

# Versatility™ Universal Handle

Get A Handle On Your Catheter, FAST

## Fast-Track Development

**Whether you're developing a steerable device, catheter, or sheath, Nordson MEDICAL can handle it.**

The Versatility Universal Handle platform shaves months off your product development timeline, at a fraction of the cost of conventional development. (See reverse for a comparison of time and cost.) The Versatility handle eliminates the need to design and tool a handle in-house, allowing teams to test concepts faster and focus their efforts on developing the clinical potential of their device.

## Versatile Design

The Versatility handle platform can accommodate shafts up to 24 Fr. The universal design features ready-made molded components you can easily configure for a variety of applications and functionalities, including:



① **Articulation:**

Unidirectional, bidirectional, or multiplanar

② **Translation:**

Precise advancement/retraction

③ **Rotation:**

Precise angular positioning

## Proven Functionality

With the Versatility handle, we've worked out the kinks, so you don't have to. You get a sleek, robust handle with high-fidelity molded parts and proven functionality that will lend credibility to your prototype with the look of a finished product.

# Versatility™ Universal Handle

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## Order Online or Go Semicustom

You can leverage the Versatility handle platform in two ways:

Order a Versatility handle kit from our Online Store and add components to build your own device prototype

Work with Nordson MEDICAL to create a semicustom device prototype using Versatility and a shaft built to your specifications

### Options for Every Team's Needs

HANDLE TYPE	SHAFT SIZES	MOTION	AVAILABILITY
<b>Versatility™ Universal Handle Kit*</b>	0-10 Fr with your device	1 or 2 motions: choose from articulation, translation, or rotation	Ships in as little as 24 hours
<b>Versatility™ Mini Universal Handle Kit*</b>	0-24 Fr with your device	Steerable unidirectional or bidirectional catheter handle	Ships in as little as 24 hours
<b>Design Your Own Steerable Sheath</b>	0-24 Fr with shaft built to your specifications, including custom reinforced shafts	1 or 2 motions: choose from articulation, translation, or rotation	Available in as little as 2 weeks

\*Assembly required. Kit includes handle components only. Shaft and other components available separately.

## CASE STUDY | STARTUP GETS JUMP-START WITH NORDSON

A cardiovascular startup company used the Versatility handle and additional Nordson MEDICAL components to develop a steerable device for an embolic protection application.

Leveraging the Versatility handle and Vention's advanced components saved more than \$75,000 and shaved 9 weeks off the schedule for a critical development milestone.

#### Development Milestone:

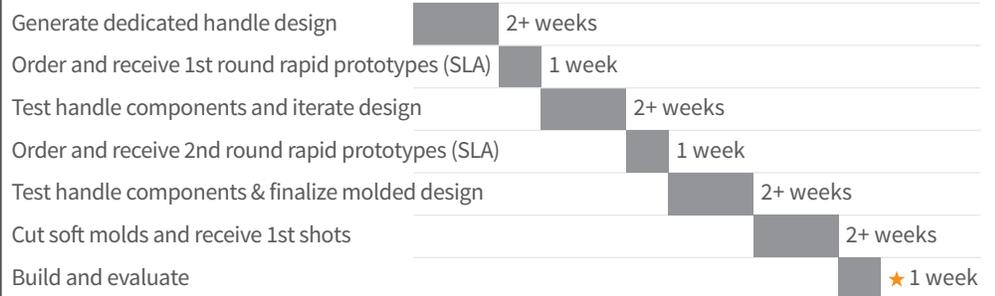
High-fidelity prototype with proven molded handle

\* Costs include braided shaft development by Nordson MEDICAL. Development times and costs may vary based on application.

### Time and Cost Comparison

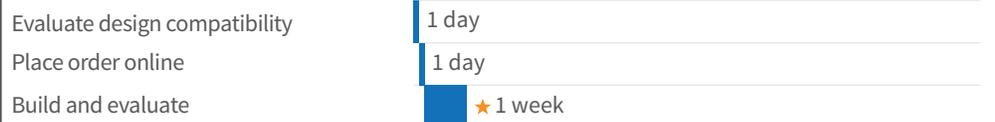
#### Conventional Development

Device development without Versatility™ handle. Minimum 11 weeks and \$87K



#### Development leveraging Versatility™ handle\*

<2 weeks and \$12K



MAR-Versatility-DS-02

# Medical Tubing

Capabilities



Balloons



Co-Extrusions



Dual/Variable Flex



Microbore



Multi-Layer



Multi-Lumen



Over the Wire



Para-Tubing



Profile



Rod/Beading



Single-Lumen



Striping



Tapered or Bumped

## Secondary Operations

- Assembly
- Bonding
- Braiding or Braid Wire Reinforcement
- Coating
- Coiling or Coil Wire Reinforcement
- Cutting
- Flaring
- Forming
- Insert Molding
- Laminating
- Laser Drilling
- Multi Durometer
- Multi Segment
- Overmolding
- Printing
- Punching
- Shaping
- Skiving
- Stretching
- Swaging
- Tipping

## Typical Materials

- Aesno (Nylon 12) (including finished catheter & balloon catheter manufacturing)
- Besno (Nylon 11)
- Braid - Aramid Fibers
- Braid - Round or SS Flat Wire
- Ethylene Vinyl Acetate (EVA)
- Fluoropolymer
- Fluoropolymer Composite (PTFE-Composite)
- Grilamid® (Nylon 12)
- Nanofiber Composite
- NEOFロン™
- Pebax® (EverGlide®)
- Pebax® (Mobilize)
- Pebax® (PEBASlide)
- Pebax® (ProPell S™)
- Polyetheretherketone (PEEK)
- Pellethane® (Polyurethane)
- Polyester Terephthalate (PET)
- Polyamide (Ny 6 or Ny66) (PA6, PA66, N6, N66)
- Polycarbonate (PC)
- Polyimide (PI)
- Polyolefin (TPO)
- Polyphenylsulfone (PPSU)
- Polypropylene (PP)
- Polyurethane (PU)
- Polyacetal (POM)
- Polytetrafluoroethylene (PTFE)
- Polyurethane TP\* (PU TP)
- Tecoflex® (Polyurethane)
- Texin® (TPE)
- Thermoplastic Elastomer (TPE)\*
- Vestamid® (Nylon 12)

# Medical Tubing

Capabilities

As the leading industry expert for a wide range of medical tubing, Nordson MEDICAL offers a broad range of specialty tubing for the most unique and difficult applications. Nordson MEDICAL offers world class tolerances with industry leading process capabilities\*:

- >1.5cpk
- IDs as small as .004”
- Walls as thin as .00025”
- ODs as large as .5”

\*Some capabilities are material dependent

Standard off-the-shelf tubing is available for delivery in as little as one day. Visit our Online Store for thousands of components and technologies in stock and ready to ship. Non-standard offerings are available in as little as two weeks.

We can provide a full range of solutions from quick turn prototyping to high volume production.

We will strategically partner with you to understand your needs and find the best solution.

With over 25 years of experience, our quality is unparalleled. All facilities are ISO certified.

## Want to Customize Your Extrusion?

To complement our extensive tubing offerings, Nordson MEDICAL also provides expertise in design, engineering, and manufacturing. With the ability to manufacture a full range of medical tubing, we can bring your idea to life by providing flexible solutions to fit every design team's budget and timeline:

### ProtoExtrusion™ Online Design Tool

Select from a wide range of options and get a custom, single-lumen extrusion made to your specifications shipped in as little as 1 week.

### Design Your Own Extrusion

If you need customization beyond our standard specs, request a quote for a fully-custom extrusion.

MAR-MedTub-DS-02

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# Polyimide Tubing

Capabilities

## **Polyimide is a thermoset tubing material. Polyimide tubing features:**

- Very thin wall thickness
- Tight-tolerance inner and outer diameters
- Outstanding electrical insulation properties
- Stiffness and column strength as required
- Ability to withstand very high temperatures

## **Polyimide tubing is ideal for medical device applications including:**

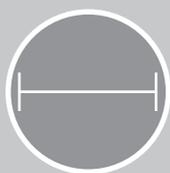
- Cardiovascular, peripheral, and neurological catheters
- Urological retrieval devices
- Electrical insulation
- Fiber optics
- Intravascular drug delivery
- Gastrointestinal devices



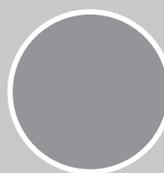
## **READY-TO-SHIP TUBING SPEEDS PRODUCT DEVELOPMENT & SAVES COSTS**

Our online offering of polyimide tubing helps you speed product development timelines by avoiding the wait for price quotes and long lead times. You have quick and easy access to a full range of polyimide tubing products available for immediate shipment, with non-stock items delivered in as little as two weeks. And with very low minimum orders, you save costs by ordering only what you need.

## **Polyimide tubing is available online in more than 250 configurations:**



**INNER DIAMETER (ID) RANGE:**  
0.004" - 0.080" (in 0.001" increments)



**WALL THICKNESSES:**  
thin and ultra thin

**GO TO OUR ONLINE STORE TO ORDER YOUR TUBING TODAY.**



## Additional Capabilities

### Custom Polyimide Tubing

We offer a wide range of polyimide tubing, manufactured to your specifications:

- ID range: 0.004" - 0.085"
- Wall thickness range: 0.0005" - 0.010"
- Available in amber, red, yellow, black, and green
- Quick turn: available in as little as 2 weeks

### Braid-Reinforced Tubing

Braided tubing adds the strength of stainless steel or other materials, for:

- Excellent torque at higher pick counts
- Improved hoop strength
- Improved tensile strength at lower pick counts

### Custom Composite Tubing

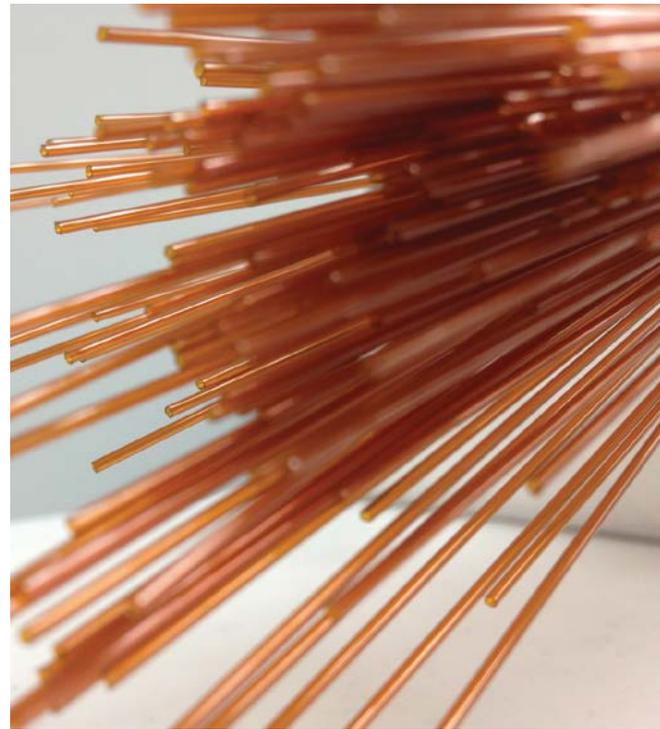
Composite tubing comprises multiple polymers that can be blended, braided, or layered to provide performance characteristics including:

- Low-friction layer inside or outside
- Fusible thermoplastic outer layer
- Improved kink radius
- Excellent torque when braided

We offer more than 80 layer combinations, with multiple materials including PTFE, Nylon, PEBAX®, Polyurethane, and Polyimide, as well as braiding.

### Precision Wire Coatings

We can insulate any wire material with polyimide to give high dielectric strength with precision tolerances.



**Nordson MEDICAL is an industry leader in medical tubing, offering single-lumen, multi-lumen, coextruded, polyimide, composite, multi-layer, braided, and coil-reinforced tubing.**

MAR-Polyimide-DS-02

## Catheters, Sheaths & Specialized Medical Tubing

Nordson MEDICAL offers polymer science, unique engineering technology, and innovation to provide new and distinctive custom catheter solutions for medical device companies. Nordson MEDICAL's polymer solution casting is an additive manufacturing process that results in unique and specialized designs unobtainable by extrusion technology. Polymer solution casting can achieve both flexibility and pushability along a catheter shaft by utilizing liquid polymer layers to encapsulate multiple components and reinforcements such as braids, coils, and hypotubes. This technology lends itself to varying wall thicknesses and diameters along the length of a device in a single piece construction while maintaining tight tolerances and without compromising product quality, features, and functionality.



### Multitude of Product Options and Capabilities

#### Shapes:

- Single- and multi-lumen
- Complex geometric designs

#### Embedded Reinforcement/Features:

- Coiling and braiding (flat, round wire)
- Hypotubes
- Malleable and laser-cut wires
- Radiopaque/imaging targets (marker bands, tantalum dots)
- Medical-grade stainless steel or nitinol

#### Tubing/Shaft Features:

- Kink resistant
- Column strength
- Varying durometer or wall thickness along the length
- Lubricious inner and/or outer surface compatible with PTFE liners

#### Single-Piece Construction:

- Varying wall or diameter
- Tapered tubing
- Material variety and combinations for localized requirements

#### Hubs, Luers, Caps, and Connectors:

- Custom or standard colors
- Hub bonding

#### Materials:

- Polyurethane
- Polyvinyl chloride
- Silicone urethane copolymers
- Custom formulations, compounds, and blends

#### Secondary Operations:

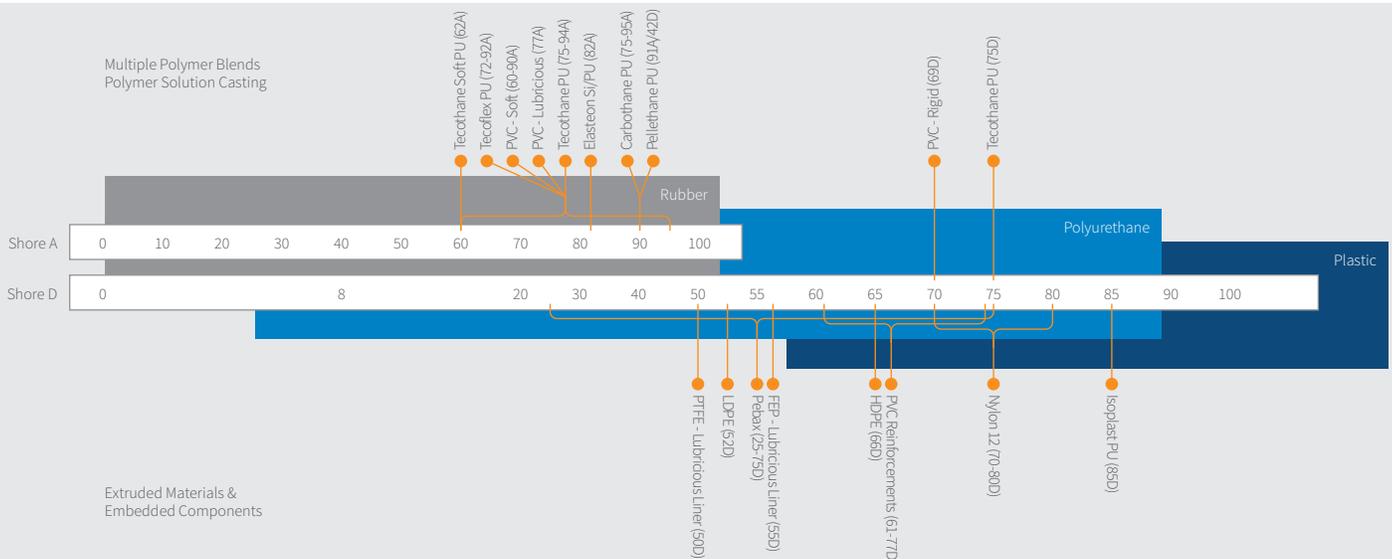
- Pad printing
- Tipping
- Skiving
- Hold punching
- Bending
- Forming
- Bonding
- Custom branding
- Packaging
- Labeling

## Manufacturing Excellence

Nordson MEDICAL offers manufacturing and assembly options for medical device manufacturers to assist with production resource management such as cost reductions, line extensions, and large-scale commercial production releases.

### Markets Served

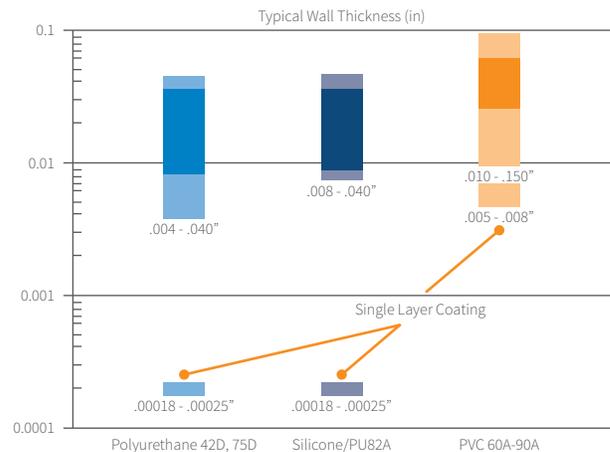
- Bariatrics/Obesity
- Cardiology/Vascular
- Cardiovascular
- Endoscopy
- Extracorporeal Life Support
- Neurovascular
- Oncology
- Peripheral Vascular
- Pulmonary/Respiratory
- Structural Heart & Valve Therapy
- Vascular
- And more



### Sophisticated Engineering

We'll assist in identifying critical specifications, selecting appropriate materials for your application, reviewing your specifications to take advantage of our polymer solution casting capabilities, and implementing any test methods to support your medical device needs.

- Testing services include: mechanical properties, chemistry, bench testing, and material properties
- Rapid prototyping with on-site production capabilities
- On-site tooling and fixturing capabilities



MAR-PolymerSolutionCasting-DS-01

# Fluoropolymer(FEP)

Heat Shrink Tubing

## Processed with Traditional Extrusion Equipment

Nordson MEDICAL's fluoropolymer tubing leverages a proprietary compounding/blending process to provide custom color and radiopaque fillers while maintaining excellent quality. From pellet to product, we process an array of fluoropolymer materials including FEP, PFA, PCTFE, ETFE, PVDF, ECTFE, and EFEP. We are one of the few companies in the world with expertise across all of these raw materials.



### Features and Benefits

- **Fluoropolymer Tubing Options:**
  - Single-lumen tubing
  - Multi-lumen/profile extrusions
  - Radiopaque tubing
  - FEP heat shrink tubing
- **Device Components:**
  - Etched liners
  - Tubing for packaging
- **Value-Added Features:**
  - OD etching for outer jacket bonding
  - Dip etching for easy hub attachment
  - Atraumatic taper and radius tips
  - Flanging and flaring
  - Notching and drilling
  - Welding

### Specifications

- **Materials:**
  - FEP
  - PFA
  - PCTFE
  - ETFE
  - PVDF
  - ECTFE
  - EFEP

### FEP Heat Shrink Tubing

Nordson MEDICAL engineers around optimal functionality. Our FEP heat shrink tubing is tailored to your exact requirements through custom sizing, colors, and shrink ratios.

- Custom colors
- Various packaging applications
- Ideal for strain relief applications
- Fluoropolymer heat shrink
  - Chemically inert
  - Surface etching available
- Recovered heat shrink can be sterilized with gas (EtO) or steam (autoclave)
- Minimum expanded ID: custom-sized to fit over application OD
- Maximum recovered ID: custom-sized to shrink below application OD
- Approximate FEP Melt Recovery Temperatures: 425°F (218°C)
- Custom shrink ratios up to 1.8:1

MAR-FEP-Heat-Shrink-Tubing-DS-01

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# Polyester(PET)

Heat Shrink Tubing

## The World's Thinnest, Smallest, & Strongest Heat Shrink Tubing

Nordson MEDICAL's polyester (PET) heat shrink tubing is ultra-thin-walled, high-strength, optically clear or pigmented and heat shrinkable. This technology was developed specifically for the medical device industry, and has been at the leading edge of medical device tubing since its creation.

### PET Heat Shrink Tubing is an extremely unique material with impressive characteristics including:

- Ultra-thin wall, ultra-high strength, and high dielectric strength
- Can be recovered at relatively low temperatures
- Axial shrinkage pulls components together
- Can be transformed into custom parts by drawing/shrinking onto a shaped mandrel (conical, square, triangular, etc.)
- Can be "heat-set" so that it is stable up to a prescribed temperature
- Can be printed for shaft marking/indicating

### Applications

- Braid termination
- Insulation
- Encapsulation, bundling, and strain relief
- Masking for coating procedures
- Micro-hose clamps
- Tube joining (variable stiffness catheters)
- Balloon bonding
- Shaft lamination
- Tipping
- General reflow (RX ports, braided shaft lamination, etc.)



# Processing Guidelines

Heat Shrink Tubing

## SIZING

- Diameter range: 0.006" – 1.5" (0.15 – 38.1 mm)
- Wall thickness range: 0.0001" – 0.004" (0.0025 – 0.10 mm)
- Tight fit is best: 15% gap or less\*
- Shrink ratios: 1.1:1 up to 3:1\*\*

## REFLOW SETTINGS

- Material shrink temp range: 185°F to 374°F (85°C to 190°C)
- Material melt temp: 473°F (245°C)
- Recommended hot box range: 300°F to 450°F (149°C to 232°C)

## MATERIAL COMPATIBILITY

PET releases easily from most common thermoplastics. However, some low-durometer urethanes tend to tack to the PET and may require a resting period (~1hr) or may not be compatible. Run test samples with these materials

\*NOTE: PET should be sized no larger than 15% above the maximum diameter of your part. Recommended approach is to use a heat shrink tube with a minimum expanded ID that just clears the maximum diameter of your part.

\*\*NOTE: Recovery >20% can be achieved by drawing or holding the ends of the heat shrink as it is heated.

## Additional Mechanical/Electrical Properties of PET

- Very high tensile strength (>20,000 PSI)
- One of the highest dielectric strength ratings of any thermoplastic material (>4,000 V/mil (60Hz))
- Extremely smooth surface finish of ID transfers to processes components
- Available in a wide range of colors including clear, white, black, green, orange, purple, yellow, transparent, and any other custom colors
- Can be bonded using a wide range of adhesives (surface treatment recommended: plasma etching, corona treating, or mechanical roughening)
- Can be sterilized using ethylene oxide, gamma radiation, e-beam, or autoclaving (repeat autoclaving is not recommended)
- Meets USP Class VI and ISO 10993 requirements

MAR-PET-Heat-Shrink-Tubing-DS-01

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# PTFE Tubing

Ram Extruded

## World-Leading Manufacturer

Choose Nordson MEDICAL, and choose one of the world's leading manufacturers of custom PTFE tubing for the medical industry. Ram extruded PTFE tubing is an ideal material choice for medical device applications that require maximum surface lubricity, high chemical and thermal resistance, and/or exact extrusion tolerances.

We offer a wide range of chemically inert PTFE tubing that delivers excellent dielectric insulation properties, a working temperature range of 500°F to -400°F, and high thermal resistance. Our custom PTFE extrusion capabilities include:

- Custom profiles and monofilament
- Custom multi-lumen: 2 - 6 lumens
- Micro-bore: 0.002" - 0.020" (0.051 mm - 0.51 mm) IDs
- Thin wall: 0.021" - 0.300" (0.52 mm - 7.62 mm) IDs; walls from 0.001" (0.025 mm)
- Radiopaque fillers
- Inline and dip etching



### Tubing Options

- Single-lumen tubing
- Multi-lumen/profile extrusions
- Thin-wall & micro-bore tubing
- Radiopaque tubing
- Splittable tubing
- Etched liners

### Performance Specifications

- Upper Service Temperature: 500°F/260°C
- Melting Point: 635°F - 650°F/327°C
- Tensile Strength: 2500 - 4000 psi
- Specific Gravity: 2.13 - 2.24
- Coefficient of Friction: 0.08

### Device Components

- Tear-away/splittable sheath
- Filled PTFE
  - Custom colors
  - Radiopaque fillers
- Etched PTFE liner
  - Micro-bore/thin-wall/over-wire
- Tubing for packaging or stent crimping/assembly

MAR-PTFE-Tubing-Ram-Extruded-DS-01

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## Etched PTFE Liners on Mandrels

When your catheter assembly needs a lubricious inner layer, a PTFE liner is the ideal choice. But not all PTFE liner tubing is the same. We supply etched PTFE liners on solid, silver-plated, copper-core mandrels, which give you these advantages:

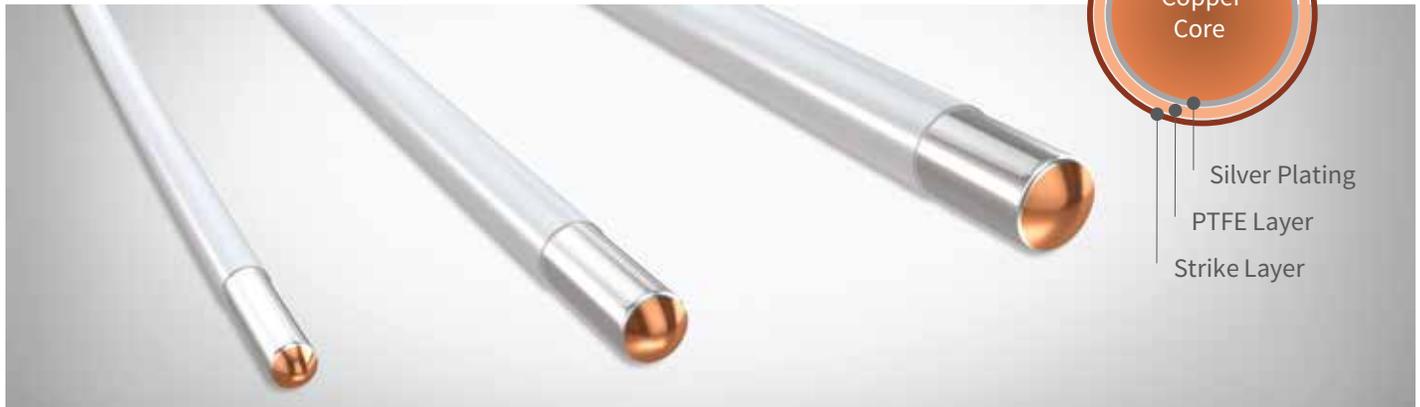
- Thinner walls

Our PTFE liners on mandrels are fabricated with a film-cast process similar to what we use for our polyimide tubing. Ultrathin liner tubing (as thin as 0.0005” or 0.0127 mm) allows you to design thinner catheter walls.

- Time savings

Sourcing PTFE liners on mandrels means you don’t have to stretch the liner onto another mandrel. This streamlines the assembly process and also allows you to:

- Maintain precise IDs
- Reduce risk of adhesion issues



## Strike Layer Boosts Adhesion

Our PTFE liners on mandrels can be fabricated with a microthin thermoplastic outer layer to enhance adhesion. This “strike layer” adds up to 60% more bond strength between the etched PTFE surface and the catheter assembly. Strike layers as thin as 0.0003” (0.0076 mm) are available in a wide range of thermoplastic materials, including:

- Nylon (11 and 12)
- Pebax® (55D, 70D and 72D)
- Polyurethane (Tecoflex®)

## Stock and Custom Options

Need liner tubing fast? We offer select configurations of etched PTFE liners on mandrels in our Online Store, in stock and ready to ship within 24 hours. A full range of options is available on a custom basis. Contact us to discuss your PTFE liner needs.

### Properties of PTFE

PTFE (polytetrafluoroethylene) has the lowest coefficient of friction of any polymer, making it a popular choice for catheter applications that require lubricity. It also features:

- Temperature and chemical resistance
- Biocompatibility
- Precise tolerances
- High dielectric strength
- Excellent insulative properties

### PTFE Liner Tubing Specifications

Inner Diameter (ID) Range	0.014”–0.096” (0.356 mm–2.438 mm)
Outer Diameter (OD) Range	0.015”–0.099” (0.381 mm–2.515 mm)
Wall Thickness	0.0005”–0.003” (0.0127 mm–0.0762 mm)
Length	Custom cut or continuous-spoiled lengths also available
Strike Layer Thickness	As thin as 0.0003” (0.0076 mm)
Strike Layer Materials	Nylon (11 and 12) Pebax <sup>®</sup> (55D, 70D and 72D) Polyurethane (Tecoflex <sup>®</sup> )

MAR-PTFE-Tubing-Film-Cast-Liner-DS-01