

PVP2025

Pressure Vessels & Piping Conference 2025

July 20-25, 2025, Montreal, Quebec, Canada

HOW ACCURATE IS TORQUE? IMPROVING THE ACCURACY OF TORQUE BY LEVERAGING STUD MANUFACTURERS, TOOLING, AND PRACTICES

Barrett Meigs VSP Technologies Houston, TX	Scott Hamilton VSP Technologies Houston, TX	James Province Houston Fastener Houston, TX	Brad Tinney Birmingham Fastener Birmingham, AL
---	--	--	---

ABSTRACT

This paper investigates strategies for improving torque accuracy in bolted flange assemblies by evaluating the influence of stud manufacturers, tooling types, and bolting patterns. Torque application is the most common method for achieving axial load in bolted joints. Still, traditional approaches have exhibited a +/-30% accuracy, largely due to variations in friction and assembly practices.

To address these concerns, the authors conducted a series of tests using studs from three different manufacturers, applied with three types of torque tools (hydraulic, battery-powered, and manual wrenches) across three bolting patterns: the star, modified star, and quadrant. Nut factors were determined using Skidmore-Wilhelm test fixtures, and ultrasonic (UT) measurements were employed to assess actual bolt stress during flange assembly.

The results of over 1600 studs tested show that stud quality is critical in achieving more consistent torque accuracy, with significant variations in nut factors observed between manufacturers. Among the tooling tested, hydraulic wrenches provided the highest accuracy, followed by manual tools, while battery-powered tools excelled in speed. Bolting patterns did not show significant differences in load distribution, but the quadrant pattern offered advantages in assembly time. These findings emphasize the importance of high-quality fasteners and appropriate tooling in reducing torque variance, ultimately enhancing the reliability of flange joints.

