



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

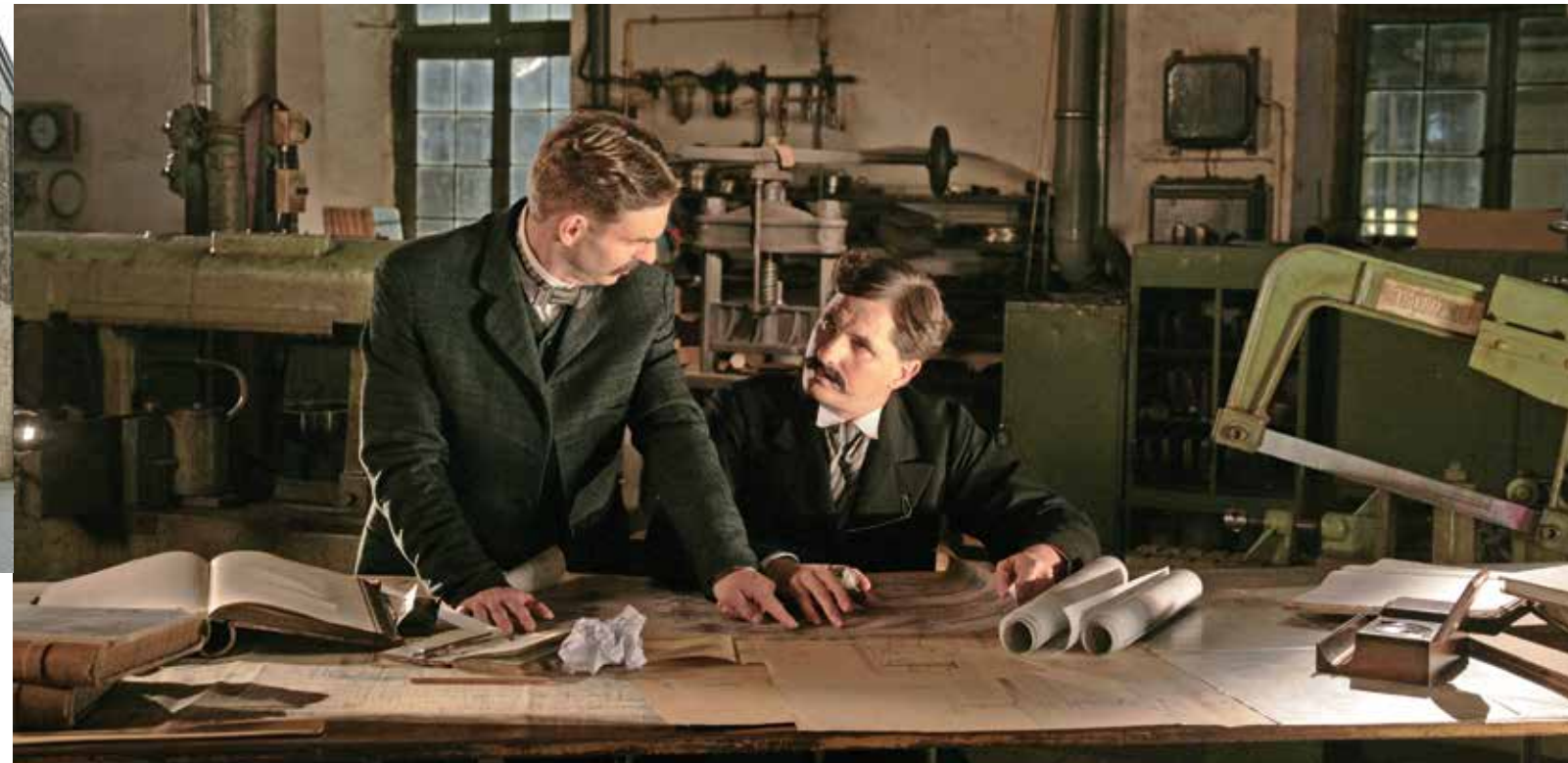


MANNESMANN
STAINLESS TUBES

A Member of the Salzgitter Group

1 Titelseite Headline US

2 Titelseite Subline US



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Seamless stainless steel and nickel-based alloy tubes and pipes are our everyday passion and our history at 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)

1 Titelseite Headline US

Hollow Bar advantages for component manufacturing

3 Headline Seite

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.

6 Bildunterschrift

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

2 Titelseite Subline US

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

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.

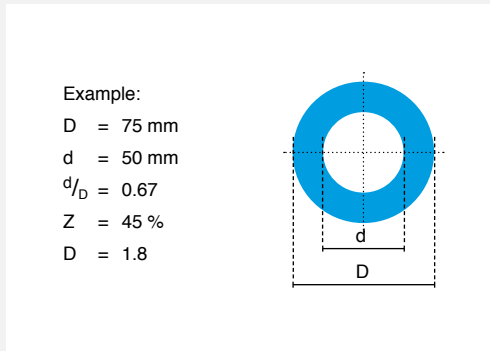
Hollow Bar minimizes material wastage and reduces the total machining requirements by avoiding the initial drilling operation.

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.)

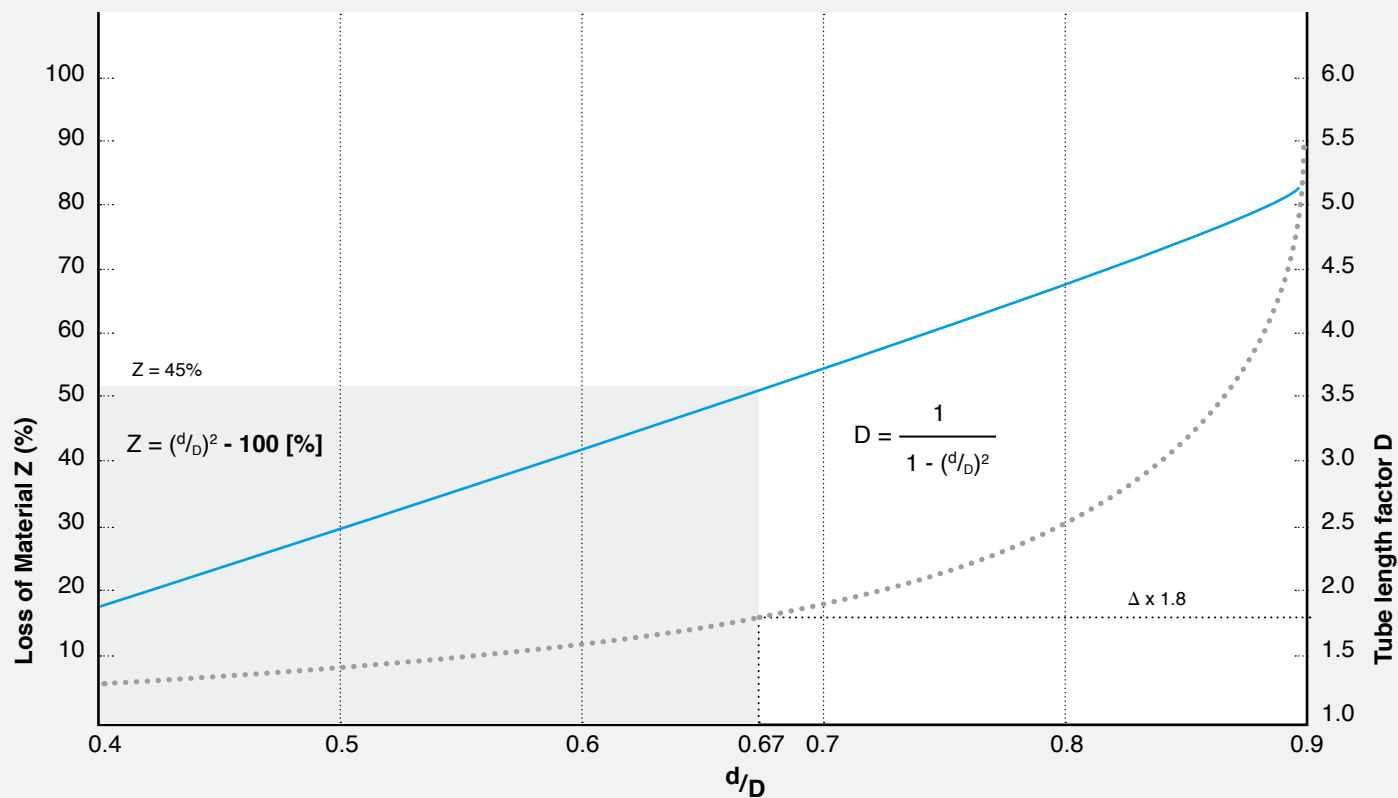
In the case of Mechanical Tubing to ASTM A 511, the outside diameter and the wall dimensions generally lie in the centre of the tolerance range. Thus, when ordering product for machining it is important to take into account the differences in the tolerances between the Hollow Bar and the ASTM A 511 Mechanical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

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

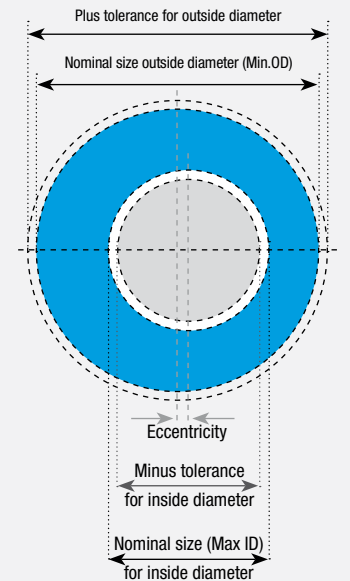


Typical material savings

The red line represents the loss of material 'Z' involved when turning a solid round into a Mechanical Tube. Here 45% of the solid round must be removed for this purpose. The dotted line illustrates the tube length factor 'D', which indicates the extra length available for the mechanical parts production as opposed to solid rounds of the same weight. The example shows a 1.8-fold tube length increase, which means that almost twice as many parts can be made from the tubular weight of material.



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 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.

1 Titelseite Headline US

2 Titelseite Subline US

Hollow Bar – Standard sizes 3 Headline Seite

| 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 |

1 Titelseite Headline US

2 Titelseite Subline US

3 Headline Seite

| Rough size and weight | | | Finish-turned sizes | | | |
|---|----------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
| Nominal outside diameter inches 5 Tabelleninhalt | 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

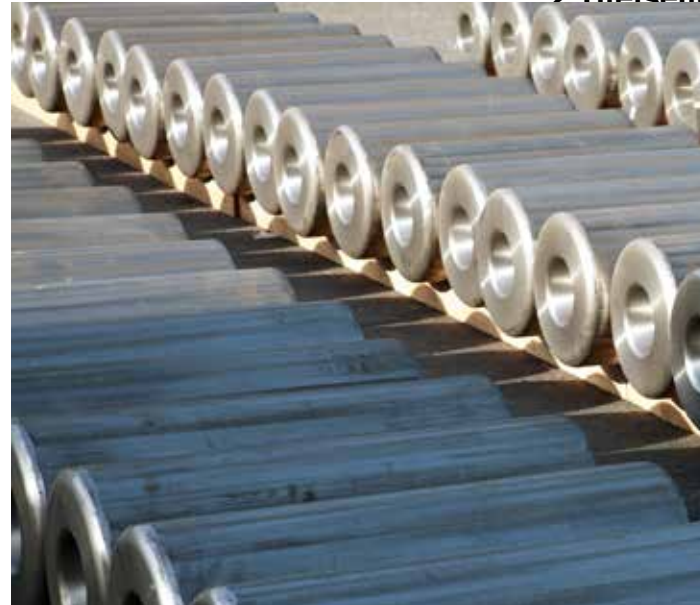
| Outside diameter inches | Ratio of wall thickness to outside diameter | Outside diameter tolerance inches | Wall thickness tolerance, % | | | | Cut length in. * |
|-------------------------|---|-----------------------------------|-----------------------------|------------------------|-----------------------------|-------------|------------------|
| | | | 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).

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

1 Titelseite Headline US

2 Titelseite Subline US



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.

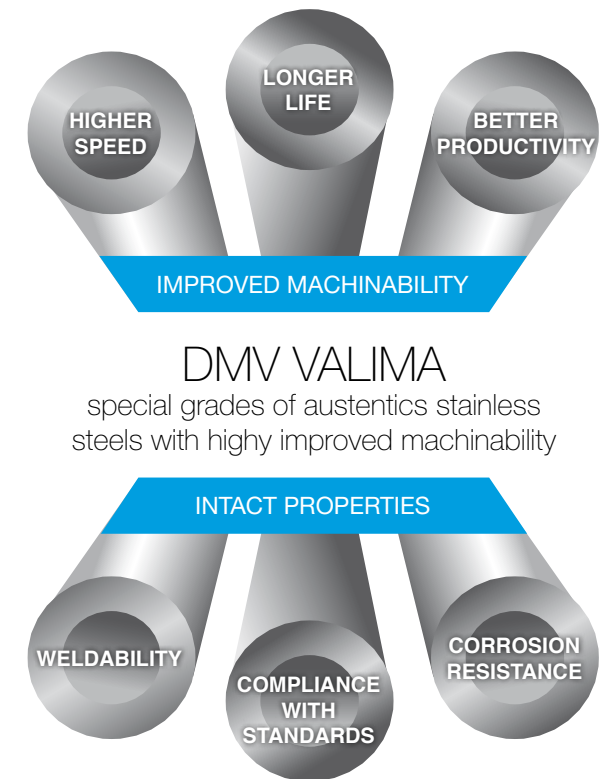
VALIMA Grades

... 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.



| MST 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 | | |

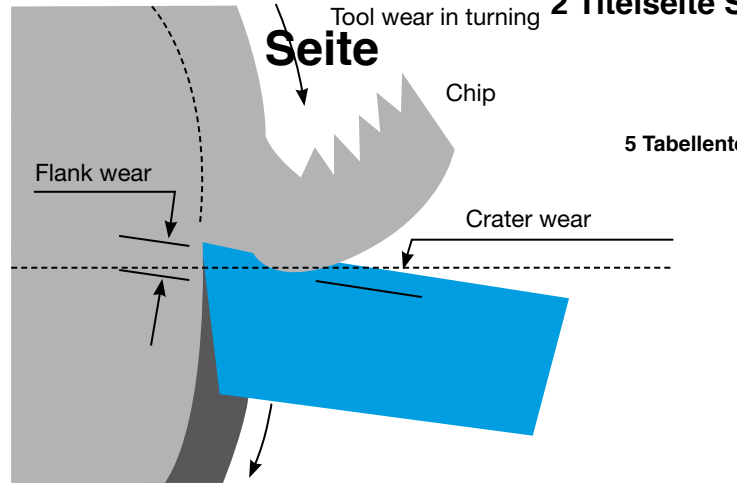
(...) Grade designation and/or Standard not specific for Hollow Bars.

| VALIMA Designation | MST 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.

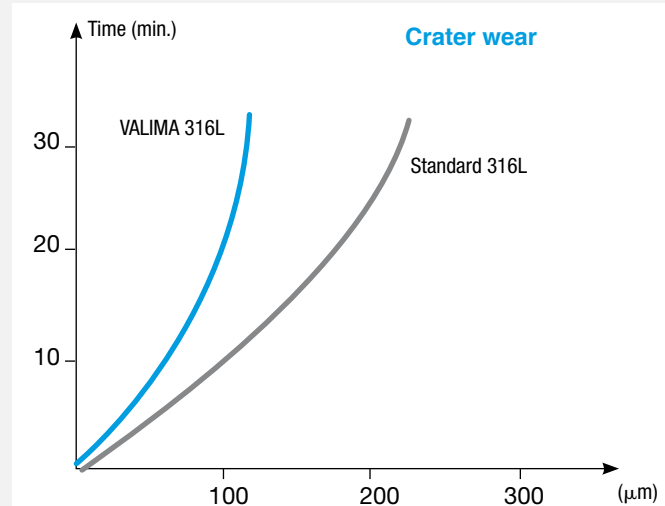
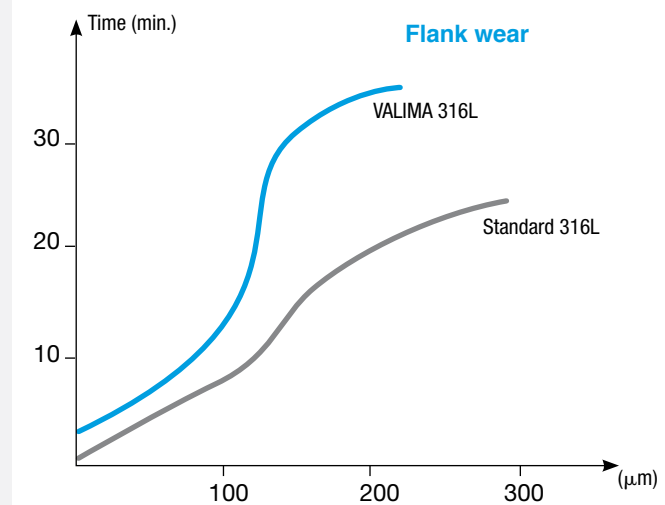
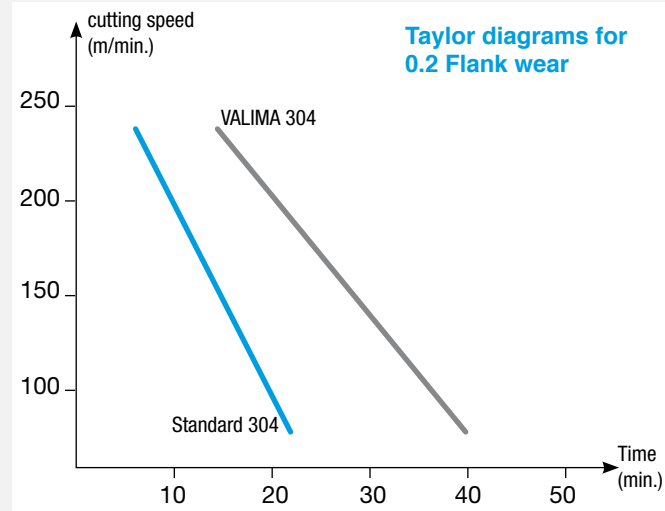
* DMV 316L with 2.5 - 3% Mo.

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VALIMA machining characteristics



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 consistency

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 downtime, 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

MST 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 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).

1 Titelseite Headline US

MST Quality management 3 Headline Seite

Quality assurance

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

6 Bildunterschrift

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.

2 Titelseite Subline US

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 MST, when placing your order.

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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. MST 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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