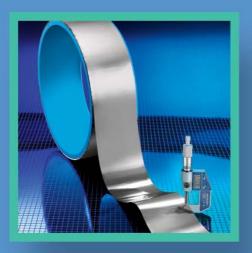
Ulbrich * METALSfor**MEDICAL**

One Metal Supplier, Endless Solutions





We Deliver Precision®



Global Representation with Service and Distribution Centers Worldwide.





We Deliver Precision®

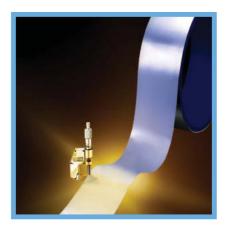
A family owned company in its third generation of leadership, Ulbrich has been supplying stainless steel and specialty metals to the medical device industry for over 50 years. In that time we have participated in the development and manufacturing of dozens of innovative devices. With Industry Leading Dimensional Control, real time gauging and SPC, a large variety of alloys, and simply the best service available, we plan to stay in this business a long time! We are comprised of a series of manufacturing divisions and service centers, all with local management and all designed to provide custom products with top notch service.

Our Products

To some customers, we are a precision re-roller, processing coils of specialty steel to exacting specifications for a hypodermic needle application. To others, we start with fine wire and roll it into precision flat wire with extremely close tolerances to dimensions a fraction the size of a human hair to be used for braided stainless steel reinforced tubing. We may also start with wire and roll it into a net cross sectional shape to be used as orthodontic brace wire. These and many other capabilities are within reach at one of the Ulbrich companies.

Our Service

You can expect nothing but the best when dealing with Ulbrich. We can design custom stocking,VMI and KANBAN programs to ensure material availability and minimize inventory. We have an extensive technical staff at your service and we can produce small samples to be delivered quickly. All of our capabilities, especially our people are what separate Ulbrich from your typical metals supplier.







Precision Flat and Fine Wire

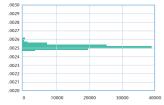


Material is wound on specialized Steeger machine.



Braided stainless steel reinforced tubing (shown magnified) for catheters and related diagnostic systems.

Width Distribution



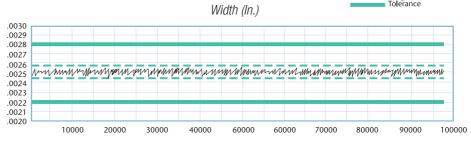
Ulbrich...The new name in ultra fine wires for demanding medical device applications. Our manufacturing facilities in Westminster, South Carolina and Oranmore, County Galway, Republic of Ireland are capable of producing gauges from .0076mm (.0003 inches), widths from .05mm (.001 inches) and rounds to .0075". Both facilities can provide 304V in a variety of tensile ranges for the most common braid wire sizes from stock or with extremely short lead-times. We can also produce fine wire in other special metals including Nitinol.

Our new "Medical Wire Focus Factory" is staffed with dedicated management and engineers, using state of the art equipment to produce the industry's top quality wires. Our production equipment uses the latest in on-line gauging and data acquisition technology, which generates full statistical summaries of each production run. Precision spooling of fine wires onto a variety of spools or bobbins using CNC winders enables trouble-free performance in the most demanding applications.

Ulbrich works closely with our customers to develop custom inventory management programs (KANBAN, VMI, etc.) Maintaining lead times that are typically much shorter than the rest of the industry, turning around sample requests quickly, and working closely with our customers in order to customize the product for their particular application are just a few examples that make our service second to none. All facilities are ISO 9001:2008 compliant.

Medical Mill - Width • SPC Chart - Continuous Data Collection

Width profile of Coil #: 33343-30B Length: 97163ft.
Target 0.002500 in. ±0.0003
Average: 0.002517 in. Average-Target: 0.000017 in. (0.70%)
Std Dev. 0.000023 in.
Cp: 4.4416 • Cpk:4.18 • Cr: 22.5%
Off Spec. Above 0.002800 in.: 0 ft. (0.00%) • In Tolerance: 97163 ft. (100.00%)
Off Spec. Below 0.002200 in.: 0 ft. (0.00%)
Max Width: 0.002650 in. at 4100 ft. • Min Width: 0.002450 in. at 1 ft.
X and R control limits based on groups of 10 readings every 50 feet
Upper Control Limit: 0.002519 in. • X double bar: 0.002517 in.
Lower Control Limit: 0.002516 in.
Max Width: 0.002650 in. at 4100 ft. • Width: 0.002450 in. at 1 ft.
3 Sigma





Capacity

1.9

1.9

1.9

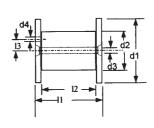
**14.0

9.0

1.0

DIN and Braided Bobbins Spools

Number	d1 Flar		d2 Bar		d Arboi		d Drive		l Overall		l: Trave		K	3
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
DIN 80	3.15	80	1.97	50	0.63	16	0.28	7	2.52	64	2.52	64	0.79	20
DIN 100	3.94	100	2.48	63	0.63	16	0.28	7	3.94	100	3.15	80	0.79	20
DIN 125	4.92	125	3.15	80	0.63	16	0.28	7	4.92	125	3.94	100	0.79	20
DIN 160	6.30	160	3.94	100	0.87	22	0.51	13	6.30	160	5.04	128	1.26	32
10	5.98	152	3.5	89	0.63	15.9	0.40	10.2	4.29	109	3.50	89	0.75	19
Braided Bobbins	2.60	66	1.37	35	0.66	17	NA	NA	3.25	83	2.84	72	NA	NA



Meets ICE 264-2-1 (DIN 46 399).

Steeger and NEB Bobbins

Number	d' Flar		d: Bar				d4 I1 Flange Width Overall Length		l2 Traverse		*Capacity			
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	gms	lbs
15mm	1.57	40	0.59	15	0.42	10.6	0.14	3.6	1.40	35.5	1.02	26	120	0.26
26mm	1.69	43	1.02	26	0.42	10.6	0.14	3.6	1.40	35.5	1.02	26	90	0.20
30mm	1.57	40	1.18	30	0.42	10.6	0.14	3.6	1.40	35.5	1.02	26	50	0.11
NEB	1.32	34	0.74	19	0.33	8.0	0.29	7.0	3.95	100	3.29	84	240	0.5

.0014"

.0015"

.0356mm

.0381mm

Multiple colors available.

Common Wire Sizes

Flat Wire

inch	mm
.0003" x .0035"	.0076mm x .0899mm
.0005" x .0025"	.0127mm x .0635mm
.0005" x .0030"	.0127mm x .0762mm
.0005" x .0050"	.0127mm x .1270mm
.0007" x .0030"	.0178mm x .0762mm
.0007" x .0050"	.0078mm x .1270mm
.0010" x .0030"	.0254mm x .0899mm
.0010" x .0050"	.0254mm x .1270mm
.0010" x .0070"	.0254mm x .1778mm
.0015" x .0050"	.0381mm x .1270mm
.0015" x .0070"	.0381mm x .1778mm
.0020" x .0100"	.0508mm x .2540mm
.0020" x .0120"	.0508mm x .3048mm

* Capacity for 304V SS

Flat Wire		
	Flat Wire	

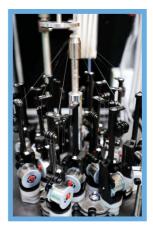
	incn						
	.0030" x .0100"	.0762mm x .254	10mm				
	.0040" x .0100"	.1016mm x .254	40mm				
	.0040" x .0120"	.1016mm x .304	48mm				
Round Wire							
	KUU						
inc	h mm	inch	mm				
.001	0" .0254mm	.00165"	.0419mm				
.001 .001		.00165" .0020"	.0419mm .0508mm				
	1" .0279mm						
.001	1" .0279mm 2" .0305mm	.0020"	.0508mm				

.0036"

.0039"

.0914mm

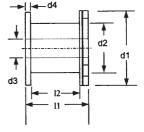
.0991mm



Close up of multiple bobbins wound on Steeger machine.

 ** Available with 16mm bore adapters.

* Capacity for 304V SS





Plated Products



Applications

- Guidewires, Catheters
- Electronic Devices
- Leads & Connectors
- Tubing Mandrels
- Braiding & Stranding
- Embedded Wire
- Orthodontia
- Copper and silver-plated copper mandrels for catheter applications
- . In-house plating equipment for your custom requirements in fine, round and flat wire

Materials

- Stainless Steels
 - 304 304L 304VM 316 316L 316LVM
- Specialty Metals
 - Copper Clad Steel & Aluminum - MP35
 - Titanium - Molybdenum

- Tungsten
- Phos/bronze

Custom Precision Plating

Delta Ulbrich Precision Metals specializes in the continuous plating of round and flat wire. We can custom plate almost any alloy with the following:

 Gold • Tin • Tin/Lead Solders • Tin/Silver Silver

Special Services Available Extra Straight Precision Spooling Straighten & Cut Customized Processes Ribbon Width • .063 and up +/-.003 • .0625 and below +/-.002

+/-.0002

• .0049-Finer

- **Thickness**
- .010-.005 +/-.0005
- *Tighter tolerances available on request.

Resistance

- All ribbon +/-5%
- All ribbon is manufactured to resistance by holding width and varying the thickness



Specialty Strip Mill



Ulbrich Stainless Steels and Special Metals precision strip products are found in a variety of medical applications ranging from Hypodermic Needles to implantable Pacemaker Cans. We re-roll coils of steel to meet highly engineered specifications on one of our eight precision rolling mills. Our controlled atmosphere annealing lines work in tandem with the rolling process to produce exacting mechanical properties as well as maintain the required finishes. In addition to rolling and annealing we have capabilities to aggressively clean the metal surface, tension level, slit, edge and oscillate wind the coils.

Our Metallurgical staff can assist in selecting alloys and formulating a specification. We can custom produce small coils (45kg, 100lb) for your R&D work or we can produce full production quantities. Ulbrich re-rolling capabilities are wide reaching and our excellent staff of people will be with you every step.

Re-Roll Capabilities

- Gauges: .0005 .125 inch (.0127 3.175mm)
- Width: Up to 14 inches (353mm)
- Tempers: Dead Soft Extra Full Hard
- Finishes: Dull Bright Ra 2-60

Special Textures - Rolled or Mechanically Applied

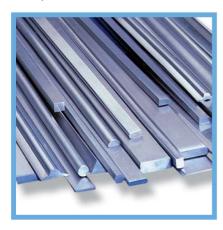
Quality System

• ISO 9001 : 2000 Certified Producer





Shaped Wire



New Product Development

Our products are engineered products, tailored to meet your specifications. Our New Product Team can help you develop custom specifications and even manage your secondary, finishing and prototype requirements.

In addition to shapes, Ulbrich Shaped Wire produces a range of flat wire products with custom edge geometry, in gauges as light as .005" and widths as wide as 1.500".

At Ulbrich Shaped Wire, we have been leading the effort to produce light gauge, wide nitinol strip in continuous coil length. Filling the void in nitinol product form availability, this new wide strip offers a unique solution to current processing limitations. Many new applications are anticipated for this product form in the future.

Sizes, Shapes & Edges

Round Wire

Soap Finish, annealed to spring tempers, in diameters from 0.028 - 0.400 inch. (.711 - 10mm) **Grease Finish,** annealed to spring tempers, in diameters from 0.016 - 0.312 inch. (.406 - 7.92mm) **Bright Finish,** extra-clean, annealed to spring tempers, in diameters from 0.010" to 0.400" (.254 - 10mm)

Flat Wire

Minimum Thickness, 0.005 inch (.127mm) in widths from .050 to .210 inch (1.27 - 5.08mm) Maximum Thickness, 0.250 inch (6.35mm) in widths from .250 to .875 inch (6.35 - 122.23mm) Maximum Width, .022 to 1.50 inch (.558 - 38.10mm) in thickness up to 0.025 (.625mm)

Gauge and Width Tolerances

Your special tolerances, or extra close tolerances, upon request.

Shapes

A wide variety of standard and custom shapes are available from .016" square to .500" half round.

Edges

The following are available on flat and rectangular wire. *Square Edges,* Flat side with very minimum radius at the corners. *Rounded Corners,* Flat side with a large radius on the corners. *Natural Rolled or Round Edges,* No flat side, slightly sharp corner where arc meets flat. *Full Rounded or Blended Edges,* No flat on side. Arc blends into flats, eliminating sharp corners. Note: This edge available at slightly higher cost.

CONC. TO CONCERN

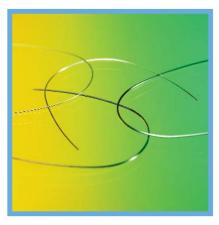


Nitinol Strip in Continuous Coil Length.



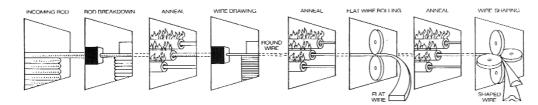
Ulbrich Shaped Wire products are found in a variety of medical applications, ranging from spacers for surgical devices to archwire for braces in the orthodontic industry. We supply to a wide range of medical device and component manufacturers. In addition to all of the stainless steel grades, we work with and stock a wide range of medical quality alloys, including titanium, titanium alloys, nickel alloys, cobalt alloys and nitinol.

The versatility of our shaped wire process allows us to produce net or near-net custom cross-sectional shapes with compositions and mechanical properties tailored to meet your specification requirements. Starting primarily with rod or wire, we breakdown to exact starting diameters to remove any variation in the raw material, allowing us to tightly control finished tolerances. Subsequent flat rolling and shape rolling or drawing with intermediate anneals to restore properties and control finished properties allow us to achieve your custom shape.



Archwires for Braces.

Shaped Wire Process



Round Wire

Diameter	Standard Tolerance
.091 and up	+/001
.05110909	+/0008
.0510201	+/0005
.0200159	+/0004
.01580089	+/0003

*Tighter tolerances available on request.





Service Centers

At our six North American service centers, Ulbrich offers a large selection of stainless steel and special metals. The coils in our inventory covers a wide range of gauges, widths, tempers and finishes suitable for the medical industry. Our service centers are capable of stocking highly engineered inventory, custom made, and designed for specific medical applications. The material we stock is produced at our own re-rolling facility or from some of the most capable specialty steel producers around the world.

We are constantly upgrading our slitting, edging and packaging capabilities to give you the highest quality product available. Ulbrich is not your basic steel service center: we specialize in supplying stainless steel and special metals to customers that have critical requirements, like those of the medical industry.

.0127 - 3.429mm

.508 - 1220mm (Ribbon wound)

Width: .5 - 914mm (.020 - 36 inch)

3.175 - 38mm (OSC wound)



Slitting & Edge Capabilities

Slitting Capabilities*

Gauges:	.0005135 inch
Width:	.020 - 48 inches
Width:	.125 - 1.5 inches
Oscillate Face:	12 inch max.

* The full range of widths can not be produced on all thicknesses.



#1 Round Edge

305mm

Width: 38mm (1.5 inch) Max. Thickness: .1778 - 1.575mm (.007 - .062 inch)





Thickness: .02286 - 3.175mm (.0009 - .125 inch)

#3 Slit Edge

#5 Square Edge Width: 57mm (2.250 inch) Max. Thickness: .1016 - 3.175mm (.004 - .062 inch)

Strip Applications

- Hypodermic Needles and Shields
- Implantable Housings: Pacemakers - Hearing Aids - Defibrillators
- Staple Guns
- Endoscopic Products
- Surgical Instruments

Ribbon ID:	2 - 24 inches
Oscillate ID:	16 inch max.
Ribbon OD:	48 inch max.
Oscillate OD:	30 inch max.

50.8 - 609.6mm 406.4mm 1220mm 762mm



Alloy Name	Product	UNS	C MAX	Ni	Cr	Мо	AMS	ASTM	Density	Description
301	S, F, ShW FW	S30100	0.15	6.0 - 8.0	16.0 - 18.0		5517, 5519, 5518	A 240, A 666	0.29	Chromium nickel steel capable of attaining high tensile strength and ductility by moderate or severe cold working.
302	S, F, ShW, FW	S30200	0.15	8.0 - 10.0	17.0 - 19.0		5516	A 240, A 666	0.29	General purpose chromium nickel stainless steel. Its corrosion resistance is superior to that of Type 301. It can be cold worked to high tensile strengths but with slightly lower ductility than Type 301.
304	S, F, ShW FW	S30400	0.08	8.0 - 10.5	18.0 - 20.0		5513	A 240, A 666	0.29	Low carbon chromium nickel stainless and heat resisting steel some what superior to Type 302 in corrosion resistance.
304L	S, F, ShW FW	S30403	0.03	8.0 - 12.0	18.0 - 20.0		5511	A 240, A 666	0.29	Very low carbon chromium nickel steel with general corrosion resistance similar to Type 304 but with superior resistance to intergranular corrosion following welding or stress relieving. It is recommended for use in parts which are fabricated by welding and which cannot be subsequently annealed.
305	S, F, ShW FW	S30500	0.12	10.0 - 13.0	17.0 - 19.0		5514	A 240	0.29	A high corrosion-resistant alloy with low rate of work hardening, designed for extra deep drawing and spinning.
316	S, F, ShW FW	S31600	0.08	10.0 - 14.0	16.0 - 18.0	2.0 - 3.0	5524	A 240, A 666	0.29	Chromium nickel stainless and heat resisting steel with superior corrosion resistance to other chromium nickel steels when exposed to many types of chemical corrodents; superior creep strength at elevated temperatures.
316L	S, F, ShW FW	S31603	0.03	10.0 - 14.0	16.0 - 18.0	2.0 - 3.0	5507	A 240, A 666	0.29	Low carbon chromium nickel stainless steel with general corrosion resistance similar to Type 316 but with superior resistance to intergranular corrosion following welding or relieving. It is recommended for use in parts which are fabricated by welding and cannot be subsequently annealed.
410	S, F, ShW FW	S41000	0.15		11.5 - 13.5		5504	A 240	0.28	General purpose corrosion and heat resisting chromium steel. Good corrosion resistance and fair machining properties. Can be treated to RC35/45.
420	S, F, ShW FW	S42000	.15 min.		12.0 - 14.0		5506	A-176	0.28	Chromium steel capable of hardening to a maximum of approximately RC53/58.
440A	S, F, ShW FW	S44002	.6075		16.0 - 18.0				0.28	High carbon grade, high chromium, capable of being heat treated to a hardness range of RC51/62.
Precip Hardening Grades 17-7PH® ₁	S, F, ShW	S17700	0.09	6.5 - 7.75	16.0-18.0		5528	A-693	0.282	A chromium nickel stainless steel with characteristics of good workability, easy hardening, high strength, and excellent mechanical properties at elevated termo, can be heat treated at relatively low temperature for high strength properties.
17-4PH® ₁	S, F, ShW	S17400	0.07	3.0 - 5.0	15.0 - 17.5		5604	A-693 (Type 630)	0.28	Precipitation hardening stainless steel with high strength and good corrosion resistance to 600°F. Used in aerospace, chemical, petrochemical, paper and metalworking industries.
Other NIOBIUM TYPE 1	S, F, ShW	NIOBIUM						B 393	0.31	Pure niobium, reactor grade, high melting point, corrosion resistant for use in medical and high temperature industrial applications.
Nickel Alloys NICKEL 200 and electronics.	S, F, ShW FW	N02200	0.15	99.0 min.				B 162	0.322	Commercially pure nickel. High corrosion resistance. Used in food handling
NICKEL 201	S, F, ShW FW	N02201	0.02	99.0 min.			5553	B 162	0.322	Similar to Nickel 200 except with a lower carbon content for better formability. Most applications in chemicals.
PERMANICKEL 300	S, F, ShW FW	N03300	0.4	Bal					0.316	Age - hardenable, high nickel alloy, with very good thermal electrical conductivity.
<i>Nickel Alloys</i> MONEL® 400 ₂	S, F, ShW	N04400	0.3	63.0 min.				B 127	0.318	A solid solution alloy with high strength and toughness over wide temp. ranges. Used in electronic components, springs.Corrosion resistant and oxidation resistance to 1000°F.
INCONEL® 6252	S, F, ShW FW	N06625	0.1	58.0 min.	20.0 - 23.0	8.0 - 10.0	5599, 5869, 5879	B 443	0.305	Outstanding corrosion resistance with excellent fabricability. Good for cryogenic to high temp. applications up to 2000°F.
HAYNES® 25 L-605 ₃	S, F, ShW	R30605	0.05 - 0.15	9.0 - 11.0	19.0 - 21.0				0.33	Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.
Titanium Grade 1-4	S, F, ShW	R50250 R50400 R50550 R50700						F 67, B 265	0.163	Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high.
Grade 9, Ti 3-2.5	S, F, ShW	R56320	0.05					B 265	0.163	Alpha-Beta alloy-considered very weldable. Superior to high strength C.P.Ti of equivalent strength level in weld toughness and useful temp. range. May be strengthened by cold working.
Titanium Alloys Ti 15-3-3-3	S, F, ShW	R58153	0.05					B 265	0.172	A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication.
Grade 5, Ti 6-4	ShW	R56400	0.08					B 265	0.16	Grade 5 titanium is the workhorse of all the titanium grades. It is also know as Ti-6AL-4V or simply Ti 6-4. Its high strength, light weight and corrosion resistance enables Ti 6-4 to be used in many applications. The most common application is for aerospace components. The alloy is also "age hardenable" by heat treatment to achieve even higher strengths.
Other* NITINOL	ShW, FW	NITINOL	0.05						0.235	NITINOL (an acronym for Nickel Titanium Naval Ordnance Laboratory) is a family of intermetallic materials, which contain a nearfy equal mixture of nickel (55 wt. %) and titanium. Other elements can be added to adjust the material properties, Nitinol exhibits unique behavior such as "Shape Memory" and "Superelasticity". Nitinol is used for both consumer and medical applications.
Trademark of Armo Trademark of Spec Trademark of Hayr * Other materials avai	cial Metals Corp nes Internationa	I, Inc.	·	ue silver nlated co	nner tungsten a	S: Strip F: Foil	Vire, Round and	Flat		

* Other materials available for medical designers include copper alloys, silver plated copper, tungsten and gold plated tungsten.

In addition to the alloys produced by sources identified herein by trademarks, Ulbrich can, in many cases, offer equivalent or similar alloys produced by alternate sources.



Ulbrich Stainless Steels & Special Metals, Inc.

Corporate Headquarters

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