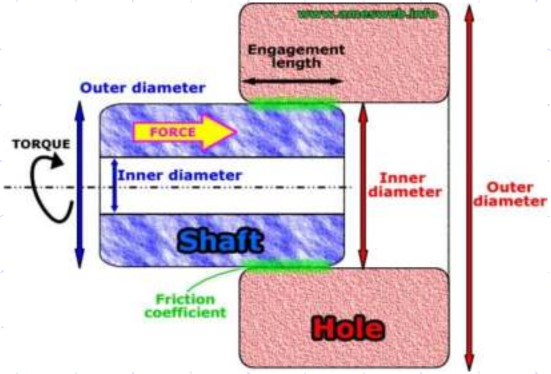
Chapter 5
Fits and Tolerances



Topics

Exercises

Fits and Tolerances: Topics

Fits and Tolerances

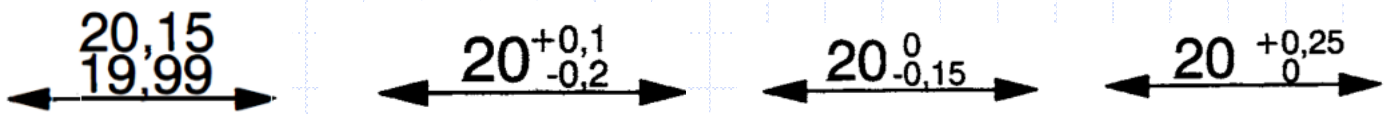
5.1) Definitions of tolerance

Definition of Tolerance

➢ No feature of a component can be perfect (i.e., no surface flat, no hole round etc), because of the manufacturing process

➢ Thus, when dimensioning any feature

- Basic nominal dimension
- Permitted variability (tolerance)
- Dimensions should be given in as large a tolerances as possible without interfering with the function of the part to reduce production costs.



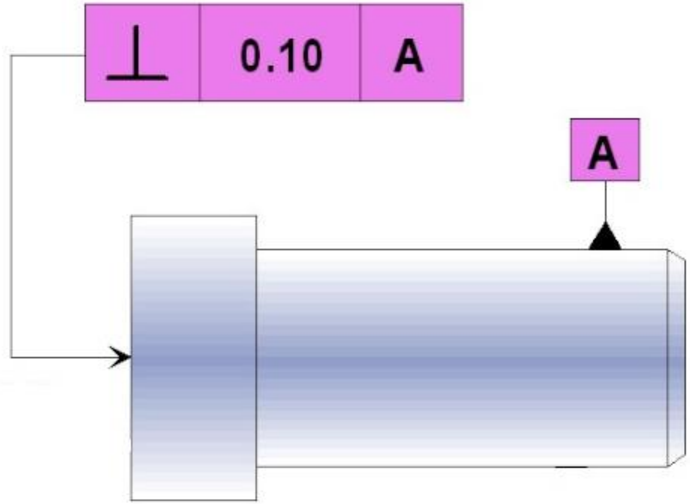
Limits Bi-lateral (a) Uni-lateral (d) Uni-lateral (e)

Definition of Tolerance

Tolerance is the total amount a dimension may vary. It is the difference between the maximum and minimum limits.

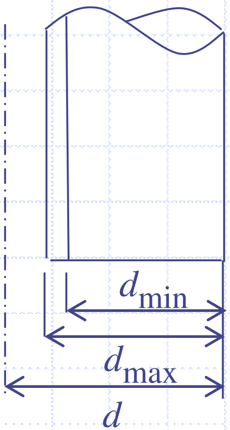
Ways to Express Tolerance

- Direct limits or as tolerance limits applied to a dimension
- Geometric tolerances
- A general tolerance note in title block



Tolerances and Fits

Designer specifies upper and lower limits to the dimensions



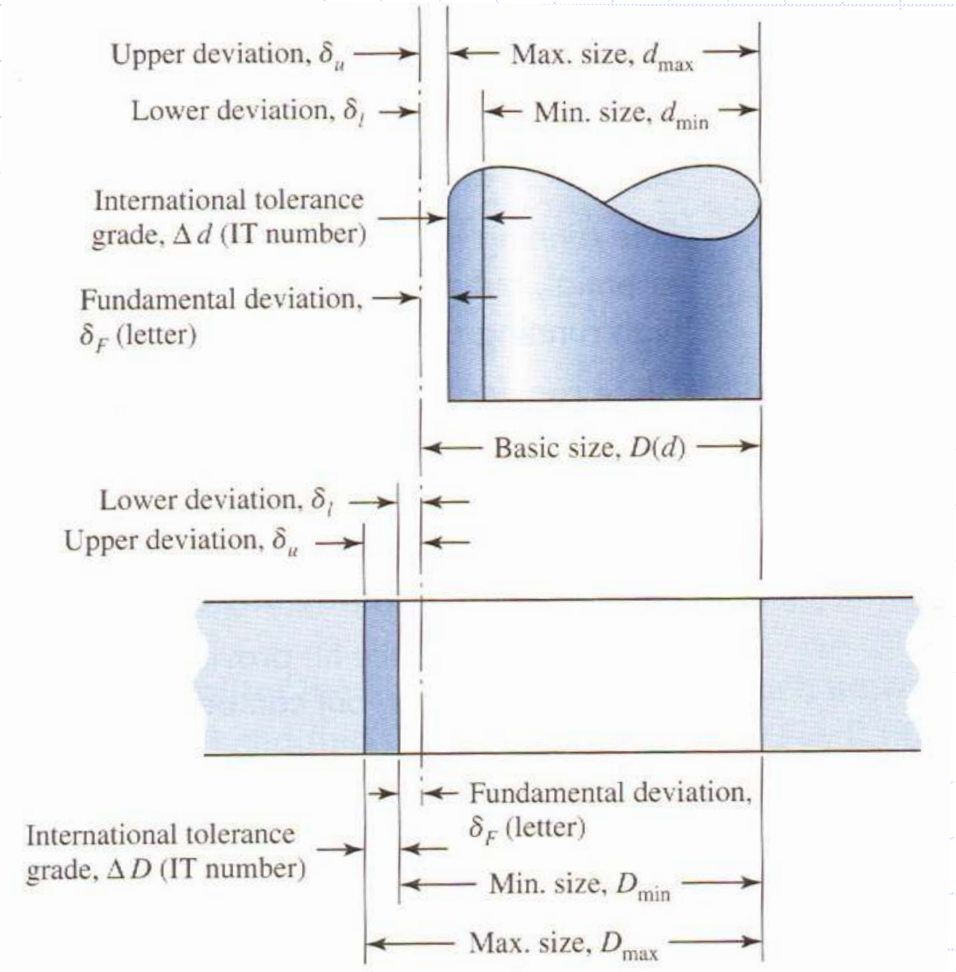
Tolerance is the difference between the maximum and minimum size limits of a part:

$$\Delta d = d_{max} - d_{min}$$

Too tight tolerance ➔ High manufacturing cost

Too large tolerance ➔ Part may not function as expected

Fits



Upper deviation, δ_u
Max. size, d_{max}
Lower deviation, δ_l
Min. size, d_{min}
International tolerance grade, Δd (IT number)
Fundamental deviation, δ_F (letter)
Basic size, $D(d)$
Lower deviation, δ_l
Upper deviation, δ_u
Fundamental deviation, δ_F (letter)
International tolerance grade, ΔD (IT number)
Min. size, D_{min}
Max. size, D_{max}

Fits and Tolerances

5.2) Basic Systems for Fit Specification

Basic Systems for Fit Specification

In order to standardize dimensioning of fits, two basic systems are used

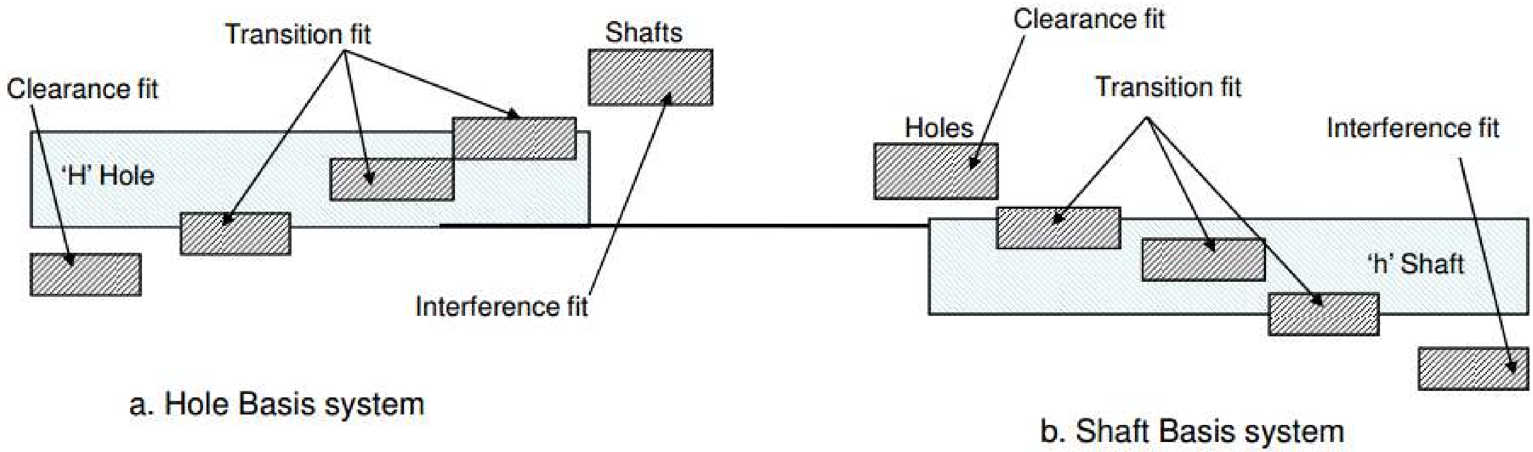
1) Basic Hole System (BHS)

Minimum hole diameter is taken as the basis. Lower deviation for the hole is equal to zero. D_{max} is prescribed according to the specified tolerance.

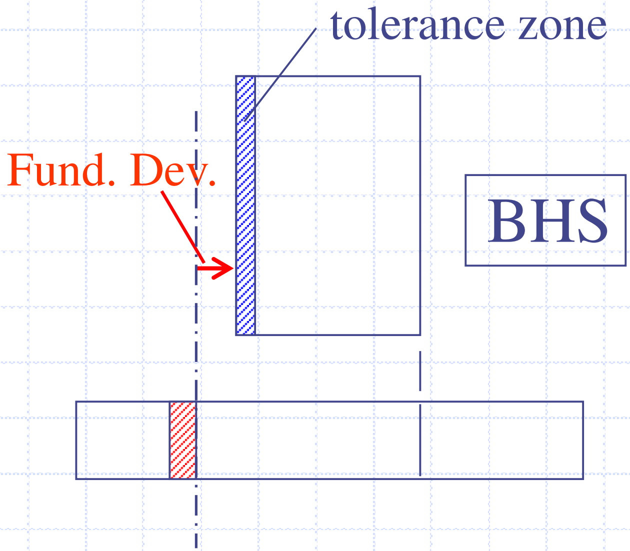
2) Basic Shaft System (BSS)

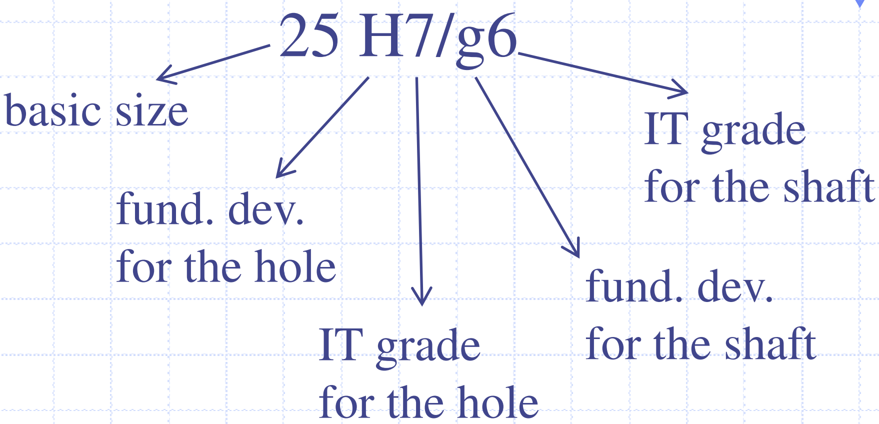
Maximum shaft diameter is taken as the basis. Upper deviation for the Shaft is equal to zero. d_{min} is prescribed according to the specified tolerance.

Basic Systems for Fit Specification



Specification for the Fits



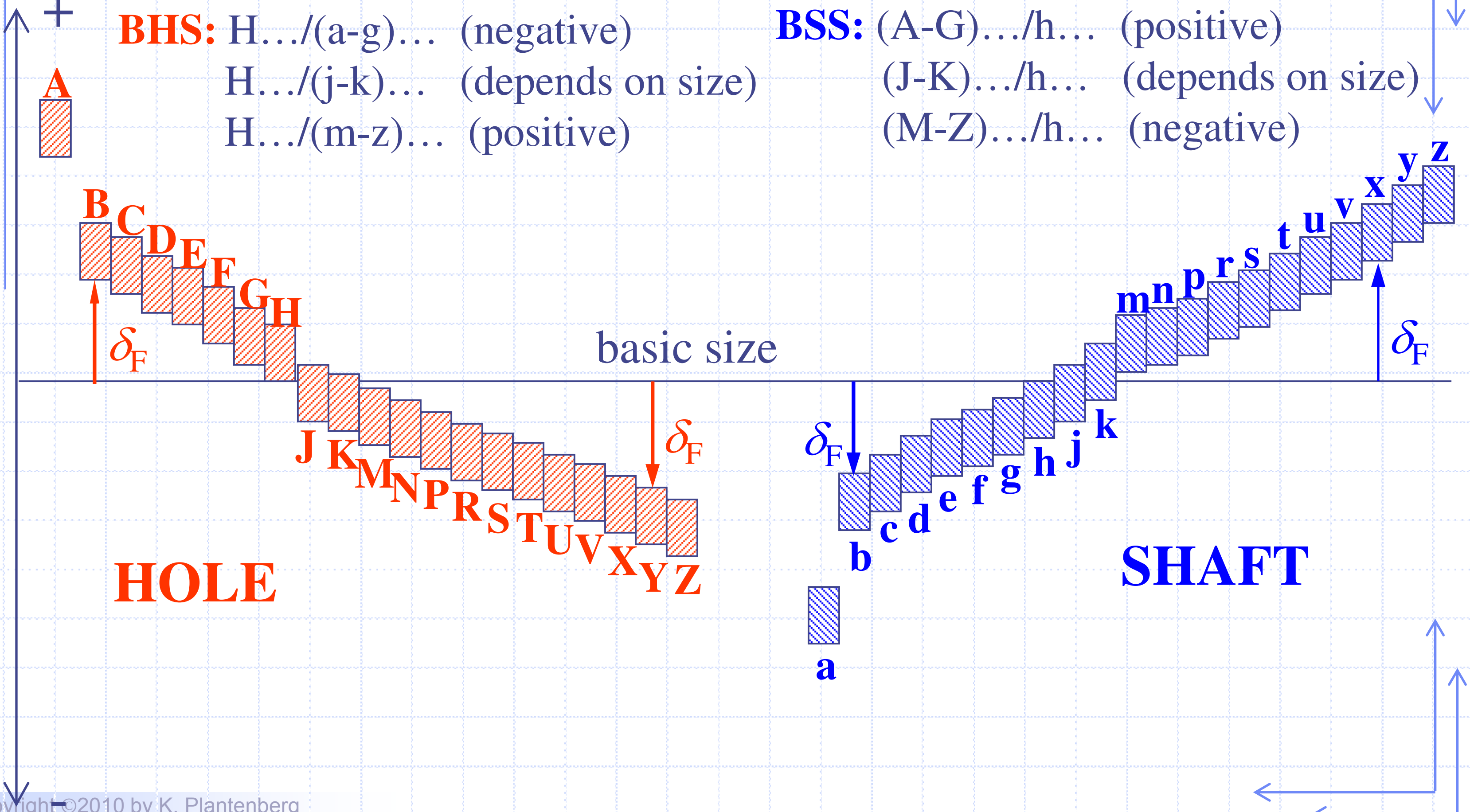


- H…/(a-z)… → BHS (fund. dev. for the hole is zero)
- (A-Z)…/h… → BSS (fund. dev. for the shaft is zero)
- Letters I, L, O, Q, W, i, l, o, q, w are not used.

Fundamental Deviations (Letter Specification)

BHS: H…/(a-g)… (negative)
H…/(j-k)… (depends on size)
H…/(m-z)… (positive)

BSS: (A-G)…/h… (positive)
(J-K)…/h… (depends on size)
(M-Z)…/h… (negative)



Fits and Tolerances

5.3) International Tolerance Grade Chart

International Tolerance Grade Chart

FUNDAMENTAL TOLERANCES OF GRADES 01, 0 AND 1 TO 16

Diameter steps in mm	Values of tolerance in microns																	(1 micron = 0.001 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	60	110	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	1150	2500	4000

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

Selected ISO fits -Shaft basis (Values in microns) 1 µm = 0.001													
Over	**1**	**3**	**6**	**10**	**18**	**30**	**50**	**80**	**120**	**180**	**250**	**315**	**400**
To and inc.	**3**	**6**	**10**	**18**	**30**	**50**	**80**	**120**	**180**	**250**	**315**	**400**	**500**
a11	-270 -330	-270 -345	-280 -370	-290 -400	-300 -430	-320 -470	-360 -530	-410 -600	-580 -710	-820 -950	-1 050 -1 240	-1 350 -1 560	-1 650 -1 900
c11	-60 -120	-70 -145	-80 -170	-95 -205	-110 -240	-130 -280	-150 -330	-180 -390	-230 -450	-280 -530	-330 -620	-400 -720	-480 -840
c19	-20 -45	-30 -60	-40 -76	-50 -93	-65 -117	-80 -142	-100 -174	-120 -207	-145 -245	-170 -285	-190 -320	-210 -350	-230 -385
d9	-20 -45	-30 -60	-40 -75	-50 -93	-65 -117	-80 -142	-100 -174	-120 -207	-145 -245	-170 -285	-190 -320	-210 -350	-230 -385
d10	-20 -60	-30 -78	-40 -98	-50 -120	-65 -149	-80 -180	-100 -220	-120 -260	-145 -305	-170 -355	-190 -400	-210 -440	-230 -480
d11	-20 -80	-30 -105	-40 -130	-50 -160	-65 -195	-80 -240	-100 -290	-120 -340	-145 -395	-170 -460	-190 -510	-210 -570	-230 -630
e7	-14 -24	-20 -32	-25 -40	-32 -50	-40 -61	-50 -75	-60 -90	-72 -107	-85 -125	-100 -146	-110 -162	-125 -182	-135 -198
e8	-14 -28	-20 -38	-25 -47	-32 -59	-40 -73	-50 -89	-60 -106	-72 -126	-85 -148	-100 -172	-110 -191	-125 -214	-135 -232
e9	-14 -39	-20 -50	-25 -61	-32 -75	-40 -92	-50 -112	-60 -134	-72 -159	-85 -185	-100 -215	-110 -240	-125 -265	-135 -290
f6	-6 -12	-10 -18	-13 -22	-16 -27	-20 -33	-25 -41	-30 -49	-36 -58	-43 -68	-50 -79	-56 -88	-62 -98	-68 -108
f7	-6 -16	-10 -22	-13 -28	-16 -34	-20 -41	-25 -50	-30 -60	-36 -71	-43 -83	-50 -96	-56 -108	-62 -119	-68 -131
f8	-6 -20	-10 -28	-13 -35	-16 -43	-20 -53	-25 -64	-30 -76	-36 -90	-43 -106	-50 -122	-56 -137	-62 -151	-68 -165
g5	-2 -6	-4 -9	-5 -11	-6 -14	-7 -16	-9 -20	-10 -23	-12 -27	-14 -32	-15 -35	-17 -40	-18 -43	-20 -47
g6	-2 -8	-4 -12	-5 -14	-6 -17	-7 -20	-9 -25	-10 -29	-12 -34	-14 -39	-15 -44	-17 -49	-18 -54	-20 -60
h5	0 -4	0 -5	0 -6	0 -8	0 -9	0 -11	0 -13	0 -15	0 -18	0 -20	0 -23	0 -25	0 -27

Selected ISO fits -Shaft basis (Values in microns) 1 μm = 0.001													
Over	**1**	**3**	**6**	**10**	**18**	**30**	**50**	**80**	**120**	**180**	**250**	**315**	**400**
To and inc.	**3**	**6**	**10**	**18**	**30**	**50**	**80**	**120**	**180**	**250**	**315**	**400**	**500**
h6	0 -6	0 -8	0 -9	0 -11	0 -13	0 -16	0 -19	0 -22	0 -25	0 -29	0 -32	0 -36	0 -40
h7	0 -10	0 -12	0 -15	0 -18	0 -21	0 -25	0 -30	0 -35	0 -40	0 -46	0 -52	0 -57	0 -63
h8	0 -14	0 -18	0 -22	0 -27	0 -33	0 -39	0 -46	0 -54	0 -63	0 -72	0 -81	0 -89	0 -97
h9	0 -25	0 -30	0 -36	0 -43	0 -52	0 -62	0 -74	0 -87	0 -100	0 -115	0 -130	0 -140	0 -155
h10	0 -40	0 -48	0 -58	0 -70	0 -84	0 -100	0 -120	0 -160	0 -185	0 -210	0 -230	0 -250	0 -250
h11	0 -60	0 -75	0 -90	0 -110	0 -130	0 -160	0 -190	0 -220	0 -250	0 -290	0 -320	0 -360	0 -400
h13	0 -140	0 -180	0 -220	0 -270	0 -330	0 -390	0 -460	0 -540	0 -630	0 -720	0 -810	0 -890	0 -970
j6	+4 -2	+6 -2	+7 -2	+8 -3	+9 -4	+11 -5	+12 -7	+13 -9	+14 -11	+16 -13	+16 -16	+18 -18	+20 -20
j7	+6 -4	+8 -4	+10 -5	+12 -6	+13 -8	+15 -10	+18 -12	+20 -15	+22 -18	+25 -21	+26 -26	+29 -28	+31 -32
js5	± 2	±2,5	±3	±4	+4,5	±5,5	±6,5	±7,5	±9	±10	11,5	±12,5	±13,5
js6	+3	± 4	±4,5	±5,5	±6,5	± 8	±9,5	±11	±12,5	±14,5	±16	±18	±20
js7	±5	± 6	±7,5	± 9	±10,5	±12,5	±15	±17,5	±20	±23	±26	±28,5	±31,5
js9	±12,5	±15	±18	±21,5	±26	±31	+37	±43,5	+50	±57,5	±65	+70	±77,5
js11	±30	±37,5	±45	±55	±65	±80	±95	+110	±125	±145	+160	±180	±200
js13	+70	±90	±110	±135	±165	±195	±230	±270	+315	±360	±405	+445	±485
k5	+4 0	+6 +1	+7 +1	+9 + 1	+11 +2	+13 +2	+15 +2	+18 +3	+21 +3	+24 +4	+27 +4	+29 +4	+32 +5
k6	+6 0	+9 +1	+10 +1	+12 + 1	+15 +2	+18 +2	+21 +2	+25 +3	+28 +3	+33 +4	+36 +4	+40 +4	+45 +5
m6	+8 +2	+12 +4	+15 +6	+18 +7	+21 +9	+25 +9	+30 +11	+35 +13	+40 +15	+46 +17	+52 +20	+57 +21	+63 +23
m7	+12 +2	+16 +4	+21 +6	+25 +7	+29 +8	+34 +9	+41 +11	+48 +13	+55 +15	+63 +17	+72 +20	+78 +21	+86 +23
n5	+8 +4	+13 +8	+16 +10	+20 +12	+24 +15	+28 +17	+33 +20	+38 +23	+45 +27	+51 +31	+57 +34	+62 +37	+67 +40
n6	+10 +4	+16 +8	+19 +10	+23 +12	+28 +15	+33 +17	+39 +20	+45 +23	+52 +27	+60 +31	+66 +34	+73 +37	+80 +40
p6	+12 +6	+20 +12	+24 +15	+29 +18	+35 +22	+42 +26	+51 +32	+59 +37	+68 +43	+79 +50	+88 +56	+98 +62	+108 +68

Selected ISO fits -Hole basis (Values in microns) 1 μm = 0.001

Over	1	3	6	10	18	30	50	80	120	180	250	315	400
To and inc.	3	6	10	18	30	50	80	120	180	250	315	400	500
D10	+60 +20	+78 +30	+98 +40	+120 +50	+149 +65	+180 +80	+220 +100	+260 +120	+305 +145	+355 +170	+400 +190	+440 +210	+480 +230
E9	+39 +14	+50 +20	+61 +25	+75 +32	+92 +40	+112 +50	+134 +60	+159 +72	+185 +85	+215 +100	+240 +110	+265 +125	+290 +135
F7	+16 +6	+22 +10	+28 +13	+34 +16	+41 +20	+50 +25	+60 +30	+71 +36	+83 +43	+96 +50	+108 +56	+119 +62	+131 +68
F8	+20 +6	+28 +10	+35 +13	+43 +16	+53 +20	+64 +25	+76 +30	+90 +36	+106 +43	+122 +50	+137 +56	+151 +62	+165 +68
G6	+8 +2	+12 +4	+14 +5	+17 +6	+20 +7	+25 +9	+29 +10	+34 +12	+39 +14	+44 +15	+49 +17	+54 +18	+60 +20
G7	+12 +2	+16 +4	+20 +5	+24 +6	+28 +7	+34 +9	+40 +10	+47 +12	+54 +14	+61 +15	+69 +17	+75 +18	+83 +20
H6	+6 0	+8 0	+9 0	+11 0	+13 0	+16 0	+19 0	+22 0	+25 0	+29 0	+32 0	+36 0	+40 0
H7	+10 0	+12 0	+15 0	+18 0	+21 0	+25 0	+30 0	+35 0	+40 0	+46 0	+52 0	+57 0	+63 0
H8	+14 0	+18 0	+22 0	+27 0	+33 0	+39 0	+46 0	+54 0	+63 0	+72 0	+81 0	+89 0	+97 0
H9	+25 0	+30 0	+36 0	+43 0	+52 0	+62 0	+74 0	+87 0	+100 0	+115 0	+130 0	+140 0	+155 0
H10	+40 0	+48 0	+58 0	+70 0	+84 0	+100 0	+120 0	+140 0	+160 0	+185 0	+210 0	+230 0	+250 0
H11	+60 0	+75 0	+90 0	+110 0	+130 0	+160 0	+190 0	+220 0	+250 0	+290 0	+320 0	+360 0	+400 0
H12	100 0	+120 0	+150 0	+180 0	+210 0	+250 0	+300 0	+350 0	+400 0	+460 0	+520 0	+570 0	+630 0
H13	140 0	+180 0	+220 0	+270 0	+330 0	+390 0	+460 0	+540 0	+630 0	+720 0	+810 0	+890 0	+970 0
J7	+4 -6	+6 -6	+8 -7	+10 -8	+12 -9	+14 -11	+18 -12	+22 -13	+26 -14	+30 -16	+36 -16	+39 -18	+43 -20
JS13	±70	±90	±110	±135	±165	±195	±230	±270	±315	±360	±405	±445	±485
K6	+0 -6	+2 -6	+2 -7	+2 -9	+2 -11	+3 -13	+4 -15	+4 -18 -	+4 21	+5 -24	+5 -27	+7 -29	+8 -32
K7	0 -10	+3 -9	+5 -10	+6 -12	+6 -15	+7 -18	+9 -21	+10 -25	+12 -28	+13 -33	+16 -36	+17 -40	+18 -45
M7	0 -12	0 -12	0 -15	0 -18	0 -21	0 -25	0 -30	0 -35	0 -40	0 -46	0 -52	0 -57	0 -63
N7	-4 -14	-4 -16	-4 -19	-5 -23	-7 -28	-8 -33	-9 -39	-10 -45	-12 -52	-14 -60	-14 -66	-16 -73	-17 -80
P7	-6 -16	-8 -20	-9 -24	-11 -29	-14 -35	-17 -42	-21 -51	-24 -59	-28 -68	-33 -79	-36 -88	-41 -98	-45 -108

Example

$\phi\ 25H7 =$

$10H10 =$

$40C11 =$

$10h9 =$

$\phi\ 25h9 =$

$\phi\ 40h11 =$

Example

ø 60 H8f7
Upper deviation = ?
Lower deviation = ?

ø 60 H7g6
Upper deviation = ?
Lower deviation = ?

ø 60 H7m6
Upper deviation = ?
Lower deviation = ?

ø 60 H7p6
Upper deviation = ?
Lower deviation = ?

Fits and Tolerances

5.4) International Tolerance Grade Numbers

International Tolerance Grade Numbers

Example: A shaft of nominal diameter 25 mm is going to be manufactured. IT grade is required to be IT7. Determine the tolerance on the shaft.

Use Table (tolerance grades, metric series)

Basic size → 18-30 (Consider the 1st appearance)

$$T_s = \Delta d = d_{\max} - d_{\min} = 0.021\,\text{mm}$$

- Tables can be used for both shafts and the holes.
- Tolerance on a shaft or a hole can be calculated by using the formulas provided by ISO.

Tolerance Designation (ISO R286)

Tolerance on a shaft or a hole can also be calculated by using the formulas provided by ISO.

$$T = K \times i$$

where,

T is the tolerance (in µm)

$i = 0.45\sqrt[3]{D} + 0.001D$ (unit tolerance, in µm)

$$K = 10(1.6)^{(IT_n - IT6)}$$

Example

Example: Consider the previous example (D = 25 mm and IT grade of IT7) and calculate the tolerance on the shaft using the formulas given in ISO standards.

$$i = 0.45\sqrt[3]{D} + 0.001D$$

Note: When the nominal sized marking the beginning and end of a range of sizes are not available, nominal size can be directly used to calculate *i*.

$$i = 1.341\ \mu\text{m}$$

$$K = 10(1.6)^{(7-6)} = 16$$

$$T_s = K \times i = 21.45\ \mu\text{m} = 0.021\ \text{mm}$$

Same result is obtained using Table

Fits and Tolerances

5.5) Fit Types

Fit Types

Fit: degree of tightness between two parts.

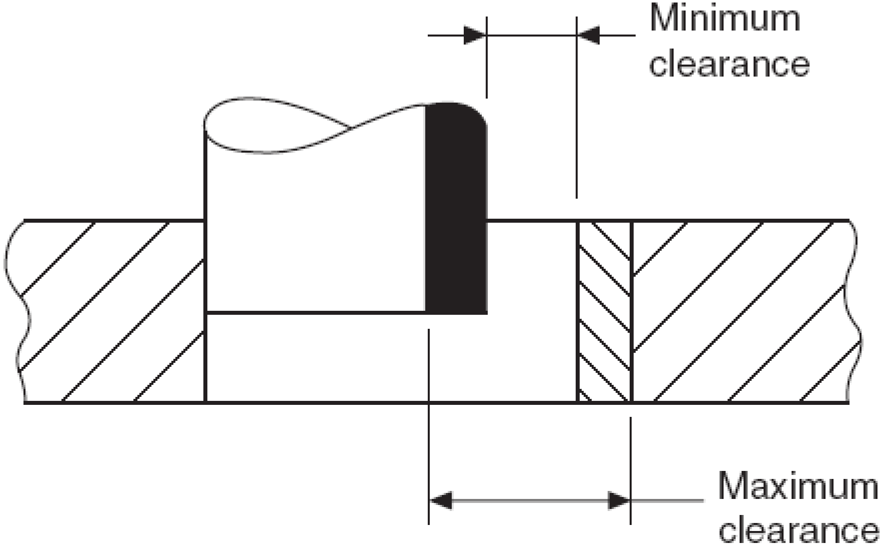
Fit types:

- ***Clearance Fit*** **– tolerance of mating parts always leaves a space**
- ***Interference Fit*** **– tolerance of mating parts always results in interference**
- ***Transition Fit*** **– sometimes interferes, sometimes clears**

Fit Types

There are three types of fits

a) Clearence Fits   b) Interference Fits   c) Transition Fits

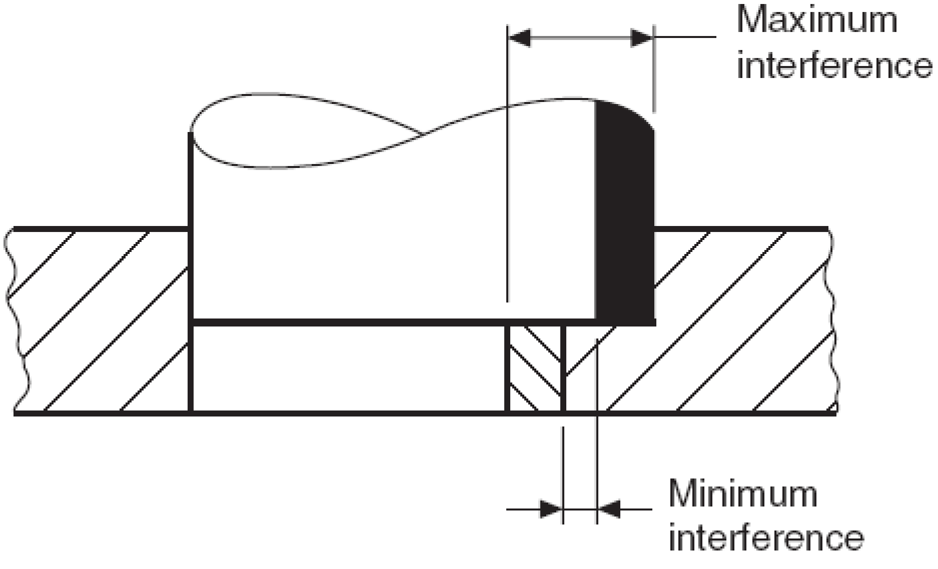


Clearance fits—allowance always positive

Fit Types

There are three types of fits

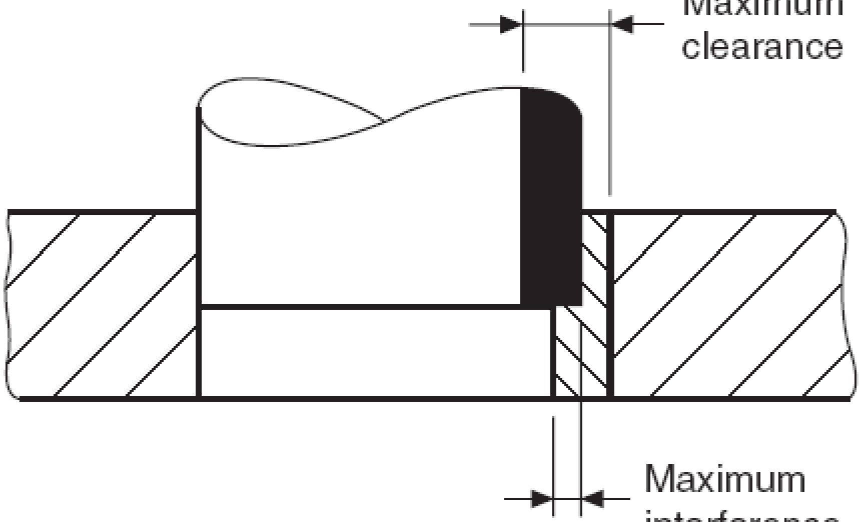
a) Clearence Fits b) Interference Fits c) Transition Fits



Interference fits—allowance always negative

Fit Types

There are three types of fits
a) Clearence Fits   b) Interference Fits   c) Transition Fits



Transition fit—allowance may be positive or negative

Fit Types

- Clearance = Hole – Shaft
- Cmax = Hmax – Smin
- Cmin = Hmin – Smax

  Both Cmax and Cmin <0 – Interference fit

  Both Cmax and Cmin >0 – Clearance fit

  Cmax > 0; Cmin < 0 – Transition fit
- System Tolerance = Cmax – Cmin
- Allowance = Min. Clearance = Cmin

Example

In the second table, interference and clearence values for commonly used fits are given.

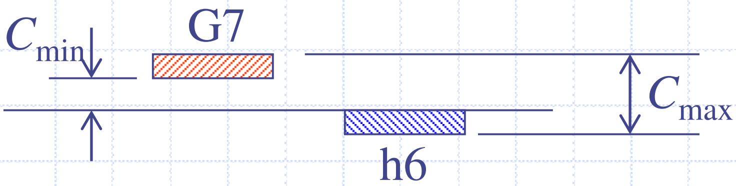
For example, consider G7/h6, D = 20 mm.

From the table we read:

$$C_{max} = +41\ \mu m$$
$$C_{min} = +7\ \mu m$$

$\longrightarrow$ clearence fit.

$$G7 \rightarrow \begin{matrix} +28\ \mu m \\ +7\ \mu m \end{matrix} \qquad h6 \rightarrow \begin{matrix} 0\ \mu m \\ -13\ \mu m \end{matrix}$$



Example

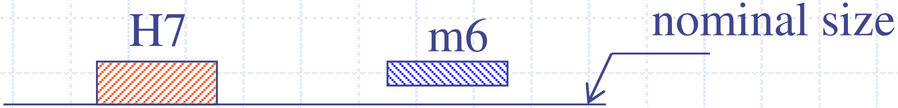
Consider H7/m6, D = 20 mm.

From the table we read:

$$C_{\max} = +12\ \mu\text{m}$$
$$I_{\max} = -21\ \mu\text{m}$$

→ interference fit.

$H7 \rightarrow \begin{matrix} +21\ \mu\text{m} \\ 0 \end{matrix}$	$m6 \rightarrow \begin{matrix} +21\ \mu\text{m} \\ +9\ \mu\text{m} \end{matrix}$

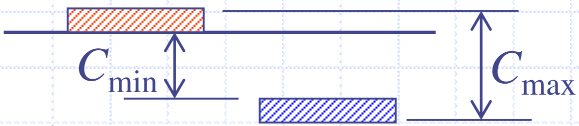


Tolerance on the Fit

Tolerance on the fit is defined as the sum of the tolerance on the hole and tolerance on the shaft.

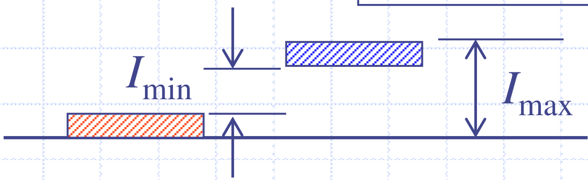
$$T_f = T_h + T_s = \left(D_{\max} - D_{\min}\right) + \left(d_{\max} - d_{\min}\right)$$

clearence



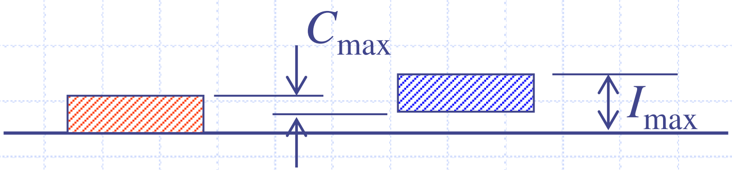
$$T_f = C_{\max} - C_{\min}$$

interference



$$T_f = I_{\max} - I_{\min}$$

transition



$$T_f = I_{\max} + C_{\max}$$

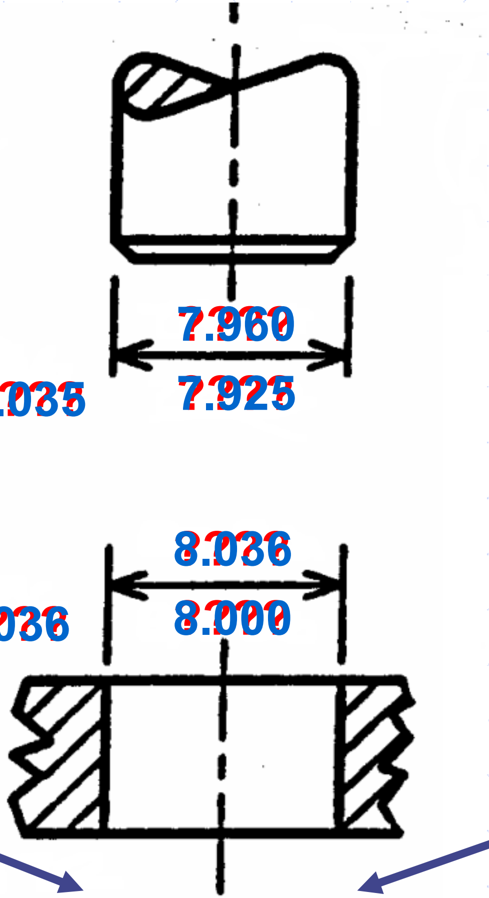
Fits and Tolerances

5.1) Exercices

Example

Free Running H9/d9
Basic Size: 8

(1) Nominal Size: 8



(2) Shaft Limits:
(3) Shaft Tolerance: 0.035

(7) Minimum
Clearance: 0.040

(4) Hole Limits:
(5) Hole Tolerance: 0.036

(8) Maximum
Clearance: 0.111

(6) Ts: 0.071

CHECK: 0.071 = 0.111 – 0.040 = 0.071

Exercices 1

For a nominal diameter of 25 mm and for a fit specification of H7/k5 determine the following:

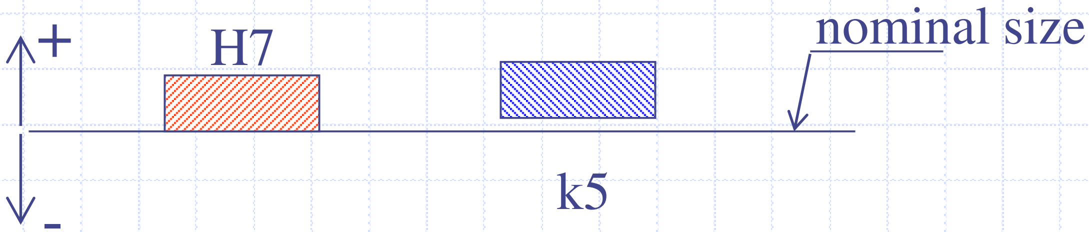
a) Type of the tolerancing system
b) Tolerance on the hole
c) Tolerance on the shaft
d) Upper and lower limits of the hole (D_{max}, D_{min})
e) Upper and lower limits of the shaft (d_{max}, d_{min})
f) Type of the fit
g) Tolerance on the fit
h) Allowance

Correction

a) H7/k5 ➔ Basic Hole System

b) D = 25 mm, from the given table:

$$\text{H7} \rightarrow \begin{matrix} +21\ \mu m \\ 0\ \mu m \end{matrix} \qquad \text{k5} \rightarrow \begin{matrix} +11\ \mu m \\ +2\ \mu m \end{matrix}$$



$$T_h = 21\ \mu m$$

c) $T_s = 9\ \mu m$

Correction

d) $D_{\min} = 25,\quad \text{(Basic Hole System)}$

$$D_{\max} = 25 + 0.021 = 25.021\ \text{mm}$$

e) $d_{\min} = 25 + 0.002 = 25.002\ \text{mm}$

$$d_{\max} = 25 + 0.011 = 25.011\ \text{mm}$$

f) Transition fit.

g) Tolerance on the fit:

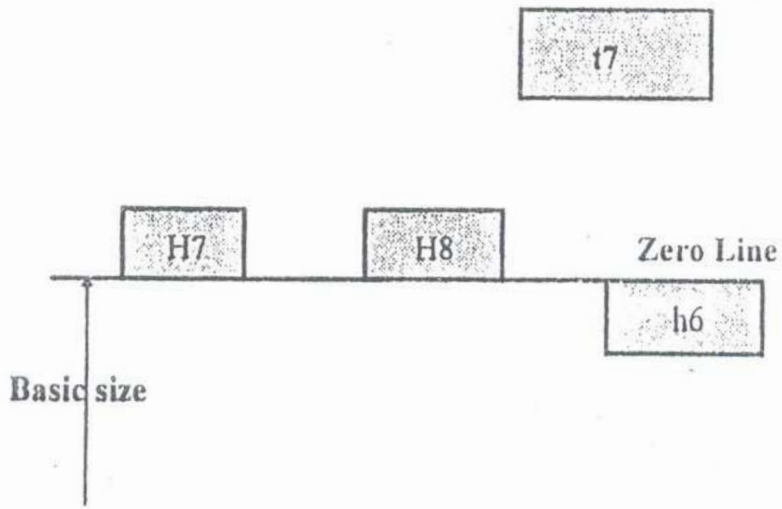
$$T_f = T_h + T_s = 21 + 9 = 30\ \mu\text{m}$$

or, $I_{\max} = 11\ \mu\text{m},\quad C_{\max} = 21 - 2 = 19\ \mu\text{m}.$

$$T_f = I_{\max} + C_{\max} = 30\ \mu\text{m}.$$

h) Allowance = $I_{\max}$ = 11 µm.

Exercise 2



For the drawn fits ϕ 60 H7/h6 and ϕ 75 H8/t7, determine the following:-

a)-The high and low limits of holes and shafts;

b)-The values of high and low deviations of holes and shafts;

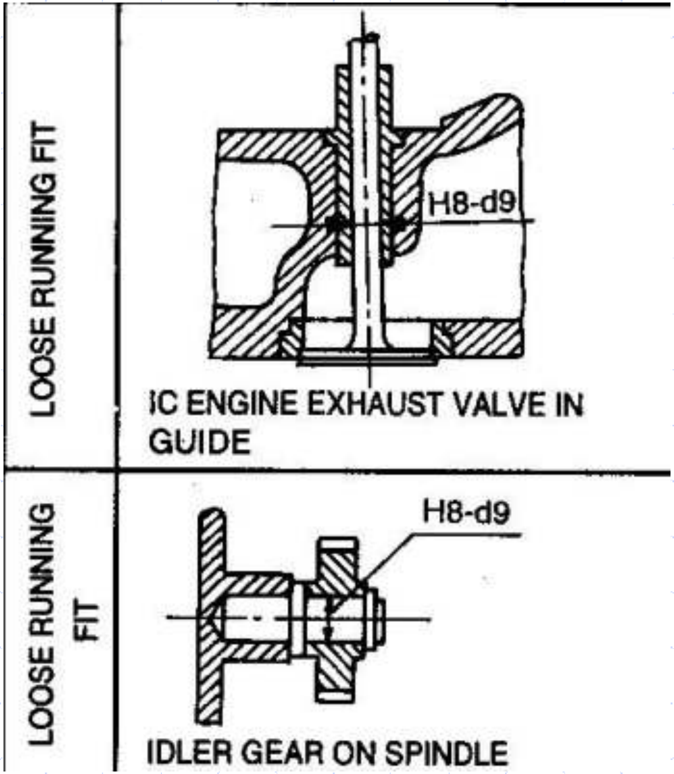
c)-The type of fits;

d)-The max. and min. values of clearance or interference;

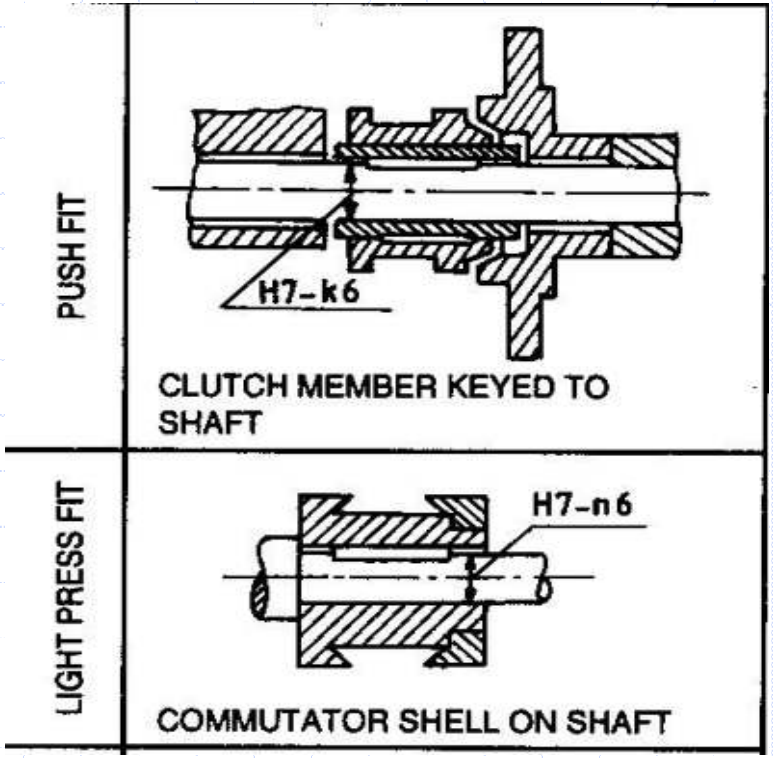
e)-Define and draw instruments for checking the dimensions of the parts.

<u>Solution:-</u> ***Report to be submitted***

Example 1

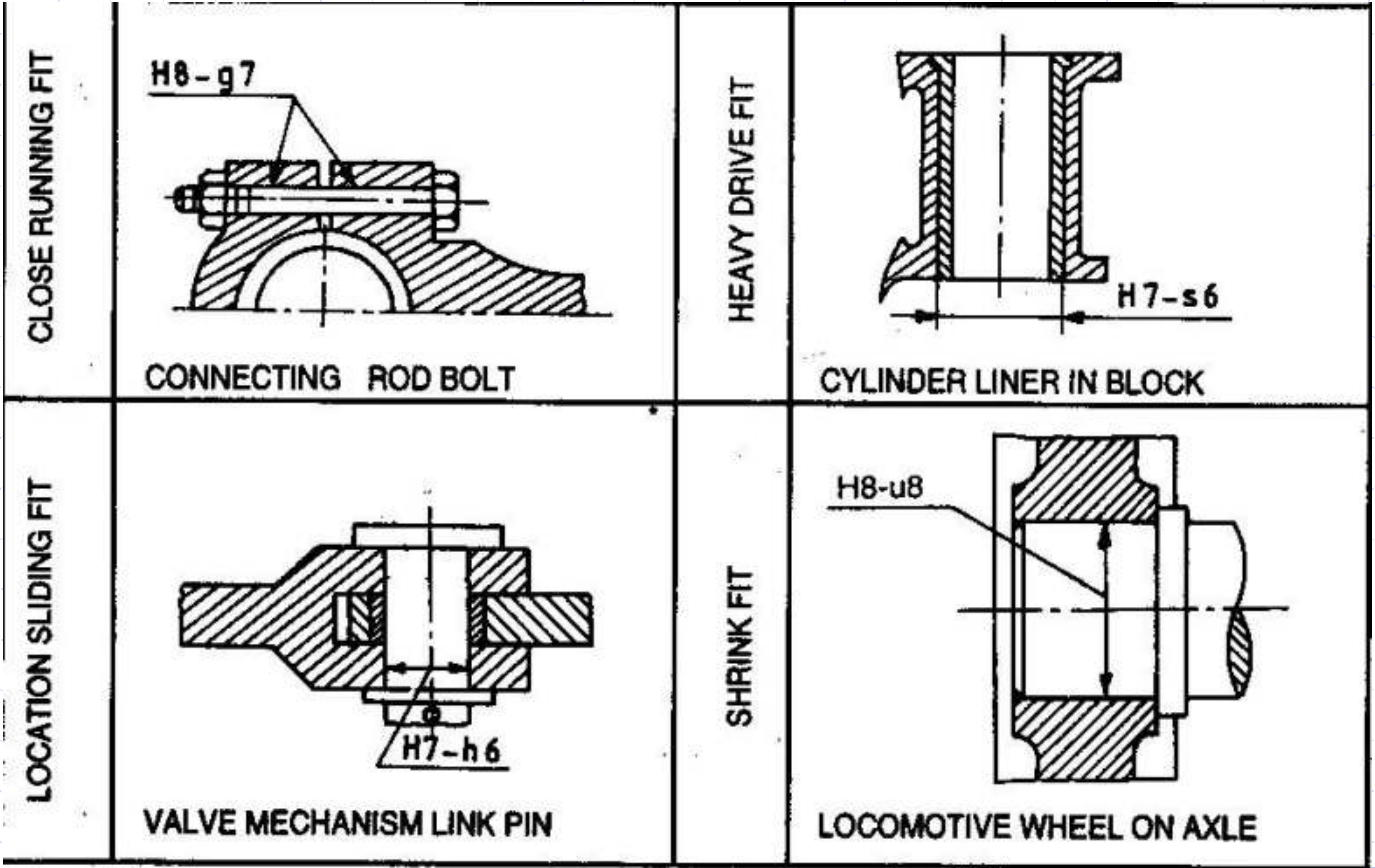


LOOSE RUNNING FIT
H8-d9
IC ENGINE EXHAUST VALVE IN GUIDE
LOOSE RUNNING FIT
H8-d9
IDLER GEAR ON SPINDLE



PUSH FIT
H7-k6
CLUTCH MEMBER KEYED TO SHAFT
LIGHT PRESS FIT
H7-n6
COMMUTATOR SHELL ON SHAFT

Example 1


CLOSE RUNNING FIT
H8-g7
CONNECTING ROD BOLT
HEAVY DRIVE FIT
H7-s6
CYLINDER LINER IN BLOCK
LOCATION SLIDING FIT
H7-h6
VALVE MECHANISM LINK PIN
SHRINK FIT
H8-u8
LOCOMOTIVE WHEEL ON AXLE

Example 2

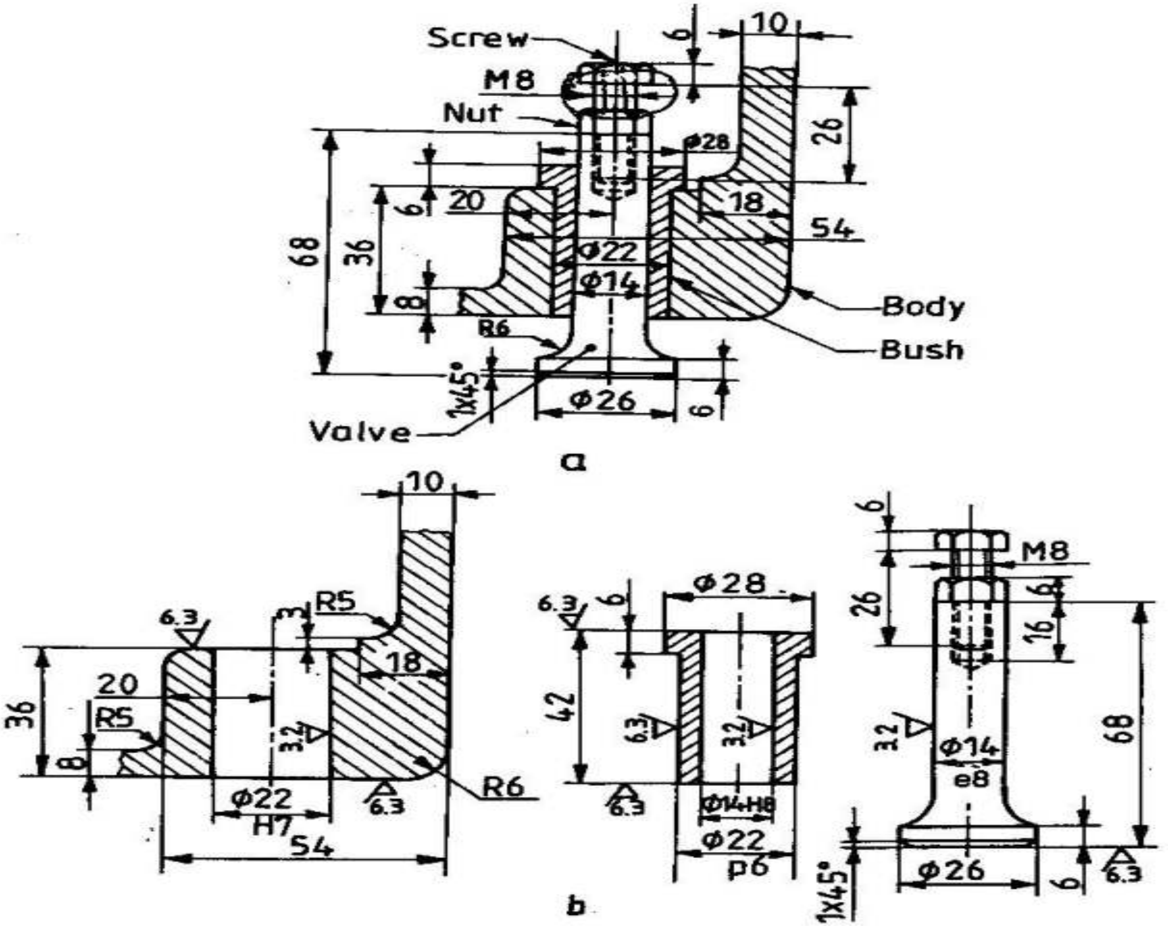


Fig. 8.1 *Tappet in guide*

Example 3

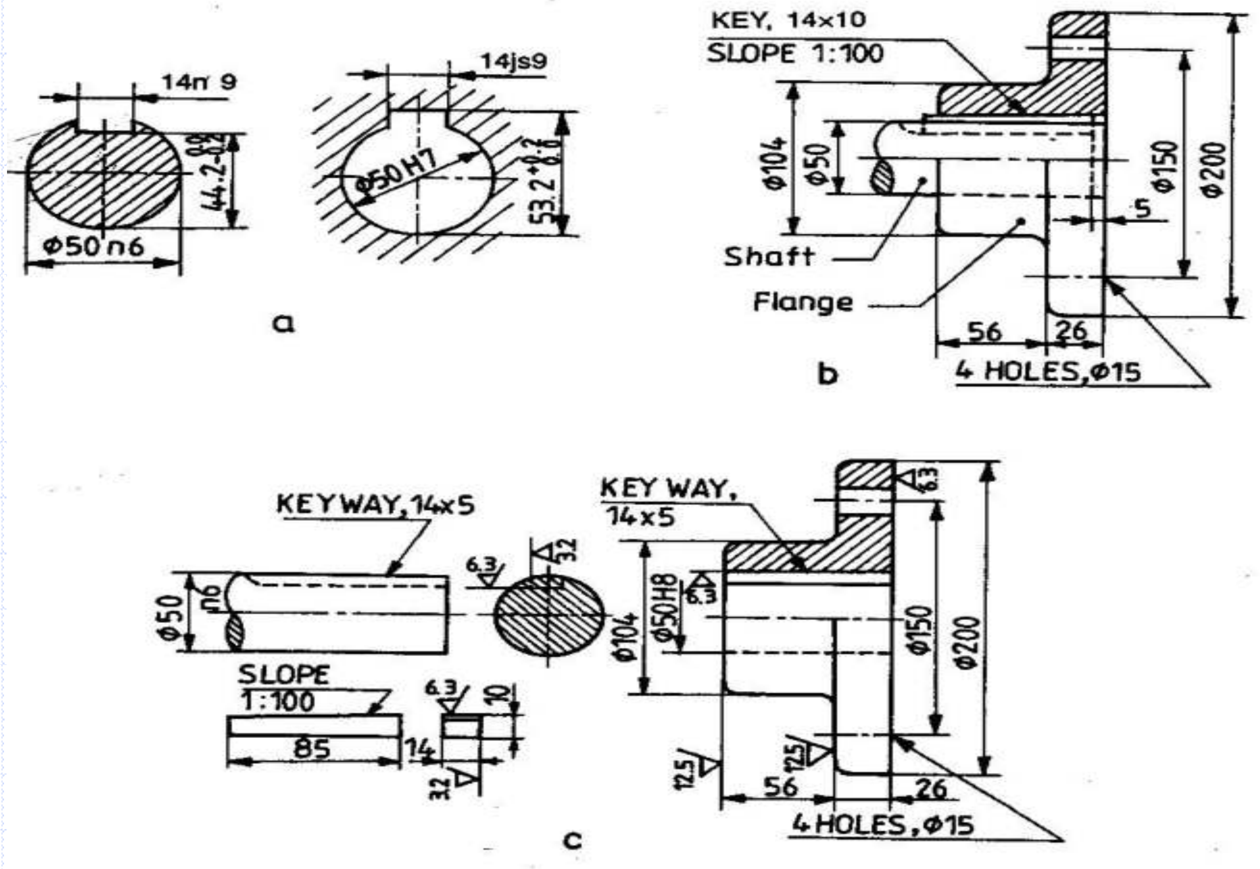
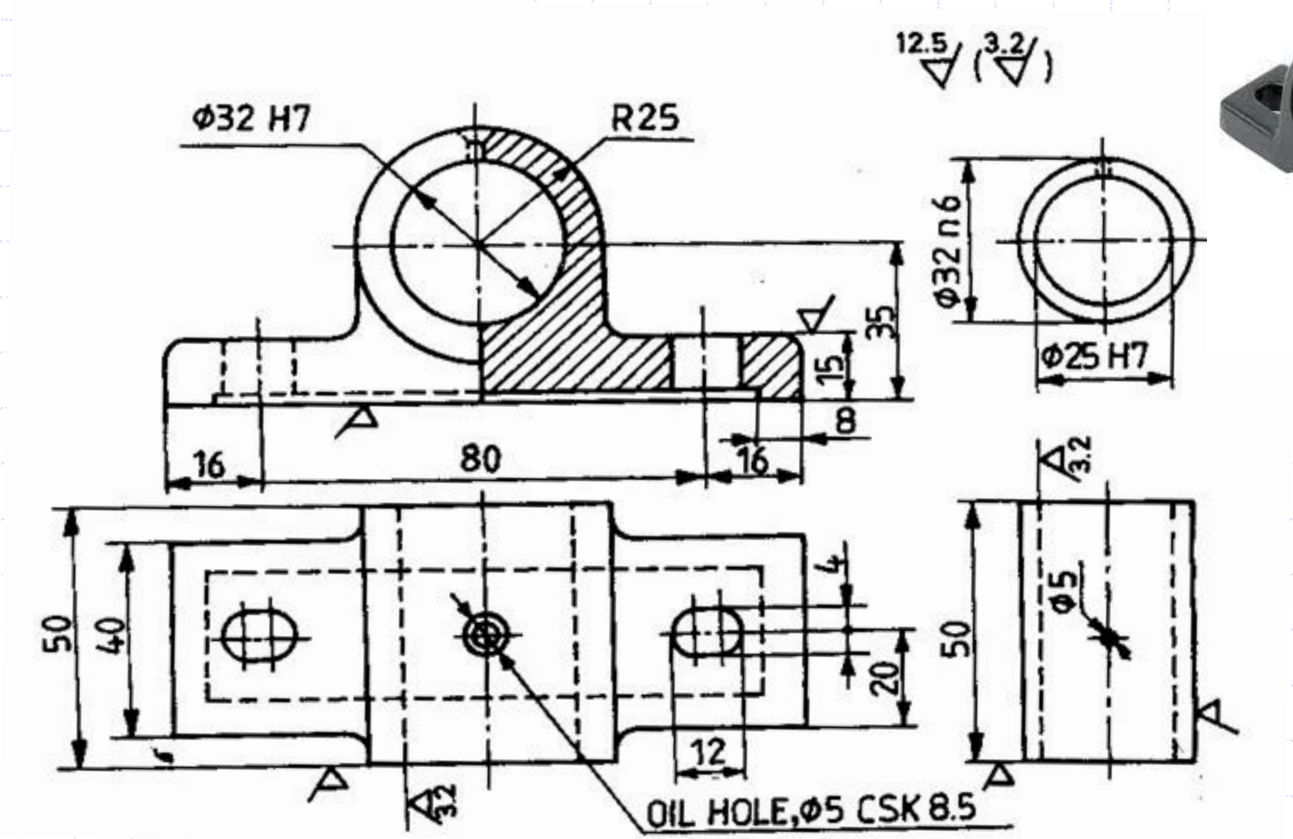


Fig. 8.2 *Flange on shaft*

Example 4



12.5 (3.2)
Φ32 H7
R25
35
15
8
16
80
16
Φ32 n6
Φ25 H7
3.2
50
40
4
20
12
Φ5
50
3.2
OIL HOLE, Φ5 CSK 8.5

Fits and Tolerances

The End