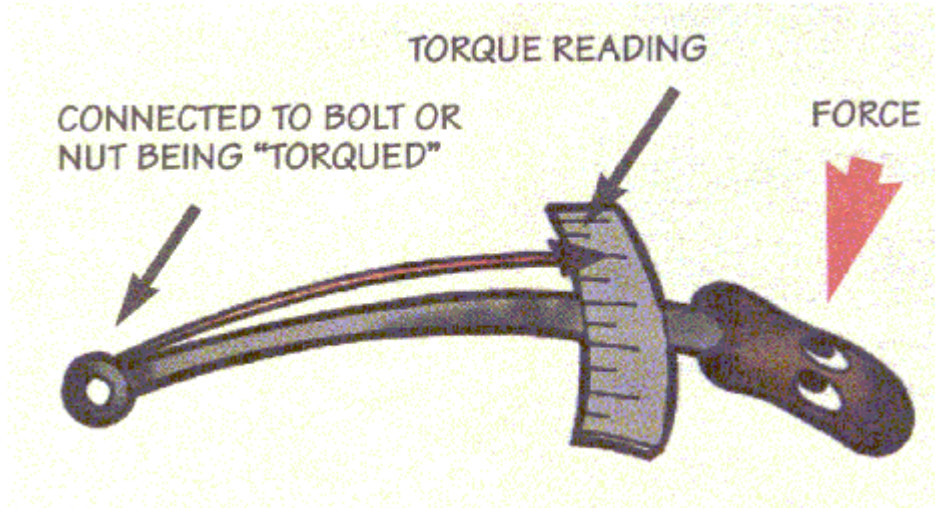


Torque Wrenches: Critical Tools For Critical Connections

Courtesy of EC&M



Critical bolt connections require you to use a torque wrench, and non-critical connections work better/last longer when you use one. Selecting, using, storing, and caring for torque wrenches properly can mean the difference between a safe installation and one that fails catastrophically.

How can you accurately measure the amount of torque you're applying to a bolt while tightening it? The obvious answer is to use a torque wrench. Yes, it's a basic connection tool, but you would be surprised at how little knowledge most have about this handy device. An understanding of torque wrench basics not only can reduce your tooling costs, but may also protect you from unannounced downtime, lost revenues, and major liability. When you're working on or installing equipment susceptible to damage because of too much bolt pressure or to vibration because of too little, you need to know how much torque you're applying.

Torque-sensing tools come in both powered and non-powered varieties. Powered torque tools normally operate on compressed air and generally are not suitable for field work. They also require significant maintenance and a higher degree of care than their non-powered counterparts. Among the manual torque-sensing tools are special wrenches and screwdrivers. The wrenches come in beam, gage, and breakaway configurations, while the screwdrivers come in gage and breakaway configurations. The same principles of selection and storage apply to all of them, and they are similar in their use.

The beam wrench is the simplest and least expensive of torque wrenches. As shown in this type of wrench reads the actual torque, but has no provision to prevent you from exceeding the desired torque. Also, you must look directly at the scale and pointer to get an accurate reading.



The click or breakaway wrench is another type of torque wrench. We use the term "breakaway" because at a predetermined torque value the handle breaks away, as though suddenly becoming disjointed (which it does). You adjust a knob, dial, or cuff until the display reads the desired torque value: That's your preset. This value tells you how much rotational force the wrench will support until it breaks away. For example, if you set the wrench for 55 ft-lbs, the handle will suddenly "fail" or "break away" when the wrench head sees 55 ft-lbs of force. The adjustment mechanism compresses a calibrated spring, which allows the handle either to stay locked or "break" at the desired torque.



The breakaway torque wrench comes in two varieties. One has a digital preset. It's a digital breakaway torque wrench (also known as a digital wrench). The other has an analog preset in the form of a vernier scale-it's a vernier breakaway torque wrench.

Of the two, the digital costs a little more and requires more care to prevent breakage. Both are



appropriate for electrical work. The digital product is rapidly replacing the vernier as the standard, but you're likely to use a vernier breakaway at some time. To select a torque wrench, you have to know the torque requirement of the fastener, which is usually a bolt. The required torque is a function of the bolt's material and diameter.

There's more to applying a torque wrench than many people think. Yes, you're turning against a spring to twist a piece of metal (the bolt) into a slightly different, but new, shape. But, there are some dynamics at work here, even though you don't see them. Here are some guidelines to follow.

Torque wrenches are designed to permit an operator to determine applied torque on bolts, nuts and other fasteners. They measure torque in ounce-inches, pound- inches and pound-feet, as well as metric measure. However, many manufacturers express torque in foot-pounds (rather than pound- feet) since this nomenclature is more familiar to the average tool user.

Metric measure torque wrenches are available in Newton meters (N.m), meter kilograms (mkg) and centimeter kilograms (cmkg) with N.m becoming the more modern, universally accepted calibration. Many torque wrenches are available with dual scales for conventional and metric measurement .

Proper Use of a Torque Wrench

- Use the torque wrench on "the rotating part" whenever possible. Normally, this is the nut, not the bolt. However, when the nut is inaccessible or the bolt is entering a threaded passage instead of a nut, you can tighten the bolt. Also, locking devices work best when you insert them under "the rotating part" instead of the other end.
- Always torque fasteners in steps. Related fasteners (those holding the same parts together) interact with each other, and you will not get true torque readings if you tighten them one at a time. You must torque all of them at each tightening stage.
 - o The normal stages for the above guidelines are 50%, 75%, and 100%. Some applications require five stages instead of three. Regardless of the tightening patterns, percentages, or sequences, the principle is the same: You don't slap a wrench on a fastener and take it from slack to full tightness in one step.
 - o A lot of this is common sense, too. You have to make sure your threads are clean. You have to use the right sized socket. If you're using a wrench, keep your handle perpendicular to the shaft of the fastener.
 - o If you're using a torque screwdriver, keep your handle parallel to the shaft of the fastener. You may already do this so you don't slip and hurt yourself, but this caution also increases accuracy.
 - o The time to release the pressure on the spring is when you've made your last torque check. It's always good to "exercise" the torque wrench before putting it away. Move the torque setting through its full range of motion, then set it back to zero. As with all metal tools, store the wrench in a dry place.
 - o Once you tighten a split-ring lock washer to its rated torque (indicated by a flattening of the lock washer), never reuse it. The reason why? On the second use, the lock washer has only 50% of its "memory," and therefore only 50% of its locking ability.
- Select a wrench that reads the desired torque at 50% to 70% of the wrench's capacity.
- Ratchet extensions do not affect the torque reading, because they do not extend the lever arm. However, they do increase the tendency to "slant" the wrench from the right angle needed for an accurate measurement. Always ensure your torque wrench is parallel to the plane the fastener sits in.
- "Crow's feet" and other extensions added between the wrench head and fastener cause the wrench to understate torque, because they add leverage on the end where you are measuring torque.
- It does not matter, from a torque measurement standpoint, where you grip the wrench. However, for safe use, grasp it by the handle grip.
- Never use a torque wrench that's been stored with the spring set above 10% of capacity.
- Always "exercise" a torque wrench through its full range of settings before using it.
- Always apply smooth, steady pressure to a torque wrench-do not jerk it.
- When a torque wrench breaks away, stop turning with it. Continuing to turn can damage the wrench and cause personal injury.
- Do not use a torque wrench for more than an hour without setting it to zero.
- Always store a torque wrench with the spring set at zero.

- Use a torque wrench as sparingly as possible; that is, don't use it instead of a regular wrench when you don't need to check torque.
- Always follow the instructions that come with the torque wrench.
- Know the location of a qualified service center to calibrate and lubricate your wrench.
- And remember, once you over torque a fastener or locking device, you have diminished its holding capacity forever.

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