



**Seamless Stainless Hollow Bar & Mechanical Tubing
in Standard & VALIMA grades**

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Seamless stainless steel and nickel-based alloy tubes and pipes are our everyday passion and our history at Salzgitter Mannesmann Stainless Tubes. As early as 1885 Reinhard and Max Mannesmann invented a rolling process for the production of seamless steel tubes in Remscheid, Germany. In the 1890's they developed it further until it reached marketability: the production method they invented was the pilger process, which still is widely in use today.

Our group integrates the tradition of three seamless stainless steel worlds (Mannesmann, Dalmine and Vallourec). Resulting in "DMV Stainless" from this international merger in 1994, DMV became a part of Salzgitter group in 2003 and adjusted its name to Salzgitter Mannesmann Stainless Tubes in 2008.

With an international network of plants and offices, we are a global top player in our markets and a consistently reliable business partner, ensuring quick and customer focused answers to changing market requirements.

Our customers profit from one of the most comprehensive product ranges in our business:

- from small instrumentation tubing to large pipe sizes with outside diameters from 6 to 250 mm (from 0.24 up to 9.84 inches) and with wall thicknesses from 0.5 up to 50 mm (from 0.02 up to 1.97 inches)
- in materials from standard austenitic stainless, duplex and super-duplex steels to highly sophisticated nickel-based alloys – this variety offers highest corrosion resistance, heat resistance and/or high-temperature, high-strength materials.

We combine high quality products for critical environments with efficient and reliable services: our customers thus enjoy a supportive personal account management.

Ongoing cycles of investment ensure that we work according to the latest technical standards. This gives us the trustworthiness to equip the so called "critical spots" of customers' plants, products and processes with the special qualities of our tubes and pipes.

Typically, these "critical" service conditions are defined e.g. by

- high temperatures
- high pressure
- aggressive media (acids or basic)

Hollow Bar advantages for component manufacturing industries

Hollow Bar and Mechanical Tubing provide an economic and efficient means of supplying high quality raw material stock for the manufacture of radially machined components; the sensible alternative to the use of solid bar.

Hollow Bar minimizes material wastage and reduces the total machining requirements by avoiding the initial drilling operation.

Typical manufacturers that use stainless steel Hollow Bar to make components that are used in:

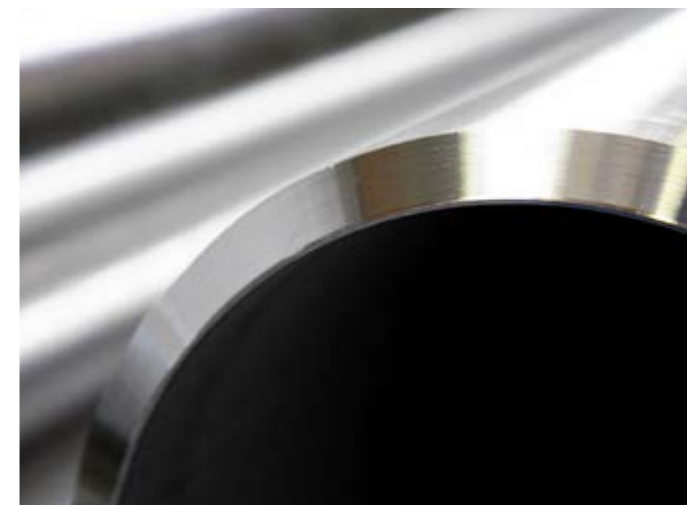
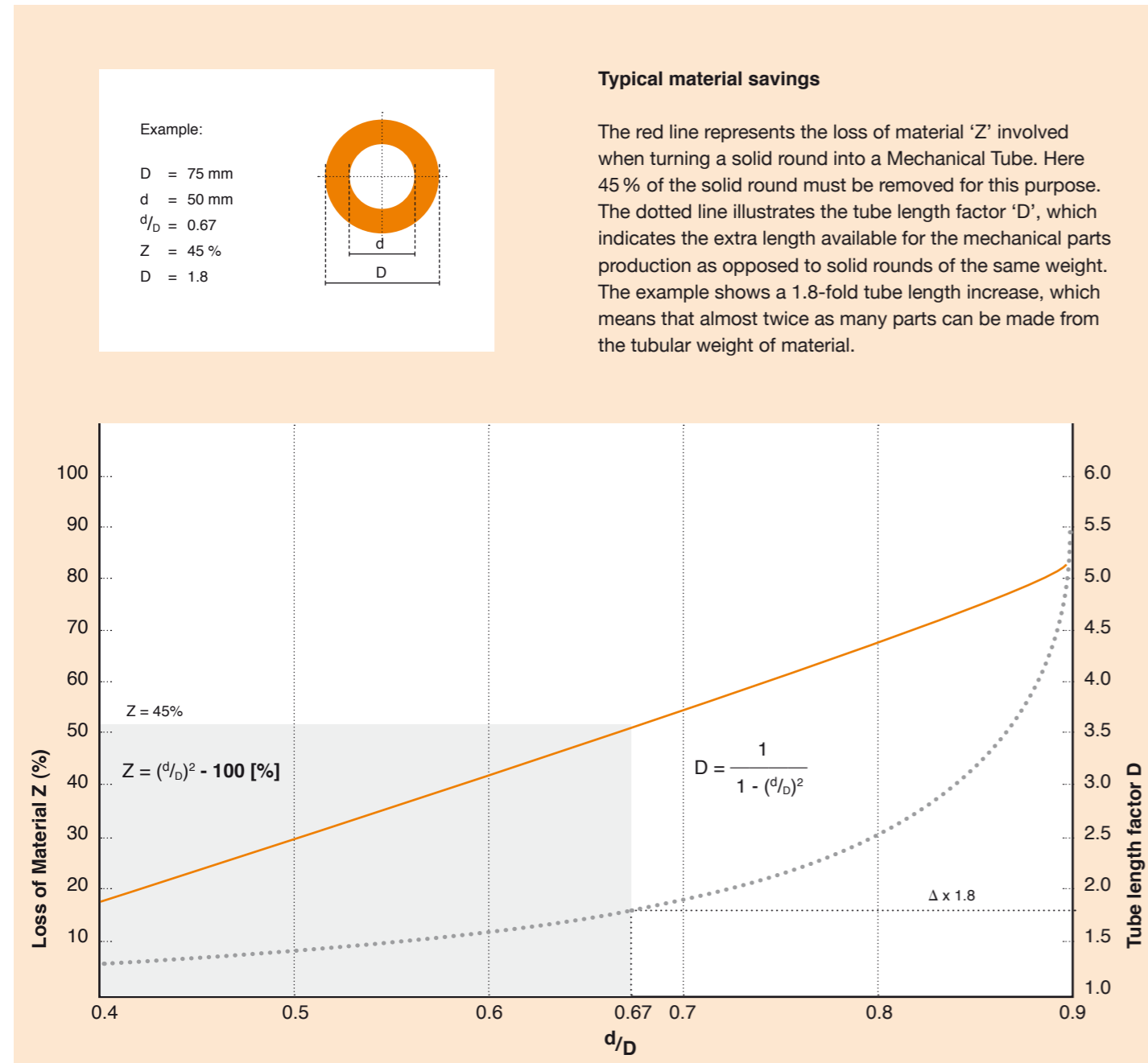
- general engineering
- chemical & petrochemical plants
- automotive production
- paper production plants
- textile production plants
- food production equipment
- anti-friction and slide bearing production

Machining allowances & production tolerances

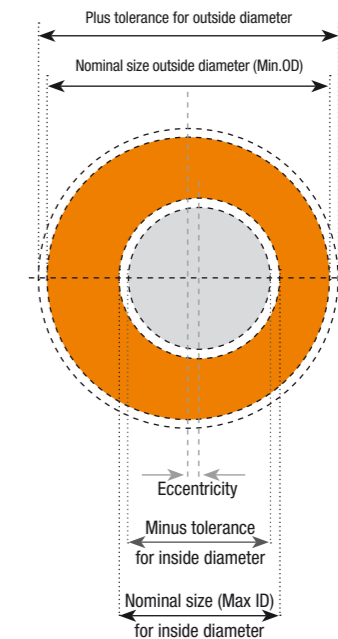
Hollow Bar is manufactured in the size ranges most frequently required by mechanical engineering manufacturing companies. However, in the case of Hollow Bar, the tolerance range for the outside diameter lies in the plus range, and for the inside diameter in the minus range. The wall thickness tolerance is determined by the degree of centre offset; this is due to the effect of the tolerance for the outside and inside diameter, the wall thickness and the centre offset. (See diagram below.)

In the case of Mechanical Tubing to ASTM A 511, the outside diameter and the wall dimensions generally lie in the centre of the tolerance range. Thus, when ordering product for machining it is important to take into account the differences in the tolerances between the Hollow Bar and the ASTM A 511 Mechanical Tubing specifications.

In most cases the machining set up is based on centring the outside diameter.



Standard Hollow Bar Tolerances



The diagram gives a general idea of the production related tolerances for Hollow Bar

Outside diameter range	Dimensional tolerances			
mm	For the outside diameter D	For the outside diameter d	For eccentricity (centre offset) E	For out-of-straightness h
32 ≤ D ≤ 250	-0/+2% (min. 1 mm)	+0/-2% (min. 1 mm)	10%	1 mm/m

Outside diameter range	Machining allowances	
mm	For the outside diameter	For the inside diameter
32 ≤ D ≤ 70	1.0 mm	1.0 mm
70 ≤ D ≤ 132	1.0 mm	1.0 mm
132 ≤ D ≤ 200	1.0 mm	2.0 mm
200 ≤ D ≤ 250	1.0 mm	2.0 mm

Note: The machining allowances are recommended minimum values and are related to short-length mechanical parts (L < 2.5 x D, max. 250mm).
Machining allowances for longer parts or special machining procedures can be customised.
Machining allowances when ordering Mechanical Tubing to ASTM A 511 are different to those for Hollow Bar and are detailed on page 9.

Hollow Bar – Standard sizes

Rough size and weight			Finish-turned sizes			
Nominal outside diameter mm	Nominal inside diameter mm	Theoretical weight kg/m	Externally centred		Internally centred	
			Max. outside diameter mm	Min. inside diameter mm	Max. outside diameter mm	Min. inside diameter mm
32	20	4.21	31.0	22.0	30.1	21.0
32	16	5.05	31.0	18.2	30.0	17.0
36	25	4.56	35.0	26.9	34.2	26.0
36	20	5.90	35.0	22.1	34.0	21.0
36	16	6.75	35.0	18.3	34.0	17.0
40	28	5.51	39.0	29.9	38.1	29.0
40	25	6.45	39.0	27.0	38.1	26.0
40	20	7.79	39.0	22.2	38.0	21.0
45	32	6.71	44.0	34.0	43.0	33.0
45	30	7.45	44.0	32.0	43.0	31.0
45	28	8.14	44.0	30.2	42.9	29.0
45	20	10.43	44.0	22.3	43.0	21.0
50	36	8.02	49.0	37.9	48.1	37.0
50	32	9.65	49.0	34.2	47.9	33.0
50	28	11.09	49.0	30.3	47.9	29.0
50	25	12.04	49.0	27.3	48.0	26.0
56	40	10.17	55.0	42.1	54.0	41.0
56	36	12.00	55.0	38.2	53.9	37.0
56	28	15.07	55.0	30.4	53.8	29.0
56	25	16.02	55.0	27.6	53.7	26.0
63	50	9.96	62.0	51.9	61.0	51.0
63	45	12.82	62.0	47.2	60.8	46.0
63	40	15.39	62.0	42.4	60.8	41.0
63	36	17.21	62.0	38.4	60.9	37.0
63	32	18.84	62.0	34.6	60.7	33.0
71	56	12.82	70.0	57.9	69.0	57.0
71	45	19.53	70.0	47.3	68.9	46.0
71	36	23.91	70.0	38.6	68.7	37.0
75	60	13.66	74.0	61.9	73.0	61.0
75	50	20.32	74.0	52.2	72.9	51.0
75	40	25.75	74.0	42.6	72.7	41.0
80	63	16.28	79.0	65.1	77.9	64.0
80	50	25.17	79.0	52.5	77.7	51.0
80	45	28.04	79.0	47.6	77.7	46.0
80	40	30.60	79.0	42.9	77.5	41.0
85	45	33.20	84.0	47.8	82.5	46.0
90	75	16.87	89.0	77.0	88.9	76.0
90	71	20.41	89.0	73.0	88.0	72.0
90	63	26.91	89.0	65.2	87.8	64.0
90	56	31.96	89.0	58.7	87.6	57.0
90	50	35.81	89.0	52.8	87.5	51.0
95	75	22.65	94.0	77.0	92.9	76.0
95	67	29.55	94.0	69.3	92.8	68.0
95	50	41.59	94.0	53.1	92.4	51.0

Rough size and weight			Finish-turned sizes			
Nominal outside diameter mm	Nominal inside diameter mm	Theoretical weight kg/m	Externally centred		Internally centred	
			Max. outside diameter mm	Min. inside diameter mm	Max. outside diameter mm	Min. inside diameter mm
100	80	24.10	99.0	82.0	97.9	81.0
100	71	32.30	99.0	73.3	97.8	72.0
100	63	38.80	99.0	65.6	97.6	64.0
100	56	43.85	99.0	59.0	97.4	57.0
106	90	21.61	105.0	91.9	103.9	91.0
106	80	31.83	105.0	82.1	103.9	81.0
106	71	40.04	105.0	73.5	103.7	72.0
106	63	46.54	105.0	65.9	103.4	64.0
106	56	51.58	105.0	59.3	103.2	57.0
112	90	29.79	111.0	92.1	109.8	91.0
112	80	40.01	111.0	82.5	109.6	81.0
112	71	48.22	111.0	73.8	109.5	72.0
112	63	54.72	111.0	66.2	109.2	64.0
118	90	38.43	117.0	92.2	115.8	91.0
118	80	48.65	117.0	82.6	115.6	81.0
118	71	56.85	117.0	74.1	115.3	72.0
118	63	63.36	117.0	66.5	115.0	64.0
125	100	37.65	124.0	102.0	122.9	101.0
125	90	49.07	124.0	92.4	122.7	91.0
125	80	59.29	124.0	82.9	122.3	81.0
125	71	67.50	124.0	74.4	122.0	72.0
132	106	41.48	131.0	108.0	129.8	107.0
132	90	60.33	131.0	92.7	129.4	91.0
132	80	70.55	131.0	83.3	129.1	81.0
132	71	78.75	131.0	74.8	128.8	72.0
140	112	47.23	139.0	114.1	137.8	113.0
140	100	62.52	139.0	102.6	137.5	101.0
140	90	73.39	139.0	93.2	137.1	91.0
140	80	84.17	139.0	83.7	136.8	81.0
150	125	46.85	149.0	126.9	147.9	126.0
150	112	65.37	149.0	114.5	147.6	113.0
150	106	73.24	149.0	108.8	147.3	107.0
150	95	86.53	149.0	98.4	147.0	96.0
150	80	102.31	149.0	84.2	146.4	81.0
160	132	55.43	159.0	134.0	157.7	133.0
160	122	70.70	159.0	124.4	157.5	123.0
160	112	84.77	159.0	115.0	157.2	113.0
160	90	111.49	159.0	94.2	156.4	91.0
170	140	63.00	169.0	143.1	167.6	142.0
170	130	79.23	169.0	132.5	167.5	131.0
170	118	97.12	169.0	121.1	167.1	119.0
170	110	108.09	169.0	113.5	166.9	111.0
170	106	113.28	169.0	109.8	166.6	107.0
170	100	120.72	169.0	104.1	166.4	101.0

Rough size and weight			Finish-turned sizes			
Nominal outside diameter mm	Nominal inside diameter mm	Theoretical weight kg/m	Externally centred		Internally centred	
			Max. outside diameter mm	Min. inside diameter mm	Max. outside diameter mm	Min. inside diameter mm
170	140	64.19	169.0	143.1	167.6	142.0
170	130	80.73	169.0	132.5	167.5	131.0
170	118	98.96	169.0	121.1	167.1	119.0
170	106	115.43	169.0	109.8	166.6	107.0
170	100	123.00	169.0	104.1	166.4	101.0
180	150	67.47	179.0	153.1	177.6	152.0
180	140	84.90	179.0	143.4	177.5	142.0
180	130	101.13	179.0	133.0	177.1	131.0
180	125	108.80	179.0	128.3	176.9	126.0
180	100	142.62	179.0	104.6	176.1	101.0
190	160	71.98	189.0	163.0	187.6	162.0
190	150	90.62	189.0	153.4	187.4	152.0
190	140	108.05	189.0	143.9	187.1	142.0
190	132	121.14	189.0	135.4	186.8	133.0
190	106	158.34	189.0	110.8	185.9	107.0
200	170	76.55	199.0	173.0	197.6	172.0
200	160	96.39	199.0	163.4	197.4	162.0
200	150	115.02	199.0	153.9	197.1	152.0
200	140	132.46	199.0	144.5	196.7	142.0
200	112	174.88	199.0	117.0	195.8	113.0
212	180	86.44	211.0	183.1	209.5	182.0
212	170	107.48	211.0	173.4	209.4	172.0
212	130	179.62	211.0	134.6	208.0	131.0
224	180	119.18	223.0	183.5	221.3	182.0
224	170	140.22	223.0	174.0	220.9	172.0
224	160	160.09	223.0	164.6	220.6	162.0
224	140	199.84	223.0	145.7	219.9	142.0
236	190	131.47	235.0	193.5	233.2	192.0
236	170	174.76	235.0	174.6	232.5	172.0
236	150	213.24	235.0	155.7	231.8	152.0
240	170	186.67	239.0	174.8	236.4	172.0
250	200	150.60	249.0	203.7	247.0	202.0
250	190	174.05	249.0	194.5	247.0	192.0
250	150	255.81	249.0	154.5	247.0	152.0

Standard sizes - Other dimensions can be supplied on agreement.

All the above dimensions, including the tables on pages 6 & 7, are for maximum length L < 2.5 x D, max. 250 mm.

The weight kg/m for molybdenum grades (DMV 316 LMC, DMV 316 TI, DMV 316 LMMC) has to be increased by approx. + 1 %

Mechanical Tubing to ASTM A 511

Standard sizes							
Outside diameter inches	Wall thickness inches	Outside diameter mm	Wall thickness mm	Outside diameter inches	Wall thickness inches	Outside diameter mm	Wall thickness mm
2.00	0.188 to 0.500	50.80	4.78 to 12.70	6.00	0.250 to 1.000	152.40	6.35 to 25.40
2.25	0.188 to 0.750	57.15	4.78 to 19.05	6.25	0.250 to 1.500	158.75	6.35 to 38.10
2.50	0.188 to 0.750	63.50	4.78 to 19.05	6.50	0.250 to 1.500	165.10	6.35 to 38.10
2.75	0.188 to 0.875	69.85	4.78 to 22.23	6.75	0.375 to 1.500	171.45	9.53 to 38.10
3.00	0.188 to 0.875	76.20	4.78 to 22.23	7.00	0.375 to 1.500	177.80	9.53 to 38.10
3.12	0.188 to 0.875	79.38	4.78 to 22.23	7.25	0.375 to 1.500	184.15	9.53 to 38.10
3.25	0.188 to 0.875	82.55	4.78 to 22.23	7.50	0.375 to 1.500	190.50	9.53 to 38.10
3.50	0.188 to 0.875	88.90	4.78 to 22.23	7.75	0.375 to 1.500	196.85	9.53 to 38.10
3.75	0.250 to 0.875	95.25	6.35 to 22.23	8.00	0.375 to 1.500	203.20	9.53 to 38.10
4.00	0.250 to 0.875	101.60	6.35 to 22.23	8.25	0.375 to 1.500	209.55	9.53 to 38.10
4.25	0.250 to 1.000	107.95	6.35 to 25.40	8.50	0.375 to 1.500	215.90	9.53 to 38.10
4.50	0.250 to 1.000	114.30	6.35 to 25.40	8.75	0.500 to 1.500	222.25	12.70 to 38.10
4.75	0.250 to 1.000	120.65	6.35 to 25.40	9.00	0.500 to 1.500	228.60	12.70 to 38.10
5.00	0.250 to 1.000	127.00	6.35 to 25.40	9.25	0.750 to 1.500	234.95	19.05 to 38.10
5.25	0.250 to 1.000	133.35	6.35 to 25.40	9.50	0.750 to 1.500	241.30	19.05 to 38.10
5.50	0.250 to 1.000	139.70	6.35 to 25.40	9.75	0.875 to 1.500	247.65	22.23 to 38.10
5.75	0.250 to 1.000	146.05	6.35 to 25.40				

Production tolerances

Permissible manufacturing tolerances for outside diameter, wall thickness and cut lengths for hot finished round tubing per ASTM A 511

Outside diameter inches	Ratio of wall thickness to outside diameter	Outside diameter tolerance inches	Wall thickness tolerance, %				Cut length in. *
			0.109" and under	0.109" to 0.172" incl.	Over 0.172" to 0.203" incl.	Over 0.203"	
Under 3	All wall thicknesses	+/- 0.023	+/- 16.5%	+/- 15%	+/- 14%	+/- 12.5%	3/16
3 to 5 1/2 excl.	All wall thicknesses	+/- 0.031	+/- 16.5%	+/- 15%	+/- 14%	+/- 12.5%	3/16
5 1/2 to 8 excl.	All wall thicknesses	+/- 0.047				+/- 12.5%	3/16
8 to 9 3/4 incl.	5% and over	+/- 0.047 **				+/- 12.5%	3/16

* These tolerances apply to cut lengths up to and including 24 ft (7.3 m). For lengths over 24 ft, and additional over tolerance of 1/8" (3.1 mm) for each 10ft (3 m) or fraction thereof shall be permissible, up to a max. tolerance of 1/2" (12.7 mm).

** SMST-Tubes manufacturing tolerance for these dimensions is +/- 1%.



Materials

Standard grades

Hollow Bar and Mechanical Tubing are supplied in a range of specially selected stainless and acid-resistant standard grades chosen to cover the majority of the corrosion and processing problems that occur in day to day practice.

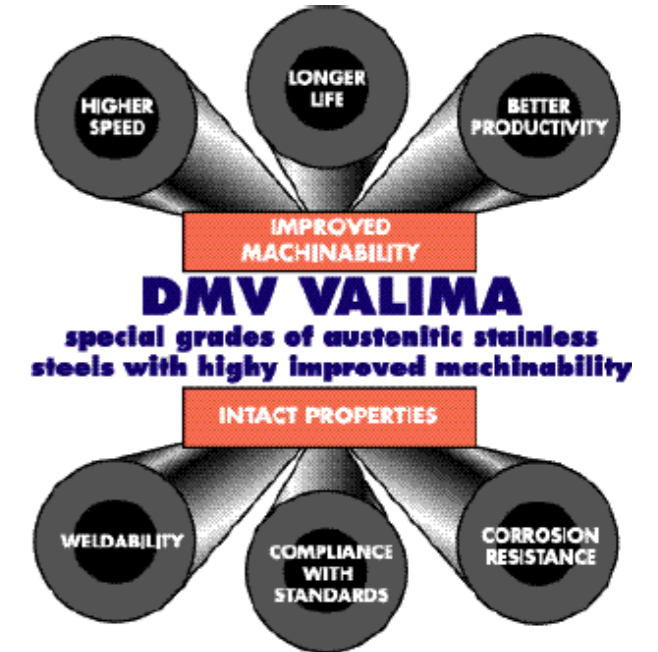
VALIMA Grades

... special stainless grades that offer enhanced machining characteristics

In VALIMA materials you have a versatile product. VALIMA grades offer better machining properties. This is the result of a combination of the melting method and a specific extrusion process.

- The inclusion of low melting point malleable oxides play a significant role of self-lubricating the metal-tool interface.
- A narrow range of sulphur content.
- The elimination of hard and abrasive inclusions.

Machining VALIMA hollows at high speed with carbide tools offers a surprisingly good finishing performance because of the easy break-up of chips and cuttings which also results in the reduction of cutting edge tool-tip wear.



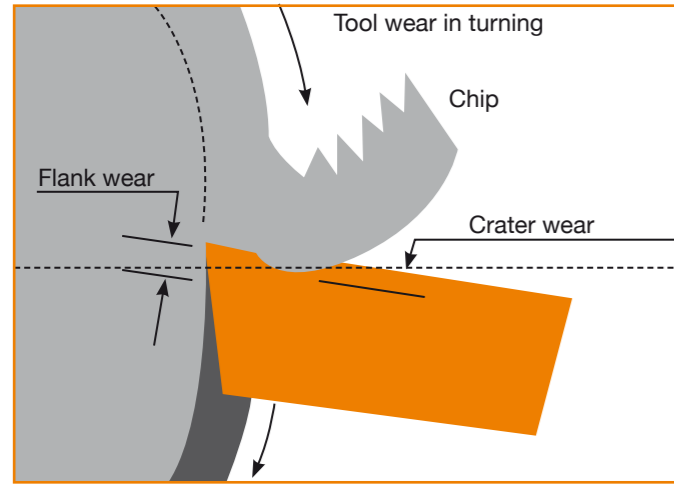
SMST Designation	USA			Europe EN 10216-5		Others	
	UNS	Designation (grade)	Standard ASTM	Steel No.	Designation	Standard (SS)	Standard (BS)
DMV 304	S 30400	MT 304 (TP 304)	A 511 (A 312)	1.4301	X5CrNi18.10	2333	304 S 15
DMV 304 L	S 30403	MT 304L (TP 304L)	A 511 (A 312)	1.4306	X2CrNi19.11	2352	304 S 11
DMV 316	S 31600	MT 316 (TP 316)	A 511 (A 312)	1.4401	X5CrNiMo17.12.2		316 S 31
DMV 316 L	S 31603	MT 316L (TP 316L)	A 511 (A 312)	1.4404	X2CrNiMo17.12.2		316 S 11
DMV 316 L Mos				1.4435	X2CrNiMo18.14.3	2353	316 S 13
DMV 321	S 32100	MT 321 (TP 321)	A 511 (A 312)	1.4541	X6CrNiTi18.10	2337	321 S 31
DMV 316 Ti		TP 316 Ti		1.4571	X6CrNiMoTi17.12.2	2350	
DMV 22.5	S 31803			1.4462	X2CrNiMoN22.5.3		

(...) Grade designation and/or Standard not specific for Hollow Bars.

VALIMA Designation	SMST Designation	USA			Europe EN 10216-5		Others	
		UNS	Designation (grade)	Standard ASTM	Steel No.	Designation	Standard (SS)	Standard (BS)
VALIMA 304	DMV 304 MC	S 30400	MT 304 (TP 304)	A 511 (A 312)	1.4301	X5CrNi18.10	2333	304 S 15
VALIMA 304 L	DMV 304 LMC	S 30403	MT 304L (TP 304L)	A 511 (A 312)	1.4306	X2CrNi19.11	2352	304 S 11
VALIMA 316	DMV 316 MC	S 31600	MT 316 (TP 316)	A 511 (A 312)	1.4401	X5CrNiMo17.12.2		316 S 31
VALIMA 316 L	DMV 316 LMC	S 31603	MT 316L (TP 316L)	A 511 (A 312)	1.4404	X2CrNiMo17.12.2		316 S 11
VALIMA 4435	DMV 316 L Mos*MC				1.4435	X2CrNiMo18.14.3	2353	316 S 13

(...) Grade designation and/or Standard not specific for Hollow Bars.

* DMV 316L with 2.5 - 3% Mo.



High speed machining

Higher cutting speeds lead to improved productivity. VALIMA Hollow Bars can be machined at speeds 50 %higher than that for standard materials. Higher speeds also lead to easier chip break-up.

Longer tool life

Often machining ordinary austenitic stainless steels, results in rapid tool wear and even cutting tool failure that leads to long uneconomic and unwanted down-times. Machining of VALIMA products have shown that, with optimum tool setting, a 40-80 per cent increase in tool life can be expected.

Product constistency

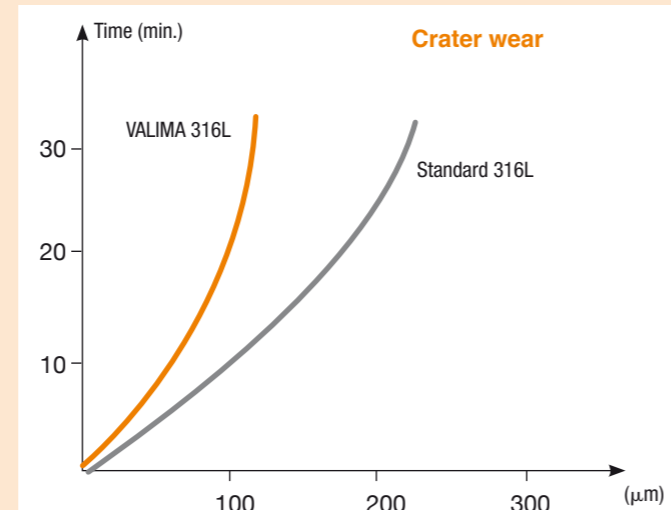
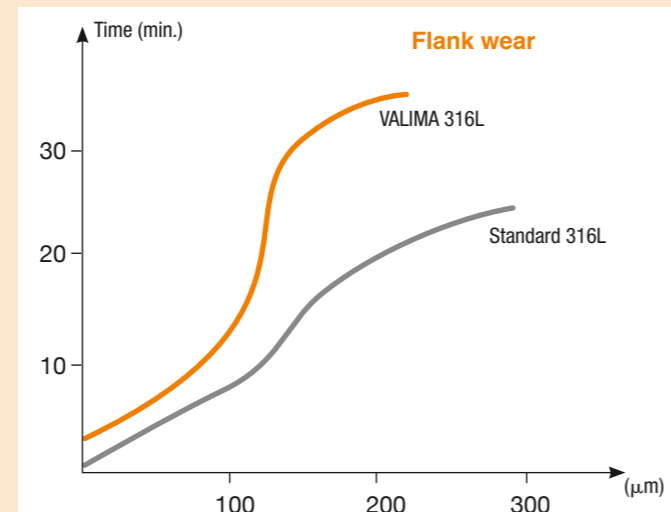
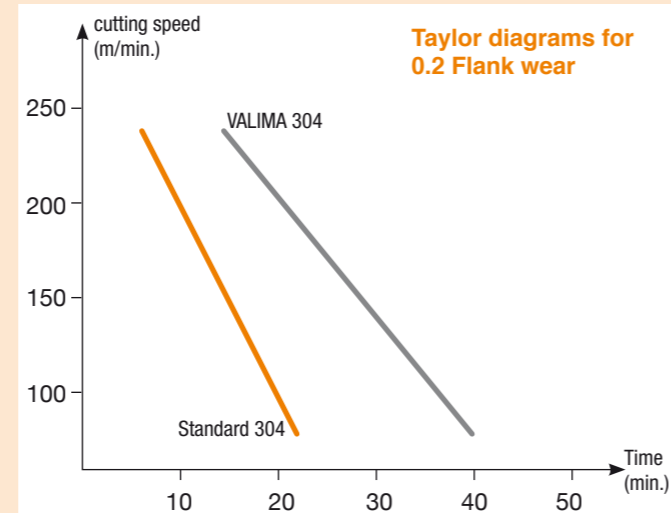
The consistency of the VALIMA products, and their machining characteristics, enables cutting speed to be reliably increased while extending the tool life and reducing maintenance down-time, thus producing significant improvements in productivity.

Industrial experience has proven that in many cases modified tool setting has resulted in a 30 per cent gain in productivity.

Problem solving

SMST-Tubes has a policy of constantly seeking to improve its product lines. Should you encounter any particular problems in the use of VALIMA products, our technical specialists are always available to provide specific technical or metallurgical solutions.

VALIMA machining characteristics



VALIMA recommended cutting criteria

Based upon our laboratory and industrial experience of the VALIMA material grades, it is recommended that the following enhanced cutting criteria can be successfully employed when carrying out drilling, turning, threading or milling operations.

Automatic machining (single-point turning)	Cutting speed m/min with:		Depth of cut mm	Feed mm/t	Carbide insert ISO
	Plain carbide	Coated carbide			
VALIMA 304L	120	170	2	0.1	M 10 - M 20
VALIMA 316L	95	140	2	0.1	M 10 - M 21

CNC Turning	Cutting speed m/min with:		Depth of cut mm	Feed mm/t	Carbide insert ISO
	Plain carbide	Coated carbide			
VALIMA 304L	150	200	3	0.4	P 10 - P 20 - P 25
VALIMA 316L	120	160	3	0.4	P 10 - P 20 - P 25

Turning	Cutting speed m/min with:		Depth of cut mm	Feed mm/t	Carbide insert ISO
	Plain carbide	Coated carbide			
TP 304L	115	150	3	0.4	
TP 316L	90	125	3	0.4	

The above figures should be compared with those in the "Machining Data Handbook", 3rd edition. Cutting conditions for a tool life of 30 mn (plain carbide) or 15 mn (coated carbide).

SMST-Tubes Quality management

Quality assurance

All SMST-Tubes Hollow Bar or Mechanical Tubes are produced in accordance with SMST-Tubes' strict manufacturing procedures. SMST-Tubes' facilities and manufacturing procedures have received ISO9001/9002 certification.

Material testing certificates

The type of test certificate required must be agreed upon when ordering.

Compliance of the chemical analysis with the delivery specification and, if required, the typical characteristics can be certified in a test report 2.2 according to EN 10204.

Results from tests carried out on the order lot are certified in an inspection certificate 3.1 according to EN 10204.

All test results other than tensile test results can also be documented in a specified test report 2.3 according to EN 10204.

Marking

Unless otherwise agreed, tubes are externally marked with the manufacturer's name and the material designation.

Tubes subject to acceptance inspection are additionally marked with the inspector's stamp and, where applicable, with a stamp verifying that ultrasonic testing has been carried out.

Other or additional marking methods can be agreed with SMST-Tubes, when placing your order.

Materials testing certificates criteria

EN 10204 Reference	Designation of the document type			Document content	Document validated by
	English version	German version	French version		
Type 2.1	Declaration of compliance with order	Werksbescheinigung	Attestation de conformité à la commande	Statement of compliance with the order	The manufacturer
Type 2.2	Test report	Werkszeugnis	Relevé de contrôle	Statement of compliance with the order, with indication of results of nonspecific inspection	The manufacturer
Type 3.1	Inspection certificate 3.1	Abnahmeprüfzeugnis 3.1	Certificat de réception 3.1	Statement of compliance with the order, with indication of results of specific inspection	The manufacturer's authorized inspection representative independent of the manufacturing department
Type 3.2	Inspection certificate 3.2	Abnahmeprüfzeugnis 3.2	Certificat de Réception 3.2	Statement of compliance with the order, with indication of results of specific inspection	The manufacturer's authorized inspection representative independent of the manufacturing department and either the purchaser's authorized inspection representative or the inspector designated by the official regulations



PLEASE TAKE NOTE:

Whilst every care has been taken in compiling the technical data in this brochure, it is given for information only, due to continuous material development and complex nature of the various factors used. SMST-Tubes cannot be held responsible for the information contained herein and our customers should carefully check for themselves, where necessary, when making an appropriate selection; bearing in mind the conditions governing the fabrication of our alloys as well as the conditions in service. Information contained in this brochure can be changed without notice.

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