CLEARANCES AND FITS

Guidelines and Tables

Machine Drawing

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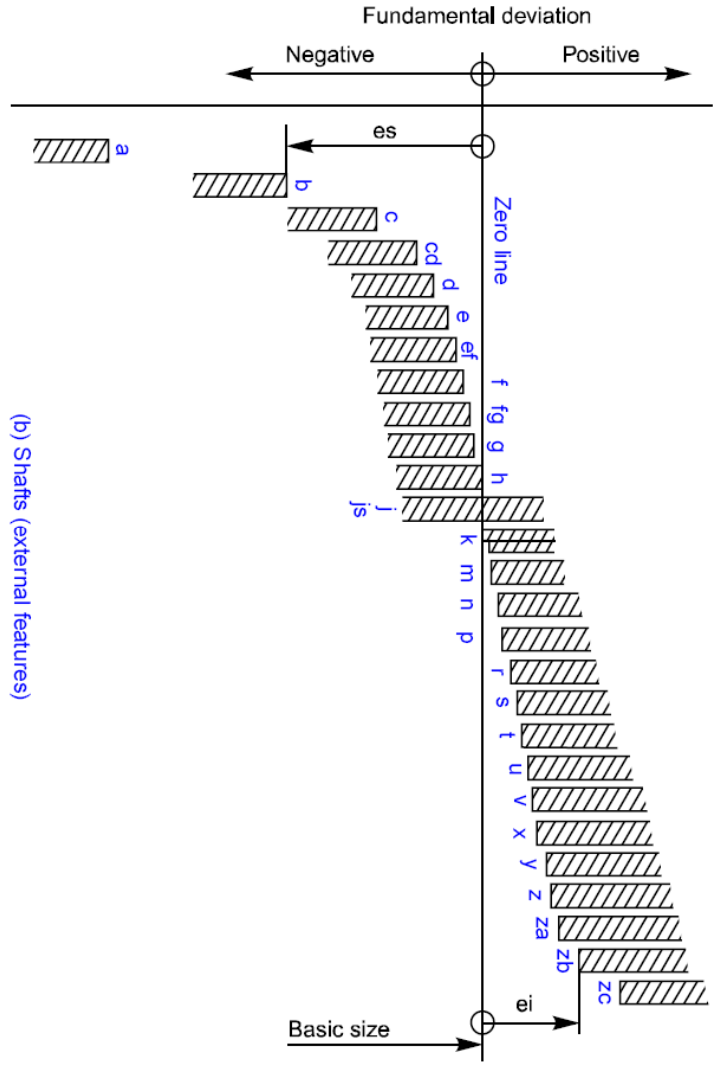

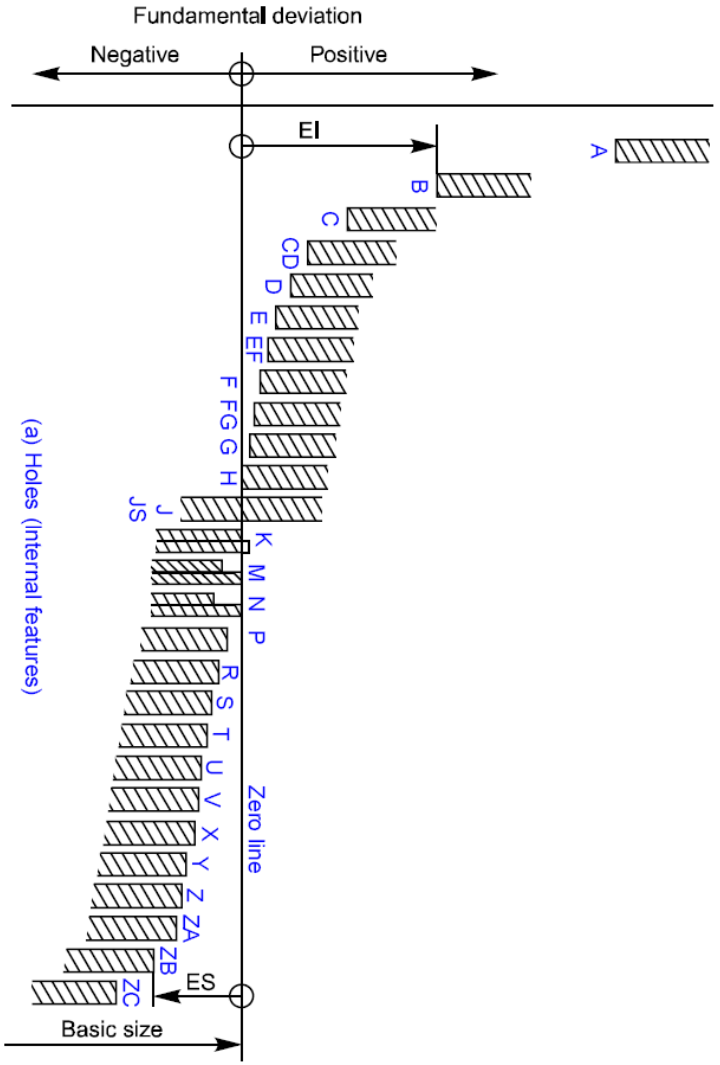

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GUIDELINES --- CLEARANCE FITS

Combinations recommended in **BOLD**

Hole-Shaft Combination	Description	Uses
H11/a11, **H11/c11**, H11/c9, H11/d11, A11/h11, **C11/h11**, D11/h11	Fits with great clearances with parts having great tolerances.	Pivots, latches, fits of parts exposed to corrosive effects, contamination with dust and thermal or mechanical deformations
H9/C9, H9/d10, **H9/d9**, H8/d9, H8/d8, **D10/h9**, D9/h9, D9/h8	Running fits with greater clearances without any special requirements for accuracy of guiding shafts.	Multiple fits of shafts of production and piston machines, parts rotating very rarely or only swinging.
H9/e9, **H8/e8**, H7/e7, **E9/h9**, E8/h8, E8/h7	Running fits with greater clearances without any special requirements for fit accuracy	Main fits of machine tools. General fits of shafts, regulator bearings, machine tool spindles, sliding rods.
H9/f8, H8/f8, **H8/f7**, **H7/f7**, F8/h7, **F8/h6**	Running fits with smaller clearances with general requirements for fit accuracy	Main fits of machine tools. General fits of shafts, regulator bearings, machine tool spindles, sliding rods.
H8/g7, **H7/g6**, **G7/h6**	Running fits with very small clearances for accurate guiding of shafts. Without any noticeable clearance after assembly.	Parts of machine tools, sliding gears and clutch disks, crankshaft journals, pistons of hydraulic machines, rods sliding in bearings, grinding machine spindles.
H11/h11, H11/h9	Slipping fits of parts with great tolerances. The parts can easily be slid one into the other and turn	Easily demountable parts, distance rings, parts of machines fixed to shafts using pins, bolts, rivets or welds.
H8/h9, H8/h8, H8/h7, **H7/h6**	Sliding fits with very small clearances for precise guiding and centring of parts. Mounting by sliding on without use of any great force, after lubrication the parts can be turned and slid by hand.	Sliding fits with very small clearances for precise guiding and centring of parts. Mounting by sliding on without use of any great force, after lubrication the parts can be turned and slid by hand.

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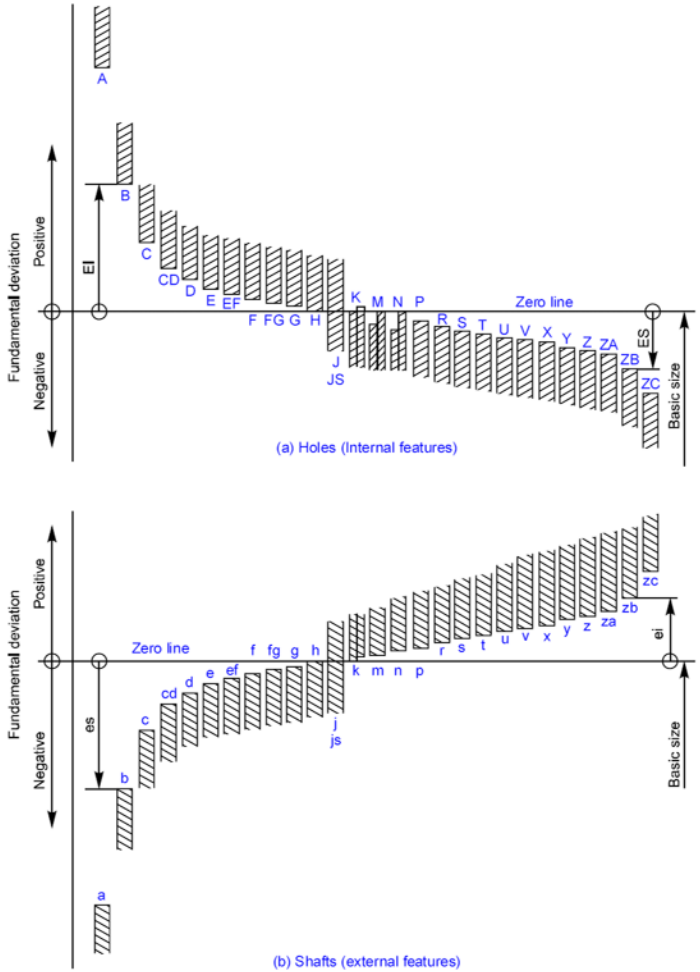
GUIDELINES --- TRANSITION FITS



Combinations recommended in **BOLD**

Hole-Shaft Combination	Description	Uses
H8/j7, H7/js6, **H7/j6**, J7/h6	Tight fits with small clearances or negligible interference. The parts can be assembled or disassembled manually.	Easily dismountable fits of hubs of gears, pulleys and bushings, retaining rings, frequently removed bearing bushings.
H8/k7, **H7/k6**, K8/h7, **K7/h6**	Similar fits with small clearances or small interferences. The parts can be assembled or disassembled without great force using a rubber mallet.	Demountable fits of hubs of gears and pulleys, manual wheels, clutches, brake disks.
H8/p7, H8/m7, H8/n7, H7/m6, **H7/n6**, M8/h6, N8/h7, **N7/h6**	Fixed fits with negligible clearances or small interferences. Mounting of fits using pressing and light force.	Fixed plugs, driven bushings, armatures of electric motors on shafts, gear rims, flushed bolts.

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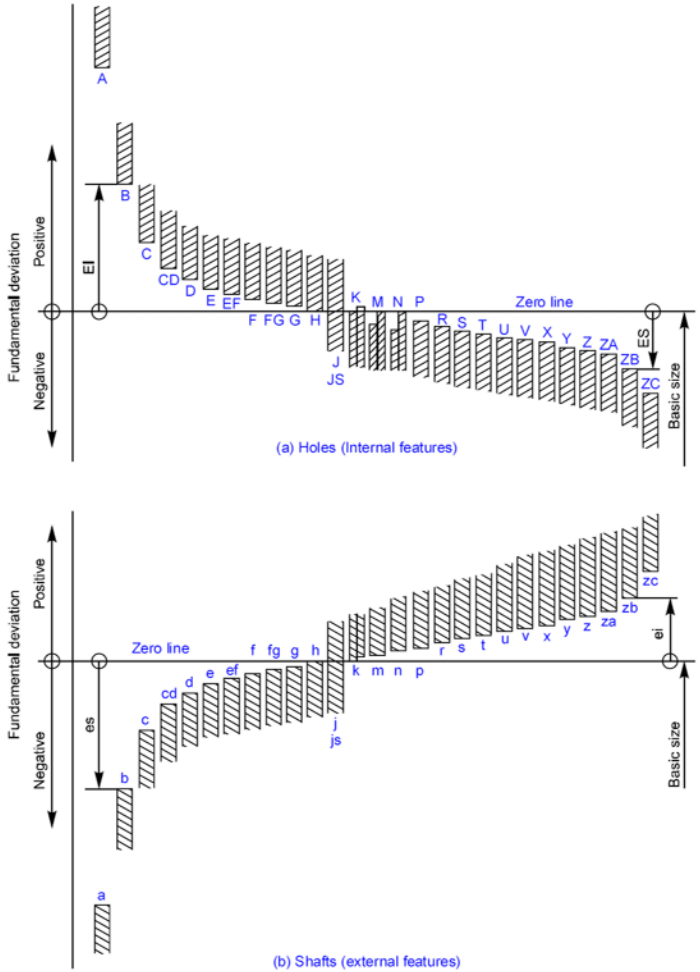
GUIDELINES --- INTERFERENCE FITS



Combinations recommended in **BOLD**

Hole-Shaft Combination	Description	Uses
H8/r7, **H7/p6**, **H7/r6**, **P7/h6**, R7/h6	Pressed fits with guaranteed interference. Assembly of the parts can be carried out using cold pressing.	Hubs of clutch disks, bearing bushings.
H8/s7, H8/t7, **H7/s6**, H7/t6, **S7/h6**, T7/h6	Pressed fits with medium interference. Assembly of parts using hot pressing. Assembly using cold pressing only with use of large forces.	Permanent coupling of gears with shafts, bearing bushings.
H8/u8, H8/u7, H8/x8, H7/u6, U8/h7, U7/h6	Pressed fits with big interferences. Assembly using pressing and great forces under different temperatures of the parts.	permanent couplings of gears with shafts, flanges.

Table 15.6. Types of fits with symbols and applications

Type of fit	*Symbol of fit*	*Examples of application*
Interference fit		
Shrink fit	H8/u8	Wheel sets, tyres, bronze crowns on worm wheel
Heavy drive fit	H7/s6	hubs, couplings under certain conditions, etc.
Press fit	H7/r6	Coupling on shaft ends, bearing bushes in hubs, valve
Medium press fit	H7/p6	seats, gear wheels.
Transition fit		
Light press fit	H7/n6	Gears and worm wheels, bearing bushes, shaft and wheel assembly with feather key.
Force fit	H7/m6	Parts on machine tools that must be changed without damage, *e.g.,* gears, belt pulleys, couplings, fit bolts, inner ring of ball bearings.
Push fit	H7/k6	Belt pulleys, brake pulleys, gears and couplings as well as inner rings of ball bearings on shafts for average loading conditions.
Easy push fit	H7/j6	Parts which are to be frequently dismantled but are secured by keys, *e.g.,* pulleys, hand-wheels, bushes, bearing shells, pistons on piston rods, change gear trains.
Clearance fit		
Precision sliding fit	H7/h6	Sealing rings, bearing covers, milling cutters on milling mandrels, other easily removable parts.
Close running fit	H7/g6	Spline shafts, clutches, movable gears in change gear trains, etc.
Normal running fit	H7/f7	Sleeve bearings with high revolution, bearings on machine tool spindles.
Easy running fit	H8/e8	Sleeve bearings with medium revolution, grease lubricated bearings of wheel boxes, gears sliding on shafts, sliding blocks.
Loose running fit	H8/d9	Sleeve bearings with low revolution, plastic material bearings.
Slide running fit	H8/c11	Oil seals (Simmerrings) with metal housing (fit in housing and contact surface on shaft), multi-spline shafts.

Table 15.1 Fundamental tolerances of grades 01, 0 and 1 to 16 (values of tolerances in microns) (1 micron = 0.001 mm)

Diameter steps in mm	*Tolerance Grades*																	
	01	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14**	*15**	*16**
To and inc 3	0.3	0.5	0.8	1.2	2	3	4	6	10	14	25	40	60	100	140	250	400	600
Over 3 To and inc 6	0.4	0.6	1	1.5	2.5	4	5	8	12	18	30	48	75	120	180	300	480	750
Over 6 To and inc 10	0.4	0.6	1	1.5	2.5	4	6	9	15	22	36	58	90	150	220	360	580	900
Over 10 To and inc 18	0.5	0.8	1.2	2	3	5	8	11	18	27	43	70	110	180	270	430	700	1100
Over 18 To and inc 30	0.6	1	1.5	2.5	4	6	9	13	21	33	52	84	130	210	330	520	840	1300
Over 30 To and inc 50	0.6	1	1.5	2.5	4	7	11	16	25	39	62	100	160	250	390	620	1000	1600
Over 50 To and inc 80	0.8	1.2	2	3	5	8	13	19	30	46	74	120	190	300	460	740	1200	1900
Over 80 To and inc 120	1	1.5	2.5	4	6	10	15	22	35	54	87	140	220	350	540	870	1400	2200
Over 120 To and inc 180	1.2	2	3.5	5	8	12	18	25	40	63	100	160	250	400	630	1000	1600	2500
Over 180 To and inc 250	2	3	4.5	7	10	14	20	29	46	72	115	185	290	460	720	1150	1850	2900
Over 250 To and inc 315	2.5	4	6	8	12	16	23	32	52	81	130	210	320	520	810	1300	2100	3200
Over 315 To and inc 400	3	5	7	9	13	18	25	36	57	89	140	230	360	570	890	1400	2300	3600
Over 400 To and inc 500	4	6	8	10	15	20	27	40	63	97	155	250	400	630	970	1550	2500	4000

*Upto 1 mm, Grades 14 to 16 are not provided.

Table 15.2 Fundamental deviations for shafts of types **a** to **k** of sizes upto 500mm *(contd.)*

Fundamental deviation in microns													(1 micron = 0.001 mm)	
Diameter steps in mm		*Upper deviation (es)*								**js**+	*Lower deviation (ei)*			
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*		*j*			*k*
over	*upto*	*All grades*									5.6	7	8	4 *to* 7	≤ 3, > 7
—	*3	– 270	– 140	– 60	– 20	– 14	– 6	– 2	0		– 2	– 4	– 6	– 0	– 0
3	6	– 270	– 140	– 70	– 30	– 20	– 10	– 4	0		– 2	– 4	—	+ 1	0
6	10	– 280	– 150	– 80	– 40	– 25	– 13	– 5	0		– 2	– 5	—	+ 1	0
10	14	– 290	– 150	– 95	– 50	– 32	– 16	– 6	0	± IT/2	– 3	– 6	—	+ 1	0
14	18														
18	24	– 300	– 160	– 110	– 65	– 40	– 20	– 7	0		– 4	– 8	—	+ 2	0
24	30														
30	40	– 310	– 170	– 120	– 80	– 50	– 25	– 9	0		– 5	– 10	—	+ 2	0
40	50	– 320	– 180	– 130											
50	65	– 340	– 190	– 140	– 100	– 60	– 30	– 10	0		– 7	– 12	—	+ 2	0
65	80	– 360	– 200	– 150											
80	100	– 380	– 220	– 170	– 120	– 72	– 36	– 12	0		– 9	– 15	—	+ 3	0
100	120	– 410	– 240	– 180											
120	140	– 460	– 260	– 200											
140	160	– 520	– 280	– 210	– 145	– 85	– 43	– 14	0		– 11	– 18	—	+ 3	0
160	180	– 580	– 310	– 230											

Table 15.2 Fundamental deviations for shafts of types **a** to **k** of sizes upto 500mm *(contd.)*

Fundamental deviation in microns													(1 micron = 0.001 mm)
Diameter steps in mm		*Upper deviation (es)*								**js+**	*Lower deviation (ei)*				
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*		*j*			*k*	
over	*upto*	*All grades*									5.6	7	8	4 *to* 7	≤ 3, > 7
180	200	– 660	– 340	– 240											
200	225	– 740	– 380	– 260	– 170	– 100	– 50	– 15	0	± IT/2	– 13	– 21	—	+ 4	0
225	250	– 820	– 420	– 280											
250	280	– 920	– 480	– 300	– 190	– 110	– 56	– 17	0		– 16	– 26	—	+4	0
280	315	– 1050	– 540	– 330											
315	355	– 1200	– 600	– 360	– 210	– 125	– 62	– 18	0		– 18	– 28	—	+ 4	0
355	400	– 1350	– 680	– 400											
400	450	– 1500	– 760	– 440	– 230	– 135	– 68	– 20	0		– 20	– 32	—	+ 5	0
450	500	– 1650	– 840	– 480											

*The deviations of shafts of types a and b are not provided for diameters upto 1 mm

+ For types js in the particular Grades 7 to 11, the two symmetrical deviations ± IT/2 may possibly be rounded, if the IT value in microns is an odd value; by replacing it by the even value immediately below.

Table 15.2 Fundamental deviations for shafts of types **m** to **zc** of sizes upto 500 mm (*contd.*)

Fundamental deviation in microns															(1 micron = 0.001 mm)
Diameter steps in mm		*Lower deviations (ei)*													
		m	*n*	*p*	*r*	*s*	*t*	*u*	*v*	*x*	*y*	*z*	*za*	*zb*	*zc*
Over	*Upto*	*All grades*													
—	3	+ 2	+ 4	+ 6	+ 10	+ 14	—	+ 18	—	+ 20	—	+ 26	+ 32	+ 40	+ 60
3	6	+ 4	+ 8	+ 12	+ 15	+ 19	—	+ 23	—	+ 28	—	+ 35	+ 42	+ 50	+ 80
6	10	+ 6	+ 10	+ 15	+ 19	+ 23	—	+ 28	—	+ 34	—	+ 42	+ 52	+ 67	+ 97
10	14	+ 7	+ 12	+ 18	+ 23	+ 28	—	+ 33	—	+ 40	—	+ 50	+ 64	+ 90	+ 130
14	18								+ 39	+ 45	—	+ 60	+ 77	+ 108	+ 150
18	24	+ 8	+ 15	+ 22	+ 28	+ 35	—	+ 41	+ 47	+ 54	+ 63	+ 73	+ 98	+ 136	+ 188
24	30						+ 41	+ 48	+ 55	+ 64	+ 75	+ 88	+ 118	+ 160	+ 218
30	40	+ 9	+ 17	+ 26	+ 34	+ 43	+ 48	+ 60	+ 68	+ 80	+ 94	+ 112	+ 148	+ 200	+ 274
40	50						+ 54	+ 70	+ 81	+ 97	+ 114	+ 136	+ 180	+ 242	+ 325
50	65	+ 11	+ 20	+ 32	+ 41	+ 53	+ 66	+ 87	+ 102	+ 122	+ 144	+ 172	+ 226	+ 300	+ 405
65	80				+ 43	+ 59	+ 75	+ 102	+ 120	+ 146	+ 174	+ 210	+ 274	+ 360	+ 480
80	100	+ 13	+ 23	+ 37	+ 51	+ 71	+ 91	+ 124	+ 146	+ 178	+ 214	+ 258	+ 335	+ 445	+ 585
100	120				+ 54	+ 79	+ 104	+ 144	+ 172	+ 210	+ 254	+ 310	+ 400	+ 525	+ 690
120	140	+ 15	+ 27	+ 43	+ 63	+ 92	+ 122	+ 170	+ 202	+ 248	+ 300	+ 365	+ 470	+ 620	+ 800
140	160				+ 65	+ 100	+ 134	+ 190	+ 228	+ 280	+ 340	+ 415	+ 535	+ 700	+ 900
160	180				+ 68	+ 108	+ 146	+ 210	+ 252	+ 310	+ 380	+ 465	+ 600	+ 780	+ 1000

Table 15.2 Fundamental deviations for shafts of types **m** to **zc** of sizes upto 500mm (*contd.*)

Fundamental deviation in microns														(1 micron = 0.001 mm)
Diameter steps in mm		*Lower deviations (ei)*												
		m	*n*	*p*	*r*	*s*	*t*	*u*	*v*	*x*	*y*	*z*	*za*	*zb*	*zc*
Over	*Upto*	*All grades*													
180	200				+ 77	+ 122	+ 166	+ 236	+ 274	+ 350	+ 425	+ 520	+ 670	+ 880	+ 1150
200	225	+ 17	+ 31	+ 50	+ 80	+ 130	+ 180	+ 258	+ 310	+ 385	+ 470	+ 575	+ 740	+ 960	+ 1250
225	250				+ 84	+ 140	+ 196	+ 284	+ 340	+ 425	+ 520	+ 640	+ 820	+ 1050	+ 1350
250	280				+ 94	+ 158	+ 218	+ 315	+ 385	+ 475	+ 580	+ 710	+ 920	+ 1200	+ 1550
280	315	+ 20	+ 34	+ 56	+ 98	+ 170	+ 240	+ 350	+ 425	+ 525	+ 650	+ 790	+ 1000	+ 1300	+ 1700
315	355				+ 108	+ 190	+ 268	+ 390	+ 475	+ 590	+ 730	+ 900	+ 1150	+ 1500	+ 1900
355	400	+ 21	+ 37	+ 62	+ 114	+ 208	+ 294	+ 435	+ 530	+ 660	+ 820	+ 1000	+ 1300	+ 1650	+ 2100
400	450				+ 126	+ 232	+ 330	+ 490	+ 595	+ 740	+ 920	+ 1100	+ 1450	+ 1850	+ 2400
450	500	+ 23	+ 40	+ 68	+ 132	+ 252	+ 360	+ 540	+ 660	+ 820	+ 1000	+ 1250	+ 1600	+ 2100	+ 2600

Table 15.3 Fundamental deviations for holes of types **A** to **N** for sizes upto 500 mm *(contd.)*

A to N

Fundamental deviation in microns																				(1 micron = 0.001 mm)
Diameter steps in mm		*Lower deviations (EI)*													*Upper deviations (ES)*				
		*A**	**B*	*C*	*D*	*E*	*F*	*G*	*H*	*Js+*	*J*			*K*		*M*		*N*		
Over	*Upto*	*All grades*									6	7	8	≤ 8	> 8	≤ 8 ‡	> 8	≤ 8	> 8*	≤ 7
—	3*	+ 270	+ 140	+ 60	+ 20	+ 14	+ 6	+ 2	0		+ 2	+ 4	+ 6	0	0	− 2	− 2	− 4	− 4	
3	6	+ 270	+ 140	+ 70	+ 30	+ 20	+ 10	+ 4	0		+ 5	+ 6	+ 10	− 1 + Δ	—	− 4 + Δ	− 4+Δ	− 8 + Δ	0	
6	10	+ 280	+ 150	+ 80	+ 40	+ 25	+ 13	+ 5	0		+ 5	+ 8	+ 12	− 1 + Δ	—	− 6+ Δ	− 6+Δ	− 10 + Δ	0	
10	14	+ 290	+ 150	+ 95	+ 50	+ 32	+ 16	+ 6	0		+ 6	+ 10	+ 15	− 1+ Δ	—	− 7 + Δ	− 7	− 12 + Δ	0	
14	18									± IT/2										Same deviation as for grades > 7 + Δ
18	24	+ 300	+ 160	+ 110	+ 65	+ 40	+ 20	+ 7	0		+ 8	+ 12	+ 20	− 2 + Δ	—	− 8 + Δ	− 8	− 15 + Δ	0	
24	30																			
30	40	+ 310	+ 170	+ 120	+ 80	+ 50	+ 25	+ 9	0		+ 10	+ 14	+ 24	− 2 + Δ	—	− 9 + Δ	− 9	− 17 + Δ	0	
40	50	+ 320	+ 180	+ 130																
50	65	+ 340	+ 190	+ 140	+ 100	+ 60	+ 30	+ 10	0		+ 13	+ 18	+ 28	− 2 + Δ	—	− 11+ Δ	− 11	− 20 + Δ	0	
65	80	+ 360	+ 200	+ 150																
80	100	+ 380	+ 220	+ 170	+ 120	+ 72	+ 36	+ 12	0		+ 16	+ 22	+ 34	− 3 + Δ	—	− 13 + Δ	− 13	− 23 + Δ	0	
100	120	+ 410	+ 240	+ 180																

Table 15.3 Fundamental deviations for holes of types **A** to **N** for sizes upto 500mm *(contd.)*

A to N

Fundamental deviation in microns																			(1 micron = 0.001 mm)
Diameter steps in mm		*Lower deviations (EI)*													*Upper deviations (ES)*				
		*A**	**B*	*C*	*D*	*E*	*F*	*G*	*H*	*Js+*	*J*			*K*		*M*		*N*		
Over	*Upto*	*All grades*									6	7	8	≤ 8	> 8	≤ 8 ‡	> 8	≤ 8	> 8*	≤ 7
120	140	+ 460	+ 260	+ 200																
140	160	+ 520	+ 280	+ 210	+ 145	+ 85	+ 43	+ 14	0		+ 18	+ 26	+ 41	– 3 + Δ	—	– 15 + Δ	– 15	– 27 + Δ	0	
160	180	+ 580	+ 310	+ 230																
180	200	+ 660	+ 340	+ 240																
200	225	+ 740	+ 380	+ 260	+ 170	+ 100	+ 50	+ 15	0		+ 22	+ 30	+ 47	– 4+ Δ	—	– 17 + Δ	– 17	– 31 + Δ	0	
225	250	+ 820	+ 420	+ 280																
250	280	+ 920	+ 480	+ 300	+ 190	+ 110	+ 56	+ 17	0		+ 25	+ 36	+ 55	– 4+ Δ	—	– 20 + Δ	– 20	– 34 + Δ	0	
280	315	+ 1050	+ 540	+ 330																
315	355	+ 1200	+ 600	+ 360	+ 210	+ 125	+ 62	+ 18	0		+ 29	+ 39	+ 60	– 4+ Δ	—	– 21 + Δ	– 21	– 37 + Δ	0	
355	400	+ 1350	+ 680	+ 400																
400	450	+ 1500	+ 760	+ 440	+ 230	+ 135	+ 68	+ 20	0		+ 33	+ 43	+ 66	– 5+ Δ	—	– 23 + Δ	– 23	– 40 + Δ	0	
450	500	+ 1650	+ 840	+ 480																

± IT/2

Same deviation as for grades > 7 + Δ

* The deviation of holes of types A and B in all grades >8 are not for diameters upto 1 mm.

+ For the hole of type Js in the grades 7 and 11, the two symmetrical ± deviations IT/2 may possibly rounded. If the IT value in microns is an odd value, replace it by the even value immediately below.

‡ Special case: For the hole M6, ES = 9 from 250 to 315 (instead of – 11).

Table 15.3 Fundamental deviations for holes of types P to ZC for sizes upto 500mm (*Contd.*)

P to ZC

Fundamental deviation in microns														(1 micron = 0.001 mm)					
Diameter steps in mm		*Upper deviations (ES)*																	
		P	*R*	*S*	*T*	*U*	*V*	X	*Y*	Z	ZA	*ZB*	ZC	Δ in microns*					
Over	*Upto*	>7												3	4	5	6	7	8
—	3	– 6	– 10	– 14	—	– 18	—	– 20	—	– 26	– 32	– 40	– 60	Δ = 0					
3	6	– 12	– 15	– 19	—	– 23	—	– 28	—	– 35	– 42	– 50	– 80	1	1.5	1	3	4	6
6	10	– 15	– 19	– 23	—	– 28	—	– 34	—	– 42	– 52	– 67	– 97	1	1.5	2	3	6	7
10	14	– 18	– 23	– 28	—	– 33	—	– 40	—	– 50	– 64	– 90	– 130	1	2	3	3	7	9
14	18						– 39	– 45	—	– 60	– 77	– 109	– 150						
18	24	– 22	– 28	– 35	—	– 41	– 47	– 54	– 63	– 73	– 93	– 136	– 188	1.5	2	3	4	8	12
24	30				– 41	– 48	– 55	– 64	– 75	– 88	– 118	– 160	– 218						
30	40	– 26	– 34	– 43	– 48	– 60	– 68	– 80	– 94	– 112	– 148	– 200	– 274	1.5	3	4	5	9	14
40	50				– 54	– 70	– 81	– 97	– 114	– 136	– 180	– 242	– 325						
50	65	– 32	– 41	– 53	– 65	– 87	– 102	– 122	– 144	– 172	– 226	– 300	– 405	2	3	5	6	11	16
65	80		– 43	– 59	– 75	– 102	– 120	– 146	– 174	– 210	– 274	– 360	– 480						
80	100	– 37	– 51	– 71	– 91	– 124	– 146	– 178	– 214	– 258	– 335	– 445	– 585	2	4	5	7	13	19
100	120		– 54	– 79	– 104	– 144	– 172	– 210	– 254	– 310	– 400	– 525	– 690						
120	140	– 43	– 63	– 92	– 122	– 170	– 202	– 248	– 300	– 365	– 470	– 620	– 800	3	4	6	7	15	23
140	160		– 65	– 100	– 134	– 190	– 228	– 280	– 340	– 415	– 535	– 700	– 900						
160	180		– 68	– 108	– 146	– 210	– 252	– 310	– 380	– 465	– 600	– 780	– 1000						

Table 15.3 Fundamental deviations for holes of types P to ZC for sizes upto 500mm (*Contd.*)

P to ZC

Fundamental deviation in microns													(1 micron = 0.001 mm)					
Diameter steps in mm		*Upper deviations (ES)*																
		p	*R*	*S*	*T*	*U*	*V*	X	*Y*	Z	ZA	*ZB*	ZC	Δ in microns*				
Over	*Upto*	*>7*												*3*	*4*	*5*	*6*	*7*	*8*
180	200		– 77	– 122	– 166	– 236	– 284	– 350	– 425	– 520	– 670	– 880	– 1150						
200	225	– 50	– 80	– 130	– 180	– 256	– 310	– 385	– 470	– 575	– 740	– 960	– 1250	3	4	6	9	17	26
225	250		– 84	– 140	– 196	– 284	– 340	– 425	– 520	– 640	– 820	– 1050	– 1350						
250	280	– 56	– 94	– 158	– 218	– 315	– 385	– 475	– 580	– 710	– 920	– 1200	– 1550	4	4	7	9	20	29
280	315		– 98	– 170	– 240	– 350	– 425	– 525	– 650	– 790	– 1000	– 1300	– 1700						
315	355	– 62	– 108	– 190	– 268	– 390	– 475	– 590	– 730	– 900	– 1150	– 1500	– 1900	4	5	7	11	21	32
355	400		– 114	– 208	– 294	– 435	– 530	– 650	– 820	– 1000	– 1300	– 1650	– 2100						
400	450	– 68	– 126	– 232	– 330	– 490	– 595	– 740	– 920	– 1100	– 1450	– 1850	– 2400	5	5	7	13	23	34
450	500		– 132	– 252	– 360	– 540	– 660	– 820	– 1000	– 1250	– 1600	– 2100	– 2600						

*In determining K, M, N upto grade 8 and P to ZC upto grade 7, take the Δ values from the columns on the right.
Example: For P7, from diameters 18 to 30 mm, Δ = 8; hence ES = – 14.

Table 15.4 Formulae for fundamental deviation for shafts upto 500 mm

Upper deviation (es)		*Lower deviation (ei)*	
Shaft designation	*In microns (for D in mm)*	*Shaft designation*	*In microns (For D in mm)*
a	$= -(265 + 1.3D)$ for $D \leq 120$	k4 to k7	$= 0.6 \sqrt[3]{D}$
	$= -3.5\ D$ for $D > 120$	k for grades ≤ 3 and ≥ 8	$= 0$
b	$\approx -(140 + 0.85\ D)$ for $D \leq 160$	m	$= +$ (IT 7 – IT 6)
	$\approx -1.8\ D$ for $D > 160$	n	$= +5\ D^{0.34}$
		p	$= +$ IT 7 + 0 to 5
c	$= -52\ D^{0.2}$ for $D \leq 40$	r	= geometric mean of values ei for p and s
	$= -(95 + 0.8\ D)$ for $D > 40$	s	$= +$ IT 8 + 1 to 4 for $D \leq 50$
d	$= -16\ D^{0.44}$		$= +$ IT 7 + 0.4 D for $D > 50$
e	$= -11\ D^{0.41}$	t	$=$ IT 7 + 0.63 D
f	$= -5.5\ D^{0.41}$	u	$= +$ IT 7 + D
g	$= -2.5\ D^{0.34}$	v	$= +$ IT 7 + 1.25 D
h	$= 0$	x	$= +$ IT 7 + 1.6 D
		y	$= +$ IT 7 + 2 D
		z	$= +$ IT 7 + 2.5 D
		za	$= +$ IT 8 + 3.15 D
		zb	$= +$ IT 9 + 4 D
j5 to j8	no formula	zc	$= +$ IT 10 + 5 D

For Js : the two deviations are equal to $\pm \frac{IT}{2}$