Torque Wrench 101: Everything You Need To Know

THETORQUEHUB.COM

Torque Wrench 101: Everything You Need To Know

Whether you're a professional mechanic or just a handyman who can work on cars from their own garage, you're no stranger to having to do a repair or two. Depending on what you are working on, those repairs can be time consuming, tedious, and borderline annoying; and because making these repairs are probably at the bottom of list of things you want to do, you're probably going to find ways to cut a few corners here or there.

One of the most common corners that are cut is when you repurpose a tool and use it for something other than its intended use, like use a plain jane wrench to tighten bolts on your engine instead of a torque wrench.

Well, in theory it should work, right? A wrench is a wrench, after all. While you may want to pat yourself on the back for a job well done, that corner you cut by using the wrong wrench could cost you a lot more than your weekend because you could blow a gasket or something worse.

It doesn't matter if you're a handyman or a professional, if you have to tighten a bolt in a tight place and make sure it is really tight, a **regular wrench isn't going to cut it**. You're going to need something called a torque wrench to get the job done.

What Is A Torque Wrench?

You might be wondering what exactly is a torque wrench. Well, to understand what a torque wrench is, you need to know understand the torque definition. According to Dictonary.com:

Torque (tôrk/) 1. MECHANICS — a twisting force that tends to cause rotation.

A torque wrench is a tool that applies a specific amount of torque to a fastener (typically a nut or a bolt). These tools typically look like a socket wrench with mechanisms inside. The tool was invented back in 1918 by Conrad Bahr while he was working for the New York City Water Department. He designed the tool to prevent bolts from being overtightened on the water main and steam pipes while they were underground.

The torque wrench is used when it's important that screws and bolts are good and tight. The wrench allows the operator to measure the amount of pressure that is applied to the nut or bolt, ensuring that it is matched to the recommended specifications for the application.

This allows for **proper tension** and loading of all the parts involved. The torque wrench measures the torque as a proxy for the tension on a bolt, which could suffer from inaccuracy if the wrench isn't calibrated correctly.

How Does A Torque Wrench Work?

A torque wrench is a calibrated tool that is going to apply a certain amount of load to a nut or a bolt. The amount of torque that is applied depends on the mount of force that you apply to the tool's handle and the length of the wrench. To figure out the torque, the torque formula is: force x length = torque.

So, let's say your torque wrench is a foot long, and you apply 30 pounds of force to the handle. That means you are applying 30 ft/lbs of torque to the bolt or nut that you are tightening. If your wrench is twice as long (2 feet) and you're applying the same amount of force to the handle (30 pounds), you are going to be applying 60 ft/lbs of torque to the bolt or nut.

The torque wrench tells you how much force you're applying to the fastener because it uses a deflection beam or a spring mechanism that's been calibrated. The tool usually features **a scale or a display screen** and it shows you the load that's been applied.

These can be calibrated to read foot-pounds (ft/lbs), inch-pounds (in/lbs) or Newton -Meters (Nm). Usually when you're working a car, the you will be using a foot pound torque wrench is going to read either 200 ft/lbs or 250 ft/lbs. It could also read 150 or 200 Nm.

The torque values for a fastener that has a 1/2inch (or larger) wrench size head will be specified in ft/lbs (English) or Newton Meters (metric). Torque values for fasteners with less than 1/2inch wrench head size is going to be specified in/lbs instead.

Different Types Of Torque Wrenches

When it comes to trying to find a torque wrench, you'll see that there are nine different types that you could choose from.

Beam

The beam torque wrench is going to be the most basic type of torque wrenches and it was developed in the early late 1920s/early 1930s. It is made of two beams: the first beam acts as a handle for the tool, but also as a lever to apply the torque to the fastener.

The second beam is only attached to the wrench to the head of the wrench. This mean is going to act like the indicator beam. When the tool isn't being used, the beams are going to be parallel to one another. When torque is applied to the tool, the second beam (usually located on the top of the tool) will move, indicating the amount of torque being applied. This type of torque wrench is simple, inexpensive, and fairly accurate.

Deflecting Beam

This type of torque wrench was developed in 1948 and it uses the principle where torque is applied and uses a deflecting beam instead of a coil spring. This method was thought to help **prolong the accuracy** over the life of the wrench and have a hight safety marger with maximum loading.

It was also designed to provide the user with a more accurate and consistent readings with each wrench. The person using the wrench could hear the signal clicking, as well as see the visible indicator that tells you when the desired torque has been reached.

Slipper

The slipper torque wrench uses a roller ball and a cam mechanism. This is attached to the driving head and the roller pushes against the cam, thus locking it into place when a specific amount of force has been set. The force is provided by an adjustable spring, and if the amount of torque is too great, the wrench will slip and no torque will be applied to the bolt.

Click

The click type torque wrench is a more sophistocated and modern methof for presetting torque, thanks to a clutch mechanism. The common form of this will use a ball detent and a spring, where the spring is preloaded via an adjustable screw head, which is then calibrated in torque units.

The ball detent then transfers the force until the preset torque has been reached. When that occurs, the force then is exerted by the spring and the ball "clicks" out of the socket. This design gives you better precision and offers both an audible notification, but you can also feel it too. The wrench isn't going to start slipping until that torque has been reached—instead it will click and bend slight at the head.

The person using the wrench can continue applying force to the wrench, which could lead to over tightening.

No-Hub Wrench

This type of wrench is specialized for plumbers so they can tighten the clamping bands on a hubless soil pipe coupling. These wrenches are usually T-handled and the ratchet only works in **a single direction**.

Electronic Torque Wrench

An electronic torque wrench measure by using a strain gauge that is attached to a torsion rod. The signal that is generated by the transducer is then converted to the necessary unit of torque (either Newton Meter or Foot/Pound), and that measurement is then displayed on the digital LED or LCD display.

These electronic wrenches can usually store several measurements and they can be transferred to a computer, or directly to a printer.

Angle Torque Wrench

These work a lot like an electronic device, except the tightening angle from the threshold is also being measured. The angle is measured by a sensor or an electronic gyroscope. The measurement process enables joints that have already been tightened to be recognized.

These readings can be stored to memory on the device and statistucally evaluated. These wrenches can also determine the breakaway torque, prevailing torque, as well as the final torque required to finish the job.

Mechatronic Torque Wrench

The torque of these wrenches are measured using the same method as a click wrench, but the torque is measured the same way as an electronic torque wrench. This tool can give you both **electronic and mechanical measurements**, which can then be documented and shared through a wireless transmission.

Hydraulic Torque Wrench

These are to be used when you need superb accuracy when tightening large torques. These are generally used for aviation applications, assembling heavy machinery, and specialized tools. The general construction of these tools depend on the company making them and the torque requirement.

However, they usually all consist of at least one hydraulic cylinder that operates the drive head ratchet. As the cylinder extends, it pushes the drive head around and retracts freely over the teeth as it ratchets. This is repeated until the desired torque is met.

How To Use A Torque Wrench

To use a torque wrench properly, you first need to look up the torque specifications for the fastener you're going to be using. If you don't know, you don't want to guess the specs, always turn to your trusty service manual. If you don't have one, you can also check Google.

You're also going to want to make sure the specifications and the tightening procedure is most recent version. Sometimes companies will update or revise the torque specifications since the guide was originally published. These incorrect specifications could lead to problems later.

When you are loading onto the bolt, it will depend on how much friction is being generated by the threads on the fastener as it's being tightened. If you use oil or some kind of lubrication on the threads, it is going to **reduce the friction** and increase the amount of load that is being applied to the fastener.

This could lead to overloading the bolt, thus increasing the chances of the bolt stretching or breaking, or the gasket getting crushed. The only exception to this rule are going to be cylinder head bolts. These bolts are generally oiled lightly with 10W-30 motor oil. Anything else, it goes on dry.

When you're tightening a fastener, you'll want to use a regular wrench to tighten it to a snug fit. Then use your torque wrench to tighten it to the final specifications for said fastener.

Many beam style torque wrenches will feature a plastic handle on one end and there will be a pivot point inside that is going to let the handle to move or wiggle slightly. The idea behind this is to so your torque reading will be more accurate and if the plastic handle touches the bar, it is going to change the effective length of the arm, as well as the amount of torque that is applied to the nut or bolt.

This is going to throw the entire reading off slightly. To ensure you have an accurate reading, keep the handle as centered on the pivot while you're tightening the bolt or nut.

How To Calibrate A Torque Wrench

While professional calibration of your torque wrench is recommended, it may not always be within your means to do so. You can do it at home in your garage by following these steps:

- 1. Mark the back of the wrench on the center of the drive on the wrench
- 2. Measure down from that mark to the spot where your hand grips the wrench.
- 3. Measure the distance between these two marks.
- 4. Place the head of the wrench in a bench vise, making sure that no other part of the wrench is touching the vise.
- 5. Move the handle so that it is in a horizontal position.
- 6. Align the torque value to the distance from step 3 x 20 pounds.
- 7. Hang a 20 pound weight from the marks that you drew in step 1 and 3.
- 8. If you hear a clicking sound, lift the weight and slowly bring it toward the wrench head until the clicking stops.
- 9. Make a mark and repeat this step to make sure that spot is correct. If you don't hear a click at first, reposition the weight and move it away from the head until you do hear the click.
- 10. Measure the distance between the square head of the wrench and the click mark you made. This is going to be the other number you will need for your torque equation. To find the true amount of torque, you're going to multiply the distance by 20 pounds.
- 11. Use the Formula: Ta=Ts x(D1/D2). Put your numbers into this equation.
    - a. Ta = Torque Applied
    - b. Ts = Torque Setting
    - c. D1 = Distance found in Step 3
    - d. D2 = Distance found in Step 10

- 12. Check your math several times to ensure you can adjust your wrench correctly.

- 13. Remember, the distance that really matters is going to be the distance **from the drive head to the spot where you hung the weight**. It doesn't matter where you put your hand, it's more about ft/lbs. The feet is in reference to the moment arm and in this case, the moment arm is going to be the distance from the center of the drive head to where you put the weight.

As you can see, torque wrench calibration is complicated. For that reason, it's recommended that you do go to a professional just so you can be sure the wrench is calibrated correctly.

Common Myths About Torque Wrenches

Like most tools, people tend to be ill-informed about how to use the tool and what they are used for. In this section, we are going to dispel some of those myths.

Myth: You Cannot Trust A Torque Wrench Once It's Been Dropped.

Truth: With this myth, when a torque wrench has been dropped, it's calibration is going to be off. Accidents happen and it being dropped once or twice isn't going to ruin the calibration. Repeated accidents are another story. You can test the calibration by **checking it against another wrench**.

Torque a fastener with one wrench and torque another with the same calibration with the dropped wrench. If the second wrench brings the bolt down further before letting you know the same amount of torque has been applied, then you know it is off.

Myth: A Torque Wrench Should Always Be "Unloaded" After It's Been Used.

Truth: If you're using one of the mechanical clicking wrenches, this is true. A click wrench pushes a ball into the detent that is held in place by a spring. The wrench is usually adjusted by twisting the handle on the wrench, which compresses the spring and requires more torque to release the ball.

However, if the wrench is stored when it is "loaded," the pressure on the spring will become weaker over time. To keep the integrity of the wrench intact, always set the wrench to the lowest setting before you store it.

Myth: Digital Wrenches Aren't Quite As Accurate As Mechanical Wrench.

Truth: Not only is this myth wrong, it is actually quite the opposite, depending on the circumstances. Mechanical wrenches usually depend on either a ball detent or a beam that will flex as the torque is applied to the fastener.

Though these are simple mechanisms that are quite dependable, it doesn't mean they are more accurate. In fact, there are some electric torque wrenches that use all electrical components and they are incredibly accurate. They can read as little as **a tenth of a pound of torque**, whereas most mechanical wrenches can only read in 1 pound increments.

In some instances where you are relying on a beam or dial torque wrench, you have to make sure you're looking at it just right, or else you're going to experience user error due to "parallax distortion," which is just a way of saying that you're looking at the device wrong.

Wrapping Up: Torque Wrench 101

The torque wrench can prove to be a priceless tool for anyone who is mechanically inclined and works on devices where there are nuts, bolts, and screws that needs to be tightened to a specific torque. What once was designed to be used to prevent tightening bolts for the water department, these tools prove to be incredibly useful for mechanics, repairmen, and DIY'ers.

There are several different types of torque wrenches that you could choose from. Some of them are your traditional mechanical wrenches that use either a slipper mechanism, a ball detent mechanism, or a beam set up.

Some devices are fully electronical that can give you a reading all the way down to a tenth of a pound of force. With these electronic wrenches, the information can be stored on the device, on a computer, or transmitted wirelessly to other devices and computers for future reference.

By using a torque wrench to tighten your nuts and bolts, you are getting a tight seal, but you're ensuring that whatever you're working on isn't going to conk out because the bolts came loose due to vibration. Remember that it is important that you always **follow the torque specifications** on all your fasteners to avoid over (or under) tightening!