TUBING DATA Cold Drawn Seamless Mechanical Steel Tubing

Cold Drawn Seamless Mechanical Steel Tubing is round and concentric. It is clean and it is accurately finished to close tolerances. It can readily be machined, bent and formed, threaded and welded. It can be satisfactorily carburized.

This tubing is produced by piercing a hot billet and swaging or rolling it to reduce diameter and to elongate. Next, it is finished to accurate size and gauge by cold drawing through a die and over a mandrel. The cold drawing operation produces tubing of great accuracy as to size, a superior, smooth finish, increased physical properties and better grain structure which result in excellent machinability.

Ordinarily, open hearth steel of medium carbon is the grade used Great care is excercised in selecting steel of the highest quality obtain able due to the severity of the foregoing operations.

THE CHEMICAL ANALYSIS, AVERAGE GRADE, IS SUBSTANTIALLY AISI C1015 AS FOLLOWS:

Carbon	.1020
Manganese	.30 — .60
Phosphorus, maximum	.045
Sulphur, maximum	.055

THE AVERAGE PHYSICAL PROPERTIES, AS COLD DRAWN, ARE AS FOLLOWS:

W	Properties	Half Hard	Soft Annealed
	Yield Point, Lbs. Per Sq. In	55,000	30,000
	Ultimate strength, Lbs. Per Sq. In	75,000	48,000
	Elongation, per cent in 2 inches	30	50
	Elongation, per cent in 8 inches	12	30
	Brinell Hardness	120	90
	Rockwell Hardness	68B	48B

A few of the many satisfactory applications are machine parts, bushings, bearings, spacers, hollow shafts, structural members, torque rods, mandrels, cylinders, pump stock, furniture, rollers, and the like.

Seamless Mechanical Steel Tubing is divided into two general classifications, Mechanical Tubing and Pressure Tubing

Mechanical Tubing means all tubing employed in construction of machinery, tools and accessories which does not have to withstand internal pressures from either liquids or gases. The application, therefore could be one of a non-moving member such as a brace or spacer, or it could be one of a moving member such as a shaft, bearing, bushing or roller. Mechanical tubing is sometimes referred to as, "a bar with

Pressure Tubing is that type of seamless tubing which has the ability to withstand internal pressures and, at the same time, act as a conduit Thus, boiler tubes, heat transfer tubes, diesel injector tubes, and the like, are typical applications

Almost all tubing carried in warehouse stock is Mechanical Tubing.

TUBING DATA Weight Computing Formulae for Round, Hot Rolled or Cold Drawn, Seamless Steel Tubing

To determine the average wall weight of a tube:

$$W = 10.68 (D - \dagger) \dagger$$

To determine the minimum wall weight of a tube:

$$W = 10.68 (D - \frac{\dagger}{.875}) \frac{\dagger}{.875}$$

Where W = Weight in pounds per foot (carried to 4 digits) D = Outside diameter in inches (to 3 decimal places)

t = Wall thickness in decimals (to 3 decimal places) All weights are carried to four digits only, the fifth digit being carried

forward if five or over, or dropped if under five.

Outside diameters and wall thicknesses are carried to three decimal places, the fourth decimal being carried forward if five or over, or dropped if under five.

TUBING DATA Standard Manufacturing Tolerances on Round, Cold Drawn, Seamless Mechanical Steel Tubing

Size Range in Inches	O.D. Tolerance in Inches	I.D. Tolerance in Inches	Wall Tolerances
Up to, but not including 3/16 O.D	+.003 000	+.000 003 (See Notes 1 and 2)	±10% (See Notes 1 and 2)
³ / ₁₆ O.D. to, but not including ½ O.D	+.004 000	+.000 004 (See Notes 1 and 2)	±10% (See Notes 1 and 2)
1/2 O.D. to, but not including 11/2 O.D	+.005 000 (See Note 3)	+.000 005 (See Notes 1 and 2)	±10%
1½ O.D. to, but not including 3½ O.D	000	+.000 010 (See Note 1)	±10% (See Note 3
3½ O.D. to, but not including 5½ O.D	+.015 000 (See Note 3)	+.005 015 (See Note 1)	±10% (See Note 1)
5½ O.D. to, but not including 8 O.D. when wall is less than 5% of O.D	±.030 (See Note 3)	±.035 (See Note 3)	±10%
5½ O.D. to, but not including 8 O.D. when wall is at least 5% and not over 7½% O.D	±.020	±.025	±10%
5½ O.D. to, but not including 8 O.D. when wall is over 7½ % of O.D	+.030 000	+.015 030 (See Note 1)	±10% (See Note 1)
8 O.D. to 10¾ O.D. when wall is less than 5% of O.D.	±.045 (See Note 3)	±.050 (See Note 3)	±10%
8 O.D. to 10% O.D. when wall is at least 5% and not over $7\%\%$ of O.D	±.035	±.040 (See Note 1)	(See Note 1)
8 O.D. to 10¾ O.D. when wall is over 7½% of O.D.	+.045 000	(See Note 1)	(See Note 1)

IMPORTANT-The above O.D., I.D. and wall tolerances apply only to normal sizes, and to unannealed and finished annealed tubing. Tubing having relatively heavy or light wall in relation to the O.D. is covered by special tolerances, reference to which is made in Footnotes 1 to 3 of

Finished and unannealed tubing constitute the bulk of cold drawn mechanical tubing. Tubes which have been given a softer anneal are apt to possess more or less ovality due to warpage in annealing, or to straightening operations. The greater degree of heat used in the softer anneals, with the attendant increase in scale, also affects the accuracy of diameter. Therefore, medium or soft annealed tubes will not be as close to size as the table indicates.

NOTE 1—For tubes with I.D. less than 50 per cent of O.D. or with Wall more than 25 per cent of O.D. or with Wall more than 1¼ inch thick or weighing more than 90 pounds per foot, which cannot be successfully drawn over a mandrel, the I.D. may vary over or under by an amount equal to 10 per cent of the wall thickness. The wall thickness may vary 121/2 per cent over or under the thickness specified.

NOTE 2-For tubes with I.D. less than 1/2 inch, or less than 1/8 inch where the wall thickness is more than 20 per cent of the O.D., which cannot be successfully drawn over a mandrel, the wall thickness may vary 15 per cent over or under that specified and the I.D. will be gov erned by the O.D. and wall thickness variations.

TUBING DATA

Standard Manufacturing Tolerances on Round, Cold Drawn, Seamless Mechanical Steel Tubing

Continued from preceding page

NOTE 3-Tubing having a wall thickness less than 3 per cent of the O.D. cannot be straightened properly without a certain amount of distortion. Consequently such tubes, while having an average O.D. and I.D. within the tolerances shown in the table, will require an ovality tolerance over and under 1/2 per cent of the nominal O.D. and I.D., this being in addition to the tolerances indicated in the table.

SPECIAL NOTE—Tolerances are applicable only to two dimensions (length excepted). Thus, if O.D. and wall are specified, the theoretical I.D. may not conform to published tolerances. If O.D. and I.D. are specified, the wall may not conform to published tolerances except that the mean or average wall (taking into account the permissible O.D. and I.D. tolerances) will not vary more than indicated under "Wall Tolerances." Stock material is generally ordered to O.D. and wall.

EXAMPLE

If a cold drawn tube is specified 11/2 inch O.D. x 11/4 inch I.D., one might expect the theoretical wall of ½ inch to be held to a variation of plus-minus 10 per cent or within the limits of .1125/.1375 inch.

However, for a nominal O.D. of 1.500 inch, the O.D. may vary between 1.500 inch and 1.510 inch, and the I.D. may vary between 1.240 inch and 1.250 inch, which may result in an average or mean wall of .130 inch instead of 1/8 inch. Consequently, the wall may vary plus-minus 10 per cent from the mean of .130 inch, or within limits of .1215/.1485 inch. If, however, the average wall were ½ inch (.125) reflecting 1.500 inch O.D. and 1.250 inch I.D., the wall limits would be plus-minus 10 per cent of 1/8 or .1125/.1375 inch. Hence, any order of tubes might vary in the entire lot as low as .1125 inch on some and as high as 1430 inch on others.

Therefore, if a buyer specifies the three dimensions of O.D., I.D. and wall, it would be impracticable to meet all three of these tolerances. If, in the case above, the size were specified 11/2 inch O.D. x 11/4 inch I.D. x 1/2 inch wall, this would entail a wall limitation of .1125/.1375 inch, which is obviously inconsistent with actual average wall resulting from standard O.D. and I.D. tolerances.

Standard Manufacturing Tolerances for Round, Soft Annealed Steel Tubing

Graup No.	Size	Outside Diameter			side neter		/all kness	Ovality	
	in Inches	Over	Under	Over	Under	Over	Under	Double Q.D. and I.D. Tolerances when Wall is:	
1	Less than ½ I.D	.010	.000	†	†	15%	15%		
2	1.D. to, but not including 1½ 0.D	.010	.000	.000	.010	10%	10%	Lighter than 16 gauge (.065	
3	1½ O.D. to, but not including 3½ O.D	.010	.010	.010	.010	10%	10%	Lighter than 13 gauge (.095)	
4	3½ O.D. to, but not including 5½ O.D	.015	.015	.015	.015	10%	10%	Lighter than 9 gauge (.148)	
5	5½ O.D. to 9 O.D	1/2 % of 0.D.	of 0.D.	14% of I.D.	½% of I.D.	10%	10%	Information on request	

Tubes having an I.D. less than 60 per cent of the O.D., or having a wall *Iubes having an I.D. less than 60 per cent of the O.D., or having a wail ¼ inch and heavier, cannot be successfully drawn over a mandrel. The I.D. of such sizes may vary 10 per cent over or under the wail thickness. The wall of such sizes may vary 12½ per cent over or under, †Tubes less than ½ inch I.D. cannot be successfully drawn over a mandrel. This wall may vary 15 per cent over or under and the I.D. will be governed by the O.D. and wall variations. The actual weight limit may be the theo-retical weight plus 10 per cent.

TUBING DATA Straightness Tolerances for Round, Cold Drawn, **Seamless Mechanical Steel Tubing**

Under standard practice, out-of-straightness tolerances should not exceed the amounts shown in tabular form below. The tolerance for any 3 feet of length is measured with a 3 foot straightedge and the use of a feeler gauge. The total tolerance, that is the maximum curvature of any point in the total length of the tube, is determined by rolling the tube on a surface plate and measuring the curvature with a feeler gauge. The table applies to lengths not over 22 feet.

Size Limits in Inches	Maximum Curvature in any 3 Feet	Maximum Curvature in Total Lengths	Maximum Curvature for Lengths under 3 Feet
O.D. 5 and smaller. Wall thickness over 3% of O.D., but not over .5	.030	.030 x Number of feet of length	Ratio of .01 per Ft.
O.D. over 5 to 8, Incl. Wall thickness over 4% of O.D., but not over .75	.045	.045 x Number of feet of length	Ratio of .015 per Ft.
O.D. over 8 to 10%, Incl. Wall thickness over 4% of O.D., but not over 1	.060	.060 x Number of feet of length	Ratio of .020 per Ft.

The tolerances apply generally to unannealed, finish annealed and medium annealed cold finished or hot finished tubes of carbon steel up to a maximum of .45 per cent carbon and to alloy steel tubes up to a maximum of .25 per cent carbon. Tubes having lighter or heavier walls and soft annealed or hardened tubes present straightening difficulties in varying degrees beyond normal, and the tolerance require-ments of such tubes should be agreed upon at the time of ordering.

Tubes for special purposes such as conveyor rolls, etc., requiring straightness tolerances closer than above, demand special straighten-ing operations and inspection which should also be agreed upon at the time of ordering

Standard Length Tolerances-Lathe Cut

Standard tolerances in	inches on commercially exact cut	lengths	are:
4' and under	Up to 2, Incl	+1/16	00
	Over 2 to 4, Incl		00
	Over 4	+1/8	00
Over 4' to 10', Incl	Up to 2, Incl	+3/22	00
	Over 2	+1/8	00
Over 10' to 24', Incl	All sizes	+3/16	00
Over 24'	All sizes	*	00

*Plus 3/16 inch plus 1/8 inch for each 10 feet or fraction over 24 feet.

Standard Ovality Tolerances

Amount by which Cold Drawn Seamless Mechanical Tubing is out of round, primarify caused by annealing or straightening operations. Ovality of normal sizes will be within O.D. tolerance. Ovality of abnormal sizes is covered by Footnote D of Tolerance Table. Ovality does not affect wall tolerance

TUBING DATA

Standard Diameter Tolerances for Square and Rectangular, Welded Steel Tubing

Rectangular, Welded Steel Tubing

TOLERANCE ON SIZE—The O.D. tolerance of square and rectangular tube as measured at the corners, disregarding tolerance on convexity or concavity of side, is the same as that of the round tube size "Flash-in Tube" used to form the square or rectangular section.

TOLERANCE ON SIDE—The convexity or concavity on the side of a square or rectangle is measured with a micrometer, tolerances being: When the longest side of a rectangle or square does not exceed 2½ inches the tolerance is ± .010 inch.

When the longest side of a rectangle or square exceeds 2½ inches the tolerance is ± .015 inch.

SQUARENESS OF SIDES—The squareness tolerance of square and rectangular tubes varies in accordance with the following formula: ± b = c x .006 inch
b Tolerance for out-of-square c = Length of longest side.

Example: Rectangular tubes 2 inch x 1 inch c = 2 inch
tb = 2 x .006 inch = .012 inch.

Thus a 2 inch x 1 inch rectangular tube may have its sides fail to be 90°

Thus a 2 inch x 1 inch rectangular tube may have its sides fail to be 90° to each other by $\pm.012$ inch. TWIST—Permissible twist in square and rectangular tubes is $\frac{1}{22}$ inch in 3 feet. This is measured by holding one end of square or rectangular tube on a surface plate with bottom side parallel to the plate, and noting the height that either corner on the opposite end of the same side, is above the surface plate.

Standard Straightness Tolerances for Round, Welded Steel Tubing

Round, Welded Steel Tubing

Commercial tolerance for straightness is .030 inch in a length of 3 feet and is checked by placing the tube on a surface plate with both ends touching the surface plate. The point of maximum deflection of the tube from the surface plate shall not be more than .030 inch for a length of 3 feet when measured with a feeler gauge.

No tube, regardless of length, shall have a deflection greater than .030 inch for any 3 foot length, when checked as outlined above with a 3 foot straight edge.

In lengths greater than 3 feet, the permissible deflection is determined by the following formula:

 $\frac{L}{3}$ x .030 inch

 $\begin{array}{c} 3 \\ L = L ength \ of \ tube \\ \textbf{EXAMPLE-A} \ tube \ 18 \ feet \ long \ would \ have a \ maximum \ deflection \ as \ computed \ by \ the \ above \ formula \ of . 180 \ inch, \ derived \ as \ follows: \\ \hline \frac{18}{2} \ x \ .030 = .180 \ inch \end{array}$

For length less than three feet, the straightness tolerance is pro-rated on the basis of .030 inch in three feet, down to a length of 12 inches. Below 12 inches, the minimum straightness tolerance is not less than 0.10 inch

Methods of Cutting Tube into Short Lengths

LATHE CUT—The tube is cut by a lather parting tool, but, in making the cut, a slight burr is thrown up, both on the inside and outside. This cutting burr is usually very slight and can be removed if necessary.

PUNCH CUT—The tube is clamped in a die and a pointed knife is forced through the tube, thereby cutting out a slug. The ends are square and flat but there is a slight dent where the knife pierces through the tube. **DISC CUT**—This type of cut off is similar to the conventional type used by plumbers in cutting pipe except that the operation is performed in a special machine. The end of the tube is rolled over about $\frac{1}{16}$ inch on a

side due to the action of the cutting knife.

SAW CUT—Saw cutting is done with a high speed saw. In making the cut the tube is sometimes distorted due to the pressure of the saw and a pronounced burr is thrown up on both the outside and inside.

TUBING DATA Standard Cutting Tolerances-Lathe Cut

Size in Inches	Gauge	Length in Inches	Toler. Plus or Minus	Size in Inches	Gauge	Length in Inches	Toler. Plus or Minus
3/8 to 1	14-22	0 to 12	1/64	1½ to 2	9-13	60½ to 120	1/16
3/8 to 1	14-22	121/32 to 60	1/32	21/32 to 3	14-20	0 to 12	1/32
3/8 to 1	14-22	601/32 to 120	1/16	21/32 to 3	14-20	121/32 to 120	1/16
11/32 to 2	14-22	0 to 12	1/64	31/32 to 4	14-18	0 to 12	3/64
11/32 to 2	14-22	121/32 to 60	1/32	31/32 to 4	14-18	121/32 to 120	1/16
11/32 to 2	14-22	601/32 to 120	1/16	31/32 to 4	9-13	0 to 12	
11/32 to 2	9-13	0 to 12	1/32	31/32 to 4	9-13	121/32 to 120	5/64
11/32 to 2	9-13	121/32 to 60	1/64			0.000	

Cutting Tolerances-Punch, Disc or Saw Cut

1 to 3 feet	13 feet and
4 to 12 feet ± 3/32 inch	longer± 1/8 inch

Standard Gauge Tolerances for Cold Rolled, Welded, Carbon Steel Tubing

Size	in Inches	Par muse	Size of Tu	be in Inches	A COLUMN TO SERVE			
Gauge	Decimal	3/8 to 7/8	1 to 2	2-1/8 to 3	3-1/8 to			
22	.028	{+.000 004	+.000 004	=	=			
20	.035	{+.000 004	+.000 004	+.000 005	=			
18	.049	\(\frac{+.000}{004}\)	+.000 005	+.000 006	1			
16	.065	\(\frac{\pm.000}{\pm.004}\)	+.000 006	+.000 006	+.000 006			
14	.083	{+.000 004	+.000 006	+.000 006	+.000 006			
12	.109	{ =	+.000 006	+.000 006	+.000 006			
11	.120	{ =	+.000 006	+.000 008	+.000 008			
10	.134	{ -	+.000 006	+.000 008	+.000 008			
9	.148	{ =	+.000 006	+.000 008	+.000 008			
8	.165	{ =	+.000 008	+.000 008	+.000 010			

TUBING DATA Standard Gauge Tolerances for Hot Rolled, Welded, Carbon Steel Tubing

Size i	n Inches Decimal	5/8 to 1-1/2	Size of Tube in Inches	3-1/8 to 5
20	.035	{+.000 006	_	=
18	.049	{+.000 006	+.002 006	Ξ
16	.065	{+.002 006	+.002 008	+.002 010
14	.083	\(\frac{\pm .002}{\pm .006}\)	+.002 008	+.002 010
12	.109	{+.002 006	+.002 008	+.002 010
11	.120	{+.002 008	+.002 010	+.002 012
10	.134	{ =	+.002 010	+.002 012
9	.148	{ =	+.002 010	+.002 012
8	.165	{ =	+.002 010	+.002 012

Definition of Ovality

Ovality is the difference between the maximum diameters of any one section of the tube. Tubing in the heavier gauges will have a closer ovality tolerance. The maximum and minimum 0.D. tolerances listed in the table should be considered as maximum limits.

As an example, in accordance with the above, 2 inch x 16 gauge standard cold rolled tube has the following tolerance:

WEIGHTS AND DIMENSIONS OF SEAMLESS AND WELDED PIPE

Pipe	O.D.						A. S. A.	PIPE SCH	EDULES						_ Double
Size	Inches	5	10	20	30	40	STD.	60	80	E.H.	100	120	140	160	E.H.
1/8	.405	.035	.049		_	.068	.068	-	.095	.095	_				_
/8	.400	.1383	.065	-		.088	.2447	-	.3145	.3145	-			_	_
1/4	.540	.049	.3297	_		.4248	.088		.119	.119			-		_
		.049	.065	lane.		.091	.091		.126	.126		-	-	_	=
3/8	.675	.3276	.4235	-	-	.5676	.5676		.7388	.7388	-		-	_	_
17	.840	.065	.109			.133	.133		.147	.147	777			.187	.294
1/2	.840	.5383	.6710	7777		.8510	.8510	-	1.088	1.088	2.00	****		1.304	1.714
3/4	1:050	.065	.083	-		.113	.113	2000	.154	.154			-	.218	.308
14		.6838	.8572 .109			1.131	1.131	-	1.474	1.474	-		5100	1.937 .250	.358
1	1.315	.8678	1,404		-	1,679	1.679	_	2.172	2.172	-	-		2.844	3.659
		.065	.109			.140	.140	-	.191	.191	to make it	2000	_	.250	.382
11/4	1.660	1,107	1.806			2,273	2.273	-	2.997	2.997	-	-	-	3.765	5.214
11/2	1.900	.065	.109		15.800	.145	.145		.200	.200	200	-	* contra	.281	.400
1 7/2	1.900	1.274	2.085		-	2.718	2.718		3.631	3.631	-	-	-	4.859	6.408
2	2.375	.065	.109		-	.154	.154		.218	.218	-	-	-	.343	.436
-		1.604 .083	2.638 .120	-		3.653	3.653 .203		5.022 .276	5.022		777	-	7.444	9.029 .552
21/2	2.875	2.475	3.531	-		5.793	5.793	-	7.661	7.661			-	10.01	13.70
	2 222	.083	.120	-	1000	.216	.216	-	.300	.300	_	-		.437	.600
3	3.500	3.029	4.332			7,576	7,576	- inter-	10.25	10.25	1000		armer .	14.32	18,58
21/	4 000	.083	.120			.226	.226	1000	.318	.318	-	-	- American	_	.636
31/2	4.000	3,472	4.973	-		9.109	9.109		12.51	12.51	-	7.00	-		22.85
4	4.500	.083	120		-	.237	.237	.281	.337	.337		.437	-	.531	.674
-		3,915	5.613			10.79	10.79 .247	12.66	14.98	.355		19.01	_	22.51	27.54 .710
41/2	5.000		_	=	-		12.53	-		17.61			_		32.53

LIGHT FIGURES—Wall Thickness in Inches

BOLD FIGURES—Weight Per Foot in Pounds

WEIGHTS AND DIMENSIONS OF SEAMLESS AND WELDED PIPE

Pipe															
Size	Inches		10	20	30	40	STD.	60	80	E.H.	100	150	140	160	- Doubl
5	5.563	.109 6.349	7.770	=	=	.258 14.62	.258 14.62	=	.375 20.78	.375	=	.500 27.04	_	.625	.750
6	6.625	.109 7.585	9.289	=	=	.280 18.97	.280 18.97	_	.432 28.57	.432 28.57	=	.562 36.39	Ξ	32.96 .718 45.30	38,55 .864
7	7.625	=	=	_	= .	_	.301 23.57	=		.500 38,05	_	-	_	_	53.16 .875 63.08
8	8.625	.109 9.914	.148 13.40	.250 22.36	24.70	.322 28.55	.322 28,55	.406 35.64	.500 43.39	.500 43.39	.593 50.87	.718 60.93	.812 67.76	.906 74.69	.875 72,42
9	9.625	=	_		_	_	.342 33,90	=	_	.500 48.72	-	_	-	_	/ 2.42
10	10.750	15.19	.165 18.70	.250 28.04	.307 34.24	.365 40.48	.365 40,48	.500 54.74	.593 64.33	.500 54.74	.718 .76.93	.843 89.20	1.000	1.125	=
11	11.750	_	=	_	_	-	.375 45,55	-	-	.500 60.07	_	_		-	-
12	12.750	.165 22.18	.180 24.20	.250	.330	.406 53.53	.375 49.56	.562 73.16	.687 88,51	.500 65.42	.843	1.000	1.125	1.312	=
14	14.000	_	.250 36.71	.312 45.68	.375 54.57	.437 63.37	.375 54.57	.593 84.91	.750	.500	.937	1.093	1.250	1.406	_
16	16.000	=	.250 42.05	.312 52.36	.375 62.58	.500 82.77	.375 62,58	.656 107.5	.843 136.5	72.09 .500 82.77	1.031 1.64.8	150.7 1.218 192.3	1,437	189.1 1.593	_
18	18.000		.250 47.39	.312 59.03	.437 82.06	.562 104.8	.375	.750	.937	.500	1.156	1,375	223.5 1.562	245.1 1.781	_
20	20.000	_	.250 52.73	.375 78.60	.500 104.1	.593	70.59 .375 78.60	.812 166.4	1.031 208.9	93.45 .500 104.1	208.0 1.280 256.1	244.1 1.500 296.4	274.2 1.750 341.1	308.5 1.968 379.0	=
24	24.000	=	.250 63.41	.375 94.62	.562 140.8	.687	.375 94.62	.968 238.1	1.218	.500 125.5	1.531	1.812 429.4	2.062 483.1	2.343 541.9	=

LIGHT FIGURES—Wall Thickness in Inches

BOLD FIGURES—Weight Per Foot in Pounds

CARBON STEEL PIPE DATA

ASTM A-120

WALL TOLERANCES

Minimum wall thickness at any point shall be not more than 12.5% under nominal wall specified.

CHEMISTRY

No specific chemical requirements listed except that for steel welded pipe shall be of soft weldable quality.

MECHANICAL PROPERTIES

None specified.

ASTM A-53

WALL TOLERANCES

Minimum wall thickness at any point shall be not more than 12.5% under nominal wall specified.

CHEMISTRY

Seamless	P max, 1%
Open-hearth or basic oxygen	0.048
Bessemer	0.110
Butt Welded	
Open-hearth or basic oxygen	0.080
Bessemer	0.130
Electric-Welded	
Open-hearth or basic oxygen	0.050

MECHANICAL PROPERTIES

Furnace-Welded (Butt Welded)

	Acid Bessemer	Open-Hearth Basic Oxygen or Electric Furnace
Tensile Strength, min. psi	50,000	45,000
Yield Point, min. psi Seamless or Electric-Weld	30,000	25,000
	Grade A	Grade B
Tensile Strength, min. psi	48,000	60,000
field Point, min. psi	30,000	35,000

ASTM A-106

WALL TOLERANCES

Minimum wall thickness at any point shall be not more than 12.5% under nominal wall specified.

CHEMIST	C max.
Grade A	0.25

DESIR	max.		max.	max.	max.
Grade A	0.25	0.27/0.93	0.048	0.058	0.10
Grade B	0.30	0.29/1.06	0.048	0.058	0.10
MECHANICAL PROPERTIES Seamless		Grade A	Grade B	Grade C	
Tensile Str			48,000	60,000	70,000
Yield Point	t, min. psi		30,000	35,000	40,000

CARBON STEEL PIPE DATA API 5L

WALL TOLERANCES

Seamless	PLUS	MINUS	Welded	PLUS	MINUS
2½" and smaller	20%	121/2%	21/2" and smaller	20%	121/2%
3"	18%	121/2%	3"	18%	121/2%
31/2" thru 18"	15%	121/2%	31/2" thru 18"	15%	121/2%
			20" thru 24"	15%	10 %

CHEMISTRY

Electric Furnace, Open-hearth or Basic Oxygen

THE ROLL OF	C max. %	Mn max. %	max. %	max. %
SMLS, Grade B	0.27	1.15	0.04	0.05
E. W., Grade B	0.26	1.15	0.04	0.05
Killed Deoxidized A	cid or Basic B	essemer		
SMLS, Grade B	0.22	1.15	0.10	0.05
E. W., Grade B	0.21	1.15	0.10	0.05
Butt Welded				

and have a major of high	N	to	1100	S	
	min. %			max. %	
Electric Furnace	0.30	0.60	_	0.045	0.060
Open-hearth or Bas	ic Oxygen				
Class I	0.30	0.60	_	0.045	0.060
Class II	0.30	0.60	0.045	0.080	0.060

MECHANICAL PROPERTIES

Seamless or Electric-Weld

		Grade A	Grade B
Tensile Strength, min. psi		48,000	60,000
Yield Point, min. psi Butt Welded		30,000	35,000
(Open-hearth or Basic Oxygen)	Class I	Class II	Besseme
Tensile Strength, min. psi	45,000	48,000	50,000
Yield Point, min. psi	25,000	28,000	30,000

DOM PRODUCT DATA

Drawn Over Mandrel, ERW Round Mechanical Steel Tubing

I.D. and O.D. Tolerances

O.D. Size Range In Inches	Tole in Ir	D. rance sches Under	Thick In Ir	D. kness iches Under	O.D. Size Range In Inches		Tole In Ir	D. rance iches Under	In In	ches
Jp to 0.500	.004	.000	-	_	4.100-4.499,	incl.	.012	.000	.000	.012
0.500-1.699, incl.	.005	.000	.000	.005	4.500-4.899,	incl.	.013	.000	.000	.013
.700-2.099, incl.	.006	.000	.000	.006	4.900-5.299,	incl.	.014	.000	.000	.014
2.100-2.499, incl.	.007	.000	.000	.007	5.300-5.549,	incl.	.015	.000	.000	.015
2.500-2.899, incl.	.008	.000	.000	.008	5.550-5.999,	incl.	.010	.010	.010	.010
2.900-3.299, incl.	.009	.000	.000	.009	6.000-6.499.	incl.	.013	.013	.013	.013
8.300-3.699, incl.	.010	.000	.000	.010	6.500-6.999,	incl.	.015	.015	.015	.015
8,700-4.099, incl.	.011	.000	.000	.011	7.000-7.250,	incl.	.018	.018	.018	.018

The ovality shall be within the above tolerance except when the wall thickness is less than 3% of the O.D. In such cases, the additional ovality shall be as follows, but the mean diameter shall be within the specified tolerance:

O.D., Inches	Additional Ovality tolerance, inch	O.D., Inches	Additional Ovality tolerance, inch
Up to 2 incl.	0.010	Over 5 to 6 incl.	0.030
Over 2 to 3 incl.	0.015	Over 6 to 7 incl.	0.035
Over 3 to 4 incl.	0.020	Over 7 to 71/4 incl.	0.040
Over 4 to 5 incl.	0.025		
(Ref. ASTM A513-69)			

Wall Thickness Tolerances

Wall Thickness Inches	½ " to ¼ " Incl.	Over % " to 1%" incl.	Over 1 % " to 3 % " Incl.	Over 314 " to 51/2" Incl.	Over 5% " to 7% " Incl.
.028	+.002 002	+.002 002	+.002 002		
.035	+.002 002	+.002 002	+.002 002		
.049	+.002 002	+.002 003	+.002 003		
.065	+.002 002	+.002 003	+.002 003	+.004 004	
.083	+.002 002	+.002 003	+.003 003	+.004 005	
.095	+.002 002	+.002 003	+.003 003	+.004 005	+.004 005
.109	+.002 003	+.002 004	+.003 003	+.005 005	+.005 005
.120	+.003 003	+.002 004	+.003 003	+.005 005	+.005 005
.134		+.002 004	+.003 003	+.005 005	+.005 005
.148		+.002 004	+.003 003	+.005 005	+.005 005
.165		+.003 004	+.003 004	+.005 006	+.005 006
.180		+.004 004	+.003 005	+.006 006	+.006 006
.203	4	+.004 005	+.004 005	+.006 007	+.006 007
.220			+.004 006	+.007 007	+.007 007

DOM PRODUCT DATA Drawn Over Mandrel, ERW Roun **Wall Thickness Tolerances**

Wall Thickness Inches	" to a"	Over , to	Over 1 . " to 3 . " Incl.	Over 3 . " to 5 . " Incl.	Over 5 to 1
.238			+.005 006	+.007 007	+.007 007
.259			+.005 006	+.007 007	+.007 007
.284			+.005 006	+.007 007	+.007 007
.300			+.006 006	+.008 008	+.008 008
.320			+.007 007	+.008 008	+.008 008
.344			+.008 008	+.009 009	+.009 009
.375			+.009 009	+.009 009	+.009 009

DOM PRODUCT DATA Drawn Over Mandrel 1020

As Drawn, or As Drawn and Stress Relieved (900°F)

MECHANICAL PROPERTIES

	Grade A	Grade B
Tensile Strength, min. psi	(a)	(b)
Yield Point, min. psi	70,000	60,000
Ultimate	80,000	70,000
% Elongation in 2" (Full Section)	15	15
Typical Hardness	B-80	B-80

(a) Tube sizes up to and including 234° O.D. with a maximum wall of .125°.

(b) Tube sizes over 2¾" O.D. and with walls heavier than .125"

Honing Allowances

Wall Thickness Inches

Train Trinoiting Striction								
O.D. (Inch)	.065 and less	Over .065 to .125 incl.	Over .125 to .180 incl.	Over .180 to .230 incl.	Over .230			
Up to and incl. 11/2	.010	.011	.013	.015	_			
Over 11/2 to 3 incl.	.010	.012	.014	.016	.018			
Over 3 to 4 incl.	.011	.013	.015	.017	.019			
Over 4 to 41/4 incl.	-	.014	.016	.018	.020			
Over 41/4 to 6 incl.	_	.015	.017	.019	.021			
Over 6 to 71/4 incl.	-	.016	.018	.020	.022			

Drawn Over Mandrel Size Range Guide

Outside Diameter	Wall	Outside Diameter	Wall	Outside Diameter	Wall
½	028—.049 028—.065 028—.095 028—.148 028—.203 028—.300 035—.313	2 to 21/8 21/4 21/8 to 31/4. 31/2 to 41/4.	035—.360 035—.375 035—.400 049—.400 065—.400 083—.400	6½ 6½ 7 to 7¼	120—.400 134—.400 165—.400 165—.375 188—.375 188—.313