

Metric Thread Reference — Coarse and Fine Pitch, Tapping Drill, Clearance Holes (ISO 273) and Tensile Stress Area, M1.6 to M64

cBallast Technical Sourcing · ISO metric screw threads (M) and clearance holes · issued 2026-09-15 · cballast.com/documents/metric-thread-reference-pitch-tap-drill-clearance-hole-stress-area

One-page metric thread reference: coarse pitch and common fine pitches for M1.6 to M64 (ISO 261/262), tapping drill diameter for the coarse pitch ($d - P$), clearance-hole diameters for fine, medium and coarse fits (ISO 273), tensile stress area A_s for strength calculations, plus tolerance classes (6g/6H, 6e, 6az/6ax), thread engagement rules for steel, cast iron and aluminium, when to use fine pitch, ISO 1478 tapping-screw (ST) sizes, and the difference between G, R and NPT pipe threads.

Metric Thread Reference — Coarse and Fine Pitch, Tapping Drill, Clearance Holes (ISO 273) and Tensile Stress Area, M1.6 to M64

Catalogue data and standard-part designations in this guide follow the cBallast C-Parts range, supplied through Bufab (Värnamo, Sweden). Values are nominal reference data; confirm against the controlling standard revision before procurement.

ISO 261 defines the general-purpose metric screw thread series; ISO 262 selects the sizes for screws, bolts and nuts (the "preferred" sizes below). The coarse pitch is the default and is what a designation such as M12 means without a pitch; a fine thread is written with its pitch, M12 $\times$ 1.5. The tapping drill for a 75 % thread is nominal diameter minus pitch; clearance holes come in three series (fine H12, medium H13, coarse H14) per ISO 273. The tensile stress area A_s is the area used with the proof and tensile stresses of ISO 898-1 to get bolt loads.

Thread | Coarse pitch (mm) | Fine pitch(es) (mm) | Tap drill, coarse (mm) | Clearance hole fine / medium / coarse (mm) | A_s (mm²) |

M1.6	0.35 — 1.25 1.7 / 1.8 / 2.0 1.27
M2	0.4 — 1.6 2.2 / 2.4 / 2.6 2.07
M2.5	0.45 — 2.05 2.7 / 2.9 / 3.1 3.39
M3	0.5 — 2.5 3.2 / 3.4 / 3.6 5.03
M4	0.7 0.5 3.3 4.3 / 4.5 / 4.8 8.78
M5	0.8 0.5 4.2 5.3 / 5.5 / 5.8 14.2
M6	1.0 0.75 5.0 6.4 / 6.6 / 7.0 20.1
M8	1.25 1.0 6.8 8.4 / 9.0 / 10.0 36.6
M10	1.5 1.25, 1.0 8.5 10.5 / 11.0 / 12.0 58.0
M12	1.75 1.5, 1.25 10.2 13.0 / 13.5 / 14.5 84.3
M14	2.0 1.5 12.0 15.0 / 15.5 / 16.5 115
M16	2.0 1.5 14.0 17.0 / 17.5 / 18.5 157
M18	2.5 2.0, 1.5 15.5 19.0 / 20.0 / 21.0 192
M20	2.5 2.0, 1.5 17.5 21.0 / 22.0 / 24.0 245
M22	2.5 2.0, 1.5 19.5 23.0 / 24.0 / 26.0 303
M24	3.0 2.0 21.0 25.0 / 26.0 / 28.0 353
M27	3.0 2.0 24.0 28.0 / 30.0 / 32.0 459
M30	3.5 2.0 26.5 31.0 / 33.0 / 35.0 561
M33	3.5 2.0 29.5 34.0 / 36.0 / 38.0 694
M36	4.0 3.0 32.0 37.0 / 39.0 / 42.0 817
M39	4.0 3.0 35.0 40.0 / 42.0 / 45.0 976
M42	4.5 3.0 37.5 43.0 / 45.0 / 48.0 1121
M45	4.5 3.0 40.5 46.0 / 48.0 / 52.0 1306
M48	5.0 3.0 43.0 50.0 / 52.0 / 56.0 1473
M52	5.0 4.0 47.0 54.0 / 56.0 / 62.0 1758
M56	5.5 4.0 50.5 58.0 / 62.0 / 66.0 2030
M60	5.5 4.0 54.5 62.0 / 66.0 / 70.0 2362
M64	6.0 4.0 58.0 66.0 / 70.0 / 74.0 2676

Tolerance classes

6g / 6H — the default external / internal classes (ISO 965-1, medium tolerance, normal engagement length). 6g has a small allowance below nominal so that plating up to about 8 μ m still fits a 6H nut.

6e and 6f — larger external allowances for thicker coatings; 4h/4H and 5g/5H are tighter fits for precision parts.

6az / 6ax (ISO 10684) — nuts tapped oversize after hot-dip galvanising: 6AZ for the standard bolt with normal 6g thread, 6AX where the bolt is also galvanised on the thread.

Left-hand — written "M20-LH" (or "M20 $\times$ 1.5 LH"); used where rotation would loosen a right-hand thread (left-side pedals, some couplings, counter-rotating shafts).

Thread engagement length

A rule of thumb for a tapped hole so that the bolt breaks before the internal thread strips: steel ("e 8.8 mating material) about $1.0 \times d$; grey cast iron $1.3\text{--}1.5 \times d$; aluminium and copper alloys $2.0 \times d$ (or use threaded inserts); plastics $2.5 \times d$ or inserts. For a nut, the standard height (ISO 4032, "H 0.9 d) is designed to develop the bolt's proof load for the matching class. Thread protrusion beyond the nut should be at least one full pitch (commonly specified as 2–3 threads) so the incomplete lead thread of the bolt is not the load-bearing one.

When to use fine pitch

Thin-walled parts and pipe-like components where a coarse pitch would leave too few engaged threads.

Adjustment threads (fine pitch = finer movement per turn) and where vibration loosening is a concern (smaller helix angle).

Higher tensile stress area for the same nominal diameter (M12 $\times$ 1.5: 88.1 mm² vs 84.3 mm² coarse) — about 5 % more preload capacity.

Avoid fine pitch in soft materials, in dirty environments (cross-threading) and where standard nuts and taps must be stocked; coarse is the default for a reason.

Tapping-screw (ST) threads — ISO 1478

Sheet-metal (tapping) screws use the ST thread: ST2.2, ST2.9, ST3.5, ST4.2, ST4.8, ST5.5, ST6.3, ST8, ST9.5 (nominal diameter in mm, pitch 0.8 / 1.1 / 1.3 / 1.4 / 1.6 / 1.8 / 1.8 / 2.1 / 2.1 mm respectively). The number after the ST is the nominal diameter, not a gauge; ST4.2 is close to the old No. 8 screw. Pilot holes are typically $0.8 \times d$ in steel sheet and $0.85\text{--}0.9 \times d$ in aluminium; self-drilling screws (ISO 15480–15482) need no pilot hole up to the drill-point capacity marked on the screw.

Pipe threads are not metric threads

G (ISO 228-1) is a parallel 55° Whitworth-form thread that seals on a gasket or washer, not on the thread — used on plugs, gauges and hydraulic ports (G 1/4, G 1/2). R/Rc/Rp (ISO 7-1) is the tapered version that seals on the thread with a sealant (R = external taper, Rc = internal taper, Rp = internal parallel). NPT (ASME B1.20.1) is the American 60° tapered pipe thread — R and NPT have the same nominal sizes but different flank angles and pitches and must not be mixed. A "1/4 inch" pipe thread is 13.16 mm outside diameter, unrelated to a 1/4 inch bolt.

Browse the C-Parts range · Bufab · Related: fastener standards cross-reference · torque wrench calibration (ISO 6789) · ASTM A193 B7 stud bolts.

Frequently asked questions

What tap drill does an M2 thread need? 1.6 mm for the standard 0.4 mm coarse pitch — the table runs from M1.6 (1.25 mm) upward with fine pitches alongside. What clearance hole should I drill for a bolt? Three fits per size: for M2 — 2.2 mm close, 2.4 mm medium, 2.6 mm free; pick by alignment needs. What is the stress area of a thread? The effective cross-section carrying tension (between pitch and minor diameter): 2.07 mm² for M2, rising per the table — the figure preload and proof-load calculations use.

Part numbers and designations are those of the original manufacturers and are given for identification. cBallast is an independent supplier. © cBallast 2026 · cballast.com