

GUIDE — Flange Joint Bolt Tightening

Tightening Procedure (star pattern)

1. Bring flanges into contact and install bolts; hand-tighten the nuts (finger tight).
2. Align the piping and adjust bolts to obtain a uniform gap between flange faces.
3. Tighten two opposite bolts to half of the final recommended torque for the installed pipe size.
4. Repeat step 3 for the bolts located approximately 90° from the first pair.
5. Continue tightening opposite pairs until all bolts are snug.
6. Repeat steps 3 to 5 until the final recommended torque is reached for all opposite pairs.

Table — Recommended Torque Values

Pipe Size (in/mm)	Bolt Dia. (in/mm)	Bolt Qty	½ Torque (ft·lbf / m·kgf)	Final Torque (ft·lbf / kgf·m)
2	5/8 / 1.59	4	6 / 1.82	12 / 1.62
3	5/8 / 1.59	4	8 / 2.43	16 / 2.21
4	5/8 / 1.59	8	6 / 1.82	12 / 1.62
6	3/4 / 1.90	8	9 / 2.74	18 / 2.48
8	3/4 / 1.90	8	12 / 3.65	24 / 3.31
10	7/8 / 2.14	12	13 / 3.96	26 / 3.59
12	7/8 / 2.14	12	18 / 5.48	36 / 4.98
14	1 / 2.54	12	25 / 7.62	50 / 6.91
16	1 / 2.54	16	23 / 7.01	46 / 6.35
18	1 1/8 / 2.85	16	25 / 7.62	50 / 6.91
20	1 1/8 / 2.85	20	23 / 7.01	46 / 6.35
24	1 1/4 / 3.17	20	34 / 10.36	68 / 9.40
30	1 1/4 / 3.17	28	32 / 9.75	64 / 8.84
36	1 1/2 / 3.81	32	44 / 13.41	88 / 12.16
42	1 1/2 / 3.81	36	50 / 15.24	100 / 13.82
48	1 1/2 / 3.81	44	49 / 14.93	98 / 13.54
60	1 3/4 / 4.44	52	69 / 21.03	138 / 19.07

Preventing Gasket/lining Over-Tightening

Use a steel stop ring or a non-compressible gasket to limit compression to 25% of the lining on the flange face (if the rubber-lined face serves as the gasket, stop the rubber about 1/32 in from the bolt hole).

Prefer a full-face, fully vulcanized gasket slightly softer than the flange face—mandatory with hard rubber.

Over-compression: rubber may crack/tear under dynamic loading if its elastic limits are exceeded.

When Tabulated Torques Become Misleading

- Improper tightening procedure.
- Warped/misaligned flanges → high bending stresses.
- Stretching and thinning of rubber folded across the full face.
- Irregular flange surface condition, bolt condition.
- Lubricants on rubber faces that alter torque readings.

Assembly Procedure — Rubber-Lined Flanges

- Use a star pattern; first bring all bolts to 'snug' contact.
- Apply 15 ft·lbf on each bolt in a criss-cross sequence.
- Re-check torque after 4–6 h; then again at 24 h to confirm 15 ft·lbf.
- In service: if a leak appears, tighten gradually and only as much as needed to stop it.

Gasket selection: thickness \approx lining ($\geq 1/8$ in), hardness \leq lining hardness, ideally \approx 60 Shore A (e.g., Neoprene, Butyl, EPDM). A release agent (e.g., Never-Seez) eases disassembly.

Recommendations by Lining Hardness

- 35–49 Shore A: use a full-face fiber gasket.
- 50–70 Shore A: the rubber lining face can serve as the gasket (no extra gasket required).
- ≥ 71 Shore A: use a 60 Shore A EPDM or Neoprene gasket.

Semi-hard/hard linings with tie-gum are not recommended on flange faces (risk of extrusion/cracking with over-tightening).

Installation Reminders

- Tighten to 15–20 ft·lbf in a star pattern; recheck at 4–6 h, then 24 h.
- Always plan for a 1/8 in rubber gasket for piping (except engineered exceptions).
- Use a release agent to facilitate disassembly.