# An Axial Coupler, Version 1.0.0

## By R. G. Sparber



I use two lengths of PEX tubing to form a temporary circular curtain rod. The tubing is removed from the fabric for storage. When assembled, it forms a cylinder about 6 feet in diameter.

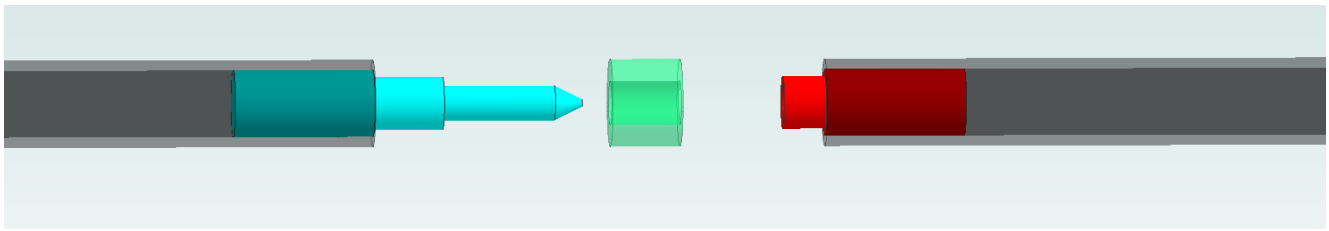
The two lengths of PEX are connected using couplers. Initially, these were friction fit, but eventually, the tubing belled out, and the couplers failed to hold.

I have replaced these couplers with the one shown here.

The pin assembly on the left slides into the receiver on the right. This is a close, sliding fit.

Once the pin is fully inserted,

I turn the threaded locking cylinder which advances onto the threaded spigot of the receiver.



This 3D rendering, minus threads, shows the parts. The pin, on the left in blue, is a tight fit into the PEX. Just outside the tubing is a ½ inch section threaded 3/8-16. The right-most inch has been turned to 0.248 inches. The bevel on the end makes it easier to thread through the fabric.

The ¼ inch-long coupler, shown in green and set to translucent, has an outside diameter (OD) equal to the OD of the tubing. It is drilled and tapped 3/8-16. The outside has been intentionally left smooth to reduce the chance of over-tightening.

On the right, we have the receiver, in red. The exposed ¼ inch is threaded 3/8-16. It is drilled through 15/64 inch and reamed to 0.250 inch.

I assure you that this coupler works well, but a subtle feature is at play.

Consider spinning a nut onto a bolt. Then, take another bolt and place it end to end with the first bolt. As you turn the nut towards the second bolt, the nut will likely jam.

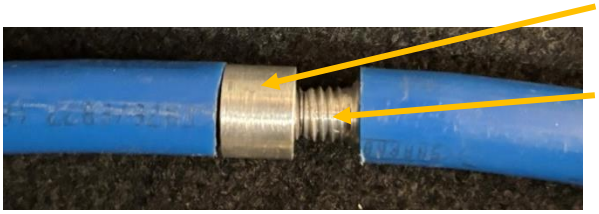
The nut can only span the two bolts if the threads are closely aligned both axially and radially.

Axial alignment means the center lines of the bolts are in alignment.

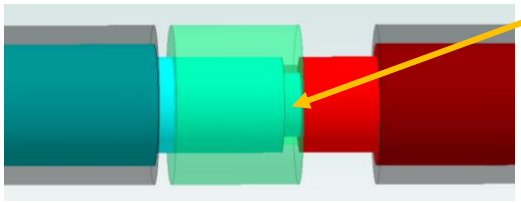
Radial alignment means that the end of the thread on the left bolt ends right where the end of the thread starts on the right bolt. Only then can the nut smoothly thread across the two bolts.

My axial coupler has no such requirement.

The key to this mystery lies in the alignment pin. This close-fitting pin ensures axial alignment. But how does it also achieve radial alignment?



As the threaded coupler turns, it follows the pin side's threads. When the coupler contacts the receiver side threads, it likely cannot engage. Instead, it pushes on the end of these threads.



A gap forms inside the coupler as it is turned. Eventually, the gap is large enough that the threaded sections are on the same helix.

On average, it takes one-half turn for the threads to line up. Then, the coupler can engage the receiver's threads while still riding on the pin side threads. Once the threaded coupler has engaged the receiver, the two halves of the PEX are locked together.

Full disclosure: I had assumed I could align the two parts of the axial coupler so the threaded section would join them. I was amazed that it worked even when I failed to align. Only then did I realize that I had lucked out. I can't think of another case where I stumbled into such an excellent solution.

I welcome your comments and questions.

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