



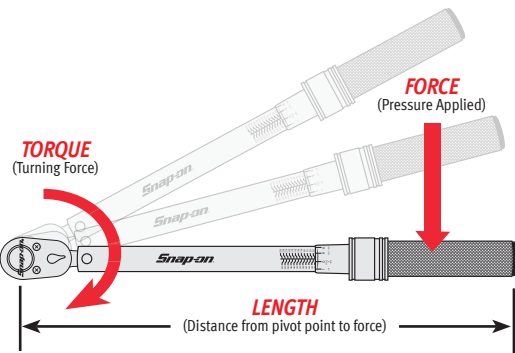
TORQUE WRENCH 101



WHAT IS TORQUE?

Torque is rotational or turning force.

Torque is measured in length and force: Length means distance from "center of drive" to "center of handle". Force means "pounds", "Newtons" etc.



HOW DO YOU CALCULATE TORQUE?

Torque = Length x Force

The standard torque formula used to calculate torque is: " $L \times F = T$ "

EXAMPLE: 2 ft. (length) x 30 lbs. (amount of force at center of handle) equals 60 ft. lbs. of torque (60 Ft. Lbs.)



WHAT IS A TORQUE INSTRUMENT?

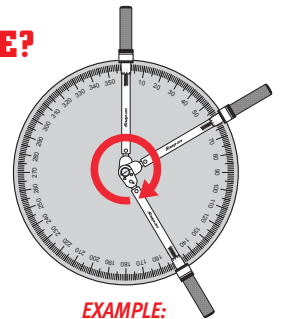
A torque instrument is any device that applies a pre-determined amount of torque to a fastener.

Whether it is mechanical or electronic in design, a torque instrument has some type of indicating device which lets the operator know when the correct torque has been achieved: "click" or "impulse-break" feel; sound; lights; gauge; or some combination of these.

WHAT IS TORQUE PLUS ANGLE?

Torque Plus Angle creates a more exact clamp load for torque-sensitive equipment.

Auto manufacturers and makers of other high performance equipment are increasingly specifying fasteners with a combination of torque value followed by additional tightening with "angle", or degrees of wrench turn. Manufacturers can calculate a more exact final "clamp load" for their applications, since "torque & angle" minimizes the impact of thread or under-head friction.



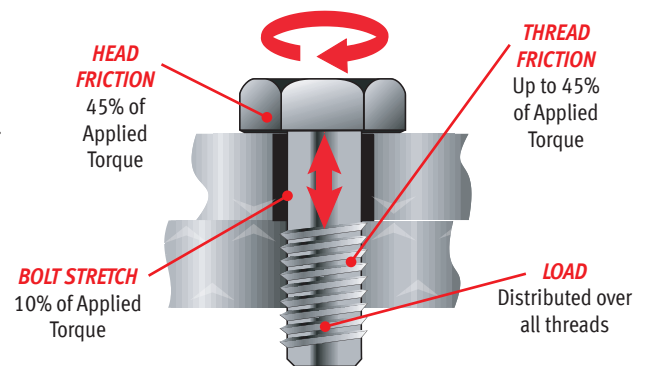
EXAMPLE:

Apply 80 ft. lbs. of torque, then apply 90 degrees of rotation

WHAT DOES TORQUE DO?

Torque creates a "Clamp Load" to join two pieces of material.

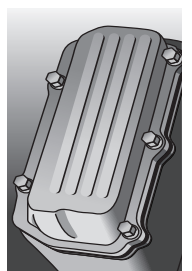
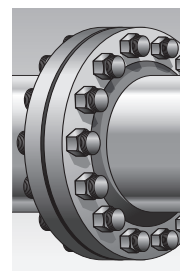
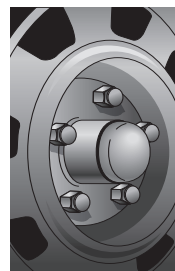
- Bolts (or threaded fasteners), are designed to create clamping force, also called "clamp load".
- When torque is applied to a threaded fastener, it draws together the joint, (two pieces of material).
- As additional torque is applied to the fastener, the joint is pulled together creating a clamp load as the fastener begins the stretching process. It's this fastener stretch that creates and maintains clamping force, like a stretched bungee cord maintaining tension.
- The actual amount of clamp load is determined by several factors:
 - The amount of torque applied to the fastener.
 - The material and grade of the fastener.
 - The external friction on the joint – friction under the fastener head, and friction between the threads of the fastener and material it's connected to.



WHY IS APPLYING PROPER TORQUE IMPORTANT?

Creating proper Clamp Load prevents damage and equipment failures.

- Safety & Performance: Applying accurate torque is critical to assembly applications, engines and precision equipment.
- Creating a proper clamp load is the main objective when applying torque to a fastener. Engine cylinder heads, pipe coupling, wheels, all need to be "clamped" uniformly to specific torque values.
- There are three main factors that affect the correct application of torque: (1) Condition of components, (2) Accuracy of torque instrument, (3) Properly applied torque values.
- Applying torque incorrectly can lead to stripped threads, premature loosening or broken fasteners that can cause catastrophic failure. Leaking joints may cause engine or equipment failures.



TORQUE TERMS

A.S.M.E. – American Society of Mechanical Engineers, known for setting codes and standards for mechanical devices, including torque.

CW (Clockwise) / CCW (Counter Clockwise) – Used in all accuracy statements & Certs. Some tools have different accuracy depending on direction of use.

Calibration – Adjusting a torque tool or a torque transducer in order to bring it back within spec, which is performed on a calibration system such as the Snap-on TTC2200 or TTC2800. Typical calibration accuracy is $\pm 4\%$ CW of indicated value.

Certification – A form which lists the results of the calibration test. Almost all Snap-on tools are supplied with a N.I.S.T.

traceable cert. Snap-on also conforms to the ISO 6789, which is the standard set forth by the International Organization for Standardization (ISO) for torque measurement.

Cycling – For mechanical torque wrenches, to “exercise” the wrench for use. With a new wrench, and for first use of the day, set the wrench at the desired

torque value and pull for several clicks on a stationary fastener. This exercises the internal wrench mechanism and ensures smooth and accurate operation.

ISO 17025 – A laboratory accreditation standard. Most all torque wrenches (including Snap-on) do not come with ISO 17025 accredited certifications. But torque wrenches can receive accredited

TYPES OF *Snap-on* TORQUE INSTRUMENTS



Micrometer (Click Type)

Also referred to as a “Click” wrench, these are the most popular type of mechanical torque wrench. An internal spring is tightened by turning the handle. The spring pushes against a block, and both are calibrated so the block pivots when the torque setting has been reached. This quick pivoting motion creates the “click” sound. When the force at the handle is released, the block resets to its original position and is ready for the next torque application.

OPERATION

Set the desired torque value by pulling up on the lock ring while turning the handle. Always approach torque setting from a lower setting. The tube displays the major torque values, and the lock ring has the minor torque values. Slowly apply force at the handle until the “click” is felt or heard, and then release force.

ADVANTAGES

Most common type of torque wrench. “Click” felt at the handle indicates torque value reached. Rugged, durable legacy design.

LIMITATIONS

After day’s use, internal spring pressure must be released by unwinding the handle.

APPLICATIONS

Highly versatile: any general purpose torque applications: auto engine, machine maintenance, construction, oil field, compressor/generator, etc.



Electronic Torque Wrenches

THE MOST VERSATILE AND ACCURATE TORQUE WRENCH

Operates by means of a internal electronic strain gage with digital readout. Torque value setting can be heard (beep), felt (vibration), and seen (digital screen and lights). TechAngle and Control Tech models enable fast and easy application of desired torque, plus additional angle application through internal gyro chip which measures up to 360 degrees of rotation.

OPERATION

Turn on using the power button, set the units of torque by pressing the “U” button, and set the desired torque using the “+ or -” keys.

ADVANTAGES

Highly accurate; easy to use; at least 3 units of measure (ft. lbs., in. lbs., Nm); some models measure angle. Faster for most applications. Peak hold mode measures breakaway torque.

LIMITATIONS

More susceptible to damage if exposed to moisture.

APPLICATIONS

May be used virtually anywhere a click wrench is used. Every customer who is using click wrenches should experience the advantages and benefits of an electronic torque wrench.



Mechanical Dial

Uses a fixed, non-ratcheting square drive. Available in single scale and dual scale models. As force is applied at the handle, an internal beam flexes against a precision movement which rotates a needle pointing to the torque value against the dial scale. A memory needle indicates the highest torque value achieved.

OPERATION

Reset the orange pointer to zero by grasping the black bezel ring and turning. Turn the blue needle until it contacts, but does not move, the main orange pointer needle. Pull to desired torque and release. Needle must NEVER exceed 180 degrees of movement.

ADVANTAGES

Very accurate, user can visually track the approaching and achieved torque value on scale. You can also observe the “effect” of torque on the work piece.

LIMITATIONS

Fixed (non-ratcheting) head. Subject to viewing angle (parallax) error.

APPLICATIONS

Wherever the “effect” of torque needs to be observed. Recommended for use with all torque multipliers. Lower cost substitute for electronic wrenches when high accuracy is required.



Split Beam (Quick Adjust)

Also called a “Quick Adjust” wrench, this type is most popular for automotive tire and wheel installation and other heavy use environments. Torque value is set by turning a small knob on the side of the wrench. Two internal arms (the “split beam”) bend when force is applied at the handle, and a trigger device reacts when the set torque is reached, causing a “click” that can be felt and heard.

OPERATION

Set the desired torque value by turning the knob on the side of the wrench. Always approach torque setting from a lower setting. Apply force at the handle until the “click” is felt or heard, and then release force.

ADVANTAGES

Fast to set; no unwinding after use. “Click” felt in handle indicates torque value. One way ratchet eliminates damage due to misuse as a breaker bar.

LIMITATIONS

One way ratchet does not allow counterclockwise torque (this is a very rare need). Less fine adjustment vs. micrometer.

APPLICATIONS

Brake, tire and wheel shops; any general purpose mechanical applications.

certification for an additional fee (range of \$50-\$200 depending on tool) if the end-user desires.

N.I.S.T. – National Institute of Standards and Technology is a non-regulatory agency of the US Department of Commerce. They are the federal agency that sets standards for all weights and measures in the U.S. All Snap-on torque products are calibrated on

testers calibrated with weights and arms that are all traceable back to N.I.S.T.

Newton – A common unit of weight used for torque from the SI system (not metric). Equivalent to 102 grams / 0.273 lbs.

Rolling Torque – Measuring the prevailing torque, or resistance, of a rotating shaft.

Strain Gage – Electronic device used to measure the bend (turn resistance) of an object. The measured strain is then translated into torque.

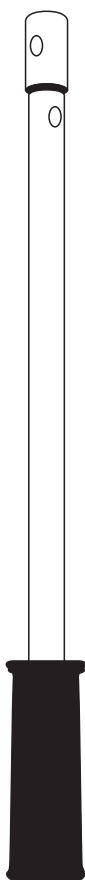
Testing – Determines the accuracy of the tool. It does not include adjusting the tool. Commonly called “as found” data.

Torque Then Angle – Tightening the

fastener to a specific torque, then further turning a specific number of degrees (angle) of rotation. Example: 70 ft. lbs. + 40 degrees.

Torque to Yield (TTY) – Same method as T&A except utilizes “single use” or “TTY” fasteners (special one-time-use fasteners which are stretched into their yield zone and cannot be used again).

TYPES OF **Snap-on** TORQUE INSTRUMENTS



Interchangeable Head

Micrometer style allow various head designs and sizes to be used in the same wrench body. Available in preset, single setting design and adjustable type.

OPERATION

Set the desired torque value by pulling up on the lock ring while turning the handle. Always approach torque setting from a lower setting. The tube displays the major torque values, and the lock ring has the minor torque values. Apply force at the handle until the “click” is felt or heard, and then release force.

ADVANTAGES

Versatility of head style to meet application. Rugged, durable design.

LIMITATIONS

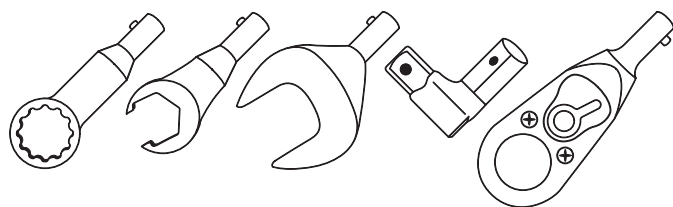
Adaptors must be purchased separately.

APPLICATIONS

General purpose torque applications: auto engine, machine maintenance, construction, oil field, compressor/generator, etc. Applications that require custom drivers. Applications requiring more than one head style.

WRENCH HEADS

Interchangeable head torque wrenches accept J, Y, X, or Z interchangeable heads. Receiver on handle assembly must be the same as the head. Example: “Y” shank tools only work with “Y” shank heads. “A” suffix are the same length when shank size is the same.

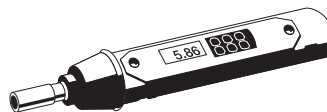


Shank Sizes

J=0.425"
Y=0.560"
X=0.735"
Z=0.990"

Dual Pin

The new dual pin (DP) heads ONLY fit DP handles.



Electronic Torque Screwdrivers

Highly accurate torque instruments for extremely low torque applications. These tools utilize electronic strain gauges to accurately measure applied torque while providing the operator with real-time feedback, by means of a digital readout and led light/color progression, during the torque event. Many models also utilize an internal gyro to accurately measure degrees of rotation as well.

OPERATION

Turn on using the power button, set the units of torque by pressing the “U” button, and set the desired torque using the up and down arrows. Can be used with optional T-handle for extra leverage.

ADVANTAGES

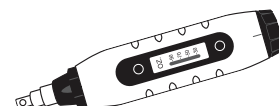
Highly accurate and easy to use. Units of measure can be easily changed. Torque data can be stored for QC purposes. Certain smart versions can be used for error proofing.

LIMITATIONS

More susceptible to damage if exposed to moisture.

APPLICATIONS

TPMS sensors. Electronics repair and other light equipment assembly. Any application that requires 80 in-lbs or less torque.



Torque Drivers

Used for applying torque in low torque applications, such as electronic assembly, manufacturing, medical devices, etc. Available as torque limiting drivers (preset or adjustable) as well as screwdrivers (preset or adjustable) and specialty TPMS screwdrivers for industries where highly accurate low torque is critical.

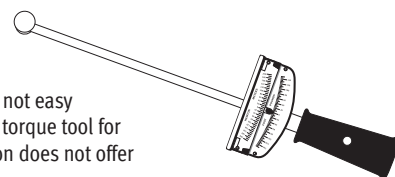


Handheld Systems

Highest versatility in applying torque, allowing use with socket extensions, universal joints and ratcheting drivers. VERSATORQ2 is also a data acquisition system that can store and download up to 3500 torque values. Intrinsically safe for hazardous environments.

Beam Wrench

The beam wrench, invented in the early 1900's, is a very simple design, not easy to read, and not considered a precise torque tool for today's standards of accuracy. Snap-on does not offer this type of wrench.



Using these questions and scripts can help you identify torque wrench sales opportunities with your customers:

REMEMBER, PROPER TORQUE WRENCH USE IS CRITICAL TO SAFE AND RELIABLE PERFORMANCE OF YOUR CUSTOMER'S EQUIPMENT AND ASSEMBLY ACTIVITIES

– IT'S WHY THOSE MANUFACTURERS CREATED THE TORQUE SPECIFICATIONS IN THE FIRST PLACE. YOU PROVIDE A VALUABLE SERVICE BY HELPING YOUR CUSTOMERS REVIEW THEIR TORQUE APPLICATION NEEDS AND OFFERING THEM WORLD CLASS SNAP-ON TORQUE PRODUCTS.

- What types of fasteners do you use here?
- Don't the product or equipment manufacturers provide torque specifications for those fasteners? Many other similar facilities like yours use torque to ensure proper assembly.
- Do you measure the torque (with a torque wrench) during assembly?
- How do you know you're meeting the specifications?
 - If not, could that be a safety issue..... a product performance or reliability issue.... a liability issue?
 - Many companies are learning that "just making it tight" is not good enough, or just not safe.
- Customers experiencing fastener or component breakage, parts coming off, leakage, thread stripping, crushed gaskets, pinched connectors are all signs that improper torque is being applied.
- Often, simply the introduction of a torque wrench in a previously hand tightened application will solve many problems.
- How many torque wrenches are currently used in your facility?
 - (What departments use them, and what are the applications they are used for? (i.e. used in production, machine maintenance, field service, etc.)
- How old are the torque wrenches in use?
- Who oversees calibrating and/or repairing torque wrenches here?
 - (This is a good person to meet with as they can be strong influencers on the brand of wrenches purchased, and issues to be addressed).
- Is calibration done in-house, or sent outside?
 - If calibration is done in-house, this confirms they are heavy users of torque wrenches and could open other sales opportunities for a new or upgraded calibration system.
 - If not done in-house, but they use approximately 25 or more torque wrenches, then this also opens a sales opportunity to help them save time and money with the purchase of their own Snap-on calibration system. You can also offer them calibration and repair training (for additional cost).

CONVERSIONS & ABBREVIATIONS

foot pound = **ft.lb.**
 inch pound = **in.lb.**
 Newton meter = **Nm**
 deciNewton meter = **dNm**

centiNewton meter = **cNm**
 kilogram = **kg**
 centimeter kilogram = **cmk**

PROPER WRENCH SELECTION

Proper wrench selection is just as important as the wrench itself.

The more critical the torque requirement, the more accurate the wrench should be. Choose a torque wrench that has roughly twice the capacity of the torque being applied. For example, for an application of 100 ft.lbs., choose a 200 ft.lbs. wrench. If a 200 ft.lbs. wrench is not available, then a 250 ft.lbs. would work as well. The "sweet spot" of a torque wrench is between 40% and 80% of the maximum scale (for a 250 ft. lb. wrench, between 100 and 200 ft. lbs).

AVOID SELLING A WRENCH THAT WILL BE USED AT THE BOTTOM OF THE SCALE AND ALSO AT THE TOP OF THE SCALE. MECHANICAL TORQUE WRENCHES ARE TYPICALLY CALIBRATED FROM 20% TO 100% OF FULL SCALE.

PROPER TORQUE WRENCH USAGE

- Always hold handle in the center of the grip.
- Approach final torque slowly and evenly.
- A wrench's "sweet spot" is between 40-80% of maximum capacity.
- The wrench selected should be scaled in the same torque units that are specified.
- Wrench should be tested if dropped.
- Should never be used in a "breakaway" situation.
- Most types should be "cycled" before use.
- Should never be used in excess of its capacity.
- Calibrate once per year or every 5000 cycles, per ASME.

TORQUE WRENCH CARE

- Always wind down Micrometer wrenches to lowest setting for storage
- Wipe clean with soft cloth
- Store in its case with desiccant pack and manual
- Keep in a cool, dry place

CALIBRATION

Proper care and maintenance is recommended to ensure accurate performance.

Torque wrenches should be calibrated if dropped or abused, and ASME recommends calibration at least every 5,000 cycles or once per year, whichever comes first. Contact your Snap-on representative for calibration assistance.

Convert		Multiply		To
Ft. lbs.	x	1.356	=	Nm
Ft. lbs.	x	12	=	in. lbs.
In. lbs.	x	0.08333	=	ft. lbs.
In. lbs.	x	16	=	in. ozs.
Nm	x	0.7376	=	ft. lbs.
Nm	x	8.851	=	in. lbs.

TORQUE HELP LINE - WHO YOU GONNA CALL?

For General Inquires and Product Availability in North America: 877-762-7664

Technical / Training:

Gary Fitzhugh
800-525-6319 ext. 270
 gary.j.fitzhugh@snapon.com

Technical:

Duane Vallejos
800-525-6319 ext. 278
 duane.a.vallejos@snapon.com

SNAP-ON REPAIR CENTERS:

Eastern Repair Center (PA):

800-848-5067
 easternrepairinquiries@snapon.com

Western Repair Center (NV):

888-762-7972
 westernrepairinquiries@snapon.com

Northern Repair Center (IL):

877-777-4412
 northernrepairinquiries@snapon.com

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