Technical Data Sheet
UGI® 209

Chemical analysis (%)

C	Si	Mn	Ni	Cr	Mo	Nb	N	V	P	S
≤ 0,06	≤ 0,75	4,0 – 6,0	11,5 – 13,5	20,5 – 23,5	2,0 – 3,0	0,1 – 0,3	0,2 – 0,4	0,1 – 0,3	≤ 0,04	≤ 0,03

P.R.E.N index, guaranteed pitting corrosion resistance : > 31

22-08-2018 – REV01

General presentation

An austenitic stainless steel with high corrosion resistance and superior mechanical performances.

UGI® 209 is an austenitic stainless steel with a high yield strength designed for use in very severe corrosive environments.

This grade also features excellent cryogenic properties and very high, stable amagnetism.

Classification

Austenitic stainless steel

Designation

Europe EN		USA UNS		Japan JIS	Others Designation
1.4681	X5CrNiMnMoNNb22-12-5-2	S20910		XM-19	Nitronic 50

Standard

This grade meets the requirements of the NACE MR 0175 standard.

Microstructure

Entirely austenitic solution annealed structure with no intercrystalline precipitation.

For cold hardened products, an austenitic cold hardened structure with twin crystals.

Mechanical properties

Tensile data

Condition	Temperature T (°C)	Tensile strength Rm (MPa)	Yield strength Rp0,2 (MPa)	Elongation A (%)	Hardness (HRb)
Solution annealed	-195	1550	880	41	
	-70	1000	580	49	
	20	830	540	45	95
	200	650	400	38	
	800	350	300	55	

(Indicative values)

In accordance with NACE MR0175, this grade can be used up to a hardness of 35HRc for applications in the oil industry in an H_2S environment.

Swiss Steel Group

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

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Strength data

Temperature	Impact strength
T	KV
(°C)	(J)
- 195	75
- 40	255
20	270

Physical properties

These properties depend on the metallurgical state. Some indicative values characteristic of the solution annealed state are shown below.

Température	Density	Elastic modulus	Thermal conductivity	Expansion coefficient From 20 to 200°C	Electrical resistivity	Specific heat
(°C)	(kg/dm^3)	(N/mm^2)	(W/m.°C)	(°C^{-1})	(µΩ.mm)	(J.kg^{-1}.°C^{-1})
20	7.88	200 000	15	17.2x10-6	820	500
200	-	180 000	16		-	-

(Indicative values)

Magnetic properties

The composition and excellent stability of the austenitic structure make UGI®209 a very amagnetic grade for different cold hardening levels and temperatures.
Some indicative values are shown below.

	Temperature (°C)			Cold hardening (% of reduction)		
	20	-120	-260	0	30	60
Relative permeability (under 16 kA/m)	1.004	1.0025	1.008	1.004	1.003	1.004

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Corrosion resistance

Generalized corrosion

The tests carried out in a 2M sulfur environment indicate an hourly mass loss. For this type of corrosion, the UGI® 209's resistance is very good: slightly lower than that of UGI®904L but significantly higher than that of UGI® 316L.

Mass loss (g/m²/h) at 82°C (+/- 4°C)

UGI® 316L	30 (+/- 5)
UGI® 209	6 (+/- 4)
UGI® 904L	2 (+/- 1)

Localized corrosion

– Intercrystalline corrosion

UGI® 209 resists the standardized ASTM A262 test, Method E ($CuSO_4$ + H_2SO_4 + Cu environment), and no cracking is observed after 24 hours of testing and after bending on a mandrel to 180°.

– Pitting corrosion

The tests carried out in accordance with standard ASTM G48, Method E, make it possible to determine the maximum usage temperature without corrosion. The UGI® 209's resistance is much higher than that of the UGI® 316 L grade.

Maximum temperature according to ASTM G48 E for a mass loss of 5g/m² (24h)

UGI® 316L	10 (+/- 5)
UGI® 209	40 (+/- 5)
UGI® 904L	35 (+/- 5)

The tests carried out in accordance with standard ASTM G48, Method A, make it possible to compare the Mass loss of one or several grades. The UGI® 209's resistance is much higher than that of UGI® 316L.

Mass loss (g/m²/h) according to G48 A at 42°C (+/- 2°C)

UGI® 316L	From 15 to 20
UGI® 209	< 1,5
UGI® 904L	< 1

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Pitting potential: The tests carried out in an NaCl environment with different concentrations and temperatures demonstrate the excellent behavior of UGI® 209 compared with UGI® 316L.

Environement	0.02 M NaCl at 23°C	0,86 M NaCl at 55 °C
UGI® 316L	No pitting	Pitting
UGI® 209	No pitting	No pitting
UGI® 904L	No pitting	Pitting

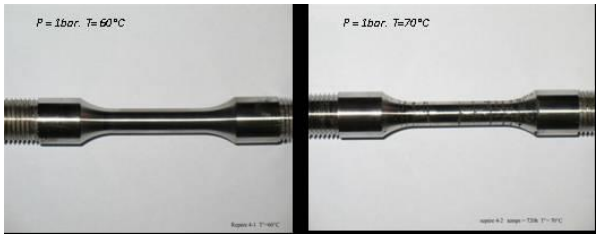
– Crevice corrosion

The depassivation pH of the different grades in a NaCl (2M) solution at 23°C was determined. This test was introduced to report on the crevice corrosion phenomena. Its result corresponds to the pH below which the passive layer dissolves. The test values for the depassivation pH show the good resistance of UGI® 209.

Depassivation pH		
UGI® 316L	2	+/- 0.1
UGI® 209	1.1	+/- 0.1
UGI® 904L	1.2	+/- 0.1

– Stress corrosion

The NACE MR0175/ISO15156 test consists in determining the breaking conditions for standardized specimens. The usage limit for UGI® 209 given by the NACE MR0175/ISO15156 (condition 1 bar of H_2S in the NACE A solution) is T= 66°C. Our experimental tests show that UGI® 209 easily meets the test criteria, since no Fracture occurs at 60°C or even at 70°C. However, superficial cracks are visible at 70°C.



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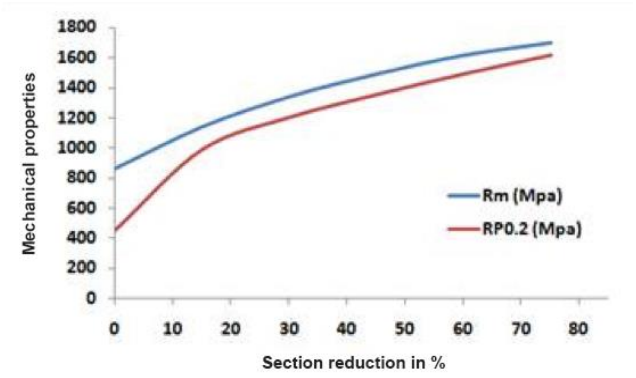
Hot transformation

UGI® 209 is suitable for forging, with the same equipment as that used for the 300 series austenitic steels, at higher power
levels. No pre-heating is required. Heating to roughly 1200°C is recommended before the hot transformation, followed by rapid cooling. To guarantee good corrosion resistance results after forging, a treatment involving a return to a solution at about 1100°C followed by a solution annealing and rapid water quenching is preferable.

Cold transformation

Cold hardening properties



(Indicative values)

Machinability

The UGI® 209 is machined with the same equipment as the standard austenitic grades (AISI 304, 316), with the cutting conditions reduced by half. Due to the hardening of the grade through cold hardening, the use of carbide-coated tools is recommended. Ugitech will soon be distributing a specific guide on the subject**.**

Welding

The UGI® 209 grade can be easily welded using the appropriate settings for standard austenitic steels. The liquid zone should be protected from the ambient nitrogen to maintain a good level of intercrystalline corrosion resistance.
While the 209 filler metal has the best properties, grades of the AISI 308L and AISI 309 type can also be used.
After welding, to achieve the best performance we recommend a treatment in a solution at 1120°C followed by rapid cooling.

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Heat treatment

Annealing solution

We recommend performing the solution annealing and return to solution at a temperature between 1050 and 1100°C. For large sections, solution annealing and rapid water quenching is recommended.

Surface treatment

The pickling conditions for UGI® 209 are similar to those for a type AISI 904L steel.This grade can be electropolished.

Products available

Products	Shape	Surface finish	Tolerance	Dimension	
Bar	Round	Rolled ans descaled	12 to13	22 to 90	mm
		Turned and polished	9 to 11	22 to 90	mm
		Drawn	8 to 9	1,8 to 55	mm
		Ground	6 to 9	1,5 to 80	mm
	Hexagonal	Drawn	11	3 to 55	mm
Wire rod	Round	Pickled		5,5 & 9.0 to 32	mm
Drawn wire	Round	Mat		0.05 to 14	mm
	Profil	Bright		2 to 70	mm²

Other formats: contact us

Applications

- Sea water : pumps, propeller shafts, cables, guy lines
- Chemical industry: urea synthesis, pumps, valves, bolts, exchanger tubes
- Nuclear industry: nuclear fuel recycling
- Oil industry: off-shore drilling, filters, perforated casings, petrochemicals
- Pulp and Paper industry