



DMV 347HFG

1. Applications

DMV 347HFG is designed for applications such as superheater and reheater boiler tubes.

DMV 347HFG is proven to be suitable in most advanced biomass and coal fired boilers using steam temperatures up to 570°C (1058°F) in supercritical vessel designs.

| | | | |
|-------------------------------------|-------------------------------|----------------------------------|-------------------------------|
| Carbon C 0.06 - 0.10 | Chromium Cr 18.5 | Nickel Ni 11 | |
| Niobium Nb+Ta Tantalum | Carbon =8xC min | | |
| Manganese Mn 2 | Silicon Si 0.75 | Phosphorus P <0.040 | Sulfur S S<0.030 |

Chemical composition nominal %

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 fireside corrosion resistance together with good steam oxidation 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, UNS S34710
- 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 347HFG is produced as a seamless austenitic tube with a dimensional range covering all common austenitic reheater and superheater boiler tube sizes. Following VdTÜV Material Data Sheet 547, the max. outer diameter is 65mm and the max. wall thickness is 12.5mm.

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 | 8xC | 1.0 |

3.4 Mechanical Properties

3.4.1 Tensile Properties at 20C (68F) 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.

| | 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 Tensile Properties at Elevated Temperature

Following VdTÜV Material Data Sheet 547.

| 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 | (572) | 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 | (1292) | 117 (17.0) | 142 (20.6) |

() = calculated values

3.4.3 Impact Test at 20C (68F)

According to VdTÜV Material Data Sheet 547, 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%).

3.4.4 ASME Code Case 2159-2 maximum allowable stresses at elevated temperatures.

| Temp | | MAX allowable stresses | | MAX allowable stresses 2) | |
|------------|------------------|------------------------|-------------------|---------------------------|-------------------|
| °F | °C ¹⁾ | ksi | MPa ¹⁾ | ksi ²⁾ | MPa ¹⁾ |
| -20 to 100 | -29 to 38 | 20 | 137.9 | - | - |
| 200 | 93 | 18.1 | 124.8 | 20 | 137.9 |
| 300 | 149 | 16.9 | 116.5 | 20 | 137.9 |
| 400 | 204 | 15.9 | 109.6 | 19.9 | 137.2 |
| 500 | 260 | 15.2 | 104.8 | 19.3 | 133.1 |
| 600 | 316 | 14.6 | 100.7 | 19.1 | 131.7 |
| 650 | 343 | 14.4 | 99.3 | 19.0 | 131.0 |
| 700 | 371 | 14.1 | 97.2 | 18.9 | 130.3 |
| 750 | 399 | 13.9 | 95.8 | 18.8 | 129.6 |
| 800 | 427 | 13.8 | 95.1 | 18.6 | 128.2 |
| 850 | 454 | 13.6 | 93.8 | 18.3 | 126.2 |
| 900 | 482 | 13.4 | 92.4 | 18.1 | 124.8 |
| 950 | 510 | 13.3 | 91.7 | 17.9 | 123.4 |
| 1000 | 538 | 13.1 | 90.3 | 17.7 | 122.0 |
| 1050 | 566 | 13.0 | 89.6 | 17.5 | 120.7 |
| 1100 | 593 | 12.8 | 88.3 | 16.6 | 114.5 |
| 1150 | 621 | 12.6 | 86.9 | 12.8 | 88.3 |
| 1200 | 649 | 9.7 | 66.9 | 9.7 | 66.9 |
| 1250 | 677 | 7.3 | 50.3 | 7.3 | 50.3 |
| 1300 | 704 | 5.4 | 37.2 | 5.4 | 37.2 |
| 1350 | 732 | 4.0 | 27.6 | 4.0 | 27.6 |

1) calculated values 2) increased deformation (1%) acceptable

3.4.5 Creep Rupture Strength

Average preliminary creep strength Values for 10,000 h and 100,000 h acc. to Material Datasheet VdTÜV 547.

| Temp | | 10,000h | 100,000h |
|------|--------|------------|------------|
| °C | (°F) | MPa (ksi) | 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) |
| 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

While our Company has compiled and organized this data to the best of its knowledge, the data is provided on an "as is" basis only. To the fullest extent permissible by applicable law, we neither make any representation nor give any warranty -neither express, implied or statutory- regarding this data, including, but not limited to, with respect to completeness, accuracy, reliability, security, timeliness, fitness or suitability for any particular purpose, merchantability or any decisions you may make based on it. To the same extent, our company does not assume any other liability regarding this data for any direct, indirect or consequential or any other losses or damages of whatsoever kind (whether based on contract, tort, delict, warranty or any other legal theory) resulting from its use. The use of this data is at your own risk, unless otherwise agreed in writing. Our company reserves the right to modify its content at its own discretion at any time and without prior notice.

3.5 Physical Properties

Coefficient of Thermal Expansion following VdTÜV Material Data Sheet 547.

| Coefficient of Thermal Expansion between 20°C (68°F) and... | | | |
|---|--------|----------------------|----------------------|
| Temperature | | 10 ⁻⁶ /°K | 10 ⁻⁶ /°F |
| °C | (°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.

| Thermal Conductivity | | | |
|----------------------|--------|---------|-----------------|
| Temperature | | W/(m°C) | Btu / (ft h °F) |
| °C | (°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.

| Modulus of Elasticity | | | |
|-----------------------|--------|---------------------|---------------------|
| Temperature | | 10 ³ MPa | 10 ³ ksi |
| °C | (°F) | | |
| 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

4 Application Properties

4.1 Heat Treatment

The heat treatment of cold finished DMV 347HFG 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 347HFG is designed for application in furnace atmospheres at high temperatures 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 347HFG 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.

For further details on DMV 347HFG download our comprehensive reference booklet DMV 347HFG.

Material solutions and tube expertise

DMV
tubes@dmv-tubes.com
Tel. +49 208 458 01
www.dmv-tubes.com

