Material Data sheet Issue: July 2023

Hardened special steel W.-Nr. 1.4031Mo

1. Application examples

Due to the alloy with 13% chromium and 1% molybdenum, this alloy is corrosion-resistant in moist air, steam and water, but not sufficiently resistant to chloride ions and acids. The advantages of this steel are its good wear resistance and minimal internal stresses. With a tensile strength of 1700 to 1950 N/mm², this material is ideal for springs, gauges, tools and knives.

The stainless, hardened knife steel 1.4034 is available in thicknesses from 1.0 mm.

Other areas of application:
Knives and saws in the food industry, scalpels, textile knives Wear strips, pressure blades, shock absorber valves and reed valves for compressors.

In the DIN EN 10 151 standard, the comparable material 1.4031 is approved as spring steel. The material we offer also has a molybdenum content of approx. 1%, which improves corrosion resistance.

It is also suitable for high mechanical loads and has a high fatigue strength and is the only stainless steel used for shock absorber valves and reed valves.

If there are high demands on hardness and wear resistance, grade 1.4037 (hardened to 1900-2200 N/mm²) should be used, which is in stock in thicknesses of 0.25-1.00mm.

2. Material codes

German Norm:	not specified, equivalent to X 38Cr13Mo1
AISI:	420 + 1% Mo
ASTM:	
English Norm:	X 39Cr13 + 1% Mo
French Norm:	Z 40 C 14 CI + 1% Mo
Japanese Norm:	SUS 420 J2 + 1% Mo

3. Alloy Composition *

C: ca. 0,38%
Si: ca. 0,40%
Mn: ca. 0,60%
P: max. 0,025%
S: max. 0,010%
Cr: ca. 13,5%
Mo: ca. 1,0%

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

4. Delivery condition

Condition:	hardened and tempere
Surface:	white polished Ra 0,1-0,25 µm, Mean value 0,16 µm respective Ra 0,20 – 0,50 µm depending on thickess
Ultimate tensile strength:	1700-1900 N/mm²
Further mechanical data:	see chapter 7 and 8.

5. Sizes

thicknesses:	0,076-2,00 mm
Material width:	depending on thickness from 70 – 370 mm, individual widths are available upon request.
Edges:	cut
Length:	variable lengths from 5 to 10 000 mm or as coil

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

thickness	***width:***	***flatness:***	***Annotation:***
0,076	ca. 70 mm	P3	Small amount on stock
0,102	ca. 300 mm	P2	
0,152	ca. 300 mm	P3	
0,203	ca. 305 mm	P3	
0,250	ca. 300 mm	P3	
0,305	ca. 305 mm	P3	
0,400	ca. 310 mm	P2	
0,508	ca. 310 mm	P3	
0,60	ca. 370 mm	P2	
0,70	ca. 420 mm	P2	
0,80	ca. 359,5mm	P3	
1,00	370x2000mm	P2	
1,50	320x2000mm	P2	
1,975	370x2000mm	P2	

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6. Tolerances

thickness tolerace:	T1 to T3 depending on the available material
width tolerance:	B1
straightness:	normal
flatness:	P2 (0,3 % of the strip width), some thicknesses only P3 (0,2 % of the strip width)

The flatness P3 and a very well polished surface Y8 are necessary if used for flapper valves in compressors.

7. Further mechanical data

Yield strength Rp0,2 :	> 1450 N/mm²
Elongation A80:	no data available
Fatigue strength:	high fatigue strength, suitable for shock absorber valves and flapper valves

If good tumbling is done, the following values can be achieved:
Reversed bending stress (Mean stress = 0):
710 MPa at a failure rate of 5 %.

Fluctuating bending stress (Minimum stress = 0):
625 MPa at a failure rate of 5 %

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

Please ask if the requested batch meets the high demands for shock absorber valves or compressor valves.

The operation temperature should not exceed 350°C. Please remember that the modus of elasticity decreases at higher temperatures.
The stainless hardened steels have a much higher maximum operation temperature than the hardened carbon steels and the austenitic stainless steels.

8. Physical properties

Density:	7,7 g/cm³
Thermal conductivity:	24 W/(m °C) bei 20 °C
Heat capacity:	460 J/(kg °C) medium value bei 50 – 100 °C
Thermal expansion:	10,5 x 10 -6 (between 30 - 100 °C)
	11,0 x 10 -6 (between 30 - 200 °C)
	11,5 x 10 -6 (between 30 - 300 °C)
Electric resistance:	0,62 Ohm x mm²/m
Modus of elasticity:	210 000 MPa bei 20 °C
Relative permeability μr:	ca. 97

The operation temperature should not exceed 350 °C. Please remember that the modus of elasticity decreases at higher temperatures.
The stainless hardened steels have a much higher maximum operation temperature than the hardened carbon steels and the austenitic stainless steels.

9. Blanking
We recommend a punch-to-die clearance of 4-10 % of the strip thickness.
The corner radius should be at least 0.25 mm and the punching die should be at least twice the strip thickness.
After blanking a stress relieving at a maximum temperature of 250°C for 30-60 minutes is suggested.
The pieces should then be tumbled to receive a good edge roundness.
We suggest to produce the pieces by photo etching.

10. Laser cutting
As the material melts at the edge, a higher hardness and therefore a lower toughness at the cutting zone is possible.
As alternative we recommend water jet cutting.

11. Photo etching
This alloy is very easy to etch.

12. Bending
As this material is supplied in the hardened and tempered condition, the rolling direction is not important regarding the bending.

Bending radius:	minimum 5 times of the strip thickness for a thickness up to 0.25 mm minimum 5 times of the strip thickness for a thickness up to 0.50 mm minimum 12 times of the strip thickness for a thickness of more than 0.60 mm
Spring back angle:	As the spring back depends on several factors, bending tests are necessary. As guidance an angle of 10° at a strip thickness of 0.20 mm and an angle of 20° at a strip thickness of 0.60 mm can be expected.

13. Flat grinding
The alloy 1.4031Mo is magnetic and can be fixed by magnetic clamping devices of flat grinding machines.

14. Welding
Due to the high content of carbon the alloy 1.4031Mo is difficult to weld.

15. Corrosion resistance
This alloy is in the group 1 in the Nirosta-table of corrosion resistance of stainless steels (see www.nirosta.de/Publikationen). This alloy is less resistant than the alloys 1.4310 (in group 4) and 1.4404 (in group 5).

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Please check there and by tests if the alloy 1.4031Mo is resistant enough for your application.

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.