

# Using the Pinch-off Tool



Replacement Value - The Pinch-off tool is a delicate instrument. Although it resembles stout wire-cutters, it is a hand-made precision cutting tool. Its replacement value is \$1,800.00. Please use them with care.

Background - The pinch-off tool works best on very clean, soft “bright annealed” copper tubes. The seal is formed when the tungsten dowels are pushed together with enough force to allow for P-orbital overlap. Copper atoms are pushed close enough together that a chemical bond takes place. This seal is an actual “cold weld” and will allow for longterm sample storage if done correctly.

## Instructions

Using the pinch off tool is a simple matter; assuming several rules are followed.

- 1) The weld works best when the copper tube is very clean and soft. Using fine steel wool, clean the surface at the intended weld site.
- 2) Avoid bending the tube, as this leads to work hardening, which can adversely affect the seal.
- 3) Check the tungsten dowels on the pinch off tool. They should spin freely and be clean of debris. A lubricate can be used to help in the cutting process. Clean #10 machine oil or silicon-based sprays work best. Check for free rotation by using your fingers. Carefully (avoid closing the tool on your finger) spin the dowels until you are convinced they move freely. If they do not, use a little oil to break them free.
- 4) Place the copper tube between the tungsten dowels. Be careful to center the tube so that upon flattening out there is room for the copper to expand. Also, cut the tube at 90 degrees to the long axis. This will aid in opening the seal later.
- 5) With the tube in the proper orientation, slowly and evenly push the handles together. As the tube collapse the resistance will go up. At a point when it seems difficult to push further, the tube will suddenly deform plastically and sever. This part should be done slowly to assure the best seal possible. If the tube deforms but does not sever, hold pressure on the handles for a few seconds. If this does not work, slowly release the pressure on the handles. Sometimes the copper is severed but is being held together by the tungsten dowels. As a last resort, if the tube will not “fall” apart, slowly pull the pieces apart. Any disturbance of the sealing surface could affect the seal. Having gravity pull them apart as the tube is severed is best.
- 6) A good seal is very bright, clean and sharp. Although the weld is good enough to hold against high vacuum, the seal is quite fragile. Do not touch or bump the sealed edge. To assure its protection it is best to carefully cover the tube ends with electrical tape.



