

CNC Machining Tolerance Quick Reference

ISO 286 IT grades, ISO 2768 general tolerances and surface roughness by process - the three tables we check most often when quoting. Print it, tape it next to your drawings.

1 Standard tolerances, ISO 286 - IT grades (um)

IT grade = how wide the tolerance band is for a given nominal size. Lower grade = tighter band. Rule of thumb: lathe/mill work lands at IT8-9, grinding reaches IT6-7, and every step tighter costs money.

Over - To (mm)	IT6	IT7	IT8	IT9	IT10	IT11	IT12
0 - 3	6	10	14	25	40	60	100
3 - 6	8	12	18	30	48	75	120
6 - 10	9	15	22	36	58	90	150
10 - 18	11	18	27	43	70	110	180
18 - 30	13	21	33	52	84	130	210
30 - 50	16	25	39	62	100	160	250
50 - 80	19	30	46	74	120	190	300
80 - 120	22	35	54	87	140	220	350
120 - 180	25	40	63	100	160	250	400
180 - 250	29	46	72	115	185	290	460
250 - 315	32	52	81	130	210	320	520
315 - 400	36	57	89	140	230	360	570
400 - 500	40	63	97	155	250	400	630

2 Which process holds which IT grade

Process	Typical IT	Typical surface roughness Ra (um)	Relative cost
Turning (CNC lathe)	IT8 - IT9	0.8 - 6.3	Low
Milling (3/5-axis)	IT8 - IT9	0.8 - 6.3	Low - mid
Reaming / boring	IT7 - IT8	0.8 - 3.2	Mid
Grinding (cyl/surface)	IT6 - IT7	0.16 - 1.6	High
Honing / lapping	IT5 - IT6	0.012 - 0.8	High
Wire EDM	IT7 - IT8	1.6 - 6.3	Mid - high
Drilling	IT10 - IT12	1.6 - 12.5	Low

3 General tolerances without individual markings, ISO 2768-m / -c / -f (mm)

If a drawing only says 'ISO 2768-m', every un-toleranced linear dimension gets these deviations. F = fine, M = medium (most common), C = coarse. Medium is our default unless the drawing says otherwise.

Nominal range (mm)	f (fine)	m (medium)	c (coarse)	v (very coarse)
0.5 - 3	+/- 0.05	+/- 0.1	+/- 0.2	+/- 0.5
3 - 6	+/- 0.05	+/- 0.1	+/- 0.3	+/- 0.5
6 - 30	+/- 0.1	+/- 0.2	+/- 0.5	+/- 1
30 - 120	+/- 0.15	+/- 0.3	+/- 0.8	+/- 1.5
120 - 400	+/- 0.2	+/- 0.5	+/- 1.2	+/- 2.5
400 - 1000	+/- 0.3	+/- 0.8	+/- 2	+/- 4
1000 - 2000	+/- 0.5	+/- 1.2	+/- 3	+/- 6

4 How we read tolerance callouts when quoting

- Holes and shafts

A fit like 25H7/g6 (ISO 286) means hole 25 +21/0 um, shaft 25 -7/-20 um. We confirm each fit dimension on CMM.

- Tighter is not always better

Every IT grade below 8 adds an operation - usually grinding. If the part does not rotate, IT9 may be all you need.

- GD&T vs +/-

Position and profile callouts control accumulation across features. Flat +/- tolerances on a chain of holes rarely reflect real assembly needs.

- Material matters

Thin-wall aluminium and stainless move differently after machining - we stress-relieve and semi-finish, then finish to size.

- Surface finish callouts

Ra 0.8 on a turned face is routine. Ra 0.4 and below usually means grinding or polishing - flag it for a quote check.

Need a tolerance-checked quote?

Send your drawing to quote@cnc.techfoor.com or use the form at cnc.techfoor.com/contact - DFM feedback within 24 h.