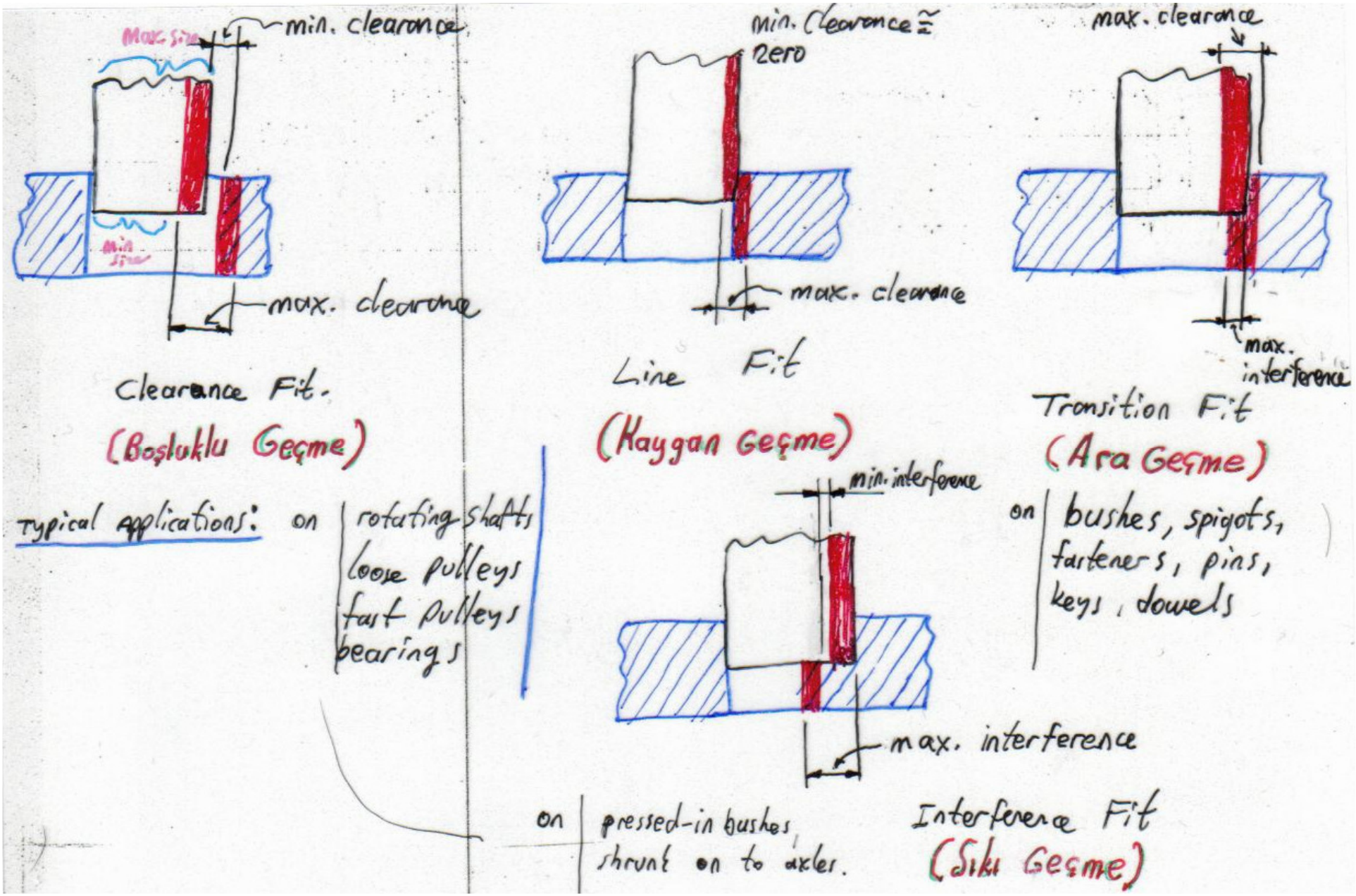
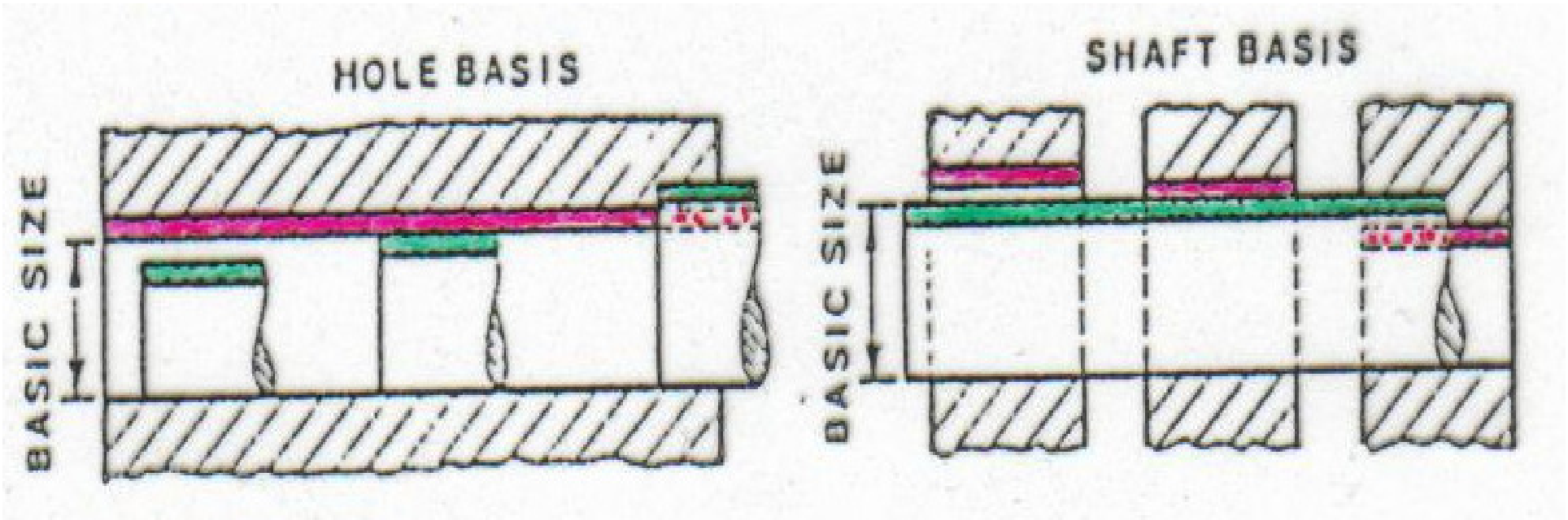
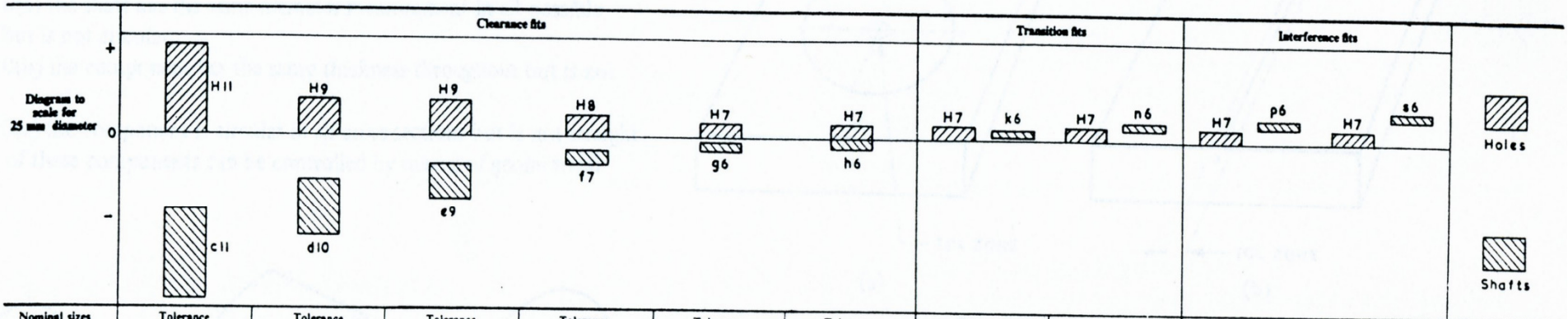
SIZE TOLERANCES

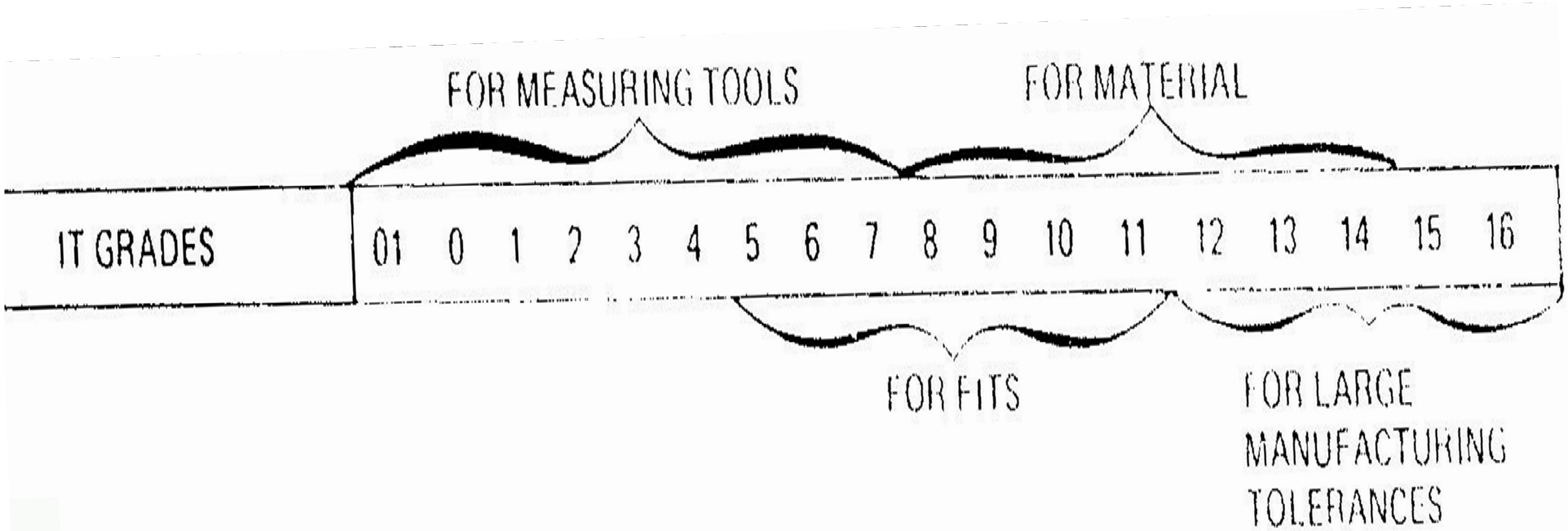



HOLE BASIS
BASIC SIZE
SHAFT BASIS
BASIC SIZE

SELECTED ISO FITS—HOLE BASIS

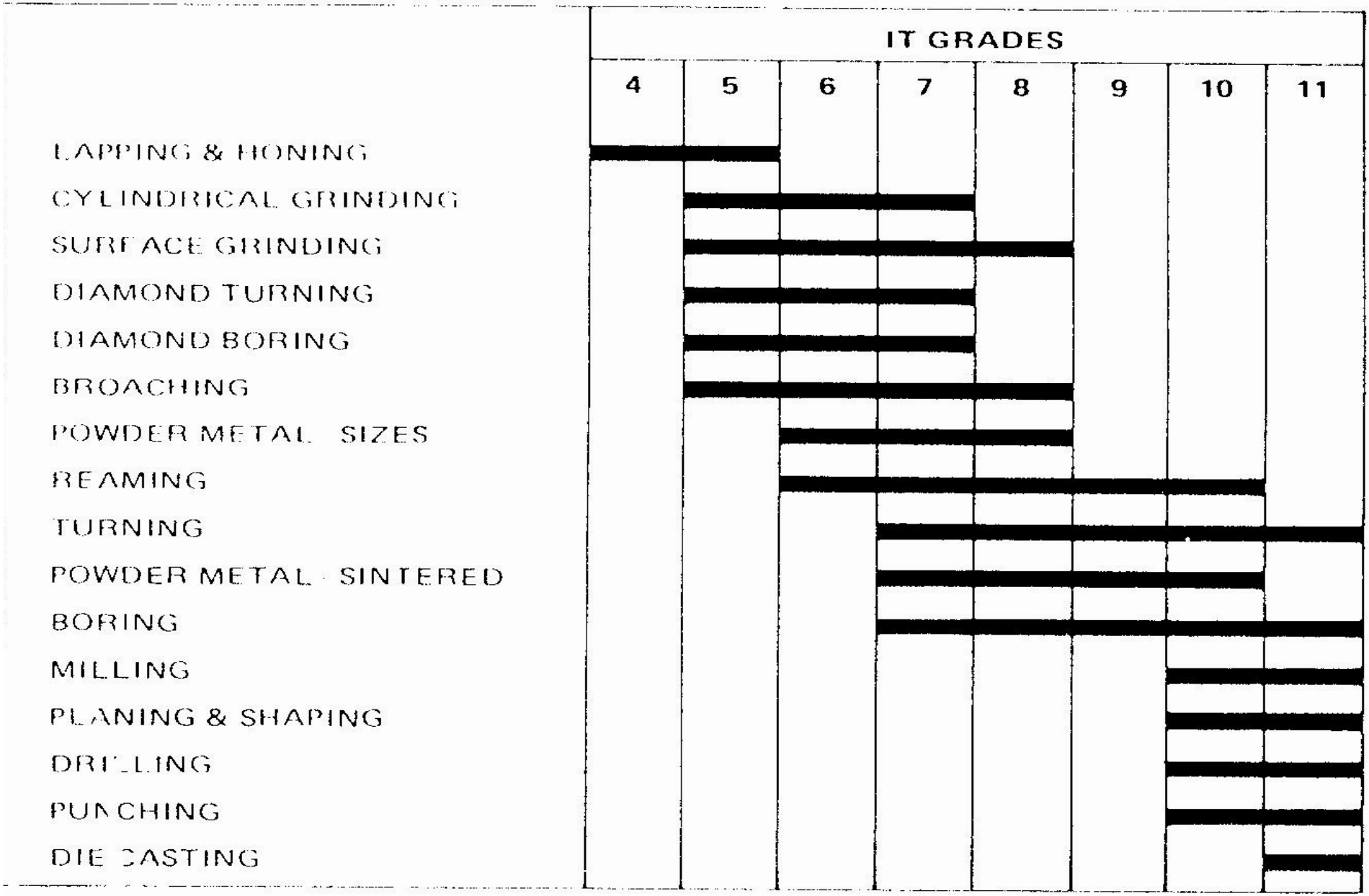


Nominal sizes		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Tolerance		Nominal sizes	
Over	To	H11	c11	H9	d10	H9	e9	H8	f7	H7	g6	H7	h6	H7	k6	H7	n6	H7	p6	H7	s6	Over	To
mm	mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	0 001 mm	mm	mm
—	3	+ 60 0	− 60 − 120	+ 25 0	− 20 − 60	+ 25 0	− 14 − 39	+ 14 0	− 6 − 16	+ 10 0	− 2 − 8	+ 10 0	− 6 0	+ 10 0	+ 6 + 0	+ 10 0	+ 10 + 4	+ 10 0	+ 12 + 6	+ 10 0	+ 20 + 14	—	3
3	6	+ 75 0	− 70 − 145	+ 30 0	− 30 − 78	+ 30 0	− 20 −50	+ 18 0	− 10 − 22	+ 12 0	− 4 − 12	+ 12 0	− 8 0	+ 12 0	+ 9 + 1	+ 12 0	+ 16 + 8	+12 0	+ 20 + 12	+12 0	+ 27 + 19	3	6
6	10	+ 90 0	− 80 − 170	+ 36 0	− 40 − 98	+ 36 0	− 25 − 61	+ 22 0	− 13 − 28	+ 15 0	− 5 − 14	+ 15 0	− 9 0	+ 15 0	+ 10 + 1	+ 15 0	+ 19 + 10	+15 0	+ 24 + 15	+ 15 0	+ 32 + 23	6	10
10	18	+ 110 0	− 95 − 205	+ 43 0	− 50 − 120	+ 43 0	− 32 − 75	+ 27 0	− 16 − 34	+ 18 0	− 6 − 17	+ 18 0	− 11 0	+ 18 0	+ 12 + 1	+ 18 0	+ 23 + 12	+ 18 0	+ 29 + 18	+18 0	+ 39 + 28	10	18
18	30	+ 130 0	− 110 − 240	+ 52 0	− 65 − 149	+ 52 0	− 40 − 92	+ 33 0	− 20 − 41	+ 21 0	− 7 − 20	+ 21 0	− 13 0	+ 21 0	+ 15 + 2	+ 21 0	+ 28 + 15	+ 21 0	+ 35 + 22	+ 21 0	+ 48 + 35	18	30
30	40	+ 160 0	− 120 − 280	+ 62 0	− 80 − 180	+ 62 0	− 50 − 112	+ 39 0	− 25 − 50	+ 25 0	− 9 − 25	+ 25 0	− 16 0	+ 25 0	+ 18 + 2	+ 25 0	+ 33 + 17	+25 0	+ 42 + 26	+ 25 0	+ 59 + 43	30	40
40	50	+ 160 0	− 130 − 290																			40	50
50	65	+ 190 0	− 140 − 330	+ 74 0	− 100 − 220	+ 74 ·0	− 60 − 134	+ 46 0	− 30 − 60	+ 30 0	− 10 − 29	+ 30 0	− 19 0	+ 30 0	+ 21 + 2	+30 0	+ 39 + 20	+ 30 0	+ 51 + 32	+ 30 0	+ 72 + 53	50	65
65	80	+ 190 0	− 150 − 340																	+ 30 0	+ 78 + 59	65	80
80	100	+ 220 0	− 170 − 390	+ 87 0	− 120 − 260	+ 87 0	− 72 − 159	+ 54 0	− 36 − 71	+ 35 0	− 12 − 34	+ 35 0	− 22 0	+ 35 0	+ 25 + 3	+ 35 0	+ 45 + 23	+ 35 0	+ 59 + 37	+ 35 0	+ 93 + 71	80	100
100	120	+ 220 0	− 180 − 400																	+ 35 0	+ 101 + 79	100	120
120	140	+ 250 0	− 200 − 450	+ 100 0	− 145 − 305	+ 100 0	− 84 − 185	+ 63 0	− 43 − 83	+ 40 0	− 14 − 39	+ 40 0	− 25 0	+ 40 0	+ 28 + 3	+ 40 0	+ 52 + 27	+ 40 0	+ 68 + 43	+ 40 0	+ 117 + 92	120	140
140	160	+ 250 0	− 210 − 460																	+ 40 0	+ 125 + 100	140	160
160	180	+ 250 0	− 230 − 480																	+ 40 0	+ 133 + 108	160	180
180	200	+ 290 0	− 240 − 530	+ 115 0	− 170 − 355	+115 0	− 100 − 215	+ 72 0	− 50 − 96	+ 46 0	− 15 − 44	+ 46 0	− 29 0	+ 46 0	+ 33 + 4	+ 46 0	+ 60 + 31	+ 46 0	+ 79 + 50	+ 46 0	+ 151 + 122	180	200
200	225	+ 290 0	− 260 − 550																	+ 46 0	+ 15º + 130	200	225
225	250	+ 290 0	− 280 − 570																	+ 46 0	+ 169 + 140	225	250
250	280	+ 320 0	− 300 − 620	+ 130 0	− 190 − 400	+ 130 0	− 110 − 240	+ 81 0	− 56 − 108	+ 52 0	− 17 − 49	+ 52 0	−32 0	+ 52 0	+ 36 + 4	+ 52 0	+ 66 + 34	+ 52 0	+ 88 + 56	+ 52 0	+ 190 + 158	250	280
280	315	+ 320 0	− 330 − 650																	+ 52 0	+ 202 + 170	280	315
315	355	+ 360 0	− 360 − 720	+ 140 0	− 210 − 440	+ 140 0	− 125 − 265	+ 89 0	− 62 − 119	+ 57 0	− 18 − 54	+ 57 0	− 36 0	+ 57 0	+ 40 + 4	+ 57 0	+ 73 + 37	+ 57 0	+ 98 + 62	+ 57 0	+ 226 + 190	315	355
355	400	+ 360 0	− 400 − 760																	+ 57 0	+ 244 + 208	355	400
400	450	+ 400 0	− 440 − 840	+ 155 0	− 230 − 480	+ 155 0	− 135 − 290	+ 97 0	− 68 − 131	+ 63 0	− 20 − 60	+ 63 0	− 40 0	+ 63 0	+ 45 + 5	+ 63 0	+ 80 + 40	+ 63 0	+ 108 + 68	+ 63 0	+ 272 + 232	400	450
450	500	+ 400 0	− 480 − 880																	+63 0	+ 292 + 252	450	500



The International Tolerance grades and their applications.

IT GRADES AND THEIR RELATIONSHIP TO MACHINING PROCESSES



DESCRIPTION OF PREFERRED FITS

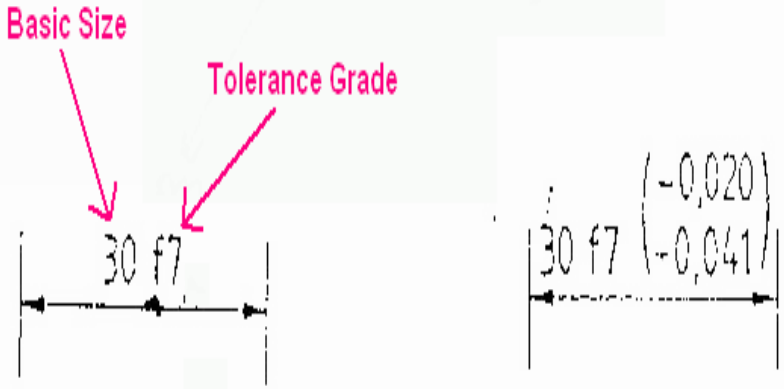
	ISO SYMBOL		DESCRIPTION
	Hole Basis	Shaft Basis	
Clearance Fits	H11/c11	C11/h11	*Loose running* fit for wide commercial tolerances or allowances on external members.
	H9/d9	D9/h9	*Free running* fit not for use where accuracy is essential, but good for large temperature variations, high running speeds, 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[1]	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.

More Clearance

More Interference

Alıştırma Derecesi	Geçme Cinsleri	Normal Delik Delik/Mil	Normal Mil Delik/Mil	Geçme Özelliği
Hassas	Hareketsiz Geçmeler:			
	Sıkı Geçme	H6 / p5	P6 / h5	Presle yapılır
	Çakma Geçme	H6 / n5	N6 / h5	Çekiçle zor yapılır
	Tutuk Geçme	H6 / k6	K6 / h5	Çekiçle kolay yapılır
	Kakma Geçme	H6 / j6	J6 / h5	Tokmak veya elle yapılır
	Hareketli Geçmeler:			
	Kaygan Geçme	H6 / h5	H6 / h5	Yağlanırsa elle yapılır
İnce	Hareketsiz Geçmeler:			
	Preste Geçme	H7 / s6,r6	S7 / h6	Presle yapılır 1)
	Sıkı Geçme	H7 / n6	N7 / h6	Presle yapılır
	Çakma Geçme	H7 / m6	M7 / h6	Çekiçle zor yapılır
	Tutuk Geçme	H7 / k6	K7 / h6	Çekiçle kolay yapılır
	Kakma Geçme	H7 / j6	J7 / h6	Tokmak veya elle yapılır
	Hareketli Geçmeler:			
	Kaygan Geçme	H7 / h6	H7 / h6	Yağlanırsa elle yapılır
	Tutuk Döner Geçme	H7 / g6	G7 / h6	Elle yapılır
	Döner Geçme	H7 / f7	F7 / h6	Elle yapılır
	Serbest Döner Geçme	H7 / e8	E8 / h6	Elle yapılır
	Serbest Geçme	H7 / d9	D9 / h6	Elle yapılır
Orta	Hareketli Geçmeler:			
	Kaygan Geçme	H8 / h9	H8 / h8,h9	Elle yapılır
	Döner Geçme	H8 / f8	F8 / h8,h9	Elle yapılır
	Serbest Geçme	H8 / d10	D10 / h8, h9	Elle yapılır
Kaba	Hareketli Geçmeler			
	Kaba Geçme 1	H11 / h11	H11 / h11	Elle yapılır
	Kaba Geçme 2	H11 / d11	D11 / h11	Elle yapılır
	Kaba Geçme 3	H11 / c11	C11 / h11	Elle yapılır
	Kaba Geçme 4	H11 / a11	A11 / h11	Elle yapılır

Not: 1) S6 toleransı 160 mm.ye kadar, r6 toleransı ise 160 mm.den yukarı çaplar için kullanılmalıdır.



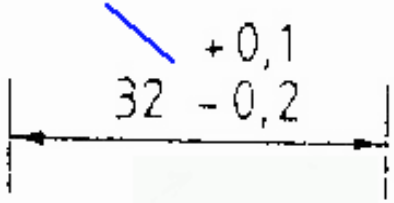
Examples:

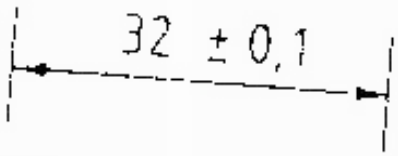
for holes: 45 H8

for shafts: 40 f7

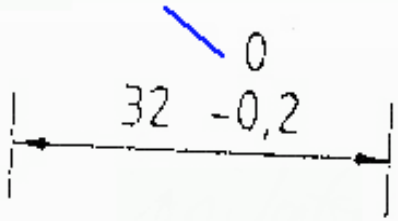
for fits : 40 H8/ f7

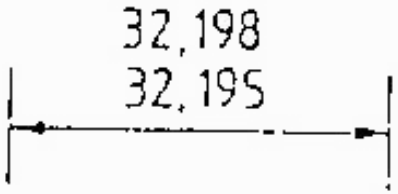
Bilateral tolerance

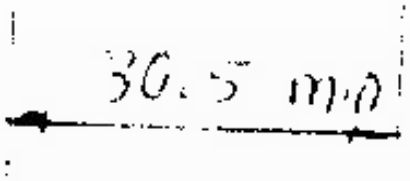




Unilateral tolerance







Precision of Nominal Value

Metric Tolerancing In the metric system the dimension need not be shown to the same number of decimal places as its tolerance. For example:

1.5 ± 0.04 *not* 1.50 ± 0.04

10 ± 0.1 *not* 10.0 ± 0.1

When bilateral tolerancing is used, both the plus and the minus values have the same number of decimal places, using zeros when necessary. For example:

$30^{+0.15}_{-0.10}$ *not* $30^{+0.15}_{-0.1}$

Inch Tolerancing In the inch system the dimension is given to the same number of decimal places as its tolerance. For example:

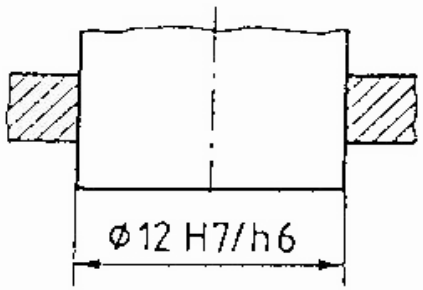
Bilateral:

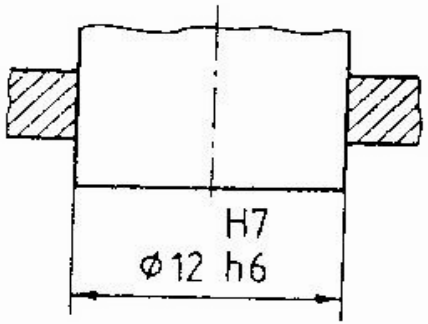
$.500 \mp .004$ *not* $.50 \mp .004$

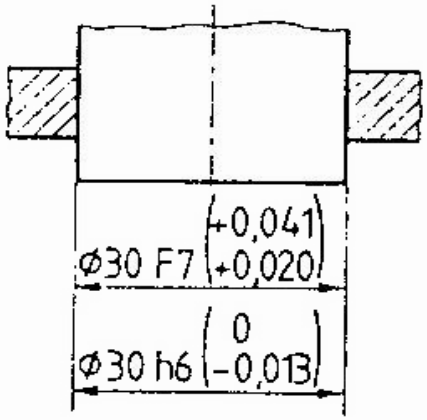
Unilateral:

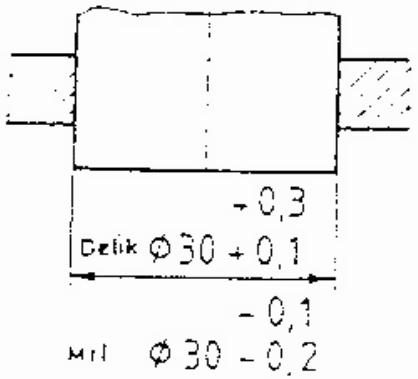
$.750^{+.500}_{-.000}$ *not* $.750^{+.005}_{-0}$

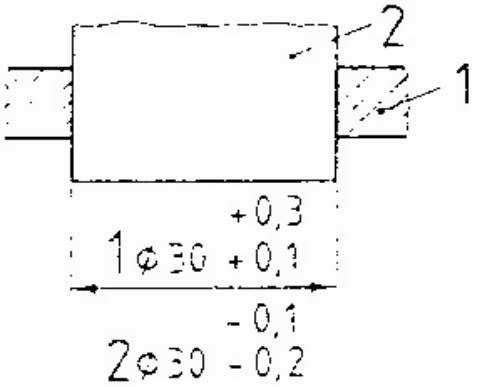
$30.0° \mp .2°$ *not* $30° \mp .2°$

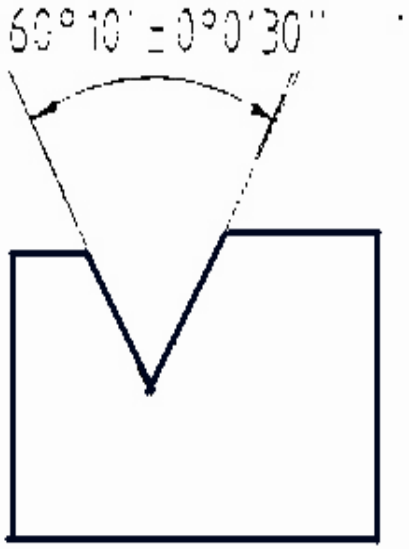

Ø12 H7/h6

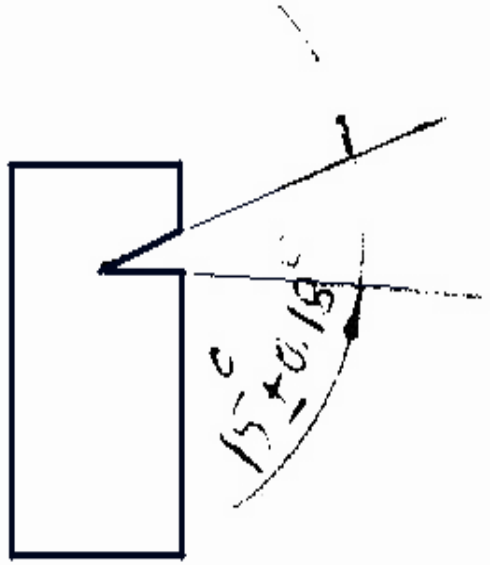

H7
Ø12 h6


Ø30 F7 (+0,041 +0,020)
Ø30 h6 (0 -0,013)


-0,3
Delik Ø30 +0,1
-0,1
Mil Ø30 -0,2


2
1
+0,3
1Ø30 +0,1
-0,1
2Ø30 -0,2


60° 10' ± 0° 0' 30"



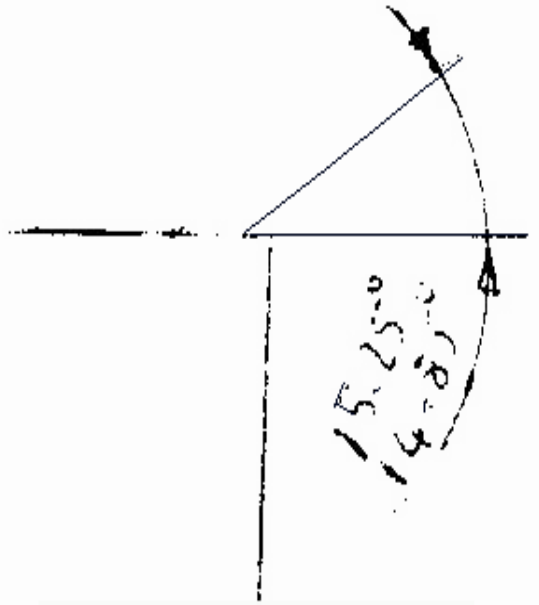


Table 3

FINE, MEDIUM, AND COARSE SERIES: GENERAL TOLERANCE – LINEAR DIMENSIONS

Variations in mm

Basic dimensions mm		0.5 to 3	over 3 to 6	over 6 to 30	over 30 to 120	over 120 to 315	over 315 to 1,000	over 1,000 to 2,000
Permissible variations	Fine series	±0.05	±0.05	±0.1	±0.15	±0.2	±0.3	±0.5
	Medium series	±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2
	Coarse series		±0.2	±0.5	±0.8	±1.2	±2	±3

TABLE 6 GENERAL TOLERANCE – ANGLES AND TAPERS

Length of the shorter leg mm		up to 10	Over 10 to 50	Over 50 to 120	Over 120 to 400
Permissible Variations	in degrees and minutes	±1°	±0°30′	±0°20′	±0°10′
	in millimeters per 100 mm	±1.8	±0.9	±0.6	±0.3

Dimensions in mm

General Tolerance
Unless Otherwise Specified The Following Tolerances are Applicable

Linear	Over to	0.5 6	6 30	30 120	120 315	315 1000	1000 2000
Tol	±	0.1	0.2	0.3	0.5	0.8	1.2

This table is a medium series of values taken from Table 5 It is placed on the working drawing to provide the tolerances for various ranges of sizes.

Dimensions are in mm.

Basic sizes		Tolerance grades[3]																
Over	Up to and including	IT01	IT0	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12	IT13	IT14	IT15	IT16
0	3	0.0003	0.0005	0.0008	0.0012	0.002	0.003	0.004	0.006	0.010	0.014	0.025	0.040	0.060	0.100	0.140	0.250	0.400	0.600
3	6	0.0004	0.0006	0.001	0.0015	0.0025	0.004	0.005	0.008	0.012	0.018	0.030	0.048	0.075	0.120	0.180	0.300	0.480	0.750
6	10	0.0004	0.0006	0.001	0.0015	0.0025	0.004	0.006	0.009	0.015	0.022	0.036	0.058	0.090	0.150	0.220	0.360	0.580	0.900
10	18	0.0005	0.0008	0.0012	0.002	0.003	0.005	0.008	0.011	0.018	0.027	0.043	0.070	0.110	0.180	0.270	0.430	0.700	1.100
18	30	0.0006	0.001	0.0015	0.0025	0.004	0.006	0.009	0.013	0.021	0.033	0.052	0.084	0.130	0.210	0.330	0.520	0.840	1.300
30	50	0.0006	0.001	0.0015	0.0025	0.004	0.007	0.011	0.016	0.025	0.039	0.062	0.100	0.160	0.250	0.390	0.620	1.000	1.600
50	80	0.0008	0.0012	0.002	0.003	0.005	0.008	0.013	0.019	0.030	0.046	0.074	0.120	0.190	0.300	0.460	0.740	1.200	1.900
80	120	0.001	0.0015	0.0025	0.004	0.006	0.010	0.015	0.022	0.035	0.054	0.087	0.140	0.220	0.350	0.540	0.870	1.400	2.200
120	180	0.0012	0.002	0.0035	0.005	0.008	0.012	0.018	0.025	0.040	0.063	0.100	0.160	0.250	0.400	0.630	1.000	1.600	2.500
180	250	0.002	0.003	0.0045	0.007	0.010	0.014	0.020	0.029	0.046	0.072	0.115	0.185	0.290	0.460	0.720	1.150	1.850	2.900
250	315	0.0025	0.004	0.006	0.008	0.012	0.016	0.023	0.032	0.052	0.081	0.130	0.210	0.320	0.520	0.810	1.300	2.100	3.200
315	400	0.003	0.005	0.007	0.009	0.013	0.018	0.025	0.036	0.057	0.089	0.140	0.230	0.360	0.570	0.890	1.400	2.300	3.600
400	500	0.004	0.006	0.008	0.010	0.015	0.020	0.027	0.040	0.063	0.097	0.155	0.250	0.400	0.630	0.970	1.550	2.500	4.000
500	630	0.0045	0.006	0.009	0.011	0.016	0.022	0.030	0.044	0.070	0.110	0.175	0.280	0.440	0.700	1.100	1.750	2.800	4.400
630	800	0.005	0.007	0.010	0.013	0.018	0.025	0.035	0.050	0.080	0.125	0.200	0.320	0.500	0.800	1.250	2.000	3.200	5.000
800	1000	0.0055	0.008	0.011	0.015	0.021	0.029	0.040	0.056	0.090	0.140	0.230	0.360	0.560	0.900	1.400	2.300	3.600	5.600
1000	1250	0.0065	0.009	0.013	0.018	0.024	0.034	0.046	0.066	0.105	0.165	0.260	0.420	0.660	1.050	1.650	2.600	4.200	6.600
1250	1600	0.008	0.011	0.015	0.021	0.029	0.040	0.054	0.078	0.125	0.195	0.310	0.500	0.780	1.250	1.950	3.100	5.000	7.800
1600	2000	0.009	0.013	0.018	0.025	0.035	0.048	0.065	0.092	0.150	0.230	0.370	0.600	0.920	1.500	2.300	3.700	6.000	9.200
2000	2500	0.011	0.015	0.022	0.030	0.041	0.057	0.077	0.110	0.175	0.280	0.440	0.700	1.100	1.750	2.800	4.400	7.000	11.000
2500	3150	0.013	0.018	0.026	0.036	0.050	0.069	0.093	0.135	0.210	0.330	0.540	0.860	1.350	2.100	3.300	5.400	8.600	13.500

[3] IT Values for tolerance grades larger than IT16 can be calculated by using the following formulas:
IT17 = IT12 × 10; IT18 = IT13 × 10; etc.

General tolerances —

Part 1:
Tolerances for linear and angular dimensions without individual tolerance indications

Table 1 – Permissible deviations for linear dimensions except for broken edges
(external radii and chamfer heights, see table 2)

Values in millimetres

Tolerance class		Permissible deviations for basic size range							
Designation	Description	0,5[1] up to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400	over 400 up to 1 000	over 1 000 up to 2 000	over 2 000 up to 4 000
f	fine	±0,05	±0,05	±0,1	±0,15	±0,2	±0,3	±0,5	–
m	medium	±0,1	±0,1	±0,2	±0,3	±0,5	±0,8	±1,2	±2
c	coarse	±0,2	±0,3	±0,5	±0,8	±1,2	±2	±3	±4
v	very coarse	–	±0,5	±1	±1,5	±2,5	±4	±6	±8

1) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Table 2 – Permissible deviations for broken edges (external radii and chamfer heights)

Values in millimetres

Tolerance class		Permissible deviations for basic size range		
Designation	Description	0,5[1] up to 3	over 3 up to 6	over 6
f	fine	±0,2	±0,5	±1
m	medium			
c	coarse	±0,4	±1	±2
v	very coarse			

1) For nominal sizes below 0,5 mm, the deviations shall be indicated adjacent to the relevant nominal size(s).

Table 3 – Permissible deviations of angular dimensions

Tolerance class		Permissible deviations for ranges of lengths, in millimetres, of the shorter side of the angle concerned				
Designation	Description	up to 10	over 10 up to 50	over 50 up to 120	over 120 up to 400	over 400
f	fine	±1°	±0°30′	±0°20′	±0°10′	±0°5′
m	medium					
c	coarse	±1°30′	±1°	±0°30′	±0°15′	±0°10′
v	very coarse	±3°	±2°	±1°	±0°30′	±0°20′

ÇİZELGE 1 - Kırılmış Kenarlar Hariç, Uzunluk Ölçüleri İçin Sınır Sapmaları (Yarı Çap Ölçüleri ve Pah/Havşa Yükseklikleri Çizelge 2'de dir)

Değerler mm'dir.

Tolerans Sınıfı		Anma Ölçüsü Alanları İçin Sınır Sapmaları							
Sembol	Adı	≥0,5[1)] ≤3	>3 ≤6	>6 ≤30	>30 ≤120	>120 ≤400	>400 ≤1000	>1000 ≤2000	>2000 ≤4000
f	İnce	±0,05	±0,05	±0,1	±0,15	±0,2	±0,3	±0,5	-
m	Orta	±0,1	±0,1	±0,2	±0,3	±0,5	±0,8	±1,2	±2
c	Kaba	±0,2	±0,3	±0,5	±0,8	±1,2	±2	±3	±4
v	Çok Kaba	-	±0,5	±1	±1,5	±2,5	±4	±6	±8

1) 0,5 mm'nin altındaki anma ölçüleri için, sınır sapmaları, doğrudan doğruya ilgili anma ölçüsünün yanında yer almalıdır.

ÇİZELGE 2 - Kırılmış Kenarlar İçin Sınır Sapmaları (Yarı Çap Ölçüleri ve Pah/Havşa Yükseklikleri)

Değerler mm'dir.

Tolerans Sınıfı		Anma Ölçüsü Alanları İçin Sınır Sapmaları		
Sembol	Adı	≥ 0,5[1)] ≤ 3	> 3 ≤ 6	> 6
f	İnce	± 0,2	± 0,5	± 1
m	Orta			
c	Kaba	± 0,4	± 1	± 2
v	Çok Kaba			

1) 0,5 mm'nin altındaki anma ölçüleri için, sınır sapmaları, doğrudan doğruya ilgili anma ölçüsünün yanında yer almalıdır.

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ÇİZELGE 3 - Açı Ölçüleri İçin Sınır Sapmaları

Tolerans Sınıfı		İlgili Açının Kısa Kolu İçin mm Olarak Uzunluk Alanlarına Göre Sınır Sapmaları				
Sembol	Adı	≤ 10	> 10 ≤ 50	> 50 ≤ 120	> 120 ≤ 400	> 400
f	İnce	±1°	±0°30'	±0°20'	±0°10'	±0°5'
m	Orta					
c	Kaba	±1°30'	±1°	±0°30'	±0°15'	±0°10'
v	Çok Kaba	±3°	±2°	±1°	±0°30'	±0°20'

5 Indications on drawings

If general tolerances in accordance with this part of ISO 2768 shall apply, the following information shall be indicated in or near the title block:

a) "ISO 2768";

b) the tolerance class in accordance with this part of ISO 2768.

EXAMPLE

ISO 2768-m

5 - TEKNİK RESİMLERİN ÖLÇÜLENDİRİLMESİ

Genel toleranslar ISO 2768'in bu bölümüne uygun olarak teknik resim yazı alanı içinde veya yanında

a) "ISO 2768",

b) ISO 2768'in bu bölümüne uygun tolerans sınıfını belirterek

Örnek: "ISO 2768-m"

şeklinde yazılmalıdır.

NOT - Şüpheli hallerde "Genel Tolerans" adı baş tarafa yazılmalıdır.