Technical Data Sheet
UGIMA® 4104

Chemical analysis (weight %)

C	Si	Mn	Ni	Cr	Mo	P	S
0.10 – 0.15	≤ 0.7	1,0 – 1.5	≤0.5	15.5 - 17.5	0.2 – 0.5	< 0.040	0.25 - 0.35

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General presentation

UGIMA® 4104 is an improved machinability stainless steel manufactured only by UGITECH.

Its properties are identical to those of UGI® 4104, except for its machinability, which is even better:

UGIMA® 4104 is a stainless steel produced by the method of inclusion population development and control, UGIMA®, perfected by UGITECH.

The new technological advances of UGIMA® 4104 are extremely advantageous, whatever the machining conditions, machine or tooling used.

Productivity increases of 4% have been obtained over our UGI® 4104 during turning in the softened condition. Increases of 25% have been obtained in the treated condition and up to 100% when drilling Ø4 mm HSS in the softened condition.

Classification

Improved Machinability high sulphur Ferritic/Martensitic Stainless Steel

Designation

Material No

Europe EN		USA UNS	Japan JIS
1.4104	X14CrMoS17	S43020	

Other material name

USA AISI	France AFNOR	Germany DIN	UK BS	Sweden SIS
430F	Z10CF17	X12CrMoS17		2383

Mechanical properties

Tensile data

Temperature	Tensile strength	Yield strength	Elongation	
T	Rp0,2 %	Rm	A	Z
(°C)	(MPa)	(MPa)	(%)	(%)
Softened	≤ 600	≤ 750	≥ 15	≥ 50
Treated + QT 650	650 - 800	≥ 500	≥ 12	≥ 35

(limit values for information only)

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Physical properties

Density	7900 kg.m^{-3}	
Linear density of round bars	D^2 × 0.00620464 kg/m (*D*: diameter in mm)	
Linear density of hexagonal bars	h^2 × 0.0068416 kg/m (*h*: height of the hexagon in mm)	
Linear density of square bars	a^2 × 0.0079 kg/m (*a*: side of the square in mm)	
Elasticity module: Gpa at	20 °C	215
	100°C	212
	200°C	205
	300°C	200
	400°C	190
Heat capacity at 20°C	460 J / Kg / K	
Thermal conductivity at 20°C	25 W / m / K	
Expansion ratio		
between 20°C and 100°C	10.0	
between 20°C and 200°C	10.5	
between 20°C and 300°C	10.5	
between 20°C and 400°C	10.5	

Magnetic and electrical properties

Ferromagnetic

Saturation field: 1.6 T

Electrical resistivity: 730 µΩ. mm at 20°C

Corrosion resistance

Environment	Behaviour or use
Nitric acid	Use with caution
Phosphoric acid	**Poor**
Sulphuric acid	**Poor**
Acetic acid	Use with caution
Sodium carbonate	Use with caution
NaCl (Saline mist)	Use with caution
Humidity	**GOOD**
Sea water	**Poor**
Oil	**Poor**

UGIMA® 4104 has excellent ability to withstand corrosion in certain environments.

Its corrosion resistance is typical of ferritic stainless steel and is similar to that of 4104 in every respect; its corrosion resistance is similar to that of a 430 ferritic stainless steel, but it is impaired by the high sulphur content in environments liable to cause pitting or crevice corrosion.

➔ **Contact us for these types of environments**

This grade is appropriate for all office equipment applications.

The use of UGIMA® 4104 is compatible with all the fluids, lubricants, oils and greases used in the machining industry. However, UGIMA® 4104 is not recommended for use in marine environments and highly oxidising chemical environments.

Optimum corrosion resistance is obtained where a surface is free from all traces of machining oil or foreign particles (of iron for example).

UGIMA® 4104 is pickled in the same way as 4104 ferritic steel. This also applies to decontamination.

Note: the corrosion resistance of a stainless steel depends on many factors related to the composition of the corrosive atmosphere (chloride concentration, presence or absence of oxidizing agents, temperature, pH, agitation or no agitation, and so on), as well as to the preparation of the material (surfaces free from metal particles, surface finish such as hardening, polishing, and so on). Precautionary measures should also be taken for certain tests such as the saline mist test (French standard NFX 41002): for example marking labels that might cause corrosion run-outs and reduce the test resistance time should not be used on the sample.

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Hot transformation

Forging

UGIMA® 4104 can be forged.

It has a low flow stress (hot hardness) similar to that of a type 1.4016 (430) ferritic stainless steel, i.e. approximately 50% of that of type 1.4301 (304) austenitic stainless steel.

Heating: between 1100°C and 1250°C; minimum forging temperature: 950°C

After forging: two-phase ferrite + martensite structure, to be softened, if required.

Machinability

The performance of UGIMA® 4104 in machining is exceptionally good, due to the optimisation of the inclusion population. This is true not only for very high speeds and severe cutting conditions, as a result of the UGIMA®, process, but also for low speeds and less severe cutting conditions, because of the new improvements achieved through this latest development. UGIMA® 4104 is therefore particularly appropriate for screw machining, as its improved machinability is effective through an extensive range of cutting conditions and machining operations. Its performance is based on extremely good chip breakability, extended tool life and excellent surface finish.

The cutting conditions shown in the tables below are those which we established in the trial phase of the development of UGIMA® 4104.

If you would like to use the grade to best advantage for your components and working environment, contact our Technical Service.

Welding

This grade is difficult to weld.

As with all semi-ferritic grades, there are various risks in welding UGIMA® 4104 if certain precautionary measures are not taken (hydrogen induced cold weld cracking, lack of weld ductility, intergranular corrosion, etc.). This operation should therefore be particularly rigorous.

To minimise the risks of **cold weld cracking** in a heat-affected zone [and in a weld metal zone, in the event of homogenous welding or welding without filler material], the parts should be **preheated to between 150 and 230°C** to remove the hydrogen present in the base metal and minimise tensile stress on cooling. If coated **electrodes** are used, they should be thoroughly **dried** to ensure that no hydrogen is supplied in the form of water vapour. For the same reasons, in arc welding, **the shielding gas must not contain H_2**.

After welding, to restore the resilience of the heat-affected zones [and the weld metal zones, in the event of homogenous welding or welding without filler material], the martensite should undergo a post weld annealing heat treatment at 760°C (1 hour) + quenching to transform it into ferrite + carbides. If there is a risk of the welded components being distorted during hardening, they must be cooled slowly in an oven to 600°C before mandatory quenching to avoid any risk of embrittlement at T < 500°C. To ensure improved weld bead resilience during arc welding, the shielding gas must not contain N_2 and CO_2 is not recommended. In general, the only shielding gas recommended is argon (plus 2% of oxygen for MIG welding only).

Finally, it is difficult to prevent **intergranular corrosion in a heat-affected zone** [**and in a weld metal zone**, in the event of homogenous welding or welding without filler material] and the risk is even greater when high welding energy is used. The **welding energy** should therefore be **minimised** to reduce grain boundary chrome depletion by $Cr_{23}C_6$ precipitation.

If **filler metal** is required, a **homogeneous ferritic filler (430L**, or **430LNb** for welding thicknesses < 3 mm), or an **austenitic filler (ER308LSi, 309LSi, etc.)**, or a **duplex filler (ER312)** can be used. The austenitic and duplex filler metals eliminate the risks of cold weld cracking and intergranular corrosion in a weld metal zone, but not in a heat-affected zone. Preheating and post welding heat treatment are therefore required in all cases. Due to the large amount of S in UGIMA® 4104, **it is not advisable to use an "Ni base" filler wire**, as is sometimes

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recommended for welding AISI430 semi-ferritic grades (**risk of thermal cracking**).

Heat treatment

UGIMA® 4104 has a soft ferritic structure after being treated up to approximately 830°C. Above this temperature, it forms austenite, which is transformed into martensite by cooling: approximately 50% martensite maximum after treatment to about 1100°C.

It can be **softened** to a ferritic structure **at about 780-820°C** (minimum 2 hours)

It can be **hardened** to a ferrite + martensite structure between **900°C** and **1070°C**.

+QT650 tempered steel is hardened between 950° and 1070°C and tempered between 550°C and 650°C

Available products

Products	Form	Finition	Tolerance	Dimensions
Hot rolled descled Bars			13	
Cold finished drawn, turned, ground Bars			6 to 11	
Drawn Bars	Hexagonal		11	

Other formats : contact us

Applications

- General component manufacture and screw machining industries
- Automotive industry
- Transport industry
- Electrical appliance industry…