SOCKET CAP, SHOULDER, SET SCREWS, AND HEX KEYS (INCH SERIES)

1 INTRODUCTORY NOTES

1.1 Scope

This Standard covers complete general and dimensional data for various types of hexagon socket cap screws, shoulder screws, set screws, and hexagon keys recognized as an American National Standard. Also included are appendices that provide specifications for hexagon socket gages and gaging, tables showing applicability of keys and bits to various socket screw types and sizes, drill and counterbore sizes for socket head cap screws, and formulas used for dimensional data. However, where questions arise concerning acceptance of product, the dimensions in the tables shall govern over recalculation by formula. Recess dimensions for Type VI recesses are given in Mandatory Appendix III.

1.2 Socket Cap Screws

The head types covered by this Standard are specified in paras. 1.2.1 through 1.2.5.

1.2.1 Socket Head Cap Screws. The socket head shall have a flat chamfered top surface with smooth or knurled cylindrical sides and a flat bearing surface. Specifications are given in Tables 1 through 7. Dimensions for drilled holes and counterbores are included in Table A-1 of Nonmandatory Appendix A.

1.2.2 Drilled Hexagon Socket Head Cap Screws. Specifications for hexagon socket head cap screws having two, four, and six holes drilled in the head for lock wire applications are given in Table 7.

1.2.3 Socket Flat Countersunk Head Cap Screws. The flat countersunk head shall have a flat top surface and a conical-bearing surface with an angle of approximately 82 deg. Specifications are given in Tables 8 through 10.

1.2.4 Socket Button Head Cap Screws. The button head shall have a low rounded top surface with a large flat bearing surface. Specifications are given in Table 11.

1.2.5 Socket Low Head Cap Screws. These are similar to socket head cap screws, except they have reduced head height and a smaller socket size. They are designed to be used in applications where height clearance is a problem. Specifications are given in Table 12.

1.3 Socket Head Shoulder Screws

The socket head shoulder screw is a hexagon socket head screw having a cylindrical shoulder under the head. Specifications are given in Table 13.

1.4 Socket Set Screws

The socket set screw is a screw threaded the entire length except for its length of point. The point is designed to bear on a mating part. The common point styles are cup, flat, oval, cone, and half dog. Specifications for set screws are shown in Tables 14 through 16.

1.5 Keys and Bits for Driving Socket Screws

The tools for driving socket screws are hexagon keys and bits. Table 17 contains the requirements for hexagon keys and bits.

1.6 Dimensions

All dimensions in this Standard are given in inches unless stated otherwise. All dimensions apply prior to coating unless stated otherwise.

1.7 Finish

Because of the high hardness of these products, it is recommended that they not be electroplated.

1.8 Identification Marking

Products described in paras. 1.2.1 through 1.2.4 and 1.3 with diameters larger than #10 shall be marked with the identification of the source manufacturer or private label distributor accepting the responsibility for conformance to this Standard. Marking size, type, and location of marks are at manufacturer's option. Products shall not be marked on bearing surface.

1.9 Terminology

For definitions of terms relating to fasteners or to component features thereof used in this Standard, refer to ASME B18.12, Glossary of Terms for Mechanical Fasteners.

1.10 Responsibility for Modifications

The manufacturer shall not be held responsible for malfunctions of product due to plating or other modifications, when such plating or modification is not accomplished under his control or direction.

1.11 Referenced Standards

The following is a list of publications referenced in this Standard. Unless otherwise specified, the most recent standard available shall be used.

ASME B1.1, Unified Inch Screw Threads, (UN and UNR Thread Form)

ASME B1.3, Screw Thread Gaging Systems for Acceptability — Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ)

ASME B18.2.9, Straightness Gage and Gaging for Bolts and Screws

ASME B18.12, Glossary of Terms for Mechanical Fasteners

ASME B18.18, Quality Assurance for Fasteners

ASME B18.24, Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

ASME B46.1, Surface Texture (Surface Roughness, Waviness, and Lay)

ASME B47.1, Gage Blanks

ASME Y14.5, Dimensioning and Tolerancing

ASME Y14.6, Screw Thread Representation

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, P. O. Box 2900, Fairfield, NJ 07007-2900 (www.asme.org)

ASTM A574, Standard Specification for Alloy Steel Socket Head Cap Screws

ASTM F835, Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws

ASTM F837, Standard Specification for Stainless Steel Socket Head Cap Screws

ASTM F879, Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws

ASTM F880, Standard Specification for Stainless Steel Socket Set Screws

ASTM F912, Standard Specification for Alloy Steel Socket Set Screws

ASTM F1941, Standard Specification for Electrodeposited Coatings on Threaded Fasteners

Publisher: American Society for Testing and Materials (ASTM International), 100 Barr Harbor Drive, P. O. Box C700, West Conshohocken, PA 19428-2959 (www.astm.org)

2 GENERAL DATA

2.1 Sockets

Unless otherwise specified, screws shall have hexagon sockets in accordance with the provisions set forth in the notes to the respective dimensional tables.

2.1.1 Hexagon Sockets. Hexagon sockets shall conform to the specifications given in Table 18. Gages and gaging procedures are included in Mandatory Appendix I.

2.1.2 Type VI Sockets. Type VI recesses shall conform to the specifications given in Mandatory Appendix III. Gages and gaging procedures are included in Mandatory Appendix III.

2.2 Threads

Threads on all screw products covered by this Standard shall be in accordance with ASME B1.1 for the series and class specified in the notes to the respective product dimensional tables.

Acceptability of screw threads shall be based on System 22, ASME B1.3, except where otherwise specified in Note (12) of Table 14.

2.3 Quality Assurance

Products shall be furnished in accordance with category 2 of ASME B18.18. The requirements from other relative standards, such as ASTM A574 or ASTM F1941, shall apply.

Table 14 Dimensions of Hexagon Socket Set Screws

J

Note (1)

V

T

L

T

Flat Point

L

W → [Note (2)]

C

Oval Point

L

Slight flat permissible

R [Note (3)]

Slight flat or rounding permissible

**Cup Point
(See Table 16)**

L

W → [Note (2)]

118°
±5°

C

Cone Point

L

Y

Slight flat or rounding permissible
[Note (4)]

Half Dog Point

Slight fillet permissible

[Note (2)] 35°

Q

P

Slight chamfer or radius permissible

L
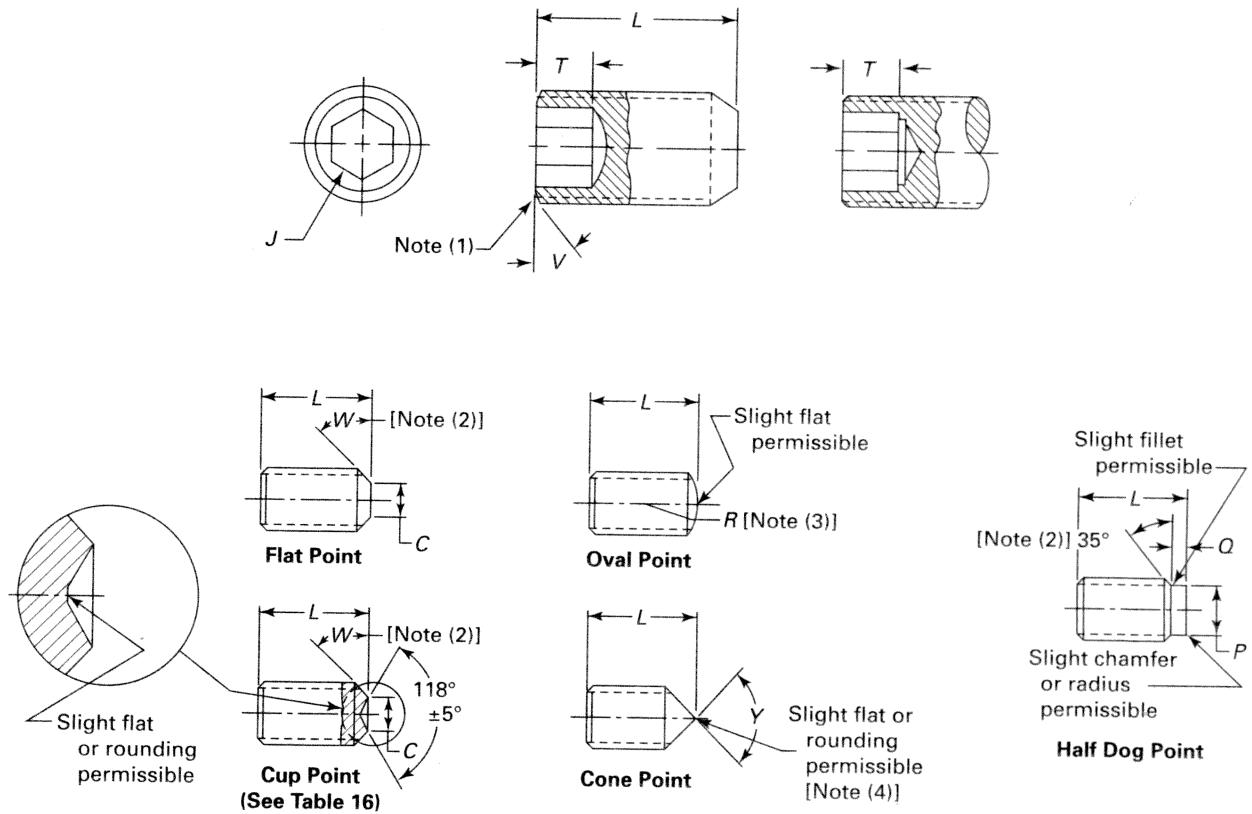
Table 14 Dimensions of Hexagon Socket Set Screws (Cont'd)

Nominal Size (Basic Screw Diameter)	Nominal Hexagon Socket Size, J	Min Key Engagement to Develop Functional Capability of Key, T — Hex Socket, T_H	Cup and Flat Point Diameters, C Max.	C Min.	Basic Oval Point Radius, R	Cone Point Angle 90 deg ±2 deg for These Nominal Lengths or Longer: 118 deg ±2 deg for Shorter Nominal Lengths, Y	Half Dog Point Diameter, P Max.	P Min.	Length, Q Max.	Q Min.	Shortest Optimum Nominal Length to Which T_H Applies, B — Cup and Flat Points	B — 90 deg Cone and Oval Points	B — Half Dog Point	Shortest Optimum Nominal Length to Which T_S Applies, B_1 — Cup and Flat Points	B_1 — 90 deg Cone and Oval Points	B_1 — Half Dog Point
0 (0.0600)	... 0.028	0.050	0.033	0.027	0.045	0.09	0.040	0.037	0.017	0.013	0.13	0.13	0.13	0.06	0.13	0.13
1 (0.0730)	... 0.035	0.060	0.040	0.033	0.055	0.09	0.049	0.045	0.021	0.017	0.13	0.19	0.13	0.13	0.19	0.13
2 (0.0860)	... 0.035	0.060	0.047	0.039	0.064	0.13	0.057	0.053	0.024	0.020	0.13	0.19	0.19	0.13	0.19	0.19
3 (0.0990)	... 0.050	0.070	0.054	0.045	0.074	0.13	0.066	0.062	0.027	0.023	0.19	0.19	0.19	0.13	0.19	0.19
4 (0.1120)	... 0.050	0.070	0.061	0.051	0.084	0.19	0.075	0.070	0.030	0.026	0.19	0.19	0.19	0.13	0.19	0.19
5 (0.1250)	1/16 0.062	0.080	0.067	0.057	0.094	0.19	0.083	0.078	0.033	0.027	0.19	0.19	0.19	0.13	0.19	0.19
5 (0.1250)	1/16 0.062	0.080	0.067	0.057	0.094	0.19	0.083	0.078	0.033	0.027	0.19	0.19	0.19	0.13	0.19	0.19
6 (0.1380)	1/16 0.062	0.080	0.074	0.064	0.104	0.19	0.092	0.087	0.038	0.032	0.19	0.25	0.19	0.13	0.25	0.19
6 (0.1380)	1/16 0.062	0.080	0.074	0.064	0.104	0.19	0.092	0.087	0.038	0.032	0.19	0.25	0.19	0.13	0.25	0.19
8 (0.1640)	5/64 0.078	0.090	0.087	0.076	0.123	0.25	0.109	0.103	0.043	0.037	0.19	0.25	0.25	0.19	0.25	0.25
10 (0.1900)	3/32 0.094	0.100	0.102	0.088	0.142	0.25	0.127	0.120	0.049	0.041	0.19	0.25	0.25	0.19	0.25	0.25
1/4 (0.2500)	1/8 0.125	0.125	0.132	0.118	0.188	0.31	0.156	0.149	0.067	0.059	0.25	0.31	0.31	0.25	0.31	0.31
5/16 (0.3125)	5/32 0.156	0.156	0.172	0.156	0.234	0.38	0.203	0.195	0.082	0.074	0.31	0.44	0.38	0.31	0.44	0.38
3/8 (0.3750)	3/16 0.188	0.188	0.212	0.194	0.281	0.44	0.250	0.241	0.099	0.089	0.38	0.44	0.44	0.38	0.44	0.44
7/16 (0.4375)	7/32 0.219	0.219	0.252	0.232	0.328	0.50	0.297	0.287	0.114	0.104	0.44	0.63	0.50	0.44	0.63	0.50
1/2 (0.5000)	1/4 0.250	0.250	0.291	0.270	0.375	0.57	0.344	0.334	0.130	0.120	0.50	0.63	0.63	0.50	0.63	0.63
5/8 (0.6250)	5/16 0.312	0.312	0.371	0.347	0.469	0.75	0.469	0.456	0.164	0.148	0.63	0.88	0.88	0.63	0.88	0.88
3/4 (0.7500)	3/8 0.375	0.375	0.450	0.425	0.562	0.88	0.562	0.549	0.196	0.180	0.75	1.00	1.00	0.75	1.00	1.00
7/8 (0.8750)	1/2 0.500	0.500	0.530	0.502	0.656	1.00	0.656	0.642	0.227	0.211	0.88	1.00	1.00	0.88	1.00	1.00
1 (1.0000)	9/16 0.562	0.562	0.609	0.579	0.750	1.13	0.750	0.734	0.260	0.240	1.00	1.25	1.25	0.88	1.25	1.00
1 1/8 (1.1250)	9/16 0.562	0.562	0.689	0.655	0.844	1.25	0.844	0.826	0.291	0.271	1.25	1.50	1.25	...	...	...
1 1/4 (1.2500)	5/8 0.625	0.625	0.767	0.733	0.938	1.50	0.938	0.920	0.323	0.303	1.25	1.50	1.50	...	...	...
1 3/8 (1.3750)	5/8 0.625	0.625	0.848	0.808	1.031	1.63	1.031	1.011	0.354	0.334	1.50	1.75	1.50	...	...	...
1 1/2 (1.5000)	3/4 0.750	0.750	0.926	0.886	1.125	1.75	1.125	1.105	0.385	0.365	1.50	2.00	1.75	...	...	...
1 3/4 (1.7500)	1 1.000	1.000	1.086	1.039	1.312	2.00	1.312	1.289	0.448	0.428	1.75	2.25	2.00	...	...	...
2 (2.0000)	1 1.000	1.000	1.244	1.193	1.500	2.25	1.500	1.474	0.510	0.490	2.00	2.50	2.50	...	...	...

Table 14   Dimensions of Hexagon Socket Set Screws (Cont'd)

GENERAL NOTE: For additional requirements, refer to Notes (5) through (15) and section 2, General Data, of this Standard.

NOTES:

(1) *Face.* The plane of the face on the socket end of the screw shall be approximately normal to the axis of the screw, and shall be chamfered on screws longer than lengths listed in this Table, columns B and B_1. The chamfer angle, V, shall be between 30 deg and 45 deg. The chamfer shall extend slightly below the root diameter of the thread and the edge between flat and chamfer may be slightly rounded. For screws equal to or shorter than the lengths listed in this Table, columns B and B_1, or screws 0.250 in. diameter or greater, with a national coarse thread, including lengths longer than listed in this Table, columns B and B_1, chamfering shall be at the option of the manufacturer. If chamfered, the chamfer angle, V, shall not exceed 45 deg.

(2) *Point Angles.* Point angles specified shall apply only to those portions of the angles that lie below the root diameter of the thread. The angles may vary in the threaded portions due to manufacturing processes.

   W shall be 45 deg, +5 deg −0 deg, for screws of lengths equal to or longer than the lengths listed in this Table, columns B and B_1, and 30 deg minimum for shorter screws.

(3) *Oval Point Radius Tolerance.* The tolerance shall be +0.015 in. for screw nominal sizes through 5 (0.125 in.) and +0.031 in. for screw nominal sizes 6 (0.138 in.) and larger.

(4) *Cone Point Configuration.* The apex of the cone may be flatted or rounded to the extent of 10% of the basic diameter of the screw.

(5) *Nominal Size.* Where specifying nominal size in decimals, zeros preceding decimal and in the fourth decimal place shall be omitted.

(6) *Length.* The length of the screw shall be measured overall, parallel to the axis of the screw. The basic length dimension on the product shall be the nominal length expressed as a two-place decimal.

(7) *Standard Lengths.* Standard length increments for set screws shall be as tabulated below.

Nominal Screw Length	Standard Length Increment
0.13 through 0.19*	0.03
0.19 through 0.50	0.06
0.50 through 1.00	0.13
1.00 through 2.00	0.25
2.00 through 6.00	0.50
Over 6.00	1.00

*A nominal screw length of 0.13 through 0.19 is applicable only to nominal sizes 0 (0.060 in.) through 3 (0.099 in.), inclusive.

(8) *Hexagon Sockets.* See Table 6 for hexagon socket dimensions and Mandatory Appendix I for gaging of hexagon sockets.

(9) *Socket Depths.* The key engagement dimensions shall apply only to nominal screw lengths equal to or longer than the lengths listed in this Table, columns B and B_1, respectively. For hexagon socket key engagement dimensions in screws of shorter nominal lengths than those listed in column B of this Table, see Table 15.

(10) *Half Dog Point Runout.* The runout of the half dog point shall not exceed 3% of the nominal size and shall not exceed 0.010 FIM for nominal sizes up to and including $\frac{3}{4}$ in. diameter and 0.020 FIM for nominal sizes over $\frac{3}{4}$ in. diameter.

   Runout is defined as the full indicator movement (FIM) obtained by holding on the thread major diameter near the half dog point, and rotating the screw 360 deg and indicating on the half dog point diameter.

Table 14   Dimensions of Hexagon Socket Set Screws (Cont'd)

(11) *Tolerance on Length*. Tolerance on length of set screws shall be as tabulated below.

Nominal Screw Length	Tolerance on Length
Up to 0.63, incl.	±0.01
Over 0.63 to 2.00, incl.	±0.02
Over 2.00 to 6.00, incl.	±0.03
Over 6.00	±0.06

(12) *Threads*. Threads shall be Unified external thread: Class 3A, UNC and UNF Series.

Thread lead deviation is controlled by standard thread gages within a thread length equal to 1.5 basic thread diameters. When using set screws longer than 1.5 basic diameters in length, the pitch diameter of the set screw may need to be reduced, or the tapped hole's pitch diameter may need to be increased to avoid interference during assembly.

Thread acceptability shall be based on System 22, ASME B1.3. NOT GO gaging shall not be required for set screws equal to or shorter than 7-pitch lengths.

Class 3A threads do not provide a plating allowance. When set screws must be plated, they should be manufactured with an undersized pitch diameter to accommodate the plating.

(13) *Material*

(a) *Steel, Alloy*. Socket set screws shall be fabricated from alloy steel and shall conform in all respects to ASTM F912.

(b) *Steel, Corrosion-Resistant*. Socket set screws shall be fabricated from austenitic corrosion-resistant steel and shall conform in all respects to ASTM F880.

(14) *Flat Point*. The plane of the end on the flat point shall be perpendicular to the axis of the thread within 2 deg obtained by holding the screw on the major thread diameter near the flat point, and inspecting on an optical comparator or comparable inspection equipment.

(15) *Designation*. To promote uniformity and understanding in communications relating to products conforming to this Standard, it is recommended that Hexagon Socket Set Screws be designated in accordance with the following data, preferably in the sequence shown:

(a) product name and point style

(b) designation of the standard

(c) nominal size (number, fractional or decimal equivalent)

(d) thread pitch

(e) nominal length (fractional or decimal equivalent)

(f) material

(g) protective finish, if required

EXAMPLES:

Hexagon Socket Set Screw, Cup Point, ASME B18.3, $\frac{1}{4}$-20 × $\frac{1}{4}$, Alloy Steel

Hexagon Socket Set Screw, Cup Point, ASME B18.3, 6-32 × 0.250, Corrosion-Resistant Steel

For the recommended B18 part identifying numbering system (PIN), see ASME B18.24.

Table 15 Hexagon Key Engagements for Short Length Set Screws

Nominal Size (Basic Screw Diameter)	Nominal Hexagon Socket Size, J		Nominal Screw Length, L	Minimum Key Engagement		
				Cup [Note (1)] and Flat Point	118 deg Cone and Oval Point	Half Dog Point
0 (0.0600)	. . .	0.028	0.06	0.030	0.028	Note (2)
			0.09	0.040	0.040 [Note (3)]	0.028
1 (0.0730)	. . .	0.035	0.06	0.030	0.029	Note (2)
			0.09	0.040	0.040 [Note (3)]	0.040
2 (0.0860)	. . .	0.035	0.06	0.030	0.029	Note (2)
			0.09	0.040	0.040	0.035
3 (0.0990)	. . .	0.050	0.09	0.040	0.039	Note (2)
			0.13	0.055	0.040 [Note (3)]	0.045
4 (0.1120)	. . .	0.050	0.09	0.045	0.039	Note (2)
			0.13	0.060	0.045	0.045
5 (0.1250)	1/16	0.062	0.09	0.040	0.039	Note (2)
			0.13	0.060	0.045	0.045
6 (0.1380)	1/16	0.062	0.09	0.040	0.039	Note (2)
			0.13	0.060	0.045	0.045
			0.16	0.070	0.065	0.065
8 (0.1640)	5/64	0.078	0.13	0.060	0.050	0.045
			0.16	0.070	0.060	0.060
			0.19	Note (4)	0.065	0.065
10 (0.1900)	3/32	0.094	0.13	0.060	0.042	0.042
			0.19	Note (4)	0.060	0.060
1/4 (0.2500)	1/8	0.125	0.19	0.090	0.065	0.055
			0.25	Note (4)	0.110	0.090
5/16 (0.3125)	5/32	0.156	0.25	0.125	0.099	0.090
			0.31	Note (4)	0.140	0.105
3/8 (0.3750)	3/16	0.188	0.25	0.110	0.090	0.075
			0.31	0.140	0.115	0.105
			0.38	Note (4)	0.165	0.155
7/16 (0.4375)	7/32	0.219	0.38	0.160	0.125	0.125
			0.44	Note (4)	0.160	0.160
1/2 (0.5000)	1/4	0.250	0.38	0.175	0.130	0.130
			0.44	0.215	0.155	0.155
			0.50	Note (4)	0.195	0.195
5/8 (0.6250)	5/16	0.312	0.50	0.205	0.145	0.145
3/4 (0.7500)	3/8	0.375	0.63	0.255	0.190	0.190
			0.75	Note (4)	0.325	0.295
7/8 (0.8750)	1/2	0.500	0.75	0.330	0.255	0.255
			0.87	Note (4)	0.419	0.330
1 (1.0000)	9/16	0.562	0.75	0.280	0.175	0.175
			0.87	0.380	0.280	0.280
			1.00	Note (4)	0.380	0.380

Table 15 Hexagon Key Engagements for Short Length Set Screws (Cont'd)

GENERAL NOTES:

(a) CAUTION: The use of short-length set screws listed in this Table can result in failure of the socket, key, or mating threads during tightening because key engagement and thread length are less than optimum. Therefore, it is strongly recommended that screws of lengths equal to or greater than the lengths specified in columns B and B_1 of Table 14 be used wherever possible.

(b) See Table 14, and the illustrations and notes thereto, for additional dimensions and specifications.

NOTES:

(1) Cup angle may be 118 deg or 130 deg, +5 deg, depending upon screw length and manufacturing process.

(2) These sizes are impractical to manufacture because of point configuration and short length.

(3) Cone point angle for these lengths shall be 90 deg; see column Y of Table 14.

(4) These screws are covered in Table 14.

Table 16 Dimensions of Optional Cup Points

Nominal Size (Basic Screw Diameter)	Point Diameter, C_1		Point Diameter, C_2		Point Length, S	
	Max.	Min.	Max.	Min.	Max.	Min.
0 (0.0600)	0.032	0.027	0.027	0.022	0.007	0.004
1 (0.0730)	0.038	0.033	0.035	0.030	0.008	0.005
2 (0.0860)	0.043	0.038	0.043	0.038	0.010	0.007
3 (0.0990)	0.050	0.045	0.051	0.046	0.011	0.007
4 (0.1120)	0.056	0.051	0.059	0.054	0.013	0.008
5 (0.1250)	0.062	0.056	0.068	0.063	0.014	0.009
6 (0.1380)	0.069	0.062	0.074	0.068	0.017	0.012
8 (0.1640)	0.082	0.074	0.090	0.084	0.021	0.016
10 (0.1900)	0.095	0.086	0.101	0.095	0.024	0.019
$\frac{1}{4}$ (0.2500)	0.125	0.114	0.156	0.150	0.027	0.022
$\frac{5}{16}$ (0.3125)	0.156	0.144	0.190	0.185	0.038	0.033
$\frac{3}{8}$ (0.3750)	0.187	0.174	0.241	0.236	0.041	0.036
$\frac{7}{16}$ (0.4375)	0.218	0.204	0.286	0.281	0.047	0.042
$\frac{1}{2}$ (0.5000)	0.250	0.235	0.333	0.328	0.054	0.049
$\frac{5}{8}$ (0.6250)	0.312	0.295	0.425	0.420	0.067	0.062
$\frac{3}{4}$ (0.7500)	0.375	0.357	0.523	0.518	0.081	0.076
$\frac{7}{8}$ (0.8750)	0.437	0.418	. . .	. . .	. . .	. . .
1 (1.0000)	0.500	0.480	. . .	. . .	. . .	. . .
$1\frac{1}{8}$ (1.1250)	0.562	0.542	. . .	. . .	. . .	. . .
$1\frac{1}{4}$ (1.2500)	0.625	0.605	. . .	. . .	. . .	. . .
$1\frac{3}{8}$ (1.3750)	0.687	0.667	. . .	. . .	. . .	. . .
$1\frac{1}{2}$ (1.5000)	0.750	0.730	. . .	. . .	. . .	. . .
$1\frac{3}{4}$ (1.7500)	0.875	0.855	. . .	. . .	. . .	. . .
2 (2.0000)	1.000	0.980	. . .	. . .	. . .	. . .

GENERAL NOTES:

(a) Type A point shown in Fig. 1 is the cup point dimensioned in Table 14. Types B through G are typical variations of the cup point, which is supplied by some manufacturers.

(b) For dimensions not shown above, refer to Table 14.

Fig. 1 Cup Point Variations

Type A

Type B

Type C

*This diameter may be counterbored.
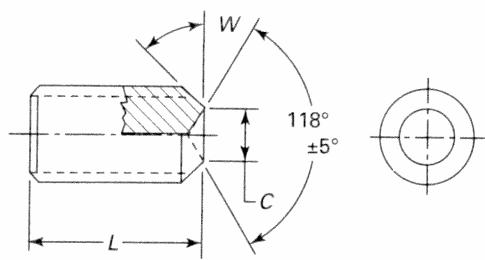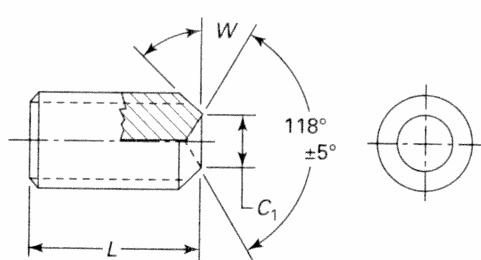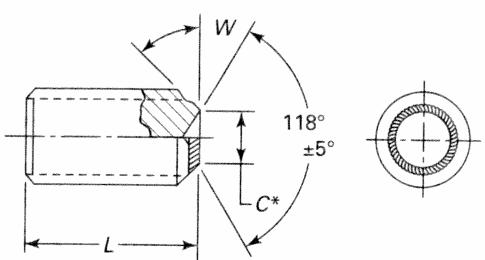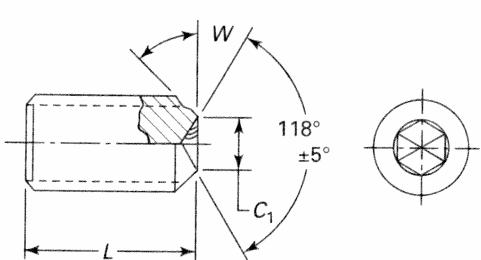
Type D
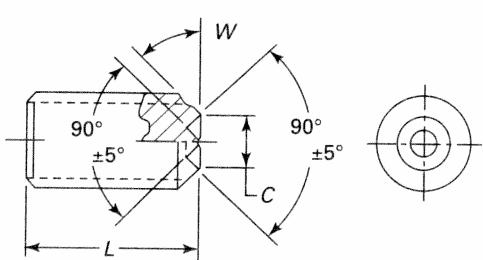
Type E
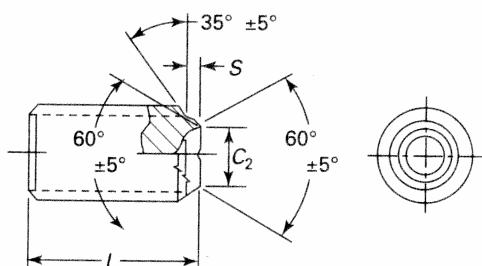
Type F
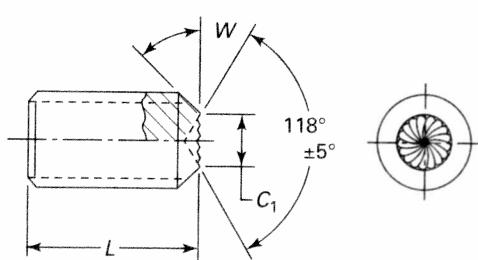
Type G

Table 17   Dimensions of Hexagon Keys and Bits

Key

Bit

Note (1)
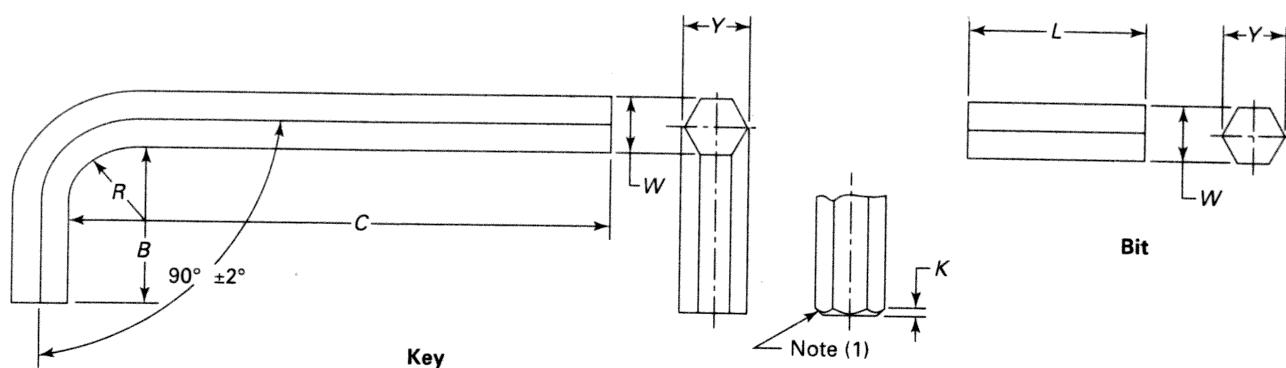
Nominal Key or Bit and Socket Size	Hexagon Width Across Flats, W		Hexagon Width Across Corners, Y		Length, B		Length, C				Minimum Radius of Bend, R	Length of Bit, ±0.062, L	Maximum Chamfer, K	Minimum Torsion Load, in.-lb
							Short Arm Series		Long Arm Series					
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.				
...	0.028	0.0280	0.0275	0.0314	0.0300	0.312	0.125	1.312	1.125	2.688	2.500	0.062	...	0.003	0.94
...	0.035	0.0350	0.0345	0.0393	0.0378	0.438	0.250	1.312	1.125	2.766	2.578	0.062	...	0.004	1.80
...	0.050	0.0500	0.0490	0.0560	0.0540	0.625	0.438	1.750	1.562	2.938	2.750	0.062	...	0.006	5.25
$\frac{1}{16}$	0.062	0.0625	0.0615	0.0701	0.0680	0.656	0.469	1.844	1.656	3.094	2.906	0.062	...	0.008	10.25
$\frac{5}{64}$	0.078	0.0781	0.0771	0.0880	0.0859	0.703	0.516	1.969	1.781	3.281	3.094	0.078	...	0.008	20.0
$\frac{3}{32}$	0.094	0.0937	0.0927	0.1058	0.1035	0.750	0.562	2.094	1.906	3.469	3.281	0.094	...	0.009	35.0
$\frac{7}{64}$	0.109	0.1094	0.1079	0.1238	0.1210	0.797	0.609	2.219	2.031	3.656	3.469	0.109	...	0.014	55.0
$\frac{1}{8}$	0.125	0.1250	0.1235	0.1418	0.1390	0.844	0.656	2.344	2.156	3.844	3.656	0.125	...	0.015	82.0
$\frac{9}{64}$	0.141	0.1406	0.1391	0.1593	0.1566	0.891	0.703	2.469	2.281	4.031	3.844	0.141	...	0.016	118.0
$\frac{5}{32}$	0.156	0.1562	0.1547	0.1774	0.1745	0.938	0.750	2.594	2.406	4.219	4.031	0.156	...	0.016	160.0
$\frac{3}{16}$	0.188	0.1875	0.1860	0.2135	0.2105	1.031	0.844	2.844	2.656	4.594	4.406	0.188	...	0.022	278.0
$\frac{7}{32}$	0.219	0.2187	0.2172	0.2490	0.2460	1.125	0.938	3.094	2.906	4.969	4.781	0.219	...	0.024	440.0
$\frac{1}{4}$	0.250	0.2500	0.2485	0.2845	0.2815	1.219	1.031	3.344	3.156	5.344	5.156	0.250	...	0.030	665.0
$\frac{5}{16}$	0.312	0.3125	0.3110	0.3570	0.3531	1.344	1.156	3.844	3.656	6.094	5.906	0.312	...	0.032	1275.0
$\frac{3}{8}$	0.375	0.3750	0.3735	0.4285	0.4238	1.469	1.281	4.344	4.156	6.844	6.656	0.375	...	0.044	2200.0
$\frac{7}{16}$	0.438	0.4375	0.4355	0.5005	0.4944	1.594	1.406	4.844	4.656	7.594	7.406	0.438	...	0.047	3500.0
$\frac{1}{2}$	0.500	0.5000	0.4975	0.5715	0.5650	1.719	1.531	5.344	5.156	8.344	8.156	0.500	...	0.050	5200.0
$\frac{9}{16}$	0.562	0.5625	0.5600	0.6420	0.6356	1.844	1.656	5.844	5.656	9.094	8.906	0.562	...	0.053	6500.0
$\frac{5}{8}$	0.625	0.6250	0.6225	0.7146	0.7080	1.969	1.781	6.344	6.156	9.844	9.656	0.625	...	0.055	9000.0
$\frac{3}{4}$	0.750	0.7500	0.7470	0.8580	0.8512	2.219	2.031	7.344	7.156	11.344	11.156	0.750	...	0.070	15500.0
$\frac{7}{8}$	0.875	0.8750	0.8720	1.0020	0.9931	2.469	2.281	8.344	8.156	12.844	12.656	0.875	...	0.076	24600.0
1	1.000	1.0000	0.9970	1.1470	1.1350	2.719	2.531	9.344	9.156	14.344	14.156	1.000	...	0.081	28800.0
$1\frac{1}{4}$	1.250	1.2500	1.2430	1.4337	1.4138	3.250	2.750	11.500	11.000	...	...	1.250	3.750	0.092	...
$1\frac{1}{2}$	1.500	1.5000	1.4930	1.7204	1.6981	3.750	3.250	13.500	13.000	...	...	1.500	4.500	0.104	...
$1\frac{3}{4}$	1.750	1.7500	1.7430	2.0072	1.9825	4.250	3.750	15.500	15.000	...	...	1.750	5.250	0.115	...
2	2.000	2.0000	1.9930	2.2939	2.2668	4.750	4.250	17.500	17.000	...	...	2.000	6.000	0.126	...
$2\frac{1}{4}$	2.250	2.2500	2.2430	2.5807	2.5511	5.250	4.750	19.500	19.000	...	...	2.250	6.750	0.137	...
$2\frac{3}{4}$	2.750	2.7500	2.7420	3.1541	3.1187	6.250	5.750	23.500	23.000	...	...	2.750	8.250	0.159	...
3	3.000	3.0000	2.9920	3.4409	3.4030	6.750	6.250	25.500	25.000	...	...	3.000	9.000	0.171	...

GENERAL NOTE: For additional requirements, refer to Notes (2) through (7).

Table 17 Dimensions of Hexagon Keys and Bits (Cont'd)

NOTES:

(1) Each end shall be square with the axis of each arm within 4 deg and edges may be sharp or chamfered at the option of the manufacturer. The chamfer shall not exceed the values listed.

(2) Hexagon keys are furnished as Short Arm Series or Long Arm Series.

(3) Any truncation or rounding of hexagon corners within the specified across-corner dimensions shall be evident on all corners.

(4) For nominal socket sizes above 1 in., it is recommended that bits be used in conjunction with standard hexagon wrenches or power drives. When the application makes the use of keys necessary, the keys should conform to the dimensions listed. Bits 1 in. and smaller are available, but the lengths have not been standardized.

(5) *Material (Steel Alloy).* Hexagon keys and bits shall be fabricated from an alloy steel having two or more of the following alloying elements: chromium, nickel, molybdenum, or vanadium, in sufficient quantity to ensure that the specified minimum hardness of 48 HRC at the surface for nominal sizes up to and including $\frac{3}{8}$ in., and 45 HRC for nominal sizes over $\frac{3}{8}$ in., is met when hexagon keys and bits are hardened by quenching from the austenitizing temperature and tempered.

(6) For plated hexagon keys and bits, all dimensions are before plating. Because of the high hardness of these products, it is recommended that they not be electroplated.

(7) *Designation.* To promote uniformity and understanding in communications relating to products conforming to this Standard, it is recommended that hexagon keys or bits be designated in accordance with the following data, preferably in the sequence shown:

    (a) product name

    (b) designation of the standard

    (c) nominal key or bit size

    (d) series

    (e) protective finish, if required

    EXAMPLES:

    Hexagon Key, ASME B18.3, $\frac{1}{8}$ Short Arm Series

    Hexagon Key, ASME B18.3, $\frac{1}{8}$ Long Arm Series, Nickel Plated [see Note (6)]

    Hexagon Key Bit, ASME B18.3, $1\frac{1}{2}$ Hex

Table 18 Dimensions of Hexagon Sockets
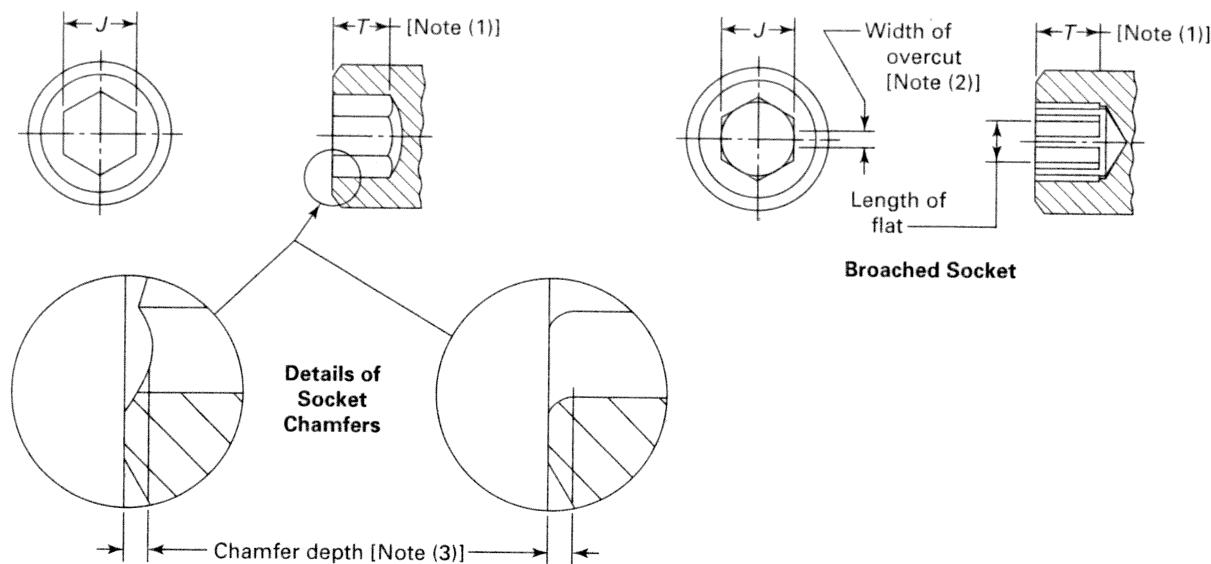
Broached Socket

Details of Socket Chamfers

Chamfer depth [Note (3)]

Nominal Socket Size	Socket Width Across Flats, *J*		Nominal Socket Size	Socket Width Across Flats, *J*		Nominal Socket Size	Socket Width Across Flats, *J*	
	Max.	Min.		Max.	Min.		Max.	Min.
... 0.025	0.0285	0.0280	$\frac{3}{16}$ 0.188	0.1900	0.1875	$\frac{7}{8}$ 0.875	0.8850	0.8750
... 0.035	0.0355	0.0350	$\frac{7}{32}$ 0.219	0.2217	0.2187	1 1.000	1.0200	1.0000
... 0.050	0.0510	0.0500	$\frac{1}{4}$ 0.250	0.2530	0.2500	$1\frac{1}{4}$ 1.250	1.2750	1.2500
$\frac{1}{16}$ 0.062	0.0635	0.0625	$\frac{5}{16}$ 0.312	0.3160	0.3125	$1\frac{1}{2}$ 1.500	1.5300	1.5000
$\frac{5}{64}$ 0.078	0.0791	0.0781	$\frac{3}{8}$ 0.375	0.3790	0.3750	$1\frac{3}{4}$ 1.750	1.7850	1.7500
$\frac{3}{32}$ 0.094	0.0952	0.0937	$\frac{7}{16}$ 0.438	0.4420	0.4375	2 2.000	2.0400	2.0000
$\frac{7}{64}$ 0.109	0.1111	0.1094	$\frac{1}{2}$ 0.500	0.5050	0.5000	$2\frac{1}{4}$ 2.250	2.2950	2.2500
$\frac{1}{8}$ 0.125	0.1270	0.1250	$\frac{9}{16}$ 0.562	0.5680	0.5625	$2\frac{3}{4}$ 2.750	2.8050	2.7500
$\frac{9}{64}$ 0.141	0.1426	0.1406	$\frac{5}{8}$ 0.625	0.6310	0.6250	3 3.000	3.0600	3.0000
$\frac{5}{32}$ 0.156	0.1587	0.1562	$\frac{3}{4}$ 0.750	0.7570	0.7500	...	...	...

GENERAL NOTES:

(a) Sockets up to and including 1 in. nominal size shall be checked in accordance with the hexagon socket gages and gaging specified in Mandatory Appendix I. Suitability of larger sockets shall be determined by means of direct measurement for various technical and economic reasons.

(b) Dimensions of sockets apply before plating. When plated, see Mandatory Appendix I. (For plated products, see para. 1.7.)

(c) Broach petals at the bottom of the socket are permissible.

(d) For additional requirements, refer to section 2, General Data, of this Standard.

NOTES:

(1) Applicable socket depths are specified in the dimensional tables and notes for the respective screw types.

(2) For broached sockets, the maximum acceptable overcut shall be a size causing an average 20% flat length reduction in the maximum dimension across flat hexagon for socket sizes up to and including 1 in., and 30% for larger sockets. The maximum overcut on any one of the six flats shall not exceed a 40% reduction in flat length for any size socket.

(3) Where hexagon sockets are chamfered, the depth of chamfer shall not exceed 10% of the nominal socket size for sizes up to and including $\frac{1}{16}$ in., and 7.5% for larger sizes. For chamfered sockets, it is permissible for the NOT GO socket gage to enter to the depth of chamfer as specified in Mandatory Appendix I.

MANDATORY APPENDIX I
GAGES AND GAGING FOR HEXAGON SOCKETS

I-1 GENERAL

The gages specified herein are intended for use in determining the acceptability of sockets up to and including the 1-in. nominal hexagon socket size. Suitability of hexagon sockets of nominal sizes larger than 1 in. shall be determined by direct measurement for various technical and economic reasons. For dimensions of gages for sockets, see Table I-1.

I-2 GAGING OF HEXAGON SOCKETS

Hexagon sockets in screws shall allow the GO member of the gage to enter freely to the minimum key engagement depths specified in the dimensional tables for the respective screw types.

For hexagon sockets that are not chamfered, the NOT GO gage member shall not enter any of the three across-flat dimensions of the socket for nominal socket sizes of $\frac{1}{8}$ in. and larger, and the hexagonal NOT GO gage member shall not enter the socket for nominal socket sizes smaller than $\frac{1}{8}$ in.

For chamfered hexagon sockets, the NOT GO gage member shall be permitted to enter only to a depth equivalent to 10% of the nominal socket size for nominal socket sizes up to and including $\frac{1}{16}$ in., and to 7.5% of the nominal socket sizes for larger sockets.

For coated products, use GO gages identical in design and tolerances to those shown in Table I-1, except having minimum dimensions equal to minimum sizes of keys and bits shown in Table 17.

I-3 GAGES

Gages shall be made from any grade of steel, through-hardened and tempered to 60 HRC minimum.

The form of hexagonal gage members shall be within the tolerance zone specified. See ASME Y14.5.

The surface roughness on hexagon flats shall be 8 μin. (arithmetical average) maximum. See ASME B46.1.

The gage handles shall conform to ASME B47.1.

Table I-1 Dimensions of Gages for Hexagon Sockets
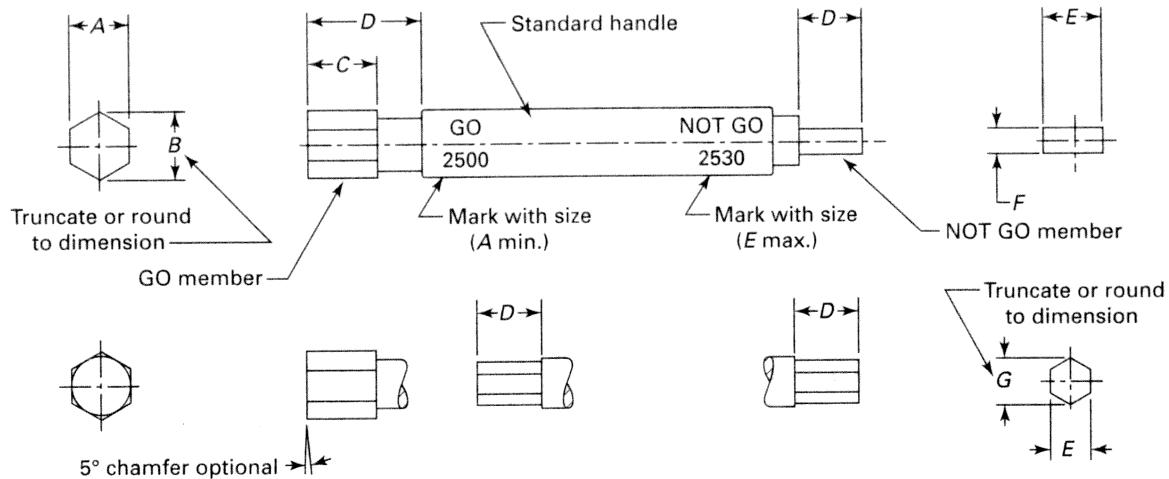
Nominal Socket Size		GO Gage Width Across Flats, A		GO Gage Width Across Corners, B		Minimum GO Gage Length, C	Minimum Usable Gage Length, D	NOT GO Gage Width, E		NOT GO Gage Thickness, F		NOT GO Gage Width Across Corners, G	
		Max.	Min.	Max.	Min.			Max.	Min.	Max.	Min.	Max.	Min.
...	0.028	0.0281	0.0280	0.0316	0.0314	0.062	0.062	0.0285	0.0284	...	...	0.0308	0.0303
...	0.035	0.0351	0.0350	0.0395	0.0393	0.093	0.093	0.0355	0.0354	...	...	0.0386	0.0381
...	0.050	0.0501	0.0500	0.0562	0.0560	0.187	0.187	0.0510	0.0509	...	...	0.0550	0.0545
$\frac{1}{16}$	0.062	0.0626	0.0625	0.0703	0.0701	0.187	0.187	0.0635	0.0634	...	...	0.0688	0.0683
$\frac{5}{64}$	0.078	0.0782	0.0781	0.0882	0.0880	0.187	0.187	0.0791	0.0790	...	...	0.0862	0.0857
$\frac{3}{32}$	0.094	0.0939	0.0937	0.1060	0.1058	0.250	0.250	0.0952	0.0950	...	...	0.1036	0.1031
$\frac{7}{64}$	0.109	0.1096	0.1094	0.1240	0.1238	0.250	0.250	0.1111	0.1109	...	...	0.1212	0.1207
$\frac{1}{8}$	0.125	0.1252	0.1250	0.1420	0.1418	0.250	0.250	0.1270	0.1268	0.057	0.055	...	...
$\frac{9}{64}$	0.141	0.1408	0.1406	0.1595	0.1593	0.250	0.250	0.1426	0.1424	0.064	0.062	...	...
$\frac{5}{32}$	0.156	0.1564	0.1562	0.1776	0.1774	0.250	0.250	0.1587	0.1585	0.071	0.069	...	...
$\frac{3}{16}$	0.188	0.1877	0.1875	0.2137	0.2135	0.250	0.375	0.1900	0.1898	0.088	0.086	...	...
$\frac{7}{32}$	0.219	0.2189	0.2187	0.2492	0.2490	0.250	0.437	0.2217	0.2215	0.102	0.100	...	...
$\frac{1}{4}$	0.250	0.2502	0.2500	0.2848	0.2845	0.312	0.500	0.2530	0.2528	0.117	0.115	...	...
$\frac{5}{16}$	0.312	0.3127	0.3125	0.3573	0.3570	0.312	0.625	0.3160	0.3158	0.150	0.148	...	...
$\frac{3}{8}$	0.375	0.3752	0.3750	0.4288	0.4285	0.500	0.750	0.3790	0.3788	0.180	0.178	...	...
$\frac{7}{16}$	0.438	0.4377	0.4375	0.5008	0.5005	0.500	0.875	0.4420	0.4418	0.211	0.209	...	...
$\frac{1}{2}$	0.500	0.5002	0.5000	0.5718	0.5715	0.500	1.000	0.5050	0.5048	0.241	0.239	...	...
$\frac{9}{16}$	0.562	0.5627	0.5625	0.6424	0.6420	0.750	1.125	0.5680	0.5678	0.269	0.267	...	...
$\frac{5}{8}$	0.625	0.6252	0.6250	0.7150	0.7146	0.750	1.250	0.6310	0.6308	0.302	0.300	...	...
$\frac{3}{4}$	0.750	0.7502	0.7500	0.8585	0.8580	0.750	1.500	0.7570	0.7568	0.364	0.362	...	...
$\frac{7}{8}$	0.875	0.8752	0.8750	1.0025	1.0020	0.875	1.750	0.8850	0.8848	0.423	0.421	...	...
1	1.000	1.0002	1.0000	1.1475	1.1470	1.000	2.000	1.0100	1.0098	0.489	0.487	...	...