SALZGITTER MANNESMANN STAINLESS TUBES
A Member of the Salzgitter Group

D A T A S H E E T
DMV 600 / DMV 600 H

1 – Applications

DMV 600 / DMV 600 H is generally used in a wide variety of applications up to a temperature of approximately 700°C (1290°F).
For service above 700°C (1290°F), higher creep-rupture properties via controlled carbon content and coarse size can be achieved.

DMV 600 / DMV 600 H is mainly in operation in the following fields:

- Thermocouple sheathing in aggressive atmospheres
- Heat treatment furnace retorts and components, particularly with carburizing or nitriding atmospheres
- Catalyst regenerators in petro-chemical production
- Nuclear reactor components
- Vinylchloride monomer production: resistance to chlorine, hydrogen chloride, oxidation and carburization
- Tubes in steam generators

2 – Main Features

DMV 600 / DMV 600 H is a stable, fully austenitic solid-solution nickel-iron-chromium alloy with higher carbon content.

3 – Description

3.1 Specifications

- UNS N06600 acc. to ASTM B 163 and
- ASME SB 163
- UNS N06600 acc. to ASTM B 167 and ASME SB 167
- 2.4816 acc. to DIN 1775
- 2.4816 acc. to prDIN 59755
- 2.4816 acc. to VdTÜV material datasheet 305

3.2 Chemical Composition

DMV 600 / 600 H contains:

	% min.	% max.
C	0.025	0.10
Si		0.50
Mn		1.00
P		0.015
S		0.015
Cr	14.00	17.00
Ni	72.00	
Al		0.30
Ti	0.20	0.30
Cu		0.50
Fe	6.0	10.0
Co		1.0

3.3 Mechanical Properties

3.3.1 Tensile Properties at 20°C (68°F), Annealed Condition

UNS N06600 acc. to ASTM B 167:
Hot worked annealed < 5” (127 mm):

	MPa	ksi
0.2% Y.S. min.	205	30
U.T.S. min.	550	80
E in 2” min.	35%	

UNS N06600 acc. to ASTM B 167:
Cold worked annealed < 5” (127 mm):

	MPa	ksi
0.2% Y.S. min.	240	35
U.T.S. min.	550	80
E in 2” min.	35%	

Grade 2.4816 (solution annealed) acc. to VdTÜV material datasheet 305:

	MPa	ksi
0.2% Y.S. min.	180	(26.1)
1.0% Y.S. min.	210	(30.4)
U.T.S. min.	500	(72.5)
A	35%	

1 MPa=1 N/mm^2; 1 ksi=6.9 MPa
( ) = calculated values

3.3.2 Tensile Properties at Elevated Temperature

Grade 2.4817 (solution annealed) according to VdTÜV material datasheet 305 (validity from -10°C – 450°C (14°F – 842°F)):

Temperature °C (°F)	0.2% Y.S. min. MPa (ksi)	U.T.S. min. MPa (ksi)
100 (212)	170 (24.6)	480 (69.6)
200 (392)	160 (23.2)	500 (66.7)
300 (572)	150 (21.7)	485 (64.5)
400 (752)	150 (21.7)	480 (63.8)
450 (842)	145 (21.0)	435 (63.0)

( ) = calculated values

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3.3.3 Impact Resistance

According to VdTÜV material datasheet 305 the impact resistance at 20°C must be min. 200 J/cm^2 in longitudinal direction (average value of three samples with min. 140 J/cm^2 individual value).

3.3.4 Creep Rupture Strength

For application above this temperature limit, the use of material in solution annealed condition with a minimum average grain size of 65 µm, ASTM No. 5 or coarser is recommended.

Temperature °C (°F)	10,000 h min. MPa (ksi)	100,000 h min. MPa (ksi)
500 (932)	297 (43.0)	215 (31.2)
600 (1112)	138 (20.0)	97 (14.1)
700 (1292)	63 (9.1)	42 (6.1)
800 (1472)	29 (4.2)	17 (2.5)
850 (1562)	17 (2.5)	9 (1.3)
900 (1652)	13 (1.9)	7 (1.0)

( ) = calculated values

Up to approximately 700°C (1290°F) there is virtually no difference between the creep strengths of material in the annealed and solution annealed conditions. For application above this temperature limit, the use of material in solution annealed condition with a minimum average grain size of 65 µm, ASTM No. 5 or coarser, is recommended.

3.4 Physical Properties

Coefficient of Thermal Expansion between 20°C (68°F) and …		
Temperature °C (°F)	10^{-6} / K	10^{-6} /°F
100 (212)	13.7	(7.6)
200 (392)	14.1	(7.8)
300 (572)	14.4	(8.0)
400 (752)	14.8	(8.2)
500 (932)	15.1	(8.4)
600 (1112)	15.4	(8.5)

( ) = calculated values

Thermal Conductivity		
Temperature °C (°F)	W / (m K)	Btu in / (ft h °F)
20 (68)	14.8	(8.55)
100 (212)	15.8	(9.13)
200 (392)	17.0	(9.83)
300 (572)	18.4	(10.6)
400 (752)	20.0	(11.6)
500 (932)	22.0	(12.7)
600 (1112)	24.0	(13.9)

( ) = calculated values

Modulus of Elasticity		
Temperature °C (°F)	10^3 MPa	10^3 ksi
20 (68)	214	(31.0)
100 (212)	209	(30.3)
200 (392)	205	(29.7)
300 (572)	200	(29.0)
400 (752)	194	(28.1)
500 (932)	187	(27.1)
600 (1112)	180	(26.1)

( ) = calculated values

3.5 Corrosion Properties

DMV 600 / DMV 600 H tubes and pipes have an excellent behaviour at elevated temperatures. They are particularly useful under the following conditions:

- In air up to 1150°C (2102°F)
- In non sulphurous reducing atmospheres up to about 1100°C (2012°F), though in case of presence of steam or in the presence of CO_2 up to 980°C (1796°F)
- In NH_3 atmospheres up to 900°C (1652°F)
- In oxidizing sulphurous atmospheres up to 800°C (1472°F)
- In hydrofluoric acid environments up to 600°C (1112°F)
- In dry chloride and dry hydrochloride environment up to 540°C (1004°F)

4 – Supply

4.1 Dimensional Range

DMV 600 / DMV 600 H 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.

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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

To improve long-time properties at elevated temperature, solution heat

treatment of DMV 600 / DMV 600 H at 1080°C – 1150°C (1976°F – 2100°F) followed by water quenching or rapid air cooling will be performed.

During any heating operations, strict precautions regarding cleanliness (especially contamination from grease) must be observed. The furnace atmosphere must have very low sulphur content.

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

5.2 Bending

DMV 600 / DMV 600 H is generally suitable for further cold or hot forming.

Cold bending of tubes and pipes can be carried out under similar conditions to those required for austenitic stainless steels. These 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.

Hot bending should be carried out in the range of 900°C – 1200°C (1652°F – 2192°F). However the range of 650°C – 870°C (1202°F – 1598°F) must be avoided.

Cooling after hot bending should be in water or as fast as possible. Especially the range of 650°C – 870°C (1202°F – 1598°F) needs to be avoided.

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 600 / DMV 600 H 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 600 / DMV 600 H tubes and pipes to a wide range of world-wide customers in the chemical and petrochemical industry.

For any specific queries, please contact our sales offices.

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QUALITY IN ROUND TERMS.

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03/2010