A High-Pressure Adapter with Gauge: Schrader Valve to Military Valve, Version 1.2

By R. G. Sparber

I enjoy paddling my AirVolution™ kayak. I do not enjoy pumping it up.

I also would not enjoy paying over $300 for a battery-powered Stand-Up Paddleboard inflator[2] able to pressurize my kayak to the needed10 PSI.

As I looked at the internal views of these inflators, I was surprised to see that they are made up of a high volume/low-pressure inflator and a connected low-volume/high-pressure compressor.

Well, I already built an adapter for my battery-powered[3] high-volume/low-pressure inflator using a Ryobi inflator. This inflator fills Chamber 1 in 20 seconds and Chamber 2 in 30 seconds to ½ PSI. There is still a lot of gunt work with the hand pump to get to 10 PSI. Not fun.

I also own a Ryobi low-volume/high-pressure compressor that runs on the same battery. I just needed to build another adapter. But this time, I wanted to include a pressure gauge, so I do not over inflate the chambers. If you own a similar compressor that runs on your car's power, that will work just as well.

---

[1] This work is licensed under the Creative Commons Attribution 4.0 International License. To view a copy of this license, visit http://creativecommons.org/licenses/by/4.0/ or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

[2] For example, the Jobe 20 PSI.

[3] If you are new to Ryobi battery-powered tools, there is a substantial initial cost – a battery charger and the battery ($150). Depending on the total volume of your kayak or SUP, you may not need this big a battery, in which case, the cost will be lower.

The pressure gauge posed two minor problems. I wasn't looking forward to paying as much for shipping as I paid for the gauge.

The Schrader valve, with a threaded shank, secures to the adapter. Another case of shipping costing more than the part?

Much to my amazement, I hit paydirt while searching the web! This beauty costs only $10.97 at Home Depot! It is made by Danco and is called a Gas Test Gauge (part number 94352). The right face of the body accepts a threaded fitting.

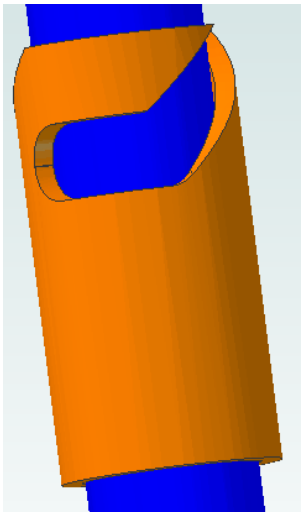
Also at Home Depot, I can buy a 3/4 in. x 1/2 in. PVC Sch. 40 MPT x S Reducer Male Adapter for 85 cents. All I had to do was wrap the threads in Teflon tape and screw it in.

The challenge was in making the Miliary valve bayonet. Even here, I was lucky. ½-inch schedule 40 PVC pipe has almost the same outside and inside diameters as a store-bought bayonet.

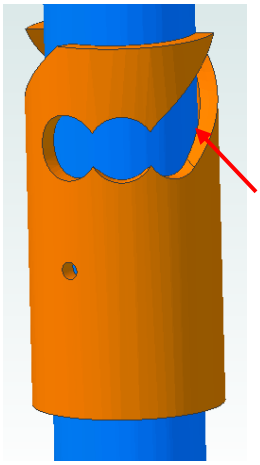
Here is the finished adapter. The compressor attaches to the Schrader valve on the top. The bayonet engages the Military valve at the bottom.

The gauge has been rotated 90° to make it easier to read. Not shown is a cap that protects the bayonet when not in use.

My search of the web turned up Schrader to Military valve adapters, but none gave me continuous monitoring of the pressure at the valve. Monitoring the pressure at the pump will tell you the applied pressure, not the chamber's pressure. I was also able to find Military valve bayonets but none that would fit my coupler.



In this 3D rendering, I have placed an opaque cylinder inside the bayonet to highlight the finished cut.

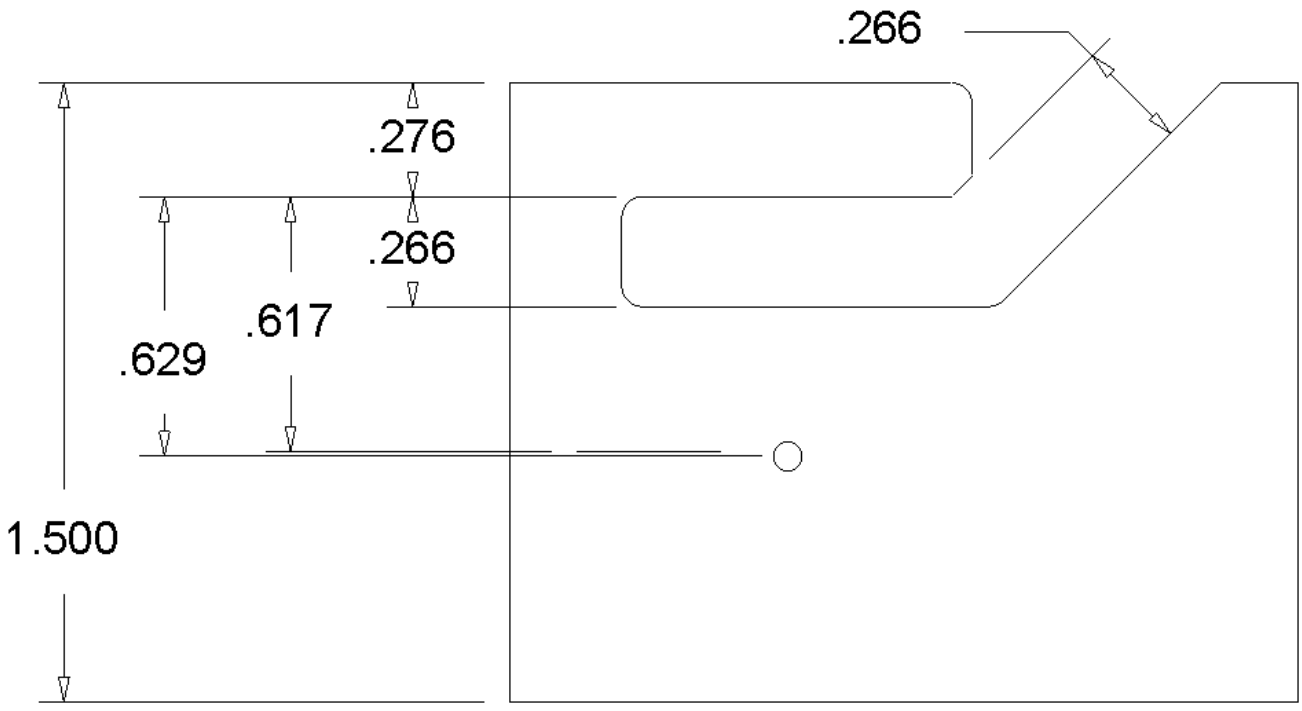


The radial slot starts out as a chain of three holes. I then file off the points.

The helical cut was formed with a Dremel fitted with a 1-inch diameter cut-off wheel.

Partial Shop Drawing

This is a flat drawing of dimensions that do not involve the curvature of the pipe. The one exception is for the helical cut. If you follow the procedure, you will not need to look at this drawing.



Tools

You will need

- a drill press with drill press vise and table clamp
- a small clamp plus a piece of flat metal (see page 5)
- a 17/64-inch and a #50 drill bit[4]
- a Dremel with a small cut-off wheel
- a way to cut the PVC pipe
- a steel rule able to read down to 64ths
- a sharp pencil
- a round file less than ¼-inch in diameter, plus a flat file less than ¼-inch thick and ½-inch wide.
- A bench vise is handy but not essential.

Materials

- 3-inches of ½-inch schedule 40 PVC pipe
- the coupler described above
- a few inches of Teflon tape,
- a size 211 O-ring
- a 4 penny nail.

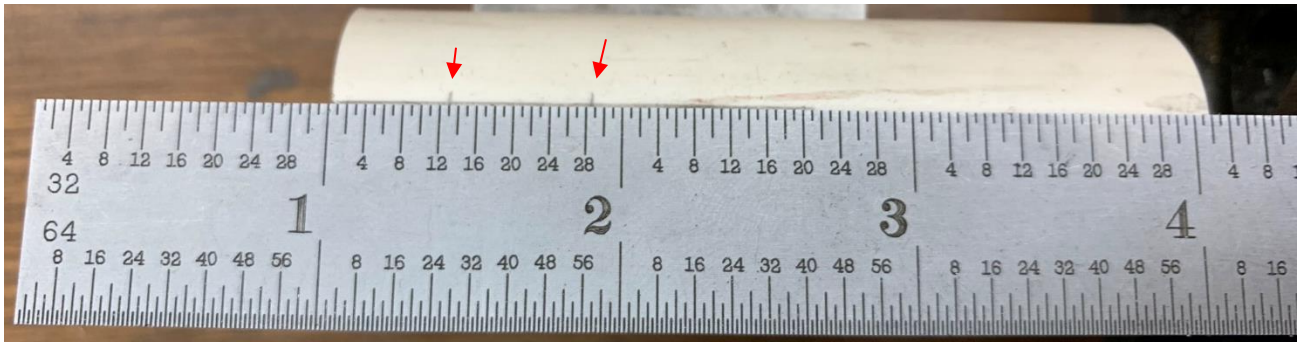
You may find the following procedure challenging. The good news is that if you make a mistake, you are only out a little PVC pipe.

[4] You can avoid buying the #50 drill bit. Heat the 4 penny nail with a torch and melt the hole through the PVC pipe.

The Fabrication Procedure

Square up the end of the 3-inch length of ½-inch schedule 40 PVC pipe. This is a critical first step.

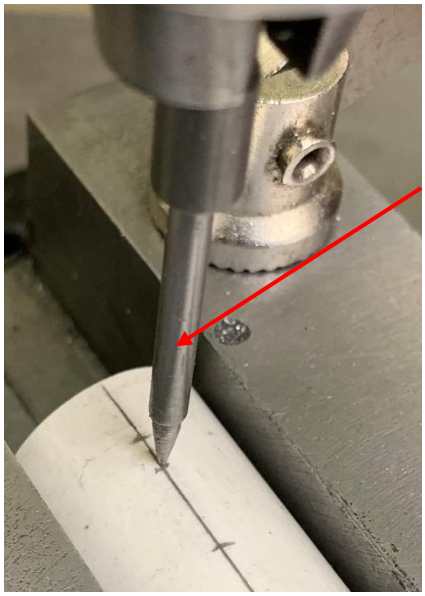
Lightly clamp the pipe in the drill press vise and draw a line about 2-inches long using the fixed jaw as a guide.



With the end of the pipe at the 1-inch mark and aligned with your pencil line, place a mark at 13/32. Make a second mark at 29/32.

With the pencil line facing up, securely clamp the pipe in the vise. You will be drilling through, so be sure the gap in the vise is underneath.

Clamp a stop on the fixed jaw so you can rotate the pipe, and it will not move axially. Notice that if the end is not square, there will be axial motion, which will spoil the part.



If you own a spud, use it to align the center of rotation of the drill press at the 13/32 tick mark. If not, you can use the smallest drill bit you own. Turn the chuck by hand and verify that the point of the drill bit does not wiggle off center. That would indicate that it is bent.

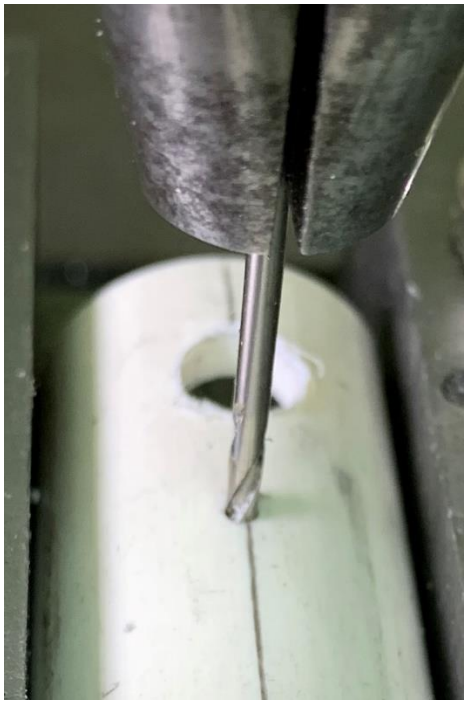
Clamp the vise down.

Chuck up the 17/64 drill bit and drill all the way through the pipe.

Rotate the pipe until the drill bit is no longer over the hole. If you have a way to measure this rotation, it is 35°.

Tighten the vise and drill through.

Rotate the pipe one more time (35°) and drill through for the third time.



Rotate the pipe back to the first hole.

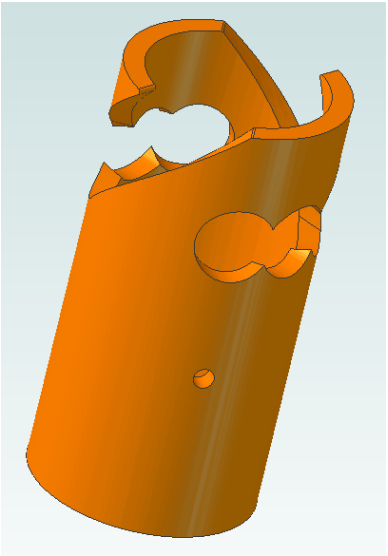
Install the #50 drill bit and slide the pipe until the second tick mark is aligned. Then drill through.

Remove the pipe from the vise and draw a tangent line from this last hole at approximately a 45° angle.

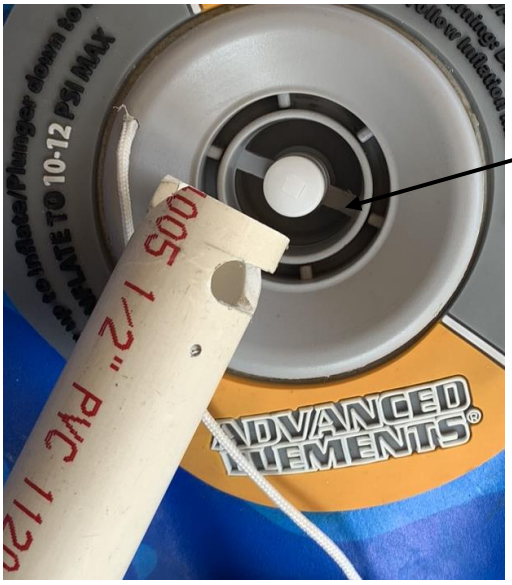
Insert the drill bit and draw a second line, parallel to the first, that is also tangent to the hole.

Repeat on the other side in the same relative position.

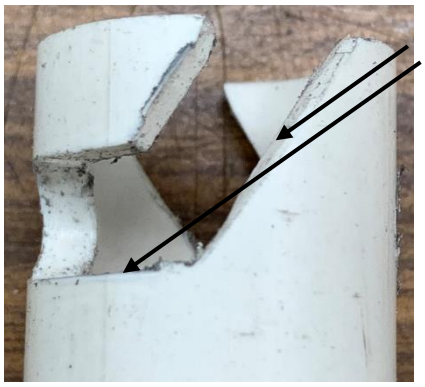
Using the Dremel cut-off wheel and your files, shape the PVC to this shape on both sides.



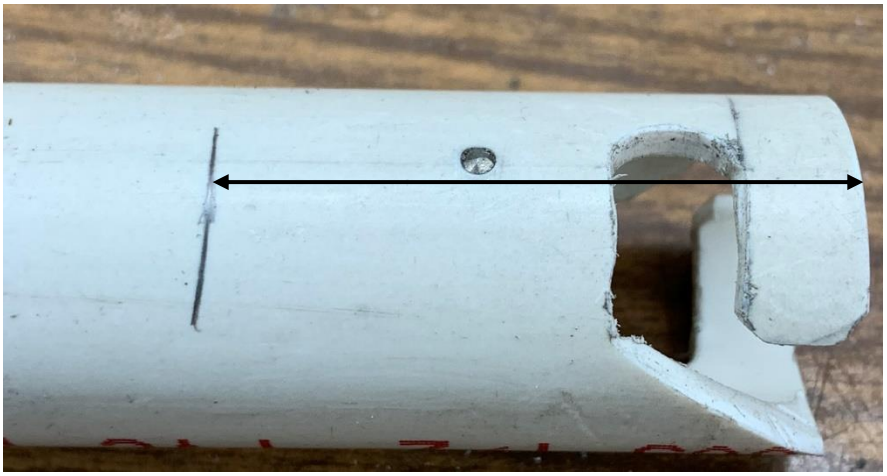
Round off all sharp corners.



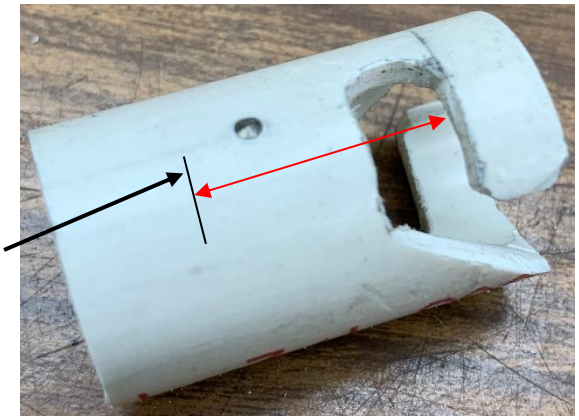
Trial fit the bayonet. It should smoothly lock onto the bar inside the valve.



File only these edges of the pipe as necessary, so you clear the bar.



Draw a line 1½ -inches from the end. Then cut off the part at this line.



Draw a line 39/64-inches from the bottom edge of the finger, as shown here.

Work the nail through the small cross hole. Then use the cut-off wheel to cut off the head.

Using the outside diameter of the pipe as your gauge, cut the pointed end of the nail off, so you are left with a rod slightly shorter than the diameter. File off any burr.

Install the rod in the pipe.

Press the bayonet into the threaded coupler until the line is barely visible.

Roll the O-ring over the bayonet and make it snug on the face of the coupler[5].

Looking at the threaded end of the coupler, tightly wrap six layers of Teflon tape clockwise.

Then thread the coupler into the body of the gauge assembly. Start by tightening with just your hands.

[5] Sometimes there are raised letters on the face of couplers. If you find any, file them off.

Attach your compressor. Lock the adapter to a Military valve and inflate to full pressure. If the threaded joint leaks, tighten another ¼ turn with wrenches and then retest. Over tightening will crack the plastic coupler. If the valve to O-ring contact area leaks, press the bayonet into the coupler a little more and retest.

I found that there was no need to cement the bayonet to the coupler. This has the added advantage of enabling you to remove the bayonet if it becomes damaged.

The bayonet is fragile, so I suggest you slide a coupler or end cap over it before placing the adapter in storage.

How well does the adapter work? Using my Ryobi battery-powered compressor, I reached 10 PSI in chamber 1 in 6 minutes, and chamber 2 took 9 minutes. This drained two 2 ampere-hour batteries. The metal part of the adapter got too hot to hold, but the plastic part stayed cool. The compressor was just warm to the touch[6].

This sure beats working that hand pump!

If you do make one of these adapters, please send me a picture of it in use. I will add it to this article with proper credit to you.

[6] My owner's manual says to let the compressor cool for five minutes after it has run continuously for five minutes. So far, I have not had a problem but did open the unit up and applied a high temperature grease to all moving parts.

I welcome your comments and questions.

If you want me to contact you each time I publish an article, email me with "Subscribe" in the subject line. In the body of the email, please tell me if you are interested in metalworking, software plus electronics, and/or kayaking so I can put you on the right distribution list.

If you are on a list and have had enough, email me "Unsubscribe" in the subject line. No hard feelings.

Rick Sparber
Rgsparber.ha@gmail.com
Rick.Sparber.org