Technical data
UGIMA® -X 4021

Chemical analysis (%)

C	Si	Mn	Ni	Cr	Mo	P	S	N
0,16 - 0,25	≤ 1.0	≤ 1,0	≤ 0,75	13,0 - 14,0	-	≤ 0,040	0,020 - 0,030	-

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General presentation

UGIMA®-X 4021 is a martensitic grade in the QTcondition, combining excellent mechanical properties with good corrosion resistance on suitably polished surfaces in moderately aggressive, non-chloride media. It has good resistance to oxidizing atmospheres up to 600°C.

With a chromium content of over 13%, UGIMA® -X 4021 is suitable for food contact under European regulation CE 1935/2004, and therefore for use in food applications.

UGIMA®-X 4021 is an improved machinability grade developed exclusively by Ugitech. Its characteristics are identical to those of other 1.4021 stainless steels, with the exception of its machinability, which enables productivity gains of around 28% in machining compared UGI® 4021 and around 14% compared with UGIMA® 4021. In addition, the UGIMA®-X process applied to this grade has made it possible to significantly reduce the dispersion of machinability performance from one heatto the next, and therefore from one batch of material to the next.

Classification

Martensitic stainless steel

Designation

No. Material

Europ		USA		Japan
EN 10088-3		**ASTM**	**AISI**	**SUS**
N°	Name			
1.4021	X20Cr13	S42000	420	420J1

Other material designation

France	Germany	UK
AFNOR	DIN	BS
Z20C13	1.4021	420S29/420S37

Mechanical properties

Metallurgical condition	Yield strength 0,2%	Tensile strength	Hardness	Elongation at break	Energy absorbed
	Rp0.2%	Rm	Brinell	A	KV
	(MPa)	(MPa)	HB	(%)	(J)
A Annealed		≤ 760	≤ 230		
QT700	≥ 500	700 - 850		≥ 13	≥ 25
QT800	≥ 600	800 - 950		≥ 12	≥ 20

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Physical properties

Temperature	Density	Modulus of elasticity	Thermal conductivity	Expansion coefficient (between 20°C and T°)	Heat capacity	Electrical resistivity	Magnetizable
(°C)	(kg/dm^3)	(GPa)	(W/m.°C)	(10-6/°C)	(J/kg.K)	(µΩ.mm)	(J/kg.°C)
20	7,7	215	30		460	0.60	yes
100		212		10.5			
200		205		11			
300		200		11.5			
400		190		12			

Corrosion resistance

UGIMA®-X 4021 has good corrosion resistance under the following conditions:

- Fresh waters with moderate chloride concentrations.
- Oxidizing salt solutions free of chlorides, fluorides, iodides and bromides....
- Cold, dilute nitric solutions.
- Certain cold, dilute organic acids: picric, tannic, lactic...
- Non-corrosive products such as: alcohol, benzol, petroleum, oil, soap.

Pitting corrosion

- The pitting corrosion resistance of a stainless steel depends on many factors related to the composition of the corrosive medium (chloride concentration, presence or absence of oxidizing agents, temperature, pH, agitation or lack of agitation, etc.) and the preparation of the material (surfaces free of metal particles, surface finish, e.g. hardening, polishing, etc.). Special precautions must be taken for certain tests, such as the salt spray test (ISO 9227): for example, the test sample must not bear any marking labels that could lead to corrosion drips and reduce the duration of the test.
- UGIMA®-X 4021 has a salt spray resistance (ISO 9227) of less than 300 h, like other martensitic grades with a chromium content between 12 and 14%: 1.4006; 1.4021; 1.4028; 1.4031; 1.4034.

Food compatibility

- With a chromium content of over 13%, UGIMA®-X 4021 is suitable for use in food applications, as it complies with CE 1935/2005 in Europe, NFA 36-711 of April 2002 in France and Decree no. 140 of November 11, 2013 in Italy, as well as regulations in Belgium, Switzerland and Germany.

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Hot forming - Forging

Pre-forging heating to between 900°C and 1100°C is recommended. Hot working should preferably be followed by slow air cooling. A complete quenching and tempering treatment is recommended after hot working.

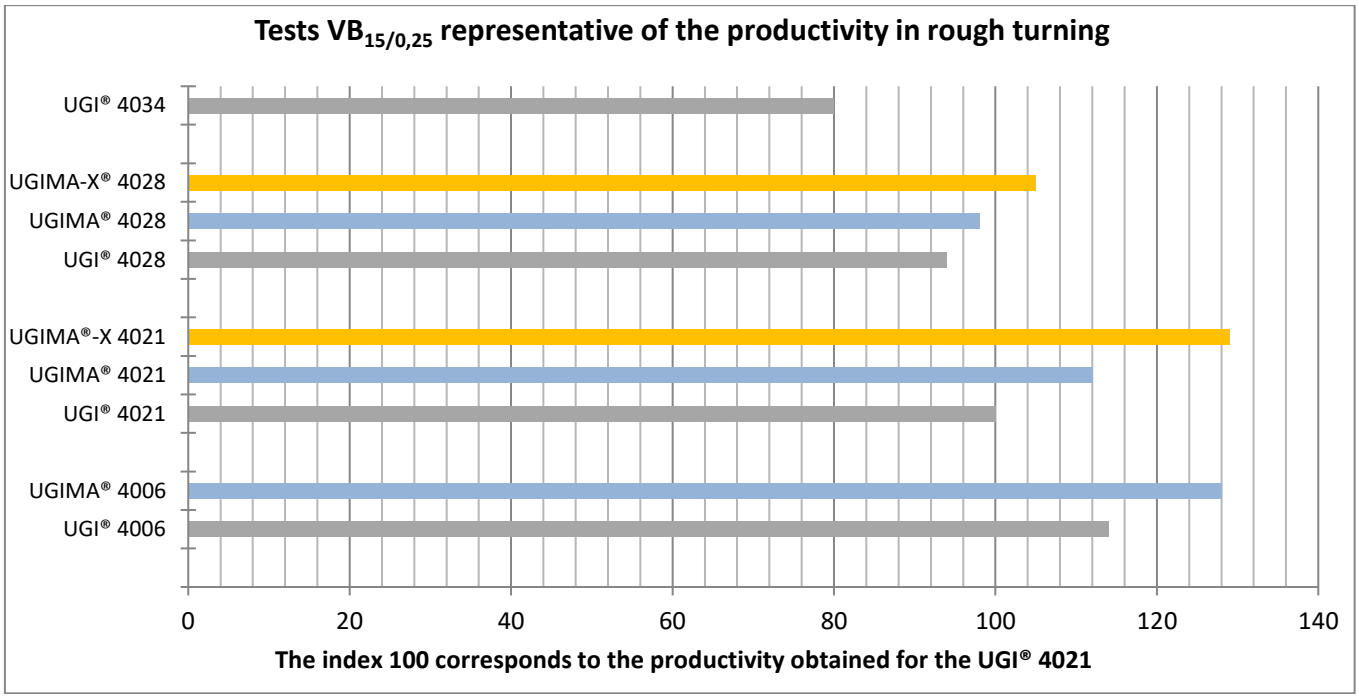
Machinability.

UGIMA®-X 4021, like most high-carbon martensitic grades, is best machined in the QT700 or QT800 heat-treated condition rather than in the annealedcondition, which can lead to sticking and build-up edge on tools

Applying the UGIMA®-X® process to grade 1.4021 results in productivity gains of around 28% in machining compared to UGI® 4021 and around 14% compared to UGIMA® 4021.

The graph below positions the productivity of UGIMA®-X 4021 in relation to other martensitic grades with lower or higher carbon content, based on the results of the standardized $VB_{15/0,25}$ test. The $VB_{15/0,25}$ test measures the cutting speed inducing, in 15 min of cutting without lubricant, wear of 0.25 mm on the flank face of inserts (here the reference inserts SECO TP0501 CNMG 120408-M3 and SANDVIK GC4405 CNMG 120408-PM adapted to martensitic grades). All the grades in the graph below are positioned in proportion to the UGI® 4021, which represents index 100 productivity.

In terms of chipbreaking, the performance of UGIMA®-X 4021 is similar or even slightly better than that of UGIMA® 4021 and UGI® 4021.



The application of the UGIMA®-X process to grade 1.4021 also ensures excellent reproducibility of machinability from one heatto the next, and therefore from one material batch to the next, a dispersion that is stronger with UGI® 4021 and UGIMA® 4021.

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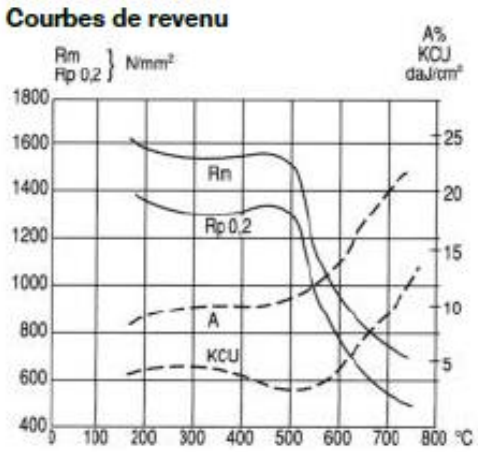
The above data summarize the results obtained on hot-rolled bars having undergone a QT 800 quenched & tempered heat treatment as described in the heat treatment section. If you need advice on machining UGIMA® -X 4021 in the annealed condition, please contact our Customer Technical Support department: machining.stainless@swissteelgroup.com

Welding

Like the UGI® 4021, the UGIMA®-X 4021 can be welded using most arc welding processes (MIG/TIG, with or without filler metal, coated electrodes, plasma...), laser, resistance (spot or roller), friction or electron beam...
However, it is necessary to preheat the parts to be welded to between 150°C and 250°C, and then carry out a post-weld heat treatment immediately after welding. Simple stress-relieving between 200 and 300°C can sometimes suffice to avoid problems of cold cracking in the Weld Metal (WM) and Heat Affected Zone (HAZ). However, when using a homogeneous filler metal, or no filler metal at all, post-weld heat treatment at 600-650°C is often necessary. Finally, when using an austenitic filler metal, stress-relieving treatment at 250-300°C is preferred to avoid the risk of corrosion in the Weld Metal .

Heat treatment

- The annealed condition (A) is obtained by annealing with a temperature hold between 745°C and 825°C followed by slow air cooling.
- Quenched & tempered conditions (QT 700 and QT 800) are obtained by a first quenching heat treatment of between 950°C and 1050°C, followed by rapid cooling in air or oil, followed by a tempering treatment depending on the desired strength:
  QT700: 650°C to 750°C
  QT800: 600°C to 700°C
- To avoid the risk of quench cracks, tempering should be carried out as soon as possible after quenching.
- The graph opposite shows the mechanical properties obtained for different tempering temperatures.
- Due to the risk of embrittlement, it is preferable to avoid the temperature range between 400°C and 600°C.



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Available products

Product	Shape	Finish	Tolerance	Dimensions (mm)
Bars	Round	Cold drawn and polished, drawn polished bar screw machining quality	8 and 9	Ø 2 to 31 mm
		Hot rolled and descaled	13	Ø 20 to 130 mm
		Turned and polished	9 à 11	Ø 20 to 130 mm
		Turned and polished, screw machining quality	9 à 11	Ø 20 to 55 mm
		Turned and polished for bar feeder	10	Ø 55 to 75 mm
		Hot rolled and descaled for bar feeder	11 à 12	Ø 55 to 75 mm
		Ground	6 à 9	Ø 22 to 115 mm
	Hexagonal	Cold drawn	9 à 10	3 à 55 mm

Others: please consult us

Applications

- Cutlery and food industry
- Medical industry
- Automotive industry
- Oil and gas industry
- Mechanical engineering