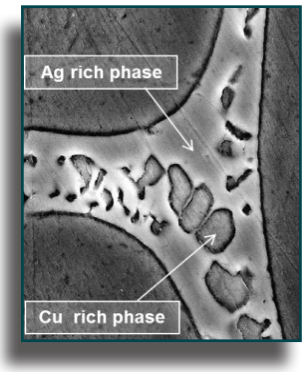
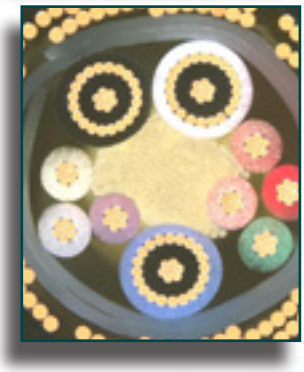
HITACHI
Inspire the Next





Ultrasound · Medical · Inspection Interconnect Solutions

Hitachi Cable America Inc.

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HITACHI

Inspire the Next

Note: Products in this catalog are subject to change without notification.

The Hitachi Cable America Advantage

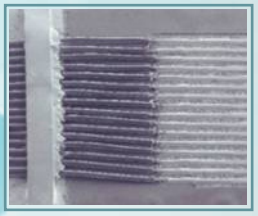
For almost 30 years, Hitachi Cable America, a member of Hitachi Metals Group (Hitachi), has been designing and manufacturing some of the most advanced and reliable power and communication cables in the world. Our products are used globally across a broad spectrum of industries, including medical, financial, manufacturing, educational, government and military. We have facilities around the world that are experienced in manufacturing complex and ultra-fine gauge cable. Our proprietary alloys manufactured through Hitachi Metals are instrumental to our success.

At Hitachi, it is our mission to provide our customers with the maximum cable performance that they have come to expect. We strive to exceed cable performance requirements while improving our own techniques. Our on-site drawing mills, tightly controlled extruders, sophisticated winding machines and advanced braiders allow us to precisely control the key cable elements that make our products so unique while ensuring optimum performance as well as long-term reliability. Whatever the need, Hitachi is ready to support you.

Hitachi offers a broad range of additional services and capabilities to meet your production needs. Our medical and probe assembly facilities are ISO 9001 and 13485 certified. We offer full RoHS compliance, Conflict Mineral verification, biocompatibility testing and sterilization support as well as vendor managed inventory programs.

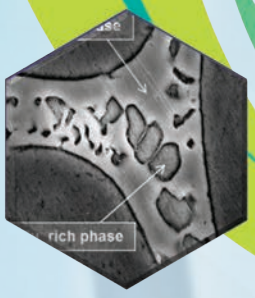
Innovation

Our commitment to continuous improvement and innovation is unwavering. We hope to be the benchmark by which all other manufacturers are measured. We promise to deliver superior quality and high performance cabling and as such we will continue to innovate through material science and process improvement until that goal is achieved.

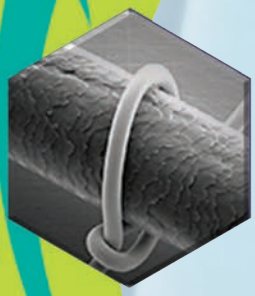


Competencies

CORE TECHNOLOGIES

1 

Advanced material development.

2 

Ultra-fine wire capability.

3 

MCX (Micro-Coaxial Cable) technology yields long flex-life with tight electrical parameter control. Micro twinax cable is also available.

4 

Bundled cable with fine wire coaxials for customer specific designs.

5 

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

6 

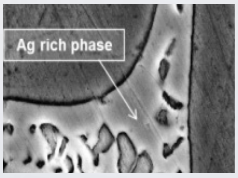
Hitachi specializes in tight-pitch termination on high-density PCBs.

7 

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.

Technology



Metal structure of Cu-Ag alloy

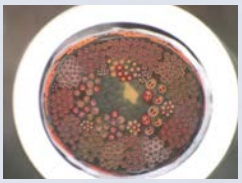
Material

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.


Extrusion machine for foamed PFA

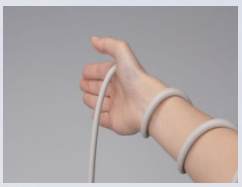
Extruding

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.


368 bundled coaxes with an outside diameter of 6.8mm

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.


High-flexibility SonaEase® cable

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. In-house we utilize advanced testing equipment to ensure only the highest standards of reliability. Whether analyzing the molecular state of a polymer resin, testing electrical properties, or flexing cables to evaluate mechanical characteristics, we can evaluate a very broad spectrum of materials and their properties.


Flex testing

Cable Test

We possess specialized cable test equipment to evaluate and confirm product reliability ranging from the flex testing machines to evaluating the mechanical characteristics of flex and twist resistance, to the electric devices to measure the electric property such as capacitance and impedance are in our labs.

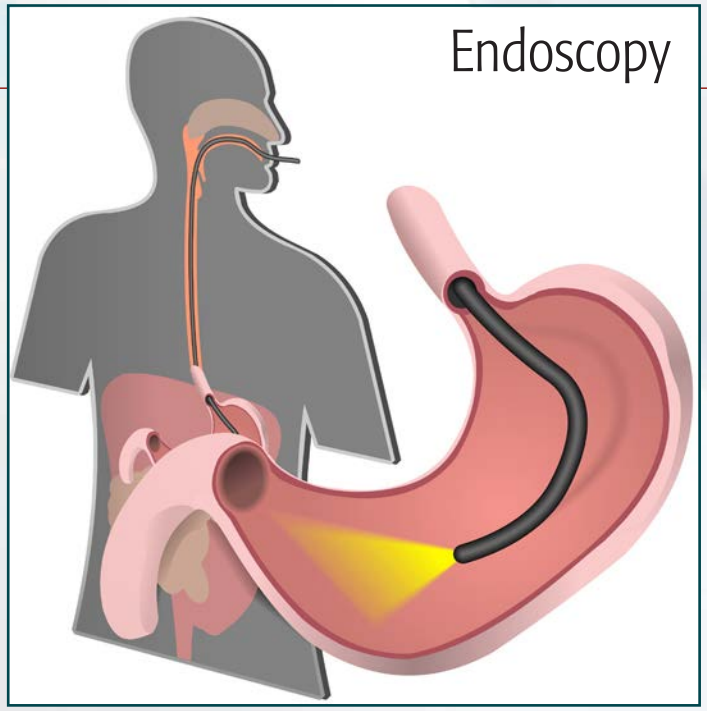

0.2mm pitch soldering

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 used in the inspection of pipeline welds. When quality matters, choose products made with Hitachi cables.

Applications



Non-destructive inspection

Overview of Micro-Coaxial Cable (MCX)

Micro-Coaxial Cable (MCX) is used in a wide array of precision medical products and cabling applications, where high-reliability, high-sensitivity and outstanding signal, capacitance and impedance characteristics are important. Micro-coax is ideal for ultrasound probes, catheters, and advanced endoscopy along with other industrial applications where non-destructive inspection and testing are required. Our micro-coaxial cable is a market leader due in part to our proprietary high-strength alloys with outstanding low-loss characteristics. Ultra-thin insulators made from special fluorine resin enable smaller diameter cables with improved flexibility. 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 every strategy.

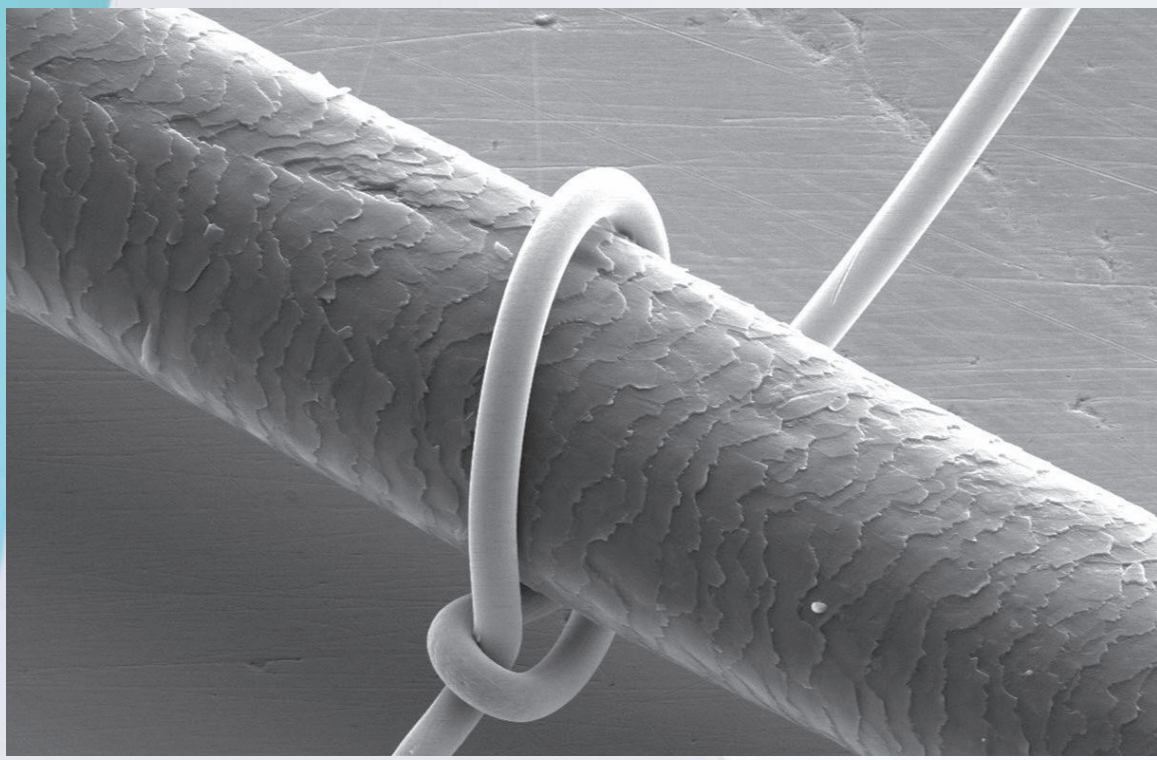


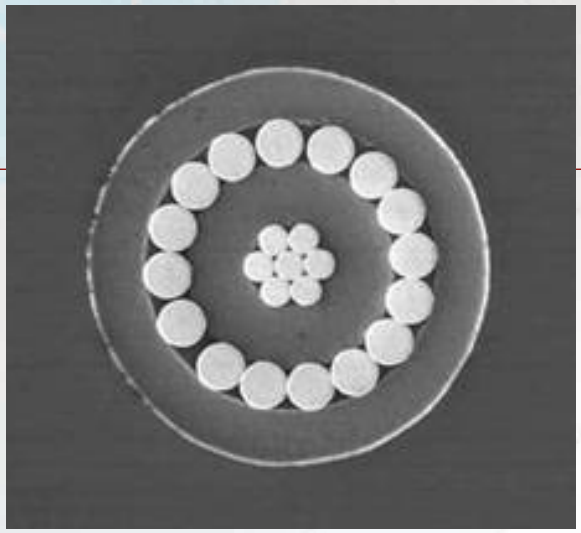
Photo: Hitachi Metals copper alloy wire wrapped around a 80 micron human hair.

Features & Benefits

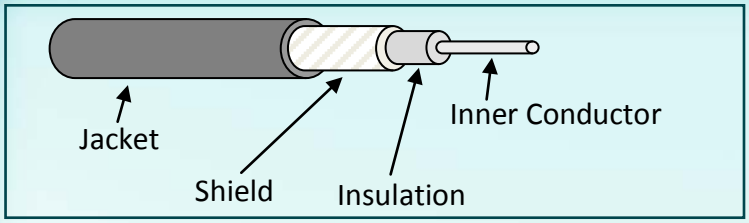
- Micro diameter and super light weight
- Excellent heat resistance and electric properties with fluorocarbon polymer insulation
- Excellent mechanical strength and flexible performance with copper alloy conductor
- Custom design of bundled cable for the required specification

High Capacitance Micro-Coaxial Cable (MCX)

We offer a broad selection of copper alloy wire with precision wire gauges ranging from 36 AWG to 50 AWG and, with a new low resistance HiFC® alloy characterized by very high-tensile strength, long flex life and conductor resistance that approaches copper. This resistance improvement can lower cable attenuation by 20% or more.



Note: 50-60 Ohm Impedance Cables



Coaxial Product Number	Inner Conductor		Conductor DCR@20C Ω/kft (Ω/km)	Insulation	Shield	Jacket		Capacitance pF/ft (pF/m)	Impedance @10MHz (Ω)
	AWG (Stranding)	Material		Material	Material	Material	Diameter Inch (mm)		
5361-110	36 (7/44) (7/0.05mm)	Tinned Copper	479 (1,569)	PFA[3]	Tinned Copper	PFA	0.021 (0.54)	33.6 (110)	50
5381-110	38 (7/46) (7/0.04mm)	Tinned Copper Alloy	1,007 (3,300)			Polyester tape[4]	0.017 (0.44)		
5382-110			610[1] (2,000)						
5401-110	40 (7/48) (7/0.031mm)		1,525 (5,000)		Tinned Copper Alloy		0.013 (0.32)		
5402-110			975[1] (3,200)						
5411-110	41 (7/49) (7/0.028mm)	Silver Plated Copper Alloy	1,525 (5,000)				0.012 (0.31)		
5421-110	42 (7/50) (7/0.025mm)		2,227 (7,300)				0.011 (0.29)		
5422-110			1,265[1,2] (4,150)				0.012 (0.30)		
5431-110	43 (7/51) (7/0.023mm)		2,288 (7,500)				0.011 (0.27)		
5441-110	44 (7/52) (7/0.02mm)		3,203 (10,500)				0.010 (0.24)		
5451-110	45 (7/53) (7/0.018mm)		3,752 (12,300)				0.009 (0.22)		
5461-115	46 (7/54) (7/0.016mm)		4,728 (15,500)		Silver Plated Copper Alloy	PFA	0.008 (0.20)	35.1 (115)	
5481-120	48 (7/56) (7/0.012mm)		7,010 (23,000)				0.007 (0.17)	36.6 (120)	
5501-125	50 (7/58) (7/0.01mm)		11,430 (37,500)				0.006 (0.15)	38.1 (125)	
5401-090	40 (7/48) (7/0.031mm)	Silver Plated Copper Alloy	1,525 (5,000)	PFA	Tinned Copper Alloy	Polyester tape	0.015 (0.37)	27.5 (90)	60
5411-090	41 (7/49) (7/0.028mm)		1,525 (5,000)				0.014 (0.35)		
5421-090	42 (7/50) (7/0.025mm)		2,227 (7,300)				0.013 (0.32)		
5431-090	43 (7/51) (7/0.023mm)		2,288 (7,500)				0.012 (0.3)		
5441-090	44 (7/52) (7/0.02mm)		3,203 (10,500)				0.011 (0.27)		

We reserve the right to alter products at any time.

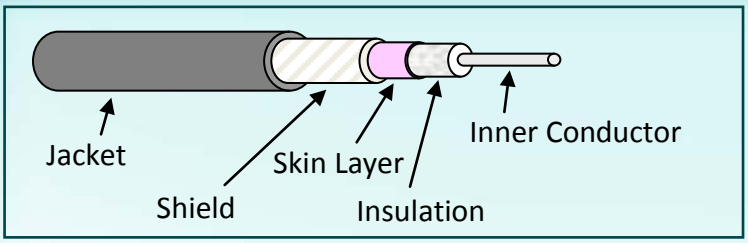
Note: Custom designs available.

[1] HiFC® = Hitachi Fine Copper
[2] Under development
[3] PFA = Perfluoroalkoxy
[4] PFA available

Low Capacitance Micro-Coaxial Cable (MCX)

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 dielectric strength properties required by the medical industry. 38 AWG to 46 AWG wire sizes available.

Note: 75-85 Ohm Impedance Cables



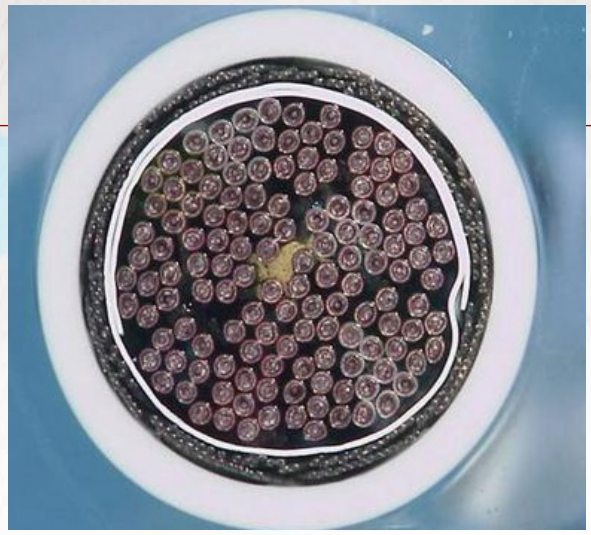
Coaxial Product Number	Inner Conductor		Conductor DCR@20C Ω/kft (Ω/km)	Insulation	Shield	Jacket		Capacitance pF/ft (pF/m)	Impedance @10MHz (Ω)
	AWG (Stranding)	Material		Material	Material	Material	Diameter Inch (mm)		
5381-060	38 (7/46) (7/0.04mm)	Silver Plated Copper Alloy	1,007 (3,300)	Cellular PFA (+Polyester tape skin)	Tinned Copper Alloy	Polyester tape	0.021 (0.54)	18.3 (60)	75
5401-060	40 (7/48) (7/0.03mm)		1,525 (5,000)				0.016 (0.41)		
5411-060	41 (7/49) (7/0.028mm)		1,525 (5,000)				0.014 (0.36)		
5421-060	42 (7/50) (7/0.025mm)		2,227 (7,300)				0.013 (0.34)		
5431-060	43 (7/51) (7/0.023mm)		2,288 (7,500)				0.012 (0.31)		
5441-060	44 (7/52) (7/0.02mm)		3,203 (10,500)				0.011 (0.28)		
5461-060	46 (7/54) (7/0.016mm)		4,728 (15,550)				0.01 (0.25)		
5401-050	40 (7/48) (7/0.03mm)	Silver Plated Copper Alloy	1,525 (5,000)	Cellular PFA (+Polyester tape skin)	Tinned Copper Alloy	Polyester tape	0.019 (0.47)	15.3 (50)	85
5411-050	41 (7/49) (7/0.028mm)		1,525 (5,000)				0.016 (0.4)		
5421-050	42 (7/50) (7/0.025mm)		2,227 (7,300)				0.016 (0.41)		
5431-050	43 (7/51) (7/0.023mm)		2,288 (7,500)				0.014 (0.35)		
5441-050	44 (7/52) (7/0.02mm)		3,203 (10,500)				0.013 (0.32)		

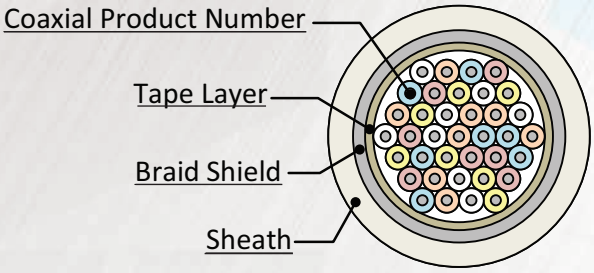
We reserve the right to alter products at any time.

Note: Custom designs available.

Bundled cable

A number of micro-coaxial cables are bundled for ultrasound probe cable. This cable should be designed with required specifications for coax number, diameter, flexibility and so on. Typical parameters are listed below and we have more for custom designs.





Numbering Code: **5xxx-xxx – xxx – xx – xx – x – xx**

- Coaxial Product Number (Page 7 or 8)
- Number of Coaxials (Table.1)
- Braid Shield (Table.2)
- Flexibility (Table.3)
- Sheath (Table.4)
- Sheath color (Table.5)

Table 1. Number of Coax

Number
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

ID	Material	Coverage%	Bend/Twist Lift Test*	Advantage
CA	Tinned Copper Alloy	90	300k cycles<	Low cost
NN	Tinned Hitachi Metals NN High-Strength Copper	90	300k cycles<	High strength (>850MPa)
SX	Tinned SX**	95	300k cycles<	Most Flexible

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

**Tinned sprial wrapped tinsel copper conductor.

NN alloy braid shield

SX braid shield

Bundled cable continued

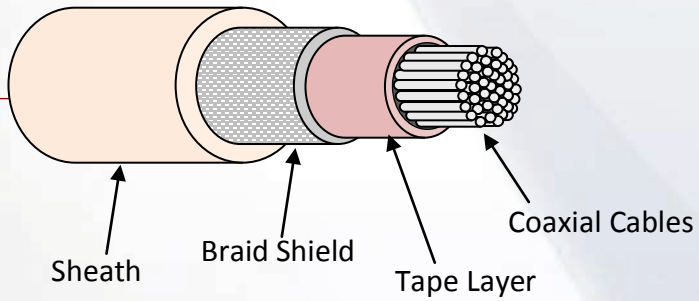


Table 3. Cable flexibility design	
CODE	Flexibility (Limpness)
SE	SonoEase®, highly flexible
HS	High Standard, very flexible
ST	Standard, average flexibility

*The diameter of SonoEase® cable will be about 0.5mm larger than the Standard cable. SonoEase® is only available in PVC. SonoEase® not available with NN braid.

Table 4. Sheath (jacket)				
CODE	Material	Operating temperature	Advantage	Application
P	PVC	-10 to 60°C	Low cost	Medical
U	Polyurethane	-40 to 100°C	Resists cut through, abrasions, chemicals & solvents	Medical, Industrial
S	Silicone Rubber	-60 to 120°C	Resists most stains and is easy to clean	Surgical

Table 5. Sheath (jacket) color	
	Color Code
PVC	(IV) Ivory, (BK) Black
Polyurethane	(WH) White, (BK) Black
Silicone Rubber	(IV) Ivory, (GR) Gray

Example of Bundled Cable

Coaxial Product Number	Inner Conductor	Jacket	Capacitance pF/ft (pF/m)	Number of coax	Braid Shield	Cable Flexibility (Limpness)	Sheath (Jacket)		
	AWG (Stranding)	Diameter Inch (mm)			Material		Material	Color	Diameter Inch (mm)
5401-110-064-CA-ST-P-IV	40 (7/48) (7/0.031 mm)	0.013 (0.32)	33.6 (110)	64	Tinned Copper Alloy	Standard	PVC	Ivory	0.220 (5.6)
5401-110-096-CA-ST-P-IV				96					0.248 (6.3)
5401-110-128-CA-ST-P-IV				128					0.272 (6.9)
5401-110-192-CA-ST-P-IV				192					0.303 (7.7)
5441-060-064-SX-SE-P-BL	44 (7/52) (7/0.02 mm)	0.011 (0.27)	18.3 (60)	64	Tinned SX	SonoEase®*	PVC	Black	0.216 (5.5)*
5441-060-192-SX-SE-P-BL				192					0.295 (7.5)*
5501-125-064-SX-HS-P-IV	50 (7/58) (7/0.01 mm)	0.005 (0.14)	38.1 (125)	64	Tinned SX	High standard	PVC	Ivory	0.075 (1.9)
5501-125-096-SX-HS-P-IV				96					0.087 (2.2)

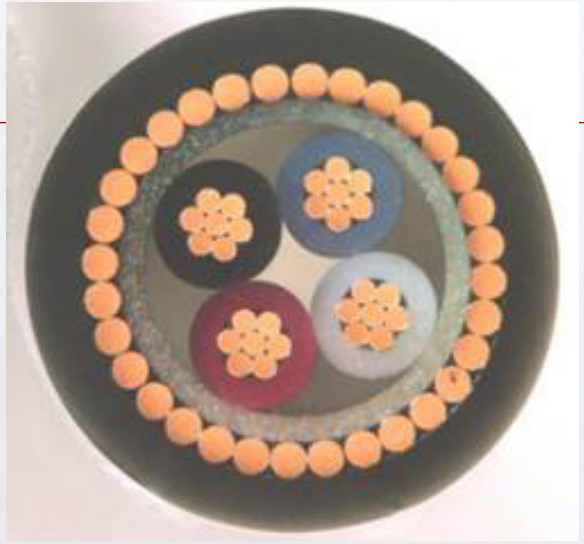
*The diameter of SonoEase® cable will be about 0.5mm larger than the Standard cable.

SonoEase® is a registered trademark of Hitachi Metals, Ltd in Japan.

Catheter cables

Our high strength micro-coaxial cable with ultra-thin medical grade jacketing is the optimal solution for advanced catheter applications.

Features & Benefits
- Various lineup of micro-coaxial and twinaxial cable : ~50AWG (Min)
- Ultra-thin fluorine resin jacket : ~15μm (Min) available
- Ultra-accurate extrusion & cabling technology
- Custom designs to customer's requirement



Catheter Cable (OD = 280μm)

Hybrid bundled cables

Hybrid bundling of a multi-function cable can be realized. Whether it's a custom medical application or an industrial cable need, Hitachi has the cable equipment with the flexibility to handle unique designs. 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.

Features & Benefits
- Various coaxial/twinaxial cable, data cables, tubes, fiber optic and power wires available
- Accurate extrusion & cabling technology
- Precision cable design
- Custom designs to meet specific requirements

Multi-function Probe cable

4D Ultrasound Cable with Air-cooling tube

Industrial Endoscope cable

Capabilities

Ultra-fine wire and paired cable

Application
- Catheter, endoscopy and surgical.

Features & Benefits
- Ultra-fine single wire and paired cables can be unshielded or shielded
- Ultra fine wire applicable : ~50AWG (Min)
- Twisted quad cable available : ~48AWG (Min)
- Solid conductor wire available ; Pair ~48AWG (Min), Quad ~46AWG (Min)
- Custom designs available.

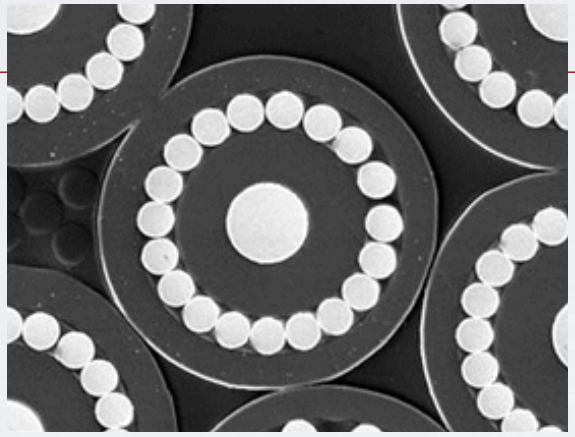
Cable Specification Examples

CABLE EXAMPLES

	Structure		Inner conductor		Insulation	Diameter Inch(mm)	Pair	Shield	Jacket		Capacitance pF/ft (pF/m)	Impedance @10MHz (Ω)
			AWG (Stranding) Material	DCR@20C Ω/kft (Ω/km)			Diameter Inch(mm)	Material	Material	Diameter Inch(mm)		
1	Single wire					0.089	-	-	-	-	-	-
2	Unshielded Twisted Pair	w/o Jacket	48 (7/56) (7/0.013mm) Silver plated copper alloy	7,230 (24,000)	PFA	-	0.178	-	-	-	TBD	TBD
3		with Jacket				-	0.178	-	PFA	0.238	TBD	TBD
4	Shielded Twisted Pair					-	0.178	Silver plated copper alloy	PFA	0.278	TBD	TBD
5	Single wire					0.07	-	-	-	-	-	-
6	Unshielded Twisted Pair	w/o Jacket	50 (7/58) (7/0.01mm) Silver plated copper alloy	12,370 (40,500)	PFA	-	0.14	-	-	-	TBD	TBD
7		with Jacket				-	0.14	-	PFA	0.2	TBD	TBD
8	Shielded Twisted Pair					-	0.14	Silver plated copper alloy	PFA	0.24	TBD	TBD

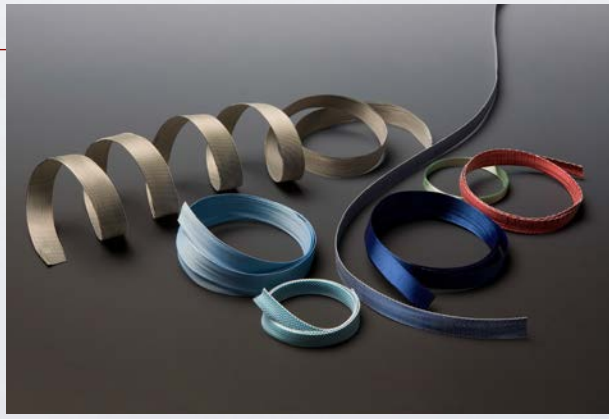
Solid conductor coaxial cable

Features & Benefits
- Various solid conductor sizes : 40~48AWG
- Custom designs to suit specific requirements



Solid conductor coaxial cables

Capabilities

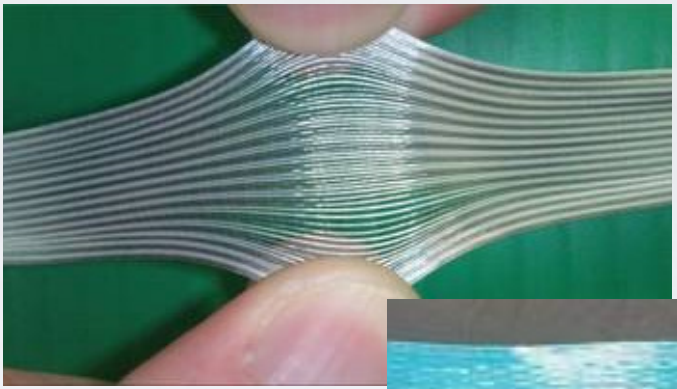


FC Band®

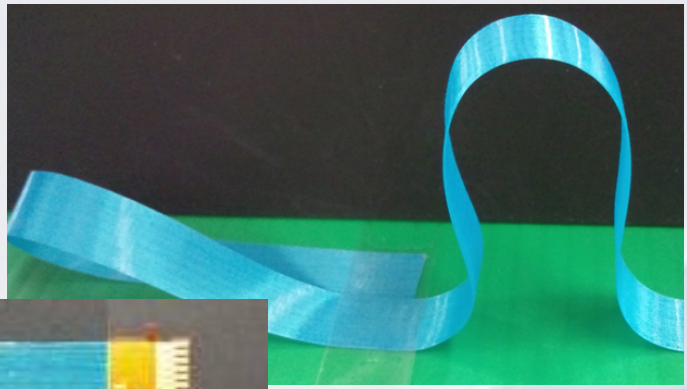
FC Band® is a flat shaped, ultra flexible woven cable. Various coaxial cables and wires can be used in FC band® designs. Shielded FPC connectors are available for FC band® assemblies.

Features & Benefits
- Flexible and easy to handle
- Various cables and woven materials can be used
- Hybrid constructions available (ex. Coaxial + Power cable)
- Small production quantities are available

Description	Characteristic	Application
High-flex type 44 & 46AWG	- Flex life cycle: Min 10Mcycles. (30degrees bending test)	- 3D/4D probe - Small space internal wiring
RF coaxial type 34~40AWG	- Target frequency: Max 6GHz	- TV, PC, Tablet, Semi-conductive tester
Coaxial type 36~42AWG	- Double shield - Low EMI	- TV, PC, Tablet, Security camera
Wire type 32~40AWG	- High ampacity - Folding available - Shield structure available - Long length: ex)1,500mm	- Board-to-board connection - Alternative FPC and FFC
Tough type 20~28AWG	- Usage temperature range: -40c ~150c - Rating voltage: 600V	- Vehicles - Switchboard



High-flex type



Wire type

FC Band® with FPC connector

FC Band is a registered trademark of Hitachi Metals Ltd in Japan.

Capabilities

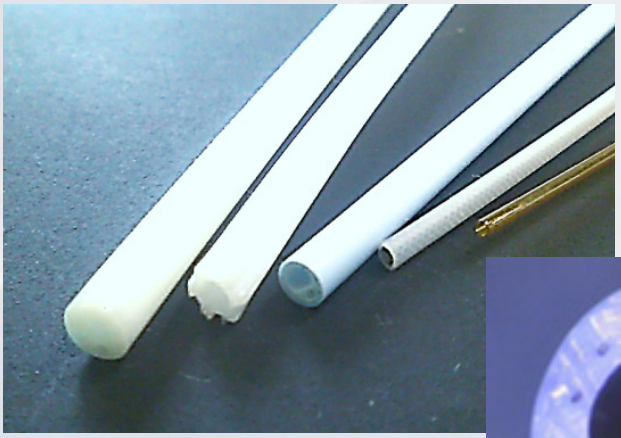
Single/Multi lumen tube (Catheter tubing)

Our high precision extruding technology supports the manufacturing of various designs of single/ multi lumen tube with a wide selection of materials.

Features & Benefits
- Various materials
- Excellent straight running stability
- High Torque (with stainless braid)

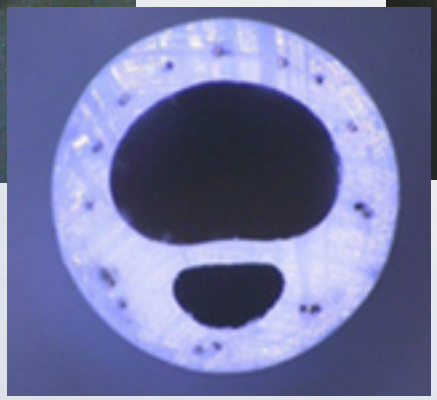
Material	Product
Fluor resin	PFA, FEP, ETFE
Nylon	Rilsan®
TPE	Pebax®
Polyurethane	Pandex®, Tecothane®, ELASTOLLAN®
Polyethylene	HI-ZEX®
Polyimide	AURUM®

Note: We also support other resins not listed here.



Single/Multi lumen tube

Cross section of multi lumen tube



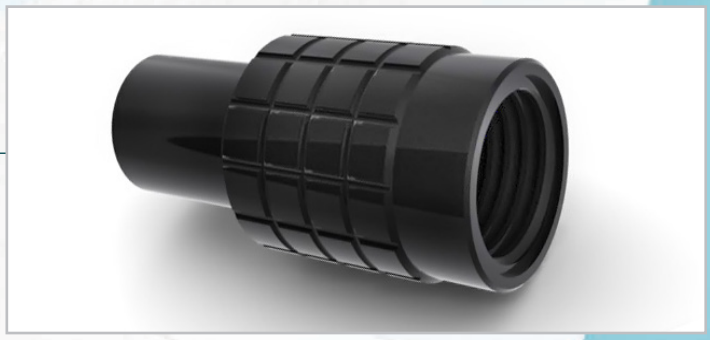
Tube with stainless steel braid

NOTES:
Rilsan and Pebax are registered trademarks of ARKEMA FRANCE.
Pandex is a registered trademark of DIC CORPORATION.
Tecothane is a registered trademark of LUBRIZOL ADVANCED MATERIALS, INC.
ELASTOLLAN is a registered trademark of BASF POLYURETHANES GmbH.
HI-ZEX and AURUM are registered trademarks of MITSUI CHEMICALS, INC.

Capabilities

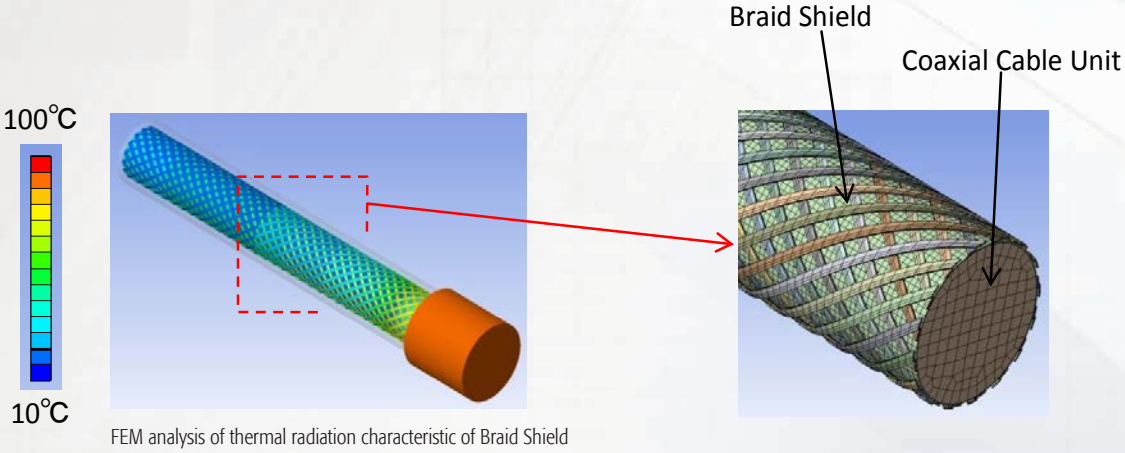
Assemblies

Hitachi offers a broad range of additional assembly services and capabilities to meet your production needs. Our medical assembly facilities are ISO 9001 and 13485 certified. We offer full RoHS compliance, Conflict Mineral verification, biocompatilility testing and sterilization support as well as vendor managed inventory programs if desired.



CAD/CAE

- CAD technology to provide 3-D developmental support and rapid concept prototypes.
- Mechanical and thermal analysis using computer aided engineering (CAE) for increased design reliability.



FEM analysis of thermal radiation characteristic of Braid Shield

Discrete Injection Molding & Machining

- Global molding capability with in-house mold tool development.
- Internal ability to design and fabricate complex machined metal parts.
- Component part verification for manufactured parts and assemblies.

PCB & Component Encapsulation

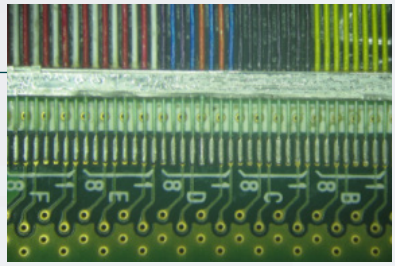
- Flexible and rigid board designs as well as discrete components.
- Watertight sealing and device protection.

Custom Overmolding

- Silicone for reusable devices and other standard medical grade materials (PVC, TPE, TPU).
- Low-cost, Halogen free materials are available.
- Two part overmold bonding expertise.

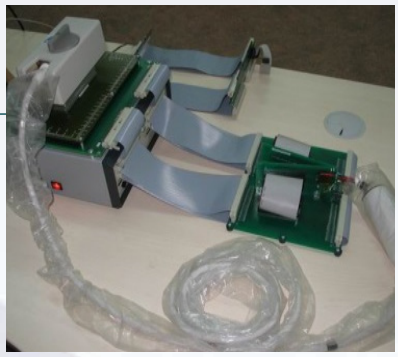
Fine Wire Prepping & Termination

- Soldering expertise up to 50 AWG (7 strands/0.010 mm).
- Jacket etching and selective laser ablation technology available.
- Process support recommendations from low volume prototypes to mass production.
- Partial pigtailed cable assemblies also available for final customer termination.



Test Expertise

- Specialty testing & software development.
- Small to large volume capacity management.
- Biocompatability, sterilization and specialty coating support available.



Full Assembly

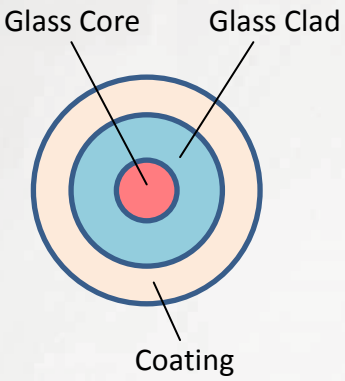
- From simple to complex fully packaged assemblies.
- Complete probes and devices.
- Partial pigtailed cable assemblies also available for final customer termination.

Capabilities

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
- Light weight
- 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 fibers available



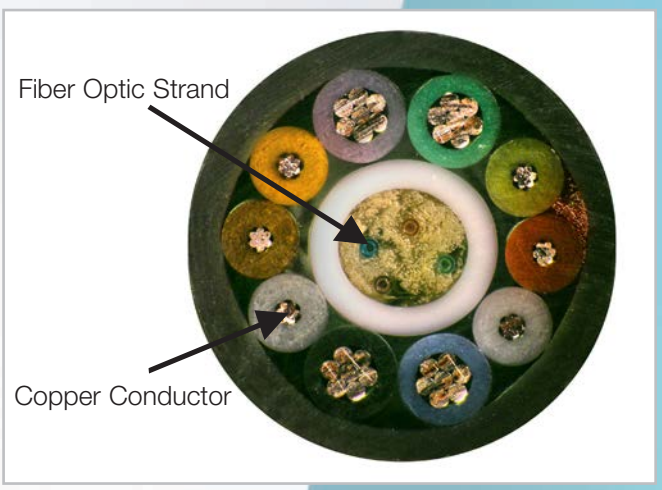
Example of optical fiber specification			
Type	Singlemode fiber	Multimode fiber (Graded index)	
Operating wavelength	1310nm, 1550nm	850nm	850nm, 1300nm
Glass core diameter	9 μm*	50 μm	50 μm
Glass clad diameter	125 μm	80 μm	125 μm
Coating diameter (Material)	250 μm (UV resin)	93 μm (Polyimide)	250 μm (UV resin)
Jacket material	PVC, FEP, UV resin, etc.		

*Mode field diameter

Hybrid Cables for Optical to Electrical Converter Applications

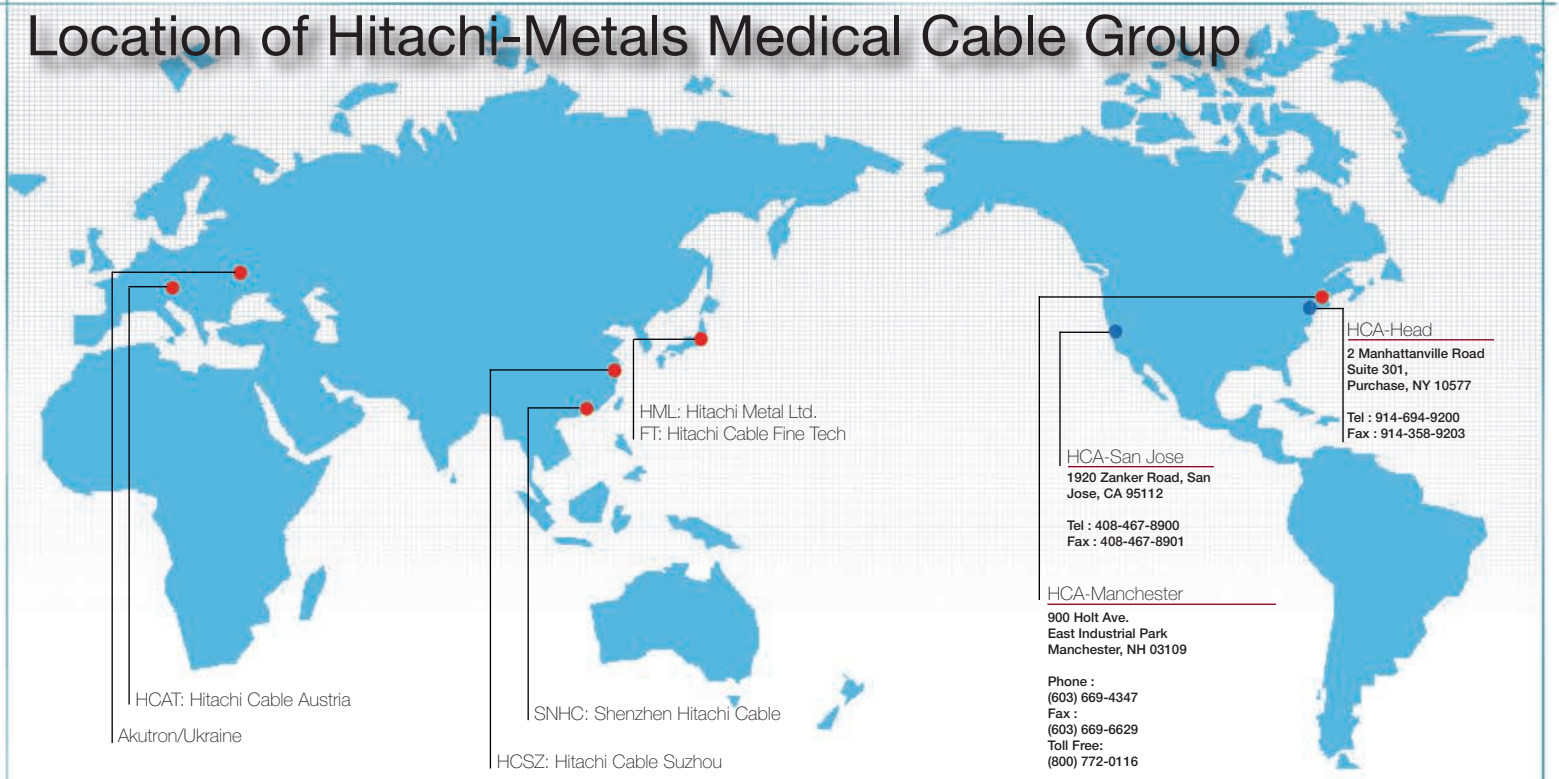
The integration of Optics and Electronics is a trend in many fields. We provide hybrid cable and the precision assembly solution to meet required optical and electrical specifications.

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



Notes

Location of Hitachi-Metals Medical Cable Group



Hitachi Cable America, Inc. is a subsidiary of Hitachi Metals America, Ltd. and is one of many worldwide metals, cable and interconnect businesses in the Hitachi Metals group. We produce unique products for domestic markets and for export around the world.

We are a supplier of high performance materials. We listen to the needs of our customers and society and develop material solutions for a better tomorrow. Whether we are producing a product to be 'smaller and lighter', 'safer and more reliable' or to transmit 'faster and farther', our definition of high performance is delivering what our evolving world needs next.

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