

# DATA SHEET

## DMV 931

### 1 – Applications

DMV 931 is used in a wide variety of applications where general corrosion resistance and resistance to chloride-ion acid is necessary:

- Pulp and paper industry
- Fine chemical synthesis
- Phosphoric acid production
- Sulphuric acid coolers
- Pickling plants with sulphuric acids
- Evaporations and crystallisation of salts
- Oil and gas production and refining
- Sour gas production

### 2 – Main Features

DMV 931 is an austenitic iron-nickel-chromium-molybdenum alloy with nitrogen addition. It was designed to fill the gap between existing super-austenitic stainless steels and nickel based alloys.

### 3 – Description

#### 3.1 Reference Standards

- UNS N08031 acc. to ASTM B 622 and ASME SB 622
- 1.4562 acc. to VdTÜV data sheet 509/2
- 1.4562 acc. to SEW 400

### 3.2 Chemical Composition

DMV 931 contains:

	% min.	% max.
<b>C</b>		0.015
<b>Si</b>		0.30
<b>Mn</b>		2.00
<b>P</b>		0.020
<b>S</b>		0.010
<b>Cr</b>	26.00	28.00
<b>Ni</b>	30.00	32.00
<b>Mo</b>	6.00	7.00
<b>Cu</b>	1.00	1.40
<b>N</b>	0.15	0.25
<b>Fe</b>	Balance	

### 3.3 Mechanical Properties

#### 3.3.1 Tensile Properties at 20°C (68°F)

UNS N08031 acc. to ASTM B 622:

	MPa	ksi
<b>0.2% Y.S. min.</b>	276	40
<b>U.T.S. min.</b>	650	94
<b>E in 2" min.</b>	40%	

Grade 1.4562 following VdTÜV data sheet 509/2:

	MPa	ksi
<b>0.2% Y.S. min.</b>	276	(40.0)
<b>1.0% Y.S. min.</b>	310	(45.0)
<b>U.T.S. min</b>	650	(94.2)
<b>A</b>	40%	

1MPa=1 N/mm<sup>2</sup>; 1 ksi=6.9 MPa

( ) = calculated values

#### 3.3.2 Tensile Properties at Elevated Temperature

Grade 1.4562 following VdTÜV data sheet 509/2:

Temp. °C (°F)	0.2% Y.S. min. MPa (ksi)	1.0% Y.S. min. MPa (ksi)
<b>100 (212)</b>	210 (30.5)	240 (34.8)
<b>200 (392)</b>	180 (26.1)	210 (30.5)
<b>300 (572)</b>	165 (23.9)	195 (28.3)
<b>400 (752)</b>	150 (21.8)	180 (26.1)
<b>500 (932)</b>	135 (19.6)	165 (23.9)
<b>550 (1022)</b>	125 (18.1)	155 (22.5)

( ) = calculated values

For UNS N08031 "maximum allowable stress values" following ASME Section VIII Division 1 are:

Temperature (°C) °F	Stress Value (MPa) ksi
<b>(38) 100</b>	(160) 23.5
<b>(93) 200</b>	(150) 22.0
<b>(149) 300</b>	(135) 19.7
<b>(204) 400</b>	(125) 18.3
<b>(260) 500</b>	(120) 17.2
<b>(316) 600</b>	(115) 16.4
<b>(371) 700</b>	(110) 15.7
<b>(426) 800</b>	(105) 15.2

( ) = calculated values

#### 3.3.3 Impact Resistance

Acc. to VdTÜV data sheet, the impact resistance at 20°C must be minimal 185 J/cm<sup>2</sup> (average value of three samples with min. 130 J/cm<sup>2</sup> individual value).

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### 3.4 Physical Properties

#### Coefficient of Thermal Expansion between 20°C (68°F) and ...

Temperature °C (°F)	10 <sup>-6</sup> / K	10 <sup>-6</sup> / °F
100 (212)	14.3	(7.9)
200 (392)	14.7	(8.2)
300 (572)	15.1	(8.4)
400 (752)	15.5	(8.6)
500 (932)	15.7	(8.7)

#### Thermal Conductivity

Temperature °C (°F)	W / (m K)	Btu in / (ft h °F)
20 (68)	11.7	(6.76)
100 (212)	13.2	(7.63)
200 (392)	15.0	(8.67)
300 (572)	16.8	(9.71)
400 (752)	18.5	(10.7)
500 (932)	20.2	(11.7)

( ) = calculated values

#### Modulus of Elasticity

Temperature °C (°F)	10 <sup>3</sup> MPa	10 <sup>3</sup> ksi
20 (68)	198	(28.7)
100 (212)	189	(27.4)
200 (392)	183	(26.5)
300 (572)	176	(25.7)
400 (752)	170	(24.6)
500 (932)	163	(23.6)

( ) = calculated values

### 3.5 Corrosion Properties

DMV 931 has high resistance to corrosion in halide media. The alloy also shows outstanding resistance to sulphuric acid, both pure and contaminated, over a wide range of concentrations and at temperatures up to 80°C (176°F).

In the severe erosion-corrosion conditions of wet process phosphoric acid production, DMV 931 has demonstrated that it is a true alternative to nickel based alloys. Extensive testing in chlorine-dioxide bleach media in the pulp and paper industry has shown that DMV 931 withstands the most severe service conditions.

For applications in hydrochloric acids, the temperature and concentration is very decisive. At room temperature and at acid concentrations from 10% up to 30% this grade shows uniform corrosion rates of up to 0.5 mm/a (0.02 "/a).

Therefore, DMV 931 is only suitable for use in organic chemistry and other processes, where the tube material encounters only traces or concentrations below ~ 5% of hydrochloric acid at room- or slightly elevated temperatures.

For hydrochloric acid applications above the room temperature and at higher concentrations, DMV 931 is not considered suitable. For such service conditions other grades, in particular nickel based alloys with high molybdenum content, are usually selected.

## 4 – DMV Supply

### 4.1 Dimensional Range

DMV 931 is produced in form of seamless tubes and pipes in the range of Outside diameter:

6 mm – 219.1 mm (0.24" – 8.6")

Wall thickness:

1 mm – 30 mm (0.04" – 1.18")

### 4.2 Delivery Condition

Tubes and pipes are delivered in cold or hot finished condition depending on size and specification. Normally they will be supplied in annealed condition.

### 4.3 U-bent

Our tubes are also available in U-bent version in lengths of up to 30 m (straight); the high deformability of the material allows cold bending down to a very small bending radius.

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### 5 – Fabrication

#### 5.1 Heat Treatment

Solution heat treatment of DMV 931 should be carried out in the temperature range of 1150°C to 1180°C (2100 – 2160°F), followed by water quenching or rapid air cooling.

For maximum corrosion resistance, the work piece must be rapidly cooled from the temperature of at least 1100°C (2000°F) down to 500°C (930°F) using a cooling rate > 150°C/min (300°F/min).

#### 5.2 Bending

DMV 931 is generally suitable for further hot or cold forming.

For hot bending, the proposed temperature is 1080°C – 1200°C (1980°F – 2190°F) followed by rapid cooling.

Cold bending of tubes and pipes must respect an elevated work-hardening rate in comparison to austenitic stainless steels. This should be taken in account when selecting forming equipment.

Cold formed tubes and pipes have to be newly solution annealed if the forming degree is > 15 % or the R/D ratio < or equal 2.5.  
For corrosion reasons, it is sometimes recommended to perform a new solution annealing even following smaller forming degrees.

#### 5.3 Welding

Preheating and heat treatment after welding are normally not necessary.

To avoid hot cracks in the weld metal, processes recommended by the filler producers have to be observed. Only approved filler materials should be considered, that have been tested for the foreseen application temperature. The calculation values for the filler materials should be respected.

In all cases, the usual cleanliness precaution for welding stainless steels should be taken into account. Where the subsequent application might be in moist environment, all oxidation must be avoided or eliminated.

### 6 – Standards and References

DMV 931 may be delivered in accordance with the commonly used European, American and other national standards.

In other cases, our specialists are at your service for any guidance on drawing up your tube specifications.

Salzgitter Mannesmann Stainless Tubes has delivered DMV 931 tubes and pipes to a wide range of world-wide customers in the chemical and petrochemical industry, as well as in the oil and gas production.

For any specific queries, please contact our sales offices.

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## DMV 931

QUALITY IN ROUND TERMS.

## Contact

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