MANNESMANN
STAINLESS TUBES
A Member of the Salzgitter Group

DMV 617 mod

1. Application

DMV 617 mod is a solid-solution, strengthened, nickel-chromium-cobalt molybdenum alloy designed for application super-heater and reheater boiler applications.
DMV 617 mod is suitable for the most advanced coal fired power stations using steam temperatures of approximately 700°C (1300°F) in advanced ultra supercritical vessel designs.

Carbon	Chromium	Cobalt	Molybdenum
C	Cr	Co	Mo
0.07	22	12	9
Titanium	**Aluminium**	**Iron**	**Nickel**
Ti	Al	Fe	Ni
0.4%	1.0%	<1.5%	balance
Manganese	**Silicon**	**Phosphorus**	**Sulfur**
Mn	Si	P	S
<0.3	<0.3	<0.012	<0.008

Chemical composition nominal %

2. Main Features

- Nickel Base material
- Excellent high temperature strength and creep strength up to 800°C (1472°F)
- Very good high temperature oxidation resistance
- Very good resistance against carburisation up to 1100°C (2000°F)
- Good weldability

3. Description

3.1 Specifications

- 2.4663, Ni Cr23Co12Mo
- ASTM B167-08, UNS N06617
- ASME SB-167
- VdTÜV Material Datasheet 485, Federal Republic of Germany
- ISO Ni Cr22Co12Mo9

3.2 Available Sizes

DMV 617 mod is produced as seamless Ni Base tube, suitable for all recently used austenitic reheater and superheater boiler tube sizes. Following VdTÜV Material Datasheet 485, 09.2001, the max. outer diameter is 150 mm and the max. wall thickness is 17 mm. Other sizes are available on request.

3.3 Chemical Composition

DMV 617 mod typical values:

	Weight %
Cr	22.0
Co	12
Mo	9
Ti	0.4
Al	1.0
C	0.07
Fe	< 1.5
Mn	< 0.3
Si	< 0.3
P	< 0.012
S	< 0.008
N	< 0.05
B	< 0.010
Ni	balance

3.4 Mechanical Properties

3.4.1 Tensile Properties at 20C (68F) Annealed Condition

According to ASME SB-167.

	MPa	ksi
0.2% Y.S. min.	240	35
U.T.S. min.	665	95
E in 2" min., %	35	

According VdTÜV Datasheet 485, 09.2001.

	MPa	ksi
Y.S. min.	170	(43)
U.T.S. min.	700	(101)
A (%)	35	

1 MPa=1 N/mm^2 ; 1 ksi=6.9 MPa
( ) = calculated values

3.4.2 Tensile Properties at Elevated Temperature

According VdTÜV Datasheet 485.

Temp		0.2% Y.S. min	1.0% Y.S. min
°C	(°F)	MPa (ksi)	MPa (ksi)
100	**(212)**	270 (39.1)	300 (43.5)
200	**(392)**	230 (33.3)	260 (37.7)
300	**(572)**	220 (31.9)	250 (36.2)
350	**(662)**	215 (31.2)	245 (35.5)
400	**(752)**	210 (30.4)	240 (34.8)
450	**(842)**	205 (29.7)	230 (33.3)
500	**(932)**	290 (42.0)	215 (31.2)
550	**(1022)**	195 (28.3)	220 (31.9)
600	**(1112)**	190 (27.5)	210 (30.4)
650	**(1202)**	187 (27.1)	207 (30.0)
700	**(1292)**	185 (26.8)	205 (29.7)
750	**(1382)**	180 (26.1)	200 (29.0)

( ) = calculated values

3.4.3 Impact Test at 20C (68F)

According to VdTÜV Material Datasheet 485, 09.2001, the Impact resistance KV in longitudinal direction is min 120 J. (Average value from 3 specimens. The average value may fall short only with one specimen, and only by max. 30%).

3.4.4 Creep Rupture Strength

Creep Strength Values for 10,000 h and 100,000 h acc. to Material Datasheet VdTÜV 485, 09.2001.

Temp		10,000h	100,000h
°C	(°F)	MPa (ksi)	MPa (ksi)
600	**(1112)**	260 (37.1)	190 (27.5)
610	**(1130)**	240 (34.8)	170 (24.6)
620	**(1148)**	220 (31.9)	155 (22.5)
630	**(1166)**	200 (29.0)	143 (20.7)
640	**(1184)**	185 (26.8)	133 (19.3)
650	**(1202)**	170 (24.6)	125 (18.1)
660	**(1220)**	160 (23.2)	119 (17.2)
670	**(1238)**	150 (21.7)	113 (16.4)
680	**(1256)**	141 (20.4)	107 (15.5)
690	**(1274)**	132 (19.1)	101 (14.6)
700	**(1292)**	123 (17.8)	95 (13.8)
710	**(1310)**	116 (16.8)	89 (12.9)
720	**(1328)**	109 (15.8)	83 (12.0)
730	**(1346)**	102 (14.8)	77 (11.2)
740	**(1364)**	96 (13.9)	71 (10.3)
750	**(1382)**	90 (13.0)	65 (9.4)
800	**(1472)**	65 (9.4)	43 (6.2)
850	**(1562)**	45 (6.5)	27 (3.9)

3.4.5 Creep Strength Values

According Survey of MFI-WM, 11.12.03, accepted for applications acc. to PED 97/23/EC.

Temp		10,000h	100,000h
°C	(°F)	MPa (ksi)	MPa (ksi)
600	(1112)	331 (48.0)	265 (38.4)
610	(1130)	317 (45.9)	249 (36.1)
620	(1148)	303 (43.9)	233 (33.8)
630	(1166)	289 (41.9)	218 (31.6)
640	(1184)	274 (39.7)	202 (29.3)
650	(1202)	259 (37.5)	187 (27.1)
660	(1220)	244 (35.4)	172 (24.9)
670	(1238)	229 (33.2)	158 (22.9)
680	(1256)	214 (31.0)	145 (21.0)
690	(1274)	199 (28.8)	132 (19.1)
700	(1292)	185 (26.8)	119 (17.2)
710	(1310)	171 (24.8)	108 (15.7)
720	(1328)	158 (22.9)	97 (14.1)
730	(1346)	145 (21.0)	87 (12.6)
740	(1364)	132 (19.1)	77 (11.2)
750	(1382)	121 (17.5)	69 (10.0)

( ) = calculated values

3.5 Physical Properties

Coefficient of Thermal Expansion following VdTÜV Material Datasheet 485.

Coefficient of Thermal Expansion between 20°C (68°F) and...			
Temperature		10^{-6}/°K	10^{-6}/°F
°C	(°F)		
100	(212)	12.4	(6.9)
300	(572)	13.3	(7.4)
500	(932)	14.0	(7.8)
600	(1112)	14.4	(8.0)
700	(1292)	15.1	(8.4)
800	(1472)	15.7	(8.7)
900	(1652)	16.3	(9.0)
1000	(1832)	16.9	(9.3)

( ) = calculated values, 1/°F = 1.8/K and 1 W/m°C) = 0.5779 Btu (ft h °F)

Thermal Conductivity following VdTÜV Material Datasheet 485.

Thermal Conductivity			
Temperature		W/(m°C)	Btu / (ft h °F)
°C	(°F)		
20	(68)	10	(5.8)
100	(212)	12	(6.9)
300	(572)	15	(8.7)
500	(932)	19	(11.0)
600	(1112)	21	(12.1)
700	(1292)	23	(13.3)
800	(1472)	25	(14.4)
900	(1652)	27	(15.6)
1000	(1832)	29	(16.8)

1W/(m°C) = 0,5779 Btu/(ft h °F)
( ) = calculated values

Modulus of Elasticity following VdTÜV Material Datasheet 485.

Modulus of Elasticity			
Temperature		10^3 MPa	10^3 ksi
°C	(°F)		
20	(68)	215	(31.1)
100	(212)	211	(30.6)
300	(572)	198	(28.7)
500	(932)	185	(26.8)
600	(1112)	177	(25.7)
700	(1292)	169	(24.5)
800	(1472)	160	(23.2)
900	(1652)	152	(22.0)
1000	(1832)	143	(20.7)

( ) = calculated values

4. Application Properties

4.1 Heat Treatment

The solution annealing of the cold finished DMV 617 mod meets the requirement of VdTÜV Material Datasheet 485, where an annealing temperature between 1140°C (2084°F) and 1200°C (2192°F) is required. Additionally, the requirements of ASME SB 167 are met where solution-treated at 2100 – 2250°F (1150 – 1232°C) is specified.

Work pieces must be free of any kind of contamination before or during any heat treatment.

DMV 617 mod is susceptible to relaxation cracking if new solution annealed and welded pipes and tubes are exposed to service temperatures within the temperature range of 550 – 780°C (1020 – 1436°F) without prior postweld stabilizing heat treatment (PWHT) at 980°C (1800°F) for 3 hrs. The heating and cooling rates for such stabilizing heat treatments are not critical. The subsequent service temperature range within relaxation cracking may occur, extents further to 500 – 780°C (932 – 1436°F), if products are reused which have already been in service and which have been repair welded with matching alloy 617 consumables without a following stabilizing heat treatment at 980°C (1800°F) for 3 hrs.

4.2 Corrosion Properties

The DMV 617 mod is designed for the application in furnace atmospheres at high temperature in the range up to 1100°C (2012°F) and has a good oxidation and carburization resistance.

4.3 Tube Bending

DMV 617 mod is generally suitable for further cold or hot forming. Hot and cold working requires high power machines due to the high mechanical properties of the material.

4.3.1 Hot working

Hot working should be done in a temperature range of 1200 to 950°C (2190 – 1740°C), followed by water quench or rapid air cooling. Heat treatment after hot working is recommended to obtain optimum properties.

4.3.2 Cold working

After cold reduction of more than 10%, or more than 5% for applications at temperatures above 900°C (1650°F) solution annealing is required before use.

4.4 Welding

Pre-heating and a heat treatment after welding are normally 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.

Details on our extensive Customer and project references available upon request.

Mannesmann Stainless Tubes
info@mst.mannesmann.com
Tel. +49 208 458 01
www.mannesmann-stainless-tubes.com

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