

Material Data sheet

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**Cold-rolled, rust-resistant spring steel W.-Nr. 1.4404**  
**Cold-rolled rust-resistant strip steel W.-Nr. 1.4404 annealed**

**1. Application examples**

Due to a molybdenum additive of 2.0 to 2.5% and an increased nickel content of over 10%, this material is very resistant to corrosion and suitable for applications in the food industry as well as environmental and partly in medical technology.

Further application examples:  
welded endless belts, conveyor belts in corrosive environments

The material 1.4404 is approved as a spring material according to DIN 17 224 (new: DIN EN 10 151).

**2. Material codes**

German Norm:	1.4404, X2CrNiMo18-12-2
AISI:	316L
ASTM:	S 31603
English Norm:	316S11
Franz. Norm:	Z 3 CND17-11-02
Japanese Norm:	SUS 316

**3. Alloy Composition \***

C: max.	0,03%
Si: max.	1,0%
Mn: max.	2,0%
P: max.	0,045%
S: max.	0,030%
Cr:	16,5-18,5%
Ni:	10-13%
Mo:	2,0-2,50%
N: max.	0,11%

\* the exact composition of each batch can be documented by a test certificate 2.2 or 3.1 according to DIN 10 204

**4.1 Delivery condition Temper rolled:**

Structure: temper rolled (austenitic with low content of martensite), not hardenable

Surface: 2H, roughness Ra maximal 0,3 µm (depending on the roughness of the working roll)

Tensile strength: 1100 to 1500 N/mm<sup>2</sup>

The tensile strength can be increased by annealing at 330-370°C (approx. 4 hours) for 100

N/mm<sup>2</sup> (depending on the primary tensile strength of the material).

#### 4.2 Delivery condition annealed:

Structure: austenitic  
Surface: 2B or 2R, roughness Ra maximal 0,3 µm (depending on the roughness of the working roll)

Tensile strength: 500-800 N/mm<sup>2</sup>

Further mechanical data: see chapter 7 and 8.

#### 5. Sizes

thicknesses: 0,01-2,00 mm  
raw material width: depending on the thicknesses from 100 to ca. 610 mm in different tensile strengths  
edges: cut  
Lengths: individual lengths from 5 to 10 000 mm or as Coil

The following sizes are available from stock (without obligation):

<b><i>thickness:</i></b>	<b><i>Tensile range 500-800 N/mm<sup>2</sup> annealed</i></b>	<b><i>Tensile range 1100-1500 N/mm<sup>2</sup> temper rolled</i></b>	<b><i>Annotation</i></b>
0,01		ca. 100	
0,02		ca. 100	
0,03		ca. 100	
0,04		ca. 100	
0,05		ca. 200	
0,10	ca. 305	ca. 305 + 610	
0,15	ca. 305 + 610	ca. 305 + 610	
0,20	ca. 305 + 610	ca. 305 + 610	
0,25	ca. 300 + 610	ca. 305 + 610	
0,30	ca. 305 + 630	ca. 305 + 610	
0,40	ca. 305 + 610	ca. 305 + 610	
0,50	ca. 305 + 610	ca. 305 + 610	
0,60	ca. 610	ca. 610	
0,80	ca. 610	ca. 610	
1,00	ca. 610	ca. 610	
1,50		300 x 2000	
2,00		300 x 2000	

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#### 6. Tolerances

thickness tolerance: DIN EN 9445 Table 1  
width tolerance: according to DIN EN 9445  
straightness: normal  
flatness: wave height max. 1,0 mm

#### 7. Further mechanical data

Yield strength Rp0,2 : depending on the ultimate tensile strength  
Elongation A80: depending on the ultimate tensile strength

For the temper rolled condition only:

If good tumbling is done, the reversed bending stress (Mean stress = 0) is at approx. 35% of the tensile strength (bending direction is at a 90° angle to the rolling direction).

As the fatigue strength depends on different factors like the corrosive conditions and the edge treatment, no definitive endurance limit values can be guaranteed.

At high forces or bending not in the right angle to the rolling direction hardened steels like the alloy 1.4031Mo are strictly recommended.

The operation temperature should not exceed 120-250°C (compare to DIN 17224 – stainless strip steel for springs). Please remember that the modulus of elasticity decreases at higher temperatures.

## 8. Physical properties

Density: 7,95 g/cm<sup>3</sup>  
Thermal conductivity: 15 W/(m °C) depending on the temperature  
Heat capacity: 500 J/(kg °C) medium value at 50 – 100 °C  
Thermal expansion: 16,0 x 10<sup>-6</sup> (between 30 - 100 °C)  
16,5 x 10<sup>-6</sup> (between 30 - 200 °C)  
17,0 x 10<sup>-6</sup> (between 30 - 300 °C)

Electric resistance: 0,75 Ohm x mm<sup>2</sup>/m  
Modus of elasticity: 180 000 MPa at 20 °C

Relative Permeability: in the annealed condition generally less than 1,02 (at 200H)  
in the temper rolled condition higher than in the annealed condition, but lower than the alloy 1.4310

## 9. Blanking

This alloy can be blanked easily. In the annealed condition this alloy can be used for deep drawing parts due to a content of more than 10% Nickel.

## 10. Laser cutting

This alloy can be laser cut without problems.

## 11. Photo etching

The alloy 1.4404 can be etched easily.

### 12.1 Biegen in hartgewalztem Zustand

As the high hardness of 1.4404 is obtained by temper rolling, the rolling direction has a big influence on the bending.

Bending at right angle (90°) to the rolling direction:

	F 1100-1300 N/mm <sup>2</sup>
Up to 0,25 mm	2,5 x t
0,25-0,50 mm	3,0 x t
0,50-0,75 mm	4,5 x t
0,75-1,00 mm	Not recommended

t = strip thickness

Bending parallel to the rolling direction:

	F1100-1300 N/mm <sup>2</sup>
Up to 0,25 mm	8,0 x t
0,25-0,50 mm	11,0 x t
0,50-0,75 mm	14,0 x t
0,75-1,00 mm	Not recommended

t = strip thickness

## 12.2 Bending in the annealed condition

The alloy 1.4404 can be bent and deep drawn easily in the annealed condition.

## 13. Flat grinding

The alloy 1.4404 has in the annealed condition an austenitic structure and is not magnetic. In the temper rolled condition is only little magnetic and can not be hold by magnetic clamping devices of flat grinding machines.

## 14. Welding

The alloy 1.4404 can be welded easily like all austenitic steels. In the temper rolled condition a change in the structure at the weldseam occurs which lowers the strength. Due to the very low content of Carbon of maximal 0.03% a corrosion at the weldseam should not occur.

## 15. Corrosion resistance

This alloy is in the group 5 in the Nirosta-table of corrosion resistance of stainless steels (see [www.nirosta.de/Publikationen](http://www.nirosta.de/Publikationen)). This alloy is more resistant than the alloys 1.4310 (in group 5), and the grades 1.4031Mo and 1.4034 (both in group 1).

Nirosta is a registered trade mark of ThyssenKrupp AG.

Please check there and by tests if the alloy 1.4404 is resistant enough for your application.

For very corrosive environments, Alloy 1.4529 is available (in hard rolled condition in thicknesses of 0.05-0.50mm and in soft condition in thicknesses of 0.15-0.50mm).

## Important Annotation

The specifications which are given in this technical information sheet about the condition and application of the alloys are only for reference and are no confirmation about certain performances and characteristics.

The information correspond to our own experiences and experiences of our suppliers. We can not guarantee for the results during processing and utilisation.