

630 UGIMA®

Technical Datasheet

Chemistry - Comparable Standard

Typical Analysis %	C	Si	Mn	P	S	Cr	Ni	Mo	Cu
Minimum						15.0	3.0		3.0
Maximum	0.07	1.00	1.00	0.040	0.030	17.5	5.0	0.50	5.0

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
Please inquire for additional information on available shapes.

Characteristics

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

* Not applicable in all situations, must be requested at time of order placement

AMS 5643*

* Aerospace applications must be approved by mill

Mechanical Properties (Typical) ** 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.

** Condition A (turned bars) - this condition is considered most "brittle" and is not recommended. Please see UGITECH technical information sheet.

Mechanicals > 1" (Solution Annealed)

Tensile Strength	120 - 175
Yield Strength (0.2%)	90 - 160
Elongation	10%
Reduction of Area	50%
Hardness	363 HBn

Magnetic and Electrical Properties

Typical Magnetic Permeability:
Magnetic in all conditions.

Electrical Resistivity:

Solution treated: 32 $\mu\Omega$ - in (800 $\mu\Omega$ - mm) @ 68°F (20°C) –
Overage condition: 28 $\mu\Omega$ - in (720 $\mu\Omega$ - mm)

Physical Properties (Typical)

Density	0.280 lbs/in ³ (7.8 g/cm ³)
Round bar weight per ft (lbs)	10.55 X ($\frac{1}{2}$ 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) = 6.0×10^{-6} in/in/°F (10.8×10^{-6} cm/cm/°C)
Modulus of Elasticity in Tension	28.6×10^6 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	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 provided on the next page is for comparative purposes only and illustrates the performance in different environments. Consult your local **Swiss Steel 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.

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Forging (Hot Working)

Following conditions are recommended for forging **630 UGIMA®**:

Slow heating to 1475°F (800°C), then more rapidly to 2100-2190°F (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	●●○○
Acetic Acid	●●○○
Petroleum	○○○○Restricted

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 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), and a Post Weld Heat Treatment (PWHT) must be done on the weld to obtain a precipitation hardening (PWHT conditions depending on the mechanical characteristics to be reached). If not, then AWS E308L or ER308LSi can be used. A suggested protective gas for MIG welding is Ar + 1%CO₂ or 1-2% O₂.

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 austenitization, 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 **Swiss Steel USA** Metallurgist with specific concerns.

Machineability

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.

CONDITION AND HEAT TREATMENT

Condition	H900	H1025	H1075	H1150	H1150M
Aging Temp °F (°C)	900 (480)	1025 (550)	1075 (580)	1150 (620)	1400 (760) + 1150 (620)
Time Hours	1.0	4.0	4.0	4.0	2.0 / 4.0
Quench Media	Air Cool	Air Cool	Air Cool	Air Cool	Air Cool

TYPICAL MECHANICAL PROPERTY RANGES

	H900	H1025	H1075	H1150	H1150M
Tensile Strength ksi (Mpa) min.	190 (1310)	155 (1070)	145 (1000)	135 (930)	115 (795)
Yield Strength ksi (Mpa) min.	170 (1170)	145 (1000)	125 (860)	105 (725)	75 (520)
% Elongation in 2 in. or 4D min.	10	12	13	16	18
% Reduction of Area min.	35	45	45	50	55
Hardness HRC/BHN min.	40 (388)	35 (331)	32 (331)	28 (277)	24 (255)
Impact Charpy-V ft.lb (J) min.	—	15 (20)	20 (22)	30 (41)	55 (75)

		HSS TOOLING			COATED CARBIDE TOOLS			
Machining Operations	Metallurgical Condition	Depth of cut or width (in.)	Cutting Speed SFPM	Feed (ipr)	Type of Tool	Cutting Speed SFPM	Feed (ipr)	Type of Tool
Turning	Solution-Treated/ Cold Drawn	0.04	65-90	0.004-0.010	M2-M3 (T15)	220-630	0.004-0.010	C6/C7
		0.08	65-85	0.004-0.012		190-575	0.004-0.012	C6
		0.12	55-80	0.005-0.015		175-550	0.005-0.015	C5/C6
	H1150/ Cold Drawn	0.04	60-80	0.004-0.010		180-550	0.004-0.010	C6/C7
		0.08	55-75	0.004-0.012		165-495	0.004-0.012	C6
		0.12	45-70	0.005-0.015		150-440	0.005-0.015	C5/C6
	Solution-Treated	0.04	95-120	0.004-0.010		245-890	0.004-0.010	C6/C7
		0.08	75-100	0.004-0.012		205-840	0.004-0.012	C6
		0.12	65-85	0.015-0.025		175-630	0.015-0.025	C5/C6
	H1150	0.04	85-105	0.004-0.010		210-735	0.004-0.010	C6/C7
		0.08	65-90	0.004-0.012		180-660	0.004-0.012	C6
		0.12	55-80	0.015-0.025		140-625	0.015-0.025	C5/C6
Forming	Solution-Treated/ Cold Drawn	0.06	65-90	0.002-0.004	M2-M3 (T15)	220-575	0.002-0.004	C6/C7
		0.25	65-85	0.004-0.006		190-505	0.004-0.006	C6
		0.50	55-80	0.003-0.005		160-330	0.003-0.005	C5/C6
	H1150/ Cold Drawn	0.06	60-80	0.002-0.004		150-505	0.002-0.004	C6/C7
		0.25	55-75	0.004-0.006		165-595	0.004-0.006	C6
		0.50	45-70	0.003-0.005		140-295	0.003-0.005	C5/C6

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

The table values are initial suggestions and can vary depending on machine and cutting conditions.

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.

Tooling grades in parenthesis denote alternate tool material choice.

Drill speeds were developed for 118° drills. Increase speeds 10%-20% with use of 130° to 140° angle drills.

Drill cutting conditions are valid for hole depths up to 4 times diameter.

Machining speeds apply to highly rigid equipment. Reductions may be necessary on cross slide operations or less rigid equipment.

When using C1, C2 or C3 carbides, reduce speeds by 25%-40%.

Aggressive chip breaking tools is highly suggested.

For additional information, please contact your **Swiss Steel USA** Technical Support at the Corporate Office: +1 800 323 1233.

General Note

All statements regarding the properties or utilization of the materials or products mentioned are for the purpose of description only. Guarantees regarding the existence of certain properties or a certain utilization are only valid if agreed upon in writing.

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