www.ulbrich.com

We Deliver Precision®

Ulbrich Locations

Global representation with service and distribution centers worldwide.

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Ulbrich

We Deliver Precision®

Precision Alloys for Precision Parts

The alloys we process at Ulbrich Stainless Steels & Special Metals are known for their superior performance and excellent reliability. These products are the result of years of metallurgical development, offering properties well beyond those of ordinary metals. Our job is to help you fully realize that potential. To do so, Ulbrich is continually adding new equipment and technologies, expanding our quality assurance programs and working to ever tighter tolerances.

We serve markets as diverse as aerospace, aircraft and automotive, nuclear and solar energy, medical and surgical equipment, chemical processing, electronics and many others. To some customers, we are a precision re-roller processing stainless steel, nickel alloy and titanium alloy strip to exacting dimensions for critical high performance applications. To others, we are a network of specialty service centers with nine North American locations supplying various forms of stainless steel and specialty metals, expertly processed and delivered on time. For others, we start with rod or wire and shape it into various cross sections that in some cases perform as a near net shape. We also roll fine round wire into flat wire, with extremely close tolerances and to dimensions a fraction of a human hair. This and many other possibilities are available within the Ulbrich family of capabilities.

Ulbrich produces a large percentage of its products in North America, but we are an international company. We have several strategic partnerships and sales agencies throughout the world. We understand that doing business around the world is the only way to do business today. Our facilities in Asia are designed to accommodate inquiries for all our divisions from one location. No matter which country you are from, we strive to make doing business with Ulbrich as effortless as possible.

In this brochure, you will see and read about the many production capabilities that Ulbrich offers. But in the end, it's the people at Ulbrich who make the most difference. We are a family-owned company in its fourth generation of leadership. That dedicated leadership provides the environment for all our employees to focus their talent and energies in a common direction – total customer responsiveness, total company involvement, total quality commitment and continuous professional development.

Fred C. Ulbrich, Jr.
Chairman of the Board

Chris Ulbrich
Chief Executive Officer

Precision Rolling Strip to Custom Requirements

We buy stainless steels and specialty alloy strip from producers known for their high quality and reliability.

At Ulbrich Specialty Strip Mill, we believe in giving you as many options as possible.

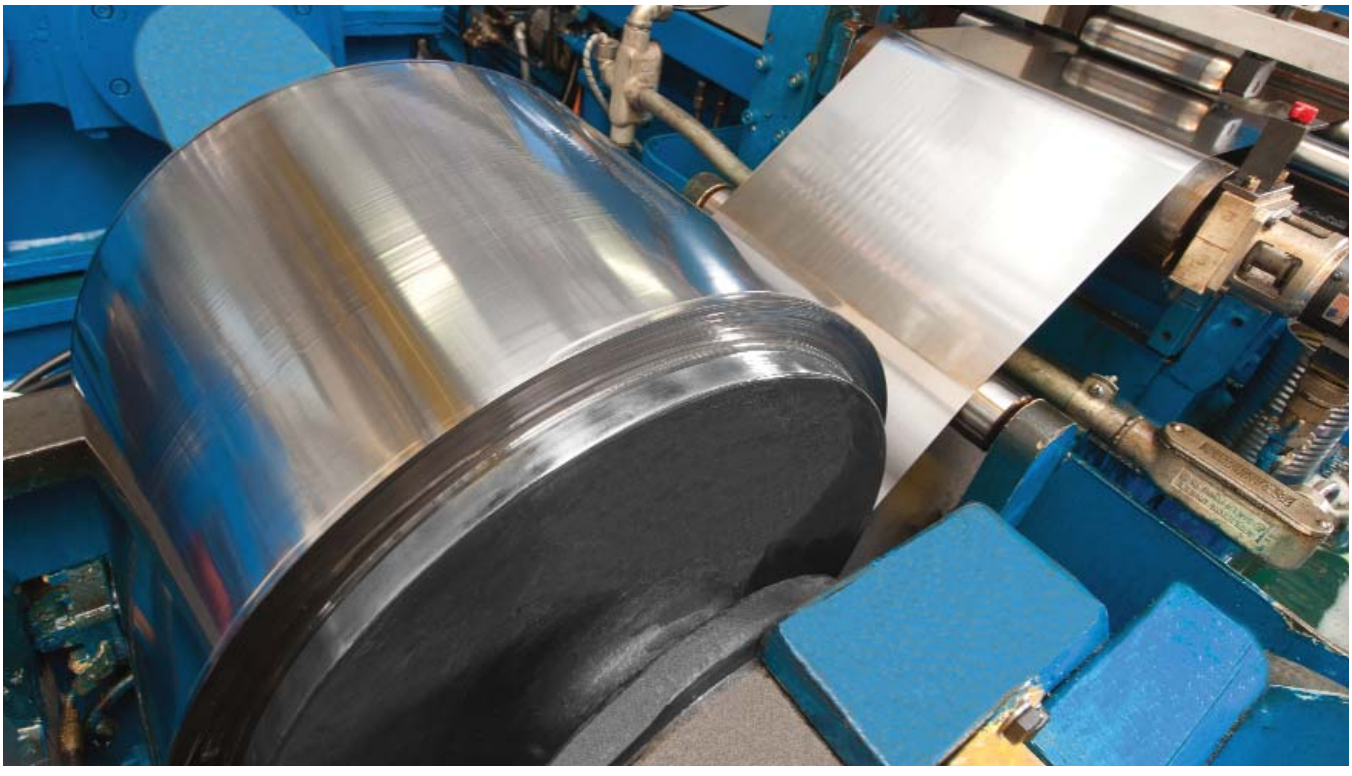
Here you'll find a full range of grades and alloys, a battery of specialized equipment to process your order, and the know-how of a long established library of information.

Our revolving inventory of over 140 alloys is on a fast track retrieval system to get your order processed quickly and efficiently. Your choices include all the more common stainless steels; nickel and nickel alloys, titanium and titanium alloys and a number of other special grades.

To maintain the highest quality, we follow rigid incoming and in-process inspection procedures. Our automated mill controls continually monitor the product to make certain all dimensions are within tolerances.

It's what you'd expect from an ISO 9001:2008 certified producer.

AS9100 ISO 9001 · TÜV SÜD ISO 9001 · ISO 17025 Quality is Assured · Accredited Nadcap™



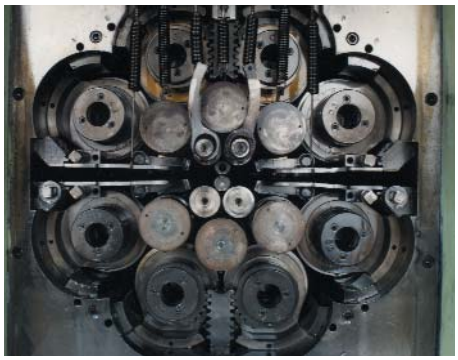
For Exact Gauges and Tempers

When your specification demands something extra, Ulbrich has the capabilities and expertise to make the proper adjustments.

We have six Sendzimir and three 4-High rolling mills, all properly equipped for precision rolling. Each mill is designed to give us different capabilities and flexibility.

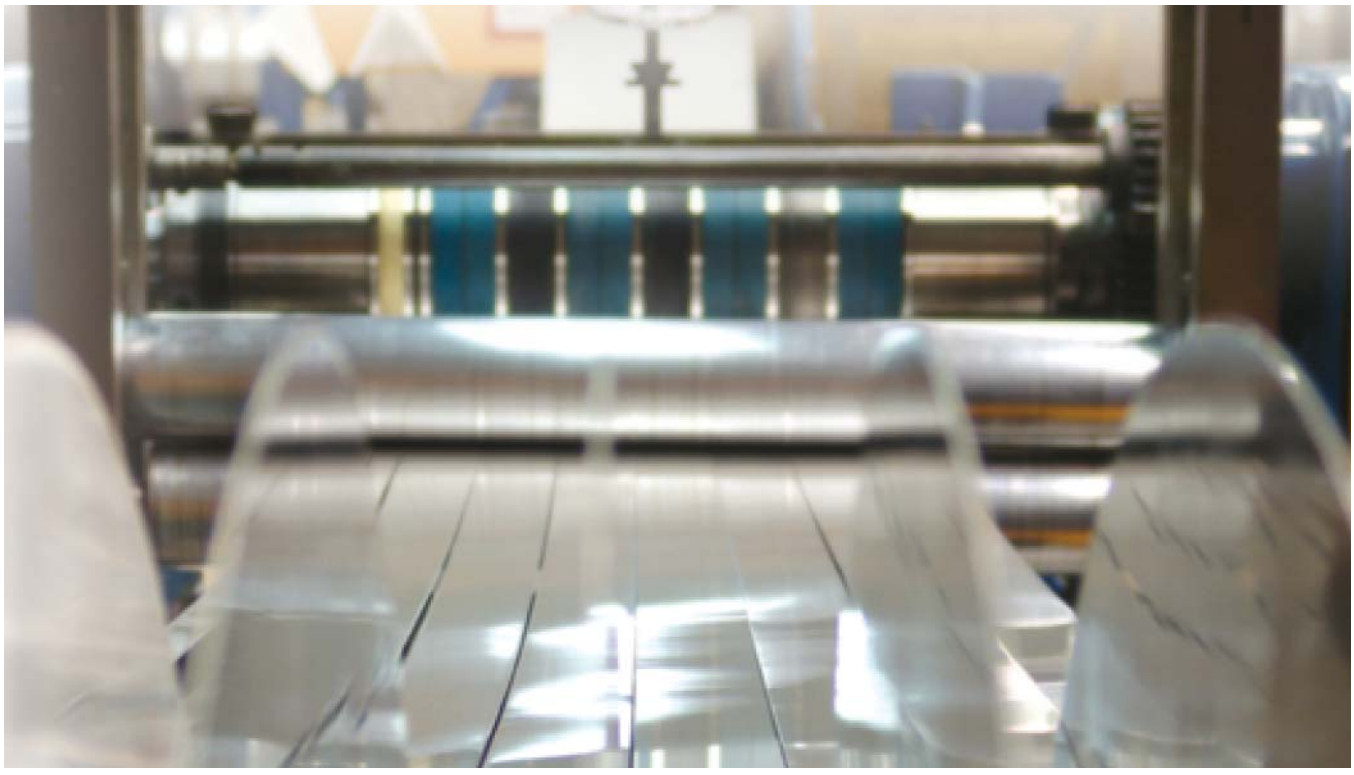
Our eight controlled atmosphere annealing lines work in tandem with the rolling process to produce exacting metallurgical properties and finishes for a wide variety of applications. In addition to rolling and annealing, we have state-of-the-art finishing equipment as well. Coil cleaning, tension leveling, slitting, edging and oscillate winding all play a role in making our products meet or exceed your expectations.

It is one thing to produce a quality precision product, but another to do it efficiently and deliver it on time. At Ulbrich, we strive to do exactly that. Our dedicated employees are committed to a never-ending continuous improvement program.



Internal view of a Z-Mill

This high speed Z-mill is equipped with automatic gauge control to instantly adjust the roll bite and maintain the desired gauge and close tolerances.

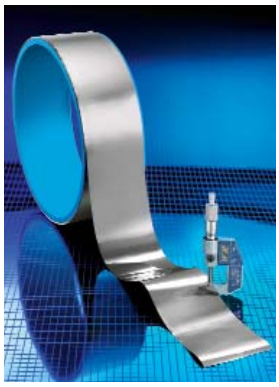


Foil and Small Quantities

Temperature and dew point of our annealing furnaces can be precisely regulated to meet user specifications.

Foils

Ulbrich Stainless Steels & Special Metals has dedicated itself to being one of the premier producers of specialty metal foils, which we define as .0015" (.0381mm) and below. Our approach to this market has your requirements put first.



Ulbrich knows your precision engineered products require stringent rolling, slitting, annealing and finishing processes. That is why Ulbrich invested in an Ultralite building and machinery where the only focus is ultralite materials.

This area manufactures only ultralite materials utilizing the most innovative rolling, slitting, annealing, and finishing equipment with our experienced personnel.

Small Orders

We pride ourselves in being able to ship small quantities in any strip product we make or stock. We do this to help minimize excess material as you are developing new applications or maybe you simply need a small amount. Whether in production or development, we strive to meet or exceed your expectations in as many ways as we can. Our success is measured by your satisfaction.

Alloys and Sizes

Strip Alloys:

- 300 & 400 series Stainless Steels
- Precipitation hardening Stainless Steels
- Nickel & Nickel Alloys
- Cobalt Alloys
- Titanium & Titanium Alloys
- Others on request

Gauge Range:

- .0004 to .125 inch (0.010 to 3.175mm)

Width:

- 14.00 inch max. (356mm max.)

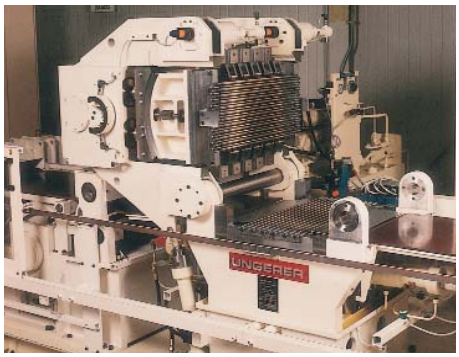
Tempers:

- Fully annealed through extra full hard

Surface Finishes:

- Dull • Bright • Special textures

This high pressure hot water jet cleaning system is used for applications requiring ultra clean surfaces.



We meet requirements for strip that must be truly flat (.005 piw) with the latest in stretch bend leveling technology, with rugged tension bridles and a nest of small diameter bending rolls.

Service Centers

Our six North American and two Asian service centers, offer a wide selection of stainless steel and special metals. Coils in our inventory cover a wide range of gauges, widths, tempers and finishes. We also provide expert processing and packaging. These are stand alone service centers with their own executive management, order entry and customer service capabilities.

In addition to our standard stainless steel and special metals inventory, we stock to meet the requirements of our individual customers and markets. Statistical process controls (SPC) are in effect at each slitter station to maintain tight dimensional tolerances. Ribbon wound coils can be built up on any one of several core sizes and disc paks are available to protect and stabilize narrow width strip during shipment and processing.

This multihead slitter cuts several narrow widths at a time and recoils the strip on oscillate wound spools.

Service Centers

United States of America

Oscillate (or traverse) wound strip is available on either open coils or spools. Special edges, from deburred, to square, to full round, are within our capability.

Orders of production or prototype quantities are processed quickly and efficiently and usually delivered within one week or less.

Locations: • California • Connecticut • Illinois

Strip and Coil: • Stainless Steel: 300 series, 400 Series, PH Grades
• Nickel Alloys • Titanium and Titanium Alloys • Cobalt Alloys

Gauge Range: • .002 to .135 inch (.0508 to 3.429 mm)

Width Range: • .020 to 54 inches (.5 to 1368 mm)

Edges: • Rounded • Square • Deburred

Packaging: • Ribbon Wound Coils
• Oscillate Wound Coils & Spools • Cut-To-Length

Round Bar

High Temp Nickel Alloys*:
• 718 per AMS 5662 • 625 rounds per AMS 5666
• A286 per AMS 5732 •A286 per AMS 5731
• Hastelloy[1] X per AMS 5754

[1] Trademark of Haynes International, Inc.
* Ony available at Ulbrich of California

Disc paks and cores in a variety of sizes are available.

Oscillate wound coils

Canada and Mexico

Spacious warehouse dedicated to serve the Canadian market.

Diversified Ulbrich of Canada is a stainless steel and aluminum service center providing sheet, plate, bar, strip, tubing and structural angle to the Canadian market since 1971. After joining the Ulbrich family of companies in 1997, we expanded our product line and processing capabilities to offer a full line of products and services to our valued customers.

Located strategically in both Toronto and Montreal, our Diversified facilities total over 150,000 square feet of warehouse and production space dedicated to serve the Canadian market.

Ulbrinox is a company that brings a global approach to the metalworking industry since 1997. Its strategic location in the state of Queretaro, allows us to satisfy the necessities of the Mexican and Latin American markets.

This service center stocks strip, coil, sheet, plate and blank in a wide variety of alloys, such as stainless steel, aluminum, copper and brass. In addition, Ulbrinox offers stainless steel round, flat and shaped wire.

Asia

Penang, Malaysia

Strategically located High Precision coil center specializing in light gauge stainless steel and special metals strip. This new precision slitting facility will produce material gauges from .002" to .030" (.0508mm - .76 mm) and supply a width range of .090" - 12.0" (2.28mm - 300mm). This coil center has the ability to produce pancake and flange coil packages, as well as oscillated spools in a variety of sizes. The new facility will also have a new edging line able to produce deburred, round, & skived edges ranging from .002" to .040" (0.0508mm - 1.07mm) gauges with a 1.25" (31.75mm) max width.

Suzhou, China

Ulbrich Precision Special Metals (Suzhou) Co., Ltd., will provide stainless steel and special metals strip to our valued customers in the Jiangsu region and beyond. This location offers our strip products in thicknesses ranging from .001" -.060" (.0254mm to 1.52mm) and widths from 0.065" to 24" (1.651mm to 609mm) as well as edging capabilities and cut to length services.

Our new locations will offer over 170 types of Stainless Steels and Special Metals strips, many not readily available in Asia.

Shaped Wire

Ulbrich Shaped Wire specializes in the manufacture of custom made shapes and flats for a wide variety of industries. Depending on the complexity of the profile, shapes may be either net or near net suitable for stamping, coining, forming, or machining. All tooling is custom manufactured in house by our state of the art tooling center. We also offer metallurgical and engineering support for all customers. Ulbrich Shaped Wire supplies a wide range alloys including Nitinol which can be provided as a flat, coiled wire product that is not readily available in the market place.

Filling a void in nitinol product form availability, this "strip" produced in continuous coil length in our wire mill offers your engineers a unique solution to current processing limitations.

Intermediate and final strand annealing is used to control mechanical properties.

Net or near-net custom cross-sectional shapes are used in a broad range of applications in a variety of industries.

Alloys:

- Stainless Steels
- Cobalt Alloys
- Titanium Alloys
- Nitinol Alloys
- Nickel Alloys
- Many Others

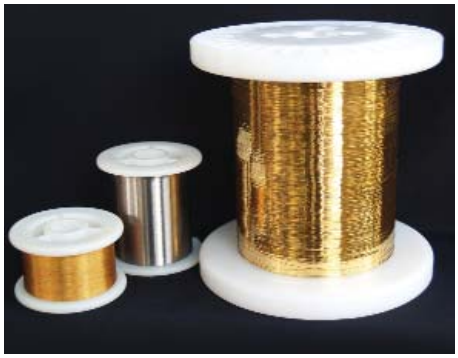
Shaped Wire:

- A variety of standard and custom shapes are available in widths from .016 to 1.00 inch (.406 to 25.4 mm)

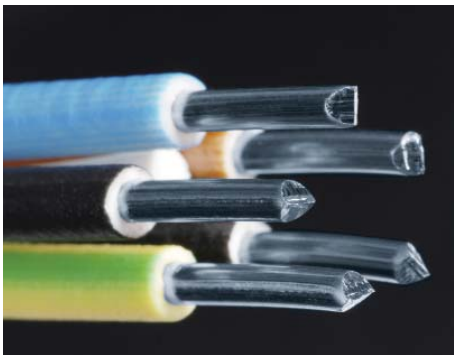
Gauge Range: .005 to .335 inch (.120 to 8.509 mm)

Width Range: .020 to 1.50 inches (.508 to 38.1 mm)

Precision Flat & Fine Wire



Plated products for a variety of industries.



Telecommunications products.

Engineered music wire products.

Our Precision Flat Wire facilities are capable of producing gauges for many demanding applications serving a variety of industries. Our "Focus Factory" approach dedicates managers and engineers along with state of the art equipment to produce and manage industry specific requirements.

Our production equipment uses the latest in "on-line" gauging and data acquisition technology that generates full statistical summaries with each production run, enabling us to control our process and offer tolerances as tight as +/- .0001 in (.0025 mm) on our lightest gauges. Precision spooling of fine wires onto a variety of spools or bobbins using CNC winders enables trouble-free performance in the most demanding applications. We offer a wide range of finishes for photovoltaic applications, saw blades, as well as for certain medical applications.

Alloys:

- Stainless Steel • Titanium Alloys • Nickel Alloys
- Cobalt Alloys • Nitinol Alloys • Carbon Steel
- Copper and copper alloys • Aluminum

Gauge Range: .0002 to .210 inch (.00508 to 5.33 mm)

Width Range: .002 to 1.5 inches (.0508 to 38.1 mm)

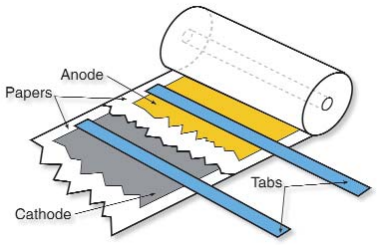
Rounds: .00075 to .400 inches (.019 to 10.16 mm)

Surface Finishes:

- Tin and Lead Coated
- Heat Treated and Tempered
- Bright Polish

Applications:

- Tinned copper and aluminum tabs for capacitors
- Aluminum and nickel tabs for batteries
- Gold plated products for a variety of applications in the electronics, medical and aerospace markets



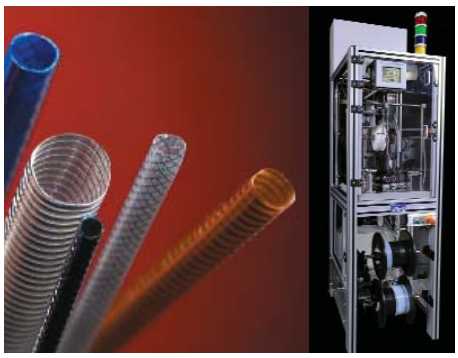
- Silver plated copper flat shield wires for telecom cables
- Silver plated copper wires for applications in music strings and medical devices

Precision Flat & Fine Wire

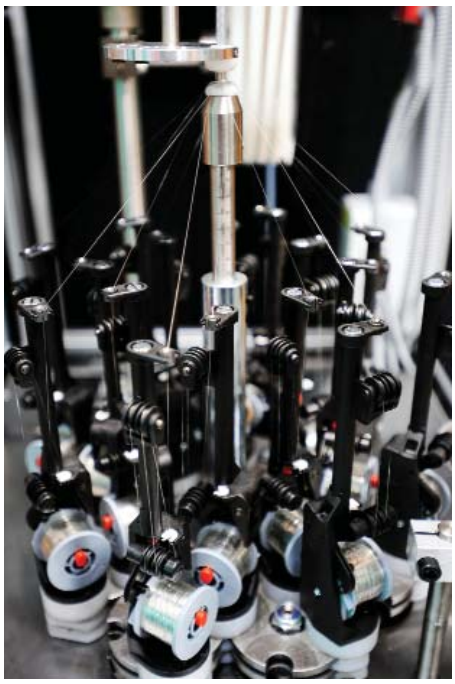
Ulbrich Precision Flat Wire and Ulbrich Precision Metals are your perfect source for your ultra-fine wire requirements. Precision plated or bare in various geometries including rounds, squares, and flats. All to extremely close tolerances.

We process a vast amount of materials for various markets that include: Medical, Electronics, Telecommunications and Energy Materials.

Ulbrich supplies materials in spools, cut to length, pancake coils, precision layer wound and other custom packages. Traverse spools, flanges, various barrels and bore sizes available to satisfy all your requirements.



Ultra-fine wire is braided on specialized braiding equipment. (Steeger machine shown above)



Close up of multiple bobbins wound on Steeger machine.

Specialty Alloys:

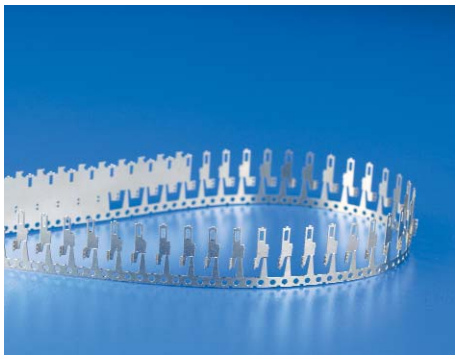
- Copper Clad
- Copper Aluminum Clad
- Aluminum Clad
- Alloy 52
- Nickel Plated Steel
- Molybdenum
- MP35N
- Tungsten
- Phosphorus Bronze
- L605
- Copper Beryllium

Plating:

- Gold type I, II, III per MIL-G-45204 Solder per MIL-P-81728*
- Silver per QQ-S-365 and ASTM B-298 Military Standard -1276*
- Copper per MIL-C-14550
- Nickel per QQ-N-290*
- Tin per MIL-T-10727 Solder-ability per MIL-STD-202

* ASTM Specifications

Applications Cover A Wide Range

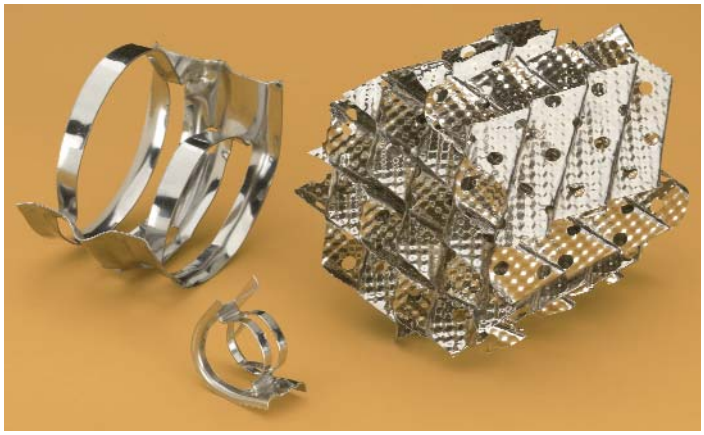


Carrier strip for electronic connectors.

Strip and wire products from Ulbrich Stainless Steels are used in many of the world's leading edge applications, including aircraft engines, automotive components; surgical, diagnostic and other medical instruments; consumer and industrial electronics, chemical processing equipment; solar, nuclear and conventional power generation equipment, and many more.

Here are just a few:

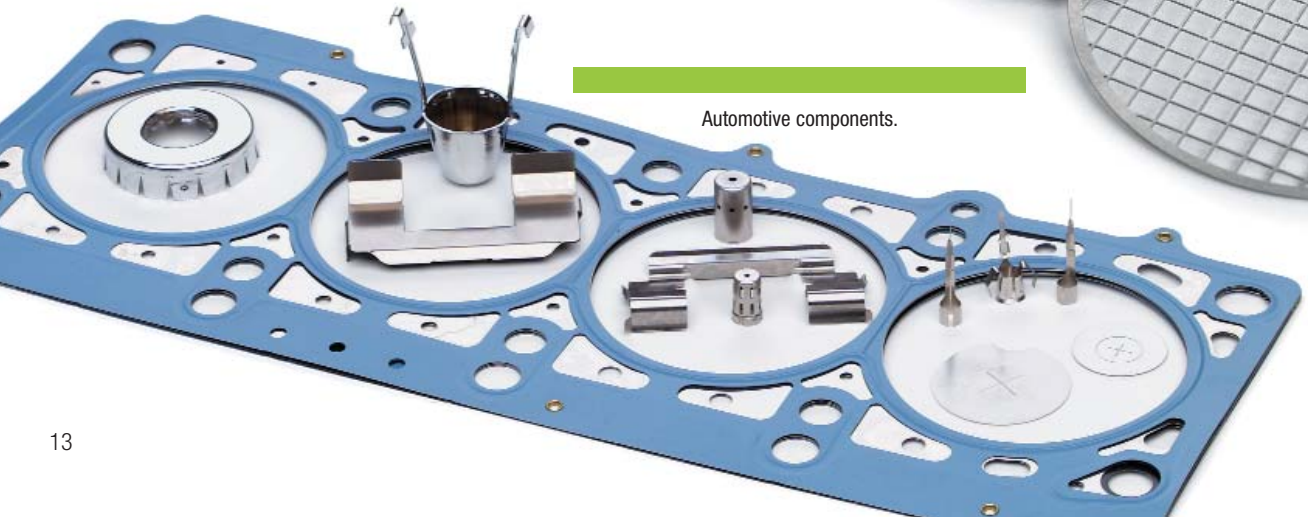
Photo etched parts.



Random and structured tower packing for chemical processing facilities.

Stainless steel springs.

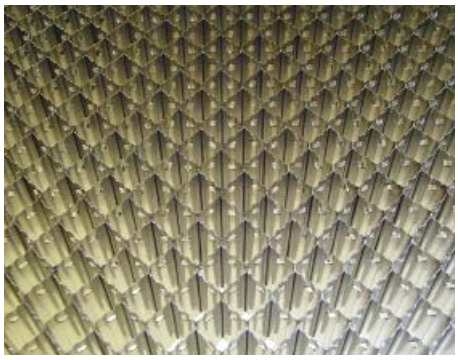
Photo etched parts.



Automotive components.

Applications Cover A Wide Range

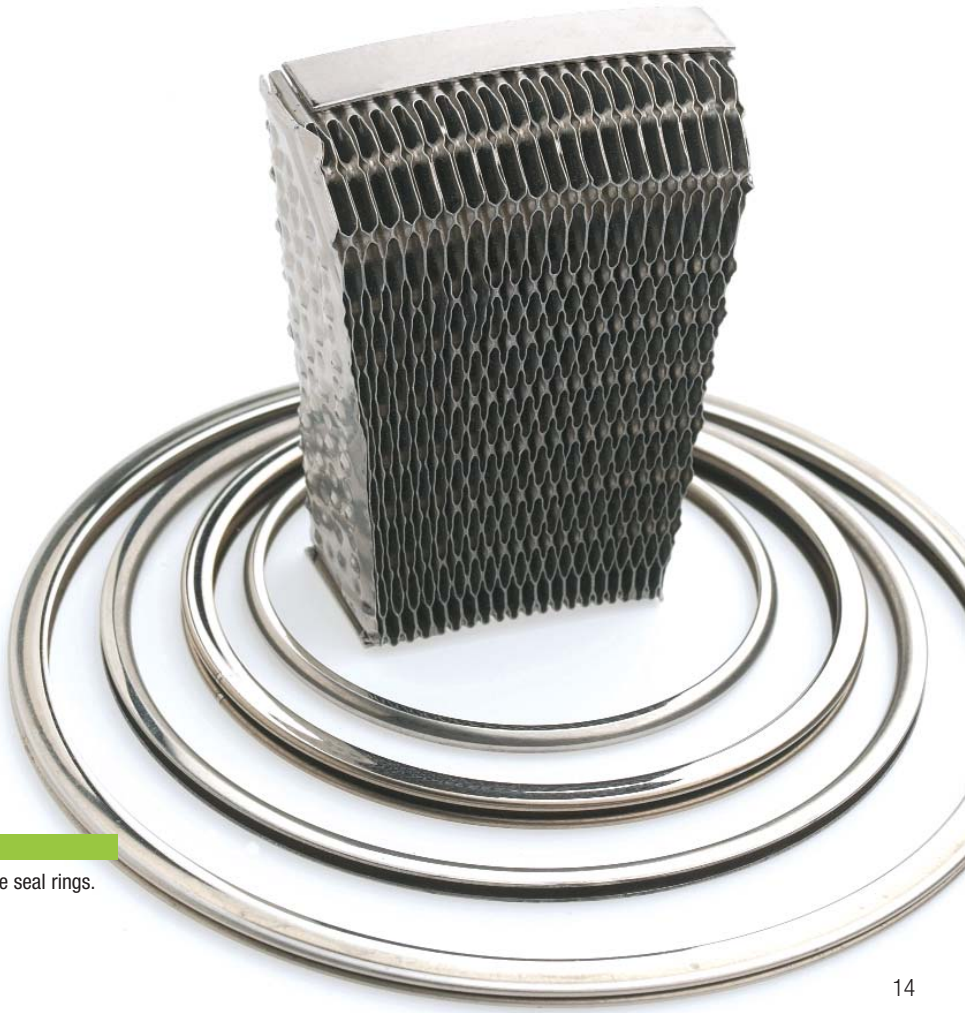
Fixed stator vanes for aircraft and land based turbines.



Titanium honeycomb sections.

Hypodermic needle
with guard.

Stampings for surgical tools and pacemaker cans.



Recuperator sections and high pressure seal rings.

Technical Details (Gauges, Tempers, Edges, Tolerances, etc.)

Strip Rolling Mill Capabilities

Gauge:	.0004 - .125 inch
	.010 - 3.175mm
Width:	up to 14 inches
	up to 356mm
Finishes:	Dull - Bright Ra 2-60
	Special Textures - Rolled
	or Mechanically Applied
Tempers:	Dead Soft - Extra Full Hard

Sheet Inventory**

Thickness:	8 ga. - 26 ga.
	.1644 - .0179 inch
	4.17 - .45mm
Width:	up to 72 inches
	up to 1828mm
Finishes:	2B, #4 Polish, BA
	XLBUFF

** Diversified Ulbrich of Canada only

Plate Inventory**

Thickness:	.1875 - 2 inches
	4.76 - 50.8mm
Width:	up to 96" x 288"
	up to 2438 x 7315mm
Finishes:	HRAP, #4 Polish

** Diversified Ulbrich of Canada only

Edges

A.I.S.I. No. 1 — Round edge
Width: 1.500 inches (38mm) max.
Thickness: .007-.062 inch (.1778-1.575mm)
Broken corner
Width: 3.500 inches (89mm) max.
Thickness: .062-.125 inch (1.575-3.175mm)

A.I.S.I. No. 3 — Slit edge
Width: .020 inch (.5mm) min.
Thickness: .0009-.125 inch (.02286-3.175mm)

A.I.S.I. No. 5 — Square edge
Width: 2.250 inches (57mm) max.
Thickness: .004-.062 inch (1016-1.575mm)
Broken corner
Width: 3.500 inches (89mm) max.
Thickness: .062-.125 inch (1.575-3.175mm)

Slitting Capabilities*

Gauge:	.0004 - .165 inch
(Ribbon wound)	.010 - 3.429mm
Gauge:	.0025 - .060 inch
(Oscillate wound)	.063 - 1.52mm
Width:	.032 - 54 inches
(Ribbon wound)	.508 - 1368mm
Width:	.062 - 1.00 inches
(Oscillate wound)	1.57 - 25.4mm
Oscillate Face:	3.5 - 12 inch max.
	88 - 304mm
Ribbon ID:	2 - 24 inches
	50.8 - 609.6mm
Oscillate ID:	5 - 16 inch max.
	127 - 406mm
Ribbon OD:	48 inch max.
	1220mm
Oscillate OD:	30 inch max.
	762mm

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

Specialty Wire Group

Flat Wire Gauge:	.0002 - .210 inch
	.0058 - 5.33mm
Flat Wire Width:	.002 - 1.5 inch
	.05 - 38.1mm
Round Wire Dia.:	.00075 - .400 inch
	.019 - 10.16mm
Shaped Wire:	rectangular, hexagonal, octagonal, triangular, half-round, many custom profiles on request.

Alloy Specifications

In addition to our core products, we produce several electronic, glass sealing and low expansion alloys.

Alloy	UNS
Nimonic® 75[1]	N06075
Nimonic® 80A[1]	N07080
Haynes® 263[2]	N07263
Hastelloy® G-3[2]	N06985
Hastelloy® C-4[2]	N06455
Inconel® 601[1]	N06601

Alloy	UNS
18-9 LW™[4]	S30430
303 (Wire Only)	S30300
416 (Wire Only)	S41623
Ulbraseal 36[7]	K93600
Ulbraseal 42[7]	K94100
Ulbraseal 29-17[7]	K93610

[1, 2, 4] See pages 16 and 17.
[7] Trademark of Ulbrich Stainless Steels & Special Metals, Inc.

The certification of our facilities to ISO 9001:2008 confirms the quality standards we've maintained since our beginnings three quarters of century ago.

Name	Trademark	UNS	C MAX	Ni	Cr	Mo	AMS	ASTM	Density (lb/cu. in.)	Description
Austenitic Grades 201		S20100	0.15	3.5 - 5.5	16.0 - 18.0			A 240, A 666	0.28	Chromium nickel manganese steel was developed as a satisfactory alternate for Type 301 for many applications.
301		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		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		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		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		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.
309		S30900	0.08	12.0 - 15.0	22.0 - 24.0		5523	A 240, A 167	0.29	High corrosion-resistant, chromium nickel grade with carbon limited to .08 to reduce carbon precipitation during welding.
310		S31000	0.25	19.0 - 22.0	24.0 - 26.0		5521	A 240, A 167	0.29	Similar to 309 with higher resistance to corrosion and oxidation at elevated temperatures.
316		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		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.
316TI		S31635	0.08	10.0 - 14.0	16.0 - 18.0	2.0 - 3.0		A 240	0.29	Ti stabilized version of 316 with resistance to sensitization. (The Formation of grain boundary chromium carbides at evaluated temperatures.)
317L		S31703	0.03	11.0 - 15.0	18.0 - 20.0	3.0 - 4.0		A 240	0.29	Similar to 316L but with additional molybdenum to improve corrosion resistance.
321		S32100	0.08	9.0 - 12.0	17.0 - 19.0		5510	A 240	0.29	Chromium nickel steel containing titanium.Recommended for parts fabricated by welding which cannot be subsequently annealed. Also recommended for parts to be used at temperatures between 800°F and 1850°F.
347		S34700	0.08	9.0 - 13.0	17.0 - 19.0		5512	A 240	0.29	Chromium nickel steel containing columbium and tantalum which is recommended for parts fabricated by welding which cannot be subsequently annealed. Also recommended for parts to be used at temperatures between 800°F and 1850°F.
CARPENTER® 20 CB	3, 10	N08020	0.06	32.5 - 35.0	19.0 - 21.0	2.0 - 3.0		B 463	0.289	A highly corrosion-resistant alloy used in the chemical industry for applications where corrosion resistance is extremely critical,superior to the general run of 300 type stainless.
Ferritic Grades 430		S43000	0.12		16.0 - 18.0		5503	A 240	0.28	General purpose grade, corrosion-resistant, straight chromium grade, non-heat-treatable.
430LI		S43000	0.022		16.0 - 18.0				0.28	Similar to straight 430 in corrosion and mechanical properties. The low interstitial s provide improved transverse bending over straight 430.
434		S43400	0.12		16.0 - 18.0	0.75 - 1.25		A 240	0.28	Modification of Grade 430 designed for automotive trim and resistance to atmospheric corrosion.
444		S44400	0.025	1.0 max.	17.5 - 19.5	1.75 - 2.50		A 240	0.28	A low carbon, low nitrogen, ferritic that provides pitting and crevice corrosion resistance superior to most ferritic grades.
Duplex Grades 2304		S32304	0.03	3.0 - 5.5	21.5 - 24.5			A 240	0.28	A lean austenitic-ferritic duplex stainless steel with general corrosion resistance similar to 316, but with yield strength nearly double that of austenitic stainless steels.
2205		S32205	0.03	4.5 - 6.5	22.0 - 23.0	3.0 - 3.5		A 240	0.28	A nitrogen, molybdenum enhanced austenitic-ferritic duplex stainless steel with general corrosion resistance similar to 904L, but with a yield strength nearly double that of austenitic stainless steels.
2507		S32750	0.03	6.0 - 8.0	24.0 - 26.0	3.0 - 5.0		A 240	0.28	A super austenitic-ferritic duplex stainless steel with exceptional strength and corrosion resistance ideal for chemical process, petrochemical, and seawater applications.
Martensitic Grades 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®	4	S17700	0.09	6.5 - 7.75	16-18.0		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 temp., can be heat treated at relatively low temperature for high strength properties.
17-4PH®	4	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.
PH15-7Mo®	4	S15700	0.09	6.50 - 7.7	14.0 - 16.0	2.0 - 3.0	5520	A-693	0.282	Similar to 17-7PH® alloy, but with molybdenum added for higher strength with heat treatment.
A286	4	S66286	0.08	24.0 - 27.0	13.5 - 16.0	1.0 1.75	5525		0.286	An iron, nickel chromium alloy designed for service up to 1300°F where high strength and corrosion resistance are required.
AM 350	8	S35000	.07 - .11	4.0 - 5.0	16.0 - 17.0	2.5 - 3.2	5548	A-693	0.286	Similar to 17-7PH® alloy and PH15-7Mo® alloy, but with slightly higher elevated temperature capability.
Nickel Alloys NICKEL 200 and electronics.		N02200	0.15	99.0 min.				B 162	0.322	Commercially pure nickel. High corrosion resistance. Used in food handling
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.
PERMANICKEL 300		N03300	0.4	Bal					0.316	Age - hardenable, high nickel alloy, with very good thermal electrical conductivity.

Name	Trademark	UNS	C MAX	Ni	Cr	Mo	AMS	ASTM	Density (lb/cu. in.)	Description
Nickel Alloys MONEL® 400	1	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.
MONEL® 401[1]	1	N04401	0.5	44.0 min.					0.321	An alloy used for thermal and electronic applications. This alloys is some times called Constantan and is 44% Nickel and 56% Copper.
MONEL® K-500	1	N05500	0.25	63.0 min.					0.305	Similar to Monel® 400™ but with higher tensile strength; a precipitation hardening alloy. Used in oil well drilling collars, doctor blades. Good strength and ductility 423°F to 1200°F.
INCONEL® 600	1	N06600	0.15	72.0 min.	14.0 - 17.0		5540	B 168	0.304	Has high corrosion and heat resistance combined with excellent strength and workability. Mainly used in corrosive atmospheres. Oxidation resistance to 2150°F.
INCONEL® 625	1	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.
INCONEL® 718	1	N07718	0.08	50.0 - 55.0	17.0 - 21.0	2.80 - 3.30	5596, 5597	B670	0.296	High strength and corrosion resistance for use in temp. ranges from -423°F to 1300°F. Nuclear applications.
INCONEL® X-750	1	N07750	0.08	70.0 min.	14.0 - 17.0		5542, 5598		0.3	A precipitation hardening nickel-chromium alloy with useful strength to 1500°F. Good corrosion and oxidation resistance.
INCOLOY® 800	1	N08800	0.1	30.0 - 35.0	19.0 - 23.0		5871	B 409	0.29	Nickel-iron-chromium alloy that is carburization resistant at elevated temp.
INCOLOY® 825	1	N08825	0.05	38.0 - 46.0	19.5 - 23.5	2.5 - 3.5		B 424	0.293	An alloy that is highly resistant to aggressively corrosive environments such as sulfuric, phosphoric acids and seawater.
Ni-SpanC® 902	1	N09902	0.06	41.0 - 43.5	4.9 - 5.75				0.293	A nickel-iron-chromium alloy used in precision spring applications subject to severe temp. fluctuations.
HASTELLOY® C-276	2	N10276	0.01	Bal	14.5 - 16.5	15.0 - 17.0		B 575	0.321	Used in chemical industry for resistance to oxidizing agents. Replaces Hastelloy® C™ with better fabricability.
HASTELLOY C-22		N06022	0.015	Bal	20.0 - 22.5	12.5 - 14.5		B 575	0.314	A versatile nickel chromium molybdenum tungsten alloy with resistance to a variety of industrial chemicals. Superior weldability.
HASTELLOY G-30		N06030	0.03	Bal	28.0 - 31.5	4.0 - 6.0		B 582	0.297	High chromium nickel base alloy with superior corrosion resistance to phosphoric acids and environments with highly oxidizing acids.
HASTELLOY® B-3		N10675	0.01	65.0 min.	1.0 - 3.0	27.0 - 32.0			0.333	Used in chemical industry for resistance to hydrochloric acid, sulfuric acid, phosphoric acid. Oxidation atmosphere resistant to 1400°F.
HASTELLOY® X	2	N06002	0.05 - 0.15	Bal	20.5 - 23.0	8.0 - 10.0			0.297	Jet engine components for afterburner sections, blades, tailpipes, furnace applications, honey-comb, bellows, ducting. Good strength and oxidation resistance to 2200°F.
HAYNES® 214	2	N07214	0.05	Bal	15.0 - 17.0	0.5 max			0.29	Nickel based precipitation strengthened alloy with oxidation resistance to 2200°F. For furnace parts exposed to carburizing, chlorine contaminated and oxidizing atmospheres; gas turbine parts.
HAYNES® 230	2	N06230	0.05 - 0.15	Bal	20.0 - 24.0	1.0 - 3.0			0.319	Nickel-chromium-tungsten-molybdenum alloy with outstanding resistance to oxidizing environments up to 2100°F for prolonged periods.
HAYNES® 242	2	N10242	0.03	Bal	7.0 - 9.0	24.0 - 26.0			0.327	Age hardenable, nickel alloy for use up to 1300°F. Low thermal expansion, good oxidation resistance and excellent aged ductility. Suited for gas turbine engines and chemical process plants.
Cobalt Alloys HAYNES® 188	2	R30188	0.05-0.15	20.0 - 24.0	21.0 - 23.0				0.324	A cobalt-based alloy with excellent high temperature strength and oxidation resistance to 2000°F, combined with outstanding post-standing ductility.
HAYNES® 25 L-605	2	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.
WASPALOY	6	N07001	0.03 - 0.10	Bal	18.0 - 21.0	3.5 - 5.0	5544		0.294	Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.

Name	N	C	H	Fe	O	Pd	Ti	Density	Description
Titanium Commercially Pure Ti 35A G1	0.03 max	0.08 max	0.015 max	0.20 max	0.18 max	-	bal	0.163	Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250
Ti 40A G2	0.03 max	0.08 max	0.015 max	0.30 max	0.25 max	-	bal	0.163	Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50400
Ti 55A G3	0.05 max	0.08 max	0.015 max	0.30 max	0.35 max	-	bal	0.163	Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550
Ti 75A G4	0.05 max	0.08 max	0.015 max	0.50 max	0.40 max	-	bal	0.163	Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS 50700
Ti G7/11	0.03 max	0.08 max	0.015 max	0.30 max	0.25 max	0.12-.25	bal		A commercially pure titanium with a small amount of Palladium addition to enhace corrosion resistance and a reducing atmosphere. ASTM B265 7/11. UNS R52400

Name	V	Al	Sn	Mo	Nb	Cr	Zr	Ti+residuals	Description
Titanium Alloys Ti 15-3-3-3	14-16	2.5-3.5	2.5-3.5	-	-	2.5-3.5	-	bal	A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R58153
Ti 3-2.5 G9	2-3	2.5-3.5	-	-	-	-	-	bal	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. ASTM B265 G9. UNS R56320
Ti Beta 21S, G21	-	2.5-3.5	-	14-16	2.3-3.2	-	-	bal	A cold formable metastable beta alloy available in foil and strip with improved oxidation resistance, elevated temperature strength and creep resistance. ASTM B265 G21. , UNS R58210
Ti 6-4 G5	3.5-4.5	5.5-6.75	-	-	-	-	-	bal	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. ASTM B265 G5. UNS R56400. Wire Only.
Ti 6-2-4-2	-	5.5-6.75	1.5-2.5	1.5-2.5	-	-	3.5-4.5	bal	Ti 6Al-2Sn-4Zr-2Mo has good tensile creep and fatigue properties up to 1000°F. It is the most commonly used high temperature titanium alloy in jet engine compressors and airframe structures. AMS 4975. UNS R54620. Wire Only.

Name	ASTM	Density	Description
Other NITINOL	F 2063-05	0.233	Nitinol is a metal alloy of nickel and titanium, where the two elements are present in roughly equal atomic percentages. Nitinol exhibits unique behavior such as "shaped memory" and "superelasticity". Wire only.
NIOBIUM TYPE 1	B 393	0.31	Pure niobium, reactor grade, high melting point, corrosion resistant for use in medical and high temperature industrial applications.
Zirconium 702	B 551	0.235	Exhibits a superior corrosion resistance and high heat transfer efficiency. Zirconium has good ductility, formability and strength comparable with common engineering alloys.

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Providing Quality Products, Services, and Solutions
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  - Provide Total Cost alternatives
  - Continuously train our employees and our customers
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Chris Ulbrich
Chief Executive Officer

Issued: 6/2007

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