

Precision steel tubes for machining
and cold-drawn profile tubes

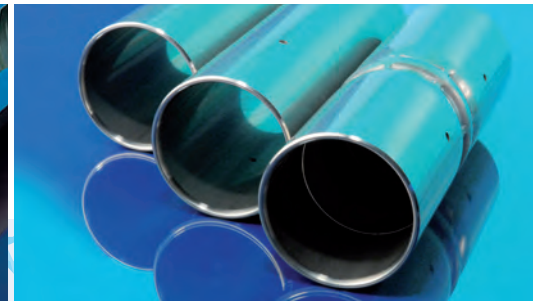
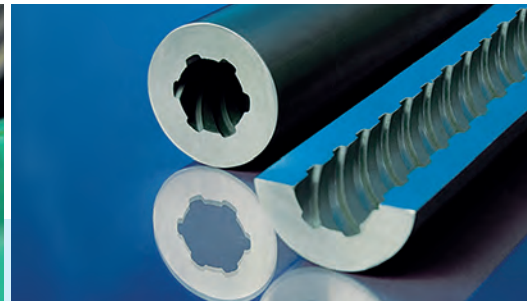
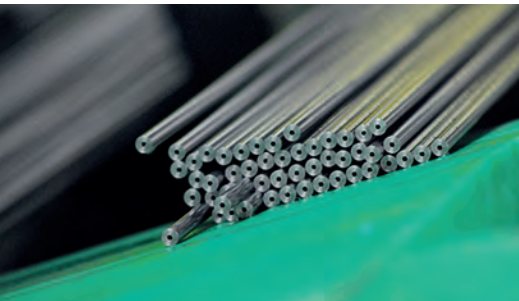


MANNESMANN
PRECISION TUBES

A Member of the Salzgitter Group

Content

The company	3
Precision steel tubes for machining	4 – 7
FCS variants	8 – 9
Range of dimensions	10 – 15
1 FCS dimension range / internal and external round	10 – 11
2 FCS dimension range / internal round and external hexagon	12
3 Precision steel tubes for cylindrical hollow turned parts	13
4 MW 1000 L	14 – 15
Properties of material groups	16 – 17
Ordering information	18
Profiles	19



Company

Mannesmann Precision Tubes, based in Mülheim an der Ruhr with around 2,300 employees. Worldwide activities and international access – your partner for high quality steel tubes.

Our locations in Germany, France, the Netherlands and Mexico form the basis for high delivery performance and customer satisfaction. Mannesmannröhren-Werk GmbH, based in Zeithain supplies pre-material (seamless hot rolled hollows) to the precision tube mills of the Salzgitter Group.

The Group-Structure

Synergy effects as a result of our integration with the Salzgitter Group ensure an outstanding efficiency – from the pre-material to the finished precision steel tube.

The subsidiaries and affiliates of the Business Unit Mannesmann specialize in different steel tube products and are each out in front in their own markets.



Precision steel tubes for machining



Cylindrical hollow parts for turning can be made from solid round steel or tubes.

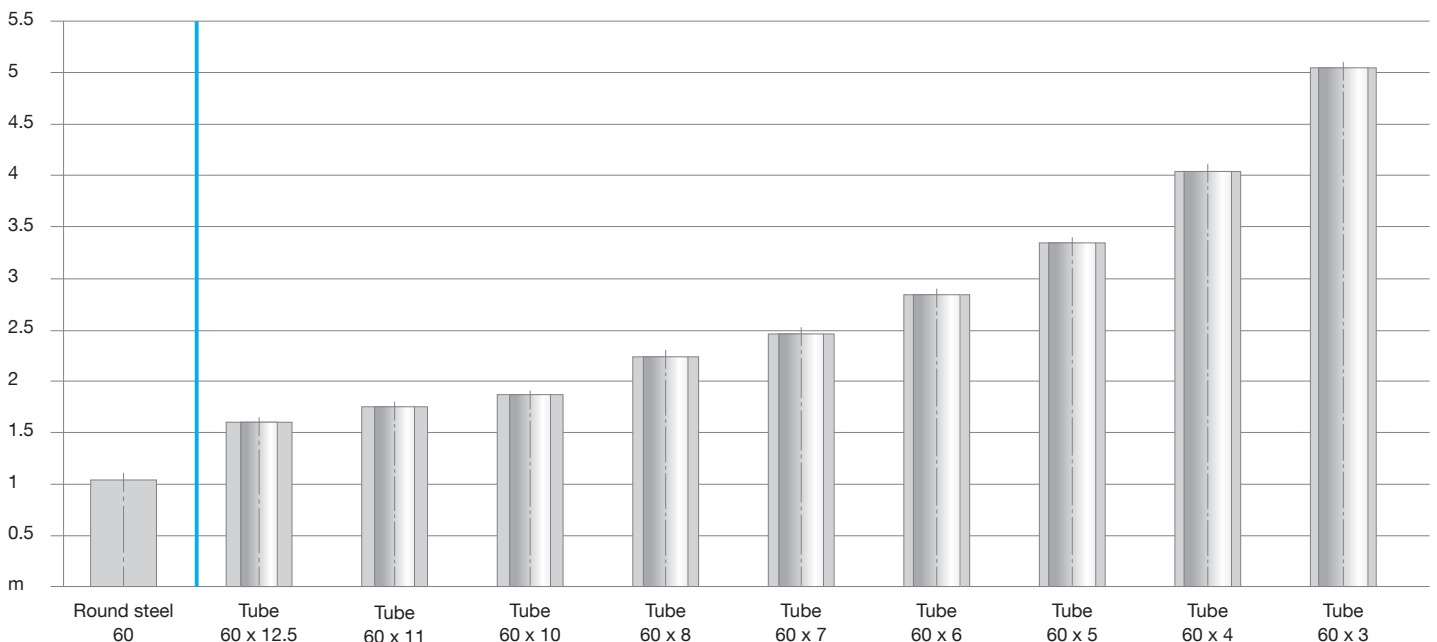
Cost-effectiveness is further increased by small eccentricity and close external and internal dimensional tolerances.

The use of Mannesmann precision steel tubes results in the following economic advantages:

- Lower material consumption
- Saving of machining steps
- Shorter machining times
- Better utilisation of machinery
- Transport cost savings

One metre of round steel with a diameter of 60 mm weighs 22.2 kg.

With the same weight, various tube profiles with the same outside diameter will have the following lengths:



The graphic clearly shows the economic advantage of using precision steel tubes.

Material saving:

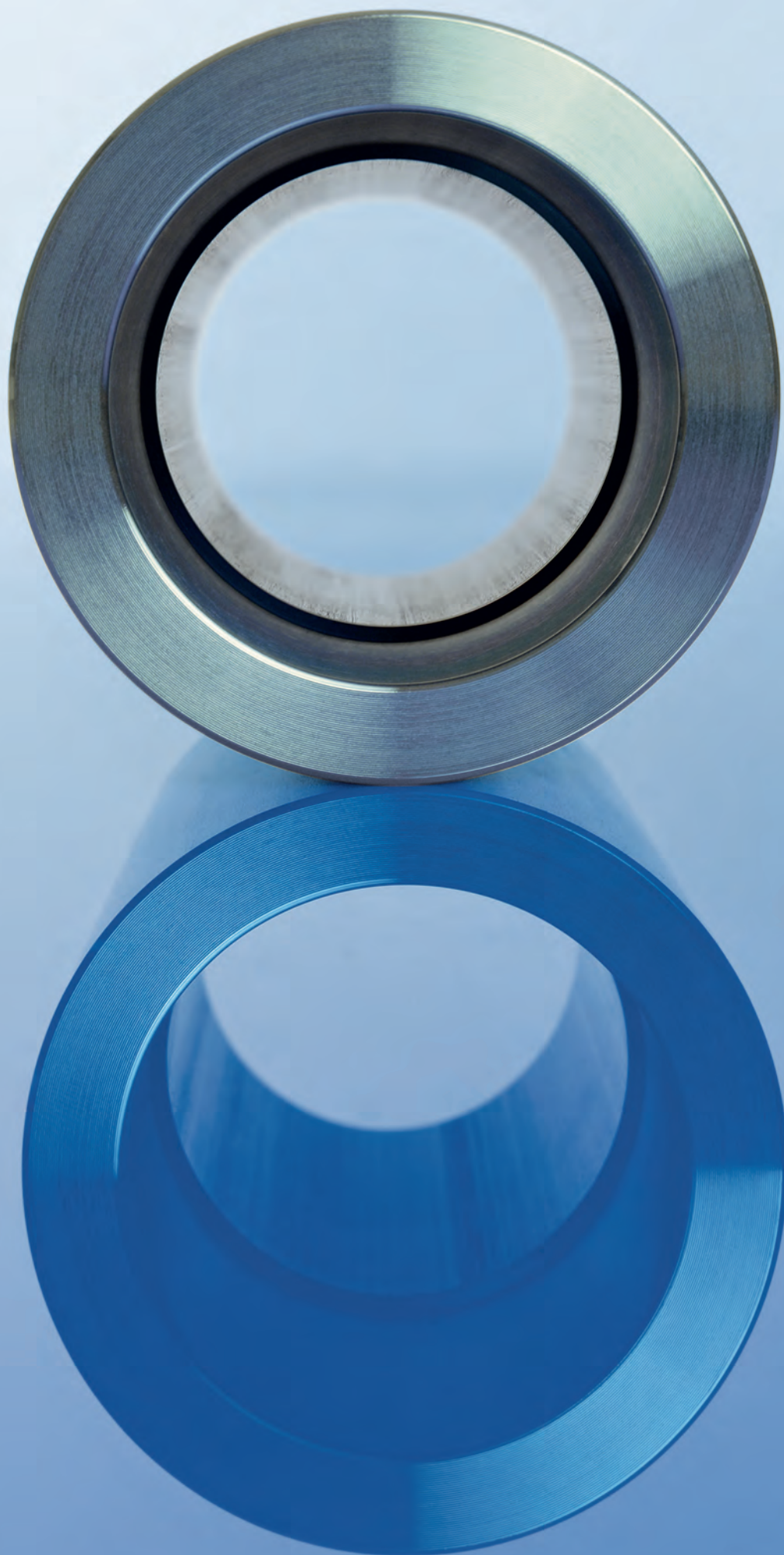
The lower the ratio of outside diameter to inside diameter, the more evident is the use of precision steel tubes for machining.

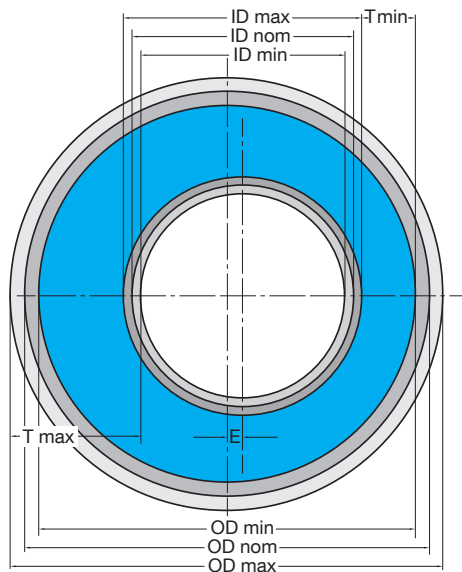
The tube with its annular cross-section is the natural semi-finished material for the production of hollow cylindrical machined parts.

Its dimensions approximate those of the finished product, minimising machining and thus also the cut volume.

Flat surfaces and precise workmanship enable small machining allowances, resulting in less cutting and gentle use of the lathe and tool.

In particular production according to DIN EN 10305-1, which is preferred by Mannesmann Precision Tubes, enables especially tight machining allowances compared to tubes according to DIN EN 10294-1.





- OD max = Outside diameter with plus tolerance
- OD nom = Nominal size of the outside diameter
- OD min = Outside diameter with minus tolerance
- ID max = Inside diameter with plus tolerance
- ID nom = Nominal size of the inside diameter
- ID min = Inside diameter with minus tolerance
- T min = Smallest permissible wall thickness
- T max = Largest permissible wall thickness
- E = Eccentricity

The limit dimensions for materials for machining apply for the outside diameter and the wall thickness. These figures are adequate for metal cutting on lathes for the normal case of external centring and concentric machining. The machining allowances are recommended guideline values for short turned parts (length <math>< 2.5 \times \text{diameter}</math>, maximum 75 mm), which should be maintained if possible.

Production conditions, particularly the surface requirements for the finished turned part or longer workpieces, can make it necessary to choose a larger machining allowance. The finished turned size is the final size after turning. Allowances for fine processing (for example grinding, polishing, honing) have to be provided additionally.

In choosing a size to order, not only the machining allowances but also the maximum deviation for the wall thickness and the eccentricity have to be considered. When deciding a machining allowance, it should be considered whether a concentric finished part is intended or whether any existing eccentricity is essential for the function of the part. In most cases, concentric internal and external machining will be undertaken. The wall thickness tolerance can occur as eccentricity. The maximum value of the

eccentricity corresponds to the absolute value of the wall thickness tolerance. The achievable dimensions of the finished part differ according to whether the tube is to be centred to the inside diameter or the outside diameter for final machining. This is due to the interaction of the tolerances of outside diameter, inside diameter and wall thickness or eccentricity.

The much more frequent case in practice is machining to the outside diameter. The tube is centred externally and any possible eccentricity is avoided while machining the inside.

Therefore when precision steel tubes are machined, only the tolerances of the outside diameter and the wall thickness are normally checked. If the part is machined to the inside diameter, the situation is reversed. Should centring to the inside diameter be intended in a particular case, then the tube inside diameter can be dimensioned and its tolerance checked by special agreement.

In this case, the outside diameter of the tube and the maximum eccentricity still have to be given.

Please contact us to discuss the choice of suitable tolerances.



Steel for subsequent machining

Based on the material data sheet Mannesmann Precision Tubes MS 1013
Issue 10/2014, Revision 1

Short name

FCS 10/FCS 20/FCS 35

Scope of applicability¹⁾

The grades described here are suitable for further machining, for example by turning. The chips are small due to the regulated sulphur content, which enables fully automatic chip clearance.

Chemical composition (ladle analysis)

Short name	C%	Si%	Mn%	P%	S%
FCS 10	0.07 – 0.10	0.10 – 0.25	0.95 – 1.30	max. 0.025	0.08 – 0.11
FCS 20	0.16 – 0.20	0.10 – 0.25	1.40 – 1.60	max. 0.030	0.08 – 0.11
FCS 35	0.32 – 0.39	0.10 – 0.35	1.35 – 1.65	max. 0.030	0.07 – 0.13

The addition of further microalloying elements is permissible and the manufacturer is entitled to do this.

Mechanical properties at room temperature

Short name	Delivery state	R _m in MPa	R _{p0.2} in MPa	A in %
FCS 10	K (+C)	≥ 520	≥ 420	≥ 8
	K+N (+N)	370 - 520	≥ 250	≥ 25
	K+S (+SR)	≥ 450	≥ 380	≥ 16
FCS 20	K (+C)	≥ 660	≥ 570	≥ 6
	K+N (+N)	530 - 680	≥ 370	≥ 22
	K+S (+SR)	≥ 610	≥ 530	≥ 12
FCS 35	K (+C)	≥ 720	≥ 650	≥ 4
	K+N (+N)	650 - 720	≥ 420	≥ 16
	K+S (+SR)	≥ 700	≥ 630	≥ 12

Other mechanical properties are possible on request.

Welding

Due to the chemical composition, which is optimised for the machining properties, welding of the steels is only possible with limitations.

¹⁾ These statements are only intended for information. The final responsibility for the suitability of the specific product for the intended purpose remains solely with the processor.

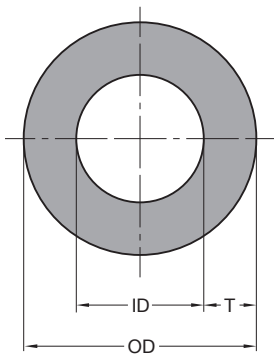
For the FCS variants:

For intermediate sizes of outside/inside diameter, the next higher value of permissible deviation applies.

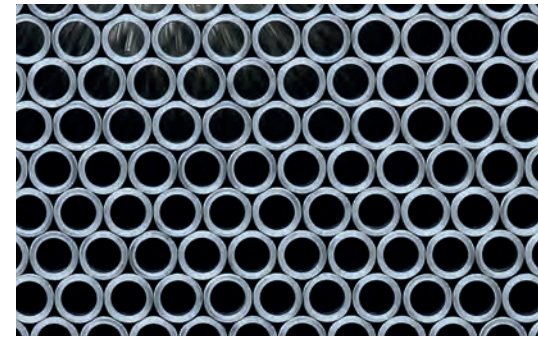
The permissible deviation for the inside diameter is in the minus

range, so that no special supplement has to be considered when deciding the size to order.

Range of dimensions



OD = Outside diameter
ID = Inside diameter
T = Wall thickness



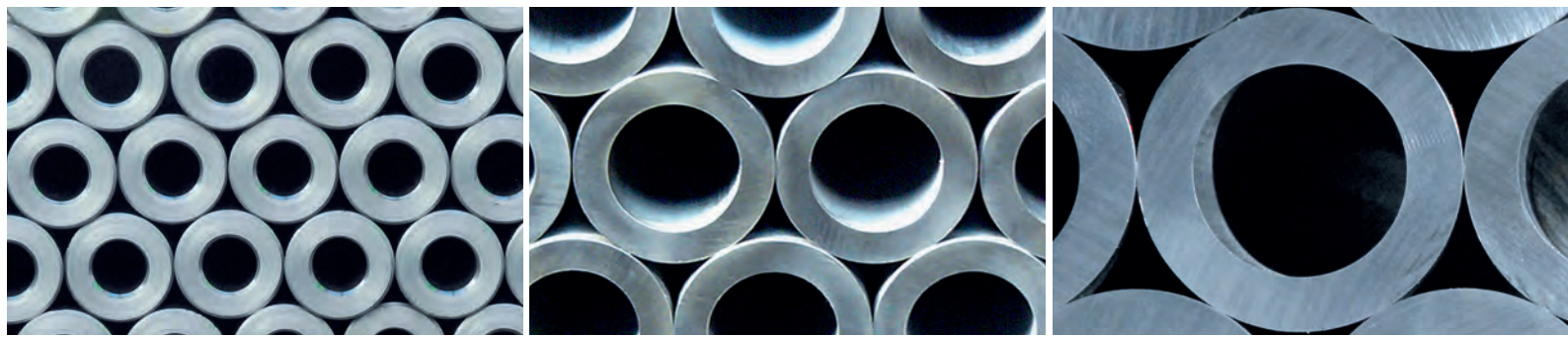
FCS 10/FCS 20/FCS 35

Range of dimensions, internal and external round

Outside diameter		Wall thickness												
Nominal size	Tolerance	1.80	2.00	3.00	4.00	4.50	5.00							
18	+0/-0.11	-0.15	14	-0.15	14	-0.15	12	-0.25	10	-0.35	9	-0.35	8	-0.50
20	+0/-0.13	-0.15	16	-0.15	16	-0.15	14	-0.25	12	-0.35	11	-0.35	10	-0.40
22	+0/-0.13	-0.15	18	-0.15	18	-0.15	16	-0.20	14	-0.25	13	-0.25	12	-0.40
24	+0/-0.13	-0.15	20	-0.15	20	-0.15	18	-0.20	16	-0.25	15	-0.25	14	-0.35
25	+0/-0.13	-0.15	21	-0.15	21	-0.15	19	-0.20	17	-0.25	16	-0.25	15	-0.35
28	+0/-0.13	-0.15	24	-0.15	24	-0.15	22	-0.20	20	-0.20	19	-0.20	18	-0.30
30	+0/-0.13	-0.15	26	-0.15	26	-0.15	24	-0.20	22	-0.20	21	-0.20	20	-0.20
32	+0/-0.16	-0.15	28	-0.22	28	-0.22	26	-0.20	24	-0.20	23	-0.20	22	-0.20
35	+0/-0.16	-0.15	31	-0.22	31	-0.22	29	-0.20	27	-0.20	26	-0.20	25	-0.20
38	+0/-0.16	-0.15	34	-0.22	34	-0.22	32	-0.25	30	-0.20	29	-0.20	28	-0.20
40	+0/-0.16	-0.15	36	-0.22	36	-0.22	34	-0.20	32	-0.20	31	-0.20	30	-0.20
42	+0/-0.16		38	-0.22	38	-0.22	36	-0.20	34	-0.25	33	-0.25	32	-0.25
45	+0/-0.16		41	-0.22	41	-0.22	39	-0.25	37	-0.25	36	-0.25	35	-0.25
46	+0/-0.16		42	-0.22	42	-0.22	40	-0.25	38	-0.25	37	-0.25	36	-0.25
50	+0/-0.16		46	-0.22	46	-0.22	44	-0.25	42	-0.25	41	-0.25	40	-0.25
55	+0/-0.19				51	-0.25	49	-0.25	47	-0.25	46	-0.25	45	-0.25
60	+0/-0.19				56	-0.25	54	-0.25	52	-0.30	51	-0.30	50	-0.25
63	+0/-0.30				59	-0.25	57	-0.25	55	-0.30	54	-0.30	53	-0.30
65	+0/-0.30				61	-0.25	59	-0.25	57	-0.30	56	-0.30	55	-0.30
70	+0/-0.30				66	-0.25	64	-0.25	62	-0.30	61	-0.30	60	-0.30
75	+0/-0.30				71	-0.25	69	-0.25	67	-0.30	66	-0.30	65	-0.40
80	+0/-0.30				76	-0.25	74	-0.25	72	-0.30	71	-0.30	70	-0.40
82	+0/-0.35				78	-0.25	76	-0.25	74	-0.30	73	-0.30	72	-0.40
90	+0/-0.4								82	-0.35	81	-0.35	80	-0.35
100	+0/-0.45								92	-0.35	91	-0.35	90	-0.35
105	+0/-0.5								97	-0.40	96	-0.40	95	-0.40

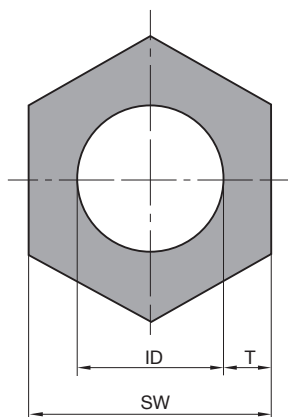
Wall thickness +/- 6% of the nominal size
with WS testing, without US testing
on request

Range of dimensions



Wall thickness +/- 6% of the nominal size																		
5.50	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	13.50									
7	-0.50																	
9	-0.40																	
11	-0.40																	
13	-0.35	12	-0.40	10	-0.40													
14	-0.35	13	-0.40	11	-0.40													
17	-0.30	16	-0.40	14	-0.40													
19	-0.20	18	-0.40	16	-0.40	14	-0.40											
21	-0.20	20	-0.30	18	-0.40	16	-0.40											
24	-0.20	23	-0.30	21	-0.30	19	-0.30	17	-0.40									
27	-0.20	26	-0.30	24	-0.30	22	-0.30	20	-0.30	18	-0.40							
29	-0.20	28	-0.25	26	-0.20	24	-0.30	22	-0.30	20	-0.40							
31	-0.25	30	-0.25	28	-0.20	26	-0.25	24	-0.25	22	-0.30							
34	-0.25	33	-0.25	31	-0.25	29	-0.25	27	-0.25	25	-0.30	23	-0.30					
35	-0.25	34	-0.25	32	-0.25	30	-0.25	28	-0.25	26	-0.30	24	-0.30	22	-0.30			
39	-0.25	38	-0.25	36	-0.25	34	-0.25	32	-0.25	30	-0.30	28	-0.30	26	-0.30			
44	-0.25	43	-0.25	41	-0.25	39	-0.25	37	-0.25	35	-0.30	33	-0.30	31	-0.30	29	28	
49	-0.25	48	-0.25	46	-0.25	44	-0.25	42	-0.25	40	-0.30	38	-0.40	36	-0.40	34	33	
52	-0.30	51	-0.30	49	-0.30	47	-0.30	45	-0.40	43	-0.40	41	-0.40	39	-0.40	37	36	
54	-0.30	53	-0.30	51	-0.30	49	-0.40	47	-0.40	45	-0.40	43	-0.40	41	-0.40	39	38	
59	-0.30	58	-0.30	56	-0.30	54	-0.40	52	-0.40	50	-0.40	48	-0.40	46	-0.40	44	43	
64	-0.40	63	-0.40	61	-0.40	59	-0.40	57	-0.40	55	-0.40	53	-0.40	51	-0.40	49	48	
69	-0.40	68	-0.40	66	-0.40	64	-0.40	62	-0.40	60	-0.40	58	-0.40	56	-0.40	54	53	
71	-0.40	70	-0.40	68	-0.40	66	-0.40	64	-0.40	62	-0.40	60	-0.40	58	-0.40	56	55	
79	-0.40	78	-0.40	76	-0.40	74	-0.40	72	-0.40	70	-0.40	68	-0.40	66	-0.40	64	63	
89	-0.45	88	-0.45	86	-0.45	84	-0.45	82	-0.45	80	-0.45	78	-0.45	76	-0.45	74	73	
94	-0.50	93	-0.50	91	-0.50	89	-0.50	87	-0.50	85	-0.50	83	-0.50	81	-0.50	79	78	

Range of dimensions



SW = Width across flats
 ID = Inside diameter
 T = Wall thickness

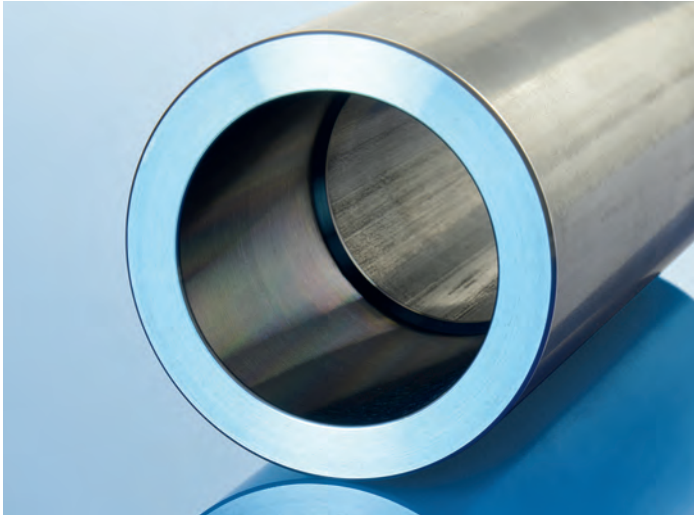


FCS 10/FCS 20/FCS 35

Range of dimensions, round and external hexagon

Outside diameter		Wall thickness +/- 10% of the nominal size											
Width across flats	Tolerance	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00		
32	+0/-0.16		26 -0.20	24 -0.20	22 -0.20	20 -0.30	18 -0.40	16 -0.40	14 -0.40				
35	+0/-0.16		29 -0.20	27 -0.20	25 -0.20	23 -0.20	21 -0.30	19 -0.30	17 -0.40				
38	+0/-0.16			30 -0.20	28 -0.20	26 -0.20	24 -0.20	22 -0.30	20 -0.30	18 -0.40			
40	+0/-0.16			32 -0.20	30 -0.25	28 -0.20	26 -0.20	24 -0.25	22 -0.30	20 -0.40			
42	+0/-0.16			34 -0.20	32 -0.25	30 -0.25	28 -0.25	26 -0.25	24 -0.25	22 -0.30	20 -0.30		
45	+0/-0.16			37 -0.25	35 -0.25	33 -0.25	31 -0.25	29 -0.25	27 -0.25	25 -0.30	23 -0.30		
46	+0/-0.16				36 -0.25	34 -0.25	32 -0.25	30 -0.25	28 -0.25	26 -0.30	24 -0.30		
50	+0/-0.16					38 -0.25	36 -0.25	34 -0.25	32 -0.25	30 -0.30	28 -0.30		
55	+0/-0.19					43 -0.25	41 -0.30	39 -0.40	37 -0.40	35 -0.30	33 -0.40		
60	+0/-0.19					48 -0.25	46 -0.30	44 -0.40	42 -0.40	40 -0.40	38 -0.40		
63	+0/-0.30						49 -0.40	47 -0.40	45 -0.40	43 -0.40	41 -0.40		
65	+0/-0.30						51 -0.40	49 -0.40	47 -0.40	45 -0.40	43 -0.40		
70	+0/-0.30						56 -0.40	54 -0.40	52 -0.40	50 -0.40	48 -0.40		
75	+0/-0.30						61 -0.40	59 -0.40	57 -0.40	55 -0.40	53 -0.40		
80	+0/-0.30						66 -0.40	64 -0.40	62 -0.40	60 -0.40	58 -0.40		

WS and US testing on hollow

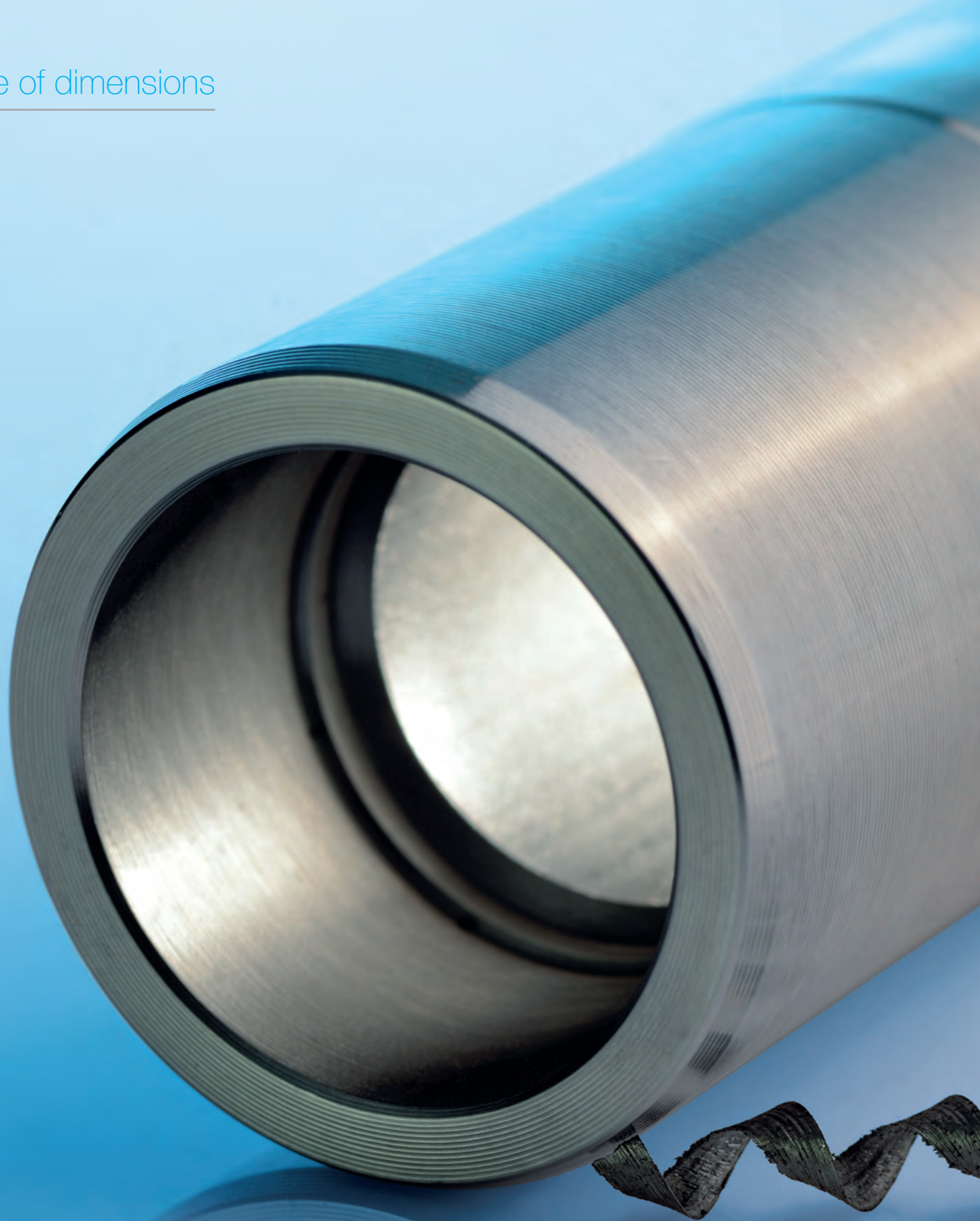


Range of dimensions	Permissible deviations		Machining allowance on finished turned size
	mm	unannealed	unannealed
For the outside diameter OD			
10 to ≤ 30	+0.2	+0.2	+0.4
> 30 to ≤ 60	+0.3	+0.3	+0.5
> 60 to ≤ 100	+0.4	+0.5	+0.6
> 100 to ≤ 125	+0.5	+0.6	+0.6
> 125 to ≤ 150	+0.7	+0.8	+0.8
For the inside diameter ID with outside diameter			
10 to ≤ 30	-0.3	-0.4	-0.5
> 30 to ≤ 60	-0.4	-0.5	-0.5
> 60 to ≤ 100	-0.5	-0.6	-0.6
> 100 to ≤ 125	-0.6	-0.7	-0.7
> 125 to ≤ 150	-0.8	-0.8	-0.8

Precision steel tube for cylindrical hollow turned parts

Outside diameter		Wall thickness												
Nominal size	Tolerance	1.50	1.80	2.00	3.00	4.00	5.00	8.00	10.00	12.00	15.00	17.00	20.00	25.00
16														
18														
20														
25														
30														
35														
40														
45														
50														
55														
60														
70														
80														
90														
100														
120														
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160														
180														
200														
220														
250														
300														
350														
370														
380														

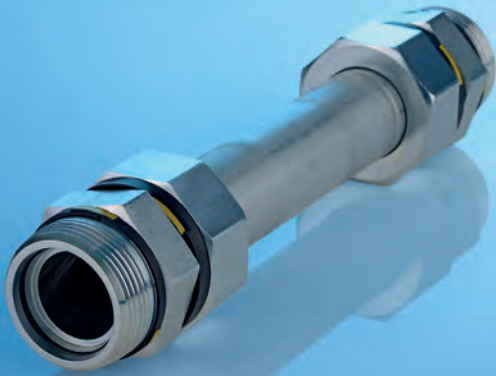
- On request
- 5% eccentricity
- 7.5% eccentricity
- 10% eccentricity



MW 1000 L in delivery states Z2 and Z3 according to material data sheet WBL 049R, January 2009

Outside diameter		Wall thickness +/-5% of the nominal size									
Nominal size		2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	
20											
25											
30											
35											
40											
45											
50											
55											
60											
65											
70											
80											

Tolerances on request



Properties of material groups

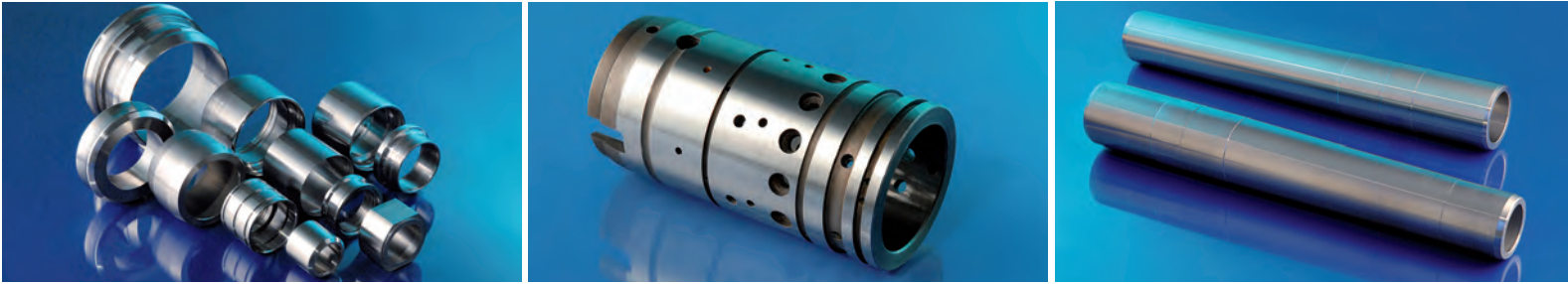


Ladle analysis

Material group	Description	Ladle analysis in %*							
		C	Si	Mn	P max	S	Cr	Mo	Ni
Machining	FCS10	0.07 – 0.10	0.10 – 0.25	0.95 – 1.30	0.025	0.080 – 0.110			
	FCS20	0.16 – 0.20	0.10 – 0.25	1.40 – 1.60	0.030	0.080 – 0.110			
	FCS35	0.32 – 0.39	0.10 – 0.35	1.35 – 1.65	0.030	0.070 – 0.130			
Hardened steel	C15E	0.12 – 0.18	≤ 0.40	0.30 – 0.60	0.035	≤ 0.035			
	17Cr3	0.14 – 0.20	≤ 0.40	0.40 – 0.70	0.025	≤ 0.035	0.60 – 0.90		
	16MnCr5*	0.14 – 0.19	≤ 0.40	1.00 – 1.30	0.025	≤ 0.035	0.80 – 1.10		
	20MnCr5	0.17 – 0.22	≤ 0.40	1.10 – 1.40	0.025	≤ 0.035	1.00 – 1.30		
	20MoCr4	0.17 – 0.23	≤ 0.40	0.70 – 1.00	0.025	≤ 0.035	0.30 – 0.60	0.40 – 0.50	
Heat treatment steel	C22E	0.17 – 0.24	≤ 0.40	0.40 – 0.70	0.035	≤ 0.035	≤ 0.40	≤ 0.10	≤ 0.63
	C35E	0.32 – 0.39	≤ 0.40	0.50 – 0.80	0.035	≤ 0.035	≤ 0.40	≤ 0.10	≤ 0.63
	C45E*	0.42 – 0.50	≤ 0.40	0.50 – 0.80	0.035	≤ 0.035	≤ 0.40	≤ 0.10	≤ 0.63
	C60E	0.57 – 0.65	≤ 0.40	0.60 – 0.90	0.035	≤ 0.035	≤ 0.40	≤ 0.10	≤ 0.63
	28Mn6	0.25 – 0.32	≤ 0.40	1.30 – 1.65	0.035	≤ 0.035	≤ 0.40	≤ 0.10	≤ 0.40
	25CrMo4	0.22 – 0.29	≤ 0.40	0.60 – 0.90	0.035	≤ 0.030	0.90 – 1.20	0.15 – 0.30	
	MW1000L	≤ 0.28	0.30 – 0.80	2.00 – 2.60	0.030	≤ 0.035	0.50 – 0.80	0.20 – 0.40	
	30CrMo4	0.27 – 0.34	≤ 0.35	0.35 – 0.60	0.035	≤ 0.035	0.80 – 1.15	0.15 – 0.30	
High grade steels	34CrMo4	0.30 – 0.37	≤ 0.40	0.60 – 0.90	0.035	≤ 0.035	0.90 – 1.20	0.15 – 0.30	
	42CrMo4	0.38 – 0.45	≤ 0.40	0.60 – 0.90	0.035	0.015 – 0.050	0.90 – 1.20	0.15 – 0.30	
	E420J2/20MnV6	0.16 – 0.22	0.10 – 0.50	1.30 – 1.70	0.030	0.015 – 0.050	≤ 0.30	≤ 0.08	≤ 0.63
	E470/20MnV6	0.16 – 0.22	0.10 – 0.50	1.30 – 1.70	0.030	≤ 0.015			
Bearing steel	100Cr6	0.93 – 1.05	0.15 – 0.35	0.25 – 0.45	0.025	≤ 0.040	1.35 – 1.60	≤ 0.10	
Steels to US standards	SAE 5115	0.13 – 0.18	0.15 – 0.30	0.70 – 0.90	0.035	≤ 0.040	0.70 – 0.90		
	SAE 5120	0.17 – 0.22	0.15 – 0.30	0.70 – 0.90	0.035	≤ 0.040 ≤ 0.040	0.70 – 0.90		
	SAE 8617	0.15 – 0.20	0.20 – 0.35	0.70 – 0.90	0.040	≤ 0.040	0.40 – 0.60	0.15 – 0.25	0.40 – 0.70
	SAE 4337/4340	0.35 – 0.40	0.20 – 0.35	0.60 – 0.80	0.040	≤ 0.040	0.70 – 0.90	0.20 – 0.30	1.65 – 2.00
	SAE 4140	0.38 – 0.43	0.15 – 0.35	0.75 – 1.00	0.030	≤ 0.040	0.80 – 1.10	0.15 – 0.25	≤ 0.25
	SAE 1049/1050	0.46 – 0.53/0.48 – 0.55		0.60 – 0.90	0.030	≤ 0.050			
	SAE 1513	0.10 – 0.16		1.10 – 1.40	0.040	≤ 0.050			

* Also available as grade with increased sulphur content

+ The addition of further microalloying elements is permissible and the manufacturer is entitled to do this



Material properties

Material group	Description	Delivery state	Wall thickness	$R_{p0.2}$	R_m	A	CVN
			mm	MPa	MPa	%	J (RT, along)
Machining	FCS10	K (+C)		≥ 420	≥ 520	≥ 8	
		K+N (+N)		≥ 250	370 – 520	≥ 25	
		K+S (+SR)		≥ 380	≥ 450	≥ 16	
	FCS20	K (+C)		≥ 570	≥ 660	≥ 6	
		K+N (+N)		≥ 370	530 – 680	≥ 22	
		K+S (+SR)		≥ 530	≥ 610	≥ 12	
FCS35	K (+C)		≥ 650	≥ 720	≥ 4		
	K+N (+N)		≥ 420	650 – 720	≥ 16		
	K+S (+SR)		≥ 630	≥ 700	≥ 12		
Heat treatment steel	C22E	+N	≤ 16	260	420 – 550	21	
			> 16	240	400 – 530	24	
	C35E	+N	≤ 16	300	520 – 670	17	
			> 16	280	500 – 650	19	
	C45E*	+N	≤ 16	350	610 – 760	16	
			> 16	330	590 – 740	17	
	C60E	+N	≤ 16	390	720 – 900	13	
			> 16	370	700 – 880	14	
	28Mn6	+N	≤ 16	380	580 – 730	16	
			> 16	360	520 – 670	17	
	25CrMo4	tempered	≤ 8	700	900 – 1100	12	55
			> 8 to 20	600	800 – 1000	14	50
			> 20	450	700 – 900	15	50
	MW1000L	Z1 (+A)		400	600	20	
			Z2 (+N)	1000	1300	10	
			Z3 (+N+A)	900	1100	14	
	34CrMo4/ SAE 4140	tempered	≤ 8	800	1000 – 1200	11	45
			> 8 to 20	650	900 – 1000	12	40
			> 20	550	800 – 1000	14	45
	42CrMo4	tempered	≤ 8	900	1100 – 1300	10	38
			> 8 to 20	750	1000 – 1200	11	35
			> 20	650	900 – 1100	12	35
High grade steels	E420J2/20MnV6 E470/20MnV6						
	SAE 4337/4340	tempered	≤ 8	1000	1200 – 1400	9	50
			> 8 to 20	900	1100 – 1300	10	45
			> 20	800	1000 – 1200	11	45

Ordering information and scope of application

Ratio T/D	Limit sizes according to DIN EN 10305-1 are to be multiplied by
≥ 0.05	1
$0.05 > T/D \geq 0.025$	1.5
< 0.025	2

Ordering info:

Example unannealed according to DIN EN 10305-1
41 +/- 0.15 x 32 +/- 0.15

New:

41.5 +0.3 - 0 x 31.5 -0.4 + 0 oder 41 + 0.5 + 0.8 x 32 -0.5 - 0.9

If the dimensions of the starting tube are not clearly stated in enquiries or orders, then the following statements are necessary:

- Final size after turning (finished turned size)
- Outside or inside centring for machining
- Processing length
- Permissible central deviation of the inside diameter to the outside diameter
- External or internal machining

General

- Lengths of 3 – 3.2 m, further lengths on request
- Tolerance/eccentricity according to overviews of dimensions, or on request
- Straightness: 1:1000 mm

Delivers states

+ C / + LC / + SR / + A / + N / tempered

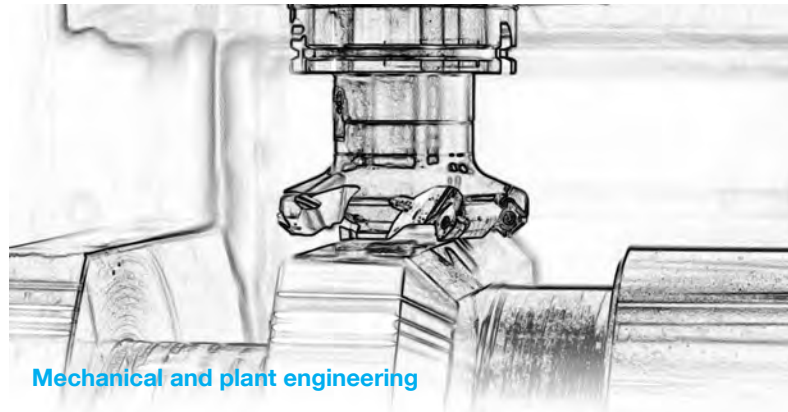
Scope of application



Agricultural machinery



Printing machinery



Mechanical and plant engineering



Vehicle and coach building

Profile types

same wall thicknesses

different wall thicknesses

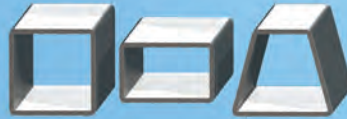
Round tubes



Oval and flat oval tubes



Square, rectangular and trapezoidal tubes



Multiple-cornered tubes



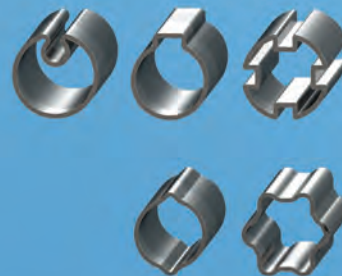
Polygonal tubes



D-shaped and curved-sided profile tubes



Grooved profile tubes



Mannesmann Precision Tubes GmbH
Wiesenstraße 36
45473 Mülheim an der Ruhr, Germany
www.mannesmann-precision-tubes.com

Automotive

Mannesmann Precision Tubes GmbH
Wiesenstraße 36
45473 Mülheim an der Ruhr, Deutschland
Phone: +49 208 458-1203
Fax: +49 208 458-1251
E-Mail: automotive.mpt@mannesmann.com

Mannesmann Precision Tubes France SAS
ZI La Saunière
89600 Saint-Florentin, Frankreich
Phone: +33 3 86 43 50 66
Fax: +33 3 86 43 50 20
E-Mail: automotive.mptfr@mannesmann.com

Mannesmann Precision Tubes Mexico S.A. de C.V.
Parque Industrial el Salto Calle A No. 239
45680 El Salto/Jalisco, México
Phone: +52 33 3688-1107
Fax: +52 33 3688-1196
E-Mail: info.mptmx@mannesmann.com

Industry und Energy

Mannesmann Precision Tubes GmbH
Wiesenstraße 36
45473 Mülheim an der Ruhr, Deutschland
Phone: +49 208 458-1507
Fax: +49 208 458-1635
E-Mail: industry.mpt@mannesmann.com
energy.mpt@mannesmann.com

Mannesmann Precision Tubes France SAS
Avenue Jean Juif Z.I. Marolles
51300 Vitry Le François, Frankreich
Phone: +33 3 26 41 23 04
Fax: +33 3 26 41 23 32
E-Mail: industry.mpt@mannesmann.com
energy.mpt@mannesmann.com

Mannesmann Precision Tubes Netherlands B.V.
Engelseweg 173
5705 AD Helmond, Niederlande
Phone: +31 492 596-596
Fax: +31 492 596-505
E-Mail: industry.mpt@mannesmann.com
energy.mpt@mannesmann.com



MANNESMANN. Das Rohr.