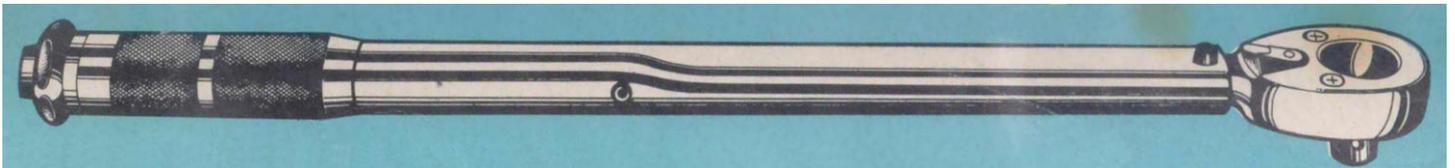


1/2" micrometer

torque wrench



4.5mkg—21.4mkg  
(44Nm—210Nm)

Part No.17205-6  
Qty.1



Purchased 1985  
\$ 41.60

## **HOW TO USE YOUR NEW TORQUE WRENCH**

You have chosen one of the finest torque indicating wrenches that more than half century of professional tool making experience can produce. Your new wrench is a precision instrument designed to accurately measure torque. Other uses should be avoided. It should never be used to break loose stubborn fasteners.

The self-contained torque limiting mechanism employs an exclusive, patented design that minimizes friction, and is rugged and dependable. The precision made parts are sealed so dirt or liquids cannot easily affect the built-in accuracy of the mechanism. The wrench is not affected by extreme changes of temperature.

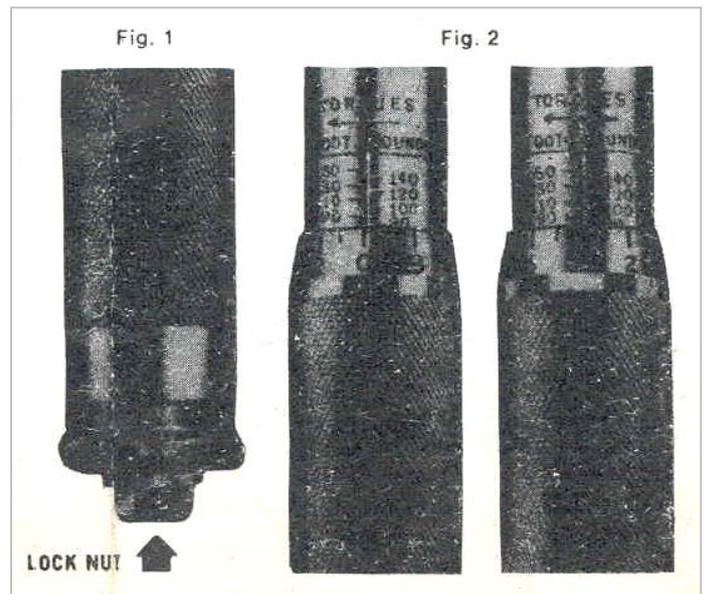
**1.** Balancing wrench in left hand with graduations visible, unlock knurled handle by turning lock nut counter-clockwise. **See Fig. 1.**

**2.** Set amount of torque required by turning knurled handle to read exact amount on case graduations.

**Example:** You wish to apply 84 foot lbs. of torque to a bolt. First turn knurled handle until the zero graduation on the bevelled edge of the knurled handle is lined up with the vertical mark on the case, and is even with the 80 ft-lbs. graduation. Now turn knurled handle clock-wise until the 4 lb. graduation on the bevelled edge of the handle is in line with the vertical line on the case. Lock handle securely by turning lock nut clockwise. Wrench is now set at 84 ft-lbs. torque and is ready to use. **See Fig. 2.**

**3.** Install the proper socket or attachment to the square drive and apply to the object being torqued. Apply a smooth steady pull to the handle of the wrench. When the torque applied equals the torque setting of the wrench the wrench will automatically release. The release is distinct and unmistakable. It can be felt as well as heard. Upon release of pressure on the handle, the wrench will automatically reset itself.

**CAUTION:** Do not continue pulling on the wrench after preset torque has been reached and the wrench has released. Pressure must be taken off the handle and the wrench allowed to automatically reset itself. Continuing to apply pressure after the wrench has released will result in damage to the part being torqued by applying more than the specified amount of torque. Your torque wrench was calibrated and tested before leaving the factory and is guaranteed to meet or exceed Federal Specifications GGG-W-00686c.



Because your torque wrench is a precision measuring instrument, it should be serviced only where skilled men and special tools and equipment are available.

**NOTE:** Left hand thread torquing can be done with a ratchet head torquer by removing the ratchet wheel and inserting it so the drive plug comes out on top.

### **What is a Torque Wrench?**

A torque wrench is a precision measuring instrument much the same as a micrometer, vernier calipers or any other accurate measuring instrument. Its purpose is to measure or limit the amount of torque being applied at a given point.

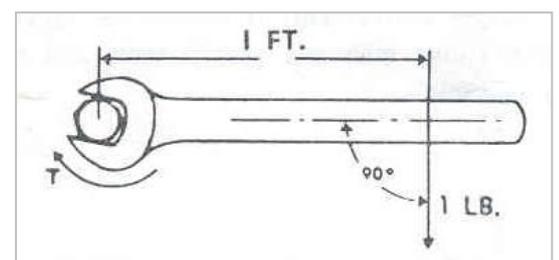
### **What is Torque?**

Torque is twist or the resistance to rotation. When used in reference to a bolt, torque is the resistance to turning of the bolt or nut.

### **How is Torque Measured?**

Torque is based on the fundamental law of the lever - that is - force times distance equals the torque or twist around a point.

Torque is most commonly measured in foot pounds or inch pounds. For example: If a 1 pound force is applied 1 foot from the



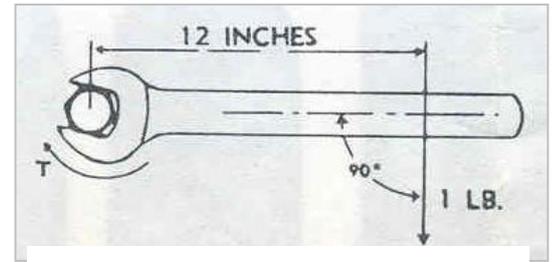
Torque 1 Foot Pound

center of the bolt the resulting torque developed would be referred to as one foot pound of torque.

If the distance is measured in inches the resulting torque would be referred to as twelve inch pounds of torque.

### What Does Torque Do to a Bolt?

Applying the exact amount of torque to a nut or bolt induces the correct amount of tension or elongation in the bolt that is necessary to hold the parts together. Furthermore, by applying the correct amount of torque specified to a bolt the danger of distortion to the part or adjoining parts is eliminated.



Torque 12 Inch Pounds

### What is Tension?

Tension is straight pull and is measured in pounds.

Torque wrenches are at times referred to as tension wrenches. **This is not true.**

Wrenches that are designed to measure or limit the amount of torque applied to a nut or bolt are definitely torque measuring instruments.

### Importance of Accurate Torque

If a nut or bolt is not tightened enough it will eventually work loose and drop off. At the other extreme if too much torque is applied the nut or bolt will very likely snap off.

In either event an obvious failure occurred due to improper torquing of the fastener.

### Metal is an Elastic Material

Every type and grade of metal has a definite limit to which it can be safely stretched or stressed. This is defined as the elastic limit of the material. Design engineers must consider many things in selecting the correct fastener. As engines, transmissions, and machines become more complex, their design is such that maximum efficiency is dependent upon applying the correct amount of torque to the fasteners that hold component parts together. After the correct fastener and material has been chosen the design engineer establishes the exact amount of torque to be applied. This torque specification will induce a stress or elongation of the bolt of approximately 60-70% of its ultimate elastic limit.

In the case of aluminium and other soft metals, their ultimate strength often dictates the correct amount of torque rather than the strength of the steel bolts holding them together. Soft materials in joints such as gaskets, also tends to reduce the amount of torque that normally would be applied.

Too much pressure would damage or distort the material.

### How Adapters Affect Torque

To understand why certain types of adapters and extensions change the amount of torque delivered at the bolt head it should be remembered that the amount of torque produced on the bolt is the result of the amount of force applied and the length of the torque wrench plus the length of the extension or adapter.

**Remember the torque law: Force X distance = torque.**

However, when special accessories are used that add length to the torque wrench, the setting no longer reads true and corrections must be made to compensate for any added length.

Adapters or extensions may be used with a torque wrench for many reasons.

1. To adapt torque wrench to special fittings or applications.
2. To increase or multiply torque past the capacity of the wrench.
3. To torque fasteners in hard to reach locations.

### How to Compute Torque

If an adapter is attached to the square drive of a torque wrench the wrench will not give the actual torque indicated by the setting of the handle. A simple formula however, allows you to figure out what the setting should be to deliver a pre-determined amount of torque at the end of any adapter to the fastener.

Here is the formula  $C = D \frac{A}{A+B}$  or  $C = Dx(A/A+B)$

**NOTE:** The above formula applies only to torquers (Torque Wrench Extensions).

The letters in the formula have the following meaning:

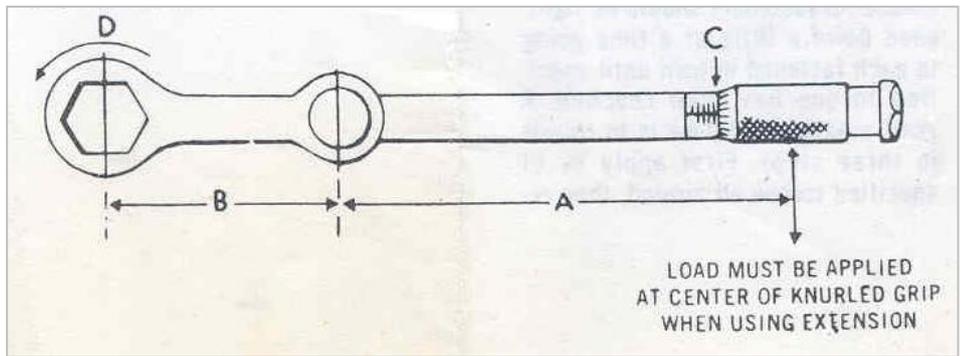
A = length of torque wrench.

B = length of adapter.

C = torque wrench setting.  
 D = desired torque at end of extension.

Here is a typical problem.  
 You have an adapter that adds 6" inches to a torque wrench you are using.

What should the setting be to obtain 90 pounds of torque at the end of the adapter?



A = 14" **\*SEE NOTE.** B = 6". D = 90 foot pounds. C = unknown.

$C = D \times (A / (A + B))$  or  $90 \times (14 / (14 + 6)) = 90 \times (14 / 20) = 90 \times .7 = 63.0$  foot pounds.

Your answer is: A setting of 63 foot pounds on the torque wrench will give 90 foot pounds of torque at the bolt.

**\*NOTE:** Use the following dimensions for distance "A" on each model torque wrench.

By using the above figures in the formula for dimension "A" an accuracy of + or - 2% of the desired torque at the end of the adapter will result.

**It is important to understand the following when using adapters or extensions on torque wrenches.**

1. The formulas given apply only to **torque wrenches**.
2. Load should be applied at center of hand grip,
3. Length of adapter must be measured from the center of adapter opening to center of square drive opening. Measure only distance that is parallel to torque wrench.
4. If your torque wrench reads in inch pounds then measure in inches. If it is calibrated in foot pounds then measure in feet. Or if it is more convenient change everything to inches.

**Conversion Formulas**

It is often necessary or helpful to change torque readings from foot pounds to inch pounds or inch pounds to foot pounds. To convert from one specification to another it should be remembered that there are twelve inches in a foot and one foot pound of torque equals 12 inch pounds of torque.

From the above, the following formulas may be used:

Foot pounds x 12 = inch pounds.	Inch pounds / 12 = foot pounds.
Cm – Kgs / 13.8 = foot pounds.	Cm - Kgs / 1.15 = inch pounds.
M/Kgs = Ft lbs x .1383	Ft lbs. = M/Kgs x 7.2329
Cm – Kgs = inch pounds x 1.15	Cm – Kgs = foot pounds x 13.8

**Helpful Information on Torquing**

1. Always follow manufacturer's specifications whenever available. Look for footnotes that might indicate under what conditions the torque values were established.
2. Any assembly held together by a number of fasteners should be tightened down a little at a time going to each fastener in turn until specified torque has been reached. A good practice to follow is to torque in three steps. **First**, apply 3/4 of specified torque all around. **Second**, then reset wrench and apply the specified amount of torque. **Third** step is to retorque all bolts to be sure none were missed.
3. Never use a torque wrench on a nut already tightened with a standard wrench or socket. For accurate torque the final turn of the nut must be done with a torque wrench.

**Testing Accuracy of a Torque Wrench**

It is impossible to check the accuracy of a torque wrench by using another wrench.

**For example:** the wrench is used to tighten a bolt to 90 foot pounds. Another torque wrench is used to loosen the bolt as an accuracy test for either wrench. This is a test or comparison that is frequently performed and invariably results in an assumption that one of the torque wrenches is not calibrated correctly.

**What is not generally known or understood is that the break-loose torque is considerably less than the applied torque.** This means that the torque required to loosen a bolt previously tightened to 90 foot pounds would be considerably less than the 90 foot pounds of applied torque. In view of the above it is easy to see why one of the torque wrenches could be considered inaccurate.

A torque wrench should be tested on a torque wrench testing machine to determine its true accuracy.

Because your torque wrench is a precision measuring instrument it should be serviced only where skilled men and special tools and equipment are available.