Taper Pin Installation

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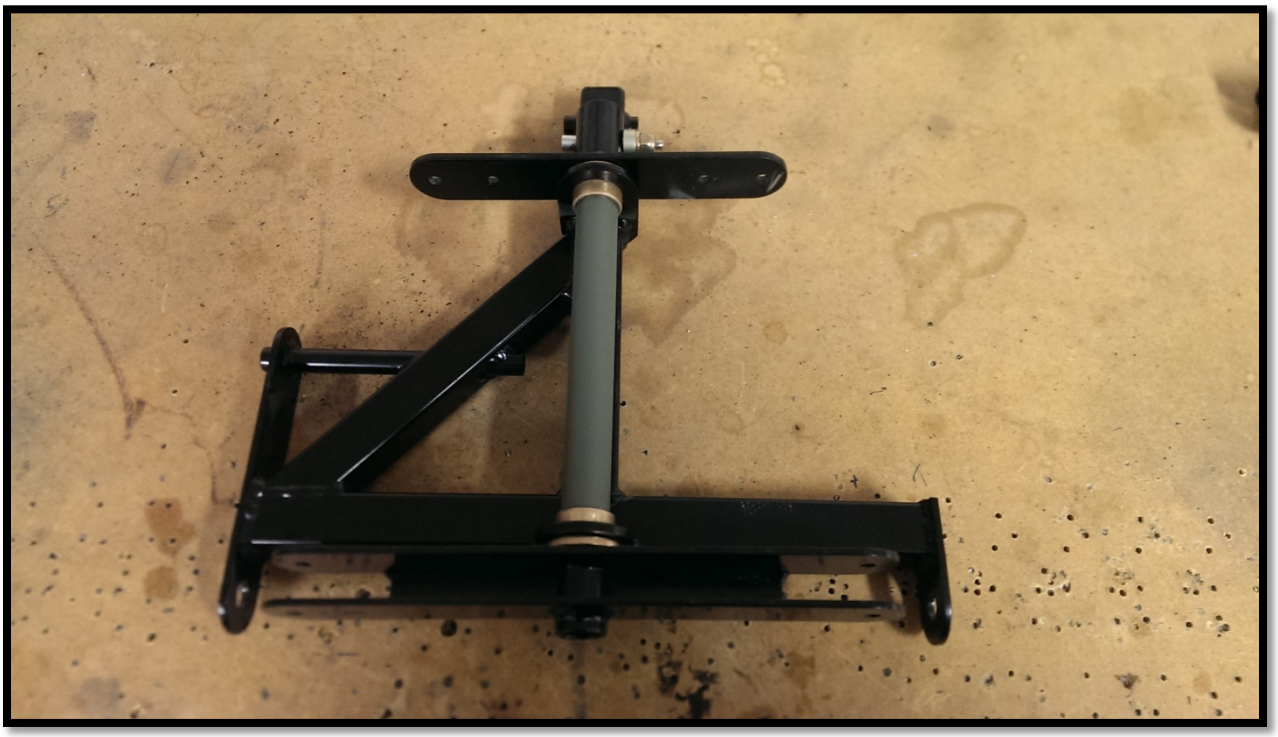
I recently began working on my Waiex flight control system. A specific part of this control system is the mixer assembly. This assembly receives a single input from a control rod which attaches to the control stick assembly. The mixer assembly then simply splits the input to two control rods which actuate the ruddervators.



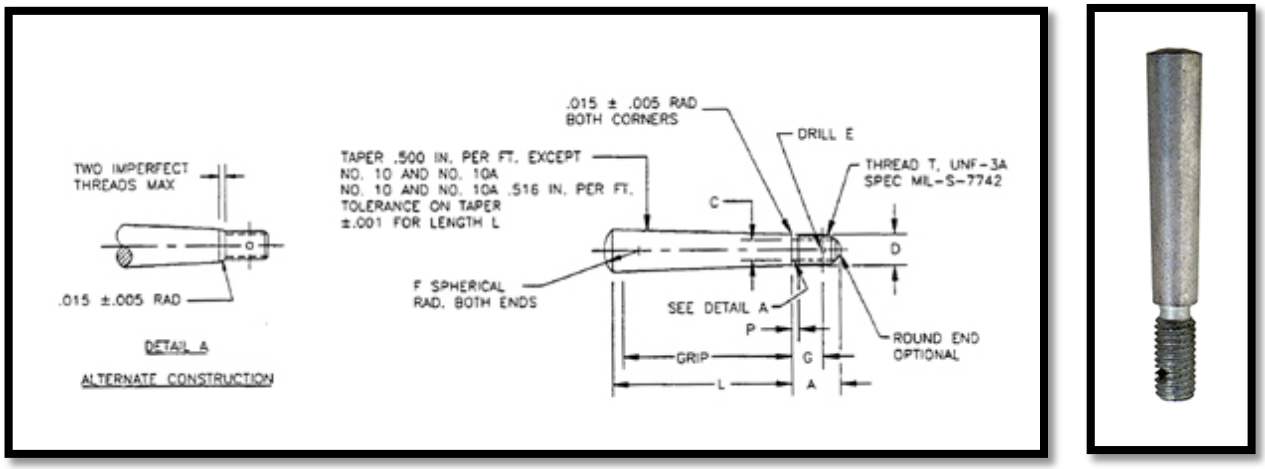
Assembled Mixer Tree. This assembly is called out on plans sheet WIX-C02.

It is important to assemble these components so that there is no slop in the attaching parts. To help reduce the potential for a sloppy connection, the plans call for a taper pin which attaches the upper output arm to the pivot shaft of the mixer assembly. I had never personally installed a taper pin prior to this project, so a little research was in order. Unfortunately, Advisory Circular (AC) 43.13 1b/2b (known as the mechanic's bible) did not provide much guidance on the actual installation of a taper pin. By the way, if you don't have a copy of AC 43.13 handy, I'd recommend picking one up. Aircraft Spruce sells them for $20 USD http://www.aircraftspruce.com/catalog/bvpages/ac4313act.php

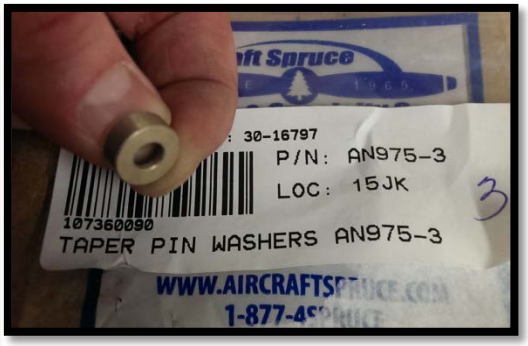
What is a Taper Pin?

An AN386 taper pin is manufactured from alloy steel and has a minimum tensile strength 125,000 PSI. AN versions are usually cadmium plated and are installed with a AN975 taper pin washer, AN320 shear castle nut and cotter pin or with AN364 elastic stop nut. When installed, the small end of the tapered shank should protrude no more than 1/16" above the surface of the assembly. The first dash number –

is the Brown & Sharpe (B&S) taper pin reamer number and the second dash number is the grip length in eighths of an inch. Undrilled threaded shanks add the letter "A" after second dash number.



The Sonex/Waiex plans do not call for the use of the recommended AN975 taper pin washer. The only problem with not installing the special washer is that if the taper pin is installed correctly, the inside diameter of an AN960-10 washer may not seat completely over the protruding shank. As stated above, no more than 1/16” is to protrude past the attaching material. This can be tricky to achieve and a taper pin washer helps to take up the extra space. Here are a couple of pictures showing what I’m referring to.

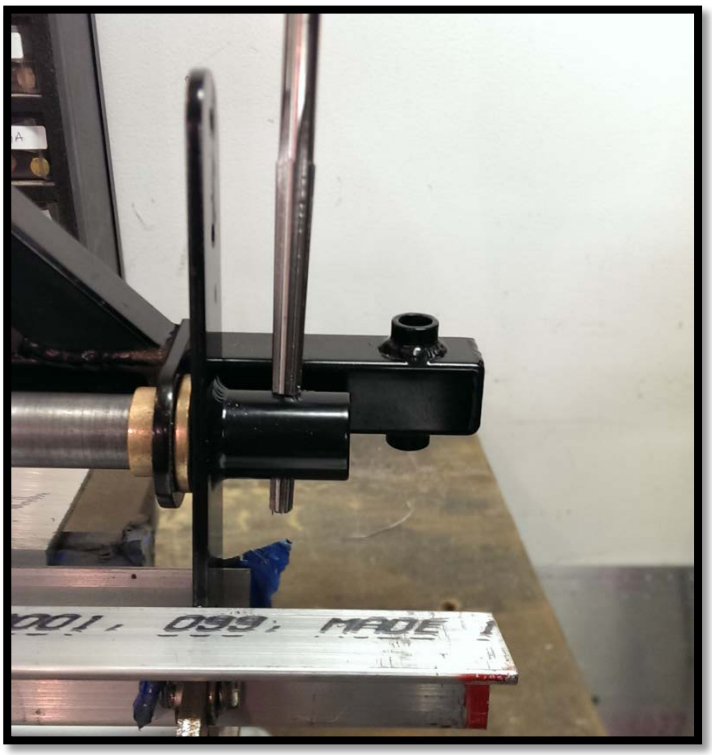


How Do You Install a Taper Pin?

To achieve a tapered hole in the pivot assembly you must use a taper pin reamer. Disclosure: The tapered reamers used for this installation are quite pricey. I purchased one from Aircraft Spruce for $48 USD. http://www.aircraftspruce.com/catalog/topages/reamers.php?clickkey=73650

The B&S No. 1 tapered reamer is the size that you will need when installing an AN386-1-8 taper pin.

First, you need to mark your hole location and pilot drill. I started with a #40 steel bit, updrilled to a #30, and updrilled once more to a #11 hole size. The #11 bit is just slightly smaller than the small end of the taper reamer. I then inserted the reamer and opened up the hole making sure to make several light passes so not to oversize the hole.

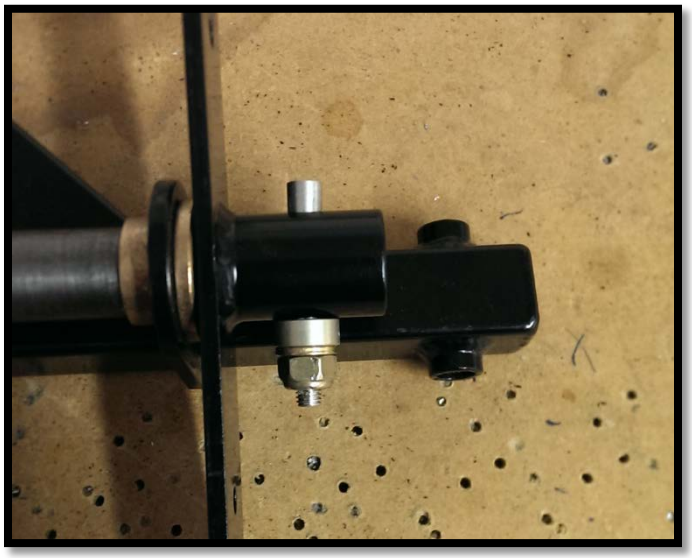


Don't Oversize the Hole!

Be careful! A brand new taper reamer is extremely sharp! It is very easy to oversize the tapered hole and this is exactly what I did on my first try reaming the hole. In the end I had to order new pivot shaft and output arm weldments. The next photo is not what you want to see. I do want to emphasize that this is not an extremely hard task to complete. Just take your time, ream the hole slowly, and do multiple fit checks.

Final Installation

Here is what the final installation build-up looks like. So as not to have excessive thread protrusion, I added an additional AN960-10 washer under the AN364 fiber lock nut. On the second try I did achieve a very tight fit with no slop in the mixer assembly. As always, this worked for me and your mileage may vary. Blue skies and safe, happy building!



Other Taper Pin Applications

Other builders have recommended installing the same taper pins in the control stick assembly to help reduce the amount of slop. Feeling slop in the control stick is not desirable and this method works well and is strong enough for the application area. The plans call for an AN4 bolt to be installed. However, when drilling circular double-wall tubing, it is difficult to achieve a perfectly round close-tolerance hole using basic shop techniques and tools. I decided to install the same size taper pins in my control sticks and I'm happy with the results. Here's a link to a discussion on Sonexbuilders.net which has some good info on this topic: http://www.sonexbuilders.net/viewtopic.php?f=3&t=396&hilit=taper+pin&start=10