

TECHNICAL GUIDE • QUICK REFERENCE

Bolt Sizes, Property Classes and Clearance Holes

A bolt's property class gives its strength: the first number $\times 100$ is the tensile strength in N/mm^2 , and the two numbers multiplied $\times 10$ give the yield. So 8.8 is 800 N/mm^2 tensile and 640 N/mm^2 yield. For structural steelwork, BS EN 1090-2 normal round holes are the bolt diameter plus 1mm for M12 and M14, plus 2mm for M16 to M24, and plus 3mm for M27 and larger.

SIZE	PITCH (MM)	STRESS AREA (MM^2)	ACROSS FLATS (MM)	NORMAL HOLE (MM)
M8	1.25	36.6	13	Not in table
M10	1.5	58.0	16	Not in table
M12	1.75	84.3	18	13
M16	2	157	24	18
M20	2.5	245	30	22
M24	3	353	36	26
M27	3	459	41	30
M30	3.5	561	46	33

Property classes (ISO 898-1)

CLASS	TENSILE R_m MIN (N/MM^2)	YIELD MIN (N/MM^2)	EUROCODE F_yB / F_uB (N/MM^2)
4.6	400	240 (ReL)	240 / 400
8.8 ($d \leq 16\text{mm}$)	800	640 (Rp0.2)	640 / 800
8.8 ($d > 16\text{mm}$)	830	660 (Rp0.2)	640 / 800
10.9	1040	940 (Rp0.2)	900 / 1000

Design to Eurocode 3 uses the nominal values from BS EN 1993-1-8 Table 3.1 in the last column. Nuts should be the matching class (8 for 8.8, 10 for 10.9).

Clearance holes (BS EN 1090-2)

- Normal round holes: M12 and M14 +1mm; M16 to M24 +2mm; M27 and larger +3mm.
- Hole tolerance $\pm 0.5\text{mm}$ unless the execution specification states otherwise.
- Oversize and slotted holes have their own clearances and reduce slip resistance. They must be specified by the designer.
- The table does not give clearances for M8 and M10. Use the execution specification.

Why there are no torque values

We did not find a reputable open source that gives torque values valid across UK structural work. Torque depends on the friction of the thread and nut face, which changes with coating (black, galvanised, zinc plated) and lubrication. Use the project specification. For preloaded assemblies, follow BS EN 1090-2 and BS EN 14399 with the manufacturer's k-class data.

Common questions

What does 8.8 mean on a bolt?

It is the property class to ISO 898-1. The first 8 means a nominal tensile strength of 800 N/mm². The second 8 means the yield is 80% of that, 640 N/mm². Above M16 the minimum tensile strength is 830 N/mm² and yield 660 N/mm².

What size hole for an M20 bolt?

22mm for a normal round hole in structural steelwork to BS EN 1090-2: the bolt diameter plus 2mm. The usual tolerance is ± 0.5 mm unless the execution specification says otherwise.

What torque should I use for an M16 8.8 bolt?

We do not publish torque values. The torque needed depends on friction, lubrication, coating and the joint, so a single figure can be badly wrong. Non-preloaded structural bolts are usually tightened snug tight. Preloaded bolts follow BS EN 1090-2 with the bolt maker's data. Use the value in your project specification.

Sources

1. ISO 898-1:2013 mechanical properties of fasteners: bolts, screws and studs, Table 3 (ISO)
2. BS EN 1993-1-8 Table 3.1: nominal yield and ultimate strengths of bolts (BSI)
3. BS EN 1090-2:2018+A1:2024 execution of steel structures, 6.6 holing: nominal clearances and ± 0.5 mm tolerance (summarised in SCI ED018) · <https://steel-sci.com/images/ed018-execution-of-stainless-steel-structures-6-feb-2014.pdf>
4. SteelConstruction.info GN 5.08: hole sizes and positions for preloaded bolts · <https://steelconstruction.info/upload/Uploads%20since%20nov25/GN-5-08.pdf>
5. ISO 4014 / ISO 4032 hexagon bolts and nuts: widths across flats; ISO 261/262 coarse thread pitches (ISO)

Full guide: www.koyda.com/guides/bolt-sizes-grades-and-holes/

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