



ANSI BOLT TIGHTENING SEQUENCE GUIDE

For proper ANSI flange bolt tightening, follow a sequential “star” or criss-cross pattern, tightening bolts in stages to ensure even gasket compression and a secure, leak-free connection.

General Principles

Sequential Tightening:

- Avoid tightening bolts to their final torque in a single pass, as this can cause uneven gasket compression and leaks.

Star/Criss-Cross Pattern:

- Tighten bolts in a star or criss-cross sequence to ensure even pressure distribution around the flange.
- Always start with a bolt and move across the bolt circle to tighten the next bolt. Continue this sequence in a systematic manner.

Staged Tightening:

- Tighten bolts in multiple passes, increasing the torque in gradual steps rather than applying full torque immediately.
- Some manufacturers recommend four passes instead of three to further improve bolt tension uniformity.

Final Torque:

- Ensure that the final torque is achieved according to the flange class, bolt size, material, and manufacturer recommendations.

Example Tightening Sequence (4, 8, 12, etc. Bolt Flanges)

Pass 1:

- Tighten all bolts to approximately 30% of the final torque value in a star/criss-cross pattern.

Pass 2:

- Tighten all bolts to approximately 60% of the final torque value in a star/criss-cross pattern.

Pass 3:

- Tighten all bolts to the final torque value (100%) in a star/criss-cross pattern.

Final Check (Optional Fourth Pass):

- After the final pass, recheck all bolts in a circular sequence (clockwise) to confirm uniform torque application.
- This step is crucial as some bolts may relax due to gasket compression.

Post-Torque Inspection (If Required):

- In certain applications (e.g., high-temperature or high-pressure systems), re-torquing may be necessary after initial system pressurization or following a waiting period (typically 4 to 24 hours).

Important Considerations

Bolt Size and Class:

- The final torque value is dependent on the bolt size, material, and flange class (ANSI 150, 300, etc.).

Torque Wrench Calibration:

- Always use a properly calibrated torque wrench to ensure accurate bolt tightening.
- Inspect and calibrate torque wrenches periodically according to industry standards.

Gasket Compression:

- Ensure that the gasket compresses evenly throughout the entire bolt circle to prevent leaks and premature failure.
- Check for proper gasket selection based on system conditions (pressure, temperature, and media compatibility).

Bolt Material:

- Consider the bolt material (carbon steel, stainless steel, alloy steel, etc.), as different materials require different torque values and may have different lubrication requirements.

Important Considerations Cont.

Lubrication:

- Lubricating bolt threads and nut surfaces reduces friction and ensures consistent clamping force.
- Anti-seize compounds should be used for stainless steel bolts to prevent galling.

Temperature Effects:

- Ensure that torque values account for operating temperatures, as thermal expansion and contraction can affect bolt preload.

Service Requirements:

- The method of flange tightening may be dependent on bolt size, system pressure rating, and service conditions.
- Some critical applications may require hydraulic tensioning or ultrasonic bolt stress verification instead of standard torqueing.

Resources

ANSI B16.5 Standard - Provides detailed information on::

- Flange dimensions
- Bolt sizes and torque recommendations
- Flange pressure classes
- Material specifications

For accurate torque values, always refer to the latest ANSI B16.5 standard or the specific flange manufacturer's recommendations.