



Technical English
Unit 26
professional english
Mechanical fasteners 1

Prof. Hala J. El-Khozondar
Spring 2017

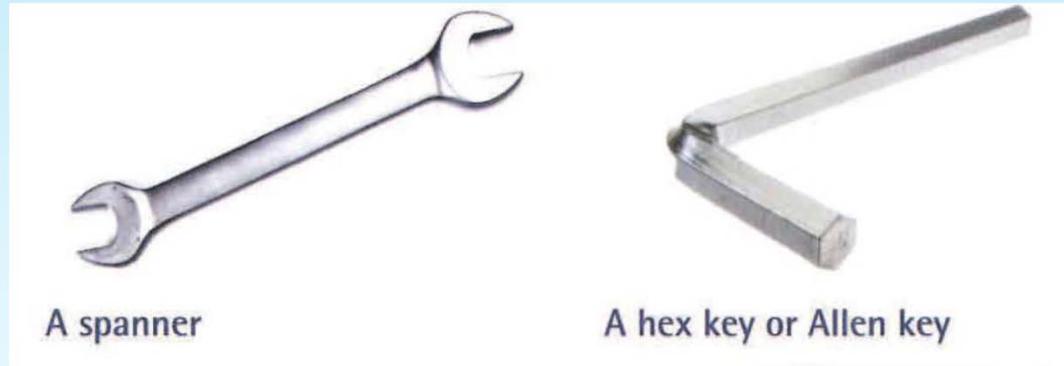
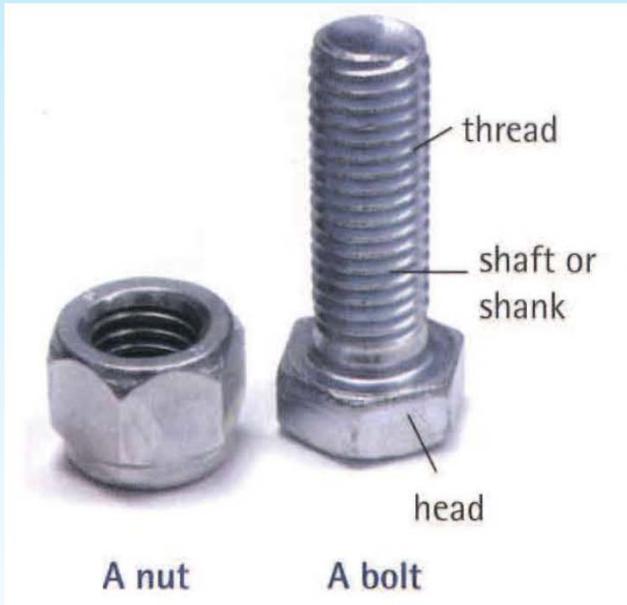


Contents

- 
- 
- A. Bolts
 - B. Preload in bolted joints
 - C. Washers
- 
- 

A. Bolts

The photo below shows a common **fastener** (or **fixing**): a bolt, with a nut. Bolts have threads grooves on the outside of the bolt's **shaft** (or **shank**), which run around the shaft in a **helical** pattern. The **threaded** shaft allows a nut, which has a thread inside it, to be screwed onto the bolt (by a turning motion). Nuts usually have a **right-hand thread** - they are **screwed** on by turning them **clockwise** (in the direction of clock hands) and **unscrewed** by turning them **anticlockwise**. However, in some situations, left-hand threads are used.



BrE: anticlockwise; ArnE: counterclockwise
BrE: spanner; ArnE: wrench

A. Bolts

Most bolts have **heads** with **hexagonal** perimeters (**hexagonal heads** or **hex heads**). These allow a **spanner** to turn them. Heads can also have a hexagonal hole in their top, called a **socket head**. This allows a hex key (or **Allen key**) to fit into them.

Note: A nut is **screwed onto** a bolt; a bolt can be **screwed into** a threaded hole.

B. Preload in bolted joints

Turning force, called **torque**, is applied to bolts to **tighten** them- that is, to make them grip tightly. As a bolt is tightened, the **tension** (stretching force) in its shaft increases, and the components being **bolted together** are pressed tightly together. This pressing force is called **preload** (or **clamp load**) . If enough preload is applied, friction between the components will prevent them sliding in different directions. This is an advantage, as sliding subjects the sides of bolts to **shear** force (scissoring force), which can cause them to break. In steel structures, bolts that apply high preloads to prevent sliding are called **high strength friction grip (HSFG)** bolts.

B. Preload in bolted joints

The amount of torque applied to bolts can be adjusted using a **torque wrench**, a tool which can tighten and **loosen** bolts, and which indicates how much torque is applied. This helps to ensure that bolts are tightened enough, but not over-**tightened**. Torque wrenches are also useful for checking that **bolted joints** do not **work loose** - that is, that they do not become loose over time.

Note: See Unit 31 for more on torque, tension, shear and other forces.

C. Washers

Washers are metal discs which fit between the head of a bolt or a nut and the components being bolted together. Ordinary washers- called **flat washers** or **plain washers**- have a larger outside diameter than the bolt head or nut. Their wider area is intended to **spread the load** (distribute pressure) over the surface of the component as the bolt is tightened.



A plain or flat washer



A helical spring washer



A conical spring washer

C. Washers

Spring washers are designed to be compressed, to allow the amount of preload to be adjusted as the bolt is tightened.

In some situations, spring washers are used to allow a bolt to move slightly, in order to absorb shocks. Common types of spring washer are **helical spring washers** and **conical spring washers**.

26.1 Change one word in each of the sentences below to make them correct. Look at A opposite to help you.

- 1 Wrenches are well-known examples of fasteners.
- 2 In most cases, nuts are screwed onto bolts by turning them anticlockwise.
- 3 The threaded part of a bolt is the head.
- 4 Threads are cut to form a hexagonal pattern.
- 5 Allen keys are designed to fit around the heads of bolts.



Exercises



26.1 Change one word in each of the sentences below to make them correct. Look at A opposite to help you..

- 
- 1 Bolts are well-known examples of fasteners.
 - 2 In most cases, nuts are screwed onto bolts by turning them clockwise.
 - 3 The threaded part of a bolt is the shaft/shank.
 - 4 Threads are cut to form a helical pattern.
 - 5 Allen keys are designed to fit into the heads of bolts.
- 

26.2 Use the words in the box to complete the text about bolted joints, taken from a bolt supplier's website

1 tighten

3 work loose

5 torque

7 shear force

2 preload

4 over-tighten

6 tension

8 loosen

loosen

preload

tension

torque

work loose

In structural applications, it is essential to (1) bolts correctly – firstly to make sure that joints are held together with the right amount of (2), and secondly to help ensure that the bolts do not (3) over time. However, that does not mean to say, ‘the tighter the better’.

If excessive force is used to (4) a bolt, the bolt will no longer be strong enough to transmit the extra load to the joint. At this point, various problems can occur. The shank may begin to twist as it is subjected to additional (5) from the wrench, eventually causing the bolt to fail. Alternatively, as the bolt is stretched due to increasing (6) in the shank, this force will be transmitted to the threads in the form of a scissoring action, resulting in excessive (7) acting between the threads of the bolt and nut, potentially causing permanent damage to the threads. This will not only make it impossible to subsequently tighten and (8) the bolt normally, but also cause tension to be released from the shank as the nut slips, reducing preload and compromising the strength of the joint.

26.3 Decide whether the sentences below are true or false, and correct the false sentences. Look at C opposite to help you.

1 The purpose of all washers is to spread the load from the bolt across the surfaces of the components being bolted together.

2 Plain washers are flat.

3 Spring washers change shape as a bolt is tightened.

4 Spring washers ensure that, no matter how much a bolt is tightened, the amount of preload remains the same.

5 In situations where components are subjected to shocks, spring washers ensure that no movement occurs between the bolt and the component.

1 false – The purpose of flat washers and plain washers is to spread the load.

2 true

3 true

4 false – Spring washers allow the amount of preload to be adjusted.

5 false – Spring washers allow some movement to occur.

I know it



A plain or
flat washer

Any Questions