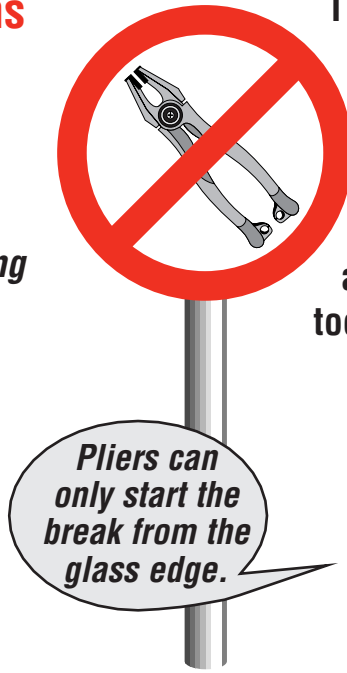
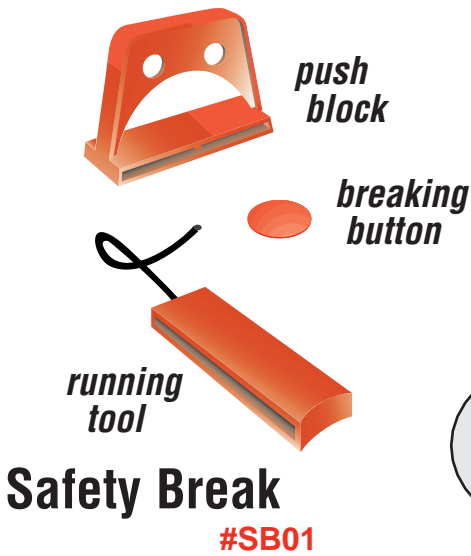


The SAFETY BREAK SYSTEM

User Instructions



The three-part Safety Break and the one-piece M-80 allow glass breaking anywhere along the score... this feature is an enormous advantage over tools that work only from the glass edge.



The M-80 and the Safety Break are a great glass breaking team... both are a must for the glass enthusiast!

Now that you have a Safety Break or M-80, you may want to know why our breaking tools look different than all other breaking tools. The reason is obvious when you use the Safety Break System the way I use it... it's not so obvious if you learned to break glass with pliers.

Many excellent stained glass teachers entered the craft before the Safety Break was introduced in 1980. They learned to break glass with a variety of running, grooving, wide jaw and narrow jaw pliers. With pliers the break is usually started at the glass edge... we discovered the glass edge is not always the best place to start the break.

The Safety Break System will do what the pliers do with one important exception. We know glass starts to break from a good score at about one degree of bend and is completely broken before two degrees of bend. When you over bend the scored glass to break it, you lose all control of the break. With pliers you can easily over bend the glass... we

designed the Safety Break System to prevent over bending the glass during the break.

An interesting shape in glass is a quarter moon shape. The shape has both an inside and outside curve and a long slender points at each end. The way pliers are designed you are forced to start the break on or near the tips and have no way to continue the break with the pliers other than over bending the glass by squeezing harder. Quite often this results in a loss of one or both tips. Also, with pliers on this type of shape, the over bending often produces a flare on the outside curve that must be removed by grinding.

Because the M-80 and Safety Break are designed to start the break anywhere along the score... we do not have to start the break near the tips to breakout the quarter moon shape. Saving tips and preventing flares is the best reason to use the Safety Break System. The tutorial lessons will help you learn how.

You aren't alone if you don't understand how glass breaks from a score. Much of the following instruction uses a balloon full of water to explain proper scoring and breaking techniques. Thinking of glass as a balloon full of water is our way to help you understand how to effectively work with glass. It is no accident that very little is written about the score... it's a difficult subject to understand and harder to explain.

Use inexpensive double strength window glass and work your way through the directions. Working with glass is fun and the more you know and practice the more enjoyment your glass work will bring. If you learned your glass breaking with pliers I suggest you learn the Safety Break System with the attitude of learning something new. Just put your pliers away for a brief period... both ideas are correct but they are completely different.

**Don Abel, President
Morton Glass Works**

IMPORTANT

Read this section first!

The more you know about the score and how glass breaks... the more fun you will have with your Safety Break and M-80!

To help understand why glass will break from a small score we developed a simple explanation. Think of glass as a balloon full of water.

The balloon and water quite accurately represent the three layers of glass. Let the top and bottom of the balloon be the top and bottom tension layers of glass, let the water be the middle compression layer of glass.

By placing a small rubber band over your wrist you will feel a squeezing force... this is the type of tension you can associate with the top and bottom layers of glass.

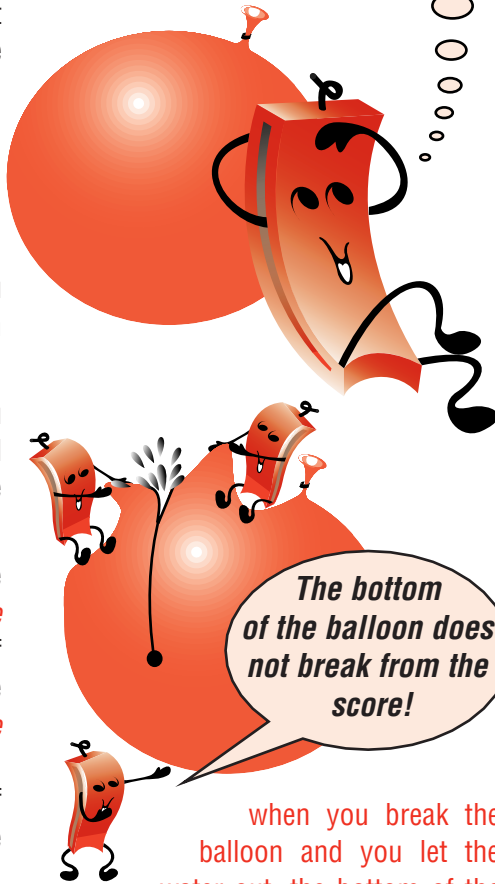
Squeeze a soft rubber ball until you make it smaller... associate being held in this squeezed together state with the compressed middle layer of glass.

As we add water to the balloon, the water causes the balloon to stretch (*like the rubber band*) and the stretching of the balloon causes the water to be pulled into a rounded shape (*like the squeezed rubber ball*). The scoring and breaking techniques will make sense if you keep in mind these two opposite forces.

When we score a piece of glass we crush the top tension layer with the glass cutter and start a small crack in the compressed middle layer... with very little bending the compressed layer will crack completely but stop at the bottom tension layer.

The bottom layer must be cracked or broken in some way before the scored glass will separate... remember that

To understand the score and how glass breaks... think of glass as a balloon full of water.



when you break the balloon and you let the water out, the bottom of the balloon is still intact and must always be cracked by some form of flexing.

The bottom of the balloon does not break from the score made by the glass cutter. In straight lines the bottom layer breaks with ease... in a deep inside curve it is easy to break the balloon and let the water out, but the bottom of the balloon holds the glass firmly together... when breaking curved scores, how you

deal with the bottom of the balloon will make the difference between success or failure.

As you learn to use your new Safety Break or M-80 it is important that you understand the importance of a good score. The idea behind the balloon full of water is to help you determine the scoring pressure that will work best with the glass you are using.

A good score is one that completely breaks the top tension layer without entering the middle compression layer. Picture a good score as breaking the balloon without getting your cutter wet. Your various colors and textures of glass will often require different scoring pressures... just think of the different glass as having a different balloon thickness... the thicker the balloon the more scoring pressure needed to make the score. The test score is an easy and effective way to determine the thickness of the balloon. One thing you might keep in mind is that much of the textured art glass looks rugged and you often feel a stronger than normal score is needed... most of the time the opposite is the case and you can easily see this in a test score.

The water balloon model was developed to give you a practical working explanation of why glass breaks from a score... a picture in your mind so you will understand what a good score is and is not. All this comes back to your new Safety Break or M-80... they will work better with a good score.

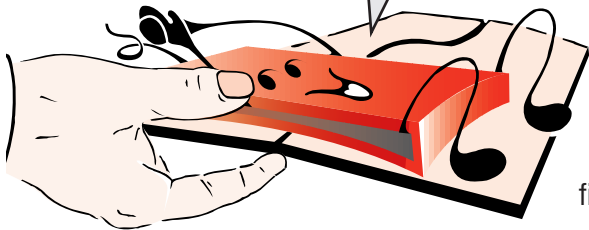
Anyone can learn to score and break glass well... practice practice practice.

A reliable test score is the only way to determine the correct scoring pressure!

Lesson #1 will help you develop a test score!

Running Tool

When you use me like this your finger becomes the red button... just hold me down over the score and push up with your finger!

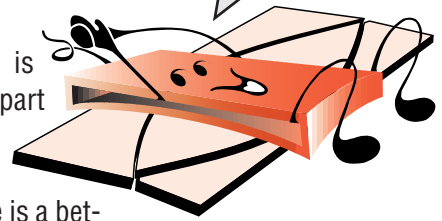


Use me over the red button to remove a narrow strip from the glass edge!

To break more than one score at a time... just use both hands and push up with your fingers!



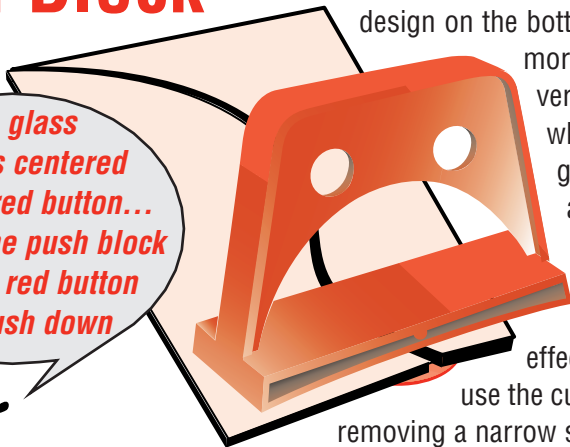
The running tool is the most versatile part of the Safety Break.



Most breaks can be made without the red button... the advantage is a better quality break. The end of your finger pushing up under the scored glass gives a very centered and torque free break... the results are square breaks free of flares and burrs. To learn how to use the runner without the button... you must feel like you are trying to push your finger up through the glass... **the force must be upward!**

Push Block

The glass score is centered over the red button... position the push block over the red button and push down



The push block and the red button are always used together. Although the design on the bottom is similar to the running tool the push block is much more powerful. The push block and button combination work very well when the glass is clear enough to see the button... when you need the power, and cannot see through the glass, the M-80 is the better option... the M-80 head is always centered over the breaking button. One big advantage of this push block design is being perfectly centered over the button is not as critical as earlier push block designs. Both the push block and the M-80 are more effective when there is more glass on each side of the score... use the curved end of the running tool for splitting slender strips or removing a narrow strip from the glass edge.

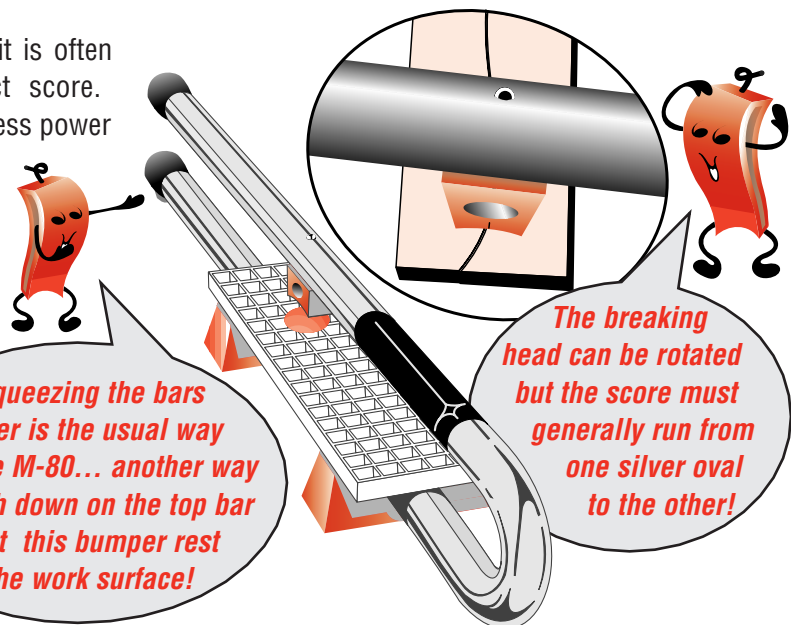
M-80

In textured or rippled art glass it is often difficult to achieve the perfect score. Because the M-80 has the effortless power

to start the break anywhere along the score, you can work around many scoring problems... It's bad luck when your cutter drops into a hole or skids out on a ridge... with the M-80 go to the area of the mishap and gently try to start the break on each side... by working back and forth you can often cause the break to skip over the problem. In difficult curves it will be the bottom of the balloon (or nonscored side of the glass) that must be carefully broken before the pieces will separate... gently go over and over the score until the the bottom layer cracks and the piece comes apart.

Squeezing the bars together is the usual way to use the M-80... another way is to push down on the top bar and let this bumper rest on the work surface!

The breaking head can be rotated but the score must generally run from one silver oval to the other!



Lesson #1 Developing A Test Score

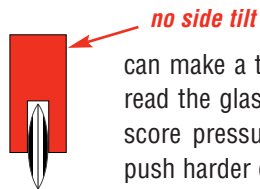
When learning to score glass, one question a student will ask is... How hard should I push? Throw a ball into a basket... How hard do you throw? No one can tell you... you learn the answer... miss the basket short... throw harder... miss long... throw lighter. Practice more... hit the basket more.

When scoring glass you have no basket to shoot at. To give you a basket we developed the balloon full of water... the thickness of the balloon will determine whether to push

harder or lighter. The test score will give you this information... without it you are shooting baskets blindfolded.

Use 1/8" window glass and a good glass cutter to develop your test score. If you have any doubts about your cutter have it checked by a professional.

The test score is needed because one color or brand of glass may score completely different than another. With a new glass you



can make a test score, break the piece and read the glass edge... if you used your test score pressure you will know if you must push harder or lighten up.

Your test score will be the pressure needed to make a good score on window glass... once you find the correct pressure you must practice it.

Two fundamentals for a valid test score... keep the wheel perpendicular to the glass... maintain even cutter pressure.

To start the exercise it would be ideal to have a 3" to 4" wide strip of window glass and plan to remove 1" strips with each score.

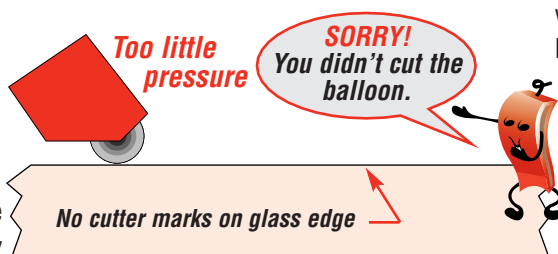
Step 1... make a straight line score... use a lot more cutter pressure than you think is needed... use the M-80 or Push Block setup on page 3 to break the score.

Step 2... compare your glass edge to the overscore diagram... if you see the heavy marks the glass is telling you that too much pressure was used... if you do not see heavy marks,

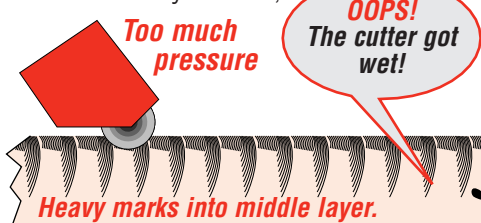
Think of the balloon as you test for the overscore... not only will you cut the balloon but you will get your cutter wet as you stir up the inner glass.

The **UNDERScore** is too little scoring pressure and the glass edge will show very few or no cutter marks. As you test for the underscore... think of the balloon full of water... the underscore may partially cut the balloon but not completely. If the score is a straight line you can often complete the break by over bending the glass... in a curved score or one near the glass edge, the break will not follow the score.

We hope you are finding that very little cutter pressure will produce a breakable score... with the overscore you can't put the genie back in the bottle... with an underscore you can improve



Underscore



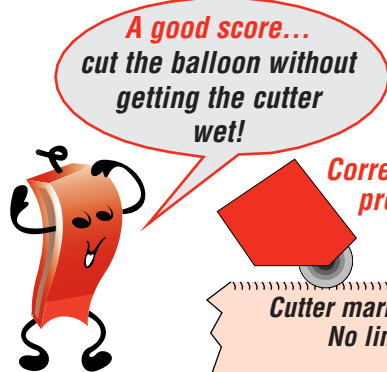
Overscore

score a 2nd time with greater pressure... repeat the exercise until you see the heavy marks.

The glass edge of an **OVERSCORE** has large marks running into the middle of the glass. The marks are the start of many cracks in every direction. In a curved score (or a score that is close to the outer edge), as you bend the glass to break it, the break will not stay in the score... it will find one of the cracks from the overscore and tend to run straight rather than follow the curve (if near an edge the break will find a crack and run to the outer edge). Don't be fooled by the ease of breaking the overscore in a straight line... you do not want an overscore for any reason.

Step 3... now that you know what is too much pressure, we can test for too little pressure... make a straight line score with less pressure than you feel is needed... use the Push Block or M-80 setup to make the break... if the glass breaks, continue to Step 4... if your glass does not break you will need to try again using more pressure.

Step 4... use the underscore and good score diagrams to check your score. if you see marks on the top edge you may be nearer the good score... if you see marks, make a 2nd score with even less pressure... keep trying until you find a pressure that breaks but gives no marks.



Good Score

your chances... before you try to break the score, go over the entire score with gentle breaking pressure... you may want to do this several times... the idea is to gently flex the partially cut balloon until it breaks... call this gentle flexing "conditioning the score".

Step 5... Develop your test score by making a score that gives good cutter marks on the edge and none in the inner glass... **once you find the correct pressure and can repeat it you have a test score.** To determine the pressure needed to score a different glass... make your test score... read the glass edge... adjust your scoring pressure more or less than your test score pressure.

Lesson # 2 Glass Breaking Fundamentals

Preventing flares and burrs on inside and outside curves is the object of this lesson. The larger you make the piece the easier it will be... start with about an 8" window glass square... as your technique improves try making the shape smaller and smaller.

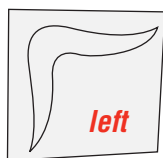
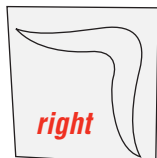


Fig. 1



It is important not to tilt the cutter to the side as you score around the corner, you may find that fig. 1 "left" is positioned better for a lefty and "right" is better if you are right handed.

After your score in fig. 2a, follow the directions printed on the figure... it does not matter if you start at 1 or 2.

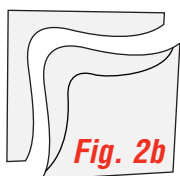


Fig. 2b

Fig. 2b shows the first score and break... when compared to fig. 4, the scrap in fig. 2b is in one piece. In fig. 4 two scores and two breaks are used to remove the outer scrap... the outside curve develops a burr and flare that must be removed. The break in fig. 2a is actually easier than the method in fig. 4.

When you start the break at 1 or 2... the run will follow the score and turn the corner and stop because the breaking angle fall below 1° of bend (review fig. 5 for more on bending angle). After 1 and 2 the glass is usually completely broken but held together by the bottom of the balloon... gentle pressure at 3, 4 and 5 will usually break the bottom layer and the scrap is removed in one piece without flares and burrs.

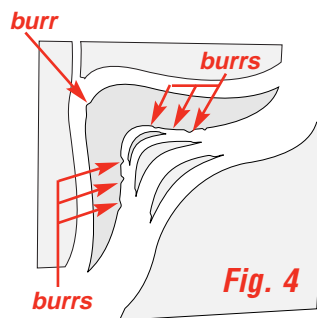
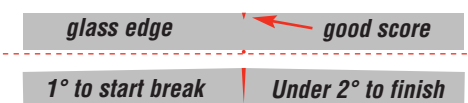


Fig. 4

With pliers the scores and breakout will look much like this... lots of grinding will be needed to remove the burrs.

Fig. 5 Bend Needed To Break Glass



From a good score... glass will start to break at one degree of bend and is completely broken with less than two degrees of bend.

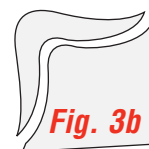


Fig. 3b

Fig. 3b, like fig. 2b, has one continuous score and the scrap is left in one piece... compare fig. 3b to fig. 4.

Fig. 2a and fig. 3a can be accomplished with the Morton Runner and your finger, the Push Block and Button or the M-80... review the different options on page 3.

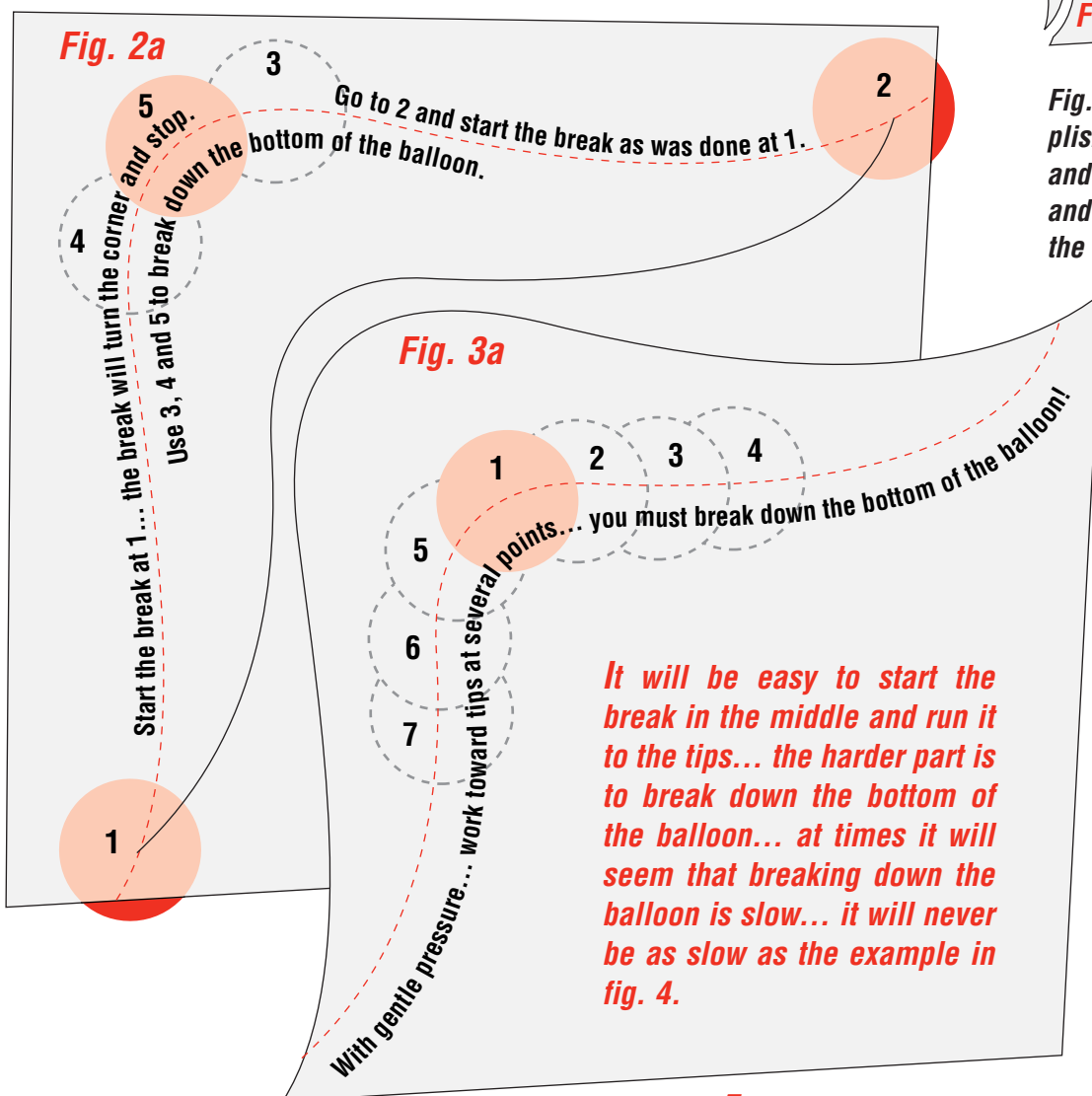


Fig. 3a shows a starting point in the middle of the score. Saving the tips and preventing flares and burrs is the benefit of this method. With a good score fig. 3a is a much easier break than you might first think... just break the balloon with a good score... start in the middle of the score and let the water out with gentle pressure... break down the bottom of the balloon by going over and over the score until the scrap breaks away.

As you learn to score and break accurately you can eliminate much of the grinding associated with pliers and techniques of the past.

Lesson # 3 Glass Breaking Fundamentals

You have many breaking options with the M-80 and Safety Break. Because there are no set rules for when to use the runner and your finger, the push block and the button or the M-80, you should experiment with the different methods. Practice with window glass until you can score and break the shapes shown... make your shapes larger at first and smaller as you progress.

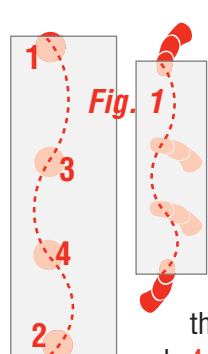
Compare each figure to the shape practiced in lesson #2... the shapes may look different but the breakout sequences are all the same. The following symbols are used in the figures:

● or ○ is the red button... the lighter red is the button seen through the glass. Some glass will prevent you from seeing the button... this is never a problem with the M-80 and is usually a problem with the Push Block... the Runner and your finger usually work well because centering is much less important to a good break.

☪ or ☪ is your finger used as the button with the Running Tool.

⋯ A red dotted line is the score.

The red number next to the button is the suggested breakout order... remember this is only a guide... the important part is the starting point and any areas that will require special attention to break down the bottom layer.



In fig. 1 the 1 & 2 are starting points... it makes no difference if you start at 2 then go to 1... bending from the breaking tools at 1 and 2 will often completely break the inner glass and 3 and 4 are needed only to break down the bottom layer so the pieces will separate.

In fig. 2 the bending from the breaking tools at 1 and 2 can be more gentle because the idea is to just start to let the water out and then continue the bending at 3 and 4. You may have

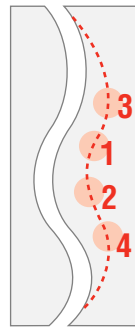


Fig. 2

to gently go over the area between 3 and 4 to complete the break ... the lesson from fig. 2 is the breaking starts in the middle of the score and is worked toward the tips.

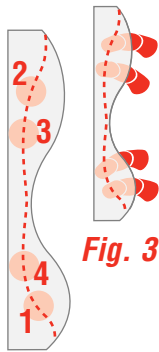


Fig. 3

Fig. 3 uses the scrap from fig. 2 to practice starting a break from two different areas of the score and then run them together to protect both the tips and the fragile area in the center.

The scallop shapes of fig. 4 are often found in designs with leaves and flowers. Most breaking techniques leave burrs and flares on the inside curve.

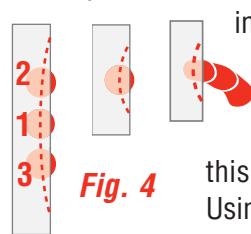


Fig. 4

The Safety Break System is second to none in this type of break. Using the Runner with your finger will give the best results and can eliminate almost all grinding.

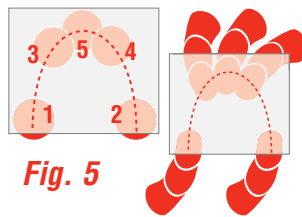


Fig. 5

The bigger you make the shape the easier it will be. After you start the run at 1 and 2 you will find the piece is usually completely broken but held firmly together by the bottom of the balloon... patience and gentle flexing at 3, 4 and 5

will break down the bottom layer and the piece will come apart. If you have both Safety Break and M-80... start the run at 1 and 2 with the Runner and your finger... use the M-80 to break down the bottom layer by gentle flexing in the 3, 4 and 5 area.

The running tool of the Safety Break was developed for the type of breaks encountered when using a straight line cutting system like our Portable Glass Shop (see fig.6). Preventing burrs and flares is the most important factor to accurate geometric shapes like the square, diamond and trapezoid.

In fig. 6 the break is started near the middle of the score... this helps prevent burrs... the design of the runner eliminates the need to be centered to get even pressure on each side of the score... this prevents flares. Practice this type of break... start with a 2" to 3" wide glass strip. Try making some breaks where you are not centered on the score.



Fig. 6

A good score makes breaking glass easy. Unfortunately stained glass has some holes, creases and ridges that will cause your score to be interrupted. Any interruption of the score can create an area where the break runs out of the score and spoils the piece.

The M-80 is our answer to a poor score and fig. 7 is a way you can practice recovering from a scoring mishap.

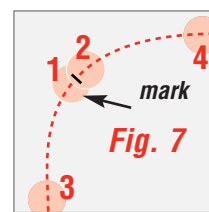


Fig. 7

recovered from a scoring mishap. Draw a curved line on window glass... somewhere along the line make a mark. Start your score... when you get to the marked area stop and lift up the cutter... continue the score by leaving 1/8" to 1/4" gap. With the M-80 try to gently start the break at 1 and 2... work back and forth and try to connect the two scores before finishing the break. With practice you can expect to recover about 50% of the time, saving a lot of glass.