

---

# THE CUB DOCTOR

## Installing New Stabilizer Liner Tubes/Stabilizers on Fabric Pipers

By Clyde Smith,

P.O. Box 721, Lock Haven, PA 17745

570.748.7975

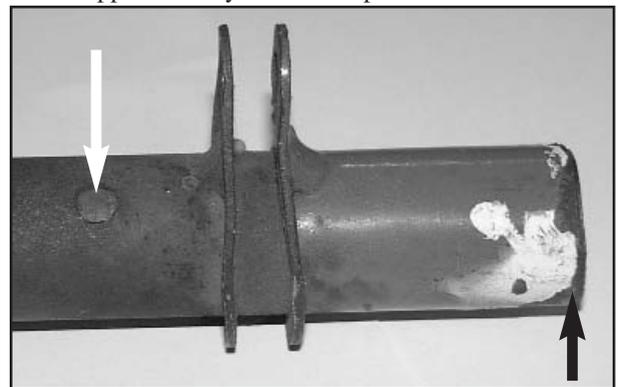
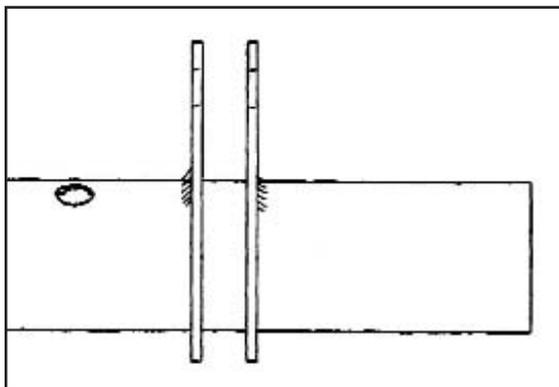
I have chosen to write in this issue about the proper procedure for installing new stabilizer liner tubes or new stabilizers on the fabric Pipers. Whenever you do a thorough rebuild or a complete museum quality restoration, I would recommend installing new front and rear stabilizer liner tubes. The old ones may be rusty or have worn or elongated holes where the bolts pass through each end. Needless to say, what stresses these members is what they have been through during their life on that particular airplane. These tubes carry the loads exerted on the horizontal tail surfaces into the tail of the fuselage frame, assisted only by the tail brace wires. Whenever you pick up the tail using the horizontal stabilizer as a handle, an uneven stress is carried by the front liner tube into the airframe, through the jackscrew, of all things. These tubes are very important and are specially fabricated, not just a standard piece of round 4130 steel stock.

First, let's get up close and personal with these two critical members. The forward liner tube is found under two part numbers. The first, or early one was Piper No. 80132-11. The later one, which is a direct replacement, was Piper No. 80132-80, (Univair No. U86062-080). The rear liner tube has a similar history. The early one is Piper No. 80132-10 and the later one and direct replacement, is Piper 86062-79, (Univair No. 86062-079). The earlier tubes were used up through the end of the 40's; the later tubes started with the PA-18 in the early 50's and continued through all the fabric models thereafter. Both these tubes are centerless ground and chrome plated. The front tube is 16" long, .940" in diameter with a wall thickness of .055". The rear tube is 8" long, .749" in diameter and a wall thickness of .045". Both the tubes are 4130 chromoly steel. Univair is the only manufacturer I know of making these parts.

Now, these tubes slide into a mating fit on components located at the tail of the fuselage frame. The front tube slides through a device called

a stabilizer attachment link. Again, we have an early and a later part number. The later link is still manufactured by Univair. The number of the earlier link was 40771-00 and the later replacement is Piper No. 14180-02 (Univair No. U14180-002). I highly recommend converting to the later replacement link. It can be identified by a bronze bushing in each end and a grease fitting on one end. This tube is larger in diameter than the earlier one and that additional space is to provide a cavity to hold grease all around the liner tube that it shrouds. The earlier link tubes had only two oil holes on the topside at either end, but would still often seize up from rust. The rear liner tube slides through the rear stabilizer attachment bracket that is welded to the upper longerons of the fuselage frame. The rear liner tube must be free to rotate through the 7 degrees of travel from the up and down movement at the front of the horizontal stabilizer. The factory provided an oil hole to lubricate the rear liner tube at each annual inspection, but that in itself wasn't quite enough, as this practice was largely forgotten or not even known about, and many a rear liner seized up due to rust, making the elevator trim system nonfunctional. Some people welded a nut over that hole, to attach a grease fitting when rebuilding their airplane, but occasionally that would obstruct the elevator travel when the upper elevator horn would make contact with the improperly located fitting.

Now for the liner tube installation. First, you will need to pre-fit the tube and mark it, so it is not recommended to put any lubricant on it at this time. Slide the front liner into the mating link until equal amounts of the liner are exposed on either end. You may mark the tube any way you desire - such as with a felt marker- and make a line around each end, or wrap tape around one side, or even install and tighten a worm clamp around one side. You want to do something so that when you install the stabilizer on the other side, it does not push the liner tube out of its centered position. You MUST have equal amounts of the liner tube installed into each stabilizer section. Now, slide the rear liner tube into its mating fitting at the tail end of the upper longerons and center this tube as you did the forward one. Again, I have done the math for you and you should have approximately 2-9/16" exposed on either side of

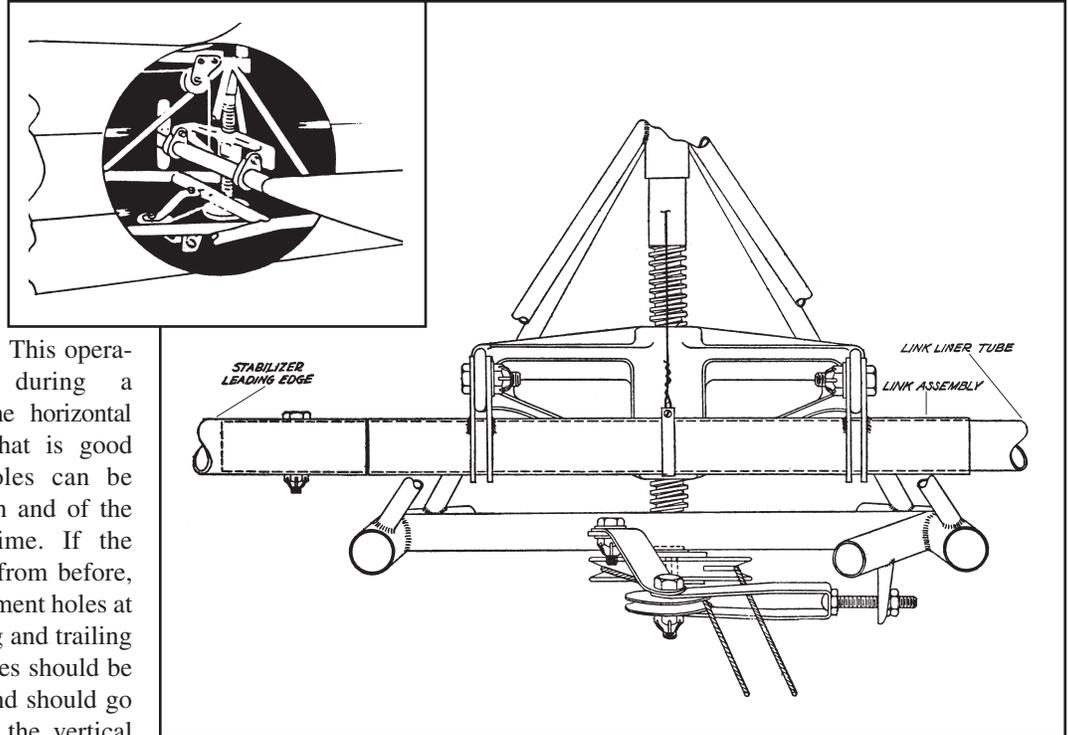


*Here is the drawing of stabilizer attachment link, #40771-00 next to an actual link that has a link liner tube, 80132-80, froze solid in the attachment link, due to rust. Also note the oil hole, on the inside of the attachment flanges. The flanges were warped when the owner unsuccessfully tried to free the liner tube. Also note that the liner tube was sawed off, so that the owner could remove the stabilizer.*

---

the welded fitting. Mark it or clamp it so you know where it should be after one of the stabilizers is installed.

Now, let's take a look at the horizontal stabilizers that will fit over these liner tube ends. The stabilizers should be uncovered, but don't necessarily have to be. This operation should be done during a "pre-cover" assembly. If the horizontal stabilizers are brand new that is good because the attachment holes can be drilled at the correct location and of the correct diameter at this time. If the stabilizers are to be re-used from before, take a close look at the attachment holes at the inboard end of the leading and trailing edge tube members. The holes should be 3/16" or .191" in diameter and should go down through the center of the vertical axis of each tube when the stabilizer is laying flat. If the holes are elongated, egg-shaped, or multiple holes have been drilled, you will have a decision to make. Take a look at the stabilizer and inspect its condition. Look for rust, pitting, damaged butt rib from beating on it with a hammer, stone dents in the leading edge tube, internal rust from water inside the outer end of the leading edge tube, misalignment of the elevator hinge ears and general overall condition. If the stabilizer passes these tests, then the worn attachment holes can either be welded shut, redressed and pre-drilled, or weld or braze an AN960-10 washer over the top and bottom of each hole. If the stabilizer is in marginal condition, then it may be best to conduct funeral services for it and proceed on with a new or serviceable part. Remember, when you cover and install this part, it should be in a condition to last at least another 30 years at best. If the holes are worn or oversized, before welding, clamp the washer in a position, that holds it closest to the vertical axis and proceed with the welding process. It is important to note that the Piper tail surface installation drawings call out that hole location to be a minimum of 1/2" and a maximum of 1" out from the end of each tube, and of course, on the vertical axis of the tube. Make sure your holes fall within this parameter. If the stabilizer is brand new with no holes, I like to pre-drill the stabilizer first. I take a steel strap or straight edge and lay it along the front and rear tubes of the stab where the holes should be. Then scuff or rub the strap enough to make a little mark on the very top tangent point of each tube. Do the same thing to the opposite side of the surface. Now, measure out a fixed dimension (I use 3/4") from the inboard end of each tube and make a mark



*This is a cleaned up copy of the illustration from the Piper Cub Service Manual. Here you can see how the stabilizer attachment link, the liner tube, and stabilizer itself assemble together with the trim yoke. The inset photo shows the assembly in the tail of the fuselage.*

where the tangent line and measured line intersect. Center punch that point all four places. Now drill through one side of each tube only with a #12 drill. That is, drill through the top of each tube at the mark, then turn the stab over and drill through the bottom of each tube at that mark. If you did your marking and measuring correctly, the holes should be perfectly vertical. DO NOT try to drill clear through the tube unless you have an elaborate fixture like the factory did. Deburr the holes and set the surface aside.

We are now ready for the last phase of this operation; that is the installation of the stabilizers. This step can be done even if the stabilizers are in a covered state, just make sure the holes meet the previous criteria that I talked about. No lubrication is necessary at this time. It makes things too messy. First, install the liner tubes and pre-position them so they are centered and marked as I previously mentioned. Install one stabilizer, let's say the left one, first by sliding the leading and trailing edge tubes over the protruding liner tubes. Push the stab on until its bottoms out against the fuselage members. Now check the exposure of the liner tubes out the right side and realign them as necessary so the previously marked dimensions are evident. Support the outer portion of the stabilizer and then drill down through the top of the forward and aft liner tube using the pre-drilled holes in the stabilizer as a guide. DO NOT attempt to drill clear through and expect to come out the bottom hole. Now drill from the bottom up on the two lower holes. I use a

---

pin or a very short cut-off AN3 bolt to lock the top holes in place so the liner tube won't try to twist inside the stabilizer tube. Once the holes are completely drilled, remove the stabilizer and the liners and clean and deburr all the new holes. I have actually pre-drilled the liner tubes inside one stabilizer using the given dimensions, and temporarily bolting them in place, without having it ever on the airplane, creating a "sub-assembly" and then installing that part into the mating fuselage fittings. However you wish to do this first operation is fine as long as you achieve the proper results. Next, with the left side in place on the fuselage, slide the right side stabilizer over the exposed liner tube ends on the right side of the fuselage frame. Make sure to hold the left side stab in some manner so that you won't push the left side back out. Both left and right stabilizer frames should be in tight against the mating attachment members already on the fuselage. Now drill down through the top holes of the front and rear stabilizer tubes through the top of the liner tubes and stop. Remove the drill, pin the holes, and drill up from the bottom through the previously drilled stabilizer holes. Remove the right stab frame from the liner tube ends, deburr the holes and blow or vacuum all metal filings from the area. It's best to vacuum the chips because then you know where they are. Blowing them around may lodge them somewhere you don't want and then when they begin to rust, you could have a problem. Now you are done with the major part of this operation. You may disassemble everything, but first I would code the liner tubes with a felt marker using maybe a "LT and RT", for the left top and right top, so you know how the liners are supposed to fit when the final assembly is done. Of course, it would be a good idea to also mark the stabilizers so you remember which one was the left one and which one was the right.

As a follow-up, DON'T turn an existing liner tube 90° and drill new holes in each end as if it were a new one. DON'T do any welding on any of the liner tubes. DON'T install a new undrilled stabilizer frame on an existing pre-drilled liner tube; it is impossible to hit the existing holes in the liner tube without elaborate jiggling. Before the final assembly of the tail

surfaces on the airplane, coat each liner tube with a thin film of grease, such as that used for motorboat trailer wheel bearings. I would also pre-coat the inside walls of the liner tubes with LPS#3 or an equivalent preservative. Also, pre-treat the inside of the stabilizer tubes with grease and some kind of preservative back into the inside portion of each tube as I had written about in a previous CUB DOCTOR article. The liner tubes aren't cheap. They are a special, very important, manufactured part. There are handling, machining and plating charges aside from the usual material cost and the profit margin for the finished PMA'd part. At this writing, the current list price for these parts is \$33 for the U86062-079 rear liner tube and \$63 for the 86062-080 front liner tube. These prices have actually come down from what they used to be. If you want to install the newer improved front link assembly, U14180-002, with the bushings and the grease fitting expect to pay \$172.53 for that part. These are Univair prices, and, at this moment, I don't know of anyone else manufacturing these parts that are PMA'd.

Finally, I have attempted to write this procedure so that EVERYONE can understand it. You may find an easier or quicker way to do some of these steps and that is okay as long as the final results turn out the same. Remember, safety is of utmost importance. If you did any structural repairs to the stabilizers or the fuselage frame, a FAA Form 337 will be necessary. Installing these parts that I have mentioned that are all PMA'd simply requires a logbook entry. Good Luck!