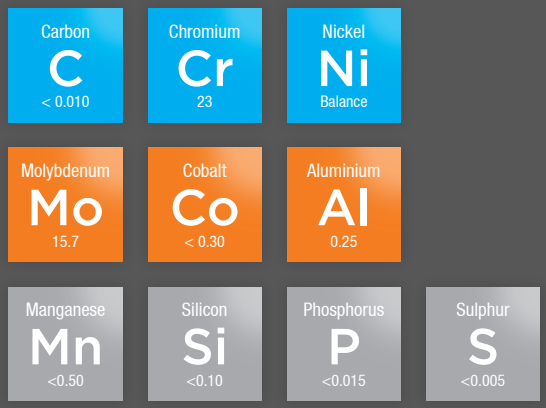
MANNESMANN STAINLESS TUBES
A Member of the Salzgitter Group

DMV 59

1. Applications

DMV 59 is the material of choice for a wide variety of applications where general corrosion resistance and high mechanical strength is necessary, for example in:

- Equipment and components in sour gas service
- Pulp and paper industry
- Diverse components and systems for flue gas desulphurization in fossil-fired power stations and waste incineration plants
- Phosphoric acid production
- Petroleum production and refining
- Sulphuric acid coolers
- Chemical Processing Industry



Chemical composition nominal %

2. Main Features

DMV 59 is an austenitic nickel-chromium-molybdenum alloy with an extra-low carbon and silicon content. This grade was designed to show superior characteristics in the C-group of nickel based alloys, even though its chemical composition is easier structured.

3. Description

3.1 Reference Standards

- UNS N06059 acc. to ASTM B 622 and ASME SB 622
- 2.4605 acc. to DIN 17744, DIN 17751 and prDIN 59755

3.2 Chemical Composition

DMV 59 contains:

	% min.	% max.
C		0.010
Si		0.10
Mn		0.50
P		0.015
S		0.005
Cr	22.00	24.00
Ni	Balance	
Mo	15.0	16.5
Co		0.30
Al	0.10	0.40
Fe		1.5

3.3 Mechanical Properties

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

UNS N06059 acc. to ASTM B 622:

	MPa	ksi
0.2% Y.S. min.	310	45
U.T.S. min.	690	100
E in 2", min.	45%	

1 MPa = 1 N/mm² ; 1 ksi = 6.9 MPa

Grade 2.4605 following DIN 17751:

	MPa	ksi
0.2% Y.S. min.	340	(49.3)
1.0% Y.S. min.	380	(55.1)
U.T.S. min.	690	(100)
A	40%	

1 MPa = 1 N/mm² ; 1 ksi = 6.9 MPa
( ) = calculated values

3.3.2 Tensile Properties at Elevated Temperatures

Grade 2.4605 following VdTÜV data sheet 505 (valid for forgings, rod, bar, sheet, plate and strip) prescribes:

Temperature		0.2% Y.S. min.	1.0% Y.S. min.
°C	(°F)	MPa (ksi)	MPa (ksi)
100	**(212)**	290 (43.0)	330 (47.8)
200	**(392)**	250 (36.2)	290 (42.0)
300	**(572)**	220 (31.9)	260 (37.7)
400	**(752)**	190 (27.5)	230 (33.3)
450	**(842)**	175 (25.4)	215 (31.2)

( ) = calculated values

For UNS N06059 "maximum allowable stress values" following ASME Sec. II Part D (valid for forgings, rod, bar, sheet, plate and strip) are:

Temperature		Stress Value
(°C)	°F	MPa (ksi)
(38)	**100**	(173) 25.0
(93)	**200**	(173) 25.0
(149)	**300**	(170) 24.7
(204)	**400**	(161) 23.3
(260)	**500**	(152) 22.0
(316)	**600**	(144) 20.9
(371)	**700**	(137) 19.8
(399)	**750**	(134) 19.4

3.3.3 Impact Resistance

According to VdTÜV data sheet 505 (valid for forgings, rod, bar, sheet, plate and strip) the impact resistance at 20 °C must be minimal 225 J/cm2 in longitudinal direction (average value of three samples with min. 160 J/cm2 individual value).

3.4 Physical Properties

Coefficient of Thermal Expansion between 20°C (68°F) and …			
°C	(°F)	10^{-6} / K	10^{-6} /°F
100	**(212)**	11.9	(6.6)
200	**(392)**	12.2	(6.8)
300	**(572)**	12.5	(6.9)
400	**(752)**	12.7	(7.1)
500	**(932)**	13.1	(7.2)

Thermal Conductivity			
°C	(°F)	W / (m K)	Btu / (ft h °F)
20	**(68)**	10.4	(6.01)
100	**(212)**	12.1	(6.99)
200	**(392)**	13.7	(7.92)
300	**(572)**	15.4	(8.90)
400	**(752)**	17.0	(9.83)
500	**(932)**	18.6	(10.8)

Modulus of Elasticity			
°C	(°F)	GPa	10^3 ksi
20	**(68)**	210	(30.5)
100	**(212)**	207	(30.0)
200	**(392)**	200	(29.0)
300	**(572)**	196	(28.5)
400	**(752)**	190	(27.6)
500	**(932)**	185	(26.7)

( ) = calculated values

3.5 Corrosion Properties

DMV 59 is suitable for many chemical process applications in both oxidizing and reducing media. Because of the high nickel, chromium and molybdenum contents, the grade exhibits excellent resistance to attack by chloride ions. Also the better behaviour in 10% sulphuric acid shows an advantage for use in Chemical Processing Industries (CPI).

Moreover, the excellent corrosion resistance of DMV 59 in hydrochloric acid should not be forgotten to be mentioned.

4. Supply Range

4.1 Dimensional Range

Nominal Dimensional Range		
Cold Finished		
Outside Diameter	mm	inch
min	1.6	0.063
max	244.5	9.626
Wall Thickness	mm	inch
min	0.1	0.004
max	40	1.575
Hot Finished		
Outside Diameter	mm	inch
min	32	1.260
max	280	11.024
Wall Thickness	mm	inch
min	2.8	0.110
max	60	2.362

Specific dimensions by grade available upon request.

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.

5. Fabrication

5.1 Heat Treatment

Solution heat treatment of DMV 59 should be carried out in the temperature range of 1100 °C to 1180 °C (2010 – 2160 °F), preferably at about 1120 °C (2050 °F) followed by water quenching or rapid air cooling.

As for all austenitic stainless steels and nickel based alloys, the cleanliness requirements (especially contamination from greases) must be strictly observed.

The furnace atmosphere must have very low sulphur content.

When subsequently used in a moist environment, oxidation must be avoided by use of highly reducing atmosphere (cracked armonia, hydrogen, …) or removed by pickling after heat treatment.

5.2 Bending

DMV 59 is suitable for further hot or cold forming.

For hot bending, the proposed temperature is 950 °C – 1180 °C (1740 °F – 2160 °F) followed by rapid cooling. Heat treatment after hot working is recommended to ensure the maximum corrosion resistance.

Cold bending of tubes and pipes must respect an elevated work-hardening rate than the classical austenitic stainless steels. This should be taken into account when selecting forming equipment.

Cold formed tubes and pipes have to be newly solution annealed if the forming degree is > 20% 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 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 59 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.

Mannesmann Stainless Tubes has delivered DMV 59 tubes and pipes to a wide range of worldwide customers in the chemical and petrochemical industries.

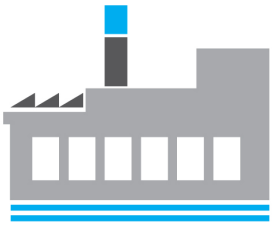
For any specific queries, please contact our sales offices.

Visit our Tech Centre for full product range details, calculators and learning.

CHEMICAL INDUSTRY

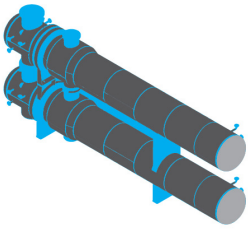
POWERGEN

OIL & GAS

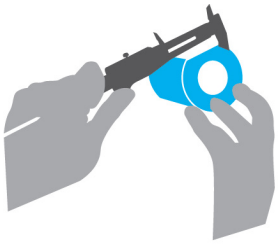


GENERAL INDUSTRY

FERTILISER

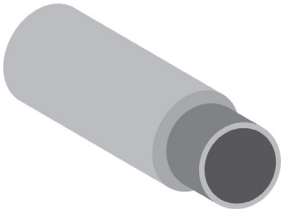


HEAT EXCHANGERS



PRECISION TUBE

DISTRIBUTION



BIMETALLIC TUBES

Mannesmann Stainless Tubes
info@mst.mannesmann.com
Tel. +49 208 458 01
www.mannesmann-stainless-tubes.com

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