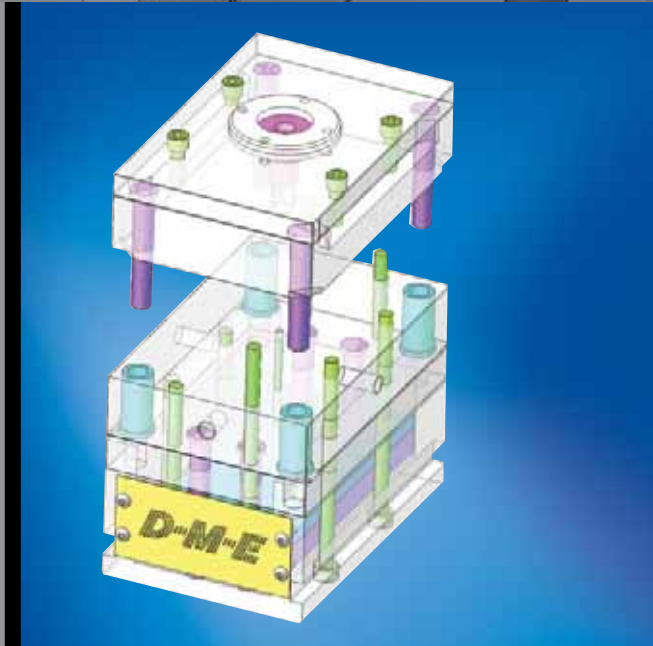


# Technical Reference

## Table of Contents

<i>Metric Equivalents and Conversions</i> .....	286
<i>Steel Hardness Chart</i> .....	287
<i>Tensile Strength</i> .....	288
<i>Draft Angles</i> .....	289
<i>Steel Designations</i> .....	290
<i>Determining Metric Tolerances</i> .....	291-302
<i>American Standard Mold Base Features</i> .....	303-306



# Metric Equivalents and Conversions

## Equivalents: Inch, fraction, decimal, millimeter

INCHES	MILLIMETERS	INCHES	MILLIMETERS
1	25.4	34	863.6
2	50.8	35	889.0
3	76.2	36	914.4
4	101.6	37	939.8
5	127.0	38	965.2
6	152.4	39	990.6
7	177.8	40	1016.0
8	203.2	41	1041.4
9	228.6	42	1066.8
10	254.0	43	1092.2
11	279.4	44	1117.6
12	304.8	45	1143.0
13	330.2	46	1168.4
14	355.6	47	1193.8
15	381.0	48	1219.2
16	406.4	49	1244.6
17	431.8	50	1270.0
18	457.2	51	1295.4
19	482.6	52	1320.8
20	508.0	53	1346.2
21	533.4	54	1371.6
22	558.8	55	1397.0
23	584.2	56	1422.4
24	609.6	57	1447.8
25	635.0	58	1473.2
26	660.4	59	1498.6
27	685.8	60	1524.0
28	711.2	61	1549.4
29	736.6	62	1574.8
30	762.0	63	1600.2
31	787.4	64	1625.6
32	812.8	65	1651.0
33	838.2	66	1676.4

INCHES		MILLIMETERS	INCHES		MILLIMETERS
1/64	0.015625	0.396875	33/64	0.515625	13.096875
1/32	0.031250	0.793750	17/32	0.531250	13.493750
3/64	0.046875	1.190625	35/64	0.546875	13.890625
1/16	0.062500	1.587500	9/16	0.562500	14.287500
5/64	0.078125	1.984375	37/64	0.578125	14.684375
3/32	0.093750	2.381250	19/32	0.593750	15.081250
7/64	0.109375	2.778125	39/64	0.609375	15.478125
1/8	0.125000	3.175000	5/8	0.625000	15.875000
9/64	0.140625	3.571875	41/64	0.640625	16.271875
5/32	0.156250	3.968750	21/32	0.656250	16.668750
11/64	0.171875	4.365625	43/64	0.671875	17.065625
3/16	0.187500	4.762500	11/16	0.687500	17.462500
13/64	0.203125	5.159375	45/64	0.703125	17.859375
7/32	0.218750	5.556250	23/32	0.718750	18.256250
15/64	0.234375	5.953125	47/64	0.734375	18.653125
1/4	0.250000	6.350000	3/4	0.750000	19.050000
17/64	0.265625	6.746875	49/64	0.765625	19.446875
9/32	0.281250	7.143750	25/32	0.781250	19.843750
19/64	0.296875	7.540625	51/64	0.796875	20.240625
5/16	0.312500	7.937500	13/16	0.812500	20.637500
21/64	0.328125	8.334375	53/64	0.828125	21.034375
11/32	0.343750	8.731250	27/32	0.843750	21.431250
23/64	0.359375	9.128125	55/64	0.859375	21.828125
3/8	0.375000	9.525000	7/8	0.875000	22.225000
25/64	0.390625	9.921875	57/64	0.890625	22.621875
13/32	0.406250	10.318750	29/32	0.906250	23.018750
27/64	0.421875	10.715625	59/64	0.921875	23.415625
7/16	0.437500	11.112500	15/16	0.937500	23.812500
29/64	0.453125	11.509375	61/64	0.953125	24.209375
15/32	0.468750	11.906250	31/32	0.968750	24.606250
31/64	0.484375	12.303125	63/64	0.984375	25.003125
1/2	0.500000	12.700000	1	1.000000	25.400000

## Equivalents: Decimal, millimeter

INCHES	MILLIMETERS	INCHES	MILLIMETERS	INCHES	MILLIMETERS
0.001	0.0254	0.01	0.254	0.1	2.54
0.002	0.0508	0.02	0.508	0.2	5.08
0.003	0.0762	0.03	0.762	0.3	7.62
0.004	0.1016	0.04	1.016	0.4	10.16
0.005	0.1270	0.05	1.270	0.5	12.70
0.006	0.1524	0.06	1.524	0.6	15.24
0.007	0.1778	0.07	1.778	0.7	17.78
0.008	0.2032	0.08	2.032	0.8	20.32
0.009	0.2286	0.09	2.286	0.9	22.86

## Measurement conversions

MULTIPLY BY	FROM	TO	MULTIPLY BY
	← TO	← FROM	
0.03937	inch	millimeter	25.4
0.0016	inch <sup>2</sup>	millimeter <sup>2</sup>	645.16
0.061	inch <sup>3</sup>	centimeter <sup>3</sup>	16.3871
0.2642	gallon (U.S.)	liter	3.7854
0.03527	oz. (avdp.)	gram	28.3495
2.2044	pound	kilogram	0.4536
62.43	lbs/ft <sup>3</sup>	g/cm <sup>3</sup>	0.0160
0.145	psi	kPa	6.8948
14.2247	psi	kg/cm <sup>2</sup>	0.0703
1.8°C + 32	°F	°C	(°F-32)/1.8

# Steel Hardness Chart

CROSS-REFERENCE BETWEEN DIFFERENT HARDNESS MEASUREMENTS					
BRINELL HARDNESS BHN*	VICKERS HARDNESS HV	ROCKWELL HARDNESS HRA	ROCKWELL HARDNESS HRB	ROCKWELL HARDNESS HRC	SHORE HARDNESS HS
10mm BALL, 3000kgf LOAD	136° DIAMOND PYRAMID, 10kgf LOAD	BRALE PENETRATOR, 60kgf LOAD	1/16 INCH BALL, 100kgf LOAD	BRALE PENETRATOR, 150kgf LOAD	
86	90		48		
95	100		56.2		
105	110		62.3		
114	120		66.7		
124	130		71.2		20
133	140		75		21
143	150		78.7		22
152	160		81.7	(0)	24
162	170		85	(3)	25
171	180		87.1	(6)	26
181	190		89.5	(8.5)	28
190	200		91.5	(11)	29
200	210		93.4	(13.4)	30
209	220		95	(15.7)	32
219	230		96.7	(18)	33
228	240	60.7	98.1	20.3	34
238	250	61.6	99.5	22.2	36
247	260	62.4	(101)	24	37
256	270	63.1	(102)	25.6	38
265	280	63.8	(103.5)	27.1	40
275	290	64.5	(104.5)	28.5	41
284	300	65.2	(105.5)	29.8	42
303	320	66.4	(107)	32.2	45
322	340	67.6	(108)	34.4	47
341	360	68.7	(109)	36.6	50
360	380	69.8	(110)	38.8	52
379	400	70.8		40.8	55
397	420	71.8		42.7	57
415	440	72.8		44.5	59
433	460	73.6		46.1	62
452	480	74.5		47.7	64
471	500	75.3		49.1	66
488	520	76.1		50.5	67
507	540	76.7		51.7	69
525	560	77.4		53	71
545	580	78		54.1	72
564	600	78.6		55.2	74
582	620	79.2		56.3	75
601	640	79.8		57.3	77
620	660	80.3		58.3	79
638	680	80.8		59.2	80
656	700	81.3		60.1	81
670	720	81.8		61	83
684	740	82.2		61.8	84
698	760	82.6		62.5	86
710	780	83		63.3	87
722	800	83.4		64	88
745	840	84.1		65.3	91
767	880	84.7		66.4	93

\*A 10mm steel ball is used for 450 BHN and below. A 10mm carbide ball is used above 450 BHN.

Also known as Firth Diamond Hardness Number.

Values in parentheses are not contained in the normal definition range for hardness checking, but are often used in comparable measure.

# Tensile Strength

GENERAL STEEL GROUP THROUGH HARDNESS VERSUS APPROXIMATE TENSILE STRENGTH									
HARDNESS		TENSILE STRENGTH							
BRINELL HARDNESS BHN*	ROCKWELL HARDNESS HRC	PLAIN CARBON STEEL AND LOW ALLOY STEEL		STAINLESS STEEL AUSTENITIC TYPE			STAINLESS STEEL CHROMIUM TYPE		
10mm BALL, 3000kgf LOAD	BRALE PENETRATOR, 60kgf LOAD	N/mm <sup>2</sup> (APPROX.)	PSI (APPROX.)	kgf/mm <sup>2</sup> (APPROX.)	N/mm <sup>2</sup> (APPROX.)	PSI (APPROX.)	kgf/mm <sup>2</sup> (APPROX.)	N/mm <sup>2</sup> (APPROX.)	PSI (APPROX.)
86		285	41,334						
95		320	46,410						
105		350	50,761						
114		385	55,837						
124		415	60,188						
133		450	65,264						
143		480	69,615	50	490	71,115	50	490	71,115
152	(0)	510	73,966	56	549	79,649	53	520	75,382
162	(3)	545	79,042	62	608	88,183	59	579	83,916
171	(6)	575	83,393	62	608	88,183	59	579	83,916
181	(8.5)	610	88,470	68	667	96,716	65	637	92,450
190	(11)	640	92,820	68	667	96,716	65	637	92,450
200	(13.4)	675	97,897	75	736	106,673	71	696	100,983
209	(15.7)	705	102,248	75	736	106,673	71	696	100,983
219	(18)	740	107,324	80	785	113,784	78	765	110,939
228	20.3	770	111,675	80	785	113,784	78	765	110,939
238	22.2	800	116,026	85	834	120,896	81	794	115,206
247	24	835	121,102	88	863	125,162			
256	25.6	865	125,453	91	892	129,429	88	863	125,162
265	27.1	900	130,529	94	922	133,696			
275	28.5	930	134,880	97	951	137,963	96	941	136,541
284	29.8	965	139,856	100	981	142,230			
303	32.2	1,030	149,383	109	1,069	155,031	106	1,040	150,764
322	34.4	1,095	158,810	118	1,157	167,831	113	1,108	160,720
341	36.6	1,155	167,512	127	1,245	180,632	120	1,177	170,676
360	38.8	1,220	176,939	136	1,334	193,433	127	1,245	180,632
379	40.8	1,290	187,091	145	1,422	206,234	134	1,314	190,588
397	42.7	1,350	195,793	156	1,530	221,879			
415	44.5	1,420	205,945	167	1,638	237,524			
433	46.1	1,485	215,372	178	1,746	253,169			
452	47.7	1,555	225,525	189	1,853	268,815			
471	49.1	1,630	236,402	200	1,961	284,460			
488	50.5	1,700	246,554	209	2,050	297,261			
507	51.7	1,775	257,432	218	2,138	310,061			
525	53	1,845	267,584	227	2,226	322,862			
545	54.1	1,920	278,461	236	2,314	335,663			
564	55.2	1,995	289,339	245	2,403	348,464			

\*A 10mm steel ball is used for 450 BHN and below. A 10mm carbide ball is used above 450 BHN.

Values in parentheses are not contained in the normal definition range for hardness checking, but are often used in a comparable measure.

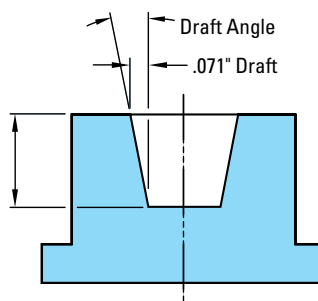
The Tensile Strength relationship to hardness is inexact, even for the steel, unless it is determined for a specific material. Therefore, this chart provides only very general approximate Tensile Strength values.

# Draft Angles

DEPTH	1/2°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	15°	20°	25°	30°	DEPTH
1/32	.0003	.0005	.001	.0016	.002	.0027	.003	.0038	.004	.005	.0055	.006	.0066	.008	.011	.014	.018	1/32
1/16	.0005	.0011	.002	.0033	.004	.0055	.007	.0077	.009	.010	.011	.012	.013	.017	.023	.029	.036	1/16
3/32	.0008	.0017	.003	.0049	.006	.008	.010	.0115	.013	.015	.0165	.018	.020	.025	.034	.044	.054	3/32
1/8	.0011	.0022	.004	.0066	.009	.0109	.013	.015	.018	.020	.022	.024	.027	.033	.045	.058	.072	1/8
5/32	.0014	.0028	.005	.008	.011	.014	.016	.019	.022	.025	.027	.030	.033	.042	.057	.073	.089	5/32
3/16	.0016	.0033	.006	.0098	.013	.016	.019	.023	.027	.030	.033	.036	.040	.050	.068	.087	.108	3/16
7/32	.0019	.0039	.008	.011	.015	.019	.023	.027	.031	.035	.039	.042	.047	.059	.080	.102	.126	7/32
1/4	.0022	.0043	.009	.013	.018	.022	.026	.031	.035	.040	.044	.049	.053	.067	.091	.117	.144	1/4
9/32	.0025	.005	.010	.014	.020	.024	.030	.034	.040	.045	.049	.055	.060	.075	.102	.131	.162	9/32
5/16	.0027	.0055	.011	.016	.022	.027	.033	.038	.044	.050	.055	.061	.066	.084	.114	.146	.180	5/16
11/32	.003	.006	.012	.018	.024	.030	.036	.042	.049	.055	.061	.067	.073	.092	.125	.160	.197	11/32
3/8	.0032	.0066	.013	.020	.026	.033	.039	.046	.053	.060	.066	.073	.080	.100	.136	.175	.217	3/8
13/32	.0035	.007	.014	.021	.028	.035	.043	.050	.057	.064	.071	.079	.086	.108	.148	.189	.234	13/32
7/16	.0038	.0077	.015	.023	.031	.038	.046	.054	.062	.069	.077	.085	.093	.117	.159	.204	.253	7/16
15/32	.0041	.008	.016	.024	.033	.041	.049	.058	.066	.074	.083	.091	.100	.126	.171	.219	.270	15/32
1/2	.0044	.0088	.018	.026	.035	.044	.053	.061	.071	.079	.088	.097	.106	.134	.182	.233	.289	1/2
17/32	.0046	.009	.019	.028	.037	.046	.056	.065	.075	.084	.093	.103	.113	.142	.193	.247	.306	17/32
9/16	.0049	.0099	.020	.030	.039	.049	.059	.069	.079	.088	.099	.109	.120	.151	.205	.262	.325	9/16
19/32	.0052	.010	.021	.031	.042	.052	.062	.073	.084	.094	.105	.115	.127	.159	.216	.277	.343	19/32
5/8	.0055	.011	.022	.033	.044	.055	.066	.077	.088	.100	.110	.120	.133	.167	.227	.291	.361	5/8
21/32	.0057	.011	.023	.035	.046	.057	.069	.082	.092	.104	.115	.127	.140	.176	.239	.306	.379	21/32
11/16	.006	.012	.024	.036	.048	.060	.072	.085	.096	.109	.121	.133	.147	.183	.250	.321	.397	11/16
23/32	.0063	.013	.025	.038	.050	.063	.075	.088	.101	.114	.126	.139	.153	.193	.261	.335	.415	23/32
3/4	.0065	.013	.027	.039	.053	.066	.079	.092	.106	.119	.132	.146	.159	.201	.273	.350	.433	3/4
25/32	.0068	.014	.028	.040	.055	.068	.081	.096	.110	.124	.137	.152	.166	.209	.284	.364	.451	25/32
13/16	.0071	.014	.029	.043	.057	.071	.085	.100	.115	.129	.143	.158	.173	.218	.296	.379	.469	13/16
27/32	.0074	.015	.030	.045	.059	.074	.089	.104	.119	.134	.149	.163	.180	.226	.307	.393	.487	27/32
7/8	.0076	.015	.031	.046	.061	.077	.092	.107	.123	.139	.154	.171	.186	.234	.318	.408	.505	7/8
29/32	.0079	.016	.032	.048	.063	.079	.095	.111	.128	.144	.159	.176	.193	.243	.329	.422	.523	29/32
15/16	.0082	.017	.033	.050	.066	.082	.098	.115	.132	.149	.165	.182	.200	.251	.341	.437	.541	15/16
31/32	.0085	.017	.034	.051	.068	.084	.101	.119	.137	.153	.170	.188	.206	.260	.353	.452	.559	31/32
1	.0087	.0175	.035	.052	.070	.087	.105	.123	.141	.158	.176	.194	.213	.268	.364	.466	.577	1
DEPTH	1/2°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	15°	20°	25°	30°	DEPTH

The depth columns represent cavities from 1/32" to 1" in increments of 1/32". The most commonly used draft angles are noted in degrees at the top and bottom of the table. The measurement listed in any block represents the amount of draft obtained with the corresponding angle and cavity depth.

**EXAMPLE:** The difference between the diameter of the top and the diameter of the bottom of a 1/2" inch cavity with a draft angle of 8° is found by noting the figure in the table opposite the 1/2" depth and corresponding to the 8° draft angle (.071") and multiplying by two (1.420").



The length and necessary angle for cam pins used in actuating core pulls can also be calculated with this table.

**EXAMPLE:** The length of a pin set at a 15° angle required to pull a core 1". Since 20° and 1" of length allow .364" travel, a 4" pin permits four times the travel (1.456").

# Steel Designations

GENERAL STEEL GROUP DESIGNATIONS					
PLAIN CARBON STEEL	LOW ALLOY CARBON STEEL	COLD WORK TOOL STEEL	HOT WORK TOOL STEEL	STAINLESS STEEL AUSTENITIC TYPE	STAINLESS STEEL CHROMIUM TYPE (MARTENSITIC & FERRITIC)
AISI	AISI	AISI	AISI	AISI	AISI
1000 SERIES	4000 SERIES	A2	H10	201	410
	5000 SERIES	A3A	H11	203	416
	6000 SERIES	4	H12	205	420
	8000 SERIES	A5	H13	301	429
	9000 SERIES	A6	H14	302	430
		A7	H19	303	431
		A8	H21	304	434
		A9	H22	305	436
		A10	H23	307	439
		D2	H24	308	440
		D3	H25	309	442
		D4	H26	310	444
		D5	H40	314	446
		D7	H41	316	
			H42	317	
			H43	318	
				321	
				329	
				330	
				332	
				334	
				347	
				348	
				384	
				385	

GENERAL STEEL CROSS-REFERENCE INFORMATION*	
GERMAN WERKSTOFF STANDARD NUMBER FOR STEEL	U.S. STEEL NUMBER AISI
1.0716	NO CROSS-REFERENCE
1.0718	12 L 13 TYPE*
1.1191	1045 TYPE*
1.1730	NO CROSS-REFERENCE
1.2210	L-2 TYPE*
1.2344	H-13 TYPE*
1.2826	NO CROSS-REFERENCE
1.4305	303 TYPE STAINLESS*
1.5710 (AFNOR 35 NC 6)	3135 TYPE*
1.7131	5115 TYPE (SIMILAR TO 1018 & 8620)*
1.8159 (DIN 50 CrV 4)	6150 TYPE*

\*Exchangeability should only be considered after thorough examination of individual case.

# Determining Metric Tolerances

**Table 1: Description of Preferred Fits**

Table 1 is pulled from the ANSI metric tolerances section of the machinists' handbook, which conforms to the ISO and DIN tolerances for hole basis and shaft basis fits. Table 1 provides an overview of the hole basis and shaft basis fits that make up clearance fit, transition fit and interference fit combinations.

	ISO SYMBOL			
	HOLE BASIS	SHAFT BASIS		
CLEARANCE FITS	H11/c11	C11/h11	LOOSE RUNNING FIT	FOR WIDE COMMERCIAL TOLERANCES OR ALLOWANCES ON EXTERNAL MEMBERS.
	H9/d9	D9/h9	FREE RUNNING FIT	NOT FOR USE WHERE ACCURACY IS ESSENTIAL, BUT GOOD FOR LARGE TEMPERATURE VARIATIONS, HIGH RUNNING SPEEDS, OR HEAVY JOURNAL PRESSURES.
	H8/f7	F8/h7	CLOSE RUNNING FIT	FOR RUNNING ON ACCURATE MACHINES AND FOR ACCURATE LOCATION AT MODERATE SPEEDS AND JOURNAL PRESSURES.
	H7/g6	G7/h6	SLIDING FIT	NOT INTENDED TO RUN FREELY, BUT TO MOVE AND TURN FREELY AND LOCATE ACCURATELY.
	H7/h6	H7/h6	LOCATIONAL CLEARANCE FIT	PROVIDES SNUG FIT FOR LOCATING STATIONARY PARTS; BUT CAN BE FREELY ASSEMBLED AND DISASSEMBLED.
TRANSITION FITS	H7/k6	K7/h6	LOCATIONAL TRANSITION FIT	FOR ACCURATE LOCATION, A COMPROMISE BETWEEN CLEARANCE AND INTERFERENCE.
	H7/n6	N7/h6	LOCATIONAL TRANSITION FIT	FOR MORE ACCURATE LOCATION WHERE GREATER INTERFERENCE IS PERMISSIBLE.
INTERFERENCE FITS	H7/p6*	P7/h6	LOCATIONAL INTERFERENCE FIT	FOR PARTS REQUIRING RIGIDITY AND ALIGNMENT WITH PRIME ACCURACY OF LOCATION BUT WITHOUT SPECIAL BORE PRESSURE REQUIREMENTS.
	H7/s6	S7/h6	MEDIUM DRIVE FIT	FOR ORDINARY STEEL PARTS OR SHRINK FITS ON LIGHT SECTIONS, THE TIGHTEST FIT USABLE WITH CAST IRON.
	H7/u6	U7/h6	FORCE FIT	SUITABLE FOR PARTS WHICH CAN BE HIGHLY STRESSED OR FOR SHRINK FITS WHERE THE HEAVY PRESSING FORCES REQUIRED ARE IMPRACTICAL.

Excerpt from *Machinists' Handbook*, pg. 661, 25 Ed., Industrial Press.  
 \*The H7/p6 Hole Basis fit is a transition fit for basic sizes in ranges from 0 through 3mm.

# Determining Metric Tolerances

**Table 2: Commonly used Hole-Basis System of fits**

Table 2 shows closer detail on the hole-basis system of fits than Table 1. When using the hole-basis system of fits, the smallest diameter in the hole tolerance range is fixed to the zero line (basic nominal hole size or diameter), and the clearance between the shaft and hole extends below the zero line, or negative relative to the basic nominal hole size.

BASIC HOLES	LETTER SYMBOLS AND GRADE NUMBERS OF SHAFTS																
	CLEARANCE FITS						TRANSITION FITS					INTERFERENCE FITS					
	b	c	d	e	f	g	h	js	k	m	n	p	f	s	t	u	x
H5						4	4	4	4	4							
H6						5	5	5	5	5							
					6	6	6	6	6	6	6*	6*					
H7				6	6	6	6	6	6	6	6	6*	6*	6	6	6	6
				7	7	7	7	7	7	7	7	7*	7*	7	7	7	7
					7		7										
H8				8	8		8										
			9	9													
H9			8	8			8										
		9	9	9			9										
H10	9	9	9														

\*Exceptions occur in some steps of dimensions.

**Table 3: Commonly used Shaft-Basis System of fits**

Table 3 shows closer detail on the shaft-basis system of fits than Table 1. When using the shaft-basis system of fits, the largest diameter in the shaft tolerance range is fixed to the zero line (basic nominal shaft size or diameter), and the clearance between the shaft and hole extends above the zero line, or positive relative to the basic shaft size.

BASIC SHAFTS	LETTER SYMBOLS AND GRADE NUMBERS OF HOLES																
	CLEARANCE FITS						TRANSITION FITS					INTERFERENCE FITS					
	B	C	D	E	F	G	H	Js	K	M	N	P	F	S	T	U	X
h5							5	5	5	5							
h6							6	6	6	6	6*	6					
					6	6	6	6	6	6	6	6*					
h7				7	7	7	7	7	7	7	7	7*	7	7	7	7	7
				7	7	7	7	7	7	7	7	7	7*	7			
					8		8										
h8			8	8	8		8										
			9	9			9										
h9			8	8			8										
		9	9	9			9										
h10	10	10	10														

\*Exceptions occur in some steps of dimensions.

# Determining Metric Tolerances

**Table 4: IT Standard Tolerances**

Table 4 details the ISO-basic tolerances (International Tolerance Grades, or, "IT") which apply to all linear sizes (external and internal sizes, diameters, lengths, widths and thicknesses). An IT-grade number establishes the magnitude of the tolerance zone, while the tolerance position letter determines where the tolerance zone is in relation to the zero line. The combination of tolerance position letter (A-X, a-x) and IT-grade number (01-8) creates the overall tolerance symbol (i.e., F8/h7 when using the shaft-basis system of fits).

For nominal size range up to 500mm according to DIN 7151/ISO 286, and for nominal size range over 500mm, according to DIN 7172/ISO 286.

ITEMS IN MM		IT STANDARD TOLERANCES (UNITS IN 0.001MM)																			
OVER	TO	IT01	IT0	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12	IT13	IT14	IT15	IT16	IT17	IT18
0	3	0.3	0.5	0.8	1.2	2	3	4	6	10	14	25	40	60	100	140	250	400	600	—	—
3	6	0.4	0.6	1	1.5	2.5	4	5	8	12	18	30	48	75	120	180	300	480	750	—	—
6	10	0.4	0.6	1	1.5	2.5	4	6	9	15	22	36	58	90	150	220	360	580	900	1500	—
10	18	0.5	0.8	1.2	2	3	5	8	11	18	27	43	70	110	180	270	430	700	1100	1800	2700
18	30	0.6	1	1.5	2.5	4	6	9	13	21	33	52	84	130	210	330	520	840	1300	2100	3300
30	50	0.6	1	1.5	2.5	4	7	11	16	25	39	62	100	160	250	390	620	1000	1600	2500	3900
50	80	0.8	1.2	2	3	5	8	13	19	30	46	74	120	190	300	460	740	1200	1900	3000	4600
80	120	1	1.5	2.5	4	6	10	15	22	35	54	87	140	220	350	540	870	1400	2200	3500	5400
120	180	1.2	2	3.5	5	8	12	18	25	40	63	100	160	250	400	630	1000	1600	2500	4000	6300
180	250	2	3	4.5	7	10	14	20	29	46	72	115	185	290	460	720	1150	1850	2900	4600	7200
250	315	2.5	4	6	8	12	16	23	32	52	81	130	210	320	520	810	1300	2100	3200	5200	8100
315	400	3	5	7	9	13	18	25	36	57	89	140	230	360	570	890	1400	2300	3600	5700	8900
400	500	4	6	8	10	15	20	27	40	63	97	155	250	400	630	970	1550	2500	4000	6300	9700
500	630	4.5	6	9	11	16	22	30	44	70	110	175	280	440	700	1100	1750	2800	4400	—	—
630	800	5	7	10	13	18	25	35	50	80	125	200	320	500	800	1250	2000	3200	5000	—	—
800	1000	5.5	8	11	15	21	29	40	56	90	140	230	360	560	900	1400	2300	3600	5600	—	—

NOMINAL SIZE RANGE

# Determining Metric Tolerances

**Table 5: Fundamental deviations of holes and shafts**

Table 5 details fundamental deviations between holes and shafts, and is provided for reference.

HOLES	GRADE		IT6 TO IT16													
	DIVISIONS		FUNDAMENTAL DEVIATIONS (LOWER DEVIATIONS)					Js	FUNDAMENTAL DEVIATIONS (UPPER DEVIATIONS)							
	LETTER SYMBOLS		D	E	F	G	H		K	M	N	P	R	S	T	U
	SIGNS		+	+	+	+			-	-	-	-	-	-	-	
ABOVE	UP TO															
500	560	260	145	76	22	0	DEVIATIONS (+/-) IT/2	0	26	44	78	150	280	400	600	
560	630											155	310	450	660	
630	710	290	160	80	24	0		0	30	50	88	175	340	500	740	
710	800											185	380	560	840	
800	900	320	170	86	26	0		0	34	56	100	210	430	620	940	
900	1000											220	470	680	1050	
1000	1120	350	195	98	28	0		0	40	66	120	250	520	780	1150	
1120	1250											260	580	840	1300	
1250	1400	390	220	110	30	0		0	48	78	140	300	640	960	1450	
1400	1600											330	720	1050	1600	
1600	1800	430	240	120	32	0		0	58	92	170	370	820	1200	1850	
1800	2000											400	920	1350	2000	
2000	2240	480	260	130	34	0		0	68	110	195	440	1000	1500	2300	
2240	2500											460	1100	1650	2500	
2500	2800	520	290	145	38	0		0	76	135	240	550	1250	1900	2900	
2800	3150											580	1400	2100	3200	
ABOVE	UP TO															
SIGNS		-	-	-	-			+	+	+	+	+	+	+		
LETTER SYMBOLS		d	e	f	g	h	js	k	m	n	p	r	s	t	u	
DIVISIONS		FUNDAMENTAL DEVIATIONS (UPPER DEVIATIONS)					FUNDAMENTAL DEVIATIONS (LOWER DEVIATIONS)									
GRADE		IT6 TO IT16														

# Determining Metric Tolerances

**Table 6: Tolerances for inside dimensions (holes)**

Table 6 details tolerances for inside dimensions (holes) based relative to the tolerance symbol. Upper and lower values are provided as either positive or negative (or zero) values relative to the nominal size chosen. Pick the range in which the desired nominal value falls into, and then either add or subtract the tolerances to find the upper and lower tolerance range for the desired nominal size.

UNITS IN MM		TOLERANCES FOR INSIDE DIMENSIONS (HOLES) (UNITS IN 0.001MM)																				
OVER	TO	A11	B8	B11	C11	D9	D10	D11	E8	E9	F6	F7	F8	G6	G7	H5	H6	H7	H8	H9	H10	
0	1	—	—	—		+120	+45	+60	+80	+28	+39	+12	+16	+20	+8	+12	+4	+6	+10	+14	+25	+40
1	3	+330 +270	+154 +140	+200 +140		+60	+20	+20	+20	+14	+14	+6	+6	+6	+2	+2	0	0	0	0	0	0
3	6	+345 +270	+158 +140	+215 +140	+145 +70	+60 +30	+78 +30	+105 30	+38 +20	+50 +20	+18 +10	+22 +10	+28 +10	+12 +4	+16 +4	+5 0	+8 0	+12 0	+18 0	+30 0	+48 0	
6	10	+370 +280	+172 +150	+240 +150	+170 +80	+76 +40	+98 +40	+130 +40	+47 +25	+61 +25	+22 +13	+28 +13	+35 +13	+14 +5	+20 +5	+6 0	+9 0	+15 0	+22 0	+36 0	+58 0	
10	14	+400	+177	+260	+205	+93	+120	+160	+59	+75	+27	+34	+43	+17	+24	+8	+11	+18	+27	+43	+70	
14	18	+290	+150	+150	+95	+50	+50	+50	+32	+32	+16	+16	+16	+6	+6	0	0	0	0	0	0	
18	24	+430	+193	+290	+240	+117	+149	+195	+73	+92	+33	+41	+53	+20	+28	+9	+13	+21	+33	+52	+84	
24	30	+300	+160	+160	+110	+65	+65	+65	+40	+40	+20	+20	+20	+7	+7	0	0	0	0	0	0	
30	40	+470 +310	+209 +170	+330 +170	+280 +120	+142	+180	+240	+89	+112	+41	+50	+64	+25	+34	+11	+16	+25	+39	+62	+100	
40	50	+480 +320	+219 +180	+340 +180	+290 +130	+80	+80	+80	+50	+50	+25	+25	+25	+9	+9	0	0	0	0	0	0	
50	65	+530 +340	+236 +190	+380 +190	+330 +140	+174	+220	+290	+106	+134	+49	+60	+76	+29	+40	+13	+19	+30	+46	+74	+120	
65	80	+550 +360	+246 +200	+390 +200	+340 +150	+100	+100	+100	+60	+60	+30	+30	+30	+10	+10	0	0	0	0	0	0	
80	100	+600 +380	+274 +220	+440 +220	+390 +170	+207	+260	+340	+126	+159	+58	+71	+90	+34	+47	+15	+22	+35	+54	+87	+140	
100	120	+630 +410	+294 +240	+460 +240	+400 +180	+120	+120	+120	+72	+72	+36	+36	+36	+12	+12	0	0	0	0	0	0	
120	140	+710 +460	+323 +260	+510 +260	+450 +200																	
140	160	+770 +520	+343 +280	+530 +280	+460 +210	+245	+305	+395	+148	+185	+68	+83	+106	+39	+54	+18	+25	+40	+63	+100	+160	
160	180	+830 +580	+373 +310	+560 +310	+480 +230																	
180	200	+950 +660	+412 +340	+630 +340	+530 +240																	
200	225	+1030 +740	+452 +380	+670 +380	+550 +260	+285	+355	+460	+172	+215	+79	+96	+122	+44	+61	+20	+29	+46	+72	+115	+185	
225	250	+1110 +820	+492 +420	+710 +420	+570 +280																	
250	280	+1240 +920	+561 +480	+800 +480	+620 +300	+320	+400	+510	+191	+240	+88	+108	+137	+49	+69	+23	+32	+52	+81	+130	+210	
280	315	+1370 +1050	+621 +540	+860 +540	+650 +330	+190	+190	+190	+110	+110	+56	+56	+56	+17	+17	0	0	0	0	0	0	
315	355	+1560 +1200	+689 +600	+960 +600	+720 +360	+350	+440	+570	+214	+265	+98	+119	+151	+54	+75	+25	+36	+57	+89	+140	+230	
355	400	+1710 +1350	+769 +680	+1040 +680	+760 +400	+210	+210	+210	+125	+125	+62	+62	+62	+18	+18	0	0	0	0	0	0	
400	450	+1900 +1500	+857 +760	+1160 +760	+840 +440	+385	+480	+630	+232	+290	+108	+131	+165	+60	+83	+27	+40	+63	+97	+155	+250	
450	500	+2050 +1650	+937 +840	+1240 +840	+880 +480	+230	+230	+230	+135	+135	+68	+68	+68	+20	+20	0	0	0	0	0	0	

Technical Reference | Determining Metric Tolerances

# Determining Metric Tolerances

Table 6: Tolerances for inside dimensions (holes) — continued

UNITS IN MM		TOLERANCES FOR INSIDE DIMENSIONS (HOLES) (UNITS IN 0.001MM)																			
OVER	TO	H11	H12	H13	J6	J7	J8	K6	K7	K8	M6	M7	M8	N6	N7	N8	R7	JS6	JS7	JS8	JS9
0	1	+60	+100	+140	+2	+4	+6	0	0	0	-2	-2	-2	-4	-4	-4	-10	+3	+5	+7	+12.5
1	3	0	0	0	-4	-6	-8	-6	-10	-14	-8	-12	-16	-10	-14	-18	-20	-3	-5	-7	-12.5
3	6	+75	+120	+180	+5	+6	+10	+2	+3	+5	-1	0	+2	-5	-4	-2	-11	+4	+6	+9	+15
		0	0	0	-3	-6	-8	-6	-9	-13	-9	-12	-16	-13	-16	-20	-23	-4	-6	-9	-15
6	10	+90	+150	+220	+5	+8	+12	+2	+5	+6	-3	0	+1	-7	-4	-3	-13	+4.5	+7.5	+11	+18
		0	0	0	-4	-7	-10	-7	-10	-16	-12	-15	-21	-16	-19	-25	-28	-4.5	-7.5	-11	-18
10	14	+110	+180	+270	+6	+10	+15	+2	+6	+8	-4	0	+2	-9	-5	-3	-16	+5.5	+9	+13.5	+21.5
14	18	0	0	0	-5	-8	-12	-9	-12	-19	-15	-18	-25	-20	-23	-30	-34	-5.5	-9	-13.5	-21.5
18	24	+130	+210	+330	+8	+12	+20	+2	+6	+10	-4	0	+4	-11	-7	-3	-20	+6.5	+10.5	+16.5	+26
24	30	0	0	0	-5	-9	-13	-11	-15	-23	-17	-21	-29	-24	-28	-36	-41	-6.5	-10.5	-16.5	-26
30	40	+160	+250	+390	+10	+14	+24	+3	+7	+12	-4	0	+5	-12	-8	-3	-25	+8	+12.5	+19.5	+31
40	50	0	0	0	-6	-11	-15	-13	-18	-27	-20	-25	-34	-28	-33	-42	-50	-8	-12.5	-19.5	-31
50	65	+190	+300	+460	+13	+18	+28	+4	+9	+14	-5	0	+5	-14	-9	-4	-30	+9.5	+15	+23	+37
		0	0	0	-6	-12	-18	-15	-21	-32	-24	-30	-41	-33	-39	-50	-60	-9.5	-15	-23	-37
65	80																	-32			
																		-62			
80	100	+220	+350	+540	+16	+22	+34	+4	+10	+16	-6	0	+6	-16	-10	-4	-38	+11	+17.5	+27	+43.5
		0	0	0	-6	-13	-20	-18	-25	-38	-28	-35	-48	-38	-45	-58	-73	-11	-17.5	-27	-43.5
100	120																	-41			
																		-76			
120	140																	-48			
																		-88			
140	160	+250	+400	+630	+18	+26	+41	+4	+12	+20	-8	0	+8	-20	-12	-4	-50	+12.5	+20	+31.5	+50
		0	0	0	-7	-14	-22	-21	-28	-43	-33	-40	-55	-45	-52	-67	-90	-12.5	-20	-31.5	-50
160	180																	-53			
																		-93			
180	200																	-60			
																		-106			
200	225	+290	+460	+720	+22	+30	+47	+5	+13	+22	-8	0	+9	-22	-14	-5	-63	+14.5	+23	+36	+57.5
		0	0	0	-7	-16	-25	-24	-33	-50	-37	-46	-63	-51	-60	-77	-109	-14.5	-23	-36	-57.5
225	250																	-67			
																		-113			
250	280	+320	+520	+810	+25	+36	+55	+5	+16	+25	-9	0	+9	-25	-14	-5	-74	+16	+26	+40.5	+65
		0	0	0	-7	-16	-26	-27	-36	-56	-41	-52	-72	-57	-66	-86	-126	-16	-26	-40.5	-65
280	315																	-78			
																		-130			
315	355	+360	+570	+890	+29	+39	+60	+7	+17	+28	-10	0	+11	-26	-16	-5	-87	+18	+28.5	+44.5	+70
		0	0	0	-7	-18	-29	-29	-40	-61	-46	-57	-78	-62	-73	-94	-144	-18	-28.5	-44.5	-70
355	400																	-93			
																		-150			
400	450	+400	+630	+970	+33	+43	+66	+8	+18	+29	-10	0	+11	-27	-17	-6	-103	+20	+31.5	+48.5	+77.5
		0	0	0	-7	-20	-31	-32	-45	-68	-50	-63	-86	-67	-80	-103	-166	-20	-31.5	-48.5	-77.5
450	500																	-109			
																		-172			

# Determining Metric Tolerances

Table 6: Tolerances for inside dimensions (holes) — continued

UNITS IN MM		TOLERANCES FOR INSIDE DIMENSIONS (HOLES) (UNITS IN 0.001MM)									
OVER	TO	JS10	JS11	JS12	JS13	JS14	JS15	JS16	JS17	JS18	
NOMINAL SIZE RANGE	0	1	+20	+30	+50	+70	+125	+200	+300	—	—
	1	3	-20	-30	-50	-70	-125	-200	-300	—	—
	3	6	+24	+37.5	+60	+90	+150	+240	+375	—	—
			-24	-37.5	-60	-90	-150	-240	-375	—	—
	6	10	+29	+45	+75	+110	+180	+290	+450	+750	—
			-29	-45	-75	-110	-180	-290	-450	-750	—
	10	14	+35	+55	+90	+135	+215	+350	+550	+900	+1350
			-35	-55	-90	-135	-215	-350	-550	-900	-1350
	18	24	+42	+65	+105	+165	+260	+420	+650	+1050	+1650
			-42	-65	-105	-165	-260	-420	-650	-1050	-1650
	30	40	+50	+80	+125	+195	+310	+500	+800	+1250	+1950
			-50	-80	-125	-195	-310	-500	-800	-1250	-1950
	50	65	+60	+95	+150	+230	+370	+600	+950	+1500	+2300
			-60	-95	-150	-230	-370	-600	-950	-1500	-2300
	80	100	+70	+110	+175	+270	+435	+700	+1100	+1750	+2700
			-70	-110	-175	-270	-435	-700	-1100	-1750	-2700
	120	140	+80	+125	+200	+315	+500	+800	+1250	+2000	+3150
			-80	-125	-200	-315	-500	-800	-1250	-2000	-3150
	180	200	+92.5	+145	+230	+360	+575	+925	+1450	+2300	+3600
			-92.5	-145	-230	-360	-575	-925	-1450	-2300	-3600
250	280	+105	+160	+260	+405	+650	+1050	+1600	+2600	+4050	
		-105	-160	-260	-405	-650	-1050	-1600	-2600	-4050	
315	355	+115	+180	+285	+445	+700	+1150	+1800	+2850	+4450	
		-115	-180	-285	-445	-700	-1150	-1800	-2850	-4450	
400	450	+125	+200	+315	+485	+775	+1250	+2000	+3150	+4850	
		-125	-200	-315	-485	-775	-1250	-2000	-3150	-4850	

# Determining Metric Tolerances

**Table 7: Tolerances for outside dimensions (shafts)**

Table 7 details tolerances for outside dimensions (shafts) based relative to the tolerance symbol. Upper and lower values are provided as either positive or negative (or zero) values relative to the nominal size chosen. Pick the range in which the desired nominal value fall into, and then either add or subtract the tolerances to find the upper and lower tolerance range for the desired nominal size.

UNITS IN MM		TOLERANCES FOR OUTSIDE DIMENSIONS (SHAFTS) (UNITS IN 0.001MM)																				
OVER	TO	a11	b8	b11	c11	d9	d10	d11	e7	e8	e9	f6	f7	f8	f9	g5	g6	g7	h4	h5	h6	h7
0	1	—	—	—	-60	-20	-20	-20	-14	-14	-14	-6	-6	-6	-6	-2	-2	-2	0	0	0	0
1	3	-270 -330	-140 -154	-140 -200	-120	-45	-60	-80	-24	-28	-39	-12	-16	-20	-31	-6	-8	-12	-3	-4	-6	-10
3	6	-270 -345	-140 -158	-140 -215	-70 -145	-30 -60	-30 -78	-30 -105	-20 -32	-20 -38	-20 -50	-10 -18	-10 -22	-10 -28	-10 -40	-4 -9	-4 -12	-4 -16	0 -4	0 -5	0 -8	0 -12
6	10	-280 -370	-150 -172	-150 -240	-80 -170	-40 -76	-40 -98	-40 -130	-25 -40	-25 -47	-25 -61	-13 -22	-13 -28	-13 -35	-13 -49	-5 -11	-5 -14	-5 -20	0 -4	0 -6	0 -9	0 -15
10	14	-290 -400	-150 -177	-150 -260	-95 -205	-50 -93	-50 -120	-50 -160	-32 -50	-32 -59	-32 -75	-16 -27	-16 -34	-16 -43	-16 -59	-6 -14	-6 -17	-6 -24	0 -5	0 -8	0 -11	0 -18
14	18	-300 -430	-160 -193	-160 -290	-110 -240	-65 -117	-65 -149	-65 -195	-40 -61	-40 -73	-40 -92	-20 -33	-20 -41	-20 -53	-20 -72	-7 -16	-7 -20	-7 -28	0 -6	0 -9	0 -13	0 -21
18	24	-310 -470	-170 -209	-170 -330	-120 -280	-80	-80	-80	-50	-50	-50	-25	-25	-25	-25	-9	-9	-9	0	0	0	0
24	30	-320 -480	-180 -219	-180 -340	-130 -290	-142	-180	-240	-75	-89	-112	-41	-50	-64	-87	-20	-25	-34	-7	-11	-16	-25
30	40	-340 -530	-190 -236	-190 -380	-140 -330	-100	-100	-100	-60	-60	-60	-30	-30	-30	-30	-10	-10	-10	0	0	0	0
40	50	-360 -550	-200 -246	-200 -390	-150 -340	-174	-220	-290	-90	-106	-134	-49	-60	-76	-104	-23	-29	-40	-8	-13	-19	-30
50	65	-380 -600	-220 -274	-220 -440	-170 -390	-120	-120	-120	-72	-72	-72	-36	-36	-36	-36	-12	-12	-12	0	0	0	0
65	80	-410 -630	-240 -294	-240 -460	-180 -400	-207	-260	-340	-107	-126	-159	-58	-71	-90	-123	-27	-34	-47	-10	-15	-22	-35
80	100	-460 -710	-260 -323	-260 -510	-200 -450	-145	-145	-145	-85	-85	-85	-43	-43	-43	-43	-14	-14	-14	0	0	0	0
100	120	-520 -770	-280 -343	-280 -530	-210 -460	-245	-305	-395	-125	-148	-185	-68	-83	-106	-143	-32	-39	-54	-12	-18	-25	-40
120	140	-580 -830	-310 -373	-310 -560	-230 -480	-170	-170	-170	-100	-100	-100	-50	-50	-50	-50	-15	-15	-15	0	0	0	0
140	160	-660 -950	-340 -412	-340 -630	-240 -530	-190	-190	-190	-110	-110	-110	-56	-56	-56	-56	-17	-17	-17	0	0	0	0
160	180	-740 -1030	-380 -452	-380 -670	-260 -550	-285	-355	-460	-146	-172	-215	-79	-96	-122	-165	-35	-44	-61	-14	-20	-29	-46
180	200	-820 -1110	-420 -492	-420 -710	-280 -570	-190	-190	-190	-110	-110	-110	-56	-56	-56	-56	-17	-17	-17	0	0	0	0
200	225	-920 -1240	-480 -561	-480 -800	-300 -620	-320	-400	-510	-162	-191	-240	-88	-108	-137	-186	-40	-49	-69	-16	-23	-32	-52
225	250	-1050 -1370	-540 -621	-540 -860	-330 -650	-210	-210	-210	-125	-125	-125	-62	-62	-62	-62	-18	-18	-18	0	0	0	0
250	280	-1200 -1560	-600 -689	-600 -960	-360 -720	-350	-440	-570	-182	-214	-265	-98	-119	-151	-202	-43	-54	-75	-18	-25	-36	-57
280	315	-1350 -1710	-680 -769	-680 -1040	-400 -760	-230	-230	-230	-135	-135	-135	-68	-68	-68	-68	-20	-20	-20	0	0	0	0
315	355	-1500 -1900	-760 -857	-760 -1160	-440 -840	-385	-480	-630	-198	-232	-290	-108	-131	-165	-223	-47	-60	-83	-20	-27	-40	-63
355	400	-1650 -2050	-840 -937	-840 -1240	-480 -880	-230	-230	-230	-135	-135	-135	-68	-68	-68	-68	-20	-20	-20	0	0	0	0
400	450	-1650 -2050	-840 -937	-840 -1240	-480 -880	-230	-230	-230	-135	-135	-135	-68	-68	-68	-68	-20	-20	-20	0	0	0	0
450	500	-1650 -2050	-840 -937	-840 -1240	-480 -880	-230	-230	-230	-135	-135	-135	-68	-68	-68	-68	-20	-20	-20	0	0	0	0

Technical Reference | Determining Metric Tolerances

NOMINAL SIZE RANGE

# Determining Metric Tolerances

Table 7: Tolerances for outside dimensions (shafts) — continued

UNITS IN MM		TOLERANCES FOR OUTSIDE DIMENSIONS (SHAFTS) (UNITS IN 0.001MM)																			
OVER	TO	h8	h9	h10	h11	j5	j6	j7	k5	k6	k7	k8	m5	m6	m7	n5	n6	n7	r6	js6	js7
0	1	0	0	0	0	+2	+4	+6	+4	+6	+10	+14	+6	+8	+12	+8	+10	+14	+16	+3	+5
1	3	-14	-25	-40	-60	-2	-2	-4	0	0	0	0	+2	+2	+2	+4	+4	+4	+10	-3	-5
3	6	0	0	0	0	+3	+6	+8	+6	+9	+13	+18	+9	+12	+16	+13	+16	+20	+23	+4	+6
		-18	-30	-48	-75	-2	-2	-4	+1	+1	+1	0	+4	+4	+4	+8	+8	+8	+15	-4	-6
6	10	0	0	0	0	+4	+7	+10	+7	+10	+16	+22	+12	+15	+21	+16	+19	+25	+28	+4.5	+7.5
		-22	-36	-58	-90	-2	-2	-5	+1	+1	+1	0	+6	+6	+6	+10	+10	+10	+19	-4.5	-7.5
10	14	0	0	0	0	+5	+8	+12	+9	+12	+19	+27	+15	+18	+25	+20	+23	+30	+34	+5.5	+9
14	18	-27	-43	-70	-110	-3	-3	-6	+1	+1	+1	0	+7	+7	+7	+12	+12	+12	+23	-5.5	-9
18	24	0	0	0	0	+5	+9	+13	+11	+15	+23	+33	+17	+21	+29	+24	+28	+36	+41	+6.5	+10.5
24	30	-33	-52	-84	-130	-4	-4	-8	+2	+2	+2	0	+8	+8	+8	+15	+15	+15	+28	-6.5	-10.5
30	40	0	0	0	0	+6	+11	+15	+13	+18	+27	+39	+20	+25	+34	+28	+33	+42	+50	+8	+12.5
40	50	-39	-62	-100	-160	-5	-5	-10	+2	+2	+2	0	+9	+9	+9	+17	+17	+17	+34	-8	-12.5
50	65	0	0	0	0	+6	+12	+18	+15	+21	+32	+46	+24	+30	+41	+33	+39	+50	+60	+9.5	+15
		-46	-74	-120	-190	-7	-7	-12	+2	+2	+2	0	+11	+11	+11	+20	+20	+20	+41	-9.5	-15
65	80																		+62		
																			+43		
80	100	0	0	0	0	+6	+13	+20	+18	+25	+38	+54	+28	+35	+48	+38	+45	+58	+73	+11	+17.5
		-54	-87	-140	-220	-9	-9	-15	+3	+3	+3	0	+13	+13	+13	+23	+23	+23	+51	-11	-17.5
100	120																		+76		
																			+54		
120	140																		+88		
																			+63		
140	160	0	0	0	0	+7	+14	+22	+21	+28	+43	+63	+33	+40	+55	+45	+52	+67	+90	+12.5	+20
		-63	-100	-160	-250	-11	-11	-18	+3	+3	+3	0	+15	+15	+15	+27	+27	+27	+65	-12.5	-20
160	180																		+113		
																			+84		
180	200																		+106		
																			+77		
200	225	0	0	0	0	+7	+16	+25	+24	+33	+50	+72	+37	+46	+63	+51	+60	+77	+109	+14.5	+23
		-72	-115	-185	-290	-13	-13	-21	+4	+4	+4	0	+17	+17	+17	+31	+31	+31	+80	-14.5	-23
225	250																		+113		
																			+84		
250	280	0	0	0	0	+7	+16	+26	+27	+36	+56	+81	+43	+52	+72	+57	+66	+86	+126	+16	+26
		-81	-130	-210	-320	-16	-16	-26	+4	+4	+4	0	+20	+20	+20	+34	+34	+34	+94	-16	-26
280	315																		+130		
																			+98		
315	355	0	0	0	0	+7	+18	+29	+29	+40	+61	+89	+46	+57	+78	+62	+73	+94	+144	+18	+28.5
		-89	-140	-230	-360	-18	-18	-28	+4	+4	+4	0	+21	+21	+21	+37	+37	+37	+108	-18	-28.5
355	400																		+150		
																			+114		
400	450	0	0	0	0	+7	+20	+31	+32	+45	+68	+97	+50	+63	+86	+67	+80	+103	+166	+20	+31.5
		-97	-155	-250	-400	-20	-20	-32	+5	+5	+5	0	+23	+23	+23	+40	+40	+40	+126	-20	-31.5
450	500																		+172		
																			+132		

NOMINAL SIZE RANGE

Technical Reference | Determining Metric Tolerances

# Determining Metric Tolerances

**Table 7: Tolerances for outside dimensions (shafts) — continued**

UNITS IN MM		TOLERANCES FOR OUTSIDE DIMENSIONS (SHAFTS) (UNITS IN 0.001MM)											
OVER	TO	js8	js9	js10	js11	js12	js13	js14	js15	js16	js17	js18	
NOMINAL SIZE RANGE	0	1	+7	+12.5	+20	+30	+50	+70	+125	+200	+300	—	—
	1	3	-7	-12.5	-20	-30	-50	-70	-125	-200	-300	—	—
	3	6	+9	+15	+24	+37.5	+60	+90	+150	+240	+375	—	—
			-9	-15	-24	-37.5	-60	-90	-150	-240	-375	—	—
	6	10	+11	+18	+29	+45	+75	+110	+180	+290	+450	+750	—
			-11	-18	-29	-45	-75	-110	-180	-290	-450	-750	—
	10	14	+13.5	+21.5	+35	+55	+90	+135	+215	+350	+550	+900	+1350
	14	18	-13.5	-21.5	-35	-55	-90	-135	-215	-350	-550	-900	-1350
	18	24	+16.5	+26	+42	+65	+105	+165	+260	+420	+650	+1050	+1650
	24	30	-16.5	-26	-42	-65	-105	-165	-260	-420	-650	-1050	-1650
	30	40	+19.5	+31	+50	+80	+125	+195	+310	+500	+800	+1250	+1950
	40	50	-19.5	-31	-50	-80	-125	-195	-310	-500	-800	-1250	-1950
	50	65	+23	+37	+60	+95	+150	+230	+370	+600	+950	+1500	+2300
	65	80	-23	-37	-60	-95	-150	-230	-370	-600	-950	-1500	-2300
	80	100	+27	+43.5	+70	+110	+175	+270	+435	+700	+1100	+1750	+2700
	100	120	-27	-43.5	-70	-110	-175	-270	-435	-700	-1100	-1750	-2700
	120	140	+31.5	+50	+80	+125	+200	+315	+500	+800	+1250	+2000	+3150
	140	160	-31.5	-50	-80	-125	-200	-315	-500	-800	-1250	-2000	-3150
	160	180											
	180	200											
200	225	+36	+57.5	+92.5	+145	+230	+360	+575	+925	+1450	+2300	+3600	
225	250	-36	-57.5	-92.5	-145	-230	-360	-575	-925	-1450	-2300	-3600	
250	280	+40.5	+65	+105	+160	+260	+405	+650	+1050	+1600	+2600	+4050	
280	315	-40.5	-65	-105	-160	-260	-405	-650	-1050	-1600	-2600	-4050	
315	355	+44.5	+70	+115	+180	+285	+445	+700	+1150	+1800	+2850	+4450	
355	400	-44.5	-70	-115	-180	-285	-445	-700	-1150	-1800	-2850	-4450	
400	450	+48.5	+77.5	+125	+200	+315	+485	+775	+1250	+2000	+3150	+4850	
450	500	-48.5	-77.5	-125	-200	-315	-485	-775	-1250	-2000	-3150	-4850	

# Determining Metric Tolerances

**Table 8: Tolerances for inside dimensions (holes)**

Table 8 details tolerances for inside dimensions (holes) based relative to the tolerance symbol. This table works the same way as Table 6, but is pulled from a different source (ANSI standards) and details S7 and U7 fits. Pick the nominal size value that is closest to the desired nominal size to determine the required tolerance range relative to the chosen tolerance symbol.

<b>HOLE BASIS FIT</b>	<b>Example:</b>	Nominal size:	[mm]	60	Hole:	[mm]		
		Size range to be used:		50 to 65			H7	+0.030 (0.030mm range)
		ISO-Grade No.:		IT7 (hole), IT6 (shaft)		60		-0
		Tolerance Symbol:		H7/k6		Shaft:		
		Desired Fit:		Locational Transition Fit		[mm]		
<b>This Gives:</b>		Allowance for hole:		0.030mm		60	k6	+0.021 (0.019mm range)
		Allowance for shaft:		0.019mm				+0.002

TOLERANCES FOR INSIDE DIMENSIONS (HOLES) (UNITS IN 0.001MM)						
NOMINAL SIZE RANGE	PICK CLOSEST VALUE TO DESIRED DIMENSION (UNITS IN MM)	S7	U7	PICK CLOSEST VALUE TO DESIRED DIMENSION (UNITS IN MM)	S7	U7
	1		-14 -24	-18 -28	25	-27 -48
1.2		-14 -24	-18 -28	30	-27 -48	-40 -61
1.6		-14 -24	-18 -28	40	-34 -59	-51 -76
2		-14 -24	-18 -28	50	-34 -59	-61 -86
2.5		-14 -24	-18 -28	60	-42 -72	-76 -106
3		-14 -24	-18 -28	80	-48 -78	-91 -121
4		-15 -27	-19 -31	100	-58 -93	-111 -146
5		-15 -27	-19 -31	120	-66 -101	-131 -166
6		-15 -27	-19 -31	160	-85 -125	-175 -215
8		-17 -32	-22 -37	200	-105 -151	-219 -265
10		-17 -32	-22 -37	250	-123 -169	-267 -313
12		-21 -39	-26 -44	300	-150 -202	-330 -382
16		-21 -39	-26 -44	400	-187 -244	-414 -471
20		-27 -48	-33 -54	500	-229 -292	-517 -580

# Determining Metric Tolerances

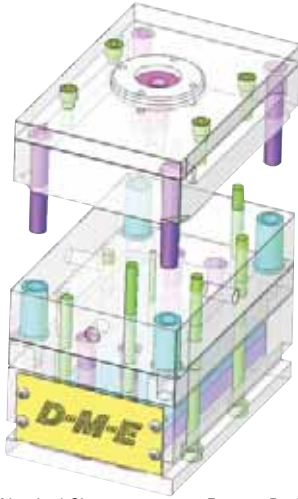
**Table 9: Tolerances for outside dimensions (shafts)**

Table 9 details tolerances for outside dimensions (shafts) based relative to the tolerance symbol. This table works the same way as Table 7, but is pulled from a different source (ANSI standards) and details s6 and u6 fits. Pick the nominal size value that is closest to the desired nominal size to determine the required tolerance range relative to the chosen tolerance symbol.

<b>HOLE BASIS FIT</b>		[mm]	Hole:		
Example:	Nominal size:	24	[mm]		
	Size range to be used:	18 to 30	24	F6	+0.033 (0.013mm range)
	ISO-Grade No.:	IT6			-0
	Tolerance Symbol:	F6/h6	Shaft:		
	Desired Fit:	Clearance Fit	[mm]		
This Gives:	Allowance for hole:	0.013mm	24	h6	0 (0.013mm range)
	Allowance for shaft:	0.013mm			-0.013

TOLERANCES FOR OUTSIDE DIMENSIONS (SHAFTS) (UNITS IN 0.001MM)						
NOMINAL SIZE RANGE	PICK CLOSEST VALUE TO DESIRED DIMENSION (UNITS IN MM)	s6	u6	PICK CLOSEST VALUE TO DESIRED DIMENSION (UNITS IN MM)	s6	u6
		1	+20 +14	+24 +18	25	+48 +35
	1.2	+20 +14	+24 +18	30	+48 +35	+61 +48
	1.6	+20 +14	+24 +18	40	+59 +43	+76 +60
	2	+20 +14	+24 +18	50	+59 +43	+86 +70
	2.5	+20 +14	+24 +18	60	+72 +53	+106 +87
	3	+20 +14	+24 +18	80	+78 +59	+121 +102
	4	+27 +19	+31 +23	100	+93 +71	+146 +124
	5	+27 +19	+31 +23	120	+101 +79	+166 +144
	6	+27 +19	+31 +23	160	+125 +100	+215 +190
	8	+32 +23	+37 +28	200	+151 +122	+265 +236
	10	+32 +23	+37 +28	250	+169 +140	+313 +284
	12	+39 +28	+44 +33	300	+202 +170	+382 +350
	16	+39 +28	+44 +33	400	+244 +208	+471 +435
	20	+48 +35	+54 +41	500	+292 +252	+580 +540

# American Standard Mold Base Features

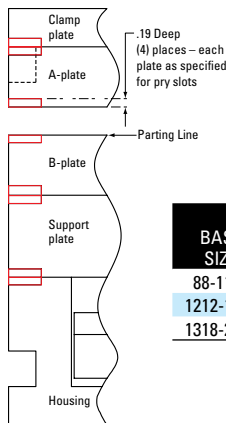


- 43 Nominal Sizes
- 9 Plate Thicknesses
- 4 Steel Types
- Guided Ejection
- Pry Slots
- Lifting Holes
- Leader Pin Vents
- Ejector Housing Cover
- Feature Positions
- Feature Omissions
- Three-Piece or Welded Housing Type
- Clamp Slot Type
- Mixed Steel
- Sprue Puller Pin Diameter
- Stop Pin Location

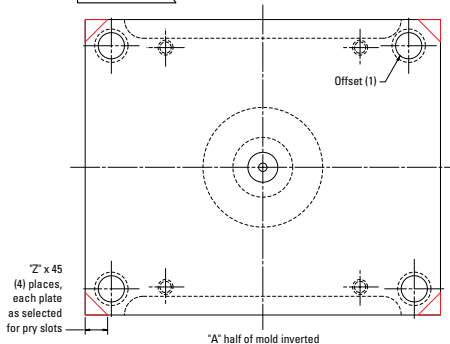
## Pry Slots



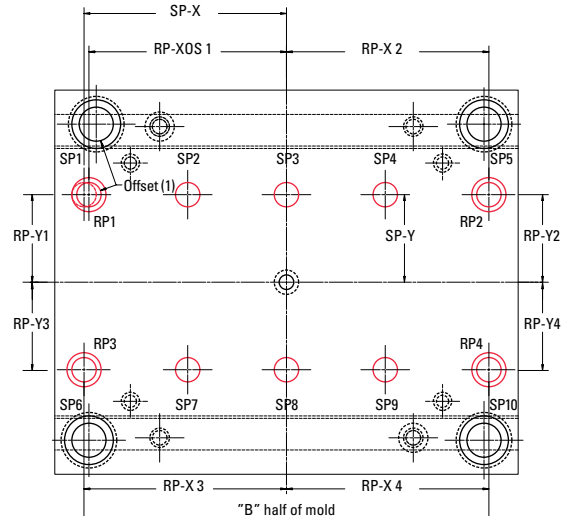
Mold base features Pry Slots, installed in any plate specified, on the parting and/or non-parting line side. This provides handling ease when opening and/or disassembling a mold.



BASE SIZE	SLOT LENGTH Z
88-1123	.56 X 45°
1212-1315	.88 X 45°
1318-2435	1.00 X 45°



## Return Pins and Stop Pins

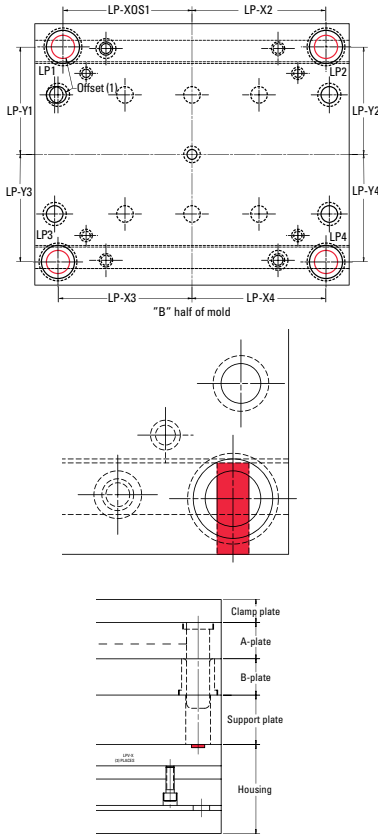


BASE SIZE	RP DIAMETER (RECOM'D)	RP-Y SP-Y	POSITION 1		POSITION 2		SP-x1 SP-x6	SP-x2 SP-x7	SP-x3 SP-x8	SP-x4 SP-x9	SP-x5 SP-x10
			RP-x0s	RP-x	RP-x0s	RP-x					
88	0.500	1.500	3.250	3.375	3.188	3.312	3.375				3.375
812	0.500	1.500	5.250	5.375	5.188	5.312	5.375		On Center		5.375
108	0.625	2.250	3.250	3.375	3.125	3.250	3.375				3.375
1012	0.625	2.250	5.188	5.312	5.063	5.188	5.312		On Center		5.312
1016	0.625	2.250	7.250	7.375	7.125	7.250	7.375	2.500		2.500	7.375
1020	0.625	2.250	9.250	9.375	9.125	9.250	9.375	3.125		3.125	9.375
1112	0.625	2.812	5.250	5.375	5.125	5.250	5.375		On Center		5.375
1114	0.625	2.812	6.250	6.375	6.125	6.250	6.375		On Center		6.375
1118	0.625	2.812	8.250	8.375	8.125	8.250	8.375		On Center		8.375
1123	0.625	2.812	11.000	11.125	10.875	11.000	11.125	3.750		3.750	11.125
1212	0.750	3.188	5.250	5.375	5.000	5.125	5.375		On Center		5.375
1215	0.750	3.188	6.750	6.875	6.500	6.625	6.875	2.250		2.250	6.875
1220	0.750	3.188	9.250	9.375	9.000	9.125	9.375	3.094		3.094	9.375
1223	0.750	3.188	11.000	11.125	10.750	10.875	11.125	3.750		3.750	11.125
1315	0.750	3.812	6.750	6.875	6.500	6.625	6.875	2.250		2.250	6.875
1318	0.750	3.812	8.250	8.375	8.000	8.125	8.375	2.750		2.750	8.375
1321	0.750	3.812	9.500	9.625	9.375	9.500	9.625	4.000		4.000	9.625
1323	0.750	3.812	10.875	11.000	10.750	10.875	11.000	4.000		4.000	11.000
1326	0.750	3.812	12.125	12.250	12.000	12.125	12.250	4.000		4.000	12.250
1329	0.750	3.812	13.875	14.000	13.750	13.875	14.000	5.000		5.000	14.000
1518	0.750	3.875	8.125	8.250	7.938	8.062	8.250	2.750		2.750	8.250
1524	0.750	3.875	11.000	11.125	10.875	11.000	11.125	3.750		3.750	11.125
1529	0.750	3.875	13.875	14.000	13.750	13.875	14.000	4.688		4.688	14.000
1616	0.750	4.375	7.125	7.250	7.000	7.125	7.250	2.375		2.375	7.250
1620	0.750	4.375	9.125	9.250	9.000	9.125	9.250	3.062		3.062	9.250
1623	0.750	4.375	10.875	11.000	10.750	10.875	11.000	4.000		4.000	11.000
1626	0.750	4.375	12.125	12.250	12.000	12.125	12.250	4.000		4.000	12.250
1629	0.750	4.375	13.875	14.000	13.750	13.875	14.000	4.688		4.688	14.000
1635	0.750	4.375	16.875	17.000	16.750	16.875	17.000	8.500	On Center	8.500	17.000
1724	0.750	4.625	11.000	11.125	10.875	11.000	11.125	3.750		3.750	11.125
1729	0.750	4.625	13.875	14.000	13.750	13.875	14.000	4.688		4.688	14.000
1818	0.750	5.375	8.125	8.250	8.000	8.125	8.250	2.750		2.750	8.250
1820	0.750	5.375	9.125	9.250	9.000	9.125	9.250	3.062		3.062	9.250
1823	0.750	5.375	10.875	11.000	10.750	10.875	11.000	4.000		4.000	11.000
1826	0.750	5.375	12.125	12.250	12.000	12.125	12.250	4.000		4.000	12.250
1829	0.750	5.375	13.875	14.000	13.750	13.875	14.000	4.688		4.688	14.000
1835	0.750	5.375	16.875	17.000	16.750	16.875	17.000	8.500	On Center	8.500	17.000
1924	0.750	6.125	11.000	11.125	10.875	11.000	11.125	3.750		3.750	11.125
1929	0.750	6.125	13.875	14.000	13.750	13.875	14.000	4.688		4.688	14.000
1935	0.750	6.125	16.875	17.000	16.750	16.875	17.000	8.500	On Center	8.500	17.000
2424	0.750	7.750	11.000	11.125	10.875	11.000	11.125	3.750		3.750	11.125
2429	0.750	7.750	13.875	14.000	13.750	13.875	14.000	4.688		4.688	14.000
2435	0.750	7.750	16.875	17.000	16.750	16.875	17.000	8.500	On Center	8.500	17.000

# American Standard Mold Base Features

## Leader Pins, Vents & Bushings

Leader Pins and Bushings align both halves of the mold at the parting line. Leader Pin Vents, which allow trapped air to escape from the mold, are designed into all 15-inch-and-wider series molds. When desired, they can be specified on smaller molds.



SIZE	DIA	LPxos	LPx	LPy
88	0.750	3.000	3.125	3.125
812	0.750	5.000	5.125	3.125
108	0.750	2.938	3.125	4.062
1012	0.875	4.875	5.062	4.062
1016	0.875	6.938	7.125	4.062
1020	0.875	8.938	9.125	4.062
1112	0.875	4.938	5.125	4.562
1114	0.875	5.938	6.125	4.562
1118	0.875	7.938	8.125	4.562
1123	0.875	10.688	10.875	4.562
1212	1.000	4.625	4.812	5.000
1215	1.000	6.125	6.312	5.000
1220	1.000	8.625	8.812	5.000
1223	1.000	10.375	10.562	5.000
1315	1.000	6.125	6.312	5.688
1318	1.000	7.375	7.562	5.688
1321	1.000	8.750	8.938	5.688
1323	1.000	10.125	10.312	5.688
1326	1.000	11.375	11.562	5.688
1329	1.000	13.125	13.312	5.688
1518	1.250	7.375	7.562	6.062
1524	1.250	10.250	10.438	6.062
1529	1.250	13.125	13.312	6.062
1616	1.250	6.375	6.562	6.562
1620	1.250	8.375	8.562	6.562
1623	1.250	10.125	10.312	6.562
1626	1.250	11.375	11.562	6.562
1629	1.250	13.125	13.312	6.562
1635	1.250	16.125	16.312	6.562
1724	1.250	10.250	10.438	6.812
1729	1.250	13.125	13.312	6.812
1818	1.250	7.375	7.562	7.562
1820	1.250	8.375	8.562	7.562
1823	1.250	10.125	10.312	7.562
1826	1.250	11.375	11.562	7.562
1829	1.250	13.125	13.312	7.562
1835	1.250	16.125	16.312	7.562
1924	1.250	10.250	10.438	8.312
1929	1.250	13.125	13.312	8.312
1935	1.250	16.125	16.312	8.312
2424	1.500	10.062	10.250	10.250
2429	1.500	12.938	13.125	10.250
2435	1.500	15.938	16.125	10.250

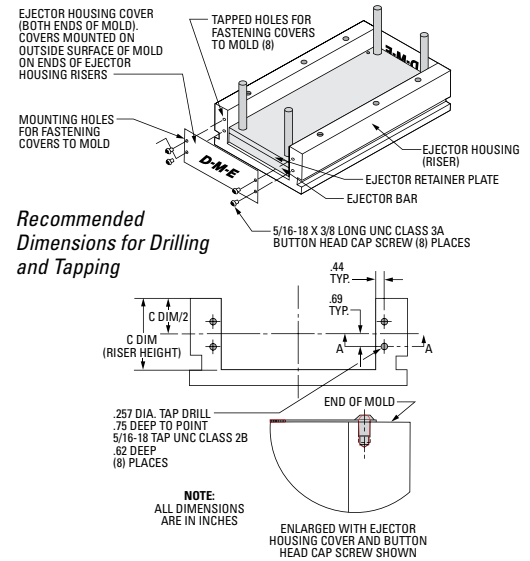
## Ejector Housing & Cover

### Ejector Housing Cover

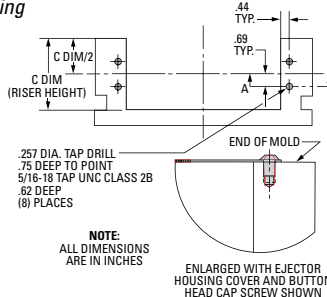
For additional operator safety, SelectBase molds include an ejector housing cover, except when a longer length ejector bar is selected. The perforated D-M-E logo helps the operator to visually determine if the ejector plate and ejector retainer plate are in the returned position. The cover is fastened on both sides with 5/16-18 button-head cap screws. Once again, D-M-E is leading the industry into a safer work environment.

### Ejector Housing

D-M-E offers a selection of housing types to fit application demands. A one-piece welded housing is available for customers requiring maximum rigidity and robust durability. For maximum flexibility of configuration options, a three-piece housing is also available.

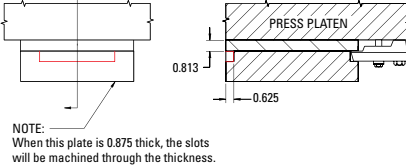


### Recommended Dimensions for Drilling and Tapping

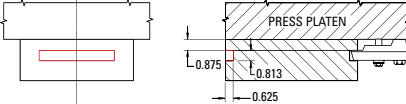


## Clamp Slots

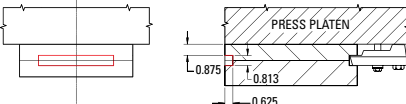
### Type A



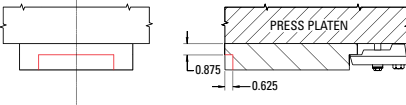
### Type B



### Type C



### Type D



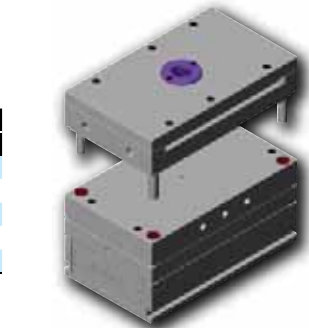
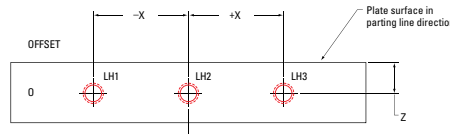
## Lifting Holes

### Lifting Hole Diameters

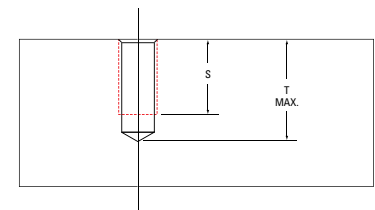
BASE SIZE	PLATE THICKNESS	
	0.875	1.375
88-1118	1/2-13 UNC	1/2-13 UNC
1123-1524	5/8-11 UNC	5/8-11 UNC
1529-1829	5/8-11 UNC	3/4-10 UNC
1835-2429	5/8-11 UNC	1"-8 UNC
2435	N/A	1"-8 UNC

### Lifting Holes

THREAD SIZE	S	T MAX.
1/2-13	1.00	1.38
5/8-11	1.25	1.75
3/4-10	1.50	2.00
1"-8	2.00	2.62



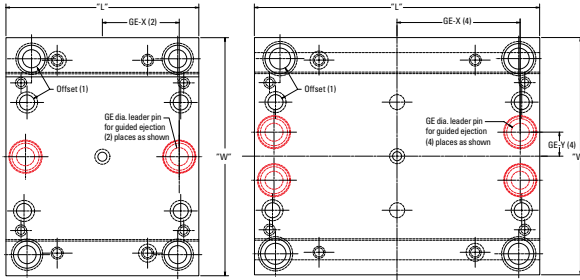
Lifting Holes can be used to install hoist rings for ease of handling. Mold base can be configured only with Lifting Holes which are appropriate for the specific mold base size. Refer to the D-M-E catalog for a comprehensive selection of Hoist Rings.



# American Standard Mold Base Features

## Guided Ejection Systems

Guided Ejection Systems hold the ejector assembly in alignment and support the weight of the ejector assembly throughout the molding cycle – greatly reducing wear on ejection components and preventing cocking of the ejector assembly.

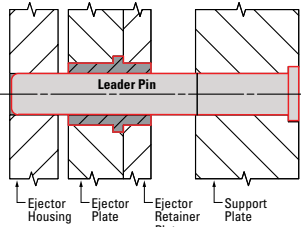


"B" HALF OF MOLD FOR 88, 812 & 108 MOLD BASE SIZE ONLY

"B" HALF OF MOLD FOR 1012 - 2435 BASES

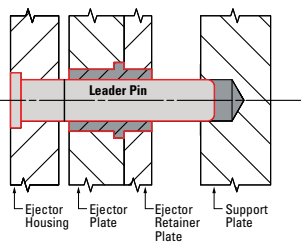
## Guided Ejection Positions

PIN DIAMETER (RECOM'D)	BASE SIZE	GE X	GE Y
0.750	88	3.000	Center
	812	5.000	Center
	108	3.062	Center
	1012	5.000	1.000
	1016	7.062	1.000
	1020	9.062	1.000
	1112	5.062	1.625
	1114	6.062	1.625
	1118	8.062	1.625
	1123	10.812	1.625
0.875	212	5.000	1.750
	1215	6.500	1.750
	1220	9.000	1.750
	1223	10.750	1.750
	1315	6.500	2.375
	1318	8.000	2.375
	1321	9.375	2.375
	1323	10.750	2.375
	1326	12.000	2.375
	1329	13.750	2.375
1.000	1518	7.875	2.375
	1524	10.812	2.375
	1529	13.688	2.375
	1616	6.938	2.875
	1620	8.938	2.875
	1623	10.688	2.875
	1626	11.938	2.875
	1629	13.688	2.875
	1635	16.688	2.875
	1724	10.812	3.125
	1729	13.688	3.125
	1818	7.938	3.875
	1820	8.938	3.875
	1823	10.688	3.875
	1826	11.038	3.875
1829	13.688	3.875	
1835	16.688	3.875	
1924	10.812	4.625	
1929	13.688	4.625	
1935	16.688	4.625	
1.250	2424	10.688	6.125
	2429	13.562	6.125
	2435	16.562	6.125



### System 1

When pins are installed in the support plate, the ejector housing can be removed from the mold without removing ejector plates. This permits easy access to service the ejector system.



### System 2

Pins installed in the ejector housing permit fast installation. When the ejector housing is removed from the mold base, the complete ejector assembly is removed.

## Sizes & Thicknesses

### 43 Nominal Sizes

- The American Standard Mold Base is available in 43 nominal sizes to match the mold space requirements for your application.
- As the creator of the American mold base standard, D-M-E has the largest selection of mold base sizes and most are available in less than five business days.

CODE	THICKNESS
7	0.875
13	1.375
17	1.875
23	2.375
27	2.875
33	3.375
37	3.875
47	4.875
57	5.875

### 9 Plate Thicknesses

- D-M-E offers mold plates for all nominal sizes up to 5-7/8".
- Our own steel processing facility manufactures our mold plate directly from raw steel slabs.

NOMINAL SIZE	WIDTH (IN)	LENGTH (IN)	WEIGHT RANGE (LBS)	
			MIN	MAX
88	7.875	7.875	116	305
812	7.875	11.875	175	460
108	9.875	8.000	156	393
1012	9.875	11.875	235	592
1016	9.875	16.000	316	798
1020	9.875	20.000	395	997
1112	10.875	12.000	261	659
1114	10.875	14.000	305	769
1118	10.875	18.000	392	988
1123	10.875	23.500	511	1290
1212	11.875	12.000	285	719
1215	11.875	15.000	379	899
1220	11.875	20.000	505	1199
1223	11.875	23.500	594	1409
1315	13.375	15.000	427	1038
1318	13.375	18.000	512	1246
1321	13.375	20.750	590	1436
1323	13.375	23.500	669	1627
1326	13.375	26.000	740	1800
1329	13.375	29.500	839	2042
1518	14.875	17.875	599	1410
1524	14.875	23.750	796	1873

NOMINAL SIZE	WIDTH (IN)	LENGTH (IN)	WEIGHT RANGE (LBS)	
			MIN	MAX
1529	14.875	29.500	989	2327
1616	15.875	16.000	573	1347
1620	15.875	20.000	716	1683
1623	15.875	23.500	841	1978
1626	15.875	26.000	930	2189
1629	15.875	29.500	1056	2483
1635	15.875	35.500	1270	2988
1724	16.500	23.750	883	2078
1729	16.500	29.500	1097	2581
1818	17.875	18.000	725	1706
1820	17.875	20.000	806	1896
1823	17.875	23.500	947	2227
1826	17.875	26.000	1048	2464
1829	17.875	29.500	1189	2796
1835	17.875	35.500	1430	3365
1924	19.500	23.750	1044	2456
1929	19.500	29.500	1297	3050
1935	19.500	35.500	1648	3758
2424	23.750	23.750	1343	3062
2429	23.750	29.500	1668	3804
2435	23.750	35.500	2008	4578

## Steels for Structural and Holder Block Applications

**D-M-E #1 Steel** is a medium carbon quality steel with greater tensile strength than typical plain carbon warehouse steels. It machines easily, but is not "sticky", permitting a faster and smoother cut. International comparisons: DIN 1.1178 (CK 30) and 1.1730 (C 45 W); JIS S 30 CM, S50C, S55C; ISO 683-1 C30E4.

**D-M-E #2 Steel** is a medium alloy steel specified for durability in structural applications. It is supplied pre-heat treated to 28-34 HRC (271-321 Bhn). A high strength steel, it is ideal for cavity and core retainer plates, clamping plates and support plates in molds. International comparisons: DIN 1.2312 (40CrMnMoS 8 6), 1.7218 (25CrMo4) and 1.2331 (41CrMoS4); JIS SCM 430; ISO 683-2 Type 1.

**D-M-E #7 Steel** is a modified AISI 400 series stainless steel for holder block applications. It is supplied pre-heat treated to 32-36 HRC (302-340 Bhn). This stainless steel offers corrosion-resistance and exceptional machinability but cannot be further hardened (see D-M-E #6). For humid environments, corrosive plastics, "clean room" or "100% stainless" applications, it is an ideal choice for all structural mold plates. International comparisons: none.

## Steels for Cavity & Core Applications

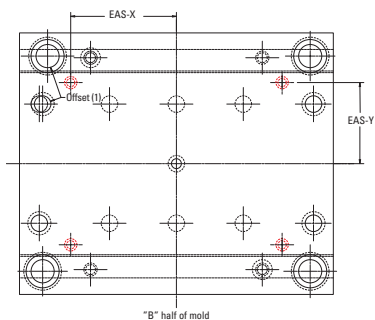
**D-M-E #3 Steel** is a P-20 AISI 4130 type cavity steel. Exceptionally clean, it is pre-heat treated to 28-34 HRC (271-321 Bhn). It provides good machinability, the ability to heat treat to higher hardness, and exceptional polishability. International comparisons: DIN 1.2311 G40CrMnMo7; JIS none; ISO none.

**D-M-E #5 Steel** is an AISI/SAE H-13 type thermal shock resistant, hotwork die steel. Supplied fully annealed (approximately 200 Bhn; 13-20 HRC) for easy machinability, it can be subsequently heat treated to the desired hardness with a minimum of deformation. Mainly used for die cast dies, it is also suitable for plastic molds with exceptional hardness or polishability requirements. D-M-E #5 Steel meets or exceeds the acceptance criteria established by the NADCA as detailed in Technical Digest Number 01-80-01D. International comparisons: DIN 1.2344 (X40CrMoV5-1); JIS SKD 61; ISO 4955 H13.

**D-M-E #6 Steel** is a modified AISI 420 type stainless steel. It is supplied fully annealed to 179-241 Bhn (8-23 HRC), making it readily machinable. Unlike D-M-E #7 steel, D-M-E #6 steel is a cavity-grade material that can be subsequently heat treated to the desired hardness and has excellent polishability. International comparisons: DIN 1.4028 (X30Cr13); JIS SUS 420 J 2; ISO none.

# American Standard Mold Base Features

## Ejector Assembly Screws

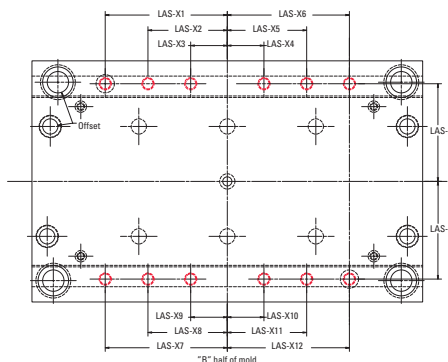
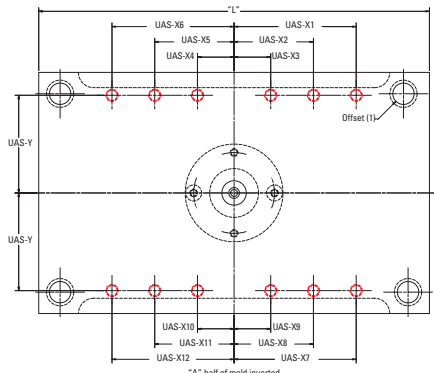


Ejector Assembly Screw Positions

BASE SIZE	SCREW SIZE	EAS X	EAS Y
88	5/16-18	3.375	2.250
812	5/16-18	5.375	2.250
108	5/16-18	3.375	3.062
1012	5/16-18	5.312	3.062
1016	5/16-18	7.375	3.062
1020	5/16-18	9.375	3.062
1112	5/16-18	4.562	3.312
1114	5/16-18	5.562	3.312
1118	5/16-18	7.562	3.312
1123	5/16-18	10.312	3.312
1212	5/16-18	4.500	3.812
1215	5/16-18	6.000	3.812
1220	5/16-18	8.500	3.812
1223	5/16-18	10.250	3.812
*1315	3/8-16	5.812	4.250
*1318	3/8-16	7.312	4.250
1321	3/8-16	8.688	4.250
1323	3/8-16	10.062	4.250
1326	3/8-16	11.312	4.250
1329	3/8-16	13.062	4.250
1518	3/8-16	8.312	5.000
1524	3/8-16	11.250	5.000
1529	3/8-16	14.125	5.000
1616	3/8-16	7.375	5.438
1620	3/8-16	9.375	5.438
1623	3/8-16	11.125	5.438
1626	3/8-16	12.375	5.438
1629	3/8-16	14.125	5.438
1635	3/8-16	17.125	5.438
1724	3/8-16	11.250	5.750
1729	3/8-16	14.125	5.750
1818	3/8-16	8.375	6.438
1820	3/8-16	9.375	6.438
1823	3/8-16	11.125	6.438
1826	3/8-16	12.375	6.438
1829	3/8-16	14.125	6.438
1835	3/8-16	17.125	6.438
1924	1/2-13	11.250	7.250
1929	1/2-13	14.125	7.250
1935	1/2-13	17.125	7.250
2424	1/2-13	11.250	8.875
2429	1/2-13	14.125	8.875
2435	1/2-13	17.125	8.875

\*New dimensions 10/02

## Upper & Lower Assembly Screws



Upper and Lower Assembly Screw Positions

BASE SIZE	SCREW SIZE	UASy LASy	UASx1 LASx1	UASx2 LASx2	UASx3 LASx3	UASx4 LASx4	UASx5 LASx5	UASx6 LASx6	UASx7 LASx7	UASx8 LASx8	UASx9 LASx9	UASx10 LASx10	UASx11 LASx11	UASx12 LASx12
88	1/2-13	3.125	1.375	—	—	—	—	1.375	1.375	—	—	—	—	1.375
812	1/2-13	3.125	2.250	—	—	—	—	2.250	2.250	—	—	—	—	2.250
108	1/2-13	4.000	1.875	—	—	—	—	1.875	1.875	—	—	—	—	1.875
1012	1/2-13	4.000	3.250	—	—	—	—	3.250	3.250	—	—	—	—	3.250
1016	1/2-13	4.000	5.000	—	—	—	—	5.000	5.000	—	—	—	—	5.000
1020	1/2-13	4.000	6.500	—	—	1.000	—	6.500	6.500	—	1.000	—	—	6.500
1112	1/2-13	4.469	3.188	—	—	—	—	3.188	3.188	—	—	—	—	3.188
1114	1/2-13	4.469	3.188	—	—	—	—	3.188	3.188	—	—	—	—	3.188
1118	1/2-13	4.469	5.875	—	—	1.000	—	5.875	5.875	—	1.000	—	—	5.875
1123	1/2-13	4.469	8.625	—	3.188	3.188	—	8.625	8.625	—	3.188	3.188	—	8.625
1212	1/2-13	4.969	2.812	—	—	—	—	2.812	2.812	—	—	—	—	2.812
1215	1/2-13	4.969	4.500	—	—	1.000	—	4.500	4.500	—	1.000	—	—	4.500
1220	1/2-13	4.969	6.625	—	—	1.000	—	6.625	6.625	—	1.000	—	—	6.625
1223	1/2-13	4.969	8.625	—	2.812	2.812	—	8.625	8.625	—	2.812	2.812	—	8.625
1315	1/2-13	5.719	4.500	—	—	1.000	—	4.500	4.500	—	1.000	—	—	4.500
1318	1/2-13	5.719	5.438	—	—	1.000	—	5.438	5.438	—	1.000	—	—	5.438
1321	1/2-13	5.719	6.750	—	—	1.000	—	6.750	6.750	—	1.000	—	—	6.750
1323	1/2-13	5.719	8.125	—	2.750	2.750	—	8.125	8.125	—	2.750	2.750	—	8.125
1326	1/2-13	5.719	9.375	—	3.250	3.250	—	9.375	9.375	—	3.250	3.250	—	9.375
1329	1/2-13	5.719	11.125	—	3.250	3.250	—	11.125	11.125	—	3.250	3.250	—	11.125
1518	1/2-13	6.469	5.438	—	—	1.000	—	5.438	5.438	—	1.000	—	—	5.438
1524	1/2-13	6.469	7.750	—	2.750	2.750	—	7.750	7.750	—	2.750	2.750	—	7.750
1529	1/2-13	6.469	10.625	—	3.688	3.688	—	10.625	10.625	—	3.688	3.688	—	10.625
1616	1/2-13	6.969	4.250	—	—	1.000	—	4.250	4.250	—	1.000	—	—	4.250
1620	1/2-13	6.969	6.250	—	—	1.000	—	6.250	6.250	—	1.000	—	—	6.250
1623	1/2-13	6.969	8.000	—	2.750	2.750	—	8.000	8.000	—	2.750	2.750	—	8.000
1626	1/2-13	6.969	9.250	—	3.125	3.125	—	9.250	9.250	—	3.125	3.125	—	9.250
1629	1/2-13	6.969	11.000	—	3.688	3.688	—	11.000	11.000	—	3.688	3.688	—	11.000
1635	1/2-13	6.969	14.000	8.500	2.875	2.875	8.500	14.000	14.000	8.500	2.875	2.875	8.500	14.000
1724	1/2-13	7.281	7.750	—	2.750	2.750	—	7.750	7.750	—	2.750	2.750	—	7.750
1729	1/2-13	7.281	10.625	—	3.688	3.688	—	10.625	10.625	—	3.688	3.688	—	10.625
1818	1/2-13	7.969	5.438	—	—	1.000	—	5.438	5.438	—	1.000	—	—	5.438
1820	1/2-13	7.969	6.438	—	—	1.000	—	6.438	6.438	—	1.000	—	—	6.438
1823	1/2-13	7.969	8.125	—	2.750	2.750	—	8.125	8.125	—	2.750	2.750	—	8.125
1826	1/2-13	7.969	9.375	—	3.125	3.125	—	9.375	9.375	—	3.125	3.125	—	9.375
1829	1/2-13	7.969	11.125	—	3.688	3.688	—	11.125	11.125	—	3.688	3.688	—	11.125
1835	1/2-13	7.969	14.125	8.500	2.875	2.875	8.500	14.125	14.125	8.500	2.875	2.875	8.500	14.125
1924	1/2-13	8.781	7.750	—	2.750	2.750	—	7.750	7.750	—	2.750	2.750	—	7.750
1929	1/2-13	8.781	11.125	—	3.688	3.688	—	11.125	11.125	—	3.688	3.688	—	11.125
1935	1/2-13	8.781	14.125	8.500	2.875	2.875	8.500	14.125	14.125	8.500	2.875	2.875	8.500	14.125
2424	5/8-11	10.844	7.750	—	2.750	2.750	—	7.750	7.750	—	2.750	2.750	—	7.750
2429	5/8-11	10.844	10.625	—	3.688	3.688	—	10.625	10.625	—	3.688	3.688	—	10.625
2435	5/8-11	10.844	13.625	8.500	2.750	2.750	8.500	13.625	13.625	8.500	2.750	2.750	8.500	13.625

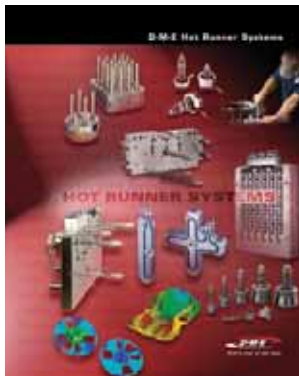
# D-M-E: Your Complete Mold Technologies Provider



*Every step of the way*

## Check Out All of the D-M-E Mold Technology Catalogs

And You'll See Why We're an Essential Resource to Thousands of Customers Worldwide!



CATALOG: 174 PAGES

### D-M-E Hot Runner Systems

Moldmakers, molders and mold designers worldwide look to the D-M-E Hot Runner Systems Catalog for essential hot runner solutions. From best-in-class components to complete, fully-functioning hot half systems, D-M-E has the broadest range of hot runner products and services.



CATALOG: 156 PAGES

### MUD Quick-Change Systems From D-M-E

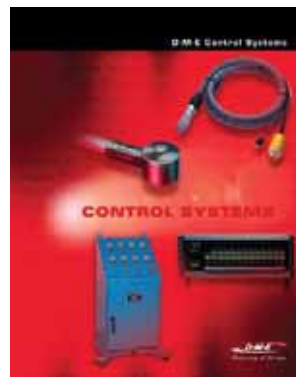
Reduce downtime by as much as 75 percent with an innovative approach to fast production changeovers. Master Unit Die is the leader in quick-change systems and the MUD Catalog offers many systems that will maximize your production volume.



CATALOG: 316 PAGES

### D-M-E Mold Components

With the largest selection of mold components available around the globe, the D-M-E Mold Components Catalog has the products that will help you meet the unprecedented demands you face for speed, cost reduction and performance.



CATALOG: 76 PAGES

### D-M-E Control Systems

Powerful. Flexible. Affordable. That's what molders want from today's generation of hot runner, valve gate, and process controls, and D-M-E delivers with a broad line of controllers sure to fit the most demanding application.



CATALOG: 76 PAGES

### D-M-E Equipment and Supplies

From high-speed cutting tools and finishing and polishing systems to a vast array of maintenance, repair and operation-related products, the D-M-E Equipment and Supplies Catalog is an invaluable resource for mold technology professionals.



CATALOG: 68 PAGES

### D-M-E Technical Services

From powerful, online resources available 24/7, to our team of trained, experienced experts committed to helping customers achieve maximum productivity, reliable operation, and better performance, D-M-E's goal is simple: to be an essential resource for your molding challenges every step of the way.