

Guide for Selecting a Precision Torque Wrench

CLICK VS CAM-OVER TECHNOLOGY

AUTHORED BY

Damian Valdiviezo
Product Manager, Mountz Torque

WHITE PAPER SYNOPSIS

A torque wrench is built with a mechanism to limit the amount of torque an operator applies. The type of torque limiting mechanism is what separates different torque wrench technology. Learn how susceptible the click wrench mechanism is to torque failures and how a cam-over wrench mechanism safeguards against fastening failures and over-torque occurrences.

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In any application where the fastening of bolts and screws is critical—which includes the aerospace, automotive, medical device, electronics, and packaging industries, to name a few—businesses depend on torque tools to deliver the precise amount of force necessary to hold a fastener in place indefinitely.

Whether you're in manufacturing or maintenance, the most important attributes your torque wrench should have are quality and reliability. And the best way to be sure the wrench you're investing in will hold up on the line is to choose the right torque wrench technology.

Applying the right amount of torque to each fastener maximizes its holding potential. When too much torque is applied, it can strip or crimp threads, damage the fastener, or harm the assembly. Under-tightening can cause a screw or bolt to work free under stress, vibration, and fall out.

What is Torque?

Torque is a “turning” or “twisting” force and differs from tension, which is created by a straight pull. However, we use torque to create tension (see Figure 1).

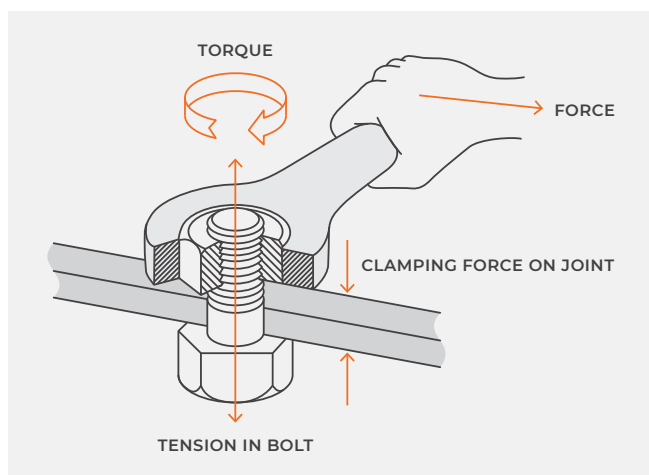


Figure 1

As the nut and bolt are tightened, the two plates are clamped together. The thread angle in the bolt converts the force applied into tension (or stretch) in the bolt shank. The amount of tension created in the bolt is critical.

A bolt tensioned properly works at its optimum efficiency and will resist coming undone. However, if the tension is too low, the nut could vibrate or work loose. If the tension is too high (overstretched), the bolt could break. Every bolt has a correct optimum torque/tension figure for each fastening application. It is important to have these figures available so that the end product will be safe, efficient, and economical.

Torque Wrench Mechanisms

In essence, all torque wrenches do the same thing. They apply a radial force to a fastener to tighten it or loosen it. In addition, the torque wrench must have some mechanism to limit the amount of torque their operator applies. The type of torque limiting mechanism is what separates different torque wrench technology.

Each class of wrench relies on different torque limitation methods, and different methods are most effective for different applications. Selecting the appropriate wrench is important as it will determine the type of technology and budget invested for the fastening solution.

Click Wrench Mechanism

The most common type of torque wrench in the world, and the simplest, is the click wrench (see Figure 2). Click wrenches are basic tools. Most click wrenches are built with an internal spring mechanism that is compressed against a lever.

A click wrench typically deflects by 3° and emits an audible “click” sound when the predetermined torque amount is reached. The click mechanism is not a 100 % process safe as the wrench is easily susceptible to torque failures and over-torque results. Often an operator misses the “click” sound nor feels the click movement. Because a click wrench does not physically prevent an operator from applying additional force he/she unknowingly generating over-torque.

Cam-Over Wrench Mechanism

Engineered with a cam-over technology, the poka-yoke wrench prevents over-torque. The wrench uses an internal cam-over mechanism

to physically prevent the operator from over-torquing fasteners by slipping, or disengaging once torque is reached (see Figure 3). Even if operators try to use the tool on the same fastener after it has slipped, it will simply slip again, refusing to deliver more torque than specified. This total control over the torque delivery renders cam-over wrenches ideal for the most critical torque applications.

Safeguarding against fastening failures requires you to deploy a torque wrench designed error-proofing for the assembly process. Implementing this error-proofing wrench removes the operator's influence out of the torque equation and delivers an accurate and repeatable fastening result than a standard click type wrench. You can provide cam-over wrench to any operator and have the confidence that he/she will deliver the correct torque, time after time.

See Figure 4 on the following page that compares wrench mechanisms.

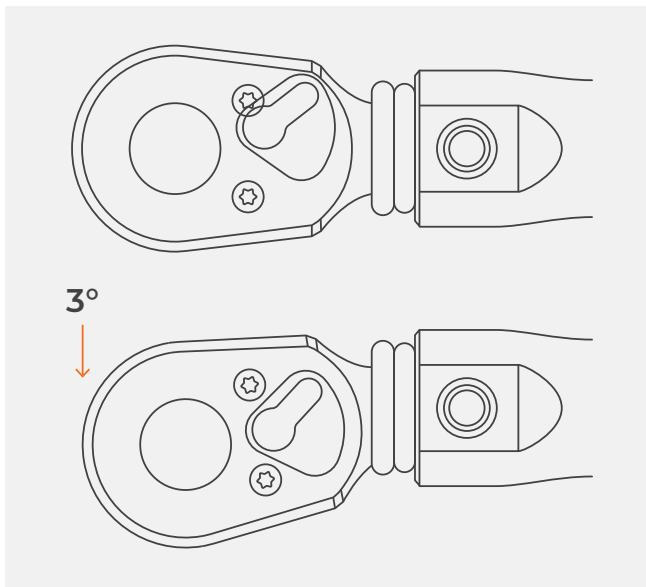


Figure 2: Click Wrench Mechanism

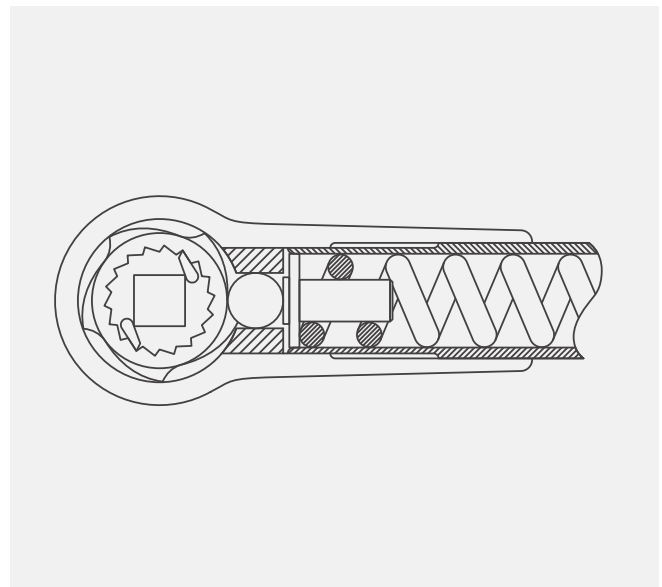


Figure 3: Cam-Over Wrench Mechanism

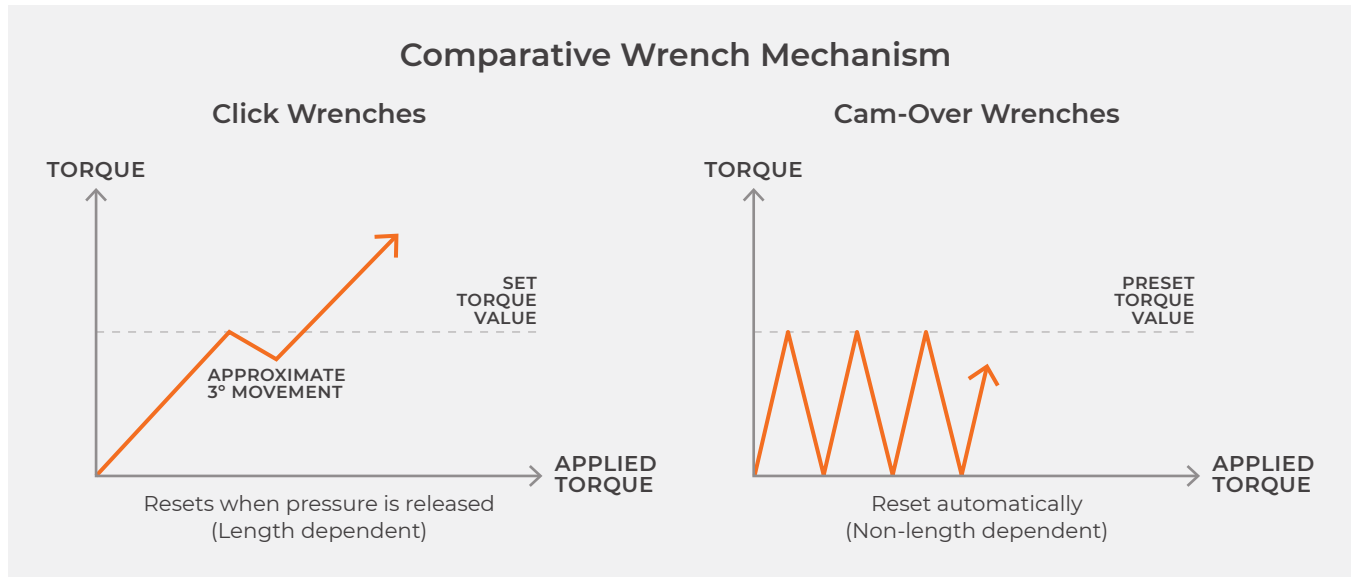


Figure 4

Preset Cam-Over Torque Wrench Improves Productivity

Modern, effective preset torque wrenches improve productivity by guaranteeing that the correct torque value is consistently applied to each fastener. Preset cam-over wrenches are ideal for fastening applications where operators repeatedly assemble parts at the same torque setting (see Figure 5). A preset torque wrench is similar to setting an alarm clock to signal the achievement of a selected time. The wrench is pre-set to the application's required torque value. The tool signals the operator once torque is achieved.

A preset torque wrench does not feature an external torque adjustment scale. These tools have an internal torque adjustment mechanism for setting the torque value and must be preset internally using a hex key and a torque analyzer.

The locking mechanism prevents incidental adjustments or the operator tampering with the torque setting. Once the tool is set the wrench's end cap is sealed with a calibration sticker and is now ready to be used for tightening fasteners. However, if the preset torque value needs to be changed for new fastening application the flexible preset tool can easily be adjusted to a new preset torque value.



Figure 5

User Case: Automotive Powertrain Assembly

The powertrain assembly process is one of the highest quality standard requirements for any type of automotive vehicle being manufactured. Assemblies and subassemblies for motors and transmissions on the vehicles are considered critical assembly processes where the highest technology for torque fastening available is a must.

In June 2008, Mountz was asked by a long time global automotive customer to help resolve a nagging, repetitive torque issue. The automotive manufacturer needed assistance in determining the best way to manually assure that bolts holding the transmission oil pan were tightened correctly to a proper torque value. The manufacturer was using an electronic DC Controller for the fastening application (see Figure 6). They were needing a secondary QC process and a precision torque instrument to ensure the fastening operation was correctly torqued. The additional safety step for the final assembly process was to deploy a means to have a “Go or No Go” verification on the assembly line. The error-proofing solution would verify and guarantee that all the nuts holding the oil pan were tightened to target torque without over-torquing the bolts. They wanted to error-proofing solution that would provide an extra layer of security on their fastening process. Mountz offered a preset cam-over torque wrench that would accurately and

repeatability reach the target torque and would cam-over once the designated torque value was correctly and consistently achieved. The cam-over technology safeguarded against fastening failures and provided an error-proofing process for this critical tightening application. This process has been replicated by other global automotive manufactures on similar torque applications.

Making a Business Case for Upgrading Your Click Wrench to a Cam-Over Wrench

Click wrenches are so popular because they are inexpensive as compared to other types of torque tools. A click wrench doesn't stop the operator from applying too much torque—the tool simply informs the operator in time to stop themselves. The most obvious upgrade from a click wrench is to a cam-over torque wrench, which physically prevents its operator from applying too much torque. Stopping over-torque occurrences requires the deployment of a torque wrench designed error-proofing for the assembly process.

Error-proofing the tightening process improves the quality control method for manufacturers by reducing the number of defective products pulled from the assembly line and hedging the risk of liability from product failures in the field. A screw rattling loose in the avionics of a high-performance jet or from an implanted medical device can cause major liability and reputational damage.

Preset cam-over torque wrenches are the best wrenches for high-level process and quality control. The tool's repeatability, traceability, and precision grant companies the peace of mind of knowing that their critical products will stand up to use. Locking down the manufacturing process with documented, secured torque applications for each fastener improves profit margins by guaranteeing quality assurance.

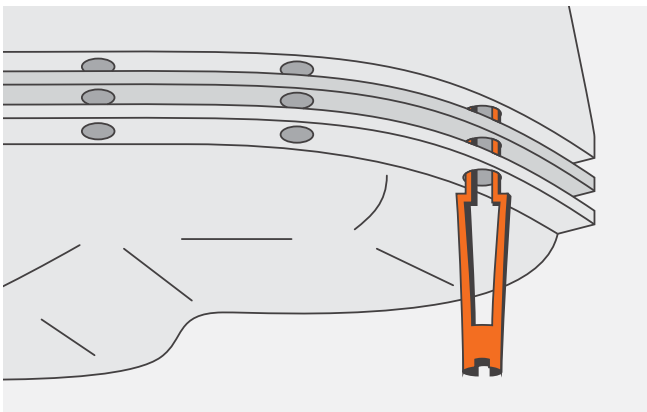


Figure 6

Click vs. Cam-Over Wrench Demonstration

Making sure our customers have the right wrench Mountz offers an educational “Click vs Cam” product demonstration to help demonstrate and train customers in understanding the differences between the two types of wrench mechanisms and the pending effect it has with a critical assembly process (see Figure 7). The product demonstration shows how easily and quickly a click wrench can unknowingly over-torque a fastener. Also, where an operator grips a click wrench can influence the torque output as most of these wrenches are length dependant tool types. Then a cam-over demonstration shows how this type of wrench prevents over-torque and eliminates fastener breakage issues.

Preventive Maintenance for a Torque Wrench

To maintain consistent accuracy, torque wrenches must be checked periodically for wear or defective parts. A properly structured preventive maintenance program optimizes tool performance and reduces unexpected downtime, thereby saving time and money. The more often a torque wrench is used the faster it will wear or go out of calibration. Monitoring the number of cycles per day or total hours that a tool is used is the most accurate way to establish proper maintenance intervals.

ISO 6789-1:2017 requires the tool to stay within the maximum permissible relative deviation



Figure 7

after 5,000 torque applications. Click wrenches tend to require frequent and costly repairs and drift out tolerance quickly. The click wrench's ratchet head and spring are common components that wear out and need replacement.

The durable design of the cam-over wrench needs less expensive frequent repairs and maintain the tool's calibration longer. With a control procedure, customers can expect 10,000 torque applications from Mountz FGC tools. That tool exceeds the ISO standard between calibration checks, which allows the wrench to last longer time on the production line and reduces the calibration budget and downtime.

Cam-Over Technology Legacy

As “the torque tool specialists,” Mountz has a fifty-five-year history of bold thinking and a 100% focus on torque that delivers confidence at every turn. From the development of the first electronic torque calibrator that launched a new product category, Mountz has always pursued new torque innovations, like cam-over technology, to help our customers optimize precision, accuracy, and quality across their manufacturing processes. Quality is at the heart of everything we do.

Next Generation Cam-Over Torque Wrench

Engineered and assembled in Silicon Valley, the new Mountz FGC line of precision preset cam-over wrenches are the most advanced torque wrenches for high-level process and quality control. The wrench's repeatability, traceability, and precision safeguards against fastening failures.

When under- or over-torquing puts your products at risk, the FGC cam-over wrenches deliver the accuracy you need. Mountz FGC tools stay in calibration 2X longer than the most stringent industry standard (ISO 6789). Engineered with a cam-over mechanism, the poka-yoke wrench prevents over-torque.

Key Claims of FGC

FEATURE	WHAT IS IT?	ADVANTAGE	END USER BENEFIT
Cycles Before Calibration	<ul style="list-style-type: none"> ISO 6789-1:2017 calls for maximum of 5,000 torque applications 	<ul style="list-style-type: none"> Exceeds standards Mountz 2x ISO standards: 10,000 cycles before re-calibration 	<ul style="list-style-type: none"> Longer time on the production line Reduces calibration budget and down time
Cam-Over Technology	<ul style="list-style-type: none"> Poka-yoke Design Eliminate over-torque Limits the amount of force applied 	<ul style="list-style-type: none"> Ensures correct torque is applied Eliminates fastener breakage issues 	<ul style="list-style-type: none"> Precision and accuracy Error-proofing assembly process Safeguards against fastening failures
Locking Mechanism	<ul style="list-style-type: none"> Internal mechanism prevents accidental torque setting changes 	<ul style="list-style-type: none"> Avoids torque setting drift Prevents incidental adjustments Accurate and incremental torque setting 	<ul style="list-style-type: none"> Ensures fastening precision and repeatability Reliable process control Longer period before re-calibration
Preset Tool	<ul style="list-style-type: none"> Internal torque adjustment mechanism Non-graduated setting torque tool 	<ul style="list-style-type: none"> Tool is set to a designated torque value Correct torque value is consistently applied 	<ul style="list-style-type: none"> Enhance process reliability Improve production quality Increase productivity Reduce scrap rates
Non-length Dependent	<ul style="list-style-type: none"> Independent torque output vs. hand position 	<ul style="list-style-type: none"> Operator's hand position on the tool does not affect on torque output 	<ul style="list-style-type: none"> Allows for precision tightening Higher repeatability Less training for correct operation
Metal End Cap	<ul style="list-style-type: none"> Anodized aluminum end cap for all models 	<ul style="list-style-type: none"> Durable and doesn't strip out like plastic 	<ul style="list-style-type: none"> Fewer parts need replacement Easier to service
Ergonomics	<ul style="list-style-type: none"> Ergonomic handle 	<ul style="list-style-type: none"> Cushion, non-slip grip 	<ul style="list-style-type: none"> Improve operator's efficiency Reduce discomfort, fatigue, and risk of injury
Durability	<ul style="list-style-type: none"> Coated corrosion-resistant stainless steel head Anodized aluminum handle Non-strip ratchet head 	<ul style="list-style-type: none"> Long tool service life 	<ul style="list-style-type: none"> Reduces need to replace tools/parts Lower required tool inventory
Safety & Quality Standards	<ul style="list-style-type: none"> ISO 6789-1:2017 & ASME B107.300-2010 standards 	<ul style="list-style-type: none"> Meets & exceeds the requirements for design and calibration for both standards for hand torque tools & instruments 	<ul style="list-style-type: none"> Compliance with materials, markings, accuracy, drives, capacity, load, testing and safety standards



ABOUT MOUNTZ

Mountz, The Torque Tool Specialists®, has been a leader in the torque tool industry for more than 50 years. Engineered in the Silicon Valley and serving the globe, Mountz focuses on delivering high-quality torque products, services, and solutions to ensure customers can always proceed with confidence. We are committed to forging a safer world through precision and accuracy, and by innovating every day.



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SILICON VALLEY HEADQUARTERS AND SERVICE CENTER

1080 N. 11th St., San Jose, CA 95112
408-292-2214 / M-F 6am-5pm PST

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19051 Underwood Road, Foley, AL 36535

INTERNATIONAL

For enquiries outside of the USA,
Canada, and Mexico, please contact:
international@mountztorque.com
Phone: +44 800 014 8753