

***Ulbrich* * MEDICAL-METALS**

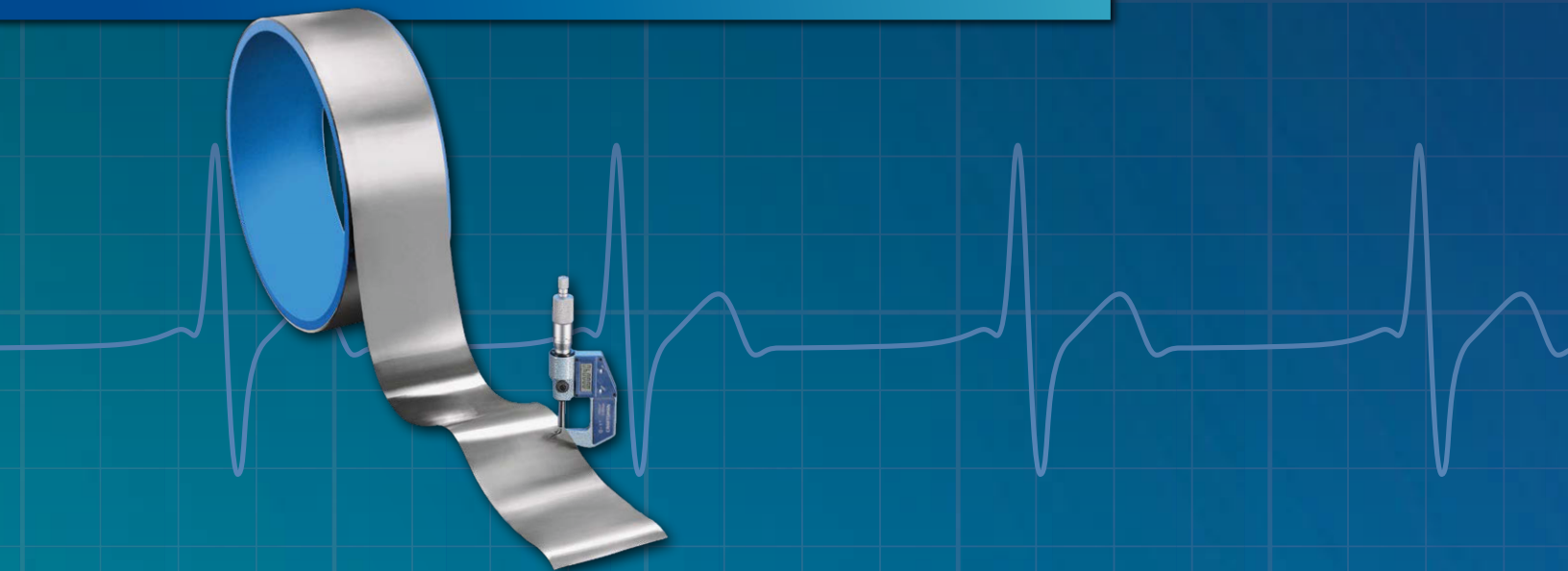
One Metal Supplier, Endless Solutions

Metals for Medical

Ulbrich Stainless Steels and Special Metals, Inc.



Global Representation with Service and
Distribution Centers Worldwide.



Ulbrich is a family owned company in its fourth generation of leadership. Established in 1924, Ulbrich has become a critical supplier of stainless steels and special metals to the Medical Device Industry. During this time, we have participated in the development and manufacturing of hundreds of innovative medical devices. With industry leading Dimensional Control, real time gauging and Statistical Process Control (SPC), a large variety of medical alloys, and the best service available, we strive to produce and distribute the highest quality materials. We are comprised of a series of manufacturing divisions of specialty strip and precision wires, all with local management and all designed to provide custom precision products to satisfy your needs.

Our Products

- » Precision Flat and Ultrafine Round Wire
- » Shaped Wire
- » Precision Strip

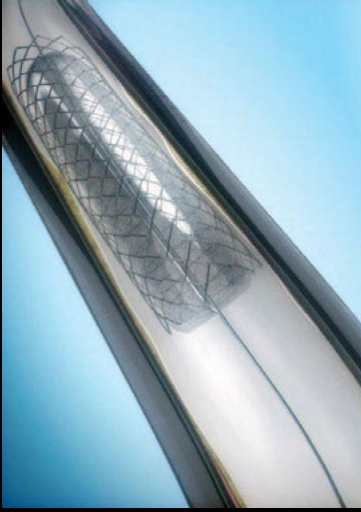
Our Service

You can expect nothing but the best when dealing with Ulbrich. All of our capabilities, especially our people are what separate Ulbrich from your typical metals supplier.

- » Extensive technical staff focused on your specific needs
- » Inventory management and custom stocking programs: VMI, KANBAN, etc.
- » Production of small samples to be delivered quickly
- » All facilities are ISO 9001:2008 compliant



Precision Flat and Ultrafine Wire



Coronary stent with applicator



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

Ulbrich Specialty Wire Products, located in Westminster, SC., is capable of producing flat wire as thin as .00025 inch (0.006 mm) and as narrow as .0015 inch (0.038 mm). In addition, this manufacturing facility can draw ultrafine round wire as small as .00075" in diameter.

Our medical wire focus factory can efficiently control dimensional tolerances to $\pm 5\%$ down to .001" round and is staffed with dedicated management and engineers.

Additional Value to your business:

- 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
- Lead times that are typically much shorter than the rest of the industry
- Working closely with our customers in order to customize the product for their particular application

MATERIALS

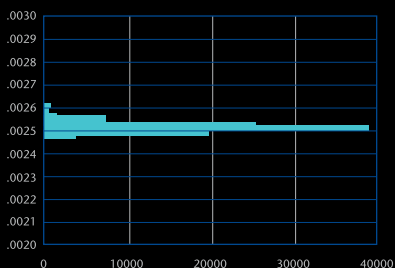
□ Stainless Steels

304 | 304V | 304L | 304LV | 316 | 316L | 316LVM

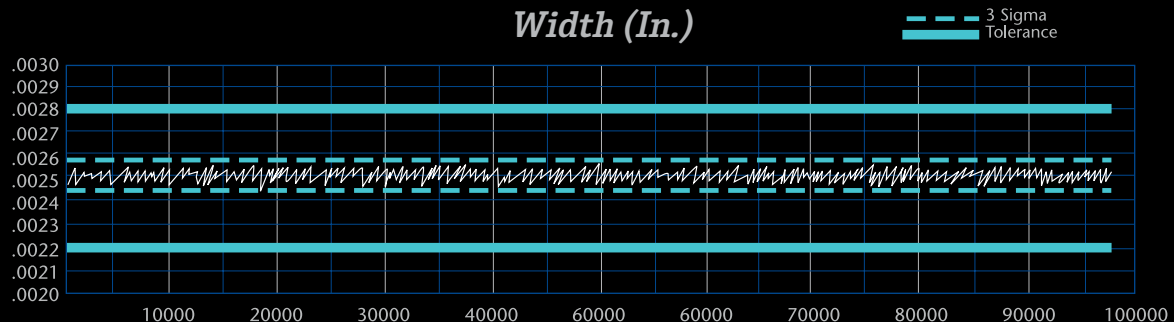
□ Specialty Metals

Nitinol | MP35N | Copper | Aluminum | Tungsten | Beryllium Copper
Titanium | Molybdenum | Phosphor Bronze | L605 | ...and other alloys

Width Distribution



Width (In.)



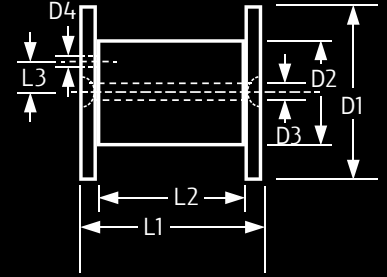
BULK SPOOLS

NUMBER	D1 Flange		D2 Barrel		D3 Arbor Hole		D4 Drive Pin		L1 O/A Length		L2 Traverse		L3		*Capacity lbs
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	
DIN 80	3.15	80	1.97	50	.63	16	.28	7	2.52	64	2.52	64	.79	20	1.9
DIN 100	3.94	100	2.48	63	.63	16	.28	7	3.94	100	3.15	80	.79	20	1.9
DIN 125	4.92	125	3.15	80	.63	16	.28	7	4.92	125	3.94	100	.79	20	1.9
DIN 160	6.30	160	3.94	100	.87	22	.51	13	6.30	160	5.04	128	1.26	32	**14.0
10	5.98	152	3.5	89	.63	15.9	.40	10.2	4.29	109	3.50	89	.75	19	9.0

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

* Capacity for 304V SS

** Available with 16 mm bore adapters

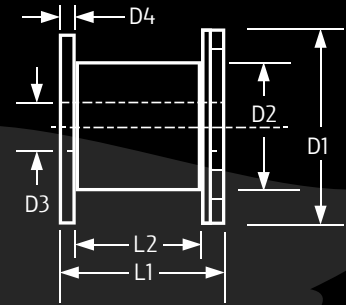


STEEGER, NEB AND WARDWELL BOBBINS

NUMBER	D1 Flange		D2 Barrel		D3 Arbor Hole		D4 Flange Width		L1 O/A Length		L2 Traverse		*Capacity	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	grams	lbs
15 MM	1.57	40	.59	15	.42	10.6	.14	3.6	1.40	35.5	1.02	26	120	0.26
26 MM	1.69	43	1.02	26	.42	10.6	.14	3.6	1.40	35.5	1.02	26	90	0.20
30 MM	1.57	40	1.18	30	.42	10.6	.14	3.6	1.40	35.5	1.02	26	50	0.11
NEB	1.32	34	.74	19	.33	8.0	.29	7.0	3.95	100	3.29	84	225	0.5
WARDWELL	2.60	66	1.37	35	.66	17	NA	NA	3.25	83	2.84	72	450	1.0

Multiple colors available

* Capacity for 304V SS

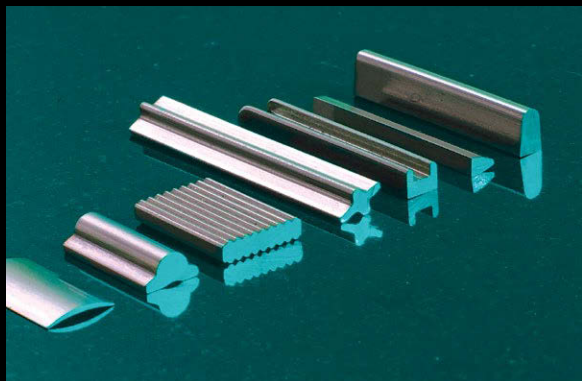


COMMON WIRE SIZES

FLAT WIRE	
inch	mm
.0003" x .0035"	0.0076 mm x 0.0899 mm
.0005" x .0025"	0.0127 mm x 0.0635 mm
.0005" x .0030"	0.0127 mm x 0.0762 mm
.0005" x .0050"	0.0127 mm x 0.1270 mm
.0007" x .0030"	0.0178 mm x 0.0762 mm
.0007" x .0050"	0.0078 mm x 0.1270 mm
.0010" x .0030"	0.0254 mm x 0.0899 mm
.0010" x .0050"	0.0254 mm x 0.1270 mm
.0010" x .0070"	0.0254 mm x 0.0762 mm
.0015" x .0050"	0.0381 mm x 0.1270 mm
.0015" x .0070"	0.0381 mm x 0.1778 mm
.0020" x .0100"	0.0508 mm x 0.2540 mm
.0020" x .0120"	0.0508 mm x 0.3048 mm
.0030" x .0100"	0.0762 mm x 0.2540 mm
.0040" x .0100"	0.1016 mm x 0.2540 mm

ROUND WIRE	
inch	mm
.0039"	0.0991 mm
.0036"	0.0914 mm
.0030"	0.0762 mm
.0025"	0.0635 mm
.0020"	0.0508 mm
.00165"	0.0419 mm
.0015"	0.0381 mm
.0014"	0.0356 mm
.0013"	0.0330 mm
.0012"	0.0305 mm
.0011"	0.0279 mm
.0010"	0.0254 mm

Shaped Wire



Ulbrich Shaped Wire supplies both shaped wire products as well as flat wire to a wide variety of medical device and component manufacturers.

We work with and stock a wide range of medical quality alloys, including most stainless steel grades, 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 specific requirements.

Starting with wire rod, we breakdown to exact starting diameters and remove any variation in the starting stock which allows us to tightly control our final tolerances. Our unique ability to anneal in line allows us to provide our customers with the mechanical properties they require without having to worry about inconsistencies in hardness throughout their spools or cut lengths.

SIZES, SHAPES AND EDGES

Round Wire

Soap, Grease and Bright Finish: .040 – .400 inch (1.016 to 10.16 mm)

Flat Wire

Thickness: .005 – .335 inch (0.127 – 8.509 mm)

Width: .020 – 1.50 inch (0.508 – 38.1 mm)

Gauge and Width Tolerances

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

Shapes

A variety of standard and custom shapes are available in widths from .016 to 1.00 inch (0.406 to 25.4 mm).

Edges

The following are available on flat and rectangular wire:

Square Edges

Natural Round

Custom Profiled Corners and Radius



Nitinol strip
in continuous coil length

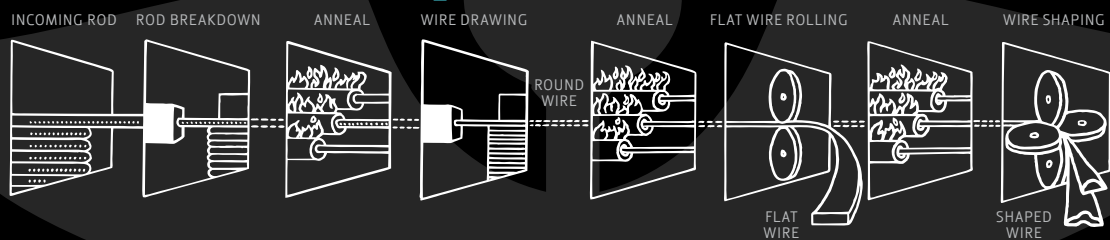
New Product Development

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 inch (0.127 mm) and widths as wide as 1.500 inch (38.1 mm).

At Ulbrich Shaped Wire, we have been leading the effort to produce light gauge, nitinol strip in continuous coil length. Filling the void in nitinol product form availability, this flat wire offers a unique solution to current processing limitations.

Shaped Wire Process

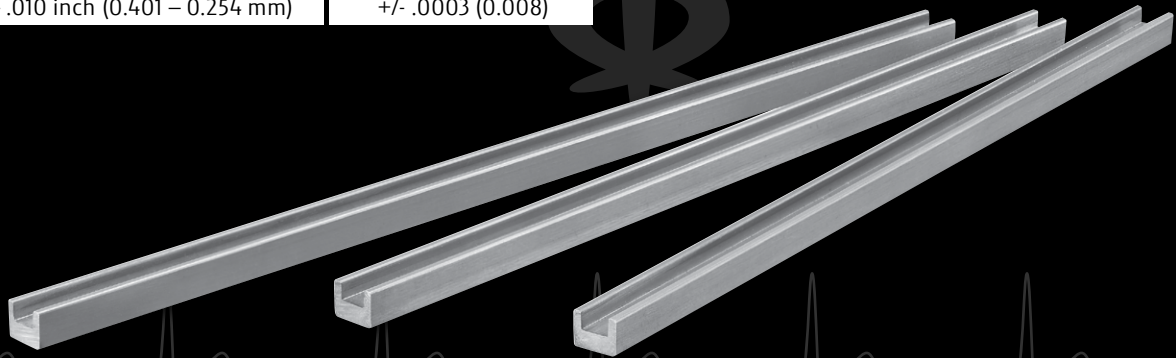


ROUND WIRE	
Diameter	Standard Tolerance
.325 – .091 inch (8.255 – 2.311 mm)	+/- .001 (0.025)
.0909 – .0511 inch (2.309 – 1.298 mm)	+/- .0008 (0.020)
.051 – .0201 inch (1.295 – 0.511 mm)	+/- .0005 (0.013)
.020 – .0159 inch (0.508 – 0.404 mm)	+/- .0004 (0.010)
.0158 – .010 inch (0.401 – 0.254 mm)	+/- .0003 (0.008)

Dual gauge strip
for medical applications



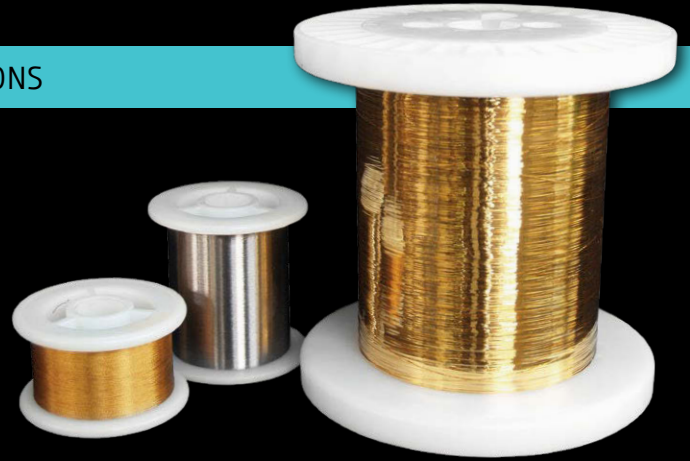
Medical channels



Plated Products

APPLICATIONS

- ☐ Reinforced Catheters
- ☐ Guidewires
- ☐ Coils
- ☐ Electronic Devices
- ☐ Leads and Connectors
- ☐ Tubing Mandrels
- ☐ Braiding
- ☐ Embedded Wire
- ☐ Orthodontia
- ☐ Copper and Silver-Plated Copper Mandrels for Catheter Applications



MATERIALS

- ☐ Stainless Steels
304 | 304L | 304VM | 316 | 316L | 316LVM
- ☐ Specialty Metals
MP35 | Copper Clad Steel and Aluminum | Tungsten | Titanium | Phos/Bronze

CUSTOM PRECISION PLATING

Specialized in the continuous plating of fine, round and flat wire, we have in-house plating equipment for your custom requirements. We can plate almost any alloy with:

- ☐ Gold
- ☐ Silver
- ☐ Nickel
- ☐ Tin
- ☐ Tin/Lead Solders
- ☐ Tin/Silver

SPECIAL SERVICES AVAILABLE

- ☐ Precision Spooling
 - ☐ Straighten and Cut
 - ☐ Customized Processes
- (Precision size tolerances for all round and flat wire are available per your specific requirements.)

Specialty Strip Mill



Ulbrich Stainless Steels and Special Metals precision strip products are found in a variety of medical applications ranging from hypodermic needles, surgical instruments and implantable devices such as pacemaker and defibrillators.

ADDED VALUE CAPABILITIES

- ☐ Controlled Atmosphere Annealing Lines
- ☐ Tension Leveling
- ☐ Slitting and Edging
- ☐ Oscillate Winding
- ☐ In-House Testing Lab
- ☐ Special Finishes

RE-ROLL CAPABILITIES

Gauges .0004 – .125 inch (0.010 – 3.175 mm)

Width Up to 14 inch (353 mm)

Tempers Dead Soft – Extra Full Hard

Finishes Dull – Bright Ra 2-60

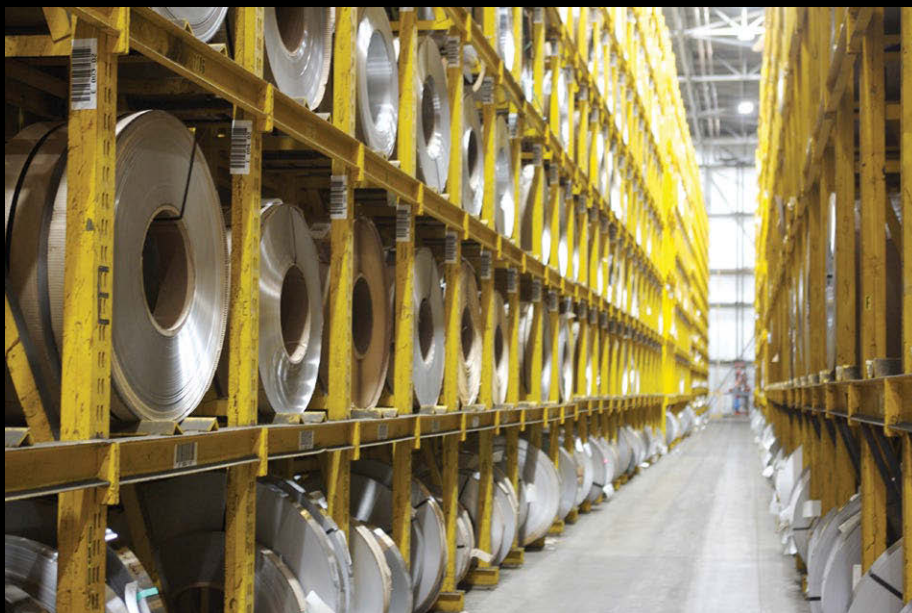
Special Textures Rolled or Mechanically Applied



Service Centers

Our service centers are capable of stocking highly engineered inventory 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.



SLITTING AND EDGE CAPABILITIES

Slitting Capabilities*

Gauges .0004 inch – .125 inch (0.010 – 3.175 mm)

Width .020 – 48 inch (0.508 – 1220 mm, Ribbon Wound)

Width .125 – 1.5 inch (3.175 – 38.1 mm, OSC Wound)

Oscillate Face 12 inch max. (305 mm)

Ribbon ID 2 – 24 inch (50.8 – 609.6 mm)

Oscillate ID 16 inch max. (406.4 mm)

Ribbon OD 48 inch max. (1220 mm)

Oscillate OD 30 inch max. (762 mm)

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

#1 Round Edge

Width Oscillate .250 – 1.250 inch (6.35 – 31.75 mm)

Width Pancake .250 – 3.0 inch (6.35 – 76.2 mm)

Thickness .008 – .140 inch (0.203 – 3.55 mm)

#3 Slit Edge

Width .020 – 36 inch (0.508 – 914 mm)

Thickness .0009 – .125 inch (0.02286 – 3.175 mm)

























#5 Square Edge





Width 2.250 inch (57 mm max.)

Thickness .004 – .062 inch (0.1016 – 3.175 mm)

Strip Applications

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

THE ULBRICH FAMILY OF ALLOYS: MEETING ALL YOUR STOCK AND CUSTOM NEEDS WITH PRECISION										
Alloy Name	Product	UNS	C MAX	Ni	Cr	Other	AMS	ASTM	Density	Description
301		S30100	0.15	6.0–8.0	16.0–8.0		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		S30200	0.15	8.0–10.0	17.0–19.0		5516	A 240, A 666 A 313, A 276, A 580	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		S30400	0.08	8.0–10.5	18.0–20.0		5513	A 240, A 666 A 313, A 276, A 580	0.29	Low carbon chromium nickel stainless and heat resisting steel somewhat superior to Type 302 in corrosion resistance. *Vacuum Arc Remelted (VAR).
304L		S30403	0.03	8.0–12.0	18.0–20.0		5511	A 240, A 666 A 313, A 276, A 580	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. *Vacuum Arc Remelted (VAR).
305		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		S31600	0.08	10.0–14.0	16.0–18.0	2.0–3.0 MO	5524	A 240, A 666 A 313, A 276, A 580	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 corrosdents; superior creep strength at elevated temperatures.
316L		S31603	0.03	10.0–14.0	16.0–18.0	2.0–3.0 MO	5507	A 240, A 666 A 313, A 276, A 580	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.
316LVM		S31673	0.03	13.0–15.0	17.0–19.0	0.50 CU, 2.0–3.0 MO		F 139 A 240, A 666 A 313, A 276, A 580	0.29	A highly refined medical grade of stainless steel designed for implant applications. Vacuum Arc Remelted (VAR).
410		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		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		S44002	.60–.75		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		S17700	0.09	6.5–7.75	16.0–18.0	0.75–1.5 AL	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 temperature, can be heat treated at relatively low temperature for high strength properties.
17-4PH		S17400	0.07	3.0–5.0	15.0–17.5	3.0–5.0 CU	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.
Nickel Alloys NICKEL 201		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.
MONEL® 400,		N04400	0.3	63.0 min.		28.0–34.0 CU		B 127	0.318	A solid solution alloy with high strength and toughness over wide temperature ranges. Used in electronic components, springs. Corrosion resistant and oxidation resistance to 1000°F.
INCONEL® 625,		N06625	0.1	58.0 min.	20.0–23.0	8.0–10.0 MO	5599, 5869, 5879	B 443	0.305	Outstanding corrosion resistance with excellent fabricability. Good for cryogenic to high temperature applications up to 2000°F.
Cobalt Alloys HAYNES® 25 (L-605) ₂		R30605	0.05–0.15	9.0–11.0	19.0–21.0	BAL CO			0.33	Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.
MP35N®		R30035	0.02	33.0–37.0	19.0–21.0	BAL CO	5758, 5844, 5845	F 562	0.304	An age hardenable Nickel-Cobalt base alloy that has a unique combination of properties – ultra high strength, toughness, ductility and outstanding corrosion resistance. Used in fasteners, springs, nonmagnetic electrical components medical instruments, medical and dental devices, seawater, oil and gas well, and chemical and food processing environments.
Titanium Grade 1–4		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		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 temperature range. May be strengthened by cold working.
Titanium Alloys Ti 15-3-3.3		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		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		NITINOL	0.05						0.235	NITINOL (an acronym for Nickel Titanium Naval Ordnance Laboratory) is a family of intermetallic materials, which contain a nearly 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.
NIOBIUM TYPE 1		NIOBIUM						B 393	0.31	Pure niobium, reactor grade, high melting point, corrosion resistant for use in medical and high temperature industrial applications.

 Strip  Foil  Shaped Wire  Fine Wire (Round and Flat)

¹ Trademark of Special Metals Corporation group of companies. ² Trademark of Haynes International, Inc.
 * 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.

CORPORATE HEADQUARTERS

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We Deliver Precision®

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