

# Seamless Mechanical Steel Tubing

Specifications & Size Ranges

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ArcelorMittal

# Seamless Mechanical Steel Tubing Specifications & Size Ranges

## Custom Production

Tubular Products Division of ArcelorMittals' seamless mechanical tubing is manufactured to meet your specific application requirements. Controlled modifications and adjustments are made to the tubemaking process for each order and take into consideration end use and all finishing operations (including heat treatment) that will be performed after you have received the tubing.

Your Tubular Products representative will be happy to work with you to develop the information that is required.

## Size Range

Tubular Products seamless mechanical tubing is furnished in both cold-drawn and hot-finished form in a wide range of sizes, from 1.375" to 7.750" OD and from 0.188" to 1.625" wall thickness, as shown on the chart to the right.

## Minimum Quantities

Hot-finished carbon and alloy—10,000 pounds, or 4,536 kilograms minimum.

Cold-drawn carbon and alloy—5,000 pounds minimum or 125 feet minimum, 2,268 kilograms minimum or 38.1 meters minimum, whichever is greater.

Quantity variation—standard  $\pm 10\%$  of the ordered weight, or  $\pm 25$  feet or 7.61 meters, whichever is greater.

Outside Diameter			WALL THICKNESS - Inches/mm																			
Inches	mm		0.188 4.78	0.213 5.41	0.214 5.44	0.217 5.51	0.250 6.35	0.260 6.60	0.312 7.93	0.313 7.95	0.375 9.53	0.437 11.10	0.438 11.13	0.450 11.43	0.484 12.29	0.485 12.32	0.500 12.70	0.516 13.11	0.531 13.49	0.563 14.30	0.570 14.48	
1-3/8	1.375	34.93																				
1-1/2	1.500	38.10																				
1-5/8	1.625	41.28																				
1-3/4	1.750	44.45																				
1-7/8	1.875	47.63																				
2	2.000	50.80																				
2-1/8	2.125	53.98																				
2-3/16	2.188	55.58																				
2-1/4	2.250	57.15																				
2-3/8	2.375	60.33																				
2-1/2	2.500	63.50																				
2-5/8	2.625	66.68																				
2-3/4	2.750	69.85																				
2-7/8	2.875	73.03																				
3	3.000	76.20																				
3-1/8	3.125	79.38																				
3-1/4	3.250	82.55																				
3-3/8	3.375	85.73																				
3-1/2	3.500	88.90																				
3-5/8	3.625	92.08																				
3-3/4	3.750	95.25																				
3-7/8	3.875	98.43																				
4	4.000	101.60																				
4-1/8	4.125	104.78																				
4-1/4	4.250	107.95																				
4-3/8	4.375	111.13																				
4-1/2	4.500	114.30																				
4-5/8	4.625	117.48																				
4-3/4	4.750	120.65																				
4-7/8	4.875	123.83																				
5	5.000	127.00																				
5-1/8	5.125	130.18																				
5-1/4	5.250	133.35																				
5-3/8	5.375	136.53																				
5-1/2	5.500	139.70																				
5-5/8	5.625	142.88																				
5-3/4	5.750	146.05																				
5-7/8	5.875	149.23																				
6	6.000	152.40																				
6-1/8	6.125	155.58																				
6-1/4	6.250	158.75																				
6-3/8	6.375	161.93																				
6-1/2	6.500	165.10																				
6-5/8	6.625	168.28																				
6-3/4	6.750	171.45																				
6-7/8	6.875	174.63																				
7	7.000	177.80																				
7-1/8	7.125	180.98																				
7-1/4	7.250	184.15																				
7-3/8	7.375	187.33																				
7-1/2	7.500	190.50																				
7-5/8	7.625	193.68																				
7-3/4	7.750	196.85																				

■ Cold-Drawn    
 ■ Hot-Finished or Cold-Drawn    
 ■ Hot-Finished

																				Outside Diameter										
0.578	0.625	0.641	0.700	0.703	0.750	0.766	0.813	0.825	0.828	0.875	0.891	0.938	1.075	1.078	1.125	1.203	1.250	1.325	1.328	1.375	1.450	1.453	1.500	1.578	1.625	Inches	mm			
4.68	15.88	16.28	17.78	17.86	19.05	19.46	20.65	20.96	21.03	22.23	22.63	23.83	27.31	27.38	28.58	30.56	31.75	33.66	33.73	34.93	36.83	36.91	38.10	40.08	41.28					
																											1-3/8	1.375	34.93	
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																												7-3/4	7.750	196.85



# Machining

Determining the proper tube size is essential when producing a machined part from seamless mechanical tubing. To calculate the tube size needed to machine a given part, several important points should be considered:

- The finished machined part size—OD, ID, length and tolerances
- The machining sequence, type of machining and processing
  - Will the tubing be machined true to the OD or ID?
  - Will the OD or ID be machined?
  - Will heat treating be used, and at what point in the production process?
  - How will it be held or chucked?
- Metallurgical requirements such as tensile, yield, elongation, microstructure and hardness.

Recommended tubing rough size will be developed by Tubular Products upon receipt of your inquiry. A print or sketch of the part to be produced should be included.

## COLD-DRAWN SEAMLESS MECHANICAL TUBING

### Diameter Tolerances — Inches/Millimeters

OD Size Range Inches, Inclusive	Wall Percent of OD	OD Inches		ID Inches		Quenched & Tempered OD & ID ± Inches	OD Size Range mm, Inclusive	Wall Percent of OD	OD mm		ID mm		Quenched & Tempered OD & ID ± mm
		Over	Under	Over	Under				Over	Under	Over	Under	
0.500-1.699	All	.005	.000	.000	.005	.015	12.70- 43.16	All	0.13	0.00	0.00	0.13	0.38
1.700-2.099	All	.006	.000	.000	.006	.020	43.17- 53.32	All	0.15	0.00	0.00	0.15	0.51
2.100-2.499	All	.007	.000	.000	.007	.023	53.33- 63.48	All	0.18	0.00	0.00	0.18	0.58
2.500-2.899	All	.008	.000	.000	.008	.025	63.49- 73.64	All	0.20	0.00	0.00	0.20	0.64
2.900-3.299	All	.009	.000	.000	.009	.028	73.65- 83.80	All	0.23	0.00	0.00	0.23	0.71
3.300-3.699	All	.010	.000	.000	.010	.030	83.81- 93.96	All	0.25	0.00	0.00	0.25	0.76
3.700-4.099	All	.011	.000	.000	.011	.033	93.97-104.12	All	0.28	0.00	0.00	0.28	0.84
4.100-4.499	All	.012	.000	.000	.012	.036	104.13-114.28	All	0.30	0.00	0.00	0.30	0.91
4.500-4.899	All	.013	.000	.000	.013	.038	114.29-124.44	All	0.33	0.00	0.00	0.33	0.97
4.900-5.299	All	.014	.000	.000	.014	.041	124.45-134.60	All	0.36	0.00	0.00	0.36	1.04
5.300-5.549	All	.015	.000	.000	.015	.044	134.61-140.95	All	0.38	0.00	0.00	0.38	1.12
5.550-5.999	Under 6 6 to 7 1/2 Over 7 1/2	.010 .009 .018	.010 .009 .000	.010 .009 .009	.010 .009 .009	.047 .047 .047	140.96-152.38	Under 6 6 to 7 1/2 Over 7 1/2	0.25 0.23 0.46	0.25 0.23 0.00	0.25 0.23 0.23	0.25 0.23 0.23	1.19 1.19 1.19
6.000-6.499	Under 6 6 to 7 1/2 Over 7 1/2	.013 .010 .020	.013 .010 .000	.013 .010 .010	.013 .010 .010	.050 .050 .050	152.39-165.08	Under 6 6 to 7 1/2 Over 7 1/2	0.33 0.25 0.51	0.33 0.25 0.00	0.33 0.25 0.25	0.33 0.25 0.25	1.27 1.27 1.27
6.500-6.999	Under 6 6 to 7 1/2 Over 7 1/2	.015 .012 .023	.015 .012 .000	.015 .012 .012	.015 .012 .012	.057 .053 .053	165.09-177.78	Under 6 6 to 7 1/2 Over 7 1/2	0.38 0.30 0.58	0.38 0.30 0.00	0.38 0.30 0.30	0.38 0.36 0.30	1.45 1.35 1.35
7.000-7.499	Under 6 6 to 7 1/2 Over 7 1/2	.018 .013 .026	.018 .013 .000	.018 .013 .013	.018 .013 .013	.065 .056 .056	177.79-190.48	Under 6 6 to 7 1/2 Over 7 1/2	0.46 0.33 0.66	0.46 0.33 0.00	0.46 0.33 0.33	0.46 0.33 0.33	1.65 1.42 1.42
7.500-8.000	Under 6 6 to 7 1/2 Over 7 1/2	.020 .015 .030	.020 .015 .000	.020 .015 .015	.020 .015 .015	.070 .060 .060	190.49-203.20	Under 6 6 to 7 1/2 Over 7 1/2	0.51 0.38 0.76	0.51 0.38 0.00	0.51 0.38 0.38	0.51 0.38 0.38	1.78 1.52 1.52

### Wall Thickness Tolerances — Inches/Millimeters

Wall Thickness Percent of OD	Maximum Percent Over & Under Nominal		Wall Thickness Percent of OD	Maximum Percent Over & Under Nominal	
	Under 1.499" ID	1.500" ID & Over		Under 38.07mm ID	38.07mm ID & Over
Under 10	10.0	7.5	Under 10	10.0	7.5
10 to 25	10.0	6.0	10 to 25	10.0	6.0
Over 25	12.5	7.5	Over 25	12.5	7.5

## HOT-FINISHED SEAMLESS MECHANICAL TUBING

### Diameter Tolerances — Inches/Millimeters

OD Size Range Inches, Inclusive	As Rolled or Annealed OD, ± Inches	Quenched & Tempered OD & ID ± Inches	OD Size Range mm Inclusive	As Rolled or Annealed OD, ± mm	Quenched & Tempered OD & ID ± mm
2.000-2.499	.017	.027	50.80- 63.48	0.43	0.686
2.500-2.999	.019	.029	63.49- 76.17	0.48	0.737
3.000-3.499	.021	.032	76.18- 88.87	0.53	0.813
3.500-3.999	.023	.035	88.88-101.57	0.58	0.889
4.000-4.499	.025	.038	101.58-114.28	0.64	0.965
4.500-4.999	.027	.041	114.29-126.97	0.69	1.041
5.000-5.499	.029	.044	126.98-139.67	0.74	1.118
5.500-5.999	.031	.047	139.68-152.38	0.79	1.194
6.000-6.499	.033	.050	152.39-165.08	0.84	1.270
6.500-6.999	.035	.053	165.09-177.78	0.89	1.346
7.000-7.499	.037	.056	177.79-190.48	0.94	1.422

### Wall Thickness Tolerances — Inches/Millimeters

Wall Thickness Percent of OD	Maximum Percent Over & Under Nominal		Wall Thickness Percent of OD	Maximum Percent Over & Under Nominal	
	OD 2" and Over			OD 50.08mm and Over	
Under 10	10.0		Under 10	10.0	
10 to 25	7.5		10 to 25	7.5	



### Straightness Tolerances – Inches/Millimeters

OD Size Range Inches, Inclusive	Wall Thickness Percent of OD	Maximum Deviation from Straight Total Inches in any 3 Feet	OD Size Range Millimeters, Inclusive	Wall Thickness Percent of OD	Maximum Deviation from Straight Total Millimeters in any 1 Meter
Up to 5.000	Over 3% of OD	.030	Up to 127.00	Over 3% of OD	0.83
5.001-7.750	Over 4% of OD	.045	127.01-196.85	Over 4% of OD	1.25

Straightness, or camber, is measured for any 3 ft. or meter of length with a 3 ft. or meter straight edge and a feeler gauge. These tolerances do not apply to tubes supplied quench and tempered. Please inquire for specific capabilities.

### Cut Length Tolerances – Inches/Millimeters

Length Range Feet Inclusive	OD, Inches		Length Range Meters Inclusive	OD, Millimeters	
	up to 4.000 Inclusive	4.001-7.750 Inclusive		up to 101.60 Inclusive	101.63-196.85
4 & Less	+.094	+.125	1.219 & Less	+2.39	+3.18
Over 4 to 10	+.125	+.125	Over 1.219 to 3.048	+3.18	+3.18
Over 10 to 24	+.125	+.125	Over 3.048 to 7.315	+3.18	+3.18
Over 24 to 34	+.250	+.250	Over 7.315 to 10.363	+6.35	+6.35
Over 34	+.375	+.375	Over 10.363	+9.53	+9.53

### Chemical Composition of Selected Seamless Tubing Steel Grades

SAE Grades and Near Equivalent DIN Grades	Chemical Composition (%)								
	C	Mn	P	S	Si	Cr	Mo	V and/or Nb	Al
SAE 1010	.08/.13	.30/.60	.04 m	.05 m					
DIN ST 30 Al	.10 m	<=.55	.04 m	.04 m	.05 m				.02 min
SAE 1015	.13/.18	.30/.60	.04 m	.05 m	.15/.35				
DIN ST 35	.17 m	>=.40	.05 m	.05 m	.35 m				
SAE 1018	.15/.20	.60/.90	.04 m	.05 m	.15/.35				
DIN ST 45	.21 m	>=.40	.05 m	.05 m	.35 m				
SAE 1026	.22/.28	.60/.90	.04 m	.05 m	.15/.35				
DIN CK 24	.20/.28	.50/.80	.035 m	.035 m	.30/.50				
SAE 1035	.32/.38	.60/.90	.04 m	.05 m	.15/.35				
DIN CK 35	.32/.39	.50/.80	.035 m	.035 m	.15/.35				
SAE 1040	.37/.44	.60/.90	.04 m	.05 m	.15/.35				
DIN CK 40	.37/.43	.50/.80	.035 m	.035 m	.15/.35				
SAE 1524	.19/.25	1.35/1.65	.04 m	.05 m	.15/.35				
DIN 22 Mn 6	.18/.25	1.30/1.65	.035 m	.035 m	.15/.30				
SAE 4130	.28/.33	.40/.60	.035 m	.040 m	.15/.35	.80/1.10	.15/.25		
DIN 33Cr Mo 4	.30/.37	.50/.80	.035 m	.035 m	-.40	.90/1.20	.15/.30		
SAE 4140	.38/.43	.75/1.00	.035 m	.040 m	.15/.35	.80/1.10	.15/.25		
DIN 42 Cr Mo 4	.38/.45	.50/.80	.035 m	.035 m	-.40	.90/1.20	.15/.30		
LTVC 520	.15/.20	1.20/1.50	.035 m	.040 m	.35 m				.020 min
DIN ST 52	.22 m	1.60 m	.05 m	.05 m	.55 m				.02 min
LTVC 620	.15/.20	1.20/1.50	.035 m	.040 m	.35 m			.15 m	.020 min
DIN STE 47*	.18	1.50			.35			.09V	

m = maximum \*Nominal Comp.

### Typical Mechanical Properties—Cold-Drawn and Stress-Relief Annealed

Steel Grade	Near Equivalent DIN Grade	Yield Strength		Tensile Strength		% Elong in 2"	Hardness Rb	Full Size Cv Impact @ -20°C
		KSI	N/mm <sup>2</sup>	KSI	N/mm <sup>2</sup>			
1010	ST 30 Al	50	345	65	450	15	72	
1015	ST 35	55	380	70	485	15	80	
1018	ST 45	65	450	80	550	15	85	
1026	CK 24	75	520	85	585	15	85	
1035	CK 35	80	550	90	620	12	90	
1040	CK 40	80	550	95	655	10	91	
1524	22 Mn 6	85	585	95	655	12	91	
4130	33 Cr Mo 4	85 **	585 **	100 **	690 **	12	92	
4140	42 Cr Mo 4	95 **	655 **	115 **	790 **	10	98	
LTVC 520	ST 52	75	520	85	585	15	85	*20ft-lb / 27J
LTVC 620	STE 47	90	620	100	690	15	92	*10ft-lb / 14J

### Normalized Properties

LTVC 520	ST 52	48	330	70	485	25	72	
LTVC 620	STE 47	52	352	72	490	25	78	

\* Individual inquiries are required on tube sizes greater than .375" wall

\*\* These tensile values would not apply for these grades when supplied "annealed for best machinability."

These tensile properties are typical minimum values for each grade in sizes up to maximum of .500" wall thicknesses. Inquiries for other steel grades, thermal conditions, or heavier wall sizes should be referred to Dofasco Tubular Products.

## Heat Treating

Mechanical properties of most steel grades can be varied greatly by heat treating. Through a controlled cycle of heating and cooling, certain desired properties are obtained by producing predictable changes in the microstructure of the steel.

Tubular Products' seamless tubing is custom-produced to meet the individual requirements of each order. Your application and special requirements determine the type of heat treatment necessary to achieve the desired mechanical properties.

The following heat treatment conditions are available:

- Hot-finished only:
  - As-rolled
  - As-rolled and annealed
  - Normalized
  - Normalized and tempered
  - Quenched and tempered
- Cold-drawn only:
  - Unannealed
  - Stress relief annealed
  - Subcritical annealed
  - Normalized
  - Normalized and tempered
  - Quenched and tempered

Other heat treatments are available by special arrangement.

# Seamless Mechanical Steel Tubing Specifications & Size Ranges

## Special Configurations

Tubular Products special seamless tubing configurations start with the highest quality steels. Grade, chemical analysis and surface condition are carefully considered, and production processes are tailored to achieve the best tubing for the end use.

The configurations are formed from round tube by cold drawing. The tube is drawn over a shaped mandrel or through a shaped die, or both. Improved tolerances, finishes and mechanical properties result.

### For Specific Recommendations

For specific recommendations about special tubing configurations, please furnish the following information: (1) end use; (2) sizes; (3) dimensions and corner radii (if appropriate) of the mating part; (4) description of heat-treating and other finishing operations that will be performed; (5) mechanical properties required.

A sketch or print of your part configuration is important, as is information about any special requirements.

### Round OD/Hex ID

Most hex ID tubing is produced to telescope with hex bar stock, and dimensions established at time of order development are checked with “go/no go” plug gauges.



### Hex OD/Round ID

Shapes and tolerances will be per your requirements. Tolerances matching your application requirements will be developed at time of order.



### Hex OD/Hex ID

This configuration is produced with die and mandrel specially designed to achieve tolerances suitable for your application requirements. Radii and tolerances are developed at time of order.



### Oval

Various types and sizes of oval configurations can be cold-drawn from seamless tubing.



### MECHANICAL TUBING BUSINESS

Contact us at the following location:

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[www.arcelormittal.com/tubular](http://www.arcelormittal.com/tubular)



# ArcelorMittal