



## **Seamless stainless instrumentation tubing**

# Seamless stainless instrumentation tubing

DMV Instrumentation Tubing is produced between the ranges of 6 x 1 mm to 76 x 2.9 mm sizes from five grades of stainless steel to cater for the majority of specialist industrial uses. This tubing has a multitude of uses throughout the following industries:

## Transportation systems

- Automotive
- Railway
- Shipping construction
- Aircraft

## Mechanical Engineering

- Factory facilities
- High pressure applications

## Materials

The standard austenitic stainless grades used for these applications are as follows:

### DMV 304 H

For DMV 304 H the carbon content is increased up to 0.08%. This chemical analysis enables this stainless steel grade higher mechanical values compared to DMV 304 L.

### DMV 304 L

The internal limits of the chemical analysis of all DMV grades are more restricted as prescribed in the international standards. These actions warranty a reduction of precipitations and improve clearly the corrosion resistance and weldability of DMV 304 L.

### DMV 316 L

The minimum content of molybdenum for DMV 316 L is defined by 2.25wt%. The addition of this element improves specially the pitting and crevice corrosion resistance compared to DMV 304 L.

### DMV 316 Ti

The grade DMV 316 Ti is stabilised by titanium. Like DMV 316 L this grade shows a good corrosion resistance, but a better pitting and crevice resistance in non oxidising acids.

### DMV 321

DMV 321 is also a titanium stabilised grade and can be used under severe wet chemical requirements. Beside this good corrosion resistance it shows higher mechanical strength at elevated temperatures, compared to the above mentioned grades.



Dimensions		Weight kg / m	Working pressure in bar up to 120°C for				
OD mm	WT mm		DMV 304	DMV 304 L	DMV 316 L	DMV 316 Ti	DMV 321
6.0	1.0	0.12	409	382	400	436	418
	1.5	0.17	664	621	650	708	679
6.35	0.89 / 0.91	0.12	333 / 343	311 / 321	326 / 335	355 / 365	340 / 350
	1.22 / 1.24	0.16	493 / 502	460 / 470	482 / 491	525 / 535	503 / 513
	1.63 / 1.65	0.19	–	–	–	–	–
8.0	1.0	0.17	307	287	300	327	313
	1.5	0.24	498	466	488	531	509
	2.0	0.29	690	645	675	735	705
9.53	0.89 / 0.91	0.19	222 / 228	208 / 214	217 / 224	237 / 243	227 / 233
	1.22 / 1.24	0.25	328 / 335	307 / 313	321 / 327	350 / 356	335 / 342
	1.63 / 1.65	0.32	460 / 467	430 / 436	450 / 456	490 / 497	470 / 477
10.0	1.0	0.22	245	229	240	261	251
	1.5	0.31	399	373	390	425	407
	2.0	0.40	552	516	540	588	564
10.2	1.0	0.23	241	225	235	256	246
	2.0	0.40	541	506	529	576	553
12.0	1.0	0.27	204	191	200	218	209
	1.5	0.39	332	311	325	354	339
	2.0	0.49	460	430	450	490	470
12.7	0.89 / 0.91	0.26	167 / 171	156 / 160	163 / 168	177 / 183	170 / 175
	1.22 / 1.24	0.35	246 / 251	230 / 235	241 / 246	262 / 268	252 / 257
	1.63 / 1.65	0.45	345 / 350	323 / 327	338 / 343	368 / 373	353 / 358
	2.11	0.55	459	429	449	488	469
14.0	1.0	0.32	192	179	188	204	196
	2.0	0.59	383	358	375	408	392
	2.5	0.71	479	448	469	510	490
15.0	1.0	0.34	164	153	160	174	167
	1.5	0.50	266	248	260	283	272
	2.0	0.64	368	344	360	392	376
16.0	1.0	0.37	153	143	150	163	157
	1.5	0.54	249	233	244	265	255
	2.0	0.69	345	323	338	368	353
	2.5	0.83	431	403	422	459	441
	3.0	0.96	503	470	492	536	514
17.2	2.3	0.84	359	335	351	382	367
18.0	1.0	0.42	136	127	133	145	139
	1.5	0.61	221	207	217	236	226
	2.0	0.79	307	287	300	327	313
	3.0	1.11	447	418	438	476	457
20.0	1.5	0.68	199	186	195	212	204
	2.0	0.89	276	258	270	294	282
	2.5	1.08	345	323	388	368	353
	3.0	1.25	403	376	394	429	411
	4.0	1.57	537	502	525	572	548
	5.0	1.84	671	627	656	715	685
21.3	2.0	0.95	252	236	246	268	257
	2.6	1.20	328	306	320	349	335
	3.2	1.42	403	377	394	429	412
22.0	1.0	0.52	112	104	109	119	114
	1.5	0.75	181	169	177	193	185
	2.0	0.98	251	235	245	267	256
24.0	4.0	1.97	447	418	438	476	457
25.0	1.5	0.87	159	149	156	170	163
	2.0	1.13	221	206	216	235	226
	2.5	1.38	276	258	270	294	282
	3.0	1.62	331	310	324	353	338
26.9	2.0	1.23	200	186	195	213	204
	2.6	1.55	259	242	254	276	265
28.0	5.0	2.83	479	448	469	510	490
30.0	2.5	1.69	230	215	225	245	235
	3.0	1.99	276	258	270	294	282
	4.0	2.56	368	344	360	392	376
33.7	2.0	1.56	164	153	160	174	167
	3.2	2.40	262	245	256	279	268

# Seamless stainless instrumentation tubing

Dimensions		Weight kg / m	Working pressure in bar up to 120°C for				
OD mm	WT mm		DMV 304	DMV 304 L	DMV 316 L	DMV 316 Ti	DMV 321
40.0	2.0	1.87	134	125	131	143	137
42.0	3.0	2.88	192	179	188	204	196
60.3	2.9	4.09	129	121	126	137	132
76.1	2.9	5.22	102	96	100	109	104

Table 1: Dimensions and pressures

According to DIN 2413-1: 1993-10; pipelines under predominately idle stress up to 120°C design temperature (min. -10°C); tubes with inspection certificate and diameter ratio OD/ID ≤ 2.0; austenite with Rp0.2 ≤ 0.5 Rm and A ≥ 30%, without additional wall thickness for corrosion / take off; pressure vessel regulations are to be considered. Please note: DIN 2413-1: 1993-10 will be substituted by DIRECTIVE 97/23/EC in May 2003.

SMST-Tubes designation	UNS	Rp 0.2		Rm		Elongation A <sup>1) 5</sup>		Density				
		min. MPa	ksi	min. MPa	ksi	min. %	kg / dm <sup>3</sup>	K <sup>2)</sup>	lb / in <sup>3</sup>	K <sup>2)</sup>		
DMV 304 H	S30400	200	29.0	500	72.0	740	107	45	7.97	40.0	0.29	0.092
DMV 304 L	S30403	175	25.0	470	68.0	720	104	45	7.97	40.0	0.29	0.092
DMV 316 L	S31603	190	27.5	490	71.0	720	104	45	7.97	40.0	0.29	0.092
DMV 316 Ti	S31635	205	30.0	515	75.0	780	113	30	7.97	40.0	0.29	0.092
DMV 321	S32100	200	29.0	490	71.0	740	107	40	7.97	40.0	0.29	0.092

Table 2: Mechanical properties at 20°C (68°F).

All Figures are in weight percent. In case of order, the limits of the order specification will apply. For calculations according to DIN 2413 the figures for Rp 1.0 will apply. These values are available for all grades.

<sup>1)</sup> 5 d or 5.65 √S

<sup>2)</sup> Factors for deflection weight per metre (kg/m) and per foot (lb/ft):  $M = T(D-T) / K$

M = weight kg/m or lb/ft, D = outside diameter, T = wall thickness

SMST-Tubes designation	UNS	Electric resistivity 10 <sup>-6</sup> Ωm	Coefficient of expansion <sup>1)</sup>		Thermal conductivity		Specific heat		Modulus of elasticity				Magnetic permeability <sup>2)</sup>		
			10 <sup>-6</sup> / °C	10 <sup>-6</sup> / °F	W / m°C	BTU/lb°F	J / Kg°C	BTU/lb°F	Traction 20°C		Traction 300°C			Torsion 20°C	
DMV 304 H	S30400	0.72	16.5	9.4	15	8.7	500	0.12	200	29	180	26	84	12	A (1.02)
DMV 304 L	S30403	0.72	16.5	9.4	15	8.7	500	0.12	200	29	180	26	84	12	A (1.02)
DMV 316 L	S31603	0.75	16.0	9.2	13.6	7.8	500	0.12	200	29	180	26	84	12	A (1.02)
DMV 316 Ti	S31635	0.80	16.0	9.2	13.5	7.8	500	0.12	200	29	180	26	84	12	A (1.05)
DMV 321	S32100	0.72	16.5	9.2	15	8.7	500	0.12	200	29	180	26	84	12	A (1.05)

Table 3: Physical properties at 20°C (68°F)

<sup>1)</sup> Mean coefficient of expansion 25-100°C (77-212°F)

<sup>2)</sup> A = non magnetic

SMST-Tubes designation	Nearest equivalent standard						Mean chemical composition <sup>1)</sup>				
	UNS	NF	DIN	BS	JIS	C max.	Cr	Ni	Mo	Others	
DMV 304 H	S30400	Z 6 CN 18.09	1.4301	304 S 15	SUS 304	0.08	18.5	9.5			
DMV 304 L	S30403	Z 2 CN 18.10	1.4306	304 S 12	SUS 304 L	0.03	19.0	11.0			
DMV 316 L	S31603	Z 2 CN 17.12	1.4404	316 S 12	SUS 316 L	0.03	17.0	12.0	2.25		
DMV 316 Ti	S31635	Z 2 CND 17.12	1.4571	320 S 17		0.08	17.0	11.5	2.25	Ti > 5C < 0.06%	
DMV 321	S32100	Z 6 CNT 18.10	1.4541	321 S 12	SUS 321	0.08	18.5	10.5		Ti > 5xC < 0.06%	

Table 4: Equivalent specification, analyses

SMST-Tubes designation	Rp 0.2 min.										Rm min.									
	°C MPa					°F ksi					°C MPa					°F ksi				
DMV 304 H	100	200	300	400	500	212	392	572	752	932	100	200	300	400	500	212	392	572	752	932
DMV 304 L	160	130	110	100	90	23,0	19,0	16,0	14,5	13,0	450	400	380	380	360	65,0	58,0	55,0	55,0	52,0
DMV 316 L	150	120	100	90	80	21,5	17,5	14,5	13,0	11,5	410	360	340	340	320	59,5	52,0	49,5	49,5	46,5
DMV 316 L	170	140	120	110	100	24,5	20,5	17,5	16,0	14,5	450	400	390	390	370	65,0	58,0	56,5	56,5	53,5
DMV 316 Ti	190	165	145	135	130	27,5	24,0	21,0	19,5	19,0	470	450	435	430	410	68,0	65,0	63,0	62,5	59,5
DMV 321	180	160	140	125	120	26,0	23,0	20,5	18,0	17,5	460	410	390	390	370	66,5	59,5	56,5	56,5	53,5

Table 5: Mechanical properties at elevated temperatures

# Technical Specifications

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## **Standards:**

ASTM A 312, ASTM A 269, ASTM A 213 AW. Also the norms DIN 17458 Pk1 and NFA 49 - 117.

## **Tolerances:**

For OD  $\leq$  20 mm: DIN 2391 : 1994-09

For OD  $>$  20 mm: D3/T3 EN ISO 1127 : 1996-04

D3:  $\pm$  0.75% but min.  $\pm$  0.3 mm

T3:  $\pm$  10% but min.  $\pm$  0.2 mm

D4:  $\pm$  0.50% but min.  $\pm$  0.1 mm on request

## **Lengths:**

Metric sizes are normally delivered in standard length of 6,000 mm. For imperial sizes lengths of 6,096 mm are available. Longer straight tubes up to 24 meters are available on request.

## **Delivery conditions:**

For OD  $\leq$  15 mm: normally delivered bright annealed.

For OD  $>$  15 mm: bright annealed or annealed and pickled.

Tubes are delivered with plain ends.

## **Certification:**

EN 10204 3.1.B or EN 10204 3.1.A

## **Quality Approval:**

The group-wide quality and accreditation regime is applied to ensure equal quality management and quality assurance. Compliance with ISO 9001/9002 is rigorously met. Copies of other approvals and certifications are provided on request.

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