

Tolerance Standards Applicable to Powder Metallurgy Parts

ISO 286

ISO 2768

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<https://powdermetallurgy.com>

ISO 286

ISO 286, or IT grade, is an international standard that defines a system for tolerances and fits for cylindrical parts.

The table below presents some data for ISO 286 international tolerance grades.

Nominal size (mm)	IT01	IT0	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12	IT13	IT14	IT15	IT16
	μm												mm					
— to 3	0.3	0.5	0.8	1.2	2	3	4	6	10	14	25	40	60	0.1	0.14	0.25	0.4	0.6
>3 to 6	0.4	0.6	1	1.5	2.5	4	5	8	12	18	30	48	75	0.12	0.18	0.3	0.48	0.75
>6 to 10	0.4	0.6	1	1.5	2.5	4	6	9	15	22	36	58	90	0.15	0.22	0.36	0.58	0.9
>10 to 18	0.5	0.8	1.2	2	3	5	8	11	18	27	43	70	110	0.18	0.27	0.43	0.7	1.1
>18 to 30	0.6	1	1.5	2.5	4	6	9	13	21	33	52	84	130	0.21	0.33	0.52	0.84	1.3
>30 to 50	0.6	1	1.5	2.5	4	7	11	16	25	39	62	100	160	0.25	0.39	0.62	1	1.6
>50 to 80	0.8	1.2	2	3	5	8	13	19	30	46	74	120	190	0.3	0.46	0.74	1.2	1.9
>80 to 120	1	1.5	2.5	4	6	10	15	22	35	54	87	140	220	0.35	0.54	0.87	1.4	2.2
>120 to 180	1.2	2	3.5	5	8	12	18	25	40	63	100	160	250	0.4	0.63	1	1.6	2.5
>180 to 250	2	3	4.5	7	10	14	20	29	46	72	115	185	290	0.46	0.72	1.15	1.85	2.9
>250 to 315	2.5	4	6	8	12	16	23	32	52	81	130	210	320	0.52	0.81	1.3	2.1	3.2
>315 to 400	3	5	7	9	13	18	25	36	57	89	140	230	360	0.57	0.89	1.4	2.3	3.6
>400 to 500	4	6	8	10	15	20	27	40	63	97	155	250	400	0.63	0.97	1.55	2.5	4
>500 to 630	—	—	9	11	16	22	32	44	70	110	175	280	440	0.7	1.1	1.75	2.8	4.4
>630 to 800	—	—	10	13	18	25	36	50	80	125	200	320	500	0.8	1.25	2	3.2	5
>800 to	—	—	11	15	21	28	40	56	90	140	230	360	560	0.9	1.4	2.3	3.6	5.6

1000																		
>1000 to 1250	—	—	13	18	24	33	47	66	105	165	260	420	660	1.05	1.65	2.6	4.2	6.6
>1250 to 1600	—	—	15	21	29	39	55	78	125	195	310	500	780	1.25	1.95	3.1	5	7.8
>1600 to 2000	—	—	18	25	35	46	65	92	150	230	370	600	920	1.5	2.3	3.7	6	9.2
>2000 to 2500	—	—	22	30	41	55	78	110	175	280	440	700	1100	1.75	2.8	4.4	7	11
>2500 to 3150	—	—	26	36	50	68	96	135	210	330	540	860	1350	2.1	3.3	5.4	8.6	13.5

ISO 2768

What is ISO 2768?

ISO 2768 is an international standard that specifies general tolerances for linear and angular dimensions, as well as form and position tolerances on engineering drawings.

ISO 2768 – 1

ISO 2768 TI specifies Linear and Angular Dimensions, External Radius and Chamfer Heights.

The ISO 2768 standard divides 4 tolerance classes

- F: fine tolerance
- M: medium tolerance
- C: coarse tolerance
- V: very coarse tolerance

Linear Dimensions

Permissible deviations in mm for ranges in nominal lengths	f	m	c	v
0.5 – 3	±0.05	±0.10	±0.20	—
>3 – 6	±0.05	±0.10	±0.30	±0.50
>6 – 30	±0.10	±0.20	±0.50	±1.0
>30 – 120	±0.15	±0.30	±0.80	±1.5
>120 – 400	±0.20	±0.50	±1.20	±2.5
>400 – 1000	±0.30	±0.80	±2.00	±4.0
>1000 – 2000	±0.50	±1.20	±3.00	±6.0
>2000 – 4000	—	±2.00	±4.00	±8.0

External Radius and Chamfer Heights

Permissible deviations in mm for ranges in nominal lengths	f	m	c	v
0.5 – 3	±0.2	±0.2	±0.4	±0.4
>3 – 6	±0.5	±0.5	±1.0	±1.0
>6	±1.0	±1.0	±2.0	±2.0

Angular Dimensions

Permissible deviations in degrees and minutes for ranges in nominal lengths	f	m	c	v
up to 10	$\pm 1^\circ$	$\pm 1^\circ$	$\pm 1^\circ 30'$	$\pm 3^\circ$
> 10 – 50	$\pm 0^\circ 30'$	$\pm 0^\circ 30'$	$\pm 1^\circ$	$\pm 2^\circ$
> 50 – 120	$\pm 0^\circ 20'$	$\pm 0^\circ 20'$	$\pm 0^\circ 30'$	$\pm 1^\circ$
> 120 – 400	$\pm 0^\circ 10'$	$\pm 0^\circ 10'$	$\pm 0^\circ 15'$	$\pm 0^\circ 30'$
> 400	$\pm 0^\circ 5'$	$\pm 0^\circ 5'$	$\pm 0^\circ 10'$	$\pm 0^\circ 20'$

DIN ISO 2768 – 2

ISO 2768-2 defines general tolerances for linear and angular dimensions without individual tolerance indications in technical drawings for mechanical engineering. It is divided into three tolerance classes:

- H (High) – tightest
- K (Medium) – most commonly used
- L (Coarse) – for rougher tolerances

Straightness and Flatness

Ranges in nominal lengths in mm	f	m	c
up to 10	0.02	0.05	0.1
> 10 – 30	0.05	0.1	0.2
> 30 – 100	0.1	0.2	0.4
> 100 – 300	0.2	0.4	0.8
> 300-1000	0.3	0.6	1.2
> 1000-3000	0.4	0.8	1.6

Perpendicularity

Ranges in nominal lengths in mm	H	K	L
up to 100	0.2	0.4	0.6
> 100 – 300	0.3	0.6	1
> 300 – 1000	0.4	0.8	1.5
> 1000 – 3000	0.5	0.8	2

Symmetry

Ranges in nominal lengths in mm	H	K	L
up to 100	0.5	0.6	0.6
> 100 – 300	0.5	0.6	1
> 300 – 1000	0.5	0.8	1.5
> 1000 – 3000	0.5	1	2

Run-out

Class	H	K	L
Circular Run-Out (mm)	0.1	0.2	0.5