



The torque wrench; possibly the most important tool in your toolbox

By Wes Fleming #87301

TORQUE – *noun* – a force that produces or tends to produce rotation; *also*, a measure of the effectiveness of such a force that consists of the product of the force and the perpendicular distance from the line of action of the force to the axis of rotation.

WRENCH – *noun* – a hand or power tool for twisting or turning a bolt until its head snaps off.

NOW THAT WE'VE

gotten that out of the way, let's combine those two words into what is one of the most important tool in any amateur or pro mechanic's kit: the torque wrench.

Conrad Bahr, born in 1872, found himself working for the New York City Water Department in 1918. One of the frustrating aspects of his job down in the steam tunnels and sewers under the city

was coming across fasteners that were too tight (making it difficult to loosen them) or too loose, which allowed leaks and other problems.

To address these issues, Bahr had an idea for a tool that allows anybody, no matter how strong they may be, to tighten a fastener to a specific point and no further, thus ensuring not only consistency across a specific application, but a level of precision that would allow engineers to more carefully design the systems used in everyday life. Bahr and George Pfeferle, an engineer and inventor with

the S.R. Dresser Manufacturing Company, filed a patent application for their "torque measuring wrench" in 1935.

The reasoning behind the torque wrench was, as Bahr wrote in his patent application, to prevent "the application of excessive strain to bolts" and to ensure proper tightening of fasteners because "The physical strength of operators varies, and the leverage at which their force is exerted may frequently vary and generally it has been

course) helps to keep my bike upright and handling in a predictable fashion through every mile.

Many of us think that we can estimate the proper torque with our hands, eyes and mind, somehow feeling the proper time to stop tightening a fastener. This feeling is so pervasive among motorcyclists that I did a semi-scientific study in 2015, engaging six friends and a professional motorcycle mechanic to test my hypothesis that when it

comes to tightening a fastener to a specific torque value, human beings are largely incapable of accurately determining when to stop turning the wrench. In my experiment, the participants were able to hit the proper torque—again, without using a torque wrench—in just 11 percent of the attempts. In 77 percent of the attempts, the fastener was under torqued, which won't result in a stuck or broken fastener, but could result in a fastener that gives way under load, especially on something as critical as the lug bolts for the rear wheel. Based on those results, my conclusion was that using a torque wrench every time on every critical fastener is of paramount importance.

Because our motorcycles use the metric system, torque values for them are listed in Newton-meters. A Newton-meter is the force of one Newton applied perpendicularly to the end of an arm one meter long. A Newton measures the force that gives a one-kilogram mass an acceleration of one meter per second per second; it's named after Isaac Newton, the father of physics and

found by experiment that it is practically impossible for an operator to judge with any reasonable degree of accuracy to what a degree of strain a bolt is tightened, or to secure any uniformity in the tightening of bolts of a series."

Being able to tighten a bolt or a nut to a specific level and do so consistently is a critical part of our lives as motorcyclists, and I think about that every time I tighten the five bolts that hold the rear wheel of my 2005 R 1200 GS to the rear wheel carrier with a force of 60 Newton-meters (44 foot-pounds). The simple process of accurately tightening those bolts (in a star pattern, of



calculus, in honor of his Second Law of Motion. The U.S. equivalent is pound-feet, but that seems awkward to say, so we often say foot-pounds.

Torque wrenches measure that force, and because it's rare to find a torque wrench with a one-meter-long shaft, they are calibrated to function at whatever length they are. Most of us who already own a torque wrench have a click micrometer wrench. It functions by way of a spring; the handle twists clockwise and counter clockwise to reach the desired torque setting, and when the twisting force reaches that point, it produces an audible and tactile "click" that lets the user know to stop twisting. Click micrometer torque wrenches are generally affordable and easy to manufacture, but they require that the tension be released after use or they could drift out of spec during storage.

Many professional mechanics use split-beam torque wrenches, primarily because they are faster to set and don't require the same tension release as the twist-handled click micrometer wrenches. You just release a small lock lever, turn the dial to the desired setting, close the lock lever and twist away. They produce an audible click, but not a tactile one you can feel through the handle. They are easier to use, but more difficult to manufacture and therefore carry a higher consumer cost. Typical brands like Snap-On can cost several hundreds of dollars, but the upside is you can get them used in pawn shops or on eBay and send them back to the manufacturer to have them recalibrated and therefore save considerably over the cost of buying a new one.

No matter the type of torque wrench you buy, commit to using it on every critical fastener you tighten. Look up the torque spec and stick to it; trust me when I say you and I do not know better than the engineers that designed the systems and specified the torque values. There's something both satisfying and comforting knowing you're rolling down the road on wheels that have their lug bolts, axle bolts, fork tube pinch bolts and brake caliper mounting bolts securely fastened and tightened to the proper torque values. ☺

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