

PTFE Tube Stretching, Sizing, and Installation

Storing

Tubing is best kept in a relatively airtight, opaque enclosure to protect from moisture and UV rays which can degrade bonding strength. Do not expose to chlorine for same reason.

Sizing

Allow 0.1mm – 0.2mm push-rod clearance, depending on size, for pushrods up to 0.8mm diameter. Music wire benefits from minimal clearance, due to its flexibility it can use the extra support. Carbon rods should have at least 0.15mm clearance as they are stiffer, requiring less support, and rougher surfaces and high spots will cause friction with tighter fits. You do not need to have one continuous length of tubing. You can string short lengths together if you miscalculate final lengths, just be careful not to let the Ca get into the junctions. Some tape applied separately before each junction end will tend to stop the flow if you get too close.

Stretching

The PTFE tube can be reliably reduced in size by stretching. Smaller sizes can be gripped with the fingers, but clamping ends between popsicle sticks is best, with vice grips. As soon as the wood starts to crush, that's plenty. Or grab the ends with good, serrated pliers, or cyanoacrylate (CA) them between epoxy mixing sticks or such. Only a few pounds force is exerted in stretching small and medium tube, so if by yourself you can tape one end down to something stationary. Larger sizes require more secure hold-down to stretch, especially beyond 2x (see, "getting full stretch"). Room temperature should be 20 deg C minimum, but full stretch cannot always be achieved below 25 deg C. If you typically keep your house cool, the easiest room to warm is of course the kitchen. Just turn the stove burners on for a few minutes. For safety, do not shut doors or leave the room, and shut off burners (for even heating also) before going to work on stretching the tubing. Pull at a slow, steady rate of about 2cm to 10 cm per second, though do not stop pulling until the desired length is reached. Otherwise you may find the tube unwilling or more difficult to stretch further. Hold for 30 seconds at the end of the stretch, then release tension. Rebound will be about 5%, so if you stretch a 1m piece 3x (3m), you will wind up about 15cm short. Tubes usually break at the ends if overstretched. The sudden snap back will cause some waviness along the tube, but a light stretch will adequately correct this or any other kind of kink.

Resizing

This can be accomplished if ID was stretched too small, tube is out of round, or the tube as-is is just a little snug for your rod. Create a ball-draw using a rod or wire that will go through. Build up one end of it with a tiny bit of Ca, enough to form a tiny droplet, let it cure, a little kicker helps here (sand smooth if necessary). Wire requires some sanding first. When cured just pull it through, inch at a time. Alternatives include attaching a tapered bit of metal tube, 0.1mm to 0.25mm over desired ID. Anything from telescoping tube, to syringe needles. Remove any burrs after cut-off of tubing. Also knotted string/thread stiffened with CA. Ball bearings from a machine supply can be pushed through also.

Mounting Pushrods

Using a 0.05mm+ larger wire/rod dia for installation will create a straighter wall, lowering friction. This consideration is more important with carbon fibre (cf) rod for where there are significant bends. With cf rod, you can easily add a few thousandths to any section of your installation rod by coating with CA (sand smooth if necessary). If the actual cf push-rod winds up fitting snug, it can be easily sanded in that area. Lightly tape PTFE in place where necessary to make contact with the pod and boom. With a fine micro tip or pin applicator, run a small amount of CA along the entire length, allowing gravity to help. For neatness, you can stop short of the taped areas, and finish these last after removing the tape. Secure the stress areas at the ends, or any significant bends, with a glob of thick CA, or little patches of glass, etc. Remove installation wire, and you now have an essentially slop and friction free push rod guide!

Internal Pushrods

These can be accomplished with steel installation wire and little rare earth magnets to pull this assembly against inside of boom then gravity feeding CA. Tape tube ends up to prevent CA from entering.