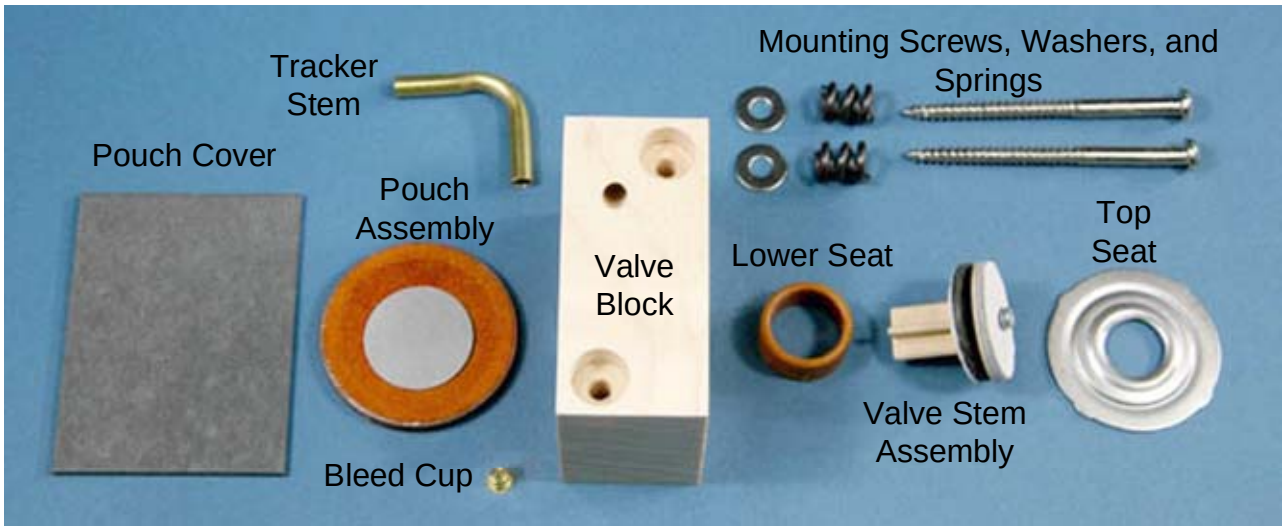
Notes on Making the Wurlitzer Unit Valve Part 1



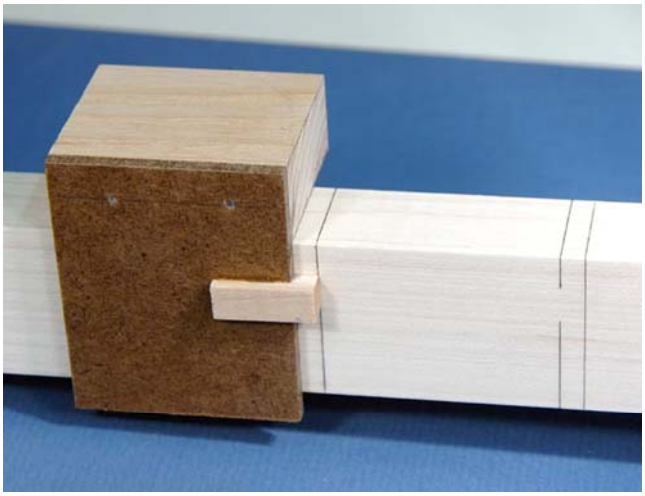
Here are the parts of the Wurlitzer Unit Valve. If my count is correct there are 43 Unit Valves needed in the 105 including the two for the Snare Drum Beater. My objective was to end up with at least 50 good valve blocks when I was done experimenting with various valve seats, bleeds, and leather combinations. After collecting the various parts, I began with the Valve Blocks.

Valve Block

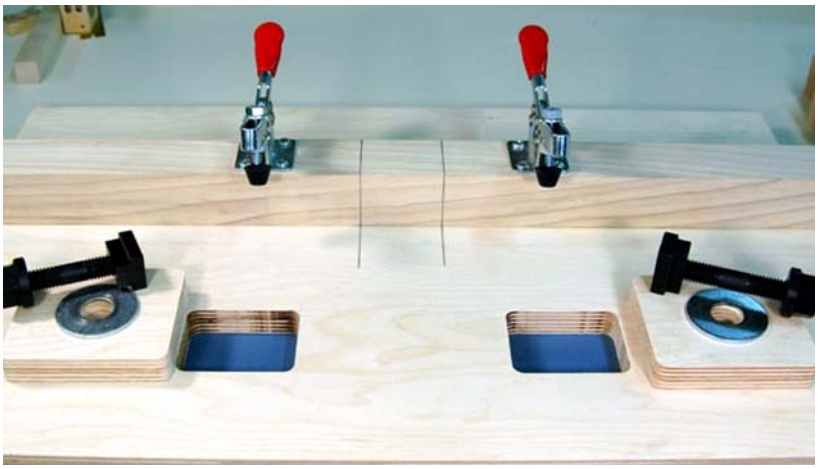
Over the years I have collected a number of drawings of the Wurlitzer Unit Valve in addition to making my own set of measurements. All of these drawings are different to some degree, mostly from inconsistencies in measurement of the actual valve, and/or inconsistencies

of manufacture or perhaps changes in the valve when they were rebuilt. All of these drawings have inconsistencies and obvious errors of one type or another. So as a starting point I had to settle on a valve design I would use to build my set with the objective to make them as close to the original Wurlitzer design as possible. I have attached my drawing. There are a number of changes made from the original Wurlitzer valves. In some cases the changes were made to take advantage of available parts such as a modification to use an available alternative to the original lower valve seat. In other cases minor changes were made to make the manufacture easier.

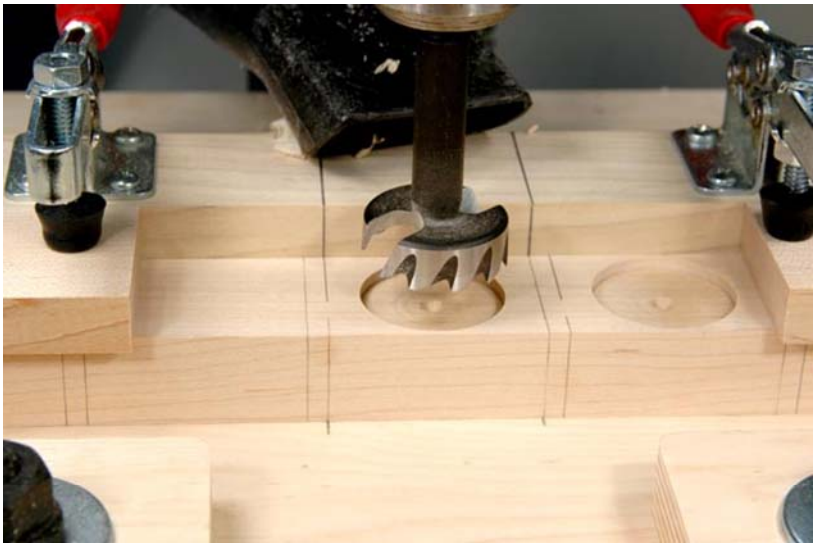
My approach to making the valve block was to make strips of blocks and cut them apart when all the drilling operations were completed, similar to the process used to make the Piccolo pipes. I started with strips of hard maple long enough to make about 12 valve blocks each. I made several extra strips just in case...



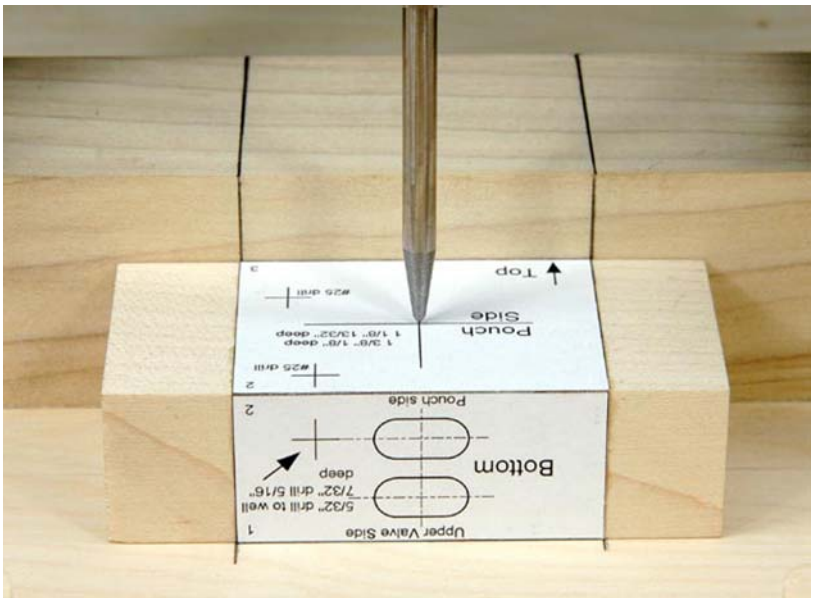
All of these strips were jointed, planed, and drum sanded to very accurate dimensions. Next I marked these strips with a simple template to outline the edges of each block and provide a fixed space between blocks to account for the saw blade I would use to cut them apart. Since I planned to sand the edges of the block when finished, I made this space a little oversized. I also marked each face on one end of each strip with a B, T, P, or U so that I would not get confused.



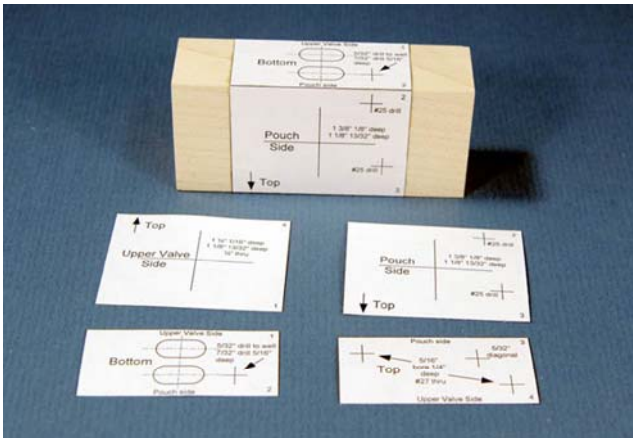
I used this fixture mounted on a drill press to hold and index the strips. The same template used to mark the strips was used to mark the fixture. Since my drill press had a table that used T-nuts for clamping, I cut holes large enough in the fixture to allow me to move the fixture over the area of an individual valve block. I made wood “washers” to allow the necessary range of adjustment. Clamps could be used as well, but they should hold the fixture very solidly.



I used toggle clamps to hold the strip in place while doing a given operation. They are adjusted for the largest dimension of the block and I used spacer blocks to hold the strip when clamping in the short dimension.



The process is simple. Set the bit once and make that operation for all blocks by lining up the lines on the strip to the lines marked on the fixture. The depth stop on the drill press is set for the required depth of cut. This method of indexing turns out to be very quick, accurate, and repeatable. I used a template to do all setup. The template very accurately locates every hole. It is used by aligning the template to the indexing marks on the fixture and using a sharp drill or punch to align the whole fixture to the drill center point and then clamping the fixture very firmly. After the fixture is aligned and securely clamped to the drill press, the valve strips are indexed and clamped for each operation using the toggle clamps.



A copy of this template is attached to this document. I used a metal ruler as a straight edge and a razor blade to cut it out. Then glued it to a section of valve strip material. I used fish glue to glue it on and sprayed it with a light coat of clear lacquer to help it last longer. Be sure to glue the template sections on in the right order and orientation. Amazing how easy it is to do it wrong!... The numbers on the lower right hand corner of each section help confirm the right sequence and orientation. This was a later addition to the template….

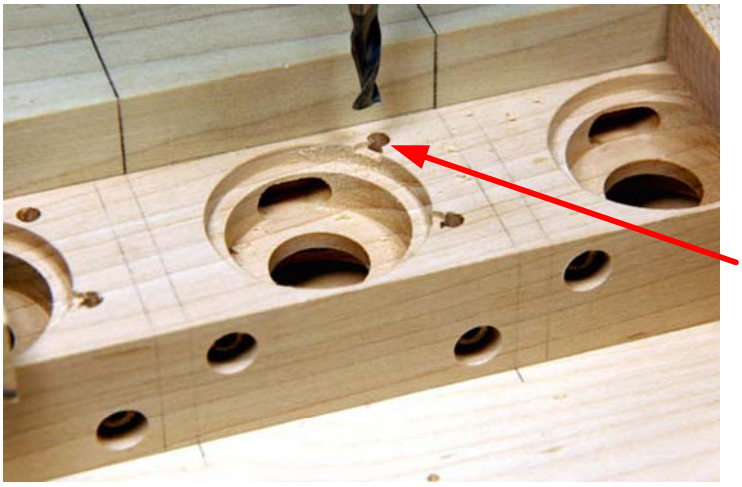
To make the depth setup a little easier, I took a piece of valve strip stock and used the router table to make a step block with each of the drill depths. It took a little time to make but was well worth it. Sorry no template here. I could not see any easy way to do it. This block allowed me to set the drill depth, lock the drill press quill at that point and then set the depth stop.

A couple of comments about Forstner drill bits: These bits are most stable when the point on the drill is in contact with wood. This point is somewhat blunt, keeping the bit centered as well as tends to control the bit feed into the wood keeping the bit from grabbing. This means that it is best to layout a set of tasks so that the point of the bit is always in contact with wood if at all possible.

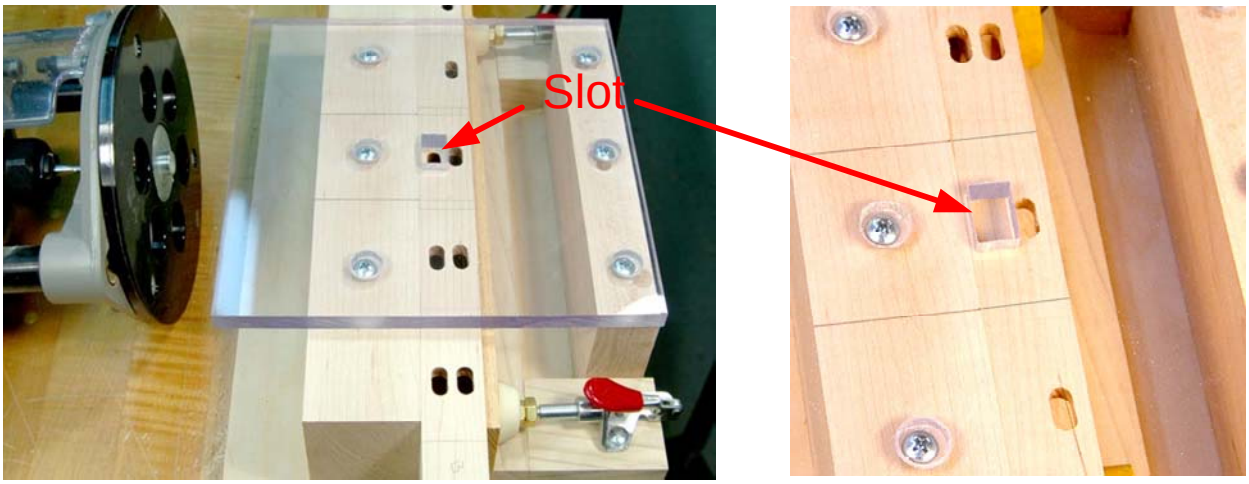
To do this, drill all three holes on the first side first, in the order of largest to smallest. What you will find is that after you drill the largest hole, and begin to drill the next largest, that the bit will begin cutting a little before the center point contacts wood.

This is because the first drill bit left a small “dimple” in the center of the hole, keeping the second drill from immediately contacting wood. So for a brief time, the bit can tend to “grab” and cause the work to jump if not clamped well. If you use toggle clamps or some other form of clamp to hold the strip, and feed slowly at first, you will not have a problem. If you hold the strips by hand you may find that some of your holes are off center because the strip moved slightly when the bit first grabbed the work.

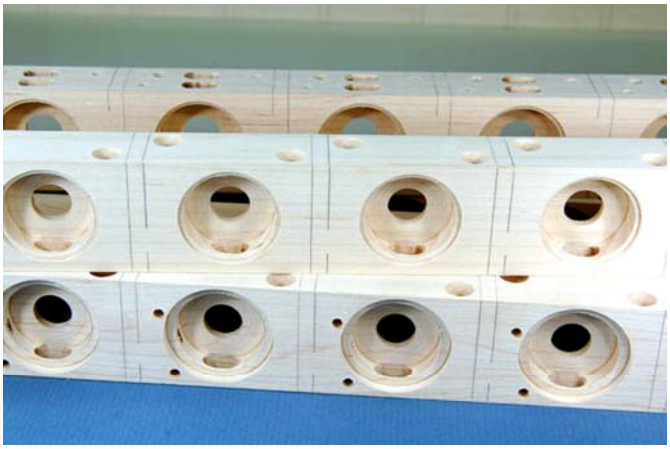
Drill the smallest valve chamber thru-hole just deeper than the thickness of the wall between the two sections of the valve. On the reverse side, drill the largest diameter first. When you drill the 1-1/8" hole on the second side, you will find that as the point of the bit drills into the small hole and the point loses contact with wood, the outer rim of the bit acts as a bearing and controls the bit, keeping it centered and stable. Note that all 5 face pouch/valve chamber holes (3 on one side and 2 on the other) are made with one fixture setup.



A channel needs to be cut on the pouch side of the block between each of the two face holes and the pouch chamber. This gives the tracker bar tube (hole not yet drilled), and one side of the bleed, access to the back of the pouch. A ¼" router bit or ¼" Forstner bit in the drill press can be used to cut this channel. Just a "touch" of the bit will do it. As an alternative, you can wait and cut these channels after the Pouch Assembly is glued in using a small sharp chisel to cut the complete channel from each hole to the center of the pouch through both the block and the fiber rings of the Pouch Assembly.

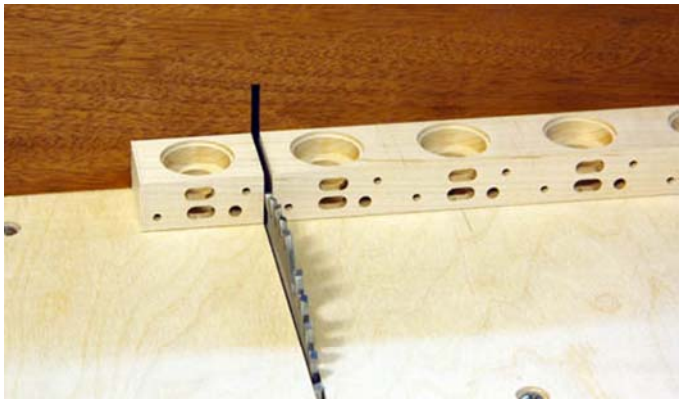


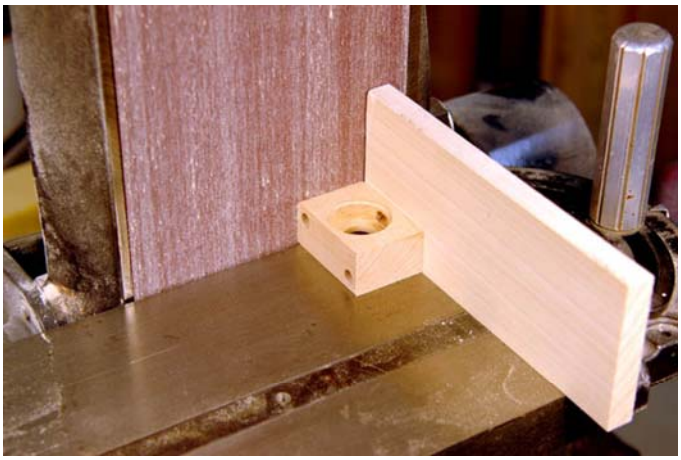
Here is the fixture for cutting the two ¼"x½" slots in the bottom of the block. I used a piece of 3/8" Plexiglas with a slot cut in it to accept a router guide bushing. I used a ¼" spiral router bit in a plunge router to make the cuts. The same setup is used for both holes.



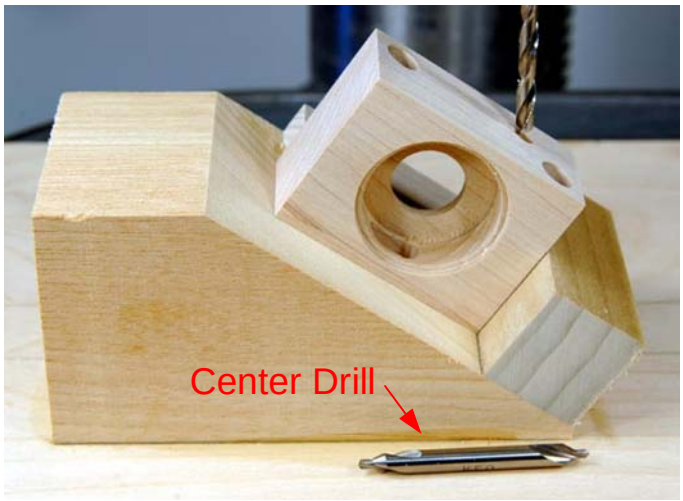
Finished strips of Valve Blocks (except for tracker bar tube holes) ready to be cut apart

The blocks were cut apart on a table saw using a cross-cut slide.

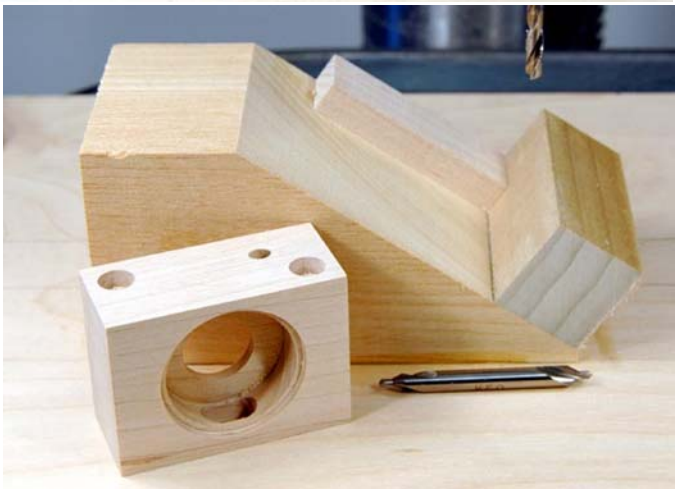




I sanded the sides of the blocks to the guide lines with a belt sander.



I did not want to make an angle fixture to mount the large indexing fixture on to drill the angled tracker bar tube hole, so I decided to drill those holes after the blocks were cut apart. I used the alignment template to align the fixture but had to cut one end of the template and sand it flush with the template edge line so that it would fit in this fixture. Because I was concerned about starting a drill at an angle, I used a center drill first before using the regular 5/32" drill bit. A center drill would probably not be necessary when using a 5/32" brad-point drill bit.



Here is the angle fixture without the block so you can see the back cleat. The fixture was glued to a base board and mounted on the drill press with clamps. An angle template for making this fixture is attached.

Miscellaneous Comments:

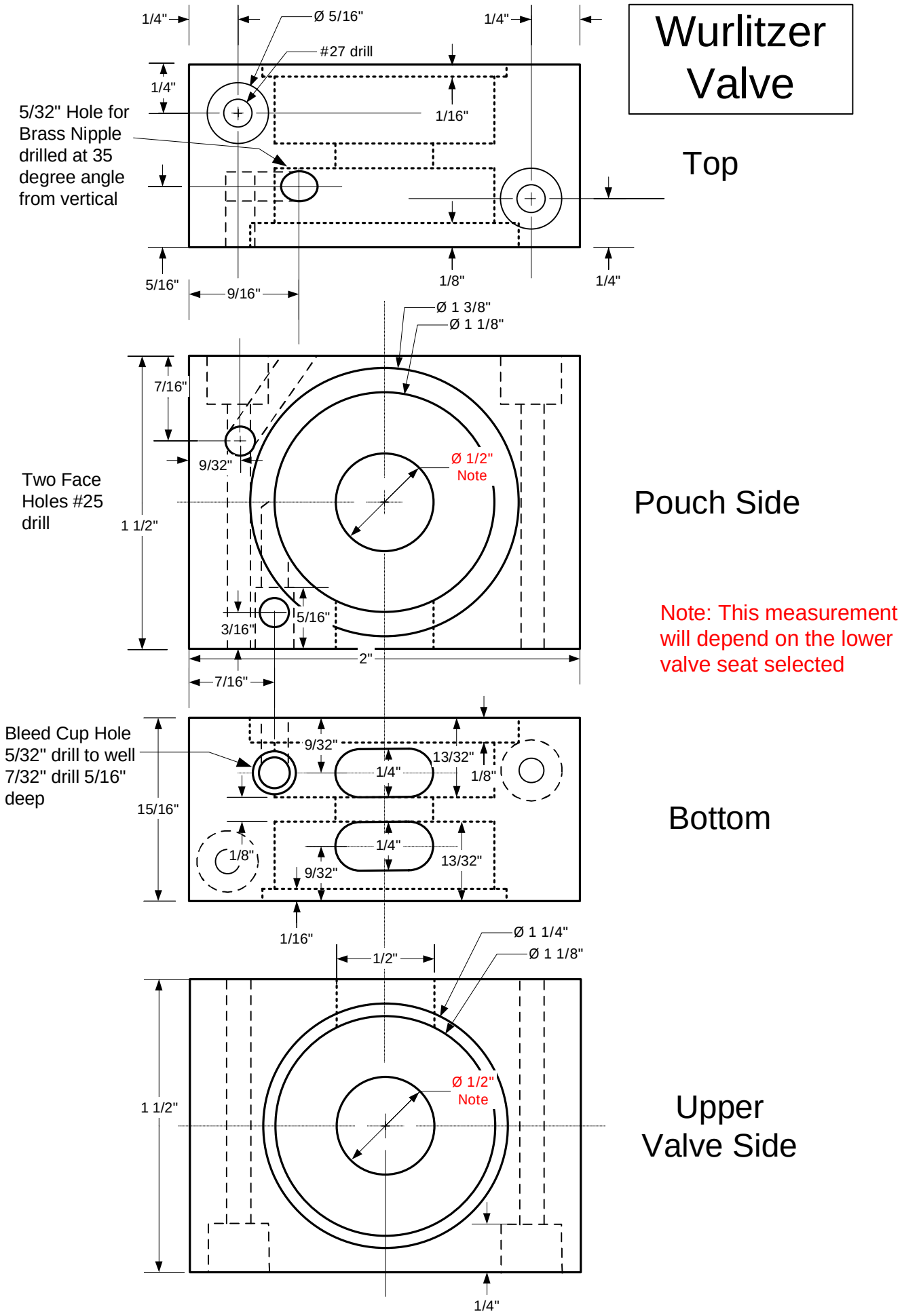
* Some dimensions of the valve block will depend upon the the final selection of valve components. For example, the center valve chamber hole will be dictated by the lower valve seat selected. The size of the counter sink for the mounting screws will depend upon the actual springs selected and the size of the #6 washers you find, if in fact you use a washer at all. You may find it hard to find a #6 washer that will fit in a 5/16" hole. It may have to be increased in size to 3/8". Nothing is more frustrating than having to go back and increase the size of 100 holes by 1/16" when you thought you were done. For that reason it is probably a good idea to have all the parts you are going to use before beginning the blocks.
* If you are going to use a plain brass or bakelite lower valve seat and count on a press-fit of a piece of tubing in the block hole, make sure that the drill you select will support a press fit. Some drills will be over-size by a few thousands or the tubing may be undersized resulting in the lower seat falling through! It is worth testing the drill/seat combination before you make a set of blocks.
* When drilling the 1-3/8" hole for the pouch, make the depth a little deeper than 1/8" by the thickness of the pouch leather you will use (10-15 thousandths). Two fiber pouch rings from PPCo glued together are almost exactly 1/8" and the added thickness of the pouch leather will cause the assembly to stick up above the block, preventing a good seal when gluing on the valve cover. It is easier to fix this problem now rather than trying to re-drill the block later or trying to sand the ring to reduce its thickness. Use a depth micrometer or a dial indicator to check and fine tune this hole depth when setting up the drill press stop.

Part 2 includes notes and information on the Pouch and Valve Stem Assemblies.

Part 3 Includes notes and information on sealing the block, selecting/making valve seats, bleed installation, assembling the valve, setting valve travel, and finishing.

The attachments that follow include the drawing of the block, the alignment template, and a template to construct the angle for drilling the tracker tube holes.

Wurlitzer Valve



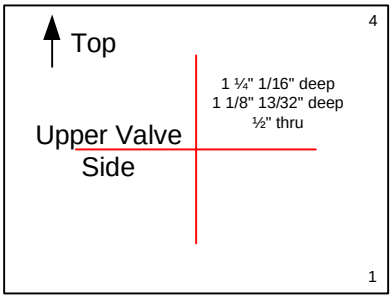
Template Printing Instructions:

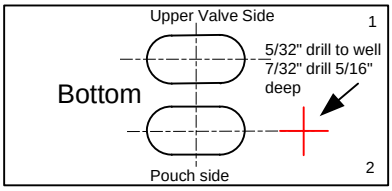
Test Printings of these templates have been done using Adobe Acrobat Reader versions 5.1, 6.0, and 7.0 on an HP Laser Printer.

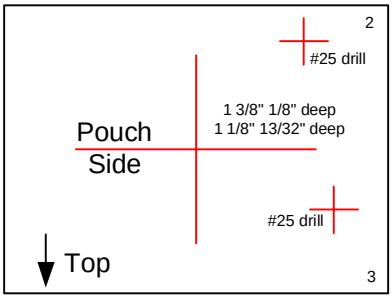
As a default, the Adobe Reader automatically reduces the size of a page to about 95% when printing. To get accurately dimensioned Templates, this default must be reset each printing:

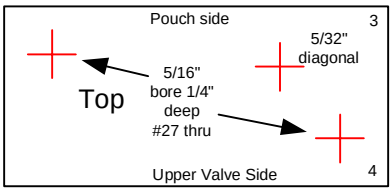
Adobe Acrobat Reader v6.x and v7.x: After hitting a Print command and before clicking OK in the Print window set Page Handling/Page Scaling to None

Adobe Acrobat Reader v5.x: After hitting a Print command and before clicking OK in the Print window make sure under Copies and Adjustments that Shrink oversized pages to paper size is not checked.









Setup Template