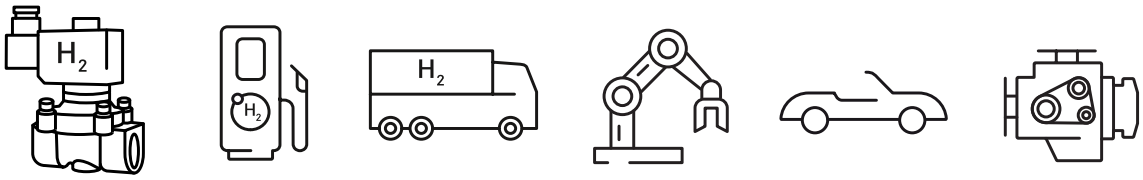
1.4435, Zapp HyType®, AISI 316L mod. X2CrNiMo18-14-3, Data Sheet

Zapp is certified to ISO 9001 I IATF 16949



Classification Material 1.4435 from Zapp

- 1.4435 mod, X2CrNiMo18-14-3 mod (DIN EN 10088-3)
- AISI 316L mod, UNS S31603 mod (ASTM A276)
- ISO 1114-4:2017
- CSA ANSI/CSA CHMC 1-2014:2014-02

Hydrogen as an Energy Carrier

Hydrogen is playing an increasingly important role in our world as a clean and climate-neutral **energy carrier of the future**.

The use of hydrogen places **high demands** on safety engineering and operational stability. Effective prevention of hydrogen embrittlement must be ensured.

Material Zapp HyType® from the Zapp Group

The material Zapp HyType® is a high-performance material specially developed for hydrogen applications. An optimized chemical composition of material 1.4435, 316L stainless steel, X2CrNiMo18-14-3 guarantees the stability of the austenitic microstructure. This effectively **prevents hydrogen embrittlement**. The high degree of melt purity additionally adds to the very good fatigue strength.

Typical Applications

Zapp HyType® as a stable austenite can be used in **fuel cells and hydrogen engines**. Zapp HyType® is suitable for safety-critical components in direct contact with hydrogen such as

- pressure reducing valves
- shut-off valves
- safety valves
- housings / pistons
- fittings

Corrosion Resistance

Zapp HyType® has excellent corrosion resistance. The material is resistant to intergranular corrosion, as well as pitting and crevice corrosion.

Typical Chemical Composition (approx. values in %)

C	Mn	P	S	Cr	Ni
≤ 0.03	≤ 2.0	≤ 0.025	≤ 0.010	17.00-19.00	13.50 – 15.00

Mo	N	Cu
2.5 – 3.00	max. 0.1	max 0.5

Mechanical Properties

Material	Yield Strength R_e [MPa]	Tensile Strength Rm [MPa]
Zapp HyType® 220	> 220	500 – 700
Zapp HyType® 600	> 600	800 – 1,100

* Different strengths possible depending on dimensions.

Physical Properties

Density ρ	8.0 kg/dm³
Modulus of Elasticity E at 20° C	200 GPa
Thermal Conductivity λ at 20°C	13.4 W/(m*K)
Coefficient of thermal Expansion α	(10^{-6} K^{-1})
20 – 100 °C	17.2
20 – 200 °C	17.5
20 – 300 °C	17.7
20 – 400 °C	18.0
20 – 500 °C	18.2
20 – 600 °C	18.4
20 – 700 °C	18.5
Specific Heat c at 20°C	440 J/(kg*K)
Specific Electrical Resistivity ρ	0.81 [Ohm*mm²/m]

Non-Destructive Testing

Eddy current crack testing	Eddy current crack testing to DIN EN 10277 -1 Tab 1 class 4
ultrasonic testing	up to KSR 0.7 mm

Information about further grades at Zapp.

Weldability
Zapp HyType® is **weldable**.

Material properties may be affected in the weld area. A comprehensive process validation has to be carried out.

Polishability
Zapp HyType® exhibits **very good** polishability.

Magnetism
Zapp HyType® is **not magnetic**. Even after severe forming, the microstructure remains fully austenitic and amagnetic.

Cold Forming
Zapp HyType® has very good cold formability.

Heat Treatment
Solution annealing at 1,000 – 1,100 °C
Rapid cooling is necessary to ensure a precipitation-free structure.

Machining
Zapp HyType® is well suited for serial production of precision turned parts.

Please see our linecard of other stainless steel and special steel grades at Zapp.

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Further information regarding our products and locations are available in our image brochure and under www.zapp.com

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