Fastener Engineering News You Can Use

FASTENER FORUM

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GENERAL FASTENERS COMPANY / MNP CORPORATION

Engineering & Testing Center

Product Development Support from Concept through Production

Find out why our experienced Application Engineers are relied on for cost-effective design support and data analysis. We are here to assist you!

For support on any fastened assembly: Contact your Applications Engineer, Send an email to **gfengineer@genfast.com or call 248-307-0565**

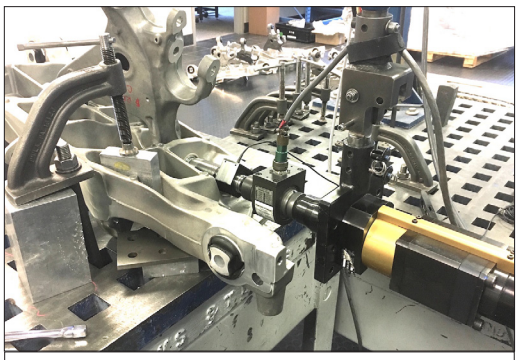
Pardon our Dust
Exciting changes are in the works!

Our Corporate Engineering Center is undergoing some changes in 2022! The General Fasteners Quality Assurance team is moving to the Madison Heights, Michigan location. This move will consolidate our Applications Engineering Center and Quality Assurance Lab into one comprehensive, market-leading, ***Technical Center of Excellence.***

Our Applications Engineers will have on-site access to dimensional and metallurgical expertise necessary for comprehensive product assembly analysis.

Construction is underway and the move will take place in early fall. We do not anticipate any interruption in Torque/Tension test services and are working to minimize the downtime of any mechanical test services.

Engineering & Testing Center in Madison Heights, Michigan



Torque/Tension test services

New location for General Fasteners Company headquarters

General Fasteners Company headquarters, previously located on Amrhein Road in Livonia, Michigan, has moved. The new address is:

General Fasteners Company
19500 Victor Parkway, Ste. 525
Livonia, MI 48152

Although the Quality Assurance team is moving to Madison Heights, you can still call this office at 734-452-2400 for Customer Service, Purchasing, Human Resources, and Accounts Payable.

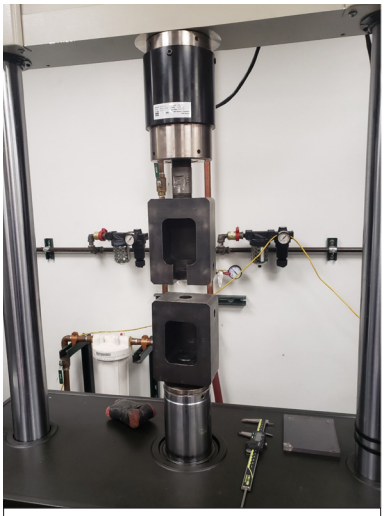
test tips

The Effects of Torsional Stress on Ultrasonic Calibrations

Ultrasonic Calibrations are routinely performed on fasteners at the General Fasteners/MNP Engineering Lab. During this calibration, either torsional or direct axial force is applied to the fastener, and the time-of-flight change of a sound wave is recorded and correlated to the externally measured clamp load.

Before we get into the details of calibration, let's review how ultrasonic clamp load measurement works. Like using sonar to measure ocean depth, we use the time-of-flight for the reflection of a sound wave to measure the length of a fastener. As we assemble the fastener, the length changes. (Remember, an assembled bolt behaves like a stretched spring!) Using system software, we can correlate the time-of-flight change to the load that is being applied to stretch the fastener, otherwise known as the clamp load. During calibration, we measure the clamp load with an external load cell. The method chosen for load application during calibration is critical for understanding sources of variation in actual ultrasonic clamp load measurement.

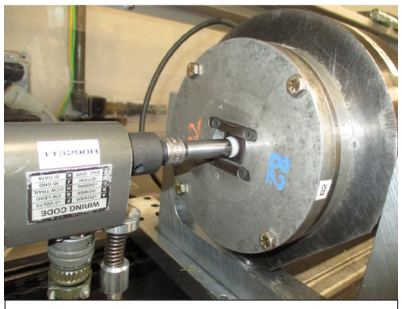
We have a choice of applying the axial force directly from a tensile test machine (Fig.1), or by tightening into a torque/tension system (Fig. 2). Both methods have their benefits and drawbacks. The key difference is the application of torsional stress.



(Fig. 1) Example of a tensile test frame. Note the actuator can be set up for a variety of grip lengths.

During loading in an axial load frame, only tensile stress is induced in the fastener. When

threaded fasteners are torque-tightened, both torsional and axial stress are applied. The torsional stress comes from twisting forces generated by the friction that must be overcome to turn the fastener. When torque is applied and torsional stress is introduced, the overall stress in the part increases, and the bolt will yield at a lower clamp load. (Fig. 3)



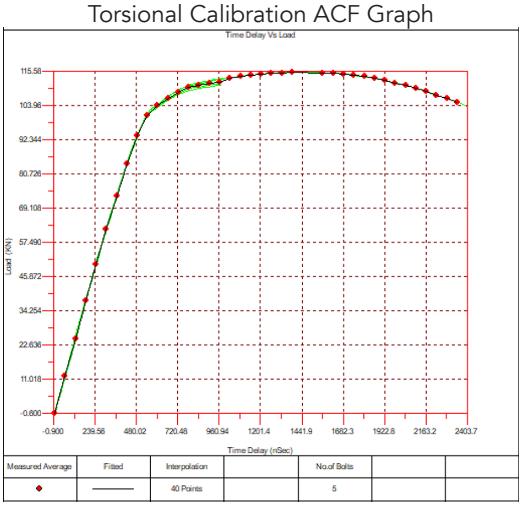
(Fig. 2) Example of a torsional calibration in a torque/tension load cell with multiple plates to simulate the application grip length.

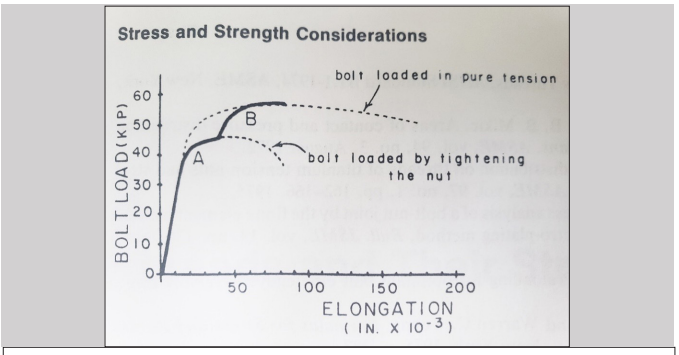
The <u>benefits of a torsional calibration</u> are:

- More accurate yield and max load values
- Ability to accurately simulate the behavior of the joint during tightening
- Ability to monitor thread and bearing surface friction

Ongoing studies and tests are being conducted to better understand the effects of torsional stress and thread friction on torsional ultrasonic calibration results, and how they compare to axial ultrasonic calibrations.

Torsional Calibration ACF Graph





(Fig. 3) (from Guide to Design Criteria for Bolted and Riveted Joints, Wiley, New York)

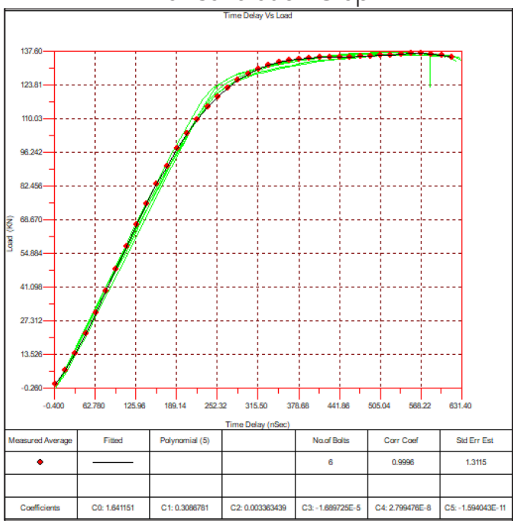
Load/Elongation graphs of bolts loaded in pure tension (solid and dashed line A) and by tightening the nut (solid and dashed line B).

After assembly, if the part is not tightened beyond its ultimate stress, the torsional stress will "relax", giving the bolt more axial load carrying capability. (Represented by the solid line that connects A and B.)

The <u>benefits of an axial calibration</u> (pure tension) are:

- Ability to test short grip ranges and smaller fasteners
- The resolution of the grip range is not limited by the availability of hard fixtures
- Best for static ultrasonic clamp load measurement (measurement taken after tightening)

Axial Calibration Graph



Your test lab should understand the effects of the ultrasonic load calibration method on the accuracy of your subsequent load measurements. Contact us with any inquiries.