MANNESMANN
STAINLESS TUBES
A Member of the Salzgitter Group

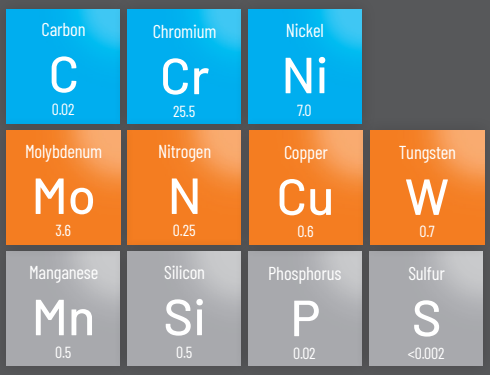
DMV 25.7N

1. Applications

DMV 25.7N is a super-duplex (austenitic-ferritic) stainless steel with tungsten, copper and nitrogen additions.

The combination of high mechanical properties and excellent corrosion resistance, especially pitting and crevice, presents a good basis for diverse pipe and tube applications such as:

- **Oil & Gas production and processing:**
  OCTG (Oil Country Tubular Goods)
  Subsea, process and utility services
- **Chemical, Petrochemical, Urea and Food industries** especially in the presence of high stress and high chloride content bearing environments
- **Maritime Applications** ship building; desalination plants; seawater systems



Chemical composition nominal %

2. Main Features

DMV 25.7N is characterised by:

- Balanced austenitic - ferritic microstructure
- High mechanical properties: yield strength is more than twice that of austenitic stainless steel grade AISI 316L
- Resistance to general corrosion, pitting, crevice is superior to that of stainless steel grade AISI 316L
- High resistance to stress corrosion cracking and hydrogen sulphide attack
- Typical range of service temperature: - 50°C up to +280°C (-58°F up to +540°F)
- Good weldability

3. Description

3.1 Reference Standards

- UNS S32760 acc. to ASTM A 789 / A 790; ASME SA 789 / SA 790; NACE MR0175 / ISO 15156
- 1.4501 acc. to EN 10216-5 or EN 10297-2
- ISO 13680
- API 5LC / DNV OS F101

3.2 Chemical composition

DMV 25.7N typical values:

	weight %
C	< 0.03
Si	≤ 1.0
Mn	≤ 1.0
P	≤ 0.035
S	≤ 0.015
Cr	25.5
Ni	7.0
Mo	3.6
N	0.2 - 0.3
Cu	0.5 - 1.0
W	0.5 - 1.0
Fe	Balance

PREN ≥ 41
(PREN = %Cr + 3.3 x %Mo + 16 x %N)
PREW ≥ 42
(PREW = %Cr + 3.3 x (%Mo + 0.5 x %W) + 16 x %N)

3.3 Mechanical Properties

Following values are guaranteed in the solution annealed condition:

	MPa	ksi
0.2% Y.S. min.	550	80
U.T.S.	800 - 1000	116 - 145
A% min.	25	

1 MPa=1 N/mm²; 1 ksi=6.9 MPa

3.3.2 Tensile Properties at Elevated Temperature

Temperature		0.2 Y.S. min	
°C	(°F)	MPa	ksi
50	**(122)**	502	72.8
100	**(212)**	450	65.2
150	**(302)**	420	60.9
200	**(392)**	400	58.0
250	**(482)**	380	55.1

1 MPa=1 N/mm2; 1 ksi=6.9 MPa

3.3.3 Hardness

DMV 25.7N has max. 28 HRC / max. 271 HB in conformity with NACE MR0175.
N.B. Higher mechanical values can be achieved in the cold hardened condition.

3.3.4 Impact Resistance

The V-notch impact energy at 20°C (68°F) is min. 100 J (76 ft lb) and at -50°C (-58°F) is min. 60 J (44 ft lb).
N.B. This grade is liable to metallographic modification after prolonged exposure in the range 600 - 900°C (1112 - 1652°F) leading to reduced impact properties. Prolonged service above 280°C (540°F) can also lead to a reduction in impact resistance and increase in hardness.achieved in the cold hardened condition.

3.4 Physical Properties

Density at 20°C (68°F)	
g / cm³	lbs / in³
7.95	0.286

Coefficient of Thermal Expansion between 20°C (68°F) and...			
Temperature		10⁻⁶/K	10⁻⁶/°F
°C	(°F)		
100	**(212)**	13.6	7.5
200	**(392)**	14.1	7.8
300	**(572)**	14.3	8.2
400	**(752)**	14.7	8.3

Thermal Conductivity			
Temperature		W/(m K)	Btu/ (hr ft °F)
°C	(°F)		
20	**(68)**	13.9	8
100	**(212)**	15.5	9
200	**(392)**	16.2	10
300	**(572)**	18.5	11
400	**(752)**	20.2	12

Modulus of Elasticity			
Temperature		10^3 MPa	10^3 ksi
°C	(°F)		
20	**(68)**	200	29.0
100	**(212)**	195	28.3
200	**(392)**	187	27.1
300	**(572)**	179	25.9

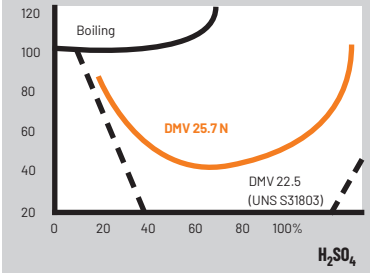
3.5 Corrosion Properties

3.5.1 General Corrosion

The chemical composition of DMV 25.7N has superior resistance to corrosion in

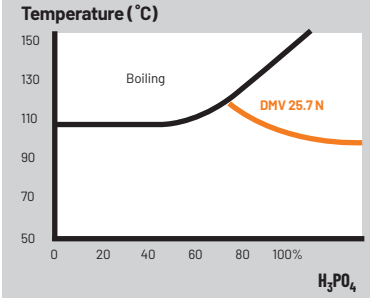
- Sulphuric acid

Isocorrosion chart in sulphuric acid for 0.1 mm/year (4 mpy)



- Phosphoric acid

Isocorrosion chart in phosphoric acid for 0.1 mm/year (4 mpy)



- Acetic acid
- Hydrochloric acid
- Organic acids

3.5.2 Intergranular Corrosion

The high chromium level and the austenitic-ferritic structure of DMV 25.7N ensures to pass the ASTM A 262 E (Strauss test) and ISO 3651-B.

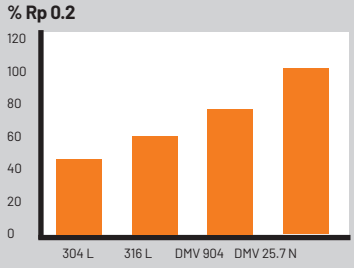
3.5.3 Stress Corrosion Cracking

The austenitic–ferritic structure of this stainless steel confers a high level of resistance to **S**tress **C**orrosion **C**racking (SCC):

- **In chloride environments: (Chloride Stress Cracking - CSC)**

The figure below gives the results of stress corrosion cracking in comparison to other stainless steels.

Stress corrosion cracking in chloride

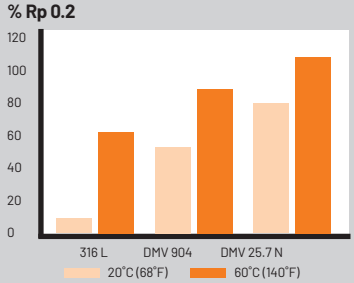


Threshold stress which does not cause cracking after one month in aerated NaCl 300 g/l at 110°C (230°F)

- **In H2S – Cl environments: (Sulphide Stress Cracking - SSC)**

For this environment the figure below shows for 1 bar H2S in comparison to other stainless steels the results:

Stress corrosion cracking H_2S 1 bar



Threshold stress which does not cause rupture in one month in NACE TM0177 solution

DMV 25.7N is approved by NACE MR0175 / ISO 15156-3 for use in sour environment. It shows very good resistance to sulphide stress cracking corrosion test at 24°C (75.2°F) and 90°C (194°F) over 720 hours period (NACE TM0177) in CO_2 – H_2S – Cl media as in table below:

Test solution	NACE TM0177	NACE TM0177
pH_2S	1 bar	16 bars
NaCl	50 g/l	50 g/l
Test temp.	24°C (75.2°F)	90°C (194°F)
Stress value	425 N/mm²	390 N/mm²
Test results	no failure after 720 h	no failure after 720 h

3.5.4 Pitting and Crevice Corrosion

The chromium, molybdenum and nitrogen contents are the principle factors determining resistance to pitting and crevice corrosion resistance. Comparison of resistance to pitting corrosion in chloride environments can be determined using the Pitting Resistance Equivalent Number (or PREN). This is defined as, in weight % PRE = % Cr + 3.3% Mo + 16x %N

In Duplex stainless steels the corrosion resistance in either the ferritic or austenitic phase is determined by the PREN value so the phase with the lowest value will determine the actual pitting corrosion resistance.

For DMV 25.7N seamless tubes the minimum PREN value is 42.5.

In 6% FeCl3 solution (ASTM G 48) the **C**ritical **P**itting **T**emperature (**CPT**) and **C**ritical **C**revice corrosion **T**emperature (**CCT**) are, respectively:

CPT	50°C	122°F
CCT	30°C	86°F

3.5.5 Galvanic Corrosion

Galvanic corrosion can occur when two dissimilar metals are connected. The position of DMV 25.7N on the electropotential scale is very similar to that of austenitic stainless steels. This enables it to be coupled with austenitic stainless steels within its passivity range.

4 Supply range

4.1 Dimensional Range

Outside diameter: up to 250 mm (9.84 inches)
Wall thickness: up to 50 mm (1.97 inches).

4.2 Delivery Condition

Pipes and tubes 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

Also available upon request.

5. Fabrication

5.1 Heat Treatment

Pipes and tubes are delivered in the annealed condition.

In case a subsequent processing requires an additional heat treatment, this has to be performed at 1100 - 1140°C (2010 - 2085°F) followed by rapid cooling in air or water.

This is especially recommended when the steel has been exposed in temperature ranges 350 - 525°C (662 - 977°F) and 600 - 950°C.

(1112 - 1742°F) for a long duration causing embrittlement and reduced corrosion resistance.

5.2 Expanding

DMV 25.7N tubes and pipes can be expanded similarly to austenitic stainless steels, bearing in mind, however, their greater strength. "Close fit" clearance per TEMA is recommended.

5.3 Bending

Cold
Despite their greater strength, during bending DMV 25.7N tubes behaves similarly to austenitic steels. When plastic deformation exceeds 25%, subsequent heat treatment is necessary.

Hot
Bending is possible in the range 1000 - 950°C (2010 - 1742°F) and must be followed by rapid cooling. It should, however, be noticed that the strength of DMV 25.7N is low at high temperatures which can have a negative influence on the final shape.

5.4 Cutting and Machining

A higher wear rate of the tools than that of austenitic steels can be noticed when cutting and machining of DMV 25.7N due to the higher hardness.

5.5 Welding

DMV 25.7N has a good weldability. Welding is possible with all processes usual for stainless steels. Preheating and heat treatment after welding is normally not necessary.

Butt welding or welding to tube plate is carried out using the gas tungsten arc welding process (TIG / GTAW) with a filler metal having a similar composition (PREN > 41) enriched with elements to favour austenite formation. Use moderate heat input in the range of 10 to 25 kJ / cm.

In all cases it is imperative to remove all traces of superficial oxidation which might initiate localised attack.

6 Standards and References

DMV 25.7N is delivered in accordance with European, American and other international standards.

Mannesmann Stainless Tubes has delivered DMV 25.7N tubes and pipes to a wide range of different applications world-wide. You can get more detailed information for the special fields of OCTG, Umbilicals and other oil & gas applications in separate annexes, which are available on request.

For obtaining material samples or specific queries, please contact our sales offices.

OUR DUPLEX FAMILY

Austenitic Ferritic																
DMV Designation	Nearest equivalent			Typical Chemical composition						Density		Min. Mechanical Prop. at RT				
	UNS	EN	JIS	Cmax	Cr	Ni	Mo	Cu	Others			Yield St. $R_{P0.2}$		Tensile St. R_m		
										g/cm³	lb/in³	MPa	ksi	MPa	ksi	
DMV 22.5	S31803	1.4462 1.4501		0.03	22.0	5.5	3.0		N 0.17[2)]	7.8	0.28	450	65	620	90	
DMV 25.7N	S32760	1.4410 1.4477		0.03	25.0	7.0	4.0	0.8	N 0.25; W 0.5[2)]	7.8	0.28	550	80	750	109	
DMV 25.7NS	S32750			0.03	25.5	7.0	4.0		N 0.3[2)]	7.8	0.28	550	80	750	109	
DMV 29.7	S32906			0.03	29	7	2.3	<0.80	N 0.35[2)]	7.8	0.28	650	394	800	116	

Dimensional Range	Instrumentation		Heat Exchangers U-bent tubes		Heat Exchangers Straight tubes		Process Pipe	
Outside Diameter	mm	inch	mm	inch	mm	inch	mm	inch
min	6.0	0.236	12.7	0.5	9.5	0.374	6.0	0.236
max	25.0	0.984	38.1	1.5	50.8	2.0	280.0	11.024
wall thickness	mm	inch	mm	inch	mm	inch	mm	inch
min	0.5	0.02	0.89	0.035	0.89	0.035	0.5	0.02
max	2.5	0.098	4.5	0.177	4.5	0.177	50.0	1.969

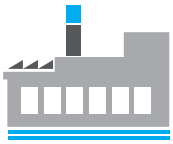
TOLERANCES

According to typical manufacturing Norms or individual customer requirements.

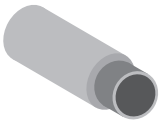
Outside Diameter	Hot Extruded	Cold Finished Tubes		
EN ISO 1127 tolerance class	D2	D2	D3	D4
Permissible deviation	± 1.0% (min. ± 0.5 mm (±0.0197"))	± 1.0% (min. ± 0.5 mm (±0.0197"))	± 0.75% (min. ± 0.3 mm (±0.0012"))	± 0.5% (min. ± 0.1 mm (±0.0039"))

Wall Thickness	Hot Extruded		Cold Finished	
	≤ 5 mm (0.1969")	> 5 mm (0.1969")		
EN ISO 1127 tolerance class	T1	T2	T3	T4 (on request)
Permissible deviation	± 15.0% (min. ± 0.6 mm (±0.0236"))	± 12.5% (min. ± 0.4 mm (±0.0157"))	±10% (min. ± 0.2 mm (±0.0074"))	± 7.5% (min. ± 0.05 mm (±0.002"))

OIL & GAS



GENERAL INDUSTRY



BIMETALLIC TUBES

DISTRIBUTION

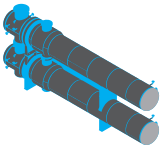
POWERGEN

POWERGEN

CHEMICAL INDUSTRY

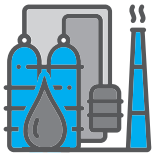
SOLAR

PRECISION TUBE



HEAT EXCHANGERS

FERTILISER



PETROCHEMICAL

MST QR code system to fight fake products
All of our orders are shipped with QR code validated certificates. Expect authentic Mannesmann quality tubes only with validated QR code.

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

MANNESMANN
STAINLESS TUBES
A Member of the Salzgitter Group

DMV 25.7 N EN 014/2024