Insulated Medical Wire and Micro-Diameter Tubing

Film-Insulated, Fine Wire
Coated Mandrel Wire
Micro-Diameter Tubing:
- Polyimide
- Hybrid
- Conductor Embedded
Your Great Ideas + Our Comprehensive Capabilities = Innovative Solutions

Film-Insulated, Fine Wire
Teleflex Medical OEM manufactures a full line of insulated and uninsulated wire products. Customer uses include:
- Electrophysiology
- Peripheral vascular
- Pain management
- Urology
- Cardiology
- Neurology
- Endoscopy
- Laparoscopy

Metal Types and Constructions
- Copper/copper alloys, stainless steel, nickel/copper
- Alloy 400, copper clad steel, copper clad stainless steel, titanium, nitinol, silver, constantan, CS95, DFT®, and nickel/nickel alloys
- Environmentally friendly copper alloys: HPC-35EF® and HPC-80EF®
- Plating on metals include silver, and nickel
- Single end, stranded, bunched, bobbins, or flat

Film Insulated
- Unique polymer coating process over most wire materials
  - Coatings include: polyimide, polyester, nylon, polyurethane, formvar, butvar, Pebax®, and epoxy
  - Single end (round), multi-filar (twisted or parallel)
  - 30 to 46 AWG with single, heavy, triple, quad coatings, and thermocouple types T, J, K, and E
  - Natural or colored polymers available

Specialized Wire Capabilities
- Laser-stripped, film-insulated wire
- Cut to length and straightened wire
- Thermocouple welding

Coated Mandrel Wire
- Forms high-precision tubing ID’s
- Low friction polymer coated over most base metals
- PD-Slick™ material (a combination of polyimide and PTFE) is used as a top layer over polyimide or PTFE to improve bondability and flexibility

Micro-Diameter Tubing
Teleflex Medical OEM has decades-long experience in the precision extrusion of PTFE, FEP, and other high-performance fluoropolymers and thermoplastics.

Recognizing the surging demand for tubing with extremely small dimensions for wall thickness and inside diameter, we expand our capabilities to include micro-diameter polyimide and polymer tubing components that are used for many customer applications, including cardiovascular, neurovascular, endoscopy and laparoscopy.

Polyimide
- Standard material for high strength products
- Excellent radiation, solvent, and cryogenic resistance

Thermoplastics
- Materials include: Pebax®, nylon and Vestamid®
- Used as a top layer, over polyimide or PTFE, to improve bondability and flexibility

Hybrids
- Different polymers layered in a single tube construction
- Outstanding combination of strength, flexibility, and bondability

Reinforcement
- Increased strength, flexibility, torque, burst strength, and kink resistance
- Metal wire or non-metallic (PEEK, polyester) fibers inside the tubing wall
- Round or flat wire that is coiled or braided
- Longitudinal wires may be added for increased axial strength and stiffness

Conductor Embedded
- Coiled or braided construction
- Conductor or thermocouple wires inside the tubing wall
- Provides electrical pathways for power or sensors

Low Friction
- In order to reduce friction, PTFE or PTFE composites are applied on the ID or OD

Specialized Tubing Capabilities
- Polyimide tubing, micro-cut lengths
- Flaring, tipping, and forming for polyimide tubes
- Laser machining for polyimide tubes
- Pad printing on tubing products
Teleflex Medical OEM offers an extensive line of polymer materials for micro-diameter tubing products, including ultra-small, thin-walled catheters. In addition, we have expertise in a full range of Pebax® durometers, nylon, and Vestamid®. Are you looking for a customized solution? You can count on our expert team for unique composites and tubing constructs.

### Characteristics of Selected Tubing Materials*

<table>
<thead>
<tr>
<th></th>
<th>Polyimide</th>
<th>PD-Slick™ (reduced friction)</th>
<th>PEEK (reference only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Break Strength (PSI); (MPa)</td>
<td>44,367; 306</td>
<td>23,082; 160</td>
<td>16,000; 110</td>
</tr>
<tr>
<td>Ultimate Elongation (%)</td>
<td>80</td>
<td>65</td>
<td>20</td>
</tr>
<tr>
<td>Modulus of Elasticity (KSI); (MPa)</td>
<td>286; 1,970</td>
<td>232; 1,600</td>
<td>500; 3,400</td>
</tr>
<tr>
<td>Dielectric Strength (V/MIL, Dry DC)</td>
<td>3,400</td>
<td>3,311</td>
<td>480</td>
</tr>
<tr>
<td>Operation Temperature (°C) (MAX)</td>
<td>240</td>
<td>240</td>
<td>249</td>
</tr>
<tr>
<td>Moisture Absorption (24 hrs)</td>
<td>0.84 WT%</td>
<td>0.23 WT%</td>
<td>0.1 WT%</td>
</tr>
<tr>
<td>Coefficient of Dynamic Friction (Dry)</td>
<td>0.27</td>
<td>0.13</td>
<td>0.38</td>
</tr>
<tr>
<td>Scrape Resistance (Cycles to Failure)</td>
<td>8</td>
<td>5</td>
<td>N/A</td>
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<table>
<thead>
<tr>
<th></th>
<th>PTFE</th>
<th>PEBAX® 63D</th>
<th>NYLON 12</th>
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<tbody>
<tr>
<td>Tensile Break Strength (PSI); (MPa)</td>
<td>4,000;28</td>
<td>3,509; 24</td>
<td>6,530; 45</td>
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<tr>
<td>Ultimate Elongation (%)</td>
<td>250</td>
<td>28</td>
<td>5</td>
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<tr>
<td>Modulus of Elasticity (KSI); (MPa)</td>
<td>59; 407</td>
<td>14; 96</td>
<td>203; 1,400</td>
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<tr>
<td>Dielectric Strength (V/MIL, Dry DC)</td>
<td>1,500</td>
<td>2,079</td>
<td>737</td>
</tr>
<tr>
<td>Operation Temperature (°C) (MAX)</td>
<td>260</td>
<td>156</td>
<td>100</td>
</tr>
<tr>
<td>Moisture Absorption (24 hrs)</td>
<td>0 WT%</td>
<td>1.02 WT%</td>
<td>1.60 WT%</td>
</tr>
<tr>
<td>Coefficient of Dynamic Friction (Dry)</td>
<td>0.09</td>
<td>0.22</td>
<td>N/A</td>
</tr>
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<td>Scrape Resistance (Cycles to Failure)</td>
<td>2</td>
<td>0.5</td>
<td>N/A</td>
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</table>

*Physical properties are all nominal values and should not be used for specification purposes.

LET’S GET TO WORK ON YOUR PROJECT

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- Phone: 1.508.964.6080
- Fax: 1.864.708.3021
- Email: oeminfo@teleflex.com
- Web: www.teleflexmedicaloem.com
### Specs: Micro-Diameter Tubing

Teleflex Medical OEM offers some of the tightest tolerance polymer and wire-reinforced polymer tubing constructions in the industry. Our processes allow for the manufacture of small diameters and ultra-thin wall sections.

<table>
<thead>
<tr>
<th>SIZE</th>
<th>TUBING ID</th>
<th>ID TOLERANCE</th>
<th>WALL THICKNESS</th>
<th>WALL TOLERANCE</th>
<th>BRAID/COIL WIRE REINFORCEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG</td>
<td>INCHES</td>
<td>MM</td>
<td>INCHES</td>
<td>MM</td>
<td>YES/NO</td>
</tr>
<tr>
<td>44 - 42</td>
<td>0.0020 - 0.0025</td>
<td>0.0508 - 0.0635</td>
<td>± 0.0002</td>
<td>± 0.005</td>
<td>0.0003 - 0.0005</td>
</tr>
<tr>
<td>41 - 40</td>
<td>0.0028 - 0.0031</td>
<td>0.0711 - 0.0787</td>
<td>± 0.0002</td>
<td>± 0.005</td>
<td>0.0003 - 0.0005</td>
</tr>
<tr>
<td>39 - 36</td>
<td>0.0035 - 0.0050</td>
<td>0.089 - 0.127</td>
<td>± 0.0002</td>
<td>± 0.005</td>
<td>0.0005 - 0.001</td>
</tr>
<tr>
<td>35 - 33</td>
<td>0.0056 - 0.0071</td>
<td>0.142 - 0.180</td>
<td>± 0.0002</td>
<td>± 0.005</td>
<td>0.0005 - 0.0015</td>
</tr>
<tr>
<td>32 - 30</td>
<td>0.0080 - 0.0100</td>
<td>0.203 - 0.254</td>
<td>± 0.00025</td>
<td>± 0.0064</td>
<td>0.0005 - 0.003</td>
</tr>
<tr>
<td>29 - 24</td>
<td>0.0113 - 0.0201</td>
<td>0.287 - 0.511</td>
<td>± 0.0003</td>
<td>± 0.0076</td>
<td>0.0005 - 0.005</td>
</tr>
<tr>
<td>23 - 20</td>
<td>0.0226 - 0.0320</td>
<td>0.574 - 0.813</td>
<td>± 0.0003</td>
<td>± 0.0076</td>
<td>0.0005 - 0.007</td>
</tr>
<tr>
<td>19 - 15</td>
<td>0.0359 - 0.0571</td>
<td>0.912 - 1.45</td>
<td>± 0.0005</td>
<td>± 0.0127</td>
<td>0.0100 - 0.007</td>
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<tr>
<td>14-13</td>
<td>0.0641 - 0.0720</td>
<td>1.63 - 1.83</td>
<td>± 0.0007</td>
<td>± 0.0178</td>
<td>0.0015 - 0.007</td>
</tr>
<tr>
<td>12-11</td>
<td>0.0808 - 0.0910</td>
<td>2.05 - 2.31</td>
<td>± 0.0007</td>
<td>± 0.0178</td>
<td>0.002 - 0.007</td>
</tr>
</tbody>
</table>
Ultrafine constructions may be available upon request

Specs: Micro-Diameter, Film-Insulated, Fine Wire

This table defines the dimensions of standard, polyimide film insulation thickness builds over copper wire.

<table>
<thead>
<tr>
<th>AWG SIZE</th>
<th>BARE WIRE DIAMETER (IN)</th>
<th>MIN MAX</th>
<th>MIN MAX</th>
<th>MIN MAX</th>
<th>MIN MAX</th>
<th>MIN MAX</th>
<th>MIN MAX</th>
<th>MIN MAX</th>
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<td>0.0021</td>
<td>0.0022</td>
<td>0.0023</td>
<td>0.0024</td>
<td>0.0025</td>
<td>0.0026</td>
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<td>0.0028</td>
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<tr>
<td>31</td>
<td>0.0018</td>
<td>0.0019</td>
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<td>0.0021</td>
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<td>0.0023</td>
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<td>32</td>
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<td>0.0017</td>
<td>0.0018</td>
<td>0.0019</td>
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<td>0.0021</td>
<td>0.0022</td>
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<td>0.0025</td>
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<td>0.0015</td>
<td>0.0016</td>
<td>0.0017</td>
<td>0.0018</td>
<td>0.0019</td>
<td>0.0020</td>
<td>0.0021</td>
<td>0.0022</td>
<td>0.0023</td>
<td>0.0024</td>
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<td>0.0014</td>
<td>0.0015</td>
<td>0.0016</td>
<td>0.0017</td>
<td>0.0018</td>
<td>0.0019</td>
<td>0.0020</td>
<td>0.0021</td>
<td>0.0022</td>
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<tr>
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<td>0.0011</td>
<td>0.0012</td>
<td>0.0013</td>
<td>0.0014</td>
<td>0.0015</td>
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<td>0.0017</td>
<td>0.0018</td>
<td>0.0019</td>
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<tr>
<td>36</td>
<td>0.0009</td>
<td>0.0010</td>
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<td>0.0013</td>
<td>0.0014</td>
<td>0.0015</td>
<td>0.0016</td>
<td>0.0017</td>
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<td>0.0009</td>
<td>0.0010</td>
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<td>0.0013</td>
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<tr>
<td>38</td>
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<td>0.0010</td>
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<td>0.0014</td>
<td>0.0015</td>
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<td>0.0017</td>
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<tr>
<td>39</td>
<td>0.0006</td>
<td>0.0007</td>
<td>0.0008</td>
<td>0.0009</td>
<td>0.0010</td>
<td>0.0011</td>
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<td>0.0014</td>
<td>0.0015</td>
<td>0.0016</td>
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<tr>
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<td>0.0006</td>
<td>0.0007</td>
<td>0.0008</td>
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<td>0.0010</td>
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<td>0.0013</td>
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<td>0.0015</td>
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<tr>
<td>41</td>
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<td>0.0005</td>
<td>0.0006</td>
<td>0.0007</td>
<td>0.0008</td>
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<td>0.0010</td>
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<tr>
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<td>0.0004</td>
<td>0.0005</td>
<td>0.0006</td>
<td>0.0007</td>
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<td>0.0009</td>
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<td>0.0011</td>
<td>0.0012</td>
<td>0.0013</td>
</tr>
<tr>
<td>43</td>
<td>0.0002</td>
<td>0.0003</td>
<td>0.0004</td>
<td>0.0005</td>
<td>0.0006</td>
<td>0.0007</td>
<td>0.0008</td>
<td>0.0009</td>
<td>0.0010</td>
<td>0.0011</td>
<td>0.0012</td>
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<tr>
<td>44</td>
<td>0.0001</td>
<td>0.0002</td>
<td>0.0003</td>
<td>0.0004</td>
<td>0.0005</td>
<td>0.0006</td>
<td>0.0007</td>
<td>0.0008</td>
<td>0.0009</td>
<td>0.0010</td>
<td>0.0011</td>
</tr>
</tbody>
</table>
This is Innovation. This is Precision. This is Teleflex Medical OEM.

WORK WITH THE EXPERTS™
Teleflex Medical OEM is here to help you succeed. We are a leading provider of development and manufacturing services to medical device manufacturers across the world. We set ourselves apart with:

- Extensive, vertically-integrated capabilities
- Decades of experience
- Deep, across application expertise
- State-of-the-industry facilities

You can count on Teleflex Medical OEM to deliver innovative solutions for custom-engineered:

- Extrusion/micro-diameter tubing
- Diagnostic and interventional catheters
- Balloons and balloon catheters
- Film-insulated, fine wire
- Coated mandrel wire
- Conductors
- Sheath/dilator sets
- Sutures and performance fibers
- Biodegradable sutures, yarns, and resins

WE’RE READY TO PARTNER WITH YOU
At Teleflex Medical OEM, we’ve built a dedicated team of engineers, material and polymer experts, and skilled technicians to provide you with an industry-leading expertise in the development and manufacture of advanced tubing and medical wires.

Driven by your needs, our approach is collaborative and dynamic from concept to execution. Sit down with us. Discuss ideas and concepts. Provide feedback on prototypes. Our team will seem like a natural extension of your own R&D department and operations staff.

OUR ADVANTAGE: VERTICALLY INTEGRATED CAPABILITIES
Teleflex Medical OEM is a true single source solution. We have virtually everything necessary for your project’s success.

- Product concept development
- Engineering
- Design for manufacturability
- Regulatory services
- Material selection and formulation
- Prototyping
- Testing and validation
- Production process development
- Custom tooling
- Manufacturing, both small and large volumes
- Assembly
- Packaging
- Sterilization*

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- Web: www.teleflexmedicaloem.com

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