# PROTERIAL

# Our Promise

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**Proterial** produces world-class, high-performance materials for data communications, medical device component manufacturing, and automotive products.

Since 1910, we've brought together specialists of all kinds to improve our skills and technologies, reflecting our commitment to achieve the best possible quality in everything we do. Moving forward, we'll continue to elevate both our products and the processes and people that define them.

Only by conducting all our activities with unfaltering integrity can we meet the expectations and trust of the communities we serve. By creating new and ongoing value, we'll help customers realize innovation and contribute to a sustainable society.

With our **professional** determination, **progressive** intent, and **proactive** approach, we'll strive unceasingly to provide exceptional materials that pave the way to a brighter future.

 

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# Secondary Operations & Machining Capabilities

July 2023

# Trimming Machines

**Ways of cutting tubes for a variety of reasons from holding tight tolerances to just cleaning up rough extruded ends. The trimming method will depend on the size and material of the tube, what the customer is requesting for cut quality, and the typical order size.**

**Automated cutting machine** that easily and accurately turns one long extrusion into small final lengths. The machine has numerous options built in and interchangeable tooling that allows for precision cutting of most materials and is capable of processing sizes Ø0.010 to Ø0.500 inch and lengths as short as 0.020 inch. This machine can process a 4-foot-long extrusion down to 120 short pieces in about a minute with the right materials.

**Manual trimming machine** used to clean up the ends or trim a product to its final length. An operator must push down a foot pedal for the blade to extend. This machine is capable of processing tubes up to Ø0.500 inch. It has interchangeable bushings to hold the tube securely in place and there are multiple extension tracks that can be assembled to trim almost any length. Plastic bushings are made in house to fit almost any diameter. Custom shapes can be made.

**Manual trimming** is also used to clean up the ends or trim a product to its final length. The operator moves the slide to cut the tube(s). This device is designed to cut up to 8 tubes at a time by laying each one in its own groove. Interchangeable inserts mean this device is capable processing tubes up to Ø0.25 inch. There are multiple extensions that can be assembled to trim almost any length. Metal Inserts are made in house to fit almost any diameter. Custom inserts and extension can also be made to fit different assemblies.

**Additionally**, we can create manual slits or angled cuts in tubes with the use of other custom fixtures. Some examples include slitting a tipped tube, cutting an external lumen off, or splitting a multi-lumen tube.

# Samples of Trimmed Tubing

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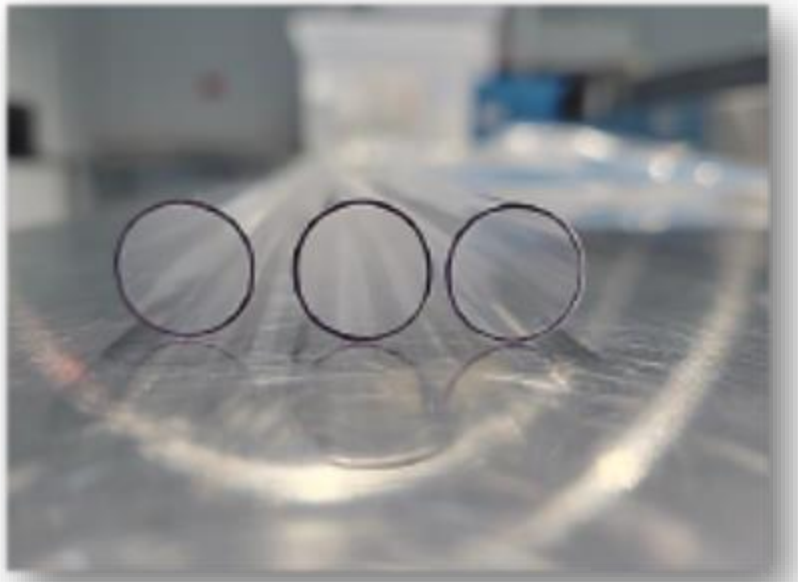

# Heating Machines

Any machine that uses heat to change the shape of an extruded tube. Most used for tipping or flaring one end of an extrusion but also used for bonding two tubes together, forming the tube into a custom shape, and laminating or reflowing one material on top of another to create a multi-layered tube.

We use a **machines** that use a combination of heat and pressure applied by the grips to form the tube into its desired shape. Capable of processing tubes from approximately Ø0.039 to Ø0.325 inch with a tip or flare length dependent on the custom tooling. Based on the die and mandrel design and can produce open or closed tipped tubes in a variety of shapes with the capability of bonding two similar sized tubes together as a butt weld. We also use an open nozzle to heat the tube and/or tooling so that the tube can be manipulated into its desired shape.

Other **manual heat forming methods** include using an annealing oven or a heat tunnel from extrusion along with either a die, a mandrel, or a combination of the two in order to form tubes into their desired shape.

# Samples of Flared Tubes & Luers

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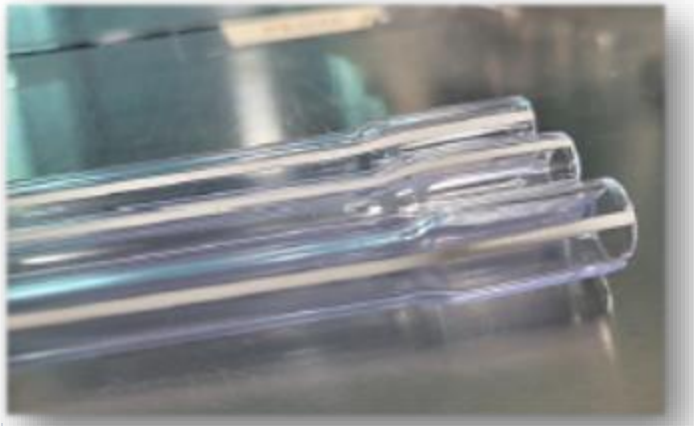

ID from Ø.247” to Ø.370” over 01.0” with consistent wall

OD change from Ø.122” to Ø.174” over 0.4” with consistent wall

Luer with OD change from Ø.144” to Ø.196” over 0.065” with consistent wall

ID change from Ø.012” to Ø.040” over 0.150” with consistent OD

Braided purple Grillamid and Pebax 6333 tube butt welded to white Pebax 3533 tip

Vestamid Care ML94 and Pebax 4033 triple lumen tubes butt welded together

10mm long tube bonded inside longer tube

# Samples of Formed &Laminated Tubes

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Tube Shaped with RF heating machine

Braided tube formed into a hook using an annealing oven

These two photos show one continuous tube. The core is nylon with metal braid covered with Pebax in varying durometers (7233, 6533, 5533, and 4533) to naturally give the tube different bend radii along the tube.

# Punching and Drilling Machines

**Any machine that uses bits to create holes in an extruded tube.**

We have **two machines** capable of drilling and punching holes into tubes. Drilling creates a circular hole by spinning a circular hollow drill bit and drilling into the tube. Punching uses bits that just punch into the tube without rotation to form the holes. Punch bits can come in a variety of simple shapes (ovals, semi-circles, etc.) and all bits come in a variety of sizes. Sacrificial mandrels must be used for most materials in order to support the ID of the tube during the process.

Catheter guides are typically made in house as needed and custom shapes are possible. Sacrificial mandrels are typically extruded in house.

# Samples of Drilled and Punched Tubes

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Four Ø.20” drilled holes in a line

One Ø.118” drilled hole

Nine .236”x.122” semi-circle punched holes spaced around the tube

Thirteen .105”x.026” oval punched holes placed into specific lumens

# Assembly Methods

Any method used to assemble purchased components onto an extruded tube. Typical methods are adhesive or glue, solvent bonds, press fit, or screwed into place. Some components, like clamps, can just be slid onto a tube, usually accompanied by a luer and/or molded hub to keep the clamp on the tube.

One method we use is **UV glue application and curing**. Glue can be applied with a few different methods, depending on the glue in question. We have glue applicators that use a spring-loaded bushing to apply glue to the outside of an extrusion. We can also use glue in syringes that we then apply to the tubes manually. Both methods of glue application then typically requires the glue to be cured with UV light.

We also have **solvent dispensers** which are used to apply a solvent to the outside of the tubes. When the tube is then slid inside the luer or other connector in the assembly, the solvent works to break down the surface molecules of both materials, mix them together, and create a permanent seal as the solvent evaporates. (Solvent bonding will only work with two compatible materials.)

Other typical methods of assembly are simple **press fit designs**. In most cases, this involves a taper or a luer with ribs to facilitate a proper hold. Press fit designs typically have a lower tensile strength than designs held together with solvent or glue.

Other luers are a two-part system that gets **threaded** together while holding part of the tube in between the two components.

# Samples of Assembled Tubes

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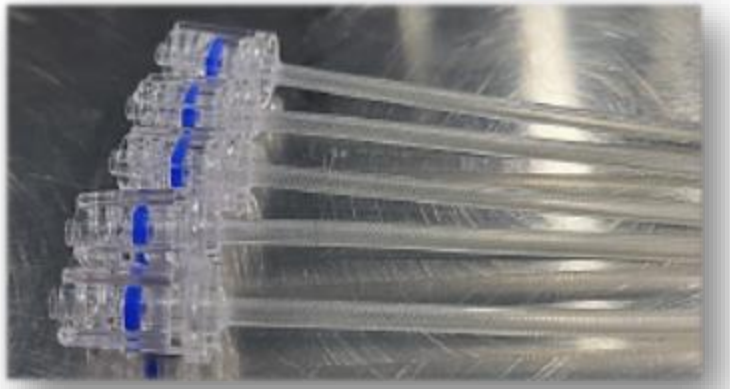
Pressfit luer into tube ID (no adhesive used)



Luer and tube glued together with UV Adhesive, applied with applicator bushing

Luer and tube are solvent bonded together

Luer and tube glued together with UV Adhesive, applied with syringe

# Printing Machines

**Machines used to apply ink to extruded tubes by transferring ink from an etched cliché to the tube via pad. Ink can be applied to one side as a stamp print or to the entire circumference of a tube with a roll print.**

We currently has **4 different printers**. Their basic function is to transfer ink from an etched cliché with the desired artwork to a print pad to the tubes. Cliches are fully customizable. We can process tubes with artwork up to 850mm long (tubes can be longer) in a single print. We are capable of just a single stamp print or a 360°roll print around the entire tube.

The **pretreatment** machine used to temporarily change the surface energy of plastic tubes in order to improve adhesion of some inks. This process is not necessary for all products; it is dependent on the tube material and ink type.

The **post treatment** machine to heat tubes after they have been printed on. Some inks require heat in order to completely cure. Tubes are sent under a heat source on a conveyor belt before they are transferred to trays or tables to complete their curing process.

# Samples of Printed Products

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# Molding Machines

**The shaping of rubber or plastic articles by injecting heated material into a mold.**

Our **injection molding machine** is used to inject melted resin into a mold cavity to produce a part. Material is fed into a heated barrel, mixed using a helical screw, and then injected into the cavity. Important parameters to consider are barrel temperatures, injection speed, injection pressure, and holding pressure.

Resin can be injected into an empty cavity or around other components as an **overmold**. Molded parts can have holes through the center by using metal corepins.

# Samples of Printed Products

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Molded PICC junctions in single, dual, and triple configurations

Molded Midline junctions in single and dual configurations

Molded Luers

Strain reliefs molded over metal ferrules for cable assembly

# Testing Capabilities

We have a machine used to test assemblies for any potential **leaks**. Luers or tubes are placed into the ports on the machine while the other end of the assembly is clamped shut. Then each port is individually pressurized (pressure and test time are dictated by the customer).

**Occlusion** testing machine used to test assemblies for occlusions. Assemblies are placed against the ports on the machine while the other end of the assembly is left open. Then each tube is individually pressurized to determine the flow rate through the assembly (pressure and flow rate are dictated by the customer).

**X-ray machine** used to view the internal geometry of parts without damaging the part. Some customers require 100% visual inspection with this machine while other times it is used for troubleshooting a process. While the x-ray machine is on, the image will be displayed on the computer screen. Photos can be saved as reference as needed.