

Drip Irrigation: The Spaghetti Line to Hard Pipe Connection, Version 1.1

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The bottom line: <https://www.youtube.com/watch?v=k4i-DE2aFow>

The Back Story

Drip irrigation is a wondrous invention². It lets us precisely control how much water to deliver to a precise location. Water is fed into a main line. As needed, small lines, called “spaghetti lines,” tap in.



A quick, easy, and low-cost configuration consists of “soft pipe” laying on the surface and spaghetti lines connecting to it as needed.



Low-cost couplers enable the user to punch a hole in the soft pipe and plug in a spaghetti line.

Here in Arizona, the sun will cook the plasticizer out of the soft pipe in less than a year. It becomes stiff, will crack, and eventually leak. Cut out one failed section, and there will be another in a few days.

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² See https://en.wikipedia.org/wiki/Drip_irrigation for one version of the story.

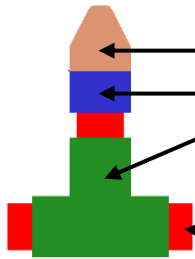
The obvious solution is to bury the soft pipe. The intense heat³ also drives the plasticizer out; it just takes a few years. But now you can't see the leak until plants start to die and your water bill starts to climb. Then you must dig up the defective soft pipe, which is no fun in the middle of summer. It doesn't take long to realize that the cost is in the labor of digging. It doesn't matter what you place in the trench.

This leads many people to change to Schedule 40 PVC pipe. This is called "hard pipe." I have some runs of hard pipe that have been in the ground for 20 years with no leaks. At the time of this writing, the cost is around 20 cents per foot. My worst water leak cost me the equivalent of 1500 feet of hard pipe.



I can buy a coupler that lets me join a single spaghetti line into hard pipe. The one on the left has a barb that lock to the inside of the tube. The one on the right has a countersunk hole that compresses the outside of the tube.

The barb style is much easier to use, but both provide a watertight joint as long as the line remains pliable.



They screw onto a threaded to slip fit connector. The connector joins to a T. The total cost for materials is around \$4 per connection.

Ah, but there is also a substantial hidden cost. If the pipe is already in the ground, it is difficult to add that T. Typically, I must dig back four feet on both sides of the desired location. Then I must bend the pipe enough to fit it into the T. If the pipe is old, there is a risk that it will crack. I can buy a sliding coupler that lets me adjust the pipe's length. That makes the job easier but will add another \$5. They are also another point of failure.

The Problem to be Solved

The challenge is to be able to connect a spaghetti line to the hard pipe at any point at low cost and with minimal digging.

³ Using a non-contact thermometer, I measured the crushed rock over my pipe at 160° F in mid-afternoon.

The Solution



I can duplicate the countersunk hole found in this kind of connector.

A few tools will be needed:

- A battery-powered electric drill
- #7 drill bit⁴ 
- Countersink – the included angle is not important

I put a collar around my countersink to limit the depth of cut, but it is not necessary. Just go slow while countersinking and check your progress often.



A custom tool will also have to be fabricated:



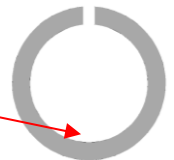
I took a 10 penny 3-inch long nail and ground the point off. The end was then rounded. The head was turned down to around 0.2-inches on my lathe. You can free-hand grind it with no loss of functionality. This will be our mandrel.

The Procedure

This procedure is typically done at the bottom of a hole in the ground.



Chuck up the #7 drill and carefully drill through the PVC pipe wall. Go slow, so you do not cut the other side as you break through.



⁴ The size of the drill is critical. Do not substitute.



Chuck up the countersink. Drill down until the top of the countersunk hole is a little over $\frac{1}{4}$ -inch in diameter.



Cut a length of spaghetti line approximately equal to the length of the mandrel. The mandrel must be a loose fit to the inside diameter of the line.



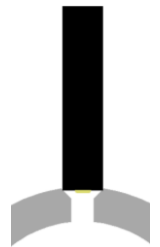
Notice that the spaghetti line is supported by the mandrel. There is room for the line to compress as it goes through the hole in the PVC pipe.



Chuck up the spaghetti line with its mandrel with the head inside the chuck. Tighten the chuck until it firmly holds the assembly. Too tight, and the chuck will damage the line.



Firmly push down on the drill while the end of the spaghetti line is seated in the countersunk hole. Then run the drill at the lowest possible RPM. You will feel the assembly feeding in. When about $\frac{1}{4}$ -inch of the line has penetrated, you are done.



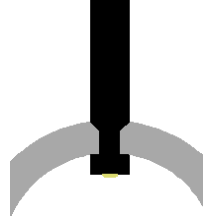
Do not run the drill too fast as this will machine away the outside diameter of the line and cause it to leak.



Loosen the chuck and remove the drill. The mandrel should lift out.



There is a small amount of damage to the outside diameter of the line, but it is a tight fit and will not leak.



The final step is to add a double-ended barbed coupler to the spaghetti line. These couplers cost around 10 cents each.



Alternatively, you can directly connect the emitter to the spaghetti line. Then run a second line from the output of the emitter to the plant.

And what if you don't want this connection at a later date? There are two options.



You can remove the double-ended barbed coupler and stuff in a plug. I don't like this option because, eventually, the spaghetti line will harden, and the joint will leak.

I prefer to patch the hole. See <https://rick.sparber.org/PPPD.pdf> for details.

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