

# DATA SHEET

## DMV 310 N

### 1 – Application

Designed for application as superheater and reheater boiler tube grade, DMV 310 N has proved to be suitable in most advanced coal fired power stations using steam temperatures of up to approximately 620°C (1148°F) in supercritical and ultra supercritical vessel designs.

### 2 – Main Features

- Austenitic nitrogen alloyed stainless steel
- Very good high temperature corrosion resistance
- Very good creep resistance at high temperatures, especially in the range of 600°C (1112°F) to 670°C (1238°F)

### 3 – Description

#### 3.1 Specifications

- 1.4952, X6CrNiNbN 25 20, European Steel registration
- Cases of ASME Boiler and Pressure vessel Code Case 2115-1, February 7, 2000, United States
- Following VdTÜV Material Data Sheet 546, 09.2003, Federal Republic of Germany

#### 3.2 Available Sizes

DMV 310 N is produced as seamless austenitic tube, suitable for all recently used austenitic reheater and superheater boiler tube sizes. Following VdTÜV Material Data Sheet 546, 09.2003, the max. outer diameter is 65 mm and the max. wall thickness is 12.5 mm. Other sizes are available on request.

#### 3.3 Chemical Composition

Mass % according ASME Case 2115-1, February 7, 2000

	% min.	% max.
<b>C</b>	0.04	0.10
<b>Si</b>		0.75
<b>Mn</b>		2.00
<b>P</b>		0.030
<b>S</b>		0.030
<b>Cr</b>	24.00	26.00
<b>Ni</b>	17.00	23.00
<b>Nb</b>	0.20	0.60
<b>N</b>	0.15	0.35

#### 3.4 Mechanical Properties

##### 3.4.1 At Solution Annealed Condition

According to ASME Case 2115-1, February 7, 2000

	MPa	ksi
<b>Y.S. min.</b>	(296)	43
<b>U.T.S. min.</b>	(655)	95
<b>E in 2", min., %</b>		30

1 MPa=1 N/mm<sup>2</sup> ; 1 ksi=6.9 MPa

( ) = calculated values

Following VdTÜV Material Data Sheet 546, 09.2003

	MPa	ksi
<b>0.2% Y.S. min.</b>	295	(42.8)
<b>1.0% Y.S. min.</b>	325	(47.8)
<b>U.T.S.</b>	655-900	(95 - 130.5)
<b>A %</b>		30

( ) = calculated values

##### 3.4.2 Impact Resistance

According to VdTÜV Material Data Sheet 546, 09.2003, the Impact resistance KV in longitudinal direction is min 85J. (Average value from 3 specimens. The average value may fall short only with one specimen, and only by max. 30%)

##### 3.4.3 At Elevated Temperature

Following VdTÜV Material Data Sheet 546, 09.2003

Temp. °C (°F)	0.2% Y.S. min. MPa (ksi)	1.0% Y.S. min. MPa (ksi)
<b>100 (212)</b>	240 (34.8)	265 (38.4)
<b>200 (392)</b>	205 (29.7)	230 (33.4)
<b>300 (572)</b>	190 (27.6)	210 (30.5)
<b>350 (662)</b>	190 (27.6)	210 (30.5)
<b>400 (752)</b>	180 (26.1)	200 (29.0)
<b>450 (842)</b>	175 (25.4)	195 (28.2)
<b>500 (932)</b>	170 (24.7)	190 (27.6)
<b>550 (1022)</b>	165 (23.9)	185 (26.8)
<b>600 (1112)</b>	160 (23.2)	180 (26.1)
<b>650 (1202)</b>	160 (23.2)	180 (26.1)
<b>700 (1292)</b>	155 (22.5)	175 (25.4)
<b>750 (1382)</b>	155 (22.5)	175 (25.4)

( ) = calculated values

# DATA SHEET

## DMV 310 N

### 3.4.4 Creep Strength Values

Creep Strength Values for 10,000 h and 100,000 h acc. to Material Datasheet VdTÜV 546, 09/2003.

Temp. °C (°F)	10,000h MPa (ksi)	100,000h MPa (ksi)
600 (1112)	284 (41.2)	184 (26.7)
610 (1130)	260 (37.7)	170 (27.7)
620 (1148)	238 (34.5)	154 (22.3)
630 (1166)	212 (30.7)	140 (20.3)
640 (1184)	190 (27.6)	126 (18.3)
650 (1202)	171 (24.8)	114 (16.5)
660 (1220)	154 (22.3)	102 (14.8)
670 (1238)	142 (20.6)	90 (13.1)
680 (1256)	130 (18.9)	82 (11.9)
690 (1274)	118 (17.1)	73 (10.6)
700 (1292)	108 (17.7)	66 (9.6)
710 (1310)	98 (14.2)	59 (8.6)
720 (1328)	89 (12.9)	53 (7.7)
730 (1346)	79 (11.5)	48 (7.0)
740 (1364)	71 (10.3)	43 (6.2)
750 (1382)	64 (9.3)	39 (5.7)

( ) = calculated values

### 3.4.5 Max. Allowable Stress Values

According ASME Case 2115-1, February 7, 2000.

Temperature °C (°F)	0.2% Y.S. min. MPa (ksi)
-28 – 37.8 (-20 to 100)	187 (27.1)
93.3 (200)	165 (24.0)
149 (300)	150 (21.7)
204 (400)	138 (20.2)
260 (500)	132 (19.2)
316 (600)	128 (18.5)

Temperature °C (°F)	0.2% Y.S. min. MPa (ksi)
343 (650)	126 (18.3)
371 (700)	125 (18.1)
399 (750)	123 (17.8)
427 (800)	121 (17.6)
454 (850)	120 (17.4)
482 (900)	118 (17.1)
510 (950)	117 (16.9)
538 (1000)	114 (16.6)
566 (1050)	112 (16.3)
593 (1100)	111 (16.1)
621 (1150)	94 (13.6)
649 (1200)	70 (10.1)
677 (1250)	52 (7.6)
704 (1300)	39 (5.7)
732 (1350)	30 (4.3)

( ) = calculated values

### 3.5 Physical Properties

Coefficient of Thermal Expansion following VdTÜV Material Data Sheet 546, 09.2003

...Temperature °C (°F)	10 <sup>-6</sup> /K	10 <sup>-6</sup> /°F
100 (212)	13.38	(7.43)
200 (392)	15.58	(8.66)
300 (572)	16.01	(8.89)
400 (752)	17.03	(9.46)
500 (932)	17.18	(9.54)
600 (1112)	17.51	(9.73)
700 (1292)	17.86	(9.92)
750 (1382)	18.02	(10.01)

( ) = calculated values

Thermal Conductivity following VdTÜV Material Data Sheet 546, 09.2003

Thermal Conductivity		
Temperature °C (°F)	W / (m°C)	Btu / (ft h °F)
20 (68)	12.1	(6.99)
100 (212)	13.4	(7.74)
200 (392)	15.1	(8.73)
300 (572)	16.7	(9.65)
400 (752)	18.2	(10.5)
500 (932)	19.8	(11.4)
600 (1112)	21.2	(12.3)
700 (1292)	24.0	(13.9)
750 (1382)	24.4	(14.1)

( ) = calculated values

Modulus of Elasticity following VdTÜV Material Data Sheet 546, 09.2003

Modulus of Elasticity		
Temperature °C (°F)	10 <sup>3</sup> MPa	10 <sup>3</sup> ksi
20 (68)	193	(28.0)
100 (212)	191	(27.7)
200 (392)	184	(26.7)
300 (572)	175	(25.4)
400 (752)	167	(24.2)
500 (932)	161	(23.3)
600 (1112)	150	(21.8)
700 (1292)	144	(20.9)
750 (1382)	141	(20.5)

( ) = calculated values

# DATA SHEET

## DMV 310 N

### 4 – Application Properties

#### 4.1 Heat Treatment

The solution annealing of the cold finished DMV 310 N meets the requirement of VdTÜV Material Data Sheet 546, where an annealing temperature between 1180°C (2156°F) and 1270°C (2318°F) is required. Additionally, the requirements of ASME Code Case 2115-1 are met where solution-treated at 2000°F (1093°C) minimum is specified.

#### 4.2 Corrosion Properties

DMV 310 N is designed for the application in furnace atmospheres at high temperature in the range of 600°C (1112°F) to 670°C (1238°F) and has a good corrosion resistance in such atmospheres.

#### 4.3 Tube Bending

DMV 310 N is generally suitable for further cold or hot forming. After hot forming a new solution annealing is necessary, in case the hot forming has not followed a controlled temperature process between 1175°C (2147°F) and 1250°C (2282°F).

Cold formed tubes have to be newly solution annealed if the forming degree is > 20% or the R/D ratio is < or equal 2.5. For corrosion reasons, it is recommended to perform a new solution annealing even following smaller forming degrees.

#### 4.4 Welding

Pre-heating and a heat treatment after welding are not necessary. To avoid hot cracks in the weld, the 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 considered.

### 5 – Specifications and References

DMV 310 N may be delivered in accordance with European Steel registration, grade 1.4952, X6CrNiNbN 25 20, cases of ASME Boiler and Pressure vessel Code Case 2115-1, and following VdTÜV Material Data Sheet 546, 09.2003. Frequently the DMV 310 N is delivered according to project specific customer specifications.

Customers	Power Plant	Qty [t]	Del.
National Power	West Burton	51	1993
National Power	Drax and Tilbury	24	1994
Powergen	Ratcliffe on Soar	10	1996
Mitsui Babcock	Renfrew Scotland	36	1996
Babcock Hitachi Europe	Nieder- aussem	430	2004
Kvaerner	Shotton	13	2005
Kvaerner	Chappelle	13	2005
Kvaerner	Raume	17	2005
Kvaerner	Pitea	52	2005
Harbin Boiler	Tieling 1	130	2006
Harbin Boiler	Kanshan 1 & 2	204	2006
Dongfang Boiler Works	Suizhong Unit 1	113	2007
Dongfang Boiler Works	Beilun 1	120	2007
Harbin Boiler	Wuhu Unit 1	140	2007
Mitsui Babcock	Tremble County	620	2007
Dongfang Boiler Works	Beilun 2	110	2008
Dongfang Boiler Works	Suizhong Unit 2	111	2008
Dongfang Boiler Works	Laizhou 1 + 2	225	2008
Slovenské energetické strojárne	Hoechst	218	2008

Further information on projects is available upon request.

# DATA SHEET

## DMV 310 N

QUALITY IN ROUND TERMS.

## Contact

### Headquarters

#### Salzgitter Mannesmann Stainless Tubes GmbH

Wiesenstraße 36  
45473 Mülheim an der Ruhr  
Germany

Tel.: +49 208 458 01  
Fax: +49 208 458 2640  
www.smst-tubes.com

### Sales Contacts

#### Salzgitter Mannesmann Stainless Tubes Italia S.r.l.

Via Piò 30  
24062 Costa Volpino (BG)  
Italy  
Tel.: +39 035 975 744  
Fax: +39 035 975 803  
Email: salesitaly@smst-tubes.com

#### Salzgitter Mannesmann Stainless Tubes Deutschland GmbH

Wiesenstraße 36  
45473 Mülheim an der Ruhr  
Germany  
Tel.: +49 208 458 2611  
Fax: +49 208 458 2641  
Email: salesgermany@smst-tubes.com

#### Salzgitter Mannesmann Stainless Tubes France SAS

Route de Semur  
21500 Montbard  
France  
Tel.: +33 3 80 89 52 00  
Fax: +33 3 80 89 52 26  
Email: salesfrance@smst-tubes.com

#### Salzgitter Mannesmann Stainless Tubes USA, Inc.

12050 West Little York  
Houston Texas 77041  
USA  
Tel.: +1 713 466 7278  
Fax: +1 713 466 3769  
Email: salesusa@smst-tubes.com

Whilst every care has been taken in compiling the technical information in this brochure, due to the continuing development and complex nature of the various factors used, it is given for information only. Our company cannot be held responsible for the information contained herein and our customers should carefully check for themselves where necessary in order to make the appropriate selection, bearing in mind the conditions governing the fabrication of our alloys as well as the conditions in service. Information held in this datasheet can be changed without notice.