WEBFoot Custom Calls
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Acrylic Drill Bit User's Guide:

Always wear appropriate safety gear and eye protection when using any tools, whether power tools or hand operated.

The WEBFoot Custom Calls Acrylic Drill bits are specifically designed for deep hole drilling in cast acrylic material. These bits feature a specially ground cutting edge to reduce crazing (small fractures in the cut surface), scratching, and chip out as the bit passes through the end of the material.

There are four major components to successfully drilling acrylic and achieving high quality surface finishes of the bores being created.

- Drill bit running true
- Lubrication
- Drill Bit Speed (RPM)
- Feed speed of the bit into the material (Feed Rate)

True running drill bit:

Drill alignment plays a huge role not only in regards to the surface finish left ater drilling, but also in the accuracy of the size of the hole being made. Be sure that your drill bit is on the center of the axis that is it rotating on. If the bit wiggles, also known as Run-out, the size of the hole will vary as well as the finish the cutting edges leave behind. A dial indicator is idea for measuring run-out, when measuring run-out, the amount of run-out is specified as T.I.R (Total Indicator Run-out). This takes in to account the total movement of the tool or part from the axis that it is rotating on. Though not a necessity, if you have a dial indicator available, it is suggested you measure the TIR of your drill and if possible make any adjustments possible prior to drilling.

Lubrication:

There are several types of lubrication that you can use when drilling acrylic. Of course, they are all liquid, and have the potential to create quite a mess. Keep this in mind when setting up. A drop cloth, catch pan, or other types of containment setups may be well worth the effort when it comes to clean up.

The main goal of the lubrication is not so much to lubricate the cutting edge, as it is to reduce friction, and therefore reduce heat buildup. Heat is the enemy of acrylic, and causes crazing, bubbles, and other surface imperfections. General theory for application of any lubrication you choose to use is to maintain as much lube in the bore and on the bit as possible at all times. Not only does the lubrication help to reduce heat buildup, it also acts as a coolant to reduce the heat that has been built up in the process. As you drill, regularly withdrawing the bit, and filling the bore entirely with lube is recommended.

- WD40: Many people use WD40 as lubrication for the drill bit. It is a thin liquid and can easily migrate to the bottom of the hole. It is readily available and available in aerosol cans making application more convenient.
- ATF (Automatic Transmission Fluid): Preferably Dextron/Mercon type rather than the old Ford Type F (due to friction modifiers in Type F). ATF is another commonly used lube for drilling acrylic. It is not as thin as WD40 but still migrates well to the point of the drill bit. ATF is also readily available though the application is not quite as convenient as the aerosol cans of WD40. Some believe the better lubricating properties of ATF yields a better finish but it seems to be more of a personal preference/availability issue.
- Automotive Antifreeze: Some use antifreeze as their coolant choice due to cost. And though it may work well, it does not appear to be any better than many of the other coolant choices. That being the case, the toxicity of antifreeze makes it a less desirable choice. Automotive antifreeze has a sweet smell and taste that animals (like house pets) are attracted to and it is exceptionally poisonous to animals.
- Dish soap and Water: Readily available and inexpensive, a strong mix of dish soap and water (roughly 1:2 ratio of soap to water) is a good coolant. The down side of using this as a lubricant is the water. If using this mix, be sure to completely wipe down any metal surfaces and then wipe with a rust preventative to preserve your equipment. Rust on any machine is not good.
- Water Soluble Oil/Coolant: This is used in most machine shops by various machines. It is designed to enhance efficiency of the cutter, reduce heat, lubricate cutting surfaces, and inhibit rusting of metal surfaces. It is not as readily available as other lubricants, nor as cheap as most, but overall it is a combination of rust inhibitors, lubrication, and cooling. Generally it is mixed with water at an 8-12% ratio, though higher concentrations are regularly used. WSO is available many places online.
- Feel free to experiment, you may find the next best thing since sliced bread and peanut butter. You're only limited by your imagination. Vegetable oil, Mineral Oil, Motor Oil, and so on.

RPM (Drill Speed):

RPM of the bit is another huge contributor to a quality surface finish. Slower is better! Generally best results have been achieved running in the 400-600 RPM range with the larger bits (.500" to .750" range). Smaller bits in the .200" to .250" range can be run faster, but results vary by size and RPM so you may wish to experiment a little with the higher RPMS.

Feed Rate:

Not to say this is the MOST important of all the main contributing variables, it does have a large impact on the finish your drill bit will leave behind. Since almost all users will be running manual machines, its nearly impossible to specify the feed rate in specific terms

due to the inability to precisely control the feed “by hand.” This creates the need to experiment a little and “get a feel” for the proper feed rate for the bit you are using. Generally speaking, the best results are achieved feeling the bit very slowly, and in increments of 1/8” at a time, completely withdrawing the bit to clean the flutes prior to adding more coolant and re-entering the bore. Feeding the bit too quickly will result in a poor surface finish and crazing of the bore walls. Feeding the bit too slowly will increase heat build up in the bore, resulting in bubbles and “wiping” (where the cut chips from the point are rubbed against the sidewall of the bore by the flutes of the drill causing scratching and excess heat build up). A recommended feed rate is .003” IPR (inch per revolution), which equates to 1.8” of cutting travel per minute at 600 RPM. Keep in mind this specification only accounts for actual cutting time and does not account for the time to withdraw the bit, clean the flutes, apply more lube, and re-enter the bore. Take your time when starting out! Gradually work up your feed and speed until the results suffer, and then back off a “smidge”. Drilling time will be directly related to RPM, Lubrication, Drill Size, Hole Depth, and the machine being used.

Drilling acrylic is a cross between an Art and a Science when it comes to manual machines due to the variable of “Human Interaction”. Practice and experience will yield the best results. If you have Clear polished acrylic rod available, that is one of the best choices to practice with because you can not only see exactly what is going on inside the bore, but also easily see the finished results so that you can adjust your methods accordingly.

Enjoy!