

WEIGHTS and USEFUL DATA

CIRCUMFERENCE & AREAS OF CIRCLES	14-15
GLOSSARY OF TERMS	14-3
HARDNESS CONVERSION TABLE	14-7
INCHES INTO DECIMALS OF A FOOT	14-9
MECHANICAL PROPERTIES OF VARIOUS STEELS	14-20
METRIC SYSTEM EQUIVALENTS	14-22
NUMERICAL EQUIVALENTS	14-24
SPECIFICATIONS, AISI & SAE	14-10
STANDARD ABBREVIATIONS	14-5
USEFUL INFORMATION	14-2

Russel Metals

USEFUL INFORMATION

To find circumference of a circle multiply diameter by 3.1416.

To find diameter of a circle multiply circumference by .31831.

To find area of a circle multiply square of diameter by .7854.

Radius of circle equals half of diameter.

Area of rectangle. Length multiplied by breadth. Doubling the diameter of a circle increases its area four times.

To find area of a triangle multiply base by $\frac{1}{2}$ perpendicular height.

Area of ellipse = product of both diameters \times .7854.

Area of parallelogram = base \times height.

To find side of an inscribed square multiply diameter by 0.7071 or multiply circumference by 0.2251 or divide circumference by 4.4428.

Side of inscribed cube = radius of sphere \times 1.1547.

To find side of an equal square multiply diameter by .8862.

Square. A side multiplied by 1.4142 equals diameter of its circumscribing circle.

A side multiplied by 4.443 equals circumference of its circumscribing circle.

A side multiplied by 1.128 equals diameter of an equal circle.

A side multiplied by 3.547 equals circumference of an equal circle.

To find cubic inches in a ball multiply cube of diameter by .5236.

To find cubic contents of a cone, multiply area of base by $\frac{1}{3}$ the height.

Surface of frustum of cone or pyramid = sum of circumference of both ends \times $\frac{1}{2}$ slant height plus area of both ends.

Contents of frustum of cone or pyramid = multiply area of two ends and get square root. Add the 2 areas and \times $\frac{1}{3}$ altitude.

Doubling the diameter of a pipe increases its capacity four times.

A cubic foot of water contains 7.4805 U.S. (6.2278 Imp.) gallons, 1728 cubic inches, and weighs 62 $\frac{1}{2}$ lbs.

To find the pressure in pounds per square inch of a column of water multiply the height of the column in feet by .434.

Steam rising from water at its boiling point (212 degrees) has a pressure equal to the atmosphere (14.7 lbs. to the square inch).

A standard horse power. The evaporation of 30 lbs. of water per hour from a feed water temperature of 100° F. into steam at 70 lbs. gauge pressure.

To ascertain heating surface in tubular boilers multiply $\frac{2}{3}$ the circumference of boiler by length of boiler in inches and add to it the area of all the tubes.

One metre equals 39.37 inches. See metric tables Section 14, page 22.

To find millimetre equivalent of inch decimals, multiply by 25.4.

GLOSSARY OF TERMS

ANNEALING – A heating and cooling operation, usually slow cooling, performed on steels in the solid state.

Annealing is a comprehensive term, the purpose of which may be:

- (1) To remove stresses.
- (2) To induce softness.
- (3) To alter ductility, toughness, electrical, magnetic or other physical properties.
- (4) To refine the crystalline structure.
- (5) To remove gases.
- (6) To produce a definite microstructure.

CARBURIZING – A case hardening process by which carbon alone is added to a limited or specified penetration by heating steel below its melting point in contact with carbonaceous solids, liquids, or gases.

CASE – The surface area of an iron-base alloy whose carbon content has been increased substantially by case hardening.

CASE HARDENING – A process of carburizing or cyaniding followed by quenching, or of nitriding, which is used to substantially increase the surface hardness of an iron-base alloy.

CORE – The interior portion of an iron-base alloy whose chemical composition has not been substantially changed as the result of case hardening.

ELASTIC LIMIT – The greatest stress a material is capable of developing without a measurable change remaining after complete release of the stress. To determine the elastic limit, a load is applied to a specimen at a uniform rate, and the stress at which the specimen suddenly elongates is recorded on an “extensometer”, reading to 0.0002 inch, which is attached to the specimen to indicate distance between gauge marks.

HARDENING – A Heat Treating Process that implies heating steel to a temperature above the critical range, and cooling it rapidly enough through the critical range to harden it appreciably.

HARDNESS TESTS –

- (a) **Brinell Hardness** – A hardness test performed on a Brinell hardness testing machine. The smooth surface of a specimen is indented with a spherical-shaped hardened steel ball of known diameter by means of a predetermined load applied to the ball. The diameter of the impression is measured in millimeters with a micrometer microscope, and the reading is compared with a chart to determine the Brinell Hardness number (Bhn).

(b) Rockwell Hardness – A hardness test performed on a Rockwell hardness testing machine. Hardness is determined by a dial reading which indicates the depth of penetration of a steel ball or diamond cone when a load is applied.

(c) Scleroscope or Shore Hardness – A hardness test performed on a Shore Scleroscope Hardness Tester. The hardness is determined by the rebound of a diamond pointed hammer (or tup) when it strikes the surface of a specimen. The hammer (or tup) is enclosed in a glass tube and the height of the rebound is read either against a graduated scale inscribed on the tube, or on a dial, depending on the model instrument used.

COLD SHORTNESS – The characteristic of metals that are brittle at ordinary or low temperatures.

EFFECT OF CARBON ON STEEL – Increasing the carbon content increases the tensile strength and hardness.

EFFECT OF SULPHUR ON STEEL – When sulphur is over .06 there is a tendency to red shortness. Free cutting steel, for threading and screw machine work, is obtained by increasing sulphur content to about .075 to .10.

EFFECT OF PHOSPHOROUS ON STEEL – Produces brittleness and general cold shortness. Strengthens low carbon steel, increases resistance to corrosion, and improves machinability.

EFFECT OF MANGANESE ON STEEL – Manganese is added in the making of steel to prevent red shortness and increase hardenability.

EFFECT OF SILICON ON STEEL – Used as a general purpose deoxidizer. Strengthens low alloy steels and increases hardenability. Used as alloying element for electrical and magnetic steels.

EFFECT OF COPPER ON STEEL – Used to increase atmospheric corrosion resistance, and sensitivity to both cold and hot shortness.

EFFECT OF NICKEL ON STEEL – Strengthens and toughens ferrite and pearlitic steels, and renders high chromium alloy steels austenitic (stainless steels).

EFFECT OF CHROMIUM ON STEEL – Increases hardenability, resistance to corrosion and oxidation, abrasion and high temperature strength.

EFFECT OF MOLYBDENUM ON STEEL – Increases hardenability and coarsening temperature. Raises the creep strength and red hardness, and enhances corrosion resistance of stainless steel.

EFFECT OF VANADIUM ON STEEL – Elevates coarsening temperatures, increases hardenability, and is a strong deoxidizer.

(Cont'd)

EFFECT OF BORON ON STEEL – Increases hardenability of lower carbon steels – up to 0.008% maximum boron content. Has improved machinability, as well as hot and cold working characteristics over standard alloy steels.

STANDARD ABBREVIATIONS

A & P – Annealed and Pickled	Ex. – Extra
Av. – Average	F.C. – Free Cutting
B & O – Blued and Oiled	F.T. – Free Turning
C.D. – Cold Drawn	H.D. – Hard Drawn
C.F. – Cold Finished	Hex. – Hexagon
C.R. – Cold Rolled	H.F. – Hot Finished
C & S – Cut and Straightened	H.H. – Half Hard
Dia. – Diameter (used for Round Bars)	H.R. – Hot Rolled
D & S – Dehydrated and Sealed	Hvy. – Heavy

HEAT TREATMENT – Steel is heat treated to improve it for the service intended or to prepare it for operations such as cold rolling, cold drawing or machining. This process is broadly defined as an operation or combination of operations involving the heating and cooling of steel in the solid state to obtain a certain desired condition or set of properties.

MECHANICAL WORKING – Changing the former structure of a metal by subjecting it to pressure by rolling, pressing, or forging. The crystalline structure is refined and the quality of the metal is improved as the particles are forced into intimate contact. The strength is always increased by working and the hardness and ductility may be affected depending upon the amount of work done and by the temperature at which the working is carried on.

NITRIDING – A process by which nitrogen alone is added to a limited or specified penetration by heating certain alloy steels, which have a properly conditioned surface, in contact with ammonia gas or other substance from which the steel may absorb nitrogen. This produces an extremely hard, wear-resistant surface.

NORMALIZING – The normalizing process is applied to steel to restore its normal condition after hot working, cold working, or non-uniform cooling, or to efface the effects of a previous heat treatment. Normalizing is accomplished by heating to a temperature about 100° F. above the critical range and then cooling in still air at room temperature.

PERCENTAGE OF ELONGATION – The percentage of increase in length of a tension test specimen after rupture.

PICKLING – Removing scale by immersion in a dilute acid bath.

QUENCHING – Cooling by immersion in some medium, which may be any liquid or gas, or even a solid in suitable form, to absorb heat rapidly from the article to be quenched.

(Cont'd)

REDUCTION OF AREA – The difference between the original cross sectional area and that of the smallest area at point of rupture. It is usually stated as a percentage of the original area.

SPHERODIZING – A heat treating process which is generally applied to high carbon steel to improve machinability. It consists of prolonged heating at a temperature just below or within the critical temperature range, followed usually by slow cooling.

TEMPERING OR DRAWING – This process is applied to relieve stresses due to hardening and to adjust the hardness to the value desired. The hardened steel is reheated to a temperature below the lower critical range and is then permitted to cool.

TENSILE STRENGTH – The maximum load, per unit of original cross-sectional area, a material in tension is capable of withstanding before complete failure or rupture.

YIELD POINT – The load per unit of original cross-sectional area at which a marked increase in the deformation of a specimen occurs without increase of load. It is usually determined by the sudden drop of the beam of the testing machine or by use of dividers or by means of an extensometer.

RED SHORTNESS – Brittleness in steel when it is red hot.

HARDNESS CONVERSION TABLE

Approximate Values

BRINELL		ROCKWELL		TENSILE STRENGTH
Diam. in Mm. 3000 Kg. Load 10 Mm. Ball	Hardness Number	C Scale	B Scale	
		150 Kg. Load, 120 Deg. Cone	100 Kg. Load, 1/16 in. Ball	1000 lb Per Sq. In.
2.20	780	70	—	384
2.25	745	68	—	368
2.30	712	66	—	352
2.35	682	64	—	337
2.40	653	62	—	324
2.45	627	60	—	311
2.50	601	58	—	298
2.55	578	57	—	287
2.60	555	55	—	276
2.65	534	53	—	266
2.70	514	52	—	256
2.75	495	50	—	247
2.80	477	49	—	238
2.85	461	47	—	229
2.90	444	46	—	220
2.95	429	45	—	212
3.00	415	44	—	204
3.05	401	42	—	196
3.10	388	41	—	189
3.15	375	40	—	182
3.20	363	38	—	176
3.25	352	37	—	170
3.30	341	35	—	165
3.35	331	35	—	160
3.40	321	34	—	155
3.45	311	33	—	150
3.50	302	32	—	146
3.55	293	31	—	142
3.60	285	30	—	138
3.65	277	29	—	134
3.70	269	28	—	131
3.75	262	26	—	128
3.80	255	25	—	125
3.85	248	24	—	122
3.90	241	23	100	119

(Cont'd)

HARDNESS CONVERSION TABLE (Cont'd)

Approximate Values

BRINELL		ROCKWELL		TENSILE STRENGTH 1000 lb Per Sq. In.
Diam. in Mm. 3000 Kg. Load 10 Mm. Ball	Hardness Number	C Scale	B Scale	
		150 Kg. Load, 120 Deg. Cone	100 Kg. Load, 1/16 in. Ball	
3.95	235	22	99	116
4.00	229	21	98	113
4.05	223	20	97	110
4.10	217	—	96	107
4.15	212	—	96	104
4.20	207	—	95	101
4.25	202	—	94	99
4.30	197	—	93	97
4.35	192	—	92	95
4.40	187	—	91	93
4.45	183	—	90	91
4.50	179	—	89	89
4.55	174	—	88	87
4.60	170	—	87	85
4.65	166	—	86	83
4.70	163	—	85	82
4.75	159	—	84	80
4.80	156	—	83	78
4.85	153	—	82	76
4.90	149	—	81	75
4.95	146	—	80	74
5.00	143	—	79	72
5.05	140	—	78	71
5.10	137	—	77	70
5.15	134	—	76	68
5.20	131	—	74	66
5.25	128	—	73	65
5.30	126	—	72	64
5.35	124	—	71	63
5.40	121	—	70	62
5.45	118	—	69	61
5.50	116	—	68	60

CONVERSION TABLE OF INCHES INTO DECIMALS OF A FOOT

Inches	Decimal of a Ft.	Inches	Decimal of a Ft.	Inches	Decimal of a Ft.	Inches	Decimal of a Ft.
		3"—.250		6"—.50		9"—.750	
$\frac{1}{16}$	.0052	$\frac{1}{16}$	.2552	$\frac{1}{16}$	.5052	$\frac{1}{16}$	.7552
$\frac{1}{8}$	.0104	$\frac{1}{8}$	.2604	$\frac{1}{8}$	.5104	$\frac{1}{8}$	.7604
$\frac{3}{16}$	.0156	$\frac{3}{16}$	.2656	$\frac{3}{16}$	.5156	$\frac{3}{16}$	.7656
$\frac{1}{4}$	.0208	$\frac{1}{4}$	.2708	$\frac{1}{4}$	.5108	$\frac{1}{4}$	.7708
$\frac{5}{16}$	.0260	$\frac{5}{16}$	.2760	$\frac{5}{16}$	.5260	$\frac{5}{16}$	.7760
$\frac{3}{8}$	.0312	$\frac{3}{8}$	.2812	$\frac{3}{8}$	.5312	$\frac{3}{8}$	.7812
$\frac{7}{16}$	.0364	$\frac{7}{16}$	.2864	$\frac{7}{16}$	.5364	$\frac{7}{16}$	.7864
$\frac{1}{2}$	.0416	$\frac{1}{2}$	.2916	$\frac{1}{2}$	.5416	$\frac{1}{2}$	.7916
$\frac{9}{16}$	.0468	$\frac{9}{16}$	.2968	$\frac{9}{16}$	.5468	$\frac{9}{16}$	.7968
$\frac{5}{8}$	.0520	$\frac{5}{8}$	.3020	$\frac{5}{8}$	.5520	$\frac{5}{8}$	.8020
$\frac{11}{16}$	.0572	$\frac{11}{16}$	.3072	$\frac{11}{16}$	.5572	$\frac{11}{16}$	.8072
$\frac{3}{4}$	.0625	$\frac{3}{4}$	.3125	$\frac{3}{4}$	.5625	$\frac{3}{4}$	.8125
$\frac{13}{16}$	.0677	$\frac{13}{16}$	.3177	$\frac{13}{16}$	.5677	$\frac{13}{16}$	.8177
$\frac{7}{8}$	.0729	$\frac{7}{8}$	.3229	$\frac{7}{8}$	.5729	$\frac{7}{8}$	.8229
$\frac{15}{16}$	.0781	$\frac{15}{16}$	.3281	$\frac{15}{16}$	.5781	$\frac{15}{16}$	.8281
1"—.0833		4"—.3333		7"—.5833		10"—.8333	
$\frac{1}{16}$	.0885	$\frac{1}{16}$	.3385	$\frac{1}{16}$	.5885	$\frac{1}{16}$	.8385
$\frac{1}{8}$	.0937	$\frac{1}{8}$	.3437	$\frac{1}{8}$	.5937	$\frac{1}{8}$	.8437
$\frac{3}{16}$	.0989	$\frac{3}{16}$	.3489	$\frac{3}{16}$	.5989	$\frac{3}{16}$	.8489
$\frac{1}{4}$	.1041	$\frac{1}{4}$	.3541	$\frac{1}{4}$	.6041	$\frac{1}{4}$	.8541
$\frac{5}{16}$	.1093	$\frac{5}{16}$	.3593	$\frac{5}{16}$	.6093	$\frac{5}{16}$	.8593
$\frac{3}{8}$	.1145	$\frac{3}{8}$	.3645	$\frac{3}{8}$	.6145	$\frac{3}{8}$	.8645
$\frac{7}{16}$	.1197	$\frac{7}{16}$	.3697	$\frac{7}{16}$	.6197	$\frac{7}{16}$	.8697
$\frac{1}{2}$	.1250	$\frac{1}{2}$	.3750	$\frac{1}{2}$	.6250	$\frac{1}{2}$	.8750
$\frac{9}{16}$	.1302	$\frac{9}{16}$	.3802	$\frac{9}{16}$	.6320	$\frac{9}{16}$	.8802
$\frac{5}{8}$	.1354	$\frac{5}{8}$	.3854	$\frac{5}{8}$	.6354	$\frac{5}{8}$	.8854
$\frac{11}{16}$	.1406	$\frac{11}{16}$	.3906	$\frac{11}{16}$	.6406	$\frac{11}{16}$	.8906
$\frac{3}{4}$	.1458	$\frac{3}{4}$	.3958	$\frac{3}{4}$	.6458	$\frac{3}{4}$	.8958
$\frac{13}{16}$	.1510	$\frac{13}{16}$	.4010	$\frac{13}{16}$	.6510	$\frac{13}{16}$	.9010
$\frac{7}{8}$	.1562	$\frac{7}{8}$	.4062	$\frac{7}{8}$	.6562	$\frac{7}{8}$	.9062
$\frac{15}{16}$	.1614	$\frac{15}{16}$	.4114	$\frac{15}{16}$	.6614	$\frac{15}{16}$	.9114
2"—.1666		5"—.4166		8"—.6666		11"—.9166	
$\frac{1}{16}$	.1718	$\frac{1}{16}$	.4218	$\frac{1}{16}$	.6718	$\frac{1}{16}$	.9218
$\frac{1}{8}$	.1770	$\frac{1}{8}$	.4270	$\frac{1}{8}$	.6770	$\frac{1}{8}$	.9270
$\frac{3}{16}$	.1822	$\frac{3}{16}$	.4322	$\frac{3}{16}$	.6822	$\frac{3}{16}$	.9322
$\frac{1}{4}$	.1875	$\frac{1}{4}$	.4375	$\frac{1}{4}$	.6875	$\frac{1}{4}$	.9375
$\frac{5}{16}$	.1927	$\frac{5}{16}$	.4427	$\frac{5}{16}$	.6927	$\frac{5}{16}$	.9427
$\frac{3}{8}$	.1979	$\frac{3}{8}$	.4479	$\frac{3}{8}$	.6979	$\frac{3}{8}$	.9479
$\frac{7}{16}$	.2031	$\frac{7}{16}$	.4531	$\frac{7}{16}$	.7031	$\frac{7}{16}$	.9531
$\frac{1}{2}$	.2083	$\frac{1}{2}$	.4583	$\frac{1}{2}$	.7083	$\frac{1}{2}$	.9583
$\frac{9}{16}$	.2135	$\frac{9}{16}$	.4635	$\frac{9}{16}$	.7135	$\frac{9}{16}$	.9635
$\frac{5}{8}$	.2187	$\frac{5}{8}$	.4687	$\frac{5}{8}$	.7187	$\frac{5}{8}$	.9687
$\frac{11}{16}$	.2239	$\frac{11}{16}$	.4739	$\frac{11}{16}$	.7239	$\frac{11}{16}$	.9739
$\frac{3}{4}$	.2291	$\frac{3}{4}$	.4791	$\frac{3}{4}$	.7291	$\frac{3}{4}$	.9791
$\frac{13}{16}$	.2343	$\frac{13}{16}$	.4843	$\frac{13}{16}$	.7343	$\frac{13}{16}$	.9843
$\frac{7}{8}$	.2395	$\frac{7}{8}$	.4895	$\frac{7}{8}$	.7395	$\frac{7}{8}$	.9895
$\frac{15}{16}$	.2447	$\frac{15}{16}$	.4947	$\frac{15}{16}$	.7447	$\frac{15}{16}$	.9947

A. I. S. I. AND S. A. E. SPECIFICATIONS

AISI NUMBER	SAE NUMBER	CHEMICAL COMPOSITION LIMITS, PER CENT			
		C	Mn	P. Max.	S. Max.
*C 1006	1006	0.08 max.	0.25/0.40	0.040	0.050
C 1008	1008	0.10 max.	0.30/0.50	0.040	0.050
C 1010	1010	0.08/0.13	0.30/0.60	0.040	0.050
C 1012	—	0.10/0.15	0.30/0.60	0.040	0.050
C 1015	1015	0.13/0.18	0.30/0.60	0.040	0.050
C 1016	1016	0.13/0.18	0.60/0.90	0.040	0.050
C 1017	1017	0.15/0.20	0.30/0.60	0.040	0.050
C 1018	1018	0.15/0.20	0.60/0.90	0.040	0.050
C 1019	1019	0.15/0.20	0.70/1.00	0.040	0.050
C 1020	1020	0.18/0.23	0.30/0.60	0.040	0.050
C 1021	—	0.18/0.23	0.60/0.90	0.040	0.050
C 1022	1022	0.18/0.23	0.70/1.00	0.040	0.050
C 1023	—	0.20/0.25	0.30/0.60	0.040	0.050
C 1025	1025	0.22/0.28	0.30/0.60	0.040	0.050
C 1026	—	0.22/0.28	0.60/0.90	0.040	0.050
C 1029	—	0.25/0.31	0.60/0.90	0.040	0.050
C 1030	1030	0.28/0.34	0.60/0.90	0.040	0.050
C 1031	—	0.27/0.34	1.35/1.65	0.040	0.050
*C 1033	1033	0.29/0.36	0.70/1.00	0.040	0.050
C 1034	1034	0.32/0.38	0.50/0.80	0.040	0.050
C 1035	1035	0.32/0.38	0.60/0.90	0.040	0.050
C 1038	1038	0.35/0.42	0.60/0.90	0.040	0.050
C 1039	—	0.37/0.44	0.70/1.00	0.040	0.050
C 1040	1040	0.37/0.44	0.60/0.90	0.040	0.050
C 1042	1042	0.40/0.47	0.60/0.90	0.040	0.050
C 1043	1043	0.40/0.47	0.70/1.00	0.040	0.050
C 1045	1045	0.43/0.50	0.60/0.90	0.040	0.050
C 1046	1046	0.43/0.50	0.70/1.00	0.040	0.050
C 1049	1049	0.46/0.53	0.60/0.90	0.040	0.050
C 1050	1050	0.48/0.55	0.60/0.90	0.040	0.050
C 1053	—	0.48/0.55	0.70/1.00	0.040	0.050
C 1055	1055	0.50/0.60	0.60/0.90	0.040	0.050
C 1060	1060	0.55/0.65	0.60/0.90	0.040	0.050
C 1065	1065	0.60/0.70	0.60/0.90	0.040	0.050
C 1069	—	0.65/0.75	0.40/0.70	0.040	0.050

(Cont'd)

*The indicated % are for bar products, unless stated otherwise.
Plate, sheet and tubing may be slightly different.*

**AISI Sheet/Plate chemistry*

A. I. S. I. AND S. A. E. SPECIFICATIONS (cont'd)

AISI NUMBER	SAE NUMBER	CHEMICAL COMPOSITION LIMITS, PER CENT			
		C	Mn	P. Max.	S. Max.
C 1070	1070	0.65/0.75	0.60/0.90	0.040	0.050
C 1072	—	0.65/0.76	1.00/1.30	0.040	0.050
C 1074	1074	0.70/0.80	0.50/0.80	0.040	0.050
C 1075	—	0.70/0.80	0.40/0.70	0.040	0.050
C 1078	1078	0.72/0.85	0.30/0.60	0.040	0.050
C 1080	1080	0.75/0.88	0.60/0.90	0.040	0.050
C 1084	—	0.80/0.93	0.60/0.90	0.040	0.050
*C 1085	1085	0.80/0.93	0.70/1.00	0.040	0.050
C 1090	1090	0.85/0.98	0.60/0.90	0.040	0.050
C 1095	1095	0.90/1.03	0.30/0.50	0.040	0.050
C 1108	—	0.08/0.13	0.50/0.80	0.040	0.08/0.13
C 1109	1109	0.08/0.13	0.60/0.90	0.040	0.08/0.13
C 1110	—	0.08/0.13	0.30/0.60	0.045	0.08/0.13
C 1113	—	0.10/0.16	1.00/1.30	0.040	0.24/0.33
C 1115	1115	0.13/0.18	0.60/0.90	0.040	0.08/0.13
C 1116	1116	0.14/0.20	1.10/1.40	0.040	0.16/0.23
C 1117	1117	0.14/0.20	1.00/1.30	0.040	0.08/0.13
C 1118	1118	0.14/0.20	1.30/1.60	0.040	0.08/0.13
C 1119	1119	0.14/0.20	1.00/1.30	0.040	0.24/0.33
C 1120	1120	0.18/0.23	0.70/1.00	0.040	0.08/0.13
C 1125	—	0.22/0.28	0.60/0.90	0.040	0.08/0.13
C 1126	1126	0.23/0.29	0.70/1.00	0.040	0.08/0.13
C 1137	1137	0.32/0.39	1.35/1.65	0.040	0.08/0.13
C 1138	1138	0.34/0.40	0.70/1.00	0.040	0.08/0.13
C 1140	1140	0.37/0.44	0.70/1.00	0.040	0.08/0.13
C 1141	1141	0.37/0.45	1.35/1.65	0.040	0.08/0.13
C 1144	1144	0.40/0.48	1.35/1.65	0.040	0.24/0.33
C 1145	1145	0.42/0.49	0.70/1.00	0.040	0.04/0.07
C 1146	1146	0.42/0.49	0.70/1.00	0.040	0.08/0.13
C 1148	—	0.45/0.52	0.70/1.00	0.040	0.04/0.07
C 1151	1151	0.48/0.55	0.70/1.00	0.040	0.08/0.13
**C 12L14	12L14	.15 max.	0.85/1.15	.04/.09	0.26/0.35
**C 12L15	12L15	.09 max	0.75/1.25	.04/.06	0.25/0.35

(Cont'd)

*The indicated % are for bar products, unless stated otherwise.
Plate, sheet and tubing may be slightly different.*

**AISI Sheet/Plate chemistry*

***This specification has 0.15/0.35% Lead added.*

A. I. S. I. AND S. A. E. SPECIFICATIONS

AISI NUMBER	SAE NUMBER	CHEMICAL COMPOSITION LIMITS, PER CENT			
		C	Mn	P. Max.	S. Max.
1320	1320	0.18/0.23	1.60/1.90	0.040	0.040
1321	—	0.17/0.22	1.80/2.10	0.050	0.050
1330	1330	0.28/0.33	1.60/1.90	0.035	0.040
1335	1335	0.33/0.38	1.60/1.90	0.035	0.040
1340	1340	0.38/0.43	1.60/1.90	0.035	0.040
1524	1524	0.19/0.25	1.35/1.65	0.040	0.050
1527	1527	0.22/0.29	1.20/1.50	0.040	0.050
1536	1536	0.30/0.37	1.20/1.50	0.040	0.050
1541	1541	0.36/0.44	1.35/1.65	0.040	0.050
1552	1552	0.47/0.55	1.20/1.50	0.040	0.050
2515	2515	0.12/0.17	0.40/0.60	0.040	0.040
3115	3115	0.13/0.18	0.40/0.60	0.040	0.040
3120	3120	0.17/0.22	0.60/0.80	0.040	0.040
3130	3130	0.28/0.33	0.60/0.80	0.040	0.040
3135	3135	0.33/0.38	0.60/0.80	0.040	0.040
3140	3140	0.38/0.43	0.70/0.90	0.040	0.040
3141	3141	0.38/0.43	0.70/0.90	0.040	0.040
3145	3145	0.43/0.48	0.70/0.90	0.040	0.040

Note: AISI # continued below with additional chemistries.

AISI NUMBER	SAE NUMBER	CHEMICAL COMPOSITION LIMITS, PER CENT			
		Si	Ni	Cr	Mo
1320	1320	0.15/0.35	—	—	—
1321	—	0.15/0.35	—	—	—
1330	1330	0.15/0.35	—	—	—
1335	1335	0.15/0.35	—	—	—
1340	1340	0.15/0.35	—	—	—
2515	2515	0.20/0.35	4.75/5.25	—	—
3115	3115	0.20/0.35	1.10/1.40	0.55/0.75	—
3120	3120	0.20/0.35	1.10/1.40	0.55/0.75	—
3130	3130	0.20/0.35	1.10/1.40	0.55/0.75	—
3135	3135	0.20/0.35	1.10/1.40	0.55/0.75	—
3140	3140	0.20/0.35	1.10/1.40	0.55/0.75	—
3141	3141	0.20/0.35	1.10/1.40	0.70/0.90	—
3145	3145	0.20/0.35	1.10/1.40	0.70/0.90	—

(Cont'd)

The indicated % are for bar products, unless stated otherwise.
Plate, sheet and tubing may be slightly different.

A. I. S. I. AND S. A. E. SPECIFICATIONS (cont'd)

AISI NUMBER	SAE NUMBER	CHEMICAL COMPOSITION LIMITS, PER CENT			
		C	Mn	P. Max.	S. Max.
3150	3150	0.48/0.53	0.70/0.90	0.035	0.040
4017	4017	0.15/0.20	0.70/0.90	0.035	0.040
4023	4023	0.20/0.25	0.70/0.90	0.035	0.040
4024	4024	0.20/0.25	0.70/0.90	0.035	0.035/0.050
4027	4027	0.25/0.30	0.70/0.90	0.035	0.040
4028	4028	0.25/0.30	0.70/0.90	0.035	0.035/0.050
4032	4032	0.30/0.35	0.70/0.90	0.035	0.040
4037	4037	0.35/0.40	0.70/0.90	0.035	0.040
4042	4042	0.40/0.45	0.70/0.90	0.035	0.040
4047	4047	0.45/0.50	0.70/0.90	0.035	0.040
4053	4053	0.50/0.56	0.75/1.00	0.035	0.040
4063	4063	0.60/0.67	0.75/1.00	0.035	0.040
4068	4068	0.63/0.70	0.75/1.00	0.035	0.040
4130	4130	0.28/0.33	0.40/0.60	0.035	0.040
4137	4137	0.35/0.40	0.70/0.90	0.035	0.040

Note: AISI # continued below with additional chemistries.

AISI NUMBER	SAE NUMBER	CHEMICAL COMPOSITION LIMITS, PER CENT			
		Si	Ni	Cr	Mo
3150	3150	0.20/0.35	1.10/1.40	0.70/0.90	—
4017	4017	0.15/0.35	—	—	0.20/0.30
4023	4023	0.15/0.35	—	—	0.20/0.30
4024	4024	0.15/0.35	—	—	0.20/0.30
4027	4027	0.15/0.35	—	—	0.20/0.30
4028	4028	0.15/0.35	—	—	0.20/0.30
4032	4032	0.15/0.35	—	—	0.20/0.30
4037	4037	0.15/0.35	—	—	0.20/0.30
4042	4042	0.15/0.35	—	—	0.20/0.30
4047	4047	0.15/0.35	—	—	0.20/0.30
4053	4053	0.15/0.35	—	—	0.20/0.30
4063	4063	0.15/0.35	—	—	0.20/0.30
4068	4068	0.15/0.35	—	—	0.20/0.30
4130	4130	0.20/0.35	—	0.80/1.10	0.15/0.25
4137	4137	0.20/0.35	—	0.80/1.10	0.15/0.25

(Cont'd)

*The indicated % are for bar products, unless stated otherwise.
Plate, sheet and tubing may be slightly different.*

A. I. S. I. AND S. A. E. SPECIFICATIONS (cont'd)

AISI NUMBER	SAE NUMBER	CHEMICAL COMPOSITION LIMITS, PER CENT			
		C	Mn	P. Max.	S. Max.
4140	4140	0.38/0.43	0.75/1.00	0.035	0.040
4142	—	0.40/0.45	0.75/1.00	0.035	0.040
4145	4145	0.43/0.48	0.75/1.00	0.035	0.040
4147	—	0.45/0.50	0.75/1.00	0.035	0.040
4150	4150	0.48/0.53	0.75/1.00	0.035	0.040
4317	4317	0.15/0.20	0.45/0.65	0.035	0.040
4320	4320	0.17/0.22	0.45/0.65	0.035	0.040
4337	—	0.35/0.40	0.60/0.80	0.035	0.040
4340	4340	0.38/0.43	0.60/0.80	0.035	0.040
4608	4608	0.06/0.11	0.25/0.45	0.035	0.040
4615	4615	0.13/0.18	0.45/0.65	0.035	0.040
4620	4620	0.17/0.22	0.45/0.65	0.035	0.040
4621	4621	0.18/0.23	0.70/0.90	0.035	0.040
4640	4640	0.38/0.43	0.60/0.80	0.035	0.040
4812	4812	0.10/0.15	0.40/0.60	0.035	0.040
4815	4815	0.13/0.18	0.40/0.60	0.035	0.040

Note: AISI # continued below with additional chemistries.

AISI NUMBER	SAE NUMBER	CHEMICAL COMPOSITION LIMITS, PER CENT			
		Si	Ni	Cr	Mo
4140	4140	0.15/0.35	—	0.80/1.10	0.15/0.25
4142	—	0.15/0.35	—	0.80/1.10	0.15/0.25
4145	4145	0.15/0.35	—	0.80/1.10	0.15/0.25
4147	—	0.15/0.35	—	0.80/1.10	0.15/0.25
4150	4150	0.15/0.35	—	0.80/1.10	0.15/0.25
4317	4317	0.15/0.35	1.65/2.00	0.40/0.60	0.20/0.30
4320	4320	0.15/0.35	1.65/2.00	0.40/0.60	0.20/0.30
4337	—	0.15/0.35	1.65/2.00	0.70/0.90	0.20/0.30
4340	4340	0.15/0.35	1.65/2.00	0.70/0.90	0.20/0.30
4608	4608	0.25 max.	1.40/1.75	—	0.15/0.25
4615	4615	0.15/0.35	1.65/2.00	—	0.20/0.30
4620	4620	0.15/0.35	1.65/2.00	—	0.20/0.30
4621	4621	0.15/0.35	1.65/2.00	—	0.20/0.30
4640	4640	0.15/0.35	1.65/2.00	—	0.20/0.30
4812	4812	0.15/0.35	3.25/3.75	—	0.20/0.30
4815	4815	0.15/0.35	3.25/3.75	—	0.20/0.30

*The indicated % are for bar products, unless stated otherwise.
Plate, sheet and tubing may be slightly different.*

CIRCUMFERENCES AND AREAS OF CIRCLES

Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.
$\frac{1}{16}$	.1963	.0031	7	21.9912	38.4846	14	43.9824	153.938
$\frac{1}{8}$	.3927	.0123	$\frac{1}{8}$	22.3839	39.8713	$\frac{1}{8}$	44.3751	156.700
$\frac{1}{4}$	.7854	.0491	$\frac{1}{4}$	22.7766	41.2826	$\frac{1}{4}$	44.7678	159.485
$\frac{3}{8}$	1.1781	.1104	$\frac{3}{8}$	23.1693	42.7184	$\frac{3}{8}$	45.1605	162.296
$\frac{1}{2}$	1.5708	.1963	$\frac{1}{2}$	23.5620	44.1787	$\frac{1}{2}$	45.5532	165.130
$\frac{5}{8}$	1.9635	.3068	$\frac{5}{8}$	23.9547	45.6636	$\frac{5}{8}$	45.9459	167.990
$\frac{3}{4}$	2.3562	.4418	$\frac{3}{4}$	24.3474	47.1731	$\frac{3}{4}$	46.3386	170.874
$\frac{7}{8}$	2.7489	.6013	$\frac{7}{8}$	24.7401	48.7071	$\frac{7}{8}$	46.7313	173.782
1	3.1416	.7854	8	25.1328	50.2656	15	47.1240	176.715
$\frac{1}{8}$	3.5343	.9940	$\frac{1}{8}$	25.5255	51.8487	$\frac{1}{8}$	47.5167	179.673
$\frac{1}{4}$	3.9270	1.2272	$\frac{1}{4}$	25.9182	53.4563	$\frac{1}{4}$	47.9094	182.655
$\frac{3}{8}$	4.3197	1.4849	$\frac{3}{8}$	26.3109	55.0884	$\frac{3}{8}$	48.3021	185.661
$\frac{1}{2}$	4.7124	1.7671	$\frac{1}{2}$	26.7036	56.7451	$\frac{1}{2}$	48.6948	188.692
$\frac{5}{8}$	5.1051	2.0739	$\frac{5}{8}$	27.0963	58.4264	$\frac{5}{8}$	49.0875	191.748
$\frac{3}{4}$	5.4978	2.4053	$\frac{3}{4}$	27.4890	60.1322	$\frac{3}{4}$	49.4802	194.828
$\frac{7}{8}$	5.8905	2.7612	$\frac{7}{8}$	27.8817	61.8625	$\frac{7}{8}$	49.8729	197.933
2	6.2832	3.1416	9	28.2744	63.6174	16	50.2656	201.062
$\frac{1}{8}$	6.6759	3.5466	$\frac{1}{8}$	28.6671	65.3968	$\frac{1}{8}$	50.6583	204.216
$\frac{1}{4}$	7.0686	3.9761	$\frac{1}{4}$	29.0598	67.2008	$\frac{1}{4}$	51.0510	207.395
$\frac{3}{8}$	7.4613	4.4301	$\frac{3}{8}$	29.4525	69.0293	$\frac{3}{8}$	51.4437	210.598
$\frac{1}{2}$	7.8540	4.9087	$\frac{1}{2}$	29.8452	70.8823	$\frac{1}{2}$	51.8364	213.825
$\frac{5}{8}$	8.2467	5.4119	$\frac{5}{8}$	30.2379	72.7599	$\frac{5}{8}$	52.2291	217.077
$\frac{3}{4}$	8.6394	5.9396	$\frac{3}{4}$	30.6306	74.6621	$\frac{3}{4}$	52.6218	220.354
$\frac{7}{8}$	9.0321	6.4918	$\frac{7}{8}$	31.0233	76.5889	$\frac{7}{8}$	53.0145	223.655
3	9.4248	7.0686	10	31.4160	78.540	17	53.4072	226.981
$\frac{1}{8}$	9.8175	7.6699	$\frac{1}{8}$	31.8087	80.516	$\frac{1}{8}$	53.7999	230.331
$\frac{1}{4}$	10.2102	8.2958	$\frac{1}{4}$	32.2014	82.516	$\frac{1}{4}$	54.1926	233.706
$\frac{3}{8}$	10.6029	8.9462	$\frac{3}{8}$	32.5941	84.541	$\frac{3}{8}$	54.5853	237.105
$\frac{1}{2}$	10.9956	9.6211	$\frac{1}{2}$	32.9868	86.590	$\frac{1}{2}$	54.9780	240.529
$\frac{5}{8}$	11.3883	10.3206	$\frac{5}{8}$	33.3795	88.664	$\frac{5}{8}$	55.3707	243.977
$\frac{3}{4}$	11.7810	11.0447	$\frac{3}{4}$	33.7722	90.763	$\frac{3}{4}$	55.7634	247.450
$\frac{7}{8}$	12.1737	11.7933	$\frac{7}{8}$	34.1649	92.886	$\frac{7}{8}$	56.1561	250.948
4	12.5664	12.5664	11	34.5576	95.033	18	56.5488	254.470
$\frac{1}{8}$	12.9591	13.3641	$\frac{1}{8}$	34.9503	97.205	$\frac{1}{8}$	56.9415	258.016
$\frac{1}{4}$	13.3518	14.1863	$\frac{1}{4}$	35.3430	99.402	$\frac{1}{4}$	57.3342	261.587
$\frac{3}{8}$	13.7445	15.0330	$\frac{3}{8}$	35.7357	101.623	$\frac{3}{8}$	57.7269	265.183
$\frac{1}{2}$	14.1372	15.9043	$\frac{1}{2}$	36.1284	103.869	$\frac{1}{2}$	58.1196	268.803
$\frac{5}{8}$	14.5299	16.8002	$\frac{5}{8}$	36.5211	106.139	$\frac{5}{8}$	58.5123	272.448
$\frac{3}{4}$	14.9226	17.7206	$\frac{3}{4}$	36.9138	108.434	$\frac{3}{4}$	58.9050	276.117
$\frac{7}{8}$	15.3153	18.6655	$\frac{7}{8}$	37.3065	110.754	$\frac{7}{8}$	59.2977	279.811
5	15.7080	19.6350	12	37.6992	113.098	19	59.6904	283.529
$\frac{1}{8}$	16.1007	20.6290	$\frac{1}{8}$	38.0919	115.466	$\frac{1}{8}$	60.0831	287.272
$\frac{1}{4}$	16.4934	21.6476	$\frac{1}{4}$	38.4846	117.859	$\frac{1}{4}$	60.4758	291.040
$\frac{3}{8}$	16.8861	22.6907	$\frac{3}{8}$	38.8773	120.277	$\frac{3}{8}$	60.8685	294.832
$\frac{1}{2}$	17.2788	23.7583	$\frac{1}{2}$	39.2700	122.719	$\frac{1}{2}$	61.2612	298.648
$\frac{5}{8}$	17.6715	24.8505	$\frac{5}{8}$	39.6627	125.185	$\frac{5}{8}$	61.6539	302.489
$\frac{3}{4}$	18.0642	25.9673	$\frac{3}{4}$	40.0554	127.677	$\frac{3}{4}$	62.0466	306.355
$\frac{7}{8}$	18.4569	27.1086	$\frac{7}{8}$	40.4481	130.192	$\frac{7}{8}$	62.4393	310.245
6	18.8496	28.2744	13	40.8408	132.733	20	62.8320	314.160
$\frac{1}{8}$	19.2423	29.4648	$\frac{1}{8}$	41.2335	135.297	$\frac{1}{8}$	63.2247	318.099
$\frac{1}{4}$	19.6350	30.6797	$\frac{1}{4}$	41.6262	137.887	$\frac{1}{4}$	63.6174	322.063
$\frac{3}{8}$	20.0277	31.9191	$\frac{3}{8}$	42.0189	140.501	$\frac{3}{8}$	64.0101	326.051
$\frac{1}{2}$	20.4204	33.1831	$\frac{1}{2}$	42.4116	143.139	$\frac{1}{2}$	64.4028	330.064
$\frac{5}{8}$	20.8131	34.4717	$\frac{5}{8}$	42.8043	145.802	$\frac{5}{8}$	64.7955	334.102
$\frac{3}{4}$	21.2058	35.7848	$\frac{3}{4}$	43.1970	148.490	$\frac{3}{4}$	65.1828	338.164
$\frac{7}{8}$	21.5985	37.1224	$\frac{7}{8}$	43.5897	151.202	$\frac{7}{8}$	65.5809	342.250

(Cont'd)

CIRCUMFERENCES AND AREAS OF CIRCLES (cont'd)

Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.
21	65.9736	346.361	28	87.9648	615.754	35	109.956	962.115
$\frac{1}{8}$	66.3663	350.497	$\frac{1}{8}$	88.3575	621.264	$\frac{1}{8}$	110.349	969.000
$\frac{1}{4}$	66.7590	354.657	$\frac{1}{4}$	88.7502	626.798	$\frac{1}{4}$	110.741	975.909
$\frac{3}{8}$	67.1517	358.842	$\frac{3}{8}$	89.1429	632.357	$\frac{3}{8}$	111.134	982.842
$\frac{1}{2}$	67.5444	363.051	$\frac{1}{2}$	89.5356	637.941	$\frac{1}{2}$	111.527	989.800
$\frac{5}{8}$	67.9371	367.285	$\frac{5}{8}$	89.9283	643.549	$\frac{5}{8}$	111.919	996.783
$\frac{3}{4}$	68.3298	371.543	$\frac{3}{4}$	90.3210	649.182	$\frac{3}{4}$	112.312	1003.790
$\frac{7}{8}$	68.7225	375.826	$\frac{7}{8}$	90.7137	654.840	$\frac{7}{8}$	112.705	1010.822
22	69.1152	380.134	29	91.1064	660.521	36	113.098	1017.878
$\frac{1}{8}$	69.5079	384.466	$\frac{1}{8}$	91.4991	666.228	$\frac{1}{8}$	113.490	1024.960
$\frac{1}{4}$	69.9006	388.822	$\frac{1}{4}$	91.8918	671.959	$\frac{1}{4}$	113.883	1032.065
$\frac{3}{8}$	70.2933	393.203	$\frac{3}{8}$	92.2845	677.714	$\frac{3}{8}$	114.276	1039.195
$\frac{1}{2}$	70.6860	397.609	$\frac{1}{2}$	92.6772	683.494	$\frac{1}{2}$	114.668	1046.349
$\frac{5}{8}$	71.0787	402.038	$\frac{5}{8}$	93.0699	689.299	$\frac{5}{8}$	115.061	1053.528
$\frac{3}{4}$	71.4714	406.494	$\frac{3}{4}$	93.4626	695.128	$\frac{3}{4}$	115.454	1060.732
$\frac{7}{8}$	71.8641	410.973	$\frac{7}{8}$	93.8553	700.982	$\frac{7}{8}$	115.846	1067.960
23	72.2568	415.477	30	94.248	706.860	37	116.239	1075.213
$\frac{1}{8}$	72.6495	420.004	$\frac{1}{8}$	94.641	712.763	$\frac{1}{8}$	116.632	1082.490
$\frac{1}{4}$	73.0422	424.558	$\frac{1}{4}$	95.033	718.690	$\frac{1}{4}$	117.025	1089.792
$\frac{3}{8}$	73.4349	429.135	$\frac{3}{8}$	95.426	724.642	$\frac{3}{8}$	117.417	1097.118
$\frac{1}{2}$	73.8276	433.737	$\frac{1}{2}$	95.819	730.618	$\frac{1}{2}$	117.810	1104.469
$\frac{5}{8}$	74.2203	438.364	$\frac{5}{8}$	96.212	736.619	$\frac{5}{8}$	118.203	1111.844
$\frac{3}{4}$	74.6130	443.015	$\frac{3}{4}$	96.604	742.645	$\frac{3}{4}$	118.595	1119.244
$\frac{7}{8}$	75.0057	447.690	$\frac{7}{8}$	96.997	748.695	$\frac{7}{8}$	118.988	1126.669
24	75.3984	452.390	31	97.390	754.769	38	119.381	1134.118
$\frac{1}{8}$	75.7911	457.115	$\frac{1}{8}$	97.782	760.869	$\frac{1}{8}$	119.773	1141.591
$\frac{1}{4}$	76.1838	461.864	$\frac{1}{4}$	98.175	766.992	$\frac{1}{4}$	120.166	1149.089
$\frac{3}{8}$	76.5765	466.638	$\frac{3}{8}$	98.568	773.140	$\frac{3}{8}$	120.559	1156.612
$\frac{1}{2}$	76.9692	471.436	$\frac{1}{2}$	98.960	779.313	$\frac{1}{2}$	120.952	1164.159
$\frac{5}{8}$	77.3619	476.259	$\frac{5}{8}$	99.353	785.510	$\frac{5}{8}$	121.344	1171.731
$\frac{3}{4}$	77.7546	481.107	$\frac{3}{4}$	99.746	791.732	$\frac{3}{4}$	121.737	1179.327
$\frac{7}{8}$	78.1473	485.979	$\frac{7}{8}$	100.138	797.979	$\frac{7}{8}$	122.130	1186.948
25	78.5400	490.875	32	100.531	804.250	39	122.522	1194.593
$\frac{1}{8}$	78.9327	495.796	$\frac{1}{8}$	100.924	810.545	$\frac{1}{8}$	122.915	1202.263
$\frac{1}{4}$	79.3254	500.742	$\frac{1}{4}$	101.317	816.865	$\frac{1}{4}$	123.308	1209.958
$\frac{3}{8}$	79.7181	505.712	$\frac{3}{8}$	101.709	823.210	$\frac{3}{8}$	123.700	1217.677
$\frac{1}{2}$	80.1108	510.706	$\frac{1}{2}$	102.102	829.579	$\frac{1}{2}$	124.093	1225.420
$\frac{5}{8}$	80.5035	515.726	$\frac{5}{8}$	102.495	835.972	$\frac{5}{8}$	124.486	1233.188
$\frac{3}{4}$	80.8962	520.769	$\frac{3}{4}$	102.887	842.391	$\frac{3}{4}$	124.879	1240.981
$\frac{7}{8}$	81.2889	525.838	$\frac{7}{8}$	103.280	848.833	$\frac{7}{8}$	125.271	1248.798
26	81.6816	530.930	33	103.673	855.301	40	125.664	1256.64
$\frac{1}{8}$	82.0743	536.048	$\frac{1}{8}$	104.065	861.792	$\frac{1}{8}$	126.057	1264.51
$\frac{1}{4}$	82.4670	541.190	$\frac{1}{4}$	104.458	868.309	$\frac{1}{4}$	126.449	1272.40
$\frac{3}{8}$	82.8597	546.356	$\frac{3}{8}$	104.851	874.850	$\frac{3}{8}$	126.842	1280.31
$\frac{1}{2}$	83.2524	551.547	$\frac{1}{2}$	105.244	881.415	$\frac{1}{2}$	127.235	1288.25
$\frac{5}{8}$	83.6451	556.763	$\frac{5}{8}$	105.636	888.005	$\frac{5}{8}$	127.627	1296.22
$\frac{3}{4}$	84.0378	562.003	$\frac{3}{4}$	106.029	894.620	$\frac{3}{4}$	128.020	1304.21
$\frac{7}{8}$	84.4305	567.267	$\frac{7}{8}$	106.422	901.259	$\frac{7}{8}$	128.413	1312.22
27	84.8232	572.557	34	106.814	907.922	41	128.806	1320.26
$\frac{1}{8}$	85.2159	577.870	$\frac{1}{8}$	107.207	914.611	$\frac{1}{8}$	129.198	1328.32
$\frac{1}{4}$	85.6086	583.209	$\frac{1}{4}$	107.600	921.323	$\frac{1}{4}$	129.591	1336.41
$\frac{3}{8}$	86.0013	588.571	$\frac{3}{8}$	107.992	928.061	$\frac{3}{8}$	129.984	1344.52
$\frac{1}{2}$	86.3940	593.959	$\frac{1}{2}$	108.385	934.822	$\frac{1}{2}$	130.376	1352.66
$\frac{5}{8}$	86.7867	599.371	$\frac{5}{8}$	108.778	941.609	$\frac{5}{8}$	130.769	1360.82
$\frac{3}{4}$	87.1794	604.807	$\frac{3}{4}$	109.171	948.420	$\frac{3}{4}$	131.162	1369.00
$\frac{7}{8}$	87.5721	610.268	$\frac{7}{8}$	109.563	955.255	$\frac{7}{8}$	131.554	1377.21

(Cont'd)

CIRCUMFERENCES AND AREAS OF CIRCLES (cont'd)

Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.
42	131.947	1385.45	49	153.938	1885.75	56	175.930	2463.01
$\frac{1}{8}$	132.340	1393.70	$\frac{1}{8}$	154.331	1895.38	$\frac{1}{8}$	176.322	2474.02
$\frac{1}{4}$	132.733	1401.99	$\frac{1}{4}$	154.724	1905.04	$\frac{1}{4}$	176.715	2485.05
$\frac{3}{8}$	133.125	1410.30	$\frac{3}{8}$	155.116	1914.72	$\frac{3}{8}$	177.108	2496.11
$\frac{1}{2}$	133.518	1418.63	$\frac{1}{2}$	155.509	1924.43	$\frac{1}{2}$	177.500	2507.19
$\frac{5}{8}$	133.911	1426.99	$\frac{5}{8}$	155.902	1934.16	$\frac{5}{8}$	177.893	2518.30
$\frac{3}{4}$	134.303	1435.37	$\frac{3}{4}$	156.295	1943.91	$\frac{3}{4}$	178.286	2529.43
$\frac{7}{8}$	134.696	1443.77	$\frac{7}{8}$	156.687	1953.69	$\frac{7}{8}$	178.678	2540.58
43	135.089	1452.20	50	157.080	1963.50	57	179.071	2551.76
$\frac{1}{8}$	135.481	1460.66	$\frac{1}{8}$	157.473	1973.33	$\frac{1}{8}$	179.464	2562.97
$\frac{1}{4}$	135.874	1469.14	$\frac{1}{4}$	157.865	1983.18	$\frac{1}{4}$	179.857	2574.20
$\frac{3}{8}$	136.267	1477.64	$\frac{3}{8}$	158.258	1993.06	$\frac{3}{8}$	180.249	2585.45
$\frac{1}{2}$	136.660	1486.17	$\frac{1}{2}$	158.651	2002.97	$\frac{1}{2}$	180.642	2596.73
$\frac{5}{8}$	137.052	1494.73	$\frac{5}{8}$	159.043	2012.89	$\frac{5}{8}$	181.035	2608.03
$\frac{3}{4}$	137.445	1503.30	$\frac{3}{4}$	159.436	2022.85	$\frac{3}{4}$	181.427	2619.36
$\frac{7}{8}$	137.838	1511.91	$\frac{7}{8}$	159.829	2032.82	$\frac{7}{8}$	181.820	2630.71
44	138.230	1520.53	51	160.222	2042.83	58	182.213	2642.09
$\frac{1}{8}$	138.623	1529.19	$\frac{1}{8}$	160.614	2052.85	$\frac{1}{8}$	182.605	2653.49
$\frac{1}{4}$	139.016	1537.86	$\frac{1}{4}$	161.007	2062.90	$\frac{1}{4}$	182.998	2664.91
$\frac{3}{8}$	139.408	1546.56	$\frac{3}{8}$	161.400	2072.98	$\frac{3}{8}$	183.391	2676.36
$\frac{1}{2}$	139.801	1555.29	$\frac{1}{2}$	161.792	2083.08	$\frac{1}{2}$	183.784	2687.84
$\frac{5}{8}$	140.194	1564.04	$\frac{5}{8}$	162.185	2093.20	$\frac{5}{8}$	184.176	2699.33
$\frac{3}{4}$	140.587	1572.81	$\frac{3}{4}$	162.578	2103.35	$\frac{3}{4}$	184.569	2710.86
$\frac{7}{8}$	140.979	1581.61	$\frac{7}{8}$	162.970	2113.52	$\frac{7}{8}$	184.962	2722.41
45	141.372	1590.43	52	163.363	2123.72	59	185.354	2733.98
$\frac{1}{8}$	141.765	1599.28	$\frac{1}{8}$	163.756	2133.94	$\frac{1}{8}$	185.747	2745.57
$\frac{1}{4}$	142.157	1608.16	$\frac{1}{4}$	164.149	2144.19	$\frac{1}{4}$	186.140	2757.20
$\frac{3}{8}$	142.550	1617.05	$\frac{3}{8}$	164.541	2154.46	$\frac{3}{8}$	186.532	2768.84
$\frac{1}{2}$	142.943	1625.97	$\frac{1}{2}$	164.934	2164.76	$\frac{1}{2}$	186.925	2780.51
$\frac{5}{8}$	143.335	1634.92	$\frac{5}{8}$	165.327	2175.08	$\frac{5}{8}$	187.318	2792.21
$\frac{3}{4}$	143.728	1643.89	$\frac{3}{4}$	165.719	2185.42	$\frac{3}{4}$	187.711	2803.93
$\frac{7}{8}$	144.121	1652.89	$\frac{7}{8}$	166.112	2195.79	$\frac{7}{8}$	188.103	2815.67
46	144.514	1661.91	53	166.505	2206.19	60	188.496	2827.44
$\frac{1}{8}$	144.906	1670.95	$\frac{1}{8}$	166.897	2216.61	$\frac{1}{8}$	188.889	2839.23
$\frac{1}{4}$	145.299	1680.02	$\frac{1}{4}$	167.290	2227.05	$\frac{1}{4}$	189.281	2851.05
$\frac{3}{8}$	145.692	1689.11	$\frac{3}{8}$	167.683	2237.52	$\frac{3}{8}$	189.674	2862.89
$\frac{1}{2}$	146.084	1698.23	$\frac{1}{2}$	168.076	2248.01	$\frac{1}{2}$	190.067	2874.76
$\frac{5}{8}$	146.477	1707.37	$\frac{5}{8}$	168.468	2258.53	$\frac{5}{8}$	190.459	2886.65
$\frac{3}{4}$	146.870	1716.54	$\frac{3}{4}$	168.861	2269.07	$\frac{3}{4}$	190.852	2898.57
$\frac{7}{8}$	147.262	1725.73	$\frac{7}{8}$	169.254	2279.64	$\frac{7}{8}$	191.245	2910.51
47	147.655	1734.95	54	169.646	2290.23	61	191.638	2922.47
$\frac{1}{8}$	148.048	1744.19	$\frac{1}{8}$	170.039	2300.84	$\frac{1}{8}$	192.030	2934.46
$\frac{1}{4}$	148.441	1753.45	$\frac{1}{4}$	170.432	2311.48	$\frac{1}{4}$	192.423	2946.48
$\frac{3}{8}$	148.833	1762.74	$\frac{3}{8}$	170.824	2322.15	$\frac{3}{8}$	192.816	2958.52
$\frac{1}{2}$	149.226	1772.06	$\frac{1}{2}$	171.217	2332.83	$\frac{1}{2}$	193.208	2970.58
$\frac{5}{8}$	149.619	1781.40	$\frac{5}{8}$	171.610	2343.55	$\frac{5}{8}$	193.601	2982.67
$\frac{3}{4}$	150.011	1790.76	$\frac{3}{4}$	172.003	2354.29	$\frac{3}{4}$	193.994	2994.78
$\frac{7}{8}$	150.404	1800.15	$\frac{7}{8}$	172.395	2365.05	$\frac{7}{8}$	194.386	3006.92
48	150.797	1809.56	55	172.788	2375.83	62	194.779	3019.08
$\frac{1}{8}$	151.189	1819.00	$\frac{1}{8}$	173.181	2386.65	$\frac{1}{8}$	195.172	3031.26
$\frac{1}{4}$	151.582	1828.46	$\frac{1}{4}$	173.573	2397.48	$\frac{1}{4}$	195.565	3043.47
$\frac{3}{8}$	151.975	1837.95	$\frac{3}{8}$	173.966	2408.34	$\frac{3}{8}$	195.957	3055.71
$\frac{1}{2}$	152.368	1847.46	$\frac{1}{2}$	174.359	2419.23	$\frac{1}{2}$	196.350	3067.97
$\frac{5}{8}$	152.760	1856.99	$\frac{5}{8}$	174.751	2430.14	$\frac{5}{8}$	196.743	3080.25
$\frac{3}{4}$	153.153	1866.55	$\frac{3}{4}$	175.144	2441.07	$\frac{3}{4}$	197.135	3092.56
$\frac{7}{8}$	153.546	1876.14	$\frac{7}{8}$	175.537	2452.03	$\frac{7}{8}$	197.528	3104.89

(Cont'd)

CIRCUMFERENCES AND AREAS OF CIRCLES (cont'd)

Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.
63	197.921	3117.25	70	219.912	3848.46	77	241.903	4656.64
$\frac{1}{8}$	198.313	3129.64	$\frac{1}{8}$	220.305	3862.22	$\frac{1}{8}$	242.296	4671.77
$\frac{1}{4}$	198.706	3142.04	$\frac{1}{4}$	220.697	3876.00	$\frac{1}{4}$	242.689	4686.92
$\frac{3}{8}$	199.099	3154.47	$\frac{3}{8}$	221.090	3889.80	$\frac{3}{8}$	243.081	4702.10
$\frac{1}{2}$	199.492	3166.93	$\frac{1}{2}$	221.483	3903.63	$\frac{1}{2}$	243.474	4717.31
$\frac{5}{8}$	199.884	3179.41	$\frac{5}{8}$	221.875	3917.49	$\frac{5}{8}$	243.867	4732.54
$\frac{3}{4}$	200.277	3191.91	$\frac{3}{4}$	222.268	3931.37	$\frac{3}{4}$	244.259	4747.79
$\frac{7}{8}$	200.670	3204.44	$\frac{7}{8}$	222.661	3945.27	$\frac{7}{8}$	244.652	4763.07
64	201.062	3217.00	71	223.054	3959.20	78	245.045	4778.37
$\frac{1}{8}$	201.455	3229.58	$\frac{1}{8}$	223.446	3973.15	$\frac{1}{8}$	245.437	4793.70
$\frac{1}{4}$	201.848	3242.18	$\frac{1}{4}$	223.839	3987.13	$\frac{1}{4}$	245.830	4809.05
$\frac{3}{8}$	202.240	3254.81	$\frac{3}{8}$	224.232	4001.13	$\frac{3}{8}$	246.223	4824.43
$\frac{1}{2}$	202.633	3267.46	$\frac{1}{2}$	224.624	4015.16	$\frac{1}{2}$	246.616	4839.83
$\frac{5}{8}$	203.026	3280.14	$\frac{5}{8}$	225.017	4029.21	$\frac{5}{8}$	247.008	4855.26
$\frac{3}{4}$	203.419	3292.84	$\frac{3}{4}$	225.410	4043.29	$\frac{3}{4}$	247.401	4870.71
$\frac{7}{8}$	203.811	3305.56	$\frac{7}{8}$	225.802	4057.39	$\frac{7}{8}$	247.794	4886.18
65	204.204	3318.31	72	226.195	4071.51	79	248.186	4901.68
$\frac{1}{8}$	204.597	3331.09	$\frac{1}{8}$	226.588	4085.66	$\frac{1}{8}$	248.579	4917.21
$\frac{1}{4}$	204.989	3343.89	$\frac{1}{4}$	226.981	4099.84	$\frac{1}{4}$	248.972	4932.75
$\frac{3}{8}$	205.382	3356.71	$\frac{3}{8}$	227.373	4114.04	$\frac{3}{8}$	249.364	4948.33
$\frac{1}{2}$	205.775	3369.56	$\frac{1}{2}$	227.766	4128.26	$\frac{1}{2}$	249.757	4963.92
$\frac{5}{8}$	206.167	3382.44	$\frac{5}{8}$	228.159	4142.51	$\frac{5}{8}$	250.150	4979.55
$\frac{3}{4}$	206.560	3395.33	$\frac{3}{4}$	228.551	4156.78	$\frac{3}{4}$	250.543	4995.19
$\frac{7}{8}$	206.953	3408.26	$\frac{7}{8}$	228.944	4171.08	$\frac{7}{8}$	250.935	5010.86
66	207.346	3421.20	73	229.337	4185.40	80	251.328	5026.56
$\frac{1}{8}$	207.738	3434.17	$\frac{1}{8}$	229.729	4199.74	$\frac{1}{8}$	251.721	5042.28
$\frac{1}{4}$	208.131	3447.17	$\frac{1}{4}$	230.122	4214.11	$\frac{1}{4}$	252.113	5058.03
$\frac{3}{8}$	208.524	3460.19	$\frac{3}{8}$	230.515	4228.51	$\frac{3}{8}$	252.506	5073.79
$\frac{1}{2}$	208.916	3473.24	$\frac{1}{2}$	230.908	4242.93	$\frac{1}{2}$	252.899	5089.59
$\frac{5}{8}$	209.309	3486.30	$\frac{5}{8}$	231.300	4257.37	$\frac{5}{8}$	253.291	5105.41
$\frac{3}{4}$	209.702	3499.40	$\frac{3}{4}$	231.693	4271.84	$\frac{3}{4}$	253.684	5121.25
$\frac{7}{8}$	210.094	3512.52	$\frac{7}{8}$	232.086	4286.33	$\frac{7}{8}$	254.077	5137.12
67	210.487	3525.66	74	232.478	4300.85	81	254.470	5153.01
$\frac{1}{8}$	210.880	3538.83	$\frac{1}{8}$	232.871	4315.39	$\frac{1}{8}$	254.862	5168.93
$\frac{1}{4}$	211.273	3552.02	$\frac{1}{4}$	233.264	4329.96	$\frac{1}{4}$	255.255	5184.87
$\frac{3}{8}$	211.665	3565.24	$\frac{3}{8}$	233.656	4344.55	$\frac{3}{8}$	255.648	5200.83
$\frac{1}{2}$	212.058	3578.48	$\frac{1}{2}$	234.049	4359.17	$\frac{1}{2}$	256.040	5216.82
$\frac{5}{8}$	212.451	3591.74	$\frac{5}{8}$	234.442	4373.81	$\frac{5}{8}$	256.433	5232.84
$\frac{3}{4}$	212.843	3605.04	$\frac{3}{4}$	234.835	4388.47	$\frac{3}{4}$	256.826	5248.88
$\frac{7}{8}$	213.236	3618.35	$\frac{7}{8}$	235.227	4403.16	$\frac{7}{8}$	257.218	5264.94
68	213.629	3631.69	75	235.620	4417.87	82	257.611	5281.03
$\frac{1}{8}$	214.021	3645.05	$\frac{1}{8}$	236.013	4432.61	$\frac{1}{8}$	258.004	5297.14
$\frac{1}{4}$	214.414	3658.44	$\frac{1}{4}$	236.405	4447.38	$\frac{1}{4}$	258.397	5313.28
$\frac{3}{8}$	214.807	3671.86	$\frac{3}{8}$	236.798	4462.16	$\frac{3}{8}$	258.789	5329.44
$\frac{1}{2}$	215.200	3685.29	$\frac{1}{2}$	237.191	4476.98	$\frac{1}{2}$	259.182	5345.63
$\frac{5}{8}$	215.592	3698.76	$\frac{5}{8}$	237.583	4491.81	$\frac{5}{8}$	259.575	5361.84
$\frac{3}{4}$	215.985	3712.24	$\frac{3}{4}$	237.976	4506.67	$\frac{3}{4}$	259.967	5378.08
$\frac{7}{8}$	216.378	3725.75	$\frac{7}{8}$	238.369	4521.56	$\frac{7}{8}$	260.360	5394.34
69	216.770	3739.29	76	238.762	4536.47	83	260.753	5410.62
$\frac{1}{8}$	217.163	3752.85	$\frac{1}{8}$	239.154	4551.41	$\frac{1}{8}$	261.145	5426.93
$\frac{1}{4}$	217.556	3766.43	$\frac{1}{4}$	239.547	4566.36	$\frac{1}{4}$	261.538	5443.26
$\frac{3}{8}$	217.948	3780.04	$\frac{3}{8}$	239.940	4581.35	$\frac{3}{8}$	261.931	5459.62
$\frac{1}{2}$	218.341	3793.68	$\frac{1}{2}$	240.332	4596.36	$\frac{1}{2}$	262.324	5476.01
$\frac{5}{8}$	218.734	3807.34	$\frac{5}{8}$	240.725	4611.39	$\frac{5}{8}$	262.716	5492.41
$\frac{3}{4}$	219.127	3821.02	$\frac{3}{4}$	241.118	4626.45	$\frac{3}{4}$	263.109	5508.84
$\frac{7}{8}$	219.519	3834.73	$\frac{7}{8}$	241.510	4641.53	$\frac{7}{8}$	263.502	5525.30

(Cont'd)

CIRCUMFERENCES AND AREAS OF CIRCLES (cont'd)

Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.	Dia- meter Ins.	Circum- ference Ins.	Area Sq. Ins.
84	263.894	5541.78	90	282.744	6361.74	96	301.594	7238.25
$\frac{1}{8}$	264.287	5558.29	$\frac{1}{8}$	283.137	6379.42	$\frac{1}{8}$	301.986	7257.11
$\frac{1}{4}$	264.680	5574.82	$\frac{1}{4}$	283.529	6397.13	$\frac{1}{4}$	302.379	7275.99
$\frac{3}{8}$	265.072	5591.37	$\frac{3}{8}$	283.922	6414.86	$\frac{3}{8}$	302.772	7294.91
$\frac{1}{2}$	265.465	5607.95	$\frac{1}{2}$	284.315	6432.62	$\frac{1}{2}$	303.164	7313.84
$\frac{5}{8}$	265.858	5624.56	$\frac{5}{8}$	284.707	6450.40	$\frac{5}{8}$	303.557	7332.80
$\frac{3}{4}$	266.251	5641.18	$\frac{3}{4}$	285.100	6468.21	$\frac{3}{4}$	303.950	7351.79
$\frac{7}{8}$	266.643	5657.84	$\frac{7}{8}$	285.493	6486.04	$\frac{7}{8}$	304.342	7370.79
85	267.036	5674.51	91	285.886	6503.90	97	304.735	7389.83
$\frac{1}{8}$	267.429	5691.22	$\frac{1}{8}$	286.278	6521.78	$\frac{1}{8}$	305.128	7408.89
$\frac{1}{4}$	267.821	5707.94	$\frac{1}{4}$	286.671	6539.68	$\frac{1}{4}$	305.521	7427.97
$\frac{3}{8}$	268.214	5724.69	$\frac{3}{8}$	287.064	6557.61	$\frac{3}{8}$	305.913	7447.08
$\frac{1}{2}$	268.607	5741.47	$\frac{1}{2}$	287.456	6575.56	$\frac{1}{2}$	306.306	7466.21
$\frac{5}{8}$	268.999	5758.27	$\frac{5}{8}$	287.849	6593.54	$\frac{5}{8}$	306.699	7485.37
$\frac{3}{4}$	269.392	5775.10	$\frac{3}{4}$	288.242	6611.55	$\frac{3}{4}$	307.091	7504.55
$\frac{7}{8}$	269.785	5791.94	$\frac{7}{8}$	288.634	6629.57	$\frac{7}{8}$	307.484	7523.75
86	270.178	5808.82	92	289.027	6647.63	98	307.877	7542.98
$\frac{1}{8}$	270.570	5825.72	$\frac{1}{8}$	289.420	6665.70	$\frac{1}{8}$	308.270	7562.24
$\frac{1}{4}$	270.963	5842.64	$\frac{1}{4}$	289.813	6683.80	$\frac{1}{4}$	308.662	7581.52
$\frac{3}{8}$	271.356	5859.59	$\frac{3}{8}$	290.205	6701.93	$\frac{3}{8}$	309.055	7600.82
$\frac{1}{2}$	271.748	5876.56	$\frac{1}{2}$	290.593	6720.08	$\frac{1}{2}$	309.448	7620.15
$\frac{5}{8}$	272.141	5893.55	$\frac{5}{8}$	290.991	6738.25	$\frac{5}{8}$	309.840	7639.50
$\frac{3}{4}$	272.534	5910.58	$\frac{3}{4}$	291.383	6756.45	$\frac{3}{4}$	310.233	7658.88
$\frac{7}{8}$	272.926	5927.62	$\frac{7}{8}$	291.776	6774.68	$\frac{7}{8}$	310.626	7678.28
87	273.319	5944.69	93	292.169	6792.92	99	311.018	7697.71
$\frac{1}{8}$	273.712	5961.79	$\frac{1}{8}$	292.562	6811.20	$\frac{1}{8}$	311.411	7717.16
$\frac{1}{4}$	274.105	5978.91	$\frac{1}{4}$	292.954	6829.49	$\frac{1}{4}$	311.804	7736.63
$\frac{3}{8}$	274.497	5996.05	$\frac{3}{8}$	293.347	6847.82	$\frac{3}{8}$	312.196	7756.13
$\frac{1}{2}$	274.890	6013.22	$\frac{1}{2}$	293.740	6866.16	$\frac{1}{2}$	312.589	7775.66
$\frac{5}{8}$	275.283	6030.41	$\frac{5}{8}$	294.132	6884.53	$\frac{5}{8}$	312.982	7795.21
$\frac{3}{4}$	275.675	6047.63	$\frac{3}{4}$	294.525	6902.93	$\frac{3}{4}$	313.375	7814.78
$\frac{7}{8}$	276.068	6064.87	$\frac{7}{8}$	294.918	6921.35	$\frac{7}{8}$	313.767	7834.38
88	276.461	6082.14	94	295.310	6939.79	100	314.160	7854.00
$\frac{1}{8}$	276.853	6099.43	$\frac{1}{8}$	295.703	6958.26			
$\frac{1}{4}$	277.246	6116.74	$\frac{1}{4}$	296.096	6976.76			
$\frac{3}{8}$	277.638	6134.08	$\frac{3}{8}$	296.488	6995.28			
$\frac{1}{2}$	278.032	6151.45	$\frac{1}{2}$	296.881	7013.82			
$\frac{5}{8}$	278.424	6168.84	$\frac{5}{8}$	297.274	7032.39			
$\frac{3}{4}$	278.817	6186.25	$\frac{3}{4}$	297.667	7050.98			
$\frac{7}{8}$	279.210	6203.69	$\frac{7}{8}$	298.059	7069.59			
89	279.602	6221.15	95	298.452	7088.24			
$\frac{1}{8}$	279.995	6238.64	$\frac{1}{8}$	298.845	7106.90			
$\frac{1}{4}$	280.388	6256.15	$\frac{1}{4}$	299.237	7125.59			
$\frac{3}{8}$	280.780	6273.69	$\frac{3}{8}$	299.630	7144.31			
$\frac{1}{2}$	281.173	6291.25	$\frac{1}{2}$	300.023	7163.04			
$\frac{5}{8}$	281.566	6308.84	$\frac{5}{8}$	300.415	7181.81			
$\frac{3}{4}$	281.959	6326.45	$\frac{3}{4}$	300.808	7200.60			
$\frac{7}{8}$	282.351	6344.08	$\frac{7}{8}$	301.201	7219.41			

AVERAGE MECHANICAL PROPERTIES OF VARIOUS STEELS

Many factors aside from chemical content have a bearing on the mechanical properties of steel. The size of the section, rolling temperature, amount of work on the section, cooling rate, etc., all have an influence on the properties of the finished product. In the case of cold drawn or cold rolled steel, the tensile strengths and yield points of identical compositions may differ greatly depending on the amount of size reduction accomplished in the drawing or rolling process. The figures shown in the following tables, therefore, must be taken only as an indication of the probable mechanical properties of the steels listed. They are average results derived from many tests, but in individual cases test results may differ widely from these figures.

SAE	AISI	Condition	Tensile Strength psi	Yield Point	Hardness	
					Brinell	Rock- well "C"
1015	C1015	Hot Rolled	58,000	38,000	124	
		Cold Drawn	65,000	47,000	146	
1020	C1020	Hot Rolled	67,000	43,000	131	
		Cold Drawn	74,000	47,000	137	
1025	C1025	Hot Rolled	70,000	42,000	134	
		Cold Drawn	79,000	66,000	159	
1035	C1035	Hot Rolled	87,000	54,000	174	7
		Cold Drawn	93,000	67,000	192	12
1040	C1040	Hot Rolled	91,000	57,000	187	10
		Cold Drawn	98,000	69,000	207	15
		Heat Treated	110,000	84,000	225	20
		1" Rd. Water Quenched 1500° F. Drawn 1000° F.				
1045	C1045	Hot Rolled	97,000	59,000	201	12
		Cold Drawn	106,000	79,000	223	19
		Heat Treated	120,000	93,000	277	29
		1" Rd. Water Quenched 1500° F. Drawn 1000° F.				
1095	C1095	Hot Rolled Annld.	106,000	60,000	201	12
		Heat Treated	178,000	122,000	363	39
		1" Rd. Oil Quenched 1450° F.				
		Drawn 1000° F.				

(Cont'd)

AVERAGE MECHANICAL PROPERTIES OF VARIOUS STEELS (cont'd)

SAE	AISI	Condition	Tensile Strength psi	Yield Point	Hardness	
					Brinell	Rock- well "C"
2317	A2317	Hot Rolled	85,000	56,000	163	3
		Cold Drawn	95,000	75,000	197	12
2330	A2330	Hot Rolled	98,000	64,000	207	16
		Cold Drawn	110,000	90,000	235	22
		Heat Treated	125,000	104,000	270	22
		1" Rd. Oil Quenched 1500° F. Drawn 1000° F.				
2340	A2340	Hot Rolled	111,000	82,000	223	19
		Cold Drawn	115,000	99,000	235	21
		Heat Treated	138,000	123,000	302	31
		1" Rd. Oil Quenched 1500° F. Drawn 1000° F.				
3130	A3130	Hot Rolled	100,000	72,000	212	15
		Cold Drawn	105,000	85,000	223	19
		Heat Treated	126,000	108,000	276	29
		1" Rd. Oil Quenched 1525° F. Drawn 1000° F.				
3140	A3140	Hot Rolled	97,000	64,000	195	12
		Cold Drawn	115,000	98,000	248	24
		Heat Treated	142,000	125,000	298	32
		1" Rd. Oil Quenched 1525° F. Drawn 1000° F.				
3240	A3240	Hot Rolled Annld.	97,000	70,000	187	12
		Cold Drawn	112,000	92,000	235	22
		Heat Treated	165,000	148,000	352	36
		1" Rd. Oil Quenched 1450° F. Drawn 1000° F.				
4140	A4140	Hot Rolled Annld.	90,000	64,000	187	12
		Cold Drawn	113,000	91,000	241	23
		Heat Treated	158,000	135,000	341	36
		1" Rd. Oil Quenched 1575° F. Drawn 1000° F.				
4640	A4640	Hot Rolled Annld.	100,000	87,000	201	12
		Cold Drawn	125,000	97,000	269	27
		Heat Treated	157,000	139,000	335	35
		1" Rd. Oil Quenched 1525° F. Drawn 1000° F.				
6150	A6150	Hot Rolled Annld.	103,000	70,000	217	18
		Heat Treated	175,000	157,000	375	40

METRIC SYSTEM EQUIVALENTS

Length Equivalents

Unit	Milli-meters	Centi-meters	Inches	Feet	Yard	Meters
1 Millimeter =	1	1	.03937	.003281	.001094	.001
1 Centimeter =	10	1	.3937	.032808	.010936	.01
1 Inch =	25.4001	2.54001	1	.083333	.027778	.025400
1 Foot =	304.801	30.4801	12	1	.333333	.304801
1 Yard =	914.402	91.4402	36	3	1	.914402
1 Meter =	1000	100	39.37	3.28083	1.09361	1

Unit	Feet	Yards	Meters	Rods	Furlongs	Miles (Statute)
1 Rod =	16.5	5.5	5.02921	1	.025 (1/40)	.003125 (1/320)
1 Furlong =	660	220	201.168	40	1	.125 (1/8)
1 Kilometer =	3280.8	1093.6	1000	199	4.971	.62137
1 Mile (statute) =	5280	1760	1609.35	320	8	1

1 Nautical Mile = 6080.2 feet = 1.15155 statute miles = ½ league.

1 Light Year = 5.879 trillion miles = 9.46 trillion kilometers

Weight Equivalents

Unit	Grains	Grams	Ounces (Troy)	Ounces (Avoir.)	Pounds (Troy)	Pounds (Avoir.)	Kilo-grams
1 Grain =	1	.064799	.002083	.002286	.000174	.000143	.000065
1 Gram =	15.4324	1	.032151	.035274	.002679	.002205	.001
1 Ounce (Troy) =	480	31.1035	1	1.09714	.083333	.068571	.031104
1 Ounce (Avoir.) =	437.5	28.3495	.911458	1	.075955	.0625	.028350
1 Pound (Troy) =	5760	373.242	12	13.1657	1	.822857	.373242
1 Pound (Avoir.) =	7000	453.592	14.5833	16	1.21528	1	.453592
1 Kilogram =	15432.4	1000	32.1507	35.2740	2.67923	2.20462	1

Unit	Kilograms	Pounds (Troy)	Pounds (Avoir.)	Metric Tons	Net (Short) Tons	Gross (Long) Tons
1 Metric Ton =	1000	2679.23	2204.62	1	1.10231	.984206
1 Net (Short) Ton =	907.185	2430.56	2000	.907185	1	.892857
1 Gross (Long) Ton =	1016.05	2722.22	2240	1.01605	1.12	1

Area Equivalents

Unit	Square Inches	Square Feet	Square Yards	Square Meters
1 Square Foot =	144	1	.1111	.09290
1 Square Yard =	1296	9	1	.83613
1 Square Meter =	1550	10.7639	1.19599	1
1 Square Rod =	39204	272.25	30.25	25.293
1 Are =	155000	1076.39	119.599	100
1 Acre	6272640	43560	4840	4046.86
1 Square Mile (640 Acres) =	—	27878400	3097600	2589999
1 Square Kilometer =	—	10763867	1195985	1000000

METRIC SYSTEM

Length

1 meter (m)	=	$\left\{ \begin{array}{l} 10 \text{ decimeters (dm)} \\ 100 \text{ centimeters (cm)} \\ 1,000 \text{ millimeters (mm)} \end{array} \right.$
1 dekameter (dkm)	=	10 meters (m)
1 hectometer (hm)	=	100 meters (m)
1 kilometer (km)	=	1,000 meters (m)

Weight

1 gram (g)	=	$\left\{ \begin{array}{l} 10 \text{ decigrams (dg)} \\ 100 \text{ centigrams (cg)} \\ 1,000 \text{ milligrams (mg)} \end{array} \right.$
1 dekagram (dkg)	=	10 grams (g)
1 hectogram (hg)	=	100 grams (g)
1 kilogram (kg)	=	1,000 grams (g)
1 metric ton	=	$\left\{ \begin{array}{l} 1,000 \text{ kilograms (kg)} \\ 1,000,000 \text{ grams (g)} \end{array} \right.$

Volume & Capacity

1 liter (l)	=	$\left\{ \begin{array}{l} 1 \text{ cubic decimeter (dm}^3\text{)} \\ 10 \text{ deciliters (dl)} \\ 100 \text{ centiliters (cl)} \\ 1,000 \text{ milliliters (ml)} \\ 1,000 \text{ cubic centimeters (cm}^3\text{ or cc)} \end{array} \right.$
1 dekaliter (dkl)	=	10 liters (l)
1 hectoliter (hl)	=	100 liters (l)
1 kiloliter (kl)	=	$\left\{ \begin{array}{l} 1 \text{ cubic meter (m}^3\text{)} \\ 1 \text{ stere (s)} \\ 1,000 \text{ liters (l)} \end{array} \right.$

Area

1 centare (ca)	=	$\left\{ \begin{array}{l} 1 \text{ square meter (m}^2\text{)} \\ 100 \text{ square decimeters (dm}^2\text{)} \\ 10,000 \text{ square centimeters (cm}^2\text{)} \\ 1,000,000 \text{ square millimeters (mm}^2\text{)} \end{array} \right.$
1 are (a)	=	$\left\{ \begin{array}{l} 1 \text{ square dekameter (dkm}^2\text{)} \\ 100 \text{ square meters (m}^2\text{)} \end{array} \right.$
1 hectare (ha)	=	$\left\{ \begin{array}{l} 100 \text{ ares (a)} \\ 10,000 \text{ square meters (m}^2\text{)} \end{array} \right.$
1 square kilometer (km ²)	=	1,000,000 square meters (m ²)

Other prefixes occasionally used:

micro – one millionth
deca – 10 times (same as deka)

myria – 10,000 times
mega – 1,000,000 times

NUMERICAL EQUIVALENTS OF FRACTIONS, DECIMALS & MILLIMETERS

Inch Fractions	Inch Decimals	M.M.	Inch Fractions	Inch Decimals	M.M.
$\frac{1}{64}$	.0156	.3962	$\frac{33}{64}$	.5156	13.0962
$\frac{1}{32}$	.0312	.7925	$\frac{17}{32}$	.5312	13.4925
$\frac{3}{64}$	.0469	1.1913	$\frac{35}{64}$	.5469	13.8912
$\frac{1}{16}$	.0625	1.5875	$\frac{9}{16}$	.5625	14.2875
$\frac{5}{64}$	.0781	1.9844	$\frac{37}{64}$	.5781	14.6837
$\frac{3}{32}$	.0937	2.3799	$\frac{19}{32}$	.5937	15.0799
$\frac{7}{64}$	.1093	2.7762	$\frac{39}{64}$	.6094	15.4787
$\frac{1}{8}$	.1250	3.1750	$\frac{5}{8}$	.6250	15.8750
$\frac{9}{64}$	.1406	3.5712	$\frac{41}{64}$	.6406	16.2712
$\frac{5}{32}$	.1562	3.9675	$\frac{21}{32}$	.6562	16.6675
$\frac{11}{64}$	.1719	4.3663	$\frac{43}{64}$	.6719	17.0662
$\frac{3}{16}$	.1875	4.7625	$\frac{11}{16}$	.6875	17.4625
$\frac{13}{64}$	.2031	5.1587	$\frac{45}{64}$	.7031	17.8587
$\frac{7}{32}$	.2187	5.5549	$\frac{23}{32}$	.7187	18.2549
$\frac{15}{64}$	.2344	5.5938	$\frac{47}{64}$	.7344	18.6538
$\frac{1}{4}$	.2500	6.3500	$\frac{3}{4}$	.7500	19.0500
$\frac{17}{64}$	.2656	6.7462	$\frac{49}{64}$	.7656	19.4462
$\frac{9}{32}$	.2812	7.1425	$\frac{25}{32}$	.7812	19.8425
$\frac{19}{64}$	.2969	7.5412	$\frac{51}{64}$	.7969	20.2413
$\frac{5}{16}$	.3125	7.9375	$\frac{13}{16}$	.8125	20.6375
$\frac{21}{64}$	.3281	8.3337	$\frac{53}{64}$	.8281	21.0337
$\frac{11}{32}$	.3437	8.7299	$\frac{27}{32}$	.8437	21.4299
$\frac{23}{64}$	.3594	9.1287	$\frac{55}{64}$	.8594	21.8287
$\frac{3}{8}$	.3750	9.5250	$\frac{7}{8}$	.8750	22.2250
$\frac{25}{64}$	.3906	9.9212	$\frac{57}{64}$	.8906	22.6212
$\frac{13}{32}$	.4062	10.3174	$\frac{29}{32}$	.9062	23.0175
$\frac{27}{64}$	.4219	10.7167	$\frac{59}{64}$	.9219	23.4162
$\frac{7}{16}$	.4375	11.1125	$\frac{15}{16}$	.9375	23.8125
$\frac{29}{64}$	.4531	11.5087	$\frac{61}{64}$	.9531	24.2087
$\frac{15}{32}$	.4687	11.9049	$\frac{31}{32}$	.9687	24.6049
$\frac{31}{64}$	.4844	12.3037	$\frac{63}{64}$	.9844	25.0037
$\frac{1}{2}$	.5000	12.7000	1	1.000	25.4000