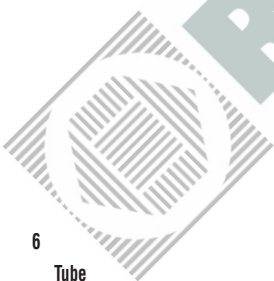


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Russel Metals

STRUCTURAL TUBING



HOLLOW STRUCTURAL SECTIONS (H.S.S.)

Structural tubing is the term given to tubular sections that perform a structural function in the engineering concept. It is sometimes used in a mechanical application but is never recommended for the conveyance of liquids or gases under pressure.

H.S.S. is offered to guaranteed physicals and in commercial quality.

Specification: CSA – G40.21 Grade 50W Class “C” and “H”
ASTM – A500 Grades “B” and “C”

ROUND H.S.S.



O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
1.050	.100	1.02	2.875	.125	3.68
	.125	1.24		.150	4.37
	.134	1.60		.188	5.40
1.315	.100	1.30		.250	7.01
	.125	1.59	3.000	.125	3.84
1.660	.100	1.67		.134	4.10
	.125	2.05		.150	4.57
1.690	.100	1.70		.188	5.66
	.125	2.09		.250	7.35
1.900	.110	2.10	3.500	.150	5.37
	.125	2.38		.188	6.66
	.150	2.81		.210	7.39
	.188	3.45		.250	8.69
2.000	.100	2.03		.313	10.66
	.125	2.50	3.750	.100	3.90
	.150	2.96		.110	4.28
	.188	3.64		.125	4.85
2.375	.100	2.43		.134	5.18
	.125	3.01		.150	5.78
	.150	3.57		.188	7.16
	.188	4.40		.210	7.95
	.250	5.68		.250	9.36

Cont'd

ROUND STRUCTURAL TUBING (cont'd)

ROUND H.S.S.



O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
4.000	.125	5.17	6.625	.188	13.00
	.134	5.53		.250	17.00
	.150	6.17		.313	21.10
	.188	7.67	8.625	.375	25.10
	.210	8.51		.188	17.00
	.250	10.02		.250	22.40
	.313	12.34		.313	27.80
				.375	33.10
4.500	.188	8.68	10.750	.438	38.40
	.210	9.63		.500	43.40
	.250	11.36		.250	28.10
	.313	14.01		.313	34.90
	.375	16.54		.375	41.60
5.000			12.750	.438	48.30
	.134	6.97		.500	54.80
	.150	7.78		.250	33.40
	.188	9.67		.313	41.60
	.250	12.69		.375	49.60
	.313	15.69		.438	57.70
	.375	18.54		.500	65.50
5.562	.188	10.80	14.000	.250	36.80
	.250	14.20		.313	45.80
	.313	17.60		.375	54.70
				.438	63.50
6.000			16.000	.500	72.20
	.134	8.41		.250	42.10
	.150	9.38		.313	52.50
	.188	11.68		.375	62.70
	.250	15.37		.438	72.90
	.313	19.03		.500	82.90
	.375	22.55			

Cont'd

SQUARE STRUCTURAL TUBING

SQUARE H.S.S.



O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
1 x 1	.100	1.14	2¼ x 2¼	.100	2.84
	.110	1.23		.125	3.48
	.125	1.35		.150	4.09
	.150	1.54		.188	4.96
1¼ x 1¼	.100	1.48	2½ x 2½	.250	6.26
	.110	1.57		.100	3.26
	.125	1.78		.110	3.58
	.150	2.05		.125	3.91
1½ x 1½	.100	1.82	3 x 3	.134	4.16
	.110	1.97		.150	4.60
	.125	2.21		.188	5.61
	.134	2.33		.210	6.16
	.150	2.56		.250	7.11
	.188	3.05		.100	3.95
1¾ x 1¾	.250	4.07		.110	4.32
	.100	2.24	3½ x 3½	.125	4.76
	.110	2.45		.134	5.07
	.125	2.76		.150	5.62
2 x 2	.100	2.58		.188	6.89
	.110	2.83		.210	7.59
	.125	3.06		.250	8.81
	.134	3.24		.313	10.59
	.150	3.58		.375	12.17
	.188	4.33		.125	5.61
2⅝ x 2⅝	.250	5.41		.134	5.98
	.134	3.47		.150	6.64

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SQUARE STRUCTURAL TUBING (cont'd)

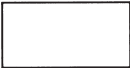
SQUARE H.S.S.



O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
3½ x 3½	.188	8.17	6 x 6	.188	14.56
	.210	9.01		.250	19.02
	.250	10.51		.313	23.33
	.313	12.70		.375	27.48
	.375	14.71		.500	35.24
4 x 4	.125	6.46	7 x 7	.188	17.13
	.134	6.89		.250	22.42
	.150	7.66		.313	27.63
	.188	9.45		.375	32.58
	.210	10.51		.500	42.05
	.250	12.21	8 x 8	.188	19.63
	.313	14.83		.250	25.82
5 x 5	.375	17.27		.313	31.84
	.500	21.63		.375	37.69
	.150	9.71		.500	48.85
	.188	12.00	10 x 10	.250	32.63
	.250	15.62		.313	40.35
	.313	19.08		.375	47.90
	.375	22.37		.500	62.46
	.500	28.43	12 x 12	.250	39.43
5½ x 5½	.188	13.28		.313	48.86
	.250	17.32		.375	58.10
	.313	21.18		.500	76.07
	.375	24.92			

RECTANGULAR STRUCTURAL TUBING

RECTANGULAR H.S.S.

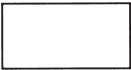


O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
1½ x 1	.100	1.56	3 x 2	.150	4.60
	.110	1.71		.188	5.61
	.125	1.91		.210	6.16
2 x 1	.100	1.82	3 x 2½	.250	7.11
	.110	1.94		.188	6.25
	.125	2.21		.188	6.25
	.134	2.49		.125	4.76
	.150	2.75		.134	5.07
2½ x 1½	.188	3.05	3½ x 2½	.150	5.62
	.100	2.58		.188	6.89
	.110	2.83		.210	7.59
	.125	3.06		.250	8.81
	.150	3.58		.313	10.59
	.188	4.33	4 x 2	.125	4.76
3 x 1	.250	5.41		.134	5.07
	.100	2.58		.150	5.62
	.110	2.83		.188	6.89
	.125	3.06		.210	7.59
	.150	3.58		.250	8.81
3 x 1½	.188	4.33		.313	10.59
	.250	5.41	4 x 3	.125	5.61
	.100	2.92		.134	5.98
	.125	3.48		.150	6.64
3 x 2	.150	4.09		.188	8.17
	.188	4.96		.210	9.01
	.100	3.26		.250	10.51
	.110	3.58		.313	12.70
	.125	3.91		.375	14.71
	.134	4.16			

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RECTANGULAR STRUCTURAL
TUBING (cont'd)

RECTANGULAR H.S.S.

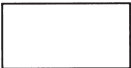


O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
5 x 2	.125	5.61	6 x 2	.125	6.46
	.134	5.98		.134	6.89
	.150	6.64		.150	7.66
	.188	8.17		.188	9.45
	.210	9.01		.210	10.51
	.250	10.51		.250	12.21
	.313	12.70		.313	14.83
	.375	14.71		.375	17.27
5 x 2½	.188	8.81	6 x 3	.125	7.31
	.250	11.40		.134	7.81
	.313	13.80		.150	8.69
	.375	16.00		.188	10.70
5 x 3	.125	6.46		.250	13.91
	.134	6.89		.313	16.96
	.150	7.66		.375	19.82
	.188	9.45	6 x 4	.150	9.71
	.210	10.51		.188	12.00
	.250	12.21		.250	15.62
	.313	14.83		.313	19.08
	.375	17.27		.375	22.37
5 x 4	.125	7.31		.500	28.43
	.134	7.81	7 x 2	.125	7.31
	.150	8.69		.134	7.81
	.188	10.70		.150	8.69
	.250	13.91		.188	10.70
	.313	16.96		.250	13.91
	.375	19.82		.313	16.96
				.375	19.82

Cont'd

RECTANGULAR STRUCTURAL
TUBING (cont'd)

RECTANGULAR H.S.S.



O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
7 x 3	.150	9.71	9 x 5	.313	27.63
	.188	12.00		.375	32.58
	.250	15.62		.500	42.05
	.313	19.08	9 x 7	.188	19.63
	.375	22.37		.250	25.82
7 x 4	.188	13.28		.313	31.84
	.250	17.32	10 x 4	.375	37.69
	.313	21.24		.500	48.85
	.375	24.92		.188	17.13
7 x 5	.188	14.56		.250	22.42
	.250	19.02	10 x 6	.313	27.63
	.313	23.33		.375	32.58
	.375	27.48		.500	42.05
	.500	35.24		.188	19.63
8 x 3	.188	13.28		.250	25.82
	.250	17.32	12 x 8	.313	31.84
	.313	21.24		.375	37.69
	.375	24.92		.500	48.85
8 x 4	.188	14.56		.250	32.63
	.250	19.02	14 x 6	.313	40.35
	.313	23.33		.375	47.90
	.375	27.48		.500	62.46
	.500	35.24		.250	32.63
8 x 6	.188	17.13	14 x 10	.313	40.35
	.250	22.42		.375	47.90
	.313	27.63		.500	62.46
	.375	32.58		.250	39.43
	.500	42.05		.313	48.86
9 x 5	.188	17.13		.375	58.10
	.250	22.42		.500	76.07

Cont'd

RUSS-WELD STRUCTURAL TUBING



Russ-Weld tubing is a commercial quality tubing that is rolled to commercial tolerances and is guaranteed weldable. Russ-Weld is stocked in standard 24'.0" lengths (no randoms) but is available in special sizes and lengths with minimum 5 ton orders. Russ-Weld is available only from Russel Metals branches across Canada.

SQUARE RUSS-WELD			SQUARE RUSS-WELD		
O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
1 x 1	.100	1.14	2½ x 2½	.125	3.91
	.125	1.35		.188	5.61
1¼ x 1¼	.100	1.48		.250	7.11
	.125	1.78	3 x 3	.125	4.76
1½ x 1½	.100	1.82		.150	5.62
	.125	2.21	3½ x 3½	.188	6.89
	.188	3.05		.250	8.81
2 x 2	.110	2.83		.250	10.51
	.125	3.06			
	.188	4.33			
	.250	5.41			



RECTANGULAR RUSS-WELD			RECTANGULAR RUSS-WELD		
O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
3 x 1½	.125	3.48	4 x 2	.125	4.76
	.188	4.96		.188	6.89
3 x 2	.125	3.91		.250	8.81
	.188	5.61			
	.250	7.11			
3½ x 2½	.188	6.89			

Cont'd

RUSS-WELD STRUCTURAL TUBING



Russ-Weld tubing is a commercial quality tubing that is rolled to commercial tolerances and is guaranteed weldable. Russ-Weld is stocked in standard 24'.0" lengths (no randoms) but is available in special sizes and lengths with minimum 5 ton orders. Russ-Weld is available only from Russel Metals branches across Canada.

ROUND RUSS-WELD 			ROUND RUSS-WELD 		
O.D. Inches	Wall Thickness Inches	Weight lb/ft.	O.D. Inches	Wall Thickness Inches	Weight lb/ft.
1.050	.100	1.02	1.660	.100	1.67
	.125	1.24		.125	2.05
	.154	1.60		.140	2.28
1.315	.100	1.30	1.900	.100	2.10
	.125	1.59		.125	2.38
	.133	1.68		.145	2.72

REDKOTE

A-500

Redkote is a hot rolled, cold formed, continuously welded tube which after forming is coated with approximately 0.6 mils of weldable, non-fuming, nontoxic primer.

Square			Rectangle		
Size		Wt/Ft.	Size		Wt/Ft.
1 x 1 x .120		1.30	2 x 1 x .120		2.21
1¼ x 1¼ x .125		1.78	3 x 1½ x .188		4.96
1½ x 1½ x .120		2.08	3 x 2 x .125		3.89
1½ x 1½ x .188		3.05	3 x 2 x .188		5.61
2 x 2 x .125		3.06	3 x 2 x .250		7.11
2 x 2 x .188		4.33	4 x 2 x .125		4.76
2 x 2 x .250		5.41	4 x 2 x .188		6.88
2½ x 2½ x .125		3.90	4 x 2 x .250		8.80
2½ x 2½ x .188		5.61	4 x 3 x .250		10.50
2½ x 2½ x .250		7.11	5 x 3 x .188		9.45
3 x 3 x .125		4.75	5 x 3 x .250		12.20
3 x 3 x .188		6.89	6 x 2 x .188		9.45
3 x 3 x .250		8.81	6 x 4 x .188		12.00
3½ x 3½ x .188		8.17	6 x 4 x .250		15.60
4 x 4 x .188		9.45	6 x 4 x .375		22.35
4 x 4 x .250		12.20			
4 x 4 x .375		17.27			
5 x 5 x .250		15.60			
6 x 6 x .188		14.56			
6 x 6 x .250		19.02			

HOLLOW STRUCTURAL SECTIONS

MANUFACTURING TOLERANCES

ASTM A500C

Permissible variations in dimensions

WALL THICKNESS

Maximum allowable variation is $\pm 10\%$ from nominal, excluding the weld zone, measured at the center of the flat in shapes.

OUTSIDE DIAMETER

Round

Maximum allowable variation for nominal outside diameter 1.900" and smaller $\pm 5\%$, and for 2.000" and larger $\pm 7.5\%$ when measured at least 2" from end of tubes.

Square and Rectangle

Outside dimensions measured across the flats at position at least 2" from either end of a section, including an allowance for convexity or concavity, and shall not vary from the specified dimensions by more than the tolerances prescribed below.

LARGEST OUTSIDE DIMENSION Inches	TOLERANCE Inches
2½ and under	+ - 0.020
Over 2½-3½ inclusive	+ - 0.025
Over 3½-5½ inclusive	+ - 0.030
Over 5½	+ - 1%

SPECIFIED MILL LENGTH TOLERANCE

22 ft and under	Over 22' to 44'
$+1\frac{1}{2}" -1\frac{1}{4}"$	$+3\frac{3}{4}" -1\frac{1}{4}"$

STRAIGHTNESS

Maximum deviation (*inches*)

$$\frac{\frac{1}{8} \text{ inch} \times \text{length in feet}}{5}$$

HOLLOW STRUCTURAL SECTIONS

MANUFACTURING TOLERANCES

ASTM A500C

TWIST

The tolerances for twist or variations with respect to axial alignment of the section for square and rectangle structural tubing shall not vary by more than the table below.

LARGEST OUTSIDE DIMENSION (Inches)	MAXIMUM TWIST PER 3 FEET OF LENGTH (Inches)
1½ and under	0.050
Over 1½ - 2½ inclusive	0.062
Over 2½ - 4 inclusive	0.075
Over 4 - 6 inclusive	0.087
Over 6 - 8 inclusive	0.100
Over 8	0.112

SQUARENESS OF SIDES

For square or rectangular structural tubing, adjacent sides may deviate from 90° by a tolerance of +/-2° maximum.

RADIUS OF CORNERS

For square or rectangular structural tubing, the radius of any outside corner of the section shall not exceed three times the specified wall thickness.

HOLLOW STRUCTURAL SECTIONS

MANUFACTURING TOLERANCES

CSA G40.20 AND G40.21

WEIGHT

Maximum permissible variation per length is +10%/-3.5%, from theoretical, assuming steel density is .2836 lb per cubic inch.

WALL THICKNESS

Maximum allowable variation is +10%/-5% from nominal, excluding the weld zone, measured at the center of the flat in shapes.

CROSS SECTIONAL DIMENSIONS (squares and rectangles)

Outside dimensions measured across the flats or diameter at positions at least 2 inches from either end of a piece, including an allowance for convexity or concavity, shall not vary from the specified dimensions of the section by more than the tolerances prescribed below.

LARGEST OUTSIDE DIMENSION Inches	TOLERANCE* Inches
To 2½ inclusive	±0.02
Over 2½-3½ inclusive	±0.03
Over 3½-5½ inclusive	±0.04
Over 5½	±1%

SPECIFIED MILL LENGTH TOLERANCE

Permissible deviation for a mill hot cut is:

± one inch for lengths 24' and under

± two inches for lengths over 24'

STRAIGHTNESS

Maximum deviation (*inches*)

$$\frac{1/2 \text{ inch} \times \text{length in feet}}{5}$$

HOLLOW STRUCTURAL SECTIONS

MANUFACTURING TOLERANCES

CSA G40.20 AND G40.21 (cont'd)

TWIST

Tolerances for twist of rectangular or other non-circular profiles are prescribed as follows: Twist of a rectangular section may be measured by holding down the side of one end of the section on a flat surface and noting the height that either corner at the opposite end of that side is above the surface.

LARGEST OUTSIDE DIMENSION Inches	MAXIMUM TWIST PER 3 FEET OF LENGTH Inches
To 1½ inclusive	0.050
Over 1½-2½ inclusive	0.062
Over 2½-4 inclusive	0.075
Over 4-6 inclusive	0.087
Over 6-8 inclusive	0.100
Over 8	0.112

CORNER RADII

WALL THICKNESS Inches	MAXIMUM OUTSIDE CORNER Inches	
	Perimeter to 24 inches inclusive	Perimeter over 24 inches
To 0.109 inclusive	0.218	
Over 0.109-0.134 inclusive	0.268	
Over 0.134-0.156 inclusive	0.312	
Over 0.156-0.188 inclusive	0.470	
Over 0.188-0.250 inclusive	0.625	0.750
Over 0.250-0.313 inclusive	0.785	0.940
Over 0.313-0.375 inclusive	0.938	1.125
Over 0.375-0.500 inclusive	1.250	1.500
Over 0.500		3 x wall thickness

RADI OF CORNERS OF WELDED SQUARE AND RECTANGULAR TUBING

Squares and Rectangles Made from Tubes of the Following Diameter Ranges, Inches*	Wall thickness in BWG, and Inches	Radius Tolerances, Inches†
½ to 1½, incl.	22 (0.028)	⅓ to ⅙
½ to 2½, incl.	20 (0.035)	⅓ to ⅙
½ to 4, incl.	18 (0.049)	⅜ to ⅝
½ to 4⅞, incl.	16 (0.065)	⅙ to ⅚
¾ to 4⅞, incl.	14 (0.083)	⅝ to ⅞
Over 4⅞ to 6, incl.	14 (0.083)	⅜ to ⅝
1 to 4⅞, incl.	13 (0.095)	⅜ to ⅝
Over 4⅞ to 6, incl.	13 (0.095)	⅜ to ⅝
1¼ to 4, incl.	12 (0.109)	⅙ to ⅚
Over 4 to 6, incl.	12 (0.109)	⅜ to ⅝
1¼ to 4, incl.	11 (0.120)	⅙ to ⅚
Over 4 to 6, incl.	11 (0.120)	⅜ to ⅝
2 to 4, incl.	10 (0.134)	⅝ to ⅞
Over 4 to 6, incl.	10 (0.134)	⅜ to ⅝
2 to 4, incl.	9 (0.148)	⅜ to ⅝
Over 4 to 8, incl.	9 (0.148)	⅜ to ⅝
2 to 8, incl.	8 (0.165)	¼ to ½
2 to 8, incl.	7 (0.180)	¼ to ½
2½ to 4, incl.	6 (0.203)	⅝ to ⅞
Over 4 to 8, incl.	6 (0.203)	⅝ to ⅞
2½ to 8, incl.	5 (0.220)	⅜ to ⅝
2½ to 8, incl.	4 (0.238)	⅜ to ⅝
2½ to 8, incl.	3 (0.259)	⅜ to ⅝

* This table establishes a standard radius. The purchaser and producer may negotiate special radii. Slight radius flattening is more pronounced in heavier wall tubing.

† These radius tolerances apply to standard grades of steel. The purchaser and producer may negotiate tolerances on other grades of steel.

MECHANICAL TUBING

SEAMLESS A-519
17/24 FT RDMS

D.O.M. A-513 T5
17/24 FT RDMS

E.R.W. A-513 T1 OR T2
20 FT

MECHANICAL TUBING IS THE TERM GIVEN TO TUBES THAT IN THEIR ORIGINAL CONDITION OR IN A MACHINED OR WELDED CONDITION PERFORM A MECHANICAL FUNCTION (I.E. DRIVE SHAFTS.)

Seamless Tubing cold drawn and/or hot finished specification
MT 1015/1018/1026, A.S.T.M. – A519. Random lengths 17-24 feet.

Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
0.250	0.028	0.194	0.066		X		
	0.035	0.180	0.080		X		
	0.049	0.152	0.105		X		
0.313	0.028	0.257	0.085		X		
	0.035	0.243	0.104		X		
	0.049	0.215	0.138		X		
	0.065	0.183	0.172		X		
0.375	0.028	0.319	0.104		X		
	0.035	0.305	0.127		X		
	0.049	0.277	0.171		X		
	0.065	0.245	0.215		X		
	0.083	0.209	0.259		X		
	0.120	0.135	0.327		X		
0.500	0.028	0.444	0.141		X		
	0.035	0.430	0.174		X	X	
	0.049	0.402	0.236		X	X	
	0.058	0.384	0.274		X		
	0.065	0.370	0.302		X	X	
	0.083	0.334	0.370		X		
	0.109	0.282	0.455		X		
	0.120	0.260	0.487		X		
0.563	0.035	0.493	0.197		X		
	0.065	0.433	0.346		X		
	0.083	0.397	0.425		X		
	0.120	0.323	0.568		X		
0.625	0.035	0.555	0.221		X	X	
	0.049	0.527	0.301		X	X	
	0.058	0.509	0.351		X		
	0.065	0.495	0.389		X	X	
	0.083	0.459	0.480		X	X	
	0.109	0.407	0.601		X		
	0.120	0.385	0.647		X		
	0.134	0.357	0.703		X		
	0.156	0.313	0.781		X		
0.688	0.188	0.249	0.877		X		
	0.065	0.558	0.432		X		
	0.083	0.522	0.536		X		
	0.095	0.498	0.602		X		
	0.109	0.470	0.674		X		
0.750	0.120	0.448	0.728		X		
	0.035	0.680	0.267		X	X	
	0.049	0.652	0.367		X	X	
	0.065	0.620	0.476		X	X	
	0.083	0.584	0.591		X	X	
	0.095	0.560	0.665		X	X	

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
0.750	0.109	0.532	0.746		X		
	0.120	0.510	0.807		X	X	
	0.134	0.482	0.882		X		
	0.156	0.438	0.990		X		
	0.188	0.374	1.128		X		
	0.219	0.312	1.242		X		
	0.250	0.250	1.335		X		
0.813	0.065	0.683	0.519		X		
	0.083	0.647	0.647		X		
	0.095	0.623	0.728		X		
	0.120	0.573	0.888		X		
	0.134	0.545	0.972		X		
0.875	0.035	0.805	0.314		X		
	0.049	0.777	0.432		X	X	
	0.058	0.759	0.506		X		
	0.065	0.745	0.562		X	X	
	0.083	0.709	0.702		X	X	
	0.095	0.685	0.791		X	X	
	0.109	0.657	0.892		X		
	0.120	0.635	0.968		X		
	0.134	0.607	1.060		X		
	0.156	0.563	1.198		X		
	0.188	0.499	1.379		X		
	0.250	0.375	1.669		X		
	0.313	0.249	1.879	X			
1.000	0.035	0.930	0.361		X	X	
	0.049	0.902	0.498		X	X	
	0.065	0.870	0.649		X	X	
	0.083	0.834	0.813		X	X	
	0.095	0.810	0.918		X	X	
	0.109	0.782	1.037		X	X	
	0.120	0.760	1.128		X	X	
	0.134	0.732	1.239		X		
	0.156	0.688	1.406		X		
	0.188	0.624	1.630		X		
	0.219	0.562	1.827		X		
	0.250	0.500	2.003		X		
	0.313	0.374	2.297		X		
	0.375	0.250	2.503	X			
1.065	0.083	0.899	0.870		X		
	0.095	0.875	0.984		X		
	0.109	0.847	1.113		X		
	0.120	0.825	1.211		X		
	0.156	0.753	1.514		X		
	0.188	0.689	1.761		X		
	0.250	0.565	2.176		X		
1.125	0.035	1.055	0.407		X	X	
	0.049	1.027	0.563		X	X	
	0.065	0.995	0.736		X	X	
	0.083	0.959	0.924		X	X	
	0.095	0.935	1.045		X		
	0.109	0.907	1.183		X		
	0.120	0.885	1.288		X		
	0.134	0.857	1.418		X		
	0.156	0.813	1.614		X		
	0.188	0.749	1.881		X		
	0.219	0.687	2.119		X		
	0.250	0.625	2.336		X		

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
1.125	0.281	0.563	2.533	X	X		
	0.313	0.499	2.714	X	X		
1.188	0.065	1.058	0.780		X	X	
	0.120	0.948	1.369		X		
	0.156	0.876	1.719		X		
	0.188	0.812	2.008		X		
	0.219	0.750	2.266		X		
	0.250	0.688	2.504		X		
1.250	0.035	1.180	0.454			X	
	0.049	1.152	0.629		X	X	
	0.065	1.120	0.823		X	X	
	0.083	1.084	1.034		X	X	
	0.095	1.060	1.172		X	X	
	0.109	1.032	1.328		X	X	
	0.120	1.010	1.448		X	X	
	0.134	0.982	1.597		X		
	0.156	0.938	1.823		X		
	0.188	0.874	2.132		X		
	0.219	0.812	2.411		X		
	0.250	0.750	2.670		X		
	0.313	0.624	3.132		X		
	0.375	0.500	3.504		X		
1.313	0.120	1.073	1.529		X		
	0.134	1.045	1.687		X		
	0.156	1.001	1.928		X		
	0.188	0.937	2.259		X		
	0.219	0.875	2.559		X		
	0.250	0.813	2.838		X		
	0.313	0.687	3.343		X		
	0.375	0.563	3.757		X		
1.375	0.049	1.277	0.694		X	X	
	0.065	1.245	0.909		X	X	
	0.083	1.209	1.145		X	X	
	0.095	1.185	1.299		X	X	
	0.109	1.157	1.474		X		
	0.120	1.135	1.608		X	X	
	0.134	1.107	1.776		X		
	0.156	1.063	2.031		X		
	0.188	0.999	2.383		X		
	0.219	0.937	2.704		X		
	0.250	0.875	3.004		X		
	0.281	0.813	3.283		X		
	0.313	0.749	3.550		X		
	0.375	0.625	4.005		X		
1.438	0.156	1.126	2.136		X		
	0.188	1.062	2.510		X		
	0.219	1.000	2.851		X		
	0.250	0.938	3.172		X		
1.500	0.035	1.430	0.548		X	X	
	0.049	1.402	0.759		X	X	
	0.065	1.370	0.996		X	X	
	0.083	1.334	1.256		X	X	
	0.095	1.310	1.426		X	X	
	0.109	1.282	1.619		X	X	
	0.120	1.260	1.769		X	X	
	0.134	1.232	1.955		X		
	0.156	1.188	2.239		X		

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
1.500	0.188	1.124	2.634		X		
	0.219	1.062	2.996		X		
	0.250	1.000	3.338		X		
	0.281	0.938	3.658		X		
	0.313	0.874	3.968		X		
	0.375	0.750	4.506		X		
	0.438	0.624	4.968	X			
	0.500	0.500	5.340	X			
1.563	0.120	1.323	1.849		X		
	0.156	1.251	2.344		X		
	0.250	1.063	3.506		X		
	0.375	0.813	4.758		X		
1.625	0.049	1.527	0.825		X	X	
	0.065	1.495	1.083		X	X	
	0.083	1.459	1.367		X	X	
	0.095	1.435	1.552		X	X	
	0.109	1.407	1.765		X	X	
	0.120	1.385	1.929		X	X	
	0.134	1.357	2.134		X		
	0.156	1.313	2.447		X		
	0.188	1.249	2.885		X		
	0.219	1.187	3.289		X		
	0.250	1.125	3.671		X		
	0.281	1.063	4.033		X		
	0.313	0.999	4.386		X		
	0.375	0.875	5.006		X		
	0.500	0.625	6.008	X			
1.750	0.049	1.652	0.890		X	X	
	0.065	1.620	1.170		X	X	
	0.083	1.584	1.478		X	X	
	0.095	1.560	1.679		X	X	
	0.109	1.532	1.910		X		
	0.120	1.510	2.089		X	X	
	0.134	1.482	2.313		X		
	0.156	1.438	2.656		X		
	0.188	1.374	3.136		X		
	0.219	1.312	3.581		X		
	0.250	1.250	4.005		X		
	0.313	1.124	4.804		X		
	0.375	1.000	5.507		X		
	0.500	0.750	6.675	X			
1.875	0.049	1.777	0.956		X	X	
	0.065	1.745	1.257		X	X	
	0.083	1.709	1.589		X	X	
	0.095	1.685	1.806		X	X	
	0.109	1.657	2.056		X		
	0.120	1.635	2.249		X		
	0.156	1.563	2.864		X		
	0.188	1.499	3.387		X		
	0.219	1.437	3.873		X		
	0.250	1.375	4.339		X		
	0.281	1.313	4.784		X		
	0.313	1.249	5.222		X		
	0.375	1.125	6.008		X		
	0.438	0.999	6.722	X			
	0.500	0.875	7.343	X			
2.000	0.035	1.930	0.735		X	X	

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
2.000	0.049	1.902	1.021		X	X	
	0.065	1.870	1.343		X	X	
	0.083	1.834	1.699		X	X	
	0.095	1.810	1.933		X	X	
	0.109	1.782	2.201		X	X	
	0.120	1.760	2.409		X	X	
	0.134	1.732	2.670		X		
	0.156	1.688	3.072		X		
	0.188	1.624	3.638		X		
	0.219	1.562	4.166		X		
	0.250	1.500	4.673		X		
	0.281	1.438	5.159		X		
	0.313	1.374	5.639		X		
	0.375	1.250	6.508		X		
	0.438	1.124	7.307		X		
	0.500	1.000	8.010		X		
	0.563	0.874	8.640	X			
	0.625	0.750	9.178	X			
	0.750	0.500	10.013	X			
2.125	0.049	2.027	1.086		X	X	
	0.065	1.995	1.430		X	X	
	0.083	1.959	1.810		X		
	0.095	1.935	2.060		X		
	0.120	1.885	2.570		X		
	0.156	1.813	3.281		X		
	0.188	1.749	3.889		X		
	0.219	1.687	4.458		X		
	0.250	1.625	5.006		X		
	0.281	1.563	5.534		X		
	0.313	1.499	6.057		X		
	0.375	1.375	7.009		X		
	0.500	1.125	8.678	X	X		
2.250	0.049	2.152	1.152		X		
	0.065	2.120	1.517		X	X	
	0.083	2.084	1.921		X	X	
	0.095	2.060	2.186		X		
	0.120	2.010	2.730		X	X	
	0.134	1.982	3.028		X		
	0.156	1.938	3.489		X		
	0.188	1.874	4.140		X		
	0.219	1.812	4.750		X		
	0.250	1.750	5.340		X		
	0.281	1.688	5.909		X		
	0.313	1.624	6.475		X		
	0.375	1.500	7.509		X		
	0.438	1.374	8.476		X		
	0.500	1.250	9.345	X			
	0.563	1.124	10.144	X			
	0.625	1.000	10.847	X			
	0.750	0.750	12.015	X			
2.375	0.065	2.245	1.604			X	
	0.083	2.209	2.032			X	
	0.109	2.157	2.638			X	
	0.120	2.135	2.890		X	X	
	0.156	2.063	3.697		X		
	0.188	1.999	4.391		X		
	0.219	1.937	5.043		X		
	0.250	1.875	5.674		X		

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
2.375	0.313	1.749	6.893		X		
	0.375	1.625	8.010		X		
	0.500	1.375	10.013		X		
	0.625	1.125	11.681	X			
	0.750	0.875	13.016	X			
2.500	0.065	2.370	1.690		X	X	
	0.083	2.334	2.143		X	X	
	0.095	2.310	2.440		X	X	
	0.109	2.282	2.783		X		
	0.120	2.260	3.050		X	X	
	0.156	2.188	3.905		X		
	0.188	2.124	4.642		X		
	0.219	2.062	5.335		X		
	0.250	2.000	6.008		X		
	0.281	1.938	6.659		X		
	0.313	1.874	7.311		X		
	0.375	1.750	8.511		X		
	0.438	1.624	9.646		X		
	0.500	1.500	10.680		X		
	0.563	1.374	11.647	X	X		
	0.625	1.250	12.516	X			
	0.750	1.000	14.018	X			
2.625	0.065	2.495	1.777		X	X	
	0.095	2.435	2.567		X		
	0.120	2.385	3.210		X		
	0.188	2.249	4.893		X		
	0.250	2.125	6.341		X		
	0.313	1.999	7.729		X		
	0.375	1.875	9.011		X		
	0.438	1.749	10.230	X	X		
	0.500	1.625	11.348		X		
	0.625	1.375	13.350	X			
	0.750	1.125	15.019	X			
2.750	0.065	2.620	1.864		X	X	
	0.083	2.584	2.364		X	X	
	0.095	2.560	2.694		X		
	0.120	2.510	3.371		X	X	
	0.156	2.438	4.322		X		
	0.188	2.374	5.144		X		
	0.219	2.312	5.920		X		
	0.250	2.250	6.675		X		
	0.281	2.188	7.410		X		
	0.313	2.124	8.147		X		
	0.375	2.000	9.512		X		
	0.438	1.874	10.815	X	X		
	0.500	1.750	12.015		X		
	0.563	1.624	13.150		X		
	0.625	1.500	14.184		X		
	0.750	1.250	16.020	X			
	0.875	1.000	17.522	X			
2.875	0.065	2.745	1.951			X	
	0.120	2.635	3.531		X	X	
	0.188	2.499	5.395		X		
	0.219	2.437	6.212		X		
	0.250	2.375	7.009		X		
	0.313	2.249	8.564		X		
	0.375	2.125	10.013		X		
	0.438	1.999	11.400		X		

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
2.875	0.500	1.875	12.683		X		
	0.563	1.749	13.902		X		
	0.625	1.625	15.019		X		
3.000	0.049	2.902	1.544			X	
	0.065	2.870	2.037		X	X	
	0.083	2.834	2.586		X	X	
	0.095	2.810	2.947		X	X	
	0.120	2.760	3.691		X	X	
	0.156	2.688	4.738		X		
	0.188	2.624	5.646		X		
	0.219	2.562	6.505		X		
	0.250	2.500	7.343		X		
	0.281	2.438	8.160		X		
	0.313	2.374	8.982		X		
	0.375	2.250	10.513		X		
	0.438	2.124	11.985		X		
	0.500	2.000	13.350		X		X
	0.563	1.874	14.653		X		
	0.625	1.750	15.853		X		
	0.750	1.500	18.023	X			X
	0.875	1.250	19.858	X			X
	1.000	1.000	21.360	X			X
3.125	0.120	2.885	3.851		X		
	0.188	2.749	5.897		X		
	0.250	2.625	7.676		X		
	0.313	2.499	9.400		X		
	0.375	2.375	11.014		X		
	0.438	2.249	12.569		X		
	0.500	2.125	14.018		X		
	0.563	1.999	15.405		X		
	0.625	1.875	16.888		X		
	0.750	1.625	19.024		X		
	0.875	1.375	21.026	X			
3.250	0.065	3.120	2.211		X	X	
	0.083	3.084	2.807		X	X	
	0.095	3.060	3.201		X	X	
	0.120	3.010	4.011		X	X	
	0.156	2.938	5.155		X		
	0.188	2.874	6.148		X		
	0.250	2.750	8.010		X		
	0.281	2.688	8.910		X		
	0.313	2.624	9.818		X		
	0.375	2.500	11.514		X		
	0.438	2.374	13.154		X		
	0.500	2.250	14.685		X		
	0.563	2.124	16.157		X		
	0.625	2.000	17.522		X		
	0.750	1.750	20.025	X			X
	0.875	1.500	22.194	X			X
	1.000	1.250	24.030	X			X
3.500	0.065	3.370	2.385		X	X	
	0.083	3.334	3.029		X	X	
	0.095	3.310	3.455		X	X	
	0.120	3.260	4.332		X	X	
	0.156	3.188	5.571		X		
	0.188	3.124	6.650		X		
	0.219	3.062	7.674		X		
	0.250	3.000	8.678		X		

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
3.500	0.281	2.938	9.660		X		
	0.313	2.874	10.654		X		
	0.375	2.750	12.516		X		
	0.438	2.624	14.324		X		
	0.500	2.500	16.020		X		X
	0.563	2.374	17.660		X		
	0.625	2.250	19.191		X		
	0.750	2.000	22.028		X		X
	0.875	1.750	24.531		X		X
	1.000	1.500	26.700		X		X
3.625	0.120	3.385	4.492		X		
	0.188	3.249	6.901		X		
	0.250	3.125	9.011		X		
	0.313	2.999	11.071		X		
	0.375	2.875	13.016		X		
	0.438	2.749	14.908		X		
	0.500	2.625	16.688		X		
	0.625	2.375	20.025		X		
	0.750	2.125	23.029	X			
3.750	0.120	3.510	4.652		X	X	
	0.188	3.374	7.152		X		
	0.250	3.250	9.345		X		
	0.313	3.124	11.489		X		
	0.375	3.000	13.517		X		
	0.438	2.874	15.493		X		
	0.500	2.750	17.355		X		X
	0.563	2.624	19.163		X		
	0.625	2.500	20.859		X		
	0.750	2.250	24.030	X			
	0.875	2.000	26.867	X			X
	1.000	1.750	29.370	X			X
3.875	0.120	3.635	4.812		X		
	0.188	3.499	7.403		X		
	0.250	3.375	9.679		X		
	0.375	3.125	14.018		X		
	0.500	2.875	18.023		X		
	0.625	2.625	21.694		X		
	0.750	2.375	25.031	X			
4.000	0.065	3.870	2.732		X	X	
	0.083	3.834	3.472		X	X	
	0.095	3.810	3.962		X	X	
	0.120	3.760	4.973		X	X	
	0.188	3.624	7.654		X		
	0.219	3.562	8.843		X		
	0.250	3.500	10.013		X		
	0.313	3.374	12.325		X		
	0.375	3.250	14.518		X		
	0.438	3.124	16.662		X		
	0.500	3.000	18.690		X		X
	0.563	2.874	20.666		X		
	0.625	2.750	22.528		X		
	0.750	2.500	26.033	X			X
	0.875	2.250	29.203	X			X
	1.000	2.000	32.040	X			X
	1.125	1.750	34.543				X
	1.250	1.500	36.713	X			X
4.125	0.250	3.625	10.346		X		

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
4.125	0.313	3.499	12.743		X		
	0.375	3.375	15.019		X		
	0.500	3.125	19.358		X		
	0.625	2.875	23.363		X		
4.250	0.065	4.120	2.905		X	X	
	0.095	4.060	4.216		X	X	
	0.120	4.010	5.293		X	X	
	0.188	3.874	8.156		X		
	0.250	3.750	10.680		X		
	0.313	3.624	13.161		X		
	0.375	3.500	15.519		X		
	0.438	3.374	17.832		X		
	0.500	3.250	20.025		X		
	0.625	3.000	24.197		X		
	0.750	2.750	28.035	X			X
	0.875	2.500	31.539	X			X
	1.000	2.250	34.710	X			X
	1.125	2.000	37.547	X			X
	1.250	1.750	40.050				X
4.500	0.065	4.370	3.079		X	X	
	0.083	4.334	3.915		X	X	
	0.095	4.310	4.469		X	X	
	0.120	4.260	5.613		X	X	
	0.134	4.232	6.248		X		
	0.188	4.124	8.658		X		
	0.219	4.062	10.013		X		
	0.250	4.000	11.348		X		
	0.313	3.874	13.996		X		
	0.375	3.750	16.521		X		
	0.438	3.624	19.001		X		
	0.500	3.500	21.360		X		X
	0.625	3.250	25.866	X	X		
	0.750	3.000	30.038	X			X
	0.875	2.750	33.876	X			X
	1.000	2.500	37.380	X			X
	1.125	2.250	40.551	X			X
	1.250	2.000	43.388	X			X
	1.500	1.500	48.060				X
4.625	0.250	4.125	11.681		X		
	0.313	3.999	14.414		X		
	0.375	3.875	17.021		X		
	0.500	3.625	22.028		X		
4.750	0.120	4.510	5.934		X		
	0.188	4.374	9.160		X		
	0.250	4.250	12.015		X		
	0.313	4.124	14.832		X		
	0.375	4.000	17.522		X		
	0.500	3.750	22.695		X		X
	0.625	3.500	27.534		X		
	0.750	3.250	32.040	X			X
	0.875	3.000	36.212	X			X
	1.000	2.750	40.050	X			X
	1.250	2.250	46.725				X
	1.500	1.750	52.065				X
5.000	0.065	4.870	3.426		X	X	
	0.083	4.834	4.359		X	X	
	0.120	4.760	6.254		X	X	

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
5.000	0.188	4.624	9.662		X		
	0.250	4.500	12.683		X		
	0.313	4.374	15.668		X		
	0.375	4.250	18.523		X		
	0.438	4.124	21.340		X		
	0.500	4.000	24.030		X		X
	0.625	3.750	29.203		X		X
	0.750	3.500	34.043	X			X
	0.875	3.250	38.548	X			X
	1.000	3.000	42.720	X			X
	1.125	2.750	46.558				X
	1.250	2.500	50.063	X			X
	1.500	2.000	56.070	X			X
5.250	0.120	5.010	6.575		X		
	0.188	4.874	10.164		X		
	0.250	4.750	13.350		X		
	0.313	4.624	16.504		X		
	0.375	4.500	19.524		X		
	0.500	4.250	25.365		X		X
	0.625	4.000	30.872		X		
	0.750	3.750	36.045	X			X
	0.875	3.500	40.884	X			X
	1.000	3.250	45.390	X			X
	1.125	3.000	49.562				X
	1.250	2.750	53.400				X
	1.500	2.250	60.075				X
5.500	0.065	5.370	3.773		X	X	
	0.083	5.334	4.802			X	
	0.120	5.260	6.895		X	X	
	0.188	5.124	10.666		X		
	0.250	5.000	14.018		X		
	0.313	4.874	17.339		X		
	0.375	4.750	20.526		X		
	0.438	4.624	23.679		X		
	0.500	4.500	26.700		X		X
	0.625	4.250	32.541		X		
	0.750	4.000	38.048	X			X
	0.875	3.750	43.221	X			X
	1.000	3.500	48.060	X			X
	1.125	3.250	52.566				X
	1.250	3.000	56.738	X			X
	1.500	2.500	64.080				X
5.750	0.188	5.374	11.168		X		
	0.250	5.250	14.685		X		
	0.313	5.124	18.175		X		
	0.375	5.000	21.527		X		
	0.500	4.750	28.035		X		X
	0.625	4.500	34.209		X		
	0.750	4.250	40.050	X			X
	0.875	4.000	45.557	X			
	1.000	3.750	50.730	X			X
	1.250	3.250	60.075	X			X
	1.500	2.750	68.085				X
6.000	0.065	5.870	4.120		X	X	
	0.083	5.834	5.245		X	X	
	0.109	5.782	6.858			X	
	0.120	5.760	7.536		X	X	
	0.134	5.732	8.395			X	

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
6.000	0.188	5.624	11.670		X		
	0.250	5.500	15.353		X		
	0.313	5.374	19.011		X		
	0.375	5.250	22.528		X		
	0.500	5.000	29.370		X		X
	0.625	4.750	35.878		X		X
	0.750	4.500	42.053	X			X
	0.875	4.250	47.893	X			X
	1.000	4.000	53.400	X			X
	1.125	3.750	58.573				X
	1.250	3.500	63.413	X			X
	1.500	3.000	72.090				X
	1.750	2.500	79.433				X
	2.000	2.000	85.440				X
6.250	0.120	6.010	7.856		X		
	0.188	5.874	12.172		X		
	0.250	5.750	16.020		X		
	0.375	5.500	23.529		X		
	0.500	5.250	30.705		X		X
	0.625	5.000	37.547		X		X
	0.750	4.750	44.055	X			X
	0.875	4.500	50.229	X			X
	1.000	4.250	56.070	X			X
	1.125	4.000	61.577				X
	1.250	3.750	66.750				X
	1.500	3.250	76.095				X
6.500	0.188	6.124	12.673		X		
	0.250	6.000	16.683		X		
	0.375	5.750	24.531		X		
	0.500	5.500	32.040		X		X
	0.625	5.250	39.216		X		X
	0.750	5.000	46.058	X			X
	0.875	4.750	52.566	X			
	1.000	4.500	58.740	X			X
	1.250	4.000	70.088				X
	1.500	3.500	80.100				X
	1.750	3.000	88.778				X
	2.000	2.500	96.120				X
6.625	0.109	6.407	7.585			X	
	0.120	6.385	8.337			X	
	0.134	6.357	9.289			X	
	0.313	5.999	21.100		X		
6.750	0.250	6.250	17.355		X		
	0.375	6.000	25.532		X		
	0.500	5.750	33.375		X		X
	0.625	5.500	40.884		X		
	0.750	5.250	48.060	X			X
	0.875	5.000	54.902				X
	1.000	4.750	61.410	X			X
	1.250	4.250	73.425				X
	1.500	3.750	84.105				X
7.000	0.065	6.870	4.814		X	X	
	0.083	6.834	6.132			X	
	0.109	6.782	8.022			X	
	0.120	6.760	8.817			X	
	0.134	6.732	9.826				
	0.188	6.624	13.677		X		

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
7.000	0.250	6.500	18.023		X		
	0.375	6.250	26.533		X		
	0.500	6.000	34.710		X		X
	0.625	5.750	42.553		X		X
	0.750	5.500	50.063		X		X
	0.875	5.250	57.238				X
	1.000	5.000	64.080	X			X
	1.125	4.750	70.588				X
	1.250	4.500	76.763				X
	1.500	4.000	88.110				X
	1.750	3.500	98.123				X
	2.000	3.000	106.800				X
7.250	0.250	6.750	18.690		X		
	0.375	6.500	27.534		X		
	0.500	6.250	36.045		X		
	0.625	6.000	44.222		X		X
	0.750	5.750	52.065		X		X
	1.000	5.250	66.750		X		X
	1.125	5.000	73.592				X
	1.250	4.750	80.100				X
	1.500	4.250	92.115				X
7.500	0.188	7.124	14.681		X		
	0.250	7.000	19.358		X		
	0.375	6.750	28.536		X		
	0.500	6.500	37.380		X		X
	0.625	6.250	45.891		X		X
	0.750	6.000	54.068		X		X
	1.000	5.500	69.420		X		X
	1.250	5.000	83.438				X
	1.500	4.500	96.120				X
	1.750	4.000	107.468				X
	2.000	3.500	117.480				X
7.750	0.188	7.374	15.183		X		
	0.250	7.250	20.025		X		
	0.375	7.000	29.537		X		
	0.500	6.750	38.715		X		X
	0.625	6.500	47.559		X		
	0.750	6.250	56.070	X			X
	1.000	5.750	72.090	X			X
	1.250	5.250	86.775				X
	1.500	4.750	100.125				X
8.000	0.065	7.870	5.508			X	
	0.083	7.834	7.018			X	
	0.109	7.782	9.186			X	
	0.120	7.760	10.099			X	
	0.134	7.732	11.257			X	
	0.188	7.624	15.685		X		
	0.250	7.500	20.693		X		
	0.375	7.250	30.538		X		
	0.500	7.000	40.050		X		X
	0.625	6.750	49.228		X		X
	0.750	6.500	58.073	X			X
	0.875	6.250	66.583				X
	1.000	6.000	74.760	X			X
	1.125	5.750	82.603				X
	1.250	5.500	90.113				X
	1.500	5.000	104.130				X
	1.750	4.500	116.813				X

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
8.000	2.000	4.000	128.160				X
	2.250	3.500	138.173				X
	2.500	3.000	146.850				
8.250	0.250	7.750	21.360		X		
	0.375	7.500	31.539		X		
	0.500	7.250	41.385		X		X
	0.625	7.000	50.897	X	X		
	0.750	6.750	60.075		X		X
	1.000	6.250	77.430		X		X
	1.125	6.000	85.607				X
	1.250	5.750	93.450				X
	1.500	5.250	108.135				X
8.500	0.250	8.000	22.028		X		
	0.375	7.750	32.541		X		
	0.500	7.500	42.720		X		X
	0.625	7.250	52.566		X		
	0.750	7.000	62.078	X			X
	1.000	6.500	80.100	X			X
	1.250	6.000	96.788				X
	1.500	5.500	112.140				X
	1.750	5.000	126.158				X
	2.000	4.500	138.840				X
	2.500	3.500	160.200				X
8.750	0.375	8.000	33.542		X		
	0.500	7.750	44.055		X		X
	0.750	7.250	64.080		X		X
	1.000	6.750	82.770				X
	1.250	6.250	100.125				X
	1.500	5.750	116.145				X
	2.000	4.750	144.180				X
9.000	0.250	8.500	23.363		X		
	0.375	8.250	34.543		X		
	0.500	8.000	45.390		X		X
	0.625	7.750	55.903				X
	0.750	7.500	66.083	X			X
	1.000	7.000	85.440	X			X
	1.250	6.500	103.463				X
	1.500	6.000	120.150				X
	1.750	5.500	135.503				X
	2.000	5.000	149.520				X
	2.250	4.500	162.203				X
	2.500	4.000	173.550				X
	3.000	3.000	192.240				X
9.250	0.250	8.750	24.030		X		
	0.375	8.500	35.544		X		
	0.500	8.250	46.725		X		
	0.625	8.000	57.572		X		X
	0.750	7.750	68.085				X
	1.000	7.250	88.110				X
	1.250	6.750	106.800				X
	1.500	6.250	124.155				X
9.500	0.250	9.000	24.698		X		
	0.375	8.750	36.546		X		
	0.500	8.500	48.060		X		X
	0.750	8.000	70.088	X			X
	1.000	7.500	90.780	X			X
	1.250	7.000	110.138				X

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
9.500	1.500	6.500	128.160				X
	1.750	6.000	144.848				X
	2.000	5.500	160.200				X
9.750	0.250	9.250	25.365		X		
	0.500	8.750	49.395		X		
	0.750	8.250	72.090	X			
	1.000	7.750	93.450				X
	1.250	7.250	113.475				X
	1.500	6.750	132.165				X
10.000	0.083	9.834	8.791			X	
	0.109	9.782	11.514			X	
	0.120	9.760	12.662			X	
	0.134	9.732	14.119			X	
	0.188	9.624	19.701		X		
	0.250	9.500	26.033		X		
	0.375	9.250	38.548		X		
	0.500	9.000	50.730		X		X
	0.750	8.500	74.093	X			X
	1.000	8.000	96.120	X			X
	1.125	7.750	106.633				X
	1.250	7.500	116.813				X
	1.500	7.000	136.170				X
	1.750	6.500	154.193				X
	2.000	6.000	170.880				X
	2.250	5.500	186.233				X
	2.500	5.000	200.250				X
	3.000	4.000	224.280				X
10.250	0.500	9.250	52.065		X		
	0.750	8.750	76.095				X
	1.000	8.250	98.790				X
	1.250	7.750	120.150				X
	1.500	7.250	140.175				X
10.500	0.250	10.000	27.368		X		
	0.375	9.750	40.551		X		
	0.500	9.500	53.400		X		X
	0.750	9.000	78.098	X			X
	1.000	8.500	101.460	X			X
	1.250	8.000	123.488				X
	1.500	7.500	144.180				X
	1.750	7.000	163.538				X
	2.000	6.500	181.560				X
	2.500	5.500	213.600				X
	3.000	4.500	240.300				X
10.750	0.250	10.250	28.035	X			
	0.375	10.000	41.552		X		
	0.500	9.750	54.735		X		
	0.750	9.250	80.100	X			
	1.000	8.750	104.130				X
	1.250	8.250	126.825				X
	1.500	7.750	148.185				X
	1.750	7.250	168.210				X
	2.000	6.750	186.900				X
	2.250	6.250	204.255				X
	2.500	5.750	220.275				X
11.000	0.500	10.000	56.070		X		X
	0.750	9.500	82.103				X
	1.000	9.000	106.800				X

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Outside Diameter O.D.	Wall Thickness Inch	Inside Diameter I.D.	Weight per Foot	SMLS	D.O.M.	E.R.W.	HR SMLS
11.000	1.250	8.500	130.163				X
	1.500	8.000	152.190				X
	1.750	7.500	172.883				X
	2.000	7.000	192.240				X
	2.500	6.000	226.950				X
	3.000	5.000	256.320				X
11.250	0.500	10.250	57.405				X
	0.750	9.750	84.105				X
	1.000	9.250	109.470				X
	1.250	8.750	133.500				X
	1.500	8.250	156.195				X
	2.000	7.250	197.580				X
11.500	0.500	10.500	58.740				X
	0.750	10.000	86.108				X
	1.000	9.500	112.140				X
	1.250	9.000	136.838				X
	1.500	8.500	160.200				X
	1.750	8.000	182.228				X
	2.000	7.500	202.920				X
	2.500	6.500	240.300				X
12.000	0.250	11.500	31.373		X		
	0.375	11.250	46.558		X		
	0.500	11.000	61.410		X		X
	0.625	10.750	75.928				X
	0.750	10.500	90.113		X		X
	1.000	10.000	117.480		X		X
	1.250	9.500	143.513				X
	1.500	9.000	168.210				X
	1.750	8.500	191.573				X
	2.000	8.000	213.600				X
	2.250	7.500	234.293				X
	2.500	7.000	253.650				X
	3.000	6.000	288.360				X

Additional sizes available on request from 12.250 on to 26.000

SEAMLESS TUBING TOLERANCES

A.S.T.M. – A519

O.D. AND I.D. TOLERANCES FOR COLD DRAWN SEAMLESS MECHANICAL STEEL TUBING

The tabulated tolerances can be applied simultaneously only to two of the cross-sectional dimensions. However, when mechanical tubing is specified to OD and ID dimensions, the maximum and minimum wall thickness measured at any cross-section cannot deviate from the mean (arithmetic average) of those readings by more than the percentage wall thickness tolerance applicable to the particular product involved.

OD Size Range, Inches	Wall: Percent of OD	Unannealed or Stress Relief Annealed ≤ 1200°F				Soft Annealed or Normalized			
		OD Inches		*ID Inches		OD Inches		*ID Inches	
		+	-	+	-	+	-	+	-
Up to 0.499	All .004	.000	—	—	.005	.002	—	—	—
0.500/1.699	All	.005	.000	.000	.005	.007	.002	.002	.007
1.700/2.099	All	.006	.000	.000	.006	.006	.005	.005	.006
2.100/2.499	All	.007	.000	.000	.007	.008	.005	.005	.008
2.500/2.899	All	.008	.000	.000	.008	.009	.005	.005	.009
2.900/3.299	All	.009	.000	.000	.009	.011	.005	.005	.011
3.300/3.699	All	.010	.000	.000	.010	.013	.005	.005	.013
3.700/4.099	All	.011	.000	.000	.011	.013	.007	.010	.010
4.100/4.499	All	.012	.000	.000	.012	.014	.007	.011	.011
4.500/4.899	All	.013	.000	.000	.013	.016	.007	.012	.012
4.900/5.299	All	.014	.000	.000	.014	.018	.007	.013	.013
5.300/5.549	All	.015	.000	.000	.015	.020	.007	.014	.014
5.550/5.999	Under 6	.010	.010	.010	.010	.018	.018	.018	.018
	6 to 7½	.009	.009	.009	.009	.016	.016	.016	.016
	Over 7½	.018	.000	.009	.009	.017	.015	.016	.016
6.000/6.499	Under 6	.013	.013	.013	.013	.023	.023	.023	.023
	6 to 7½	.010	.010	.010	.010	.018	.018	.018	.018
	Over 7½	.020	.000	.010	.010	.020	.015	.018	.018

*ID tolerances apply to dimensions of 0.625" and over when ID is at least half the O.D. Over 12" consult our nearest service centre.

SEAMLESS TUBING TOLERANCES

A.S.T.M. – A519 (cont'd)

O.D. AND I.D. TOLERANCES FOR COLD DRAWN SEAMLESS MECHANICAL STEEL TUBING

OD Size Range, Inches	Wall: Percent of OD	Unannealed or Stress Relief Annealed ≤ 1200°F				Soft Annealed or Normalized			
		OD Inches		*ID Inches		OD Inches		*ID Inches	
		+	-	+	-	+	-	+	-
6.500/6.999	Under 6	.015	.015	.015	.015	.027	.027	.027	.027
	6 to 7½	.012	.012	.012	.012	.021	.021	.021	.021
	Over 7½	.023	.000	.012	.012	.026	.015	.021	.021
7.000/7.499	Under 6	.018	.018	.018	.018	.032	.032	.032	.032
	6 to 7½	.013	.013	.013	.013	.023	.023	.023	.023
	Over 7½	.026	.000	.013	.013	.031	.015	.023	.023
7.500/7.999	Under 6	.020	.020	.020	.020	.035	.035	.035	.035
	6 to 7½	.015	.015	.015	.015	.026	.026	.026	.026
	Over 7½	.029	.000	.015	.015	.036	.015	.026	.026
8.000/8.499	Under 6	.023	.023	.023	.023	.041	.041	.041	.041
	6 to 7½	.016	.016	.016	.016	.028	.028	.028	.028
	Over 7½	.031	.000	.015	.016	.033	.022	.028	.028
8.500/8.999	Under 6	.025	.025	.025	.025	.044	.044	.044	.044
	6 to 7½	.017	.017	.017	.017	.030	.030	.030	.030
	Over 7½	.034	.000	.015	.019	.038	.022	.030	.030
9.000/9.499	Under 6	.028	.028	.028	.028	.045	.045	.049	.049
	6 to 7½	.019	.019	.019	.019	.033	.033	.033	.033
	Over 7½	.037	.000	.015	.022	.043	.022	.033	.033
9.500/9.999	Under 6	.030	.030	.030	.030	.045	.045	.053	.053
	6 to 7½	.020	.020	.020	.020	.035	.035	.035	.035
	Over 7½	.040	.000	.015	.025	.048	.022	.035	.035
10.000/10.750	Under 6	.034	.034	.034	.034	.045	.045	.060	.060
	6 to 7½	.022	.022	.022	.022	.039	.039	.039	.039
	Over 7½	.044	.000	.015	.029	.055	.022	.039	.039
11.000/12.000	Under 6	.035	.035	.035	.035	.050	.050	.065	.065
	6 to 7½	.025	.025	.025	.025	.045	.045	.045	.045
	Over 7½	.045	.000	.015	.035	.060	.022	.045	.045

*ID tolerances apply to dimensions of 0.625" and over when ID is at least half the O.D. Over 12" consult our nearest service centre.

SEAMLESS TUBING TOLERANCES

A.S.T.M. – A519 (cont'd)

WALL TOLERANCES FOR SEAMLESS ROUND MECHANICAL TUBING, COLD DRAWN

Maximum Percent Over and Under Nominal – Cold Worked		
Wall thickness Percent of Outside Diameter	Up to 1.500 Inches	1.500 Inches & Over
25 & Under	Up to	7.5
Over 25	12.5	10.0

STRAIGHTNESS TOLERANCES FOR SEAMLESS ROUND MECHANICAL TUBING COLD DRAWN OR HOT FINISHED

The straightness variation for any 3 ft. (0.9m) of length is measured with a 3-ft. straight-edge and the use of a feeler gauge. The total variation, that is the maximum curvature at any point in the total length of the tube is determined by rolling the tube on a surface plate and measuring the concavity with a feeler gauge.

The tolerances apply generally to unannealed, finish-annealed and medium-annealed cold-finished or hot-finished tubes. When straightening stresses would interfere with the use of the end product, the straightness tolerances shown do not apply when tubing is specified "not to be straightened after furnace treatment". These straightness tolerances do not apply to soft annealed or quenched and tempered tubes.

Size Limits	Maximum Curvature in any 3 ft. in. (mm/m)	Maximum Curvature in Total Lengths, in. (mm)	Maximum Curvature for Lengths under 3 ft or 1m
OD 5 in. (127.0 mm) and smaller, wall thickness, over 3 percent of OD but not over 0.5 in. (12.7 mm)	0.030 (0.83)	0.030 x (no. of ft. of length/3) (0.83 x no. of m of length)	ratio of 0.010 in/ft. or 0.83 mm/m
OD over 5 to 8 in. (127.0 to 203.2 mm), incl. wall thickness, over 4 percent of OD but not over 0.75 in. (19.0 mm)	0.045 (1.25)	0.045 x (no. of ft. of length/3) (1.25 x no. of m of length)	ratio of 0.015 in/ft. or 1.25 mm/m
OD over 8 to 12 1/4 in. (203.2 to 323.8 mm), incl. wall thickness, over 4 percent of OD but not over 1 in. (25.4 mm)	0.060 (1.67)	0.060 x (no. of ft. of length/3) (1.67 x no. of m of length)	ratio of 0.020 in/ft. or 1.67 mm/m

Cont'd

SEAMLESS TUBING TOLERANCES

A.S.T.M. – A519 (cont'd)

OUTSIDE DIAMETER TOLERANCES FOR SEAMLESS ROUND MECHANICAL TUBING, HOT FINISHED

Outside Diameter Size Range, in. (mm)	Outside Diameter Tolerance, in. (mm)	
	Over	Under
Up to 2.999 (76.17)	0.020 (0.51)	0.020 (0.51)
3.000 – 4.499 (76.20 – 114.27)	0.025 (0.64)	0.025 (0.64)
4.500 – 5.999 (114.30 – 152.37)	0.031 (0.79)	0.031 (0.79)
6.000 – 7.499 (152.40 – 190.47)	0.037 (0.94)	0.037 (0.94)
7.500 – 8.999 (190.50 – 228.57)	0.045 (1.14)	0.045 (1.14)
9.000 – 10.750 (228.60 – 273.05)	0.050 (1.27)	0.050 (1.27)

- a) Diameter tolerances are not applicable to normalized and tempered or quenched and tempered conditions.
- b) The common range of sizes of hot finished tubes is 1½ in. (38.1 mm) to 10¾ in. (273.0 mm) outside diameter with wall thickness at least 3 per cent of outside diameter, but not less than 0.095 in. (2.41 mm)
- c) Larger sizes are available; consult our nearest service centre for sizes and tolerances.

WALL TOLERANCES FOR SEAMLESS ROUND MECHANICAL TUBING, HOT FINISHED

Maximum Percent Over and Under Nominal			
Wall Thickness Percent of Outside Diameter	Up To 3"	3" To 6"	6" To 10.750"
Under 15	12.5	10.0	10.0
15 and Over	10.0	7.5	10.0

MACHINING ALLOWANCES FOR CARBON MECHANICAL TUBING

O.D.	Commercial Quality		Magnaflux Quality	
	For C.D. (Per Side)	For H.R. (Per Side)	For C.D. (Per Side)	For H.R. (Per Side)
½" to 1½"	.010"	—	.035"	—
1½" to 3"	.020"	.025"	.045"	.050"
Over 3" to 4½"	.030"	.030"	.055"	.055"
Over 4½" to 5½"	.030"	.035"	.055"	.060"
Over 5½" to 6½"	.040"	.040"	.065"	.065"
Over 6½" to 8"	.040"	.050"	.065"	.075"
Over 8" to 10"	.050"	.070"	.075"	.095"

PHYSICAL PROPERTIES
OF COLD DRAWN AND HOT FINISHED
SEAMLESS MECHANICAL TUBING

TYPICAL PROPERTIES

Approximate Mechanical Properties						
Grade ASTM AISI SAE		Chemistry Percent	Temper Condition	Tensile Strength PSI	Yield Strength PSI	Elongation in 2" %
1010	C	.05-.15	As-Welded	55,000	40,000	20
	Mn	.30-.60	Normalized	50,000	40,000	35
	P	.040 max	Soft Annealed	45,000	35,000	45
	S	.050 max	Cold Drawn	70,000	55,000	20
MT 1015	C	.13-.18	Hot Rolled	48,000	30,000	28
	Mn	.30-.60	Normalized	67,000	55,000	6
	P	.040 max	Soft Annealed	46,000	27,000	31
	S	.050 max	Cold Drawn	51,000	32,000	27
1018	C	.15-.20	Hot Rolled	60,000	35,000	30
	Mn	.60-.90	Normalized	58,000	38,000	35
	P	.040 max	Soft Annealed	50,000	33,000	40
	S	.050 max	Cold Drawn	85,000	70,000	10
1020	C	.15-.23	Hot Rolled	60,000	37,000	30
	Mn	.30-.60	Normalized	60,000	40,000	35
	P	.040 max	Soft Annealed	52,000	33,000	40
	S	.050 max	Cold Drawn	85,000	70,000	10
C 1026	C	.22-.28	Hot Rolled	70,000	47,000	28
	Mn	.60-.90	Normalized	67,000	50,000	33
	P	.040 max	Soft Annealed	60,000	36,000	35
	S	.050 max	Cold Drawn	87,000	72,000	10
C 1035	C	.32-.38	Hot Rolled	72,000	47,000	25
	Mn	.60-.90	Normalized	70,000	50,000	30
	P	.040 max	Soft Annealed	63,000	38,000	35
	S	.050 max	Cold Drawn	90,000	75,000	10
C 1045	C	.43-.50	Hot Rolled	75,000	45,000	15
	Mn	.60-.90	Normalized	75,000	48,000	15
	P	.040 max	Soft Annealed	65,000	35,000	20
	S	.050 max	Cold Drawn	75,000	48,000	15
C 1050	C	.48-.55	Hot Rolled	80,000	50,000	10
	Mn	.60-.90	Normalized	78,000	50,000	12
	P	.040 max	Soft Annealed	68,000	38,000	18
	S	.050 max	Cold Drawn	95,000	85,000	4

Cont'd

PHYSICAL PROPERTIES OF COLD DRAWN AND HOT FINISHED SEAMLESS MECHANICAL TUBING

TYPICAL PROPERTIES (cont'd)

Approximate Mechanical Properties						
Grade ASTM AISI SAE	Chemistry Percent		Temper Condition	Tensile Strength PSI	Yield Strength PSI	Elongation in 2" %
C 1118	C	.14-.20	Hot Rolled	60,000	40,000	30
	Mn	1.30-1.60	Normalized	60,000	43,000	30
	P	.040 max	Soft Annealed	58,000	40,000	35
	S	.08-.13	Cold Drawn	80,000	70,000	10
C 1524	C	.19-.25	Hot Rolled	75,000	52,000	27
	Mn	1.35-1.65	Normalized	75,000	52,000	27
	P	.040 max	Soft Annealed	67,000	46,000	32
	S	.050 max	Cold Drawn	95,000	85,000	25
4130	C	.28-.33	Hot Rolled	90,000	70,000	20
	Mn	.40-.60	Normalized	90,000	70,000	20
	P	.040 max	Soft Annealed	80,000	50,000	30
	S	.040 max	Condition N	90,000	70,000	20
	Si	.15-.35	CDSR	110,000	95,000	15
	Cr	.80-1.10	WQ & T 900 F	161,000	137,000	15
	Mo	.15-.25	WQ & T 1100 F	128,000	113,000	21
4135	C	.33-.38	Hot Rolled	95,000	80,000	15
	Mn	.70-.90	Normalized	95,000	80,000	15
	P	.040 max	Soft Annealed	85,000	55,000	30
	S	.040 max	Condition N	95,000	80,000	15
	Si	.15-.35	CDSR	115,000	100,000	12
	Cr	.80-1.10	OQ & T 800 F	207,000	175,000	10
	Mo	.15-.25	OQ & T 1000 F	160,000	135,000	15
4140	C	.38-.43	Hot Rolled	120,000	90,000	20
	Mn	.75-1.10	Normalized	120,000	90,000	20
	P	.040 max	Soft Annealed	90,000	65,000	25
	S	.040 max	CDSR	120,000	100,000	10
	Si	.15-.35	OQ & T 400 F	290,000	250,000	11
	Cr	.80-1.10	OQ & T 900 F	180,000	155,000	18
	Mo	.15-.25	OQ & T 1300 F	120,000	105,000	25

Cont'd

PHYSICAL PROPERTIES OF COLD DRAWN AND HOT FINISHED SEAMLESS MECHANICAL TUBING

TYPICAL PROPERTIES (cont'd)

Approximate Mechanical Properties					
Grade ASTM AISI SAE	Chemistry Percent	Temper Condition	Tensile Strength PSI	Yield Strength PSI	Elongation in 2" %
4340	C .38-.43	Hot Rolled	180,000	125,000	11
	Mn .60-.80	Normalized	180,000	125,000	11
	P .040 max	Soft Annealed	110,000	75,000	20
	S .040 max	OQ & T 400 F	290,000	250,000	10
	Si .15-.35	OQ & T 600 F	260,000	235,000	11
	Cr .70-.90	OQ & T 800 F	220,000	200,000	12
	Ni 1.65-2.00	OQ & T 1000 F	185,000	160,000	15
	Mo .20-.30	OQ & T 1300 F	140,000	130,000	22
8620	C .18-.23	Hot Rolled	50,000	75,000	25
	Mn .70-.90	Cold Drawn	100,000	90,000	10
	P .035 max	S-R Anneal	80,000	95,000	18
	S .040 max	Normalized	50,000	75,000	25
	Si .20-.35				
	Ni .40-.70				
	Cr .40-.60				
	Mo .15-.25				
A106 B	C .30 max	Hot Rolled	60,000 Min	35,000 Min	30
	Mn .29-1.06	Mechanical			
	Si .10 min				

CDSR – Cold Drawn Stress Relieved • WQ & T – Water Quench & Temper.
OQ & T – Oil Quench & Temper.

Many other grades are available on special order.

D.O.M. TUBING TOLERANCES

O.D. AND I.D. TOLERANCES

A.S.T.M. – A513

Note – Measurements for diameter are to be taken at least 2 in. from the ends of the tubes.

OD Size Range ^A	Wall Percent of OD	Types 3, 4, (Sink Drawn) ^{A, B} and 5, 6, (Mandrel Drawn) ^{B, C} OD, In.		Types 5 and 6 (Mandrel Drawn) ^{B, C} ID In.	
		Over	Under	Over	Under
Up to 0.499	all	0.004	0.000	—	—
0.500 to 1.699	all	0.005	0.000	0.000	0.005
1.700 to 2.099	all	0.006	0.000	0.000	0.006
2.100 to 2.499	all	0.007	0.000	0.000	0.007
2.500 to 2.899	all	0.008	0.000	0.000	0.008
2.900 to 3.299	all	0.009	0.000	0.000	0.009
3.300 to 3.699	all	0.010	0.000	0.000	0.010
3.700 to 4.099	all	0.011	0.000	0.000	0.011
4.100 to 4.499	all	0.012	0.000	0.000	0.012
4.500 to 4.899	all	0.013	0.000	0.000	0.013
4.900 to 5.299	all	0.014	0.000	0.000	0.014
5.300 to 5.549	all	0.015	0.000	0.000	0.015
5.550 to 5.999	under 6	0.010	0.010	0.010	0.010
	6 and over	0.009	0.009	0.009	0.009
6.000 to 6.499	under 6	0.013	0.013	0.013	0.013
	6 and over	0.010	0.010	0.010	0.010
6.500 to 6.999	under 6	0.015	0.015	0.015	0.015
	6 and over	0.012	0.012	0.012	0.012
7.000 to 7.499	under 6	0.018	0.018	0.018	0.018
	6 and over	0.013	0.013	0.013	0.013
7.500 to 7.999	under 6	0.020	0.020	0.020	0.020
	6 and over	0.015	0.015	0.015	0.015
8.000 to 8.499	under 6	0.023	0.023	0.023	0.023
	6 and over	0.016	0.016	0.016	0.016
8.500 to 8.999	under 6	0.025	0.025	0.025	0.025
	6 and over	0.017	0.017	0.017	0.017
9.000 to 9.499	under 6	0.028	0.028	0.028	0.028
	6 and over	0.019	0.019	0.019	0.019
9.500 to 9.999	under 6	0.030	0.030	0.030	0.030
	6 and over	0.020	0.020	0.020	0.020
10.000 to 10.999	all	0.034	0.034	0.034	0.034
11.000 to 11.999	all	0.035	0.035	0.035	0.035
12.000 to 12.500	all	0.037	0.037	0.037	0.037

^A Tubing, flash in or flash controlled which is further processed without mandrel to obtain tolerances closer than those shown in Tables 4 and 7.

^B The ovality shall be within the above tolerances except when the wall thickness is less than 3% of the outside diameter, in such cases see 11.6.2 of A.S.T.M. – A513.

^C Tubing produced to outside diameter and wall thickness, or inside diameter and wall thickness, or outside diameter and inside diameter, with mandrel to obtain tolerances closer than those shown in Tables 4 and 7 of A.S.T.M. – A513 and no dimensional indication of inside diameter flash.

Cont'd

D.O.M. TUBING TOLERANCES (cont'd)

WALL THICKNESS TOLERANCES

A.S.T.M. – A513

Wall Thickness		Outside Diameter, in.							
		¾ to 1¼ incl		Over 1¼ to 1½ incl		Over 1½ to 3¼ incl		Over 3¼ to 12½ incl	
		Wall thickness Tolerances, in., Plus and Minus							
In.	B.W.G. ⁴	Plus	Minus	Plus	Minus	Plus	Minus	Plus	Minus
0.035	20	0.002	0.002	0.002	0.002	0.002	0.002	—	—
0.049	18	0.002	0.002	0.002	0.003	0.002	0.003	—	—
0.065	16	0.002	0.002	0.002	0.003	0.002	0.003	0.004	0.004
0.083	14	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.005
0.095	13	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.005
0.109	12	0.002	0.003	0.002	0.004	0.003	0.003	0.005	0.005
0.120	11	0.003	0.003	0.002	0.004	0.003	0.003	0.005	0.005
0.134	10	—	—	0.002	0.004	0.003	0.003	0.005	0.005
0.148	9	—	—	0.002	0.004	0.003	0.003	0.005	0.005
0.165	8	—	—	0.003	0.004	0.003	0.004	0.005	0.006
0.180	7	—	—	0.004	0.004	0.003	0.005	0.006	0.006
0.203	6	—	—	0.004	0.005	0.004	0.005	0.006	0.007
0.220	5	—	—	0.004	0.006	0.004	0.006	0.007	0.007
0.238	4	—	—	0.005	0.006	0.005	0.006	0.007	0.007
0.259	3	—	—	0.005	0.006	0.005	0.006	0.007	0.007
0.284	2	—	—	0.005	0.006	0.005	0.006	0.007	0.007
0.300	1	—	—	0.006	0.006	0.006	0.006	0.008	0.008
0.320		—	—	0.007	0.007	0.007	0.007	0.008	0.008
0.344		—	—	0.008	0.008	0.008	0.008	0.009	0.009
0.375		—	—	—	—	0.009	0.009	0.009	0.009
0.400		—	—	—	—	0.010	0.010	0.010	0.010
0.438		—	—	—	—	0.011	0.011	0.011	0.011
0.460		—	—	—	—	0.012	0.012	0.012	0.012
0.480		—	—	—	—	0.012	0.012	0.012	0.012
0.531		—	—	—	—	0.013	0.013	0.013	0.013
0.563		—	—	—	—	—	—	0.013	0.013
0.580		—	—	—	—	—	—	0.014	0.014

⁴ Birmingham Wire Gauge.

D.O.M. TUBING TOLERANCES (cont'd)

RECOMMENDED HONING ALLOWANCES FINISHED WALL THICKNESS, INCHES (MM)

	Over .065 (1.65) to .125 (3.18)	Over .125 (3.18) to .180 (4.57)	Over .180 (4.57) to .230 (5.84)	Over .230 (5.84) to .360 (9.14)	Over .360 (9.14) to .460 (11.68)	Over .460 (11.68) to .563 (14.30)
Finished O.D.	.125 (3.18)	.180 (4.57)	.230 (5.84)	.360 (9.14)	.460 (11.68)	.563 (14.30)
Up to 1.500 (38.10)	.011 (.28)	.013 (.33)	.015 (.38)			
Over 1.500 (38.10) to 3.000 (76.20)	.012 (.30)	.014 (.36)	.016 (.41)	.018 (.46)		
Over 3.000 (76.20) to 4.000 (101.60)	.013 (.33)	.015 (.38)	.017 (.43)	.019 (.48)	.021 (.53)	.023 (.58)
Over 4.000 (101.60) to 4.750 (120.65)	.014 (.36)	.016 (.41)	.018 (.46)	.020 (.51)	.022 (.56)	.024 (.61)
Over 4.750 (120.65) to 6.000 (152.40)	.015 (.38)	.017 (.43)	.019 (.48)	.021 (.53)	.023 (.58)	.025 (.64)
Over 6.000 (152.40) to 8.000 (203.20)	.016 (.41)	.018 (.46)	.020 (.51)	.022 (.56)	.024 (.61)	.026 (.66)
Over 8.000 (203.20) to 10.500 (266.70)			.022 (.56)	.023 (.58)	.025 (.64)	.027 (.69)
Over 10.500 (266.70) to 12.500 (317.50)			.023 (.58)	.024 (.61)	.026 (.66)	.028 (.71)
Over 12.500 (317.50) to 14.000 (355.60)			.024 (.61)	.025 (.64)	.027 (.69)	.029 (.74)
Over 14.000 (355.60) to 15.000 (381.00)			.025 (.64)	.026 (.66)	.028 (.71)	.030 (.76)

MACHINING ALLOWANCES FINISHED WALL THICKNESS, INCHES (MM)

	.187 (4.75) and Under	Over .187 (4.75) and .230 (5.84)	Over .230 (5.84) and .360 (9.14)	Over .360 (9.14) and .460 (11.68)	Over .460 (11.68) and .580 (14.73)
Finished O.D.	.187 (4.75) and Under	.230 (5.84)	.360 (9.14)	.460 (11.68)	.580 (14.73)
Up to 1.500 (38.10)	.015 (.38)	.020 (.51)	.025 (.64)	.025 (.64)	
Over 1.500 (38.10) to 3.000 (76.20)	.020 (.51)	.025 (.64)	.030 (.76)	.030 (.76)	
Over 3.000 (76.200) to 4.750 (120.65)	.025 (.64)	.030 (.76)	.035 (.89)	.035 (.89)	.040 (1.02)
Over 4.750 (120.65) to 6.000 (152.40)	.030 (.76)	.035 (.89)	.040 (1.02)	.040 (1.02)	.045 (1.14)
Over 6.000 (152.40) to 7.000 (177.80)	.035 (.89)	.040 (1.02)	.045 (1.14)	.045 (1.14)	.050 (1.27)
Over 7.000 (177.80) to 8.000 (203.20)	.035 (.89)	.043 (1.09)	.048 (1.22)	.048 (1.22)	.053 (1.35)
Over 8.000 (203.20) to 10.500 (266.70)	.035 (.89)	.045 (1.14)	.050 (1.27)	.050 (1.27)	.055 (1.40)
Over 10.500 (266.70) to 12.500 (317.50)		.045 (1.14)	.055 (1.40)	.055 (1.40)	.060 (1.52)
Over 12.500 (317.50) to 14.000 (355.60)		.045 (1.14)	.055 (1.40)	.055 (1.40)	.060 (1.52)
Over 14.000 (355.60) to 15.000 (381.00)		.045 (1.14)	.055 (1.40)	.055 (1.40)	.060 (1.52)

Camber: For every 12" (304.80 mm) or fraction thereof over 12" (304.80 mm), add .010" (0.25 mm) for camber. For sizes over 7½" (190.50 mm), add .020" for camber.

D.O.M. TUBING TOLERANCES (cont'd)

CENTERLESS GRINDING ALLOWANCES

FINISHED WALL THICKNESS, INCHES (MM)

Finished O.D.	.125 (3.18) and Under	Over to .180 (4.57)	Over to .230 (5.84)	Over to .360 (9.14)	Over to .460 (11.68)	Over to .580 (14.73)
Up to 3.000 (76.20)	.012 (.30)	.014 (.36)	.016 (.41)	.020 (.51)	.022 (.56)	
Over 3.000 (76.20) to 4.750 (120.65)	.016 (.41)	.018 (.46)	.020 (.51)	.022 (.56)	.024 (.61)	.026 (.66)
Over 4.750 (120.65) to 6.000 (152.40)	.018 (.46)	.020 (.51)	.022 (.56)	.024 (.61)	.026 (.66)	.028 (.71)
Over 6.000 (152.40) to 7.000 (177.80)	.020 (.51)	.022 (.56)	.024 (.61)	.026 (.66)	.028 (.71)	.030 (.76)
Over 7.000 (177.80) to 8.000 (203.20)		.024 (.61)	.026 (.66)	.027 (.69)	.029 (.74)	.031 (.79)
Over 8.000 (203.20) to 10.500 (266.70)			.026 (.66)	.028 (.71)	.030 (.76)	.032 (.81)
Over 10.500 (266.70) to 12.500 (317.50)			.028 (.71)	.030 (.76)	.032 (.81)	.034 (.86)
Over 12.500 (317.50) to 14.000 (355.60)			.030 (.76)	.032 (.81)	.034 (.86)	.036 (.91)
Over 14.000 (355.60) to 15.000 (381.00)			.033 (.84)	.035 (.89)	.036 (.91)	.037 (.94)

Ovality shall be within tolerance, except when the wall thickness is less than 3% of the OD, an ovality tolerance in addition to the above OD & ID tolerances is required. The additional ovality shall be as follows; however, mean OD or ID must be within the minimum and maximum permitted by the tolerance table.

OD, In.	Additional Ovality Tolerances, In.	OD, In.	Additional Ovality Tolerances, In.
Up to 2 incl.	.010	Over 6 to 7 incl.	.035
Over 2 to 3 incl.	.015	Over 7 to 8 incl.	.040
Over 3 to 4 incl.	.020	Over 8 to 9 incl.	.045
Over 4 to 5 incl.	.025	Over 9 to 10 incl.	.050
Over 5 to 6 incl.	.030	Over 10	.055

STRAIGHTNESS TOLERANCES FOR D.O.M. TUBING

Inches	Millimetres
.030" in any 3 ft. of length up to 8.000" OD	0.83 mm in any metre of length up to 203.20 mm OD
.060" in any 3 ft. of length over 8.000" OD	1.66 mm in any metre of length over 203.20 mm OD
Straightness or camber is measured for any 3 ft. of length with a 3 ft. straight edge and a feeler gauge.	Straightness or camber is measured for any metre of length with a metre straight edge and a feeler gauge.

HONED I.D. CYLINDER TUBING

SPECIFICATION – C1020 AND C1026

A.S.T.M. – A513

I.D. SURFACE MAX .20 MICRO

This material is an E.R.W. cold drawn over mandrel mechanical tube, honed or skived and burnished to provide a high quality surface finish on the I.D. combined with close dimensional tolerance

Size and Weight

O.D.	Min. I.D.	Max. I.D.	Weight per Lin. Ft.
2 $\frac{3}{8}$	2.000	2.003	4.391
2 $\frac{1}{2}$	2.000	2.003	6.008
3	2.500	2.503	7.343
3 $\frac{1}{2}$	3.000	3.003	8.678
4	3.500	3.503	10.01
4 $\frac{1}{2}$	4.000	4.003	11.35
5	4.500	4.503	12.68
5 $\frac{1}{2}$	5.000	5.003	14.02
6	5.500	5.503	15.35
6 $\frac{1}{2}$	6.000	6.003	16.69
7	6.250	6.255	26.53
8	7.250	7.255	30.54
8 $\frac{1}{2}$	7.750	7.755	32.54

Honed Cylinder Tube can also be provided in special sizes custom honed to your specifications in Seamless or D.O.M. quality.

Cont'd

HONED I.D. CYLINDER TUBING (cont'd)

Suggested safe loads for Honed I.D. Cylinder Tubing

O.D. (inches)	I.D. (inches)	P.S.I.
2	1½	5,000
2½	2	3750
3	2½	3000
3½	3	2500
4	3½	2143
4½	4	1875
5	4½	1666
5½	5	1500
6	5½	1364
6½	6	1250

Above information based on "common" formula using 15000 fiber stress, and is for estimating purposes only. Refer to your engineering department for final dimensions.

TYPICAL MINIMUM TENSILE PROPERTIES (PSI)

DOM Tubing As Drawn 1020, 1026 Grades

Grade	1020	1026
Yield	55,000	65,000
Ultimate	65,000	75,000
% Elongation – 2"	10	10
Typical Hardness – Min. Rockwell B	75	78

METHOD FOR CALCULATING WORKING PRESSURES FOR HYDRAULIC CYLINDERS

High Pressure Hydrostatic Test Pressures: The following test pressures are based on the use of Barlow's Formula, $P = 2 St/D$, where:

P = Hydrostatic test pressure

S = Allowable fiber stress*

t = Specified wall thickness

D = Specified outside diameter

* The allowable fiber stress is based on 80 percent of the typical minimum yield strength applicable for the tube size and grade involved.

Example:

5.000" O.D. x .580" wall, 1020 E.W. DOM, 60,000 psi Typical Minimum Yield
 $2 \times [(.80 \times 60,000) \times .580] \div 5.000 = 11,100$ psi TEST PRESSURE

SQUARE E.R.W. TUBING

O.D.	Ga.	Wall	Weight per Foot	O.D.	Ga.	Wall	Weight per Foot
½"	22	.028	.18	1⅝"	16	.065	1.13
	20	.035	.22		14	.083	1.42
	18	.049	.30		13	.095	1.62
	16	.065	.39		12	.109	1.84
⅝"	22	.028	.23	1½"	11	.120	2.01
	20	.035	.31		10	.134	2.22
	18	.049	.43		20	.035	.69
	16	.065	.56		18	.049	.96
	14	.083	.70	1½"	16	.065	1.26
	13	.095	.79		14	.083	1.59
¾"	20	.035	.36		13	.095	1.81
	18	.049	.50		12	.109	2.06
	16	.065	.65		11	.120	2.25
	14	.083	.81		10	.134	2.49
	13	.095	.92	1⅝"	20	.035	.75
⅞"	20	.035	.38		18	.049	1.02
	18	.049	.53		16	.065	1.34
	16	.065	.69		14	.083	1.70
	14	.083	.86		13	.095	1.93
	13	.095	.98		12	.109	2.20
	12	.109	1.11		11	.120	2.41
1"	20	.035	.45		10	.134	2.67
	18	.049	.63	1¾"	20	.035	.78
	16	.065	.82		18	.049	1.09
	14	.083	1.03		16	.065	1.43
	13	.095	1.17		14	.083	1.81
	12	.109	1.33		13	.095	2.06
	11	.120	1.45		12	.109	2.35
	10	.134	1.61		11	.120	2.57
1⅛"	20	.035	.50		10	.134	2.95
	18	.049	.69	1⅞"	20	.035	.85
	16	.065	.91		18	.049	1.16
	14	.083	1.15		16	.065	1.56
	13	.095	1.30		14	.083	1.98
	12	.109	1.47		13	.095	2.25
	11	.120	1.61		12	.109	2.57
1¼"	20	.035	.59		11	.120	2.81
	18	.049	.82	2"	10	.134	3.11
	16	.065	1.08		18	.049	1.28
	14	.083	1.37		16	.065	1.69
	13	.095	1.55		14	.083	2.14
	12	.109	1.77		13	.095	2.44
	11	.120	1.93		12	.109	2.78
	10	.134	2.13		11	.120	3.05
	9	.148	2.38		10	.134	3.39
1⅜"	20	.035	.62				
	18	.049	.86				

Cont'd

**SQUARE E.R.W.
TUBING (cont'd)**
**RECTANGLE E.R.W.
TUBING**

O.D.	Ga.	Wall	Weight per Foot	O.D.	Ga.	Wall	Weight per Foot
2 $\frac{1}{8}$ "	18	.049	1.34	$\frac{1}{2}$ x 1	18	.049	.47
	16	.065	1.77		16	.065	.61
	14	.083	2.25	$\frac{1}{2}$ x 1 $\frac{1}{2}$	18	.049	.63
	13	.095	2.56		16	.065	.83
	12	.109	2.92		14	.083	1.04
	11	.120	3.21	$\frac{3}{4}$ x 1 $\frac{1}{2}$	16	.065	.94
	10	.134	3.56		16	.065	1.05
2 $\frac{1}{4}$ "	18	.049	1.41	$\frac{3}{4}$ x 1 $\frac{3}{4}$	16	.065	1.05
	16	.065	1.86	1 x 1 $\frac{1}{2}$	16	.065	1.05
	14	.083	2.36		14	.083	1.32
	13	.095	2.69	1 x 2	18	.049	.97
	12	.109	3.07		16	.065	1.27
	11	.120	3.38		14	.083	1.60
	10	.134	3.74		13	.095	1.74
2 $\frac{1}{2}$ "	18	.049	1.54	1 $\frac{1}{4}$ x 2	16	.065	1.38
	16	.065	2.04		14	.083	2.16
	14	.083	2.59	1 $\frac{1}{2}$ x 2 $\frac{1}{2}$	16	.065	1.93
	13	.095	2.95		14	.083	2.45
	12	.109	3.37				
	11	.120	3.69				
	10	.134	4.10				
3"	16	.065	2.59				
	14	.083	3.29				
	13	.095	3.75				
	12	.109	4.28				
	11	.120	4.70				
	10	.134	5.22				
	9	.148	5.74				
3 $\frac{1}{2}$ "	14	.083	3.84				
	13	.095	4.39				
	12	.109	5.01				
	11	.120	5.50				
	10	.134	6.12				
	9	.148	6.73				
4"	14	.083	4.41				
	13	.095	5.03				
	12	.109	5.75				
	11	.120	6.31				
	10	.134	7.03				
	9	.148	7.73				

C.R.E.W. – H.R.E.W. TUBING TOLERANCES SIZE TOLERANCES ON ROUND TUBING

AS ROLLED TUBING

Outside Diameter Range, Inches	Outside Diameter Plus and Minus
$\frac{3}{8}$ to $\frac{5}{8}$ incl.	.003"
over $\frac{5}{8}$ to $1\frac{1}{8}$ incl.	.0035"
over $1\frac{1}{8}$ to 2 incl.	.005"
over 2 to $2\frac{1}{2}$ incl.	.006"
over $2\frac{1}{2}$ to 3 incl. – .035" to .259" walls	.008"
– .284" to .320" walls	.010"
over 3 to $3\frac{1}{2}$ incl. – .035" to .259" walls	.009"
– .284" to .320" walls	.012"
over $3\frac{1}{2}$ to 4 incl. – .035" to .259" walls	.010"
– .284" to .500" walls	.015"
over 4 to 6 incl.	.020"
over 4 to 8 incl.	.025"

SINK DRAWN TUBING

Outside Diameter Range, Inches	Outside Diameter Plus and Minus
Up to 0.499	.002"
0.500 to 1.699, incl.	.0025"
1.700 to 2.099, incl.	.003"
2.100 to 2.499, incl.	.0035"
2.500 to 2.899, incl.	.004"
2.900 to 3.299, incl.	.0045"
3.300 to 3.699, incl.	.005"
3.700 to 4.099, incl.	.0055"
4.100 to 4.499, incl.	.006"
4.500 to 4.899, incl.	.0065"
4.900 to 5.299, incl.	.007"
5.300 to 5.549, incl.	.0075"
5.550 to 5.999, incl.	.010"
6.000 to 6.499, incl.	.013"
6.500 to 6.999, incl.	.015"
7.000 to 7.500, incl.	.018"

Note: Measurements for diameter are to be taken at least two inches from the ends of the tubes.

SEAM HEIGHT (INSIDE)

- Flash-in tubing – maximum height of inside flash will not exceed the wall thickness or in any case exceed $\frac{3}{32}$ ".
- Flash Controlled – .010" maximum (standard). – .005" maximum (on request).

GAUGES AND TOLERANCES FOR STEEL TUBING

Nominal sizes are in accordance with Birmingham Wire Gauges (B.W.G.).
Tolerances are in accordance with A.S.T.M. – A513.

Gauge	Nominal Size (Inches)	Tolerances (Inches)
22	.028	.026 up to .029
21	.032	over .029 up to .033
20	.035	over .033 up to .037
19	.042	over .037 up to .045
18	.049	over .045 up to .053
17	.058	over .053 up to .060
16	.065	over .060 up to .067
15	.072	over .067 up to .077
14	.083	over .077 up to .087
13	.095	over .087 up to .100
12	.109	over .100 up to .112
11	.120	over .112 up to .124
10	.134	over .124 up to .138
9	.148	over .138 up to .153
8	.165	over .153 up to .170
7	.180	over .170 up to .185
6	.203	over .185 up to .209
5	.220	over .209 up to .224
4	.238	over .224 up to .242
3	.259	over .242 up to .263

Note: Tubing with wall thickness heavier than .259" can be supplied to mechanical tolerances if required.

STRAIGHTNESS TOLERANCE FOR ROUND TUBING

The straightness tolerance for round tubing is 0.030 inches per 3 foot lengths (0.8 mm/m). For lengths under 1 foot, the straightness tolerance is 0.010 inches. For each additional foot of length, the tolerance is increased 0.010 inches.

Ref. ASTM A513-78

PHYSICAL PROPERTIES FOR STEEL TUBING

AS WELDED TUBING

	Yield Strength psi (MPa), min.	Ultimate Strength psi (MPa), min.	Elongation in 2 in. or 50 mm, %, min.	RB min.	RB max.
1008	30,000 (207)	42,000 (290)	15	50	—
1010	32,000 (221)	45,000 (310)	15	55	—
1015	35,000 (241)	48,000 (331)	15	58	—
1020	38,000 (262)	52,000 (359)	12	62	—
1021	40,000 (276)	54,000 (372)	12	62	—
1025	40,000 (276)	56,000 (386)	12	65	—
1026	45,000 (310)	62,000 (427)	12	68	—
1030	45,000 (310)	62,000 (427)	10	70	—
1035	50,000 (345)	66,000 (455)	10	75	—

NORMALIZED TUBING

1008	23,000 (159)	38,000 (262)	30	—	65
1010	25,000 (172)	40,000 (276)	30	—	65
1015	30,000 (207)	45,000 (310)	30	—	70
1020	35,000 (241)	50,000 (345)	25	—	75
1021	35,000 (241)	50,000 (345)	25	—	78
1025	37,000 (255)	55,000 (379)	25	—	80
1026	40,000 (276)	60,000 (414)	25	—	85
1030	40,000 (276)	60,000 (414)	25	—	85
1035	45,000 (310)	65,000 (448)	20	—	88

SINK DRAWN TUBING

1008	38,000 (262)	48,000 (331)	8	65	—
1010	40,000 (276)	50,000 (345)	8	65	—
1015	45,000 (310)	55,000 (379)	8	67	—
1020	50,000 (345)	60,000 (414)	8	70	—
1021	52,000 (359)	62,000 (428)	7	70	—
1025	55,000 (379)	65,000 (448)	7	72	—
1026	55,000 (379)	70,000 (483)	7	77	—
1030	62,000 (427)	70,000 (483)	7	78	—
1035	70,000 (483)	80,000 (552)	7	82	—

**TOLERANCES – SQUARE
AND RECTANGULAR TUBING**

OUTSIDE DIMENSIONS*

Largest Nominal Outside Dimensions, Inches*	Wall thickness, Inches*	Outside Tolerance at All Sides at Corners ± Inches*
3⁄16 to 5⁄8, incl.	0.020 to 0.083, incl.	0.004
Over 5⁄8 to 1 1⁄8, incl.	0.025 to 0.156, incl.	0.005
Over 1 1⁄8 to 1 1⁄2, incl.	0.025 to 0.192, incl.	0.006
Over 1 1⁄2 to 2, incl.	0.032 to 0.192, incl.	0.008
Over 2 to 3, incl.	0.035 to 0.259, incl.	0.010
Over 3 to 4, incl.	0.049 to 0.259, incl.	0.020
Over 4 to 6, incl.	0.065 to 0.259, incl.	0.020
Over 6 to 8, incl.	0.185 to 0.259, incl.	0.025

*Measured at corners at least 2 inches from the cut end of the tubing.

CONVEXITY AND CONCAVITY

Tubes having two parallel sides are also measured in the centre of the flat sides for convexity and concavity. This tolerance applies to the specific size determined at the corners, and is measured on the following basis:

Largest Nominal Outside Dimension, Inches	Tolerance Plus and Minus Inches
2 1⁄2 and under	0.010
Over 2 1⁄2 to 4	0.015
Over 4 to 8	0.025

Ref. ASTM A513-79

TWIST TOLERANCE

Largest Dimension	Twist Tolerance in 3 ft. Inches
Under 1⁄2"	.032
Over 1⁄2" to 1 1⁄2" inclusive	.050
Over 1 1⁄2" to 2 1⁄2" inclusive	.062
Over 2 1⁄2" to 4" inclusive	.075
Over 4" to 6" inclusive	.087
Over 6" to 8" inclusive	.100

Ref. ASTM A513-79

STRAIGHTNESS TOLERANCE

The straightness tolerance is 1⁄16 inch in 3 ft.

Ref. ASTM A513-79

BOILER TUBING

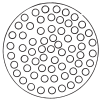


BOILER TUBES – Electric resistance welded to A.S.T.M.
A-178 Grade A
– Seamless to A.S.T.M. A-192

O.D.	MINIMUM WALL		Weight per Foot	O.D.	MINIMUM WALL		Weight per Foot
	Gauge	Decimal			Gauge	Decimal	
1"	13	.095	1.037	2 $\frac{3}{4}$ "	12	.105	3.504
	12	.109	1.168		10	.135	4.244
	11	.120	1.263		9	.148	4.658
	10	.135	1.384		$\frac{1}{4}$	.250	7.526
	9	.148	1.500		$\frac{5}{16}$	.3125	9.146
1 $\frac{1}{4}$ "	13	.095	1.328	3"	12	.105	3.838
	11	.120	1.628		10	.135	4.652
	10	.135	1.793		9	.148	5.110
	9	.148	1.951		7	.180	6.147
1 $\frac{1}{2}$ "	13	.095	1.619		$\frac{1}{4}$	.250	8.290
	10	.135	2.201		$\frac{5}{16}$	.3125	10.10
	8	.165	2.646	3 $\frac{1}{4}$ "	11	.120	4.555
	7	.180	2.847		9	.148	5.561
	$\frac{1}{4}$	.250	3.708		6	.200	7.478
1 $\frac{3}{4}$ "	13	.095	1.910		5	.220	8.039
	9	.148	2.884		$\frac{5}{16}$	.3125	11.06
	13	.095	2.201	3 $\frac{1}{2}$ "	11	.120	4.921
2"	12	.105	2.503		10	.135	5.469
	11	.120	2.726		9	.148	6.012
	10	.135	3.018		7	.180	7.247
	9	.148	3.305	3 $\frac{3}{4}$ "	9	.148	6.463
2 $\frac{1}{4}$ "	13	.095	2.492		8	.165	7.188
	12	.105	2.837	4"	10	.135	6.286
	8	.165	4.160		9	.148	6.915
2 $\frac{1}{2}$ "	12	.105	3.171		8	.165	7.693
	10	.135	3.835		6	.200	9.336
	9	.148	4.207				
	7	.180	5.047				
	$\frac{5}{16}$	.3125	8.190				

Cont'd

CONDENSER TUBING



Cold Drawn Seamless: A.S.T.M. A179
A.S.T.M. A-192

O.D.	MINIMUM WALL		Weight per Foot
	Gauge	Decimal	
1/4	20	.035	.090
3/8	18	.049	.191
	16	.065	.238
1/2	20	.035	.197
	18	.049	.266
	16	.065	.337
5/8	20	.035	.250
	18	.049	.340
	16	.065	.436
	13	.095	.601
3/4	20	.035	.303
	18	.049	.415
	16	.065	.534
	14	.083	.665
	12	.109	.834
	11	.120	.897
7/8	16	.065	.633
	12	.109	1.001
1	16	.065	.732
	14	.083	.918
	12	.109	1.168
	11	.120	1.263
	10	.134	1.384
1 1/4	11	.120	1.628
	10	.134	1.793
1 1/2	16	.065	1.127

HYDRAULIC LINE TUBING

Cold Drawn Specification AMS-5050, SAE J-524

SIZES AND ESTIMATED BURSTING PRESSURES FOR SEAMLESS AND WELDED HYDRAULIC LINE TUBING

O.D.	Wall Decimal	I.D.	Weight per Ft.	Bursting*. Pressure P.S.I.
1/4	.035	.180	.0804	12600
	.049	.152	.1052	17640
5/16	.035	.243	.1039	10063
	.049	.215	.1382	14089
	.065	.183	.1722	18690
3/8	.035	.305	.1271	8400
	.049	.277	.1706	11760
	.060	.255	.2019	14400
	.065	.245	.2152	15600
1/2	.035	.430	.1738	6300
	.042	.416	.2054	7560
	.049	.402	.2360	8820
	.065	.370	.3020	11700
	.072	.356	.3291	12960
	.083	.334	.3696	14940
5/8	.035	.555	.2205	5040
	.049	.527	.3014	7056
	.065	.495	.3888	9360
	.072	.481	.4252	10368
	.083	.459	.4805	11950
	.095	.435	.5377	12960
3/4	.035	.680	.2673	4200
	.042	.666	.3176	5040
	.049	.652	.3668	5880
	.065	.620	.4755	7800
	.072	.606	.5214	8640
	.083	.584	.5913	9960
	.095	.560	.6646	11400
	.109	.532	.7462	13080
	.120	.510	.8074	14400
7/8	.049	.777	.4323	5140
	.065	.745	.5623	6680
	.072	.731	.6175	7400
	.083	.709	.7021	8530
	.095	.685	.7914	9770
	.109	.657	.8917	11210

Design Pressure Per Barlow's Formula – See Page 54

Cont'd

HYDRAULIC LINE TUBING (cont'd)

Cold Drawn Specification AMS-5050, SAE J-524

SIZES AND ESTIMATED BURSTING PRESSURES FOR SEAMLESS AND WELDED HYDRAULIC LINE TUBING

O.D.	Wall Decimal	I.D.	Weight per Ft.	Bursting*. Pressure P.S.I.
1	.049	.902	.4977	4410
	.065	.870	.6491	5850
	.072	.856	.7136	6480
	.083	.834	.8129	7470
	.095	.810	.9182	8550
	.109	.782	1.037	9810
	.120	.760	1.128	10800
1¼	.049	1.152	.6285	3520
	.065	1.120	.8226	4680
	.083	1.084	1.034	5970
	.095	1.060	1.172	6840
	.109	1.032	1.328	7840
	.120	1.010	1.448	8640
1½	.065	1.370	.9962	3900
	.083	1.334	1.256	4980
	.095	1.310	1.426	5700
	.109	1.282	1.619	6540
	.120	1.260	1.769	7200
	.134	1.232	1.955	8040
1¾	.049	1.652	.8900	3125
	.065	1.620	1.169	3340
	.083	1.584	1.477	4150
	.095	1.560	1.679	6188
	.109	1.532	1.910	7081
	.120	1.510	2.089	7975
	.134	1.482	2.313	8938
2	.065	1.870	1.343	2920
	.083	1.834	1.699	3735
	.095	1.810	1.933	5500
	.120	1.760	2.409	6875
	.134	1.732	2.670	7838

*Per Barlows Formula $P = \frac{25 \times t}{OD}$

Working pressures can be determined by dividing recommended safety factor into estimated bursting pressure.

PIPE SCHEDULE

**bold figures
indicate
wall thickness**

light figures
indicate
wt./ft.

PIPE SIZE	O.D. in INCHES	5	10	20	30	40	STD	60
1/8	.405	.035 .1383	.049 .1863			.068 .2447	.068 .2447	
1/4	.540	.049 .2570	.065 .3297			.088 .4248	.088 .4248	
3/8	.675	.049 .3276	.065 .4235			.091 .5656	.091 .5656	
1/2	.840	.065 .5358	.083 .6710			.109 .8510	.109 .8510	
3/4	1.050	.065 .6838	.083 .8572			.113 1.131	.113 1.131	
1	1.315	.065 .8678	.109 1.404			.133 1.679	.133 1.679	
1 1/4	1.660	.065 1.107	.109 1.806			.140 2.273	.140 2.273	
1 1/2	1.900	.065 1.274	.109 2.085			.145 2.718	.145 2.718	
2	2.375	.065 1.604	.109 2.638			.154 3.653	.154 3.653	
2 1/2	2.875	.083 2.475	.120 3.531			.203 5.793	.203 5.793	
3	3.500	.083 3.029	.120 4.332			.216 7.576	.216 7.576	
3 1/2	4.000	.083 3.472	.120 4.973			.226 9.109	.226 9.109	
4	4.500	.083 3.915	.120 5.631			.237 10.79	.237 10.79	.281 12.22
4 1/2	5.000						.247 12.53	
5	5.563	.109 6.349	.134 7.770			.258 14.62	.258 14.62	
6	6.625	.109 7.585	.134 9.289			.280 18.97	.280 18.97	
7	7.625						.301 23.57	
8	8.625	.109 9.914	.148 13.40	.250 22.36	.277 24.70	.322 28.55	.322 28.55	.406 35.64
9	9.625						.342 33.90	

Cont'd

PIPE SCHEDULE (cont'd)

bold figures
indicate
wall thickness

light figures
indicate
wt/ft.

PIPE SIZE	O.D. in INCHES	5	10	20	30	40	STD	60
10	10.75	.134 15.19	.165 18.70	.250 28.04	.307 34.24	.365 40.48	.365 40.48	.500 54.74
11	11.75						.375 45.55	
12	12.750	.165 22.18	.180 24.20	.250 33.38	.330 43.77	.406 53.53	.375 49.56	.562 73.16
14	14		.250 36.71	.312 45.68	.375 54.57	.437 63.37	.375 54.57	.593 84.91
16	16		.250 42.05	.312 52.36	.375 62.58	.500 82.77	.375 62.58	.656 107.50
18	18		.250 47.39	.312 59.03	.437 82.06	.562 104.80	.375 70.59	.750 138.20
20	20		.250 52.73	.375 78.60	.500 104.10	.593 122.90	.375 78.60	.812 166.40
22	22		.250 58.07	.375 86.61	.500 114.80		.375 86.61	.875 197.40
24	24		.250 63.41	.375 94.62	.562 140.80	.687 171.20	.375 94.62	.968 238.10
26	26		.312 85.60	.500 136.20			.375 102.60	
28	28		.312 92.26	.500 146.80	.625 182.70		.375 110.60	
30	30		.312 98.93	.500 157.50	.625 196.10		.375 118.60	
32	32		.312 105.60	.500 168.2	.625 209.40	.688 230.10	.375 126.70	
34	34		.344 123.70	.500 178.90	.625 222.80	.688 244.80	.375 137.70	
36	36		.312 118.90	.500 189.60	.625 236.10	.750 282.30	.375 142.70	
42	42						.375 166.70	
48	48						.375 190.70	

Cont'd

PIPE SCHEDULE (cont'd)

**bold figures
indicate
wall thickness**

light figures
indicate
wt/ft.

PIPE SIZE	O.D. in INCHES	80	XH	100	120	140	160	XXH
1/8	.405	.095 .3145	.095 .3145					
1/4	.540	.119 .5351	.119 .5351					
3/8	.675	.126 .7388	.126 .7388					
1/2	.840	.147 1.088	.147 1.088				.187 1.034	.294 1.714
3/4	1.050	.154 1.474	.154 1.474				.218 1.937	.308 2.441
1	1.315	.179 2.172	.179 2.172				.250 2.844	.358 3.659
1 1/4	1.660	.191 2.997	.191 2.997				.250 3.765	.382 5.214
1 1/2	1.900	.200 3.631	.200 3.631				.281 4.859	.400 6.408
2	2.375	.218 5.022	.218 5.022				.343 7.444	.436 9.029
2 1/2	2.875	.276 7.662	.276 7.662				.375 10.01	.552 13.70
3	3.500	.300 10.25	.300 10.25				.437 14.32	.600 18.58
3 1/2	4.000	.318 12.51	.318 12.51					.636 22.85
4	4.500	.337 14.98	.337 14.98		.437 19.01		.531 22.51	.674 27.54
4 1/2	5.000		.355 17.61					.710 32.53
5	5.563	.375 20.78	.375 20.78		.500 27.04		.625 32.96	.750 38.55
6	6.625	.432 28.57	.432 28.57		.562 36.39		.718 45.30	.864 53.16
7	7.625		.500 38.05					.875 63.08
8	8.625	.500 43.39	.500 43.39	.593 50.87	.718 60.63	.812 67.76	.906 74.69	.875 72.42
9	9.625		.500 48.72					

Cont'd

PIPE SCHEDULE (cont'd)

bold figures
indicate
wall thickness

light figures
indicate
wt/ft.

PIPE SIZE	O.D. in INCHES	80	XH	100	120	140	160	XXH
10	10.75	.593 64.33	.500 54.74	.718 76.93	.843 89.20	1.000 104.10	1.125 115.70	
11	11.75		.500 60.07					
12	12.750	.687 88.51	.500 65.42	.843 107.20	1.000 125.50	1.125 139.70	1.312 160.30	
14	14	.750 106.10	.500 72.09	.937 130.70	1.093 150.70	1.250 170.20	1.406 189.10	
16	16	.843 136.50	.500 82.77	1.031 164.80	1.218 192.30	1.437 223.50	1.593 245.10	
18	18	.937 170.80	.500 93.45	1.156 208.00	1.375 244.10	1.562 274.20	1.781 308.50	
20	20	1.031 208.90	.500 104.10	1.280 256.10	1.500 296.40	1.750 341.10	1.968 379.00	
22	22	1.125 250.80	.500 114.80	1.375 302.90	1.625 353.60	1.875 403.0	2.125 451.10	
24	24	1.218 296.40	.500 125.50	1.531 367.40	1.812 429.40	2.062 483.10	2.343 541.90	
26	26		.500 136.20					
28	28		.500 146.80					
30	30		.500 157.50					
32	32		.500 168.20					
34	34		.500 178.90					
36	36		.500 189.60					
42	42		.500 221.60					
48	48		.500 253.60					

PIPE TOLERANCE TABLE

Specification	Pipe Permissible Variation in Weight per Foot				Permissible Variation in Outside Diameter At Any Point			Permissible Minimum Wall Thickness At Any Point
	Standard or Extra Strong		Double Extra Strong		Pipe Size Inches	Standard, Extra Strong or Double Extra Strong		
	Plus	Minus	Plus	Minus		Plus	Minus	
ASTM A 120 or A 53	5%	5%	10%	10%	1½ & smaller 2 & larger	0.015" 1%	0.031" 1%	Not more than 12½% under the nominal wall thickness specified
ASTM A 106	*8½%	*3½%	*10%	*3½%	1½ & smaller 2 to 4 5 to 8 10 to 18 20 and 24	0.015" 0.031" 0.062" 0.083" 0.125"	0.031" 0.031" 0.031" 0.031" 0.031"	
API 5L	*10%	*3½%			1½ & smaller 2 & larger	0.015" 1%	0.031" 1%	
ASTM A 72	5%	5%	10%	10%	1½ & smaller 2 & larger	0.015" 1%	0.031" 1%	Not specified

* For ASTM A106 and API 5L pipe, permissible variation in weight is on a “per length” rather than “per foot” basis.