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Develop a method to estimate the tension of torque-shear high strength bolts

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A torque shear type high strength bolt is clamped as the pin-tail is broken by a specially designed electric wrench. However, it is uncertain that the tension is properly induced to the shank of a bolt when the pin-tail is removed from the bolt. In order to solve a problem involved in the uncertainty, this study was conducted to develop a method to identify the clamping force of high strength bolts quantitatively. The new method to identify the induced tension suggested in this study is to analyze electric energy applied to high strength bolts until the pin-tails are broken by diverse type of electric torque wrenches. Clamping force was measured and accumulated current data was obtained through various tests. Regression analysis of axial force as a function of accumulated currents was conducted with various values of bolt diameter and wrench rpm. The error between the values measured by an axial force meter and those estimated by a prototype of a measuring device developed in this study was 4% regardless of different parameter values. The device including algorithms to compute load based on electricity was found reliable enough to be applied to construction sites. The prototype embedded with the algorithms for different bolt diameters and electric wrench types was upgraded through three stages. The method to determine the clamping force of a high strength bolt is deemed reasonable because total energy applied to the clamping force of the bolt is the same as the electric energy accumulated by an electric torque wrench.

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