

Ultrasonic Drill

First to set up the machine:

1. Place the drill on a table where you can easily sit or stand in front of the unit at a convenient height.
2. Run some tubing from the drain of the drill to a bucket that you will place on the floor below the drill. It is best to locate it on the right side of the machine since the water feed line will go to the tray on the right side of the machine.
3. Install the copper tube into the end of the red water injector and tighten the fitting until the copper tube is secure, do not overtighten.
4. Install the water injector assembly into the tray base on the right side aiming the copper tube directly at the drill cone.
5. Find a bucket that has a fairly narrow bottom and place the pump in the bottom of the bucket. The bucket will be filled with water sufficient to submerge the pickup of the pump but not too deep. Keep the pump motor out of the water. When the grit and water return to the bucket, it is best if the return line is close to the pickup of the pump, so the grit can quickly get recirculated back to the drill.
6. Run some tubing from the outlet port of the pump to the water injector.
7. Silver solder a piece of drill tubing onto the drill horn. If you are not familiar with silver soldering, this will take a bit of practice. It is best to use something like 56% safety silv silver solder, using some white flux when you first heat the drill horn. Get the solder to flow onto the horn first, then holding the drill tubing with needle nose pliers, heat it lightly, then dip the end of it into the flux as well...and then heating primarily the horn, position the tubing in the silver solder that you put into the end of the horn. It is tricky not to overheat the drill tubing, and if the tubing is overheated too much, it will break more easily. If you are new to this, you will get more practice doing this than any other thing before you master it. (We have a short video on the HP lapidary youtube channel that shows how to do this)
8. Install the horn onto the drill using an adjustable wrench and the special horn wrench that is supplied with your drill. Make sure it is on tight! If it is not very tight, the vibrations will not transfer well and the drilling will be diminished.
9. Connect the drill power cable to the back of the amplifier.
10. Turn down the main dial on the amplifier then plug it in and turn it on. Then turn on the drill head switch. You will hear a high pitched whine when the main dial is turned up a just a little bit. Turn the drill head and amplifier back off .
11. With all tubing secured, turn on the water pump. The water should flow into the water tray and then flow over the end of the drill horn. Adjust the flow with the valve on the injector assembly so it flows onto and then runs down the drill horn. This should be a steady stream. This water flow will direct the grit onto the tip of the drill tubing allowing it to drill quickly. 12. Put 150 grit silicon carbide into the water reservoir. Depending on the size and shape of your bucket, you may require more or less grit. What you want to see is that a steady stream of grit laden water is coming down the drill horn. If you get

a nice coating of grit on your fingers when you run the pump, then you have enough grit. With ultrasonic drilling, the delivery of grit onto the workpiece is the most critical thing. If you don't see much grit, check to see that there is sufficient grit in the reservoir. Typically about 5 lbs of 150 grit is about the right amount.

13. With the pump running, now turn on the amplifier and then the drill head. Slowly turn up the power using the gain dial. As you do so, you will first see the water spraying out sideways in an erratic fashion, as you near the harmonic frequency, you will see the water spray form an inverted cone shape. If you don't get a perfect cone, you can try small adjustments on the frequency adjustment on the lower left corner of the amplifier. You can adjust the frequency by turning the special magnet core set screw. (Usually it is possible to turn it with your fingertips, but it can be turned with an 2.5 mm allen wrench, but you must remove the allen wrench with each adjustment since the metal in the wrench will affect the adjustment. Be very careful with the adjusting screw if you use an allen wrench as it is made from powdered magnetic material and can be broken if forced.) Once you have established a nice inverted cone shaped water spray, now you are ready to drill!

Drilling; This part is pretty easy:

1. Make sure you are getting a nice flow of grit to your workpiece, position the work piece under the drill while it is running....and then apply some gentle pressure. You will hear the drill begin cutting into the stone. If you press too hard, it will squeal a bit more like fingers on a chalkboard. When there is plenty of grit, you can make a hole in a 1/4" thick slab in a minute or less. When drilling a slab, lighten up your pressure just before the drill goes thru to avoid breaking out the back side of the hole. Experiment on a cheap slab until you get comfortable with the feel of the drill.