

# DATA SHEET

## DMV 304 HCu

### 1 – Application

DMV 304 HCu has been designed for application as superheater and reheater boiler tube grade. 304 HCu has proved to be suitable in most advanced coal fired power stations using steam temperatures of up to approximately 600°C (1112°F) in supercritical and ultra supercritical vessel designs.

### 2 – Main Features

- Austenitic stainless steel alloyed with Copper and Boron to increase the creep strength
- Very good high temperature corrosion resistance
- Very good creep resistance at high temperatures, specially in the range of 580°C (1076°F) to 640°C (1184°F)
- Inner surface shot peening treatment possible upon request

### 3 – Description

#### 3.1 Specifications

- 1.4907, X10CrNiCu Nb 18 9 3, European Steel registration
- Cases of ASME Boiler and Pressure vessel Code Case 2328-1, March 6, 2003, United States
- Following VdTÜV Material Data Sheet 550, 09.2003, Federal Republic of Germany

#### 3.2 Available Sizes

DMV 304 HCu is produced as seamless austenitic tube, suitable for all recently used austenitic reheater and superheater boiler tube sizes. Following VdTÜV Material Data Sheet 550, 09.2003, the max. outer diameter is 65 mm and the max. wall thickness is 12.5 mm. Other sizes are available upon request.

#### 3.3 Chemical Composition

Mass % according ASME Case 2328-1, March 6, 2003

	% min.	% max.
<b>C</b>	0.07	0.13
<b>Si</b>		0.30
<b>Mn</b>		1.00
<b>P</b>		0.040
<b>S</b>		0.010
<b>Cr</b>	17.00	19.00
<b>Ni</b>	7.50	10.50
<b>Nb(Cb)</b>	0.30	0.60
<b>Cu</b>	2.50	3.50
<b>N</b>	0.05	0.12
<b>Al</b>	0.003	0.030
<b>B</b>	0.001	0.010

#### 3.4 Mechanical Properties

##### 3.4.1 At Solution Annealed Condition

According ASME Code Case 2328-1

	MPa	ksi
<b>Y.S. min.</b>	(235)	34
<b>U.T.S. min.</b>	(590)	85
<b>E in 2", min., %</b>	35	

1 MPa=1 N/mm<sup>2</sup> ; 1 ksi=6.9 MPa  
( ) = calculated values

Following VdTÜV Material Data Sheet 550, 09.2003

	MPa	ksi
<b>0.2% Y.S. min.</b>	235	(34.1)
<b>1.0% Y.S. min.</b>	270	(39.2)
<b>U.T.S.</b>	590 - 850	(85.6 - 123.3)
<b>A %</b>	35	

( ) = calculated values

##### 3.4.2 Impact Resistance

According VdTÜV Material Data Sheet 550, 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%)

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### 3.4.3 At Elevated Temperature

Following VdTÜV Material Data Sheet 550, 09.2003

Temp. °C (°F)	0.2% Y.S. min. MPa (ksi)	1.0% Y.S. min. MPa (ksi)
100 (212)	205 (29.7)	230 (33.4)
200 (392)	180 (26.1)	205 (29.7)
300 (572)	170 (24.7)	195 (28.2)
400 (752)	160 (23.2)	185 (26.8)
500 (932)	150 (21.8)	175 (25.4)
550 (1022)	145 (21.0)	170 (24.7)
600 (1112)	140 (20.3)	165 (23.9)
650 (1202)	135 (19.6)	160 (23.2)
700 (1292)	135 (19.6)	160 (23.2)
750 (1382)	125 (18.1)	150 (21.8)

( ) = calculated values

### 3.4.4 Creep Strength Values

Average preliminary creep strength values for 10,000 h and 100,000 h acc. to VdTÜV Material Data Sheet 550, 09.2003. The lower scale band can be estimated as 20% lower than average values.

Temp. °C (°F)	10,000h MPa (ksi)	100,000h MPa (ksi)
600 (1112)	240 (34.8)	182 (26.4)
610 (1130)	222 (32.2)	165 (23.9)
620 (1148)	206 (29.9)	152 (22.0)
630 (1166)	192 (28.4)	139 (20.2)
640 (1184)	174 (25.2)	126 (18.3)
650 (1202)	160 (23.2)	116 (16.8)
660 (1220)	146 (21.2)	105 (15.2)
670 (1238)	134 (19.4)	96 (13.9)
680 (1256)	124 (18.0)	86 (12.5)
690 (1274)	114 (16.5)	78 (11.3)
700 (1292)	101 (14.6)	68 (9.9)
710 (1310)	92 (13.3)	61 (8.8)
720 (1328)	84 (12.2)	54 (7.8)
730 (1346)	76 (11.0)	48 (7.0)
740 (1364)	68 (9.9)	42 (6.1)
750 (1382)	61 (8.8)	37 (5.4)

( ) = calculated values

### 3.5 Physical Properties

Coefficient of Thermal Expansion following VdTÜV Material Data Sheet 550, 09.2003

Coefficient of Thermal Expansion between 20°C and ...		
...Temp. °C (°F)	10 <sup>-6</sup> /°K	10 <sup>-6</sup> /°F
100 (212)	16.4	(9.11)
200 (392)	17.1	(9.50)
300 (572)	17.5	(9.72)
400 (752)	17.8	(9.89)
500 (932)	18.1	(10.1)
600 (1112)	18.4	(10.2)
700 (1292)	18.6	(10.3)
750 (1382)	18.7	(10.4)

( ) = calculated values

Thermal Conductivity following VdTÜV Material Data Sheet 550, 09.2003

Thermal Conductivity		
Temperature °C (°F)	W / (m°C)	Btu / (ft h °F)
20 (68)	14.5	(8.38)
100 (212)	16.2	(9.36)
200 (392)	19.4	(11.2)
300 (572)	21.5	(12.4)
400 (752)	23.0	(13.3)
500 (932)	25.2	(14.6)
600 (1112)	28.6	(16.5)
700 (1292)	31.0	(17.9)
750 (1382)	31.0	(17.9)

( ) = calculated values

Modulus of Elasticity following VdTÜV Material Data Sheet 550, 09.2003

Modulus of Elasticity		
Temperature °C (°F)	10 <sup>3</sup> MPa	10 <sup>3</sup> ksi
20 (68)	189	(27.4)
100 (212)	182	(26.4)
200 (392)	174	(25.2)
300 (572)	165	(23.9)
400 (752)	156	(22.6)
500 (932)	149	(21.6)
600 (1112)	141	(20.5)
700 (1292)	134	(19.4)
750 (1382)	130	(18.9)

( ) = calculated values

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### 4 – Application Properties

#### 4.1 Heat Treatment

The heat treatment of cold finished DMV 304 HCu meets the requirement of VdTÜV Material Data Sheet 550, where an annealing temperature of the tubes between 1100°C (2012°F) and 1180°C (2156°F) is required. Additionally, the requirements of ASME Code Case 2328-1 are met where solution-treatment at 2000°F (1093°C) minimum is specified.

#### 4.2 Corrosion Properties

DMV 304 HCu is designed for the application in furnace atmospheres at high temperature in the range of 580°C (1076°F) to 640°C (1184°F) and has a good corrosion resistance in such atmospheres.

#### 4.3 Tube Bending

DMV 304 HCu 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 1100°C (2012°F) and 1150°C (2102°F).

Following the VdTÜV Material Data Sheet 550, 09.2003 cold formed tubes have to be newly solution annealed if the forming degree is > 25% or the R/D ratio is < or equal 2.0. 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 metal, 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 304 HCu may be delivered in accordance with European Steel registration, grade 1.4907, X10CrNiCu Nb 18 9 3, cases of ASME Boiler and Pressure vessel 2328-1, and following VdTÜV Material Data Sheet 550, 09.2003

Frequently the DMV 304 HCu is delivered according to project specific customer specifications.

Customer	Power Plant	Qty [t]	Del.
Harbin Boiler	Tieling 1	517	2006
Harbin Boiler	Kanshan 1&2	940	2006
Dongfang Boiler Works	Beilun 1	528	2007
Harbin Boiler	Tieling 2	550	2007
Alstom	Belchatow	575	2007
Harbin Boiler	Wuhu 1	609	2007
Harbin Boiler	Heyuan	320	2008
Dongfang Boiler Works	Beilun 2	515	2008
Dongfang Boiler Works	Suizhong 1+2	1014	2008
Dongfang Boiler Works	Laizhou 1 + 2	1007	2008
Harbin Boiler	Lusigang	1546	2008
Harbin Boiler	Chaozhou	353	2008
Harbin Boiler	Xiaguan	389	2008

Further information on projects is available upon request.

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## DMV 304 HCu

QUALITY IN ROUND TERMS.

## Contact

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