

# Technical Data Sheet

## UGI® 4116N

### Chemical analysis (%)

C	Si	Mn	Cr	Mo	N	V	P	S
0.48 – 0.55	≤ 1.0	≤ 1.0	14.0 – 15.0	0.50 – 0.80	0.05 – 0.15	0.10 – 0.15	≤ 0.040	≤ 0.015

17-02-2016 – REV 08

### General presentation

The high carbon and nitrogen content of UGI® 4116N leads to a very attractive corrosion resistance versus hardness properties. It can replace grades 1.4112 / 1.4125 (AISI 440B and 440C) in many applications.

Processing similar to type 1.4034 (AISI 420) stainless steel, therefore much easier than 1.4112 / 1.4125 (AISI 440B and 440C)

Recommended applications: pins, shafts, nozzles, wear resistant parts, etc. as a replacement of 1.4112/1.4125 or AISI 440B / 440C.

### Classification

Martensitic stainless steel, with Nitrogen addition.

### Designation

UGI® 4116N is conformed to EN 10088-3: 1.4116 X50CrMoV15, NF A-36-711 : 1.4116 and SEW 400 : 1.4110

### Mechanical properties

The following Table summarizes the mechanical properties at room temperature which may be obtained

Condition	Hardness	Impact Values KCV
Fully Annealed	210 HV	-
Air Cooled from 1050°C + Tempered 200°C/1h	57,5 HRC	6.7 J/cm²
Air Cooled from 1050°C + Cryogenic Cooling (-80°C/1h) + Tempering 200°C/1h	58.5 HRC	2.3 J/cm²

### Comparison with higher-carbon stainless steel grades:

	UGI® 4116N	1.4112 (440B)	1.4125 (440C)
% C + N	0.6	0.9	1.0
% Cr mini / maxi	14.0 / 15.0	17.0 / 19.0	16.0 / 18.0
% Mo mini / maxi	0.50 / 0.80	0.9 / 1.3	0.4 / 0.8
Max Hardness (solution anneal T°)	58.5 HRC (1050°C)	59 HRC (1030°C)	61 HRC (1030°C)
Hardness (Quench+Temp. 200°C / 1h)	57.5 HRC	57 HRC	60 HRC
Impact values KCV (Quench+Temp. 200°C / 1h)	6 J/cm²	2 J/cm²	1.5 J/cm²

### Physical properties

Temperature	Density	Weight of round bars	Elastic modulus	Thermal conductivity	Expansion coefficient	Electrical resistivity
(°C)	(kg/m³)	Kg/m	(N/mm²)	(W/m.°C)	( / °C)	(μΩ.mm)
20	7700	0,00605 D²	215 000	30		650
Between 20 and 300					11,2 X 10 <sup>-6</sup> °C	



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Production sites: Ugitech SA  
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### Corrosion resistance

Environment	Behavior
Nitric Acid	Medium
Phosphoric Acid	Not recommended
Sulfuric Acid	Not recommended
Acetic Acid	Not recommended
Soda	Medium
NaCl (Salt Fog)	Not recommended
Humidity	Excellent
Seawater	Not recommended

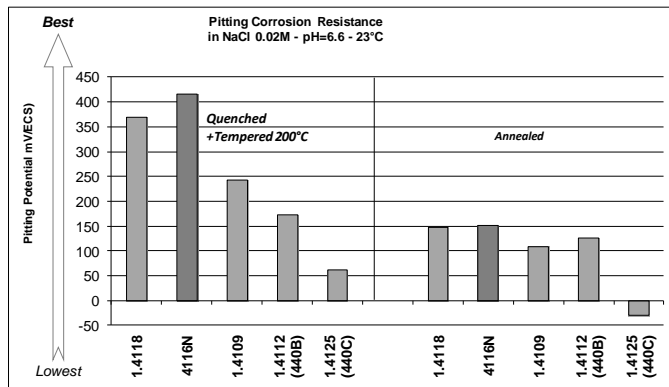
The corrosion behavior of UGI® 4116N is similar to that of grade 1.4021 (AISI 420), far better than that of 1.4112 / 1.4125 (AISI 440B and 440C).

### Localised corrosion

#### — Pitting corrosion

UGI® 4116N performs better than high-carbon martensitic grades such as 1.4109, 1.4112 and 1.4125.

The pitting corrosion resistance is better in the Tempered than in the Annealed condition, a feature that is similar for all high-carbon martensitic grades



### Hot transformation

#### Forming

UGI® 4116N can be readily forged in the 950°C – 1200°C temperature range. Heating between 1180°C and 1200°C prior

to forging is recommended, and forging temperatures should not decrease below 950°C.

After forging, a slow cooling to room temperature is necessary, followed by annealing treatment, if a minimum hardness is required.

### Machinability

UGI® 4116N can be machined in the annealed condition. The machinability of UGI® 4116N is comparable to that of grade 1.4034 and significantly better than the machinability of grades 1.4112 and 1.4125 (AISI 440B / 440C).

### Overall Comparison between UGI 4116N and high-carbon Stainless Steel grades

Chemical analysis (wt %)	UGI® 4116N	1.4112 (AISI 440B)	1.4125 (AISI 440C)
	min / max	min / max	min / max
<b>C</b>	0.48 / 0.55	0.85 / 0.95	0.95 / 1.2
<b>Cr</b>	14.0 / 15.0	17.0 / 19.0	16.0 / 18.0
<b>Mo</b>	0.50 / 0.80	0.9 / 1.3	0.4 / 0.8
<b>N</b>	0.05 / 0.15	-	-
<b>V</b>	0.10 / 0.15	0.07 / 0.12	-
<b>Hardness / mechanical properties</b>			
Maximum Hardness	58.5 HRC	59 HRC	61 HRC
(Solution Anneal Temperature)	(1050°C)	(1030°C)	(1030°C)
Hardness – Quenching + Tempering 200°C / 1h	57,5 HRC	57 HRC	60 HRC
Impact - Quenching + Tempering 200°C / 1h	6,7 J/cm²	1,8 J/cm²	1,3 J/cm²
<b>Pitting corrosion (mV/ECS)</b>			
Annealed specimens			
Longitudinal	-	160	70
Transverse	150	70 à 130	-30
Quenched and tempered specimens			
Longitudinal	-	-	150
Transverse	415	330	65
<b>Machining</b>			
Turning / Drilling	4116N > 1.4112 > 1.4125		



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### Welding

Welding of grade UGI® 4116N is only possible with special precautions, and should be avoided whenever possible.

### Heat treatment

#### Solution annealing:

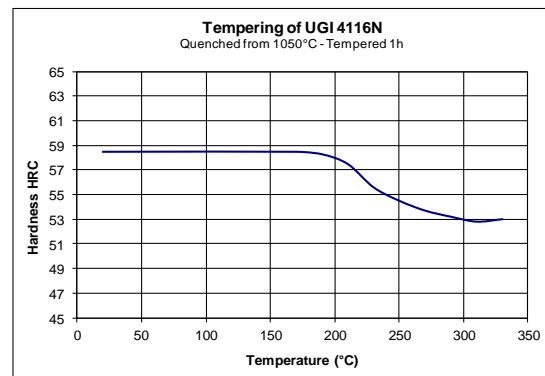
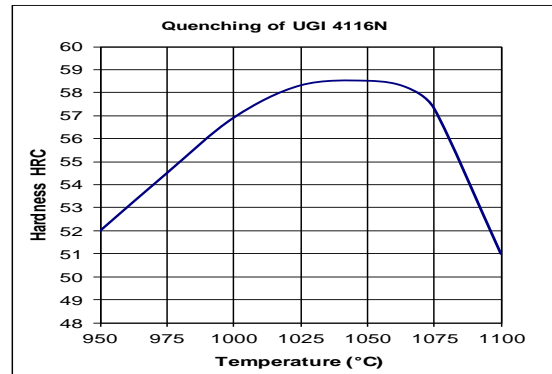
For minimum hardness, grade 4116N should be treated at about 840°C a few hours followed by very slow cooling. The hardness thus obtained lies around 210 HV<sub>1kg</sub>.

#### Solution Treatment and Quenching

Oil quench or air cooling should be carried out from a recommended solution temperature of 1050°C.

### Tempering

See below the curve that was obtained after a 10 minutes solution annealing treatment at 1050°C followed by air cooling. Tempering at 200°C achieves a good hardness / toughness balance.



### Available products

Products	Shape	Surface finish	Tolerance	Dimension
Hot finished bars	round	Black		⌀ 23 - 115 mm
	hexagonal	hot rolled descaled	K12 and K13	⌀ 22 - 115 mm
		hot rolled descaled		⌀ 22 - 58 mm
Cold finished bars	round	turned & polished	ISO 9 - 10	⌀ 22 - 115 mm
		bright drawn	ISO 9 - 10	⌀ 1,8 - 30 mm
		ground	ISO 6 - 7 - 8 - 9	⌀ 1,5 - 70 mm
	hexagonal	drawn		⌀ 3,0 - 60 mm
Wire rod	round	pickled		⌀ 5,5 - 32 mm
Drawn wire	round	matt		⌀ 1,0 - 14 mm

Other formats: please contact us

### Applications

- Parts (pins, shafts, nozzles...) already made with 4112/4125 or 440B/C...High hardness re-quirements with a rather good corrosion resistance.



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