High Performance Medical Solutions

- Discrete & Bundled Cable
- Catheter Tubing
- Medical Machining
- Assembly & Fabrication Services
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**REACH Compliant**

**HITACHI**

**Inspire the Next**
The Hitachi Advantage

Hitachi Ltd.

Hitachi, Ltd. is a Japanese multinational conglomerate company headquartered in Chiyoda, Tokyo, Japan. It is listed on the Tokyo Stock Exchange (TYO 65010) and is ranked as a significant Fortune Global 500 business. Hitachi operates eleven business segments: Information & Telecommunication Systems, Social Infrastructure, High Functional Materials & Components, Financial Services, Power Systems, Electronic Systems & Equipment, Automotive Systems, Railway & Urban Systems, Digital Media & Consumer Products, Construction Machinery and Other Components & Systems. At the heart of Hitachi are our values and a strong belief in Social Innovation. Social Innovation through Mobility, Smart Life, Industry, Energy and IT, can help to address some of the larger issues that will aid in improving the lives of billions of people worldwide.

Hitachi Metals Ltd. (HML) and Hitachi Metals America (HMA)

Hitachi Metals Group Ltd., is a division of Hitachi Ltd. It plays an important role in supplying a wide array of innovative high-performance materials for a broad range of markets. Their unique materials and expertise enables HML to produce extremely sophisticated high volume advanced metal materials and components for electric vehicles, engines, automobiles, transportation equipment, electronic components and industrial infrastructures centered around melting and casting technologies. Their specialty alloys, ultra-fine wire and cable production, magnetic materials and batteries are all critical elements to the performance of medical OEM products worldwide. The factory in Suzhou, China (HCSZ) offers mass production capability and it is ISO 13485:2016 certified. The factory in Ibaraki, Japan (HML) is ISO 9001:2016 certified and it provides cutting edge development and next generation technologies for components that are highly advanced and/or difficult to manufacture. Together, the plants offer full RoHS compliance, Conflict Mineral verification, biocompatibility testing and sterilization support as well as vendor managed inventory programs as required.

Hitachi Cable America (HCA)

Hitachi Cable America, is a member of the Hitachi Metals Group, and is a holding company that consists of three divisions: the High Performance Medical Solutions division, the Performance Cable Systems and Materials division, and the Automotive division. These groups have been designing and manufacturing advanced and reliable power and communication cables at our Manchester, NH USA facility since 1986. Our products are used globally for a broad spectrum of markets, including medical, energy, wireless, IT, industrial, educational, government and defense.

High Performance Medical Solutions division (HPMS)

The High Performance Medical Solutions division (HPMS) provides ISO-13485:2016 compliant manufacturing services of components and finished medical devices for OEMs worldwide though our HTP-MEDS product line. We specializes in complex catheter tubing, high pressure braided tubing, secondary operations and device assembly such as PICC catheters; introducer sheaths; and fluid transport tubing. Our division is strong in tight pitch, high-density terminations and cable assemblies for low and high volume ultrasound cable assemblies as well as micro-camera devices for endoscopy and advanced surgical applications. With global sales offices, production centers in Rhode Island, Connecticut and New Hampshire, as well as overseas cable production in Japan and China, HPMS is well positioned to handle your medical needs. We service a broad range of markets from endovascular to cardiovascular; structural heart; cardiac rhythm management; electrophysiology; neurovascular; pain access; pain management; and ultrasound. Other products include: high performance copper, fiber optic cable suited for harsh environment medical and cleanroom applications, heat resistant plastic optical fiber (POF), low friction cross-linked PTFE, HI-TECH MACHINE & FABRICATION product line (in-house machining and equipment fabrication services), and 3D additive metal printing.
Hitachi Competencies & Technologies

Hitachi Group Companies provide services and solutions that meet the most stringent of medical needs. Our rich line-up of quality products and industry experience allow us to reach new frontiers in medical science and development. Whether it’s a novel material, a component requirement, or a complex assembly, our global Group Companies are prepared to solve your specialized medical needs.

**Material Development**
- High Performance Materials
- Specialty Alloy Wire
- 3DAM Powders

**Extruded Tubing**
- Precision Catheter Tubing
- High Pressure Braided Tubing
- Full Device Assembly & Packaging

**Your Solution**

**Full Device Assembly**

**Sub-Assemblies, Secondary Operations**

**Cable and Tubing Extrusions & Medical Machining and Component Fabrication**

**Discrete Wire & Bundled Cable**
- Fine Wire & Cable Production
- Cable Preparation Services
- Cable Assembly

**Machining & Fabrication**
- Extrusion Tooling
- Medical Machining
- Medical Fabrication
There are many types and uses for medical cables. Hitachi offers a broad range of products and capabilities to support varying applications.

One of Hitachi’s many strengths is building complex fine wire bundles. These are traditionally found in ultrasound imaging environments for medical probe cables in both medical and non-medical applications where precision and performance are paramount.

Hitachi offers customized cables to meet specific needs depending on the application or equipment. This expertise can be expanded upon to other applications such as endoscopes, catheters, and animal probes. We strive to listen to the needs of our customers and develop standard and custom solutions that OEMs require.

Hitachi has become a recognized leader in the medical cable space. Since our founding in 1910, Hitachi has lived up to our founders mission: “Contribute to society through the development of superior, original technology and products.” Some recent examples are:

- SONOEASE®, a bundling technology offering softer and superior flexibility/limpness to reduce operator fatigue and increase the product life cycle.
- Our HiFC® alloy provides improved conductivity when required.
- Our 48 gauge (AWG) low impedance coax is among the smallest in the industry.
- Our new non-tacky silicone jacketing offers unsurpassed performance for harsh environment and sterilization requirements.
- 50 gauge (AWG) coax, 46 gauge (AWG) STP/UTP designs and Twinax as small as 40 gauge (AWG) with alloys that outperform the competition.
Advanced material development.

Ultra-fine wire capability.

Micro-coaxial cable technology yields long flex-life with tight electrical parameter control. Micro twinax cable is also available.

Bundled cable with fine wire micro-coaxial cable for customer specific designs.

Ultra high density micro-coaxial cable cable designs deliver a soft, but robust, feel for customer applications.

Hitachi specializes in tight-pitch termination on high-density PCBs.

Termination capability includes board-level termination, cable sub-assemblies and full probe solutions.

In addition to our core technologies identified above, Hitachi Cable America also offers expert design services which include concept development, rapid prototyping, CAD and Solid modeling.
Material
The control of metallurgical microstructures with an in-depth study of thermal and mechanical influences is essential to realizing a High-Strength / High-Conductivity conductor. It is because of our advanced analytical techniques and broad experience that we have become a leader in high performance materials.

Extruding
The determining factor in the performance of a micro-coaxial cable is the state of the insulation layer. Low capacitance coaxial cable relies on the precise extrusion of the foamed PFA material. 50AWG coaxial cable cannot be produced without tight controls on ultra-thin PFA. Therefore, the stable characteristics of our cables are created by precisely controlling the extrusion process.

Cabling
To achieve the targeted characteristics, it is imperative to control the raw materials as well as the processes from beginning to end. Thermal and tensional conditioning along with spatial adherence is paramount and is applied at every stage of production to build a cable that not only meets but often exceeds the engineered intent.

Design
When it comes to custom specifications, we have the materials and expertise to produce highly unique designs. Our cable development team can quickly predict with a degree of high accuracy the success of a specific design. In doing so, we can reduce lead times and minimize waste, all while creating novel characteristics that satisfy the need.

Cable Test
We possess specialized cable test equipment to evaluate and confirm product reliability ranging from the flex testing machines evaluating the mechanical characteristics of flex and twist resistance, to the laboratory devices required for measuring the electrical characteristics such as capacitance and impedance.

Assembly
Terminating a cable is sometimes just as challenging as making one. Often, the finer a coaxial cable becomes, the narrower the soldering pitch needs to be. We encourage our customers to involve Hitachi early in the design so that these termination considerations are taken into account. Through dialogue we can advise of suitable polymers and lead-free solder, or other processes, for the assembled structures. If customers desire, we can manage both assembly and final product packaging in our controlled facilities.
Hitachi Micro-Coax Cables are also used in the inspection of pipeline welds. When quality matters, choose products made with Hitachi cables.
Micro-Coaxial Cable

Micro-Coaxial Cable is used in a wide array of precision medical products and cabling applications, where limited space, high-reliability, high-sensitivity and outstanding signal, capacitance and impedance characteristics are important. Micro-coaxial cable is ideal for ultrasound probes, catheters, endoscopy, oximetry systems, sensors, robotics and industrial automation and inspection. We offer a full range of standard sizes from 32 to 50 gauge (AWG) using high-strength silver-plated or tinned-copper alloys that are rated to +200°C. Our micro-coaxial cable is a market leader due in part to our proprietary high-strength alloys with outstanding lowloss characteristics. PFA dielectric and jacket material provide stable properties for outstanding signal integrity, low capacitance, and consistent controlled impedance resulting in smaller diameter cables with improved flexibility and life. Our precision cabling technology enables our customers to use complex bundles while providing size and performance advantages without compromising on today’s Healthcare or Industrial standards. At Hitachi, we offer a wide range of turn-key design and manufacturing support. Whether buying bulk cable or receiving a completely manufactured assembly, we are perfectly positioned to meet your needs.

Photo: Hitachi Metals copper alloy wire wrapped around an 80 micron human hair.

Features & Benefits

- Micro diameter and light weight
- Excellent heat resistance and electrical characteristics with fluorocarbon polymer insulation
- Excellent mechanical strength and flexible performance with copper alloy conductor
- Custom designs for bundled cables are available upon request
We offer a broad selection of copper alloy wire with precision wire gauges ranging from 36 to 50 gauge (AWG). These superfine, high strength, highly conductive 7 strand constructions are useful for small diameter flexible cables. We offer standard 50 & 60 Ohm impedance products. Please call if alternate constructions are required.

![Diagram of a coaxial cable](image)

### Table: Coaxial Cables

<table>
<thead>
<tr>
<th>Coaxial Product Number</th>
<th>AWG (Stranding)</th>
<th>Material</th>
<th>Conductor DCR@20°C (Ω/kft)</th>
<th>Insulation</th>
<th>Shield</th>
<th>Jacket</th>
<th>Capacitance @10MHz (pF/m)</th>
<th>Impedance @10MHz (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5361-110</td>
<td>36 (7/44)</td>
<td>Tinned Copper</td>
<td>479 (1.569)</td>
<td></td>
<td></td>
<td>PFA²</td>
<td>0.021 (0.54)</td>
<td>33.6 (110)</td>
</tr>
<tr>
<td>5381-110</td>
<td>38 (7/46)</td>
<td>Tinned Copper Alloy</td>
<td>1,007 (3.300)</td>
<td></td>
<td></td>
<td></td>
<td>0.017 (0.44)</td>
<td>35.1 (115)</td>
</tr>
<tr>
<td>5382-110</td>
<td></td>
<td>HiFC®</td>
<td>610¹ (2.000)</td>
<td></td>
<td></td>
<td></td>
<td>0.013 (0.32)</td>
<td>35.1 (115)</td>
</tr>
<tr>
<td>5401-110</td>
<td>40 (7/48)</td>
<td>Tinned Copper Alloy</td>
<td>1,525 (5.000)</td>
<td></td>
<td></td>
<td>PFA²</td>
<td>0.012 (0.31)</td>
<td>36.6 (120)</td>
</tr>
<tr>
<td>5402-110</td>
<td>40 (7/48)</td>
<td>HiFC®</td>
<td>975¹ (3.200)</td>
<td></td>
<td></td>
<td></td>
<td>0.011 (0.29)</td>
<td>35.1 (115)</td>
</tr>
<tr>
<td>5411-110</td>
<td>41 (7/49)</td>
<td>Tinned Copper</td>
<td>1,525 (5.000)</td>
<td></td>
<td></td>
<td>PFA²</td>
<td>0.011 (0.27)</td>
<td>35.1 (115)</td>
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<tr>
<td>5412-110ᵃ</td>
<td>42 (7/50)</td>
<td>Tinned Copper Alloy</td>
<td>2,227 (7.300)</td>
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<td></td>
<td></td>
<td>0.010 (0.24)</td>
<td>35.1 (115)</td>
</tr>
<tr>
<td>5431-110</td>
<td>43 (7/51)</td>
<td>Tinned Copper Alloy</td>
<td>2,288 (7.500)</td>
<td></td>
<td></td>
<td></td>
<td>0.009 (0.22)</td>
<td>35.1 (115)</td>
</tr>
<tr>
<td>5441-110</td>
<td>44 (7/52)</td>
<td>Tinned Copper Alloy</td>
<td>3,203 (10,500)</td>
<td></td>
<td></td>
<td></td>
<td>0.007 (0.17)</td>
<td>36.6 (120)</td>
</tr>
<tr>
<td>5451-110</td>
<td>45 (7/53)</td>
<td>Tinned Copper Alloy</td>
<td>3,752 (12,300)</td>
<td></td>
<td></td>
<td>PFA²</td>
<td>0.006 (0.15)</td>
<td>38.1 (125)</td>
</tr>
<tr>
<td>5461-115ᵃ</td>
<td>46 (7/54)</td>
<td>Tinned Copper Alloy</td>
<td>4,728 (15,500)</td>
<td></td>
<td></td>
<td></td>
<td>0.005 (0.15)</td>
<td>38.1 (125)</td>
</tr>
<tr>
<td>5481-120ᵃ</td>
<td>48 (7/56)</td>
<td>Tinned Copper Alloy</td>
<td>7,010 (23,000)</td>
<td></td>
<td></td>
<td>PFA²</td>
<td>0.006 (0.12)</td>
<td>27.5 (90)</td>
</tr>
<tr>
<td>5501-125ᵃ</td>
<td>50 (7/58)</td>
<td>Tinned Copper Alloy</td>
<td>11,430 (37,500)</td>
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<td></td>
<td></td>
<td>0.014 (0.35)</td>
<td>27.5 (90)</td>
</tr>
<tr>
<td>5401-090</td>
<td>40 (7/48)</td>
<td>Silver Plated Copper Alloy</td>
<td>1,525 (5.000)</td>
<td></td>
<td></td>
<td>PFA²</td>
<td>0.015 (0.37)</td>
<td>27.5 (90)</td>
</tr>
<tr>
<td>5411-090</td>
<td>41 (7/49)</td>
<td>Silver Plated Copper Alloy</td>
<td>1,525 (5.000)</td>
<td></td>
<td></td>
<td></td>
<td>0.014 (0.35)</td>
<td>27.5 (90)</td>
</tr>
<tr>
<td>5421-090</td>
<td>42 (7/50)</td>
<td>Silver Plated Copper Alloy</td>
<td>2,227 (7.300)</td>
<td></td>
<td></td>
<td>PFA²</td>
<td>0.013 (0.32)</td>
<td>27.5 (90)</td>
</tr>
<tr>
<td>5431-090</td>
<td>43 (7/51)</td>
<td>Silver Plated Copper Alloy</td>
<td>2,288 (7.500)</td>
<td></td>
<td></td>
<td></td>
<td>0.012 (0.3)</td>
<td>27.5 (90)</td>
</tr>
<tr>
<td>5441-090</td>
<td>44 (7/52)</td>
<td>Silver Plated Copper Alloy</td>
<td>3,203 (10,500)</td>
<td></td>
<td></td>
<td></td>
<td>0.011 (0.27)</td>
<td>27.5 (90)</td>
</tr>
</tbody>
</table>

Note: Custom designs available.

¹ HiFC® = Hitachi Fine Copper

- HiFC® is a new generation of pure copper with a high conductivity, the same as that of a high purity 6N copper. This results in a cable with lower resistance and 20% improvement in attenuation but the bend life is reduced as compared to our standard copper alloy.
- HiFC® is a registered trademark of Hitachi Metals, Ltd in Japan.

² PFA = Perfluoroalkoxy

³ Polymer tape is standard for the part numbers shown. PFA Jacketed versions are available under alternate part numbers not listed here.

⁴ Part numbers shown in red are items that we typically stock, all other part numbers shown throughout the catalog are built to order with standard MOQs and lead times.
Hitachi’s advanced foam PFA extrusion process delivers low capacitance cable with reliable performance. We utilize a polyester tape skin over the foam to deliver the dielectric withstand voltage required by the medical industry. 38 AWG to 48 AWG wire sizes are available. These are 70, 75, and 85 Ohm impedance cables.

### Coaxial Cable Specifications

<table>
<thead>
<tr>
<th>Coaxial Product Number</th>
<th>Inner Conductor</th>
<th>Conductor DCR@20°C (Ω/kft)</th>
<th>Insulation</th>
<th>Shield</th>
<th>Jacket</th>
<th>Capacitance pF/ft (pF/m)</th>
<th>Impedance @10MHz (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5381-060</td>
<td>38 (7/46)</td>
<td>1,007 (3,300)</td>
<td></td>
<td></td>
<td></td>
<td>0.021 (0.54)</td>
<td>18.3 (60)</td>
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<tr>
<td>5401-060</td>
<td>40 (7/48)</td>
<td>1,525 (5,000)</td>
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<td></td>
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<td>0.016 (0.41)</td>
<td>15.3 (50)</td>
</tr>
<tr>
<td>5411-060</td>
<td>41 (7/49)</td>
<td>1,525 (5,000)</td>
<td></td>
<td></td>
<td></td>
<td>0.014 (0.36)</td>
<td>15.3 (50)</td>
</tr>
<tr>
<td>5421-060</td>
<td>42 (7/50)</td>
<td>2,227 (7,300)</td>
<td>Cellular PFA (+Polyester tape skin)</td>
<td>Tinned Copper Alloy</td>
<td>Polyester tape</td>
<td>0.013 (0.34)</td>
<td>15.3 (50)</td>
</tr>
<tr>
<td>5431-060</td>
<td>43 (7/51)</td>
<td>2,288 (7,500)</td>
<td></td>
<td></td>
<td></td>
<td>0.012 (0.31)</td>
<td>15.3 (50)</td>
</tr>
<tr>
<td>5441-060</td>
<td>44 (7/52)</td>
<td>3,203 (10,500)</td>
<td></td>
<td></td>
<td></td>
<td>0.011 (0.28)</td>
<td>15.3 (50)</td>
</tr>
<tr>
<td>5461-060</td>
<td>46 (7/54)</td>
<td>4,728 (15,550)</td>
<td></td>
<td></td>
<td></td>
<td>0.01 (0.25)</td>
<td>15.3 (50)</td>
</tr>
<tr>
<td>5481-070</td>
<td>48 (7/56)</td>
<td>7,010 (23,000)</td>
<td>PFA with Aperture (+Polyester tape skin)</td>
<td>Silver Plated Copper Alloy</td>
<td>Polyester tape</td>
<td>0.008 (0.21)</td>
<td>21.4 (70)</td>
</tr>
<tr>
<td>5401-050</td>
<td>40 (7/48)</td>
<td>1,525 (5,000)</td>
<td></td>
<td></td>
<td></td>
<td>0.019 (0.47)</td>
<td>15.3 (50)</td>
</tr>
<tr>
<td>5411-050</td>
<td>41 (7/49)</td>
<td>1,525 (5,000)</td>
<td></td>
<td></td>
<td></td>
<td>0.016 (0.41)</td>
<td>15.3 (50)</td>
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<tr>
<td>5421-050</td>
<td>42 (7/50)</td>
<td>2,227 (7,300)</td>
<td>Cellular PFA (+Polyester tape skin)</td>
<td>Tinned Copper Alloy</td>
<td>Polyester tape</td>
<td>0.016 (0.41)</td>
<td>15.3 (50)</td>
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<tr>
<td>5431-050</td>
<td>43 (7/51)</td>
<td>2,288 (7,500)</td>
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<td></td>
<td>0.014 (0.35)</td>
<td>15.3 (50)</td>
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<tr>
<td>5441-050</td>
<td>44 (7/52)</td>
<td>3,203 (10,500)</td>
<td></td>
<td></td>
<td></td>
<td>0.013 (0.32)</td>
<td>15.3 (50)</td>
</tr>
</tbody>
</table>

Note: Custom designs available.

### Internal Conductor Diagram

**48 gauge (AWG - American Wire Gauge)**

Our newly developed coaxial cable for medical applications uses multiple fluorocarbon polymer monofilaments as a wrapped insulation layer surrounding the wire as opposed to the foam fluorocarbon polymer extruded directly over the wire. Our new product will make such medical devices as ultrasound diagnostic equipment and endoscopes more user-friendly and capable of producing higher-definition diagnostic images. We will continue to introduce new wire and cable products for medical applications that advance state-of-the-art medical technology. 50 gauge (AWG) is currently under development, call for more information.
Hitachi solid conductor constructions combine all the attributes of the stranded wire coaxials while offering a slightly smaller diameter with improved current carrying capacity, and lower loss.

**Features & Benefits**
- High Capacitance
- Various solid conductor sizes: 40 through 50 gauge (AWG)
- Custom designs to suit specific requirements

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### Solid Conductor Coaxial Cable

**Composition of Hitachi Conductors vs Industry Conductors**

<table>
<thead>
<tr>
<th>AWG Size</th>
<th>Conductor (Strands / Wire Dia. Um)</th>
<th>Standard Conductor Resistance (ohm/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>43 (7/51) (7/0.023 mm)</td>
<td>7,500</td>
</tr>
<tr>
<td>44</td>
<td>44 (7/52) (7/0.020 mm)</td>
<td>9,800</td>
</tr>
<tr>
<td>45</td>
<td>45 (7/53) (7/0.018 mm)</td>
<td>12,300</td>
</tr>
<tr>
<td>46</td>
<td>46 (7/54) (7/0.016 mm)</td>
<td>15,500</td>
</tr>
<tr>
<td>48</td>
<td>48 (7/56) (7/0.012 mm)</td>
<td>23,700</td>
</tr>
<tr>
<td>50</td>
<td>50 (7/58) (7/0.10 mm)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

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### Solid conductor coaxial cables

---

#### Table:

<table>
<thead>
<tr>
<th>Coaxial Product Number</th>
<th>Inner Conductor</th>
<th>Conductor DCR@20°C 1Ω/kft (Ω/km)</th>
<th>Insulation</th>
<th>Shield</th>
<th>Jacket</th>
<th>Capacitance pF/ft (pF/m)</th>
<th>Impedance @10MHz (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5403-110</td>
<td>40 (1/40)</td>
<td>1,372 (4,500)</td>
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</tr>
<tr>
<td>5423-110</td>
<td>42 (1/42)</td>
<td>2,134 (7,000)</td>
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<td>0.011 (0.274)</td>
<td>35.1 (115)</td>
</tr>
<tr>
<td>5443-110</td>
<td>44 (1/44)</td>
<td>3,353 (11,000)</td>
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<td>0.009 (0.221)</td>
<td>36.6 (120)</td>
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<td>5,395 (17,700)</td>
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<td>0.007 (0.19)</td>
<td>38.1 (125)</td>
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<td>5483-120</td>
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<td>9,601 (31,500)</td>
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<td></td>
<td></td>
<td>0.006 (0.156)</td>
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</tr>
<tr>
<td>5503-125</td>
<td>50 (1/50)</td>
<td>13,868 (45,500)</td>
<td></td>
<td></td>
<td></td>
<td>0.005 (0.139)</td>
<td></td>
</tr>
</tbody>
</table>

---

**Features & Benefits**

- High Capacitance
- Various solid conductor sizes: 40 through 50 gauge (AWG)
- Custom designs to suit specific requirements

---

**Comparison of Hitachi Conductors vs Industry Conductors**

<table>
<thead>
<tr>
<th>AWG Size</th>
<th>Conductor (Strands / Wire Dia. Um)</th>
<th>Standard Conductor Resistance (ohm/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>43 (7/51) (7/0.023 mm)</td>
<td>7,500</td>
</tr>
<tr>
<td>44</td>
<td>44 (7/52) (7/0.020 mm)</td>
<td>9,800</td>
</tr>
<tr>
<td>45</td>
<td>45 (7/53) (7/0.018 mm)</td>
<td>12,300</td>
</tr>
<tr>
<td>46</td>
<td>46 (7/54) (7/0.016 mm)</td>
<td>15,500</td>
</tr>
<tr>
<td>48</td>
<td>48 (7/56) (7/0.012 mm)</td>
<td>23,700</td>
</tr>
<tr>
<td>50</td>
<td>50 (7/58) (7/0.10 mm)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

---

**Solid Conductor Coaxial Cable**

Hitachi solid conductor constructions combine all the attributes of the stranded wire coaxials while offering a slightly smaller diameter with improved current carrying capacity, and lower loss.
The chart below is a useful tool for understanding the behavior of a single coaxial (with 7 strand conductors) in relation to size, group bundling, frequency and flex life.

### Micro-Coaxial Performance

<table>
<thead>
<tr>
<th>Item</th>
<th>48 AWG (7/56) (120 pF/m)</th>
<th>46 AWG (7/54) (115 pF/m)</th>
<th>48 AWG (7/56) (115 pF/m)</th>
<th>46 AWG (7/54) (60 pF/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of micro-coaxial</td>
<td>.008 in (0.195 mm)</td>
<td>.008 in (0.195 mm)</td>
<td>.0085 in (0.215 mm)</td>
<td>.010 in (0.250 mm)</td>
</tr>
<tr>
<td>Cable Diameter (128 micro-coaxials)</td>
<td>.122 in (3.1 mm)</td>
<td>.138 in (3.5 mm)</td>
<td>.150 in (3.8 mm)</td>
<td>.169 in (4.3 mm)</td>
</tr>
<tr>
<td>Characteristic impedance (at 10 MHz)</td>
<td>50 Ω</td>
<td>50 Ω</td>
<td>70 Ω</td>
<td>75 Ω</td>
</tr>
<tr>
<td>Capacitance (at 1 kHz)</td>
<td>120 pF/m</td>
<td>115 pF/m</td>
<td>70 pF/m</td>
<td>60 pF/m</td>
</tr>
<tr>
<td>Inner Conductor Resistance</td>
<td>21.5 Ω/m</td>
<td>14.5 Ω/m</td>
<td>21.5 Ω/m</td>
<td>14.5 Ω/m</td>
</tr>
<tr>
<td>Attenuation (at 10 MHz)</td>
<td>2.1 dB/m</td>
<td>1.45 dB/m</td>
<td>1.3 dB/m</td>
<td>0.85 dB/m</td>
</tr>
<tr>
<td>Attenuation (at 50 MHz)</td>
<td>2.9 dB/m</td>
<td>2.35 dB/m</td>
<td>1.8 dB/m</td>
<td>1.25 dB/m</td>
</tr>
<tr>
<td>+/- 90 degrees bend test (Radius = 2 mm)</td>
<td>Over 500k cycles</td>
<td>Over 500k cycles</td>
<td>Over 500k cycles</td>
<td>Over 500k cycles</td>
</tr>
</tbody>
</table>

The image above illustrates flex testing using the “tick-tock” test configuration.

The chart illustrates the performance of different micro-coaxial cables in terms of attenuation and frequency response.
**Bundled Cable**

A number of micro-coaxials are bundled for ultrasound probe cable. Typical design specifications should include the style of coax, the number of coax, the shield configuration, flexibility requirements, type of sheath and sheath color. Custom designs are also available upon request.

![Diagram of coaxial cable components](image)

### Numbering Code:

5xxx-xxx – xxx – xx – xx – x – xx

- **Micro-Coaxial Product Number**: (Page 10,11,12)
- **Number of Micro-Coaxials**: (Table 1)
- **Braid Shield**: (Table 2)
- **Flexibility**: (Table 3)
- **Sheath**: (Table 4)
- **Sheath Color**: (Table 5)

### Table 1. Number of Micro-Coaxials

| Number of Micro-Coaxials | 18, 34, 64, 68, 96, 128, 192 |

Note: 18, 34, 68, 132 conductor cables utilize a urethane outer jacket. Add 0 to front of 2 digit quantities when building part number. Ex: 18 = 018

### Table 2. Braid Shield

<table>
<thead>
<tr>
<th>Code</th>
<th>Material</th>
<th>Coverage%</th>
<th>Bend/Twist Lift Test*</th>
<th>Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>Tinned Copper Alloy</td>
<td>90</td>
<td>300k cycles&lt;</td>
<td>Low cost</td>
</tr>
<tr>
<td>NN</td>
<td>Tinned Hitachi Metals NN High-Strength Copper</td>
<td>90</td>
<td>300k cycles&lt;</td>
<td>High strength (&gt;850MPa)</td>
</tr>
<tr>
<td>SX</td>
<td>Tinned SX**</td>
<td>95</td>
<td>300k cycles&lt;</td>
<td>Most Flexible</td>
</tr>
</tbody>
</table>

*Bend Radius equals 3x the cable diameter utilizing a 500g weight. Twist equals 300mm length utilizing a 500g weight.**

**Tinned spiral wrapped tinsel copper conductor.**

---

**High Strength NN alloy braid shield**

**Highly Flexible SX braid shield**
### Table 3. Cable Flexibility

<table>
<thead>
<tr>
<th>CODE</th>
<th>Flexibility / Limpness - (less resistance to bending / conforming to gravity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE</td>
<td>SonoEase®, highly flexible (PVC Only and not available with NN braid)</td>
</tr>
<tr>
<td>HS</td>
<td>High Standard, very flexible (Diameter consistent with Standard diameter)</td>
</tr>
<tr>
<td>ST</td>
<td>Standard, average flexibility</td>
</tr>
</tbody>
</table>

### Table 4. Sheath (jacket) Material

<table>
<thead>
<tr>
<th>CODE</th>
<th>Material</th>
<th>Operating Temperature</th>
<th>Advantage</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>PVC</td>
<td>-10 to 60°C</td>
<td>Low cost</td>
<td>Medical</td>
</tr>
<tr>
<td>U</td>
<td>TPU</td>
<td>-40 to 100°C</td>
<td>Resists cut through, abrasions, chemicals &amp; solvents</td>
<td>Medical, Industrial</td>
</tr>
<tr>
<td>S</td>
<td>Silicone Rubber</td>
<td>-60 to 120°C</td>
<td>Resists most stains and is easy to clean</td>
<td>Surgical</td>
</tr>
<tr>
<td>SS</td>
<td>Non-Sticky Silicone Rubber</td>
<td>-60 to 120°C</td>
<td>Non-stick surface provides reduced friction and ease of cleaning</td>
<td>Surgical</td>
</tr>
</tbody>
</table>

### Table 5. Sheath (jacket) Color

<table>
<thead>
<tr>
<th>Material</th>
<th>Color Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>(IV) Ivory, (BK) Black</td>
</tr>
<tr>
<td>Polyurethane</td>
<td>(WH) White, (BK) Black</td>
</tr>
<tr>
<td>Silicone Rubber</td>
<td>(IV) Ivory, (GR) Gray</td>
</tr>
<tr>
<td>Non-Sticky Silicone Rubber</td>
<td>(IV) Ivory, (GR) Gray</td>
</tr>
</tbody>
</table>

### Examples of Bundled Cable

<table>
<thead>
<tr>
<th>Coaxial Product Number</th>
<th>Inner Conductor</th>
<th>Jacket</th>
<th>Capacitance</th>
<th>Number of Braid Shield</th>
<th>Cable Flexibility</th>
<th>Sheath (Jacket)</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AWG (Stranding)</td>
<td>Diameter</td>
<td>pF/ft</td>
<td>Number of coax</td>
<td>Material</td>
<td>Standard</td>
<td>PVC</td>
</tr>
<tr>
<td>5401-110-064-CA-ST-P-IV</td>
<td>40 (7/48)</td>
<td>0.013 (0.32)</td>
<td>33.6 (110)</td>
<td>64</td>
<td>Tinned Copper Alloy</td>
<td>0.220 (5.6)</td>
<td></td>
</tr>
<tr>
<td>5401-110-096-CA-ST-P-IV</td>
<td>96</td>
<td>0.013 (0.32)</td>
<td>33.6 (110)</td>
<td>64</td>
<td>Tinned Copper Alloy</td>
<td>0.248 (6.3)</td>
<td></td>
</tr>
<tr>
<td>5401-110-128-CA-ST-P-IV</td>
<td>128</td>
<td>0.013 (0.32)</td>
<td>33.6 (110)</td>
<td>64</td>
<td>Tinned Copper Alloy</td>
<td>0.272 (6.9)</td>
<td></td>
</tr>
<tr>
<td>5401-110-192-CA-ST-P-IV</td>
<td>192</td>
<td>0.013 (0.32)</td>
<td>33.6 (110)</td>
<td>64</td>
<td>Tinned Copper Alloy</td>
<td>0.303 (7.7)</td>
<td></td>
</tr>
<tr>
<td>5441-060-064-SX-SE-P-BL</td>
<td>44 (7/52)</td>
<td>0.011 (0.27)</td>
<td>18.3 (60)</td>
<td>64</td>
<td>SonoEase®*</td>
<td>0.216 (5.5)*</td>
<td></td>
</tr>
<tr>
<td>5441-060-192-SX-SE-P-BL</td>
<td>192</td>
<td>0.011 (0.27)</td>
<td>18.3 (60)</td>
<td>64</td>
<td>SonoEase®*</td>
<td>0.295 (7.5)*</td>
<td></td>
</tr>
<tr>
<td>5501-125-064-SX-HS-P-IV</td>
<td>50 (7/58)</td>
<td>0.005 (0.14)</td>
<td>38.1 (125)</td>
<td>64</td>
<td>Tinned SX</td>
<td>0.075 (1.9)</td>
<td></td>
</tr>
<tr>
<td>5501-125-096-SX-HS-P-IV</td>
<td>96</td>
<td>0.005 (0.14)</td>
<td>38.1 (125)</td>
<td>64</td>
<td>Tinned SX</td>
<td>0.087 (2.2)</td>
<td></td>
</tr>
</tbody>
</table>

*The diameter of SonoEase® cable will be about 0.5mm larger than the Standard cable.
SonoEase® is a registered trademark of Hitachi Metals, Ltd in Japan.
Cables for Specific Usage

The applications for medical probe cables, typically used in ultrasound diagnostic apparatus, can be expanded to other medical equipment such as endoscopes, catheters, and animal probes. Hitachi Cable offers customized cable to meet specific needs depending on the application or equipment.

Hybrid bundled cables

Our bundles can include many different styles of cables in addition to micro-coaxial cable. Hitachi offers various tubing for air or fluidics, specialty optical fiber for data and power transport, or just basic data and power copper wiring. We custom design each cable for whatever evolving and demanding need occurs. Hybrid bundling of a multi-function cable is also available.

Features & Benefits
- Various coaxial/twinaxial cable, data cables, tubes, fiber optic and power wires available
- Accurate extrusion & cabling technology
- Multi-layered cable capability
- Custom designs available

NOTE:
Medical Grade Cables meet Biocompatibility requirements: USP Systemic Toxicity, USP Intracutaneous Toxicity, ISO Sensitization, Pyrogen, and Cytotoxicity.
Methods for Reducing Thermal Resistance

Thermal Management of Medical Cables and Devices is becoming increasingly challenging and critical to the reliability and usability of advanced surgical, imaging and implantable devices. As the trend for lighter, smaller and more operable cables continues so will the trend for finer wire with increased coaxial counts. This will drive the ongoing need for improved cable and device thermal management. When designing a cable, the shield design can have a significant impact on thermal resistance. Secondly, an improved shield can be further improved with a proper thermal connection. Contact Hitachi for additional support to maximize your designs’ performance.

Construction of Cable

<table>
<thead>
<tr>
<th>Tested Cable</th>
<th>#1 (SX shield)</th>
<th>#2 (SB shield)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo of probe cable</td>
<td><img src="https://example.com/1" alt="Image" /></td>
<td><img src="https://example.com/2" alt="Image" /></td>
</tr>
<tr>
<td>Braid Shield Material</td>
<td>SX Braid shield</td>
<td>SB Braid shield</td>
</tr>
<tr>
<td></td>
<td>Using tinsel wire</td>
<td>Using tinned copper alloy</td>
</tr>
<tr>
<td>Wire Material</td>
<td><img src="https://example.com/3" alt="Image" /></td>
<td><img src="https://example.com/4" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td>Cu Foil</td>
<td>Sn Plating</td>
</tr>
<tr>
<td></td>
<td>Nylon Fiber</td>
<td>NN Alloy</td>
</tr>
<tr>
<td></td>
<td>(Strand Number:208)</td>
<td>(Strand Number:256)</td>
</tr>
</tbody>
</table>

Thermal Resistance Reduction

<table>
<thead>
<tr>
<th>Without thermal connection of shield material</th>
<th>With thermal connection of shield material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setup of λ measurement</td>
<td>Epoxy resin Sheath</td>
</tr>
<tr>
<td>SX</td>
<td>SB</td>
</tr>
<tr>
<td>Heat conduction coef λ [W/mK]</td>
<td>6.1</td>
</tr>
<tr>
<td>Heat transfer coef h [W/m²K]</td>
<td>17.6</td>
</tr>
</tbody>
</table>

Thermal resistance[K/W] @cable length 1m

| | Without Thermal Connection | With Thermal Connection |
|--------------------------------|--------------------------|
| SX | 100.6 | 82.3 |
| SB | 90.8 | 60.6 |
In addition to micro-coaxial cable, Hitachi offers high performance single lead wire which is at the heart of our micro-coaxial cable line. Providing extremely thin wall PFA and our standard alloy materials, our lead wire offers the same exceptional characteristics that customers have come to expect.

**Physical Construction Description:**
Insulated hook-up wire, consisting of 1 conductor, unshielded and unjacketed made with PFA.

<table>
<thead>
<tr>
<th>Single Lead Wire Product Number</th>
<th>Inner Conductor</th>
<th>DCR@20°C (Ω/kft (Ω/km))</th>
<th>Insulation Material</th>
<th>Diameter Inch (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-PFA 1X36 AWG</td>
<td>36 (7/44) Tinned Annealed Copper</td>
<td>479 (1,572)</td>
<td>PFA</td>
<td>.010 (0.26)</td>
</tr>
<tr>
<td>ME-PFA 1X38 AWG</td>
<td>38 (7/46) Tinned Copper Alloy</td>
<td>1,006 (3,300)</td>
<td></td>
<td>.008 (0.21)</td>
</tr>
<tr>
<td>ME-PFA 1X40 AWG</td>
<td>40 (7/48) PFA</td>
<td>1,524 (5,000)</td>
<td></td>
<td>.006 (0.16)</td>
</tr>
<tr>
<td>ME-PFA 1X41 AWG</td>
<td>41 (7/49) Silver Plated Copper Alloy</td>
<td>1,524 (5,000)</td>
<td></td>
<td>.006 (0.155)</td>
</tr>
<tr>
<td>ME-PFA 1X42 AWG</td>
<td>42 (7/50) PFA</td>
<td>2,286 (7,500)</td>
<td></td>
<td>.005 (0.153)</td>
</tr>
<tr>
<td>ME-PFA 1X43 AWG</td>
<td>43 (7/51) PFA</td>
<td>2,286 (7,500)</td>
<td></td>
<td>.005 (0.15)</td>
</tr>
<tr>
<td>ME-PFA 1X44 AWG</td>
<td>44 (7/52) Silver Plated Copper Alloy</td>
<td>3,200 (10,500)</td>
<td></td>
<td>.004 (0.12)</td>
</tr>
<tr>
<td>ME-PFA 1X45 AWG</td>
<td>45 (7/53) PFA</td>
<td>3,749 (12,300)</td>
<td></td>
<td>.003 (0.11)</td>
</tr>
<tr>
<td>ME-PFA 1X46 AWG</td>
<td>46 (7/54) PFA</td>
<td>4,724 (15,500)</td>
<td></td>
<td>.0025 (0.065)</td>
</tr>
<tr>
<td>ME-PFA 1X48 AWG</td>
<td>48 (7/56) PFA</td>
<td>7,315 (24,000)</td>
<td></td>
<td>.003 (0.085)</td>
</tr>
<tr>
<td>ME-PFA 1X50 AWG</td>
<td>50 (7/58) PFA</td>
<td>11,450 (37,500)</td>
<td></td>
<td>.003 (0.075)</td>
</tr>
</tbody>
</table>

NOTE: Custom colors and adjustments in wall thickness available upon request.
Medical Twisted Pairs and Twinaxial Cables

Standard twisted pairs can be used for differential signal lines (putting equal but opposite voltage on each of the wires). This ensures that noise effects are significantly reduced. Twinaxial constructions have the pairs laid parallel to each other. This approach allows for very high bandwidth applications greater than that of common twisted pairs. They result in lower attenuation due to a shorter travel distance, better impedance characteristics and better control of skew within the pair. Typically twisted pairs reach their limits around ~2-4 Gbps while twinaxials can perform well at higher transmission rates. Twinax signals on the other hand are especially good at 5 Gbps+ up to and as high as 25 Gbps / channel currently. Twisted pairs may have better flex characteristics over twinaxial designs.

Features & Benefits
- Twisted quad cable available: ~48 gauge (AWG) minimum.
- Solid conductor wire available: Pair ~48 gauge (AWG) minimum, Quad ~46 gauge (AWG) minimum.
- Custom designs available. See cable examples below. Call for design support.

Cable Specification Examples*

<table>
<thead>
<tr>
<th>CABLE EXAMPLES</th>
<th>Structure</th>
<th>AWG (Stranding) Material</th>
<th>DCR@20°C (Ω/kft (Ω/km))</th>
<th>Insulation</th>
<th>Pair Diameter (mm)</th>
<th>Material</th>
<th>Shield Diameter (mm)</th>
<th>Material</th>
<th>Jacket Material</th>
<th>Capacitance pF/ft (pF/m)</th>
<th>Impedance @10MHz (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shielded Twinax w/o Jacket</td>
<td>40 (7/48)</td>
<td>16,404 (5,000)</td>
<td>PFA</td>
<td>.008 x .16 (0.203 x 0.406)</td>
<td>6 Ends 46 AWG Hard Tin Copper</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48 pF/m</td>
<td>100 +/- 5</td>
</tr>
<tr>
<td>2</td>
<td>Shielded Twinax with Jacket</td>
<td>40 (7/48)</td>
<td>.008 x .16 (0.203 x 0.406)</td>
<td>6 Ends 46 AWG Hard Tin Copper</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48 pF/m</td>
<td>100 +/- 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Unshielded Twisted Pair w/o Jacket</td>
<td>48 (7/56)</td>
<td>24,000 (7,230)</td>
<td>PFA</td>
<td>.007 (0.178)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48 pF/m</td>
<td>100 +/- 5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Unshielded Twisted Pair with Jacket</td>
<td>7/0.013 mm</td>
<td>24,000 (7,230)</td>
<td>PFA</td>
<td>.007 (0.178)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48 pF/m</td>
<td>100 +/- 5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Shielded Twisted Pair</td>
<td>Silver plated copper alloy</td>
<td>.007 (0.178)</td>
<td>Silver plated copper alloy</td>
<td>PFA</td>
<td>.011 (0.279)</td>
<td>TBD</td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Unshielded Twisted Pair w/o Jacket</td>
<td>50 (7/58)</td>
<td>40,500 (12,370)</td>
<td>PFA</td>
<td>.0055 (0.14)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48 pF/m</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Unshielded Twisted Pair with Jacket</td>
<td>7/0.01 mm</td>
<td>40,500 (12,370)</td>
<td>PFA</td>
<td>.0055 (0.14)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>48 pF/m</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Shielded Twisted Pair</td>
<td>Silver plated copper alloy</td>
<td>.0055 (0.14)</td>
<td>Silver plated copper alloy</td>
<td>PFA</td>
<td>.009 (0.229)</td>
<td>TBD</td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Call For More Information
Assemblies

Hitachi offers a broad range of additional assembly services and capabilities to meet your production needs. Our certified facilities offer RoHS compliance, conflict mineral verification, external biocompatibility testing and sterilization support if required. We also provide vendor managed inventory programs for critical production projects.

Stripping and Wire Preparation
- Fine gauge ribbonizing and wire preparation for 36 gauge (AWG) up to 46 gauge (AWG) wire are in production with finer pitch wire under development.
- Wires can be ribbonized on pitch.
- Fine pitch configurations available.
- Soldering and assembly services available.
- Custom strip lengths available.

PCB & Component Assembly
- Flexible and rigid board designs as well as discrete components.
- Watertight sealing and device encapsulation.
- Direct wire to board bonding or wire to connector assembly.
- Fine pitch terminations down to 0.15 mm 50 gauge (AWG) wire with finer pitch under development.

Custom Overmolding
- For disposable and reusable devices.
- Standard medical grade materials available (PVC, TPE and TPU).
- Low-cost, Halogen free materials are available.
- Two part overmold bonding and sealing expertise.
- Customized connector bodies & logo pad printing available.
- Hitachi can work with a variety of standard off-the-shelf component and custom connector solutions.

Full Assembly
- From simple to complex fully packaged assemblies.
- Complete probes and devices.
- Partial pigtailed cable assemblies also available for final customer termination.
- Biocompatibility, sterilization and specialty coating support are available upon request.

Test Expertise
- Specialty testing & product validation.
- Small to large volume capacity management.
- Repeated inline testing validation throughout the assembly process.
Wire Preparation & Device Soldering

Working with fine gauge wire is not a trivial matter. It is critical that there is a consistent and precise process employed to guarantee maximum performance and quality. As the gauges grow larger and the wire gets smaller, the challenges can become extreme. Hitachi has a long history of experience producing ultrasound cable assemblies and dealing with high volume, tight pitch, small wire applications. We can help you from cable preparation to final termination and we can recommend solutions for specific technical challenges.

Process Overview

1. CO₂ laser stripper to cut Jacket
2. YAG laser stripper to cut outer conductor
3. CO₂ laser stripper to cut insulation*
4. Pulse heater to solder outer & inner conductor on PCBA

Note:
*The CO₂ cut section is cleanly stripped off prior to soldering.

Typical Prep Lengths
(Custom Lengths Upon Request)

<table>
<thead>
<tr>
<th>Component</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacket</td>
<td>.020 in. (0.5 mm)</td>
</tr>
<tr>
<td>Shield</td>
<td>.020 in. (0.5 mm)</td>
</tr>
<tr>
<td>Insulator</td>
<td>.020 in. (0.5 mm)</td>
</tr>
<tr>
<td>Conductor</td>
<td>.020 in. (0.5 mm)</td>
</tr>
</tbody>
</table>

CABLES & ASSEMBLIES
ChannelFLEX® is a unique cabling solution suitable for medical, semiconductor clean rooms and standard industrial applications requiring high flex and particulate free operation. The system permits the owner to safely run cables and/or hoses in flat pods, from Point A to Point B, without concerns of binding or kinking. ChannelFLEX® reduces installation time, minimizes cable related downtime and ensures maximum performance of the applications operating over it.

1. Self Supporting
ChannelFLEX® utilizes an internal structure that supports the entire construction and eliminates the need for C-track in assembled form.

2. Pod Based Designs
Conventional C-track material, when flexed, generates particulates. ChannelFLEX® utilizes enclosed pods made from ultra-low friction material that encapsulate and trap unwanted particulates. ChannelFLEX® pods are designed to accommodate a number of cables and/or tubes carrying gases or liquids.

3. High Flex
ChannelFLEX® is designed for long and predictable flex life applications with up to 30,000,000 cycles or more for some cables.

4. Custom Design Options
The quantity of pods in the ChannelFLEX® link can also be customized. You can have individual or multiple cables per pod. If desired, a self-supporting non-metallic chain can be inserted into a pod to allow the link to maintain a minimum bend radius. This feature ensures cable and tube bend radius minimums are not exceeded.

• Pod layers can be stacked.
• Customizable pod cable quantity & pod width.
• Designs can be migrated to a laminated factory configured cable for high volume applications.
• We can populate pods for you and ship fully configured.
• Multiple bend radius option available.

5. Cleanroom Applications
ChannelFLEX® protects the environment in which it is used. The pods trap and hold any particulate released by the flexing cables and tubes within. It is IPA Class 1 rated for particulate emissions and can be used in cleanroom environments, such as those in medical or semiconductor manufacturing.
ChannelFLEX® System Overview

**Features**

<table>
<thead>
<tr>
<th>Pod</th>
<th>Pod Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pod</td>
<td>Fluoroplastic expanded PTFE (ePTFE). Layers bonded with thermoplastic</td>
</tr>
<tr>
<td>Pod</td>
<td>Conductor</td>
</tr>
<tr>
<td>Pod</td>
<td>Insulation</td>
</tr>
<tr>
<td>Pod</td>
<td>Binder Tape</td>
</tr>
<tr>
<td>Pod</td>
<td>Shield</td>
</tr>
<tr>
<td>Pod</td>
<td>Sheath</td>
</tr>
<tr>
<td>Pod</td>
<td>Support Member</td>
</tr>
<tr>
<td>Pod</td>
<td>Clamp</td>
</tr>
</tbody>
</table>

**Cables & Assemblies**

**Physical Construction Description** Each ChannelFLEX™ assembly is unique to the customer requirement, combining appropriate class 1 pod(s) to support the desired number of cables for each cable assembly. Customer can deliver assemblies fabricated in own factory to any length desired, with the ChannelFLEX™ ultimate custom cabling configuration system.

<table>
<thead>
<tr>
<th>POD Part Number</th>
<th>No. of POD</th>
<th>POD Thickness (mm)</th>
<th>POD Bluff* (mm)</th>
<th>POD Overall Bluff (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20379-1</td>
<td>1 POD</td>
<td>1.00(0.04)</td>
<td>19.0(0.75)</td>
<td>23.0(0.95)</td>
</tr>
<tr>
<td>20379-2</td>
<td>2 POD</td>
<td>1.00(0.04)</td>
<td>19.0(0.75)</td>
<td>44.0(1.77)</td>
</tr>
<tr>
<td>20379-3</td>
<td>3 POD</td>
<td>1.00(0.04)</td>
<td>19.0(0.75)</td>
<td>66.0(2.61)</td>
</tr>
<tr>
<td>20379-4</td>
<td>4 POD</td>
<td>1.00(0.04)</td>
<td>19.0(0.75)</td>
<td>87.5(3.45)</td>
</tr>
<tr>
<td>20379-5</td>
<td>5 POD</td>
<td>1.00(0.04)</td>
<td>19.0(0.75)</td>
<td>108(4.29)</td>
</tr>
<tr>
<td>20379-6</td>
<td>6 POD</td>
<td>1.00(0.04)</td>
<td>19.0(0.75)</td>
<td>129(5.08)</td>
</tr>
<tr>
<td>20379-7</td>
<td>7 POD</td>
<td>1.00(0.04)</td>
<td>19.0(0.75)</td>
<td>150(5.91)</td>
</tr>
<tr>
<td>20379-8</td>
<td>8 POD</td>
<td>1.00(0.04)</td>
<td>19.0(0.75)</td>
<td>170.1(6.70)</td>
</tr>
<tr>
<td>20387-1</td>
<td>1 POD</td>
<td>1.00(0.04)</td>
<td>30.0(1.18)</td>
<td>34.0(1.34)</td>
</tr>
<tr>
<td>20386-1</td>
<td>1 POD</td>
<td>1.00(0.04)</td>
<td>104.39(4.11)</td>
<td>109(4.29)</td>
</tr>
<tr>
<td>20385-1</td>
<td>1 POD</td>
<td>1.00(0.04)</td>
<td>125.73(4.96)</td>
<td>130(5.13)</td>
</tr>
<tr>
<td>20384-1</td>
<td>1 POD</td>
<td>1.00(0.04)</td>
<td>38.1(1.50)</td>
<td>42.7(1.68)</td>
</tr>
<tr>
<td>20383-1</td>
<td>1 POD</td>
<td>1.00(0.04)</td>
<td>61.72(2.43)</td>
<td>66.3(2.61)</td>
</tr>
<tr>
<td>20381-1</td>
<td>1 POD</td>
<td>1.00(0.04)</td>
<td>83.06(3.27)</td>
<td>87.4(3.45)</td>
</tr>
<tr>
<td>20380-3</td>
<td>3 POD</td>
<td>1.00(0.04)</td>
<td>38.1(1.50)</td>
<td>123(4.84)</td>
</tr>
</tbody>
</table>

*19mm is the standard Pod width. Other sizes, considered custom, are available.
**Self-supporting chain not sold individually.

Note: Pigtail length is custom. Image is for representation only.
# ChannelFLEX® High Flex Flat Cabling Solutions

## Application Cables

<table>
<thead>
<tr>
<th>Cable Cross Section</th>
<th>HCA/Part Number</th>
<th>Description</th>
<th>Construction</th>
<th>Diameter (Nominal) mm</th>
<th>No. of cables that fit in 19mm (0.75 inches) POD</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/C 18 AWG FEP INS. EPTEE BINDERS SPIRAL SHIELD PVC JACKET</td>
<td>41073-4</td>
<td>18 AWG 4 Conductor Shielded Servo Motor Power Cable</td>
<td>Conductor: bare copper, insulation: FEP, Binder: ePTFE, Spiral Shield, Jacket: PVC LF</td>
<td>5.97 mm 2.35 inch</td>
<td>2</td>
</tr>
<tr>
<td>4/C 18 AWG FEP INS. EPTEE BINDERS SPIRAL SHIELD PVC JACKET</td>
<td>41072-4</td>
<td>16 AWG 4 Conductor Shielded Servo Motor Power Cable</td>
<td>Conductor: bare copper, insulation: FEP, Binder: ePTFE, Spiral Shield, Jacket: PVC LF</td>
<td>6.83 mm 0.269 inch</td>
<td>1</td>
</tr>
<tr>
<td>5 PR. 26AWG ETFE INS. Filler ePTFE Binder Spiral Shield PVC Jacket</td>
<td>41426-10</td>
<td>26 AWG 5pr Shielded Servo Motor Encoder Signal Power &amp; Control</td>
<td>Conductor: tinned copper; insulation: ETFE; Binder: ePTFE; Dual Spiral Shield; Jacket: PVC LF</td>
<td>5.46 mm 0.215 inch</td>
<td>2</td>
</tr>
<tr>
<td>7/C 22AWG FEP INS. Filler ePTFE Binder Spiral Shield PVC Jacket</td>
<td>41414-7</td>
<td>22 AWG 7/c Shielded Servo Motor Power &amp; Control</td>
<td>Conductor: tinned copper; insulation: FEP; Binder: ePTFE; Spiral Shield; Jacket: PVC LF</td>
<td>5.97 mm 0.235 inch</td>
<td>2</td>
</tr>
<tr>
<td>8 PR. 26AWG ETFE INS. ePTFE Tape Spiral Shield PVC Jacket</td>
<td>41427-6</td>
<td>22 AWG 2c + 26 AWG 2pr Shielded Servo Motor Encoder Signal Power &amp; Control</td>
<td>Conductor: tinned copper; insulation: FEP &amp; ETFE; Binder: ePTFE; Dual Spiral Shield; Jacket: PVC LF</td>
<td>5.1 mm 0.200 inch</td>
<td>2</td>
</tr>
</tbody>
</table>

1. Has longer flex life
2. Has improved flexibility
3. Has EM/RFI shielding performance approaching a bead shield and certainly better than a spiral shield
4. Improved termination of the shield
### Application Cables (continued)

<table>
<thead>
<tr>
<th>Cable Cross Section</th>
<th>HG/Partner Number</th>
<th>Description</th>
<th>Construction</th>
<th>Diameter (Nominal)</th>
<th>No.of cables that fit in 19 mm (0.75 inches) PVC Duct</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/22 AWG (.15mm²) E/TFE Int. 22 AWG (.33mm²) PTFE Int.</td>
<td>41877-8</td>
<td>22 AW + 2C + 26 AWG 3pr Shielded Control Cable Power &amp; Control</td>
<td>Conductors: tinned copper; insulation: E/TFE; Binder: ePTFE; Dual Spiral Shield; Jacket: PVC LF</td>
<td>5.8 mm / 0.230 inch</td>
<td>2</td>
</tr>
<tr>
<td>4P 26 AWG FEP - E/TFE BINDER SPIRAL SHIELD PVC JACKET F = FILLER</td>
<td>41081-4</td>
<td>26 AWG 4 Conductor Shielded IEEE 1394 Communication</td>
<td>Conductor: bare copper; insulation: FEP; Binder: ePTFE; Dual Spiral Shield; Jacket: PVC LF</td>
<td>5.5 mm / 0.216 inch</td>
<td>2</td>
</tr>
<tr>
<td>4P 26 AWG FEP INS. E/TFE TAPE SPIRAL SHIELD PVC JACKET</td>
<td>41231-8</td>
<td>26 AWG Cat 5e Shielded Ethernet Patch Cable Communication</td>
<td>Conductor: tinned copper; insulation: E/TFE; Binder: ePTFE; Dual Spiral Shield; Jacket: PVC LF</td>
<td>6.1 mm / 0.240 inch</td>
<td>2</td>
</tr>
<tr>
<td>8 PR 25AWG E/TFE INS. ePTFE Binder PVC Jacket</td>
<td>41410-16</td>
<td>26 AWG 8pr Signal I/O Communication</td>
<td>Conductor: tinned copper; insulation: E/TFE; Binder: ePTFE; Jacket: PVC LF</td>
<td>5.6 mm / 0.220 inch</td>
<td>2</td>
</tr>
<tr>
<td>2C 22 AWG FEP INS. E/TFE BINDER SPIRAL SHIELD PVC JACKET F = FILLER</td>
<td>41082-2</td>
<td>22 AWG 2 Conductor Shielded IEEE 1394 Communication</td>
<td>Conductor: bare copper; insulation: FEP; Binder: ePTFE; Spiral Shield; Jacket: PVC LF</td>
<td>3.8 mm / 0.150 inch</td>
<td>2</td>
</tr>
<tr>
<td>COMPOSITE CABLE 2 COAX 20 AWG 4C 22 AWG 2C 18 AWG E/TFE TAPE SPIRAL SHIELD PVC JACKET</td>
<td>41224-8</td>
<td>24 AWG 3C + 26 AWG 3C +2C Coaxial Shielded Video Cable</td>
<td>Conductor: bare copper; insulation: FEP; Binder: ePTFE; Braided Shield; Jacket: PVC LF</td>
<td>5.8 mm / 0.225 inch</td>
<td>1</td>
</tr>
<tr>
<td>3 COAX 20 AWG Spiral Shield ePTFE Tape PVC Jacket</td>
<td>41078-3</td>
<td>3 Conductor 75 Ohms 30 AWG Coaxial Video Cable</td>
<td>Conductor: Silver Plated Alloy copper; insulation: FEP Fluoropolymer; Dual Spiral Shield; FEP Inner Jackets; Binder: ePTFE; Jacket: PVC LF</td>
<td>6.7 mm / 0.265 inch</td>
<td>1</td>
</tr>
</tbody>
</table>
Catheter tubing is used in a broad range of medical and industrial technologies. Whether it’s a neurosurgical application or a cardiovascular need, leading device companies look to HPMS for innovation and leadership. Our expertise in tubing, co-extrusions, braiding using vertical reel-to-reel continuous braiders with variable pick count, and secondary operations has made HPMS a dominant player in the catheter market. In-house tooling and rapid prototyping, enables quick-turn development with reduced time to market. All this is done in state of the art facilities with white room extrusion and ISO class 8 clean room secondary operations and full device assembly. HPMS is committed to providing the next-generation solutions that their customers have come to expect.
Tubing & Assembly Competencies

1. Precision tubing capabilities.
   - Expertise on the extrusion characteristics of a diverse range of thermoplastic materials including radiopaque fillers, low friction additives and custom blends.

2. Complex extrusions and multi-layer assemblies.
   - Advanced braiding technology provides high burst strength for multilayer tubes.

3. FROM CORE TECHNOLOGIES TO FINAL ASSEMBLY

4. High pressure braided tubes can have plastic or metal braid.

5. A wide array of secondary operations including tipping, forming, cutting, bonding and flaring.

6. Certified for full device assembly and packaging.

7. Additional processing options and capabilities.
Material
We offer material expertise in conjunction with compounding services that allow our customer to procure the exact raw materials and needed formulas. We take great care to manage all materials from procurement through production to ensure that the material quality remains consistent from lot to lot. We work with the full spectrum of standard and specialty materials such as PEEK, Nylons, TPU, PP, PE, TPE, Polyimide, and PTFE, including resins with radiopaque fillers and other functional additives.

Tool Design & Manufacturing
We offer a full service in house CNC machine shop providing us the capability to take an existing print, design and manufacture the tooling, extrude the tubing with various trials as required and make whatever fine adjustments that are needed quickly and on the fly. With a strong understanding of machine design and material behavior, our team of experts can help you realize even the most complex of design.

Tube Extrusion & Braiding
State of the art extrusion expertise with ½ inch (12.70 mm) to 1-1/2 inch (38.1 mm) single screw extruders. We use a wide array of proprietary techniques and equipment ranging from proprietary take-off equipment, pullers and bump pullers, to water treatment and product control systems. All products are continuously monitored from beginning to end so that we may ensure only the highest quality leaves our facilities. Our specialty is tapered (“bump”) tubing, micro-tubing, multi-layer and multi-lumen tubing and high pressure braided tubing.

Secondary Operations
No tubing product is complete without the supporting secondary operations that make most of our capabilities so unique. We offer pad printing reflow capability, marker band assembly, annealing services, inline printing and secondary marking, overmolding services, forming, drilling, welding, bonding solutions, packaging, and more!

Device Testing
All products are manufactured to meet and exceed customer expectations. We provide process validation, in-line continuous gaging on O.D. / I.D. / Wall thickness, SPC controls as well as function performance testing like tensile strength, elongation testing, leak and burst testing. When proprietary solutions require additional validation we will go above and beyond to ensure that those needs are met and that the quality is highly repeatable and traceable.

Assembly
ISO 13485:2016 facilities provide full device assembly and contract manufacturing services as needed to ensure that volumes are met and quality remains priority one. Whether it is a component or sub-assembly for OEM final manufacturing or a fully packaged device, we offer our customers solutions and a partner in Hitachi that ensures reliable service and solutions that are scalable and global if needed.
## Applications

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Key Technologies Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiology &amp; Peripheral Vascular</td>
<td>Braiding, Co-extrusion, RF tipping, Multi-lumen, High Precision Single Lumen</td>
</tr>
<tr>
<td>Vascular Access</td>
<td>Precision Polyurthane, Tapered / Bump Multi-lumen, RF Tipping</td>
</tr>
<tr>
<td>Gastroenterology</td>
<td>Co-extrusion, Precision Single Lumens, Multi-lumen, RF Tipping</td>
</tr>
<tr>
<td>Urology</td>
<td>Single Lumen, Multi-lumen, RF Forming, Skiving &amp; Punching</td>
</tr>
<tr>
<td>Surgery</td>
<td>High Temperature Materials, Multi-lumen, Precision Single Lumen</td>
</tr>
<tr>
<td>Neurovascular</td>
<td>Braiding, Co-extrusion, Micro-extrusion, Striping</td>
</tr>
<tr>
<td>Structural Heart</td>
<td>RF Tipping, Over-jacketing Extrusion, Single Lumen Extrusion</td>
</tr>
</tbody>
</table>
Medical Tubing

Advanced Materials
Multi-layer & Multi-durometer
Complex Geometries & Tapers
ISO 13485:2016
Full Device Manufacturing

Precision Sizing
Multi-lumen
Radio-opaque stripes for visibility inside the body by X-Ray

StandardCapabilities
- Outer Diameter:
  - 0.005 in. (0.12 mm) minimum, based on construction
  - 0.875 in. (22 mm) maximum, based on construction
- Inner Diameter:
  - 0.003 in. (0.08 mm) based on construction
- Wall Thickness:
  - 0.001 in. (0.025 mm) minimum
- HPBT Braid Diameter
  - 0.006 in. (0.15 mm) with variable pitch
  - Nylon monofilament
- Maximum Number of Lumens: Up to 24
- Number of Layers: Up to 5
- Number of Durometer Changes: Up to 2 via extrusion & multiple via secondary bonding
- Number of Taper Transitions: Up to 3

Standard Materials
ABS
Carbothane™
ECTFE
EFEP
ETFE
EVA
FEP
HDPE
Hytrek®
LCP
LDPE
LLDPE
Nylon
PBT
Pebax™
PEEK
Pellethane™
PET
PFA
Polyimide
Polypropylene
Polysulfone
POM
PVC
PVDF
Quadraflex™
Quadrathane™
Tecoflex™
Tecothane™
TPE
TPU
Ultem™
PTFE

Note:
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Ultem™ is a registered trademark of SABIC GLOBAL TECHNOLOGIES registered by GENERAL ELECTRIC COMPANY CORPORATION.
Braided & Non-Braided High Pressure Tubing

Medical fluid management tubing is designed for a large range of procedural applications. Our low pressure, high pressure, and pressure monitoring tubing are available in various materials, reinforcements and sizes.

Applications

1. Contrast Injection
2. Interventional Cardiology
3. Radiology
4. Vascular Access
5. Pressure Monitoring
6. Stent Placement
7. Inflation Tubing
8. Fluid Administration
9. Vacuum Procedures
10. Waste Management

Specifications

<table>
<thead>
<tr>
<th>Common Braided Styles</th>
<th>High Pressure Braided Tubing (HPBT)</th>
<th>High Pressure Co-Extrusion (HPCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Rating</td>
<td>1,200 psi (82.73 bar)</td>
<td>1,200 psi (82.73 bar)</td>
</tr>
<tr>
<td>Common Sizes* ID/OD Inches (ID/OD mm)</td>
<td>STYLE 1 0.071 x 0.142 (1.80 x 3.61 mm)</td>
<td>STYLE 1 0.071 x 0.142 (1.80 x 3.61 mm)</td>
</tr>
<tr>
<td></td>
<td>STYLE 2 0.088 x 0.188 (2.24 x 4.78 mm)</td>
<td>STYLE 2 0.088 x 0.188 (2.24 x 4.78 mm)</td>
</tr>
<tr>
<td>Material</td>
<td>Polyurethane with Nylon Braid</td>
<td>Polyurethane / Nylon Co-extrusion</td>
</tr>
<tr>
<td>Length* Inches (mm)</td>
<td>10, 20, 24, 30, 48, 60, 72 (254, 508, 762,1219, 1524, 1829 mm)</td>
<td>10, 20, 24, 30, 48, 60, 72 (254, 508, 762,1219, 1524, 1829 mm)</td>
</tr>
<tr>
<td>Flexibility</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Clarity</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

*Diethylhexyl Phthalate, DEHP is the most common member of the class of phthalates which are used as plasticizers and have been deemed harmful to humans. All materials mentioned are Phthalate free PVCs used.

Luer Attachment, Product Customization, and OEM Assemblies

HPMS has the ability and capacity to customize your tubing and assembly. If our variation of common sizes doesn’t fit your needs, we are happy to customize an extrusion to your specification. We can build a wide variety of custom products with luer attachments using solvent bonding, RF welding and custom over molding.

- Fixed and Rotating Luer Locks
- Clamps
- Caps and Covers
- Spikes
- Drip Chambers
- Syringes
- Valves
- Manifolds
Value-added operations are an integral part to any successful product design. Understanding the secondary operation involved and planning for them up front can dramatically decrease product costs and often increase product performance. Secondary operations can often help engineers achieve ideas that might have otherwise been impossible and they can often reduce the overall complexity of a final assembly when properly managed.

<table>
<thead>
<tr>
<th>Secondary Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF TIPPING</td>
</tr>
<tr>
<td>THERMAL FORMING</td>
</tr>
<tr>
<td>PRECISION CUTTING</td>
</tr>
<tr>
<td>PAD PRINTING</td>
</tr>
<tr>
<td>BRAIDING</td>
</tr>
<tr>
<td>RF BONDING</td>
</tr>
<tr>
<td>SKIVING</td>
</tr>
<tr>
<td>KITTING &amp; ASSEMBLY</td>
</tr>
<tr>
<td>INJECTION MOLDING</td>
</tr>
<tr>
<td>ADHESIVE BONDING</td>
</tr>
<tr>
<td>RF FLARING</td>
</tr>
<tr>
<td>DRILLING/ PUNCHING</td>
</tr>
</tbody>
</table>
Full Assembly

At HPMS, we have the expertise and systems in place to see new products through from concept to production. We offer partial and full assembly services in a Class 8 cleanroom with product labeling, complete packaging, sterilization management if required, shipping support for sterilization activities, inventory management and warehousing when required. We pride ourselves on our ability to provide a one-stop, hassle-free contract manufacturing source with exceptional quality, service and our commitment to excellence. Whether it is a final molded assembly or a multi-step conglomeration of secondary operations leading to a final packaged assembly, we are able to serve the needs of the large OEMs and the small startups alike.
Quality & Value-added Testing

Our stringent quality procedures and testing are critical to the performance of any Hitachi product. Our quality systems and best practices ensure that every lot of material leaving the factory is as equally reliable as the first lot manufactured. We pride ourselves on providing inline testing and validation services as well as having the capability to perform more comprehensive value-added testing to support your business and increase a product’s velocity to market.

To ensure that our products meet the demands of our customers, we design and manufacture the extrusion tooling in-house. Our engineers are uniquely qualified to create extremely complex and precise tooling which is maintained and inspected throughout the life of the product. The designs require a strict understanding of not only the processes involved but also how specific materials behave and interact.

Our compounding partners test and validate every batch of material that we consume. It is important that the materials are dry, free of contaminants, and thoroughly blended for uniformity. All materials receive a Certificate of Conformance and they are packaged to resist subsequent contamination and moisture intrusion. In production, those materials are further refined via dryers and screen filtering to ensure that the material meets the performance requirements.

Inline measurement testing as well as secondary quality checks seek to guarantee that every part meets and/or exceeds our customer’s expectations. Process control charts, moisture analysis prior to extrusion (which is important for TPU and other materials), in-line laser measurement for diameter control, spark testing of electrical cables, and secondary annealing of extruded tubing are all used to verify our products prior to final inspection.

Our measurement equipment is routinely calibrated to ensure that production lines remain in conformance throughout the life of a product. Process validations, strict document control procedures and Quality Management System tools help to track quality on a lot by lot basis, in addition to alerting technicians of scheduled preventative maintenance and calibration needs, including functional test equipment such as burst and tensile tester, scopes, rulers, calipers, ring gages, and pin gages.

Lab testing is also regularly performed to validate product conformance for our cable, tubing and machined components. We offer a wide array of standard testing as well as additional non-standard customer specific test services which are available upon request. This additional testing provided a significant benefit to customers seeking to minimize their vendor pool and supply chain management needs.

### Tubing
- Tensile/elongation testing
- Burst testing
- X-Ray imagery
- Automated optical inspection

### Cable/Fiber
- Cirrus testing for shorts
- Continuity and high potential testing (dielectric withstand) up to 1000V, capacitance, impedance, velocity of propagation, skew, time delay, and attenuation up to 50 GHz measurements
- Flex testing
- Optical Time Domain Reflectometer (OTDR) for fiber optic cable
- Thermal cycling chambers for ship/shock testing

### Machining
- Automated optical/pin gauge inspection
- Surface finish and flatness testing
- Specialty steels material testing
- Coating validation

### Hitachi Metals Japan
- Highly specialized testing for material science of metals and polymers
- Scanning Electron Microscope
- IR & Raman Spectroscopy
- Biological and environmental validation
- Robotic flex testing
Machining & Assembly Fabrication

HPMS offers our tubing customers a wide range of medical and clean industrial machining services for standard and exotic materials through its Hi-Tech Machine & Fabrication (HTMF) product line. HTMF specialize at manufacturing highly innovative extrusion tooling and downstream tube processing equipment. Because they are co-located with our extrusion business in Rhode Island, U.S.A., our tubing customer receive a significant velocity to market advantage when it comes to prototyping, production, and repairs. The shop is ISO 9001:2015 and ITAR registered. From concept design to finished product, HTMF is a ‘one-stop shop’ for machining and fabrication.

NAICS Codes:
- 332710
- 332721
- 339112
- 332999

Cage Code:
- 79N81

DUNS #:
- 081362144
Machining & Fabrication Competencies

1. Computer aided design and engineering services.
2. Material and processing expertise.
5. Quick-turn solutions, product stocking and standard parts.
6. Automated assembly, component inspection and quality validation.
7. Component assembly, equipment fabrication, cable assembly and delivery.

FROM CORE TECHNOLOGIES TO FINAL ASSEMBLY
Selecting a shop that fully understands the complexities of today’s high performance materials is important. At HPMS, we have developed strong competencies with almost any material through extensive development of optimal toolpaths and process speeds as well as investment in advanced cutting tools. Whether it is a standard tool steel, carbon steel, aluminum, copper, plastic or a high performance material such as Monel®, Inconel®, titanium or Exceron®, we have the expertise and the right equipment for the job.

**Design & 3D Additive Manufacturing**
We offer a full range of in-house computer aided design (CAD) and prototype development services. Our team of engineers and designers have extensive experience in tool and machine design and can offer assistance during the design phase of your project to improve manufacturability. This reduces cost and time to market while increasing product quality. We can work with your native models directly or create them from scratch for computer aided manufacturing (CAM) programming.

**Equipment Lineup**
We utilize 3-Axis up to 5-Axis state-of-the-art machining centers. We offer milling, wire / small hole EDM, turning, grinding and waterjet services as well as a full suite of fabrication and welding equipment. Matching the right equipment to the job as well as using the latest in machine technology provides consistent product quality for precision components.

**Component Manufacturing**
From 1 part to 10,000 parts, Hi-Tech has the capability and capacity to handle just about any project. Our lathe equipment is capable of turning up to 24 inches (610 mm) in diameter while our milling envelope limits are 16 inches (406 mm) x 24 inches (610 mm) x 40 inches (1016 mm). We work closely with partner manufacturers should your project have certain components that fall outside of those limits.

**Quality Assurance**
HPMS’s high level of customer satisfaction is backed by robust quality and operational systems. As an ISO certified and ITAR registered facility, material and job traceability, 100% part inspection, non-destructive testing, and strict flow down requirements are a way of life. Our advanced ERP system tracks your project from the quoting phase to shipment, allowing for precise control and scheduling. You can be assured that your products will be delivered correctly and on time, to the best of our abilities.

**Contract Manufacturing and Assembly**
When it comes to selecting a manufacturer for your project, flexibility is key. Whether it is coordinating with outside value added services, organizing a vendor-managed inventory system, or part expediting, Hi-Tech provides a manufacturing solution that reaches much further than part production. We use an extensive network of suppliers for post machining process as well as offer high level system assembly, testing, and integration services.

**Cable Assembly**
HPMS offers in-house cable assembly and wiring device services. Whether the need is for a proof of concept device or for the development of low volume production, we have the facilities and expertise to support you.
Applications

Machining Applications
- Production machining components for medical, commercial and defense.
- Extrusion Tooling, Crossheads, in-line heads, profile dies, multi-lumen, multi-layer, rubber/silicone.

Available Materials:
- 300 and 400 series stainless steels
- All tool steels
- High-temperature materials (Monel®, Inconel®, Hastelloy® and titanium)
- Specialty alloys
- Performance plastics and composites

Note:
Monel® and Inconel® are trademarks of HUNTINGTON ALLOYS CORPORATION, SPECIAL METALS DIVISION, A SUBSIDIARY OF SPECIAL METALS CORPORATION registered by the INTERNATIONAL NICKEL CO.
Hastelloy® is a registered trademark of HAYNES INTERNATIONAL, INC. registered by HAYNES STELLITE COMPANY.

Medical Extrusion Tooling
Our innovative designs provide for quick tooling change out, fast material transitions, decreased tooling costs, improved material flow that reduces weld lines, and leak free seals. We can provide standard or custom tooling solutions which reduces set up times, material loss, and overall manufacturing costs.

Equipment Lineup:
- Crossheads and inline heads (.25 in. (6.35 mm) to 3.5 in (88.9 mm) standard die capabilities)
- Multi-lumen tools
- Profile dies
- Pelletizing stand dies
- Rubber & silicone heads
- Multi-layer crossheads
  - 2 and 3 layer standard heads, up to 5 layers
  - External and encapsulated striping
  - Adjustable layer control
- Support tooling
  - Breaker plates
  - Barrel flange adapters
  - Tool carts and stands
  - Vacuum sizing tooling
  - Custom fixtures and replacement parts

Standard Features:
- Multi-flute spiral deflectors eliminate weld lines
- Positive sealing surfaces prevent tool leaks
- Quick change tooling for rapid product line changeover
- Easy die concentricity adjustment
- Threaded feed ports that are adaptable to any extruder
Capabilities

We strive to be on the cutting edge of technology and innovation. Our facilities and equipment are specifically selected to provide the best output for both quality and production volumes. We have spared no expense in procuring state-of-the-art equipment and we are dedicated to expanding our breadth of services and offerings. We welcome partners that appreciate the importance of quality and expectation for speed and reliable service.

- **In-house Design & Manufacture**
  - Extrusion Tooling
  - Spiral Flow Heads
  - Tips & Dies
  - Crossheads & Inline Extrusion Heads
  - Mold Tooling
- **Services**
  - Milling
  - EDM
  - Turning
  - Grinding
  - Swiss Screw (Partner Service)
  - Inspection & Measurement
- **Medical Component Machining**
  - Titanium & Specialty Metals
  - Tool Carts & Stands
  - Custom Fixtures
- **Tool Maintenance & Repair**
- **3D Additive Manufacturing**

New England is not only home to some of the largest and most prestigious medical OEMs, but it has a long tradition of supply to the defense industry. Connecticut is home to many of the leading military/aerospace/defense corporations in the United States. Nearby are some of the largest prime military contractors on the East Coast. HPMS, through the HTMF product line, takes pride in serving all our markets with an expertise in machining exotic metals specifically for highly demanding applications and technologies. Our commitment to quality and rapid delivery is a part of that proud New England heritage.

The appearance of U.S. Department of Defense visual information does not imply or constitute DOD endorsement. The images shown here are courtesy of https://www.defense.gov/observe/photo-gallery/

**Trusted By the Department of Defense**
Fabrication Solutions

Whether the need is for a simple water jet-cut fixture, a weld repair job, or a completely new integrated system, our fabrication department can provide superior service and timely production. Small or large, we are up to the challenge of building complex assemblies and machinery. Our industry partners allow us to fully integrate, test and deliver custom equipment.

Fabrication Solutions:
- Water jet cutting (8 ft x 13 ft (244 cm x 396 cm) Omax)
- Welding (MIG, TIG, Arc)
- Brazing, Plasma Cutting, & Basic Fabrication
- Optical / CMM Inspection
- Finishing / polishing & Ultrasonic Part Cleaning

Stop in and see our facilities at any time.
You’ll be glad you did!
Three-dimensional Additive Manufacturing (3D printing of metal), offers unrivalled design freedom for complex parts in a wide range of materials without the traditional design and manufacturing constraints.

Talk to Hitachi about being your innovation partner.
Assembly Integration

Hitachi’s global presence and portfolio of technologies allow us to provide solutions that are highly complex yet simple when viewed from a single source partner relationship. Our customers benefit from the Hitachi Group Company resources and expertise and OEMs can rely on us for high volume production expectations because, as Hitachi, we have the resources and wherewithal to support the ever-changing needs.

We are a vertically integrated supplier bringing concept to reality though all stages of production.

Please note that this is a stock photo example of a representative product which HPMS could manufacture. Due to strict confidentiality we do not openly share our customers’ details or images unless very specific approvals are provided and authorized. This is not a final device manufactured by HPMS. The assembly represents a strong conglomeration of capabilities and services that can be offered.
Optical Fiber

Optical fiber is increasingly used in medical applications where high reliability is required. Exterior jackets to withstand heat and/or cleaning solutions are available.

Features & Benefits
- High speed signal transmission
- Noise reduction / EMI proof
- Lightweight
- High temperature operation: 300°C (Polyimide) available
- Various optical connector options available
- 80μm and 125μm glass clad diameter available
- Plastic optical fiber available; -60°C – 150°C, excellent chemical resistance
- Metal clad specialty fiber available

Hybrid Cables (Optical/Electrical)
The integration of Optics and Electronics is a trend in many fields. We provide hybrid cable and the precision assembly solutions to meet highly specialized optical and electrical specifications.

Features & Benefits
- Custom cable design and development
- Unique cable assembly structures
- Vertically integration solutions with optical fiber and metal wire technologies
- Optical to Electrical converter technology also available
- Optical Pioneer since 1985

Optical Interconnect Technology
Medical equipment and devices are often situated and used in environments that are full of noise, such as high voltages and high magnetic fields. Transmission noise is the utmost hindrance for diagnostic imaging, where even the tiniest changes in the affected area should not be overlooked. Hitachi has succeeded in producing fiber and lighter optical wires using our unique mounting technologies and extending the fields of application. Noise free optical transmission, immune to the effects of electricity and magnetic force, will expand the possibilities for diagnostic imaging.

Benefits of O/E Technology
- Noise free optical transmission
- Small diameter
- Lightweight
- Can be handled with a traditional cable
- High speed / large capacity signaling
- Affordable solution for complex problems
Hitachi offers unique fiber optic solutions for medical equipment and infrastructure needs. Our plastic optical fiber offers high temperature resistance in harsh environments as well as our TPU jacketed fiber cables.

**Plastic Optical Fiber (POF)**

Whether it is for a semiconductor sensor device or for an industrial medical inspection device, our plastic optical fiber offers significant advantages. Heat resistance to 302°F (150°C), cold resistance to -140°F (-60°C), heat deformation resistance and resistance to oils, acids, alkaline and many common chemicals.

<table>
<thead>
<tr>
<th>Simplex</th>
<th>Part Number Description</th>
<th>Fiber Diameter x Number Jacket O.D. / Material Operating Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HPOF 1.5 / 2.2 SP High Heat-Resistant Plastic Optical Fiber (HPOF)</td>
<td>0.059 in x 1 (1.5 mm x 1) 0.087 in (2.2 mm) / Fluorinated Ethylene Propylene (FEP); Black -68°C to +302°F (-20°C to +150°C)</td>
</tr>
<tr>
<td></td>
<td>HPOF-S 1.5 / 2.2 SP High Heat-Resistant Plastic Optical Fiber (HPOF-S)</td>
<td>0.059 in x 1 (1.5 mm x 1) 0.087 in (2.2 mm) / Fluorinated Ethylene Propylene (FEP); Inner Clear, Outer Black -68°C to +302°F (-20°C to +150°C)</td>
</tr>
</tbody>
</table>

**NanoCore™ Cable (Plenum & Riser Styles)**

Hitachi’s NanoCore™ Single-Jacket Micro Distribution cables offer 250 micron fiber optic strands in a loose tube cable design. Each fiber strand is color coded for easy identification. The cable is flexible and easy to handle and uses lightweight, flexible aramid yarns to enhance strength. Subunits with 12 strands are only 2mm in diameter. NanoCore™ Interconnect Micro Distribution cable is ideal for MPO (MTP®) style connectors where higher data rates are desired. Custom designs with polyurethane jackets are available for improved cleaning performance.

<table>
<thead>
<tr>
<th>Fiber Type</th>
<th>Core / Clad Size</th>
<th>Wavelength (nm)</th>
<th>Maximum Distance Reach</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 GbE</td>
<td>10 GbE</td>
</tr>
<tr>
<td>OM1 62.5 um</td>
<td>62.5/125</td>
<td>850</td>
<td>300 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1300</td>
<td>550 m</td>
</tr>
<tr>
<td>OM2 50 um</td>
<td>50/125</td>
<td>850</td>
<td>750 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1300</td>
<td>550 m</td>
</tr>
<tr>
<td>OM3 50 um Laser Optimized Multi-mode Fiber</td>
<td>50/125</td>
<td>850</td>
<td>1,000 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1300</td>
<td>550 m</td>
</tr>
<tr>
<td>OM4 50 um Laser Optimized Multi-mode Fiber</td>
<td>50/125</td>
<td>850</td>
<td>1,100 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1300</td>
<td>550 m</td>
</tr>
<tr>
<td>OM5 Wideband Multimode Fiber</td>
<td>50/125</td>
<td>850</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1300</td>
<td>550 m</td>
</tr>
<tr>
<td>OS2 Single Mode</td>
<td>8.3/125</td>
<td>1310</td>
<td>&gt; 25,000 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1550</td>
<td>&gt; 40,000 m</td>
</tr>
</tbody>
</table>
Furcation Tubing

**Features and Benefits**
- Tight dimensional control for easy fiber insertion
- Available in Zipcord construction
- Aramid reinforced for added mechanical protection
- Variety of sizing options to meet customer requirements
- UL94 V-0 material options
- 18 color options
- Low shrinkage for improved environmental performance
- Jacket material options include Hytrel®, LSZH, PVC
- Bare fiber or tight buffered protection options
- Wide operation temperature range material options (-40 deg. C to 85 deg. C)
- Tube can be customized to customer standards (minimum order quantities may apply)
- Jacket color matched to all HCA fiber optic cables
- Standard inner tube color is white

**Applications**
- Breaking-out/Fanning-out cables to connectors
- Patching active devices
- Specialty fiber protection
- Coupler and splitter applications

**Environmental Characteristics**

<table>
<thead>
<tr>
<th>Material</th>
<th>Storage Temperature</th>
<th>Operating Temperature</th>
<th>Installation Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>-40° to 70° C (-40° to 158° F)</td>
<td>-20° to 70° C (-4° to 158° F)</td>
<td>0° to 70° C (32° to 158° F)</td>
</tr>
<tr>
<td>LSZH</td>
<td>-40° to 70° C (-40° to 158° F)</td>
<td>-20° to 60° C (-4° to 140° F)</td>
<td>0° to 60° C (32° to 140° F)</td>
</tr>
</tbody>
</table>

**Reinforced Furcation Tube Part Number Builder**

<table>
<thead>
<tr>
<th>Family</th>
<th>Jacket OD</th>
<th>Tube Ratio</th>
<th>Jacket Material</th>
<th>Tube Material</th>
<th>Exterior Color</th>
<th>Packaging</th>
<th>Special</th>
</tr>
</thead>
<tbody>
<tr>
<td>6800X</td>
<td>AA</td>
<td>B</td>
<td>CC</td>
<td>DD</td>
<td>EE</td>
<td>FF</td>
<td>GG</td>
</tr>
</tbody>
</table>

**X - Style**
- No Reinforcement 0
- Kevlar® Reinforcement 1

**CC - Jacket Material**
- No Jacket 00
- PVDF 01
- PVC 02
- LSZH 03

**DD - Tube Material**
- PVDF 01
- LSZH 03
- PP 04
- Hytrel® 07

**B - Tube Ratio (um)**
- 350/900 A
- 420/900 B
- 600/900 C
- 1100/1400 D
- 2100/2800 E

**AA - Jacket OD**
- No Jacket 00
- 1.0mm 10
- 2.0mm 20
- 3.0mm 30

**JE - Jacket Color**
- Blue BL
- Orange OR
- Green GN
- Brown BR
- Slate SL
- White WH
- Red RD
- Black BK
- Yellow YE
- Violet VI

EE - Jacket Color
- EE - Jacket Color

*Standard colors: Orange, Aqua, Yellow & Erika Violet.
## Material Comparison

<table>
<thead>
<tr>
<th></th>
<th>PFA</th>
<th>FEP</th>
<th>PVC with Plasticizer</th>
<th>TPU</th>
<th>Silicone</th>
<th>Hitachi Non-Sticky Silicone</th>
<th>TPE/TPR</th>
<th>ETFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hypochlorite (Bleach 10%)</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Isopropyl Alcohol</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Poor</td>
<td>Good</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Glutaraldehyde (Cidex)</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Dry Heat</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Sterrad ASP &amp; NX (low temp. hydrogen peroxide plasma gas)</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Steris VPHP (Vapour phase hydrogen peroxide)</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Steam (Autoclave)</td>
<td>Excellent</td>
<td>Good</td>
<td>Fair</td>
<td>Poor</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Fair</td>
<td>Good</td>
</tr>
<tr>
<td>Steris (Paracetic Acid Liquid)</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Good/Excellent</td>
<td>Good</td>
<td>Excellent</td>
</tr>
<tr>
<td>Ethylene Oxide (EO)</td>
<td>Excellent</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Gamma</td>
<td>Poor</td>
<td>Fair</td>
<td>Fair/Good</td>
<td>Good</td>
<td>Fair/Good</td>
<td>Fair/Good</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td>Ozone</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Haptic Feel</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Colorability</td>
<td>Good</td>
<td>Good</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good/Excellent</td>
<td>Good/Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Biocompatibility</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good/Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Plasticizers or Undesirable Additives</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Chemical Resistance</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good/Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Temperature Resistance</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Poor</td>
<td>Good/Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Fair</td>
<td>Excellent</td>
</tr>
<tr>
<td>Temperature Range - (Celsius) Fahrenheit</td>
<td>-240°C to +260°C (-400°F to +500°F)</td>
<td>-240°C to +260°C (-400°F to +500°F)</td>
<td>100°C to 260°C (212°F to 500°F)</td>
<td>-40°C to 125°C (-40°F to 257°F)</td>
<td>-40°F to 51°F</td>
<td>-55°C to 300°C (-67°F to 572°F)</td>
<td>-55°C to 300°C (-67°F to 572°F)</td>
<td>-68°C to 98°C (-90°F to 210°F)</td>
</tr>
<tr>
<td>Low Friction (non-sticky)</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Fair/Good</td>
<td>Poor</td>
<td>Excellent</td>
<td>Fair/Good</td>
<td>Excellent</td>
</tr>
<tr>
<td>Cleanability / Wipe down</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Good</td>
<td>Good/Excellent</td>
<td>Good</td>
<td>Excellent</td>
<td>Good/Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Non-staining Properties</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Poor</td>
<td>Fair/Good</td>
<td>Poor</td>
<td>Excellent</td>
<td>Poor</td>
<td>Excellent</td>
</tr>
<tr>
<td>Anti-yellowing Properties</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Poor</td>
<td>Poor</td>
<td>Good/Excellent</td>
<td>Excellent</td>
<td>Good/Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Jacket Durability (toughness)</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Excellent</td>
<td>Fair/Good</td>
<td>Fair/Good</td>
<td>Good</td>
<td>Excellent</td>
</tr>
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</table>
Hitachi Cable developed a unique irradiation technology to cross-link Polytetrafluoroethylene (PTFE), an element consisting of fluorine and carbon elements, to create a material new to the market, EXCERON®. PTFE is chemically stable and generally not cross-linked by chemical method. Hitachi was able to cross-link PTFE to create EXCERON®, a product that is suitable for many industries. PTFE is widely used in various markets, including but not limited to electric cables, semiconductors, pharmaceutical, food, and clothing.

**Features of EXCERON®**
- 1,000 times more abrasion resistance than conventional PTFE
- Minimum damage to the material rubbed against – even when it is plastic or soft metal such as aluminum.
- Improved creep resistance as compared to conventional PTFE in both room and high temperatures.
- New material provides a springy characteristic that conventional PTFE does not typically exhibit.
- EXCERON® can be provided in a wide range of raw material forms (sheet form roll stock, block stock for machining, powders, strip stock, and preformed parts).
**Other Products from Hitachi**

**Cabling Solutions for Industrial Ethernet**

To accommodate a wide variety of applications, Hitachi Cable offers dozens of unique designs intended to meet your specific needs. From high-flex to static, solid conductor to stranded, high and low temperature, oil and chemical resistant, we have the right industrial Ethernet solution. See Hitachi’s Industrial Ethernet brochure for more information.

**Cabling Solutions for Wireless Applications**

As more and more devices go wireless, the importance of the cable infrastructure supporting those wireless networks grows as well. Hitachi Cable manufactures fiber optic cables, coaxial cables, shielded and unshielded twisted pair cables and hybrid cables to support wireless applications, such as Distributed Antenna System (DAS) and Fiber to the Antenna (FTTA). See Hitachi’s Wireless Solutions brochure for more information.

**Premise & Fiber Catalog**

Since 1986, Hitachi Cable has been developing technologically advanced copper and fiber optic communication cables. Category cables including Cat 5e, 6, 6A, 7, 7A and 8, as well as fiber optic cables, are built to exceed the requirements found in the governing TIA standard, 568-C. LSZH dual rated cables and NanoCore fiber optic cables for assembly houses are also available. See Hitachi’s Premise & Fiber Optic Cable catalog for more information.

**Advanced Flat Cable Solutions**

Modern medical solutions today include robots for doctors to operate inside patients as well as robots to consistently build our medical devices and pharmaceuticals of the future. Hitachi offers flat cable designs that deliver power, data, video and control signals in both high power or very tiny package designs. Flexibility, flex life, cleanliness and the ability to mix and match suitable metal conductors for data and power use, with fiber optics gives maximum configurability control to designers of flat cable and assemblies. See Hitachi’s Advanced Flat Cable Solutions catalog for more information.
Our Vertical Markets

Medical
Our Medical components include solutions for the surgical, catheter, endoscopy and ultrasound markets. Whether a cable, a multilumen catheter, a luer and hub PICC assembly, or ultrasound probe assembly, we can provide custom cables or tubes up to finished medical devices. With our global production and design centers, we can bring you from concept to high volume production wherever you are located.

Data Center
Delivering many single mode fibers in a compact and rugged, easy to terminate cable for a mega data center is our normal mission. We offer HDMI, Ethernet, USB, DisplayPort and many other proprietary communication application solutions. Our flat cables are used inside many communication devices that power cloud data centers globally.

Building Infrastructure
High speed data communications in or between buildings requires both electrical design and material science expertise. Size, flammability, installation, and packaging-handling are all factors important to building designers. We offer low-smoke, non-halogen designs as well as UL Riser / Plenum rated designs in copper and fiber optics for a broad portfolio of building and Industrial communication applications.

Industrial / Robotics
Industrial / Robotics environments require innovation in design expertise. Data Speed, flexing, miniaturization, torsion, flex longevity, temperature, humidity, immersion, particulate generation, and chemical resistance are just a few of the characteristics that we can offer in our portfolio of solutions. Thermoplastics, thermoset materials and fluoropolymers can be combined to deliver environment-suitable interconnect cable, connectors and assemblies, especially for Industrial Ethernet solutions. Robot designers rely on our low particulate, high flex flat interconnection cable and assembly solutions.

Wireless
There are many cable solutions needed to provide a wireless infrastructure to our communities. We can design and build large gauge power wires, combined with fiber optic cables and data or control pairs, for the largest freestanding cell towers. We can provide 5G Small Cell / Distributed Antenna System (DAS) cabling solutions for outdoor venues to enable mobile vehicular communications, provide phone services at sporting events or deliver UL approved infrastructure designs for indoor spaces such as airports, malls, subways stations or skyscrapers.

Defense / Security
Hitachi Cable America has cables installed in a wide range of U.S. government and military facilities both domestically and abroad. With ruggedized, tactical cables for a variety of physical environments, shielded cables for secure data transmissions and composite cables for long distance CCTV applications, Hitachi’s U.S. made cables deliver the performance and reliability required by our government agencies. Whether establishing a fiber optic link from one corner of the base to another or delivering 10 Gigabit Ethernet to the desktop, Hitachi has the solution.

Oil / Gas / Mining / Energy
Cable Applications for the energy sector require rugged designs, especially for fiber optic communications to survive wide temperature extremes. Mining in certain regions require regional approvals. From very large cables to small ultrasound cable assemblies for non destructive pipeline testing, Hitachi can bring our years of design experience to your next project.

Transportation
(Automotive, Rail & Rolling Stock, and Aerospace) Passenger safety is a primary design concern for all transportation environments. We are material science experts and can offer guidance on cable and shielding designs to exceed U.S. and international aerospace, rapid transit / rail, and automotive standards and expectations. Flammability designs to comply with NFPA130-2010 standards or FAA regulations are part of our everyday design portfolio.
Advanced Materials
High Performance Cable
Extruded Medical Tubing
Precision Machining

“Great things are done by a series of small things brought together” - Vincent van Gogh

Hitachi Cable America Inc.
Medical Solutions for a Better Tomorrow

Hitachi Cable America Inc. High Performance Medical Solutions
Manufacturing Locations

CATHETERS, MACHINE & FABRICATION Ctr.
15 Gray Lane
Ashaway, Rhode Island 02804 USA
Phone: +1.401.315.0654
Fax: +1.401.315.0766

BRAIDED TUBING
75 Frontage Road/
CT State Rt 617
North Stonington, CT 06359
Phone: +1.860.495.5803

CABLE PRODUCTION
900 Holt Avenue
Manchester, NH 03109 USA
Tel: +1.603.669.4347
Sales: +1.800.772.0116
Fax: +1.603.669.9621
www.hca.hitachi-cable.com