Technical Data Sheet
UGIMA® 4021

Chemical composition (%)

C	Si	Mn	Ni	Cr	Mo	N	P	S
0,16 – 0,25	≤ 1.0	≤ 1,0	≤ 0,75	12,0 – 14,0	-	-	≤ 0,040	0,020 – 0,030

03-04-2023 – REV 0

General presentation

UGIMA® 4021 is a martensitic grade in the quenched ant teempered condition which combines excellent mechanical properties with good corrosion resistance on suitably polished surfaces in moderately aggressive, non-chloride environments. It has a good resistance in oxidizing atmosphere up to 600°C.
UGIMA® 4021 is a grade with improved machinability, developed exclusively by Ugitech. It has the same characteristics as other 1.4021 stainless steels, except for its machinability which allows productivity gains of around 10 to 15% in machining compared to UGI® 4021.
For food applications, the UGIMA® 4021X1 version is recommended due to its chromium content ⩾ 13%.

Classification: Martensitic stainless steel

Designation

Material No.

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

Other material name

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

Mechanical properties

Tensile data

Condition	Yield stress	Tensile strength	Hardness	Elongation	Toughness
	Rp0,2% (MPa)	**Rm (MPa)**	**Brinell (HB)**	**A (%)**	**KV (J)**
Annealed		≤ 760	≤ 230		
QT 700 not cold worked	≥ 500	700 - 850		≥ 13	≥ 25
QT 800 not cold worked	≥ 600	800 - 950		≥ 20	≥ 12

Limit values for information only; approximate ranges allowing for the different cold drawing rates it is possible to apply (cold drawing rate ↑ = hardness and strength↑)

Swiss Steel Group

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

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Physical properties

Temperature	Density	Elastic modulus	Thermal conductivity	Expansion coefficient From 20 to 200°C	Thermal conductivity	Electrical resistivity	Magnetic
(°C)	(kg/dm^3)	(GPa)	(W/m.K)	(10-6.K^{-1})	(J/kg.K)	(µΩ.mm)	
20	7,7	215	30		460	0.60	yes
100		212		10.5			
200		205		11			
300		200		11.5			
400		190		12			

(Indicative values)

Corrosion resistance

UGIMA® 4021 has a good corrosion resistance under the following conditions
- Fresh water with a moderate concentration of chlorides.
- Oxidizing saline solutions free of chlorides, fluorides, iodides, bromides ....
- Diluted and cold nitric solutions.
- Some diluted and cold organic acids: picric, tannic, lactic...
- Non-corrosive products such as: alcohol, benzol, 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 absence of agitation, etc.) as well as to 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 contain any marking labels that could lead to corrosion runs and reduce the duration of the test.
- UGIMA® 4021 has a salt spray resistance (ISO 9227) of less than 300 hours like other martensitic grades with a lower or higher carbon content (1.4006; 1.4021; 1.4028; 1.4031; 1.4034).

Heat treatment – Forging.

Heating before forging to between 900°C and 1100°C is recommended. Hot forming should preferably be followed by slow air cooling. A complete heat treatment of quenching and tempering is recommended after hot working.

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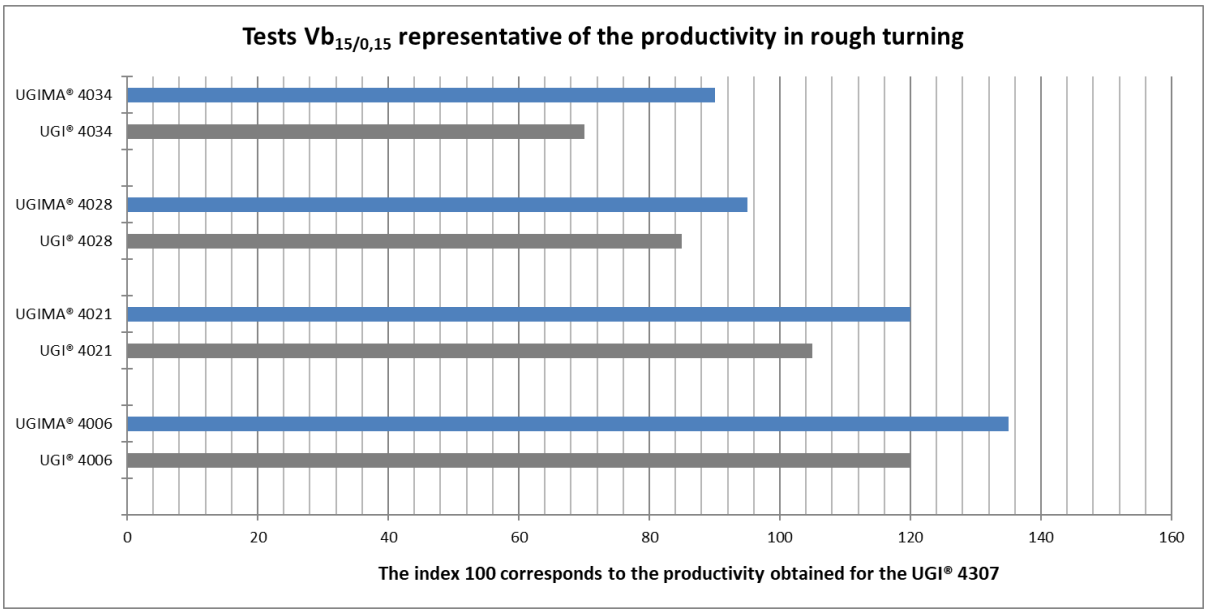
Machinability

UGIMA® 4021, like most high carbon martensitic grades, is preferably machined in the softened state.

The application of the UGIMA process to the 1.4021 grade allows productivity gains of around 10 to 15% in machining compared to UGI® 4021.

The graph below shows the productivity of UGIMA® 4021 compared to UGI® 4021 and compared to other martensitic grades with a lower or higher carbon content based on the results of the Vb15/0.15 test. The Vb15/0.15 test measures the cutting speed obtained at 0.15 mm wear on the cutting edge of a reference insert (in this case the SECO TM2000 CNMG 120408-MF4 insert) over a 15 minute cutting period without lubricant. All grades in the graph below are positioned in proportion to UGI® 4307 which represents an index 100 productivity.



The following data summarizes the results obtained on hot rolled bars having undergone a softening heat treatment as described in the heat treatment paragraph. If you need advice on how to machine UGIMA® 4021 in the treated condition, please contact our Customer Technical Support Department: machinig.support@ugitech.com

Welding

Like UGI® 4021, UGIMA® 4021 can be welded by most arc welding processes (MIG/TIG, with or without filler metal, coated electrodes, plasma...), by laser, by resistance (spot or roller), by friction or by electron beam...

It is recommended to preheat the parts to be welded between 250°C and 400°C. The temperature between passes should be in the same range.

A post-weld quenching treatment is recommended when welding is performed with a corresponding filler material followed by a tempering at 650°C to restore some of the ductility of the weld.

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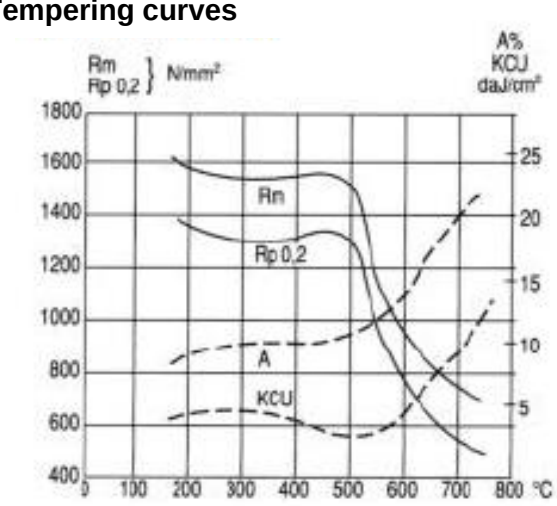
Heat treatment.

- The softened condition (Condition A) is obtained by annealing with a temperature hold between 745° C and 825° C followed by slow air cooling.
- The quenched and tempered conditions (QT 700 and QT 800 conditions) are obtained by a first quenching heat treatment between 950° C and 1050° C followed by a rapid cooling in air or oil and followed by a tempering treatment which will depend on the desired strength:
  QT 700 : 650°C to 750°C
  QT 800: 600°C to 700°C
- To avoid any risk of hardening cracks, tempering should be performed as soon as possible after hardening.
- The graph opposite gives the mechanical characteristics obtained for different tempering temperatures.
- Due to the precipitation of undesirable phases it is best to avoid the temperature range between 400 and 600° **C.**

Tempering curves



Available products

Product	Shape	Surface finish	Tolerance	Dimensions
Bar	Round	Drawn polished	8 to 9	Ø 2 to 31 mm
		Rolled and descaled	k13	Ø 22 to 130 mm
		Turnerd and polished	9 to 11	Ø 22 to 130 mm
		Screw machining quality	9 to 11	Ø 22 to 55 mm
		Ground	h6 to h9	Ø 22 to 115 mm
	Hexagonal	Drawn	9 to 10	3 to 55 mm

Other sizes: contact us

Applications

Cutlery industry
Surgical industry
Automotive industry
Oil and gas industry
Mechanical industry
Food industry using UGIMA® 4021X1 with 13% chrome min.

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