

## Suggestions for better tip-offs and more reliable units.

Tipping off units from the manifold is an important operation. Electrodes can develop cracks and leaks from improper tip-offs. These cracks may not come immediately, but can come days, weeks or months later.

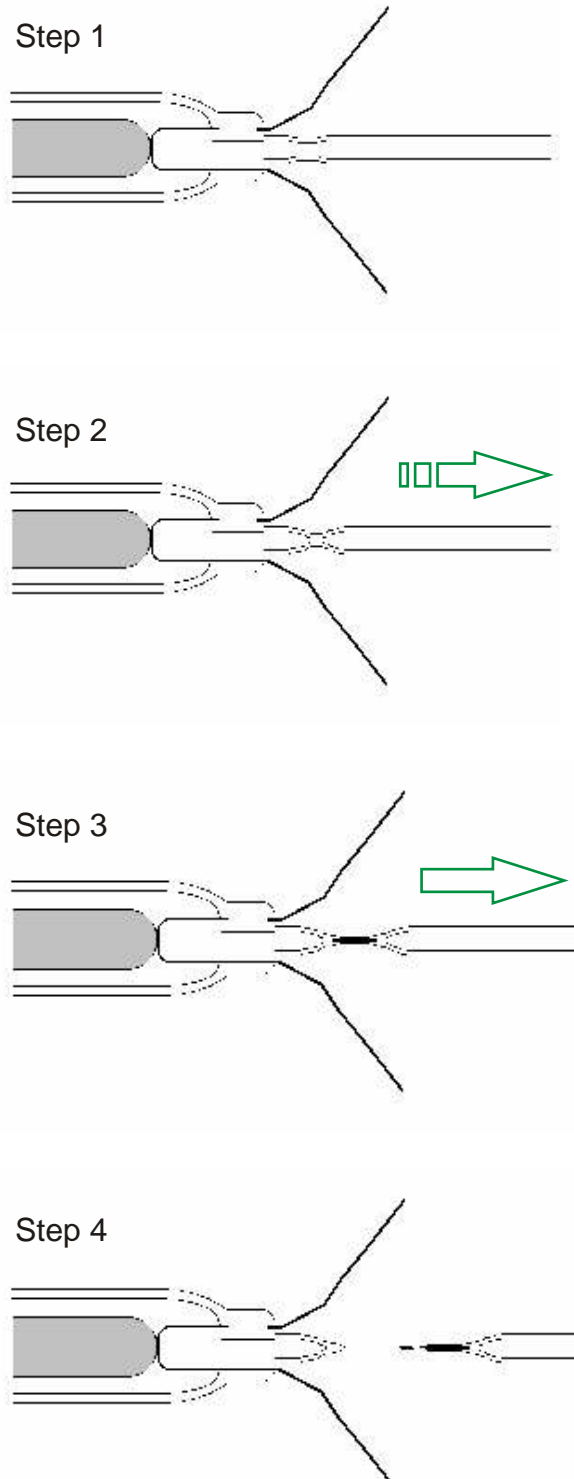
Pay attention to the shape of the remaining tubulation. Use caution so that too much glass doesn't gather on the tip of the electrode. Excessive variations in glass thickness can cause permanent stress in the tip-off during cooling.

**Step 1.** Slowly heat a focused area around the tubulation with a soft, slightly cool tipping torch. Too much or uneven heat will make the tubulation to suck too quickly and gather too much glass.

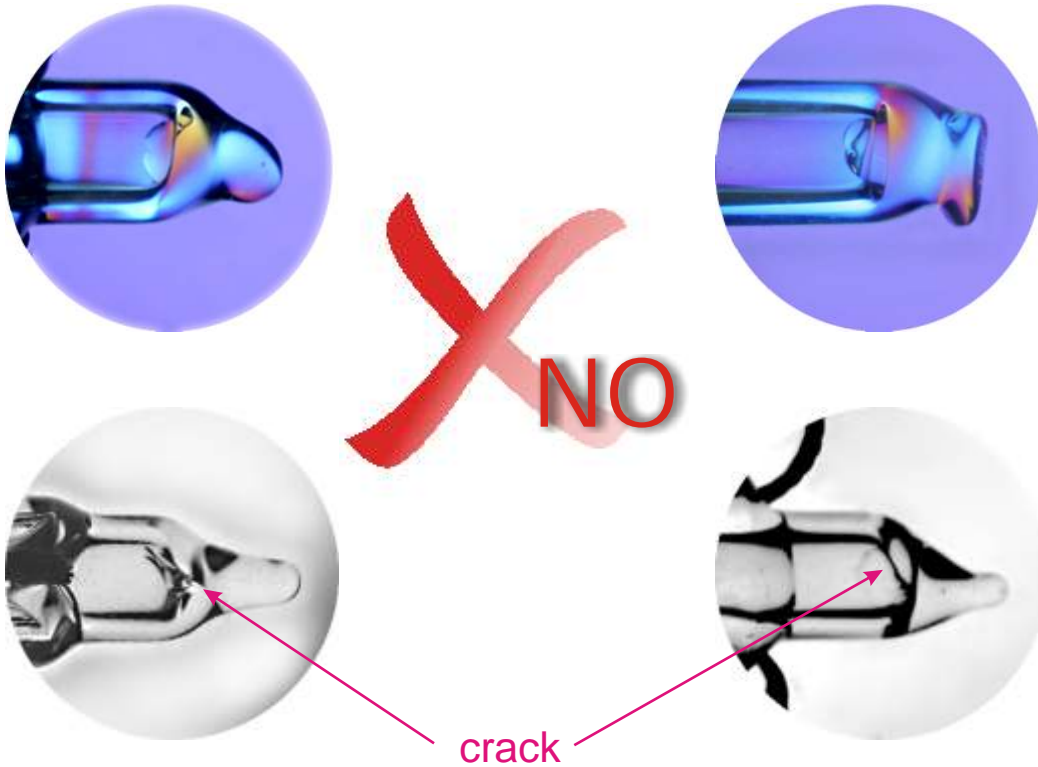
**Step 2.** Before the inner walls meet, let up on the heat and pull the tubulation to reduce the wall thickness of the glass.

**Step 3.** Continue to pull, and slowly give the reduction small amounts of even heat around the diameter of the tubulation.

**Step 4.** Gently heat the very end of the tip-off to let the glass form a strong point. Avoid too much heat, or the soft glass will be sucked in by the vacuum, creating a thick and unstable gather.



The large gather of glass below needs careful annealing. The yellow color (taken with a color polariscope) shows the areas of stress. Too much heat has been applied on the left and the tip-off has been mashed on the right.



After time the stress can cause cracks as in the pictures

For reliable units, the tip-off should look like those below. Notice that there are no yellow indications of stress under the polariscope.:

