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VARIABLES AFFECTING NUT FACTORS IN BOLTED FLANGE CONNECTIONS

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ABSTRACT

Bolted flange connections are heavily used within the chemical production/processing, transportation, marine, and power generation industries to contain processes while minimizing leaks. These leaks could cause unsafe working conditions, environmental hazards, and/or loss of product which, in turn, can cause fines or higher operating cost for plants. A way to deter this from happening is to correctly load the fasteners of the bolted flange connections to ensure the fasteners are properly stretched to apply an adequate contact stress to the gasket. Good understanding of how bolted flanged connections are optimally loaded limits leakage. When applying load via controlled torque to a fastener, the torsional energy applied is translated into a perpendicular force acting on the nut's face and threads that is mirrored on the other side of the fastener thus inducing the clamping force on the connection. To determine the clamping force generated from the applied torque, a typical torque equation is applied using an empirically derived composite friction term called the nut factor. The nut factor is a dimensionless constant that includes all of the friction effects in the torque-clamping force relationship. The friction occurs between the surfaces of bolt and nut threads and the faces of the nut and flange or washer. The higher the friction, the higher the nut factor resulting in a higher fastener torque to achieve the same clamping force load. This study looked at several variables that can cause changes in assembly nut factor magnitude including bolt grade, bolt load, lubrication, washer presence, and bolt diameter.

Keywords: Bolts, nuts, bolted connections, flanges, bolt friction, nut factor

