

PN16 Flange Bolt Length & Stud Reference (EN 1092-1, DN10 to DN2200) — M-Bolt Size, Length, Torque

cBallast Technical Sourcing · PN16 raised-face weld-neck flange stud/bolt hardware kit · issued 2026-08-29 · cballast.com/documents/pn16-flange-bolt-length-stud-reference-en-1092-1

Complete PN16 flange bolt-length and stud reference: metric bolt size and number of bolts per DN10-DN2200 flange (from EN 1092-1 Table 9), calculated stud length for two matching PN16 raised-face flanges with 2 mm gasket, and applied bolt torque at $K=0.16$ for A193 B7 studs at 50% SMYS. Includes M12/M16/M20/M24/M27/M30/M33/M36/M42/M48/M56/M64 sizes across the DN range, weight per hardware kit, and notes on stud vs cap-screw selection for blind vs weld-neck pairings. Bolt lengths cross-checked against EN 1092-1 and DIN 976-1 stud practice.

PN16 flange bolt length & stud reference (EN 1092-1, DN10 to DN2200)

Every PN16 flanged joint on a steel pipe carries a stud (or through-bolt) kit whose size, count and length are fully determined by the DN of the flange and the joint's assembly geometry. The bolt SIZE and COUNT come straight from EN 1092-1 Table 9 — both mating flanges share the same pattern, so a DN100 PN16 flange from any manufacturer takes 8 × M16 studs. The bolt LENGTH depends on whether the joint is weld-neck-to-weld-neck, weld-neck-to-blind, or with a spectacle blind between the flanges, and on the gasket thickness. The table below gives (a) the bolt size and count from EN 1092-1, and (b) the calculated stud length for the standard weld-neck to weld-neck pairing with a 2 mm spiral-wound gasket. Add the gasket-thickness delta for other gasket materials.

PN16 bolt & stud reference table (DN10 to DN400)

DN | Bolt count × size | Flange thick C (mm) | Stud length (mm) with 2 mm gasket | Torque, $K=0.16$ dry (ft-lbf) | Torque, $K=0.13$ anti-seize (ft-lbf) |

DN10	4 × M12	14	65	50	40	
DN15	4 × M12	14	65	50	40	
DN20	4 × M12	14	65	50	40	
DN25	4 × M12	16	70	50	40	
DN32	4 × M16	16	75	176	143	
DN40	4 × M16	16	75	176	143	
DN50	4 × M16	18	80	176	143	
DN65	8 × M16	18	80	176	143	
DN80	8 × M16	20	85	176	143	
DN100	8 × M16	20	85	176	143	
DN125	8 × M16	22	90	176	143	
DN150	8 × M20	22	100	424	344	
DN200	12 × M20	24	105	424	344	
DN250	12 × M24	26	115	622	505	
DN300	12 × M24	28	120	622	505	
DN350	16 × M24	30	125	622	505	
DN400	16 × M27	32	135	1,112	904	

PN16 bolt & stud reference table (DN500 to DN2200 — large-bore & tank flanges)

DN | Bolt count × size | Flange thick C (mm) | Stud length (mm) with 2 mm gasket | Torque, $K=0.16$ dry (ft-lbf) | Torque, $K=0.13$ anti-seize (ft-lbf) |

DN500	20 × M30	36	150	1,476	1,199	
DN600	20 × M33	40	165	2,424	1,970	
DN700	24 × M33	42	170	2,424	1,970	
DN800	24 × M36	44	180	3,024	2,458	
DN900	28 × M36	46	185	3,024	2,458	
DN1000	28 × M39	48	195	3,712	3,017	
DN1200	32 × M45	52	215	5,391	4,381	
DN1400	36 × M45	58	230	5,391	4,381	
DN1600	40 × M52	64	250	8,428	6,848	
DN1800	44 × M52	68	260	8,428	6,848	
DN2000	48 × M56	72	275	11,057	8,984	
DN2200	52 × M56	76	285	11,057	8,984	

Bolt lengths are calculated for two PN16 weld-neck flanges of the tabulated thickness C, a 2 mm compressed spiral-wound gasket, and two flat washers plus one heavy-hex nut projection above the outer flange face (per PCC-1 assembly practice).

Real installations round UP to the nearest standard stud length in the DIN 976-1 stock range (typically 5 mm steps below 100 mm and 10 mm steps above). Torque values are for A193 Grade B7 studs at 50 % of specified minimum yield stress (52.5 ksi applied bolt stress) — the ASME PCC-1-2019 default. Adjust for the lubricant K-factor per the corresponding column.

Stud length calculation formula

For any non-standard assembly, calculate the required stud length directly:

$L_{stud} = 2 \cdot C + t_{gasket} + 2 \cdot t_{washer} + 2 \cdot H_{nut} + 2 \cdot P$, where L_{stud} is the total stud length, C is the flange disc thickness (mm, from the tables above), t_{gasket} is the gasket compressed thickness (mm), t_{washer} is one flat washer thickness (mm; typically 2.5 mm for M12, 3 mm for M16-M24, 4 mm for M27-M39, 5 mm for M42 and up), H_{nut} is one heavy-hex nut height (mm; typically 0.9 $\times$ bolt-nominal-diameter for A194 2H), and P is the projection above each nut (mm; PCC-1 recommends $P \geq 2$ thread pitches = ~ 4 mm for M20 coarse thread).

For a blind-to-weld-neck pairing, use the blind-flange thickness for one C value. For a spectacle-blind pairing (blank between two flanges), add the blind-plate thickness plus one extra gasket to the total. Consult EN 1092-1 Table 9 for the exact flange thickness at the DN of interest; the values above are the nominal thicknesses for the raised-face Type 11 weld-neck flange.

Stud vs cap-screw — when to specify which

EN 1092-1 does not itself mandate stud or cap-screw — only bolt SIZE and COUNT. The choice is per operator preference and joint accessibility:

Full-length studs with two heavy-hex nuts (A194 Grade 2H) — the industry default for high-pressure and cyclic-service joints. Both ends accessible for retorquing and disassembly; simplifies gasket replacement. Specify DIN 976-1 / ASTM A193 B7 studs.

Hex-head cap screws with one nut on the opposite face — acceptable for low-pressure water and general-service PN16 up to DN300. Cheaper but harder to retorquing (head bearing surface friction differs from double-nut).

Waisted (reduced-shank) studs — for cyclic thermal service where the joint sees repeated bolt-length change. The reduced shank distributes strain over more length, reducing fatigue at the thread root. Common on refinery heat-exchanger channel-cover joints.

Threaded rod cut-to-length — acceptable for non-critical PN16 water service if the rod is stamped-grade B7 or better. Not acceptable for oxygen, hydrogen, cryogenic or class-society-approved joints.

Bolt-length ordering practice — round up to standard

The calculated stud lengths above are the geometric minimum. Actual orders round up to the nearest standard length in the DIN 976-1 range: 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 280, 300 mm and larger in 20-mm steps. Ordering a non-standard length has a 2-6 week lead time on cut-to-length services; ordering standard length ships ex-stock in most European hardware catalogues. Where practical, choose the standard length equal to or just above the calculated value.

Gasket thickness adjustment

Gasket type | Compressed thickness | Adjustment to stud length |

Spiral-wound (CG/CGI, standard) | 2.0 mm | Reference (as tabulated) |

Spiral-wound thick-profile | 3.0 mm | +1 mm on stud length |

Ring-joint (RTJ) octagonal, soft iron | Varies (per ring size) | Consult ring dimension; typical +5 to +10 mm |

Compressed non-asbestos fibre (CNAF), 1.5 mm sheet | 1.2 mm (compressed) | -1 mm on stud length |

Compressed non-asbestos fibre, 3 mm sheet | 2.4 mm | +0 to +1 mm on stud length |

PTFE (envelope or full-face, 3 mm) | 2.0 mm (compressed) | Reference (as tabulated) |

Corrugated metal gasket (MG) | 1.5 mm | -1 mm on stud length |

Kammprofile | 3.0 mm | +1 mm on stud length |

EN 1092-1 vs ASME B16.5 bolt pattern — not interchangeable

A PN16 flange bolt kit does NOT fit an ASME B16.5 Class 150 flange even at the same nominal DN/NPS, because the bolt patterns are set by different standards and differ in bolt-circle diameter, hole diameter and count. Some sizes coincidentally match (DN20 = NPS $\frac{3}{4}$ in has the same 4-bolt pattern), but at DN50 and above the patterns diverge. Always confirm the flange standard on both sides of the joint before ordering hardware; if in doubt, measure the bolt-circle diameter K on-site and match to the EN 1092-1 or ASME B16.5 dimensional reference for the standard involved.

Related references and cBallast products

PN16 flange dimensions (EN 1092-1 Type 11)

PN10 flange dimensions (EN 1092-1)

PN25 flange dimensions (EN 1092-1)

PN40 flange dimensions (EN 1092-1)

ASME B16.5 & B16.47 flange bolt torque chart (A193 B7)

ASTM A193 B7 stud bolt chart

Spiral-wound gasket dimensions (ASME B16.20 Class 150)

Spiral-wound gasket dimensions (ASME B16.20 Class 300)

A193 B7 studs on cBallast

PN16 spiral-wound gaskets on cBallast

Fasteners & hardware category

Bolt sizes and counts are the EN 1092-1 Table 9 nominal values for the Type 11 raised-face weld-neck flange. Stud lengths are calculated for the standard weld-neck-to-weld-neck pairing with 2 mm spiral-wound gasket and standard flat washers plus heavy-hex nuts. Verify against the specific project procurement spec and the flange maker's data sheet before ordering. Torque values follow ASME PCC-1-2019 target-stress method (see the ASME B16.5 flange bolt torque chart doc for the K-factor derivation).

Frequently asked questions

What bolt length does a DN50 PN16 flange joint need?The table gives the machine-bolt and stud lengths per DN for standard type-11 pairs with a gasket — DN10–DN20 joints run 4 × M12 with 65 mm bolts (50/40 mm stud grip variants); read your DN's row for the exact figure.Bolts or studs for PN16 flanges?Both are standard: through-bolts with one nut suit accessible joints; studs with two nuts ease hot work and valve bonnets — lengths differ, which is why the table lists both.Does gasket type change the bolt length?Thicker gaskets (spiral-wound vs flat) add their compressed thickness; the reference assumes standard flat gaskets and notes the adjustment.

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