

Appendix 4 Fit and Tolerance

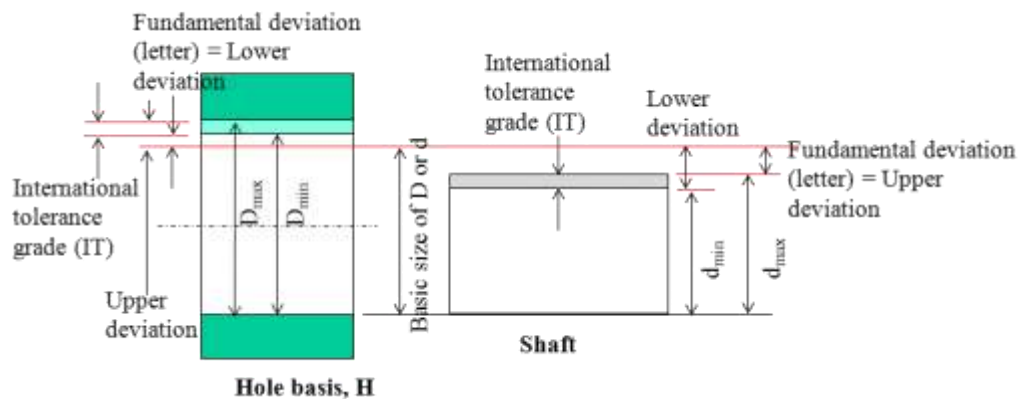
A-4-1. Fits and types of fits

The diagram below shows the fit system for a basic hole, denoted by H. Three types of fits commonly used are the clearance fit, transition fit and interference fit.

For a clearance fit, the fundamental deviation of the hole is designated by H, and that of the shaft by c, c, f, g, or h. This type of the fits is usually applicable for the fit between the inner ring of a sliding bearing sleeve and a shaft.

For a transition fit, the fundamental deviation of the hole is designated by H, and that of the shaft by k or n. This type of the fits is usually applicable for the fit between the outer ring of a rolling bearing and a housing bore, and between a gear and a shaft.

For an interference fit, the fundamental deviation of the hole is designated by H, and that of the shaft by p, s, or u. This type of the fits is usually applicable for the fit between the inner ring of a rolling bearing and a shaft.



The hole-basis system is usually used for the fit of elements like the out ring of a rolling bearing to a housing. The lower letter, h, is use to indicate the basic shaft, which for this case, is the outer diameter of the outer ring.

A-4-2. International tolerance (IT) grade and fundamental deviation for shaft [Shigley and Mischke, 1989]

TABLE A-11
A Selection of International
Tolerance Grades—
Metric Series
(Size Ranges Are for *Over* the
Lower Limit and *Including* the
Upper Limit. All Values Are
in Millimeters)

BASIC SIZES	TOLERANCE GRADES					
	IT6	IT7	IT8	IT9	IT10	IT11
0–3	0.006	0.010	0.014	0.025	0.040	0.060
3–6	0.008	0.012	0.018	0.030	0.048	0.075
6–10	0.009	0.015	0.022	0.036	0.058	0.090
10–18	0.011	0.018	0.027	0.043	0.070	0.110
18–30	0.013	0.021	0.033	0.052	0.084	0.130
30–50	0.016	0.025	0.039	0.062	0.100	0.160
50–80	0.019	0.030	0.046	0.074	0.120	0.190
80–120	0.022	0.035	0.054	0.087	0.140	0.220
120–180	0.025	0.040	0.063	0.100	0.160	0.250
180–250	0.029	0.046	0.072	0.115	0.185	0.290
250–315	0.032	0.052	0.081	0.130	0.210	0.320
315–400	0.036	0.057	0.089	0.140	0.230	0.360

Source: *Preferred Metric Limits and Fits*, ANSI B4.2-1978. See also BSI 4500.

Fundamental Deviations for Shafts—Metric Series

(Size Ranges Are for *Over* the Lower Limit and *Including* the Upper Limit. All Values Are in Millimeters)

BASIC SIZES	UPPER-DEVIATION LETTER					LOWER-DEVIATION LETTER				
	c	d	f	g	h	k	n	p	s	u
0–3	–0.060	–0.020	–0.006	–0.002	0	0	+0.004	+0.006	+0.014	+0.018
3–6	–0.070	–0.030	–0.010	–0.004	0	+0.001	+0.008	+0.012	+0.019	+0.023
6–10	–0.080	–0.040	–0.013	–0.005	0	+0.001	+0.010	+0.015	+0.023	+0.028
10–14	–0.095	–0.050	–0.016	–0.006	0	+0.001	+0.012	+0.018	+0.028	+0.033
14–18	–0.095	–0.050	–0.016	–0.006	0	+0.001	+0.012	+0.018	+0.028	+0.033
18–24	–0.110	–0.065	–0.020	–0.007	0	+0.002	+0.015	+0.022	+0.035	+0.041
24–30	–0.110	–0.065	–0.020	–0.007	0	+0.002	+0.015	+0.022	+0.035	+0.048
30–40	–0.120	–0.080	–0.025	–0.009	0	+0.002	+0.017	+0.026	+0.043	+0.060
40–50	–0.130	–0.080	–0.025	–0.009	0	+0.002	+0.017	+0.026	+0.043	+0.070
50–65	–0.140	–0.100	–0.030	–0.010	0	+0.002	+0.020	+0.032	+0.053	+0.087
65–80	–0.150	–0.100	–0.030	–0.010	0	+0.002	+0.020	+0.032	+0.059	+0.102
80–100	–0.170	–0.120	–0.036	–0.012	0	+0.003	+0.023	+0.037	+0.071	+0.124
100–120	–0.180	–0.120	–0.036	–0.012	0	+0.003	+0.023	+0.037	+0.079	+0.144
120–140	–0.200	–0.145	–0.043	–0.014	0	+0.003	+0.027	+0.043	+0.092	+0.170
140–160	–0.210	–0.145	–0.043	–0.014	0	+0.003	+0.027	+0.043	+0.100	+0.190
160–180	–0.230	–0.145	–0.043	–0.014	0	+0.003	+0.027	+0.043	+0.108	+0.210
180–200	–0.240	–0.170	–0.050	–0.015	0	+0.004	+0.031	+0.050	+0.122	+0.236
200–225	–0.260	–0.170	–0.050	–0.015	0	+0.004	+0.031	+0.050	+0.130	+0.258
225–250	–0.280	–0.170	–0.050	–0.015	0	+0.004	+0.031	+0.050	+0.140	+0.284
250–280	–0.300	–0.190	–0.056	–0.017	0	+0.004	+0.034	+0.056	+0.158	+0.315
280–315	–0.330	–0.190	–0.056	–0.017	0	+0.004	+0.034	+0.056	+0.170	+0.350
315–355	–0.360	–0.210	–0.062	–0.018	0	+0.004	+0.037	+0.062	+0.190	+0.390
355–400	–0.400	–0.210	–0.062	–0.018	0	+0.004	+0.037	+0.062	+0.208	+0.435

Source: *Preferred Metric Limits and Fits*, ANSI B4.2-1978. See also BSI 4500.

References

Shigley, J. and Mischke, C., 1989, 2001, *Mechanical Engineering Design*, McGraw Hills.