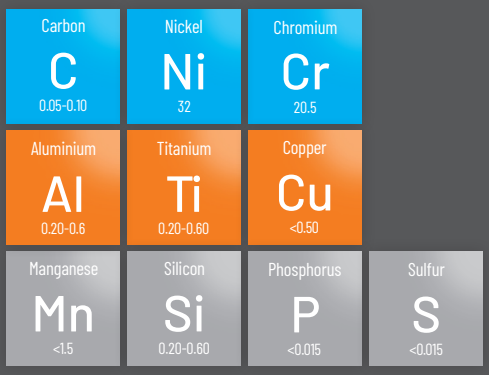
MANNESMANN
STAINLESS TUBES
A Member of the Salzgitter Group

# DMV 800H

## 1. Applications

DMV 800H is the material of choice for a wide range of applications like:

- Heating element sheathing because of good mechanical strength
- Ethylene pyrolysis tubing due to resistance to carburization and good mechanical properties
- Steam super-heater tubing owing to good mechanical strength and resistance to steam
- Furnace components




Chemical composition nominal %

## 2. Main Features

DMV 800H is an austenitic solid-solution grade containing small amounts of precipitated titanium nitrides and carbides, carbon nitrides and chromium carbides. During long term exposure below 700°C (1292°F) γ´-phase may be formed, lowering the ductility. Therefore, please check carefully the standards regulation and chemical composition for the intended application.

## 3. Description

### 3.1 Specifications

- UNS N08800 a. UNS N08810 acc. to ASTM A 213 and ASME SA 213
- UNS N08800 a. UNS N08810 acc. to ASTM A 312 and ASME SA 312
- 1.4558, 1.4958 and 1.4959 acc. to EN 10216-5

* Please check the responding chemical analysis modification with our technical department.
[ UNS N08811 is available on special request. ]

### 3.2 Chemical composition

DMV 800H contains:

| | %min | %max |
|---|---|---|
| **C** | 0.05 | 0.10 |
| **Si** | 0.20 | 0.60 |
| **Mn** | | 1.50 |
| **P** | | 0.015 |
| **S** | | 0.015 |
| **Cr** | 19.00 | 22.00 |
| **Ni** | 30.00 | 34.00 |
| **Al** | 0.20 | 0.60 |
| **Ti** | 0.20 | 0.60 |
| **Cu** | | 0.50 |
| **Fe** | 39.5 | |

### 3.3 Mechanical Properties

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

UNS N08800* acc. to ASTM B 407:
Cold worked annealed:

| | MPa | ksi |
|---|---|---|
| **0.2% Y.S. min.** | 205 | 30 |
| **U.T.S. min.** | 520 | 75 |
| **E in 2" min., %** | 30 | |

UNS N08800* acc. to ASTM B 407 and UNS N08810* acc. to ASTM B 407: Hot-finished annealed:

| | MPa | ksi |
|---|---|---|
| **0.2% Y.S. min.** | 170 | 25 |
| **U.T.S. min.** | 450 | 65 |
| **E in 2" min.** | 30 | |

Grade 1.4958 / 1.4959 according to EN 10216-5:

| | MPa | ksi |
|---|---|---|
| **0.2% Y.S. min.** | 170 | (25) |
| **1.0% Y.S. min.** | 200 | (29) |
| **U.T.S. min.** | 500 | (72) |
| **A** | 30% | |

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

#### 3.3.2 Tensile Properties at Elevated Temperature

Grade 1.4958 and 1.4959 acc. to EN 10216-5:

| Temp | | 0.2% Y.S. min | 1.0% Y.S. min |
|---|---|---|---|
| °C | (°F) | MPa (ksi) | MPa (ksi) |
| **100** | **(212)** | 140 (20.3) | 160 (23.2) |
| **150** | **(302)** | 127 (18.4) | 147 (21.3) |
| **200** | **(392)** | 115 (16.7) | 135 (19.6) |
| **250** | **(752)** | 105 (15.2) | 125 (18.1) |
| **300** | **(572)** | 95 (13.8) | 115 (16.7) |
| **350** | **(662)** | 90 (13.0) | 110 (15.9) |
| **400** | **(752)** | 85 (12.3) | 105 (15.2) |
| **450** | **(842)** | 82 (11.9) | 102 (14.8) |
| **500** | **(932)** | 80 (11.6) | 100 (14.5) |
| **550** | **(1022)** | 75 (10.9) | 95 (13.8) |

( )= calculated values

#### 3.3.3 Impact Test at 20C (68F)

Acc. to EN 10216-5 the notch impact energy at 20°C 68F) must be minimal
100 J in longitudinal and 60 J in transversal direction (average value of three samples with min. 70 J/cm2, longitudinal and 40 J/cm2 transversal individual value).

#### 3.3.4 Creep Rupture Strength

For grade 1.4958 and 1.4959 the following creep rupture strength values for 10,000 h and 100,000 h are listed in EN 10216-5:

**Grade 1.4958**

| Temp | | 10,000h | 100,000h |
|---|---|---|---|
| °C | (°F) | MPa (ksi) | MPa (ksi) |
| **500** | **(932)** | 290 (42.0) | 215 (31.2) |
| **550** | **(1022)** | 225 (32.6) | 160 (23.1) |
| **600** | **(1112)** | 140 (20.3) | 95 (13.8) |
| **650** | **(1202)** | 97 (14.1) | 63 (9.1) |
| **700** | **(1292)** | 69 (10.0) | 44 (6.4) |

( )= calculated values

**Grade 1.4959**

| Temp | | 10,000h | 100,000h |
|---|---|---|---|
| °C | (°F) | MPa (ksi) | MPa (ksi) |
| **700** | **(1292)** | 290 (42.0) | 215 (31.2) |
| **750** | **(1382)** | 225 (32.6) | 160 (23.1) |
| **800** | **(1472)** | 140 (20.3) | 95 (13.8) |
| **850** | **(1562)** | 97 (14.1) | 63 (9.1) |
| **900** | **(1652)** | 69 (10.0) | 44 (6.4) |
| **950** | **(1742)** | 69 (10.0) | 44 (6.4) |
| **1000** | **(1832)** | 69 (10.0) | 44 (6.4) |

( )= calculated values

## 3.4 Physical Properties

| Coefficient of Thermal Expansion between 20°C (68°F) and... | | | |
|---|---|---|---|
| Temperature | | $10^{-6}$/°K | $10^{-6}$/°F |
| °C | (°F) | | |
| **100** | **(212)** | 14.4 | (8.0) |
| **200** | **(392)** | 15.2 | (8.4) |
| **400** | **(752)** | 16.2 | (9.0) |
| **600** | **(1112)** | 17.0 | (9.4) |
| **800** | **(1472)** | 17.2 | (9.9) |
| **1000** | **(1832)** | 18.8 | (10.6) |

( ) = calculated values

| Thermal Conductivity | | | |
|---|---|---|---|
| Temperature | | W/(m°C) | Btu / (ft h °F) |
| °C | (°F) | | |
| **20** | **(68)** | 11.6 | (6.71) |
| **100** | **(212)** | 13.0 | (7.51) |
| **200** | **(392)** | 15.0 | (8.67) |
| **400** | **(752)** | 17.8 | (10.3) |
| **600** | **(1112)** | 21.0 | (12.1) |
| **800** | **(1472)** | 24.5 | (14.2) |
| **1000** | **(1832)** | 29.0 | (16.8) |

( ) = calculated values

| Modulus of Elasticity | | | |
|---|---|---|---|
| Temperature | | $10^3$ MPa | $10^3$ ksi |
| °C | (°F) | | |
| **20** | **(68)** | 198 | (28.7) |
| **100** | **(212)** | 193 | (28.0) |
| **200** | **(392)** | 187 | (27.1) |
| **400** | **(752)** | 173 | (25.1) |
| **600** | **(1112)** | 158 | (22.9) |
| **800** | **(1472)** | 144 | (20.9) |
| **1000** | **(1832)** | 127 | (18.4) |

( ) = calculated values

## 3.5 Corrosion Properties

For applications reinforcing high tem-perature oxidation the high chromium and nickel contents of DMV 800H make it eminently suitable for use in non sulphurous, oxidizing atmospheres up to 1000°C (1832°F) even under non isothermal conditions.

Since DMV 800H contains iron, it has a high resistance to internal oxidation, which normally affects Nickel–Chromium alloys.

In other atmospheres, like carburization due to the high Nickel and Chromium content, DMV 800H has a very good resistance: higher than that of 25% Cr-20% Ni steels. The protective oxide layer which is formed is adherent in both, static and cyclic conditions of heating and cooling. Resistance to carburization is enhanced as soon as a thin layer of oxide is formed on the surface.

Resistivity to hydrogen is excellent, so that DMV 800H is the preferred material used in the production of hydrogen in steam / hydrocarbon reforming processes.

DMV 800H also shows a good resistance in the presence of hydrogen sulphide up to about 400°C (752°F).

# 4. 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 |

## 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 Long lengths, '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 ensure complete recrystallization and a homogeneous chromium distribution, solution annealing should be carried out in a temperature range of 1150°C – 1200°C (2102°F – 2192°F). DMV 800H is susceptible to relaxation cracking if solution annealed materials are exposed to service temperatures within the range of 550°C – 750°C (1020°F – 1380°F).

During subsequent service a high degree of cold deformation and welding during fabrication enhances the susceptibility to relaxation cracking.

A stabilizing heat treatment at about 980°C (1800°F) for 3 hours has been shown to alleviate susceptibility to relaxation cracking. This has been proved for new material prior to fabrication and for material which has already been in service prior to repair welding.

As for all austenitic stainless steels, 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 800H is generally suitable for further cold or hot forming.

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

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.

To eliminate the risk of relaxation cracking, material exposed to service temperature above 550°C (1022°F) should obey strictly the mentioned instructions in chapter "5.1 Heat Treatment" of this datasheet.



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