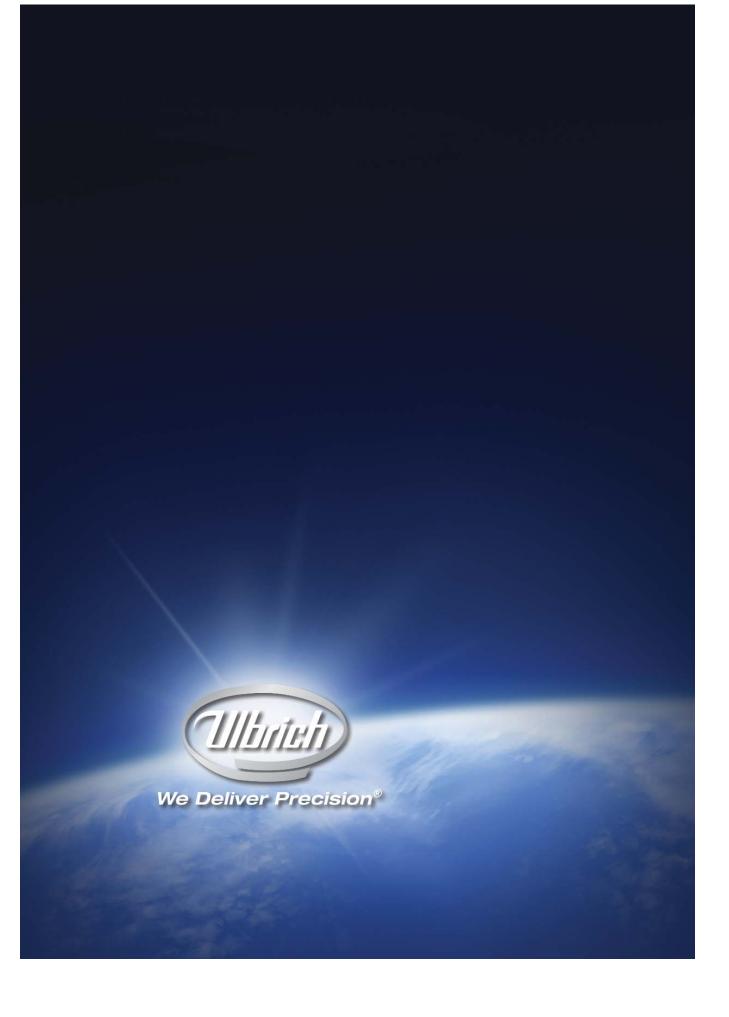


www.ulbrich.com





### Global representation with service and distribution centers worldwide.



and automotive, nuclear and solar energy, medical and surgical equipment, chemical processing, electronics and many others. To some customers, we are a precision reroller 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 supplying various forms of stainless steel and specialty metals, expertly processed and delivered on time. For specialty wire applications, 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.







## Precision Re-Rolled Strip



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 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.

#### Top photos (L to R):

High pressure hot water jet cleaning system is used for applications requiring ultra clean surfaces. Internal view of a Z-Mill.

Heavy duty slitter handles incoming coils up to 1219mm wide.

#### Bottom photo:

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

#### **Strip Alloys:**

- Austenitic
- Martensitic
- Ferritic
- Precipitation hardening stainless steels
- Nickel & Nickel Alloys
- Cobalt Alloys
- Titanium & Titanium Alloys
- Others on request

#### Gauges Range:

• 0,010 to 3,175mm

### Width Range:

• 3 to 350mm

#### Tempers:

• Fully annealed through extra full hard

### Surface Finishes:

- Dull
- Bright



# Specialty Wire Group



#### **Precision Flat Wire**

Our Precision Flat Wire facilities are capable of producing gauges from 0,00508mm and widths from 0,05mm 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  $\pm$  0,0025mm 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 process a variety of materials, including stainless steel, aluminum alloys, copper and brass alloys, nickel alloys, carbon steel and Nitinol. We offer a wide range of finishes from tin and lead coated for photovoltaic applications to heat treated and tempered for saw blades as well as bright polished finishes for certain medical applications.



#### **Specialty Wire Products**

• Flat Wire Gauges: 0,00508 - 5,33mm

• Flat Wire Widths: 0,0508 - 38,1mm

• Round Wire Dia.: 0,019 - 10,16mm

• Shaped Wire: A variety of standard and

custom shapes are available in widths from 0,406 to

25,4mm.

Top photo: Straightening, inspecting and spooling photovoltaic wire prior to packaging.

Left photo

New state-of-the-art "Focus Factory," solder cladding on photovoltaic wire is held to tolerances of  $\pm$  2.5 microns.

# Specialty Wire Group

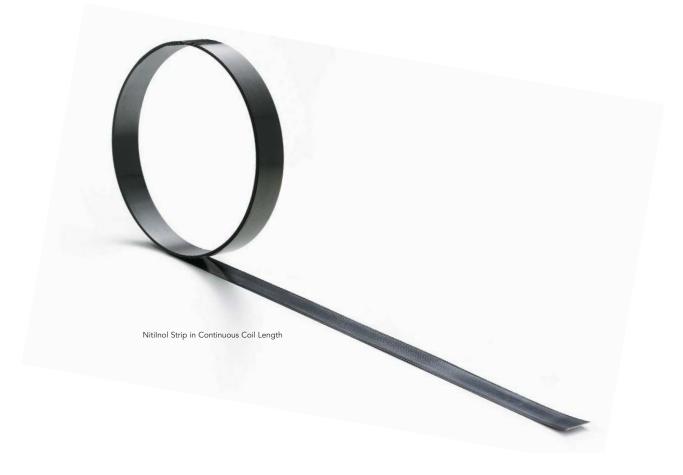


### **Shaped Wire**

The ability of our Shaped Wire facility to produce customized cross sections is saving important manufacturing costs in many applications. The versatility of our shaped wire process allows us to produce net or near-net custom cross-sectional shapes in continuous wire form that eliminates the need for subsequent machining and other secondary operations – and significantly reduces scrap! Our products are engineered in alloy compositions and mechanical properties tailored to meet your specifications.

We also offer flat wire in gauges from 0,12mm up to 8,509mm and in widths from 0,508mm up to 38,46mm. Like our shaped wire products, it is available customized to your specifications, with custom edge geometry and superior tolerances. In addition to all of the stainless steel grades, we offer nickel and cobalt alloys, titanium alloys, shape memory and super-elastic Nitinol alloys and many others. Our wire mill has been leading the effort to produce a light gauge, wide width Nitinol product. Although it is rolled from rod, it can be more accurately described as "strip" product.

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.



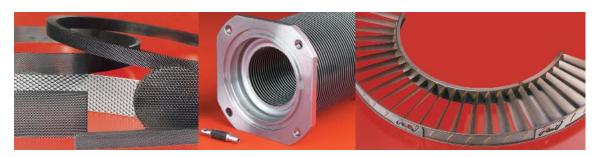
# Applications Cover a Wide Range



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;



# Applications Cover a Wide Range

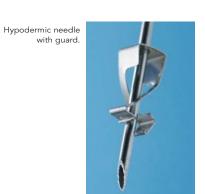


Stampings for surgical tools and pacemaker cans.

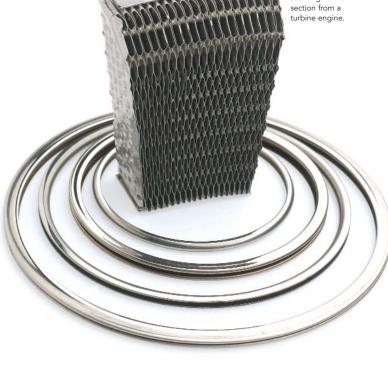




Wrist watch stampings.



High pressure seal rings and a





Fixed stator vanes for aircraft and land based tur-

Name	Trademark	UNS	C MAX	Ni	Cr	Мо	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 fathicated 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	.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®	4	\$17700	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	.0711	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.

	Trademark	UNS	C MAX	Ni	Cr	Мо	AMS	ASTM	Density ( lb/cu. in.)	Description
<i>Nickel Alloys</i> 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® 4011	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.
	2	R30605	0.05 - 0.15	9.0 - 11.0	19.0 - 21.0				0.33	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.
HAYNES® 25 L-605	2					3.5 - 5.0	5544			resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation
HAYNES® 25 L-605 WASPALOY		R30605	0.05 - 0.15	9.0 - 11.0	19.0 - 21.0	3.5 - 5.0	5544 Pd	Ti	0.33	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia	6	R30605 N07001	0.05 - 0.15	9.0 - 11.0 Bal	19.0 - 21.0 18.0 - 21.0			<b>Ti</b>	0.33	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.
HAYNES® 25 L-605 WASPALOY Name Titanium Commercia Ti 35A G1	6	R30605 N07001	0.05 - 0.15 0.03 - 0.10	9.0 - 11.0 Bal	19.0 - 21.0 18.0 - 21.0	0			0.33 0.294 Density	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburation resistant to 1900°F, Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2	6	R30605  N07001  N  0.03 max	0.05 - 0.15 0.03 - 0.10 C 0.08 max	9.0 - 11.0  Bal  H  0.015 max	19.0 - 21.0 18.0 - 21.0 <b>Fe</b> 0.20 max	0 0.18 max	Pd -	bal	0.33 0.294 Density 0.163	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2  Ti 55A G3	6	R30605  N07001  N  0.03 max  0.03 max	0.05 - 0.15 0.03 - 0.10 C 0.08 max	9.0 - 11.0  Bal  H  0.015 max	19.0 - 21.0 18.0 - 21.0 Fe 0.20 max 0.30 max	0 0.18 max 0.25 max	Pd -	bal bal	0.33 0.294 Density 0.163	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F, Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50555
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2 Ti 55A G3  Ti 75A G4	6	R30605  N07001  N  0.03 max  0.03 max	0.05 - 0.15 0.03 - 0.10 C 0.08 max 0.08 max	9.0 - 11.0  Bal  H  0.015 max  0.015 max	19.0 - 21.0 18.0 - 21.0 Fe 0.20 max 0.30 max	0.18 max 0.25 max 0.35 max	Pd -	bal bal bal	0.33 0.294 Density 0.163 0.163	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM 9265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM 9265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM 8265/F67. UNS R50400
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2  Ti 55A G3  Ti 75A G4  Ti G7/11	6	R30605  N07001  N  0.03 max  0.03 max  0.05 max	0.05 - 0.15  0.03 - 0.10  C  0.08 max  0.08 max  0.08 max	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max	0 0.18 max 0.25 max 0.35 max 0.40 max	Pd	bal bal bal	0.33 0.294 Density 0.163 0.163	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50360  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS S0700  A commercially pure titanium with a small amount of Palladium addition to enhace corrosion resistance and a reducing atmosphere. ASTM B265 7/11.
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2 Ti 55A G3 Ti 75A G4 Ti G7/11  Name  Titanium Alloys	6	N07001  N  0.03 max  0.05 max  0.05 max	0.05 - 0.15  0.03 - 0.10  C  0.08 max  0.08 max  0.08 max	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max  0.30 max	0 0.18 max 0.25 max 0.35 max 0.40 max	Pd 0.1225	bal bal bal bal bal	0.33 0.294 Density 0.163 0.163 0.163	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM 8265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM 8265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM 8265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM 8265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM 8265/F67. UNS R505700  A commercially pure titanium with a small amount of Palladium addition to enhace corrosion resistance and a reducing atmosphere. ASTM 8265 7/11.  Description
Name  Titanium Commercia Ti 35A G1 Ti 40A G2 Ti 75A G4 Ti G7/11  Name  Titanium Alloys Ti 15-3-3-3	6	R30605  N07001  N  0.03 max  0.03 max  0.05 max  0.05 max	0.05 - 0.15 0.03 - 0.10 C 0.08 max 0.08 max 0.08 max 0.08 max	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max  0.30 max	0 0.18 max 0.25 max 0.35 max 0.40 max	Pd	bal bal bal bal bal	0.33  0.294  Density  0.163  0.163  0.163  Th-residuals	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50350  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50700  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  Description  A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R56153  Alpha-Beta alloy-considered very weldable. Superior. April 1000 1000 1000 1000 1000 1000 1000 10
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2  Ti 55A G3  Ti 75A G4  Ti G7/11  Name  Titanium Alloys Ti 15-3-3-3  Ti 3-2.5 G9	6	R30605  N07001  N  0.03 max  0.05 max  0.05 max  V  14-16	0.05 - 0.15  0.03 - 0.10  C  0.08 max  0.08 max  0.08 max  0.08 max	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max  0.30 max	0 0.18 max 0.25 max 0.35 max 0.40 max	Pd	bal bal bal bal bal	0.33  0.294  Density  0.163  0.163  0.163  Ti+residuals	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F, Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50300  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R503700  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  Description  A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R58153  Alpha-Beta alloy-considered very weldable. Superior to high strength. C.PT or equivalent strength level in widel toughness and useful temp. range. May be strengthened by cold working. ASTM B265 G9. UNS R56320
Name  Titanium Commercia Ti 35A G1 Ti 40A G2 Ti 55A G3 Ti 75A G4 Ti G7/11  Name  Titanium Alloys Ti 15-3-3-3 Ti 3-2.5 G9 Ti Beta 21S, G21	6	R30605  N07001  N  0.03 max  0.05 max  0.05 max  V  14-16	0.05 - 0.15 0.03 - 0.10  C 0.08 max 0.08 max 0.08 max 0.08 max 2.5-3.5	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max  0.30 max  -	0.18 max 0.25 max 0.35 max 0.40 max 0.25 max -	Pd	bal bal bal bal cal	0.33  0.294  Density  0.163  0.163  0.163  Ti+residuals  bal	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  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  Description  A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R55153  Alpha-Beta alloy-considered every weldable. Superior to high strength. CP.T1 or equivalent strength level in weld toughness and useful temp. range. May be strengthened by cold working. ASTM B265 G5. UNS R56320  Grade 5 titanium is the workhorse of all the titanium grades. It is also know as Ti-AAL-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 a schieve even hiches treatments. ASTM B265 G5.
Name  Titanium Commercia Ti 35A G1 Ti 40A G2 Ti 75A G4 Ti 67/11  Name  Titanium Alloys Ti 15-3-3-3 Ti 75-2-5 G9 Ti Beta 21S, G21 Ti 6-4 G5 Ti 6-2-4-2	6	R30605  N07001  N  0.03 max  0.05 max  0.05 max  V  14-16  2-3	0.05 - 0.15 0.03 - 0.10  C 0.08 max 0.08 max 0.08 max 0.08 max 2.5-3.5 2.5-3.5	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max  0.30 max  -	0.18 max 0.25 max 0.35 max 0.40 max 0.25 max -	Pd	bal bal bal bal bal 3.5-4.5	0.33 0.294  Density 0.163 0.163 0.163  Ti+residuals bal bal bal	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS S0700  A commercially pure titanium with a small amount of Palladium addition to enhace corrosion resistance and a reducing atmosphere. ASTM B265 7711.  UNS R52400  Description  A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R58153  Alpha-Beta alloy-considered very weldable. Superior to high strength. C.P.T or equivalent strength level in weld toughness and useful temp. range. May be strengthened by cold working. ASTM B265 G9. UNS R56320  A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R58153  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 commor application and some propersists and airframe structures. AMS 4975. UNS R5662
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2  Ti 55A G3  Ti 75A G4  Ti G7/11  Name  Titanium Alloys Ti 15-3-3-3  Ti 3-2.5 G9  Ti Beta 21S, G21  Ti 6-4 G5	6	R30605  N07001  N  0.03 max  0.05 max  0.05 max  V  14-16  2-3	0.05 - 0.15 0.03 - 0.10 C 0.08 max 0.08 max 0.08 max 0.08 max 2.5-3.5 2.5-3.5 5.5-6.75	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max  14-16	0.18 max 0.25 max 0.35 max 0.40 max 0.25 max -	Pd	bal bal bal bal car	0.33 0.294  Density 0.163 0.163 0.163  Ti+residuals bal bal bal	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F, Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50500  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50700  A commercially pure titanium with a small amount of Palladium addition to enhace corrosion resistance and a reducing atmosphere. ASTM B265 77/11.  UNS R52400  Description  A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R58153  Alpha-Beta alloy-considered very weldable. Superior to high strength. CPT of equivalent strength level in weld toughness and useful temp. range. May be strengthened by cold working. ASTM B265 G9. UNS R56320  A cold formable metastable beta alloy available in foil and strip which in improved oxidation resistance, elevated temperature strength light weight range. May be strengthened by cold working. ASTM B265 G9. UNS R56400.  Wire Only.  Ti SA1-25A-47-2Mo has good tensile creep and fatigue properties up to 1000°F. It is the most commoning used high temperature transmit to achieve even higher strengths. ASTM B265 G5.
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2  Ti 55A G3  Ti 75A G4  Ti G7/11  Name  Titanium Alloys Ti 15-3-3-3  Ti 3-2.5 G9  Ti Beta 21S, G21  Ti 6-4 G5	6	R30605  N07001  N  0.03 max  0.05 max  0.05 max  V  14-16  2-3	0.05 - 0.15 0.03 - 0.10 C 0.08 max 0.08 max 0.08 max 0.08 max 2.5-3.5 2.5-3.5 5.5-6.75	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max  14-16	0.18 max 0.25 max 0.35 max 0.40 max 0.25 max -	Pd	bal bal bal bal bal 3.5-4.5	0.33 0.294  Density 0.163 0.163 0.163  Ti+residuals bal bal bal	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50400  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50505  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50700  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  Description  A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R58153  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  A cold formable metastable beta alloy available in foil and strip which in proved oxidation resistance, elevated temperature strength and creep resistance. ASTM B265 G21. UNS R56400. Wire Only.  Grade 5 titanium is the workhorse of all the titanium grades. It is also know as Ti-AAL-47 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 a general addi
HAYNES® 25 L-605  WASPALOY  Name  Titanium Commercia Ti 35A G1  Ti 40A G2  Ti 75A G4  Ti 67/11  Name  Titanium Alloys Ti 15-3-3-3  Ti 3-2.5 G9  Ti Beta 21S, G21  Ti 6-4 G5  Ti 6-2-4-2  Name  Other	6	R30605  N07001  N  0.03 max  0.05 max  0.05 max  V  14-16  2-3	0.05 - 0.15 0.03 - 0.10 C 0.08 max 0.08 max 0.08 max 0.08 max 2.5-3.5 2.5-3.5 5.5-6.75	9.0 - 11.0  Bal  H  0.015 max  0.015 max  0.015 max  0.015 max	19.0 - 21.0  18.0 - 21.0  Fe  0.20 max  0.30 max  0.30 max  14-16	0.18 max 0.25 max 0.35 max 0.40 max 0.25 max -	Pd	bal bal bal bal  zr 3.5-4.5	0.33  0.294  Density  0.163  0.163  0.163  Ti+residuals  bal  bal  bal	resistance to 2000°F, combined with outstanding post-standing ductility.  Jet engine components, combustion chambers, afterburner parts. Oxidation and carburization resistant to 1900°F. Good high temperature strength.  Jet engine turbine wheels, buckets, spacers, shafts. Good for high temperature applications.  Description  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50250  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50450  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  Alpha phase grades of commercially pure titanium with oxygen equivalents resulting in strength levels from low to high. ASTM B265/F67. UNS R50550  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  Description  A cold formable metastable beta alloy available in foil and strip which is typically aged to high strengths after fabrication. AMS 4914. UNS R56153  Alpha-Beta alloy-considered very weldable. Superior to high strength repetitive strength level in weld toughness and useful temp. range. May be strengthened by cold working. ASTM B265 69. UNS R66320  A cold formable metastable beta alloy available in foil and strip with improved oxidation resistance, elevated temperature strength and creep resistance. ASTM B265 621., UNS R56310  A cold formable metastable beta alloy available in foil and strip with improved oxidation resistance, elevated temperature strength and creep resistance. ASTM B265 621., UNS R56400. Wire Only.  B carde 5 titanium is the workhorse of all the titanium grades. It is also know as T16AL-

<sup>4</sup> Trademark of Armco, Inc.

<sup>1</sup> Trademark of Special Metals Corporation group of companies.
2 Trademark of Haynes International, Inc.
3 Trademark of Carpenter Technologies Corporation.
10 CAPPENTER 2003-3LR® is a trademark of Hoechst Celanese Corporation.
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.



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