Technical Data Sheet
UGI® 347H – UGI® 4550

Chemical analysis (%)

C	Si	Mn	Ni	Cr	Mo	Cu	P	S	Nb
0.040 – 0.060	0.2 – 0.75	0.5 – 2.0	9.0 – 11.0	17.0 – 19.0	≤ 0.7	≤ 0.75	≤ 0.035	≤ 0.015	10xC – 1.0

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General presentation

UGI® 347H / UGI® 4550 is an austenitic stainless steel stabilized with niobium (Nb) specifically intended for use at high temperature (up to 850°C). UGI® 347H / UGI® 4550 has better mechanical properties at high temperature and better intergranular corrosion resistance than 304 / 1.4301 if it is used at between 450 and 850°C.

Classification

Stabilized austenitic stainless steel

Designation

Material No.

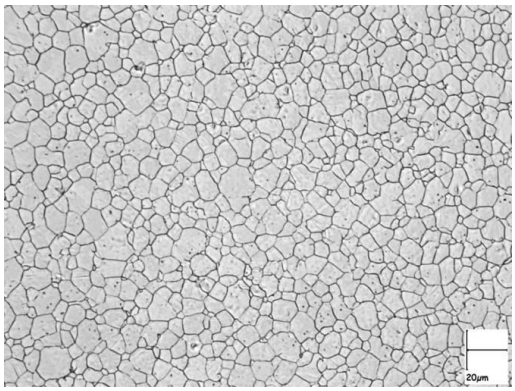
Europe	USA	Japan
EN 10088-3	ASTM A240, A182, A580	JIS
1.4550	Type 347 / UNS S34700 Type 347H / UNS S34709	SUS 347

Other material name

USA	France	Germany	UK	Sweden
AISI	**AFNOR**	**DIN**	**BS**	**S.S**
347H	X6CrNiNb18-10			

Microstructure

The micro structure of UGI® 347H / UGI® 4550 consists of an austenitic matrix. Niobium is present in the form of carbide precipitates or niobium nitrides. Depending on the diameter, some residual ferrite may remain.



Example of micro structure on wire rod in UGI® 347H / UGI® 4550 (transverse direction, electro-nitric attack)

Swiss Steel Group

Production sites: Ugitech SA
www.swisssteel-group.com

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Mechanical properties

Tensile data

Temperature	Tensile strength	Yield strength	Elongation
T	Rm	$Rp_{0.2}$	A %
(°C)	(MPa)	(MPa)	(%)
20	540 - 740	> 210	> 40
500		> 119	

Strength data (impact bending)

Temperature	Energy absorbed
T	KV longitudinal
(°C)	(J)
20	> 100
-196	> 80

Hardness data

Temperature	Rockwell C	Brinell	Rockwell B	Vickers
(°C)	(HRC)	(HBW)	(HRB)	(HV)
20		< 230		

Physical properties

Temperature	Density	Elastic modulus	Thermal conductivity	Expansion coefficient (between 20°C and T°)	Electrical resistivity	Specific heat
(°C)	(kg/dm³)	(GPa)	(W/m.°C)	(10^{-6}/°C)	(µΩ.mm)	(J/Kg.°C)
20	7.9	200	15	-	730	500
100		194		16.0		
200		186		16.5		
300		179		17.0		
400		172		17.5		
500		165		18.0		

Corrosion resistance

UGI® 347H has excellent intergranular corrosion resistance, better than that of 1.4301 (AISI 304); it is particularly suitable for applications in the temperature range between 450°C and 850°C.

Localized corrosion

– Pitting corrosion

Pitting potential measurement tests are carried out in our laboratory in a 5% NaCl environment (50g/L 0.86M) at 6.6 pH and at a temperature of 35°C, in accordance with operating standard ISO 15158.

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The pitting potential of UGI® 347H is similar to that of a standard austenitic steel (for 5 mm diameter wire rod in the longitudinal direction):

Grades	Pitting potential to ISO 15158
UGI® 347H	240+/-20 mV/ECS
1.4301 Cr = 18%; Ni = 9%; S = 60 ppm	220+/- 5 mV/ECS

– Intergranular corrosion

Due to the presence of Niobium, there is significantly less risk of sensitization to intergranular corrosion compared with standard 1.4301 austenitic steels; its maximum working temperature in dry air is 850°C, but this decreases with the presence of corrosive compounds in the air, such as water vapour or sulphur compounds.

Stress corrosion

As for the family of standard 1.4301 / 1.4307 austenitics, UGI® 347H is susceptible to stress corrosion caused by chloride ions from approximately 50°C.

Hot transformation

Forging

UGI® 347H / UGI® 4550 can be forged without the need for any special precautions. A heating temperature between 1150°C and 1250°C and an end-of-forging temperature, preferably above 950°C are recommended. As with all austenitic stainless steel grades, the force required to deform the metal is high (far higher than that required for carbon steels).
Components can be air- or water-cooled.

Cold transformation

Drawing – Profiling – Forming

UGI® 347H / UGI® 4550 is suitable for transformation via the usual cold-working processes, in the same way as the majority of austenitic stainless steels. It can easily be stretched and drawn until its cross-section is significantly reduced by as much as 80%.

Cold heading

Due to the presence of Niobium, UGI® 347H has a fine-grained structure that makes this material particularly suitable for cold or warm heading. Its fine, regular structure makes it possible to obtain uniform deformation during cold heading.

Machinability

Turning

The machinability of UGI® 347H / UGI® 4550 is similar to that of a low S 304 / 1.4301 steel. In terms of tool wear, compared with a 304 / 1.4301 low S steel, the cutting conditions (speed and/or feed) of UGI® 347H / UGI® 4550 must be reduced by approximately 10 to 15% to maintain the same useful tool life. In terms of chip breakability, UGI® 347H / UGI® 4550 is very similar to a low S 304 / 1.4301.

Welding

As with many austenitic grades, there are no particular difficulties with welding UGI® 347H / UGI® 4550 via most arc welding processes (with or without filler metal): resistance welding, electron beam welding, friction welding, LASER beam welding, etc. Oxy-acetylene welding is not recommended.

If filler metal is required, a filler product homogeneous with UGI® 347H / UGI® 4550, i.e. UGIWELD™ 347 (TIG/EE) or 347M (MIG), should be used, which will give the weld metal zone the same corrosion resistance qualities as those of UGI®347H / UGI® 4550.

In the case of MIG or TIG welding, the argon-based shielding gas (which can partly be replaced with helium), must not contain nitrogen, otherwise there is a risk that the weld metal zone will no longer be stabilized with Nb and its intergranular corrosion resistance will be lost when assemblies obtained are used at high temperature.

Niobium carbonitride precipitation heat treatment is recommended (about 850°C: see the "Stabilization" section below) for welded areas when assemblies are used at high temperature.

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Heat treatment

Solution annealing

This heat treatment involves maintaining a high temperature of between 1000 and 1100°C, followed by air cooling or water cooling. This treatment, which is called solution annealing, removes all trace of hardening, while giving the steel its lowest level of mechanical properties.

Stabilization

A treatment known as stabilization can be performed by completely precipitating the carbon and nitrogen in the form of Nb (C, N), for example for welding. This makes it possible to improve the intergranular corrosion resistance. The treatment can be performed at between 815°C and 870°C for a minimum of 5 minutes for each mm of thickness and followed by oven cooling or air cooling (ASTM standard A182 recommendation).

Available products

Product	Form	Finish	Tolerance	Dimension	
Bar	Round	Rolled descaled	12 to 13	22 to 130	mm
	Round	Turned polished	9 to 11	22 to 130	mm
	Round	Drawn	8 to 9	1.8 to 55	mm
	Round	Ground	6 to 9	1.5 to 80	mm
	Hexagonal	Drawn	11	3 to 55	mm
Wire rod	Round	Pickled		5.0 to 32	mm
Drawn wire	Round	Unpolished		0.5 to 16	mm
	Profile	Bright		2 to 70	mm²

Other sizes: contact us

Applications

- Expansion joints and equipment for the high-temperature process industry
- Boiler and incinerator components
- High-temperature filtration elements
- Parts intended for use on the hot part of the exhaust line
- Aircraft engine components