



Small Diameter Tubing for Medical Applications

Introduction

Small diameter tubing is an in-demand product in the medical market for catheters and surgical applications. Small diameters can offer several advantages over conventional tubing or competitive technologies like steel hypotubes or glass capillaries, such as helping to keep medical devices more compact and allowing tighter flow control. However, small diameter tubing with an ID that is less than 5% of the OD and an OD of less than 0.080" is difficult to manufacture, requiring more demanding and precise control measures. Having a dedicated team of engineers during development and trials, as well as the right production staff and manufacturing infrastructure, can broaden a customer's range of solutions and help ensure the timely development of a quality component.

Small Diameter Tubing Applications and Advantages

As mentioned, small diameter tubes are those with an ID that is less than 5% of the overall tube diameter and a tube diameter that is less than 0.080". This limits the tubes to those with an ID under 0.004". Tubing with this range of sizes allows for precision flow of liquids or gases and precise volumetric dosing. The relatively thick wall can allow these tubes to sustain high pressure in some instances.

Small diameter tubing can be used to replace glass or metal, depending on design considerations. This can allow for a greater range of bonding techniques, including solvent bonding and gluing that might not be possible with glass or metal and can improve throughput or reduce complexity in assembly operations.

Small Diameter Tubing Options

Small diameter tubes can be made with a variety of materials compatible with medical device applications. Tubes have been constructed with softer materials, like flex-PVC and TPEs, for dispensing tubing that is capable of withstanding high pressures. Rigid materials like PEEK have also been used as part of device assemblies. Material selection will depend not only on device design and part performance, but also on method of assembly. Fully understanding the device function and downstream steps is critical to designing a part that will function ideally in your application.

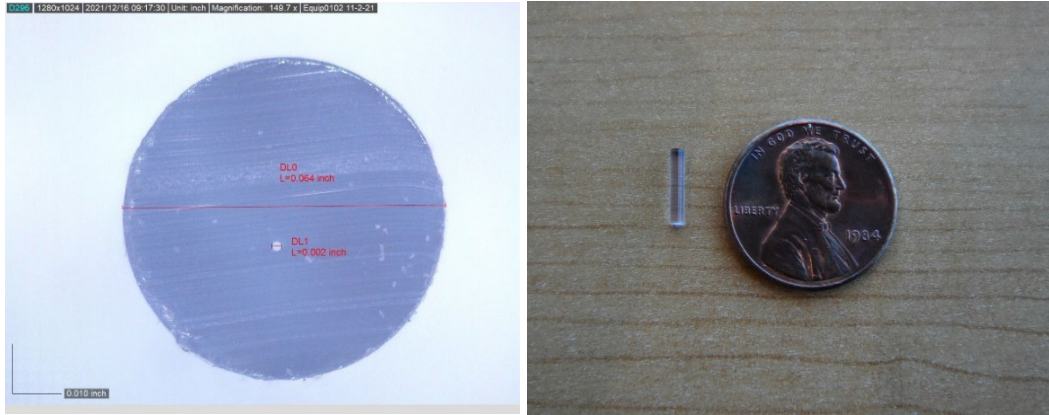
Controlling an Ultra-Small Diameter Tube with Mandrel Extrusion: An Example

One method for controlling an ultra-small ID is through mandrel extrusion.

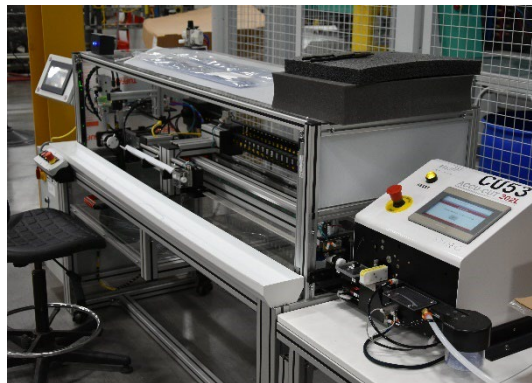
Teel had the opportunity to develop a small diameter tubing product for a unique application in the medical transducer market. The target dimensions were approximately 0.060" OD x 0.002" ID x 0.033" L with high Cpk values.

The thickness of the wall relative to the ID would be difficult to achieve with standard extrusion methods, so Teel developed a method of extruding the tubing over a wire mandrel and then extracting the wire in a separate process with automated equipment. This method would help ensure a controlled and consistent ID at the small size requested, in addition to ensuring the ID was unobstructed.

During the extrusion process, a wire is pulled through the system and coated with resin. After extrusion, the master lengths of coated wire are taken to custom-built wire extraction equipment. A cutter then pulls the plastic tubing off the wire using a defined speed and tension. As the wire is extracted, the tubing is cut to length.



Tubing product: Magnified image showing ID and image showing final size comparison



Wire extraction equipment

Conclusion

Bring your unique medical product to market by partnering with the experienced and innovative engineering team at Teel Plastics for a range of custom small diameter tubing solutions.