

C: max. 0,03
Cr: 16,5 - 17,5
Ni: 10,0 - 11,0
Mo: 2,0 - 2,5
Cu: 3,0 - 3,5

1.4578
X3CrNiCuMo 17-11-3-2

1.4578

Chromium-nickel-molybdenum austenitic stainless steel with low carbon content and copper addition

Relevant current and obsolete standards:

- EN 10088-3 : 1.4578 X3CrNiCuMo 17-11-3-2
- AISI : -
- BS : -
- JIS : -
- AFNOR : -
- DIN 17440 : 1.4578

Special grades for particular applications

- cold heading grade
- drawing grade

General properties

- corrosion resistance : very good
- mechanical properties : average
- forgeability : good
- weldability : good
- machinability : good

Special properties

- suited for cryogenic applications
- non-magnetic grade ($\mu_r \leq 1,3$)
- suited to a very high degree of cold deformation

Physical properties

- density (kg/dm³) : 8,0
- electrical resistivity at 20°C ($\Omega \text{ mm}^2/\text{m}$) : 0,73
- magnetisable : no
- thermal conductivity at 20°C (W/m K) : 15
- specific heat capacity at 20°C (J/kg K) : 500
- thermal expansion (10^{-6}K^{-1}) between 20 and 100°C : 16,7

Typical applications

- chemical industry
- food and beverage industry
- decorative items and kitchen utensils
- electronic equipment
- ship building
- screw and fastening industry

Processing

- automated machining : seldom
- machinable : yes
- hammer and die forging : not common
- cold forming : yes
- cold heading : yes
- suited to polishing : yes

Finished product forms and conditions

- wire rod
- bright bar h11, \varnothing 2 - 80
- bright coils
- solution annealed and quenched
- direct quenched from rolling
- pickled
- drawn
- straightened
- peeled
- ground

Demand tendency →

Properties, applications and processing

1.4578 is essentially the same as **1.4404**, with the exception of a copper addition of between 3 and 3.5%. The copper addition allows for superb cold forming and deformation.

Corrosion resistance (PRE = 23.1 to 27.51)

Due to the addition of between 2 and 3% molybdenum, the corrosion resistance of **1.4578** is significantly better than that of **1.4567**, especially in chloride containing environments.

Since this grade of stainless steel is still resistant to intergranular corrosion after welding, i.e. in the sensitised condition, corrosion testing in accordance with the following corrosion testing specifications is sufficient to establish resistance to corrosion:

AFNOR NF 05-159
ASTM A262-75. Practice E
DIN EN ISO 3651-2

1.4578 displays excellent resistance to corrosion in most natural waters and atmospheres (urban, rural and industrial), provided the chloride and salt concentrations are not too high. This grade of stainless steel is not resistant to sea water and as such must not be used in any sea water applications. Its resistance to corrosion in moderate chloride containing environments and organic acids, makes **1.4578** suited for use in the food and beverage industries. This steel grade can also be used for certain nitric acid applications.

The corrosion resistance of **1.4578** is very similar to that of **1.4404**, but due to its higher copper content, **1.4578** displays improved resistance to corrosion in many reducing acid environments, such as H₂SO₄ environments.

Heat treatment / mechanical properties

Optimal material properties are realised after solution annealing in the temperature range 1000 - 1100 °C followed by rapid cooling in air or water. During operation and fabrication, the time spent in the temperature range 450 - 850 °C must be minimised to avoid embrittlement.

In the solution annealed condition, the following mechanical properties may be attained when testing in the longitudinal direction:

Property	Specification	Typical
- yield strength (N/mm ²)	R _{p0.2} : ≥ 175	340
- tensile strength (N/mm ²)	R _m : 450 – 650	630
- tensile elongation (%)	A ₅ : ≥ 45	51
- hardness	HB : ≤ 215	195

Welding

1.4578 is readily weldable with, or without, the use of filler material. If a filler metal is required, then the use of **Novonit® 4404** (AISI 316 L) would be recommended. Post weld heat treatment is not necessary. It must however be borne in mind that **Novonit® 4404** does not contain high levels of copper and as such differences in the mechanical and corrosion properties might result.

Forging

Usually heated to within the temperature range 1180 - 1210°C to allow forging which takes place at temperatures between 1150 and 900°C. Forging is followed by air cooling, or water quenching when no danger of distortion exists.

Machining

As a result of the high copper addition to this steel, the work hardening tendency is retarded, i.e. the austenite phase is more stable, and as such drilling, threading and other machining operations can be performed with comparative ease.

The following cutting parameters are thus proposed as a guideline when using coated hard metal cutting tools.

tensile strengths R _m in N/mm ²	depth of cut (mm) feed (mm/rev)		
	6 mm 0,5 mm/r	3 mm 0,4 mm/r	1 mm 0,2 mm/r
solution annealed (450 - 650)	160 m/min	240 m/min	290 m/min