Technical Data Sheet
630 UGIMA®

Comparable Standard:

Typical Analysis %	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Nb+Ta
Min.						15.0 -	3.0 -		3.0 -	0.15 -
Max.	0.07	1.00	1.00	0.040	0.030	17.0	5.0	0.50	5.0	0.45

Description

» **630 UGIMA®** is an improved machining martensitic precipitation hardenable grade produced only by Ugitech. It is identical in every way to standard type 630 (17-4), except with respect to machinability. The proprietary UGIMA® manufacturing process - developed exclusively by Ugitech - results in a product that dramatically increases productivity and tool life, and improves the surface finish on all types of machined parts.

» **630 UGIMA®** provides a good combination of high strength corrosion resistance, and is often the best solution of stainless steel when high strength is required. Parts machined from solution treated bar stock should be heat treated or aged prior to use. No further heat treatment of machined parts is required when using **630 UGIMA®** in one of the precipitation hardened conditions as specified.

» **630 UGIMA®** delivers heat to heat consistency that is unsurpassed in the industry. Once an optimum set-up has been established, machinists can take advantage of increased machine efficiency rates (run “lights out production”). Also, crashes due to hard spots are a thing of the past. **630 UGIMA®** can provide a significant competitive advantage for shops that demand efficient, high volume and reliable production.

Classification

Martensitic precipitation hardenable stainless steel. High strength, good overall corrosion resistance, and oxidation resistance in continuous service to 1200° F (650° C).

Available Forms

Cold drawn bars, Turned bars, Ground bars, Wire, SMQ™
Please inquire for additional information on available forms.

Characteristics

» AISI 630 Type 630
» UNS S17400
» En 10088-3
1.4542
X5CrNiCuNB16.4
» X5CrNiCuNb16-4
» AMS 5643
» ASTM A484
» ASTM A564
» ASTM F899
» ASME SA-564

Mechanical Properties (Typical)

Solution Treated (See page 2 for conditioned values)

Mechanicals up to 1" (incl.) (Solution Annealed)	
Tensile Strength	140 - 200
Yield Strength (0.2%)	120 - 175
Elongation	10 %
Reduction of Area	40 %
Hardness	363 HBn max
Mechanicals >1" (Solution Annealed)	
Tensile Strength	120 - 175
Yield Strength (0.2%)	90 - 140
Elongation	10 %
Reduction of Area	50 %
Hardness	363 HBn max

Magnetic and Electrical Properties

Typical Magnetic Permeability: Magnetic in all conditions.
Electrical Resistivity: Solution treated: 32 μΩ - in
(800 μΩ - mm) @ 68 °F (20 °C)

Typical Physical Properties	
Density	0.280 lbs/in^3 (7.8 g/cm^3)
Round bar weight per ft (lbs)	10.55 X (1/2 bar diameter in inches)^2
Hexagonal bar weight per ft (lbs)	2.91 X (bar diameter in inches)^2
Square bar weight per ft (lbs)	3.36 X (bar diameter in inches)^2
Mean Coefficient of Linear Expansion	68 - 392 °F (20 - 200 °C) = 6.0 x 10^{-6} in/in/°F (10.8 x 10^{-6} cm/cm/°C)
Modulus of Elasticity in Tension	28.6 x 10^{-6} psi (197,000 MPa)
Thermal Conductivity	19.8 Btu/ft/hr/°F (17.0 W/m/°C) @68 °F (20 °C)

Applications

» Fasteners
» Shafts
» Valve Bodies
» Valves
» Valve Trim
» Fittings and Machined parts
» Medical devices

Applications

» Aircraft components

» Not recommended for vessels containing liquid or gasses at high pressures

Corrosion Resistance

630 UGIMA® has excellent overall corrosion resistance, with performance similar to type 304 in most corrosive environments. Due to its special metallurgical structure, **630 UGIMA®** is highly resistant to intergranular corrosion, erosion corrosion, and stress corrosion cracking, as well as corrosion fatigue.

The corrosion resistance of a stainless steel depends on many factors related to the composition of the corrosive element, pH, temperature, velocity, agitation, services, deposits, dissimilar metal contact, metallurgical condition, as well as the preparation of the surface. The table here is for comparative purposes only and illustrates the performance in different environments. Consult your local SCHMOLZ + BICKENBACH USA metallurgist to discuss your application.

Optimum corrosion resistance requires that parts be smooth, and free from surface contamination such as cutting fluid and foreign particles. Under these conditions, parts will be passive in the air. If passivation is required, the following treatment is recommended:

» Solution: 50% nitric acid + 2 - 6 wt. sodium dichromate at 70 - 120 °F (20 - 50 °C).

» Treatment: Immerse for short duration, followed by thorough rinsing to remove all residual solution.

Forging (Hot Working)

The following conditions are recommended for forging **630 UGIMA®**:

» Slow heating to 1475 °F (800 °C), then more rapidly to 2100-2190 ° (1150 - 1200 °C)

» Forge in the range of 1740 - 2190 °F (950-1200 °C)

» After forging, cool in air, water or oil

Hardenability (Cold Working)

Hardenable by heat treatment to many different conditions (see the table “ranges for **630 UGIMA®** in various precipitation hardened (aged) conditions”). Strength and hardness increase upon cold work such as drawing, forming, or machining, but workability is limited due to high solution treated yield strength.

Environment	Behavior	
Nitric Acid	⬢⬢⬢⬡	
Humidity	⬢⬢⬢⬢	
Phosphoric Acid	⬡⬡⬡⬡	Restricted
NaCl (Saline Mist)	⬢⬢⬢⬡	
Sulfuric Acid	⬡⬡⬡⬡	Restricted
Seawater	⬡⬡⬡⬡	Restricted
Acetic Acid	⬢⬢⬡⬡	
Petroleum	⬡⬡⬡⬡	Restricted
Sodium Carbonate	⬢⬢⬡⬡	

It is important to note, maintaining corrosion resistance at weld zones will require cleaning and passivation.

Welding

630 UGIMA® can be readily welded without preheating, and with or without filler metal, using most standard welding techniques such as TIG, MIG, laser, resistance, and electron beam welding. If filler or metal is used, the proper choice depends on the mechanical property requirements of the weld itself. If the joint is to have the same mechanical properties as the base metal, then the wire or electrodes should be of the same composition as the base metal (AWS E630/ER630). If not, then AWS E308L or ER308LSi can be used. A post weld stress relief treatment at 200 - 300 °C (390 - 570 °F) is recommended if components will be subject to heavy mechanical stress in service.

1. A suggested protective gas for MIG welding is Ar+1 % CO^2 or 1 - 2 %).
2. Gases containing hydrogen or nitrogen should be avoided.

Heat Treatment

The heat treatment (solution treatment) that gives **630 UGIMA®** its normal properties including heating at 1900 ° F (1040 ° C) for sufficient time to allow for full martensitic transformation, followed by rapid cooling (air quenching for thicker sections, and oil quenching for thinner sections). **630 UGIMA®** can be precipitation hardened (aged) to different hardness ranges for different applications. The process involves solution treatment per above, followed by precipitation hardening (aging) treatment depending on final properties required. Material will contract upon hardening solution treated material at the following rates: H900 – 0.0004-0.0006 in/in, H1150 – 0.0009-0.0012 in/in. Contact your local SCHMOLZ + BICKENBACH USA Metallurgist with specific concerns.

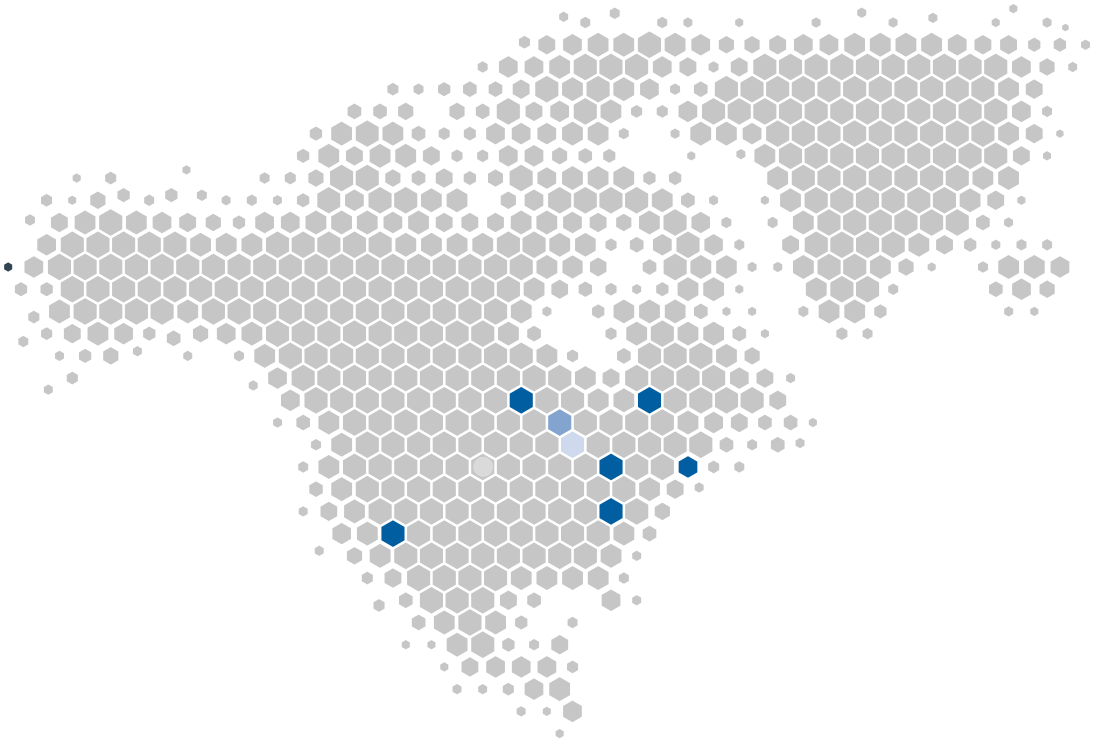
Condition and Heat Treatment				Typical Mechanical Property Ranges					
Condition	Aging Temp. °F (°C)	Time hrs.	Quench Media	Tensile Strength ksi (Mpa) min.	Yield Strength ksi (Mpa) min.	% Elongation In 2 in. or 4D min.	% Reduction of Area min.	Hardness HRC/ BHN Min.	Impact Charpy-V ft.lbf (J) min.
H900	900 (480)	1.0	Air Cool	190 (1310)	170 (1170)	10	35	40 (388)	-
H1025	1025 (550)	4.0	Air Cool	155 (1070)	145 (1000)	12	45	35 (331)	15 (20)
H1075	1075 (580)	4.0	Air Cool	145 (1000)	125 (860)	13	45	32 (311)	20 (22)
H1150	1150 (620)	4.0	Air Cool	135 (930)	105 (725)	16	50	28 (277)	30 (41)
H1150M	760 for 2h + 1150 for 4h	2.0 4.0	Air Cool Air Cool	115 (795)	75 (520)	18	55	24 (255)	55 (75)

Machinability

The key to **630 UGIMA®** lies in the process. A special melting practice (deoxidation) eliminates the hard and abrasive inclusions that prevent machinability. With this technology, hard and abrasive phases are replaced by highly specific inclusions that actually benefit machinability. Due to their lower melting points, these inclusions are soft and malleable at machining temperatures, and act as “solid” lubrication for the cutting tools. The result is better tool life, improved surface finish, and excellent chip breakability.

Machining Operations	Metallurgical Condition	Depth of cut or width (inches)	HSS Tooling			Coated Carbide Tools		
			Cutting Speed SFPM	Feed (ipr)	Type of Tool	Cutting Speed SFPM	Feed (ipr)	Type of Tool
Turning	Solution Treated/ Cold Drawn	0.04 0.08 0.12	65 - 90 65 - 85 55 - 80	0.004 - 0.010 0.004 - 0.012 0.005 - 0.015	M2 - M3 (T15)	220 - 630 190 - 575 175 - 550	0.004 - 0.010 0.004 - 0.012 0.005 - 0.015	C6/C7 C6 C5/C6
	H1150/ Cold Drawn	0.04 0.08 0.12	60 - 80 55 - 75 45 - 70	0.004 - 0.010 0.004 - 0.012 0.005 - 0.015		180 - 550 165 - 495 150 - 440	0.004 - 0.010 0.004 - 0.012 0.005 - 0.015	C6/C7 C6 C5/C6
	Solution Treated	0.04 0.08 0.12	95 - 120 75 - 100 65 - 85	0.004 - 0.010 0.004 - 0.012 0.015 - 0.025		245 - 890 205 - 840 175 - 630	0.004 - 0.010 0.004 - 0.012 0.015 - 0.025	C6/C7 C6 C5/C6
	H1150	0.04 0.08 0.12	85 - 105 65 - 90 55 - 80	0.004 - 0.010 0.004 - 0.012 0.015 - 0.025		210 - 735 180 - 660 140 - 625	0.004 - 0.010 0.004 - 0.012 0.015 - 0.025	C6/C7 C6 C5/C6
Forming	Solution Treated/ Cold Drawn	0.06 0.25 0.50	65 - 90 65 - 85 55 - 80	0.002 - 0.004 0.004 - 0.006 0.003 - 0.005	M2 - M3 (T15)	220 - 575 190 - 505 160 - 330	0.002 - 0.004 0.004 - 0.006 0.003 - 0.005	C6/C7 C6 C5/C6
	H1150/ Cold Drawn	0.06 0.25 0.50	60 - 80 55 - 75 45 - 70	0.002 - 0.004 0.004 - 0.006 0.003 - 0.005		150 - 505 165 - 595 140 - 295	0.002 - 0.004 0.004 - 0.006 0.003 - 0.005	C6/C7 C6 C5/C6
	Solution Treated	0.06 0.25 0.50	95 - 120 75 - 100 65 - 85	0.003 - 0.005 0.004 - 0.005 0.003 - 0.005		270 - 630 220 - 575 175 - 375	0.002 - 0.004 0.004 - 0.006 0.003 - 0.005	C6/C7 C6 C5/C6
	H1150	0.06 0.25 0.50	85 - 105 65 - 90 55 - 80	0.003 - 0.005 0.004 - 0.005 0.003 - 0.005		225 - 580 180 - 505 165 - 325	0.002 - 0.004 0.004 - 0.006 0.003 - 0.005	C6/C7 C6 C5/C6
Cut-off or Part-Off	Solution Treated/ Cold Drawn	0.04 0.08 0.12	65 - 90 65 - 85 55 - 80	0.0005 - 0.0015 0.001 - 0.002 0.0015 - 0.003	M2 - M3 (T15)	135 - 345 150 - 425 160 - 495	0.001 - 0.0015 0.0015 - 0.002 0.0015 - 0.003	C6 C6 C6
	H1150/ Cold Drawn	0.04 0.08 0.12	60 - 80 55 - 75 45 - 70	0.0005 - 0.0015 0.001 - 0.002 0.0015 - 0.003		125 - 325 140 - 340 150 - 355	0.0005 - 0.0015 0.0015 - 0.002 0.0015 - 0.003	C6 C6 C6
	Solution Treated	0.04 0.08 0.12	90 - 120 75 - 100 65 - 85	0.001 - 0.002 0.0015 - 0.003 0.002 - 0.004		160 - 550 205 - 645 220 - 635	0.001 - 0.003 0.0015 - 0.004 0.002 - 0.006	C6 C5/C6 C5/C6
	H1150	0.08 0.12 0.25	75 - 105 65 - 90 55 - 80	0.001 - 0.002 0.0015 - 0.003 0.002 - 0.004		150 - 425 165 - 430 201 - 495	0.001 - 0.003 0.0015 - 0.004 0.002 - 0.006	C6 C5/C6 C5/C6
Drilling	All	0.0625 0.125 0.25 0.5 0.75	35 - 100	0.001 - 0.002 0.002 - 0.005 0.004 - 0.006 0.006 - 0.010 0.008 - 0.012	M2 (TiN Coated)	194 - 335	0.002 - 0.006 0.004 - 0.010 0.004 - 0.011 0.005 - 0.011 0.006 - 0.012	C5 - C6 or C3 TiN coated
Tapping	All	All	20 - 70		M2-M7 TiN Coated			

1. The table values are initial suggestions and can vary depending on machine and cutting conditions.
2. The use of coated tools increase the tool life by 20 % to 50 % using the same cutting parameters, or it increases the cutting conditions (speed) by 10 % to 15 % using the same tool wear.
3. Tooling grades in parenthesis denote alternate tool material choice.
4. Drill speeds were developed for 118° drills. Increase speeds 10 % - 20% with use of 130° to 140° angle drills.
5. Drill cutting conditions are valid for hole depths up to 4 times diameter.
6. Machining speeds apply to highly rigid equipment. Reductions may be necessary on cross slide operations or less rigid equipment.
7. When using C1, C2 or C3 carbides, reduce speeds by 25 % - 40 %.
8. Aggressive chip breaking tools is highly suggested.



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