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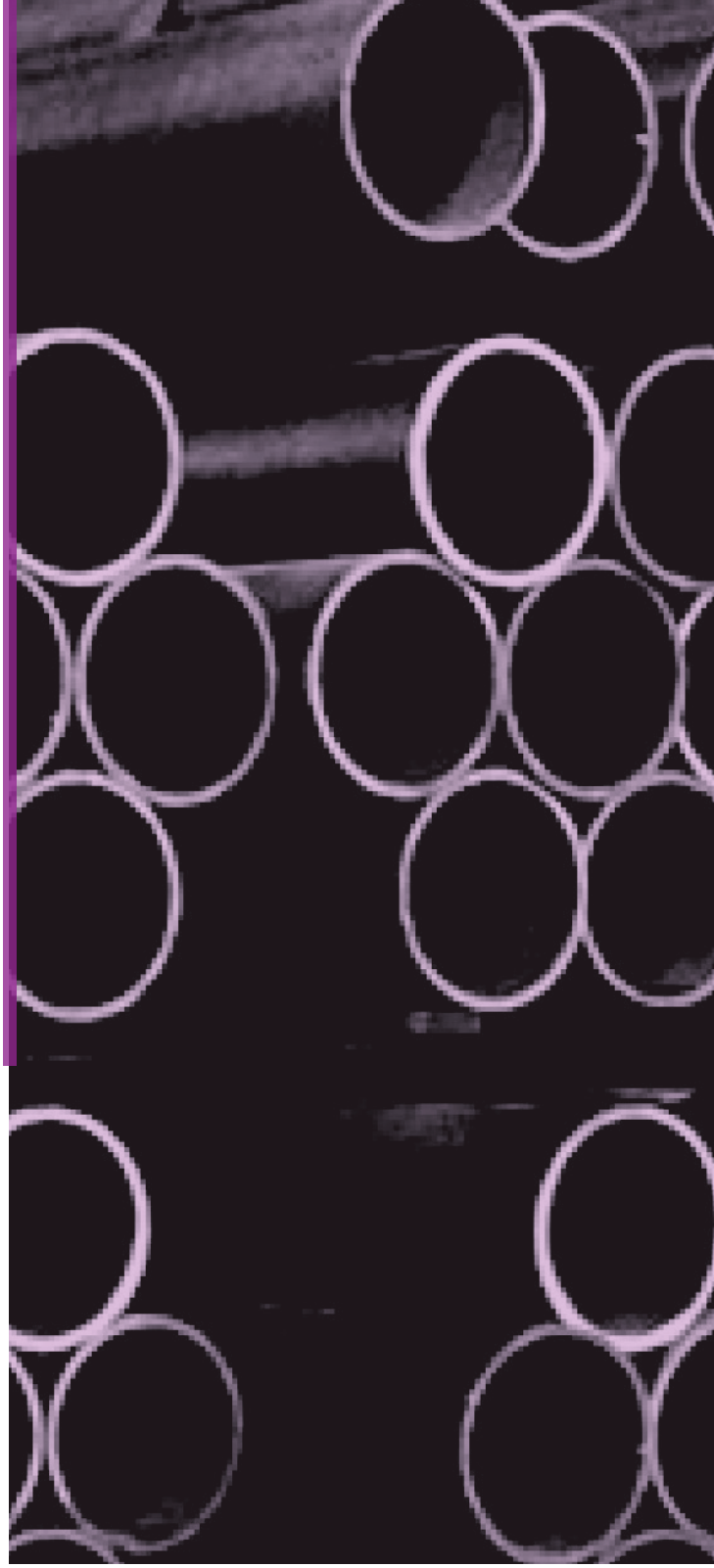
STEEL PIPES



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7a) Petroleum And Natural Gas Industries - Steel Pipe For Pipeline Transportation Systems

(Extracts from ANSI/API SPECIFICATION SL: 44th Edition)

General Information

This International Standard specifies requirements for the manufacture of two product specification levels (PSL 1 and PSL 2) of seamless and welded steel pipes for use in pipeline transportation systems in the petroleum and natural gas industries.

Chemical Composition

For PSL 1, the Chemical composition for standard grades shall be as given in Table 1.

Table 1. Chemical composition for PSL 1

Steel Grade (Steel Name)	Mass Fraction, Based Upon Heat And Product Analyses [a] %						
	C max. [b]	Mn max. [b]	P max.	S max.	V max.	Nb max.	Ti max.
Seamless Pipe							
L175 or A25	0.21	0.60	0.030	0.030	-	-	-
L175P or A25P	0.21	0.60	0.045 ~ 0.080	0.030	-	-	-
L210 or A	0.22	0.90	0.030	0.030	-	-	-
L245 or B	0.28	1.20	0.030	0.030	c, d	c, d	d
L290 or X42	0.28	1.30	0.030	0.030	d	d	d
L320 or X46	0.28	1.40	0.030	0.030	d	d	d
L360 or X52	0.28	1.40	0.030	0.030	d	d	d
L390 or X56	0.28	1.40	0.030	0.030	d	d	d
L415 or X60	0.28 [e]	1.40 [e]	0.030	0.030	f	f	f
L450 or X65	0.28 [e]	1.40 [e]	0.030	0.030	f	f	f
L485 or X70	0.28 [e]	1.40 [e]	0.030	0.030	f	f	f
Welded Pipe							
L175 or A25	0.21	0.60	-	0.030	-	-	-
L175P or A25P	0.21	0.60	0.045 ~ 0.080	0.030	-	-	-
L210 or A	0.22	0.90	-	0.030	-	-	-
L245 or B	0.26	1.20	-	0.030	c, d	c, d	d
L290 or X42	0.26	1.30	-	0.030	d	d	d
L320 or X46	0.26	1.40	-	0.030	d	d	d
L360 or X52	0.26	1.40	-	0.030	d	d	d
L390 or X56	0.26	1.40	-	0.030	d	d	d
L415 or X60	0.26	1.40	-	0.030	f	f	f
L450 or X65	0.26	1.45	-	0.030	f	f	f
L485 or X70	0.26	1.65	-	0.030	f	f	f

Remark:

a. 0.50% maximum for copper; 0.50% maximum for nickel; 0.50% maximum for chromium; and 0.15% maximum for molybdenum. For grades up to and including L360 / X52, Cu, Cr and Ni shall not be added intentionally.

b. For each reduction of 0.01% below the specified maximum concentration for carbon, an increase of 0.05% above the specified maximum concentration for manganese is permissible, up to maximum of 1.65% for grades ≥ L245 or B, but ≤ 360 or X52; up to a maximum of 1.75% for grades > L360 or X52, but < L485 or X70; and up to a maximum of 2.00% for grade L485 or X70.

c. Unless otherwise agreed, the sum of the niobium and vanadium contents shall be ≤ 0.06%.

d. The sum of the niobium, vanadium and titanium concentrations shall be ≤ 0.15%.

e. Unless otherwise agreed.

f. Unless otherwise agreed, the sum of the niobium, vanadium and titanium concentrations shall be ≤ 0.15%.

For PSL 2, the Chemical composition for standard grades shall be as given in Table 2.

Table 2. Chemical composition for PSL 2

Steel Grade (Steel Name)	Mass Fraction, Based Upon Heat And Product Analyses % Maximum									Carbon Equivalent [a] % Maximum	
	C [b]	Si	Mn [b]	P	S	V	Nb	Ti	Other	CE_{IIW}	CE_{Pcm}
Seamless And Welded Pipes											
L245R or BR	0.24	0.40	1.20	0.025	0.015	[c]	[c]	0.04	e	0.43	0.25
L290R or X42R	0.24	0.40	1.20	0.025	0.015	0.06	0.05	0.04	e	0.43	0.25
L245N or BN	0.24	0.40	1.20	0.025	0.015	[c]	[c]	0.04	e	0.43	0.25
L290N or X42N	0.24	0.40	1.20	0.025	0.015	0.06	0.05	0.04	e	0.43	0.25
L320N or X46N	0.24	0.40	1.40	0.025	0.015	0.07	0.05	0.04	d, e	0.43	0.25
L360N or X52N	0.24	0.45	1.40	0.025	0.015	0.10	0.05	0.04	d, e	0.43	0.25
L390N or X56N	0.24	0.45	1.40	0.025	0.015	0.10 [f]	0.05	0.04	d, e	0.43	0.25
L415N or X60N	0.24 [f]	0.45 [f]	1.40 [f]	0.025	0.015	0.10 [f]	0.05 [f]	0.04 [f]	g, h	as agreed	
L245Q or BQ	0.18	0.45	1.40	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
L290Q or X42Q	0.18	0.45	1.40	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
L320Q or X46Q	0.18	0.45	1.40	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
L360Q or X52Q	0.18	0.45	1.50	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
L390Q or X56Q	0.18	0.45	1.50	0.025	0.015	0.07	0.05	0.04	d, e	0.43	0.25
L415Q or X60Q	0.18 [f]	0.45 [f]	1.70 [f]	0.025	0.015	g	g	g	h	0.43	0.25
L450Q or X65Q	0.18 [f]	0.45 [f]	1.70 [f]	0.025	0.015	g	g	g	h	0.43	0.25
L485Q or X70Q	0.18 [f]	0.45 [f]	1.80 [f]	0.025	0.015	g	g	g	h	0.43	0.25
L555Q or X80Q	0.18 [f]	0.45 [f]	1.90 [f]	0.025	0.015	g	g	g	i, j	as agreed	
Welded Pipe											
L245M or BM	0.22	0.45	1.20	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
L290M or X42M	0.22	0.45	1.30	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
L320M or X46M	0.22	0.45	1.30	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
L360M or X52M	0.22	0.45	1.40	0.025	0.015	d	d	d	e	0.43	0.25
L390M or X56M	0.22	0.45	1.40	0.025	0.015	d	d	d	e	0.43	0.25
L415M or X60M	0.12 [f]	0.45 [f]	1.60 [f]	0.025	0.015	g	g	g	h	0.43	0.25
L450M or X65M	0.12 [f]	0.45 [f]	1.60 [f]	0.025	0.015	g	g	g	h	0.43	0.25
L485M or X70M	0.12 [f]	0.45 [f]	1.70 [f]	0.025	0.015	g	g	g	h	0.43	0.25
L555M or X80M	0.12 [f]	0.45 [f]	1.85 [f]	0.025	0.015	g	g	g	i	0.43 [f]	0.25
L625M or X90M	0.10	0.55 [f]	2.10 [f]	0.020	0.010	g	g	g	i		0.25
L690M or X100M	0.10	0.55 [f]	2.10 [f]	0.020	0.010	g	g	g	i, j	-	0.25
L830M or X120M	0.10	0.55 [f]	2.10 [f]	0.020	0.010	g	g	g	i, j		0.25

Remark:

a. Based upon product analysis. For seamless pipe with $t > 20.0$ mm (0.787 in), the carbon equivalent limits shall be as agreed. The CE_{IIW} limits apply if the carbon mass fraction is greater than 0.12% and the CE_{Pcm} limits apply if the carbon mass fraction is less than or equal to 0.12%.

b. For each reduction of 0.01% below the specified maximum for carbon, an increase of 0.05% above the specified maximum for manganese is permissible, up to a maximum of 1.65% for grades ≥L245 or B, but ≤ 360 or X52; up to a maximum of 1.75% for grades > L360 or X52, but < L485 pr X70; up to a maximum of 2.00% for grades ≥ L485 or X70, but ≤ L555 or X80; and up to a maximum of 2.20% for grades > L555 or X80.

c. Unless otherwise agreed, the sum of the niobium and vanadium concentrations shall be ≤ 0.05%

d. The sum of the niobium, vanadium and titanium concentrations shall be ≤ 0.15%

e. Unless otherwise agreed, 0.50% maximum for copper, 0.30% maximum for nickel, 0.30% maximum for chromium and 0.15% maximum for molybdenum.

f. Unless otherwise agreed.

g. Unless otherwise agreed, the sum of the niobium, vanadium and titanium concentrations shall be ≤ 0.15%

h. Unless otherwise agreed, 0.50% maximum for copper, 0.50% maximum for nickel, 0.50% maximum for chromium and 0.50% maximum for molybdenum.

i. Unless otherwise agreed, 0.50% maximum for copper, 1.00% maximum for nickel, 0.50% maximum for chromium and 0.50% maximum for molybdenum.

j. 0.004% maximum for boron.

Mechanical Strength (Tensile Test)

For PSL 1, the tensile properties shall be as given in Table 3.

Table 3. Requirement for the results of tensile tests for PSL 1 pipe

Pipe Grade	Pipe Body Of Seamless And Welded Pipe			Weld Seam Of EW, SAW And COW Pipes
	Yield Strength [a] MPa (psi) Minimum	Tensile Strength [a] Mpa (psi) Minimum	Elongation A % Minimum	Tensile Strength [b] MPa (psi) Minimum
L175 or A25	175 (25,400)	310 (45,000)	[c]	310 (45000)
L175P or A25P	175 (25,400)	310 (45,000)	[c]	310 (45000)
L210 or A	210 (30,500)	335 (48,600)	[c]	335 (48600)
L245R or BR L245 or B	245 (35,500)	415 (60,200)	[c]	415 (60200)
L290R or X42R L290 or X42	290 (42,100)	415 (60,200)	[c]	415 (60200)
L320 or X46	320 (46,400)	435 (63,100)	[c]	435 (63100)
L360 or X52	360 (52,200)	460 (66,700)	[c]	460 (66700)
L390 or X56	390 (56,600)	490 (71,100)	[c]	490 (71100)
L415 or X60	415 (60,200)	520 (75,400)	[c]	520 (75400)
L450 or X65	450 (65,300)	535 (77,600)	[c]	535 (77600)
L485 or X70	485 (70,300)	570 (82,700)	[c]	570 (82700)

Remark:

a. For intermediate grade, the difference between the specified minimum tensile strength and the specified minimum yield strength for the pipe body shall be as given in the table for the next higher grade.3

b. For intermediate grade, the specified minimum tensile strength for the weld seam shall be the same value as was determined for the pipe body using footnote a).

c. The specified minimum elongation, A_f, expressed in percent and rounded to the nearest percent, shall be as determined using the following equation:

$$A_f = C\,(A_{xc}^{0.2} / U^{0.9})$$

Where

C is 1940 for calculations using SI units and 625000 for calculations using USC units;

A_{xc} is the applicable tensile test piece cross-sectional area, expressed in square millimeters (square inches), as follows:

- For circular cross-section test pieces, 130 mm² (0.20 in²) for 12.5 mm (0.500 in) and 8.9 mm (0.350 in) diameter test pieces; and 65 mm² (0.10 in²) for 6.4 mm (0.250 in) diameter test piece;
- For full –section test pieces, the lesser of a) 485 mm² (0.75 in²) and b) the cross-sectional area of the test piece, derived using the specified outside diameter and the specified wall thickness of the pipe, rounded to the nearest 10 mm² (0.01 in²);
- For strip test pieces, the lesser of a) 485 mm² (0.75 in²) and b) the cross-sectional area of the test piece, derived using the specified width of the test piece and the specified wall thickness of the pipe, rounded to the nearest 10 mm² (0.001 in²);

U is the specified minimum tensile strength, expressed in megapascals (pounds per square inch).

See Table 8 , whichever is applicable, for minimum elongation values for various size tension specimens and grades.

For PSL 2, the tensile properties shall be as given in Table 4.

Table 4. Requirements for the results of tensile tests for PSL 2 pipe

Pipe Grade	Pipe Body Of Seamless And Welded Pipes						Weld Seam Of HFW, SAW And COW Pipes
	Yield Strength[a] MPa (PSI)		Tensile Strength[a] MPa (PSI)		Ratio[a, b, c]	Elongation A_f %	Tensile Strength[d] MPa (PSI)
	Minimum	Maximum	Minimum	Maximum	Maximum	Minimum	Minimum
L245R or BR L245N or BN L245Q or BQ L245M or BM	245 (35500)	450[e] (65300)[e]	415 (60200)	760 (110200)	0.93	f	415 (60200)
L290R or X42R L290N or X42N L290Q or X42Q L290M or X42M	290 (42100)	495 (71800)	415 (60200)	760 (110200)	0.93	f	415 (60200)
L320N or X46N L320Q or X46Q L320M or X46M	320 (46400)	525 (76100)	435 (63100)	760 (110200)	0.93	f	435 (63100)
L360N or X52N L360Q or X52Q L360M or X52M	360 (52200)	530 (76900)	460 (66700)	760 (110200)	0.93	f	460 (66700)
L390N or X56N L390Q or X56Q L390M or X56M	390 (56600)	545 (79000)	490 (71100)	760 (110200)	0.93	f	490 (71100)
L415N or X60N L415Q or X60Q L415M pr X60M	415 (60200)	565 (81900)	520 (75400)	760 (110200)	0.93	f	520 (75400)
L450Q or X65Q L450M or X65M	450 (65300)	600 (87000)	535 (77600)	760 (110200)	0.93	f	535 (77600)
L485Q or X70Q L485M or X70M	485 (70300)	635 (92100)	570 (82700)	760 (110200)	0.93	f	570 (82700)
L555Q or X80Q L555M or X80M	555 (80500)	705 (102300)	625 (90600)	825 (119700)	0.93	f	625 (90600)
L625M or X90M	625 (90600)	775 (112400)	695 (100800)	915 (132700)	0.95	f	695 (100800)
L690M or X100M	690 (100100)	840 (121800)	760 (110200)	990 (143600)	0.97[g]	f	760 (110200)
L830M or X120M	830 (120400)	1050 (152300)	915 (132700)	1145 (166100)	0.99[g]	f	915 (132700)

Remark:

a. For intermediate grades, the difference between the specified maximum yield strength and the specified minimum yield strength shall be as given in the table for the next higher grade, and the difference between the specified minimum tensile strength and the specified minimum yield strength shall be as given in the table for the next higher grade. For intermediate grades lower than Grade L555 or X80, the tensile strength shall be ≤ 760 MPa (110200 psi). For intermediate grades higher than Grade L555 or X80, the maximum permissible tensile strength shall be obtained by interpolation. For SI units, the calculated value shall be rounded tot the nearest 5 Mpa. For USC units, the calculated value shall be rounded to the nearest 100 psi.

b. For grades > L625 or X90, $R_{p0.2}$ applies.

c. This limit applies for pipe with D < 323.9 mm (12.750 in)

d. For intermediate grades, the specified minimum tensile strength for the weld seam shall be the same value as was determined for the pipe body using footnote a).

e. For pipe with D < 219.1 mm (8.625 in), the maximum yield strength shall be ≤ 495 MPa (71800 psi).

f. The specified minimum elongation, A_f, expressed in percent and rounded to the nearest percent, shall be as determined using the following equation:

$$A_f = C\,(A_{xc}^{0.2} / U^{0.9})$$

Where

C is 1940 for calculations using SI units and 625000 for calculations using USC units;

A_{xc} is the applicable tensile test piece cross-sectional area, expressed in square millimeters (square inches), as follows:

- For circular cross-section test pieces, 130 mm² (0.20 in²) for 12.5 mm (0.500 in) and 8.9 mm (0.350 in) diameter test pieces; and 65 mm² (0.10 in²) for 6.4 mm (0.250 in) diameter test piece;
- For full –section test pieces, the lesser of a) 485 mm² (0.75 in²) and b) the cross-sectional area of the test piece, derived using the specified outside diameter and the specified wall thickness of the pipe, rounded to the nearest 10 mm² (0.01 in²);
- For strip test pieces, the lesser of a) 485 mm² (0.75 in²) and b) the cross-sectional area of the test piece, derived using the specified width of the test piece and the specified wall thickness of the pipe, rounded to the nearest 10 mm² (0.001 in²);

U is the specified minimum tensile strength, expressed in megapascals (pounds per square inch).

See Table 8, whichever is applicable, for minimum elongation values for various size tension specimens and grades.

g. Lower $R_{t0.5}/R_m$ ratio values may be specified by agreement for L690 or X100 and L830 or X120 pipe.

Impact Test

The minimum average (of a set of three test pieces) absorbed energy for each pipe body test shall be given in Table 5, based upon full-size test pieces and a test temperature of 0 °C (32 °F) or, if agreed, a lower test temperature. Individual test values for any test piece shall be ≥ 75% of the required minimum average (of a set of three test pieces) absorbed energy value.

Table 5. CVN absorbed energy requirement for pipe body of PSL 2 pipe

Specified Outside Diameter D mm (in)	Full-size CVN Absorbed Energy Minimum K_v J (ft-lbf)						
	Grade						
	≤ L415 or X60	> L415 or X60 ≤ L450 or X65	> L450 or X65 ≤ L485 or X70	> L485 or X70 ≤ L555 or X80	> L555 or X80 ≤ L625 or X90	> L625 or X90 ≤ L690 or X100	> L690 or X100 ≤ L830 or X120
≤ 508 (20)	27 (20)	27 (20)	27 (20)	40 (30)	40 (30)	40 (30)	40 (30)
> 508 (20) to ≤ 762 (30)	27 (20)	27 (20)	27 (20)	40 (30)	40 (30)	40 (30)	40 (30)
> 762 (30) to ≤ 914 (36)	40 (30)	40 (30)	40 (30)	40 (30)	40 (30)	54 (40)	54 (40)
> 914 (36) to ≤ 1219 (48)	40 (30)	40 (30)	40 (30)	40 (30)	40 (30)	54 (40)	68 (50)
> 1219 (48) to ≤ 1422 (56)	40 (30)	54 (40)	54 (40)	54 (40)	54 (40)	68 (50)	81 (60)
> 1422 (56) to ≤ 2134 (84)	40 (30)	54 (40)	68 (50)	68 (50)	81 (60)	95 (70)	108 (80)

Bending Test

For each test unit, one full-section test piece of appropriate length shall be bent cold through 90° around a mandrel having a diameter no larger than 12D. No cracks shall occur in any portion of the test piece and no opening of the weld shall occur.

Cold Flattening Test

For flattening test, one of the two test pieces taken from both end-of-coil locations shall be tested with the weld at the 6 o'clock position or 12 o'clock position; whereas the remaining two test pieces shall be tested at the 3 o'clock position or 9 o'clock position. Test pieces taken from crop ends at weld stops shall be tested at the 3 o'clock position or 9 o'clock position only.

Acceptance criteria for flattening test shall be as follows:

a) EW pipe in grades ≥ L210 or A and LW pipe with D < 323.9 mm (12.750in)

1. For grades ≥ L415 or X60 with t ≥ 12.7 mm (0.500in), there shall be no opening of the weld before the distance between the plates is less than 66% of the original outside diameter. For all other combinations of pipe grade and specified wall thickness, there shall be no opening of the weld before the distance between the plates is less than 50% of the original outside diameter.

<table>
<tr><td></td><td>2. For pipe with a D/t, there shall be no cracks or breaks other than in the weld before the distance between the plates is less than 33% of the original outside diameter.

b) EW and CW pipe in Grade L175, L175P, A25 or A25P
1. There shall be no opening of the weld before the distance between the plates is less than 75% of the original outside diameter.
2. There shall be no cracks or breaks other than in the weld before the distance between the plates is less than 60% of the original outside diameter.</td></tr>
<tr><td>Hardness Test</td><td>Any hard spot larger than 50mm (2.0 in) in any direction shall be classified as a defect if its hardness exceeds 35 HRC, 345 HV10 or 327 HBW, based upon individual indentations.</td></tr>
<tr><td>Hydrostatic Test</td><td>The hydrostatic test shall be applied, without leakage through the weld seam or the pipe body. Test pressures for all sizes of SMLS pipe, and for welded pipe with D ≤ 457 mm (18 in), shall be held for not less than 5 s. Test pressures for welded pipe with D > 457 mm (18 in) shall be held for not less than 10 s.

The hydrostatic test pressure, P, expressed in megapascals (pound per square inch), for plain-end pipe shall be determined using below formula, with the results rounded to the nearest 0.1 MPa (10 psi)

$$P = \frac{2ST}{D}$$

Where
S us the hoop stress, expressed in megapascals (pounds per square inch), equal to a percentage of the specified minimum yield strength of the pipe, as given in Table 6.
t is the specified wall thickness, expressed in millimeters (inches)
D is the specified outside diameter, expressed in millimeters (inches)

Table 6. Percentage of specified minimum yield strength for determination of S

<table>
<tr><th rowspan="2">Pipe Grade</th><th rowspan="2">Specified Outside Diameter
D
mm (in)</th><th colspan="2">Percentage Of Specified Minimum Yield Strength For Determination Of S</th></tr>
<tr><th>Standard Test Pressure</th><th>Alternative Test Pressure</th></tr>
<tr><td>L175 or A25</td><td>≤ 141.3 (5.563)</td><td>60 [a]</td><td>75 [a]</td></tr>
<tr><td>L175P or A25P</td><td>≤ 141.3 (5.563)</td><td>60 [a]</td><td>75 [a]</td></tr>
<tr><td>L210 or A</td><td>any</td><td>60 [a]</td><td>75 [a]</td></tr>
<tr><td>L245 or B</td><td>any</td><td>60 [a]</td><td>75 [a]</td></tr>
<tr><td rowspan="4">L290 or X42 to L830 or X120</td><td>≤ 141.3 (5.563)</td><td>60 [b]</td><td>75 [c]</td></tr>
<tr><td>> 141.3 (5.563) to ≤ 219.1 (8.625)</td><td>75 [b]</td><td>75 [c]</td></tr>
<tr><td>> 219.1 (8.625) to < 508 (20)</td><td>85 [b]</td><td>85 [c]</td></tr>
<tr><td>≥ 508 (20)</td><td>90 [b]</td><td>90 [c]</td></tr>
</table>

Remark:
a. For D ≤ 88.9 mm (3.500 in); it is not necessary that the test pressure exceed 17.0 MPa (2470 psi); for D > 88.9 mm (3.500 in), it is not necessary that the test pressure exceed 19.0 MPa (2760 psi).

b. It is not necessary that the test pressure exceed 20.5 MPa (2970 psi).

c. For D ≤ 406.4 mm (16.000 in), It is not necessary that the test pressure exceed 50.0 MPa (7260 psi); for D > 406.4 mm (16.000 in), it is not necessary that the test pressure exceed 25.0 MPa (3630 psi).

The hydrostatic test pressure, P, expressed in pounds per square inch, for plain-end pipe shall be hydrostatically tested to the applicable pressure given in Table 7a(i) Page 104-116</td></tr>
</table>

Tolerances On Dimensions and Mass

The tolerances on dimensions shall be as specified in Table 7.

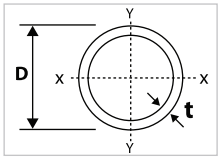
Table 7. Tolerance on dimensions

Characteristic	Circular Hollow Sections		
Outside Dimension (*OD*)	Specified OD (mm)	Pipe except the end of Outside Diameter (OD) mm	Pipe end of Outside Diameter (OD) mm
	OD < 60.3	+ 0.40, - 0.80	+1.60, - 0.40
	60.3 ≤ OD ≤ 168.3	± 0.75%	+1.60, - 0.40
	168.3 < OD ≤ 610	± 0.75 % but maximum of ± 3.2	± 0.50% but maximum of ± 1.60
	610 < OD ≤ 1422	± 0.50 % but maximum of ± 4.0	± 1.60
	OD > 1422	as agreed	as agreed
Thickness (*t*)	Wall Thickness (mm)	Tolerance (mm)	
	t ≤ 5.0	± 0.50	
	5.0 < t < 15.0	± 10%	
	t ≥ 15.0	± 1.50	
Length	Shall be delivered within a tolerance of ± 500 mm		
Straightness	Shall not deviate from straightness by more than 0.2% of the total length		
Out-of-roundness (*o*)	Specified OD (mm)	Pipe except the end of Outside Diameter (OD) mm	Pipe end of Outside Diameter (OD) mm
	OD < 60.3	Included in the diameter tolerance	Included in the diameter tolerance
	60.3 ≤ OD ≤ 168.3	≤ 2%	≤ 1.5%
	168.3 < OD ≤ 610	≤ 2%	≤ 1.5%
	610 < OD ≤ 1422	1.5% but maximum of 15	1% but maximum of 13
	OD > 1422	as agreed	as agreed
Concavity / convexity	-		
Radius of Corners	-		
Squareness of side	Shall be not more than 1.6mm		
Twist	-		
Flash Deburring / Inner Flash	Specified wall thickness (mm)	Maximum permissible depth and height of groove (mm)	
	All thickness	+ 1.50	
	≤ 4.0	- 0.10 *t*	
	> 4.0 to ≤ 8.0	- 0.40	
	> 8.0	- 0.05 *t*	
End Facing	Bevel angle	Root face	
	30° +5°, -0°	1.6mm ±0.8 mm	
Mass (*m*) per unit length	For pipe in Grade L175, L175P, A25 and A25P	+ 10 %, - 5.0 %	
	For all other pipes	+ 10 %, - 3.5 %	

Table 8 : Elongation Values

Specified Wall Thickness	Minimum Elongation (%)						
	Grade						
	L175 or A25	L210 or A	L245N or BN & L290N or X42N	L320N or X46N	L360N or X52N	L390N or X56N	L415N or X60N
2.8 - 2.9	28	27	22	21	20	19	18
3.0 - 3.2	29	27	22	21	21	19	18
3.3 - 3.4	29	28	23	22	21	20	19
3.5 - 3.7	30	28	23	22	21	20	19
3.8 - 4.0	30	29	23	22	21	20	19
4.1 - 4.2	31	29	24	23	22	20	19
4.3 - 4.5	31	29	24	23	22	21	20
4.6 - 4.8	31	30	24	23	22	21	20
4.9 - 5.0	32	30	24	23	23	21	20
5.1 - 5.3	32	30	25	24	23	21	20
5.4 - 5.5	32	31	25	24	23	21	20
5.6 - 5.8	33	31	25	24	23	22	21
5.9 - 6.1	33	31	25	24	23	22	21
6.2 - 6.3	33	31	26	25	24	22	21
6.4 - 6.6	34	32	26	25	24	22	21
6.7 - 6.9	34	32	26	25	24	22	21
7.0 - 7.1	34	32	26	25	24	23	22
7.2 - 7.4	34	32	26	25	24	23	22
7.5 - 7.6	35	33	27	26	24	23	22
7.7 - 7.9	35	33	27	26	25	23	22
8.0 - 8.2	35	33	27	26	25	23	22
8.3 - 8.4	35	33	27	26	25	23	22
8.5 - 8.7	35	33	27	26	25	24	22
8.8 - 9.0	36	34	28	26	25	24	23
9.1 - 9.2	36	34	28	27	25	24	23
9.3 - 9.5	36	34	28	27	26	24	23
9.6 - 9.7	36	34	28	27	26	24	23
9.8 - 10.0	37	34	28	27	26	24	23
10.1 - 10.3	37	35	28	27	26	24	23
10.4 - 10.5	37	35	28	27	26	24	23
10.6 - 10.8	37	35	29	27	26	25	23
10.9 - 11.1	37	35	29	28	26	25	24
11.2 - 11.3	37	35	29	28	26	25	24
11.4 - 11.6	38	35	29	28	27	25	24
11.7 - 11.8	38	36	29	28	27	25	24
11.9 - 12.1	38	36	29	28	27	25	24
12.2 - 12.4	38	36	29	28	27	25	24
12.5 - 12.6	38	36	29	28	27	25	24
≤ 12.7	38	36	30	28	27	25	24

Pipes API PIPES (API 5L)

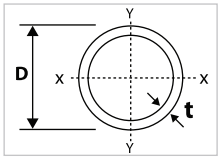


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M		Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)												
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
2 3/8	2.375	60.3		0.083	2.1	2.03	3.01	Std.	1260	1470	1760	1930	2180	2350	2520	2730	2940	-	-	-	-
								Alt.	1570	1830	2200	2410	2730	2940	3150	3410	3670	-	-	-	-
				0.109	2.8	2.64	3.97	Std.	1650	1930	2310	2530	2860	2970	2970	2970	2970	-	-	-	-
								Alt.	2070	2410	2890	3170	3580	3860	4130	4470	4820	-	-	-	-
				0.125	3.2	3.01	4.51	Std.	1890	2210	2650	2910	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2370	2470	3320	3630	4110	4420	4740	5130	5530	-	-	-	-
				0.141	3.6	3.37	5.03	Std.	2140	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	3740	4100	4630	4990	5340	5790	6230	-	-	-	-
			40 (Std)	0.154	3.9	3.66	5.42	Std.	2330	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	4090	4470	5060	5450	5840	6320	6810	-	-	-	-
				0.172	4.4	4.05	6.07	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	4560	5000	5650	6080	6520	7060	7260	-	-	-	-
				0.188	4.8	4.40	6.57	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	4990	5460	6170	6650	7120	7260	7260	-	-	-	-
			80 (XS)	0.218	5.5	5.03	7.43	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	5780	6330	7160	7260	7260	7260	7260	-	-	-	-
				0.250	6.4	5.68	8.51	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	6630	7260	7260	7260	7260	7260	7260	-	-	-	-
				0.281	7.1	6.29	9.31	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	7260	7260	7260	7260	7260	7260	7260	-	-	-	-
			(XXS)	0.436	11.1	9.04	13.47	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	7260	7260	7260	7260	7260	7260	7260	-	-	-	-
2 7/8	2.875	73.0		0.083	2.1	2.48	3.67	Std.	1040	1210	1460	1590	1800	1940	2080	2250	2430	-	-	-	-
								Alt.	1300	1520	1820	1990	2250	2430	2600	2810	3030	-	-	-	-
				0.109	2.8	3.22	4.85	Std.	1360	1590	1910	2090	2370	2550	2730	2960	2970	-	-	-	-
								Alt.	1710	1990	2390	2620	2960	3180	3410	3700	3980	-	-	-	-
				0.125	3.2	3.67	5.51	Std.	1570	1830	2190	2400	2710	2920	2970	2970	2970	-	-	-	-
								Alt.	1960	2280	2740	3000	3390	3650	3910	4240	4570	-	-	-	-
				0.141	3.6	4.12	6.16	Std.	1770	2060	2470	2710	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2210	2470	3090	3380	3830	4120	4410	4780	5150	-	-	-	-
				0.156	4.0	4.53	6.81	Std.	1950	2280	2730	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2440	2470	3420	3740	4230	4560	4880	5290	5700	-	-	-	-
				0.172	4.4	4.97	7.44	Std.	2150	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	3770	4130	4670	5030	5380	5830	6280	-	-	-	-
				0.188	4.8	5.40	8.07	Std.	2350	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	4120	4510	5100	5490	5890	6380	6870	-	-	-	-
			40 (Std)	0.203	5.2	5.80	8.69	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	4450	4870	5510	5930	6350	6880	7260	-	-	-	-
				0.216	5.5	6.14	9.16	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	4730	5180	5860	6310	6760	7260	7260	-	-	-	-
				0.250	6.4	7.02	10.51	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	5480	6000	6780	7260	7260	7260	7260	-	-	-	-
			80 (XS)	0.276	7.0	7.67	11.39	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	6050	6620	7260	7260	7260	7260	7260	-	-	-	-
			(XXS)	0.552	14.0	13.71	20.37	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	7260	7260	7260	7260	7260	7260	7260	-	-	-	-
3 1/2	3.500	88.9		0.083	2.1	3.03	4.50	Std.	850	1000	1200	1310	1480	1590	1710	1850	1990	-	-	-	-
								Alt.	1070	1250	1490	1640	1850	1990	2130	2310	2490	-	-	-	-
				0.109	2.8	3.95	5.95	Std.	1120	1310	1570	1720	1940	2090	2240	2430	2620	-	-	-	-
								Alt.	1400	1640	1960	2150	2430	2620	2800	3040	3270	-	-	-	-
				0.125	3.2	4.51	6.76	Std.	1290	1500	1800	1970	2230	2400	2570	2790	2970	-	-	-	-
								Alt.	1610	1880	2250	2460	2790	3000	3210	3480	3750	-	-	-	-
				0.141	3.6	5.06	7.57	Std.	1450	1690	2030	2220	2510	2710	2900	2970	2970	-	-	-	-
								Alt.	1810	2120	2540	2780	3140	3380	3630	3930	4230	-	-	-	-
				0.156	4.0	5.58	8.37	Std.	1600	1870	2250	2460	2780	2970	2970	2970	2970	-	-	-	-
								Alt.	2010	2340	2810	3080	3480	3740	4010	4350	4680	-	-	-	-
				0.172	4.4	6.12	9.17	Std.	1770	2060	2480	2710	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2210	2470	3100	3390	3830	4130	4420	4790	5160	-	-	-	-
				0.188	4.8	6.66	9.95	Std.	1930	2260	2710	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2420	2470	3380	3710	4190	4510	4830	5240	5640	-	-	-	-
			40 (Std)	0.216	5.5	7.58	11.31	Std.	2220	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	3890	4260	4810	5180	5550	6020	6480	-	-	-	-
				0.250	6.4	8.69	13.02	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	4500	4930	5570	6000	6430	6960	7260	-	-	-	-
				0.281	7.1	9.67	14.32	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	5060	5540	6260	6740	7230	7260	7260	-	-	-	-
			80 (XS)	0.300	7.6	10.26	15.24	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	5400	5910	6690	7200	7260	7260	7260	-	-	-	-
			(XXS)	0.600	15.2	18.60	27.63	Std.	2470	2470	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2470	2470	7260	7260	7260	7260	7260	7260	7260	-	-	-	-

Pipes API PIPES (API 5L)

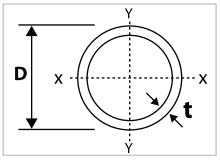


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M			Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)													
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
4	4.000	101.6		0.083	2.1	3.48	5.15	Std.	750	870	1050	1150	1290	1390	1490	1620	1740	-	-	-	-
								Alt.	930	1090	1310	1430	1620	1740	1870	2020	2180	-	-	-	-
				0.109	2.8	4.53	6.82	Std.	980	1140	1370	1500	1700	1830	1960	2130	2290	-	-	-	-
								Alt.	1230	1430	1720	1880	2130	2290	2450	2660	2860	-	-	-	-
				0.125	3.2	5.18	7.76	Std.	1130	1310	1580	1730	1950	2100	2250	2440	2630	-	-	-	-
								Alt.	1410	1640	1970	2160	2440	2630	2810	3050	3280	-	-	-	-
				0.141	3.6	5.82	8.70	Std.	1270	1480	1780	1950	2200	2370	2540	2750	2960	-	-	-	-
								Alt.	1590	1850	2220	2430	2750	2960	3170	3440	3700	-	-	-	-
				0.156	4.0	6.41	9.63	Std.	1400	1640	1970	2150	2430	2620	2810	2970	2970	-	-	-	-
								Alt.	1760	2050	2460	2690	3040	3280	3510	3800	4100	-	-	-	-
				0.172	4.4	7.04	10.55	Std.	1550	1810	2170	2370	2680	2890	2970	2970	2970	-	-	-	-
								Alt.	1940	2260	2710	2970	3350	3610	3870	4190	4520	-	-	-	-
				0.188	4.8	7.66	11.46	Std.	1690	1970	2370	2590	2930	2970	2970	2970	2970	-	-	-	-
								Alt.	2120	2470	2960	3240	3670	3950	4230	4580	4940	-	-	-	-
			40 (Std)	0.226	5.7	9.12	13.48	Std.	2030	2370	2850	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2540	2760	3560	3900	4410	4750	5090	5510	5930	-	-	-	-
				0.250	6.4	10.02	15.02	Std.	2250	2630	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2760	2760	3940	4310	4880	5250	5630	6090	6560	-	-	-	-
				0.281	7.1	11.17	16.55	Std.	2530	2760	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2760	2760	4430	4850	5480	5900	6320	6850	7260	-	-	-	-
			80 (XS)	0.318	8.1	12.52	18.68	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	-	-	-	-
								Alt.	2760	2760	5010	5490	6200	6680	7160	7260	7260	-	-	-	-
4 1/2	4.500	114.3		0.083	2.1	3.92	5.81	Std.	660	770	930	1020	1150	1240	1330	1440	1550	1770	2010	2220	2660
								Alt.	830	970	1160	1270	1440	1550	1660	1800	1940	2210	2510	2770	3330
				0.125	3.2	5.85	8.77	Std.	1000	1170	1400	1530	1730	1870	2000	2170	2330	2670	2970	2970	2970
								Alt.	1250	1460	1750	1920	2170	2330	2500	2710	2920	3330	3780	4170	5020
				0.141	3.6	6.57	9.83	Std.	1130	1320	1580	1730	1960	2110	2260	2440	2630	2970	2970	2970	2970
								Alt.	1410	1650	1970	2160	2440	2630	2820	3060	3290	3760	4260	4700	5660
				0.156	4.0	7.24	10.88	Std.	1250	1460	1750	1910	2160	2330	2500	2700	2910	2970	2970	2970	2970
								Alt.	1560	1820	2180	2390	2700	2910	3120	3380	3640	4160	4710	5210	6260
				0.172	4.4	7.96	11.92	Std.	1380	1610	1930	2110	2390	2570	2750	2970	2970	2970	2970	2970	2970
								Alt.	1720	2010	2410	2640	2980	3210	3440	3730	4010	4590	5190	5740	6900
				0.188	4.8	8.67	12.96	Std.	1500	1750	2110	2310	2610	2810	2970	2970	2970	2970	2970	2970	2970
								Alt.	1880	2190	2630	2880	3260	3510	3760	4070	4390	5010	5680	6270	7260
				0.203	5.2	9.32	13.99	Std.	1620	1890	2270	2490	2810	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2030	2370	2840	3110	3520	3790	4060	4400	4740	5410	6130	6770	7260
				0.219	5.6	10.02	15.01	Std.	1750	2040	2450	2690	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2190	2560	3070	3360	3800	4090	4380	4750	5110	5840	6610	7260	7260
			40 (std)	0.237	6.0	10.80	16.02	Std.	1900	2210	2650	2910	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2370	2760	3320	3630	4110	4420	4740	5140	5530	6320	7160	7260	7260
				0.250	6.4	11.36	17.03	Std.	2000	2330	2800	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2500	2760	3500	3830	4330	4670	5000	5420	5830	6670	7260	7260	7260
				0.281	7.1	12.67	18.77	Std.	2250	2620	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3930	4310	4870	5250	5620	6090	6560	7260	7260	7260	7260
				0.312	7.9	13.97	20.73	Std.	2500	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4370	4780	5410	5820	6240	6760	7260	7260	7260	7260	7260
			80 (XS)	0.337	8.6	15.00	22.42	Std.	2700	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4720	5170	5840	6290	6740	7260	7260	7260	7260	7260	7260
			120	0.438	11.1	19.02	28.25	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	6130	6720	7260	7260	7260	7260	7260	7260	7260	7260	7260
			160	0.531	13.5	22.53	33.56	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
			(XXS)	0.674	17.1	27.57	40.99	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
5 9/16	5.563	141.3		0.083	2.1	4.86	7.21	Std.	540	630	750	820	930	1000	1070	1160	1250	1430	1620	1790	2160
								Alt.	670	780	940	1030	1160	1250	1340	1450	1570	1790	2030	2240	2690
				0.125	3.2	7.27	10.90	Std.	810	940	1130	1240	1400	1510	1620	1750	1890	2160	2440	2700	2970
								Alt.	1010	1180	1420	1550	1750	1890	2020	2190	2360	2700	3050	3370	4060
				0.156	4.0	9.02	13.54	Std.	1010	1180	1410	1550	1750	1880	2020	2190	2360	2690	2970	2970	2970
								Alt.	1260	1470	1770	1930	2190	2360	2520	2730	2940	3370	3810	4210	5060
				0.188	4.8	10.80	16.16	Std.	1220	1420	1700	1870	2110	2270	2430	2640	2840	2970	2970	2970	2970
								Alt.	1520	1770	2130	2330	2640	2840	3040	3290	3550	4060	4590	5070	6100
				0.219	5.6	12.51	18.74	Std.	1420	1650	1980	2170	2460	2650	2830	2970	2970	2970	2970	2970	2970
								Alt.	1770	2070	2480	2720	3070	3310	3540	3840	4130	4720	5350	5910	7110
			40 (Std)	0.258	6.6	14.63	21.92	Std.	1670	1950	2340	2560	2890	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2090	2430	2920	3200	3620	3900	4170	4520	4870	5570	6300	6960	7260
				0.281	7.1	15.87	23.50	Std.	1820	2120	2550	2790	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2270	2650	3180	3490	3940	4240	4550	4920	5300	6060	6860	7260	7260
				0.312	7.9	17.51	25.99	Std.	2020	2360	2830	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2520	2760	3530	3870	4370	4710	5050	5470	5890	6730	7260	7260	7260

Pipes API PIPES (API 5L)

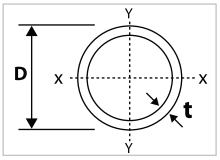


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M		Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)													
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
5 9/16	5.563	141.3		0.344	8.7	19.19	28.45	Std.	2230	2600	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3900	4270	4820	5190	5570	6030	6490	7260	7260	7260	7260
			80 (XS)	0.375	9.5	20.80	30.88	Std.	2430	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4250	4650	5260	5660	6070	6570	7080	7260	7260	7260	7260
			120	0.500	12.7	27.06	40.28	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5660	6200	7010	7260	7260	7260	7260	7260	7260	7260	7260
			160	0.625	15.9	32.99	49.17	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7080	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
			(XXS)	0.750	19.1	38.59	57.56	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
6 5/8	6.625	168.3		0.083	2.1	5.80	8.61	Std.	450	530	790	860	980	1050	1130	1220	1320	1500	1700	1880	2260
								Alt.	560	660	790	860	980	1050	1130	1220	1320	1500	1700	1880	2260
				0.109	2.8	7.59	11.43	Std.	590	690	1040	1140	1280	1380	1480	1600	1730	1970	2240	2470	2970
								Alt.	740	860	1040	1140	1280	1380	1480	1600	1730	1970	2240	2470	2970
				0.125	3.2	8.69	13.03	Std.	680	790	1190	1300	1470	1580	1700	1840	1980	2260	2560	2830	2970
								Alt.	850	990	1190	1300	1470	1580	1700	1840	1980	2260	2560	2830	3410
				0.141	3.6	9.77	14.62	Std.	770	890	1340	1470	1660	1790	1920	2080	2230	2550	2890	2970	2970
								Alt.	960	1120	1340	1470	1660	1790	1920	2080	2230	2550	2890	3200	3840
				0.156	4.0	10.79	16.21	Std.	850	990	1480	1620	1840	1980	2120	2300	2470	2830	2970	2970	2970
								Alt.	1060	1240	1480	1620	1840	1980	2120	2300	2470	2830	3200	3540	4250
				0.172	4.4	11.87	17.78	Std.	930	1090	1640	1790	2030	2180	2340	2530	2730	2970	2970	2970	2970
								Alt.	1170	1360	1640	1790	2030	2180	2340	2530	2730	3120	3530	3900	4690
				0.188	4.8	12.94	19.35	Std.	1020	1190	1790	1960	2210	2380	2550	2770	2970	2970	2970	2970	2970
								Alt.	1280	1490	1790	1960	2210	2380	2550	2770	2980	3410	3860	4260	5120
				0.203	5.2	13.94	20.91	Std.	1100	1290	1930	2110	2390	2570	2760	2970	2970	2970	2970	2970	2970
								Alt.	1380	1610	1930	2110	2390	2570	2760	2990	3220	3680	4160	4600	5530
				0.219	5.6	15.00	22.47	Std.	1190	1390	2080	2280	2580	2780	2970	2970	2970	2970	2970	2970	2970
								Alt.	1490	1740	2080	2280	2580	2780	2980	3220	3470	3970	4490	4960	5970
				0.250	6.4	17.04	25.55	Std.	1360	1580	2380	2600	2940	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1700	1980	2380	2600	2940	3170	3400	3680	3960	4530	5130	5670	6820
			40 (Std)	0.280	7.1	18.99	28.22	Std.	1520	1780	2660	2920	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1900	2220	2660	2920	3300	3550	3800	4120	4440	5070	5740	6350	7260
				0.312	7.9	21.06	31.25	Std.	1700	1980	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2120	2470	2970	3250	3670	3960	4240	4590	4940	5650	6400	7070	7260
				0.344	8.7	23.10	34.24	Std.	1870	2180	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2340	2730	3270	3580	4050	4360	4670	5060	5450	6230	7060	7260	7260
				0.375	9.5	25.05	37.20	Std.	2040	2380	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2550	2760	3570	3910	4420	4750	5090	5520	5940	6790	7260	7260	7260
			80 (XS)	0.432	11.0	28.60	42.67	Std.	2350	2740	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4110	4500	5090	5480	5870	6360	6850	7260	7260	7260	7260
				0.500	12.7	32.74	48.73	Std.	2720	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4750	5210	5890	6340	6790	7260	7260	7260	7260	7260	7260
			120	0.562	14.3	36.43	54.31	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5340	5850	6620	7130	7260	7260	7260	7260	7260	7260	7260
				0.625	15.9	40.09	59.76	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5940	6510	7260	7260	7260	7260	7260	7260	7260	7260	7260
			160	0.719	18.3	45.39	67.69	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	6840	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
				0.750	19.1	47.10	70.27	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7130	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
			(XXS)	0.864	21.9	53.21	79.06	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
				0.875	22.2	53.78	79.98	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
8 5/8	8.625	219.1		0.125	3.2	11.36	17.04	Std.	520	610	910	1000	1130	1220	1300	1410	1520	1740	1970	2180	2620
								Alt.	650	760	910	1000	1130	1220	1300	1410	1520	1740	1970	2180	2620
				0.156	4.0	14.12	21.22	Std.	650	760	1140	1250	1410	1520	1630	1760	1900	2170	2460	2720	2970
								Alt.	810	950	1140	1250	1410	1520	1630	1760	1900	2170	2460	2720	3270
				0.188	4.8	16.96	25.37	Std.	780	920	1370	1500	1700	1830	1960	2130	2290	2620	2960	2970	2970
								Alt.	980	1140	1370	1500	1700	1830	1960	2130	2290	2620	2960	3270	3940
				0.203	5.2	18.28	27.43	Std.	850	990	1480	1620	1840	1980	2120	2290	2470	2820	2970	2970	2970
								Alt.	1060	1240	1480	1620	1840	1980	2120	2290	2470	2820	3200	3530	4250
				0.219	5.6	19.68	29.48	Std.	910	1070	1600	1750	1980	2130	2290	2480	2670	2970	2970	2970	2970
								Alt.	1140	1330	1600	1750	1980	2130	2290	2480	2670	3050	3450	3810	4590
			20	0.250	6.4	22.38	33.57	Std.	1040	1220	1830	2000	2260	2430	2610	2830	2970	2970	2970	2970	2970
								Alt.	1300	1520	1830	2000	2260	2430	2610	2830	3040	3480	3940	4350	5230
			30	0.277	7.0	24.72	36.61	Std.	1160	1350	2020	2220	2510	2700	2890	2970	2970	2970	2970	2970	2970
								Alt.	1450	1690	2020	2220	2510	2700	2890	3130	3370	3850	4360	4820	5800
				0.312	7.9	27.73	41.14	Std.	1300	1520	2280	2500	2820	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1630	1900	2280	2500	2820	3040	3260	3530	3800	4340	4920	5430	6530

Pipes API PIPES (API 5L)

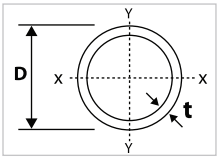


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M			Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)												
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
8 5/8	8.625	219.1	40 (Std)	0.322	8.2	28.58	42.65	Std.	1340	1570	2350	2580	2910	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1680	1960	2350	2580	2910	3140	3360	3640	3920	4480	5070	5610	6740
				0.344	8.7	30.45	45.14	Std.	1440	1680	2510	2750	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1790	2090	2510	2750	3110	3350	3590	3890	4190	4790	5420	5990	7200
				0.375	9.5	33.07	49.10	Std.	1570	1830	2740	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1960	2280	2740	3000	3390	3650	3910	4240	4570	5220	5910	6530	7260
				0.438	11.1	38.33	56.94	Std.	1830	2130	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2290	2670	3200	3500	3960	4270	4570	4950	5330	6090	6900	7260	7260
			80 (XS)	0.500	12.7	43.43	64.64	Std.	2090	2430	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2610	2760	3650	4000	4520	4870	5220	5650	6090	6960	7260	7260	7260
				0.562	14.3	48.44	72.22	Std.	2350	2740	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4110	4500	5080	5470	5860	6350	6840	7260	7260	7260	7260
				0.625	15.9	53.45	79.67	Std.	2610	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4570	5000	5650	6090	6520	7070	7260	7260	7260	7260	7260
			120	0.719	18.3	60.77	90.62	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5250	5750	6500	7000	7260	7260	7260	7260	7260	7260	7260
				0.750	19.1	63.14	94.20	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5480	6000	6780	7260	7260	7260	7260	7260	7260	7260	7260
			140	0.812	20.6	67.82	100.84	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5930	6500	7260	7260	7260	7260	7260	7260	7260	7260	7260
			(XXS)	0.875	22.2	72.49	107.79	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	6390	7000	7260	7260	7260	7260	7260	7260	7260	7260	7260
				1.000	25.4	81.51	121.33	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
10 3/4	10.750	273.1		0.156	4.0	17.67	26.54	Std.	520	610	1040	1130	1280	1380	1480	1600	1730	1970	2240	2470	2970
								Alt.	650	760	1040	1130	1280	1380	1480	1600	1730	1970	2240	2470	2970
				0.188	4.8	21.23	31.76	Std.	630	730	1250	1370	1550	1660	1780	1930	2080	2380	2690	2970	2970
								Alt.	790	920	1250	1370	1550	1660	1780	1930	2080	2380	2690	2980	3580
				0.203	5.2	22.89	34.35	Std.	680	790	1350	1480	1670	1800	1930	2090	2250	2570	2910	2970	2970
								Alt.	850	990	1350	1480	1670	1800	1930	2090	2250	2570	2910	3210	3870
				0.219	5.6	24.65	36.94	Std.	730	860	1450	1590	1800	1940	2080	2250	2420	2770	2970	2970	2970
								Alt.	920	1070	1450	1590	1800	1940	2080	2250	2420	2770	3140	3470	4170
			20	0.250	6.4	28.06	42.09	Std.	840	980	1660	1820	2060	2210	2370	2570	2770	2970	2970	2970	2970
								Alt.	1050	1220	1660	1820	2060	2210	2370	2570	2770	3160	3580	3960	4760
				0.279	7.1	31.23	46.57	Std.	930	1090	1850	2030	2290	2470	2650	2870	2970	2970	2970	2970	2970
								Alt.	1170	1360	1850	2030	2290	2470	2650	2870	3090	3530	4000	4420	5310
			30	0.307	7.8	34.27	51.03	Std.	1030	1200	2040	2230	2520	2720	2910	2970	2970	2970	2970	2970	2970
								Alt.	1290	1500	2040	2230	2520	2720	2910	3160	3400	3880	4400	4860	5850
				0.344	8.7	38.27	56.72	Std.	1150	1340	2280	2500	2830	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1440	1680	2280	2500	2830	3050	3260	3540	3810	4350	4930	5450	6550
			40 (Std)	0.365	9.3	40.52	60.50	Std.	1220	1430	2420	2660	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1530	1780	2420	2660	3000	3230	3460	3750	4040	4620	5230	5780	6950
				0.438	11.1	48.28	71.72	Std.	1470	1710	2910	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1830	2140	2910	3190	3600	3880	4160	4500	4850	5540	6280	6930	7260
			60 (XS)	0.500	12.7	54.79	81.55	Std.	1670	1950	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2090	2440	3320	3640	4110	4430	4740	5140	5530	6330	7160	7260	7260
				0.562	14.3	61.21	91.26	Std.	1880	2200	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2350	2740	3730	4090	4620	4980	5330	5780	6220	7110	7260	7260	7260
				0.625	15.9	67.65	100.85	Std.	2090	2440	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2620	2760	4150	4550	5140	5530	5930	6420	6920	7260	7260	7260	7260
			100	0.719	18.3	77.10	114.99	Std.	2410	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4780	5230	5910	6370	6820	7260	7260	7260	7260	7260	7260
				0.812	20.6	86.26	128.27	Std.	2720	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5390	5910	6680	7190	7260	7260	7260	7260	7260	7260	7260
				0.875	22.2	92.37	137.36	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5810	6370	7200	7260	7260	7260	7260	7260	7260	7260	7260
				0.938	23.8	98.39	146.32	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	6230	6820	7260	7260	7260	7260	7260	7260	7260	7260	7260
			140	1.000	25.4	104.23	155.15	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	6640	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
				1.250	31.8	126.94	189.22	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
12 3/4	12.750	323.9		0.172	4.4	23.13	34.67	Std.	490	570	960	1050	1190	1280	1380	1490	1610	1830	2080	2300	2760
								Alt.	610	710	960	1050	1190	1280	1380	1490	1610	1830	2080	2300	2760
				0.188	4.8	25.25	37.77	Std.	530	620	1050	1150	1300	1400	1500	1630	1750	2010	2270	2510	2970
								Alt.	660	770	1050	1150	1300	1400	1500	1630	1750	2010	2270	2510	3020
				0.203	5.2	27.23	40.87	Std.	570	670	1140	1250	1410	1520	1620	1760	1890	2170	2450	2710	2970
								Alt.	720	840	1140	1250	1410	1520	1620	1760	1890	2170	2450	2710	3260
				0.219	5.6	29.34	43.96	Std.	620	720	1230	1340	1520	1640	1750	1900	2040	2340	2650	2920	2970
								Alt.	770	900	1230	1340	1520	1640	1750	1900	2040	2340	2650	2920	3520

Pipes API PIPES (API 5L)

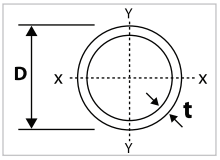


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M			Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)														
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
12 3/4	12.750	323.9	20	0.250	6.4	33.41	50.11	Std.	710	820	1400	1530	1730	1870	2000	2170	2330	2670	2970	2970	2970
								Alt.	880	1030	1400	1530	1730	1870	2000	2170	2330	2670	3020	3340	4010
				0.281	7.1	37.46	55.47	Std.	790	930	1570	1720	1950	2100	2250	2440	2620	2970	2970	2970	2970
								Alt.	990	1160	1570	1720	1950	2100	2250	2440	2620	3000	3390	3750	4510
				0.312	7.9	41.48	61.56	Std.	880	1030	1750	1910	2160	2330	2500	2700	2910	2970	2970	2970	2970
								Alt.	1100	1280	1750	1910	2160	2330	2500	2700	2910	3330	3770	4160	5010
			30	0.330	8.4	43.81	65.35	Std.	930	1090	1850	2020	2290	2460	2640	2860	2970	2970	2970	2970	2970
								Alt.	1160	1360	1850	2020	2290	2460	2640	2860	3080	3520	3990	4400	5300
				0.344	8.7	45.62	67.62	Std.	970	1130	1930	2110	2390	2570	2750	2970	2970	2970	2970	2970	2970
								Alt.	1210	1420	1930	2110	2390	2570	2750	2980	3210	3670	4160	4590	5520
			Std	0.375	9.5	49.61	73.65	Std.	1060	1240	2100	2300	2600	2800	2970	2970	2970	2970	2970	2970	2970
								Alt.	1320	1540	2100	2300	2600	2800	3000	3250	3500	4000	4530	5010	6020
			40	0.406	10.3	53.57	79.65	Std.	1150	1340	2270	2490	2810	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1430	1670	2270	2490	2810	3030	3250	3520	3790	4330	4900	5420	6520
				0.438	11.1	57.65	85.62	Std.	1240	1440	2450	2690	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1550	1800	2450	2690	3040	3270	3500	3800	4090	4670	5290	5850	7030
			XS	0.500	12.7	65.48	97.46	Std.	1410	1650	2800	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1760	2060	2800	3070	3470	3730	4000	4330	4670	5330	6040	6670	7260
			60	0.562	14.3	73.22	109.18	Std.	1590	1850	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1980	2310	3150	3450	3900	4200	4500	4870	5250	5990	6790	7260	7260
				0.625	15.9	81.01	120.76	Std.	1760	2060	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2210	2570	3500	3830	4330	4670	5000	5420	5830	6670	7260	7260	7260
			80	0.688	17.5	88.71	132.23	Std.	1940	2270	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2430	2760	3850	4220	4770	5140	5500	5960	6420	7260	7260	7260	7260
				0.750	19.1	96.21	143.56	Std.	2120	2470	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2650	2760	4200	4600	5200	5600	6000	6500	7000	7260	7260	7260	7260
				0.812	20.6	103.63	154.08	Std.	2290	2670	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4550	4980	5630	6060	6500	7040	7260	7260	7260	7260	7260
				0.875	22.2	111.08	165.17	Std.	2470	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4900	5370	6070	6530	7000	7260	7260	7260	7260	7260	7260
				0.938	23.8	118.44	176.13	Std.	2650	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5250	5750	6500	7000	7260	7260	7260	7260	7260	7260	7260
			120	1.000	25.4	125.61	186.97	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5600	6130	6930	7260	7260	7260	7260	7260	7260	7260	7260
				1.062	27.0	132.69	197.68	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5950	6510	7260	7260	7260	7260	7260	7260	7260	7260	7260
			140	1.125	28.6	139.81	208.27	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	6300	6900	7260	7260	7260	7260	7260	7260	7260	7260	7260
				1.250	31.8	153.67	229.06	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	7000	7260	7260	7260	7260	7260	7260	7260	7260	7260	7260
14	14.000	355.6		0.188	4.8	27.76	41.52	Std.	480	560	960	1050	1190	1280	1370	1480	1600	1830	2070	2290	2750
								Alt.	600	710	960	1050	1190	1280	1370	1480	1600	1830	2070	2290	2750
				0.203	5.2	29.94	44.93	Std.	520	610	1040	1130	1280	1380	1480	1600	1730	1970	2230	2470	2970
								Alt.	650	760	1040	1130	1280	1380	1480	1600	1730	1970	2230	2470	2970
				0.210	5.3	30.96	45.78	Std.	540	630	1070	1170	1330	1430	1530	1660	1790	2040	2310	2550	2970
								Alt.	680	790	1070	1170	1330	1430	1530	1660	1790	2040	2310	2550	3070
				0.219	5.6	32.26	48.33	Std.	560	660	1120	1220	1380	1490	1600	1730	1860	2130	2410	2660	2970
								Alt.	700	820	1120	1220	1380	1490	1600	1730	1860	2130	2410	2660	3200
			10	0.250	6.4	36.75	55.11	Std.	640	750	1280	1400	1580	1700	1820	1970	2130	2430	2750	2970	2970
								Alt.	800	940	1280	1400	1580	1700	1820	1970	2130	2430	2750	3040	3660
				0.281	7.1	41.21	61.02	Std.	720	840	1430	1570	1770	1910	2050	2220	2390	2730	2970	2970	2970
								Alt.	900	1050	1430	1570	1770	1910	2050	2220	2390	2730	3090	3420	4110
			20	0.312	7.9	45.65	67.74	Std.	800	940	1590	1740	1970	2120	2270	2460	2650	2970	2970	2970	2970
								Alt.	1000	1170	1590	1740	1970	2120	2270	2460	2650	3030	3430	3790	4560
				0.344	8.7	50.22	74.42	Std.	880	1030	1750	1920	2170	2340	2510	2720	2920	2970	2970	2970	2970
								Alt.	1110	1290	1750	1920	2170	2340	2510	2720	2920	3340	3780	4180	5030
			30 (Std)	0.375	9.5	54.62	81.08	Std.	960	1130	1910	2090	2370	2550	2730	2960	2970	2970	2970	2970	2970
								Alt.	1210	1410	1910	2090	2370	2550	2730	2960	3190	3640	4130	4560	5480
				0.406	10.3	59.00	87.71	Std.	1040	1220	2070	2270	2560	2760	2960	2970	2970	2970	2970	2970	2970
								Alt.	1310	1520	2070	2270	2560	2760	2960	3200	3450	3940	4470	4930	5940
			40	0.438	11.1	63.50	94.30	Std.	1130	1310	2230	2450	2770	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2230	2450	2770	2980	3190	3460	3720	4250	4820	5320	6400
				0.469	11.9	67.84	100.86	Std.	1210	1410	2390	2620	2960	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1510	1760	2390	2620	2960	3190	3420	3700	3990	4560	5160	5700	6860
			(XS)	0.500	12.7	72.16	107.39	Std.	1290	1500	2550	2790	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1610	1880	2550	2790	3160	3400	3640	3950	4250	4860	5500	6080	7260
				0.562	14.3	80.73	120.36	Std.	1450	1690	2870	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1810	2110	2870	3140	3550	3820	4090	4440	4780	5460	6180	6830	7260
				0.625	15.9	89.36	133.19	Std.	1610	1880	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2010	2340	3190	3490	3950	4250	4550	4930	5310	6070	6880	7260	7260

Pipes API PIPES (API 5L)

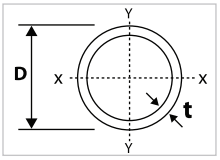


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M		Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)														
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
14	14.000	355.6		0.688	17.5	97.91	145.91	Std.	1770	2060	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2210	2580	3510	3840	4340	4680	5010	5430	5850	6680	7260	7260	7260
			80	0.750	19.1	106.23	158.49	Std.	1930	2250	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2410	2760	3830	4190	4740	5100	5460	5920	6380	7260	7260	7260	7260
				0.812	20.6	114.48	170.18	Std.	2090	2440	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2610	2760	4140	4540	5130	5520	5920	6410	6900	7260	7260	7260	7260
				0.875	22.2	122.77	182.52	Std.	2250	2630	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4460	4890	5530	5950	6380	6910	7260	7260	7260	7260	7260
			100	0.938	23.8	130.98	194.74	Std.	2410	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4780	5240	5920	6380	6830	7260	7260	7260	7260	7260	7260
				1.000	25.4	138.97	206.83	Std.	2570	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5100	5590	6310	6800	7260	7260	7260	7260	7260	7260	7260
				1.062	27.0	146.88	218.79	Std.	2730	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5420	5930	6710	7220	7260	7260	7260	7260	7260	7260	7260
				1.125	28.6	154.84	230.63	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5740	6280	7100	7260	7260	7260	7260	7260	7260	7260	7260
			140	1.250	31.8	170.37	253.92	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	6380	6980	7260	7260	7260	7260	7260	7260	7260	7260	7260
16	16.000	406.4		0.188	4.8	31.78	47.54	Std.	420	490	840	920	1040	1120	1200	1300	1400	1600	1810	2000	2400
								Alt.	530	620	840	920	1040	1120	1200	1300	1400	1600	1810	2000	2400
				0.203	5.2	34.28	51.45	Std.	460	530	910	990	1120	1210	1290	1400	1510	1730	1950	2160	2600
								Alt.	570	670	910	990	1120	1210	1290	1400	1510	1730	1950	2160	2600
				0.219	5.6	36.95	55.35	Std.	490	570	980	1070	1210	1300	1400	1510	1630	1860	2110	2330	2800
								Alt.	620	720	980	1070	1210	1300	1400	1510	1630	1860	2110	2330	2800
			10	0.250	6.4	42.09	63.13	Std.	560	660	1120	1220	1380	1490	1590	1730	1860	2130	2410	2660	2970
								Alt.	700	820	1120	1220	1380	1490	1590	1730	1860	2130	2410	2660	3200
				0.281	7.1	47.22	69.91	Std.	630	740	1250	1370	1550	1670	1790	1940	2090	2390	2700	2970	2970
								Alt.	790	920	1250	1370	1550	1670	1790	1940	2090	2390	2700	2990	3590
			20	0.312	7.9	52.32	77.63	Std.	700	820	1390	1520	1720	1860	1990	2150	2320	2650	2970	2970	2970
								Alt.	880	1020	1390	1520	1720	1860	1990	2150	2320	2650	3000	3320	3990
				0.344	8.7	57.57	85.32	Std.	770	900	1540	1680	1900	2050	2190	2380	2560	2920	2970	2970	2970
								Alt.	970	1130	1540	1680	1900	2050	2190	2380	2560	2920	3310	3660	4400
			30 (Std)	0.375	9.5	62.64	92.98	Std.	840	980	1670	1830	2070	2230	2390	2590	2790	2970	2970	2970	2970
								Alt.	1050	1230	1670	1830	2070	2230	2390	2590	2790	3190	3610	3990	4800
				0.406	10.3	67.68	100.61	Std.	910	1070	1810	1980	2240	2420	2590	2800	2970	2970	2970	2970	2970
								Alt.	1140	1330	1810	1980	2240	2420	2590	2800	3020	3450	3910	4320	5190
				0.438	11.1	72.86	108.20	Std.	990	1150	1950	2140	2420	2610	2790	2970	2970	2970	2970	2970	2970
								Alt.	1230	1440	1950	2140	2420	2610	2790	3020	3260	3750	4220	4660	5600
				0.469	11.9	77.87	115.77	Std.	1060	1230	2090	2290	2590	2790	2970	2970	2970	2970	2970	2970	2970
								Alt.	1320	1540	2090	2290	2590	2790	2990	3240	3490	4010	4510	4990	6000
			40 (XS)	0.500	12.7	82.85	123.30	Std.	1130	1310	2230	2440	2760	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2230	2440	2760	2980	3190	3450	3730	4280	4810	5320	6400
				0.562	14.3	92.75	138.27	Std.	1260	1480	2510	2750	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1580	1840	2510	2750	3110	3340	3580	3900	4200	4810	5410	5980	7190
				0.625	15.9	102.72	153.11	Std.	1410	1640	2790	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1760	2050	2790	3050	3450	3760	4000	4340	4670	5350	6020	6650	7260
				0.688	17.5	112.62	167.83	Std.	1550	1810	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1940	2260	3070	3360	3820	4140	4400	4770	5140	5880	6620	7260	7260
				0.750	19.1	122.27	182.42	Std.	1690	1970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2110	2460	3350	3700	4160	4510	4800	5200	5600	6410	7220	7260	7260
				0.812	20.6	131.84	195.98	Std.	1830	2130	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2280	2660	3620	4000	4500	4880	5190	5630	6070	6950	7260	7260	7260
				0.875	22.2	141.48	210.33	Std.	1970	2300	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2460	2760	3914	4310	4850	5260	5600	6070	6540	7260	7260	7260	7260
				0.938	23.8	151.03	224.55	Std.	2110	2460	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2640	2760	4200	4620	5200	5640	6000	6510	7010	7260	7260	7260	7260
				1.000	25.4	160.35	238.64	Std.	2250	2630	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4470	4930	5550	6010	6400	6940	7260	7260	7260	7260	7260
				1.062	27.0	169.59	252.61	Std.	2390	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	4750	5240	5890	6390	6790	7260	7260	7260	7260	7260	7260
				1.125	28.6	178.89	266.45	Std.	2530	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5030	5550	6240	6770	7200	7260	7260	7260	7260	7260	7260
				1.188	30.2	188.11	280.17	Std.	2670	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5310	5860	6590	7140	7260	7260	7260	7260	7260	7260	7260
				1.250	31.8	197.10	293.76	Std.	2760	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	5590	6160	6930	7260	7260	7260	7260	7260	7260	7260	7260
18	18.000	457.0		0.188	4.8	35.80	53.53	Std.	380	440	750	820	920	990	1070	1150	1240	1420	1610	1780	2140
								Alt.	470	550	750	820	920	990	1070	1150	1240	1420	1610	1780	2140
				0.219	5.6	41.63	62.34	Std.	440	510	870	950	1080	1160	1240	1340	1450	1650	1870	2070	2490
								Alt.	550	640	870	950	1080	1160	1240	1340	1450	1650	1870	2070	2490

Pipes API PIPES (API 5L)

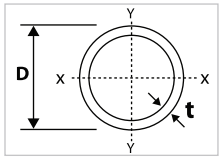


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M			Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)													
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
18	18.000	457.0	10	0.250	6.4	47.44	71.12	Std.	500	580	990	1090	1230	1320	1420	1530	1650	1890	2140	2360	2840
								Alt.	630	730	990	1090	1230	1320	1420	1530	1650	1890	2140	2360	2840
				0.281	7.1	53.23	78.77	Std.	560	660	1110	1220	1380	1490	1590	1730	1860	2120	2400	2660	2970
								Alt.	700	820	1110	1220	1380	1490	1590	1730	1860	2120	2400	2660	3200
			20	0.312	7.9	58.99	87.49	Std.	620	730	1240	1360	1530	1650	1770	1920	2060	2360	2670	2950	2970
								Alt.	780	910	1240	1360	1530	1650	1770	1920	2060	2360	2670	2950	3550
				0.344	8.7	64.93	96.18	Std.	690	800	1360	1490	1690	1820	1950	2110	2270	2600	2940	2970	2970
								Alt.	860	1000	1360	1490	1690	1820	1950	2110	2270	2600	2940	3250	3630
			(Std)	0.375	9.5	70.65	104.84	Std.	750	880	1490	1630	1840	1980	2130	2300	2480	2830	2970	2970	2970
								Alt.	940	1090	1490	1630	1840	1980	2130	2300	2480	2830	3210	3550	3630
				0.406	10.3	76.36	113.46	Std.	810	950	1610	1760	1990	2150	2300	2490	2680	2970	2970	2970	2970
								Alt.	1020	1180	1610	1760	1990	2150	2300	2490	2680	3070	3470	3630	3630
			30	0.438	11.1	82.23	122.05	Std.	880	1020	1740	1900	2150	2320	2480	2690	2900	2970	2970	2970	2970
								Alt.	1100	1280	1740	1900	2150	2320	2480	2690	2900	3310	3630	3630	3630
				0.469	11.9	87.89	130.62	Std.	940	1090	1860	2040	2300	2480	2660	2880	2970	2970	2970	2970	2970
								Alt.	1170	1370	1860	2040	2300	2480	2660	2880	3100	3540	3630	3630	3630
			(XS)	0.500	12.7	93.54	139.15	Std.	1000	1170	1980	2170	2460	2640	2830	2970	2970	2970	2970	2970	2970
								Alt.	1250	1460	1980	2170	2460	2640	2830	3070	3310	3630	3630	3630	3630
			40	0.562	14.3	104.76	156.11	Std.	1120	1310	2230	2440	2760	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2230	2440	2760	2970	3180	3450	3630	3630	3630	3630	3630
				0.625	15.9	116.09	172.95	Std.	1250	1460	2480	2720	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1560	1820	2480	2720	3070	3310	3540	3630	3630	3630	3630	3630	3630
				0.688	17.5	127.32	189.67	Std.	1380	1610	2730	2990	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1720	2010	2730	2990	3380	3630	3630	3630	3630	3630	3630	3630	3630
			60	0.750	19.1	138.30	206.25	Std.	1500	1750	2980	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1880	2190	2980	3260	3630	3630	3630	3630	3630	3630	3630	3630	3630
				0.812	20.6	149.20	221.69	Std.	1620	1890	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2030	2370	3220	3530	3630	3630	3630	3630	3630	3630	3630	3630	3630
				0.875	22.2	160.18	238.03	Std.	1750	2040	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2190	2550	3470	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
			80	0.938	23.8	171.08	254.25	Std.	1880	2190	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2350	2740	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.000	25.4	181.73	270.34	Std.	2000	2330	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2500	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.062	27.0	192.29	286.30	Std.	2120	2480	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2660	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.125	28.6	202.94	302.14	Std.	2250	2630	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.188	30.2	213.51	317.85	Std.	2380	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.250	31.8	223.82	333.44	Std.	2500	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
20	20.000	508.0		0.219	5.6	46.31	69.38	Std.	390	460	830	910	1020	1100	1180	1280	1380	1580	1790	1970	2370
								Alt.	490	570	830	910	1020	1100	1180	1280	1380	1580	1790	1970	2370
			10	0.250	6.4	52.78	79.16	Std.	450	530	950	1040	1170	1260	1350	1460	1580	1800	2040	2250	2710
								Alt.	560	660	950	1040	1170	1260	1350	1460	1580	1800	2040	2250	2710
				0.281	7.1	59.23	87.70	Std.	510	590	1060	1160	1320	1420	1520	1640	1770	2020	2290	2530	2970
								Alt.	630	740	1060	1160	1320	1420	1520	1640	1770	2020	2290	2530	3040
				0.312	7.9	65.66	97.43	Std.	560	660	1180	1290	1460	1570	1680	1830	1970	2250	2540	2810	2970
								Alt.	700	820	1180	1290	1460	1570	1680	1830	1970	2250	2540	2810	3380
				0.344	8.7	72.28	107.12	Std.	620	720	1300	1420	1610	1730	1860	2010	2170	2480	2800	2970	2970
								Alt.	770	900	1300	1420	1610	1730	1860	2010	2170	2480	2800	3100	3630
			20 (Std)	0.375	9.5	78.67	116.78	Std.	680	790	1420	1550	1760	1890	2030	2190	2360	2700	2970	2970	2970
								Alt.	840	980	1420	1550	1760	1890	2030	2190	2360	2700	3060	3380	3630
				0.406	10.3	85.04	126.41	Std.	730	850	1530	1680	1900	2050	2190	2380	2560	2920	2970	2970	2970
								Alt.	910	1070	1530	1680	1900	2050	2190	2380	2560	2920	3310	3630	3630
				0.438	11.1	91.59	136.01	Std.	790	920	1660	1810	2050	2210	2370	2560	2760	2970	2970	2970	2970
								Alt.	990	1150	1660	1810	2050	2210	2370	2560	2760	3150	3570	3630	3630
				0.469	11.9	97.92	145.58	Std.	840	980	1770	1940	2190	2360	2530	2740	2950	2970	2970	2970	2970
								Alt.	1060	1230	1770	1940	2190	2360	2530	2740	2950	3380	3630	3630	3630
			30 (XS)	0.500	12.7	104.23	155.12	Std.	900	1050	1890	2070	2340	2520	2700	2930	2970	2970	2970	2970	2970
								Alt.	1130	1310	1890	2070	2340	2520	2700	2930	3150	3600	3630	3630	3630
				0.562	14.3	116.78	174.10	Std.	1010	1180	2120	2330	2630	2830	2970	2970	2970	2970	2970	2970	2970
								Alt.	1260	1480	2120	2330	2630	2830	3030	3290	3540	3630	3630	3630	3630
				0.625	15.9	129.45	192.95	Std.	1130	1310	2360	2590	2930	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2930	3150	3380	3630	3630	3630	3630	3630	3630
				0.688	17.5	142.03	216.34	Std.	1240	1440	2600	2850	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1550	1810	2600	2850	3220	3630	3630	3630	3630	3630	3630	3630	3630
				0.750	19.1	154.34	230.27	Std.	1350	1580	2840	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1690	1970	2840	3110	3510	3630	3630	3630	3630	3630	3630	3630	3630

Pipes API PIPES (API 5L)

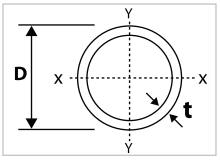


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M		Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)													
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
20	20.000	508.0	60	0.812	20.6	166.56	247.60	Std.	1460	1710	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1830	2130	3070	3360	3630	3630	3630	3630	3630	3630	3630	3630	3630
				0.875	22.2	178.89	265.95	Std.	1580	1840	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1970	2300	3310	3620	3630	3630	3630	3630	3630	3630	3630	3630	3630
				0.938	23.8	191.14	284.18	Std.	1690	1970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2110	2460	3550	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.000	25.4	203.11	302.28	Std.	1800	2100	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2250	2630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.062	27.0	215.00	320.26	Std.	1910	2230	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2390	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.125	28.6	227.00	338.11	Std.	2030	2360	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2530	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.188	30.2	238.91	355.83	Std.	2140	2490	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2670	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.250	31.8	250.55	373.43	Std.	2250	2630	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.312	33.3	262.10	389.81	Std.	2360	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.375	34.9	273.76	407.17	Std.	2480	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
22	22.000	559.0		0.219	5.6	50.99	76.42	Std.	360	420	750	820	930	1000	1080	1160	1250	1430	1620	1790	2160
								Alt.	450	520	750	820	930	1000	1080	1160	1250	1430	1620	1790	2160
			10	0.250	6.4	58.13	87.21	Std.	410	480	860	940	1060	1150	1230	1330	1430	1640	1850	2050	2460
								Alt.	510	600	860	940	1060	1150	1230	1330	1430	1640	1850	2050	2460
				0.281	7.1	65.24	96.63	Std.	460	540	970	1060	1200	1290	1380	1490	1610	1840	2080	2300	2770
								Alt.	570	670	970	1060	1200	1290	1380	1490	1610	1840	2080	2300	2770
				0.312	7.9	72.34	107.36	Std.	510	600	1070	1170	1330	1430	1530	1660	1790	2040	2310	2560	2970
								Alt.	640	740	1070	1170	1330	1430	1530	1660	1790	2040	2310	2560	3070
				0.344	8.7	79.64	118.06	Std.	560	660	1180	1290	1460	1580	1690	1830	1970	2250	2550	2820	2970
								Alt.	700	820	1180	1290	1460	1580	1690	1830	1970	2250	2550	2820	3390
			20 (Std)	0.375	9.5	86.69	128.73	Std.	610	720	1290	1410	1600	1720	1840	1990	2150	2450	2780	2970	2970
								Alt.	770	890	1290	1410	1600	1720	1840	1990	2150	2450	2780	3070	3630
				0.406	10.3	93.72	139.37	Std.	660	780	1400	1530	1730	1860	1990	2160	2330	2660	2970	2970	2970
								Alt.	830	970	1400	1530	1730	1860	1990	2160	2330	2660	3010	3330	3630
				0.438	11.1	100.96	149.97	Std.	720	840	1510	1650	1860	2010	2150	2330	2510	2870	2970	2970	2970
								Alt.	900	1050	1510	1650	1860	2010	2150	2330	2510	2870	3250	3590	3630
				0.469	11.9	107.95	160.55	Std.	770	900	1610	1770	2000	2150	2300	2490	2690	2970	2970	2970	2970
								Alt.	960	1120	1610	1770	2000	2150	2300	2490	2690	3070	3480	3630	3630
			30 (XS)	0.500	12.7	114.92	171.09	Std.	820	950	1720	1880	2130	2290	2450	2660	2860	2970	2970	2970	2970
								Alt.	1020	1190	1720	1880	2130	2290	2450	2660	2860	3270	3630	3630	3630
				0.562	14.3	128.79	192.08	Std.	920	1070	1930	2120	2390	2570	2760	2970	2970	2970	2970	2970	2970
								Alt.	1150	1340	1930	2120	2390	2570	2760	2990	3220	3000	3630	3630	3630
				0.625	15.9	142.81	212.95	Std.	1020	1190	2150	2350	2660	2860	2970	2970	2970	2970	2970	2970	2970
								Alt.	1280	1490	2150	2350	2660	2860	3070	3320	3580	3630	3630	3630	3630
				0.688	17.5	156.74	233.68	Std.	1130	1310	2360	2590	2930	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2930	3150	3380	3630	3630	3630	3630	3630	3630
				0.750	19.1	170.37	254.30	Std.	1230	1430	2580	2820	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1530	1790	2580	2820	3190	3630	3630	3630	3630	3630	3630	3630	3630
				0.812	20.6	183.92	273.51	Std.	1330	1550	2790	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1660	1940	2790	3060	3450	3630	3630	3630	3630	3630	3630	3630	3630
			60	0.875	22.2	197.60	293.87	Std.	1430	1670	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1790	2090	3010	3290	3630	3630	3630	3630	3630	3630	3630	3630	3630
				0.938	23.8	211.19	314.11	Std.	1530	1790	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1920	2240	3220	3530	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.000	25.4	224.49	334.23	Std.	1640	1910	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2050	2390	3440	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.062	27.0	237.70	354.22	Std.	1740	2030	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2170	2530	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
			80	1.125	28.6	251.05	374.08	Std.	1840	2150	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2300	2680	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.188	30.2	264.31	393.81	Std.	1940	2270	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2430	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.250	31.8	277.27	413.42	Std.	2050	2390	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2560	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.312	33.3	290.15	431.69	Std.	2150	2500	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2680	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
			100	1.375	34.9	303.16	451.06	Std.	2250	2630	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.438	36.5	316.08	470.30	Std.	2350	2750	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.500	38.1	328.72	489.41	Std.	2450	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630

Pipes API PIPES (API 5L)

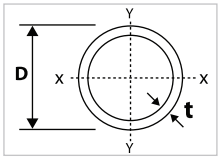


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M			Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)												
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
24	24.000	610.0	10	0.250	6.4	63.47	95.26	Std.	380	440	790	860	980	1050	1130	1220	1310	1500	1700	1880	2260
								Alt.	470	550	790	860	980	1050	1130	1220	1310	1500	1700	1880	2260
				0.281	7.1	71.25	105.56	Std.	420	490	890	970	1100	1180	1260	1370	1480	1690	1910	2110	2540
								Alt.	530	610	890	970	1100	1180	1260	1370	1480	1690	1910	2110	2540
				0.312	7.9	79.01	117.30	Std.	470	550	980	1080	1220	1310	1400	1520	1640	1870	2120	2340	2820
								Alt.	590	680	980	1080	1220	1310	1400	1520	1640	1870	2120	2340	2820
				0.344	8.7	86.99	129.00	Std.	520	600	1080	1190	1340	1440	1550	1680	1810	2060	2340	2580	2970
								Alt.	650	750	1080	1190	1340	1440	1550	1680	1810	2060	2340	2580	3110
			20 (Std)	0.375	9.5	94.71	140.68	Std.	560	660	1180	1290	1460	1580	1690	1830	1970	2250	2550	2820	2970
								Alt.	700	820	1180	1290	1460	1580	1690	1830	1970	2250	2550	2820	3390
				0.406	10.3	102.40	152.32	Std.	610	710	1280	1400	1580	1710	1830	1980	2130	2440	2760	2970	2970
								Alt.	760	890	1280	1400	1580	1710	1830	1980	2130	2440	2760	3050	3630
				0.438	11.1	110.32	163.93	Std.	660	770	1380	1510	1710	1840	1970	2140	2300	2630	2970	2970	2970
								Alt.	820	960	1380	1510	1710	1840	1970	2140	2300	2630	2980	3290	3630
				0.469	11.9	117.98	175.51	Std.	700	820	1480	1620	1830	1970	2110	2290	2460	2810	2970	2970	2970
								Alt.	880	1030	1480	1620	1830	1970	2110	2290	2460	2810	3190	3520	3630
			(XS)	0.500	12.7	125.61	187.06	Std.	750	880	1580	1730	1950	2100	2250	2440	2630	2970	2970	2970	2970
								Alt.	940	1090	1580	1730	1950	2100	2250	2440	2630	3000	3400	3630	3630
			30	0.562	14.3	140.81	210.07	Std.	840	980	1770	1940	2190	2360	2530	2740	2950	2970	2970	2970	2970
								Alt.	1050	1230	1770	1940	2190	2360	2530	2740	2950	3370	3630	3630	3630
				0.625	15.9	156.17	232.94	Std.	940	1090	1970	2160	2440	2630	2810	2970	2970	2970	2970	2970	2970
								Alt.	1170	1370	1970	2160	2440	2630	2810	3050	3280	3630	3630	3630	3630
			40	0.688	17.5	171.45	255.69	Std.	1030	1200	2170	2370	2680	2890	2970	2970	2970	2970	2970	2970	2970
								Alt.	1290	1510	2170	2370	2680	2890	3100	3350	3610	3630	3630	3630	3630
				0.750	19.1	186.41	278.32	Std.	1130	1310	2360	2590	2930	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2930	3150	3380	3630	3630	3630	3630	3630	3630
				0.812	20.6	201.28	299.41	Std.	1220	1420	2560	2800	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1520	1780	2560	2800	3170	3630	3630	3630	3630	3630	3630	3630	3630
				0.875	22.2	216.31	321.79	Std.	1310	1530	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1640	1910	2760	3020	3410	3630	3630	3630	3630	3630	3630	3630	3630
				0.938	23.8	231.25	344.05	Std.	1410	1640	2950	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1760	2050	2950	3240	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.000	25.4	245.87	366.17	Std.	1500	1750	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1880	2190	3150	3450	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.062	27.0	260.41	388.17	Std.	1590	1860	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1990	2320	3350	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.125	28.6	275.10	410.05	Std.	1690	1970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2110	2460	3540	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.188	30.2	289.71	431.80	Std.	1780	2080	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2230	2600	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.250	31.8	304.00	453.42	Std.	1880	2190	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2340	2730	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.312	33.3	318.21	473.57	Std.	1970	2300	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2460	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.375	34.9	332.56	494.95	Std.	2060	2410	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2580	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.438	36.5	346.83	516.20	Std.	2160	2520	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2700	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.500	38.1	360.79	537.33	Std.	2250	2630	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.562	39.7	374.66	558.32	Std.	2340	2730	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	2760	2760	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630	3630
26	26.000	660.0		0.250	6.4	68.82	103.15	Std.	350	400	730	800	900	970	1040	1130	1210	1380	1570	1730	2080
								Alt.	430	500	730	800	900	970	1040	1130	1210	1380	1570	1730	2080
				0.281	7.1	77.26	114.31	Std.	390	450	820	890	1010	1090	1170	1260	1360	1560	1760	1950	2340
								Alt.	490	570	820	890	1010	1090	1170	1260	1360	1560	1760	1950	2340
			10	0.312	7.9	85.68	127.04	Std.	430	500	910	990	1120	1210	1300	1400	1510	1730	1960	2160	2600
								Alt.	540	630	910	990	1120	1210	1300	1400	1510	1730	1960	2160	2600
				0.344	8.7	94.35	139.73	Std.	480	560	1000	1100	1240	1330	1430	1550	1670	1910	2160	2380	2870
								Alt.	600	690	1000	1100	1240	1330	1430	1550	1670	1910	2160	2380	2870
			(Std)	0.375	9.5	102.72	152.39	Std.	520	610	1090	1190	1350	1450	1560	1690	1820	2080	2350	2600	2970
								Alt.	650	760	1090	1190	1350	1450	1560	1690	1820	2080	2350	2600	3130
				0.406	10.3	111.08	165.02	Std.	560	660	1180	1290	1460	1570	1690	1830	1970	2250	2550	2810	2970
								Alt.	700	820	1180	1290	1460	1570	1690	1830	1970	2250	2550	2810	3380
				0.438	11.1	119.69	177.62	Std.	610	710	1270	1390	1580	1700	1820	1970	2120	2430	2750	2970	2970
								Alt.	760	880	1270	1390	1580	1700	1820	1970	2120	2430	2750	3040	3630
				0.469	11.9	128.00	190.19	Std.	650	760	1360	1490	1690	1820	1950	2110	2270	2600	2940	2970	2970
								Alt.	810	950	1360	1490	1690	1820	1950	2110	2270	2600	2940	3250	3630

Pipes API PIPES (API 5L)

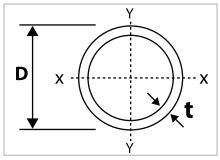


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M		Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)													
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
26	26.000	660.0	20 (XS)	0.500	12.7	136.30	202.72	Std.	690	810	1450	1590	1800	1940	2080	2250	2420	2770	2970	2970	2970
								Alt.	870	1010	1450	1590	1800	1940	2080	2250	2420	2770	3140	3470	3630
				0.562	14.3	152.83	227.70	Std.	780	910	1630	1790	2020	2180	2330	2530	2720	2970	2970	2970	2970
								Alt.	970	1130	1630	1790	2020	2180	2330	2530	2720	3110	3530	3630	3630
				0.625	15.9	169.54	252.55	Std.	870	1010	1820	1990	2250	2420	2600	2810	2970	2970	2970	2970	2970
								Alt.	1080	1260	1820	1990	2250	2420	2600	2810	3030	3460	3630	3630	3630
				0.688	17.5	186.16	277.27	Std.	950	1110	2000	2190	2480	2670	2860	2970	2970	2970	2970	2970	2970
								Alt.	1190	1390	2000	2190	2480	2670	2860	3100	3330	3630	3630	3630	3630
				0.750	19.1	202.44	301.87	Std.	1040	1210	2180	2390	2700	2910	2970	2970	2970	2970	2970	2970	2970
								Alt.	1300	1510	2180	2390	2700	2910	3120	3380	3630	3630	3630	3630	3630
				0.812	20.6	218.64	324.81	Std.	1120	1310	2360	2590	2920	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2920	3150	3370	3630	3630	3630	3630	3630	3630
				0.875	22.2	235.01	349.16	Std.	1210	1410	2540	2790	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1510	1770	2540	2790	3150	3630	3630	3630	3630	3630	3630	3630	3630
				0.938	23.8	251.30	373.39	Std.	1300	1520	2730	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1620	1890	2730	2990	3380	3630	3630	3630	3630	3630	3630	3630	3630
				1.000	25.4	267.25	397.49	Std.	1380	1620	2910	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1730	2020	2910	3180	3600	3630	3630	3630	3630	3630	3630	3630	3630
28	28.000	711.0		0.250	6.4	74.16	111.20	Std.	320	380	680	740	840	900	960	1040	1130	1290	1460	1610	1940
								Alt.	400	470	680	740	840	900	960	1040	1130	1290	1460	1610	1940
				0.281	7.1	83.26	123.24	Std.	360	420	760	830	940	1010	1080	1170	1260	1450	1640	1810	2170
								Alt.	450	530	760	830	940	1010	1080	1170	1260	1450	1640	1810	2170
			10	0.312	7.9	92.35	136.97	Std.	400	470	840	920	1040	1120	1200	1300	1400	1600	1820	2010	2410
								Alt.	500	590	840	920	1040	1120	1200	1300	1400	1600	1820	2010	2410
				0.344	8.7	101.70	150.67	Std.	440	520	930	1020	1150	1240	1330	1440	1550	1770	2000	2210	2660
								Alt.	550	650	930	1020	1150	1240	1330	1440	1550	1770	2000	2210	2660
			(Std)	0.375	9.5	110.74	164.34	Std.	480	560	1010	1110	1250	1350	1450	1570	1690	1930	2180	2410	2900
								Alt.	600	700	1010	1110	1250	1350	1450	1570	1690	1930	2180	2410	2900
				0.406	10.3	119.76	177.98	Std.	520	610	1100	1200	1360	1460	1570	1700	1830	2090	2360	2610	2970
								Alt.	650	760	1100	1200	1360	1460	1570	1700	1830	2090	2360	2610	3140
				0.438	11.1	129.05	191.58	Std.	560	660	1180	1300	1460	1580	1690	1830	1970	2250	2550	2820	2970
								Alt.	700	820	1180	1300	1460	1580	1690	1830	1970	2250	2550	2820	3390
				0.469	11.9	138.03	205.15	Std.	600	700	1270	1390	1570	1690	1810	1960	2110	2410	2730	2970	2970
								Alt.	750	880	1270	1390	1570	1690	1810	1960	2110	2410	2730	3020	3630
			20 (XS)	0.500	12.7	146.99	218.69	Std.	640	750	1350	1480	1670	1800	1930	2090	2250	2570	2910	2970	2970
								Alt.	800	940	1350	1480	1670	1800	1930	2090	2250	2570	2910	3220	3630
				0.562	14.3	164.84	245.68	Std.	720	840	1520	1660	1880	2020	2170	2350	2530	2890	2970	2970	2970
								Alt.	900	1050	1520	1660	1880	2020	2170	2350	2530	2890	3270	3620	3630
			30	0.625	15.9	182.90	272.54	Std.	800	940	1690	1850	2090	2250	2410	2610	2810	2970	2970	2970	2970
								Alt.	1000	1170	1690	1850	2090	2250	2410	2610	2810	3210	3630	3630	3630
				0.688	17.5	200.87	299.28	Std.	880	1030	1860	2030	2300	2480	2650	2870	2970	2970	2970	2970	2970
								Alt.	1110	1290	1860	2030	2300	2480	2650	2870	3100	3540	3630	3630	3630
				0.750	19.1	218.48	325.89	Std.	960	1130	2030	2220	2510	2700	2890	2970	2970	2970	2970	2970	2970
								Alt.	1210	1410	2030	2220	2510	2700	2890	3130	3380	3630	3630	3630	3630
				0.812	20.6	236.00	350.72	Std.	1040	1220	2190	2400	2710	2920	2970	2970	2970	2970	2970	2970	2970
								Alt.	1310	1520	2190	2400	2710	2920	3130	3390	3630	3630	3630	3630	3630
				0.875	22.2	253.72	377.08	Std.	1130	1310	2360	2590	2930	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2930	3150	3380	3630	3630	3630	3630	3630	3630
				0.938	23.8	271.36	403.32	Std.	1210	1410	2530	2770	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1510	1760	2530	2770	3140	3630	3620	3630	3630	3630	3630	3630	3630
				1.000	25.4	288.63	429.44	Std.	1290	1500	2700	2960	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1610	1880	2700	2960	3340	3630	3630	3630	3630	3630	3630	3630	3630
30	30.000	762.0		0.250	6.4	79.51	119.25	Std.	300	350	630	690	780	840	900	980	1050	1200	1360	1500	1810
								Alt.	380	440	630	690	780	840	900	980	1050	1200	1360	1500	1810
				0.281	7.1	89.27	132.17	Std.	340	390	710	780	880	940	1010	1100	1180	1350	1530	1690	2030
								Alt.	420	490	710	780	880	940	1010	1100	1180	1350	1530	1690	2030
			10	0.312	7.9	99.02	146.91	Std.	370	440	790	860	970	1050	1120	1220	1310	1500	1700	1870	2250
								Alt.	470	550	790	860	970	1050	1120	1220	1310	1500	1700	1870	2250
				0.344	8.7	109.06	161.61	Std.	410	480	870	950	1070	1160	1240	1340	1440	1650	1870	2070	2490
								Alt.	520	600	870	950	1070	1160	1240	1340	1440	1650	1870	2070	2490
			(Std)	0.375	9.5	118.76	176.29	Std.	450	530	950	1040	1170	1260	1350	1460	1580	1800	2040	2250	2710
								Alt.	560	660	950	1040	1170	1260	1350	1460	1580	1800	2040	2250	2710
				0.406	10.3	128.44	190.93	Std.	490	570	1020	1120	1270	1360	1460	1580	1710	1950	2210	2440	2930
								Alt.	610	710	1020	1120	1270	1360	1460	1580	1710	1950	2210	2440	2930
				0.438	11.1	138.42	205.54	Std.	530	610	1100	1210	1370	1470	1580	1710	1840	2100	2380	2630	2970
								Alt.	660	770	1100	1210	1370	1470	1580	1710	1840	2100	2380	2630	3160
				0.469	11.9	148.06	220.12	Std.	560	660	1180	1290	1460	1580	1690	1830	1970	2250	2550	2820	2970
								Alt.	700	820	1180	1290	1460	1580	1690	1830	1970	2250	2550	2820	3390
			20 (XS)	0.500	12.7	157.68	234.67	Std.	600	700	1260	1380	1560	1680	1800	1950	2100	2400	2720	2970	2970
								Alt.	750	880	1260	1380	1560	1680	1800	1950	2100	2400	2720	3000	3610
				0.562	14.3	176.86	263.67	Std.	670	790	1420	1550	1750	1890	2020	2190	2360	2700	2970	2970	2970
								Alt.	840	980	1420	1550	1750	1890	2020	2190	2360	2700	3060	3380	3630

Pipes API PIPES (API 5L)

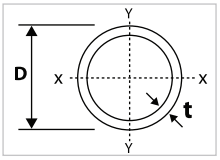


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M			Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)													
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
30	30.000	762.0	30	0.625	15.9	196.26	292.54	Std.	750	880	1580	1730	1950	2100	2250	2440	2630	2970	2970	2970	2970
								Alt.	940	1090	1580	1730	1950	2100	2250	2440	2630	3000	3400	3630	3630
				0.688	17.5	215.58	321.29	Std.	830	960	1730	1900	2150	2310	2480	2680	2890	2970	2970	2970	2970
								Alt.	1030	1200	1730	1900	2150	2310	2480	2680	2890	3300	3630	3630	3630
				0.750	19.1	234.51	349.91	Std.	900	1050	1890	2070	2340	2520	2700	2930	2970	2970	2970	2970	2970
								Alt.	1130	1310	1890	2070	2340	2520	2700	2930	3150	3600	3630	3630	3630
				0.812	20.6	253.36	376.63	Std.	970	1140	2050	2240	2530	2730	2920	2970	2970	2970	2970	2970	2970
								Alt.	1220	1420	2050	2240	2530	2730	2920	3170	3410	3630	3630	3630	3630
				0.875	22.2	272.43	405.00	Std.	1050	1230	2210	2420	2730	2940	2970	2970	2970	2970	2970	2970	2970
								Alt.	1310	1530	2210	2420	2730	2940	3150	3410	3630	3630	3630	3630	3630
				0.938	23.8	291.41	433.26	Std.	1130	1310	2360	2590	2930	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2930	3150	3380	3630	3630	3630	3630	3630	3630
				1.000	25.4	310.01	461.38	Std.	1200	1400	2520	2760	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1500	1750	2520	2760	3120	3360	3600	3630	3630	3630	3630	3630	3630
				1.062	27.0	328.53	489.38	Std.	1270	1490	2680	2930	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1590	1860	2680	2930	3310	3630	3630	3630	3630	3630	3630	3630	3630
				1.125	28.6	347.26	517.25	Std.	1350	1580	2840	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1690	1970	2840	3110	3510	3630	3630	3630	3630	3630	3630	3630	3630
				1.188	30.2	365.90	544.99	Std.	1430	1660	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1780	2080	2990	3280	3630	3630	3630	3630	3630	3630	3630	3630	3630
				1.250	31.8	384.17	572.61	Std.	1500	1750	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1880	2190	3150	3450	3630	3630	3630	3630	3630	3630	3630	3630	3630
32	32.000	813.0		0.250	6.4	84.85	127.30	Std.	280	330	590	650	730	790	840	910	980	1130	1270	1410	1690
								Alt.	350	410	590	650	730	790	840	910	980	1130	1270	1410	1690
				0.281	7.1	95.28	141.10	Std.	320	370	660	730	820	890	950	1030	1110	1260	1430	1580	1900
								Alt.	400	460	660	730	820	890	950	1030	1110	1260	1430	1580	1900
			10	0.312	7.9	105.69	156.84	Std.	350	410	740	810	910	980	1050	1140	1230	1400	1590	1760	2110
								Alt.	440	510	740	810	910	980	1050	1140	1230	1400	1590	1760	2110
				0.344	8.7	116.41	172.56	Std.	390	450	810	890	1010	1080	1160	1260	1350	1550	1750	1940	2330
								Alt.	480	560	810	890	1010	1080	1160	1260	1350	1550	1750	1940	2330
			(Std)	0.375	9.5	126.78	188.24	Std.	420	490	890	970	1100	1180	1270	1370	1480	1690	1910	2110	2540
								Alt.	530	620	890	970	1100	1180	1270	1370	1480	1690	1910	2110	2540
				0.406	10.3	137.12	203.88	Std.	460	530	960	1050	1190	1280	1370	1480	1600	1830	2070	2290	2750
								Alt.	570	670	960	1050	1190	1280	1370	1480	1600	1830	2070	2290	2750
				0.438	11.1	147.78	219.50	Std.	490	570	1030	1130	1280	1380	1480	1600	1720	1970	2230	2470	2970
								Alt.	620	720	1030	1130	1280	1380	1480	1600	1720	1970	2230	2470	2970
				0.469	11.9	158.08	235.09	Std.	530	620	1110	1210	1370	1480	1580	1710	1850	2110	2390	2640	2970
								Alt.	660	770	1110	1210	1370	1480	1580	1710	1850	2110	2390	2640	3180
			20 (XS)	0.500	12.7	168.37	250.64	Std.	560	660	1180	1290	1460	1580	1690	1830	1970	2250	2550	2820	2970
								Alt.	700	820	1180	1290	1460	1580	1690	1830	1970	2250	2550	2820	3390
				0.562	14.3	188.87	281.65	Std.	630	740	1330	1450	1640	1770	1900	2050	2210	2530	2860	2970	2970
								Alt.	790	920	1330	1450	1640	1770	1900	2050	2210	2530	2860	3160	3630
			30	0.625	15.9	209.62	312.54	Std.	700	820	1480	1620	1830	1970	2110	2290	2460	2810	2970	2970	2970
								Alt.	880	1030	1480	1620	1830	1970	2110	2290	2460	2810	3190	3520	3630
			40	0.688	17.5	230.29	343.30	Std.	770	900	1630	1780	2010	2170	2320	2520	2710	2970	2970	2970	2970
								Alt.	970	1130	1630	1780	2010	2170	2320	2520	2710	3100	3510	3630	3630
				0.750	19.1	250.55	373.93	Std.	840	980	1770	1940	2190	2360	2530	2740	2950	2970	2970	2970	2970
								Alt.	1050	1230	1770	1940	2190	2360	2530	2740	2950	3380	3630	3630	3630
				0.812	20.6	270.72	402.54	Std.	910	1070	1920	2100	2380	2560	2740	2970	2970	2970	2970	2970	2970
								Alt.	1140	1330	1920	2100	2380	2560	2740	2970	3200	3630	3630	3630	3630
				0.875	22.2	291.14	432.93	Std.	980	1150	2070	2260	2560	2760	2950	2970	2970	2970	2970	2970	2970
								Alt.	1230	1440	2070	2260	2560	2760	2950	3200	3450	3630	3630	3630	3630
				0.938	23.8	311.47	463.19	Std.	1060	1230	2220	2430	2740	2950	2970	2970	2970	2970	2970	2970	2970
								Alt.	1320	1540	2220	2430	2740	2950	3170	3430	3630	3630	3630	3630	3630
				1.000	25.4	331.39	493.32	Std.	1130	1310	2360	2590	2930	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2930	3150	3380	3630	3630	3630	3630	3630	3630
				1.062	27.0	351.23	523.33	Std.	1190	1390	2510	2750	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1490	1740	2510	2750	3110	3350	3580	3630	3630	3630	3630	3630	3630
				1.125	28.6	371.31	553.22	Std.	1270	1480	2660	2910	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1580	1850	2660	2910	3290	3540	3630	3630	3630	3630	3630	3630	3630
				1.188	30.2	391.30	582.98	Std.	1340	1560	2810	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1670	1950	2810	3070	3470	3630	3630	3630	3630	3630	3630	3630	3630
				1.250	31.8	410.90	612.61	Std.	1410	1640	2950	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1760	2050	2950	3230	3630	3630	3630	3630	3630	3630	3630	3630	3630

Pipes API PIPES (API 5L)

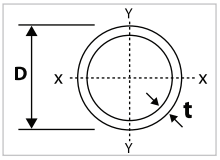


7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M		Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)												
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
34	34.000	864.0		0.250	6.4	90.20	135.35	Std.	260	310	560	610	690	740	790	860	930	1060	1200	1330	1600
								Alt.	330	390	560	610	690	740	790	860	930	1060	1200	1330	1600
				0.281	7.1	101.29	150.03	Std.	300	350	620	680	770	830	890	970	1040	1190	1350	1490	1790
								Alt.	370	430	620	680	770	830	890	970	1040	1190	1350	1490	1790
				0.312	7.9	112.36	166.78	Std.	330	390	690	760	860	920	990	1070	1160	1320	1500	1650	1990
								Alt.	410	480	690	760	860	920	990	1070	1160	1320	1500	1650	1990
			10	0.344	8.7	123.77	183.50	Std.	360	420	760	840	950	1020	1090	1180	1270	1460	1650	1820	2190
								Alt.	460	530	760	840	950	1020	1090	1180	1270	1460	1650	1820	2190
			(Std)	0.375	9.5	134.79	200.18	Std.	400	460	830	910	1030	1110	1190	1290	1390	1590	1800	1990	2390
								Alt.	500	580	830	910	1030	1110	1190	1290	1390	1590	1800	1990	2390
				0.406	10.3	145.80	216.84	Std.	430	500	900	990	1120	1200	1290	1400	1500	1720	1950	2150	2590
								Alt.	540	630	900	990	1120	1200	1290	1400	1500	1720	1950	2150	2590
				0.438	11.1	157.14	233.46	Std.	460	540	970	1070	1210	1300	1390	1510	1620	1860	2100	2320	2790
								Alt.	580	680	970	1070	1210	1300	1390	1510	1620	1860	2100	2320	2790
				0.469	11.9	168.11	250.05	Std.	500	580	1040	1140	1290	1390	1490	1610	1740	1990	2250	2490	2970
								Alt.	620	720	1040	1140	1290	1390	1490	1610	1740	1990	2250	2490	2990
			20 (XS)	0.500	12.7	179.06	266.61	Std.	530	620	1110	1220	1380	1480	1590	1720	1850	2120	2400	2650	2970
								Alt.	660	770	1110	1220	1380	1480	1590	1720	1850	2120	2400	2650	3190
				0.562	14.3	200.89	299.64	Std.	600	690	1250	1370	1550	1670	1790	1930	2080	2380	2700	2970	2970
								Alt.	740	870	1250	1370	1550	1670	1790	1930	2080	2380	2700	2980	3580
			30	0.625	15.9	222.99	332.53	Std.	660	770	1390	1520	1720	1850	1990	2150	2320	2650	2970	2970	2970
								Alt.	830	970	1390	1520	1720	1850	1990	2150	2320	2650	3000	3310	3630
			40	0.688	17.5	245.00	365.31	Std.	730	850	1530	1680	1890	2040	2190	2370	2550	2910	2970	2970	2970
								Alt.	910	1060	1530	1680	1890	2040	2190	2370	2550	2910	3300	3630	3630
				0.750	19.1	266.58	397.95	Std.	790	930	1670	1830	2060	2220	2380	2580	2780	2970	2970	2970	2970
								Alt.	990	1160	1670	1830	2060	2220	2380	2580	2780	3180	3600	3630	3630
				0.812	20.6	288.08	428.44	Std.	860	1000	1810	1980	2240	2410	2580	2790	2970	2970	2970	2970	2970
								Alt.	1070	1250	1810	1980	2240	2410	2580	2790	3010	3440	3630	3630	3630
				0.875	22.2	309.84	460.85	Std.	930	1080	1950	2130	2410	2590	2780	2970	2970	2970	2970	2970	2970
								Alt.	1160	1350	1950	2130	2410	2590	2780	3010	3240	3630	3630	3630	3630
				0.938	23.8	331.52	493.12	Std.	990	1160	2090	2280	2580	2780	2970	2970	2970	2970	2970	2970	2970
								Alt.	1240	1450	2090	2280	2580	2780	2980	3230	3480	3630	3630	3630	3630
				1.000	25.4	352.77	525.27	Std.	1060	1240	2220	2440	2750	2960	2970	2970	2970	2970	2970	2970	2970
								Alt.	1320	1540	2220	2440	2750	2960	3180	3440	3630	3630	3630	3630	3630
				1.062	27.0	373.94	557.29	Std.	1120	1310	2360	2590	2920	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2920	3150	3370	3630	3630	3630	3630	3630	3630
				1.125	28.6	395.36	589.19	Std.	1190	1390	2500	2740	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1490	1740	2500	2740	3100	3340	3570	3630	3630	3630	3630	3630	3630
				1.188	30.2	416.70	620.96	Std.	1260	1470	2640	2890	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1570	1830	2640	2890	3270	3520	3630	3630	3630	3630	3630	3630	3630
				1.250	31.8	437.62	652.60	Std.	1320	1540	2780	2970	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1650	1930	2780	3040	3440	3630	3630	3630	3630	3630	3630	3630	3630

Pipes API PIPES (API 5L)



7a(i) API Pipes (API 5L)

Plain-end Line Pipe Dimension, Weight per Unit Length and Test Pressures
API Specification 5L

Nominal Size	Outside Diameter D		Wall Thickness Sch. No (Class)	t		Unit Weight M			Minimum Test Pressure (psi) API 5L PSL 1 and 2 (Pipe Grade)													
	In	mm		In	mm	lb/ft	kg/m		L210 or Grade A	L245 or Grade B	L290 or Grade X42	L320 or Grade X46	L360 or Grade X52	L390 or Grade X56	L415 or Grade X60	L450 or Grade X65	L485 or Grade X70	L555 or Grade X80	L625 or Grade X90	L690 or Grade X100	L830 or Grade X120
36	36.000	914.0		0.250	6.4	95.54	143.24	Std.	250	290	530	580	650	700	750	810	880	1000	1130	1250	1510
								Alt.	310	360	530	580	650	700	750	810	880	1000	1130	1250	1510
				0.281	7.1	107.30	158.79	Std.	280	330	590	650	730	790	840	910	980	1120	1270	1410	1690
								Alt.	350	410	590	650	730	790	840	910	980	1120	1270	1410	1690
			10	0.312	7.9	119.03	176.52	Std.	310	360	660	720	810	870	940	1010	1090	1250	1410	1560	1880
								Alt.	390	460	660	720	810	870	940	1010	1090	1250	1410	1560	1880
				0.344	8.7	131.12	194.22	Std.	340	400	720	790	890	960	1030	1120	1200	1380	1560	1720	2070
								Alt.	430	500	720	790	890	960	1030	1120	1200	1380	1560	1720	2070
			(Std)	0.375	9.5	142.81	211.90	Std.	380	440	790	860	980	1050	1130	1220	1310	1500	1700	1880	2260
								Alt.	470	550	790	860	980	1050	1130	1220	1310	1500	1700	1880	2260
				0.406	10.3	154.48	229.54	Std.	410	470	850	930	1060	1140	1220	1320	1420	1620	1840	2030	2440
								Alt.	510	590	850	930	1060	1140	1220	1320	1420	1620	1840	2030	2440
				0.438	11.1	166.51	247.15	Std.	440	510	920	1010	1140	1230	1310	1420	1530	1750	1980	2190	2640
								Alt.	550	640	920	1010	1140	1230	1310	1420	1530	1750	1980	2190	2640
				0.469	11.9	178.14	264.72	Std.	470	550	980	1080	1220	1310	1410	1520	1640	1880	2130	2350	2820
								Alt.	590	680	980	1080	1220	1310	1410	1520	1640	1880	2130	2350	2820
			20 (XS)	0.500	12.7	189.75	282.27	Std.	500	580	1050	1150	1300	1400	1500	1630	1750	2000	2270	2500	2970
								Alt.	630	730	1050	1150	1300	1400	1500	1630	1750	2000	2270	2500	3010
				0.562	14.3	212.90	317.27	Std.	560	660	1180	1290	1460	1570	1690	1830	1970	2250	2550	2810	2970
								Alt.	700	820	1180	1290	1460	1570	1690	1830	1970	2250	2550	2810	3380
			30	0.625	15.9	236.35	352.14	Std.	630	730	1310	1440	1630	1750	1880	2030	2190	2500	2830	2970	2970
								Alt.	780	910	1310	1440	1630	1750	1880	2030	2190	2500	2830	3130	3630
				0.688	17.5	259.71	386.88	Std.	690	800	1440	1580	1790	1930	2060	2240	2410	2750	2970	2970	2970
								Alt.	860	1000	1440	1580	1790	1930	2060	2240	2410	2750	3120	3440	3630
			40	0.750	19.1	282.62	421.50	Std.	750	880	1580	1730	1950	2100	2250	2440	2630	2970	2970	2970	2970
								Alt.	940	1090	1580	1730	1950	2100	2250	2440	2630	3000	3400	3630	3630
				0.812	20.6	305.44	453.84	Std.	810	950	1710	1870	2110	2270	2440	2640	2840	2970	2970	2970	2970
								Alt.	1020	1180	1710	1870	2110	2270	2440	2640	2840	3250	3630	3630	3630
				0.875	22.2	328.55	488.22	Std.	880	1020	1840	2010	2280	2450	2630	2840	2970	2970	2970	2970	2970
								Alt.	1090	1280	1840	2010	2280	2450	2630	2840	3060	3500	3630	3630	3630
				0.938	23.8	351.57	522.47	Std.	940	1090	1970	2160	2440	2630	2810	2970	2970	2970	2970	2970	2970
								Alt.	1170	1370	1970	2160	2440	2630	2810	3050	3280	3630	3630	3630	3630
				1.000	25.4	374.15	556.59	Std.	1000	1170	2100	2300	2600	2800	2970	2970	2970	2970	2970	2970	2970
								Alt.	1250	1460	2100	2300	2600	2800	3000	3250	3500	3630	3630	3630	3630
				1.062	27.0	396.64	590.58	Std.	1060	1240	2230	2440	2760	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1330	1550	2230	2440	2760	2970	3190	3450	3630	3630	3630	3630	3630
				1.125	28.6	419.42	624.45	Std.	1130	1310	2360	2590	2930	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1410	1640	2360	2590	2930	3150	3380	3630	3630	3630	3630	3630	3630
				1.188	30.2	442.10	658.19	Std.	1190	1390	2490	2730	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1490	1730	2490	2730	3090	3330	3560	3630	3630	3630	3630	3630	3630
				1.250	31.8	464.35	691.81	Std.	1250	1460	2630	2880	2970	2970	2970	2970	2970	2970	2970	2970	2970
								Alt.	1560	1820	2630	2880	3250	3500	3630	3630	3630	3630	3630	3630	3630

Note : The value stated for imperials and metrics are not necessarily exact equivalents, therefore, each system to be used independently and regards as separately standard.

7b) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless

America Standard (Extracts from ASTM A-53 : 2007)

General Information

ASTM A53 covers seamless and welded black and hot-dipped galvanized steel pipe in NPS 1/8 to NPS 26 [DN 6 to DN 650. Pipe ordered under this specification is intended for mechanical and pressure applications and is also acceptable for ordinary uses in steam, water, gas and air lines.

Chemical Composition

The chemical Composition thus determined shall conform to the requirements given in Table 1.

Table 1. Chemical Requirements

Composition, Max,%									
	Carbon	Manganese	Phosphorus	Sulfur	Copper [A]	Nickel [A]	Chromium [A]	Molybdenum [A]	Vanadium [A]
Type S (Seamless Pipe)									
Grade A	0.25	0.95	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Grade B	0.30	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Type E (Electric-Resistance-Welded)									
Grade A	0.25	0.95	0.05	0.045	0.50	0.40	0.40	0.15	0.08
Grade B	0.30	1.20	0.05	0.045	0.50	0.40	0.40	0.15	0.08
Type F (Furnace-Welded Pipe)									
Grade A	0.30	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08

[A] The combination of these five elements shall not exceed 1.00%.

Mechanical Strength (Tensile Test)

The material shall conform to the requirements as to Tensile Properties prescribed in Table 2.

Table 2. Mechanical Properties

	Type E And S	
	Grade A	Grade B
Tensile strength, min, psi [MPa]	48000 [330]	60000 [415]
Yield strength, min, psi [MPa]	30000 [205]	35000 [240]
Elongation in 2 in. [50mm]	[A]	[A]

[A] See Table 4, whichever is applicable, for minimum elongation values for various size tension specimens and grades.

Bending Test

For pipe NPS 2 [DN 50] and smaller, a sufficient length of pipe shall be capable of being bent cold through 90° around a cylindrical mandrel, the diameter of which is twelve times the specified outside diameter of the pipe, without developing cracks at any portion and without opening the weld.

Cold Flattening Test

The flattening test shall be made on welded pipe over NPS 2 [DN 50] with all thickness extra strong and lighter.

Electric-Resistance-Welded Pipe- A test specimen at least 4 in. [100mm] in length shall be flattened cold between parallel plates in three steps with the weld located either 0˚ or 90˚ from the line of direction of the force.
1) During the first step, Which is a test for ductility of the weld, no cracks or breaks on the inside or outside surfaces at the weld shall occur until the distance between the plates is less than two thirds of the specified diameter of the pipe.
2) The flattening shall be continued as a test for ductility away from the weld. During the second step, no crack or breaks on the inside or outside surface away from the weld shall be present before the distance between the plates is less than one third of the specified outside diameter of the pipe but is not less than five times the specified wall thickness of the pipe.
3) During the third step, which is a test for soundness, the flattening shall be continued until the test specimen breaks or the opposite walls of the test specimen meet. Evidence of laminated or unsound material or of incomplete weld that is revealed by the flattening test shall be cause for rejection.

Hydrostatic Test

The hydrostatic test shall be applied, without leakage through the weld seam or the pipe body. Plain –end pipe shall be hydrostatically tested to the applicable pressure given in Table 7b (i). For all sizes of pipe, the hydrostatic test pressure shall be maintained for at least 5s.

Tolerances On Dimensions and Mass

The tolerances on dimensions shall respectively conform to Table 3.

Table 3. Tolerance on dimensions

Characteristic	Circular Hollow Sections		
Outside Dimension (*OD*)	Specified OD (mm)	Tolerance (mm)	
	NPS 1 ½ [DN 40] or smaller, NPS 2 [DN 50] or larger,	Shall not vary more than ±1/64 in. [0.4mm] Shall not vary more than ±1%	
Thickness (*t*)	Shall be not more than 12.5% under the specified wall thickness		
Length	-		
Straightness	Shall be reasonably straight		
Out-of-roundness	-		
Concavity / convexity	-		
Radius of Corners	-		
Squareness of Sides	-		
Twist	-		
Inner Flash	-		
End tolerance on diameter	-		
End Facing	NPS 1 ½ [DN 40] or smaller	Unless otherwise specified on the purchase order, end finish shall be at the option of the manufacturer.	
	NPS 2 [DN 50] or larger	Bevel angle	30°, +5°, -0°
		Root face	[1.6 mm ± 0.8 mm]
Mass (*m*) per unit length	Shall not vary by more than ±10%		

Table 4 : Elongation Values

Area A (mm^2)	Specific Wall Thickness, mm	Elongation in 50mm, min, %	
	Tension Test Specimen (38mm Specimen)	Grade A	Grade B
30 - 39	-	22	18
40 - 49	-	23	19
50 - 59	-	24	19
60 - 69	1.6 - 1.8	24	20
70 - 79	1.9 - 2.0	25	21
80 - 89	2.1 - 2.3	26	21
90 - 99	2.4 - 2.6	26	21
100 - 109	2.7 - 2.8	27	22
110 - 119	2.9 - 3.1	27	22
120 - 129	3.2 - 3.4	28	23
130 - 139	3.5 - 3.6	28	23
140 - 149	3.7 - 3.9	29	23
150 - 159	4.0 - 4.1	29	24
160 - 169	4.2 - 4.4	29	24
170 - 179	4.5 - 4.7	30	24
180 - 189	4.8 - 4.9	30	24
190 - 199	5.0 - 5.2	30	25
200 - 219	5.3 - 5.7	31	25
220 - 239	5.8 - 6.3	31	26
240 - 259	6.4 - 6.8	32	26
260 - 279	6.9 - 7.3	32	26
280 - 299	7.4 - 7.8	33	27
300 - 319	7.9 - 8.4	33	27
320 - 339	8.5 - 8.9	34	27
340 - 359	9.0 - 9.4	34	28
360 - 379	9.5 - 9.9	34	28
380 - 399	10.0 - 10.5	35	28
400 - 419	10.6 - 11.0	35	29
420 - 439	11.1 - 11.5	35	29
440 - 459	11.6 - 12.0	36	29
460 - 479	12.1 - 12.6	36	29
480 - 499	12.7 - 13.1	36	30
500 and greater	13.2 and greater	36	30

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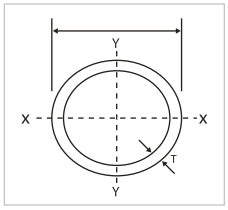

7b(i) ASTM Standard Welded Steel Pipes

(Dimension and Properties in accordance to ASTM A-53 : 2007)

Circular

NPS Designator	DN Designator	Specified Outside Diameter D		Specified Wall Thickness t		Nominal Weight (Mass) Per Unit Length, Plain End		Weight Class	Schedule No.	Test Pressure			
										Grade A		Grade B	
		in.	mm	in.	mm	lb / ft	kg / m			[A] psi	kPa	[A] psi	kPa
1/8	**6**	0.405	10.3	0.068	1.73	0.24	0.37	STD	40	700	4800	700	4800
				0.095	2.41	0.31	0.47	XS	80	850	5900	850	5900
1/4	**8**	0.540	13.7	0.088	2.24	0.43	0.63	STD	40	700	4800	700	4800
				0.119	3.02	0.54	0.80	XS	80	850	5900	850	5900
3/8	**10**	0.675	17.1	0.091	2.31	0.57	0.84	STD	40	700	4800	700	4800
				0.126	3.20	0.74	1.10	XS	80	850	5900	850	5900
1/2	**15**	0.840	21.3	0.109	2.77	0.85	1.27	STD	40	700	4800	700	4800
				0.147	3.73	1.09	1.62	XS	80	850	5900	850	5900
				0.188	4.78	1.31	1.95	-	160	900	6200	900	6200
				0.294	7.47	1.72	2.55	XXS	-	1000	6900	1000	6900
3/4	**20**	1.050	26.7	0.113	2.87	1.13	1.69	STD	40	700	4800	700	4800
				0.154	3.91	1.48	2.20	XS	80	850	5900	850	5900
				0.219	5.56	1.95	2.90	-	160	950	6500	950	6500
				0.308	7.82	2.44	3.64	XXS	-	1000	6900	1000	6900
1	**25**	1.315	33.4	0.133	3.38	1.68	2.50	STD	40	700	4800	700	4800
				0.179	4.55	2.17	3.24	XS	80	850	5900	850	5900
				0.250	6.35	2.85	4.24	-	160	950	6500	950	6500
				0.358	9.09	3.66	5.45	XXS	-	1000	6900	1000	6900
1 1/4	**32**	1.660	42.2	0.140	3.56	2.27	3.39	STD	40	1200	8300	1300	9000
				0.191	4.85	3.00	4.47	XS	80	1800	12400	1900	13100
				0.250	6.35	3.77	5.61	-	160	1900	13100	2000	13800
				0.382	9.70	5.22	7.77	XXS	-	2200	15200	2300	15900
1 1/2	**40**	1.900	48.3	0.145	3.68	2.72	4.05	STD	40	1200	8300	1300	9000
				0.200	5.08	3.63	5.41	XS	80	1800	12400	1900	13100
				0.281	7.14	4.86	7.25	-	160	1950	13400	2050	14100
				0.400	10.16	6.41	9.56	XXS	-	2200	15200	2300	15900
2	**50**	2.375	60.3	0.154	3.91	3.66	5.44	STD	40	2300	15900	2500	17200
				0.218	5.54	5.03	7.48	XS	80	2500	17200	2500	17200
				0.344	8.74	7.47	11.11	-	160	2500	17200	2500	17200
				0.436	11.07	9.04	13.44	XXS	-	2500	17200	2500	17200
2 1/2	**65**	2.875	73.0	0.203	5.16	5.80	8.63	STD	40	2500	17200	2500	17200
				0.276	7.01	7.67	11.41	XS	80	2500	17200	2500	17200
				0.375	9.52	10.02	14.90	-	160	2500	17200	2500	17200
				0.552	14.02	13.71	20.39	XXS	-	2500	17200	2500	17200
3	**80**	3.500	88.9	0.125	3.18	4.51	6.72	-	-	1290	8900	1500	10000
				0.156	3.96	5.58	8.29	-	-	1600	11000	1870	12900
				0.188	4.78	6.66	9.92	-	-	1930	13330	2260	15600
				0.216	5.49	7.58	11.29	STD	40	2220	15300	2500	17200
				0.250	6.35	8.69	12.93	-	-	2500	17200	2500	17200
				0.281	7.14	9.67	14.40	-	-	2500	17200	2500	17200
				0.300	7.62	10.26	15.27	XS	80	2500	17200	2500	17200
				0.438	11.13	14.34	21.35	-	160	2500	17200	2500	17200
				0.600	15.24	18.60	27.68	XXS	-	2500	17200	2500	17200
3 1/2	90	4.000	101.6	0.125	3.18	5.18	7.72	-	-	1120	7700	1310	19000
				0.156	3.96	6.41	9.53	-	-	1400	6700	1640	11300
				0.188	4.78	7.66	11.41	-	-	1690	11700	1970	13600
				0.226	5.74	9.12	13.57	STD	40	2030	14000	2370	16300
				0.250	6.35	10.02	14.92	-	-	2250	15500	2500	17200
				0.281	7.14	11.17	16.63	-	-	2500	17200	2500	17200
				0.318	8.08	12.52	18.63	XS	80	2800	19300	2800	19300

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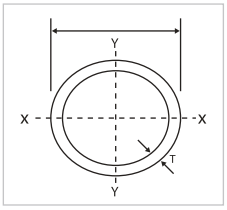

7b(i) ASTM Standard Welded Steel Pipes

(Dimension and Properties in accordance to ASTM A-53 : 2007)

Circular

NPS Designator	DN Designator	Specified Outside Diameter D		Specified Wall Thickness t		Nominal Weight (Mass) Per Unit Length, Plain End		Weight Class	Schedule No.	Test Pressure			
										Grade A		Grade B	
		in.	mm	in.	mm	lb / ft	kg / m			[A] psi	kPa	[A] psi	kPa
4	**100**	4.500	114.3	0.125	3.18	5.85	8.71	-	-	1000	6900	1170	8100
				0.156	3.96	7.24	10.78	-	-	1250	8600	1460	10100
				0.188	4.78	8.67	12.91	-	-	1500	10300	1750	12100
				0.219	5.56	10.02	14.91	-	-	1750	12100	2040	14100
				0.237	6.02	10.80	16.07	STD	40	1900	13100	2210	15200
				0.250	6.35	11.36	16.90	-	-	2000	13800	2330	16100
				0.281	7.14	12.67	18.87	-	-	2250	15100	2620	18100
				0.312	7.92	13.97	20.78	-	-	2500	17200	2800	19300
				0.337	8.56	15.00	22.32	XS	80	2700	18600	2800	19300
				0.438	11.13	19.02	28.32	-	120	2800	19300	2800	19300
				0.531	13.49	22.53	33.54	-	160	2800	19300	2800	19300
				0.674	17.12	27.57	41.03	XXS	-	2800	19300	2800	19300
5	**125**	5.563	141.3	0.156	3.96	9.02	13.41	-	-	1010	7000	1180	8100
				0.188	4.78	10.80	16.09	-	-	1220	8400	1420	9800
				0.219	5.56	12.51	18.61	-	-	1420	9800	1650	11400
				0.258	6.55	14.63	21.77	STD	40	1670	11500	1950	13400
				0.281	7.14	15.87	23.62	-	-	1820	12500	2120	14600
				0.312	7.92	17.51	26.05	-	-	2020	13900	2360	16300
				0.344	8.74	19.19	28.57	-	-	2230	15400	2600	17900
				0.375	9.52	20.80	30.94	XS	80	2430	16800	2800	19300
				0.500	12.70	27.06	40.28	-	120	2800	19300	2800	19300
				0.625	15.88	32.99	49.11	-	160	2800	19300	2800	19300
				0.750	19.05	38.59	57.43	XXS	-	2800	19300	2800	19300
6	**150**	6.625	168.3	0.188	4.78	12.94	19.27	-	-	1020	7000	1190	8200
				0.219	5.56	15.00	22.31	-	-	1190	8200	1390	9600
				0.250	6.35	17.04	25.36	-	-	1360	9400	1580	10900
				0.280	7.11	18.99	28.26	STD	40	1520	10500	1780	12300
				0.312	7.92	21.06	31.32	-	-	1700	11700	1980	13700
				0.344	8.74	23.10	34.39	-	-	1870	12900	2180	15000
				0.375	9.52	25.05	37.28	-	-	2040	14100	2380	16400
				0.432	10.97	28.60	42.56	XS	80	2350	16200	2740	18900
				0.562	14.27	36.43	54.20	-	120	2800	19300	2800	19300
				0.719	18.26	45.39	67.56	-	160	2800	19300	2800	19300
				0.864	21.95	53.21	79.22	XXS	-	2800	19300	2800	19300
8	**200**	8.625	219.1	0.188	4.78	16.96	25.26	-	-	780	5400	920	6300
				0.203	5.16	18.28	27.22	-	-	850	5900	1000	6900
				0.219	5.56	19.68	29.28	-	-	910	6300	1070	7400
				0.250	6.35	22.38	33.31	-	20	1040	7200	1220	8400
				0.277	7.04	24.72	36.31	-	30	1160	7800	1350	9300
				0.312	7.92	27.73	41.24	-	-	1300	9000	1520	10500
				0.322	8.18	28.58	42.55	STD	40	1340	9200	1570	10800
				0.344	8.74	30.45	45.34	-	-	1440	9900	1680	11600
				0.375	9.52	33.07	49.20	-	-	1570	10800	1830	12600
				0.406	10.31	35.67	53.08	-	60	1700	11700	2000	13800
				0.438	11.13	38.33	57.08	-	-	1830	12600	2130	14700
				0.500	12.70	43.43	64.64	XS	80	2090	14400	2430	16800
				0.594	15.09	51.00	75.92	-	100	2500	17200	2800	19300
				0.719	18.26	60.77	90.44	-	120	2800	19300	2800	19300
				0.812	20.62	67.82	100.92	-	140	2800	19300	2800	19300
				0.875	22.22	72.49	107.88	XXS	-	2800	19300	2800	19300
				0.906	23.01	74.76	111.27	-	160	2800	19300	2800	19300

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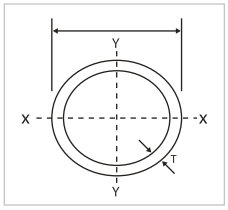

7b(i) ASTM Standard Welded Steel Pipes

(Dimension and Properties in accordance to ASTM A-53 : 2007)

Circular

NPS Designator	DN Designator	Specified Outside Diameter D		Specified Wall Thickness t		Nominal Weight (Mass) Per Unit Length, Plain End		Weight Class	Schedule No.	Test Pressure			
										Grade A		Grade B	
		in.	mm	in.	mm	lb / ft	kg / m			[A] psi	kPa	[A] psi	kPa
10	**250**	10.750	273.0	0.188	4.78	21.23	31.62	-	-	630	4300	730	5000
				0.203	5.16	22.89	34.08	-	-	680	4700	800	5500
				0.219	5.56	24.65	36.67	-	-	730	5000	860	5900
				0.250	6.35	28.06	41.75	-	20	840	5800	980	6800
				0.279	7.09	31.23	46.49	-	-	930	6400	1090	7500
				0.307	7.80	34.27	51.01	-	30	1030	7100	1200	8300
				0.344	8.74	38.27	56.96	-	-	1150	7900	1340	9200
				0.365	9.27	40.52	60.29	STD	40	1220	8400	1430	9900
				0.438	11.13	48.28	71.87	-	-	1470	10100	1710	11800
				0.500	12.70	54.79	81.52	XS	60	1670	11500	1950	13400
				0.594	15.09	64.49	95.97	-	80	1990	13700	2320	16000
				0.719	18.26	77.10	114.70	-	100	2410	16600	2800	19300
				0.844	21.44	89.38	133.00	-	120	2800	19300	2800	19300
				1.000	25.40	104.23	155.09	XXS	140	2800	19300	2800	19300
				1.125	28.57	115.75	172.21	-	160	2800	19300	2800	19300
12	**300**	12.750	323.8	0.203	5.16	27.23	40.55	-	-	570	3900	670	4600
				0.219	5.56	29.34	43.63	-	-	620	4300	720	5000
				0.250	6.35	33.41	49.71	-	20	710	4900	820	5700
				0.281	7.14	37.46	55.75	-	-	790	5400	930	6400
				0.312	7.92	41.48	61.69	-	-	880	6100	1030	7100
				0.330	8.38	43.81	65.18	-	30	930	6400	1090	7500
				0.344	8.74	45.62	67.90	-	-	970	6700	1130	7800
				0.375	9.52	49.61	73.78	STD	-	1060	7300	1240	8500
				0.406	10.31	53.57	79.70	-	40	1150	7900	1340	9200
				0.438	11.13	57.65	85.82	-	-	1240	8500	1440	9900
				0.500	12.70	65.48	97.43	XS	-	1410	9700	1650	11400
				0.562	14.27	73.22	108.92	-	60	1590	11000	1850	12800
				0.688	17.48	88.71	132.04	-	80	1940	13400	2270	15700
				0.844	21.44	107.42	159.86	-	100	2390	16500	2780	19200
				1.000	25.40	125.61	186.91	XXS	120	2800	19300	2800	19300
				1.125	28.57	139.81	208.00	-	140	2800	19300	2800	19300
				1.312	33.32	160.42	238.68	-	160	2800	19300	2800	19300
14	**350**	14.000	355.6	0.210	5.33	30.96	46.04	-	-	540	3700	630	4300
				0.219	5.56	32.26	47.99	-	-	560	3900	660	4500
				0.250	6.35	36.75	54.69	-	10	640	4400	750	5200
				0.281	7.14	41.21	61.35	-	-	720	5000	840	5800
				0.312	7.92	45.65	67.90	-	20	800	5500	940	6500
				0.344	8.74	50.22	74.76	-	-	880	6100	1030	7100
				0.375	9.52	54.62	81.25	STD	30	960	6600	1120	7700
				0.438	11.13	63.50	94.55	-	40	1130	7800	1310	9000
				0.469	11.91	67.84	100.94	-	-	1210	8300	1410	9700
				0.500	12.70	72.16	107.39	XS	-	1290	8900	1500	10300
				0.594	15.09	85.13	126.71	-	60	1530	10500	1790	12300
				0.750	19.05	106.23	158.10	-	80	1930	13300	2250	15500
				0.938	23.83	130.98	194.96	-	100	2410	16600	2800	19300
				1.094	27.79	150.93	224.65	-	120	2800	19300	2800	19300
				1.250	31.75	170.37	253.56	-	140	2800	19300	2800	19300
				1.406	35.71	189.29	281.70	-	160	2800	19300	2800	19300
				2.000	50.80	256.56	381.83	-	-	2800	19300	2800	19300
				2.125	53.97	269.76	401.44	-	-	2800	19300	2800	19300
				2.200	55.88	277.51	413.01	-	-	2800	19300	2800	19300
				2.500	63.50	307.34	457.40	-	-	2800	19300	2800	19300

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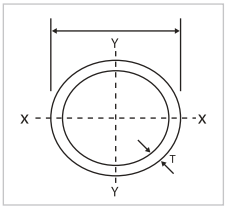

7b(i) ASTM Standard Welded Steel Pipes

(Dimension and Properties in accordance to ASTM A-53 : 2007)

Circular

NPS Designator	DN Designator	Specified Outside Diameter D		Specified Wall Thickness t		Nominal Weight (Mass) Per Unit Length, Plain End		Weight Class	Schedule No.	Test Pressure			
										Grade A		Grade B	
		in.	mm	in.	mm	lb / ft	kg / m			[A] psi	kPa	[A] psi	kPa
16	**400**	16.000	406.4	0.219	5.56	36.95	54.96	-	-	490	3400	570	3900
				0.250	6.35	42.09	62.64	-	10	560	3900	660	4500
				0.281	7.14	47.22	70.30	-	-	630	4300	740	5100
				0.312	7.92	52.32	77.83	-	20	700	4800	820	5700
				0.344	8.74	57.57	85.71	-	-	770	5300	900	6200
				0.375	9.52	62.64	93.17	STD	30	840	5800	980	6800
				0.438	11.13	72.86	108.49	-	-	990	6800	1150	7900
				0.469	11.91	77.87	115.86	-	-	1060	7300	1230	8500
				0.500	12.70	82.85	123.30	XS	40	1120	7700	1310	9000
				0.656	16.66	107.60	160.12	-	60	1480	10200	1720	11900
				0.844	21.44	136.74	203.53	-	80	1900	13100	2220	15300
				1.031	26.19	164.98	245.56	-	100	2320	16000	2710	18700
				1.219	30.96	192.61	286.64	-	120	2740	18900	2800	19300
				1.438	36.53	223.85	333.19	-	140	2800	19300	2800	19300
				1.594	40.49	245.48	365.35	-	160	2800	19300	2800	19300
18	**450**	18.000	457	0.250	6.35	47.44	70.60	-	10	500	3400	580	4000
				0.281	7.14	53.23	79.24	-	-	560	3900	660	4500
				0.312	7.92	58.99	87.75	-	20	620	4300	730	5000
				0.344	8.74	64.93	96.66	-	-	690	4800	800	5500
				0.375	9.52	70.65	105.10	STD	-	750	5200	880	6100
				0.406	10.31	76.36	113.62	-	-	810	5600	950	6500
				0.438	11.13	82.23	122.43	-	30	880	6100	1020	7000
				0.469	11.91	87.89	130.78	-	-	940	6500	1090	7500
				0.500	12.70	93.54	139.20	XS	-	1000	6900	1170	8100
				0.562	14.27	104.76	155.87	-	40	1120	7700	1310	9000
				0.750	19.05	138.30	205.83	-	60	1500	10300	1750	12100
				0.938	23.83	171.08	254.67	-	80	1880	13000	2190	15100
				1.156	29.36	208.15	309.76	-	100	2310	15900	2700	18600
				1.375	34.92	244.37	363.64	-	120	2750	19000	2800	19300
				1.562	39.67	274.48	408.45	-	140	2800	19300	2800	19300
				1.781	45.24	308.79	459.59	-	160	2800	19300	2800	19300
20	**500**	20.000	508	0.250	6.35	52.78	78.55	-	10	450	3100	520	3600
				0.281	7.14	59.23	88.19	-	-	510	3500	590	4100
				0.312	7.92	65.66	97.67	-	-	560	3900	660	4500
				0.344	8.74	72.28	107.6	-	-	620	4300	720	5000
				0.375	9.52	78.67	117.02	STD	20	680	4700	790	5400
				0.406	10.31	84.04	126.53	-	-	730	5000	850	5900
				0.438	11.13	91.59	136.37	-	-	790	5400	920	6300
				0.469	11.91	97.92	145.70	-	-	850	5900	950	6500
				0.500	12.70	104.23	155.12	XS	30	900	6200	1050	7200
				0.594	15.09	123.23	183.42	-	40	1170	8100	1250	8600
				0.812	20.62	166.56	247.83	-	60	1460	10100	1710	11800
				1.031	26.19	209.06	311.17	-	80	1860	12800	2170	15000
				1.281	32.54	256.34	381.53	-	100	2310	15900	2690	18500
				1.500	38.10	296.65	441.49	-	120	2700	18600	2800	19300
				1.750	44.45	341.41	508.11	-	140	2800	19300	2800	19300
				1.969	50.01	379.53	564.81	-	160	2800	19300	2800	19300

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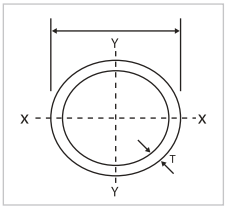


7b(i) ASTM Standard Welded Steel Pipes

(Dimension and Properties in accordance to ASTM A-53 : 2007)

Circular

NPS Designator	DN Designator	Specified Outside Diameter D		Specified Wall Thickness t		Nominal Weight (Mass) Per Unit Length, Plain End		Weight Class	Schedule No.	Test Pressure			
										Grade A		Grade B	
		in.	mm	in.	mm	lb / ft	kg / m			[A] psi	kPa	[A] psi	kPa
24	**600**	24.000	610	0.250	6.35	63.47	94.46	-	10	380	2600	440	3000
				0.281	7.14	71.25	106.08	-	-	420	2900	490	3400
				0.312	7.92	79.01	117.51	-	-	470	3200	550	3800
				0.344	8.74	86.99	129.50	-	-	520	3600	600	4100
				0.375	9.52	94.71	140.88	STD	20	560	3900	660	4500
				0.406	10.31	102.40	152.37	-	-	610	4200	710	4900
				0.438	11.13	110.32	164.26	-	-	660	4500	770	5300
				0.469	11.91	117.98	175.54	-	-	700	4800	820	5700
				0.500	12.70	125.61	186.94	XS	-	750	5200	880	6100
				0.562	14.27	140.81	209.50	-	30	840	5800	980	6800
				0.688	17.48	171.45	255.24	-	40	1030	7100	1200	8300
				0.938	23.83	231.25	344.23	-	-	1410	9700	1640	11300
				0.969	24.61	238.57	355.02	-	60	1450	10000	1700	11700
				1.219	30.96	296.86	441.78	-	80	1830	12600	2130	14700
				1.531	38.89	367.74	547.33	-	100	2300	15900	2680	18500
				1.812	46.02	429.79	639.58	-	120	2720	18800	2800	19300
				2.062	52.37	483.57	719.63	-	140	2800	19300	2800	19300
				2.344	59.54	542.64	807.63	-	160	2800	19300	2800	19300
26	**650**	26.000	660	0.250	6.35	68.82	102.42	-	-	350	2400	400	2800
				0.281	7.14	77.26	115.02	-	-	390	2700	450	3100
				0.312	7.92	85.68	127.43	-	10	430	3000	500	3400
				0.344	8.74	94.35	140.45	-	-	480	3300	560	3900
				0.375	9.52	102.72	152.80	STD	-	520	3600	610	4200
				0.406	10.31	111.08	165.28	-	-	560	3900	660	4500
				0.438	11.13	119.69	178.20	-	-	610	4200	710	4900
				0.469	11.91	128.00	190.46	-	-	650	4500	760	5200
				0.500	12.70	136.30	202.85	XS	20	690	4800	810	5600
				0.562	14.27	152.83	227.37	-	-	780	5400	910	6300

[A] The minumum test pressure for outside diameters and wall thicknesses not listed shall be computed by the formula given below. The computed test pressure shall be used in all cases, except as follows:

(1) For specified wall thicknesses greater than the heaviest specified wall thickness listed in this table for the applicable specified outside diameter, the test pressure shll be the highest value listed for the applicable specified outside diamter and grade.

(2) For pipe smaller than NPS 2 [DN 50] with a specified wall thickness less than the lightest specified wall thickness listed in this table for the applicable specified outside diameter and grade.

(3) For all sizes of Grade A and B pipe smaller than NPS 2 [DN 50], the test pressures were assigned arbitrarily. Test pressures for intermediated specified outside diameters need not exceed those given in this table for the next larger listed size.

$P = 2St/D$

where :

P	=	Minumum hydrostatic test pressure, psi [kPa],
S	=	0.60 times the specified minimum yield strength, psi [kPa],
t	=	Specified wall thickness, in. [mm], and
D	=	specified outside diamter, in. [mm].

7c) ERW Steel Pipes for Concrete Lined Pipes

British Standard (Extracts from BS EN 10224 : 2002 / MS 1968 : 2007)

General Information

BS EN 10224 specifies the requirements for cold-formed welded circular hollow sections that used for the conveyance of aqueous liquids, including water for human consumption.

Chemical Composition

The Cast analysis of the steel shall comply with the requirement of Table 1.

Table 1. Chemical composition limits of the cast analysis

Steel Grade		% By Mass, Maximum				
Steel Name	Steel Number	C	Si	Mn	P	S
L235	0252	0.16	0.35	1.20	0.030	0.025
L275	0260	0.20	0.40	1.40	0.030	0.025
L355	0419	0.22	0.55	1.60	0.030	0.025
For steel L355 additions of niobium, titanium and vanadium are permitted at the discretion of the manufacturer. In this case the inspection documents shall be state the level of these elements.						

Table 2. Permissible deviation of the product analysis from the specified cast analysis limits given in Table 1.

Element	Limiting Values %	Permissible Deviation
C	≤ 0.20 > 0.20	+ 0.02 + 0.03
Si	≤ 0.55	+ 0.05
Mn	≤ 1.60	+ 0.10
P	≤ 0.030	+ 0.005
S	≤ 0.025	+ 0.005
Cu	≤ 0.35 > 0.35	+ 0.05 + 0.07

Mechanical Strength (Tensile Test)

The minimum yield strength, tensile strength range and minimum elongation for the tubes covered shall be accordance to Table 3

Table 3. the minimum yield and tensile strength requirement

Steel Grade/ Name	Tensile Strength MPa	Min Yield Strength MPa For Thickness in mm		Minimum Elongation *A%* ($Lo = 5.65 \sqrt{S_0}$)	
		T ≤ 16	T > 16	Longitudinal	Transverse
L235	360 - 500	235	225	25	23
L275	430 - 570	275	265	21	19
L355	500 - 650	355	345	21	19

Bending Test

The weld of submerged arc welded tubes and the seam weld of fitting and fittings components made from plate or strip shall pass a weld bend test and the test pieces shall be bent through an angle of 180° around a bar of the diameter specified in Table 4. The pipe shall be free from the occurrence of flaws or cracks on its weld metal, fusion line, heat affected zone or parent metal.

Table 4. Weld bend test

Steel Name	Diamater Of Mandrel For The Weld Bend Test
L235	3T
L275	4T
L355	4T

Cold Flattening Test

EW tubes shall pass a flattening test. No crack or imperfections shall be permitted in the metal or in the weld, the weld of welded tubes shall be positioned at 90° to the direction of flattening and the test piece shall be flattened until the distance between the platens is not greater than 67% of the original outside diameter.

Drift Expanding Test

The drift expanding test may replace the flattening test for tubes up to and including 150 mm diameter and 10 mm thickness at the direction of the manufacturer. One end of the test piece shall be expanded using a cone with an included angle (β) of 60° until the increase in outside diameter is not less than the appropriate value given in Table 5 and EW tubes shall pass a drift expanding test in according with Table 5. No cracks or imperfections shall be permitted in the metal or in the weld, except that slight incipient cracking at the edges of the test piece shall not be cause for rejection

Table 5. Drift expanding test

Steel Name	For The Drift Expanding Test % Increase in d/D[a] Ratio	
	≤ 0.8	> 0.8
L235	10	12
L275	8	10
L355	6	8

Remark:
a. d= D-2T

Hydrostatic Test

The Tube shall withstand the test without leakage or visible deformation. The hydrostatic test shall be carried out at a test pressure of 70 bar or P, calculated from the following equation, whichever is the lower, unless is specified by the purchaser.

$$P = \frac{20ST}{D}$$

Where

P is the test pressure in bar
D is the specified outside diameter (mm)
T is the specified wall thickness (mm)
S is the stress in MPa corresponding to 70% of the specified minimum yield strength (Table 3) for the type pf steel concerned.

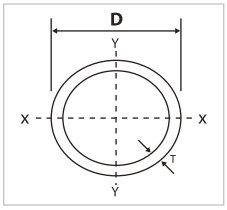
Tolerances On Dimensions and Mass

The Tolerances on dimensions shall be as specified in Table 6.

Table 6. Tolerance on dimensions

Characteristic	Circular Hollow Sections		
Outside Dimension (*OD*)	Specified OD (mm)	Tolerance (mm)	
	OD ≤ 219.1 OD > 219.1	±1% of diameter with a minimum of ± 0.5 mm ±0.75% of diameter	
Thickness (*t*)	Shall not exceed ±10% or ±0.3mm, whichever is greater.		
Length	Length mm	Tube outside diameter	
		< 406.4 mm	≥ 406.4 mm
	2000 < L ≤ 6000	+10 mm 0	+25 mm 0
	6000 < L ≤ 12000	+15 mm 0	+50 mm 0
	L > 12000	+ by agreement 0	
Straightness	Shall not deviate from straightness by more than 0.2% of the total length		
Out-of-roundness (*o*)	Shall not exceed 2%		
Concavity / convexity	-		
Radius of Corners	-		
Squareness of side	-		
Twist	-		
Inner Flash	Height of the internal weld bead Shall not exceed (0.5 + 0.05T) mm		
End tolerance on diameter	Outside diameter mm	End tolerance	
	≤ 219.1 219.1 < D ≤ 2032 > 2032	± 0.5 mm or ± 0.5% D whichever is the greater ± 1.6 mm ± 3 mm	
End Facing	Bevel angle	Root face	
	30°, +5°, -0°	1.6 ± 0.8 mm	
Mass (*m*) per unit length	-		

Pipes BS EN 10224 / MS 1968



7c(i) ERW Steel Pipes for Concrete Lined Pipe

Dimension and Unit Mass
British Standard - BS EN 10224 / MS 1968:2007

Outside Diameter (D)			Wall Thickness (t) mm																							
mm			2.0	2.3	2.6	2.9	3.2	3.6	4.0	4.5	5.0	5.4	5.6	6.3	7.1	8.0	8.8	10.0	11.0	12.5	14.2	16.0	17.5	20.0	22.2	25.0
1	2	3	Mass per unit length, kg/m																							
26.9			1.23	1.40	1.56	1.72	1.87	2.07	2.26	2.49	2.70	2.86	2.94	3.20	3.47	3.73										
		30	1.38	1.57	1.76	1.94	2.11	2.34	2.56	2.83	3.08	3.28	3.27	3.68	4.01	4.34										
	31.8		1.47	1.67	1.87	2.07	2.26	2.50	2.74	3.03	3.30	3.52	3.62	3.96	4.32	4.70										
	32		1.48	1.68	1.89	2.08	2.27	2.52	2.76	3.05	3.33	3.54	3.65	3.99	4.36	4.74										
33.7			1.56	1.78	1.99	2.20	2.41	2.67	2.93	3.24	3.54	3.77	3.88	4.26	4.66	5.07	5.40									
		35	1.63	1.85	2.08	2.30	2.51	2.79	3.06	3.38	3.70	3.94	4.06	4.46	4.89	5.33	5.69									
	38		1.78	2.02	2.27	2.51	2.75	3.05	3.35	3.72	4.07	4.34	4.47	4.93	5.41	5.92	6.34	6.91								
	40		1.87	2.14	2.40	2.65	2.90	3.23	3.55	3.94	4.32	4.61	4.75	5.24	5.76	6.31	6.77	7.40								
42.4			1.99	2.27	2.55	2.82	3.09	3.44	3.79	4.21	4.61	4.93	5.08	5.61	6.18	6.79	7.29	7.99								
		44.5	2.10	2.39	2.69	2.98	3.26	3.63	4.00	4.44	4.87	5.21	5.37	5.94	6.55	7.20	7.75	8.51	9.09	9.86						
48.3			2.28	2.61	2.93	3.25	3.56	3.97	4.37	4.86	5.34	5.71	5.90	6.53	7.21	7.95	8.57	9.45	10.1	11.0						
	51		2.42	2.76	3.10	3.44	3.77	4.21	4.64	5.16	5.67	6.07	6.27	6.94	7.69	8.48	9.16	10.1	10.9	11.9						
		54	2.56	2.93	3.30	3.65	4.01	4.47	4.93	5.49	6.04	5.47	6.68	7.41	8.21	9.08	9.81	10.9	11.7	12.8	13.9					
	57		2.71	3.10	3.49	3.87	4.25	4.74	5.23	5.83	6.41	6.87	7.10	7.88	8.74	9.67	10.5	11.6	12.5	13.7	15.0					
60.3			2.88	3.29	3.70	4.11	4.51	5.03	5.55	6.19	6.82	7.31	7.55	8.39	9.32	10.3	11.2	12.4	13.4	14.7	16.1	17.5				
	63.5		3.03	3.47	3.90	4.33	4.76	5.32	5.87	6.55	7.21	7.74	8.00	8.89	9.88	10.9	11.9	13.2	14.2	15.7	17.3	18.7				
	70		3.35	3.84	4.32	4.80	5.27	5.90	6.51	7.27	8.01	8.60	8.89	9.90	11.0	12.2	13.3	14.8	16.0	17.7	19.5	21.3	22.7			
		73	3.50	4.01	4.51	5.01	5.51	6.16	6.81	7.60	8.38	9.00	9.31	10.4	11.5	12.8	13.9	15.5	16.8	18.7	20.6	22.5	24.0			
76.1			3.65	4.19	4.71	5.24	5.75	6.44	7.11	7.95	8.77	9.42	9.74	10.8	12.1	13.4	14.6	16.3	17.7	19.6	21.7	23.7	25.3			
		82.5	3.97	4.55	5.12	5.69	6.26	7.00	7.74	8.66	9.56	10.3	10.6	11.8	13.2	14.7	16.0	17.9	19.4	21.6	23.9	26.2	28.1	30.8		
88.9			4.29	4.91	5.53	6.15	6.76	7.57	8.38	9.37	10.3	11.1	11.5	12.8	14.3	16.0	17.4	19.5	21.1	23.6	26.2	28.8	30.8	34.0		
	101.6		4.91	5.63	6.35	7.06	7.77	8.70	9.63	10.8	11.9	12.8	13.3	14.8	16.5	18.5	20.1	22.6	24.6	27.5	30.6	33.8	36.3	40.2	43.5	
		108	5.23	6.00	6.76	7.52	8.27	9.27	10.3	11.5	12.7	13.7	14.1	15.8	17.7	19.7	21.5	24.2	26.3	29.4	32.8	36.3	39.1	43.4	47.0	51.2
114.3			5.54	6.35	7.16	7.97	8.77	9.83	10.9	12.2	13.5	14.5	15.0	16.8	18.8	21.0	22.9	25.7	28.0	31.4	35.1	38.8	41.8	46.5	50.4	55.1
	127		6.17	7.07	7.98	8.88	9.77	11.0	12.1	13.6	15.0	16.2	16.8	18.8	21.0	23.5	25.7	28.9	31.5	35.3	39.5	43.8	47.3	52.8	57.4	62.9
	133		6.46	7.41	8.36	9.30	10.2	11.5	12.7	14.3	15.8	17.0	17.6	19.7	22.0	24.7	27.0	30.3	33.1	37.1	41.6	46.2	49.8	55.7	60.7	66.6
139.7			6.79	7.79	8.79	9.78	10.8	12.1	13.4	15.0	16.6	17.9	18.5	20.7	23.2	26.0	28.4	32.0	34.9	39.2	43.9	48.8	52.7	59.0	64.3	70.7
		141.3	6.87	7.88	8.89	9.90	10.9	12.2	13.5	15.2	16.8	18.1	18.7	21.0	23.5	26.3	28.8	32.4	35.3	39.7	44.5	49.4	53.4	59.8	65.2	71.7
		152.4	7.42	8.51	9.61	10.7	11.8	13.2	14.6	16.4	18.2	19.6	20.3	22.7	25.4	28.5	31.2	35.1	38.4	43.1	48.4	53.8	58.2	65.3	71.3	78.5
		159	7.74	8.89	10.0	11.2	12.3	13.8	15.3	17.1	19.0	20.5	21.2	23.7	26.6	29.8	32.6	36.7	40.1	45.2	50.7	56.4	61.1	68.6	74.9	82.6
168.3			8.20	9.42	10.6	11.8	13.0	14.6	16.2	18.2	20.1	21.7	22.5	25.2	28.2	31.6	34.6	39.0	42.7	48.0	54.0	60.1	65.1	73.1	80.0	88.3
		177.8	8.67	9.95	11.2	12.5	13.8	15.5	17.1	19.2	21.3	23.0	23.8	26.6	29.9	33.5	36.7	41.4	45.2	51.0	57.3	63.8	69.2	77.8	85.2	94.2
		193.7	9.46	10.9	12.3	13.6	15.0	16.9	18.7	21.0	23.3	25.1	26.0	29.1	32.7	36.6	40.1	45.3	49.6	55.9	62.9	70.1	76.0	85.7	93.9	104
219.1			10.7	12.3	13.9	15.5	17.0	19.1	21.2	23.8	26.4	28.5	29.5	33.1	37.1	41.6	45.6	51.6	56.5	63.7	71.8	80.1	87.0	98.2	108	120
		244.5	12.0	13.7	15.5	17.3	19.0	21.4	23.7	26.6	29.5	31.8	33.0	37.0	41.6	46.7	51.2	57.8	63.3	71.5	80.6	90.2	98.0	111	122	135
273			13.4	15.4	17.3	19.3	21.3	23.9	26.5	29.8	33.0	35.6	36.9	41.4	46.6	52.3	57.3	64.9	71.1	80.3	90.6	101	110	125	137	153
323.9					20.6	23.0	25.3	28.4	31.6	35.4	39.3	42.4	44.0	49.3	55.5	62.3	68.4	77.4	84.9	96.0	108	121	132	150	165	184
355.6					22.6	25.2	27.8	31.3	34.7	39.0	43.2	46.6	48.3	54.3	61.0	68.6	75.3	85.2	93.5	106	120	134	146	166	183	204
406.4					25.9	28.9	31.8	35.8	39.7	44.6	49.5	53.4	55.4	62.2	69.9	78.6	86.3	97.8	107	121	137	154	168	191	210	235
457							35.8	40.3	44.7	50.2	56.7	60.1	62.3	70.0	78.8	88.6	97.3	110	121	137	155	174	190	216	238	266
508							39.8	44.8	49.7	55.9	62.0	66.9	69.4	77.9	87.7	98.6	108	123	135	153	173	194	212	241	266	298
		559					43.9	49.3	54.7	61.5	68.3	73.7	76.4	85.9	96.6	109	119	135	149	168	191	214	234	266	294	329
	610						47.9	53.8	59.8	67.2	74.6	80.5	83.5	93.8	106	119	130	148	162	184	209	234	256	291	322	361
	660									72.7	80.8	87.2	90.4	102	114	129	141	160	176	200	226	254	277	316	349	392
	711									78.4	87.1	94.0	97.4	109	123	139	152	173	190	215	244	274	299	341	377	423
	762									84.1	93.3	101	104	117	132	149	163	185	204	231	262	294	321	366	405	454
	813									89.7	99.6	108	112	125	141	159	175	198	218	247	280	314	343	391	433	486
	864									95.4	106	114	119	133	150	169	186	211	231	262	298	335	365	416	461	517
	914									101	112	121	125	141	159	179	196	223	245	278	315	354	387	441	488	548
	1016									112	125	135	140	157	177	199	219	248	273	309	351	395	431	491	544	611
	1067										131	141	147	165	186	209	230	261	286	325	369	415	453	516	572	642
	1118										137	148	154	173	195	219	241	273	300	341	387	435	475	542	600	674
	1168										143	155	161	180	203	229	252	286	314	356	404	455	497	566	627	705
	1219										150	162	168	188	212	239	263	298	328	372	422	475	519	591	655	736
	1321												182	204	230	259	285	323	355	403	458	515	563	642	711	799
	1422												196	220	248	279	307	348	383	435	493	555	606	692	766	861
	1524													236	266	299	329	373	410	466	529	595	650	742	822	924
	1626													252	283	319	351	399	438	497	564	635	694	792	878	987
	1727														301	339	373	423	466	529	600	675	738	842	933	1049
	1829														319	359	395	449	493	560	636	715	782	892	989	1112
	1930															379	417	474	521	591	671	755	825	942	1044	1175
	2032															399	439	499	548	623	707	795	869	992	1100	1237
	2134																461	524	576	654	742	836	913	1043	1156	1300
	2235																483	549	604	685	778	876	957	1093	1211	1363
	2337																	574	631	717	813	916	1001	1143	1267	1425
	2438																	599	658	748	849	956	1045	1193	1323	1488
	2540																		686	779	885	996	1089	1243	1378	1551

Note : Series 1 = Tube for which all the accessories needed for the construction of piping system are standardized.
Series 2 = Tube for which not all the accessories are standardized.
Series 3 = Tube for special application for which very few standardized accessories exist.

7d) ERW Steel Tubes for Concrete Lined Pipes

- Grade : ERW 320
ERW 360
ERW 430

BS 3601 - JKR Dimension

Outside Diameter mm	Minimum Wall Thickness mm	Outside Diameter		Calculated Weight Plain Ends kg/m	Hydrostatic Test Pressure (Steel 430) bar
		Minimum mm	Maximum mm		
121.9	4.10	120.7	123.1	11.91	70
177.3	4.10	176.0	178.6	17.51	70
232.2	4.10	230.5	233.9	23.06	70
286.0	4.10	283.9	288.1	28.50	63
345.4	5.80	342.8	348.0	48.57	70
399.3	5.80	396.3	402.3	56.28	64
426.0	5.80	422.8	429.2	60.10	60
453.1	5.80	449.7	456.5	63.98	56

BS 3601 - BS 534 Dimension

Outside Diameter mm	Minimum Wall Thickness mm	Outside Diameter		Calculated Weight Plain Ends kg/m	Hydrostatic Test Pressure (Steel 430) bar
		Minimum mm	Maximum mm		
114.3	3.60	113.2	115.4	9.83	70
139.7	3.60	138.3	141.1	12.08	70
168.3	3.60	166.6	170.0	14.62	70
193.7	4.00	192.2	195.2	18.71	70
219.1	4.00	217.5	220.7	21.22	70
244.5	4.00	242.7	246.3	23.72	70
273.0	4.00	270.9	275.0	26.53	64
323.9	4.00	321.5	326.3	31.55	54
355.6	4.50	352.9	358.3	38.96	56
406.4	4.50	403.4	409.4	44.60	49
457.0	5.00	453.6	460.4	55.73	48

7e) Non-Alloy Steel Tubes Suitable For Weiding And Threading

-Technical delivery conditions
-British Standard (Extracts from BS EN 10255 : 2004)

General Information

This document specifies the requirements for circular non-alloy steel tubes suitable for welding and threading and provides a number of options for the finish of tube ends and coatings. This document covers tubes of specified outside diameter 10.2mm to 165.1mm (thread size 1/8 to 6) in two series, medium and heavy, and three types of designated thickness.

Chemical Composition

The chemical composition shall conform to the requirements of Table 1.

Table 1. Chemical composition

Steel Grade		Chemical Composition %			
Steel Name	Steel Number	C max	Mn max	P max	S max
S 195T	1.0026	0.20	1.40	0.035	0.030

Mechanical Strength (Tensile Test)

The mechanical properties shall conform to the requirements of Table 2.

Table 2. Mechanical properties

Steel Grade		Mechanical Properties		
Steel Name	Steel Number	Upper Yield Strength (MPa)	Tensile Strength (Mpa)	Elongation min %
S 195T	1.0026	195	320 to 520	20

Bending Test

The bend test shall be applied to bare tube with specified outside diameter (D) of 17.2 mm up to and including 60.3 mm and shall be carried out to an angle of 90°.
The groove in the forming tool shall have a width that fits the tube diameter accurately and a depth not less than 0.5 D.
The radius at the bottom of the groove of the former shall be as given in Table 3.
Welded tubes shall be bent with the weld at the outside of the bend and tubes shall show no crack visible without magnifying aids.

Table 3 – Specified outside diameter (D) and corresponding bending radius

Dimension in millimeters

D	17.2	21.3	26.9	33.7	42.4	48.3	60.3
Bending Radius	50	65	85	100	150	170	220

Cold Flattening Test

The flattening test shall be applied to bare tubes with specified outside diameter (D) greater than 60.3mm.
Welded tubes shall be flattened with the weld placed alternately at 0° or 90° (12 or 3 o'clock) to the direction of the flattening.
The tube section shall be flattened in a press until the distance between platens, measured under load, reaches 75% if the original outside diameter of the tube. The tube shall show no cracks or flaws visible without magnifying aids.
No cracks or flaws visible without magnifying aids shall occur in the metal other than in the weld until the distance between platens, measured under load, reaches 60% of the original outside diameter.

Leak Tightness Test

Each tube shall be tested for leak-tightness. The test can be either a hydrostatic test at a minimum of 50 bar for at least 5s,

or an electro-magnetic test.

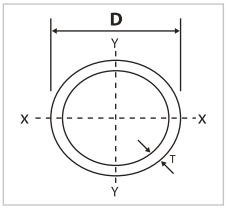
Tolerances On Dimensions and Mass

The tolerances on dimensions shall be as specified in Table 4.

Table 4. Tolerance on dimensions

Dimension Of Steel Tubes	Tolerance	
Outside Diameter	Type L	Refer to Table L
	Type L1	Refer to Table L1
	Type L2	Refer to Table L2
	Medium	Refer to Table M
	Heavy	Refer to Table H
Thickness	Type L	± 10 %
	Type L1	- 8 % with the plus tolerance limited by the mass tolerance
	Type L2	- 8 % with the plus tolerance limited by the mass tolerance
	Medium	± 10 %
	Heavy	± 10 %
Length	$L \leq 6$	- 0, + 10 mm
	$6 < L \leq 12$	- 0, + 15 mm
	$L > 12$	- 0, + *by agreement* mm
Straightness	Shall not exceed 0.20 %	
Out-of-roundness (*o*)	Included in the diameter tolerance	
Concavity / convexity	-	
Radius of Corners	-	
Squareness of side	-	
Twist	-	
Inner Flash	Height of the internal weld seam shall not exceed 60% of the specified wall thickness	
End tolerance on diameter	-	
End Facing	-	
Mass (*m*) per unit length	Type L	± 7.5 %
	Type L1	- 8 %, + 10 %
	Type L2	- 8 %, + 10 %
	Medium	± 7.5 %
	Heavy	± 7.5 %

Pipes BS EN 10255



7e(i) Non-Alloy Steel Tubes Suitable For Welding And Threading

-Technical delivery conditions
-British Standard (Extracts from BS EN 10255 : 2004)

Dimension and Mass

Table L. Dimension Of Steel Tubes: L

Specified Outside Diameter (mm) D	Designation Of Thread R	Outside Diameter (D) min. mm	Outside Diameter (D) max. mm	Thickness T mm	Mass Per Unit Length Of Bare Tube Plain End Kg/m	Mass Per Unit Length Of Bare Tube Screwed End Socketed Kg/m
13.5	1/4	13.2	13.9	2.0	0.567	0.571
17.2	3/8	16.7	17.4	2.0	0.750	0.756
21.3	1/2	21.0	21.7	2.3	1.080	1.090
26.9	3/4	26.4	27.1	2.3	1.400	1.410
33.7	1	33.2	34.0	2.9	2.200	2.220
42.4	1 1/4	41.9	42.7	2.9	2.820	2.850
48.3	1 1/2	47.8	48.6	2.9	3.250	3.290
60.3	2	59.6	60.7	3.2	4.510	4.580
76.1	2 1/2	75.2	76.0	3.2	5.750	5.870
88.9	3	87.9	88.7	3.2	6.760	6.930
101.6	3 1/2	100.3	101.2	3.6	8.700	8.880
114.3	4	113.0	113.9	3.6	9.830	10.10
139.7	5	138.5	140.8	4.5	15.00	15.50
165.1	6	163.9	166.5	4.5	17.80	18.40

Table L1. Dimension Of Steel Tubes: L1

Specified Outside Diameter (mm) D	Designation Of Thread R	Outside Diameter (D) min. mm	Outside Diameter (D) max. mm	Thickness T mm	Mass Per Unit Length Of Bare Tube Plain End Kg/m	Mass Per Unit Length Of Bare Tube Screwed End Socketed Kg/m
13.5	1/4	13.2	13.9	2.0	0.570	0.574
17.2	3/8	16.7	17.4	2.0	0.742	0.748
21.3	1/2	21.0	21.7	2.3	1.080	1.090
26.9	3/4	26.4	27.1	2.3	1.390	1.400
33.7	1	33.2	34.0	2.9	2.200	2.220
42.4	1 1/4	41.9	42.7	2.9	2.820	2.850
48.3	1 1/2	47.8	48.6	2.9	3.240	3.280
60.3	2	59.6	60.7	3.2	4.490	4.560
76.1	2 1/2	75.2	76.3	3.2	5.730	5.850
88.9	3	87.9	89.4	3.6	7.550	7.720
114.3	4	113.0	114.9	4.0	10.80	11.10

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Table L2. Dimension Of Steel Tubes : L2						
Specified Outside Diameter (mm) D	Designation Of Thread R	Outside Diameter		Thickness T mm	Mass Per Unit Length Of Bare Tube	
		min. mm	max. mm		Plain End Kg/m	Screwed End Socketed Kg/m
13.5	1/4	13.2	13.6	1.8	0.515	0.519
17.2	3/8	16.7	17.1	1.8	0.670	0.676
21.3	1/2	21.0	21.4	2.0	0.947	0.956
26.9	3/4	26.4	26.9	2.3	1.38	1.39
33.7	1	33.2	33.8	2.6	1.98	2.00
42.4	1 1/4	41.9	42.5	2.6	2.54	2.57
48.3	1 1/2	47.8	48.4	2.9	3.23	3.27
60.3	2	59.6	60.2	2.9	4.08	4.15
76.1	2 1/2	75.2	76.0	3.2	5.71	5.83
88.9	3	87.9	88.7	3.2	6.72	6.89
114.3	4	113.0	113.9	3.6	9.75	10.0

Table M. Dimension Of Steel Tubes : M (Medium)						
Specified Outside Diameter (mm) D	Designation Of Thread R	Outside Diameter		Thickness T mm	Mass Per Unit Length Of Bare Tube	
		min. mm	max. mm		Plain End Kg/m	Screwed End Socketed Kg/m
10.2	1/8	9.8	10.6	2.0	0.404	0.407
13.5	1/4	13.2	14.0	2.3	0.641	0.645
17.2	3/8	16.7	17.5	2.3	0.839	0.845
21.3	1/2	21.0	21.8	2.6	1.210	1.220
26.9	3/4	26.5	27.3	2.6	1.560	1.570
33.7	1	33.3	34.2	3.2	2.410	2.430
42.4	1 1/4	42.0	42.9	3.2	3.100	3.130
48.3	1 1/2	47.9	48.8	3.2	3.560	3.600
60.3	2	59.7	60.8	3.6	5.030	5.100
76.1	2 1/2	75.3	76.6	3.6	6.420	6.540
88.9	3	88.0	89.5	4.0	8.360	8.530
114.3	4	113.1	115.0	4.5	12.20	12.50
139.7	5	138.5	140.8	5.0	16.60	17.10
165.1	6	163.9	166.5	5.0	19.80	20.40

Table H. Dimension Of Steel Tubes : H (Heavy)						
Specified Outside Diameter (mm) D	Designation Of Thread R	Outside Diameter		Thickness T mm	Mass Per Unit Length Of Bare Tube	
		min. mm	max. mm		Plain End Kg/m	Screwed End Socketed Kg/m
10.2	1/8	9.8	10.6	2.6	0.487	0.490
13.5	1/4	13.2	14.0	2.9	0.765	0.769
17.2	3/8	16.7	17.5	2.9	1.020	1.030
21.3	1/2	21.0	21.8	3.2	1.440	1.450
26.9	3/4	26.5	27.3	3.2	1.870	1.880
33.7	1	33.3	34.2	4.0	2.930	2.950
42.4	1 1/4	42.0	42.9	4.0	3.790	3.820
48.3	1 1/2	47.9	48.8	4.0	4.370	4.410
60.3	2	59.7	60.8	4.5	6.190	6.260
76.1	2 1/2	75.3	76.6	4.5	7.930	8.050
88.9	3	88.0	89.5	5.0	10.30	10.50
114.3	4	113.1	115.0	5.4	14.50	14.80
139.7	5	138.5	140.8	5.4	17.90	18.40
165.1	6	163.9	166.5	5.4	21.30	21.90

7f) Screwed And Socketed Steel Tubes And Tubulars And For Plain End Steel Tubes Suitable For Welding Or For Screwing To BS 21 Pipe Threads

British Standard (Extracts from BS 1387 : 1985)

General Information

This British Standard specifies requirements for screwed and socketed steel tubes and tubular and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads.

Chemical Composition

The Chemical Composition of the steel shall comply with Table 1.

Table 1. Chemical Composition

Chemical Composition % max.			
C	Mn	P	S
0.20	1.20	0.045	0.045

Mechanical Strength (Tensile Test)

The Mechanical properties at room temperatures shall be as given in Table 2.

Table 2. Mechanical Properties

Mechanical Properties At Room Temperature		
Minimum Tensile Strength N/mm^2	Minimum Yield Strength, N/mm^2	Minimum Elongation On Gauge Length $Lo = 5.65\sqrt{So}$ A
320 to 460	195	20

Bending Test

The bend test applies to tubes up to and including DN 50. When tested in accordance with the following bend test the finished tubes shall withstand the test without showing any signs of fracture or failure.

The test shall be carried out using a tube bending machine and the tube shall be bend round a grooved former of the radius given in (a) or (b) as appropriate. Tubes shall be bent with the weld at 90˚ to the plane of bending. The tubes shall not be filled for this test.

a) Tubes which have not been hot-dip zinc coated shall be bend cold, without cracking, through 180˚ round a former having a radius at the bottom of the groove equal to six times the outside diameter of the tube as given in table 1, 2 and 3.

b) Hot dip zinc coated tubes shall be bent cold without cracking of the steel, through 90˚ round a former having a radius at the bottom of the groove equal to eight times the outside diameter of the tube.

Cold Flattening Test

The flattening test applies to tubes greater than DN 50.

The weld shall be placed at 90˚ to the direction of flattening.

A ring not less than 40mm in length taken from one end of each selected tube shall be flattened cold between parallel flat platens without showing either crack or flaw until the distance between the platens, measured under load, is not greater than 75% of the original outside diameter of the tube and no crack or flaws in the metal elsewhere than in the weld shall occur until the distance the between the platens is less than 60% of the original outside diameter.

Leak Tightness Test

Each tube shall be tested for leak tightness at the manufacturer's works.

The test shall be either a hydraulic test at a pressure of 50 bar, the pressure being maintained sufficiently long for proof and inspection.

Or alternatively, an eddy current test.

Tolerances On Dimensions and Mass

The tolerances on dimensions shall respectively conform to Table 3.

Table 3. Tolerance on dimensions

Dimension Of Steel Tubes		Tolerance
Outside Diameter	Light	Refer to Table A
	Medium	Refer to Table B
	Heavy	Refer to Table C
Thickness	Light tubes	- 8%
	Medium tubes	- 10%
	Heavy tubes	- 10%
Length	+ 6, - 0 mm	
Straightness	Shall not exceed 0.20 %	
Out-of-roundness (*o*)	-	
Concavity / convexity	-	
Radius of Corners	-	
Squareness of side	-	
Twist	-	
Inner Flash	-	
End tolerance of diameter	-	
End Facing	-	
Mass (*m*) per unit length	The mean consignment mass for quantities of 150mm and over of one size shall not deviate by more than ± 4% form the mass of consignment calculated from the mass given in Table A, B and C. Single tube shall deviate by more than +10%, -8% from the mass given in the Table A, B and C.	

Pipes BS 1387

7f(i) Welded Steel Pipe & Galvanised Iron Pipe

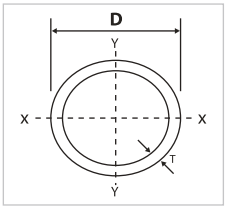


Table A - Welded Steel Pipe - Class Light (A)

BS 1387 : 1985 / Manufacturer's Standard

Nominal Size		Outside Diameter		Wall Thickness	Calculated Weight				No. of Threads/in	Socket		Test Pressure	
		Max	Min		Plain Ends		Threads and Coupling			Outer Diameter	Min Length		
		D		t									
mm	in	mm	mm	mm	Kg/m	Kg/ft	Kg/m	Kg/ft		mm	mm	Bar	psi
15	1/2	21.4	21.0	2.0	0.947	0.289	0.956	0.291	14	27.8	38.1	50	700
20	3/4	26.9	26.4	2.3	1.38	0.421	1.39	0.424	14	34.1	41.3	50	700
25	1	33.8	33.2	2.6	1.98	0.604	2.00	0.610	11	42.1	47.6	50	700
32	1 1/4	42.5	41.9	2.6	2.54	0.774	2.57	0.783	11	51.6	54.0	50	700
40	1 1/2	48.4	47.8	2.9	3.23	0.985	3.27	0.997	11	57.9	57.2	50	700
50	2	60.2	59.6	2.9	4.08	1.24	4.15	1.26	11	70.6	63.5	50	700
65	2 1/2	76.0	75.2	3.2	5.71	1.74	5.83	1.78	11	87.3	69.9	50	700
80	3	88.7	87.9	3.2	6.72	2.05	6.89	2.10	11	101.6	76.2	50	700
100	4	113.9	113.0	3.6	9.75	2.97	10.00	3.05	11	128.6	88.9	50	700

Table B - Welded Steel Pipe - Class Light (B)

BS 1387 : 1985 / Manufacturer's Standard

Nominal Size		Outside Diameter		Wall Thickness	Calculated Weight				No. of Threads/in	Socket		Test Pressure	
		Max	Min		Plain Ends		Threads and Coupling			Outer Diameter	Min Length		
		D		t									
mm	in	mm	mm	mm	Kg/m	Kg/ft	Kg/m	Kg/ft		mm	mm	Bar	psi
15	1/2	21.7	21.1	2.6	1.21	0.369	1.22	0.372	14	27.8	38.1	50	700
20	3/4	27.2	26.6	2.6	1.56	0.475	1.57	0.479	14	34.1	41.3	50	700
25	1	34.2	33.4	3.2	2.41	0.735	2.43	0.741	11	42.1	47.6	50	700
32	1 1/4	42.9	42.1	3.2	3.10	0.945	3.13	0.954	11	51.6	54.0	50	700
40	1 1/2	48.8	48.0	3.2	3.57	1.09	3.61	1.10	11	57.9	57.2	50	700
50	2	60.8	59.8	3.6	5.03	1.53	5.10	1.55	11	70.6	63.5	50	700
65	2 1/2	76.6	75.4	3.6	6.43	1.96	6.55	2.00	11	87.3	69.9	50	700
80	3	89.5	88.1	4.0	8.37	2.55	8.54	2.60	11	101.6	76.2	50	700
100	4	114.9	113.3	4.5	12.2	3.72	12.5	3.81	11	128.6	88.9	50	700
125	5	140.6	138.7	5.0	16.6	5.06	17.1	5.21	11	155.6	95.3	50	700
150	6	166.1	164.1	5.0	19.7	6.00	20.3	6.19	11	184.2	95.3	50	700

Table C - Welded Steel Pipe - Class Light (C)

BS 1387 : 1985 / Manufacturer's Standard

Nominal Size		Outside Diameter		Wall Thickness	Calculated Weight				No. of Threads/in	Socket		Test Pressure	
		Max	Min		Plain Ends		Threads and Coupling			Outer Diameter	Min Length		
		D		t									
mm	in	mm	mm	mm	Kg/m	Kg/ft	Kg/m	Kg/ft		mm	mm	Bar	psi
15	1/2	21.7	21.1	3.2	1.44	0.439	1.45	0.442	14	27.8	38.1	50	700
20	3/4	27.2	26.6	3.2	1.87	0.570	1.88	0.573	14	34.1	41.3	50	700
25	1	34.2	33.4	4.0	2.94	0.896	2.96	0.902	11	42.1	47.6	50	700
32	1 1/4	42.9	42.1	4.0	3.80	1.16	3.83	0.954	11	51.6	54.0	50	700
40	1 1/2	48.8	48.0	4.0	4.38	1.34	4.42	1.17	11	57.9	57.2	50	700
50	2	60.8	59.8	4.5	6.19	1.89	6.26	1.91	11	70.6	63.5	50	700
65	21/2	76.6	75.4	4.5	7.93	2.42	8.05	2.45	11	87.3	69.9	50	700
80	3	89.5	88.1	5.0	10.3	3.14	10.5	3.20	11	101.6	76.2	50	700
100	4	114.9	113.3	5.4	14.5	4.42	14.8	4.51	11	128.6	88.9	50	700
125	5	140.6	138.7	5.4	17.9	5.46	18.4	5.61	11	155.6	95.3	50	700
150	6	166.1	164.1	5.4	21.3	6.49	21.9	6.68	11	184.2	95.3	50	700

7g) Carbon Steel Pipes For Ordinary Piping

Japanese Industrial Standard (Extracts from JIS G 3452 : 2004)

General Information

This Japanese Industrial Standard specifies the carbon steel pipes (hereafter referred to as the "pipes") used for the piping for conveying steam, water (excepting public water supply service). Oil, gas, air, etc. at comparatively low working pressures.

The pipes shall be classified into one grade and its symbol shall be as given in Table 1. In addition, they shall be divided into black pipes and galvanized ones according to the existence of zinc coating.

Table 1. Symbol of grade

Symbol Of Grade	Division	Remark
SGP	Black pipe	Pipe without zinc coating
	Galvanized pipe	Black pipe with zinc coating

Chemical Composition

The resulting cast analysis values shall be as given in Table 2.

Table 2. Chemical Composition

Unit: %

Symbol Of Grade	P	S
SGP	0.040 max.	0.040 max.

Mechanical Strength (Tensile Test)

The resulting tensile strength and elongation shall be as given in Table 3. When the tensile test is carried out for *No.12 or *No.5 test piece for the pipe under 8 mm in wall thickness, the minimum value of elongation shall be as given in Table 4.

Table 3. Mechanical properties

Symbol Of Grade	Tensile Strength N/mm²	Elongation %	
		*No. 11 Test Piece *No. 12 Test Piece	*No. 5 Test Piece
		Longitudinal	Transverse
SGP	290 min.	30 min.	25 min.

Table 4. Elongation values for *No.12 test piece (longitudinal) and *No.5 test piece (transverse) taken from pipes under 8 mm in wall thickness

Shape Of Test Piece	Elongation Values For Wall Thickness Divisions %				
	Over 7mm to and excl. 8 mm	Over 6mm up to and incl. 7 mm	Over 5mm up to and incl. 6 mm	Over 4mm up to and incl. 5 mm	Over 3mm up to and incl. 4 mm
*No. 12 Test Piece	30	28	27	26	24
*No. 5 Test Piece	25	24	22	20	19

* Please refer to Appendix 'A' Tension Test Pieces for Metallic Materials - JIS Z 2201 (pg153-155)

Bending Test

For the black pipe of nominal size 50A or smaller. The pipe shall be bent through 90° around an inside diameter that is 6 times its outside diameter and the pipe shall be free from the occurrence of flaws or cracks on its wall surface.

Cold Flattening Test

A test piece 50 mm over in length shall be cut off from the end of a pipe. The test piece shall not generate flaws or cracks on its wall surface and in this case, the distance between the two plates shall be 2/3 of the outside diameter of the pipe. The weld shall be placed at right angles to the direction of compression.

Uniformity of zinc coating

The number of immersions in the copper sulfate test as given in Table 5. In this case, the pipe shall not show a fixed deposit of zinc even after the successive immersing operations of frequency given in Table 5.

Table 5. Uniformity test

Symbol Of Grade	Number Of Immersions (One minutes per dips)
SGP	5

Hydrostatic Test

For hydrostatic test characteristics, when not specified by the purchaser, a hydrostatic pressure of 2.5 MPa shall be selected by the manufacturer, and black pipe shall withstand it without leakage.

Tolerances On Dimensions and Mass

The dimensions, weight and dimensional tolerances of the black pipe shall be as specified in Table 6.

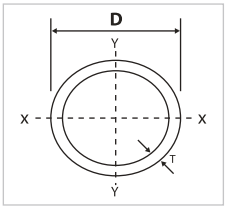
Table 6. Dimension, weights and dimensional tolerances

Nominal Diameter		Outside Diameter	Tolerance On Outside Diameter		Wall Thickness	Tolerance On Wall Thickness	Bevel Angle	Root Face	Test Pressure		Unit Mass Excluding Socket kg/m
A	B	mm	Pipes To Be Cut In Taper Thread	Other Pipes	mm				Kg/cm²	PSI	
6	1/8	10.5	± 0.5 mm	± 0.5 mm	2.0	+ not specified - 12.5 %	30° +5°,-0°	2.4 mm max.	25	360	0.419
8	1/4	13.8	± 0.5 mm	± 0.5 mm	2.3				25	360	0.652
10	3/8	17.3	± 0.5 mm	± 0.5 mm	2.3				25	360	0.851
15	1/2	21.7	± 0.5 mm	± 0.5 mm	2.8				25	360	1.31
20	3/4	27.2	± 0.5 mm	± 0.5 mm	2.8				25	360	1.68
25	1	34.0	± 0.5 mm	± 0.5 mm	3.2				25	360	2.43
32	1 1/4	42.7	± 0.5 mm	± 0.5 mm	3.5				25	360	3.38
40	1 1/2	48.6	± 0.5 mm	± 0.5 mm	3.5				25	360	3.89
50	2	60.5	± 0.5 mm	± 1 %	3.8				25	360	5.31
65	2 1/2	76.3	± 0.7 mm	± 1 %	4.2				25	360	7.47
80	3	89.1	± 0.8 mm	± 1 %	4.2				25	360	8.79
90	3 1/2	101.6	± 0.8 mm	± 1 %	4.2				25	360	10.1
100	4	114.3	± 0.8 mm	± 1 %	4.5				25	360	12.2
125	5	139.8	± 0.8 mm	± 1 %	4.5				25	360	15.0
150	6	165.2	± 0.8 mm	± 1.6 mm	5.0				25	360	19.8
175	7	190.7	± 0.9 mm	± 1.6 mm	5.3				25	360	24.2
200	8	216.3	± 1.0 mm	± 0.8 %	5.8				25	360	30.1
225	9	241.8	± 1.2 mm	± 0.8 %	6.2				25	360	36.0
250	10	267.4	± 1.3 mm	± 0.8 %	6.6				25	360	42.4
300	12	318.5	± 1.5 mm	± 0.8 %	6.9				25	360	53.0
350	14	355.6	-	± 0.8 %	7.9				25	360	67.7
400	16	406.4	-	± 0.8 %	7.9				25	360	77.6
450	18	457.2	-	± 0.8 %	7.9				25	360	87.5
500	20	508.0	-	± 0.8 %	7.9				25	360	97.4

Pipes JIS G 3452

7g(i) Carbon Steel Pipe For Ordinary Piping

JIS G 3452 : 2004 / Manufacturer's Standard



Nominal Size		Outside Diameter D		Wall Thickness t		Weight (Pain Ends)			Test Pressure	
mm	in	mm	in	mm	in	Kg/m	Kg/6m	Kg/ft	Kg/cm²	psi
6	1/8	10.5	0.413	2.0	0.079	0.419	2.514	0.13	25	360
8	1/4	13.8	0.543	2.3	0.091	0.652	3.912	0.20	25	360
10	3/8	17.3	0.681	2.3	0.091	0.851	5.106	0.26	25	360
15	1/2	21.7	0.854	2.8	0.110	1.31	7.86	0.40	25	360
20	3/4	27.2	1.071	2.8	0.110	1.68	10.08	0.51	25	360
25	1	34.0	1.339	3.2	0.126	2.43	14.58	0.74	25	360
32	1 1/4	42.7	1.681	3.5	0.138	3.38	20.28	1.03	25	360
40	1 1/2	48.6	1.913	3.5	0.138	3.89	23.34	1.19	25	360
50	2	60.5	2.382	3.8	0.150	5.31	31.86	1.62	25	360
65	2 1/2	76.3	3.004	4.2	0.165	7.47	44.82	2.28	25	360
80	3	89.1	3.508	4.2	0.165	8.79	52.74	2.68	25	360
90	3 1/2	101.6	4.000	4.2	0.165	10.10	60.60	3.08	25	360
100	4	114.3	4.500	4.5	0.177	12.20	73.20	3.72	25	360
125	5	139.8	5.504	4.5	0.177	15.00	90.00	4.57	25	360
150	6	165.2	6.504	5.0	0.197	19.80	118.80	6.03	25	360
175	7	190.7	7.508	5.3	0.209	24.20	145.20	7.38	25	360
200	8	216.3	8.516	5.8	0.228	30.10	180.60	9.17	25	360
225	9	241.8	9.520	6.2	0.244	36.00	216.00	10.97	25	360
250	10	267.4	10.528	6.6	0.260	42.40	254.40	12.92	25	360
300	12	318.5	12.539	6.9	0.272	53.00	318.00	16.15	25	360
350	14	355.6	14.000	7.9	0.311	67.70	406.20	20.63	25	360
400	16	406.4	16.000	7.9	0.311	77.60	465.60	23.65	25	360

7h) Carbon Steel Pipes For Pressure Service

Japanese Industrial Standard (Extracts from JIS G 3454 : 2007)

General Information

This Japanese Industrial Standard specifies the carbon steel pipes, used for pressure service at an approximate maximum temperature of 350˚C. The dimension range in which this Standard shall apply is generally 10.5 mm to 660.4 mm in outside diameter.

Pipes shall be classified into two grades and designations of grade and manufacturing process and classification of zinc-coating shall be as given in Table 1.

Table 1. Designation of grade, manufacturing process and classification of zinc-coating

Designation Of Grade	Designation Of Manufacturing Process		Classification Of Zinc-coating
	Pipe Manufacturing Process	Finishing Method	
STPG 370	Seamless: S Electric resistance welded: E	Hot finished: H Cold finished: C As electric resistance welded: G	Black pipes: Not zinc-coated White pipes: Zinc-coated pipes
STPG 410			

Chemical Composition

The Chemical analysis of the steel shall comply with the requirement of Table 2.

Table 2. Chemical Composition

Unit: %

Letter Symbol Of Grade	C	Si	Mn	P	S
STPG 370	0.25 max.	0.35 max.	0.30 to 0.90	0.040 max.	0.040 max.
STPG 410	0.30 max.	0.35 max.	0.30 to 1.00	0.040 max.	0.040 max.

Mechanical Strength (Tensile Test)

The tensile strength, yield point or proof stress and elongation shall be as given in Table 3.

Table 3. Mechanical properties

Designation Of Grade	Tensile Strength N/mm²	Yield Points Or Proof Stress N/mm²	Elongation %			
			*No. 11 Test Piece Or *No. 12 Test Piece	*No. 5 Test Piece	*No. 4 Test Piece	
			Pipe Axis Direction	Right Angle To Pipe Axis Direction	Pipe Axis Direction	Right Angle To Pipe Axis Direction
STPG 370	370 min.	215 min.	30 min.	25 min.	28 min.	23 min.
STPG 410	410 min.	245 min.	25 min.	20 min.	24 min.	19 min.

Remark: For pipes whose nominal diameter is 25A or under, the elongation given in table 3 shall not apply.

When the tensile test is carried out for *No. 12 or *No. 5 test piece for pipes under 8 mm in wall thickness, the minimum value of elongation shall be as given in Table 4.

Table 4. Minimum elongation values for *No. 12 test piece (pipe axis direction) and *No. 5 test piece (right angle to pipe axis direction) taken from pipes under 8 mm in wall thickness

Unit: %

Designation Of Grade	Test Piece	Elongation Value By Thickness Division						
		Over 1mm up to and incl. 2mm	Over 2mm up to and incl. 3mm	Over 3mm up to and incl. 4mm	Over 4mm up to and incl. 5mm	Over 5mm up to and incl. 6mm	Over 6mm up to and incl. 7mm	Over 7mm to and excl. 8mm
STPG370	*No. 12 Test Piece	21	22	24	26	27	28	30
	*No. 5 Test Piece	16	18	19	20	22	24	25
STPG410	*No. 12 Test Piece	16	18	19	20	22	24	25
	*No. 5 Test Piece	11	12	14	16	17	18	20

* Please refer to Appendix 'A' Tension Test Pieces for Metallic Materials - JIS Z 2201 (pg153-155)

Bending Test

The bending test is designated instead of the flattening test for pipes of which nominal diameter is 40A or under, the test piece shall be free from the occurrence of flaws or cracks. In this care, the bending angle shall be 90° and the bending inside radius shall be 6 times the outside diameter of pipes.

Cold Flattening Test

A test piece 50 mm or over in length shall be cut off form the end of the pipe. For the electric resistance welded steel pipe, the weld shall be placed at right angles to the direction of compression, and the weld compressed up to *H=2/3 D* and the portion other than the weld when compressed up to *H=1/3 D* shall be examined. The pipe shall not generate flaws or cracks on its wall surface.

Hydrostatic Test

When the pipe is subjected to hydrostatic pressure and kept under the specified pressure, as given in Table 5. Its strength to withstand the pressure without leakage shall be examined.

Table 5. Hydrostatic Test Pressure

Unit: Mpa (kg/cm²)

Schedule Number Sch	10	20	30	40	60	80
Hydrostatic test pressure	2.0 (21)	3.5 (36)	5.0 (51)	6.0 (62)	9.0 (92)	12 (123)

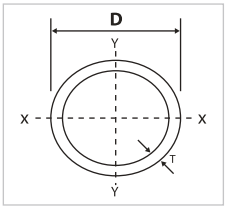
Tolerances On Dimensions and Mass

The tolerances on dimensions shall be as specified in Table 6.

Table 6. Tolerance on dimensions

Division		Hot-finished Seamless Pipe		Cold-finished Seamless Steel Pipe And Electric Resistance Welded Steel Pipe	
Outside Diameter		40 A or under	± 0.5 mm	25 A or under	± 0.3 mm
		50 A or over up to and incl. 125 A	± 1 %	32 A to 300 A	± 0.8 %
		150 A	± 1.6 mm	350 A or over	± 0.5 %
		200 A to 300 A	± 0.8 %		
		350 A or over	± 0.5 %		
Thickness		Under 4 mm	+ 0.6 mm - 0.5 mm	Under 3 mm	± 0.3 mm
		4 mm or over	+ 15 % - 12.5 %	3 mm or over	± 10 %
Length		Shall be not less than the specified length			
Straightness		Pipe shall be practically straight			
Out-of-roundness (*o*)		-			
Concavity / convexity		-			
Radius of Corners		-			
Squareness of side		-			
Twist		-			
Inner Flash		-			
End tolerance on diameter		-			
End Facing	Bevel angle	30° + 5°, - 0°			
	Root Face	2.4 mm max.			
Pipe End		Both ends shall be at a right angle to its axis			
Mass (*m*) per unit length		-			

Pipes JIS G 3454



7h(i) Dimension and Unit Mass of Carbon Steel Pipes For Pressure Service

Japanese Industrial Standard (Extracts from JIS G 3454 : 2007)

Nominal Diameter		Outside Diameter	Nominal Wall Thickness (t)											
			Schedule 10		Schedule 20		Schedule 30		Schedule 40		Schedule 60		Schedule 80	
			Thick-ness	Unit Mass	Thick-ness	Unit Mass	Thick-ness	Unit Mass	Thick-ness	Unit Mass	Thick-ness	Unit Mass	Thick-ness	Unit Mass
A	B	D	t	W	t	W	t	W	t	W	t	W	t	W
mm	inch	mm	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
6	1/8	10.5	-	-	-	-	-	-	1.7	0.369	2.2	0.450	2.4	0.479
8	1/4	13.8	-	-	-	-	-	-	2.2	0.629	2.4	0.675	3.0	0.799
10	3/8	17.3	-	-	-	-	-	-	2.3	0.851	2.8	1.00	3.2	1.11
15	1/2	21.7	-	-	-	-	-	-	2.8	1.31	3.2	1.46	3.7	1.64
20	3/4	27.2	-	-	-	-	-	-	2.9	1.74	3.4	2.00	3.9	2.24
25	1	34.0	-	-	-	-	-	-	3.4	2.57	3.9	2.89	4.5	3.27
32	1 1/4	42.7	-	-	-	-	-	-	3.6	3.47	4.5	4.24	4.9	4.57
40	1 1/2	48.6	-	-	-	-	-	-	3.7	4.10	4.5	4.89	5.1	5.47
50	2	60.5	-	-	3.2	4.52	-	-	3.9	5.44	4.9	6.72	5.5	7.46
65	2 1/2	76.3	-	-	4.5	7.97	-	-	5.2	9.12	6.0	10.4	7.0	12.0
80	3	89.1	-	-	4.5	9.39	-	-	5.5	11.3	6.6	13.4	7.6	15.3
90	3 1/2	101.6	-	-	4.5	10.8	-	-	5.7	13.5	7.0	16.3	8.1	18.7
100	4	114.3	-	-	4.9	13.2	-	-	6.0	16.0	7.1	18.8	8.6	22.4
125	5	139.8	-	-	5.1	16.9	-	-	6.6	21.7	8.1	26.3	9.5	30.5
150	6	165.2	-	-	5.5	21.7	-	-	7.1	27.7	9.3	35.8	11.0	41.8
200	8	216.3	-	-	6.4	33.1	7.0	36.1	8.2	42.1	10.3	52.3	12.7	63.8
250	10	267.4	-	-	6.4	41.2	7.8	49.9	9.3	59.2	12.7	79.8	15.1	93.9
300	12	318.5	-	-	6.4	49.3	8.4	64.2	10.3	78.3	14.3	107	17.4	129
350	14	355.6	6.4	55.1	7.9	67.7	9.5	81.1	11.1	94.3	15.1	127	19.0	158
400	16	406.4	6.4	63.1	7.9	77.6	9.5	93.0	12.7	123	16.7	160	21.4	203
450	18	457.2	6.4	71.1	7.9	87.5	11.1	122	14.3	156	19.0	205	23.8	254
500	20	508.0	6.4	79.2	9.5	117	12.7	155	15.1	184	20.6	248	26.2	311
550	22	558.8	6.4	87.2	9.5	129	12.7	171	15.9	213	-	-	-	-
600	24	609.6	6.4	95.2	9.5	141	14.3	210	-	-	-	-	-	-
650	26	660.4	7.9	127	12.7	203	-	-	-	-	-	-	-	-

Note: The unit mass value shall be calculated from the following formula assuming 1 cm^3 of steel to be 7.85g and rounded off to three significant figures in accordance with rule A of JIS Z 8401.

$W=0.02466t\,(D-t)$ where,

w = unit mass of pipe (kg/m)
t = wall thickness of pipe (mm)
D = outside diameter of pipe (mm)
0.02466 = conversion coefficient for obtaining W.

7i) Carbon Steel Tubes For General Structural Purposes

Japanese Industrial Standard (Extracts from JIS G 3444 : 2006)

General Information

This Japanese Industrial Standard specifies the carbon steel tubes used for civil engineering, architecture, steel towers, scaffoldings, struts, piles for suppression of landslide and other structures. Tubes shall be classified into 5 grades. (STK290, STK400, STK490, STK500, STK540)

Chemical Composition

The Chemical composition values shall conform to Table 1.

Table 1. Chemical Composition

Unit: %

Symbol Of Grade	C	Si	Mn	P	S
STK 290	-	-	-	0.050 max.	0.050 max.
STK 400	0.25 max.	-	-	0.040 max.	0.040 max.
STK 490	0.18 max.	0.55 max.	1.50 max.	0.040 max.	0.040 max.
STK 500	0.24 max.	0.35 max.	0.30 to 1.30	0.040 max.	0.040 max.
STK 540	0.23 max.	0.55 max.	1.50 max.	0.040 max.	0.040 max.

Mechanical Strength (Tensile Test)

The tensile strength, yield point or proof stress, and tensile strength in weld zone shall conform to Table 2.

Table 2. Mechanical properties

Symbol Of Grade	Tensile Strength N/mm²	Yield Points Or Proof Strength N/mm²	Tensile Strength In Weld Zone N/mm²
	Applied Outside Diameter		
	All Outside Diameter	All Outside Diameter	Over 350 mm
STK 290	290 min.	-	290 min.
STK 400	400 min.	235 min.	400 min.
STK 490	490 min.	315 min.	490 min.
STK 500	500 min.	355 min.	500 min.
STK 540	540 min.	390 min.	540 min.

The minimum value of elongation shall be in accordance with Table 3 corresponding to manufacturing method and outside diameter. However, *No. 5 test piece may be applied to the tubes of 200 mm or more outside diameter and may be applied to those of other outside diameter under the agreement of the purchaser.

Table 3. Test piece used for tensile test and the minimum value of elongation test

Unit: %

Symbol Of Grade	Production Menthod Of Tubes				
	Seamless And Butt Welded	Electric Resistance Welded And Arc Welded		All Production Methods	
	Applied Outside Diameter				
	All Outside Diameters	350 mm or under	Over 350 mm	All Outside Diameter	
	Test Piece And Direction Of Test Piece				
	*No. 11 Test Piece *No. 12 Test Piece	*No. 11 Test Piece *No. 12 Test Piece	*No. 5 Test Piece	*No. 4 Test Piece	
	Longitudinal Direction	Longitudinal Direction	Transverse Direction	Longitudinal Direction	Transverse Direction
STK 290	30	30	25	28	23
STK 400	23	23	18	21	17
STK 490	23	23	18	21	17
STK 500	15	15	10	14	9
STK 540	20	20	16	19	15

Remark: As for the tubes of outside diameter of 40 mm or under, the elongation value in table 4 shall be not be applied.

The minimum elongation value of tensile test in the case of *No. 12 test piece or *No. 5 test piece of tubes under 8 mm in wall thickness shall conform to Table 4.

Table 4. The minimum elongation value of tensile test in the case of *No. 12 test piece (longitudinal direction) and *No. 5 test piece (transverse direction) of tubes under 8 mm in wall thickness

Unit: mm

Symbol Of Grade	The Shape Of Test Piece	Elongation For Each Division Of Thickness							
		1 mm or under	Over 1mm up to and incl. 2mm	Over 2mm up to and incl. 3mm	Over 3mm up to and incl. 4mm	Over 4mm up to and incl. 5mm	Over 5mm up to and incl. 6mm	Over 6mm up to and incl. 7mm	Over 7mm up to and excl. 8mm
STK 290	*No. 12 Test Piece	20	21	22	24	26	27	28	30
	*No. 5 Test Piece	14	16	18	19	20	22	24	25
STK 400	*No. 12 Test Piece	12	14	16	17	18	20	22	23
	*No. 5 Test Piece	8	9	10	12	14	15	16	18
STK 490	*No. 12 Test Piece	12	14	16	17	18	20	22	23
	*No. 5 Test Piece	8	9	10	12	14	15	16	18
STK 500	*No. 12 Test Piece	4	6	8	9	10	12	14	15
	*No. 5 Test Piece	-	1	2	4	6	7	8	10
STK 540	*No. 12 Test Piece	10	11	12	14	16	17	18	20
	*No. 5 Test Piece	6	7	8	10	12	13	14	16

* Please refer to Appendix 'A' Tension Test Pieces for Metallic Materials - JIS Z 2201 (pg153-155)

Bending Test

The purchaser may specify the bendability test instead of flattening test for the tubes of 50 mm or under of outside diameter. A test piece of an appropriate length shall be cut off form the end of a tube. The test piece shall be bent at an ordinary temperature around a cylinder of the bend angle and the inside radius specified in Table 5, and then examined for the existence of flaws or cracks on the test piece. The weld zone shall be placed in the outermost part of the bent portion. In bending test, the test piece shall be free from flaws or cracks.

Table 5. Bending Test

Mechanical Properties	Bendability	
	Bend Angle	Inside Radius (*D*: Outside Diameter Of Tube)
Outside Diameter	50 mm Or Under	
STK 290	90°	6 *D*
STK 400	90°	6 *D*
STK 490	90°	6 *D*
STK 500	90°	8 *D*
STK 540	90°	6 *D*

Cold Flattening Test

A test piece 50 mm or over in length shall be cut off from the end of the pipe. The test piece shall be placed at ordinary temperature between two flat plates and flattened by compression until the distance between the plates reaches the specified values in Table 6, and then examined for the existence of flaws or cracks on the test piece. The welded zone shall be placed at right angles to the direction of compression. In flattening test, the test piece shall be free from flaws or cracks.

Table 6. Flattening Test

Symbol Of Grade	Flattening
	Distance Between Flattening Plates (*H*) (*D*: Outside Diameter Of Tube)
	All Outside Diameter
STK 290	2/3 *D*
STK 400	2/3 *D*
STK 490	7/8 *D*
STK 500	7/8 *D*
STK 540	7/8 *D*

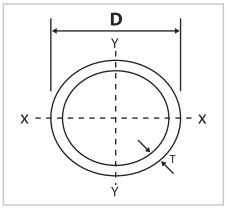
Tolerances On Dimensions and Mass

The tolerances on dimensions shall respectively conform to Table 7.

Table 7. Tolerance on dimensions

Classification		Class 1		Class 2	
Outside Diameter		Under 50 mm	± 0.5 mm	Under 50 mm	± 0.25 mm
		50 mm Or Over	± 1%	50 mm Or Over	± 0.5 %
Thickness	For Seamless steel tube	Under 4 mm	+ 0.6 mm - 0.5 mm	Under 3 mm	± 0.3 mm
		4 mm or over	+ 15 % - 12.5 %	3 mm or over	± 10 %
	For other than seamless steel tube	Under 4 mm	+ 0.6 mm - 0.5 mm	Under 3 mm	± 0.3 mm
		4 mm or over to and excl. 12 mm	+ 15 % - 12.5 %	3 mm or over to and excl. 12 mm	± 10 %
		12 mm or over	+ 15 % - 1.5 mm	12 mm or over	+ 10 % - 1.2 mm
Length		Pipe shall be the specified length or over			
Straightness		Pipe shall be practically straight			
Out-of-roundness (*o*)		-			
Concavity / convexity		-			
Radius of Corners		-			
Squareness of side		-			
Twist		-			
Inner Flash		-			
End tolerance on diameter		-			
End Facing		-			
Pipe End Angle		Both ends shall be at a right angle to its axis			
Mass (*m*) per unit length		-			

Pipes JIS G 3444

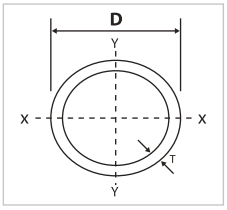


7i(i) Dimension And Unit Mass Of Carbon Steel Tubes For General Structural Purposes

Japanese Industrial Standard (Extracts from JIS G 3444 : 2006)

Outside Diameter D mm	Thickness t mm	Unit Mass W Kg/m	Informative			
			Cross-sectional Area cm^2	Geometrical Moment Of Inertia cm^4	Modulus Of Section cm^3	Radius Of Gyration Of Area cm
21.7	**2.0**	0.972	1.238	0.607	0.560	0.700
27.2	**2.0**	1.24	1.583	1.26	0.930	0.890
	2.3	1.41	1.799	1.41	1.03	0.880
34.0	**2.3**	1.80	2.291	2.89	1.70	1.12
42.7	**2.3**	2.29	2.919	5.97	2.80	1.43
	2.5	2.48	3.157	6.40	3.00	1.42
48.6	**2.3**	2.63	3.345	8.99	3.70	1.64
	2.5	2.84	3.621	9.65	3.97	1.63
	2.8	3.16	4.029	10.6	4.36	1.62
	3.2	3.58	4.564	11.8	4.86	1.61
60.5	**2.3**	3.30	4.205	17.8	5.90	2.06
	3.2	4.52	5.760	23.7	7.84	2.03
	4.0	5.57	7.100	28.5	9.41	2.00
76.3	**2.8**	5.08	6.465	43.7	11.5	2.60
	3.2	5.77	7.349	49.2	12.9	2.59
	4.0	7.13	9.085	59.5	15.6	2.58
89.1	**2.8**	5.96	7.591	70.7	15.9	3.05
	3.2	6.78	8.636	79.8	17.9	3.04
101.6	**3.2**	7.76	9.892	120	23.6	3.48
	4.0	9.63	12.26	146	28.8	3.45
	5.0	11.9	15.17	177	34.9	3.42
114.3	**3.2**	8.77	11.17	172	30.2	3.93
	3.5	9.56	12.18	187	32.7	3.92
	4.5	12.2	15.52	234	41.0	3.89
139.8	**3.6**	12.1	15.40	357	51.1	4.82
	4.0	13.4	17.07	394	56.3	4.80
	4.5	15.0	19.13	438	62.7	4.79
	6.0	19.8	25.22	566	80.9	4.74
165.2	**4.5**	17.8	22.72	734	88.9	5.68
	5.0	19.8	25.16	808	97.8	5.67
	6.0	23.6	30.01	952	115	5.63
	7.1	27.7	35.26	1100	134	5.60
190.7	**4.5**	20.7	26.32	1140	120	6.59
	5.3	24.2	30.87	1330	139	6.56
	6.0	27.3	34.82	1490	156	6.53
	7.0	31.7	40.40	1710	179	6.50
	8.2	36.9	47.01	1960	206	6.46
216.3	**4.5**	23.5	29.94	1680	155	7.49
	5.8	30.1	38.36	2130	197	7.45
	6.0	31.1	39.64	2190	203	7.44
	7.0	36.1	46.03	2520	233	7.40
	8.0	41.1	52.35	2840	263	7.37
	8.2	42.1	53.61	2910	269	7.36

Pipes JIS G 3444

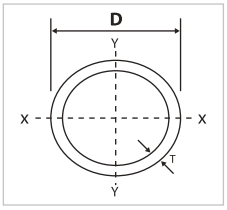


7i(i) Dimension And Unit Mass Of Carbon Steel Tubes For General Structural Purposes

Japanese Industrial Standard (Extracts from JIS G 3444 : 2006)

Outside Diameter D mm	Thickness t mm	Unit Mass W Kg/m	Informative			
			Cross-sectional Area cm^2	Geometrical Moment Of Inertia cm^4	Modulus Of Section cm^3	Radius Of Gyration Of Area cm
267.4	**6.0**	38.7	49.27	4210	315	9.24
	6.6	42.4	54.08	4600	344	9.22
	7.0	45.0	57.26	4860	363	9.21
	8.0	51.2	65.19	5490	411	9.18
	9.0	57.3	73.06	6110	457	9.14
	9.3	59.2	75.41	6290	470	9.13
318.5	**6.0**	46.2	58.91	7190	452	11.1
	6.9	53.0	67.55	8200	515	11.0
	8.0	61.3	78.04	9410	591	11.0
	9.0	68.7	87.51	10500	659	10.9
	10.3	78.3	99.73	11900	744	10.9
355.6	**6.4**	55.1	70.21	10700	602	12.3
	7.9	67.7	86.29	13000	734	12.3
	9.0	76.9	98.00	14700	828	12.3
	9.5	81.1	103.3	15500	871	12.2
	12.0	102	129.5	19100	1080	12.2
	12.7	107	136.8	20100	1130	12.1
406.4	**7.9**	77.6	98.90	19600	967	14.1
	9.0	88.2	112.4	22200	1090	14.1
	9.5	93.0	118.5	23300	1150	14.0
	12.0	117	148.7	28900	1420	14.0
	12.7	123	157.1	30500	1500	13.9
	16.0	154	196.2	37400	1840	13.8
	19.0	182	231.2	43500	2140	13.7
457.2	**9.0**	99.5	126.7	31800	1400	15.8
	9.5	105	133.6	33500	1470	15.8
	12.0	132	167.8	41600	1820	15.7
	12.7	139	177.3	43800	1920	15.7
	16.0	174	221.8	54000	2360	15.6
	19.0	205	261.6	62900	2750	15.5
500	**9.0**	109	138.8	41800	1670	17.4
	12.0	144	184.0	54800	2190	17.3
	14.0	168	213.8	63200	2530	17.2
508	**7.9**	97.4	124.1	38800	1530	17.7
	9.0	111	141.1	43900	1730	17.6
	9.5	117	148.8	46200	1820	17.6
	12.0	147	187.0	57500	2270	17.5
	12.7	155	197.6	60600	2390	17.5
	14.0	171	217.3	66300	2610	17.5
	16.0	194	247.3	74900	2950	17.4
	19.0	229	291.9	87400	3440	17.3
	22.0	264	335.9	99400	3910	17.2

Pipes JIS G 3444

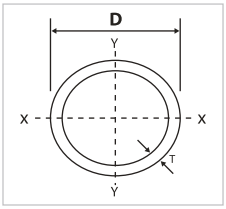


7i(i) Dimension And Unit Mass Of Carbon Steel Tubes For General Structural Purposes

Japanese Industrial Standard (Extracts from JIS G 3444 : 2006)

Outside Diameter D mm	Thickness t mm	Unit Mass W Kg/m	Informative			
			Cross-sectional Area cm^2	Geometrical Moment Of Inertia cm^4	Modulus Of Section cm^3	Radius Of Gyration Of Area cm
558.8	**9.0**	122	155.5	58800	2100	19.4
	12.0	162	206.1	77100	2760	19.3
	16.0	214	272.8	101000	3600	19.2
	19.0	253	322.2	118000	4210	19.1
	22.0	291	371.0	134000	4790	19.0
600	**9.0**	131	167.1	73000	2430	20.9
	12.0	174	221.7	95800	3200	20.8
	14.0	202	257.7	111000	3690	20.7
	16.0	230	293.6	125000	4180	20.7
609.6	**9.0**	133	169.8	76600	2510	21.2
	9.5	141	179.1	80600	2650	21.2
	12.0	177	225.3	101000	3300	21.1
	12.7	187	238.2	106000	3480	21.1
	14.0	206	262.0	116000	3810	21.1
	16.0	234	298.4	132000	4310	21.0
	19.0	277	352.5	154000	5050	20.9
	22.0	319	406.1	176000	5760	20.8
700	**9.0**	153	195.4	117000	3330	24.4
	12.0	204	259.4	154000	4390	24.3
	14.0	237	301.7	178000	5070	24.3
	16.0	270	343.8	201000	5750	24.2
711.2	**9.0**	156	198.5	122000	3440	24.8
	12.0	207	263.6	161000	4530	24.7
	14.0	241	306.6	186000	5240	24.7
	16.0	274	349.4	211000	5940	24.6
	19.0	324	413.2	248000	6960	24.5
	22.0	374	476.3	283000	7960	24.4
812.8	**9.0**	178	227.3	184000	4520	28.4
	12.0	237	301.9	242000	5960	28.3
	14.0	276	351.3	280000	6900	28.2
	16.0	314	400.5	318000	7820	28.2
	19.0	372	473.8	373000	9190	28.1
	22.0	429	546.6	428000	10500	28.0
914.4	**12.0**	267	340.2	348000	7580	31.9
	14.0	311	396.0	401000	8780	31.8
	16.0	354	451.6	456000	9970	31.8
	19.0	420	534.5	536000	11700	31.7
	22.0	484	616.5	614000	13400	31.5
1016.0	**12.0**	297	378.5	477000	9390	35.5
	14.0	346	440.7	553000	10900	35.4
	16.0	395	502.7	628000	12400	35.4
	19.0	467	595.1	740000	14600	35.2
	22.0	539	687.0	849000	16700	35.2

Pipes BS 31



7j) Galvanized Steel Condult Pipe

BS 31 : 1940 Class B (Screwed) / Manufacturer's Standard

Nominal Size		Outside Diameter (D)		Wall Thickness (t)		Calculated Weight With Coupler	No. of Threads/in	Length of Threads	
		Max	Min	Nominal	Min			Max	Min
mm	in	mm	mm	mm	mm	Kg/m		mm	mm
19	3/4	19.07	18.76	1.63	1.52	0.713	16	14.3	12.7
25	1	25.43	25.11	1.63	1.52	0.972	16	17.5	15.9
32	1 1/4	31.78	31.46	1.63	1.52	1.240	16	19.1	17.5
38	1 1/2	38.13	37.80	1.83	1.73	1.680	14	20.6	19.1
50	2	50.83	50.50	2.03	1.93	2.510	14	23.8	22.2

Features:

- Materials of hot-dip galvanised steel strip and manufactured by cold forming and high frequency welding. The outer weld zone coating restored in line with adherent zinc powder.
- Inside weld bead controlled to the minimum to minimise abrasions during wire puling.
- Screwed on both ends to BS31 and fitted with a zinc-coated coupler on one end.
- Packed in bare bundles, but the unsocketed ends protected with plastics caps.
- Easy to cut, thread, bend & pull. Dimensionally accurate. Uniform quality in every aspect.

Length

- Standard length is 3.810mm (12 1/2 ft) without coupler

Mechanical Properties :

- Tensile Strength : 274 to 365 N/mm
- Elongation : minimum 15%

7k) Window Pipe

Nominal Size		Outside Diameter	Wall Thickness	Calculated Weight		
mm	in	mm	mm	Kg/m	Kg/6m	Kg/ft
16	0.63	15.9	1.0	0.367	2.205	0.112
16	0.63	15.9	1.2	0.435	2.610	0.133

7I) Carbon Steel Tubes For General Structural Purposes

Japanese Industrial Standard (Extracts from JIS G 3445 : 2006)

General Information

This Japanese Industrial Standard specifies the carbon steel tubes, used for machinery, automobiles, bicycles, furniture, appliance and other machine parts.

Chemical Composition

The Chemical composition values shall conform to Table 1.

Table 1. Chemical Composition

Unit: %

Grade		Symbol Of Grade	C	Si	Mn	P	S
Grade 11	A	STKM 11 A	0.12 max.	0.35 max.	0.60 max.	0.040 max.	0.040 max.

Mechanical Strength (Tensile Test)

The tensile strength, yield point or proof stress and elongation shall conform to Table 2.
The minimum elongation value of tensile test in the case of *No.12 test piece or *No.5 test piece of tubes under 8 mm in wall thickness shall be as Table 3. The minimum value of elongation shall conform to Table 4 for testing by *No.4 test piece.

Table 2. Mechanical properties

Grade		Symbol Of Grade	Tensile Strength N/mm²	Yield Point Or Proof Strength N/mm²	Elongation %	
					*No. 11 Test Piece *No. 12 Test Piece Longitudinal Direction	*No. 5 Test Piece Transverse Direction
Grade 11	A	STKM 11 A	290 min.	-	35 min.	30 min.

Table 3. The minimum elongation value of tensile test in the case of *No. 12 test piece (longitudinal direction) and *No. 5 test piece (transverse direction) of tubes under 8 mm in wall thickness

Unit %

Grade		Symbol Of Grade	The Shape Of Test Piece	Elongation For Each Division Of Thickness							
				1 mm Or under	Over 1mm up to and incl. 2 mm	Over 2mm up to and incl. 3 mm	Over 3mm up to and incl. 4 mm	Over 4mm up to and incl. 5 mm	Over 5mm up to and incl. 6 mm	Over 6mm up to and incl. 7 mm	Over 7mm up to and excl. 8 mm
11	A	STKM 11A	*No. 5 Test Piece	20	21	22	24	26	27	28	30
			*No. 12 Test Piece	24	26	28	29	30	32	34	35

Table 4. The minimum elongation value of Tensile test using No. 4 test piece

Unit %

Symbol Of Grade	Longitudinal Direction	Transverse Direction
STKM 11A	33	28

* Please refer to Tension Test Pieces for Metallic Materials - JIS Z 2201

Bending Test

The purchaser can specify the bendability test instead of flattening test for the tubes of 50 mm or under of outside diameter. A suitable length of a tube shall be cut off from one end of the tube to be made into a test piece. The test piece shall be bent, at an ordinary temperature around a cylinder of the bend angle and the inside radius specified in Table 5, and then examined for the existence of flaws or cracks on the test piece. The weld zone shall be placed in the outermost part of the bent portion. In bending test, the test piece shall be free from flaws or cracks.

Table 5. Bending test

Bending Strength				
Grade		Designation	Bend Angle	Inside Radius (*D* Is Outside Dia. Of The Tube)
Grade 11	A	STKM 11 A	180°	4 D

Cold Flattening Test

A test piece of 50 mm or over in length shall be cut off from the end of a pipe. The test piece shall be placed at ordinary temperature between two flat plates and flattened by compression until the distance between the plates reaches the value specified in Table 6, and then examined for the existence of flaws or cracks on the test piece. The weld zone shall be placed at right angle to the direction of compression. In flattening test, the test piece shall be free from flaws or cracks.

Table 6. Flattening test

Flattening Strength				
Grade		Designation	Flattening Angle	Distance Between Flat Plates (H) (D is Outside Dia. Of The Tube)
Grade 11	A	STKM 11 A	90°	1/2 D

Tolerances On Dimensions and Mass

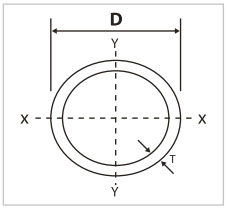
The tolerances on dimensions shall be as specified in Table 7.

Table 7. Tolerance on dimensions

Division	No. 1		No. 2		No. 3	
Outside Diameter	Under 50 mm	± 0.5 mm	Under 50 mm	± 0.25 mm	Under 25 mm	± 0.12 mm
	50 mm or over	± 1 %	50 mm or over	± 0.5 %	25 mm or over to and excl. 40 mm	± 0.15 mm
					40 mm or over to and excl. 50 mm	± 0.18 mm
					50 mm or over to and excl. 60 mm	± 0.20 mm
					60 mm or over to and excl. 70 mm	± 0.23 mm
					70 mm or over to and excl. 80 mm	± 0.25 mm
					80 mm or over to and excl. 90 mm	± 0.30 mm
					90 mm or over to and excl. 100 mm	± 0.40 mm
					100 mm or over	± 0.5 %
Thickness	Under 4 mm	+ 0.6 mm - 0.5 mm	Under 3 mm	± 0.3 mm	Under 2 mm	± 0.15 mm
	4 mm or over	+ 15 % - 12.5 %	3 mm or over	± 10 %	2 mm or over	± 0.8 %
Length	- 0, + 50 mm					
Straightness	Pipe shall be practically straight					
Out-of-roundness (*o*)	-					
Concavity / convexity	-					
Radius of Corners	-					
Squareness of side	-					
Twist	-					
Inner Flash	-					
End tolerance on diameter	-					
End Facing	-					
Pipe End Angle	Both ends shall be at a right angle to its axis					
Mass (*m*) per unit length	-					

Pipes JIS G 3445

7(I) Carbon Steel Tubes For Machine Structural Purposes



(JIS G 3445 : 2006 STKM 11A / Manufacturer's Standard)

7(I) Carbon Steel Tube - I

Nominal Size	Outside Diameter		Thickness (t)											
			SWG : 19				SWG : 18				SWG : 17			
			1.0 mm				1.2 mm				1.4 mm			
	D		0.039 in				0.047 in				0.056 in			
mm	in	mm	kg/m	kg/6m	kg/ft	lb/ft	kg/m	kg/6m	kg/ft	lb/ft	kg/m	kg/6m	kg/ft	lb/ft
12	1/2	12.7	0.289	1.734	0.088	0.194	0.340	2.040	0.104	0.228	0.390	2.340	0.119	0.262
16	5/8	15.9	0.368	2.208	0.112	0.247	0.435	2.610	0.133	0.292	0.501	3.006	0.153	0.337
19	3/4	19.1	0.447	2.682	0.136	0.300	0.530	3.180	0.162	0.356	0.611	3.666	0.186	0.411
22	7/8	22.2	0.523	3.138	0.159	0.351	0.622	3.732	0.190	0.418	0.718	4.308	0.219	0.482
25	1	25.4	0.602	3.612	0.183	0.405	0.716	4.296	0.218	0.481	0.829	4.974	0.253	0.557
28	1 1/8	28.6	0.681	4.086	0.208	0.458	0.811	4.866	0.247	0.545	0.939	5.634	0.286	0.631
32	1 1/4	31.8	0.760	4.560	0.232	0.511	0.906	5.436	0.276	0.609	1.050	6.300	0.320	0.706
35	1 3/8	34.9	-	-	-	-	1.000	6.000	0.305	0.672	1.160	6.960	0.354	0.779
38	1 1/2	38.1	0.915	5.490	0.279	0.615	1.092	6.552	0.333	0.734	1.267	7.602	0.386	0.851
41	1 5/8	41.3	-	-	-	-	1.187	7.122	0.362	0.798	1.378	8.268	0.420	0.926
44	1 3/4	44.5	-	-	-	-	1.281	7.686	0.390	0.861	1.488	8.928	0.454	1.000
47	1 7/8	47.6	-	-	-	-	1.373	8.238	0.418	0.923	1.595	9.570	0.486	1.072
50	2	50.8	-	-	-	-	1.468	8.808	0.447	0.986	1.705	10.230	0.520	1.146
54	2 1/8	54.0	-	-	-	-	1.563	9.378	0.476	1.050	1.816	10.896	0.554	1.220
57	2 1/4	57.2	-	-	-	-	-	-	-	-	1.926	11.556	0.587	1.294
60	2 3/8	60.3	-	-	-	-	1.749	10.494	0.533	1.175	2.033	12.198	0.620	1.366
65	2 1/2	63.5	-	-	-	-	-	-	-	-	2.144	12.864	0.653	1.441
80	3	76.2	-	-	-	-	-	-	-	-	-	-	-	-

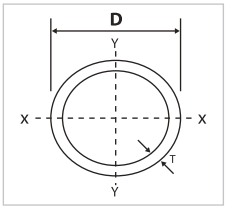
7(I) Carbon Steel Tube - II

Nominal Size	Outside Diameter D		Thickness (t) 1.5 mm 0.059 in			
mm	in	mm	kg/m	kg/6m	kg/ft	lb/ft
25	1	25.4	0.884	5.304	0.269	0.594
32	1 1/4	31.8	1.121	6.726	0.342	0.753
38	1 1/2	38.1	1.354	8.124	0.413	0.910
50	2	50.8	1.824	10.944	0.556	1.226
60	2 3/8	60.3	2.175	13.050	0.663	1.462

Note : Calculated based on 1kg=2.2046 lb and 1m=3.2808 feet

Pipes JIS G 3445

7(I) Carbon Steel Tubes For Machine Structural Purposes



(JIS G 3445 : 2006 STKM 11A / Manufacturer's Standard)

7(I) Carbon Steel Tube - III

Nominal Size	Outside Diameter		Thickness (t)											
			SWG : 16				SWG : 15				SWG : 14			
			1.6 mm				1.8 mm				2.0 mm			
	D		0.063 in				0.071 in				0.079 in			
mm	in	mm	kg/m	kg/6m	kg/ft	lb/ft	kg/m	kg/6m	kg/ft	lb/ft	kg/m	kg/6m	kg/ft	lb/ft
12	1/2	12.7	0.438	2.628	0.134	0.294	0.484	2.904	0.148	0.325	0.528	3.168	0.161	0.355
16	5/8	15.9	0.564	3.384	0.172	0.379	0.626	3.756	0.191	0.421	0.686	4.116	0.209	0.461
19	3/4	19.1	0.691	4.146	0.211	0.464	0.768	4.608	0.234	0.516	0.844	5.064	0.257	0.567
22	7/8	22.2	0.813	4.878	0.248	0.546	0.906	5.436	0.276	0.609	0.996	5.976	0.304	0.669
25	1	25.4	0.939	5.634	0.286	0.631	1.048	6.288	0.319	0.704	1.154	6.924	0.352	0.775
28	1 1/8	28.6	1.066	6.396	0.325	0.716	1.190	7.140	0.363	0.800	1.312	7.872	0.400	0.882
32	1 1/4	31.8	1.192	7.152	0.363	0.801	1.332	7.992	0.406	0.895	1.470	8.820	0.448	0.988
35	1 3/8	34.9	1.318	7.908	0.402	0.886	1.469	8.814	0.448	0.987	1.623	9.738	0.495	1.091
38	1 1/2	38.1	1.440	8.640	0.439	0.968	1.612	9.672	0.491	1.083	1.781	10.686	0.543	1.197
41	1 5/8	41.3	1.567	9.402	0.478	1.053	1.754	10.524	0.535	1.179	1.938	11.628	0.591	1.302
44	1 3/4	44.5	1.693	10.158	0.516	1.138	1.896	11.376	0.578	1.274	2.096	12.576	0.639	1.408
47	1 7/8	47.6	1.815	10.890	0.553	1.220	2.033	12.198	0.620	1.366	2.249	13.494	0.686	1.511
50	2	50.8	1.942	11.652	0.592	1.305	2.175	13.050	0.663	1.462	2.407	14.442	0.734	1.617
54	2 1/8	54.0	2.068	12.408	0.630	1.390	2.317	13.902	0.706	1.557	2.565	15.390	0.782	1.724
57	2 1/4	57.2	2.194	13.164	0.669	1.474	2.459	14.754	0.750	1.652	2.723	16.338	0.830	1.830
60	2 3/8	60.3	2.316	13.896	0.706	1.556	2.597	15.582	0.792	1.745	2.876	17.256	0.877	1.933
65	2 1/2	63.5	2.443	14.658	0.745	1.642	2.739	16.434	0.835	1.841	3.033	18.198	0.924	2.038
80	3	76.2	2.944	17.664	0.897	1.978	3.303	19.818	1.007	2.220	3.660	21.960	1.116	2.459

Note : Calculated based on 1kg=2.2046 lb and 1m=3.2808 feet

Pipes JIS Z 2201

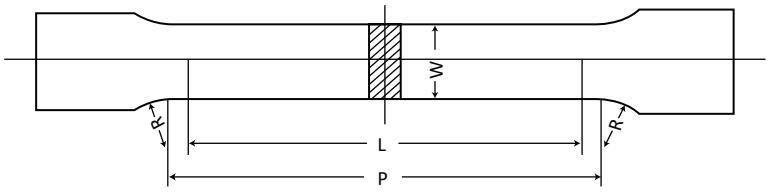
Appendix 'A'

Tension Test Pieces for Metallic Materials - Japanese Industrial Standard (Extracts from JIS Z 2201)

Classification of Test Piece

The test pieces shall be classified into No.1, No.4, No.5, No.11 and No.12 test piece in accordance with the shape and size, and the standard dimensions of these test pieces shall comply with following.

No.1 Test Piece The test piece shall be principally used for tension test of steel plates, steel flats and steel sections.



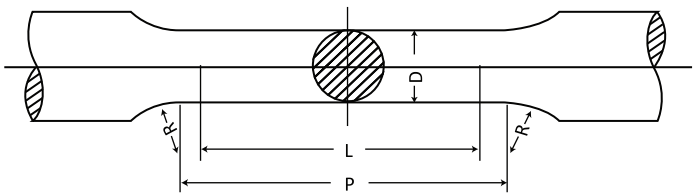
Gauge Length	*L*= 200 mm
Length of parallel portion	*P*= approx. 220 mm
Radius of shoulder	*R*= 25 mm or more

The thickness shall be as the original size

Unit: mm

Division Of Test Piece	Width *w*
1A	40 mm (or 38 mm be used)
1B	25 mm

No.4 Test Piece This test piece shall be principally used for tension test of steel castings, steel forgings, rolled steel, malleable iron castings and nodular graphite iron castings. And it shall also be used for tension test of bars and castings of non-ferrous metal (or alloy thereof).



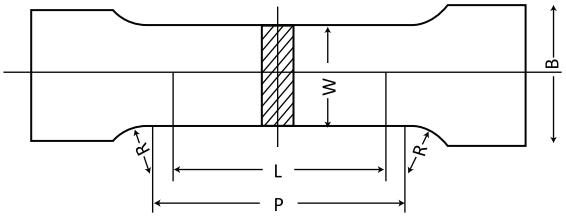
Gauge Length	*L*= 50 mm
Length of parallel portion	*P*= approx. 60 mm
Diameter	*D*= 14 mm
Radius of shoulder	*R*= 15 mm or more

This test piece is required that the section of the parallel portion is finished to a circle, but it should not be finished, as a rule, for malleable castings. Where the test piece of dimensions specified above can not be obtained for the reason of the material, the diameter of the parallel portion and the gauge length shall be determined by the following formula. In this case, the gauge length may be rounded up to an integer.

$L=4\sqrt{A} \quad =3.54D$

Where, A represents the sectional area of parallel portion of the test piece

No.5 Test Piece This test piece shall be principally used for tension test of pipes and tubes, steel sheets and non-ferrous metal (or alloy thereof) sheets and sections.

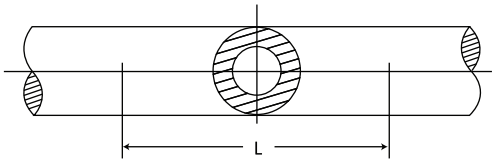


Gauge Length	*L*= 50 mm
Length of parallel portion	*P*= approx. 60 mm
Width	*W*= 25 mm
Radius of shoulder	*R*= 15 mm or more

The thickness shall be as the original size. For thin steel sheets only, the following shall be applied.

Radius of shoulder	R= 20 ~ 30 mm
Width of gripped portion	B= 30 mm or more

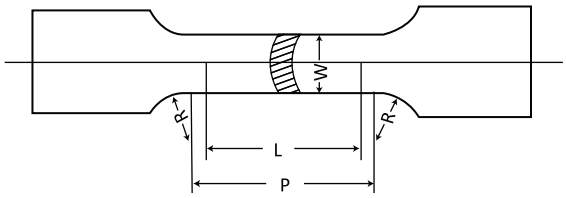
No.11 Test Piece This test piece shall be used for tension test of pipes and tubes, where the test is carried out on a specimen of tubular form.



Gauge Length *L*= 50mm

The cross-section of this test piece shall be left same as cut from the original material, and its both gripped ends should be either inserted with mandrels or flattened by hammering. Further, in the latter case, the length of parallel portion should be 100 mm or more.

No.12 Test Piece This test piece shall be principally used for tension test of pipes and tubes, where the test is not carried out on a specimen of tubular form.



Gauge Length	L= 50 mm
Length of parallel portion	p= approx. 60 mm
Radius of shoulder	R= 15 mm or more

Unit: mm

Division Of Test Piece	Width *w*
12A	19 mm
12B	25 mm
12C	38 mm

Both gripped ends of the test piece may be flattened by hammering at cold state.

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