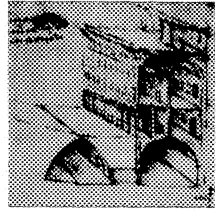


STANDARD CATALOG PARTS AND REFERENCE MATERIALS

Appendix C



-
- C.1 THREADS**
 - C.2 METRIC TWIST DRILLS**
 - C.3 BOLTS, NUTS, AND SCREWS**
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C.1 Threads

TABLE C.1.1 Standard Unified Thread Series*

Present Unified Thread Nominal Size—diameter			Coarse (NC) (UNC)		Fine (NF) (UNF)		Extra-fine (NEF) (UNEF)	
Inch	Metric equiv.	Threads per inch	Tap drill†	Threads per inch	Tap drill†	Threads per inch	Tap drill†	
060	0	1.52	—	—	80	$\frac{3}{64}$	—	—
073	1	1.85	64	No. 53	72	No. 53	—	—
086	2	2.18	56	No. 50	64	No. 50	—	—
099	3	2.51	48	No. 47	56	No. 45	—	—
112	4	2.84	40	No. 43	48	No. 42	—	—
125	5	3.17	40	No. 38	44	No. 37	—	—
138	6	3.50	32	No. 36	40	No. 33	—	—
164	8	4.16	32	No. 29	36	No. 29	—	—
190	10	4.83	24	No. 25	32	No. 21	—	—
216	12	5.49	24	No. 16	28	No. 14	32	No. 13
250	$\frac{1}{4}$	6.35	20	No. 7	28	No. 3	32	No. 2
3125	$\frac{5}{16}$	7.94	18	F	24	I	32	K
375	$\frac{3}{8}$	9.52	16	$\frac{5}{16}$	24	O	32	S
4375	$\frac{7}{16}$	11.11	14	U	20	$\frac{25}{64}$	28	Y
500	$\frac{1}{2}$	12.70	13	$\frac{27}{64}$	20	$\frac{29}{64}$	28	$\frac{15}{32}$
5625	$\frac{9}{16}$	14.29	12	$\frac{31}{64}$	18	$\frac{33}{64}$	24	$\frac{17}{32}$
625	$\frac{5}{8}$	15.87	11	$\frac{17}{32}$	18	$\frac{37}{64}$	24	$\frac{19}{32}$
6875	$\frac{11}{16}$	17.46	—	—	—	—	24	$\frac{41}{64}$
750	$\frac{3}{4}$	19.05	10	$\frac{21}{32}$	16	$\frac{11}{16}$	20	$\frac{45}{64}$
8125	$\frac{13}{16}$	20.64	—	—	—	—	20	$\frac{49}{64}$
875	$\frac{7}{8}$	22.22	9	$\frac{49}{64}$	14	$\frac{13}{16}$	20	$\frac{53}{64}$
9375	$\frac{15}{16}$	23.81	—	—	—	—	20	$\frac{57}{64}$
1 000	1	25.40	8	$\frac{7}{8}$	12	$\frac{59}{64}$	20	$\frac{61}{64}$
1 0625	$1\frac{1}{16}$	26.99	—	—	—	—	18	1
1 125	$1\frac{1}{8}$	28.57	7	$\frac{65}{64}$	12	$1\frac{3}{64}$	18	$1\frac{5}{64}$
1 1875	$1\frac{1}{4}$	30.16	—	—	—	—	18	$1\frac{9}{64}$
1 250	$1\frac{3}{8}$	31.75	7	$1\frac{7}{64}$	12	$1\frac{11}{64}$	18	$1\frac{13}{64}$
1 3125	$1\frac{5}{8}$	33.34	—	—	—	—	18	$1\frac{17}{64}$
1 375	$1\frac{3}{4}$	34.92	6	$1\frac{15}{64}$	12	$1\frac{19}{64}$	18	$1\frac{21}{64}$
1 4375	$1\frac{7}{8}$	36.51	—	—	—	—	18	$1\frac{25}{64}$
1 500	$1\frac{1}{2}$	38.10	6	$1\frac{21}{64}$	12	$1\frac{27}{64}$	18	$1\frac{29}{64}$
1 5625	$1\frac{9}{16}$	39.69	—	—	—	18	1	$1\frac{33}{64}$
1 625	$1\frac{5}{8}$	41.27	—	—	—	18	1	$1\frac{37}{64}$
1 6875	$1\frac{11}{16}$	42.86	—	—	—	18	1	$1\frac{41}{64}$
1 750	$1\frac{3}{4}$	44.45	5	$1\frac{35}{64}$	—	—	16	$1\frac{45}{64}$
2 000	2	50.80	$4\frac{1}{2}$	$1\frac{39}{64}$	—	—	16	$1\frac{49}{64}$
2 250	$2\frac{1}{4}$	57.15	$4\frac{1}{2}$	$2\frac{1}{32}$	—	—	—	—
2 500	$2\frac{1}{2}$	63.50	4	$2\frac{1}{16}$	—	—	—	—
2 750	$2\frac{3}{4}$	69.85	4	$2\frac{1}{8}$	—	—	—	—
3 000	3	76.20	4	$2\frac{3}{16}$	—	—	—	—
3 250	$3\frac{1}{4}$	82.55	4	3	—	—	—	—
3 500	$3\frac{1}{2}$	88.90	4	$3\frac{1}{4}$	—	—	—	—
3 750	$3\frac{3}{4}$	95.25	4	$3\frac{1}{2}$	—	—	—	—
4 000	4	101.60	4	$3\frac{3}{4}$	—	—	—	—

*Adapted from ANSI B1.1, 1960.
 Unified Standard—Classes 1A, 2A, 3A, 1B, 2B, and 3B.
 For recommended hole-size limits before threading, see Tables 38 and 39, ANSI B1.1-1960.
 †Tap drill for a 75% thread (not Unified—American Standard).

TABLE C.1.2 Thread Sizes and Dimensions: Fraction/Decimal/Metric

Nominal Size		Diameter				Tap Drill (for 75% Th'd.)			Threads per Inch		Pitch (mm)		T.P.I. (Approx.)	
Inch	mm	(Major)		(Minor)		Drill	Inch	mm	UNC	UNF	Coarse	Fine	Coarse	Fine
---	M1.4	.055	1.397	---	---	---	---	---	---	---	.3	2	85	127
0	---	.060	1.524	.0438	1.092	$\frac{3}{64}$	.0469	1.168	---	80	---	---	---	---
---	M1.6	.063	1.600	---	---	---	---	---	---	---	.35	2	74	127
1	---	.073	1.854	.0527	1.320	53	.0595	1.499	64	---	---	---	---	---
1	---	.073	1.854	.0550	1.397	53	.0595	1.499	---	72	---	---	---	---
---	M.2	.079	2.006	---	---	---	---	---	---	---	.4	.25	64	101
2	---	.086	2.184	.0628	1.587	50	.0700	1.778	56	---	---	---	---	---
2	---	.086	2.184	.0657	1.651	50	.0700	1.778	---	64	---	---	---	---
---	M2.5	.098	2.489	---	---	---	---	---	---	---	.45	.35	56	74
3	---	.099	2.515	.0719	1.828	47	.0785	1.981	48	---	---	---	---	---
3	---	.099	2.515	.0758	1.905	46	.0810	2.057	---	58	---	---	---	---
4	---	.112	2.845	.0795	2.006	43	.0890	2.261	40	---	---	---	---	---
4	---	.112	2.845	.0849	2.134	42	.0935	2.380	---	48	---	---	---	---
---	M3	.118	2.997	---	---	---	---	---	---	---	.5	.35	51	74
5	---	.125	3.175	.0925	2.336	38	.1015	2.565	40	---	---	---	---	---
5	---	.125	3.175	.0955	2.413	37	.1040	2.641	---	44	---	---	---	---
6	---	.138	3.505	.0975	2.464	36	.1065	2.692	32	---	---	---	---	---
6	---	.138	3.505	.1055	2.667	33	.1130	2.870	---	40	---	---	---	---
---	M4	.157	3.988	---	---	---	---	---	---	---	.7	.35	36	51
8	---	.164	4.166	.1234	3.124	29	.1360	3.454	32	---	---	---	---	---
8	---	.164	4.166	.1279	3.225	29	.1360	3.454	---	36	---	---	---	---
10	---	.190	4.826	.1359	3.429	26	.1470	3.733	24	---	---	---	---	---
10	---	.190	4.826	.1494	3.785	21	.1590	4.038	---	32	---	---	---	---
---	M5	.196	4.978	---	---	---	---	---	---	---	.8	.5	32	51
12	---	.216	5.486	.1619	4.089	16	.1770	4.496	24	---	---	---	---	---
12	---	.216	5.486	.1696	4.293	15	.1800	4.572	---	28	---	---	---	---
---	M6	.236	5.994	---	---	---	---	---	---	---	1.0	.75	25	34
$\frac{1}{4}$	---	.250	6.350	.1850	4.699	7	.2010	5.105	20	---	---	---	---	---
$\frac{1}{4}$	---	.250	6.350	.2036	5.156	3	.2130	5.410	---	28	---	---	---	---
$\frac{5}{16}$	---	.312	7.938	.2403	6.096	F	.2570	6.527	18	---	---	---	---	---
$\frac{5}{16}$	---	.312	7.938	.2584	6.553	F	.2720	6.908	---	24	---	---	---	---
---	M8	.315	8.001	---	---	---	---	---	---	---	1.25	1.0	20	25
$\frac{3}{8}$	---	.375	9.525	.2938	7.442	$\frac{5}{16}$	.3125	7.937	16	---	---	---	---	---
$\frac{3}{8}$	---	.375	9.525	.3209	8.153	Q	.3320	8.432	---	24	---	---	---	---
---	M10	.393	9.982	---	---	---	---	---	---	---	1.5	1.25	17	20
$\frac{7}{16}$	---	.437	11.113	.3447	8.738	U	.3680	9.347	14	---	---	---	---	---
$\frac{7}{16}$	---	.437	11.113	.3726	9.448	$\frac{25}{64}$	.3906	9.921	---	20	---	---	---	---
---	M12	.471	11.963	---	---	---	---	---	---	---	1.75	1.25	14.5	20
$\frac{1}{2}$	---	.500	12.700	.4001	10.162	$\frac{27}{64}$	.4219	10.715	13	---	---	---	---	---
$\frac{1}{2}$	---	.500	12.700	.4351	11.049	$\frac{29}{64}$	.4531	11.509	---	20	---	---	---	---
---	M14	.551	13.995	---	---	---	---	---	---	---	2	1.5	12.5	17
$\frac{9}{16}$	---	.562	14.288	.4542	11.531	$\frac{31}{64}$	.4844	12.3031	12	---	---	---	---	---
$\frac{9}{16}$	---	.562	14.288	.4903	12.446	$\frac{33}{64}$	.5156	13.096	---	18	---	---	---	---

Continues

TABLE C.1.2 Thread Sizes and Dimensions: Fraction/Decimal/Metric—Continued

Nominal Size		Diameter				Tap Drill (for 75% Th'd.)			Threads per Inch		Pitch (mm)		T.P.I. (Approx.)	
Inch	mm	(Major)		(Minor)		Drill	Inch	mm	UNC	UNF	Coarse	Fine	Coarse	Fine
$\frac{1}{16}$	—	.625	15.875	.5069	12.852	$\frac{17}{32}$	.5312	13.493	11	—	—	—	—	—
$\frac{3}{16}$	—	.625	15.875	.5528	14.020	$\frac{37}{64}$	.5781	14.684	—	18	—	—	—	—
—	M16	.630	16.002	—	—	—	—	—	—	—	2	1.5	12.5	17
—	M18	.709	18.008	—	—	—	—	—	—	—	2.5	1.5	10	17
$\frac{1}{2}$	—	.750	19.050	.6201	15.748	$\frac{21}{32}$	.6562	16.668	10	—	—	—	—	—
$\frac{1}{4}$	—	.750	19.050	.6688	16.967	$\frac{11}{16}$	.6875	17.462	—	16	—	—	—	—
—	M20	.787	19.990	—	—	—	—	—	—	—	2.5	1.5	10	17
—	M22	.866	21.996	—	—	—	—	—	—	—	2.5	1.5	10	17
$\frac{7}{8}$	—	.875	22.225	.7307	18.542	$\frac{49}{64}$	.7656	19.446	9	—	—	—	—	—
$\frac{7}{8}$	—	.875	22.225	.7822	19.863	$\frac{13}{16}$	.8125	20.637	—	14	—	—	—	—
—	M24	.945	24.003	—	—	—	—	—	—	—	3	2	8.5	12.5
1	—	1.000	25.400	.8376	21.2598	$\frac{7}{8}$	.8750	22.225	8	—	—	—	—	—
1	—	1.000	25.400	.8917	22.632	$\frac{59}{64}$	.9219	23.415	—	12	—	—	—	—
—	M27	1.063	27.000	—	—	—	—	—	—	—	3	2	8.5	12.5

TABLE C.1.3 Unified Screw Thread Standard Series

Nominal Size		Graded Pitch Series*			Constant Pitch Series*								Nominal Size		
		Coarse UNC	Fine UNF	Extra fine UNEF	4 UN	6 UN	8 UN	12 UN	16 UN	20 UN	28 UN	32 UN			
Primary	Secondary	Basic Major Diameter	Threads per Inch												
0		0.0600	---	80	---	---	---	---	---	---	---	---	---	0	
	1	0.0730	64	72	---	---	---	---	---	---	---	---	---	1	
2		0.0860	56	64	---	---	---	---	---	---	---	---	---	2	
	3	0.0990	48	56	---	---	---	---	---	---	---	---	---	3	
4		0.1120	40	48	---	---	---	---	---	---	---	---	---	4	
5		0.1250	40	44	---	---	---	---	---	---	---	---	---	5	
6		0.1380	32	40	---	---	---	---	---	---	---	---	UNC	6	
8		0.1640	32	36	---	---	---	---	---	---	---	---	UNC	8	
10		0.1900	24	32	---	---	---	---	---	---	---	---	UNC	10	
	12	0.2160	24	28	32	---	---	---	---	---	---	UNF	UNEF	12	
	$\frac{1}{4}$	0.2500	20	28	32	---	---	---	---	---	---	UNC	UNF	UNEF	$\frac{1}{4}$
	$\frac{5}{16}$	0.3125	18	24	32	---	---	---	---	---	---	20	28	UNEF	$\frac{5}{16}$
	$\frac{3}{8}$	0.3750	16	24	32	---	---	---	---	---	UNC	20	28	UNEF	$\frac{3}{8}$
	$\frac{7}{16}$	0.4375	14	20	28	---	---	---	---	16	UNF	UNEF	32	$\frac{7}{16}$	
	$\frac{1}{2}$	0.5000	13	20	28	---	---	---	---	16	UNF	UNEF	32	$\frac{1}{2}$	
	$\frac{9}{16}$	0.5625	12	18	24	---	---	---	UNC	16	20	28	32	$\frac{9}{16}$	
	$\frac{5}{8}$	0.6250	11	18	24	---	---	---	12	16	20	28	32	$\frac{5}{8}$	
	$\frac{11}{16}$	0.6875	---	---	24	---	---	---	12	16	20	28	32	$\frac{11}{16}$	
	$\frac{3}{4}$	0.7500	10	16	20	---	---	---	12	UNF	UNEF	28	32	$\frac{3}{4}$	
	$\frac{13}{16}$	0.8125	---	---	20	---	---	---	12	16	UNEF	28	32	$\frac{13}{16}$	
	$\frac{7}{8}$	0.8750	9	14	20	---	---	---	12	16	UNEF	28	32	$\frac{7}{8}$	
	$\frac{15}{16}$	0.9375	---	---	20	---	---	---	12	16	UNEF	28	32	$\frac{15}{16}$	
1		1.0000	8	12	20	---	---	UNC	UNF	16	UNEF	28	32	1	
	$1\frac{1}{16}$	1.0625	---	---	18	---	---	8	12	16	20	28	---	$1\frac{1}{16}$	
$1\frac{1}{8}$		1.1250	7	12	18	---	---	8	UNF	16	20	28	---	$1\frac{1}{8}$	
	$1\frac{3}{16}$	1.1875	---	---	18	---	---	8	12	16	20	28	---	$1\frac{3}{16}$	
$1\frac{1}{4}$		1.2500	7	12	18	---	---	8	UNF	16	20	28	---	$1\frac{1}{4}$	
	$1\frac{5}{16}$	1.3125	---	---	18	---	---	8	12	16	20	28	---	$1\frac{5}{16}$	
$1\frac{3}{8}$		1.3750	6	12	18	---	UNC	8	UNF	16	20	28	---	$1\frac{3}{8}$	
	$1\frac{7}{16}$	1.4375	---	---	18	---	6	8	12	16	20	28	---	$1\frac{7}{16}$	
$1\frac{1}{2}$		1.5000	6	12	18	---	UNC	8	UNF	16	20	28	---	$1\frac{1}{2}$	
	$1\frac{9}{16}$	1.5625	---	---	18	---	6	8	12	16	20	---	---	$1\frac{9}{16}$	
$1\frac{5}{8}$		1.6250	---	---	18	---	6	8	12	16	20	---	---	$1\frac{5}{8}$	
	$1\frac{11}{16}$	1.6875	---	---	18	---	6	8	12	16	20	---	---	$1\frac{11}{16}$	
$1\frac{3}{4}$		1.7500	5	---	---	---	6	8	12	16	20	---	---	$1\frac{3}{4}$	
	$1\frac{13}{16}$	1.8125	---	---	---	---	6	8	12	16	20	---	---	$1\frac{13}{16}$	
$1\frac{7}{8}$		1.8750	---	---	---	---	6	8	12	16	20	---	---	$1\frac{7}{8}$	
	$1\frac{15}{16}$	1.9375	---	---	---	---	6	8	12	16	20	---	---	$1\frac{15}{16}$	
2		2.0000	$4\frac{1}{2}$	---	---	---	6	8	12	16	20	---	---	2	
	$2\frac{1}{8}$	2.1250	---	---	---	---	6	8	12	16	20	---	---	$2\frac{1}{8}$	
$2\frac{1}{4}$		2.2500	$4\frac{1}{2}$	---	---	---	6	8	12	16	20	---	---	$2\frac{1}{4}$	

Continues

TABLE C.1.3 Unified Screw Thread Standard Series—Continued

Nominal Size		Graded Pitch Series*			Constant Pitch Series*								Nominal Size	
		Coarse UNC	Fine UNF	Extra fine UNEF	4 UN	6 UN	8 UN	12 UN	16 UN	20 UN	28 UN	32 UN		
Primary	Secondary	Basic Major Diameter	Threads per Inch											
2- $\frac{1}{2}$	2- $\frac{3}{8}$	2.3750	—	—	—	—	6	8	12	16	20	—	—	2- $\frac{3}{8}$
		2.5000	4	—	—	UNC	6	8	12	16	20	—	—	2- $\frac{1}{2}$
2- $\frac{3}{4}$	2- $\frac{5}{8}$	2.6250	—	—	—	4	6	8	12	16	20	—	—	2- $\frac{5}{8}$
		2.7500	4	—	—	UNC	6	8	12	16	20	—	—	2- $\frac{3}{4}$
3	2- $\frac{7}{8}$	2.8750	—	—	—	4	6	8	12	16	20	—	—	2- $\frac{7}{8}$
		3.0000	4	—	—	UNC	6	8	12	16	20	—	—	3
3- $\frac{1}{4}$	3- $\frac{1}{8}$	3.1250	—	—	—	4	6	8	12	16	—	—	—	3- $\frac{1}{8}$
		3.2500	4	—	—	UNC	6	8	12	16	—	—	—	3- $\frac{1}{4}$
3- $\frac{1}{2}$	3- $\frac{3}{8}$	3.3750	—	—	—	4	6	8	12	16	—	—	—	3- $\frac{3}{8}$
		3.5000	4	—	—	UNC	6	8	12	16	—	—	—	3- $\frac{1}{2}$
3- $\frac{3}{4}$	3- $\frac{1}{2}$	3.6250	—	—	—	4	6	8	12	16	—	—	—	3- $\frac{1}{2}$
		3.7500	4	—	—	UNC	6	8	12	16	—	—	—	3- $\frac{3}{4}$
4	3- $\frac{7}{8}$	3.8750	—	—	—	4	6	8	12	16	—	—	—	3- $\frac{7}{8}$
		4.0000	4	—	—	4	6	8	12	16	—	—	—	4
4- $\frac{1}{4}$	4- $\frac{1}{8}$	4.1250	—	—	—	4	6	8	12	16	—	—	—	4- $\frac{1}{8}$
		4.2500	—	—	—	4	6	8	12	16	—	—	—	4- $\frac{1}{4}$
4- $\frac{1}{2}$	4- $\frac{3}{8}$	4.3750	—	—	—	4	6	8	12	16	—	—	—	4- $\frac{3}{8}$
		4.5000	—	—	—	4	6	8	12	16	—	—	—	4- $\frac{1}{2}$
4- $\frac{3}{4}$	4- $\frac{1}{2}$	4.6250	—	—	—	4	6	8	12	16	—	—	—	4- $\frac{1}{2}$
		4.7500	—	—	—	4	6	8	12	16	—	—	—	4- $\frac{3}{4}$
5	4- $\frac{7}{8}$	4.8750	—	—	—	4	6	8	12	16	—	—	—	4- $\frac{7}{8}$
		5.0000	—	—	—	4	6	8	12	16	—	—	—	5
5- $\frac{1}{4}$	5- $\frac{1}{8}$	5.1250	—	—	—	4	6	8	12	16	—	—	—	5- $\frac{1}{8}$
		5.2500	—	—	—	4	6	8	12	16	—	—	—	5- $\frac{1}{4}$
5- $\frac{1}{2}$	5- $\frac{3}{8}$	5.3750	—	—	—	4	6	8	12	16	—	—	—	5- $\frac{3}{8}$
		5.5000	—	—	—	4	6	8	12	16	—	—	—	5- $\frac{1}{2}$
5- $\frac{3}{4}$	5- $\frac{1}{2}$	5.6250	—	—	—	4	6	8	12	16	—	—	—	5- $\frac{1}{2}$
		5.7500	—	—	—	4	6	8	12	16	—	—	—	5- $\frac{3}{4}$
6	5- $\frac{7}{8}$	5.8750	—	—	—	4	6	8	12	16	—	—	—	5- $\frac{7}{8}$
		6.0000	—	—	—	4	6	8	12	16	—	—	—	6

Courtesy of American National Standards.

TABLE C.1.4 Drill and Counterbore Sizes for Socket-Head Cap Screws (1960 Series)

Nominal Size or Basic Screw Diameter	A					B	C
	Nominal Drill Size					Counterbore Diameter	Countersink Diameter D (Max) + 2F (Max)
	Close Fit		Normal Fit				
	Number or Fractional Size	Decimal Size	Number or Fractional Size	Decimal Size			
0	0.0600	51	0.067	49	0.073	$\frac{1}{8}$	0.074
1	0.0730	46	0.081	43	0.089	$\frac{5}{32}$	0.087
2	0.0860	$\frac{3}{32}$	0.094	36	0.106	$\frac{3}{16}$	0.102
3	0.0990	36	0.106	31	0.120	$\frac{7}{32}$	0.115
4	0.1120	$\frac{1}{8}$	0.125	29	0.136	$\frac{7}{32}$	0.130
5	0.1250	$\frac{9}{64}$	0.141	23	0.154	$\frac{1}{4}$	0.145
6	0.1380	23	0.154	18	0.170	$\frac{9}{32}$	0.158
8	0.1640	15	0.180	10	0.194	$\frac{5}{16}$	0.188
10	0.1900	5	0.206	2	0.221	$\frac{3}{8}$	0.218
$\frac{1}{4}$	0.2500	$\frac{17}{64}$	0.266	$\frac{9}{32}$	0.281	$\frac{7}{16}$	0.278
$\frac{5}{16}$	0.3125	$\frac{21}{64}$	0.328	$\frac{11}{32}$	0.344	$\frac{17}{32}$	0.346
$\frac{3}{8}$	0.3750	$\frac{25}{64}$	0.391	$\frac{13}{32}$	0.406	$\frac{5}{8}$	0.415
$\frac{7}{16}$	0.4375	$\frac{29}{64}$	0.453	$\frac{15}{32}$	0.469	$\frac{23}{32}$	0.483
$\frac{1}{2}$	0.5000	$\frac{33}{64}$	0.516	$\frac{17}{32}$	0.531	$\frac{13}{16}$	0.552
$\frac{5}{8}$	0.6250	$\frac{41}{64}$	0.641	$\frac{21}{32}$	0.656	1	0.689
$\frac{3}{4}$	0.7500	$\frac{49}{64}$	0.766	$\frac{25}{32}$	0.781	$1\frac{3}{16}$	0.828
$\frac{7}{8}$	0.8750	$\frac{57}{64}$	0.891	$\frac{29}{32}$	0.906	$1\frac{3}{8}$	0.963
1	1.0000	$1\frac{1}{64}$	1.016	$1\frac{1}{32}$	1.031	$1\frac{5}{8}$	1.100
$1\frac{1}{4}$	1.2500	$1\frac{9}{32}$	1.281	$1\frac{5}{16}$	1.312	2	1.370
$1\frac{1}{2}$	1.5000	$1\frac{17}{32}$	1.531	$1\frac{9}{16}$	1.562	$2\frac{3}{8}$	1.640
$1\frac{3}{4}$	1.7500	$1\frac{25}{32}$	1.781	$1\frac{13}{16}$	1.812	$2\frac{3}{4}$	1.910
2	2.0000	$2\frac{1}{32}$	2.031	$2\frac{1}{16}$	2.062	$3\frac{1}{8}$	2.180

C.2 Metric Twist Drills

TABLE C.2.1 American National Standard Combined Drills and Countersinks—Plain and Bell Types (ANSI B94.11M-1979)

PLAIN TYPE

BELL TYPE

Plain Type								
Size Designation	Body Diameter		Drill Diameter		Drill Length		Overall Length	
	A	D	C	L				
	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
00	$\frac{1}{8}$	3.18	.025	0.64	.030	0.76	$1\frac{1}{8}$	29
0	$\frac{1}{8}$	3.18	$\frac{1}{32}$	0.79	.038	0.97	$1\frac{1}{8}$	29
1	$\frac{1}{8}$	3.18	$\frac{3}{64}$	1.19	$\frac{3}{64}$	1.19	$1\frac{1}{2}$	32
2	$\frac{3}{16}$	4.76	$\frac{5}{64}$	1.98	$\frac{5}{64}$	1.98	$1\frac{7}{8}$	48
3	$\frac{1}{4}$	6.35	$\frac{7}{64}$	2.78	$\frac{7}{64}$	2.78	2	51
4	$\frac{5}{16}$	7.94	$\frac{1}{8}$	3.18	$\frac{1}{8}$	3.18	$2\frac{1}{8}$	54
5	$\frac{7}{16}$	11.11	$\frac{3}{16}$	4.76	$\frac{3}{16}$	4.76	$2\frac{3}{4}$	70
6	$\frac{1}{2}$	12.70	$\frac{7}{32}$	5.56	$\frac{7}{32}$	5.56	3	76
7	$\frac{5}{8}$	15.88	$\frac{1}{2}$	6.35	$\frac{1}{2}$	6.35	$3\frac{1}{2}$	83
8	$\frac{3}{4}$	19.05	$\frac{5}{16}$	7.94	$\frac{5}{16}$	7.94	$3\frac{1}{2}$	89

TABLE C.2.2 Twist Drill Sizes: Decimal/Metric

Number Sizes								Letter Sizes			
No. Size	Decimal Equivalent	Metric Equivalent	Closest Metric Drill (mm)	No. Size	Decimal Equivalent	Metric Equivalent	Closest Metric Drill (mm)	Size Letter	Decimal Equivalent	Metric Equivalent	Closest Metric Drill (mm)
1	.2280	5.791	5.80	41	.0960	2.438	2.45	A	.234	5.944	5.90
2	.2210	5.613	5.60	42	.0935	2.362	2.35	B	.238	6.045	6.00
3	.2130	5.410	5.40	43	.0890	2.261	2.25	C	.242	6.147	6.10
4	.2090	5.309	5.30	44	.0860	2.184	2.20	D	.246	6.248	6.25
5	.2055	5.220	5.20	45	.0820	2.083	2.10	E	.250	6.350	6.40
6	.2040	5.182	5.20	46	.0810	2.057	2.05	F	.257	6.528	6.50
7	.2010	5.105	5.10	47	.0785	1.994	2.00	G	.261	6.629	6.60
8	.1990	5.055	5.10	48	.0760	1.930	1.95	H	.266	6.756	6.75
9	.1960	4.978	5.00	49	.0730	1.854	1.85	I	.272	6.909	6.90
10	.1935	4.915	4.90	50	.0700	1.778	1.80	J	.277	7.036	7.00
11	.1910	4.851	4.90	51	.0670	1.702	1.70	K	.281	7.137	7.10
12	.1890	4.801	4.80	52	.0635	1.613	1.60	L	.290	7.366	7.40
13	.1850	4.699	4.70	53	.0595	1.511	1.50	M	.295	7.493	7.50
14	.1820	4.623	4.60	54	.0550	1.397	1.40	N	.302	7.671	7.70
15	.1800	4.572	4.60	55	.0520	1.321	1.30	O	.316	8.026	8.00
16	.1770	4.496	4.50	56	.0465	1.181	1.20	P	.323	8.204	8.20
17	.1730	4.394	4.40	57	.0430	1.092	1.10	Q	.332	8.433	8.40
18	.1695	4.305	4.30	58	.0420	1.067	1.05	R	.339	8.611	8.60
19	.1660	4.216	4.20	59	.0410	1.041	1.05	S	.348	8.839	8.80
20	.1610	4.089	4.10	60	.0400	1.016	1.00	T	.358	9.093	9.10
21	.1590	4.039	4.00	61	.0390	0.991	1.00	U	.368	9.347	9.30
22	.1570	3.988	4.00	62	.0380	0.965	0.95	V	.377	9.576	9.60
23	.1540	3.912	3.90	63	.0370	0.940	0.95	W	.386	9.804	9.80
24	.1520	3.861	3.90	64	.0360	0.914	0.90	X	.397	10.084	10.00
25	.1495	3.797	3.80	65	.0350	0.889	0.90	Y	.404	10.262	10.50
26	.1470	3.734	3.75	66	.0330	0.838	0.85	Z	.413	10.491	10.50
27	.1440	3.658	3.70	67	.0320	0.813	0.80				
28	.1405	3.569	3.60	68	.0310	0.787	0.80				
29	.1360	3.454	3.50	69	.0292	0.742	0.75				
30	.1285	3.264	3.25	70	.0280	0.711	0.70				
31	.1200	3.048	3.00	71	.0260	0.660	0.65				
32	.1160	2.946	2.90	72	.0250	0.635	0.65				
33	.1130	2.870	2.90	73	.0240	0.610	0.60				
34	.1110	2.819	2.80	74	.0225	0.572	0.55				
35	.1100	2.794	2.80	75	.0210	0.533	0.55				
36	.1065	2.705	2.70	76	.0200	0.508	0.50				
37	.1040	2.642	2.60	77	.0180	0.457	0.45				
38	.1015	2.578	2.60	78	.0160	0.406	0.40				
39	.0995	2.527	2.50	79	.0145	0.368	0.35				
40	.0980	2.489	2.50	80	.0135	0.343	0.35				

Fraction-size drills range in size from one-sixteenth to 4 in. and over in diameter, by sixty-fourths.

C.3 Bolts, Nuts, and Screws

Socket Flat Countersunk Head Cap Screws (ANSI/ASME B18.3, 1986)

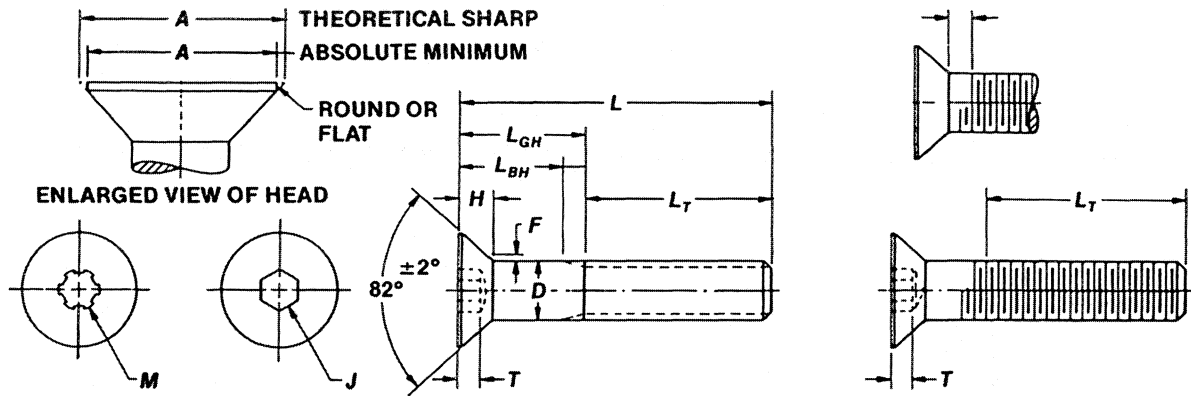


TABLE C.3.1 Dimensions of Hexagon and Spline Socket-Flat-Countersunk-Head Cap Screws

Nominal Size or Basic Screw Diameter	Body Diameter	Head Diameter		Head Height		Spline Socket Size	Hexagon Socket Size	Key Engagement	Fillet Ext. Above D			
		Theoretical Sharp	Abs Min	Reference	Flushness Tolerance							
		Max	Min	Reference	Flushness Tolerance							
0	0.0600	0.0600	0.0568	0.138	0.117	0.044	0.006	0.048	0.035	0.025	0.006	
1	0.0730	0.0730	0.0695	0.168	0.143	0.054	0.007	0.060	0.050	0.031	0.008	
2	0.0860	0.0860	0.0822	0.197	0.168	0.064	0.008	0.060	0.050	0.038	0.010	
3	0.0990	0.0990	0.0949	0.226	0.193	0.073	0.010	0.072	1/16	0.062	0.044	0.010
4	0.1120	0.1120	0.1075	0.255	0.218	0.083	0.011	0.072	1/16	0.062	0.055	0.012
5	0.1250	0.1250	0.1202	0.281	0.240	0.090	0.012	0.096	5/64	0.078	0.061	0.014
6	0.1380	0.1380	0.1329	0.307	0.263	0.097	0.013	0.096	5/64	0.078	0.066	0.015
8	0.1640	0.1640	0.1585	0.359	0.311	0.112	0.014	0.111	3/32	0.094	0.076	0.015
10	0.1900	0.1900	0.1840	0.411	0.359	0.127	0.015	0.145	1/8	0.125	0.087	0.015
1/4	0.2500	0.2500	0.2435	0.531	0.480	0.161	0.016	0.183	5/32	0.156	0.111	0.015
5/16	0.3125	0.3125	0.3053	0.656	0.600	0.198	0.017	0.216	3/16	0.188	0.135	0.015
3/8	0.3750	0.3750	0.3678	0.781	0.720	0.234	0.018	0.251	7/32	0.219	0.159	0.015
7/16	0.4375	0.4375	0.4294	0.844	0.781	0.234	0.018	0.291	1/2	0.250	0.159	0.015
1/2	0.5000	0.5000	0.4919	0.938	0.872	0.251	0.018	0.372	5/16	0.312	0.172	0.015
5/8	0.6250	0.6250	0.6163	1.188	1.112	0.324	0.022	0.454	3/8	0.375	0.220	0.015
3/4	0.7500	0.7500	0.7406	1.438	1.355	0.396	0.024	0.454	1/2	0.500	0.220	0.015
7/8	0.8750	0.8750	0.8647	1.688	1.604	0.468	0.025	...	5/8	0.562	0.248	0.015
1	1.0000	1.0000	0.9886	1.938	1.841	0.540	0.028	...	3/4	0.625	0.297	0.015
1-1/8	1.1250	1.1250	1.1086	2.188	2.079	0.611	0.031	...	7/8	0.750	0.325	0.031
1-1/4	1.2500	1.2500	1.2336	2.438	2.316	0.683	0.035	...	1	0.875	0.358	0.031
1-3/8	1.3750	1.3750	1.3568	2.688	2.553	0.755	0.038	...	1-1/8	0.875	0.402	0.031
1-1/2	1.5000	1.5000	1.4818	2.938	2.791	0.827	0.042	...	1	1.0000	0.435	0.031

Countersunk Bolts and Slotted Countersunk Bolts (ANSI/ASME B18.5, 1978)

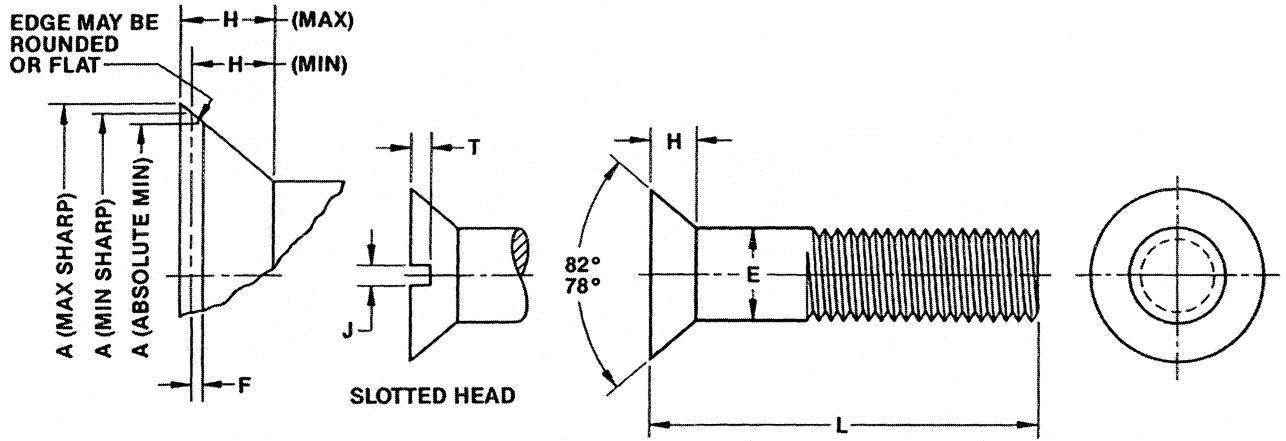


TABLE C.3.2 Dimensions of Countersunk Bolts and Slotted Countersunk Bolts

Nominal Size or Basic Bolt Diameter	E		A			F	H		J		T		
	Body Diameter		Max Edge Sharp	Min Edge Sharp	Absolute Min Edge Rounded or Flat	Flat on Min Dia Head	Head Height		Slot Width		Slot Depth		
	Max	Min					Max	Min	Max	Min	Max	Min	
1/16	0.2500	0.260	0.237	0.493	0.477	0.445	0.018	0.150	0.131	0.075	0.064	0.068	0.045
	0.3125	0.324	0.298	0.618	0.598	0.558	0.023	0.189	0.164	0.084	0.072	0.086	0.057
	0.3750	0.388	0.360	0.740	0.715	0.668	0.027	0.225	0.196	0.094	0.081	0.103	0.068
7/16	0.4375	0.452	0.421	0.803	0.778	0.726	0.030	0.226	0.196	0.094	0.081	0.103	0.068
1/4	0.5000	0.515	0.483	1.935	1.905	0.845	0.035	0.269	0.233	0.106	0.091	0.103	0.068
	0.6250	0.642	0.605	1.169	1.132	1.066	0.038	0.336	0.292	0.133	0.116	0.137	0.091
	0.7500	0.768	0.729	1.402	1.357	1.285	0.041	0.403	0.349	0.149	0.131	0.171	0.115
3/8	0.8750	0.895	0.852	1.637	1.584	1.511	0.042	0.470	0.408	0.167	0.147	0.206	0.138
1/2	1.0000	1.022	0.976	1.869	1.810	1.735	0.043	0.537	0.466	0.188	0.166	0.240	0.162
5/8	1.1250	1.149	1.098	2.104	2.037	1.962	0.043	0.604	0.525	0.196	0.178	0.257	0.173
3/4	1.2500	1.277	1.223	2.337	2.262	2.187	0.043	0.671	0.582	0.211	0.193	0.291	0.197
7/8	1.3750	1.404	1.345	2.571	2.489	2.414	0.043	0.738	0.641	0.226	0.208	0.326	0.220
1	1.5000	1.531	1.470	2.804	2.715	2.640	0.043	0.805	0.698	0.258	0.240	0.360	0.244

Hex Cap Screws (Finished Hex Bolts) (ANSI/ASME B18.2.1, 1981)

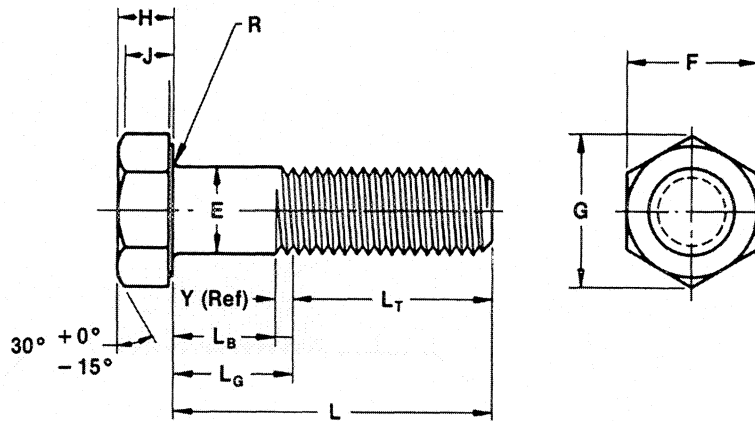


TABLE C.3.3 Dimensions of Hex Cap Screws

Nominal Size or Basic Product	E		F			G		H			J	L _T		Y	Runout of Bearing Surface FIM	
	Body Diameter		Width Across Flats			Width Across Corners		Height			Wrenching Height	Thread Length for Screw Lengths		Transition Thread Length		
	Max	Min	Basic	Max	Min	Max	Min	Basic	Max	Min		6 in. & shorter	Over 6 in.			Min	Max
1/16	0.2500	0.2500	0.2450	7/16	0.438	0.428	0.505	0.488	3/32	0.163	0.150	0.106	0.750	1.000	0.250	0.010
1/8	0.3125	0.3125	0.3065	1/4	0.500	0.489	0.577	0.557	1/16	0.211	0.195	0.140	0.875	1.125	0.278	0.011
3/16	0.3750	0.3750	0.3690	5/16	0.562	0.551	0.650	0.628	15/64	0.243	0.226	0.160	1.000	1.250	0.312	0.012
1/4	0.4375	0.4375	0.4305	3/8	0.625	0.612	0.722	0.698	3/16	0.291	0.272	0.195	1.125	1.375	0.357	0.013
5/16	0.5000	0.5000	0.4930	7/8	0.750	0.736	0.866	0.840	1/8	0.323	0.302	0.215	1.250	1.500	0.385	0.014
3/8	0.5625	0.5625	0.5545	1 1/16	0.812	0.798	0.938	0.910	5/32	0.371	0.348	0.250	1.375	1.625	0.417	0.015
1/2	0.6250	0.6250	0.6170	1 1/8	0.938	0.922	1.083	1.051	3/16	0.403	0.378	0.269	1.500	1.750	0.455	0.017
5/8	0.7500	0.7500	0.7410	1 1/4	1.125	1.100	1.299	1.254	1/4	0.483	0.455	0.324	1.750	2.000	0.500	0.020
3/4	0.8750	0.8750	0.8660	1 3/8	1.312	1.285	1.516	1.465	5/16	0.563	0.531	0.378	2.000	2.250	0.556	0.023
1	1.0000	1.0000	0.9900	1 1/2	1.500	1.469	1.732	1.675	3/8	0.627	0.591	0.416	2.250	2.500	0.625	0.026
1 1/8	1.1250	1.1250	1.1140	1 7/8	1.688	1.631	1.949	1.859	1/2	0.718	0.658	0.461	2.500	2.750	0.714	0.029
1 1/4	1.2500	1.2500	1.2390	2	1.875	1.812	2.165	2.066	5/8	0.813	0.749	0.530	2.750	3.000	0.714	0.033
1 3/8	1.3750	1.3750	1.3630	2 1/16	2.062	1.994	2.382	2.273	3/4	0.878	0.810	0.569	3.000	3.250	0.833	0.036
1 1/2	1.5000	1.5000	1.4880	2 1/4	2.250	2.175	2.598	2.480	7/8	0.974	0.902	0.640	3.250	3.500	0.833	0.039
1 3/4	1.7500	1.7500	1.7380	2 3/8	2.625	2.538	3.031	2.893	1 1/8	1.134	1.054	0.748	3.750	4.000	1.000	0.046
2	2.0000	2.0000	1.9880	3	3.000	2.900	3.464	3.306	1 1/4	1.263	1.175	0.825	4.250	4.500	1.111	0.052
2 1/4	2.2500	2.2500	2.2380	3 1/8	3.375	3.262	3.897	3.719	1 3/8	1.423	1.327	0.933	4.750	5.000	1.111	0.059
2 1/2	2.5000	2.5000	2.4880	3 1/4	3.750	3.625	4.330	4.133	1 1/2	1.583	1.479	1.042	5.250	5.500	1.250	0.065
2 3/4	2.7500	2.7500	2.7380	4	4.125	3.988	4.763	4.546	1 5/8	1.744	1.632	1.151	5.750	6.000	1.250	0.072
3	3.0000	3.0000	2.9880	4 1/2	4.500	4.350	5.196	4.959	1 3/4	1.935	1.815	1.290	6.250	6.500	1.250	0.079

Metric Hex Cap Screws (ANSI B18.2.3.1M, 1979)

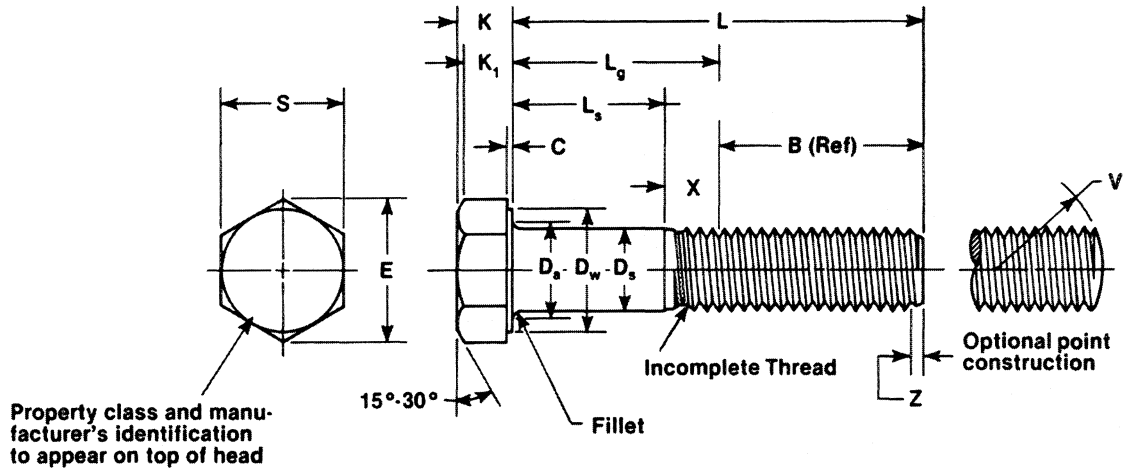


TABLE C.3.4 Dimensions of Hex Cap Screws

Nominal Screw Diameter and Thread Pitch	D_s Body Diameter		S Width Across Flats		E Width Across Corners		K Head Height		K_i Wrenching Height		C Washer Face Thickness		D_w Washer Face Dia		Runout of Bearing Surface FIM	
	Max	Min	Max	Min	Max	Min	Max	Min	Min	Max	Min	Min	Max	Min	Max	
	M5 × 0.8	5.00	4.82	8.00	7.78	9.24	8.79	3.65	3.35	2.4	0.5	0.2	6.9	0.22		
M6 × 1	6.00	5.82	10.00	9.78	11.55	11.05	4.15	3.85	2.8	0.5	0.2	8.9	0.25			
M8 × 1.25	8.00	7.78	13.00	12.73	15.01	14.38	5.50	5.10	3.7	0.6	0.3	11.6	0.28			
M10 × 1.5	10.00	9.78	16.00	15.73	18.48	17.77	6.63	6.17	4.5	0.6	0.3	14.6	0.32			
M12 × 1.75	12.00	11.73	18.00	17.73	20.78	20.03	7.76	7.24	5.2	0.6	0.3	16.6	0.35			
M14 × 2	14.00	13.73	21.00	20.67	24.25	23.35	9.09	8.51	6.2	0.6	0.3	19.6	0.39			
M16 × 2	16.00	15.73	24.00	23.67	27.71	26.75	10.32	9.68	7.0	0.8	0.4	22.5	0.43			
M20 × 2.5	20.00	19.67	30.00	29.16	34.64	32.95	12.88	12.12	8.8	0.8	0.4	27.7	0.53			
M24 × 3	24.00	23.67	36.00	35.00	41.57	39.55	15.44	14.56	10.5	0.8	0.4	33.2	0.63			
M30 × 3.5	30.00	29.67	46.00	45.00	53.12	50.85	19.48	17.92	13.1	0.8	0.4	42.7	0.78			
M36 × 4	36.00	35.61	55.00	53.80	63.51	60.79	23.38	21.62	15.8	0.8	0.4	51.1	0.93			
M42 × 4.5	42.00	41.38	65.00	62.90	75.06	71.71	26.97	25.03	18.2	1.0	0.5	59.8	1.09			
M48 × 5	48.00	47.38	75.00	72.60	86.60	82.76	31.07	28.93	21.0	1.0	0.5	69.0	1.25			
M56 × 5.5	56.00	55.26	85.00	82.20	98.15	93.71	36.20	33.80	24.5	1.0	0.5	78.1	1.47			
M64 × 6	64.00	63.26	95.00	91.80	109.70	104.65	41.32	36.68	28.0	1.0	0.5	87.2	1.69			
M72 × 6	72.00	71.26	105.00	101.40	121.24	115.60	46.45	43.55	31.5	1.2	0.6	96.3	1.91			
M80 × 6	80.00	79.26	115.00	111.00	132.72	126.54	51.58	48.42	35.0	1.2	0.6	105.4	2.13			
M90 × 6	90.00	89.13	130.00	125.50	150.11	143.07	57.74	54.26	39.2	1.2	0.6	119.2	2.41			
M100 × 6	100.00	99.13	145.00	140.00	167.43	159.60	63.90	60.10	43.4	1.2	0.6	133.0	2.69			
*M10 × 1.5	10.00	9.78	15.00	14.73	17.32	16.64	6.63	6.17	4.5	0.6	0.3	13.6	0.31			

Socket-Head Cap Screws (1960 Series) (ANSI/ASME B18.3, 1986)

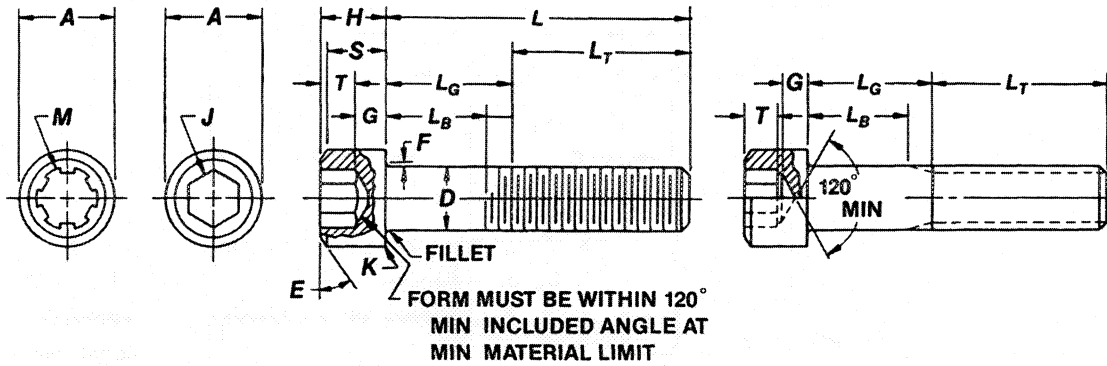


TABLE C.3.5 Dimensions of Hexagon and Spline Socket-Head Cap Screws (1960 Series)

Nominal Size or Basic Screw Diameter	D		A		H		S	M	J	T	G	K
	Body Diameter		Head Diameter		Head Height		Head Side Height	Spline Socket Size	Hexagon Socket Size	Key Engagement	Wall Thickness	Chamfer or Radius
	Max	Min	Max	Min	Max	Min	Min	Nom	Nom	Min	Min	Max
0	0.0600	0.0600	0.0568	0.096	0.091	0.060	0.054	0.060		0.025	0.020	0.003
1	0.0730	0.0730	0.0695	0.118	0.112	0.073	0.066	0.072		0.031	0.025	0.003
2	0.0860	0.0860	0.0822	0.140	0.134	0.086	0.077	0.096		0.038	0.029	0.003
3	0.0990	0.0990	0.0949	0.161	0.154	0.099	0.089	0.096		0.044	0.034	0.003
4	0.1120	0.1120	0.1075	0.183	0.176	0.112	0.108	0.111		0.051	0.038	0.005
5	0.1250	0.1250	0.1202	0.205	0.198	0.125	0.121	0.111		0.057	0.034	0.005
6	0.1380	0.1380	0.1329	0.226	0.218	0.138	0.134	0.133		0.064	0.047	0.005
8	0.1640	0.1640	0.1585	0.270	0.262	0.164	0.159	0.168		0.077	0.056	0.005
10	0.1900	0.1900	0.1840	0.312	0.303	0.190	0.185	0.183		0.090	0.065	0.005
	0.2500	0.2500	0.2435	0.375	0.365	0.250	0.244	0.216		0.120	0.095	0.008
	0.3125	0.3125	0.3053	0.469	0.457	0.312	0.306	0.291		0.151	0.119	0.008
	0.3750	0.3750	0.3678	0.562	0.550	0.375	0.368	0.372		0.182	0.143	0.008
	0.4375	0.4375	0.4294	0.656	0.642	0.438	0.430	0.454		0.213	0.166	0.010
	0.5000	0.5000	0.4919	0.750	0.735	0.500	0.492	0.454		0.245	0.190	0.010
	0.6250	0.6250	0.6163	0.938	0.921	0.625	0.616	0.595		0.307	0.238	0.010
	0.7500	0.7500	0.7406	1.125	1.107	0.750	0.740	0.675		0.370	0.285	0.010
	0.8750	0.8750	0.8647	1.312	1.293	0.875	0.864	0.698		0.432	0.333	0.015
1	1.0000	1.0000	0.9886	1.500	1.479	1.000	0.988	0.790		0.495	0.380	0.015
1	1.1250	1.1250	1.1086	1.688	1.665	1.125	1.111	1.012		0.557	0.428	0.015
1	1.2500	1.2500	1.2336	1.875	1.852	1.250	1.236	1.125		0.620	0.475	0.015
1	1.3750	1.3750	1.3568	2.062	2.038	1.375	1.360	1.237	1	0.682	0.523	0.015
1	1.5000	1.5000	1.4818	2.250	2.224	1.500	1.485	1.350	1	0.745	0.570	0.015
1	1.7500	1.7500	1.7295	2.625	2.597	1.750	1.734	1.575	1	0.870	0.665	0.015
2	2.0000	2.0000	1.9780	3.000	2.970	2.000	1.983	1.800	1	0.995	0.760	0.015
2	2.2500	2.2500	2.2280	3.375	3.344	2.250	2.232	2.025	1	1.120	0.855	0.031
2	2.5000	2.5000	2.4762	3.750	3.717	2.500	2.481	2.250	1	1.245	0.950	0.031
2	2.7500	2.7500	2.7262	4.125	4.090	2.750	2.730	2.475	2	1.370	1.045	0.031
3	3.0000	3.0000	2.9762	4.500	4.464	3.000	2.979	2.700	2	1.495	1.140	0.031
3	3.2500	3.2500	3.2262	4.875	4.837	3.250	3.228	2.925	2	1.620	1.235	0.031
3	3.5000	3.5000	3.4762	5.250	5.211	3.500	3.478	3.150	2	1.745	1.330	0.031
3	3.7500	3.7500	3.7262	5.625	5.584	3.750	3.727	3.375	2	1.870	1.425	0.031
4	4.0000	4.0000	3.9762	6.000	5.958	4.000	3.976	3.600	3	1.995	1.520	0.031

Metric Socket-Head Cap Screws (ANSI/ASME B18.3.1M, 1982)

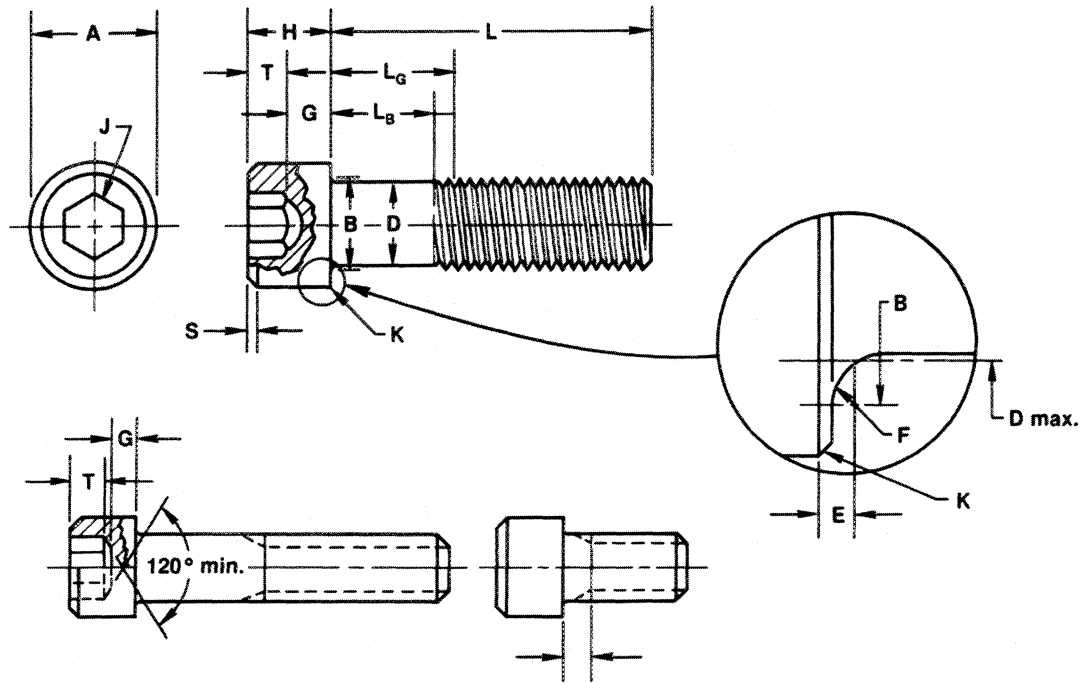


TABLE C.3.6 Dimensions of Metric Socket-Head Cap Screws

Nominal Screw Diameter and Thread Pitch	D		A		H		S	J	T	G	Under Head Fillet				K
	Body Diameter		Head Diameter		Head Height		Chamfer or Radius	Hex- agon Socket Size	Key Engage- ment	Wall Thick- ness	Transi- tion Diameter	Transi- tion Length	Junc- ture Radius	Chamfer or Radius	
	Max	Min	Max	Min	Max	Min	Max	Nom	Min	Min	Max	Min	Max	Min	Max
M1.6 × 0.35	1.60	1.46	3.00	2.87	1.60	1.52	0.16	1.5	0.80	0.54	2.0	1.8	0.34	0.10	0.08
M2 × 0.4	2.00	1.86	3.80	3.65	2.00	1.91	0.20	1.5	1.00	0.68	2.6	2.2	0.51	0.10	0.08
M2.5 × 0.45	2.50	2.36	4.50	4.33	2.50	2.40	0.25	2.0	1.25	0.85	3.1	2.7	0.51	0.10	0.08
M3 × 0.5	3.00	2.86	5.50	5.32	3.00	2.89	0.30	2.5	1.50	1.02	3.6	3.2	0.51	0.10	0.13
M4 × 0.7	4.00	3.82	7.00	6.80	4.00	3.88	0.40	3.0	2.00	1.52	4.7	4.4	0.60	0.20	0.13
M5 × 0.8	5.00	4.82	8.50	8.27	5.00	4.86	0.50	4.0	2.50	1.90	5.7	5.4	0.60	0.20	0.13
M6 × 1	6.00	5.82	10.00	9.74	6.00	5.85	0.60	5.0	3.00	2.28	6.8	6.5	0.68	0.25	0.20
M8 × 1.25	8.00	7.78	13.00	12.70	8.00	7.83	0.80	6.0	4.00	3.20	9.2	8.8	1.02	0.40	0.20
M10 × 1.5	10.00	9.78	16.00	15.67	10.00	9.81	1.00	8.0	5.00	4.00	11.2	10.8	1.02	0.40	0.20
M12 × 1.75	12.00	11.73	18.00	17.63	12.00	11.79	1.20	10.0	6.00	4.80	14.2	13.2	1.87	0.60	0.25
(1)M14 × 2	14.00	13.73	21.00	20.60	14.00	13.77	1.40	12.0	7.00	5.60	16.2	15.2	1.87	0.60	0.25
M16 × 2	16.00	15.73	24.00	23.58	16.00	15.76	1.60	14.0	8.00	6.40	18.2	17.2	1.87	0.60	0.25
M20 × 2.5	20.00	19.67	30.00	29.53	20.00	19.73	2.00	17.0	10.00	8.00	22.4	21.6	2.04	0.80	0.40
M24 × 3	24.00	23.67	36.00	35.48	24.00	23.70	2.40	19.0	12.00	9.60	26.4	25.6	2.04	0.80	0.40
M30 × 3.5	30.00	29.67	45.00	44.42	30.00	29.67	3.00	22.0	15.00	12.00	33.4	32.0	2.89	1.00	0.40
M36 × 4	36.00	35.61	54.00	53.37	36.00	35.64	3.60	27.0	18.00	14.40	39.4	38.0	2.89	1.00	0.40
M42 × 4.5	42.00	41.61	63.00	62.31	42.00	41.61	4.20	32.0	21.00	16.80	45.6	44.4	3.06	1.20	0.40
M48 × 5	48.00	47.61	72.00	72.27	48.00	47.58	4.80	36.0	24.00	19.20	52.6	51.2	3.91	1.60	0.40

Socket-Head Shoulder Screws (ANSI/ASME B18.3, 1986)

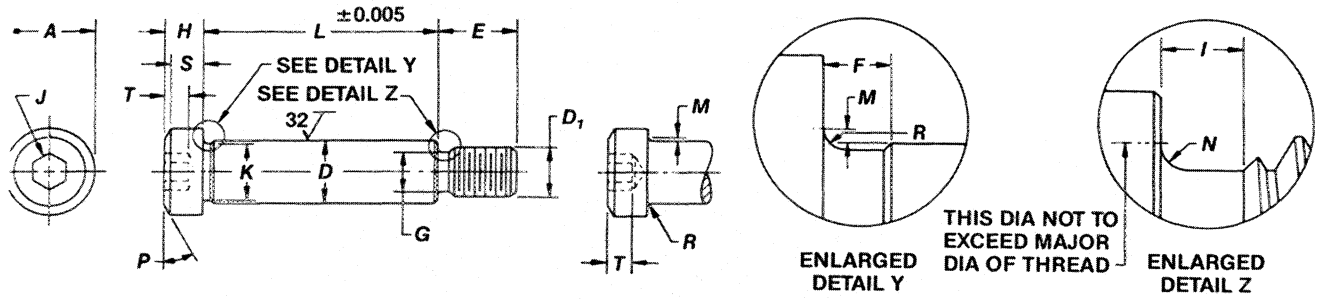


TABLE C.3.7 Dimensions of Hexagon Socket-Head Shoulder Screws

Nominal Size or Basic Shoulder Diameter	D		A		H		S	J	T	M	R		
	Shoulder Diameter		Head Diameter		Head Height		Head Side Height	Hexagon Socket Size	Key Engagement	Head Fillet Extension Above D	Head Fillet Radius		
	Max	Min	Max	Min	Max	Min	Min	Nom	Min	Max	Min		
1/8	0.250	0.2480	0.2460	0.375	0.357	0.188	0.177	0.157	1/8	0.125	0.094	0.014	0.009
	0.312	0.3105	0.3085	0.438	0.419	0.219	0.209	0.183	3/16	0.156	0.117	0.017	0.012
	0.375	0.3730	0.3710	0.562	0.543	0.250	0.240	0.209	1/4	0.188	0.141	0.020	0.015
	0.500	0.4980	0.4960	0.750	0.729	0.312	0.302	0.262	3/8	0.250	0.188	0.026	0.020
3/16	0.625	0.6230	0.6210	0.875	0.853	0.375	0.365	0.315	1/2	0.312	0.234	0.032	0.024
	0.750	0.7480	0.7460	1.000	0.977	0.500	0.490	0.421	5/8	0.375	0.281	0.039	0.030
1/2	1.000	0.9980	0.9960	1.312	1.287	0.625	0.610	0.527	3/4	0.500	0.375	0.050	0.040
5/8	1.250	1.2480	1.2460	1.750	1.723	0.750	0.735	0.633	7/8	0.625	0.469	0.060	0.050
3/4	1.500	1.4980	1.4960	2.125	2.3095	1.000	0.980	0.842	1	0.875	0.656	0.070	0.060
7/8	1.750	1.7480	1.7460	2.375	2.345	1.125	1.105	0.948	1 1/8	1.000	0.750	0.080	0.070
1	2.00	1.9980	1.9960	2.750	2.720	1.250	1.230	1.054	1 1/4	1.250	0.937	0.090	0.080
Nominal Size or Basic Shoulder Diameter	K	F	D ₁		G		I	N	E				
	Shoulder Neck Diameter	Shoulder Neck Width	Nominal Thread Size or Basic Thread Diameter		Thread Neck Diameter		Thread Neck Width	Thread Neck Fillet	Thread Length				
	Min	Max	Threads per Inch	Max	Max	Min	Basic						
1/8	0.250	0.227	0.093	10	0.1900	24	0.142	0.133	0.083	0.023	0.017	0.375	
	0.312	0.289	0.093	1 1/4	0.2500	20	0.193	0.182	0.100	0.028	0.022	0.438	
	0.375	0.352	0.093	1 1/8	0.3125	18	0.249	0.237	0.111	0.031	0.025	0.500	
	0.500	0.477	0.093	3/4	0.3750	16	0.304	0.291	0.125	0.035	0.029	0.625	
3/16	0.625	0.602	0.093	1 1/2	0.5000	13	0.414	0.397	0.154	0.042	0.036	0.750	
	0.750	0.727	0.093	3/4	0.6250	11	0.521	0.502	0.182	0.051	0.045	0.875	
1/2	1.000	0.977	0.125	1 1/4	0.7500	10	0.638	0.616	0.200	0.055	0.049	1.000	
5/8	1.250	1.227	0.125	1 1/2	0.8750	9	0.750	0.726	0.222	0.062	0.056	1.125	
3/4	1.500	1.478	0.125	1 1/8	1.1250	7	0.964	0.934	0.286	0.072	0.066	1.500	
7/8	1.750	1.728	0.125	1 1/4	1.2500	7	1.089	1.059	0.286	0.072	0.066	1.750	
1	2.000	1.978	0.125	1 1/2	1.5000	6	1.307	1.277	0.333	0.102	0.096	2.000	

Square Bolts (ANSI/ASME B18.2.1, 1981)

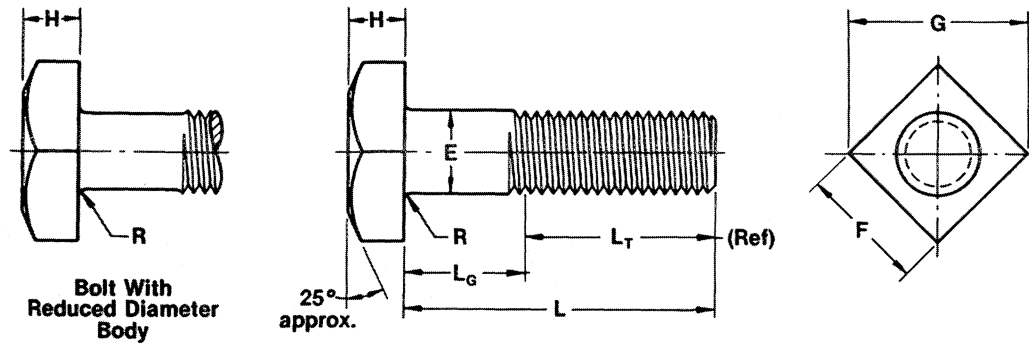


TABLE C.3.8 Dimensions of Square Bolts

Nominal Size or Basic Product Diameter	Basic Diameter	E		F		G		H		R		L _T		
		Body Dia		Width Across Flats		Width Across Corners		Height		Radius of Fillet		Thread Length for Bolt Lengths		
		Max	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	6 in. and Shorter Basic	Over 6 in. Basic
1/4	0.2500	0.260	3/16	0.375	0.362	0.530	0.498	11/64	0.188	0.156	0.03	0.01	0.750	1.000
5/16	0.3125	0.324	1/4	0.500	0.484	0.707	0.665	13/64	0.220	0.186	0.03	0.01	0.875	1.125
3/8	0.3750	0.388	5/16	0.562	0.544	0.795	0.747	1/4	0.268	0.232	0.03	0.01	1.000	1.250
7/16	0.4375	0.452	3/8	0.625	0.603	0.884	0.828	19/64	0.316	0.278	0.03	0.01	1.125	1.375
1/2	0.5000	0.515	3/4	0.750	0.725	1.061	0.995	21/64	0.348	0.308	0.03	0.01	1.250	1.500
5/8	0.6250	0.642	7/16	0.938	0.906	1.326	1.244	27/64	0.444	0.400	0.06	0.02	1.500	1.750
3/4	0.7500	0.768	1	1.125	1.088	1.591	1.494	1/2	0.524	0.476	0.06	0.02	1.750	2.000
7/8	0.8750	0.895	1 5/16	1.312	1.269	1.856	1.742	19/32	0.620	0.568	0.06	0.02	2.000	2.250
1	1.0000	1.022	1 1/2	1.500	1.450	2.121	1.991	21/32	0.684	0.628	0.09	0.03	2.250	2.500
1 1/8	1.1250	1.149	1 11/16	1.688	1.631	2.386	2.239	3/4	0.780	0.720	0.09	0.03	2.500	2.750
1 1/4	1.2500	1.277	1 7/8	1.875	1.812	2.652	2.489	27/32	0.876	0.812	0.09	0.03	2.750	3.000
1 3/8	1.3750	1.404	2 1/16	2.062	1.994	2.917	2.738	29/32	0.940	0.872	0.09	0.03	3.000	3.250
1 1/2	1.5000	1.531	2 1/4	2.250	2.175	3.182	2.986	1	1.036	0.964	0.09	0.03	3.250	3.500

Socket-Button-Head Cap Screws (ANSI/ASME B18.3, 1986)

General Note: This product is designed and recommended for light fastening applications such as guards, hinges, etc. It is not suggested for use in critical high-strength applications, where socket-head cap screws should normally be used.

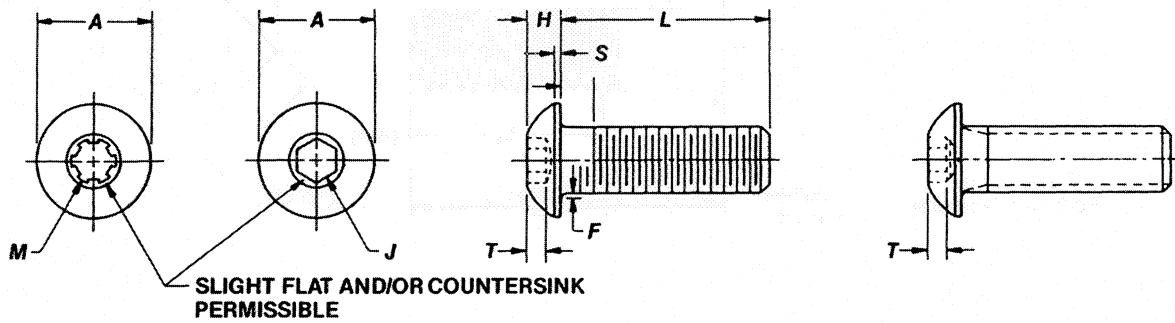


TABLE C.3.9 Dimensions of Hexagon and Spline Socket-Button-Head Cap Screws

Nominal Size or Basic Screw Diameter	A		H		S	M	J	T	F		L	
	Head Diameter		Head Height		Head Side Height	Spline Socket Size	Hexagon Socket Size	Key Engagement	Fillet Extension		Max Standard Length	
	Max	Min	Max	Min	Ref	Nom	Nom	Min	Max	Min	Nom	
0	0.0600	0.114	0.104	0.032	0.026	0.010	0.048	0.035	0.020	0.010	0.005	0.50
1	0.0730	0.139	0.129	0.039	0.033	0.010	0.060	0.050	0.028	0.010	0.005	0.50
2	0.0860	0.164	0.154	0.046	0.038	0.010	0.060	0.050	0.028	0.010	0.005	0.50
3	0.0990	0.188	0.176	0.052	0.044	0.010	0.072	$\frac{1}{16}$ 0.062	0.035	0.010	0.005	0.50
4	0.1120	0.213	0.201	0.059	0.051	0.015	0.072	$\frac{1}{16}$ 0.062	0.035	0.010	0.005	0.50
5	0.1250	0.238	0.226	0.066	0.058	0.015	0.096	$\frac{5}{32}$ 0.156	0.044	0.010	0.005	0.50
6	0.1380	0.262	0.250	0.073	0.063	0.015	0.096	$\frac{5}{32}$ 0.156	0.044	0.010	0.005	0.63
8	0.1640	0.312	0.298	0.087	0.077	0.015	0.111	$\frac{3}{16}$ 0.188	0.052	0.015	0.010	0.75
10	0.1900	0.361	0.347	0.101	0.091	0.020	0.145	$\frac{1}{8}$ 0.125	0.070	0.015	0.010	1.00
$\frac{1}{4}$	0.2500	0.437	0.419	0.132	0.122	0.031	0.183	$\frac{5}{32}$ 0.156	0.087	0.020	0.015	1.00
$\frac{3}{8}$	0.3125	0.547	0.527	0.166	0.152	0.031	0.216	$\frac{3}{16}$ 0.188	0.105	0.020	0.015	1.00
$\frac{1}{2}$	0.3750	0.656	0.636	0.199	0.185	0.031	0.251	$\frac{7}{32}$ 0.219	0.122	0.020	0.015	1.25
$\frac{3}{4}$	0.5000	0.875	0.851	0.265	0.245	0.046	0.372	$\frac{1}{2}$ 0.312	0.175	0.030	0.020	2.00
1	0.6250	1.000	0.970	0.331	0.311	0.062	0.454	$\frac{9}{16}$ 0.375	0.210	0.030	0.020	2.00

Socket Set Screws (ANSI/ASME B18.3, 1986)

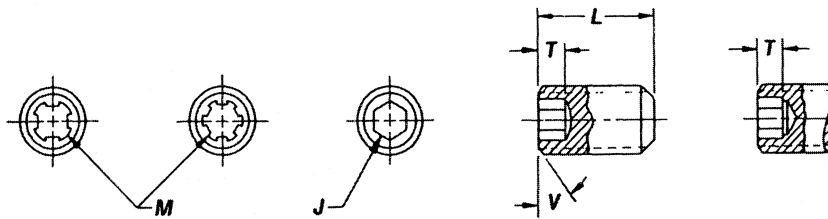


TABLE C.3.10 Dimensions of Hexagon and Spline Socket Set Screws

Nominal Size or Basic Screw Diameter		J	M	T		C		R	Y
		Hexagon Socket Size	Spline Socket Size	Min Key Engagement to Develop Functional Capability of Key		Cup and Flat Point Diameters		Oval Point Radius	Cone Point Angle $90^\circ \pm 2^\circ$ for These Nominal Lengths or Longer; $118^\circ \pm 2^\circ$ for Shorter Nominal Lengths
		Nom	Nom	Hex Socket T_H Min	Spline Socket T_S Min	Max	Min	Basic	
0	0.0600	0.028	0.033	0.050	0.026	0.033	0.027	0.045	0.09
1	0.0730	0.028	0.033	0.060	0.035	0.040	0.033	0.055	0.09
2	0.0860	0.035	0.048	0.060	0.040	0.047	0.039	0.064	0.13
3	0.0990	0.050	0.048	0.070	0.040	0.054	0.045	0.074	0.13
4	0.1120	0.050	0.060	0.070	0.045	0.061	0.051	0.084	0.19
5	0.1250	$\frac{1}{16}$	0.072	0.080	0.055	0.067	0.057	0.094	0.19
6	0.1380	$\frac{1}{16}$	0.072	0.080	0.055	0.074	0.064	0.104	0.19
8	0.1640	$\frac{5}{64}$	0.096	0.090	0.080	0.087	0.076	0.123	0.25
10	0.1900	$\frac{3}{32}$	0.111	0.100	0.080	0.102	0.088	0.142	0.25
$\frac{1}{4}$	0.2500	$\frac{1}{8}$	0.145	0.125	0.125	0.132	0.118	0.188	0.31
$\frac{5}{16}$	0.3125	$\frac{5}{32}$	0.183	0.156	0.156	0.172	0.156	0.234	0.38
$\frac{3}{8}$	0.3750	$\frac{3}{16}$	0.216	0.188	0.188	0.212	0.194	0.281	0.44
$\frac{7}{16}$	0.4375	$\frac{7}{32}$	0.251	0.219	0.219	0.252	0.232	0.328	0.50
$\frac{1}{2}$	0.5000	$\frac{1}{4}$	0.291	0.250	0.250	0.291	0.270	0.375	0.57
$\frac{5}{8}$	0.6250	$\frac{5}{16}$	0.372	0.312	0.312	0.371	0.347	0.469	0.75
$\frac{3}{4}$	0.7500	$\frac{3}{8}$	0.454	0.375	0.375	0.450	0.425	0.562	0.88
$\frac{7}{8}$	0.8750	$\frac{7}{16}$	0.595	0.500	0.500	0.530	0.502	0.656	1.00
1	1.0000	$\frac{1}{2}$	0.562	0.562	0.562	0.609	0.579	0.750	1.13
$1\frac{1}{8}$	1.1250	$\frac{5}{16}$	0.562	0.562	0.562	0.689	0.655	0.844	1.25
$1\frac{1}{4}$	1.2500	$\frac{3}{8}$	0.625	0.625	0.625	0.767	0.733	0.938	1.50
$1\frac{3}{8}$	1.3750	$\frac{1}{2}$	0.625	0.625	0.625	0.848	0.808	1.031	1.63
$1\frac{1}{2}$	1.5000	$\frac{3}{4}$	0.750	0.750	0.750	0.926	0.886	1.125	1.75
$1\frac{3}{4}$	1.7500	1	1.000	1.000	1.000	1.086	1.039	1.312	2.00
2	2.0000	1	1.000	1.000	1.000	1.244	1.193	1.500	2.25

Metric Socket Set Screws (ANSI B18.3.6M, 1979)

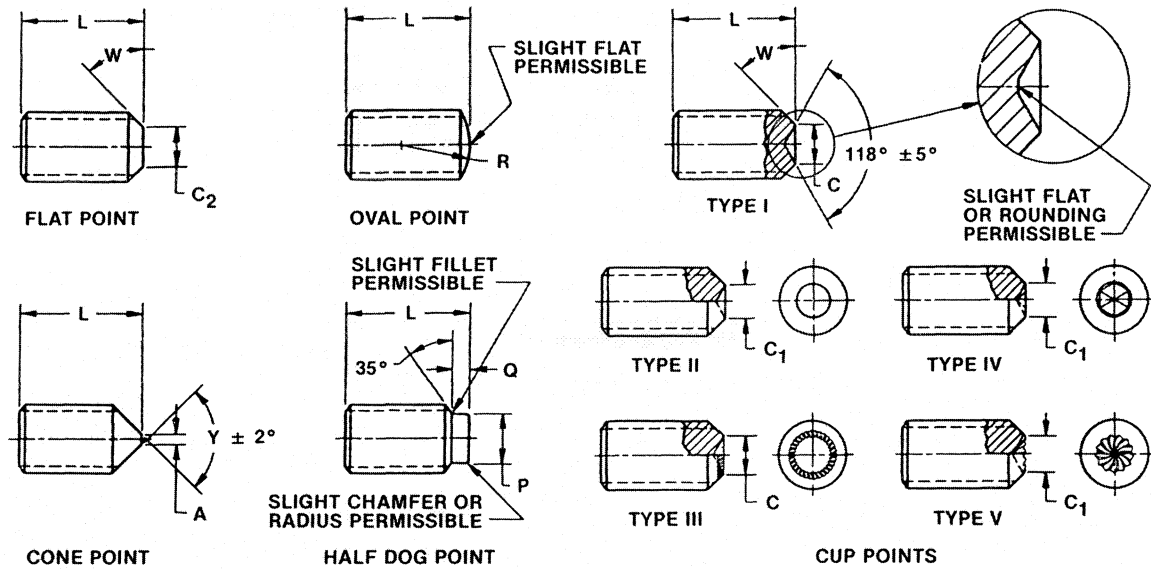


TABLE C.3.11 Dimensions of Points for Metric Socket Set Screws

Nominal Size of Basic Screw Diameter	C		C ₁		C ₂		R		Y	A		Half Dog Point				
	Cup Point Diameter for Types I and III		Cup Point Diameter for Types II, IV, and V		Flat Point Diameter		Oval Point Radius			Cone Point Angle 90° for These Lengths and over; 118° for Shorter Lengths	Flat of Truncation on Cone Point		Diameter		Length	
	Max	Min	Max	Min	Max	Min	Max	Min			Max	Min	Max	Min	Max	Min
1.6	0.80	0.55	0.80	0.64	0.80	0.55	1.60	1.20	3	1.16	0	0.80	0.55	0.53	0.40	
2	1.00	0.75	1.00	0.82	1.00	0.75	1.90	1.50	3	0.2	0	1.00	0.75	0.64	0.50	
2.5	1.20	0.95	1.25	1.05	1.50	1.25	2.28	1.88	4	0.25	0	1.50	1.25	0.78	0.63	
3	1.40	1.15	1.50	1.28	2.00	1.75	2.65	2.25	4	0.3	0	2.00	1.75	0.92	0.75	
4	2.00	1.75	2.00	1.75	2.50	2.25	3.80	3.00	5	0.4	0	2.50	2.25	1.20	1.00	
5	2.50	2.25	2.50	2.22	3.50	3.20	4.55	3.75	6	0.5	0	3.50	3.20	1.37	1.25	
6	3.00	2.75	3.00	2.69	4.00	3.70	5.30	4.50	8	1.5	1.2	4.00	3.70	1.74	1.50	
8	5.00	4.70	4.00	3.65	5.50	5.20	6.80	6.00	10	2.0	1.6	5.50	5.20	2.28	2.00	
10	6.00	5.70	5.00	4.60	7.00	6.64	8.30	7.50	12	2.5	2.0	7.00	6.64	2.82	2.50	
12	8.00	7.64	6.00	5.57	8.50	8.14	9.80	9.00	16	3.0	2.4	8.50	8.14	3.35	3.00	
16	10.00	9.64	8.00	7.50	12.00	11.57	12.80	12.00	20	4.0	3.2	12.00	11.57	4.40	4.00	
20	14.00	13.57	10.00	9.44	15.00	14.57	15.80	15.00	25	5.0	4.0	15.00	14.57	5.45	5.00	
24	16.00	15.57	12.00	11.39	18.00	17.57	18.80	18.00	30	6.0	4.8	18.00	17.57	6.49	6.00	

Hex Nuts and Hex Jam Nuts (ANSI/ASME B18.2.2, 1986)

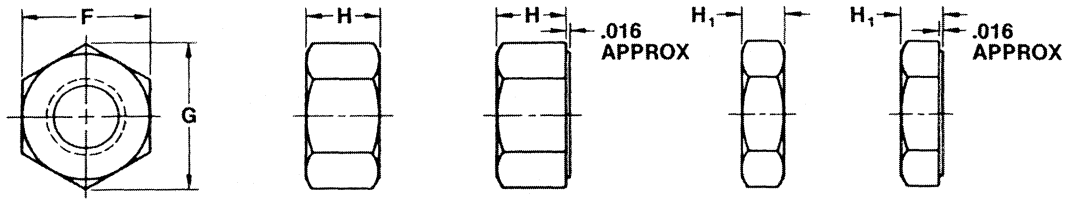


TABLE C.3.12 Dimensions of Hex Nuts and Hex Jam Nuts

Nominal Size or Basic Major Diameter of Thread	Basic	F			G		H			H ₁			Runout of Bearing Face, FIM		
		Width Across Flats			Width Across Corners		Thickness, Hex Nuts			Thickness, Hex Jam Nuts			Hex Nuts Specified Proof Load		Hex Jam Nuts
		Basic	Max	Min	Max	Min	Basic	Max	Min	Basic	Max	Min	Up to 150,000 psi	150,000 psi and Greater	All Strength Levels
														Max	
1/4	0.2500	7/32	0.438	0.428	0.505	0.488	7/32	0.226	0.212	5/32	0.163	0.150	0.015	0.010	0.015
5/16	0.3125	1/2	0.500	0.489	0.577	0.557	17/64	0.273	0.258	7/16	0.195	0.180	0.016	0.011	0.016
3/8	0.3750	5/8	0.562	0.551	0.650	0.628	21/64	0.337	0.320	7/32	0.227	0.210	0.017	0.012	0.017
7/16	0.4375	11/16	0.688	0.675	0.794	0.768	9/16	0.385	0.365	1/4	0.260	0.240	0.018	0.013	0.018
1/2	0.5000	3/4	0.750	0.736	0.866	0.840	7/16	0.448	0.427	5/16	0.323	0.302	0.019	0.014	0.019
9/16	0.5625	7/8	0.875	0.861	1.010	0.982	21/32	0.496	0.473	5/16	0.324	0.301	0.020	0.015	0.020
5/8	0.6250	1 1/16	0.938	0.922	1.083	1.051	11/16	0.559	0.535	9/16	0.387	0.363	0.021	0.016	0.021
3/4	0.7500	1 1/8	1.125	1.088	1.299	1.240	21/32	0.665	0.617	27/32	0.446	0.398	0.023	0.018	0.023
7/8	0.8750	1 1/4	1.312	1.269	1.516	1.447	11/8	0.776	0.724	31/32	0.510	0.458	0.025	0.020	0.025
1	1.0000	1 1/2	1.500	1.450	1.732	1.653	21/16	0.887	0.831	15/16	0.575	0.519	0.027	0.022	0.027
1-1/16	1.1250	1 11/16	1.688	1.631	1.949	1.859	23/16	0.999	0.939	21/16	0.639	0.579	0.030	0.025	0.030
1-1/8	1.2500	1 7/8	1.875	1.812	2.165	2.066	1 1/16	1.094	1.030	23/16	0.751	0.687	0.033	0.028	0.033
1-1/4	1.3750	2 1/16	2.062	1.994	2.382	2.273	1 11/16	1.206	1.138	25/16	0.815	0.747	0.036	0.031	0.036
1-1/2	1.5000	2 1/4	2.250	2.175	2.598	2.480	1 5/8	1.317	1.245	27/16	0.880	0.808	0.039	0.034	0.039

Square Nuts (ANSI/ASME B18.2.2, 1986)

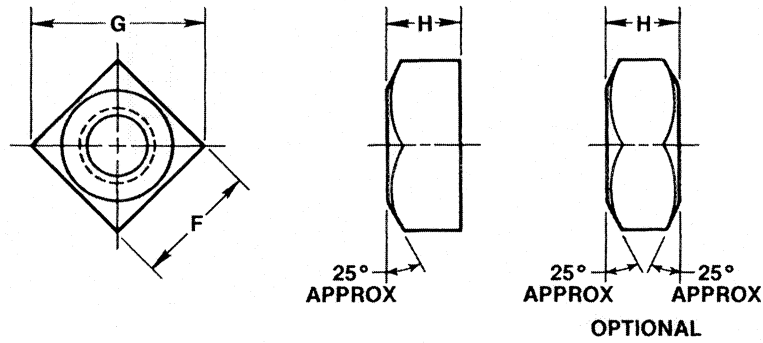


TABLE C.3.13 Dimensions of Square Nuts

Nominal Size or Basic Major Diameter of Thread		F			G		H		
		Width Across Flats			Width Across Corners		Thickness		
		Basic	Max	Min	Max	Min	Basic	Max	Min
1/4 1/16	0.2500	7/16	0.438	0.425	0.619	0.554	7/32	0.235	0.203
	0.3125	9/16	0.562	0.547	0.795	0.721	17/64	0.283	0.249
	0.3750	5/8	0.625	0.606	0.884	0.802	21/64	0.346	0.310
	0.4375	3/4	0.750	0.728	1.061	0.970	3/8	0.394	0.356
1/2 3/8	0.5000	13/16	0.812	0.788	1.149	1.052	7/16	0.458	0.418
	0.6250	1	1.000	0.969	1.414	1.300	35/64	0.569	0.525
	0.7500	1-1/8	1.125	1.088	1.591	1.464	21/32	0.680	0.632
	0.8750	1-5/16	1.312	1.269	1.856	1.712	49/64	0.792	0.740
1 3/4	1.0000	1-1/2	1.500	1.450	2.121	1.961	7/8	0.903	0.847
	1.1250	1-11/16	1.688	1.631	2.386	2.209	1	1.030	0.970
	1.2500	1-7/8	1.875	1.812	2.652	2.458	1-3/32	1.126	1.062
	1.3750	2-1/16	2.062	1.994	2.917	2.708	1-13/64	1.237	1.169
	1.5000	2-1/4	2.250	2.175	3.182	2.956	1-5/16	1.348	1.276

Metric Hex Nuts, Style 1 (ANSI B18.2.4.1M, 1979)

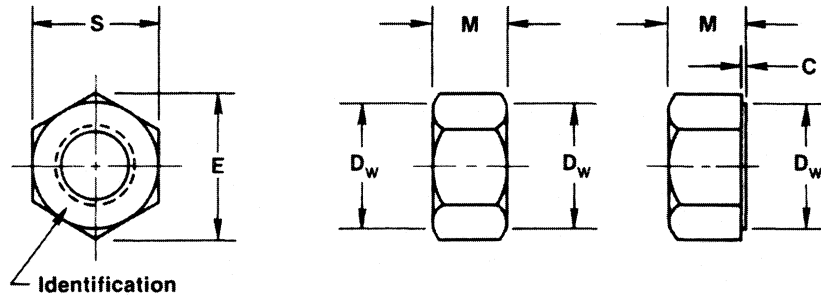


TABLE C.3.14 Dimensions of Hex Nuts, Style 1

Nominal Nut Diameter and Thread Pitch	S		E		M		D _w	C		Total Runout of Bearing Surface FIM
	Width Across Flats		Width Across Corners		Thickness			Bearing Face Diameter	Washer Face Thickness	
	Max	Min	Max	Min	Max	Min	Min	Max	Min		Max
M1.6 × 0.35	3.20	3.02	3.70	3.41	1.30	1.05	2.4	----	----	----
M2 × 0.4	4.00	3.82	4.62	4.32	1.60	1.35	3.1	----	----	----
M2.5 × 0.45	5.00	4.82	5.77	5.45	2.00	1.75	4.1	----	----	----
M3 × 0.5	5.50	5.32	6.35	6.01	2.40	2.15	4.6	----	----	----
M3.5 × 0.6	6.00	5.82	6.93	6.58	2.80	2.55	5.1	----	----	----
M4 × 0.7	7.00	6.78	8.08	7.66	3.20	2.90	5.9	----	----	----
M5 × 0.8	8.00	7.78	9.24	8.79	4.70	4.40	6.9	----	----	0.30
M6 × 1	10.00	9.78	11.55	11.05	5.20	4.90	8.9	----	----	0.33
M8 × 1.25	13.00	12.73	15.01	14.38	6.80	6.44	11.6	----	----	0.36
M10 × 1.5	16.00	15.73	18.48	17.77	8.40	8.04	14.6	----	----	0.39
M12 × 1.75	18.00	17.73	20.78	20.03	10.80	10.37	16.6	----	----	0.42
M14 × 2	21.00	20.67	24.25	23.35	12.80	12.10	19.6	----	----	0.45
M16 × 2	24.00	23.67	27.71	26.75	14.80	14.10	22.5	----	----	0.48
M20 × 2.5	30.00	29.16	34.64	32.95	18.00	16.90	27.7	0.8	0.4	0.56
M24 × 3	36.00	35.00	41.57	39.55	21.50	20.20	33.2	0.8	0.4	0.64
M30 × 3.5	46.00	45.00	53.12	50.85	25.60	24.30	42.7	0.8	0.4	0.76
M36 × 4	55.00	53.80	63.51	60.79	31.00	29.40	51.1	0.8	0.4	0.89
*M10 × 1.5	15.00	14.73	17.32	16.64	9.1	8.7	13.6	----	----	0.39

C.4 Washers

Plain Washers (ANSI/ASME B18.22.1 1965, 1981)

TABLE C.4.1 Dimensions of Preferred Sizes of Type A Plain Washers

Nominal Washer Size	A			B			C				
	Inside Diameter			Outside Diameter			Thickness				
	Tolerance			Tolerance			Max	Min			
	Basic	Plus	Minus	Basic	Plus	Minus			Basic		
---	---	---	0.078	0.000	0.005	0.188	0.000	0.005	0.020	0.025	0.016
---	---	---	0.094	0.000	0.005	0.250	0.000	0.005	0.020	0.025	0.016
---	---	---	0.125	0.008	0.005	0.312	0.008	0.005	0.032	0.040	0.025
6	0.138	---	0.156	0.008	0.005	0.375	0.015	0.005	0.049	0.065	0.036
8	0.164	---	0.188	0.008	0.005	0.438	0.015	0.005	0.049	0.065	0.036
10	0.190	---	0.219	0.008	0.005	0.500	0.015	0.005	0.049	0.065	0.036
10	1/16	---	0.188	0.015	0.005	0.562	0.015	0.005	0.049	0.065	0.036
12	0.216	---	0.250	0.015	0.005	0.562	0.015	0.005	0.065	0.080	0.051
1/4	---	N	0.250	0.015	0.005	0.625	0.015	0.005	0.065	0.080	0.051
1/4	---	W	0.312	0.015	0.005	0.734	0.015	0.007	0.065	0.080	0.051
3/8	---	N	0.312	0.015	0.005	0.688	0.015	0.007	0.065	0.080	0.051
3/8	---	W	0.375	0.015	0.005	0.875	0.030	0.007	0.083	0.104	0.064
1/2	---	N	0.375	0.015	0.005	0.812	0.015	0.007	0.065	0.080	0.051
1/2	---	W	0.438	0.015	0.005	1.000	0.030	0.007	0.083	0.104	0.064
5/8	---	N	0.438	0.015	0.005	0.922	0.015	0.007	0.065	0.080	0.051
5/8	---	W	0.500	0.015	0.005	1.250	0.030	0.007	0.083	0.104	0.064
3/4	---	N	0.500	0.015	0.005	1.062	0.030	0.007	0.095	0.121	0.074
3/4	---	W	0.562	0.015	0.005	1.375	0.030	0.007	0.109	0.132	0.086
7/8	---	N	0.562	0.015	0.005	1.156	0.030	0.007	0.095	0.121	0.074
7/8	---	W	0.625	0.015	0.005	1.469	0.030	0.007	0.109	0.132	0.086
1	---	N	0.625	0.030	0.007	1.312	0.030	0.007	0.095	0.121	0.074
1	---	W	0.688	0.030	0.007	1.750	0.030	0.007	0.134	0.160	0.108
1	---	N	0.750	0.030	0.007	1.469	0.030	0.007	0.134	0.160	0.108
1	---	W	0.812	0.030	0.007	2.000	0.030	0.007	0.148	0.177	0.122
1	1/2	N	0.875	0.030	0.007	1.750	0.030	0.007	0.134	0.160	0.108
1	1/2	W	0.938	0.030	0.007	2.250	0.030	0.007	0.165	0.192	0.136
1	---	N	1.000	0.030	0.007	2.000	0.030	0.007	0.134	0.160	0.108
1	---	W	1.062	0.030	0.007	2.500	0.030	0.007	0.165	0.192	0.136
1-1/8	---	N	1.125	0.030	0.007	2.250	0.030	0.007	0.134	0.160	0.108
1-1/8	---	W	1.250	0.030	0.007	2.750	0.030	0.007	0.165	0.192	0.136
1-1/4	---	N	1.250	0.030	0.007	2.500	0.030	0.007	0.165	0.192	0.136
1-1/4	---	W	1.375	0.030	0.007	3.000	0.030	0.007	0.165	0.192	0.136
1-3/8	---	N	1.375	0.030	0.007	2.750	0.030	0.007	0.165	0.192	0.136
1-3/8	---	W	1.500	0.045	0.010	3.250	0.045	0.010	0.180	0.213	0.153
1-1/2	---	N	1.500	0.030	0.007	3.000	0.030	0.007	0.165	0.192	0.136
1-1/2	---	W	1.625	0.045	0.010	3.500	0.045	0.010	0.180	0.213	0.153

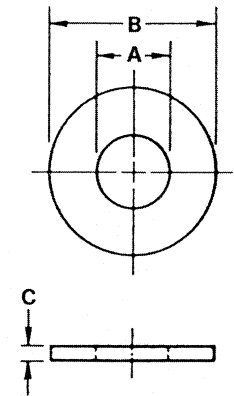


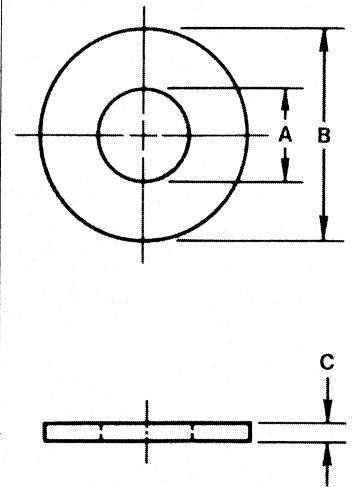
TABLE C.4.1 Dimensions of Preferred Sizes of Type A Plain Washers — *Continued*

Nominal Washer Size		A			B			C		
		Inside Diameter			Outside Diameter			Thickness		
		Tolerance			Tolerance			Basic	Max	Min
		Basic	Plus	Minus	Basic	Plus	Minus			
1- $\frac{5}{8}$	1.625	1.750	0.045	0.010	3.750	0.045	0.010	0.180	0.213	0.153
1- $\frac{3}{4}$	1.750	1.875	0.045	0.010	4.000	0.045	0.010	0.180	0.213	0.153
1- $\frac{7}{8}$	1.875	2.000	0.045	0.010	4.250	0.045	0.010	0.180	0.213	0.153
2	2.000	2.125	0.045	0.010	4.500	0.045	0.010	0.180	0.213	0.153
2- $\frac{1}{4}$	2.250	2.375	0.045	0.010	4.750	0.045	0.010	0.220	0.248	0.193
2- $\frac{1}{2}$	2.500	2.625	0.045	0.010	5.000	0.045	0.010	0.238	0.280	0.210
2- $\frac{3}{4}$	2.750	2.875	0.065	0.010	5.250	0.065	0.010	0.259	0.310	0.228
3	3.000	3.125	0.065	0.010	5.500	0.065	0.010	0.284	0.327	0.249

Metric Plain Washers (ANSI B18.22M, 1981)

TABLE C.4.2 Dimensions of Metric Plain Washers (General Purpose)

Nominal Washer Size	Washer Series	A		B		C	
		Inside Diameter		Outside Diameter		Thickness	
		Max	Min	Max	Min	Max	Min
1.6	Narrow	2.09	1.95	4.00	3.70	0.70	0.50
	Regular	2.09	1.95	5.00	4.70	0.70	0.50
	Wide	2.09	1.95	6.00	5.70	0.90	0.60
2	Narrow	2.64	2.50	5.00	4.70	0.90	0.60
	Regular	2.64	2.50	6.00	5.70	0.90	0.60
	Wide	2.64	2.50	8.00	7.64	0.90	0.60
2.5	Narrow	3.14	3.00	6.00	5.70	0.90	0.60
	Regular	3.14	3.00	8.00	7.64	0.90	0.60
	Wide	3.14	3.00	10.00	9.64	1.20	0.80
3	Narrow	3.68	3.50	7.00	6.64	0.90	0.60
	Regular	3.68	3.50	10.00	9.64	1.20	0.80
	Wide	3.68	3.50	12.00	11.57	1.40	1.00
3.5	Narrow	4.18	4.00	9.00	8.64	1.20	0.80
	Regular	4.18	4.00	10.00	9.64	1.40	1.00
	Wide	4.18	4.00	15.00	14.57	1.75	1.20
4	Narrow	4.88	4.70	10.00	9.64	1.20	0.80
	Regular	4.88	4.70	12.00	11.57	1.40	1.00
	Wide	4.88	4.70	16.00	15.57	2.30	1.60
5	Narrow	5.78	5.50	11.00	10.57	1.40	1.00
	Regular	5.78	5.50	15.00	14.57	1.75	1.20
	Wide	5.78	5.50	20.00	19.48	2.30	1.60
6	Narrow	6.87	6.65	13.00	12.57	1.75	1.20
	Regular	6.87	6.65	18.80	18.37	1.75	1.20
	Wide	6.87	6.65	25.40	24.88	2.30	1.60
8	Narrow	9.12	8.90	18.80	18.37	2.30	1.60
	Regular	9.12	8.90	25.40	24.48	2.30	1.60
	Wide	9.12	8.90	32.00	31.38	2.80	2.00
10	Narrow	11.12	10.85	20.00	19.48	2.30	1.60
	Regular	11.12	10.85	28.00	27.48	2.80	2.00
	Wide	11.12	10.85	39.00	38.38	3.50	2.50
12	Narrow	13.57	13.30	25.40	24.88	2.80	2.00
	Regular	13.57	13.30	34.00	33.38	3.50	2.50
	Wide	13.57	13.30	44.00	43.38	3.50	2.50
14	Narrow	15.52	15.25	28.00	27.48	2.80	2.00
	Regular	15.52	15.25	39.00	38.38	3.50	2.50
	Wide	15.52	15.25	50.00	49.38	4.00	3.00
16	Narrow	17.52	17.25	32.00	31.38	3.50	2.50
	Regular	17.52	17.25	44.00	43.38	4.00	3.00
	Wide	17.52	17.25	56.00	54.80	4.60	3.50
20	Narrow	22.32	21.80	39.00	38.38	4.00	3.00
	Regular	22.32	21.80	50.00	49.38	4.60	3.50
	Wide	22.32	21.80	66.00	64.80	5.10	4.00
24	Narrow	26.12	25.60	44.00	43.38	4.60	3.50
	Regular	26.12	25.60	56.00	54.80	5.10	4.00
	Wide	26.12	25.60	72.00	70.80	5.60	4.50
30	Narrow	33.02	32.40	56.00	54.80	5.10	4.00
	Regular	33.02	32.40	72.00	70.80	5.60	4.50
	Wide	33.02	32.40	90.00	88.60	6.40	5.00
36	Narrow	38.92	38.30	66.00	64.80	5.60	4.50
	Regular	38.92	38.30	90.00	88.60	6.40	5.00
	Wide	38.92	38.30	110.00	108.60	8.50	7.00



NOTES:

1. Nominal washer sizes are intended for use with comparable nominal screw or bolt sizes.
2. The 18.80/18.37 and 25.40/24.88 mm outside diameters avoid washers that could be used in coin-operated devices.

C.5 Rivets

Flat-Head Rivets and Flat-Countersunk-Head Rivets (ANSI/ASME B18.1.1 1972, R1981)

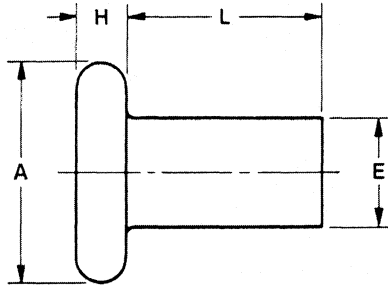


TABLE C.5.1 Dimensions of Flat-Head Rivets

Nominal Size or Basic Shank Diameter	E Shank Diameter		A Head Diameter		H Head Diameter		
	Max	Min	Max	Min	Max	Min	
	$\frac{1}{16}$	0.062	0.064	0.059	0.140	0.120	0.027	0.017
$\frac{3}{32}$	0.094	0.096	0.090	0.200	0.180	0.038	0.026
$\frac{1}{8}$	0.125	0.127	0.121	0.260	0.240	0.048	0.036
$\frac{5}{32}$	0.156	0.158	0.152	0.323	0.301	0.059	0.045
$\frac{3}{16}$	0.188	0.191	0.182	0.387	0.361	0.069	0.055
$\frac{7}{32}$	0.219	0.222	0.213	0.453	0.427	0.080	0.065
$\frac{1}{4}$	0.250	0.253	0.244	0.515	0.485	0.091	0.075
$\frac{9}{32}$	0.281	0.285	0.273	0.579	0.545	0.103	0.085
$\frac{5}{16}$	0.312	0.316	0.304	0.641	0.607	0.113	0.095
$\frac{11}{32}$	0.344	0.348	0.336	0.705	0.667	0.124	0.104
$\frac{3}{8}$	0.375	0.380	0.365	0.769	0.731	0.135	0.115
$\frac{13}{32}$	0.406	0.411	0.396	0.834	0.790	0.146	0.124
$\frac{7}{16}$	0.438	0.443	0.428	0.896	0.852	0.157	0.135

TABLE C.5.2 Dimensions of Flat-Countersunk-Head Rivets

Nominal Size or Basic Shank Diameter	E		A		H	
	Shank Diameter		Head Diameter		Head Height	
	Max	Min	Max	Min	Ref	
$\frac{1}{16}$	0.062	0.064	0.059	0.118	0.110	0.027
$\frac{3}{32}$	0.094	0.096	0.090	0.176	0.163	0.040
$\frac{1}{8}$	0.125	0.127	0.121	0.235	0.217	0.053
$\frac{5}{32}$	0.156	0.158	0.152	0.293	0.272	0.066
$\frac{3}{16}$	0.188	0.191	0.182	0.351	0.326	0.079
$\frac{7}{32}$	0.219	0.222	0.213	0.413	0.384	0.094
$\frac{1}{4}$	0.250	0.253	0.244	0.469	0.437	0.106
$\frac{5}{16}$	0.281	0.285	0.273	0.528	0.491	0.119
$\frac{3}{8}$	0.312	0.316	0.304	0.588	0.547	0.133
$\frac{7}{16}$	0.344	0.348	0.336	0.646	0.602	0.146
$\frac{1}{2}$	0.375	0.380	0.365	0.704	0.656	0.159
$\frac{5}{8}$	0.406	0.411	0.396	0.763	0.710	0.172
$\frac{3}{4}$	0.438	0.443	0.428	0.823	0.765	0.186

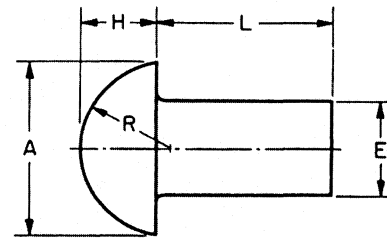
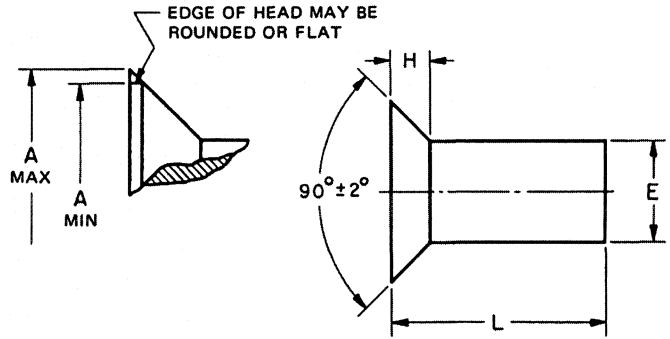


TABLE C.5.3 Dimensions of Button-Head Rivets

Nominal Size or Basic Shank Diameter	E		A		H		R	
	Shank Diameter		Head Diameter		Head Height		Head Radius	
	Max	Min	Max	Min	Max	Min	Approx	
$\frac{1}{16}$	0.062	0.064	0.059	0.122	0.102	0.052	0.042	0.055
$\frac{3}{32}$	0.094	0.096	0.090	0.182	0.162	0.077	0.065	0.084
$\frac{1}{8}$	0.125	0.127	0.121	0.235	0.215	0.100	0.088	0.111
$\frac{5}{32}$	0.156	0.158	0.152	0.290	0.268	0.124	0.110	0.138
$\frac{3}{16}$	0.188	0.191	0.182	0.348	0.322	0.147	0.133	0.166
$\frac{7}{32}$	0.219	0.222	0.213	0.405	0.379	0.172	0.158	0.195
$\frac{1}{4}$	0.250	0.253	0.244	0.460	0.430	0.196	0.180	0.221
$\frac{5}{16}$	0.281	0.285	0.273	0.518	0.484	0.220	0.202	0.249
$\frac{3}{8}$	0.312	0.316	0.304	0.572	0.538	0.243	0.225	0.276
$\frac{7}{16}$	0.344	0.348	0.336	0.630	0.592	0.267	0.247	0.304
$\frac{1}{2}$	0.375	0.380	0.365	0.684	0.646	0.291	0.271	0.332
$\frac{5}{8}$	0.406	0.411	0.396	0.743	0.699	0.316	0.294	0.358
$\frac{3}{4}$	0.438	0.443	0.428	0.798	0.754	0.339	0.317	0.387

C.6 Retaining Rings

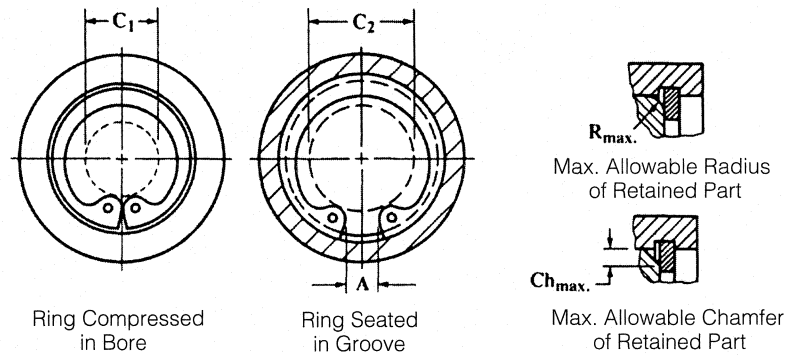


TABLE C.6.1 Dimension of Internal Retaining Rings

Ring Series and Size No.	Clearance Diameter		Gaging Diameter	Allowable Thrust Loads		Maximum Allowable Corner Radii and Chamfers	
	Ring in Bore	Ring in Groove		Sharp Corner	Abutment	R_{max} (mm)	Ch_{max} (mm)
BM No.	C_1 (mm)	C_2 (mm)	A_{min} (mm)	P_r (kN)	P_g (kN)		
-8	4.4	4.8	1.40	2.4	1.0	0.4	0.3
-9	4.6	5.0	1.50	4.4	1.2	0.5	0.35
-10	5.5	6.0	1.85	4.9	1.5	0.5	0.35
-11	5.7	6.3	1.95	5.4	2.0	0.6	0.4
-12	6.7	7.3	2.25	5.8	2.4	0.6	0.4
-13	6.8	7.5	2.35	8.9	2.6	0.7	0.5
-14	6.9	7.7	2.65	9.7	3.2	0.7	0.5
-15	7.9	8.7	2.80	10.4	3.7	0.7	0.5
-16	8.8	9.7	2.80	11.0	4.2	0.7	0.5
-17	9.8	10.8	3.35	11.7	4.9	0.75	0.6
-18	10.3	11.3	3.40	12.3	5.5	0.75	0.6
-19	11.4	12.5	3.40	13.1	6.0	0.8	0.65
-20	11.6	12.7	3.8	13.7	6.6	0.9	0.7
-21	12.6	13.8	4.2	14.5	7.3	0.9	0.7
-22	13.5	14.8	4.3	22.5	8.3	0.9	0.7
-23	14.5	15.9	4.9	23.5	8.9	1.0	0.8
-24	15.5	16.9	5.2	24.8	9.7	1.0	0.8
-25	16.5	18.1	6.0	25.7	11.6	1.0	0.8
-26	17.5	19.2	5.7	26.8	12.7	1.2	1.0
-27	17.4	19.2	5.9	33	14.0	1.2	1.0
-28	18.2	20.0	6.0	34	14.6	1.2	1.0
-30	20.0	21.9	6.0	37	16.5	1.2	1.0
-32	22.0	23.9	7.3	39	17.6	1.2	1.0
-34	24.0	26.1	7.6	42	20.6	1.2	1.0
-35	25.0	27.2	8.0	43	22.3	1.2	1.0
-36	26.0	28.3	8.3	44	23.9	1.2	1.0
-37	27.0	29.3	8.4	45	24.6	1.2	1.0
-38	28.0	30.4	8.6	46	26.4	1.2	1.0
-40	29.2	31.6	9.7	62	27.7	1.7	1.3

Continues

TABLE C.6.1 Dimension of Internal Retaining Rings — Continued

Ring Series and Size No. BM No.	Clearance Diameter		Gaging Diameter $A_{min}(mm)$	Allowable Thrust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers	
	Ring in Bore $C_1 (mm)$	Ring in Groove $C_2 (mm)$		$P_r (kN)$	$P_g (kN)$	$R_{max} (mm)$	$Ch_{max} (mm)$
	-42	29.7		32.2	9.0	65	30.2	1.7	1.3
-45	32.3	34.9	9.6	69	33.8	1.7	1.3
-46	33.3	36.0	9.7	71	36	1.7	1.3
-47	34.3	37.1	10.0	72	38	1.7	1.3
-48	35.0	37.9	10.5	74	40	1.7	1.3
-50	36.9	40.0	12.1	77	45	1.7	1.3
-52	38.6	41.9	11.7	99	50	2.0	1.6
-55	40.8	44.2	11.9	105	54	2.0	1.6
-57	42.2	45.7	12.5	109	58	2.0	1.6

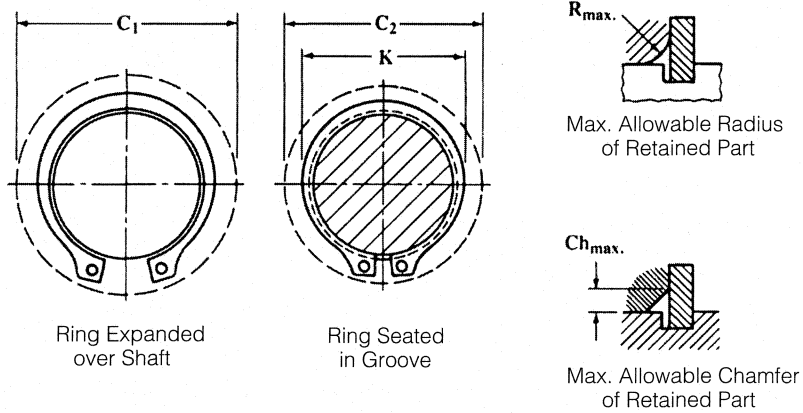


TABLE C.6.2 Dimensions of External Retaining Rings

Ring Series and Size No. AM (No.)	Clearance Diameter		Gaging Diameter $K_{max} (mm)$	Allowable Thrust Loads Sharp Corner Abutment		Maximum Allowable Corner Radii and Chamfers		Allowable Assembly Speed (rpm)
	Ring over Shaft $C_1 (mm)$	Ring in Groove $C_2 (mm)$		$P_r (kN)$	$P_g (kN)$	$R_{max} (mm)$	$Ch_{max} (mm)$	
	-4	7.0		6.8	4.90	0.6	0.2		0.35	0.25	70 000
-5	8.2	7.9	5.85	1.1	0.3	0.35	0.25	70 000
-6	9.1	8.8	6.95	1.4	0.4	0.35	0.25	70 000
-7	12.3	11.8	8.05	2.6	0.7	0.45	0.3	60 000
-8	13.6	13.0	9.15	3.1	1.0	0.5	0.35	55 000
-9	14.5	13.8	10.35	3.5	1.2	0.6	0.35	48 000
-10	15.5	14.7	11.50	3.9	1.5	0.7	0.4	42 000
-11	16.4	15.6	12.60	4.3	1.8	0.75	0.45	38 000
-12	17.4	16.6	13.80	4.7	2.0	0.8	0.45	34 000
-13	19.7	18.8	15.05	7.5	2.2	0.8	0.5	31 000
-14	20.7	19.7	15.60	8.1	2.6	0.9	0.5	28 000
-15	21.7	20.6	17.20	8.7	3.2	1.0	0.6	27 000
-16	22.7	21.6	18.35	9.3	3.5	1.1	0.6	25 000
-17	23.7	22.6	19.35	9.9	4.0	1.1	0.6	24 000

C.7 Pins

Clevis Pins (ANSI/ASME B18.8.1, 1972, R1983)

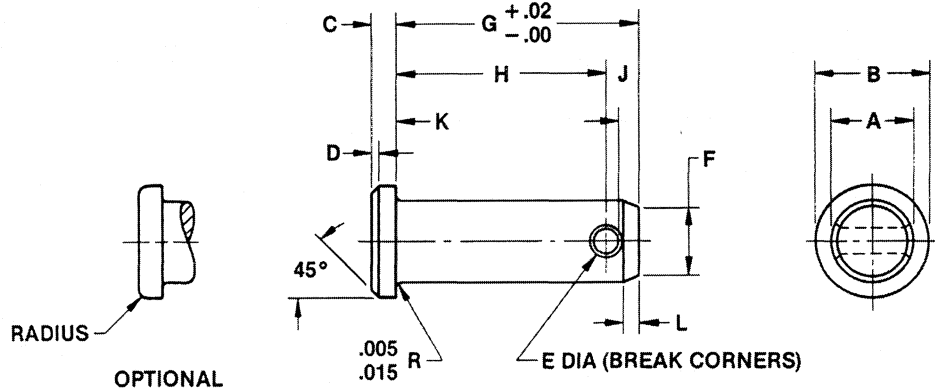


TABLE C.7.1 Dimensions of Clevis Pins

Nominal Size or Basic Pin Diameter	A		B		C		D		E		F		G		H		J		K		L		Recommended Cotter Pin Nominal Size
	Shank Diameter		Head Diameter		Head Height		Head Chamfer		Hole Diameter		Point Diameter		Pin Length		Head to Center of Hole		End to Center Ref		Head to Edge of Hole Ref		Point Length		
	Max	Min	Max	Min	Max	Min	±0.01	Max	Min	Max	Min	Basic	Max	Min	Basic	Min	Max	Min	Max	Min	Max		
1/32	0.188	0.186	0.181	0.32	0.30	0.07	0.05	0.02	0.088	0.073	0.15	0.14	0.58	0.504	0.484	0.09	0.548	0.520	0.055	0.035	1/16	0.062	
1/16	0.250	0.248	0.243	0.38	0.36	0.10	0.08	0.03	0.088	0.073	0.21	0.20	0.77	0.692	0.672	0.09	0.736	0.708	0.055	0.035	1/16	0.062	
3/32	0.312	0.311	0.306	0.44	0.42	0.10	0.08	0.03	0.119	0.104	0.26	0.25	0.94	0.832	0.812	0.12	0.892	0.864	0.071	0.049	3/32	0.093	
1/8	0.375	0.373	0.368	0.51	0.49	0.13	0.11	0.03	0.119	0.104	0.33	0.32	1.06	0.958	0.938	0.12	1.018	0.990	0.071	0.049	1/8	0.093	
5/32	0.438	0.436	0.431	0.57	0.55	0.16	0.14	0.04	0.119	0.104	0.39	0.38	1.19	1.082	1.062	0.12	1.142	1.114	0.071	0.049	5/32	0.093	
3/16	0.500	0.496	0.491	0.63	0.61	0.16	0.14	0.04	0.151	0.136	0.44	0.43	1.36	1.223	1.203	0.15	1.298	1.271	0.089	0.063	3/16	0.125	
1/4	0.625	0.621	0.616	0.82	0.80	0.21	0.19	0.06	0.151	0.136	0.56	0.55	1.61	1.473	1.453	0.15	1.548	1.521	0.089	0.063	1/4	0.125	
5/16	0.750	0.746	0.741	0.94	0.92	0.26	0.24	0.07	0.182	0.167	0.68	0.67	1.91	1.739	1.719	0.18	1.830	1.802	0.110	0.076	5/16	0.156	
3/8	0.875	0.871	0.866	1.04	1.02	0.32	0.30	0.09	0.182	0.167	0.80	0.79	2.16	1.989	1.969	0.18	2.080	2.052	0.110	0.076	3/8	0.156	
1	1.000	0.996	0.991	1.19	1.17	0.35	0.33	0.10	0.182	0.167	0.93	0.92	2.41	2.239	2.219	0.18	2.330	2.302	0.110	0.076	1	0.156	

Cotter Pins (ANSI/ASME B18.8.1, 1972, R1983)

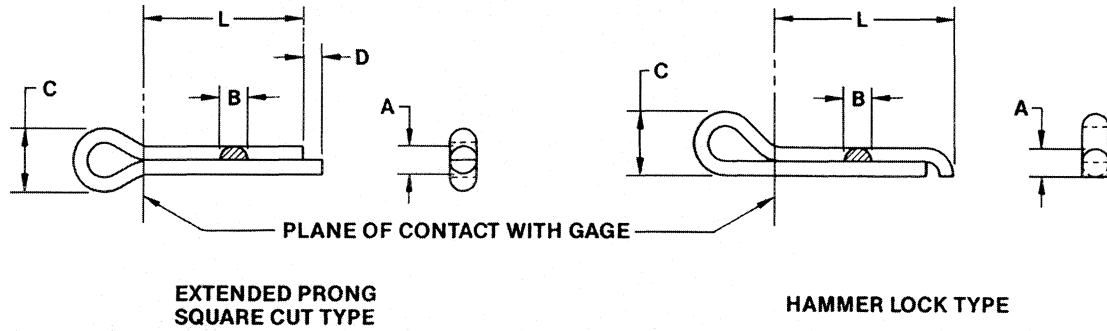


TABLE C.7.2 Dimensions of Cotter Pins

Nominal Size or Basic Pin Diameter	A		B		C	D	Recommended Hole Size	
	Total Shank Diameter		Wire Width		Head Diameter	Extended Prong Length		
	Max	Min	Max	Min	Min	Min		
1/32	0.031	0.032	0.028	0.032	0.022	0.06	0.01	0.047
3/64	0.047	0.048	0.044	0.048	0.035	0.09	0.02	0.062
1/16	0.062	0.060	0.056	0.060	0.044	0.12	0.03	0.078
5/64	0.078	0.076	0.072	0.076	0.057	0.16	0.04	0.094
3/32	0.094	0.090	0.086	0.090	0.069	0.19	0.04	0.109
7/64	0.109	0.104	0.100	0.104	0.080	0.22	0.05	0.125
1/8	0.125	0.120	0.116	0.120	0.093	0.25	0.06	0.141
5/32	0.141	0.134	0.130	0.134	0.104	0.28	0.06	0.156
3/16	0.156	0.150	0.146	0.150	0.116	0.31	0.07	0.172
1/4	0.188	0.176	0.172	0.176	0.137	0.38	0.09	0.203
5/16	0.219	0.207	0.202	0.207	0.161	0.44	0.10	0.234
3/8	0.250	0.225	0.220	0.225	0.176	0.50	0.11	0.266
7/16	0.312	0.280	0.275	0.280	0.220	0.62	0.14	0.312
1/2	0.375	0.335	0.329	0.335	0.263	0.75	0.16	0.375
5/8	0.438	0.406	0.400	0.406	0.320	0.88	0.20	0.438
3/4	0.500	0.473	0.467	0.473	0.373	1.00	0.23	0.500
7/8	0.625	0.598	0.590	0.598	0.472	1.25	0.30	0.625
1	0.750	0.723	0.715	0.723	0.572	1.50	0.36	0.750

Spring Pins (ANSI/ASME B18.8.2, 1978)

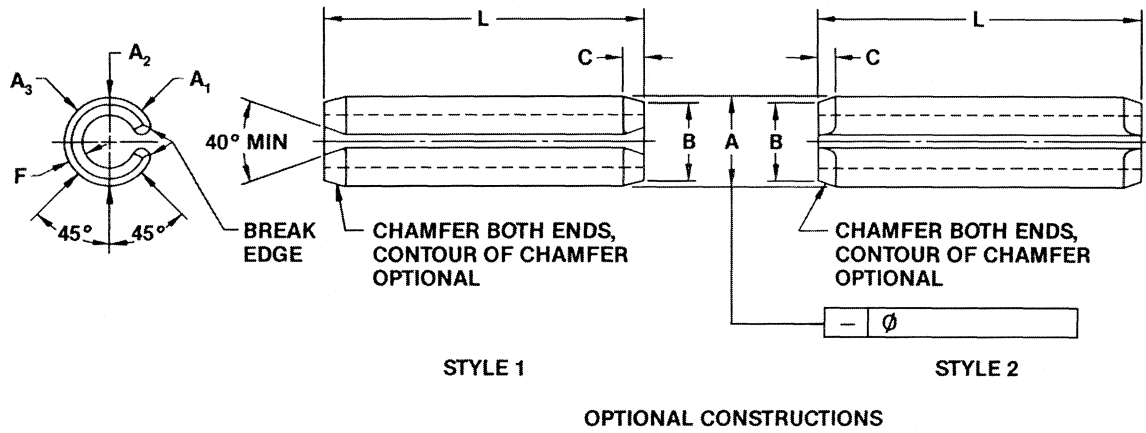


TABLE C.7.3 Dimensions of Slotted-Type Spring Pins

Nominal Size or Basic Pin Diameter	A		B		C		F		Double Shear Load, Min, lb			
	Pin Diameter		Chamfer Diameter		Chamfer Length		Stock Thickness		Material			
	Max	Min	Max	Max	Min	Basic	Max	Min	AISI 1070-1095 and AISI 420	AISI 302	Beryllium Copper	
$\frac{1}{16}$	0.062	0.069	0.066	0.059	0.028	0.007	0.012	0.065	0.062	425	350	270
$\frac{5}{64}$	0.078	0.086	0.083	0.075	0.032	0.008	0.018	0.081	0.078	650	550	400
$\frac{3}{32}$	0.094	0.103	0.099	0.091	0.038	0.008	0.022	0.097	0.094	1,000	800	660
$\frac{1}{8}$	0.125	0.135	0.131	0.122	0.044	0.008	0.028	0.129	0.125	2,100	1,500	1,200
$\frac{5}{64}$	0.141	0.149	0.145	0.137	0.044	0.008	0.028	0.144	0.140	2,200	1,600	1,400
$\frac{3}{32}$	0.156	0.167	0.162	0.151	0.048	0.010	0.032	0.160	0.156	3,000	2,000	1,800
$\frac{7}{16}$	0.188	0.199	0.194	0.182	0.055	0.011	0.040	0.192	0.187	4,400	2,800	2,600
$\frac{7}{32}$	0.219	0.232	0.226	0.214	0.065	0.011	0.048	0.224	0.219	5,700	3,550	3,700
$\frac{1}{4}$	0.250	0.264	0.258	0.245	0.065	0.012	0.048	0.256	0.250	7,700	4,600	4,500
$\frac{5}{16}$	0.312	0.328	0.321	0.306	0.080	0.014	0.062	0.318	0.312	11,500	7,095	6,800
$\frac{3}{8}$	0.375	0.392	0.385	0.368	0.095	0.016	0.077	0.382	0.375	17,600	10,000	10,100
$\frac{7}{16}$	0.438	0.456	0.448	0.430	0.095	0.017	0.077	0.445	0.437	20,000	12,000	12,200
$\frac{1}{2}$	0.500	0.521	0.513	0.485	0.110	0.025	0.094	0.510	0.500	25,800	15,500	16,800
$\frac{5}{8}$	0.625	0.650	0.640	0.608	0.125	0.030	0.125	0.636	0.625	46,000	18,800	...
$\frac{3}{4}$	0.750	0.780	0.769	0.730	0.150	0.030	0.150	0.764	0.750	66,000	23,200	...

Dowel Pins (ANSI/ASME B18.8.2, 1978)

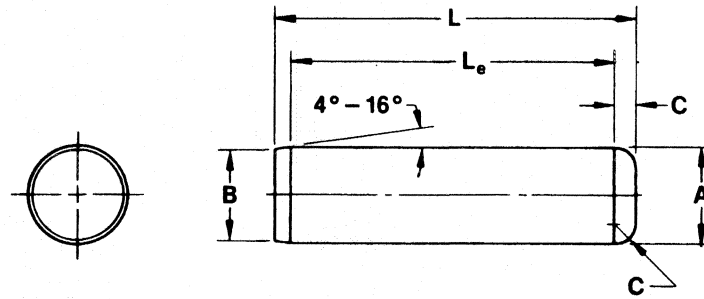


TABLE C.7.4 Hardened Ground Machine Dowel Pins

Nominal Size or Nominal Pin Diameter	Pin Diameter, A									Range of Preferred Lengths, L	Double Shear Load, Min, lb for Carbon or Alloy Steel	Suggested Hole Diameter			
	Standard Series Pins			Oversize Series Pins			Point Diameter, B		Crown Height or Radius, C						
	Basic	Max	Min	Basic	Max	Min	Max	Min	Max					Min	
$\frac{1}{16}$	0.0625	0.0627	0.0628	0.0626	0.0635	0.0636	0.0634	0.058	0.048	0.020	0.008	$\frac{2}{16}$ - $\frac{1}{4}$	800	0.0625	0.0620
$\frac{3}{32}$	0.0781	0.0783	0.0784	0.0782	0.0791	0.0792	0.0790	0.074	0.064	0.026	0.010		1,240	0.0781	0.0776
$\frac{1}{8}$	0.0938	0.0940	0.0941	0.0939	0.0948	0.0949	0.0947	0.089	0.079	0.031	0.012	$\frac{5}{16}$ - 1	1,800	0.0937	0.0932
$\frac{5}{32}$	0.1250	0.1252	0.1253	0.1251	0.1260	0.1261	0.1259	0.120	0.110	0.041	0.016	$\frac{3}{8}$ - 2	3,200	0.1250	0.1245
$\frac{3}{16}$	0.1562	0.1564	0.1565	0.1563	0.1572	0.1573	0.1571	0.150	0.140	0.052	0.020		5,000	0.1562	0.1557
$\frac{7}{32}$	0.1875	0.1877	0.1878	0.1876	0.1885	0.1886	0.1884	0.180	0.170	0.062	0.023	$\frac{1}{2}$ - 2	7,200	0.1875	0.1870
$\frac{1}{4}$	0.2500	0.2502	0.2503	0.2501	0.2510	0.2511	0.2509	0.240	0.230	0.083	0.031	$\frac{1}{2}$ - 2 $\frac{1}{2}$	12,800	0.2500	0.2495
$\frac{5}{16}$	0.3125	0.3127	0.3128	0.3126	0.3135	0.3136	0.3134	0.302	0.290	0.104	0.039	$\frac{1}{2}$ - 2 $\frac{1}{2}$	20,000	0.3125	0.3120
$\frac{3}{8}$	0.3750	0.3752	0.3753	0.3751	0.3760	0.3761	0.3759	0.365	0.350	0.125	0.047	$\frac{1}{2}$ - 3	28,700	0.3750	0.3745
$\frac{7}{16}$	0.4375	0.4377	0.4378	0.4376	0.4385	0.4386	0.4384	0.424	0.409	0.146	0.055	$\frac{7}{8}$ - 3	39,100	0.4375	0.4370
$\frac{1}{2}$	0.5000	0.5002	0.5003	0.5001	0.5010	0.5011	0.5009	0.486	0.471	0.167	0.063	$\frac{3}{4}$ - 4	51,000	0.5000	0.4995
$\frac{9}{16}$	0.6250	0.6252	0.6253	0.6251	0.6260	0.6261	0.6259	0.611	0.595	0.208	0.078	1 $\frac{1}{4}$ - 5	79,800	0.6250	0.6245
$\frac{5}{8}$	0.7500	0.7502	0.7503	0.7501	0.7510	0.7511	0.7509	0.735	0.715	0.250	0.094	1 $\frac{1}{2}$ - 6	114,000	0.7500	0.7495
$\frac{3}{4}$	0.8750	0.8752	0.8753	0.8751	0.8760	0.8761	0.8759	0.860	0.840	0.293	0.109	2, 2 $\frac{1}{2}$ - 6	156,000	0.8750	0.8745
1	1.0000	1.0002	1.0003	1.0001	1.0010	1.0011	1.0009	0.980	0.960	0.333	0.125	2, 2 $\frac{1}{2}$ - 5.6	204,000	1.0000	0.9995

Metric Spring Pins (IFI 512-S, 1982)

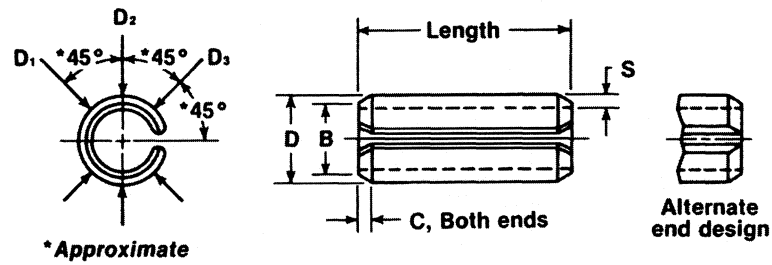


TABLE C.7.5 Dimensions of Unhardened Ground Dowel Pins

Nominal Size or Nominal Pin Diameter	A				C		Double Shear Load Min, lb	
	Pin Diameter		Chamfer Length		Material		Carbon Steel	Brass
	Max	Min	Max	Min				
$\frac{1}{16}$	0.0625	0.0600	0.0595	0.025	0.005	350	220	
$\frac{3}{32}$	0.0938	0.0912	0.0907	0.025	0.005	820	510	
$\frac{7}{64}$	0.1094	0.1068	0.1063	0.025	0.005	1,130	710	
$\frac{1}{8}$	0.1250	0.1223	0.1218	0.025	0.005	1,490	930	
$\frac{9}{32}$	0.1562	0.1535	0.1530	0.025	0.005	2,350	1,470	
$\frac{3}{16}$	0.1875	0.1847	0.1842	0.025	0.005	3,410	2,130	
$\frac{7}{32}$	0.2188	0.2159	0.2154	0.025	0.005	4,660	2,910	
$\frac{1}{4}$	0.2500	0.2470	0.2465	0.025	0.005	6,120	3,810	
$\frac{5}{16}$	0.3125	0.3094	0.3089	0.040	0.020	9,590	5,990	
$\frac{3}{8}$	0.3750	0.3717	0.3712	0.040	0.020	13,850	8,650	
$\frac{7}{16}$	0.4375	0.4341	0.4336	0.040	0.020	18,900	11,810	
$\frac{1}{2}$	0.5000	0.4964	0.4959	0.040	0.020	24,720	15,450	
$\frac{5}{8}$	0.6250	0.6211	0.6206	0.055	0.035	38,710	24,190	
$\frac{3}{4}$	0.7500	0.7548	0.7453	0.055	0.035	55,840	34,900	
$\frac{7}{8}$	0.8750	0.8705	0.8700	0.070	0.050	76,090	47,550	
1	1.0000	0.9952	0.9947	0.070	0.050	99,460	62,160	

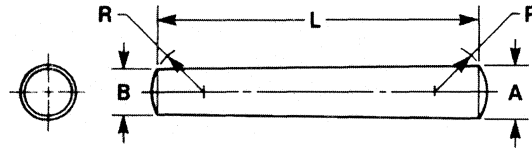


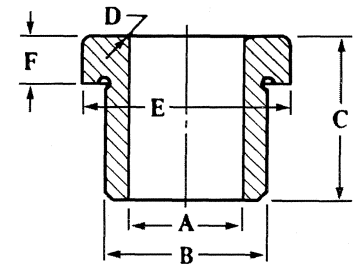
TABLE C.7.6 Dimensions of Tapered Pins

Pin Size Number and Basic Pin Diameter	A				R		
	Major Diameter (Large End)				End Crown Radius		
	Commercial Class		Precision Class		Max	Min	
	Max	Min	Max	Min			
-7	0.0625	0.0638	0.0618	0.0635	0.0625	0.072	0.052
	0.0780	0.0793	0.0773	0.0790	0.0780	0.088	0.068
	0.0940	0.0953	0.0933	0.0950	0.0940	0.104	0.084
-6	0.1090	0.1103	0.1083	0.1100	0.1090	0.119	0.099
	0.1250	0.1263	0.1243	0.1260	0.1250	0.135	0.115
	0.1410	0.1423	0.1403	0.1420	0.1410	0.151	0.131
0	0.1560	0.1573	0.1553	0.1570	0.1560	0.166	0.146
1	0.1720	0.1733	0.1713	0.1730	0.1720	0.182	0.162
2	0.1930	0.1943	0.1923	0.1940	0.1930	0.203	0.183
3	0.2190	0.2203	0.2183	0.2200	0.2190	0.229	0.209
4	0.2500	0.2513	0.2493	0.2510	0.2500	0.260	0.240
5	0.2890	0.2903	0.2883	0.2900	0.2890	0.299	0.279
6	0.3410	0.3423	0.3403	0.3420	0.3410	0.351	0.331
7	0.4090	0.4103	0.4083	0.4100	0.4090	0.419	0.399
8	0.4920	0.4933	0.4913	0.4930	0.4920	0.502	0.482
9	0.5910	0.5923	0.5903	0.5920	0.5910	0.601	0.581
10	0.7060	0.7073	0.7053	0.7070	0.7060	0.716	0.696
11	0.8600	0.8613	0.8593			0.870	0.850
12	1.0320	1.0333	1.0313			1.042	1.022
13	1.2410	1.2423	1.2403			1.251	1.231
14	1.5210	1.5223	1.5203			1.531	1.511

C.8 Bushings

TABLE C.8.1 Jig Bushings

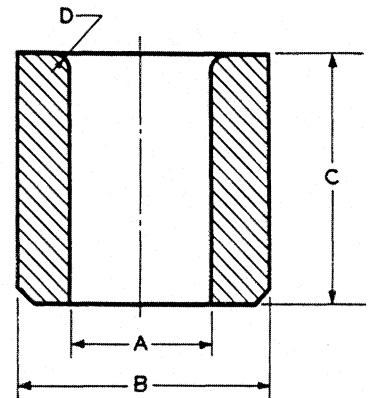
Range of Hole Sizes in Renewable Bushings	Body Diameter B								Overall Length C	Radius D	Head Diam. E	Head Thick. F _{max}	Number
	Inside Diameter A			Diameter B									
	Nom	Max	Min	Unfinished		Finished							
0.0135 to 0.1562									0.312				HL-32-5
									0.500				HL-32-8
	0.312	0.3129	0.3126	0.500	0.520	0.515	0.5017	0.5014	0.750	0.047	0.625	0.094	HL-32-12
									1.000				HL-32-16
0.1570 to 0.3125									0.312				HL-48-5
									0.500				HL-48-8
	0.500	0.5005	0.5002	0.750	0.770	0.765	0.7518	0.7515	0.750	0.062	0.875	0.094	HL-48-12
									1.000				HL-48-16
									1.375				HL-48-22
0.3160 to 0.5000									1.750				HL-48-28
									0.500				HL-64-8
									0.750				HL-64-12
	0.750	0.7506	0.7503	1.000	1.020	1.015	1.0018	1.0015	1.000	0.062	1.125	0.125	HL-64-16
									1.375				HL-64-22
									1.750				HL-64-28
0.5156 to 0.7500									2.125				HL-64-34
									0.500				HL-88-8
									0.750				HL-88-12
	1.000	1.0007	1.0004	1.375	1.395	1.390	1.3772	1.3768	1.000	0.094	1.500	0.125	HL-88-16
									1.375				HL-88-22
									1.750				HL-88-28
									2.125				HL-88-34
0.7656 to 1.0000									2.500				HL-88-40
									0.750				HL-112-12
									1.000				HL-112-16
	1.375	1.3760	1.3756	1.750	1.770	1.765	1.7523	1.7519	1.375	0.094	1.875	0.188	HL-112-22
									1.750				HL-112-28
1.0156 to 1.3750									2.125				HL-112-34
									2.500				HL-112-40
									1.000				HL-144-16
	1.750	1.7512	1.7508	2.250	2.270	2.265	2.2525	2.2521	1.375	0.094	2.375	0.188	HL-144-22
									1.750				HL-144-28
1.3906 to 1.7500									2.125				HL-144-34
									2.500				HL-144-40
									3.000				HL-144-48
	2.250	2.2515	2.2510	2.750	2.770	2.765	2.7526	2.7522	1.000	0.125	2.875	0.188	HL-176-16
									1.375				HL-176-22
								1.750				HL-176-28	
								2.125				HL-176-34	
								2.500				HL-176-40	
								3.000				HL-176-48	



All dimensions are in inches.

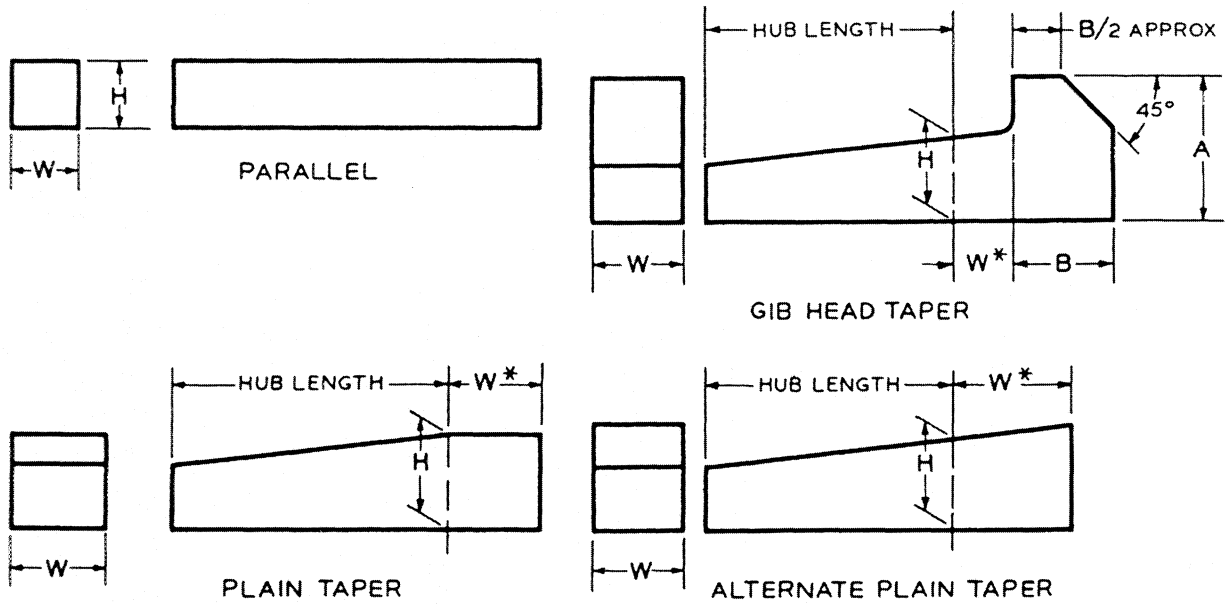
TABLE C.8.2 Headless-Type Press Fit Wearing Bushings Type-P

Range of Hole Sizes A	Body Diameter B					Body Length C	Radius D	Number
	Unfinished		Finished					
	Nom	Max	Min	Max	Min			
0.0135 up to and including 0.0625	0.156	0.166	0.161	0.1578	0.1575	0.250	0.016	P-10-4
						0.312		P-10-5
						0.375		P-10-6
						0.500		P-10-8
0.0630 to 0.0995	0.203	0.213	0.208	0.2046	0.2043	0.250	0.016	P-13-4
						0.312		P-13-5
						0.375		P-13-6
						0.500		P-13-8
0.1015 to 0.1405	0.250	0.260	0.255	0.2516	0.2513	0.250	0.016	P-16-4
						0.312		P-16-5
						0.500		P-16-8
						0.750		P-16-12
0.1406 to 0.1875	0.312	0.327	0.322	0.3141	0.3138	0.250	0.031	P-20-4
						0.312		P-20-5
						0.375		P-20-6
						0.500		P-20-8
0.1890 to 0.2500	0.406	0.421	0.416	0.4078	0.4075	0.500	0.031	P-20-12
						0.750		P-20-16
						1.000		P-26-4
						1.375		P-26-5
						1.750		P-26-6
						1.750		P-26-8
0.2570 to 0.3125	0.500	0.520	0.515	0.5017	0.5014	0.312	0.047	P-26-12
						0.375		P-26-16
						0.500		P-32-5
						0.750		P-32-6
						1.000		P-32-8
						1.375		P-32-12
1.750	P-32-16							
								P-32-22
								P-32-28



C.9 Woodruff Keys

Keys and Keyseats



Plain and Gib Head Taper Keys Have a 1/8" Taper in 12"

TABLE C.9.1 Key Dimensions and Tolerances

KEY	NOMINAL KEY SIZE	TOLERANCE							
		Width, W		Width, W	Height, H				
		Over	To (Incl)						
Parallel	Square	---	$\frac{3}{4}$	+0.000	-0.002	+0.000	-0.002		
		Bar Stock	$\frac{1}{2}$ to $\frac{1}{4}$ W	$1\frac{1}{2}$	+0.000	-0.003	+0.000	-0.003	
		---	$2\frac{1}{2}$	+0.000	-0.004	+0.000	-0.004		
		---	$3\frac{1}{2}$	+0.000	-0.006	+0.000	-0.006		
		Keystock	$1\frac{1}{4}$ to 3	$1\frac{1}{4}$	+0.001	-0.000	+0.001	-0.000	
	Rectangular	---	$3\frac{1}{2}$	+0.003	-0.000	+0.003	-0.000		
		Bar Stock	---	$\frac{1}{2}$ to $\frac{1}{4}$ W	$1\frac{1}{2}$	+0.000	-0.003	+0.000	-0.003
		---	$1\frac{1}{2}$	+0.000	-0.004	+0.000	-0.004		
		---	3	+0.000	-0.005	+0.000	-0.005		
		---	3	+0.000	-0.006	+0.000	-0.006		
Taper	Plain or Gib Head Square or Rectangular	---	4	+0.000	-0.008	+0.000	-0.008		
		---	6	+0.000	-0.013	+0.000	-0.013		
		Keystock	---	$1\frac{1}{4}$	+0.001	-0.000	+0.005	-0.005	
		---	$1\frac{1}{4}$ to 3	$1\frac{1}{4}$	+0.002	-0.000	+0.005	-0.005	
		---	3	+0.003	-0.000	+0.005	-0.005		
		---	7	+0.003	-0.000	+0.005	-0.000		

*For locating position of dimension H. Tolerance does not apply. All dimensions given in inches.

TABLE C.9.2 Depth Control Values (Three Values for S and T)

Nominal Shaft Diameter	Parallel and Taper		Parallel		Taper	
	Square	Rectangular	Square	Rectangular	Square	Rectangular
	S	S	T	T	T	T
1/16	0.430	0.445	0.560	0.544	0.535	0.519
	0.493	0.509	0.623	0.607	0.598	0.582
	0.517	0.548	0.709	0.678	0.684	0.653
	0.581	0.612	0.773	0.742	0.748	0.717
	0.644	0.676	0.837	0.806	0.812	0.781
1/8	0.708	0.739	0.900	0.869	0.875	0.844
	0.771	0.802	0.964	0.932	0.939	0.907
	0.796	0.827	1.051	1.019	1.026	0.994
	0.859	0.890	1.114	1.083	1.089	1.058
	0.923	0.954	1.178	1.146	1.153	1.121
1/4	0.986	1.017	1.241	1.210	1.216	1.185
	1.049	1.080	1.304	1.273	1.279	1.248
	1.112	1.144	1.367	1.336	1.342	1.311
	1.137	1.169	1.455	1.424	1.430	1.399
	1.201	1.232	1.518	1.487	1.493	1.462
3/8	1.225	1.288	1.605	1.543	1.580	1.518
	1.289	1.351	1.669	1.606	1.644	1.581
	1.352	1.415	1.732	1.670	1.707	1.645
	1.416	1.478	1.796	1.733	1.771	1.708
	1.479	1.541	1.859	1.796	1.834	1.771
1/2	1.542	1.605	1.922	1.860	1.897	1.835
	1.527	1.590	2.032	1.970	2.007	1.945
	1.591	1.654	2.096	2.034	2.071	2.009
	1.655	1.717	2.160	2.097	2.135	2.072
	1.718	1.781	2.223	2.161	2.198	2.136
5/8	1.782	1.844	2.287	2.224	2.262	2.199
	1.845	1.908	2.350	2.288	2.325	2.263
	1.909	1.971	2.414	2.351	2.389	2.326
	1.972	2.034	2.477	2.414	2.452	2.389
	1.957	2.051	2.587	2.493	2.562	2.468
3/4	2.021	2.114	2.651	2.557	2.626	2.532
	2.084	2.178	2.714	2.621	2.689	2.596
	2.148	2.242	2.778	2.684	2.753	2.659
	2.211	2.305	2.841	2.748	2.816	2.723
	2.275	2.369	2.905	2.811	2.880	2.786
7/8	2.338	2.432	2.968	2.874	2.943	2.849
	2.402	2.495	3.032	2.938	3.007	2.913
	2.387	2.512	3.142	3.017	3.117	2.992
	2.450	2.575	3.205	3.080	3.180	3.055
	2.514	2.639	3.269	3.144	3.244	3.119
1	2.577	2.702	3.332	3.207	3.307	3.182
	2.641	2.766	3.396	3.271	3.371	3.246
	2.704	2.829	3.459	3.334	3.434	3.309

All dimensions given in inches.

Woodruff Keys and Keysets

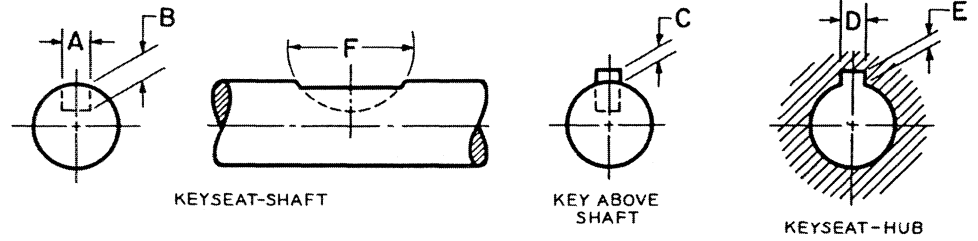


TABLE C.9.3 Keyseat Dimensions

Key No.	Nominal Size Key	Keyseat—Shaft					Key Above Shaft	Keyseat—Hub	
		Width A		Depth B	Diameter F		Height C	Width D	Depth E
		Min	Max	+0.005 -0.000	Min	Max	+0.005 -0.005	+0.002 -0.000	+0.005 -0.000
202	$\frac{1}{16} \times \frac{1}{4}$	0.0615	0.0630	0.0728	0.250	0.268	0.0312	0.0635	0.0372
202.5	$\frac{1}{16} \times \frac{5}{16}$	0.0615	0.0630	0.1038	0.312	0.330	0.0312	0.0635	0.0372
302.5	$\frac{3}{32} \times \frac{1}{8}$	0.0928	0.0943	0.0882	0.312	0.330	0.0469	0.0948	0.0529
203	$\frac{1}{16} \times \frac{3}{8}$	0.0615	0.0630	0.1358	0.375	0.393	0.0312	0.0635	0.0372
303	$\frac{3}{32} \times \frac{3}{8}$	0.0928	0.0943	0.1202	0.375	0.393	0.0469	0.0948	0.0529
403	$\frac{1}{8} \times \frac{1}{8}$	0.1240	0.1255	0.1045	0.375	0.393	0.0625	0.1260	0.0685
204	$\frac{1}{16} \times \frac{1}{2}$	0.0615	0.0630	0.1668	0.500	0.518	0.0312	0.0635	0.0372
304	$\frac{3}{32} \times \frac{1}{2}$	0.0928	0.0943	0.1511	0.500	0.518	0.0469	0.0948	0.0529
404	$\frac{1}{8} \times \frac{1}{2}$	0.1240	0.1255	0.1355	0.500	0.518	0.0625	0.1260	0.0685
305	$\frac{3}{32} \times \frac{3}{8}$	0.0928	0.0943	0.1981	0.625	0.643	0.0469	0.0948	0.0529
405	$\frac{1}{8} \times \frac{3}{8}$	0.1240	0.1255	0.1825	0.625	0.643	0.0625	0.1260	0.0685
505	$\frac{3}{16} \times \frac{3}{8}$	0.1553	0.1568	0.1669	0.625	0.643	0.0781	0.1573	0.0841
605	$\frac{3}{16} \times \frac{1}{2}$	0.1863	0.1880	0.1513	0.625	0.643	0.0937	0.1885	0.0997
406	$\frac{1}{8} \times \frac{1}{4}$	0.1240	0.1255	0.2455	0.750	0.768	0.0625	0.1260	0.0685
506	$\frac{3}{16} \times \frac{1}{4}$	0.1553	0.1568	0.2299	0.750	0.768	0.0781	0.1573	0.0841
606	$\frac{3}{16} \times \frac{3}{8}$	0.1863	0.1880	0.2143	0.750	0.768	0.0937	0.1885	0.0997
806	$\frac{1}{4} \times \frac{1}{4}$	0.2487	0.2505	0.1830	0.750	0.768	0.1250	0.2510	0.1310
507	$\frac{3}{16} \times \frac{7}{8}$	0.1553	0.1568	0.2919	0.875	0.895	0.0781	0.1573	0.0841
607	$\frac{3}{16} \times \frac{1}{8}$	0.1863	0.1880	0.2763	0.875	0.895	0.0937	0.1885	0.0997
707	$\frac{7}{32} \times \frac{7}{8}$	0.2175	0.2193	0.2607	0.875	0.895	0.1093	0.2198	0.1153
807	$\frac{1}{4} \times \frac{1}{8}$	0.2487	0.2505	0.2450	0.875	0.895	0.1250	0.2510	0.1310
608	$\frac{3}{16} \times 1$	0.1863	0.1880	0.3393	1.000	1.020	0.0937	0.1885	0.0997
708	$\frac{7}{32} \times 1$	0.2175	0.2193	0.3237	1.000	1.020	0.1093	0.2198	0.1153
808	$\frac{1}{4} \times 1$	0.2487	0.2505	0.3080	1.000	1.020	0.1250	0.2510	0.1310
1008	$\frac{11}{16} \times 1$	0.3111	0.3130	0.2768	1.000	1.020	0.1562	0.3135	0.1622
1208	$\frac{3}{8} \times 1$	0.3735	0.3755	0.2455	1.000	1.020	0.1875	0.3760	0.1935
609	$\frac{3}{16} \times \frac{1}{8}$	0.1863	0.1880	0.3853	1.125	1.145	0.0937	0.1885	0.0997
709	$\frac{7}{32} \times \frac{1}{8}$	0.2175	0.2193	0.3697	1.125	1.145	0.1093	0.2198	0.1153
809	$\frac{1}{4} \times \frac{1}{8}$	0.2487	0.2505	0.3540	1.125	1.145	0.1250	0.2510	0.1310
1009	$\frac{11}{16} \times \frac{1}{8}$	0.3111	0.3130	0.3228	1.125	1.145	0.1562	0.3135	0.1622

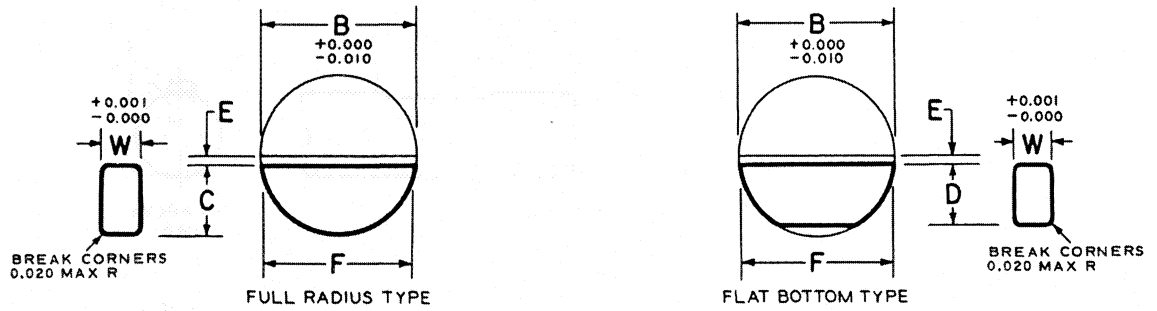


TABLE C.9.4 Woodruff Keys

Key No.	Nominal Key Size $W \times B$	Actual Length F $+0.000$ -0.010	Height of Key				Distance Below Center E
			C		D		
			Max	Min	Max	Min	
202	$\frac{1}{16} \times \frac{1}{4}$	0.248	0.109	0.104	0.109	0.104	$\frac{1}{64}$
202.5	$\frac{1}{16} \times \frac{5}{16}$	0.311	0.140	0.135	0.140	0.135	$\frac{1}{64}$
302.5	$\frac{3}{32} \times \frac{5}{16}$	0.311	0.140	0.135	0.140	0.135	$\frac{1}{64}$
203	$\frac{1}{16} \times \frac{3}{8}$	0.374	0.172	0.167	0.172	0.167	$\frac{1}{64}$
303	$\frac{3}{32} \times \frac{3}{8}$	0.374	0.172	0.167	0.172	0.167	$\frac{1}{64}$
403	$\frac{1}{8} \times \frac{3}{8}$	0.374	0.172	0.167	0.172	0.167	$\frac{1}{64}$
204	$\frac{1}{16} \times \frac{1}{2}$	0.491	0.203	0.198	0.194	0.188	$\frac{3}{64}$
304	$\frac{3}{32} \times \frac{1}{2}$	0.491	0.203	0.198	0.194	0.188	$\frac{3}{64}$
404	$\frac{1}{8} \times \frac{1}{2}$	0.491	0.203	0.198	0.194	0.188	$\frac{3}{64}$
305	$\frac{3}{32} \times \frac{5}{16}$	0.612	0.250	0.245	0.240	0.234	$\frac{1}{16}$
405	$\frac{1}{8} \times \frac{5}{16}$	0.612	0.250	0.245	0.240	0.234	$\frac{1}{16}$
505	$\frac{3}{16} \times \frac{5}{16}$	0.612	0.250	0.245	0.240	0.234	$\frac{1}{16}$
605	$\frac{3}{16} \times \frac{5}{8}$	0.612	0.250	0.245	0.240	0.234	$\frac{1}{16}$
406	$\frac{1}{8} \times \frac{3}{4}$	0.740	0.313	0.308	0.303	0.297	$\frac{1}{16}$
506	$\frac{5}{32} \times \frac{3}{4}$	0.740	0.313	0.308	0.303	0.297	$\frac{1}{16}$
606	$\frac{3}{16} \times \frac{3}{4}$	0.740	0.313	0.308	0.303	0.297	$\frac{1}{16}$
806	$\frac{1}{4} \times \frac{3}{4}$	0.740	0.313	0.308	0.303	0.297	$\frac{1}{16}$
507	$\frac{5}{32} \times \frac{7}{8}$	0.866	0.375	0.370	0.365	0.359	$\frac{1}{16}$
607	$\frac{3}{16} \times \frac{7}{8}$	0.866	0.375	0.370	0.365	0.359	$\frac{1}{16}$
707	$\frac{7}{32} \times \frac{7}{8}$	0.866	0.375	0.370	0.365	0.359	$\frac{1}{16}$
807	$\frac{1}{4} \times \frac{7}{8}$	0.866	0.375	0.370	0.365	0.359	$\frac{1}{16}$
608	$\frac{3}{16} \times 1$	0.992	0.438	0.433	0.428	0.422	$\frac{1}{16}$
708	$\frac{7}{32} \times 1$	0.992	0.438	0.433	0.428	0.422	$\frac{1}{16}$
808	$\frac{1}{4} \times 1$	0.992	0.438	0.433	0.428	0.422	$\frac{1}{16}$
1008	$\frac{5}{16} \times 1$	0.992	0.438	0.433	0.428	0.422	$\frac{1}{16}$
1208	$\frac{3}{8} \times 1$	0.992	0.438	0.433	0.428	0.422	$\frac{1}{16}$
609	$\frac{3}{16} \times 1\frac{1}{8}$	1.114	0.484	0.479	0.475	0.469	$\frac{5}{64}$
709	$\frac{7}{32} \times 1\frac{1}{8}$	1.114	0.484	0.479	0.475	0.469	$\frac{5}{64}$
809	$\frac{1}{4} \times 1\frac{1}{8}$	1.114	0.484	0.479	0.475	0.469	$\frac{5}{64}$
1009	$\frac{5}{16} \times 1\frac{1}{8}$	1.114	0.484	0.479	0.475	0.469	$\frac{5}{64}$

C.10 Standard Sheet Metal Gages

Gage	Thickness		Weight per Sq Ft		Gage
10	.1406 in.	3.571 mm	5.625 lb	2.551 kg	10
11	.1250 in.	3.175 mm	5.000 lb	2.267 kg	11
12	.1094 in.	2.778 mm	4.375 lb	1.984 kg	12
13	.0938 in.	2.383 mm	3.750 lb	1.700 kg	13
14	.0781 in.	1.983 mm	3.125 lb	1.417 kg	14
15	.0703 in.	1.786 mm	2.813 lb	1.276 kg	15
16	.0625 in.	1.588 mm	2.510 lb	1.134 kg	16
17	.0563 in.	1.430 mm	2.250 lb	1.021 kg	17
18	.0500 in.	1.270 mm	2.000 lb	0.907 kg	18
19	.0438 in.	1.111 mm	1.750 lb	0.794 kg	19
20	.0375 in.	0.953 mm	1.500 lb	0.680 kg	20
21	.0344 in.	0.877 mm	1.375 lb	0.624 kg	21
22	.0313 in.	0.795 mm	1.250 lb	0.567 kg	22
23	.0280 in.	0.714 mm	1.125 lb	0.510 kg	23
24	.0250 in.	0.635 mm	1.000 lb	0.454 kg	24
25	.0219 in.	0.556 mm	0.875 lb	0.397 kg	25
26	.0188 in.	0.478 mm	0.750 lb	0.340 kg	26
27	.0172 in.	0.437 mm	0.687 lb	0.312 kg	27
28	.0156 in.	0.396 mm	0.625 lb	0.283 kg	28
29	.0141 in.	0.358 mm	0.563 lb	0.255 kg	29
30	.0120 in.	0.318 mm	0.500 lb	0.227 kg	30

C.11 Structural Shapes and Sizes

Structural Steel Shapes

Structural steel shapes are manufactured in a wide variety of shapes, sizes and weights per linear foot. Steel mills roll these sections in six basic steel materials. The following are most common materials.

American standard beams (S) Generally called I-beams because of their resemblance to that capital letter. Used as columns and struts.

American standard channels (C) Used as struts and in trusses when light loadings are required. They are often found in steel platforming load-bearing members.

Wide-flange shapes (W) Used as both beams and columns and furnished with constant-thickness flanges.

Miscellaneous shapes (M) Similar in shape to W shapes.

Structural tees (WT, MT, and ST) Made by splitting S, W, and M shapes, usually at mid-distance of their webs. Most

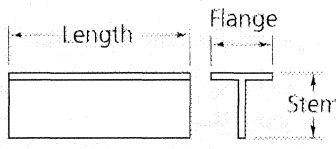
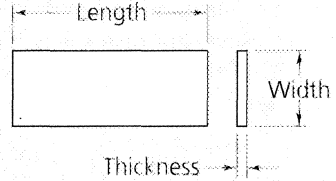
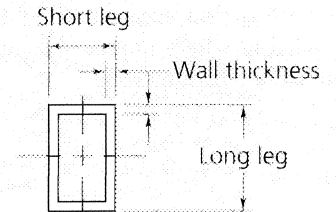
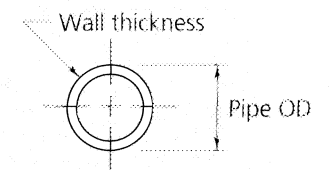
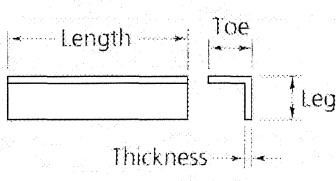
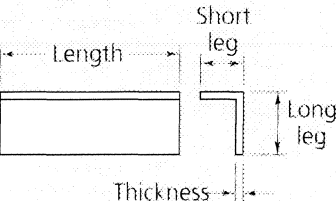
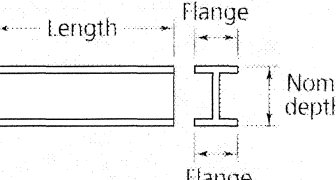
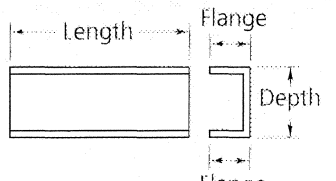
structural steel fabricators order S, W, and M shapes and cut the webs themselves to form tees.

Angels (L) Used for struts, platforms, to add framing strength and for many other items. They have two legs set at right angles to each other. These legs may be equal or unequal widths.

Flat bars (Bar) Have a rectangular cross section, and are rolled in many widths and thicknesses, but widths are normally limited to 6" or 8" depending on the thickness. If wider bars are needed, a sheet of plate is cut to form it.

Plate (PL or PL) Rectangular in cross section and comes in varied widths and thicknesses, but in larger pieces than bars. Plate widths start at 10" and are rolled up to 200" wide depending on thickness. Lengths are as long as shipping will allow.

Common Structural Steel Shapes Used on Pipe Supports

Type of Component	Graphic Representation
<p>Tees</p> <p>WT 4 X 6.5 X 3'-9" LG</p> <p>Member length Weight per foot in pounds Nominal depth in inches W tee symbol</p>	
<p>Plate</p> <p>PL 1/2 X 6 X 14"</p> <p>Member length Width in inches Thickness in inches Plate symbol</p>	
<p>Rectangular structural tubing</p> <p>TS 6 X 4 X .375 X 3'-9" LG</p> <p>Member length Wall thickness Short leg in inches Long leg in inches Structural tubing symbol</p>	
<p>Pipe</p> <p>Pipe 6 Std. X 3'-6" LG Pipe 6 Sch. 40 X 3'-9" LG</p> <p>Member length Wall thickness index Nominal pipe diameter in inches</p>	
<p>Equal leg angle</p> <p>L 3 X 3 X 3/8 X 3'-9" LG</p> <p>Member length Thickness in inches Leg width in inches Leg width in inches Angle symbol</p>	
<p>Unequal leg angle</p> <p>L 6 X 4 X 3/8 X 3'-9" LG</p> <p>Member length Thickness in inches Short leg in inches Long leg in inches Angle symbol</p>	
<p>Wide flange beam</p> <p>W 6 X 20 X 3'-9" LG</p> <p>Member length Weight per foot in pounds Nominal depth in inches Wide flange symbol</p>	
<p>Standard channels</p> <p>C 4 X 5.4 X 3'-9" LG</p> <p>Member length Weight per foot in pounds Depth in inches Channel symbol</p>	

C.12 Fits and Tolerances

The types of fits may be described briefly as follows:

RC 1 Close sliding fits are intended for the accurate location of parts that must assemble without perceptible play.

RC 2 Sliding fits are intended for accurate location but with greater maximum clearance than class RC 1. Parts made to this fit move and turn easily but are not intended to run freely, and in the larger sizes may seize with small temperature changes.

RC 3 Precision running fits are about the closest fits that can be expected to run freely. They are intended for precision work at slow speeds and light journal pressures, but are not suitable where appreciable temperature differences are likely to be encountered.

RC 4 Close running fits are intended chiefly for running fits on accurate machinery with moderate surface speeds and journal pressures, where accurate location and minimum play is desired.

RC 5 and RC 6 Medium running fits are intended for higher running speeds or heavy journal pressures or both.

RC 7 Free running fits are intended for use where accuracy is not essential or where large temperature variations are likely to be encountered or under both of these conditions.

RC 8 and RC 9 Loose running fits are intended for use where wide commercial tolerances may be necessary, together with an allowance, on the external member.

TABLE C.12.1 Running and Sliding Fits

Nominal Size Range, Inches		Class RC 1			Class RC 2			Class RC 3			Class RC 4		
		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits	
			Hole H5	Shaft g4		Hole H6	Shaft g5		Hole H7	Shaft f6		Hole H8	Shaft f7
Over	To												
0	- 0.12	0.1	+0.2	- 0.1	0.1	+ 0.25	- 0.1	0.3	+ 0.4	- 0.3	0.3	+ 0.6	- 0.3
		0.45	0	- 0.25	0.55	0	- 0.3	0.95	0	- 0.55	1.3	0	- 0.7
0.12	- 0.24	0.15	+0.2	- 0.15	0.15	+ 0.3	- 0.15	0.4	+ 0.5	- 0.4	0.4	+ 0.7	- 0.4
		0.5	0	- 0.3	0.65	0	- 0.35	1.12	0	- 0.7	1.6	0	- 0.9
0.24	- 0.40	0.2	+0.25	- 0.2	0.2	+ 0.4	- 0.2	0.5	+ 0.6	- 0.5	0.5	+ 0.9	- 0.5
		0.6	0	- 0.35	0.85	0	- 0.45	1.5	0	- 0.9	2.0	0	- 1.1
0.40	- 0.71	0.25	+0.3	- 0.25	0.25	+ 0.4	- 0.25	0.6	+ 0.7	- 0.6	0.6	+ 1.0	- 0.6
		0.75	0	- 0.45	0.95	0	- 0.55	1.7	0	- 1.0	2.3	0	- 1.3
0.71	- 1.19	0.3	+0.4	- 0.3	0.3	+ 0.5	- 0.3	0.8	+ 0.8	- 0.8	0.8	+ 1.2	- 0.8
		0.95	0	- 0.55	1.2	0	- 0.7	2.1	0	- 1.3	2.8	0	- 1.6
1.19	- 1.97	0.4	+0.4	- 0.4	0.4	+ 0.6	- 0.4	1.0	+ 1.0	- 1.0	1.0	+ 1.6	- 1.0
		1.1	0	- 0.7	1.4	0	- 0.8	2.6	0	- 1.6	3.6	0	- 2.0
1.97	- 3.15	0.4	+0.5	- 0.4	0.4	+ 0.7	- 0.4	1.2	+ 1.2	- 1.2	1.2	+ 1.8	- 1.2
		1.2	0	- 0.7	1.6	0	- 0.9	3.1	0	- 1.9	4.2	0	- 2.4
3.15	- 4.73	0.5	+0.6	- 0.5	0.5	+ 0.9	- 0.5	1.4	+ 1.4	- 1.4	1.4	+ 2.2	- 1.4
		1.5	0	- 0.9	2.0	0	- 1.1	3.7	0	- 2.3	5.0	0	- 2.8
4.73	- 7.09	0.6	+0.7	- 0.6	0.6	+ 1.0	- 0.6	1.6	+ 1.6	- 1.6	1.6	+ 2.5	- 1.6
		1.8	0	- 1.1	2.3	0	- 1.3	4.2	0	- 2.6	5.7	0	- 3.2
7.09	- 9.85	0.6	+0.8	- 0.6	0.6	+ 1.2	- 0.6	2.0	+ 1.8	- 2.0	2.0	+ 2.8	- 2.0
		2.0	0	- 1.2	2.6	0	- 1.4	5.0	0	- 3.2	6.6	0	- 3.8
9.85	- 12.41	0.8	+0.9	- 0.8	0.8	+ 1.2	- 0.8	2.5	+ 2.0	- 2.5	2.5	+ 3.0	- 2.5
		2.3	0	- 1.4	2.9	0	- 1.7	5.7	0	- 3.7	7.5	0	- 4.5
12.41	- 15.75	1.0	+1.0	- 1.0	1.0	+ 1.4	- 1.0	3.0	+ 1.8	- 3.0	3.0	+ 3.5	- 3.0
		2.7	0	- 1.7	3.4	0	- 2.0	6.6	0	- 4.4	8.7	0	- 5.2
15.75	- 19.69	1.2	+1.0	- 1.2	1.2	+ 1.6	- 1.2	4.0	+ 1.6	- 4.0	4.0	+ 4.0	- 4.0
		3.0	0	- 2.0	3.8	0	- 2.2	8.1	0	- 5.6	10.5	0	- 6.5
19.69	- 30.09	1.6	+1.2	- 1.6	1.6	+ 2.0	- 1.6	5.0	+ 3.0	- 5.0	5.0	+ 5.0	- 5.0
		3.7	0	- 2.5	4.8	0	- 2.8	10.0	0	- 7.0	13.0	0	- 8.0
30.09	- 41.49	2.0	+1.6	- 2.0	2.0	+ 2.5	- 2.0	6.0	+ 4.0	- 6.0	6.0	+ 6.0	- 6.0
		4.6	0	- 3.0	6.1	0	- 3.6	12.5	0	- 8.5	16.0	0	- 10.0
41.49	- 56.19	2.5	+2.0	- 2.5	2.5	+ 3.0	- 2.5	8.0	+ 5.0	- 8.0	8.0	+ 8.0	- 8.0
		5.7	0	- 3.7	7.5	0	- 4.5	16.0	0	- 11.0	21.0	0	- 13.0
56.19	- 76.39	3.0	+2.5	- 3.0	3.0	+ 4.0	- 3.0	10.0	+ 6.0	- 10.0	10.0	+ 10.0	- 10.0
		7.1	0	- 4.6	9.5	0	- 5.5	20.0	0	- 14.0	26.0	0	- 16.0
76.39	- 100.9	4.0	+3.0	- 4.0	4.0	+ 5.0	- 4.0	12.0	+ 8.0	- 12.0	12.0	+ 12.0	- 12.0
		9.0	0	- 6.0	12.0	0	- 7.0	25.0	0	- 17.0	32.0	0	- 20.0
100.9	- 131.9	5.0	+4.0	- 5.0	5.0	+ 6.0	- 5.0	16.0	+ 10.0	- 16.0	16.0	+ 16.0	- 16.0
		11.5	0	- 7.5	15.0	0	- 9.0	32.0	0	- 22.0	36.0	0	- 26.0
131.9	- 171.9	6.0	+5.0	- 6.0	6.0	+ 8.0	- 6.0	18.0	+ 8.0	- 18.0	18.0	+ 20.0	- 18.0
		14.0	0	- 9.0	19.0	0	- 11.0	38.0	0	- 26.0	50.0	0	- 30.0
171.9	- 200	8.0	+6.0	- 8.0	8.0	+ 10.0	- 8.0	22.0	+ 16.0	- 22.0	22.0	+ 25.0	- 22.0
		18.0	0	- 12.0	22.0	0	- 12.0	48.0	0	- 32.0	63.0	0	- 38.0

Limits are in thousandths of an inch. Limits for hole and shaft are applied algebraically to the basic size to obtain the limits of size for the parts. Symbols H5, g5, etc. are hole and shaft designations in the ABC System.

Continues

TABLE C.12.1 Running and Sliding Fits—Continued

Limits of Clearance	Class RC 5		Class RC 6		Class RC 7		Class RC 8		Class RC 9		Nominal Size Range, Inches					
	Standard Limits		Standard Limits		Standard Limits		Standard Limits		Standard Limits							
	Hole H8	Shaft e7	Hole H9	Shaft e8	Hole H9	Shaft d8	Hole H10	Shaft c9	Hole H11	Shaft	Over	To				
0.6	+ 0.6	- 0.6	0.6	+ 1.0	- 0.6	1.0	+ 1.0	- 1.0	2.5	+ 1.6	- 2.5	4.0	+ 2.5	- 4.0		
1.6	- 0	- 1.0	2.2	- 0	- 1.2	2.6	0	- 1.6	5.1	0	- 3.5	8.1	0	- 5.6	0	- 0.12
0.8	+ 0.7	- 0.8	0.8	+ 1.2	- 0.8	1.2	+ 1.2	- 1.2	2.8	+ 1.8	- 2.8	4.5	+ 3.0	- 4.5	0.12	- 0.24
2.0	- 0	- 1.3	2.7	- 0	- 1.5	3.1	0	- 1.9	5.8	0	- 4.0	9.0	0	- 6.0		
1.0	+ 0.9	- 1.0	1.0	+ 1.4	- 1.0	1.6	+ 1.4	- 1.6	3.0	+ 2.2	- 3.0	5.0	+ 3.5	- 5.0	0.24	- 0.40
2.5	- 0	- 1.6	3.3	- 0	- 1.9	3.9	0	- 2.5	6.6	0	- 4.4	10.7	0	- 7.2		
1.2	+ 1.0	- 1.2	1.2	+ 1.6	- 1.2	2.0	+ 1.6	- 2.0	3.5	+ 2.8	- 3.5	6.0	+ 4.0	- 6.0	0.40	- 0.71
2.9	- 0	- 1.9	3.8	- 0	- 2.2	4.6	0	- 3.0	7.9	0	- 5.1	12.8	0	- 8.8		
1.6	+ 1.2	- 1.6	1.6	+ 2.0	- 1.6	2.5	+ 2.0	- 2.5	4.5	+ 3.5	- 4.5	7.0	+ 5.0	- 7.0	0.71	- 1.19
3.6	- 0	- 2.4	4.8	- 0	- 2.8	5.7	0	- 3.7	10.0	0	- 6.5	15.5	0	- 10.5		
2.0	+ 1.6	- 2.0	2.0	+ 2.5	- 2.0	3.0	+ 2.5	- 3.0	5.0	+ 4.0	- 5.0	8.0	+ 6.0	- 8.0	1.19	- 1.97
4.6	- 0	- 3.0	6.1	- 0	- 3.6	7.1	0	- 4.6	11.5	0	- 7.5	18.0	0	- 12.0		
2.5	+ 1.8	- 2.5	2.5	+ 3.0	- 2.5	4.0	+ 3.0	- 4.0	6.0	+ 4.5	- 6.0	9.0	+ 7.0	- 9.0	1.97	- 3.15
5.5	- 0	- 3.7	7.3	- 0	- 4.3	8.8	0	- 5.8	13.5	0	- 9.0	20.5	0	- 13.5		
3.0	+ 2.2	- 3.0	3.0	+ 3.5	- 3.0	5.0	+ 3.5	- 5.0	7.0	+ 5.0	- 7.0	10.0	+ 9.0	- 10.0	3.15	- 4.73
6.6	- 0	- 4.4	8.7	- 0	- 5.2	10.7	0	- 7.2	15.5	0	- 10.5	24.0	0	- 15.0		
3.5	+ 2.5	- 3.5	3.5	+ 4.0	- 3.5	6.0	+ 4.0	- 6.0	8.0	+ 6.0	- 8.0	12.0	+ 10.0	- 12.0	4.73	- 7.09
7.6	- 0	- 5.1	10.0	- 0	- 6.0	12.5	0	- 8.5	18.0	0	- 12.0	28.0	0	- 18.0		
4.0	+ 2.8	- 4.0	4.0	+ 4.5	- 4.0	7.0	+ 4.5	- 7.0	10.0	+ 7.0	- 10.0	15.0	+ 12.0	- 15.0	7.09	- 9.85
8.6	- 0	- 5.8	11.3	0	- 6.8	14.3	0	- 9.8	21.5	0	- 14.5	34.0	0	- 22.0		
5.0	+ 3.0	- 5.0	5.0	+ 5.0	- 5.0	8.0	+ 5.0	- 8.0	12.0	+ 8.0	- 12.0	18.0	+ 12.0	- 18.0	9.85	- 12.41
10.0	0	- 7.0	13.0	0	- 8.0	16.0	0	- 11.0	25.0	0	- 17.0	38.0	0	- 26.0		
6.0	+ 3.5	- 6.0	6.0	+ 6.0	- 6.0	10.0	+ 6.0	- 10.0	14.0	+ 9.0	- 14.0	22.0	+ 14.0	- 22.0	12.41	- 15.75
11.7	0	- 8.2	15.5	0	- 9.5	19.5	0	- 13.5	29.0	0	- 20.0	45.0	0	- 31.0		
8.0	+ 4.0	- 8.0	8.0	+ 6.0	- 8.0	12.0	+ 6.0	- 12.0	16.0	+ 10.0	- 16.0	25.0	+ 16.0	- 25.0	15.75	- 19.69
14.5	0	- 10.5	18.0	0	- 12.0	22.0	0	- 16.0	32.0	0	- 22.0	51.0	0	- 35.0		
10.0	+ 5.0	- 10.0	10.0	+ 8.0	- 10.0	16.0	+ 8.0	- 16.0	20.0	+ 12.0	- 20.0	30.0	+ 20.0	- 30.0	19.69	- 30.09
18.0	0	- 13.0	23.0	0	- 15.0	29.0	0	- 21.0	40.0	0	- 28.0	62.0	0	- 42.0		
12.0	+ 6.0	- 12.0	12.0	+ 10.0	- 12.0	20.0	+ 10.0	- 20.0	25.0	+ 16.0	- 25.0	40.0	+ 25.0	- 40.0	30.09	- 41.49
22.0	0	- 16.0	28.0	0	- 18.0	36.0	0	- 26.0	51.0	0	- 35.0	81.0	0	- 56.0		
16.0	+ 8.0	- 16.0	16.0	+ 12.0	- 16.0	25.0	+ 12.0	- 25.0	30.0	+ 20.0	- 30.0	50.0	+ 30.0	- 50.0	41.49	- 56.19
29.0	0	- 21.0	36.0	0	- 24.0	45.0	0	- 33.0	62.0	0	- 42.0	100	0	- 70.0		
20.0	+ 10.0	- 20.0	20.0	+ 16.0	- 20.0	30.0	+ 16.0	- 30.0	40.0	+ 25.0	- 40.0	60.0	+ 40.0	- 60.0	56.19	- 76.39
36.0	0	- 26.0	46.0	0	- 30.0	56.0	0	- 40.0	81.0	0	- 56.0	125	0	- 85.0		
25.0	+ 12.0	- 25.0	25.0	+ 20.0	- 25.0	40.0	+ 20.0	- 40.0	50.0	+ 30.0	- 50.0	80.0	+ 50.0	- 80.0	76.39	- 100.9
45.0	0	- 33.0	57.0	0	- 37.0	72.0	0	- 52.0	100	0	- 70.0	160	0	- 110		
30.0	+ 16.0	- 30.0	30.0	+ 25.0	- 30.0	50.0	+ 25.0	- 50.0	60.0	+ 40.0	- 60.0	100	+ 60.0	- 100	100.9	- 131.9
56.0	0	- 40.0	71.0	0	- 46.0	91.0	0	- 66.0	125	0	- 85.0	200	0	- 140		
35.0	+ 20.0	- 35.0	35.0	+ 30.0	- 35.0	60.0	+ 30.0	- 60.0	80.0	+ 50.0	- 80.0	130	+ 80.0	- 130	131.9	- 171.9
67.0	0	- 47.0	85.0	0	- 55.0	110.0	0	- 80.0	160	0	- 110	260	0	- 180		
45.0	+ 25.0	- 45.0	45.0	+ 40.0	- 45.0	80.0	+ 40.0	- 80.0	100	+ 60.0	- 100	150	+ 100	- 150	171.9	- 200
86.0	0	- 61.0	110.0	0	- 70.0	145.0	0	- 105.0	200	0	- 140	310	0	- 210		

TABLE C.12.2 Locational Clearance Fits

Nominal Size Range, Inches		Class LC 1			Class LC 2			Class LC 3			Class LC 4			Class LC 5		
		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits	
Over	To		Hole H6	Shaft h5		Hole H7	Shaft h6		Hole H8	Shaft h7		Hole H10	Shaft h9		Hole H7	Shaft g6
0	0.12	0	+0.25	+0	0	+0.4	+0	0	+0.6	+0	0	+1.6	+0	0.1	+0.4	-0.1
		0.45	-0	-0.2	0.65	-0	-0.25	1	-0	-0.4	2.6	-0	-1.0	0.75	-0	-0.35
0.12	0.24	0	+0.3	+0	0	+0.5	+0	0	+0.7	+0	0	+1.8	+0	0.15	+0.5	-0.15
		0.5	-0	-0.2	0.8	-0	-0.3	1.2	-0	-0.5	3.0	-0	-1.2	0.95	-0	-0.45
0.24	0.40	0	+0.4	+0	0	+0.6	+0	0	+0.9	+0	0	+2.2	+0	0.2	+0.6	-0.2
		0.65	-0	-0.25	1.0	-0	-0.4	1.5	-0	-0.6	3.6	-0	-1.4	1.2	-0	-0.6
0.40	0.71	0	+0.4	+0	0	+0.7	+0	0	+1.0	+0	0	+2.8	+0	0.25	+0.7	-0.25
		0.7	-0	-0.3	1.1	-0	-0.4	1.7	-0	-0.7	4.4	-0	-1.6	1.35	-0	-0.65
0.71	1.19	0	+0.5	+0	0	+0.8	+0	0	+1.2	+0	0	+3.5	+0	0.3	+0.8	-0.3
		0.9	-0	-0.4	1.3	-0	-0.5	2	-0	-0.8	5.5	-0	-2.0	1.6	-0	-0.8
1.19	1.97	0	+0.6	+0	0	+1.0	+0	0	+1.6	+0	0	+4.0	+0	0.4	+1.0	-0.4
		1.0	-0	-0.4	1.6	-0	-0.6	2.6	-0	-1	6.5	-0	-2.5	2.0	-0	-1.0
1.97	3.15	0	+0.7	+0	0	+1.2	+0	0	+1.8	+0	0	+4.5	+0	0.4	+1.2	-0.4
		1.2	-0	-0.5	1.9	-0	-0.7	3	-0	-1.2	7.5	-0	-3	2.3	-0	-1.1
3.15	4.73	0	+0.9	+0	0	+1.4	+0	0	+2.2	+0	0	+5.0	+0	0.5	+1.4	-0.5
		1.5	-0	-0.6	2.3	-0	-0.9	3.6	-0	-1.4	8.5	-0	-3.5	2.8	-0	-1.4
4.73	7.09	0	+1.0	+0	0	+1.6	+0	0	+2.5	+0	0	+6.0	+0	0.6	+1.6	-0.6
		1.7	-0	-0.7	2.6	-0	-1.0	4.1	-0	-1.6	10	-0	-4	3.2	-0	-1.6
7.09	9.85	0	+1.2	+0	0	+1.8	+0	0	+2.8	+0	0	+7.0	+0	0.6	+1.8	-0.6
		2.0	-0	-0.8	3.0	-0	-1.2	4.6	-0	-1.8	11.5	-0	-4.5	3.6	-0	-1.8
9.85	12.41	0	+1.2	+0	0	+2.0	+0	0	+3.0	+0	0	+8.0	+0	0.7	+2.0	-0.7
		2.1	-0	-0.9	3.2	-0	-1.2	5	-0	-2.0	13	-0	-5	3.9	-0	-1.9
12.41	15.75	0	+1.4	+0	0	+2.2	+0	0	+3.5	+0	0	+9.0	+0	0.7	+2.2	-0.7
		2.4	-0	-1.0	3.6	-0	-1.4	5.7	-0	-2.2	15	-0	-6	4.3	-0	-2.1
15.75	19.69	0	+1.6	+0	0	+2.5	+0	0	+4	+0	0	+10.0	+0	0.8	+2.5	-0.8
		2.6	-0	-1.0	4.1	-0	-1.6	6.5	-0	-2.5	16	-0	-6	4.9	-0	-2.4
19.69	30.09	0	+2.0	+0	0	+3	+0	0	+5	+0	0	+12.0	+0	0.9	+3.0	-0.9
		3.2	-0	-1.2	5.0	-0	-2	8	-0	-3	20	-0	-8	5.9	-0	-2.9
30.09	41.49	0	+2.5	+0	0	+4	+0	0	+6	+0	0	+16.0	+0	1.0	+4.0	-1.0
		4.1	-0	-1.6	6.5	-0	-2.5	10	-0	-4	26	-0	-10	7.5	-0	-3.5
41.49	56.19	0	+3.0	+0	0	+5	+0	0	+8	+0	0	+20.0	+0	1.2	+5.0	-1.2
		5.0	-0	-2.0	8.0	-0	-3	13	-0	-5	32	-0	-12	9.2	-0	-4.2
56.19	76.39	0	+4.0	+0	0	+6	+0	0	+10	+0	0	+25.0	+0	1.2	+6.0	-1.2
		6.5	-0	-2.5	10	-0	-4	16	-0	-6	41	-0	-16	11.2	-0	-5.2
76.39	100.9	0	+5.0	+0	0	+8	+0	0	+12	+0	0	+30.0	+0	1.4	+8.0	-1.4
		8.0	-0	-3.0	13	-0	-5	20	-0	-8	50	-0	-20	14.4	-0	-6.4
100.9	131.9	0	+6.0	+0	0	+10	+0	0	+16	+0	0	+40.0	+0	1.6	+10.0	-1.6
		10.0	-0	-4.0	16	-0	-6	26	-0	-10	65	-0	-25	17.6	-0	-7.6
131.9	171.9	0	+8.0	+0	0	+12	+0	0	+20	+0	0	+50.0	+0	1.8	+12.0	-1.8
		13.0	-0	-5.0	20	-0	-8	32	-0	-12	8	-0	-30	21.8	-0	-9.8
171.9	200	0	+10.0	+0	0	+16	+0	0	+25	+0	0	+60.0	+0	1.8	+16.0	-1.8
		16.0	-0	-6.0	26	-0	-10	41	-0	-16	100	-0	-40	27.8	-0	-11.8

Limits are in thousandths of an inch. Limits for hole and shaft are applied algebraically to the basic size to obtain the limits of size for the parts. Symbols H6, h5, etc. are hole and shaft designations in the ABC System.

Continues

TABLE C.12.2 Locational Clearance Fits—Continued

Class LC 6			Class LC 7			Class LC 8			Class LC 9			Class LC 10			Class LC 11			Nominal Size Range, Inches	
Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits		Limits of Clearance	Standard Limits			
	Hole H9	Shaft f8		Hole H10	Shaft e9		Hole H10	Shaft d9		Hole H11	Shaft c10		Hole H12	Shaft		Hole H13	Shaft		
																Over	To		
0.3	+ 1.0	- 0.3	0.6	+ 1.6	- 0.6	1.0	+ 1.6	- 1.0	2.5	+ 2.5	- 2.5	4	+ 4	- 4	5	+ 6	- 5	0	0.12
1.9	0	- 0.9	3.2	0	- 1.6	3.6	- 0	- 2.0	6.6	- 0	- 4.1	12	- 0	- 8	17	- 0	- 11		
0.4	+ 1.2	- 0.4	0.8	+ 1.8	- 0.8	1.2	+ 1.8	- 1.2	2.8	+ 3.0	- 2.8	4.5	+ 5	- 4.5	6	+ 7	- 6	0.12	0.24
2.3	0	- 1.1	3.8	0	- 2.0	4.2	- 0	- 2.4	7.6	- 0	- 4.6	14.5	- 0	- 9.5	20	- 0	- 13		
0.5	+ 1.4	- 0.5	1.0	+ 2.2	- 1.0	1.6	+ 2.2	- 1.6	3.0	+ 3.5	- 3.0	5	+ 6	- 5	7	+ 9	- 7	0.24	0.40
2.8	0	- 1.4	4.6	0	- 2.4	5.2	- 0	- 3.0	8.7	- 0	- 5.2	17	- 0	- 11	25	- 0	- 16		
0.6	+ 1.6	- 0.6	1.2	+ 2.8	- 1.2	2.0	+ 2.8	- 2.0	3.5	+ 4.0	- 3.5	6	+ 7	- 6	8	+ 10	- 8	0.40	0.71
3.2	0	- 1.6	5.6	0	- 2.8	6.4	- 0	- 3.6	10.3	- 0	- 6.3	20	- 0	- 13	28	- 0	- 18		
0.8	+ 2.0	- 0.8	1.6	+ 3.5	- 1.6	2.5	+ 3.5	- 2.5	4.5	+ 5.0	- 4.5	7	+ 8	- 7	10	+ 12	- 10	0.71	1.19
4.0	0	- 2.0	7.1	0	- 3.6	8.0	- 0	- 4.5	13.0	- 0	- 8.0	23	- 0	- 15	34	- 0	- 22		
1.0	+ 2.5	- 1.0	2.0	+ 4.0	- 2.0	3.0	+ 4.0	- 3.0	5	+ 6	- 5	8	+ 10	- 8	12	+ 16	- 12	1.19	1.97
5.1	0	- 2.6	8.5	0	- 4.5	9.5	- 0	- 5.5	15	- 0	- 9	28	- 0	- 18	44	- 0	- 28		
1.2	+ 3.0	- 1.2	2.5	+ 4.5	- 2.5	4.0	+ 4.5	- 4.0	6	+ 7	- 6	10	+ 12	- 10	14	+ 18	- 14	1.97	3.15
6.0	0	- 3.0	10.0	0	- 5.5	11.5	- 0	- 7.0	17.5	- 0	- 10.5	34	- 0	- 22	50	- 0	- 32		
1.4	+ 3.5	- 1.4	3.0	+ 5.0	- 3.0	5.0	+ 5.0	- 5.0	7	+ 9	- 7	11	+ 14	- 11	16	+ 22	- 16	3.15	4.73
7.1	0	- 3.6	11.5	0	- 6.5	13.5	- 0	- 8.5	21	- 0	- 12	39	- 0	- 25	60	- 0	- 38		
1.6	+ 4.0	- 1.6	3.5	+ 6.0	- 3.5	6	+ 6	- 6	8	+ 10	- 8	12	+ 16	- 12	18	+ 25	- 18	4.73	7.09
8.1	0	- 4.1	13.5	0	- 7.5	16	- 0	- 10	24	- 0	- 14	44	- 0	- 28	68	- 0	- 43		
2.0	+ 4.5	- 2.0	4.0	+ 7.0	- 4.0	7	+ 7	- 7	10	+ 12	- 10	16	+ 18	- 16	22	+ 28	- 22	7.09	9.85
9.3	0	- 4.8	15.5	0	- 8.5	18.5	- 0	- 11.5	29	- 0	- 17	52	- 0	- 34	78	- 0	- 50		
2.2	+ 5.0	- 2.2	4.5	+ 8.0	- 4.5	7	+ 8	- 7	12	+ 12	- 12	20	+ 20	- 20	28	+ 30	- 28	9.85	12.41
10.2	0	- 5.2	17.5	0	- 9.5	20	- 0	- 12	32	- 0	- 20	60	- 0	- 40	88	- 0	- 58		
2.5	+ 6.0	- 2.5	5.0	+ 9.0	- 5	8	+ 9	- 8	14	+ 14	- 14	22	+ 22	- 22	30	+ 35	- 30	12.41	15.75
12.0	0	- 6.0	20.0	0	- 11	23	- 0	- 14	37	- 0	- 23	66	- 0	- 44	100	- 0	- 65		
2.8	+ 6.0	- 2.8	5.0	+ 10.0	- 5	9	+ 10	- 9	16	+ 16	- 16	25	+ 25	- 25	35	+ 40	- 35	15.75	19.69
12.8	0	- 6.8	21.0	0	- 11	25	- 0	- 15	42	- 0	- 26	75	- 0	- 50	115	- 0	- 75		
3.0	+ 8.0	- 3.0	6.0	+ 12.0	- 6	10	+ 12	- 10	18	+ 20	- 18	28	+ 30	- 28	40	+ 50	- 40	19.69	30.09
16.0	0	- 8.0	26.0	0	- 14	30	- 0	- 18	50	- 0	- 30	88	- 0	- 58	140	- 0	- 90		
3.5	+ 10.0	- 3.5	7.0	+ 16.0	- 7	12	+ 16	- 12	20	+ 25	- 20	30	+ 40	- 30	45	+ 60	- 45	30.09	41.49
19.5	0	- 9.5	33.0	- 0	- 17	38	- 0	- 22	61	- 0	- 36	110	- 0	- 70	165	- 0	- 105		
4.0	+ 12.0	- 4.0	8.0	+ 20.0	- 8	14	+ 20	- 14	25	+ 30	- 25	40	+ 50	- 40	60	+ 80	- 60	41.49	56.19
24.0	0	- 12.0	40.0	- 0	- 20	46	- 0	- 26	75	- 0	- 45	140	- 0	- 90	220	- 0	- 140		
4.5	+ 16.0	- 4.5	9.0	+ 25.0	- 9	16	+ 25	- 16	30	+ 40	- 30	50	+ 60	- 50	70	+ 100	- 70	56.19	76.39
30.5	0	- 14.5	50.0	- 0	- 25	57	- 0	- 32	95	- 0	- 55	170	- 0	- 110	270	- 0	- 170		
5.0	+ 20.0	- 5	10.0	+ 30.0	- 10	18	+ 30	- 18	35	+ 50	- 35	50	+ 80	- 50	80	+ 125	- 80	76.39	100.9
37.0	0	- 17	60.0	- 0	- 30	68	- 0	- 38	115	- 0	- 65	210	- 0	- 130	330	- 0	- 205		
6.0	+ 25.0	- 6	12.0	+ 40.0	- 12	20	+ 40	- 20	40	+ 60	- 40	60	+ 100	- 60	90	+ 160	- 90	100.9	131.9
47.0	0	- 22	67.0	- 0	- 27	85	- 0	- 45	140	- 0	- 80	260	- 0	- 160	410	- 0	- 250		
7.0	+ 30.0	- 7	14.0	+ 50.0	- 14	25	+ 50	- 25	50	+ 80	- 50	80	+ 125	- 80	100	+ 200	- 100	131.9	171.9
57.0	0	- 27	94.0	- 0	- 44	105	- 0	- 55	180	- 0	- 100	330	- 0	- 205	500	- 0	- 300		
7.0	+ 40.0	- 7	14.0	+ 60.0	- 14	25	+ 60	- 25	50	+ 100	- 50	90	+ 160	- 90	125	+ 250	- 125	171.9	200
72.0	0	- 32	114.0	- 0	- 54	125	- 0	- 65	210	- 0	- 110	410	- 0	- 250	625	- 0	- 375		

TABLE C.12.3 Locational Transition Fits

Nominal Size Range, Inches	Class LT 1			Class LT 2			Class LT 3			Class LT 4			Class LT 5			Class LT 6		
	Over	Standard Limits		Fit	Standard Limits		Fit	Standard Limits		Fit	Standard Limits		Fit	Standard Limits		Fit	Standard Limits	
		H7	js6		H8	js7		H7	k6		H8	k7		H7	n6		H7	n7
0 -- 0.12	-0.10	+0.4	+0.10	-0.2	+0.6	+0.2							-0.5	+0.4	+0.5	-0.65	+0.4	-0.65
	+0.50	-0	-0.10	+0.8	-0	-0.2							+0.15	-0	+0.25	+0.15	-0	+0.25
0.12 -- 0.24	-0.15	+0.5	+0.15	-0.25	+0.7	+0.25							-0.6	+0.5	+0.6	-0.8	+0.5	+0.8
	+0.65	-0	-0.15	+0.95	-0	-0.25							+0.2	-0	+0.3	+0.2	-0	+0.3
0.24 -- 0.40	-0.2	+0.6	+0.2	-0.3	+0.9	+0.3	-0.5	+0.6	+0.5	-0.7	+0.9	+0.7	-0.8	+0.6	+0.8	-1.0	+0.6	+1.0
	+0.8	-0	-0.2	+1.2	-0	-0.3	+0.5	-0	+0.1	+0.8	-0	+0.1	+0.2	-0	+0.4	+0.2	-0	+0.4
0.40 -- 0.71	-0.2	+0.7	+0.2	-0.35	+1.0	+0.35	-0.5	+0.7	+0.5	-0.8	+1.0	+0.8	-0.9	+0.7	+0.9	-1.2	+0.7	+1.2
	+0.9	-0	-0.2	+1.35	-0	-0.35	+0.6	-0	+0.1	+0.9	-0	+0.1	+0.2	-0	+0.5	+0.2	-0	+0.5
0.71 -- 1.19	-0.25	+0.8	+0.25	-0.4	+1.2	+0.4	-0.6	+0.8	+0.6	-0.9	+1.2	+0.9	-1.1	+0.8	+1.1	-1.4	+0.8	+1.4
	+1.05	-0	-0.25	+1.6	-0	-0.4	+0.7	-0	+0.1	+1.1	-0	+0.1	+0.2	-0	+0.6	+0.2	-0	+0.6
1.19 -- 1.97	-0.3	+1.0	+0.3	-0.5	+1.6	+0.5	-0.7	+1.0	+0.7	-1.1	+1.6	+1.1	-1.3	+1.0	+1.3	-1.7	+1.0	+1.7
	+1.3	-0	-0.3	+2.1	-0	-0.5	+0.9	-0	+0.1	+1.5	-0	+0.1	+0.3	-0	+0.7	+0.3	-0	+0.7
1.97 -- 3.15	-0.3	+1.2	+0.3	-0.6	+1.8	+0.6	-0.8	+1.2	+0.8	-1.3	+1.8	+1.3	-1.5	+1.2	+1.5	-2.0	+1.2	+2.0
	+1.5	-0	-0.3	+2.4	-0	-0.6	+1.1	-0	+0.1	+1.7	-0	+0.1	+0.4	-0	+0.8	+0.4	-0	+0.8
3.15 -- 4.73	-0.4	+1.4	+0.4	-0.7	+2.2	+0.7	-1.0	+1.4	+1.0	-1.5	+2.2	+1.5	-1.9	+1.4	+1.9	-2.4	+1.4	+2.4
	+1.8	-0	-0.4	+2.9	-0	-0.7	+1.3	-0	+0.1	+2.1	-0	+0.1	+0.4	-0	+1.0	+0.4	-0	+1.0
4.73 -- 7.09	-0.5	+1.6	+0.5	-0.8	+2.5	+0.8	-1.1	+1.6	+1.1	-1.7	+2.5	+1.7	-2.2	+1.6	+2.2	-2.8	+1.6	+2.8
	+2.1	-0	-0.5	+3.3	-0	-0.8	+1.5	-0	+0.1	+2.4	-0	+0.1	+0.4	-0	+1.2	+0.4	-0	+1.2
7.09 -- 9.85	-0.6	+1.8	+0.6	-0.9	+2.8	+0.9	-1.4	+1.8	+1.4	-2.0	+2.8	+2.0	-2.6	+1.8	+2.6	-3.2	+1.8	+3.2
	+2.4	-0	-0.6	+3.7	-0	-0.9	+1.6	-0	+0.2	+2.6	-0	+0.2	+0.4	-0	+1.4	+0.4	-0	+1.4
9.85 -- 12.41	-0.6	+2.0	+0.6	-1.0	+3.0	+1.0	-1.4	+2.0	+1.4	-2.2	+3.0	+2.2	-2.6	+2.0	+2.6	-3.4	+2.0	+3.4
	+2.6	-0	-0.6	+4.0	-0	-1.0	+1.8	-0	+0.2	+2.8	-0	+0.2	+0.6	-0	+1.4	+0.6	-0	+1.4
12.41 -- 15.75	-0.7	+2.2	+0.7	-1.0	+3.5	+1.0	-1.6	+2.2	+1.6	-2.4	+3.5	+2.4	-3.0	+2.2	+3.0	-3.8	+2.2	+3.8
	+2.9	-0	-0.7	+4.5	-0	-1.0	+2.0	-0	+0.2	+3.3	-0	+0.2	+0.6	-0	+1.6	+0.6	-0	+1.6
15.75 -- 19.69	-0.8	+2.5	+0.8	-1.2	+4.0	+1.2	-1.8	+2.5	+1.8	-2.7	+4.0	+2.7	-3.4	+2.5	+3.4	-4.3	+2.5	+4.3
	+3.3	-0	-0.8	+5.2	-0	-1.2	+2.3	-0	+0.2	+3.8	-0	+0.2	+0.7	-0	+1.8	+0.7	-0	+1.8

Limits are in thousandths of an inch. Limits for hole and shaft are applied algebraically to the basic size to obtain the limits of size for the mating parts. "Fit" represents the maximum interference (minus values) and the maximum clearance (plus values). Symbols H7, js6, etc. are hole and shaft designations in the ABC System.

TABLE C.12.4 Locational Interference Fits

Nominal Size Range, Inches		Class LN 1			Class LN 2			Class LN 3		
		Limits of Intolerance	Standard Limits		Limits of Intolerance	Standard Limits		Limits of Intolerance	Standard Limits	
			Hole H6	Shaft n5		Hole H7	Shaft p6		Hole H7	Shaft r6
Over	To									
0	- 0.12	0	+ 0.25	+0.45	0	+ 0.4	+ 0.65	0.1	+ 0.4	+ 0.75
		0.45	- 0	+0.25	0.65	- 0	+ 0.4	0.75	- 0	+ 0.5
0.12	- 0.24	0	+ 0.3	+0.5	0	+ 0.5	+ 0.8	0.1	+ 0.5	+ 0.9
		0.5	- 0	+0.3	0.8	- 0	+ 0.5	0.9	0	+ 0.6
0.24	- 0.40	0	+ 0.4	+0.65	0	+ 0.6	+ 1.0	0.2	+ 0.6	+ 1.2
		0.65	- 0	+0.4	1.0	- 0	+ 0.6	1.2	- 0	+ 0.8
0.40	- 0.71	0	+ 0.4	+0.8	0	+ 0.7	+ 1.1	0.3	+ 0.7	+ 1.4
		0.8	- 0	+0.4	1.1	- 0	+ 0.7	1.4	- 0	+ 1.0
0.71	- 1.19	0	+ 0.5	+1.0	0	+ 0.8	+ 1.3	0.4	+ 0.8	+ 1.7
		1.0	- 0	+0.5	1.3	- 0	+ 0.8	1.7	- 0	+ 1.2
1.19	- 1.97	0	+ 0.6	+1.1	0	+ 1.0	+ 1.6	0.4	+ 1.0	+ 2.0
		1.1	- 0	+0.6	1.6	- 0	+ 1.0	2.0	- 0	+ 1.4
1.97	- 3.15	0.1	+ 0.7	+1.3	0.2	+ 1.2	+ 2.1	0.4	+ 1.2	+ 2.3
		1.3	- 0	+0.7	2.1	- 0	+ 1.4	2.3	- 0	+ 1.6
3.15	- 4.73	0.1	+ 0.9	+1.6	0.2	+ 1.4	+ 2.5	0.6	+ 1.4	+ 2.9
		1.6	- 0	+1.0	2.5	- 0	+ 1.6	2.9	- 0	+ 2.0
4.73	- 7.09	0.2	+ 1.0	+1.9	0.2	+ 1.6	+ 2.8	0.9	+ 1.6	+ 3.5
		1.9	- 0	+1.2	2.8	- 0	+ 1.8	3.5	- 0	+ 2.5
7.09	- 9.85	0.2	+ 1.2	+2.2	0.2	+ 1.8	+ 3.2	1.2	+ 1.8	+ 4.2
		2.2	- 0	+1.4	3.2	- 0	+ 2.0	4.2	- 0	+ 3.0
9.85	- 12.41	0.2	+ 1.2	+2.3	0.2	+ 2.0	+ 3.4	1.5	+ 2.0	+ 4.7
		2.3	- 0	+1.4	3.4	- 0	+ 2.2	4.7	- 0	+ 3.5
12.41	- 15.75	0.2	+ 1.4	+2.6	0.3	+ 2.2	+ 3.9	2.3	+ 2.2	+ 5.9
		2.6	- 0	+1.6	3.9	- 0	+ 2.5	5.9	- 0	+ 4.5
15.75	- 19.69	0.2	+ 1.6	+2.8	0.3	+ 2.5	+ 4.4	2.5	+ 2.5	+ 6.6
		2.8	- 0	+1.8	4.4	- 0	+ 2.8	6.6	- 0	+ 5.0
19.69	- 30.09		+ 2.0		0.5	+ 3	+ 5.5	4	+ 3	+ 9
			- 0		5.5	- 0	+ 3.5	9	- 0	+ 7
30.09	- 41.49		+ 2.5		0.5	+ 4	+ 7.0	5	+ 4	+11.5
			- 0		7.0	- 0	+ 4.5	11.5	- 0	+ 9
41.49	- 56.19		+ 3.0		1	+ 5	+ 9	7	+ 5	+15
			- 0		9	- 0	+ 6	15	- 0	+12
56.19	- 76.39		+ 4.0		1	+ 6	+11	10	+ 6	+20
			- 0		11	- 0	+ 7	20	- 0	+16
76.39	- 100.9		+ 5.0		1	+ 8	+14	12	+ 8	+25
			- 0		14	- 0	+ 9	25	- 0	+20
100.9	- 131.9		+ 6.0		2	+10	+18	15	+10	+31
			- 0		18	- 0	+12	31	- 0	+25
131.9	- 171.9		+ 8.0		4	+12	+24	18	+12	+38
			- 0		24	- 0	+16	38	- 0	+30
171.9	- 200		+10.0		4	+16	+30	24	+16	+50
			- 0		30	- 0	+20	50	- 0	+40

Limits are in thousandths of an inch. Limits for hole and shaft are applied algebraically to the basic size to obtain the limits of size for the parts. Symbols H7, p 6, etc. are hole and shaft designations used in the ABC System.

TABLE C.12.5 Force and Shrink Fits

Nominal Size Range, Inches		Limits of Interference	Class FN 1		Limits of Interference	Class FN 2		Limits of Interference	Class FN 3		Limits of Interference	Class FN 4		Limits of Interference	Class FN 5					
			Standard Limits			Standard Limits			Standard Limits			Standard Limits								
			Hole H6	Shaft		Hole H7	Shaft s6		Hole H7	Shaft t6		Hole H7	Shaft u6		Hole H8	Shaft x7				
0	- 0.12	0.05	+0.25	+0.5	0.2	+0.4	+0.85	0.3	+0.4	+ 0.95	0.3	+0.6	+ 1.3	0.5	-0	+0.3	0.85	-0	+0.6	+0.9
		0.5	-0	+0.3	0.85	-0	+0.6													
0.12	- 0.24	0.1	+0.3	+0.6	0.2	+0.5	+1.0	0.4	+0.5	+ 1.2	0.5	+0.7	+ 1.7	0.6	-0	+0.4	1.0	-0	+0.7	+ 1.2
		0.6	-0	+0.4	1.0	-0	+0.7														1.2	-0	+0.9	1.7	-0	+1.2
0.24	- 0.40	0.1	+0.4	+0.75	0.4	+0.6	+1.4	0.6	+0.6	+ 1.6	0.5	+0.9	+ 2.0	0.75	-0	+0.5	1.4	-0	+1.0	+ 1.4
		0.75	-0	+0.5	1.4	-0	+1.0														1.6	-0	+1.2	2.0	-0	+1.4
0.40	- 0.56	0.1	+0.4	+0.8	0.5	+0.7	+1.6	0.7	+0.7	+ 1.8	0.6	+1.0	+ 2.3	0.8	-0	+0.5	1.6	-0	+1.2	+ 1.6
		0.8	-0	+0.5	1.6	-0	+1.2														1.8	-0	+1.4	2.3	-0	+1.6
0.56	- 0.71	0.2	+0.4	+0.9	0.5	+0.7	+1.6	0.7	+0.7	+ 1.8	0.8	+1.0	+ 2.5	0.9	-0	+0.6	1.6	-0	+1.2	+ 1.8
		0.9	-0	+0.6	1.6	-0	+1.2														1.8	-0	+1.4	2.5	-0	+1.8
0.71	- 0.95	0.2	+0.5	+1.1	0.6	+0.8	+1.9	0.8	+0.8	+ 2.1	1.0	+1.2	+ 3.0	1.1	-0	+0.7	1.9	-0	+1.4	+ 2.2
		1.1	-0	+0.7	1.9	-0	+1.4														2.1	-0	+1.6	3.0	-0	+2.2
0.95	- 1.19	0.3	+0.5	+1.2	0.6	+0.8	+1.9	0.8	+0.8	+ 2.1	1.0	+1.2	+ 3.3	1.2	-0	+0.8	1.9	-0	+1.4	+ 2.5
		1.2	-0	+0.8	1.9	-0	+1.4	2.1	-0	+1.6	2.3	-0	+1.8	3.3	-0	+1.8	3.3	-0	+2.5	
1.19	- 1.58	0.3	+0.6	+1.3	0.8	+1.0	+2.4	1.0	+1.0	+ 2.6	1.5	+1.0	+ 4.0	1.3	-0	+0.9	2.4	-0	+1.8	+ 3.0
		1.3	-0	+0.9	2.4	-0	+1.8	2.6	-0	+2.0	3.1	-0	+2.5	4.0	-0	+2.5	4.0	-0	+3.0	
1.58	- 1.97	0.4	+0.6	+1.4	0.8	+1.0	+2.4	1.2	+1.0	+ 2.8	1.8	+1.0	+ 5.0	1.4	-0	+1.0	2.4	-0	+1.8	+ 4.0
		1.4	-0	+1.0	2.4	-0	+1.8	2.8	-0	+2.2	3.4	-0	+2.8	5.0	-0	+2.8	5.0	-0	+4.0	
1.97	- 2.56	0.6	+0.7	+1.8	0.8	+1.2	+2.7	1.3	+1.2	+ 3.2	2.3	+1.2	+ 6.2	1.8	-0	+1.3	2.7	-0	+2.0	+ 5.0
		1.8	-0	+1.3	2.7	-0	+2.0	3.2	-0	+2.5	4.2	-0	+3.5	6.2	-0	+3.5	6.2	-0	+5.0	
2.56	- 3.15	0.7	+0.7	+1.9	1.0	+1.2	+2.9	1.8	+1.2	+ 3.7	2.8	+1.2	+ 7.2	1.9	-0	+1.4	2.9	-0	+2.2	+ 6.0
		1.9	-0	+1.4	2.9	-0	+2.2	3.7	-0	+3.0	4.7	-0	+4.0	7.2	-0	+4.0	7.2	-0	+6.0	
3.15	- 3.94	0.9	+0.9	+2.4	1.4	+1.4	+3.7	2.1	+1.4	+ 4.4	3.6	+1.4	+ 8.4	2.4	-0	+1.8	3.7	-0	+2.8	+ 7.0
		2.4	-0	+1.8	3.7	-0	+2.8	4.4	-0	+3.5	5.9	-0	+5.0	8.4	-0	+5.0	8.4	-0	+7.0	
3.94	- 4.73	1.1	+0.9	+2.6	1.6	+1.4	+3.9	2.6	+1.4	+ 4.9	4.6	+1.4	+ 9.4	2.6	-0	+2.0	3.9	-0	+3.0	+ 8.0
		2.6	-0	+2.0	3.9	-0	+3.0	4.9	-0	+4.0	6.9	-0	+6.0	9.4	-0	+6.0	9.4	-0	+8.0	
4.73	- 5.52	1.2	+1.0	+2.9	1.9	+1.6	+4.5	3.4	+1.6	+ 6.0	5.4	+1.6	+ 11.6	2.9	-0	+2.2	4.5	-0	+3.5	+ 10.0
		2.9	-0	+2.2	4.5	-0	+3.5	6.0	-0	+5.0	8.0	-0	+7.0	11.6	-0	+7.0	11.6	-0	+10.0	
5.52	- 6.30	1.5	+1.0	+3.2	2.4	+1.6	+5.0	3.4	+1.6	+ 6.0	5.4	+1.6	+ 13.6	3.2	-0	+2.5	5.0	-0	+4.0	+ 12.0
		3.2	-0	+2.5	5.0	-0	+4.0	6.0	-0	+5.0	8.0	-0	+7.0	13.6	-0	+7.0	13.6	-0	+12.0	
6.30	- 7.09	1.8	+1.0	+3.5	2.9	+1.6	+5.5	4.4	+1.6	+ 7.0	6.4	+1.6	+ 15.6	3.5	-0	+2.8	5.5	-0	+4.5	+ 13.6
		3.5	-0	+2.8	5.5	-0	+4.5	7.0	-0	+6.0	9.0	-0	+8.0	15.6	-0	+8.0	15.6	-0	+12.0	
7.09	- 7.88	1.8	+1.2	+3.8	3.2	+1.8	+6.2	5.2	+1.8	+ 8.2	7.2	+1.8	+ 18.2	3.8	-0	+3.0	6.2	-0	+5.0	+ 15.8
		3.8	-0	+3.0	6.2	-0	+5.0	8.2	-0	+7.0	10.2	-0	+9.0	18.2	-0	+9.0	15.8	-0	+14.0	
7.88	- 8.86	2.3	+1.2	+4.3	3.2	+1.8	+6.2	5.2	+1.8	+ 8.2	8.2	+1.8	+ 21.2	4.3	-0	+3.5	6.2	-0	+5.0	+ 17.8
		4.3	-0	+3.5	6.2	-0	+5.0	8.2	-0	+7.0	11.2	-0	+10.0	21.2	-0	+10.0	17.8	-0	+16.0	
8.86	- 9.85	2.3	+1.2	+4.3	4.2	+1.8	+7.2	6.2	+1.8	+ 9.2	10.2	+1.8	+ 24.2	4.3	-0	+3.5	7.2	-0	+6.0	+ 17.8
		4.3	-0	+3.5	7.2	-0	+6.0	9.2	-0	+8.0	13.2	-0	+12.0	24.2	-0	+12.0	17.8	-0	+16.0	
9.85	- 11.03	2.8	+1.2	+4.9	4.0	+2.0	+7.2	7.0	+2.0	+10.2	10.0	+2.0	+ 28.2	4.9	-0	+4.0	7.2	-0	+6.0	+ 20.0
		4.9	-0	+4.0	7.2	-0	+6.0	10.2	-0	+9.0	13.2	-0	+12.0	28.2	-0	+12.0	20.0	-0	+18.0	

Limits are in thousandths of an inch. Limits for hole and shaft are applied algebraically to the basic size to obtain the limits of size for the parts. Symbols H7, s6, etc. are hole and shaft designations used in the ABC System.

Continues

TABLE C.12.5 Force and Shrink Fits—Continued

Nominal Size Range, Inches		Class FN 1			Class FN 2			Class FN 3			Class FN 4			Class FN 5		
		Limits of Interference	Standard Limits		Limits of Interference	Standard Limits		Limits of Interference	Standard Limits		Limits of Interference	Standard Limits		Limits of Interference	Standard Limits	
Over	To		Hole H6	Shaft s6		Hole H7	Shaft s6		Hole H7	Shaft t6		Hole H7	Shaft u6		Hole H8	Shaft v7
11.03	12.41	2.8	+ 1.2	+ 4.9	5.0	+ 2.0	+ 8.2	7.0	+ 2.0	+ 10.2	12.0	+ 2.0	+ 15.2	17.0	+ 3.0	+ 22.0
		4.9	- 0	+ 4.0	8.2	- 0	+ 7.0	10.2	- 0	+ 9.0	15.2	- 0	+ 14.0	22.0	- 0	+ 20.0
12.41	13.98	3.1	+ 1.4	+ 5.5	5.8	+ 2.2	+ 9.4	7.8	+ 2.2	+ 11.4	13.8	+ 2.2	+ 17.4	18.5	+ 3.5	+ 24.2
		5.5	- 0	+ 4.5	9.4	- 0	+ 8.0	11.4	- 0	+ 10.0	17.4	- 0	+ 16.0	24.2	+ 0	+ 22.0
13.98	15.75	3.6	+ 1.4	+ 6.1	5.8	+ 2.2	+ 9.4	9.8	+ 2.2	+ 13.4	15.8	+ 2.2	+ 19.4	21.5	+ 3.5	+ 27.2
		6.1	- 0	+ 5.0	9.4	- 0	+ 8.0	13.4	- 0	+ 12.0	19.4	- 0	+ 18.0	27.2	- 0	+ 25.0
15.75	17.72	4.4	+ 1.6	+ 7.0	6.5	+ 2.5	+ 10.6	9.5	+ 2.5	+ 13.6	17.5	+ 2.5	+ 21.6	24.0	+ 4.0	+ 30.5
		7.0	- 0	+ 6.0	10.6	- 0	+ 9.0	13.6	- 0	+ 12.0	21.6	- 0	+ 20.0	30.5	- 0	+ 28.0
17.72	19.69	4.4	+ 1.6	+ 7.0	7.5	+ 2.5	+ 11.6	11.5	+ 2.5	+ 15.6	19.5	+ 2.5	+ 23.6	26.0	+ 4.0	+ 32.5
		7.0	- 0	+ 6.0	11.6	- 0	+ 10.0	15.6	- 0	+ 14.0	23.6	- 0	+ 22.0	32.5	- 0	+ 30.0
19.69	24.34	6.0	+ 2.0	+ 9.2	9.0	+ 3.0	+ 14.0	15.0	+ 3.0	+ 20.0	22.0	+ 3.0	+ 27.0	30.0	+ 5.0	+ 38.0
		9.2	- 0	+ 8.0	14.0	- 0	+ 12.0	20.0	- 0	+ 18.0	27.0	- 0	+ 25.0	38.0	- 0	+ 35.0
24.34	30.09	7.0	+ 2.0	+ 10.2	11.0	+ 3.0	+ 16.0	17.0	+ 3.0	+ 22.0	27.0	+ 3.0	+ 32.0	35.0	+ 5.0	+ 43.0
		10.2	- 0	+ 9.0	16.0	- 0	+ 14.0	22.0	- 0	+ 20.0	32.0	- 0	+ 30.0	43.0	- 0	+ 40.0
30.09	35.47	7.5	+ 2.5	+ 11.6	14.0	+ 4.0	+ 20.5	21.0	+ 4.0	+ 27.5	31.0	+ 4.0	+ 37.5	44.0	+ 6.0	+ 54.0
		11.6	- 0	+ 10.0	20.5	- 0	+ 18.0	27.5	- 0	+ 25.0	37.5	- 0	+ 35.0	54.0	- 0	+ 50.0
35.47	41.49	9.5	+ 2.5	+ 13.6	16.0	+ 4.0	+ 22.5	24.0	+ 4.0	+ 30.5	36.0	+ 4.0	+ 43.5	54.0	+ 6.0	+ 64.0
		13.6	- 0	+ 12.0	22.5	- 0	+ 20.0	30.5	- 0	+ 28.0	43.5	- 0	+ 40.0	64.0	- 0	+ 60.0
41.49	48.28	11.0	+ 3.0	+ 16.0	17.0	+ 5.0	+ 25.0	30.0	+ 5.0	+ 38.0	45.0	+ 5.0	+ 53.0	62.0	+ 8.0	+ 75.0
		16.0	- 0	+ 14.0	25.0	- 0	+ 22.0	38.0	- 0	+ 35.0	53.0	- 0	+ 50.0	75.0	- 0	+ 70.0
48.28	56.19	13.0	+ 3.0	+ 18.0	20.0	+ 5.0	+ 28.0	35.0	+ 5.0	+ 43.0	55.0	+ 5.0	+ 63.0	72.0	+ 8.0	+ 85.0
		18.0	- 0	+ 16.0	28.0	- 0	+ 25.0	43.0	- 0	+ 40.0	63.0	- 0	+ 60.0	85.0	- 0	+ 80.0
56.19	65.54	14.0	+ 4.0	+ 20.5	24.0	+ 6.0	+ 34.0	39.0	+ 6.0	+ 49.0	64.0	+ 6.0	+ 74.0	90.0	+ 10.0	+ 106
		20.5	- 0	+ 18.0	34.0	- 0	+ 30.0	49.0	- 0	+ 45.0	74.0	- 0	+ 70.0	106	- 0	+ 100
65.54	76.39	18.0	+ 4.0	+ 24.5	29.0	+ 6.0	+ 39.0	44.0	+ 6.0	+ 54.0	74.0	+ 6.0	+ 84.0	110	+ 10.0	+ 126
		24.5	- 0	+ 22.0	39.0	- 0	+ 35.0	54.0	- 0	+ 50.0	84.0	- 0	+ 80.0	126	- 0	+ 120
76.39	87.79	20.0	+ 5.0	+ 28.0	32.0	+ 8.0	+ 45.0	52.0	+ 8.0	+ 65.0	82.0	+ 8.0	+ 95.0	128	+ 12.0	+ 148
		28.0	- 0	+ 25.0	45.0	- 0	+ 40.0	65.0	- 0	+ 60.0	95.0	- 0	+ 90.0	148	- 0	+ 140
87.79	100.9	23.0	+ 5.0	+ 31.0	37.0	+ 8.0	+ 50.0	62.0	+ 8.0	+ 75.0	92.0	+ 8.0	+ 105	148	+ 12.0	+ 168
		31.0	- 0	+ 28.0	50.0	- 0	+ 45.0	75.0	- 0	+ 70.0	105	- 0	+ 100	168	- 0	+ 160
100.9	115.3	24.0	+ 6.0	+ 34.0	40.0	+ 10.0	+ 56.0	70.0	+ 10.0	+ 86.0	110	+ 10.0	+ 126	164	+ 16.0	+ 190
		34.0	- 0	+ 30.0	56.0	- 0	+ 50.0	86.0	- 0	+ 80.0	126	- 0	+ 120	190	- 0	+ 180
115.3	131.9	29.0	+ 6.0	+ 39.0	50.0	+ 10.0	+ 66.0	80.0	+ 10.0	+ 96.0	130	+ 10.0	+ 146	184	+ 16.0	+ 210
		39.0	- 0	+ 35.0	66.0	- 0	+ 60.0	96.0	- 0	+ 90.0	146	- 0	+ 140	210	- 0	+ 200
131.9	152.2	37.0	+ 8.0	+ 50.0	58.0	+ 12.0	+ 78.0	88.0	+ 12.0	+ 108	148	+ 12.0	+ 168	200	+ 20.0	+ 232
		50.0	- 0	+ 45.0	78.0	- 0	+ 70.0	108	- 0	+ 100	168	- 0	+ 160	232	- 0	+ 220
152.2	171.9	42.0	+ 8.0	+ 55.0	68.0	+ 12.0	+ 88.0	108	+ 12.0	+ 128	168	+ 12.0	+ 188	230	+ 20.0	+ 262
		55.0	- 0	+ 50.0	88.0	- 0	+ 80.0	128	- 0	+ 120	188	- 0	+ 170	262	- 0	+ 250
171.9	200	50.0	+ 10.0	+ 66.0	74.0	+ 16.0	+ 100	124	+ 16.0	+ 150	184	+ 16.0	+ 210	275	+ 2.5	+ 316
		66.0	- 0	+ 60.0	100	- 0	+ 90	150	- 0	+ 140	210	- 0	+ 200	316	- 0	+ 300

TABLE C.12.6 Preferred Metric Hole Basis Clearance Fits

Basic Size		Loose Running			Free Running			Close Running			Sliding			Locational Clearance		
		Hole H11	Shaft c11	Fit	Hole H9	Shaft d9	Fit	Hole H8	Shaft f7	Fit	Hole H7	Shaft g6	Fit	Hole H7	Shaft h6	Fit
1	Max	1.060	0.940	0.180	1.025	0.980	0.070	1.014	0.994	0.030	1.010	0.998	0.018	1.010	1.000	0.016
	Min	1.000	0.880	0.060	1.000	0.955	0.020	1.000	0.984	0.006	1.000	0.992	0.002	1.000	0.994	0.000
1.2	Max	1.260	1.140	0.180	1.225	1.180	0.070	1.214	1.194	0.030	1.210	1.198	0.018	1.210	1.200	0.016
	Min	1.200	1.080	0.060	1.200	1.155	0.020	1.200	1.184	0.006	1.200	1.192	0.002	1.200	1.194	0.000
1.6	Max	1.660	1.540	0.180	1.675	1.580	0.070	1.614	1.594	0.030	1.610	1.598	0.018	1.610	1.600	0.016
	Min	1.600	1.480	0.060	1.600	1.555	0.020	1.600	1.584	0.006	1.600	1.592	0.002	1.600	1.594	0.000
2	Max	2.060	1.940	0.180	2.025	1.980	0.070	2.014	1.994	0.030	2.010	1.998	0.018	2.010	2.000	0.016
	Min	2.000	1.880	0.060	2.000	1.955	0.020	2.000	1.984	0.006	2.000	1.992	0.002	2.000	1.994	0.000
2.5	Max	2.560	2.440	0.180	2.525	2.480	0.070	2.514	2.494	0.030	2.510	2.498	0.018	2.510	2.500	0.016
	Min	2.500	2.380	0.060	2.500	2.455	0.020	2.500	2.484	0.006	2.500	2.492	0.002	2.500	2.494	0.000
3	Max	3.060	2.940	0.180	3.025	2.980	0.070	3.014	2.994	0.030	3.010	2.998	0.018	3.010	3.000	0.016
	Min	3.000	2.880	0.060	3.000	2.955	0.020	3.000	2.984	0.006	3.000	2.992	0.002	3.000	2.994	0.000
4	Max	4.075	3.930	0.220	4.030	3.970	0.090	4.018	3.990	0.040	4.012	3.996	0.024	4.012	4.000	0.020
	Min	4.000	3.855	0.070	4.000	3.940	0.030	4.000	3.978	0.010	4.000	3.988	0.004	4.000	3.992	0.000
5	Max	5.075	4.930	0.220	5.030	4.970	0.090	5.018	4.990	0.040	5.012	4.996	0.024	5.012	5.000	0.020
	Min	5.000	4.855	0.070	5.000	4.940	0.030	5.000	4.978	0.010	5.000	4.988	0.004	5.000	4.992	0.000
6	Max	6.075	5.930	0.220	6.030	5.970	0.090	6.018	5.990	0.040	6.012	5.996	0.024	6.012	6.000	0.020
	Min	6.000	5.855	0.070	6.000	5.940	0.030	6.000	5.978	0.010	6.000	5.988	0.004	6.000	5.992	0.000
8	Max	8.090	7.920	0.260	8.036	7.960	0.112	8.022	7.987	0.050	8.015	7.995	0.029	8.015	8.000	0.024
	Min	8.000	7.830	0.080	8.000	7.924	0.040	8.000	7.972	0.013	8.000	7.986	0.005	8.000	7.991	0.000
10	Max	10.090	9.920	0.260	10.036	9.960	0.112	10.022	9.987	0.050	10.015	9.995	0.029	10.015	10.000	0.024
	Min	10.000	9.830	0.080	10.000	9.924	0.040	10.000	9.972	0.013	10.000	9.986	0.005	10.000	9.991	0.000
12	Max	12.110	11.905	0.315	12.043	11.950	0.136	12.027	11.984	0.061	12.018	11.994	0.035	12.018	12.000	0.029
	Min	12.000	11.795	0.095	12.000	11.907	0.050	12.000	11.966	0.016	12.000	11.983	0.006	12.000	11.989	0.000
16	Max	16.110	15.905	0.315	16.043	15.950	0.136	16.027	15.984	0.061	16.018	15.994	0.035	16.018	16.000	0.029
	Min	16.000	15.795	0.095	16.000	15.907	0.050	16.000	15.966	0.016	16.000	15.983	0.006	16.000	15.989	0.000
20	Max	20.130	19.890	0.370	20.052	19.935	0.169	20.033	19.980	0.074	20.021	19.993	0.041	20.021	20.000	0.034
	Min	20.000	19.760	0.110	20.000	19.883	0.065	20.000	19.959	0.020	20.000	19.980	0.007	20.000	19.987	0.000
25	Max	25.130	24.890	0.370	25.052	24.935	0.169	25.033	24.980	0.074	25.021	24.993	0.041	25.021	25.000	0.034
	Min	25.000	24.760	0.110	25.000	24.883	0.065	25.000	24.959	0.020	25.000	24.980	0.007	25.000	24.987	0.000
30	Max	30.130	29.890	0.370	30.052	29.935	0.169	30.033	29.980	0.074	30.021	29.993	0.041	30.021	30.000	0.034
	Min	30.000	29.760	0.110	30.000	29.883	0.065	30.000	29.959	0.020	30.000	29.980	0.007	30.000	29.987	0.000
40	Max	40.160	39.880	0.440	40.062	39.920	0.204	40.039	39.975	0.089	40.025	39.991	0.050	40.025	40.000	0.041
	Min	40.000	39.720	0.120	40.000	39.858	0.080	40.000	39.950	0.025	40.000	39.975	0.009	40.000	39.984	0.000
50	Max	50.160	49.870	0.450	50.062	49.920	0.204	50.039	49.975	0.089	50.025	49.991	0.050	50.025	50.000	0.041
	Min	50.000	49.710	0.130	50.000	49.858	0.080	50.000	49.950	0.025	50.000	49.975	0.009	50.000	49.984	0.000
60	Max	60.190	59.860	0.520	60.074	59.900	0.248	60.046	59.970	0.106	60.030	59.990	0.059	60.030	60.000	0.049
	Min	60.000	59.670	0.140	60.000	59.826	0.100	60.000	59.940	0.030	60.000	59.971	0.010	60.000	59.981	0.000
80	Max	80.190	79.850	0.530	80.074	79.900	0.248	80.046	79.970	0.106	80.030	79.990	0.059	80.030	80.000	0.049
	Min	80.000	79.660	0.150	80.000	79.826	0.100	80.000	79.940	0.030	80.000	79.971	0.010	80.000	79.981	0.000
100	Max	100.220	99.830	0.610	100.087	99.880	0.294	100.054	99.964	0.125	100.035	99.988	0.069	100.035	100.000	0.057
	Min	100.000	99.610	0.170	100.000	99.793	0.120	100.000	99.929	0.036	100.000	99.966	0.012	100.000	99.978	0.000
120	Max	120.220	119.820	0.620	120.087	119.880	0.294	120.054	119.964	0.125	120.035	119.988	0.069	120.035	120.000	0.057
	Min	120.000	119.600	0.180	120.000	119.793	0.120	120.000	119.929	0.036	120.000	119.966	0.012	120.000	119.978	0.000
160	Max	160.250	159.790	0.710	160.100	159.855	0.345	160.063	159.957	0.146	160.040	159.986	0.079	160.040	160.000	0.065
	Min	160.000	159.540	0.210	160.000	159.755	0.145	160.000	159.917	0.043	160.000	159.961	0.014	160.000	159.975	0.000
200	Max	200.290	199.760	0.820	200.115	199.830	0.400	200.072	199.950	0.168	200.046	199.985	0.090	200.046	200.000	0.075
	Min	200.000	199.470	0.240	200.000	199.715	0.170	200.000	199.904	0.050	200.000	199.956	0.015	200.000	199.971	0.000
250	Max	250.290	249.720	0.860	250.115	249.830	0.400	250.072	249.950	0.168	250.046	249.985	0.090	250.046	250.000	0.075
	Min	250.000	249.430	0.280	250.000	249.715	0.170	250.000	249.904	0.050	250.000	249.956	0.015	250.000	249.971	0.000
300	Max	300.320	299.670	0.970	300.130	299.810	0.450	300.081	299.944	0.189	300.052	299.983	0.101	300.052	300.000	0.084
	Min	300.000	299.350	0.330	300.000	299.680	0.190	300.000	299.892	0.056	300.000	299.951	0.017	300.000	299.968	0.000
400	Max	400.360	399.600	1.120	400.140	399.790	0.490	400.089	399.938	0.208	400.057	399.982	0.111	400.057	400.000	0.093
	Min	400.000	399.240	0.400	400.000	399.650	0.210	400.000	399.881	0.062	400.000	399.946	0.018	400.000	399.964	0.000
500	Max	500.400	499.520	1.280	500.155	499.770	0.540	500.097	499.932	0.228	500.063	499.980	0.123	500.063	500.000	0.103
	Min	500.000	499.120	0.480	500.000	499.615	0.230	500.000	499.869	0.068	500.000	499.940	0.020	500.000	499.960	0.000

TABLE C.12.7 Preferred Metric Hole Basis Transition and Interference Fits

Basic Size	Locational Transition			Locational Transition			Locational Interference			Medium Drive			Force			
	Hole H7	Shaft k6	Fit	Hole H7	Shaft n6	Fit	Hole H7	Shaft p6	Fit	Hole H7	Shaft s6	Fit	Hole H7	Shaft u6	Fit	
1	Max	1.010	1.006	0.010	1.010	1.010	0.006	1.010	1.012	0.004	1.010	1.020	-0.004	1.010	1.024	-0.008
	Min	1.000	1.000	-0.006	1.000	1.004	-0.010	1.000	1.006	-0.012	1.000	1.014	-0.020	1.000	1.018	-0.024
1.2	Max	1.210	1.206	0.010	1.210	1.210	0.006	1.210	1.212	0.004	1.210	1.220	-0.004	1.210	1.224	-0.008
	Min	1.200	1.200	-0.006	1.200	1.204	-0.010	1.200	1.206	-0.012	1.200	1.214	-0.020	1.200	1.218	-0.024
1.6	Max	1.610	1.606	0.010	1.610	1.610	0.006	1.610	1.612	0.004	1.610	1.620	-0.004	1.610	1.624	-0.008
	Min	1.600	1.600	-0.006	1.600	1.604	-0.010	1.600	1.606	-0.012	1.600	1.614	-0.020	1.600	1.618	-0.024
2	Max	2.010	2.006	0.010	2.010	2.010	0.006	2.010	2.012	0.004	2.010	2.020	-0.004	2.010	2.024	-0.008
	Min	2.000	2.000	-0.006	2.000	2.004	-0.010	2.000	2.006	-0.012	2.000	2.014	-0.020	2.000	2.018	-0.024
2.5	Max	2.510	2.506	0.010	2.510	2.510	0.006	2.510	2.512	0.004	2.510	2.520	-0.004	2.510	2.524	-0.008
	Min	2.500	2.500	-0.006	2.500	2.504	-0.010	2.500	2.506	-0.012	2.500	2.514	-0.020	2.500	2.518	-0.024
3	Max	3.010	3.006	0.010	3.010	3.010	0.006	3.010	3.012	0.004	3.010	3.020	-0.004	3.010	3.024	-0.008
	Min	3.000	3.000	-0.006	3.000	3.004	-0.010	3.000	3.006	-0.012	3.000	3.014	-0.020	3.000	3.018	-0.024
4	Max	4.012	4.009	0.011	4.012	4.016	0.004	4.012	4.020	0.000	4.012	4.027	-0.007	4.012	4.031	-0.011
	Min	4.000	4.001	-0.009	4.000	4.008	-0.016	4.000	4.012	-0.020	4.000	4.019	-0.027	4.000	4.023	-0.031
5	Max	5.012	5.009	0.011	5.012	5.016	0.004	5.012	5.020	0.000	5.012	5.027	-0.007	5.012	5.031	-0.011
	Min	5.000	5.001	-0.009	5.000	5.008	-0.016	5.000	5.012	-0.020	5.000	5.019	-0.027	5.000	5.023	-0.031
6	Max	6.012	6.009	0.011	6.012	6.016	0.004	6.012	6.020	0.000	6.012	6.027	-0.007	6.012	6.031	-0.011
	Min	6.000	6.001	-0.009	6.000	6.008	-0.016	6.000	6.012	-0.020	6.000	6.019	-0.027	6.000	6.023	-0.031
8	Max	8.015	8.010	0.014	8.015	8.019	0.005	8.015	8.024	0.000	8.015	8.032	-0.008	8.015	8.037	-0.013
	Min	8.000	8.001	-0.010	8.000	8.010	-0.019	8.000	8.015	-0.024	8.000	8.023	-0.032	8.000	8.028	-0.037
10	Max	10.015	10.010	0.014	10.015	10.019	0.005	10.015	10.024	0.000	10.015	10.032	-0.008	10.015	10.037	-0.013
	Min	10.000	10.001	-0.010	10.000	10.010	-0.019	10.000	10.015	-0.024	10.000	10.023	-0.032	10.000	10.028	-0.037
12	Max	12.018	12.012	0.017	12.018	12.023	0.006	12.018	12.029	0.000	12.018	12.039	-0.010	12.018	12.044	-0.015
	Min	12.000	12.001	-0.012	12.000	12.012	-0.023	12.000	12.018	-0.029	12.000	12.028	-0.039	12.000	12.033	-0.044
16	Max	16.018	16.012	0.017	16.018	16.023	0.006	16.018	16.029	0.000	16.018	16.039	-0.010	16.018	16.044	-0.015
	Min	16.000	16.001	-0.012	16.000	16.012	-0.023	16.000	16.018	-0.029	16.000	16.028	-0.039	16.000	16.033	-0.044
20	Max	20.021	20.015	0.019	20.021	20.028	0.006	20.021	20.035	-0.001	20.021	20.048	-0.014	20.021	20.054	-0.020
	Min	20.000	20.002	-0.015	20.000	20.015	-0.028	20.000	20.022	-0.035	20.000	20.035	-0.048	20.000	20.041	-0.054
25	Max	25.021	25.015	0.019	25.021	25.028	0.006	25.021	25.035	-0.001	25.021	25.048	-0.014	25.021	25.061	-0.027
	Min	25.000	25.002	-0.015	25.000	25.015	-0.028	25.000	25.022	-0.035	25.000	25.035	-0.048	25.000	25.048	-0.061
30	Max	30.021	30.015	0.019	30.021	30.028	0.006	30.021	30.035	-0.001	30.021	30.048	-0.014	30.021	30.061	-0.027
	Min	30.000	30.002	-0.015	30.000	30.015	-0.028	30.000	30.022	-0.035	30.000	30.035	-0.048	30.000	30.048	-0.061
40	Max	40.025	40.018	0.023	40.025	40.033	0.008	40.025	40.042	-0.001	40.025	40.059	-0.018	40.025	40.076	-0.035
	Min	40.000	40.002	-0.018	40.000	40.017	-0.033	40.000	40.026	-0.042	40.000	40.043	-0.059	40.000	40.060	-0.076
50	Max	50.025	50.018	0.023	50.025	50.033	0.008	50.025	50.042	-0.001	50.025	50.059	-0.018	50.025	50.086	-0.045
	Min	50.000	50.002	-0.018	50.000	50.017	-0.033	50.000	50.026	-0.042	50.000	50.043	-0.059	50.000	50.070	-0.086
60	Max	60.030	60.021	0.028	60.030	60.039	0.010	60.030	60.051	-0.002	60.030	60.072	-0.023	60.030	60.106	-0.057
	Min	60.000	60.002	-0.021	60.000	60.020	-0.039	60.000	60.032	-0.051	60.000	60.053	-0.072	60.000	60.087	-0.106
80	Max	80.030	80.021	0.028	80.030	80.039	0.010	80.030	80.051	-0.002	80.030	80.078	-0.029	80.030	80.121	-0.072
	Min	80.000	80.002	-0.021	80.000	80.020	-0.039	80.000	80.032	-0.051	80.000	80.059	-0.078	80.000	80.102	-0.121
100	Max	100.035	100.025	0.032	100.035	100.045	0.012	100.035	100.059	-0.002	100.035	100.093	-0.036	100.035	100.146	-0.089
	Min	100.000	100.003	-0.025	100.000	100.023	-0.045	100.000	100.037	-0.059	100.000	100.071	-0.093	100.000	100.124	-0.146
120	Max	120.035	120.025	0.032	120.035	120.045	0.012	120.035	120.059	-0.002	120.035	120.101	-0.044	120.035	120.166	-0.109
	Min	120.000	120.003	-0.025	120.000	120.023	-0.045	120.000	120.037	-0.059	120.000	120.079	-0.101	120.000	120.144	-0.166
160	Max	160.040	160.028	0.037	160.040	160.052	0.013	160.040	160.068	-0.003	160.040	160.125	-0.060	160.040	160.215	-0.150
	Min	160.000	160.003	-0.028	160.000	160.027	-0.052	160.000	160.043	-0.068	160.000	160.100	-0.125	160.000	160.190	-0.215
200	Max	200.046	200.033	0.042	200.046	200.060	0.015	200.046	200.079	-0.004	200.046	200.151	-0.076	200.046	200.265	-0.190
	Min	200.000	200.004	-0.033	200.000	200.031	-0.060	200.000	200.050	-0.079	200.000	200.122	-0.151	200.000	200.236	-0.265
250	Max	250.046	250.033	0.042	250.046	250.060	0.015	250.046	250.079	-0.004	250.046	250.169	-0.094	250.046	250.313	-0.238
	Min	250.000	250.004	-0.033	250.000	250.031	-0.060	250.000	250.050	-0.079	250.000	250.140	-0.169	250.000	250.284	-0.313
300	Max	300.052	300.036	0.048	300.052	300.066	0.018	300.052	300.088	-0.004	300.052	300.202	-0.118	300.052	300.382	-0.298
	Min	300.000	300.004	-0.036	300.000	300.034	-0.066	300.000	300.056	-0.088	300.000	300.170	-0.202	300.000	300.350	-0.382
400	Max	400.057	400.040	0.053	400.057	400.073	0.020	400.057	400.098	-0.005	400.057	400.244	-0.151	400.057	400.471	-0.378
	Min	400.000	400.004	-0.040	400.000	400.037	-0.073	400.000	400.062	-0.098	400.000	400.208	-0.244	400.000	400.435	-0.471
500	Max	500.063	500.045	0.058	500.063	500.080	0.023	500.063	500.108	-0.005	500.063	500.292	-0.189	500.063	500.580	-0.477
	Min	500.000	500.005	-0.045	500.000	500.040	-0.080	500.000	500.068	-0.108	500.000	500.252	-0.292	500.000	500.540	-0.580

TABLE C.12.8 Preferred Metric Shaft Basis Clearance Fits

Basic Size	Loose Running			Free Running			Close Running			Sliding			Locational Clearance			
	Hole C11	Shaft h11	Fit	Hole D9	Shaft h9	Fit	Hole F8	Shaft h7	Fit	Hole G7	Shaft h6	Fit	Hole H7	Shaft h6	Fit	
1	Max	1.120	1.000	0.180	1.045	1.000	0.070	1.020	1.000	0.030	1.012	1.000	0.018	1.010	1.000	0.016
	Min	1.060	0.940	0.060	1.020	0.975	0.020	1.006	0.990	0.006	1.002	0.994	0.002	1.000	0.994	0.000
1.2	Max	1.320	1.200	0.180	1.245	1.200	0.070	1.220	1.200	0.030	1.212	1.200	0.018	1.210	1.200	0.016
	Min	1.260	1.140	0.060	1.220	1.175	0.020	1.206	1.190	0.006	1.202	1.194	0.002	1.200	1.194	0.000
1.6	Max	1.720	1.600	0.180	1.645	1.600	0.070	1.620	1.600	0.030	1.612	1.600	0.018	1.610	1.600	0.016
	Min	1.660	1.540	0.060	1.620	1.575	0.020	1.606	1.590	0.006	1.602	1.594	0.002	1.600	1.594	0.000
2	Max	2.120	2.000	0.180	2.045	2.000	0.070	2.020	2.000	0.030	2.012	2.000	0.018	2.010	2.000	0.016
	Min	2.060	1.940	0.060	2.020	1.975	0.020	2.006	1.990	0.006	2.002	1.994	0.002	2.000	1.994	0.000
2.5	Max	2.620	2.500	0.180	2.545	2.500	0.070	2.520	2.500	0.030	2.512	2.500	0.018	2.510	2.500	0.016
	Min	2.560	2.440	0.060	2.520	2.475	0.020	2.506	2.490	0.006	2.502	2.494	0.002	2.500	2.494	0.000
3	Max	3.120	3.000	0.180	3.045	3.000	0.070	3.020	3.000	0.030	3.012	3.000	0.018	3.010	3.000	0.016
	Min	3.060	2.940	0.060	3.020	2.975	0.020	3.006	2.990	0.006	3.002	2.994	0.002	3.000	2.994	0.000
4	Max	4.145	4.000	0.220	4.060	4.000	0.090	4.028	4.000	0.040	4.016	4.000	0.024	4.012	4.000	0.020
	Min	4.070	3.925	0.070	4.030	3.970	0.030	4.010	3.988	0.010	4.004	3.992	0.004	4.000	3.992	0.000
5	Max	5.145	5.000	0.220	5.060	5.000	0.090	5.028	5.000	0.040	5.016	5.000	0.024	5.012	5.000	0.020
	Min	5.070	4.925	0.070	5.030	4.970	0.030	5.010	4.988	0.010	5.004	4.992	0.004	5.000	4.992	0.000
6	Max	6.145	6.000	0.220	6.060	6.000	0.090	6.028	6.000	0.040	6.016	6.000	0.024	6.012	6.000	0.020
	Min	6.070	5.925	0.070	6.030	5.970	0.030	6.010	5.988	0.010	6.004	5.992	0.004	6.000	5.992	0.000
8	Max	8.170	8.000	0.260	8.076	8.000	0.112	8.035	8.000	0.050	8.020	8.000	0.029	8.015	8.000	0.024
	Min	8.080	7.910	0.080	8.040	7.964	0.040	8.013	7.985	0.013	8.005	7.991	0.005	8.000	7.991	0.000
10	Max	10.170	10.000	0.260	10.076	10.000	0.112	10.035	10.000	0.050	10.020	10.000	0.029	10.015	10.000	0.024
	Min	10.080	9.910	0.080	10.040	9.964	0.040	10.013	9.985	0.013	10.005	9.991	0.005	10.000	9.991	0.000
12	Max	12.205	12.000	0.315	12.093	12.000	0.136	12.043	12.000	0.061	12.024	12.000	0.035	12.018	12.000	0.029
	Min	12.095	11.890	0.095	12.050	11.957	0.050	12.016	11.982	0.016	12.006	11.989	0.006	12.000	11.989	0.000
16	Max	16.205	16.000	0.315	16.093	16.000	0.136	16.043	16.000	0.061	16.024	16.000	0.035	16.018	16.000	0.029
	Min	16.095	15.890	0.095	16.050	15.957	0.050	16.016	15.982	0.016	16.006	15.989	0.006	16.000	15.989	0.000
20	Max	20.240	20.000	0.370	20.117	20.000	0.169	20.053	20.000	0.074	20.028	20.000	0.041	20.021	20.000	0.034
	Min	20.110	19.870	0.110	20.065	19.948	0.065	20.020	19.979	0.020	20.007	19.987	0.007	20.000	19.987	0.000
25	Max	25.240	25.000	0.370	25.117	25.000	0.169	25.053	25.000	0.074	25.028	25.000	0.041	25.021	25.000	0.034
	Min	25.110	24.870	0.110	25.065	24.948	0.065	25.020	24.979	0.020	25.007	24.987	0.007	25.000	24.987	0.000
30	Max	30.240	30.000	0.370	30.117	30.000	0.169	30.053	30.000	0.074	30.028	30.000	0.041	30.021	30.000	0.034
	Min	30.110	29.870	0.110	30.065	29.948	0.065	30.020	29.979	0.020	30.007	29.987	0.007	30.000	29.987	0.000
40	Max	40.280	40.000	0.440	40.142	40.000	0.204	40.064	40.000	0.089	40.034	40.000	0.050	40.025	40.000	0.041
	Min	40.120	39.840	0.120	40.080	39.938	0.080	40.025	39.975	0.025	40.009	39.984	0.009	40.000	39.984	0.000
50	Max	50.290	50.000	0.450	50.142	50.000	0.204	50.064	50.000	0.089	50.034	50.000	0.050	50.025	50.000	0.041
	Min	50.130	49.840	0.130	50.080	49.938	0.080	50.025	49.975	0.025	50.009	49.984	0.009	50.000	49.984	0.000
60	Max	60.330	60.000	0.520	60.174	60.000	0.248	60.076	60.000	0.106	60.040	60.000	0.059	60.030	60.000	0.049
	Min	60.140	59.810	0.140	60.100	59.926	0.100	60.030	59.970	0.030	60.010	59.981	0.010	60.000	59.981	0.000
80	Max	80.340	80.000	0.530	80.174	80.000	0.248	80.076	80.000	0.106	80.040	80.000	0.059	80.030	80.000	0.049
	Min	80.150	79.810	0.150	80.100	79.926	0.100	80.030	79.970	0.030	80.010	79.981	0.010	80.000	79.981	0.000
100	Max	100.390	100.000	0.610	100.207	100.000	0.294	100.090	100.000	0.125	100.047	100.000	0.069	100.035	100.000	0.057
	Min	100.170	99.780	0.170	100.120	99.913	0.120	100.036	99.965	0.036	100.012	99.978	0.012	100.000	99.978	0.000
120	Max	120.400	120.000	0.620	120.207	120.000	0.294	120.090	120.000	0.125	120.047	120.000	0.069	120.035	120.000	0.057
	Min	120.180	119.780	0.180	120.120	119.913	0.120	120.036	119.965	0.036	120.012	119.978	0.012	120.000	119.978	0.000
160	Max	160.460	160.000	0.710	160.245	160.000	0.345	160.106	160.000	0.146	160.054	160.000	0.079	160.040	160.000	0.065
	Min	160.210	159.750	0.210	160.145	159.900	0.145	160.043	159.960	0.043	160.014	159.975	0.014	160.000	159.975	0.000
200	Max	200.530	200.000	0.820	200.285	200.000	0.400	200.122	200.000	0.168	200.061	200.000	0.090	200.046	200.000	0.075
	Min	200.240	199.710	0.240	200.170	199.885	0.170	200.050	199.954	0.050	200.015	199.971	0.015	200.000	199.971	0.000
250	Max	250.570	250.000	0.860	250.285	250.000	0.400	250.122	250.000	0.168	250.061	250.000	0.090	250.046	250.000	0.075
	Min	250.280	249.710	0.280	250.170	249.885	0.170	250.050	249.954	0.050	250.015	249.971	0.015	250.000	249.971	0.000
300	Max	300.650	300.000	0.970	300.320	300.000	0.450	300.137	300.000	0.189	300.069	300.000	0.101	300.052	300.000	0.084
	Min	300.330	299.680	0.330	300.190	299.870	0.190	300.056	299.948	0.056	300.017	299.968	0.017	300.000	299.968	0.000
400	Max	400.760	400.000	1.120	400.350	400.000	0.490	400.151	400.000	0.208	400.075	400.000	0.111	400.057	400.000	0.093
	Min	400.400	399.640	0.400	400.210	399.860	0.210	400.062	399.943	0.062	400.018	399.964	0.018	400.000	399.964	0.000
500	Max	500.880	500.000	1.280	500.385	500.000	0.540	500.165	500.000	0.228	500.083	500.000	0.123	500.063	500.000	0.103
	Min	500.480	499.600	0.480	500.230	499.845	0.230	500.068	499.937	0.068	500.020	499.960	0.020	500.000	499.960	0.000

TABLE C.12.9 Preferred Metric Shaft Basis Transition and Interference Fits

Basic Size	Locational Transition			Locational Transition			Locational Interference			Medium Drive			Force			
	Hole K7	Shaft h6	Fit	Hole N7	Shaft h6	Fit	Hole P7	Shaft h6	Fit	Hole S7	Shaft h6	Fit	Hole U7	Shaft h6	Fit	
1	Max	1.000	1.000	0.006	0.996	1.000	0.002	0.994	1.000	0.000	0.986	1.000	-0.008	0.982	1.000	-0.012
	Min	0.990	0.994	-0.010	0.986	0.994	-0.014	0.984	0.994	-0.016	0.976	0.994	-0.024	0.972	0.994	-0.028
1.2	Max	1.200	1.200	0.006	1.196	1.200	0.002	1.194	1.200	0.000	1.186	1.200	-0.008	1.182	1.200	-0.012
	Min	1.190	1.194	-0.010	1.186	1.194	-0.014	1.184	1.194	-0.016	1.176	1.194	-0.024	1.172	1.194	-0.028
1.6	Max	1.600	1.600	0.006	1.596	1.600	0.002	1.594	1.600	0.000	1.586	1.600	-0.008	1.582	1.600	-0.012
	Min	1.590	1.594	-0.010	1.586	1.594	-0.014	1.584	1.594	-0.016	1.576	1.594	-0.024	1.572	1.594	-0.028
2	Max	2.000	2.000	0.006	1.996	2.000	0.002	1.994	2.000	0.000	1.986	2.000	-0.008	1.982	2.000	-0.012
	Min	1.990	1.994	-0.010	1.986	1.994	-0.014	1.984	1.994	-0.016	1.976	1.994	-0.024	1.972	1.994	-0.028
2.5	Max	2.500	2.500	0.006	2.496	2.500	0.002	2.494	2.500	0.000	2.486	2.500	-0.008	2.482	2.500	-0.012
	Min	2.490	2.494	-0.010	2.486	2.494	-0.014	2.484	2.494	-0.016	2.476	2.494	-0.024	2.472	2.494	-0.028
3	Max	3.000	3.000	0.006	2.996	3.000	0.002	2.994	3.000	0.000	2.986	3.000	-0.008	2.982	3.000	-0.012
	Min	2.990	2.994	-0.010	2.986	2.994	-0.014	2.984	2.994	-0.016	2.976	2.994	-0.024	2.972	2.994	-0.028
4	Max	4.003	4.000	0.011	3.996	4.000	0.004	3.992	4.000	0.000	3.985	4.000	-0.007	3.981	4.000	-0.011
	Min	3.991	3.992	-0.009	3.984	3.992	-0.016	3.980	3.992	-0.020	3.973	3.992	-0.027	3.969	3.992	-0.031
5	Max	5.003	5.000	0.011	4.996	5.000	0.004	4.992	5.000	0.000	4.985	5.000	-0.007	4.981	5.000	-0.011
	Min	4.991	4.992	-0.009	4.984	4.992	-0.016	4.980	4.992	-0.020	4.973	4.992	-0.027	4.969	4.992	-0.031
6	Max	6.003	6.000	0.011	5.996	6.000	0.004	5.992	6.000	0.000	5.985	6.000	-0.007	5.981	6.000	-0.011
	Min	5.991	5.992	-0.009	5.984	5.992	-0.016	5.980	5.992	-0.020	5.973	5.992	-0.027	5.969	5.992	-0.031
8	Max	8.005	8.000	0.014	7.996	8.000	0.005	7.991	8.000	0.000	7.983	8.000	-0.008	7.978	8.000	-0.013
	Min	7.990	7.991	-0.010	7.981	7.991	-0.019	7.976	7.991	-0.024	7.968	7.991	-0.032	7.963	7.991	-0.037
10	Max	10.005	10.000	0.014	9.996	10.000	0.005	9.991	10.000	0.000	9.983	10.000	-0.008	9.978	10.000	-0.013
	Min	9.990	9.991	-0.010	9.981	9.991	-0.019	9.976	9.991	-0.024	9.968	9.991	-0.032	9.963	9.991	-0.037
12	Max	12.006	12.000	0.017	11.995	12.000	0.006	11.989	12.000	0.000	11.979	12.000	-0.010	11.974	12.000	-0.015
	Min	11.988	11.989	-0.012	11.977	11.989	-0.023	11.971	11.989	-0.029	11.961	11.989	-0.039	11.956	11.989	-0.044
16	Max	16.006	16.000	0.017	15.995	16.000	0.006	15.989	16.000	0.000	15.979	16.000	-0.010	15.974	16.000	-0.015
	Min	15.988	15.989	-0.012	15.977	15.989	-0.023	15.971	15.989	-0.029	15.961	15.989	-0.039	15.956	15.989	-0.044
20	Max	20.006	20.000	0.019	19.993	20.000	0.006	19.986	20.000	-0.001	19.973	20.000	-0.014	19.967	20.000	-0.020
	Min	19.985	19.987	-0.015	19.972	19.987	-0.028	19.965	19.987	-0.035	19.952	19.987	-0.048	19.946	19.987	-0.054
25	Max	25.006	25.000	0.019	24.993	25.000	0.006	24.986	25.000	-0.001	24.973	25.000	-0.014	24.966	25.000	-0.022
	Min	24.985	24.987	-0.015	24.972	24.987	-0.028	24.965	24.987	-0.035	24.952	24.987	-0.048	24.939	24.987	-0.061
30	Max	30.006	30.000	0.019	29.993	30.000	0.006	29.986	30.000	-0.001	29.973	30.000	-0.014	29.966	30.000	-0.022
	Min	29.985	29.987	-0.015	29.972	29.987	-0.028	29.965	29.987	-0.035	29.952	29.987	-0.048	29.939	29.987	-0.061
40	Max	40.007	40.000	0.023	39.992	40.000	0.008	39.983	40.000	-0.001	39.966	40.000	-0.018	39.949	40.000	-0.035
	Min	39.982	39.984	-0.018	39.967	39.984	-0.033	39.958	39.984	-0.042	39.941	39.984	-0.059	39.924	39.984	-0.076
50	Max	50.007	50.000	0.023	49.992	50.000	0.008	49.983	50.000	-0.001	49.966	50.000	-0.018	49.939	50.000	-0.045
	Min	49.982	49.984	-0.018	49.967	49.984	-0.033	49.958	49.984	-0.042	49.941	49.984	-0.059	49.914	49.984	-0.086
60	Max	60.009	60.000	0.028	59.991	60.000	0.010	59.979	60.000	-0.002	59.958	60.000	-0.023	59.924	60.000	-0.057
	Min	59.979	59.981	-0.021	59.961	59.981	-0.039	59.949	59.981	-0.051	59.928	59.981	-0.072	59.894	59.981	-0.106
80	Max	80.009	80.000	0.028	79.991	80.000	0.010	79.979	80.000	-0.002	79.952	80.000	-0.029	79.909	80.000	-0.072
	Min	79.979	79.981	-0.021	79.961	79.981	-0.039	79.949	79.981	-0.051	79.922	79.981	-0.078	79.879	79.981	-0.121
100	Max	100.010	100.000	0.032	99.990	100.000	0.012	99.976	100.000	-0.002	99.942	100.000	-0.036	99.889	100.000	-0.089
	Min	99.975	99.978	-0.025	99.955	99.978	-0.045	99.941	99.978	-0.059	99.907	99.978	-0.093	99.854	99.978	-0.146
120	Max	120.010	120.000	0.032	119.990	120.000	0.012	119.976	120.000	-0.002	119.934	120.000	-0.044	119.869	120.000	-0.109
	Min	119.975	119.978	-0.025	119.955	119.978	-0.045	119.941	119.978	-0.059	119.899	119.978	-0.101	119.834	119.978	-0.166
160	Max	160.012	160.000	0.037	159.988	160.000	0.013	159.972	160.000	-0.003	159.915	160.000	-0.060	159.825	160.000	-0.150
	Min	159.972	159.975	-0.028	159.948	159.975	-0.052	159.932	159.975	-0.068	159.875	159.975	-0.125	159.785	159.975	-0.215
200	Max	200.013	200.000	0.042	199.986	200.000	0.015	199.967	200.000	-0.004	199.895	200.000	-0.076	199.781	200.000	-0.190
	Min	199.967	199.971	-0.033	199.940	199.971	-0.060	199.921	199.971	-0.079	199.849	199.971	-0.151	199.735	199.971	-0.265
250	Max	250.013	250.000	0.042	249.986	250.000	0.015	249.967	250.000	-0.004	249.877	250.000	-0.094	249.733	250.000	-0.238
	Min	249.967	249.971	-0.033	249.940	249.971	-0.060	249.921	249.971	-0.079	249.831	249.971	-0.169	249.687	249.971	-0.313
300	Max	300.016	300.000	0.048	299.986	300.000	0.018	299.964	300.000	-0.004	299.850	300.000	-0.118	299.670	300.000	-0.298
	Min	299.964	299.968	-0.036	299.934	299.968	-0.066	299.912	299.968	-0.088	299.798	299.968	-0.202	299.618	299.968	-0.382
400	Max	400.017	400.000	0.053	399.984	400.000	0.020	399.959	400.000	-0.005	399.813	400.000	-0.151	399.586	400.000	-0.378
	Min	399.960	399.964	-0.040	399.927	399.964	-0.073	399.902	399.964	-0.098	399.756	399.964	-0.244	399.529	399.964	-0.471
500	Max	500.018	500.000	0.058	499.983	500.000	0.023	499.955	500.000	-0.005	499.771	500.000	-0.189	499.483	500.000	-0.477
	Min	499.955	499.960	-0.045	499.920	499.960	-0.080	499.892	499.960	-0.108	499.708	499.960	-0.292	499.420	499.960	-0.580