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ACCURACY OF ASME PCC-1 BOLTING PATTERNS

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ABSTRACT

This paper investigates the accuracy of various bolting patterns specified in ASME PCC-1, focusing on the Star, Modified Star, and Quadrant Cross patterns in bolted joint assembly. Bolting patterns are critical in distributing the load across flanged joints during assembly, and their performance must be validated against industry standards. Torque variation, commonly accepted as $\pm 30\%$, is a key factor in determining the effectiveness of these patterns in ensuring consistent and reliable joint assemblies. This research evaluates whether different bolting sequences affect overall joint integrity by conducting tests on 12-inch Class 300 flanges with 16 studs. Previous research by Hamilton (2018) indicated that the Modified Star Pattern offers significant time savings over the Star Pattern, primarily due to fewer required passes over each stud. This paper extends that work by comparing not only time savings but also the accuracy of bolt stress achieved. Hydraulic torque tools were used to conduct the tests, and ultrasonic measurements provided data on bolt stretch to calculate the achieved bolt stress.

The results show no significant difference in bolt stress accuracy between the patterns tested. Confidence intervals for bolt scatter were within acceptable ranges across different stud manufacturers, suggesting that end-users may opt for faster patterns like the Quadrant or Modified Star without compromising joint reliability. These findings highlight opportunities for improving assembly efficiency while maintaining safety and performance standards.

