

A Newbie's Guide to Solid Rod Sculpture— Top 10 Skills to Master for Creating Solid Rod Sculpture

Text and Photography by Helen Starkweather

Let me start by saying that I have only worked with glass since January of 2008. By most measures, that makes me new enough that I should be taking classes to make glassy goodies instead of writing articles about creating them. So why am I writing an article about glass sculptures? Well, the fact that I'm new means that everything I know I learned a very short time ago. In other words, I haven't forgotten a thing. I remember every question I had to ask and every step I needed to know to make something. I know which steps I had to get past to be able to go on to the next step. And as I have created the pieces, I know what the next step is, too.

Glass pros of ten to thirty years don't necessarily remember what steps they had to go through to *learn*. They mastered the basics so long ago that they often cannot explain or even remember the core skills. I'm not talking about the technique for a given piece but the core skills they needed to apply their techniques. For example, how do I spin a one-inch rod properly? What is properly? You get a tutorial or a video and you see them spinning the rod. When you haven't done this before, it's daunting. I see people newer than myself collecting tutorials and articles for "the day" that they are good enough in basics to try them, because they are not even sure of the questions to ask. What *are* the core techniques, anyway?

When I first started, I was told practice, practice, practice. Well, okay; practice what? Those were literally the most aggravating words I have ever heard. The steps from Point A to Point B are not always as easy as someone who has done it for years makes it look. It surely wasn't for me mostly, I think, because people who've done anything for a long time go right to it and don't explain what it takes to get to that point.

I have noticed a recent surge in interest about solid sculpture and borosilicate glass. Soft glass friends are buying up boro to try, upgrading their torches, and looking for larger concentrators. While many of them are better beaders than I am—sometimes by quite a large margin—the skills for boro are a bit different than a soft glass person may be used to.

Here are some things I have learned that may help you on your journey toward solid rod sculpture. These are not helpful because I've been an expert for years, but exactly because I have not.



Skill 1: Rod Spinning

Those who have made a bead know that they have to spin the mandrel smoothly and evenly to shape the glass. I have seen beaders spinning their mandrels with their fingertips—forward, then backwards—never making a full rotation. They can get away with this because the mandrel is so small that just rolling it between your fingers or along the first finger joint equals about five to ten full rotations of the bead. I do it myself; it's fast and easy. Spinning a thick, solid rod, however, requires the ability to spin it evenly in a continuous motion. You are not going to make four to five rotations with a simple finger motion. You will not even manage one rotation with the same finger effort, depending on the size of the rod. You need to learn how to spin a one-inch rod levelly and fast or slow. This core ability will open the door to better marbles, sculptures, pendants, and blown glass.

There is no set method that I've seen. I've watched many boro masters at work, and each has his or her own technique. How you hold the rod should be what is most comfortable for you. The key is that you are able to eventually spin *two* rods evenly in the same spot at the same time. I'm no pro at this yet either but I get better every day, and I see the difference in my glass work as I improve. You will too.

A fantastic practice, shared by Chad Trent, is to "hook" the end of two same-sized boro rods. Then stretch a rubber band between the rods on the hooks. This gives you an observable tension. If the rubber band twists, you are spinning one hand too quickly. If it stretches, you are pulling your hands apart. If it sags, you are pushing your hands together. Without wasting glass, you can see where you need to improve. If you practice rolling the rods in each hand at the same time, you will quickly see what you need to work on. It's a *lot* harder than it sounds, but by the time you have this mastered, you can make anything you want in boro, from marbles to goblet foots. Not fully mastering this doesn't mean you can't make sculptures but it will help a lot, so know that you should work on it.



Skill 2: Working in One Direction

- Boro cools down faster than soft glass.
- Boro takes more heat to melt than soft glass.
- Boro is less brittle than soft glass.
- Boro needs to work hotter in the flame than soft glass.

All the above factors make boro an easier medium to sculpt in, either with tools or gravity. You will have the time to make small changes that you don't have working in soft, which can get away from you faster. If you plan your piece properly, you should always be able to work in only one direction, bottom to top, side to side, or however you want. Just do not reheat sections that have had the heat taken away. Remember, boro cools faster. While it is not as shocky as soft glass, reheating a cold and unannealed section will crack any glass. The larger your piece gets, the higher the risk of shock. Do not reheat. Plan ahead and finish two-inch sections at a time, then move forward so you need not reheat that section again. If you are making something with many components, have them annealed and ready to add to the base piece as you are making it. If you hear a PING sound at any point, which means you have a crack, you have reheated a cooler section. You cannot anneal your piece until you fix the crack, because it will destabilize your entire piece. The exception to this will be explained in the kiln section below.

Skill 3: Working with Your Kiln

Bet you thought I would talk about annealing here. Nope. If you want to make sculptures, you need to work with your kiln *during* the making of your piece. If you are making multipart pieces, this is the easiest way to do it—let the kiln do your work. If your sculpture has several parts, pop them into the kiln to evenly heat up and anneal at 1050°F while you are making other parts. When you are ready to assemble, put your base in there, too, for half an hour or so (depending on the thickness of the piece), then pull out two pieces and fuse them together. You want to do it this way because both pieces are annealed already, so they are stronger and attaching is easier. It is a huge exercise in frustration to do it any other way, and I've spent hours chasing cracks around a piece before I "got it." Save yourself some frustration; take some breaks and let your kiln do your work for you. This doesn't change the need to anneal the piece when done, since you ruffled up the molecules each time you attached another piece.

Skill 4: Working with Your Torch

For sculpture, understanding your torch and its chemistry is more important than for soft glass because of the mixed types of uses you will put it to. Boro takes a while to melt, but certain boro glass can be very bubbly and tricky to work with and must be melted even slower and more carefully. Ideally you want to set the torch to *just* neutral, not over or under, for melting all your glass. A propane-rich flame is particularly bad for silvered boro glass, because it will bring all the metals to the surface, muddying up your colors. One of the best bennies of working boro—cheap silver glass! You don't want an oxygen-rich flame either, because it produces less "bush" effect, not heating your piece as evenly.

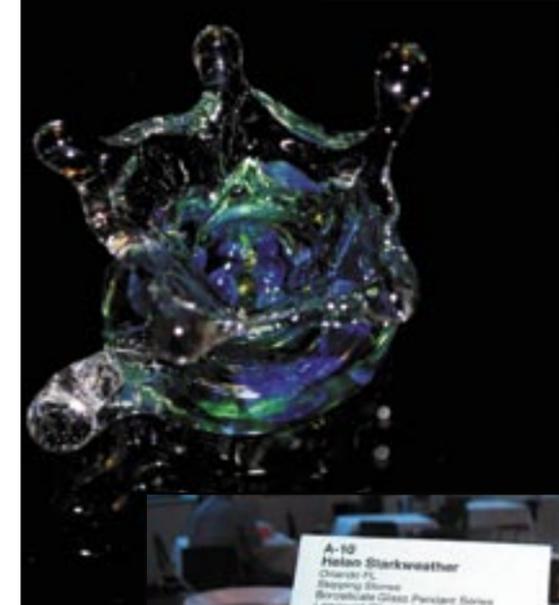


Photo courtesy of Sara Sally LaGrand



Once you get into sculpting your piece, you will want to be able to change the flame size and composition. An oxygen-rich flame will help burn the haze off of silvered boro glass to keep the colors from getting muddy or cloudy. A small, pinpoint flame is best used for spot work such as fusing very small parts on where you do not want excess undirected heat. Since every torch is different, you will want to play with the settings using a boro silver glass rod that can act as a gauge of your torch's chemistry (mix of propane and oxygen). Setting this flame is a bigger deal for boro, because so much of the glass you will work with will contain metals. It's impossible to put into a simple article all you can learn about flame chemistry, since the settings on every torch differ. It's an important factor in sculpture, and you should learn as much about your own model torch as you can from all sources.

Glass Alchemy has a glass that they recommend for setting a neutral flame called Amazon Night. It's very helpful and a beautiful glass on its own. You can read more about this on Glass Alchemy's site.

Skill 5: Working with Tools

I am a confessed tool hoarder. I love new tools, and even with a pretty large collection now I still find more tools to want. That said, while I love most of my tools for their specialized functions, there are a few that I couldn't make sculptures without. They are:

- **My Brassman Brass/Graphite Marver.** I'm biased because I helped design this, based on what I most needed in a marver. Jim further modified the design so it's even better than I envisioned. It helps hold my small pieces off of my messy table, putting them at a level where I can assemble more easily, and of course, I use it as a marver as well. Any two sides will help square pieces that I need, and the brass pulls heat out fast for the best colors out of silvered glass. The graphite top pad is a bonus because, of course, it won't melt and the stability of it mounted on the torch is essential.

I've got a three-foot scar that trails down my leg from thigh to ankle. It came from dropping a marble off of my old graphite marver that had an unstable mount. The mount shifted to the side when I banged my marble off the punty, and the marble cooked its 2200°F down the length of my inner leg as I jumped up. My legs will never look good at the beach again. Get Jim's marver if you want to play with punties; it's cheaper than the trip to the ER.

- **An old metal butter knife.** I use this for shaping, pressing a line, and otherwise pushing glass around, big and small. Despite having several, I've yet to ruin my first one. Butter knives are tough and the best sculpture tool you can get.

- **Cheap \$2 pliers from Harbor Freight.** I go through these a lot. As they are stainless and I often stick them in the flame, I buy lots at a time. I am prepared to toss a pair for every sculpture, even though some pairs last longer. Considering the price of glass, \$2 pliers will actually save you money, even if you throw them away after every complex piece. I use them to hold small pieces in the flame, saving the time of applying a punty and then smoothing the punty edges.

- **Japanese Tungsten tweezers.** The first time I saw these, I had to have them. They are part of my hand, and it makes everything sculpt easier. I can't say I figured this out myself. John Kobuki said in his marble class that they were one of his most important tools, and I have never regretted buying them. I use them as an extension of my hand in the flame.

- **Tungsten two-headed pick.** I got mine from eBay, and it's wonderful. One side is pointed, the other side is a 90 percent angle, and I use it for raking, shaping, and poking.



Photo by Will Starkweather



A quick word about temperatures:

- Soft glass melts at roughly 1400°F.
- Clear boro melts at roughly 2200°F and slumps at around 1700°F.
- Stainless steel 316L melts at 2550°F.
- Tungsten melts at 3400°F.

What do the above tell you about tools? Yep, stainless barely withstands boro-working temperatures. Of course, people tell you not to stick your tools in the flame. While this is a great idea, it's not always the most practical. I will punty my glass if I'm making a single piece, but what to do about multiple small pieces such as 1/2" flower petals, wings, or tiny legs? What takes days to assemble can turn into weeks if I punty up every piece. I stick my tools in the flame. That's why I love expensive tungsten and also the cheapest possible tools. When the tool you are consciously burning up costs \$2 and the rod you are working with costs \$10, sacrificing the cheap pliers works better for me, both timewise and moneywise.

Tungsten is the highest temperature metal. I wish they made more tools with tungsten; I just love it. However, even Tungsten can begin to deteriorate if you hold it overlong in a hot flame. Also, tungsten can fume your glass itself if you hold it in the flame in front of your piece, so I am a bit more conservative about sticking my tungsten tweezers in the flame. I still couldn't make sculptures without them. They are as good as hands. I would buy every single tungsten tool I could find for boro work. They are well worth the extra money.

With the above five tools, you can make nearly any small solid sculpture you can imagine. Of course, you'll end up buying more tools for specialty functions, but these are my core tools that I couldn't work glass without, and I highly recommend you start with these. I'd get these and practice with them. You will be amazed at the versatility.

Skill 6: Working with Boro Glass

There's a difference between boro and soft glass beyond just the COE. Boro is stiffer, takes longer to melt, and cools down faster than soft glass, giving you less time to work it out of the flame. Most favored boro colors are silvered glass, relatively new in soft glass, so those familiar with silvered soft glass already know that flame chemistry is important. Getting to know the glass before embarking on a more ambitious project is probably a good idea and a great time to practice some skills as well. The difference between boro and 104 is noticeable. The difference between different types of boro is also noticeable.

If your intention is to make small sculptures anyway, start with some small pendants with each color so you have an idea of what it does. Test your glass sculpting skills, your new tools, and ways to work at the same time as testing each glass color's workability, and you can advance your skills while figuring it out.

I like to take notes about my glass as I work it, and I try to make three to four small pendants per color to test. Small flowers, animals, and hearts—these will all make your friends smile when you give them a glass goody! Test each glass you plan to use for its ability to strike, reduce, or color change, as well as how long you can work it to get the shades you'd like.

Since we know that color in glass is composed of metals and other elements added to the glass, we can assume that these added elements will change the way each particular color behaves when compared to other colors or clear. It's pretty painful to learn about a new color by failing an ambitious project with poor color handling. Believe me, I've done it plenty!



Boro cannot be worked and reworked too often. It will go to a muddy brown color (otherwise known as “baby poop”) and stay there forever. Boro likes to be molten or cold. The more time it stays in that soft glass “working stage,” the more likely your expensive boro silver glass will finish like baby poop. Baby poop means that the boro has been heated and chilled so many times that it’s no longer able to change colors again.

On average you can “strike” the boro three times before it’s too late and the color will change no more. It’s important when working with boro to keep it hot . . . *molten* hot! Try to finish your piece(s) in this stage with no cool down between to avoid “striking” it more than a few times.

Boro cools much faster than soft glass, giving you a reduced window of time to work. Some colors take longer to melt than others, while others, such as the crayon colors, bubble and are more sensitive to high heat.

Read your boro manufacturers’ recommendations for how to handle their glass on their website. You should do this every time you buy a new color. Individual boro colors can be just as particular as soft glass colors and can handle differently. Before you dive into a big, imaginative project, test the glass you plan to use before you do and learn what it does so you don’t end up with a mess. This could save you much time and glass, too.

Skill 7: Working with Several Boro Colors Together

When you are planning a boro sculpture, you will spend a *lot* of time working on the piece. If you are not familiar with the type of glass you are using, making one mistake, such as using the wrong glass, can ruin perhaps weeks of work. For example, if you know that some sparkle colors can crack glass if encased, you would avoid using them as an embedded part of a larger whole sculpture. Here again, test the glasses that you think you may want to use in a larger project with each other on smaller projects first—pendants, beads, or small sculptures. While most boro colors will work well together, some do not, or they simply do not look right together. Testing is the best way to find out.

Skill 8: Attaching Boro to Boro

Everyone knows that you attach glass by melting it together. The idea that glasses have to be melted together is so obvious, you don’t really give it much thought. The concepts of hot seals and cold seals bounced off my skull at least a dozen times before they actually sank in. It is *not* intuitive to a newbie what they mean so I’m going over it again, because with boro, this is a more critical concept with boro’s slow melting/fast cooling properties that it really has to fully sink in. I’ve made plenty of poor joins in my early work, because while I thought I got it, I didn’t really. This is important.

- **Cold Seal—attaching a molten piece to a cooler piece, not cold piece.** This is how you attach a punty to hold your work. When done with your piece, you simply bang the join and the punty falls off. That is an imperfect seal by intention. Don’t do it by accident with a final piece, or any impact will knock the piece off. How do you do it? By melting one piece to molten and attaching it to another piece that is *not* molten. Glowing red is not molten; the join is unstable. To properly attach a cold-seal punty, you heat the punty to molten while rotating the main piece just out of the flame, then stick the molten piece to the nonmolten piece. That’s right; the piece is still hot, still red, and not molten. That is a cold seal.



- **Hot Seal—how you properly attach a piece of glass to another piece.** Both sides are molten, and after attachment, you heat the join sufficiently to leave no gaps at all around the join to fully fuse them. With small component pieces, you accomplish this by adjusting the flame to a pinpoint so you do not melt the rest of the piece and ensure that the attachment is secure. Then give it extra insurance heat so the join is not obvious. This extra “finish” step is the difference between a professional looking piece and an amateur looking piece, and it should never be skipped.

Skill 9: Prepping and Finishing

I have spent a lot of time looking at other people’s glass, trying to understand what sets apart an interesting piece from a great piece. My observation has been that the *best* pieces are always properly finished. The colors are crisp and vibrant, or intentionally earthy. There are no impactful inconsistencies, bubbles, divots, or unplanned uneven spots. And all these boil down to prep and finish. Prepping should probably go on the top of this top ten, but it’s at the end because it is part and parcel of finishing, which is to produce a piece you can be proud of from your very first effort.

- **Prepping.** Clean your glass before you start with rubbing alcohol. With boro, particularly clear, fingerprints and dust can show up as tiny spots that, while not always visible, can be very noticeable in the refractive qualities of your finished work. Little chunks of dust and other table matter can leave tiny streaks and bubbles inside and weaken the integrity of the glass itself. Clear glass is a lens; it’s the difference between a dirty drinking glass and a clean one.

One important note: As you use up a rod, the top half was clean but you’ve put your oily fingerprints from the middle on down. What to do? My solution is to only use each rod half of the way down and then fuse the two parts together later to create another whole rod. This is less problematic with boro than with soft glass, because boro is less shocky. You can then clean the top half of the fused rod later, and your work will be consistently immaculate.

- **Finish.** When I started with glass, I expended all my efforts on getting the design or concept right. Often, I was tired by the time I thought I “got it” and popped the piece in the kiln, omitting the critical finale. Once the piece was removed, I often discovered small imperfections such as chill marks and perhaps small bumps or unsmooth areas that made what could have been a spectacular piece only a good piece. Those extra five to ten minutes at the very end putting the finishing touches and flame-polishing your work may be the most important step of all. Look at the work of the best-known glass artists. Their finishes are always flawless, and that’s why they are masters. If you start out realizing how important this is, your work can only get better.

Skill 10: Planning and Creativity

Each one of us has different reasons why we torch. What we all have in common is that we want to be able to say we created something wonderful ourselves. It is nearly always cheaper to buy another artist’s work than to produce their work ourselves because we have to learn how first, and this is expensive in time and glass. If you are going to create, be creative! Every artist has so much to offer in terms of technique and skills, but in the end we all do this because we want to bring out what is inside our heads, not someone else’s. I started out with ideas of things I wanted to make, and everything I learned along the way was to teach me how to make them.

If you are brand new to boro, start by learning some technique. It is faster to take some classes, but you can certainly learn on your own. I recommend that you start with test pieces of small pendants or sculptures. I learned by trial and error, too, and each of my experiments taught me a lot. Reinforced with solid technique by taking classes and reading magazines and books, I moved along very quickly, and you will, too. The most important thing is to just do it. On a small scale with smaller pieces, you will soon develop the confidence you need to move up to more complex or larger pieces. Your only limit is what your torch and kiln can handle.

Start every project with a plan. Before I begin a project, I will imagine the finished result. Then I will mentally make the project, step by step. By the time I sit down to actually make it I know exactly what I will do, what I will need, and what it should look like. You can write it down step by step, too. If you always start with a plan, even if it doesn’t turn out exactly as you expected, it will be far closer to your vision than if you didn’t have a clue before you began. It’s also a better learning experience, because you’ll see how your mental image and knowledge differed from the real experience.

While it’s a great idea to try a tutorial, try to add your own twist to it, something you thought of that is either conceptually or technically different from what others do. Thinking outside the box is what makes you an artist—that and the ability to have fun with what you do!

While this may not be a top ten, one thing I’ve learned about working with glass is that you must have patience. If you are interested and dedicated, you will eventually master everything you wanted to know. Working with boro requires more patience than soft glass, inherently because it takes longer to melt, but also because there’s no limit to your expression in it. You are not confined to molds, mandrels, or even concepts. You can make what your heart desires. It truly is a medium where you can express yourself!

