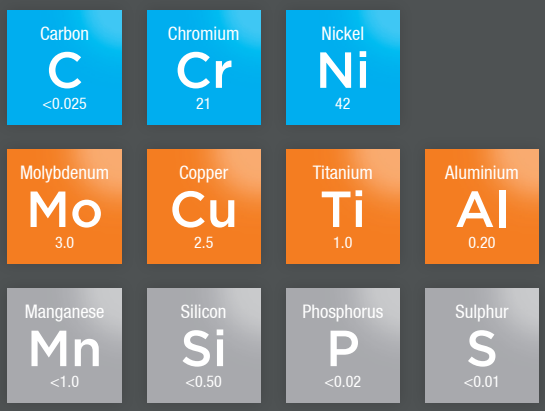
MANNESMANN
STAINLESS TUBES
A Member of the Salzgitter Group

DMV 825

1. Applications

DMV 825 is the material of choice in a wide variety of applications up to a temperature of approximately 550°C (1020°F), including:

- Chemical process industry in the production, concentration and use of phosphoric acid or sulphuric acid in general applications, meeting very aggressive conditions, like acetic acid, vinyl chloride, etc. for process services, e.g. aircooled heat exchangers in refineries
- Oil & Gas production and processing in OCTG, as tubing and casing for deep sour oil and gas wells - for subsea as well head accessories and line pipes in presence of sour gas
- Maritime applications e.g. in desalination plants; seawater systems, heat exchangers using sea water as coolant



Chemical composition nominal %

2. Main Features

DMV 825 is a titanium-stabilized fully austenitic nickel-iron-chromium-alloy with addition of copper and molybdenum.

3. Description

3.1 Reference Standards

- UNS N08825 acc. to ASTM B 163 and ASME SB 163, ASTM B 423 and ASME SB 423
- 2.4858 acc. to VdTÜV data sheet 432/2, DIN 17751

3.2 Chemical Composition

DMV 825 typical values:

	Weight %
C	< 0.025
Si	< 0.50
Mn	< 1.00
S	< 0.01
Cr	21.0
Ni	42.0
Mo	3.00
Cu	2.50
Ti	1.00
Al	0.20
Fe	Balance

PRE ≥ 31.5 ; (PRE = Cr + 3.3x Mo)

3.3 Mechanical Properties

Following values are guaranteed in the solution annealed condition:

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

UNS N08825 acc. to ASTM B 163 / B 423 (cold-worked annealed):

	MPa	ksi
0.2% Y.S. min.	241	35
U.T.S. min.	586	85
A % min.	30	

1 MPa = 1 N/mm² ; 1 ksi = 6.9 MPa

UNS N08825 acc. to ASTM B 163 / B 423 (hot-finished annealed):

	MPa	ksi
0.2% Y.S. min.	172	25
U.T.S. min.	517	75
A % min.	30	

1 MPa = 1 N/mm² ; 1 ksi = 6.9 MPa

Grade 2.4858 acc. to VdTÜV 432/2:

	MPa	ksi
0.2% Y.S. min.	235	(34.1)
1.0% Y.S. min.	265	(38.4)
U.T.S. min.	550	(79.7)
A	30	

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

3.3.2 Tensile Properties at Elevated Temperatures

For UNS N08825 "maximum allowable stress values" according to ASME Sec. II Part D are:
"Soft annealed" Condition

°C	(°F)	Stress Value MPa (ksi)
(38)	100	(146) 21.2
(93)	200	(146) 21.2
(149)	300	(140) 20.4
(204)	400	(132) 19.2
(260)	500	(126) 18.3
(316)	600	(122) 17.8
(371)	600	(119) 17.3
(426)	800	(117) 17.1
(482)	900	(116) 16.8
(538)	1000	(114) 16.6

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

Grade 2.4858 acc. to VdTÜV data sheet 432/2:

Temp. °C	Temp. (°F)	0.2% Y.S. min. MPa (ksi)	1.0% Y.S. min. MPa (ksi)
100	**(212)**	205 (29.7)	235 (34.1)
150	**(302)**	190 (27.5)	220 (31.9)
200	**(392)**	180 (26.1)	205 (29.7)
250	**(482)**	175 (25.4)	200 (29.0)
300	**(572)**	170 (24.6)	195 (28.2)
350	**(662)**	165 (23.9)	190 (27.5)
400	**(752)**	160 (23.2)	185 (26.8)
450	**(842)**	155 (22.4)	180 (26.1)

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

3.3.3 Impact Resistance

According to VdTÜV data sheet, the notch impact resistance at 20°C (68°F) in longitudinal direction must be minimal 100 J/cm² (average value of three samples, with min. 70 J/cm² individual value).

3.4 Physical Properties

Density at 20°C (68°F)	
g/cm³	lbs / in³
8.1	0.293

Coefficient of Thermal Expansion between 20°C (68°F) and …			
°C	(°F)	10^{-6} / K	10^{-6} / °F
100	**(212)**	14.1	(7.8)
200	**(392)**	14.9	(8.3)
300	**(572)**	15.2	(8.5)
400	**(752)**	15.6	(8.7)
500	**(932)**	15.8	(8.8)
600	**(1112)**	16.0	(9.0)

( ) = calculated values

Thermal Conductivity			
°C	(°F)	W / (m K)	Btu in / (ft h °F)
20	**(68)**	10.8	(6.24)
100	**(212)**	12.4	(7.17)
200	**(392)**	14.1	(8.15)
300	**(572)**	15.6	(9.02)
400	**(752)**	16.9	(9.77)
500	**(932)**	18.3	(10.6)
600	**(1112)**	19.6	(11.3)

( ) = calculated values

Modulus of Elasticity			
°C	(°F)	GPa	10^3 ksi
20	**(68)**	195	(28.3)
100	**(212)**	190	(27.4)
200	**(392)**	185	(26.8)
300	**(572)**	179	(25.9)
400	**(752)**	174	(25.2)
500	**(932)**	168	(24.4)
600	**(1112)**	161	(23.3)

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

3.5 Corrosion Properties

DMV 825 is a versatile general engineering alloy with resistance to corrosion in acids and alkalis under both oxidizing and reducing conditions.

Pipe and tube made of DMV 825 are resistant to organic acids at all concentrations up to the boiling point. Additionally, they have an excellent resistance in caustic soda.
For example, corrosion rates of max. 0.002 mm/y (0.08 mil/y) have been recorded in boiling NaOH.

Furthermore, DMV 825 is resistant in aqueous solutions of salt. However they have only a moderate resistance to oxidizing chlorides.

Due to the stabilizing effect of titanium, DMV 825 has a good resistance against intergranular corrosion. This is particularly well illustrated by the corrosion rate of less than 0.6 mm/y (0.0237 in/y) in the HUEY test (ASTM A 262 Practice C) without any sensitization.

Moreover, the high nickel content protects DMV 825 against stress corrosion in chloride and alkaline environments.

Generally speaking, the high level of alloying elements prevents pitting and crevice corrosion. Pipe and tube in DMV 825 are used for condenser and heat exchangers in sea water within the following conditions:

- Metal temperature < 60°C (140°F)
- Flow rate > 1.5 m/s (5ft/s)
- Periodic cleaning
- Rinsing with fresh water during-shutdown

However, in view of its pitting resistance index PRE ≥ 31.5 (PRE = Cr + 3.3x Mo), its behavior in oxidizing chloride environment remains limited. The critical temperature in $FeCl_3$ environment per ASTM G 48 is 15°C (59°F).

In particular, laboratory test on C-rings or U bent specimens taken from annealed or even cold worked (min. YS = 760 MPa (110 ksi) materials have shown not to be susceptible to rupture under following test conditions:

- CO_2: 40 bar
- H_2S: 3 bar
- NaCl: 100 g/l
- Temp.: up to 230°C (447°F)
- Yield: 100% of elastic limit
- Duration: 500 h

Above all, N.A.C.E. Standards MR 0175 recognises this grade as having a hardness of max. 35 HRC and being suitable in sour gas.

DMV 825 can be used, in most instances, in conjunction with stainless steels in their field of passivation as well as with copper nickel alloys.

4. DMV Supply

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

Pipe and tube 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

Pipe and tube in DMV 825 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

Heat treatment eliminates workhardening after cold working.

A stabilizing heat treatment in the range of 920°C – 980°C (1688°F –1796°F), followed by rapid air cooling or water quenching supports to achieve an optimum resistance to intergranular corrosion. As for other stainless steels, cleanliness requirements (especially contamination from greases) must be strictly observed. The furnace atmosphere must have very low sulphur content.

When subsequently used in moist environment, oxidation must be avoided by

- use of highly reducing atmosphere (cracked ammonia, hydrogen…) or
- removal by pickling after heat treatment.

DMV 825 cannot be hardened by heat treatment.

5.2 Bending

DMV 825 is generally suitable for further cold or hot forming.

- For hot bending, the proposed temperature is 900°C – 1150°C (1650°F – 2102°F) followed by rapid cooling
- Cold bending of pipe and tube can be carried out under similar conditions to those required for classic austenitic stainless steels

Cold formed pipe and tube 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

DMV 825 has a good weldability. 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 expected 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 825 may be delivered in accordance with the commonly used European, American and other national standards.
Our specialists are at your service for any guidance on drawing up your specifications.

Mannesmann Stainless Tubes has delivered DMV 825 pipe and tube to a wide range of worldwide customers in the chemical, petrochemical industries and oil and gas production and processing.

For any specific queries, please contact our sales offices.

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

MANNESMANN
STAINLESS TUBES
A Member of the Salzgitter Group

DMV 825 mod EN05/2021