

DATA SHEET

DMV 347 HFG

1 – Application

DMV 347 HFG has been designed for application as superheater and reheater boiler tube grade. 347 HFG 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 with a fine grain structure of No. 7 – 10 according to ASTM E112 after a thermomechanical treatment of softening, cold finishing and solution annealing
- 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)

3 – Description

3.1 Specifications

- 1.4908, X8CrNi 19 11, European Steel registration
- TP347HFG according ASME SA-213/SA-213M, Specification for seamless ferritic and austenitic alloy-steel boiler, superheater, and heat-exchanger tubes, United States
- Following VdTÜV Material Data Sheet 547, 06.2003, Federal Republic of Germany

3.2 Available Sizes

DMV 347 HFG is produced as seamless austenitic tube, suitable for all recently used austenitic reheater and superheater boiler tube sizes. Following VdTÜV Material Data Sheet 547, 06.2003, 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 SA-213/SA-213M

	% min.	% max.
C	0.06	0.10
Si		0.75
Mn		2.00
P		0.040
S		0.030
Cr	17.00	20.00
Ni	9.00	13.00
Nb(Cb) + Ta	8 x C	1.0

3.4 Mechanical Properties

3.4.1 At Solution Annealed Condition

According ASME SA-213/SA-213M

	MPa	ksi
Y.S. min.	(205)	30
U.T.S. min.	(550)	80
E in 2", min., %		35

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

Following VdTÜV Material Data Sheet 547, 06.2003

	MPa	ksi
0.2% Y.S. min.	205	(29.7)
1.0% Y.S. min.	240	(34.8)
U.T.S.	550 - 750	(78.8 - 108.8)
A %		35

() = calculated values

3.4.2 Impact Resistance

According to VdTÜV Material Data Sheet 547, 06.2003, 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 547, 06.2003

Temp. °C (°F)	0.2% Y.S. min. MPa (ksi)	1.0% Y.S. min. MPa (ksi)
100 (212)	182 (24.4)	217 (31.5)
200 (392)	163 (23.6)	198 (28.7)
300 (572)	152 (22.0)	187 (27.1)
350 (662)	148 (21.5)	173 (25.1)
400 (752)	143 (20.7)	173 (25.1)
450 (842)	139 (20.2)	164 (23.8)
500 (932)	136 (19.7)	161 (23.3)
550 (1022)	134 (19.4)	159 (23.1)
600 (1112)	131 (19.0)	156 (22.6)
650 (1202)	126 (18.3)	151 (21.9)
700 (1292)	122 (17.7)	147 (21.3)
750 (1382)	117 (17.0)	142 (20.6)

() = calculated values

3.4.4 Creep Strength Values

Creep Strength Values for 10,000 h and 100,000 h acc. to Material Datasheet VdTÜV 547, 06/2003.

Temp. °C (°F)	10,000h MPa (ksi)	100,000h MPa (ksi)
600 (1112)	215 (31.2)	159 (23.1)
610 (1130)	197 (28.8)	145 (21.0)
620 (1148)	182 (26.4)	134 (19.4)
630 (1166)	168 (24.4)	120 (17.4)
640 (1184)	155 (22.5)	109 (15.8)
650 (1202)	142 (20.6)	100 (14.5)
660 (1220)	130 (18.9)	90 (13.1)
670 (1238)	119 (17.3)	81 (11.7)
680 (1256)	108 (15.7)	72 (10.4)
690 (1274)	99 (14.4)	65 (9.4)

Temp. °C (°F)	10,000h MPa (ksi)	100,000h MPa (ksi)
700 (1292)	90 (13.1)	58 (8.4)
710 (1310)	81 (11.7)	51 (7.4)
720 (1328)	74 (10.7)	46 (6.7)
730 (1346)	66 (9.6)	40 (5.8)
740 (1364)	59 (8.6)	34 (4.9)
750 (1382)	53 (7.7)	30 (4.4)

() = calculated values

3.5 Physical Properties

Coefficient of Thermal Expansion following VdTÜV Material Data Sheet 547, 06.2003

Coefficient of Thermal Expansion between 20°C and ...		
...Temperature °C (°F)	10 ⁻⁶ /K	10 ⁻⁶ /°F
100 (212)	16.3	(9.06)
200 (392)	16.9	(9.39)
300 (572)	17.3	(9.61)
400 (752)	17.8	(9.89)
500 (932)	18.21	(10.1)
600 (1112)	18.5	(10.3)
700 (1292)	18.7	(10.4)
750 (1382)	18.8	(10.4)

() = calculated values

Thermal Conductivity following VdTÜV Material Data Sheet 547, 06.2003

Thermal Conductivity		
Temperature °C (°F)	W / (m°C)	Btu / (ft h °F)
20 (68)	14.1	(8.47)
100 (212)	15.4	(8.90)
200 (392)	16.9	(9.77)
300 (572)	18.3	(10.5)
400 (752)	19.7	(11.4)
500 (932)	21.2	(12.3)
600 (1112)	22.6	(13.1)
700 (1292)	23.8	(13.8)
750 (1382)	24.6	(14.2)

() = calculated values

Modulus of Elasticity following VdTÜV Material Data Sheet 547, 06.2003

Modulus of Elasticity		
Temperature °C (°F)	10 ³ MPa	10 ³ ksi
20 (68)	200	(29.0)
100 (212)	190	(27.6)
200 (392)	185	(26.8)
300 (572)	175	(25.4)
400 (752)	170	(24.7)
500 (932)	160	(23.2)
600 (1112)	155	(22.5)
700 (1292)	145	(21.0)
750 (1382)	140	(20.3)

() = calculated values

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4 – Application Properties

4.1 Heat Treatment

The heat treatment of cold finished DMV 347 HFG comprises a softening heat treatment prior to cold finishing, and a solution heat treatment after final cold finishing. During the hot forming process, the softening is performed using a temperature of min. 50°C (90°F) above the final solution annealing temperature. The solution annealing of the cold finished tube meets the requirement of VdTÜV Material Data Sheet 547, where an annealing temperature between 1180°C (2150°F) and 1250°C (2282°F) is required and also the requirements of ASME SA-213/SA-213M.

4.2 Corrosion Properties

DMV 347 HFG 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 347 HFG 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 1170°C (2138°F) and 1210°C (2210°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 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.

Customers	Power Plant	Qty [t]	Del.
Foster Wheeler	Narva 1	100	2002
Burmeister & Wain Energy	Amager – Vaerket Unit 1	70	2006
Bioener	Fynsvaerket Unit 8	65	2007
Foster Wheeler	Jyväskylä	96	2007

Further information on projects is available upon request.

5 – Specifications and References

DMV 347 HFG may be delivered in accordance with European Steel registration, 1.4908, X8CrNi 19 11, TP347HFG according to ASME SA-213/SA-213M, and following VdTÜV Material Data Sheet 547, 06.2003. Frequently the DMV 347 HFG will be delivered according to project specific customer specifications.

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QUALITY IN ROUND TERMS.

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