Metrology, standardization and certification

Lecture plan:

1. Types of fits
2. Hole and shaft systems
3. ISO code system for tolerances on linear sizes

Types of fits

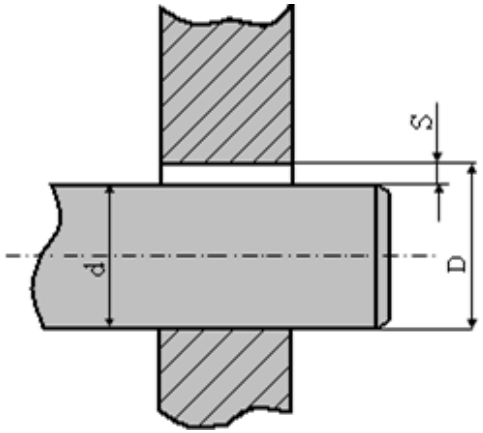
Fit: the nature of connections details, determined by the difference in their sizes before assembly

Depending on the relative motion of mating parts or their resistance to relative displacement fits is divided into three types:

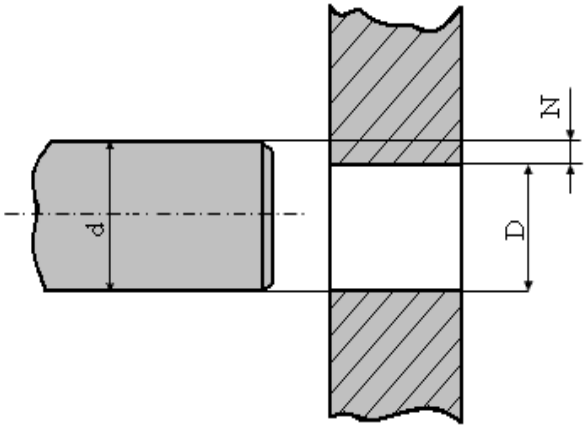
1. Clearance fit
2. Interference fit
3. Transition fit

Clearance (S)- the difference between the sizes of the hole and shaft, if the hole size is larger than the size of the shaft.

Interference (N) - the difference between the shaft and the hole sizes before assembly, if the shaft size is larger than the hole size.



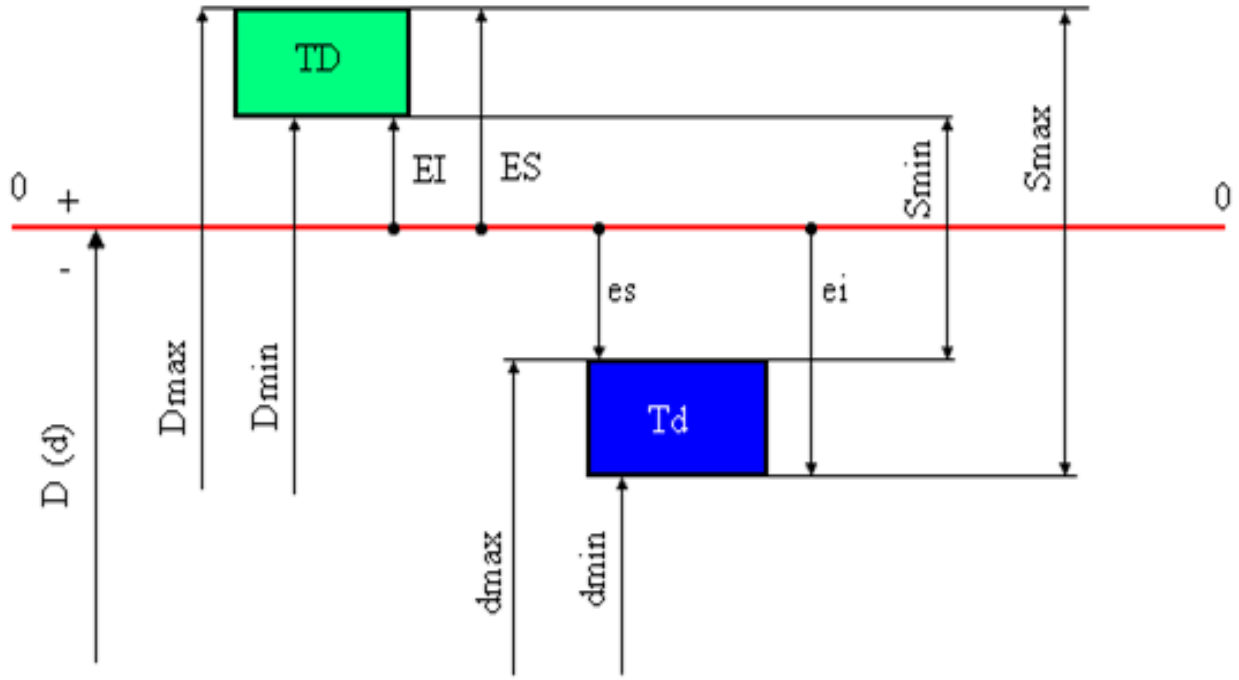
Clearance fit



Interference fit

Clearance fit

Clearance fit: the fit, in which the gap is always formed in the connection, i.e. minimum limit of size of hole larger than the maximum limit of size of shaft or equal to it



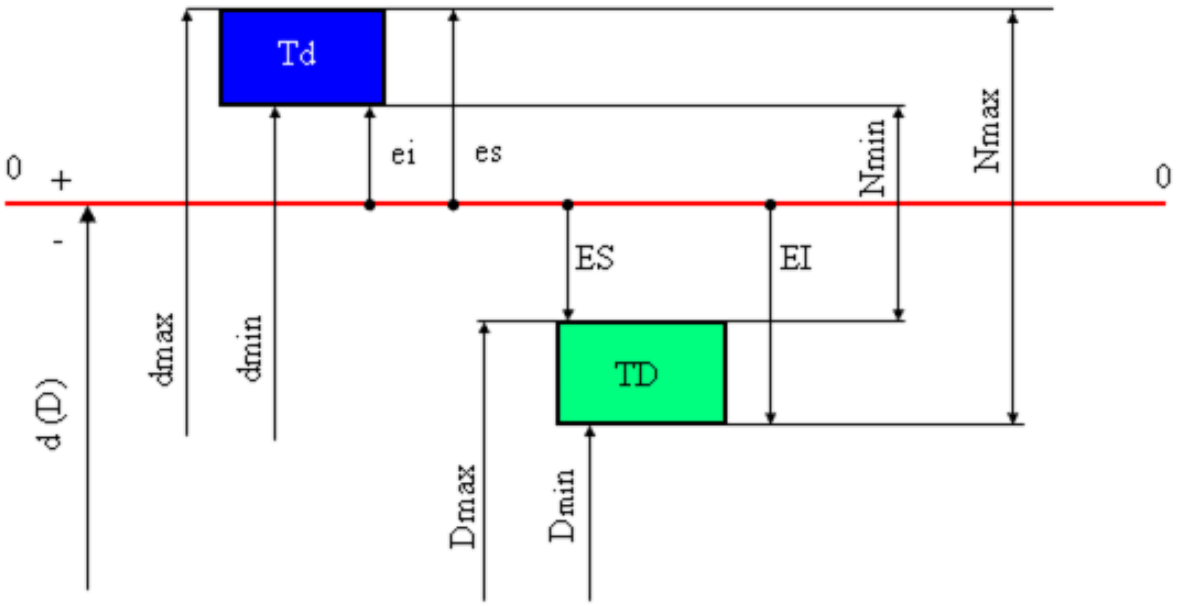
Schematic image with clearance fit

TD – diameter tolerance of the hole, Td – diameter tolerance of the shaft,

Smin - the smallest clearance; Smax – the largest clearance

Interference fit

Interference fit: the fit, in which always formed interference in the connection, i.e., the maximum limit of size of the hole smaller than the minimum limit of size of the shaft or equal to it



Schematic representation of the interference fit,

TD – diameter tolerance of the hole, Td – diameter tolerance of the shaft,

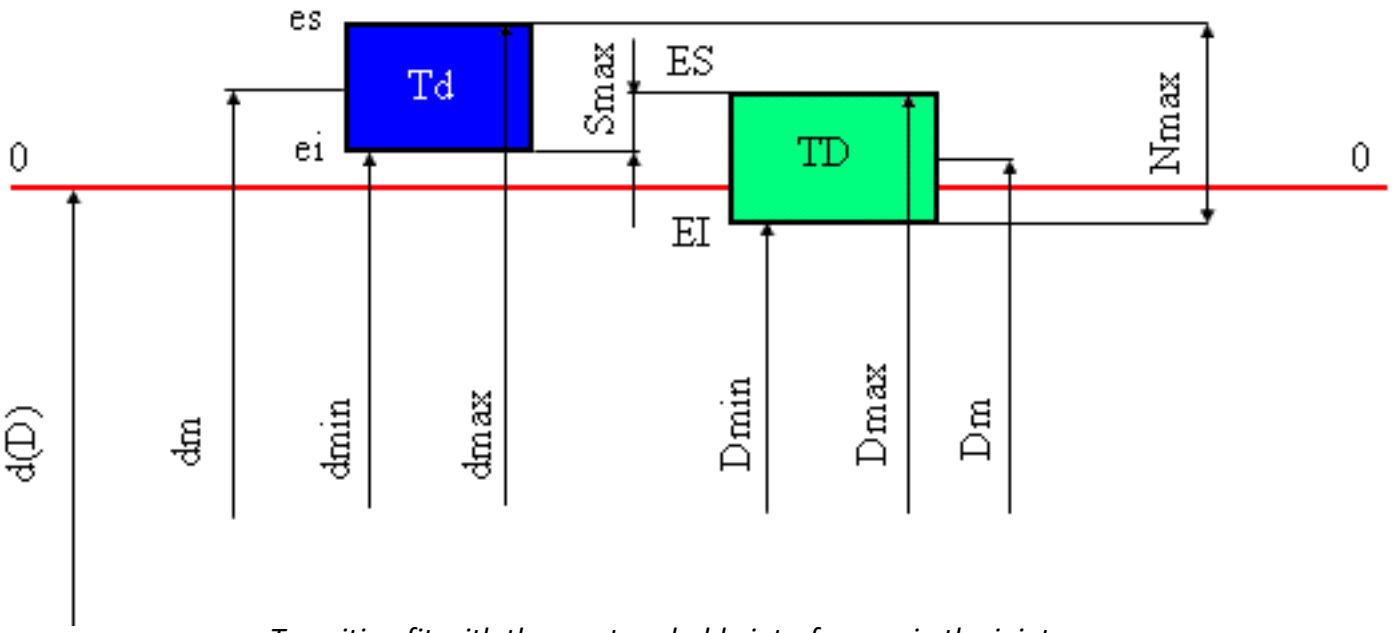
Nmin – the smallest interference, Nmax – the largest interference

Transition fits

Transition fit: the fit in which it is possible to obtain a clearance or interference in the joint.

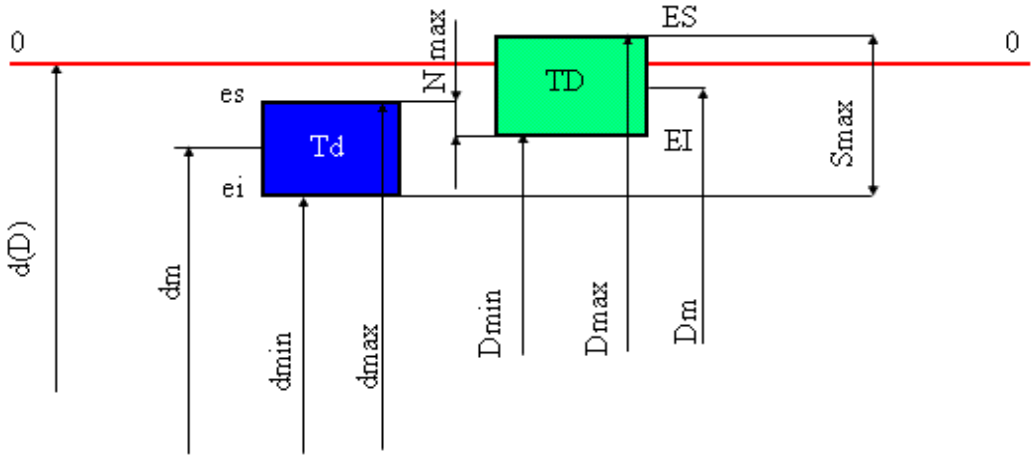
There are the following types of transition fits:

1. With the most probable interference in the joint.
2. With the most probable clearance in the connection.
3. With equiprobable clearance and interference in the connection.

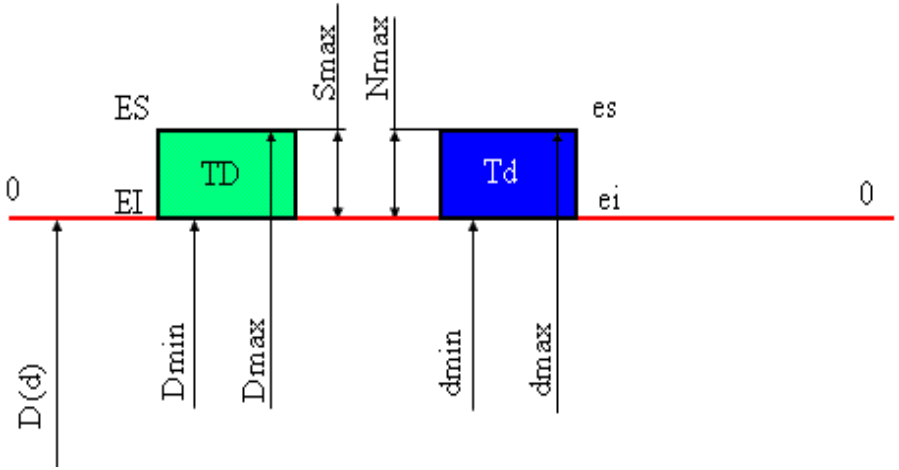


Transition fit with the most probable interference in the joint.

Transition fits



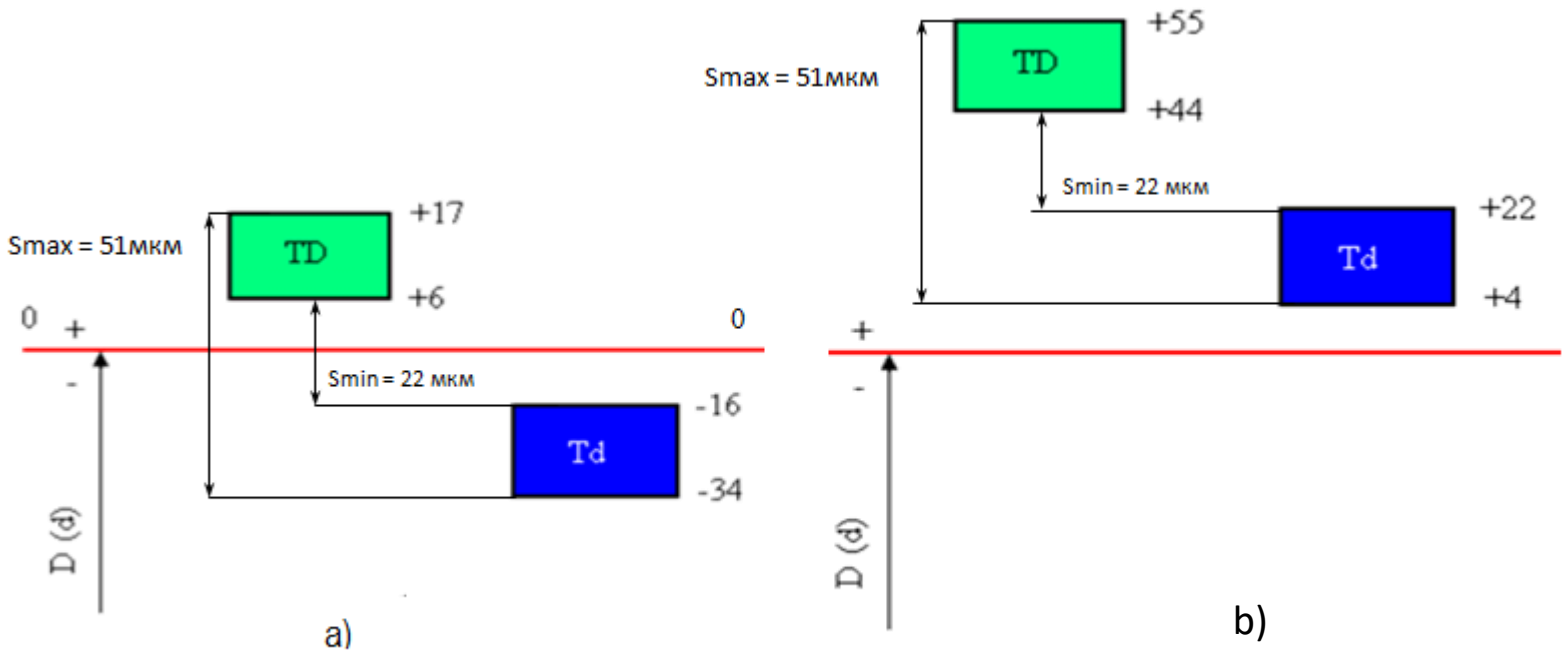
Transition fit with the most probable clearance in the joint



Transition fit with equiprobable clearance and interference in the connection

Function of transition fit is to ensure the accuracy of the centering of the elements of the parts. (EXAMPLE: Connection of pulley or toothed wheel with a gear shaft)

Hole and shaft-basis systems of fits



Fits with the same clearance

This "freedom" of choice is uneconomical. If any tolerance zones will be appointed in the design, of such zones may be countless. But this means that it is practically impossible to produce centrally for market dimensional processing tool for making holes (drills, countersinks, reamers) - the tool directly forming a size.

A tool for making holes

a)

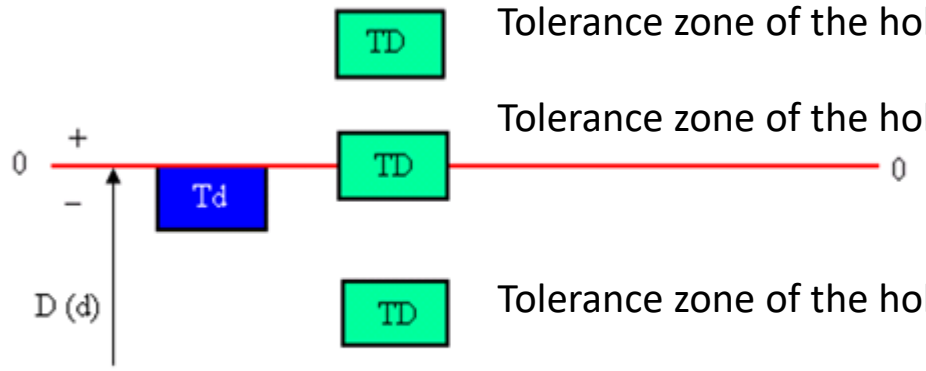
b)

A tool for making holes,

a) drill b) reamer

Hole and shaft-basis systems of fits

Basic hole - hole lower deviation is zero
Basic shaft - shaft upper deviation is zero

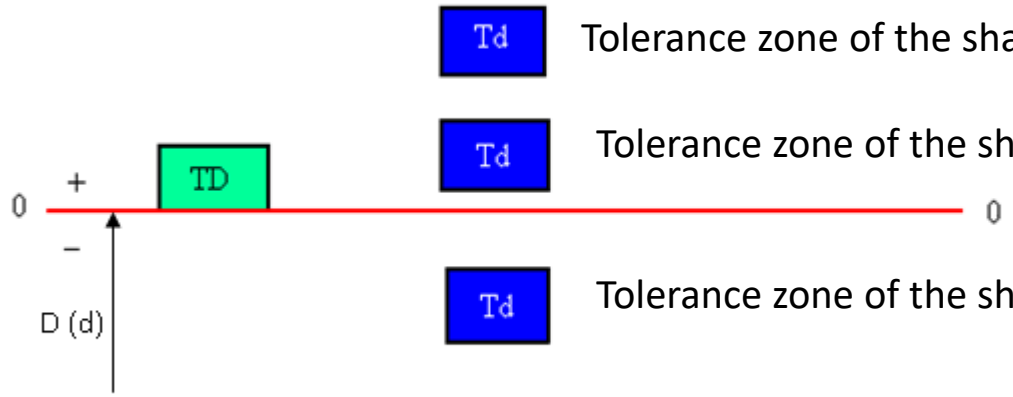


Tolerance zone of the hole for clearance fit

Tolerance zone of the hole for transition fit

Tolerance zone of the hole for interference fit

Fits in shaft-basic system



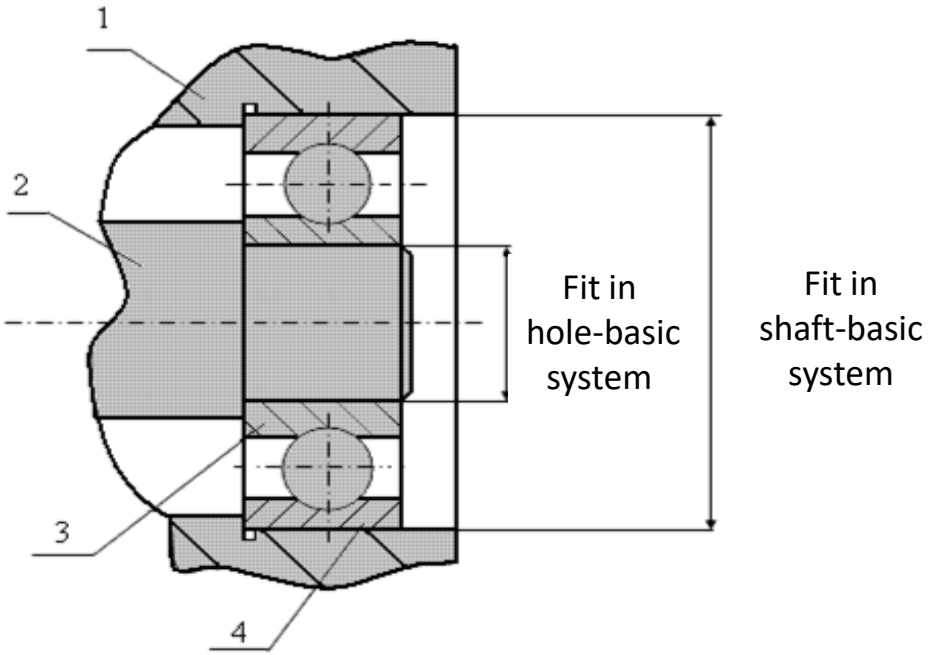
Tolerance zone of the shaft for interference fit

Tolerance zone of the shaft for transition fit

Tolerance zone of the shaft for clearance fit

Fits in hole-basic system

Example of the fits in hole-basic and in shaft-basic system



1-body; 2 – shaft; 3 – inner bearing ring; 4– outer bearing ring

ISO code system for tolerances on linear sizes

IS0 286-1 (2010) Geometrical product specifications (GPS) - ISO code system for tolerances on linear sizes - Part 1: Basis of tolerances, deviations and fits.
IS0 286-2 (2010) Geometrical product specifications (GPS) - ISO code system for tolerances on linear sizes - Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts.

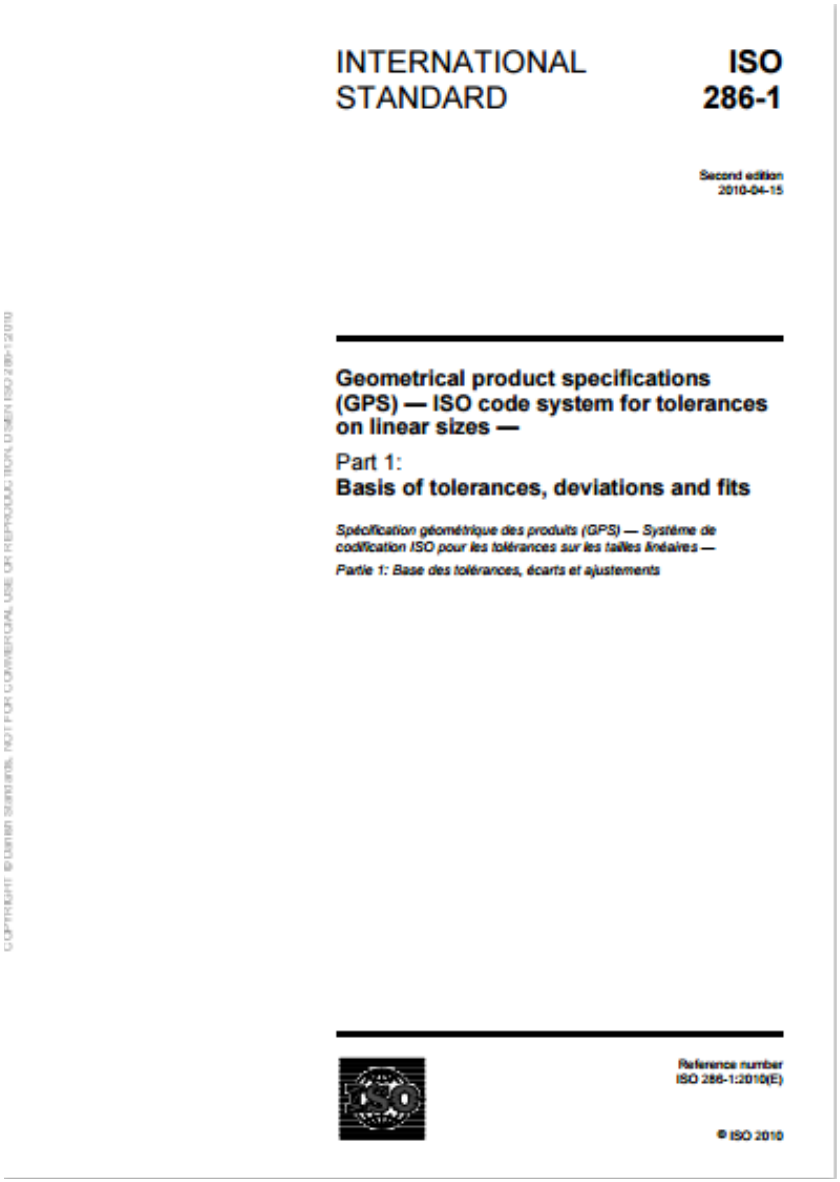
Tolerances and fits system - a set of rows of tolerances and fits, logically constructed on the basis of production experience, experimental researches, theoretical generalizations and executed as a standard

This part of ISO 286 establishes the ISO code system for tolerances to be used for linear sizes of features of the following types: a) cylinder; b) two parallel opposite surfaces.

The main features of the system of tolerances and fits:

1. Size intervals.
2. Standard tolerance factor.
3. Tolerance grades.
4. Tolerance zones of holes and shafts.
5. Hole-basic and shaft-basic fit systems.
6. Normal temperature.

ISO code system for tolerances on linear sizes



INTERNATIONAL STANDARD

ISO 286-1

Second edition
2010-04-15

Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes —

Part 1:
Basis of tolerances, deviations and fits

Spécification géométrique des produits (GPS) — Système de codification ISO pour les tolérances sur les tailles linéaires —
Partie 1: Base des tolérances, écarts et ajustements

Reference number
ISO 286-1:2010(E)

Size intervals

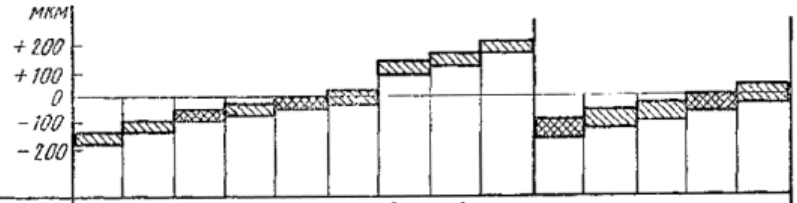
In the world there are restrictions on the use of the size of the values inherent in the concept of preferred numbers and ranks of preferred numbers, i.e standardized values to which it is necessary to round the calculated values. This approach makes it possible to reduce the number of sizes of parts and components, the amount of dimensional cutting tools and other technological and measuring equipment. Preferred number are the same all over the world and are members of the geometric progression with ratio: 1.6; 1.25; 1.12; 1.06

$$\sqrt[5]{10} \approx 1{,}6; \quad \sqrt[10]{10} \approx 1{,}25; \quad \sqrt[20]{10} \approx 1{,}12; \quad \sqrt[40]{10} \approx 1{,}06.$$

For example: for **R5** (denominator 1.6) take values from the set:R5: ... 10; 16; 25; 40; 63; 100; 160; 250; 400; 630, etc.
In **R10** (denominator 1.25) take values from the set:R10: ... 10; 12.5; 16; 20; 25; 31.5; 40; 50; 63; 80; 125; 160; 200; 250; 315; 400; 630, etc

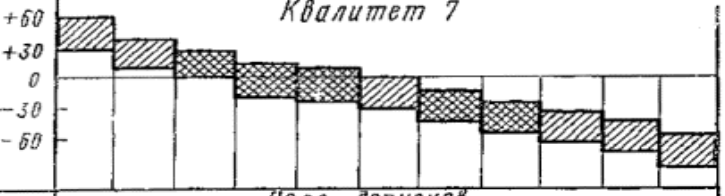
ISO 286 standard provides **13 intervals** of sizes in the range of 1 to 500 mm, within which tolerances are constant. These intervals are called basic. Intervals increase along with the size, accounting for an approximate geometric progression with ratio 1.6

Квалитеты 8 и 9



Интервал размеров, мм	Поля допусков													
	c8	d8	e8	f8	h8	j_s8*	u8	x8	z8	d9	e9	f9	h9	j_s9*
	Предельные отклонения, мкм													
От 1 до 3	-60 -74	-20 -34	-14 -28	-6 -20	0 -14	+7 -7	+32 +18	+34 +20	+40 +26	-20 -45	-14 -39	-6 -31	0 -25	+12 -12
Свыше 3 до 6	-70 -88	-30 -48	-20 -38	-10 -28	0 -18	+9 -9	+41 +23	+46 +28	+53 +35	-30 -60	-20 -50	-10 -40	0 -30	+15 -15
Свыше 6 до 10	-80 -102	-40 -62	-25 -47	-13 -35	0 -22	+11 -11	+50 +28	+56 +34	+64 +42	-40 -76	-25 -61	-13 -49	0 -36	+18 -18
Свыше 10 до 14	-95	-50	-32	-16	0	+13	+60	+67 +40	+77 +50	-50	-32	-16	0	+21
Свыше 14 до 18	-122	-77	-59	-43	-27	-13	+33	+72 +45	+87 +60	-93	-75	-59	-43	-21
Свыше 18 до 24	-110	-65	-40	-20	0	+16	+74 +41	+87 +54	+106 +73	-65	-40	-20	0	+26
Свыше 24 до 30	-143	-98	-73	-53	-33	-16	+81 +48	+97 +64	+121 +88	-117	-92	-72	-52	-26
Свыше 30 до 40	-120 -159	-80	-50	-25	0	+19	+99 +60	+119 +80	+151 +112	-80	-50	-25	0	+31
Свыше 40 до 50	-130 -169	-119	-89	-64	-39	-19	+109 +70	+136 +97	+175 +136	-142	-112	-87	-62	-31
Свыше 50 до 65	-140 -186	-100	-60	-30	0	+23	+133 +87	+158 +122	+218 +172	-100	-60	-30	0	+37
Свыше 65 до 80	-150 -196	-146	-106	-76	-46	-23	+148 +102	+192 +146	+256 +210	-174	-134	-104	-74	-37
Свыше 80 до 100	-170 -224	-120	-72	-36	0	+27	+178 +124	+232 +178	+312 +258	-120	-72	-36	0	+43
Свыше 100 до 120	-180 -234	-174	-126	-90	-54	-27	+198 +144	+264 +210	+364 +310	-207	-159	-123	-87	-43
Свыше 120 до 140	-200 -263						+233 +170	+311 +248	+428 +365					
Свыше 140 до 160	-210 -273	-145 -208	-85 -148	-43 -106	0 -63	+31 -31	+253 +190	+343 +280	+478 +415	-145 -245	-85 -185	-43 -143	0 -100	+50 -50
Свыше 160 до 180	-230 -293						+273 +210	+373 +310	+528 +465					
Свыше 180 до 200	-240 -312						+308 +236	+422 +350	+592 +520					
Свыше 200 до 225	-260 -332	-170 -242	-100 -172	-50 -122	0 -72	+36 -36	+330 +258	+457 +385	+647 +575	-170 -285	-100 -215	-50 -165	0 -115	+57 -57
Свыше 225 до 250	-280 -352						+356 +284	+497 +425	+712 +640					
Свыше 250 до 280	-300 -381	-190	-110	-56	0	+40	+396 +315	+556 +475	+791 +710	-190	-110	-56	0	+65
Свыше 280 до 315	-330 -411	-271	-191	-137	-81	-40	+431 +350	+606 +525	+871 +790	-320	-240	-186	-130	-65
Свыше 315 до 355	-360 -449	-210	-125	-62	0	+44	+479 +390	+679 +590	+989 +900	-210	-125	-62	0	+70
Свыше 355 до 400	-400 -489	-299	-214	-151	-89	-44	+524 +435	+742 +660	+1089 +1000	-350	-265	-202	-140	-70
Свыше 400 до 450	-440 -537	-230	-135	-63	0	+48	+587 +490	+837 +740	+1197 +1100	-230	-135	-68	0	+77
Свыше 450 до 500	-480 -577	-327	-232	-165	-97	-48	+637 +540	+917 +820	+1347 +1250	-385	-290	-223	-155	-77

Квалитет 7



Интервал размеров, мм	Поля допусков										
	F7	G7	H7	J_S 7	K7	M7	N7	P7	R7	S7	T7
	Предельные отклонения, мкм										
От 1 до 3	+16 +6	+12 +2	+10 0	+5 -5	0 -10	-2 -12	-4 -14	-6 -16	-10 -20	-14 -24	—
Свыше 3 до 6	+22 +10	+16 +4	+12 0	+6 -6	+3 -9	0 -12	-4 -16	-8 -20	-11 -23	-15 -27	—
Свыше 6 до 10	+28 +13	+20 +5	+15 0	+7 -7	+5 -10	0 -15	-4 -19	-9 -24	-13 -28	-17 -32	—
Свыше 10 до 14	+34	+24	+18	+9	+6	0	-5	-11	-16	-21	—
Свыше 14 до 18	+16	+6	0	-9	-12	-18	-23	-29	-34	-39	
Свыше 18 до 24	+41	+28	+21	+10	+6	0	-7	-14	-20	-27	—
Свыше 24 до 30	+20	+7	0	-10	-15	-21	-28	-35	-41	-48	-33 -54
Свыше 30 до 40	+50	+34	+25	+12	+7	0	-8	-17	-25	-34	-39 -64
Свыше 40 до 50	+25	+9	0	-12	-18	-25	-33	-42	-50	-59	-45 -70
Свыше 50 до 65	+60	+40	+30	+15	+9	0	-9	-21	-30 -60	-42 -72	-55 -85
Свыше 65 до 80	+30	+10	0	-15	-21	-30	-39	-51	-32 -62	-48 -78	-64 -94
Свыше 80 до 100	+71	+47	+35	+17	+10	0	-10	-24	-38 -73	-58 -93	-78 -113
Свыше 100 до 120	+36	+12	0	-17	-25	-35	-45	-59	-41 -76	-66 -101	-91 -126
Свыше 120 до 140									-48 -88	-77 -117	-107 -147
Свыше 140 до 160	+83 +43	+54 +14	+40 0	+20 -20	+12 -28	0 -40	-12 -52	-28 -68	-50 -90	-85 -125	-119 -159
Свыше 160 до 180									-53 -93	-93 -133	-131 -171
Свыше 180 до 200									-60 -106	-105 -151	-149 -195
Свыше 200 до 225	+96 +50	+61 +15	+46 0	+23 -23	+13 -33	0 -46	-14 -60	-33 -79	-63 -109	-113 -159	-163 -209
Свыше 225 до 250									-67 -113	-123 -169	-179 -225
Свыше 250 до 280	+108	+69	+52	+26	+16	0	-14	-36	-74 -126	-138 -190	-198 -250
Свыше 280 до 315	+56	+17	0	-26	-36	-52	-66	-88	-78 -130	-150 -202	-220 -272
Свыше 315 до 355	+119	+75	+57	+28	+17	0	-16	-41	-87 -144	-169 -226	-247 -304
Свыше 355 до 400	+62	+18	0	-28	-40	-57	-73	-98	-93 -150	-187 -244	-273 -330
Свыше 400 до 450	+131	+83	+63	+31	+18	0	-17	-45	-103 -166	-209 -272	-307 -370
Свыше 450 до 500	+68	+20	0	-31	-45	-63	-80	-108	-109 -172	-229 -292	-337 -400

Standard tolerance factor

Standard tolerance factor (i) - a measure characterizing parts manufacturing complexity depending on its size

For sizes from 1 up to 500 mm:

$$i = 0,45\sqrt[3]{D_m} + 0,001 \cdot D_m,$$

i - standard tolerance factor, μm

Dm- geometric mean extremes sizes of each interval, mm

$$D_m = \sqrt{D_{min} \cdot D_{max}}.$$

0,001 Dm - measurement error, μm

Value of Tolerance depends on the standard tolerance factor (i) and quantity of these factor (a): **T= a · *i***

For example: The value of Tolerance for quality class 7 is taken equal to 16 units of standard tolerance factor. **IT7 = 16i**

Tolerance grades

In order to meet the requirements of various products for accuracy of the components, the ISO system implements 20 grades of accuracy, which are called **tolerance grades**. The bigger is grade number, the bigger is tolerance value for a given dimension.

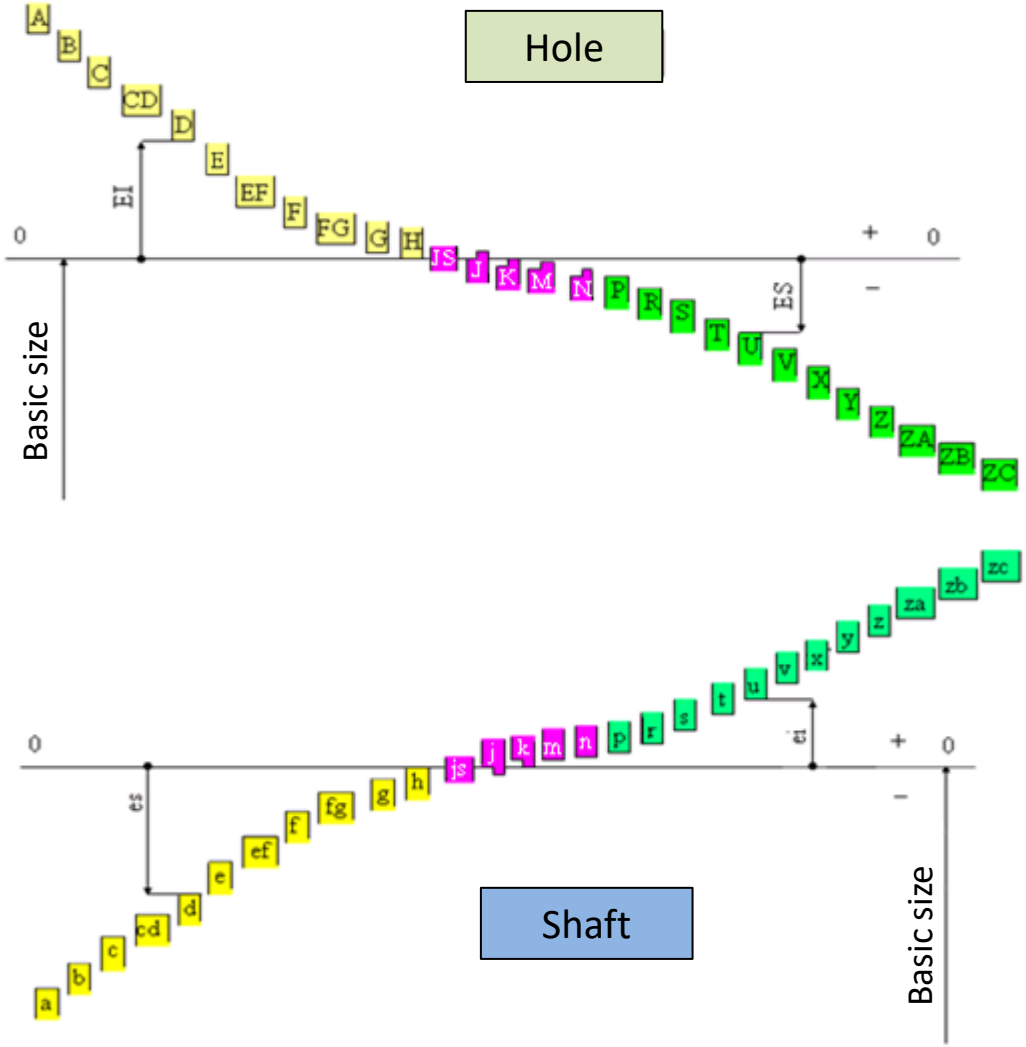
Tolerance grades is denoted as **IT01, IT0, IT1, IT2….up to IT18**.

From IT1 up to IT4

From IT5…IT14 up to IT 18

Tolerance zones for holes and shafts

Fundamental deviation - one of two deviations (upper or lower) that is used to determine the position of the tolerance zone relative to the zero line (deviation closest to the zero line)



There are 28 deviations of holes and 28 deviations of shaft.

The tolerance zone is formed like a combination of fundamental deviation and grade of tolerance.

For example:
for the shaft: **h6, g6, p6,**
and for the hole: **H7, F8, JS6**

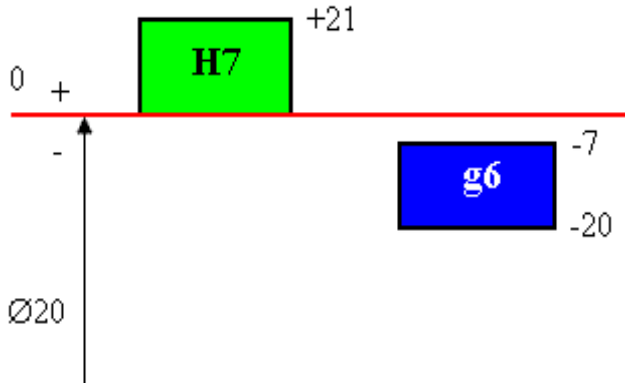
Fits in hole and shaft-basic systems

Fits in hole-basic system - fits, in which the various clearances and interferences is formed by combination of various tolerance zones of shafts with one basic hole.

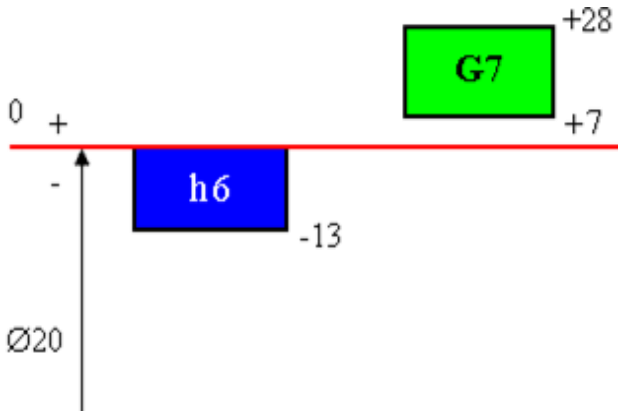
Fits in shaft-basic system - fits, in which the various clearances and interferences is formed by combination of various tolerance zones of holes with one basic shaft.

Usually, the fits is designated in the form of a fraction. Tolerance zone of hole is always indicated in the numerator, and the shaft tolerance zone - in the denominator

Example: Ø20 H7/g6 - fit in hole-basic system; Ø20 G7/h6 - fit in the shaft-basic system



Graphic image of a clearance fit in the hole-basic system (Ø20 H7/g6)



Graphic image of a clearance fit in the shaft-basic system (Ø20 G7/h6)

Normal temperature

In the world considered that the dimension values, which are listed in the regulations pertain to the details of when their temperature of 20 ° C. If the parts are different from the temperature of 20 ° C, it is necessary take into consideration the amendment:

$$\Delta l \approx l \cdot (\alpha_1 \cdot \Delta t_1 - \alpha_2 \cdot \Delta t_2),$$

Δl - temperature error;

l - the measured size in mm;

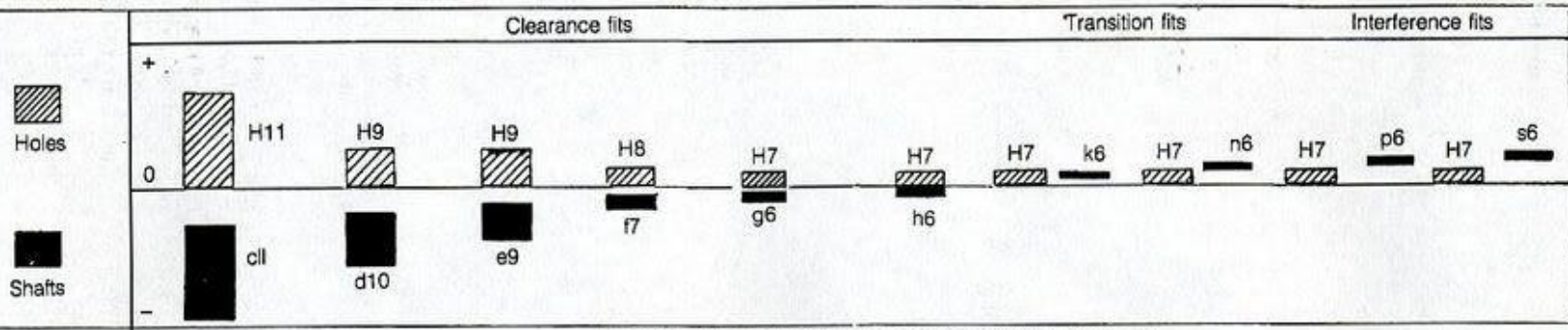
Δt_1 - the difference between the parts temperature and the temperature of 20 ° C.

Δt_2 - the difference between the temperature of measuring means and a normal temperature of 20 ° C.

α_1, α_2 - temperature coefficients of linear expansion of the materials and details of the measuring means, C^{-1}.

Table 1 Selected fits — hole basis

Diagram to scale for 25 mm diameter



Basic size (mm)		Upper and lower deviations for tolerance class (Values μm)																				Basic size (mm)	
		H11	c11	H9	d10	H9	e9	H8	f7	H7	g6	H7	h6	H7	k6	H7	n6	H7	p6	H7	s6		
Above	Up to and incl.	+	–	+	–	+	–	+	–	+	–	+	–	+	+	+	+	+	+	+	+	Above	Up to and incl.
0	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 8	10 0	20 14	0	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	159 130	200	225
225	250	290 0	280 570																	46 0	169 140	225	250
250	280	320 0	300 630	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
		Loose clearance		Average running		Average location		Precision location				Push/drive				Press		Shrink					

USEFUL TOLERANCES (mm)

Tolerance		Nominal Diameter (mm)							
		from 1 to 3	over 3 to 6	over 6 to 10	over 10 to 18	over 18 to 30	over 30 to 50	over 50 to 80	over 80 to 120
SHAFTS	e^8	- .014 - .028	- .020 - .038	- .025 - .047	- .032 - .059	- .040 - .073	- .050 - .089	- .060 - .106	- .072 - .126
	e^9	- .014 - .039	- .020 - .050	- .025 - .061	- .032 - .075	- .040 - .092	- .050 - .112	- .060 - .134	- .072 - .159
	f^6	- .006 - .012	- .010 - .018	- .013 - .022	- .016 - .027	- .020 - .033	- .025 - .041	- .030 - .049	- .036 - .058
	f^7	- .006 - .016	- .010 - .022	- .013 - .028	- .016 - .034	- .020 - .041	- .025 - .050	- .030 - .060	- .036 - .071
	g^6	- .002 - .008	- .004 - .012	- .005 - .014	- .006 - .017	- .007 - .020	- .009 - .025	- .010 - .129	- .012 - .134
	h^6	.000 - .006	.000 - .008	.000 - .009	.000 - .011	.000 - .013	.000 - .016	.000 - .019	.000 - .022
	h^7	.000 - .010	.000 - .012	.000 - .015	.000 - .018	.000 - .021	.000 - .025	.000 - .030	.000 - .035
	h^8	.000 - .014	.000 - .018	.000 - .022	.000 - .027	.000 - .033	.000 - .039	.000 - .046	.000 - .054
	h^9	.000 - .025	.000 - .030	.000 - .036	.000 - .043	.000 - .052	.000 - .062	.000 - .074	.000 - .087
	h^{11}	.000 - .060	.000 - .075	.000 - .090	.000 - .110	.000 - .130	.000 - .160	.000 - .190	.000 - .220
	h^{12}	.000 - .100	.000 - .120	.000 - .150	.000 - .180	.000 - .210	.000 - .250	.000 - .300	.000 - .350
	k^6	+.006 .000	+.009 +.001	+.010 +.001	+.012 +.001	+.015 +.002	+.018 +.002	+.021 +.002	+.025 +.003
	n^6	+.010 +.004	+.016 +.008	+.019 +.010	+.023 +.012	+.028 +.015	+.033 +.017	+.039 +.020	+.045 +.023
	p^6	+.012 +.006	+.020 +.012	+.024 +.015	+.029 +.018	+.035 +.022	+.042 +.026	+.051 +.032	+.059 +.037
HOLES	F^8	+.020 +.006	+.028 +.010	+.035 +.013	+.043 +.016	+.053 +.020	+.064 +.025	+.076 +.030	+.090 +.036
	G^7	+.012 +.002	+.016 +.004	+.020 +.005	+.024 +.006	+.028 +.007	+.034 +.009	+.040 +.010	+.047 +.012
	H^7	+.010 .000	+.012 .000	+.015 .000	+.018 .000	+.021 .000	+.025 .000	+.030 .000	+.035 .000
	H^8	+.014 .000	+.018 .000	+.022 .000	+.027 .000	+.033 .000	+.039 .000	+.046 .000	+.054 .000
	H^9	+.025 .000	+.030 .000	+.036 .000	+.043 .000	+.052 .000	+.062 .000	+.074 .000	+.087 .000
	H^{12}	+.100 .000	+.120 .000	+.150 .000	+.180 .000	+.210 .000	+.250 .000	+.300 .000	+.350 .000

PREFERRED FITS

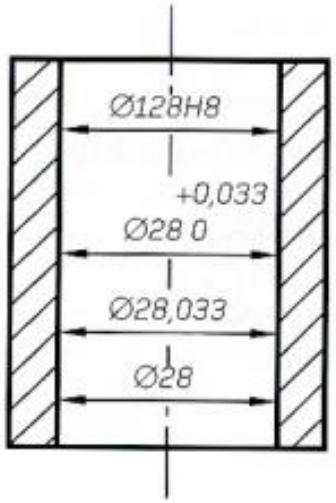
The following chart covers a simple selection of Fits for Shafts and Holes which will meet the needs of a large proportion of the requirements for normal engineering products.

Shaft Basis	Hole Basis	Description / Application
CLEARANCE FITS		
C11 / h11	H11 / c11	**LOOSE RUNNING FIT** - Wide commercial tolerances, used where accuracy is not essential.
D9 / h9	H9 / e9	**FREE RUNNING FIT** - High running speeds, large temperature variations, heavy pressures and where accuracy is not essential.
F8 / h7	H8 / f7	**CLOSE RUNNING FIT** - Accurate location at moderate speeds on accurate machines.
G7 / h6	H7 / g6	**SLIDING FIT** - Accurate location where components are intended to move and turn freely but not run freely.
H7 / h6	H7 / h6	**LOCATIONAL CLEARANCE FIT** - Snug fit for locating stationary components which need to be freely assembled and disassembled.
TRANSITION FITS		
K7 / h6	H7 / k6	**LOCATIONAL TRANSITION FIT** (Tap Fit) - Accurate location where assembly requires gentle persuasion.
N7 / h6	H7 / n6	**LOCATIONAL TRANSITION FIT** - More accurate location where assembly permits greater interference.
INTERFERENCE FITS		
P7 / h6	H7 / p6	**LOCATIONAL INTERFERENCE** - Prime accuracy of location where assembly requires alignment and rigidity.
S7 / h6	H7 / s6	**MEDIUM DRIVE FIT** (Press Fit) - For assembly of steel parts and shrink fits on light sections.
U7 / h6	H7 / u6	**FORCE FIT** (Press Fit) - For assembly of components where high pressures and stresses are permitted.

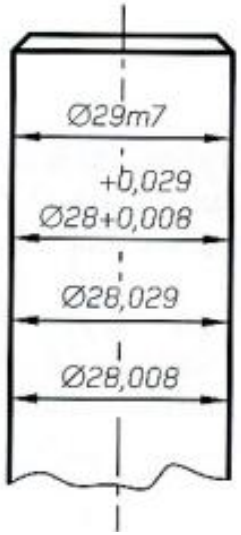
Note: See pages 56 and 57 for tolerances.

Designation of tolerances and fits in the drawing

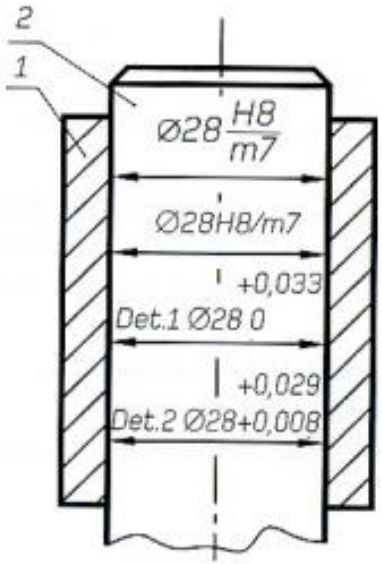
ISO



Hole

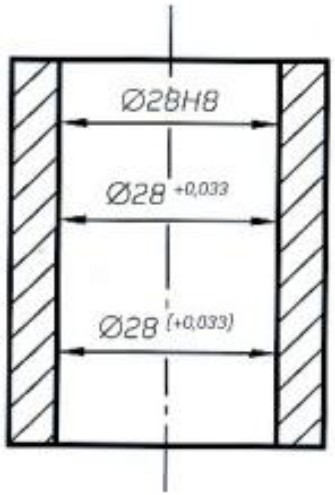


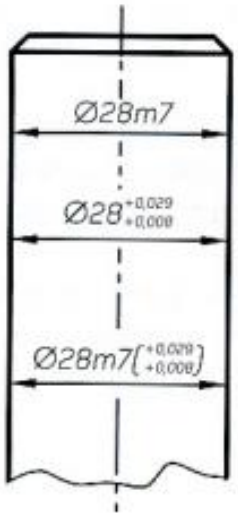
Shaft

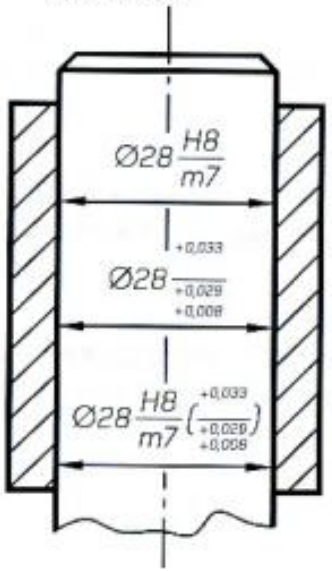


Fit

GOST







Thank you for attention