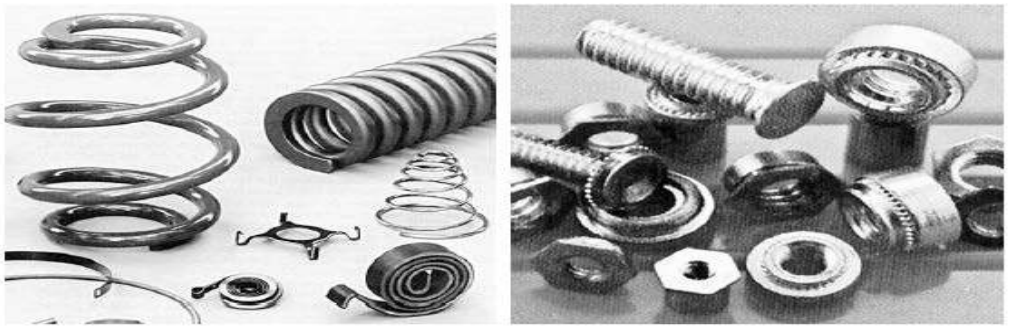
Prince Sattam Bin Abdulaziz University
El Kharj

College of Engineering
Mechanical Department

LECTURE NOTES 5: Mechanical Engineering Drawing and Graphics (ME2421)

Screw Threads and Conventional Representations



(a) (b)

Figure 13-0.1
(a) Springs. (b) Screws and Fasteners. From Machine Design:

Dr. BOUAZIZI Mohamed Lamjed, Mechanical Engineering

Defenition of Thread:

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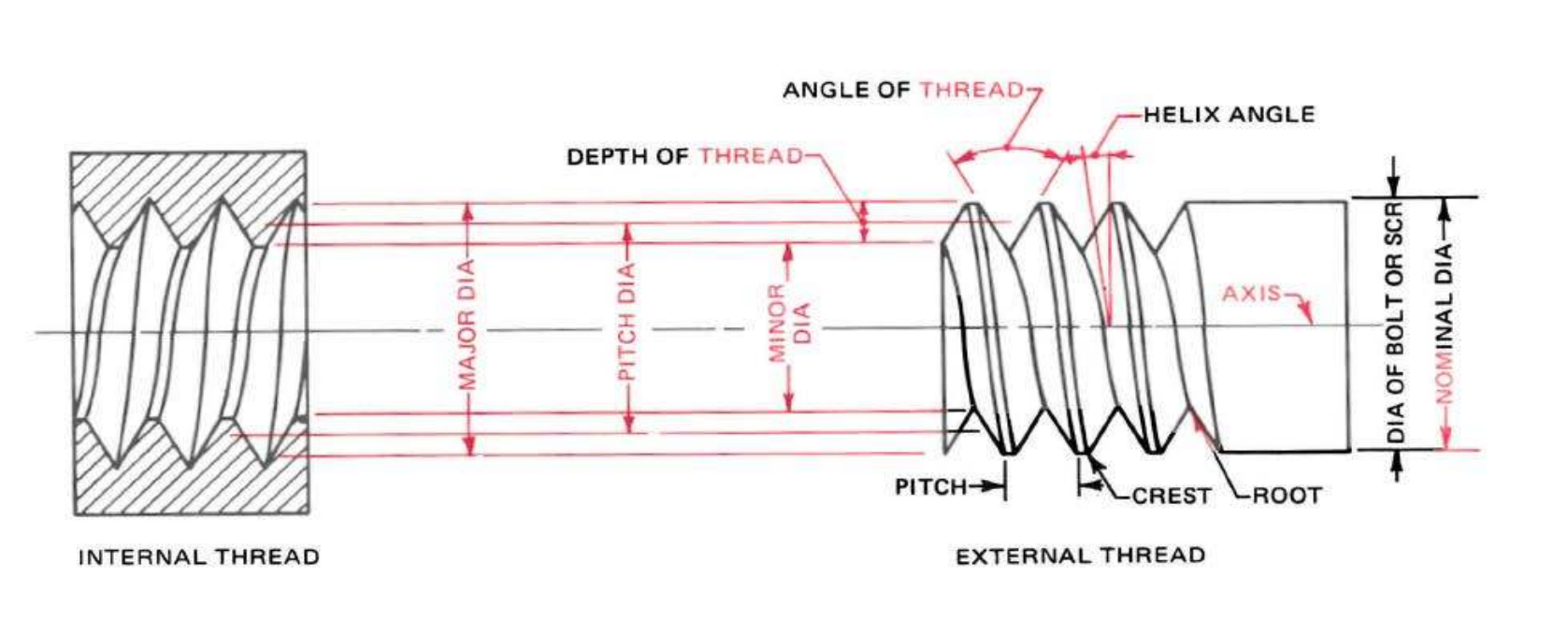
***Helix:** is a curve generated by a pointed tool on the circumference of a cylinder when it is rotated at a constant speed and the tool moves with a simultaneous of advance parallel to the axis of the cylinder as shown in figure below:*



SCREW THREAD TERMS

Types of Threads:

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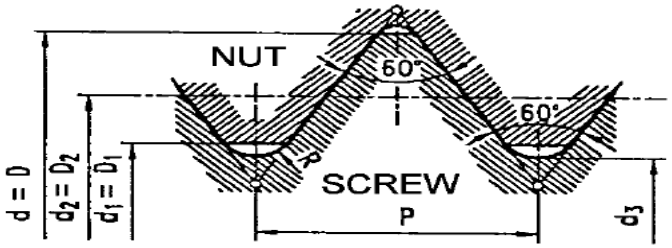
Metric Thread

Metric thread is the most used connection thread all over the world. It is sometimes called INTERNATIONAL STANDARD THREAD. It is generally used for standard screws.



Two Forms of Metric Thread

Designation	Example
Metric thread of basic lead M + major diameter in mm	**M 12**
Metric thread of fine lead M + major diameter in mm x lead	**M 12x1**

Metric thread has **thread angle 60°**. **Crest** is flat and root is rounded.

Usual dimensions of **metric threads** are: M3, M4, M5, M6, M8, M10, M12, M16, M20, M24, M30, etc.

Types of theards:

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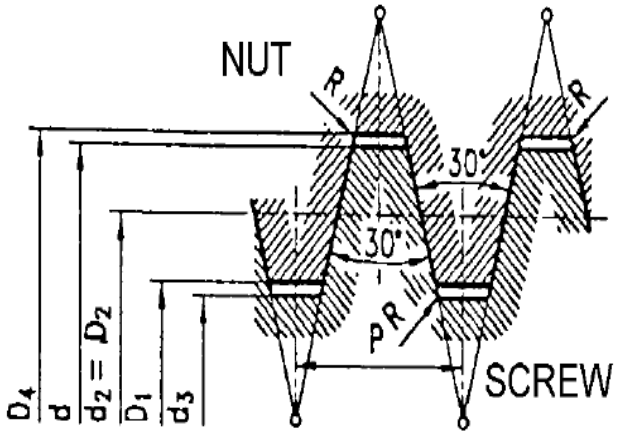
Trapezoidal Thread

Trapezoidal thread is the most used **motion thread**. In USA it is called **ACME thread**. This thread is used on 90% of **motion screws**, which are loaded from both directions.



Designation of trapezoidal thread: Tr + major diameter in mm x lead in mm: **Tr 24x5**

Trapezoidal thread has **thread angle 30°**. **Crest** is sharp with small fillets on the **root**.

Usual dimensions of **trapezoidal thread** are: Tr10x3, Tr16x4, Tr20x4, Tr30x6, Tr40x6, Tr60x8 etc.

Types of theards:

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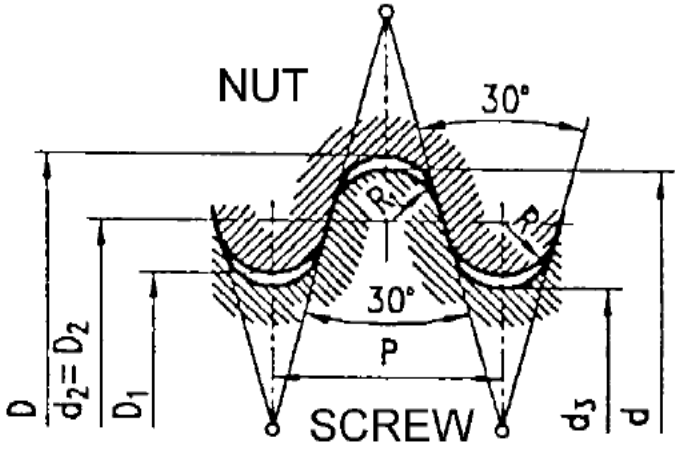
Round Thread

Round thread is used for very strongly loaded **motion screws**, which works in dusty, or in corrosion surrounding.



Designation of round thread: Rd + major diameter in mm: **Rd 40**.

Round thread has thread **angle 30°**. **Crest** and **root** are big fillets.

Usual dimensions of **round thread** are: Rd10, Rd12, Rd16, Rd20, Rd24, Rd30, Rd40, Rd50, etc.

Conventional representation of External and Internal Threads

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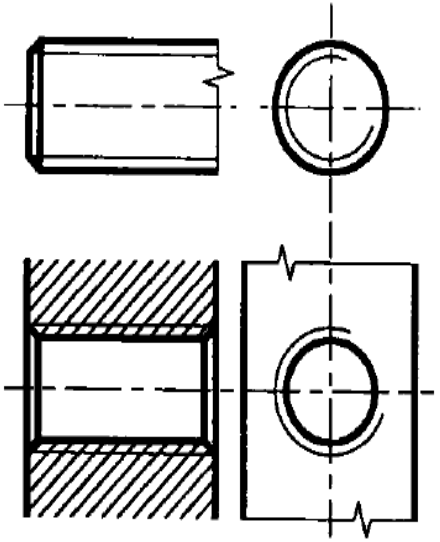
Drafting of a Threads

In a view and a section view, projected to the projection plane, which is **parallel** to the axis of a thread, we **draw only straight thick contour lines** and **thin lines, which shows the depth of grooves of the thread**. Here is used the rule for simplification of not drawn many times repeated shapes.



Conventional representation of External and Internal Threads

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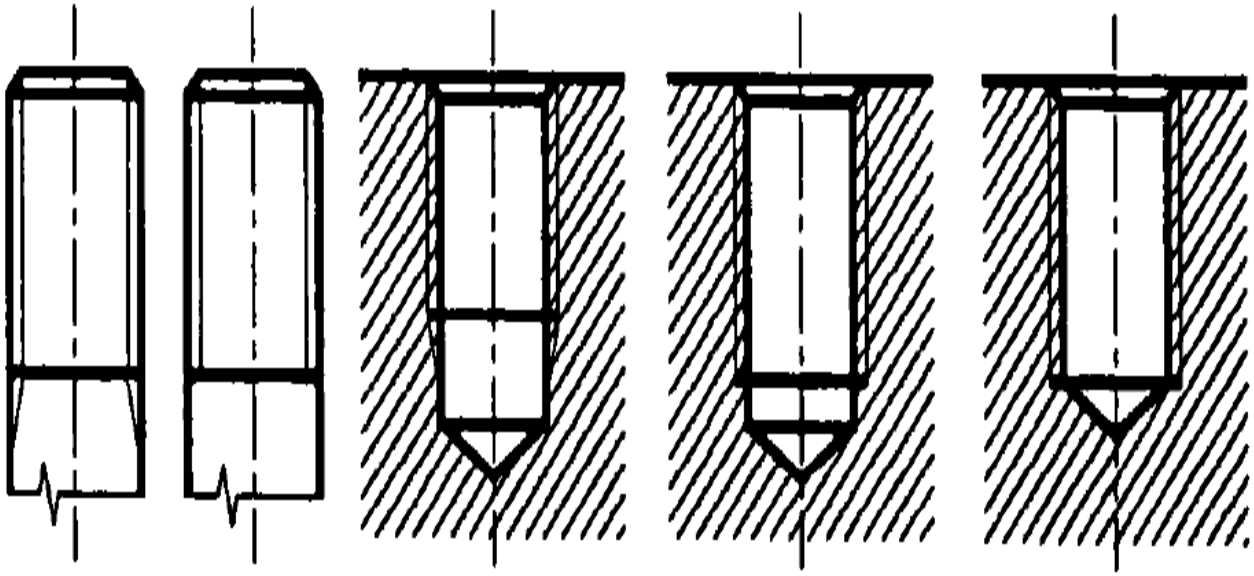
The **thick line** must be drawn **at the end of the useful thread**. It is drawn **from one outside line to the second outside line** If the threads **are cut,** the **run-out** of the thread is drawn beyond the end line of the thread. The **run-out** is tool-mark after the tap in the internal thread and after the round screw die on the external thread.



Conventional representation of External and Internal Threads

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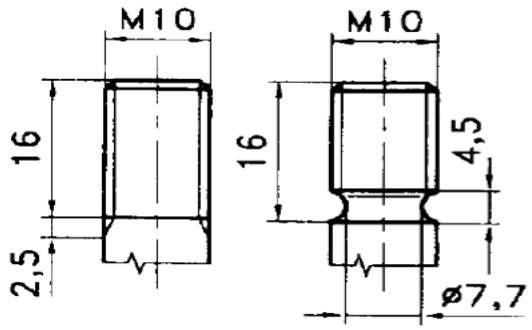
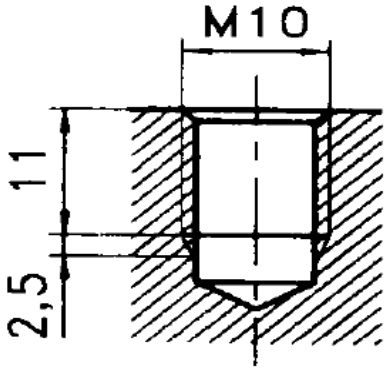
Dimensioning of the Thread



Dimension line is always drawn to the major diameter of a thread. We must always write the sign of **type of the thread and its diameter – major diameter or nominal inside diameter**, according to the type of the thread. Length of the thread is usually dimensioned to the thick line of a usable length of a thread. If the run-out of a thread is drawn, we usually dimension its length. If the thread was made on a lathe, it has usually groove at the end and we dimension the length of the thread together with this groove.



We **dimension internal threads in the same way like external threads**. Dimension line must be always drawn **to the major diameter of a thread**. In the case of the inside thread the **extension lines are drawn** from the **thin outside lines of the thread**.

Threaded fasteners:

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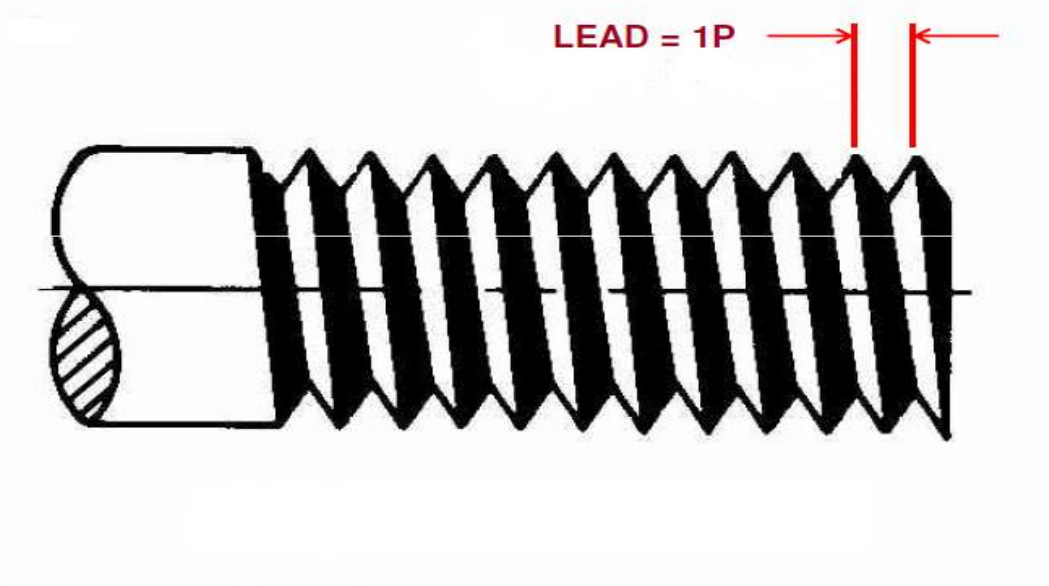
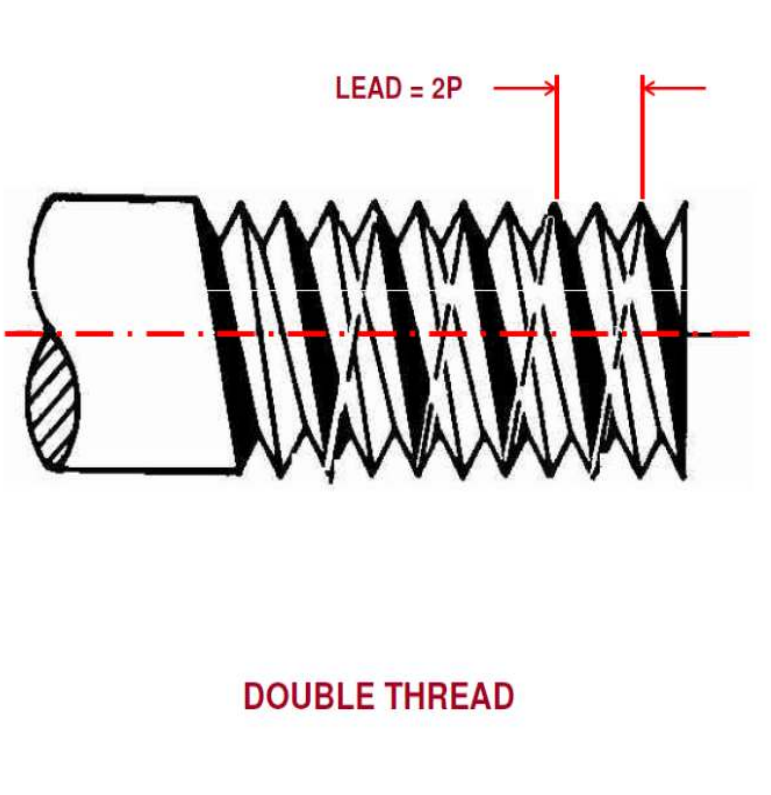
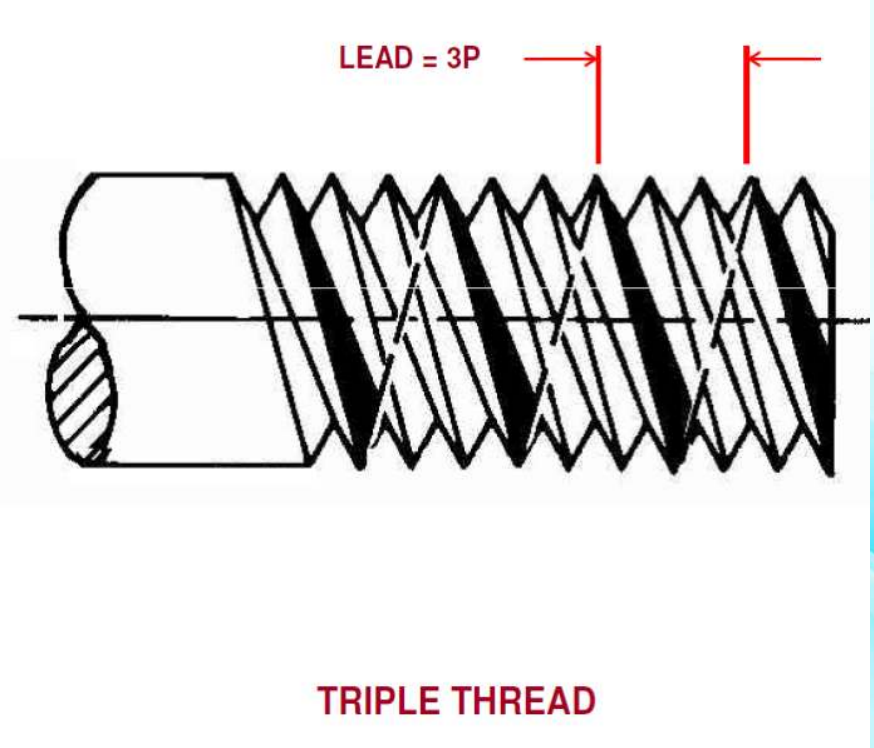
THREADED FASTENERS



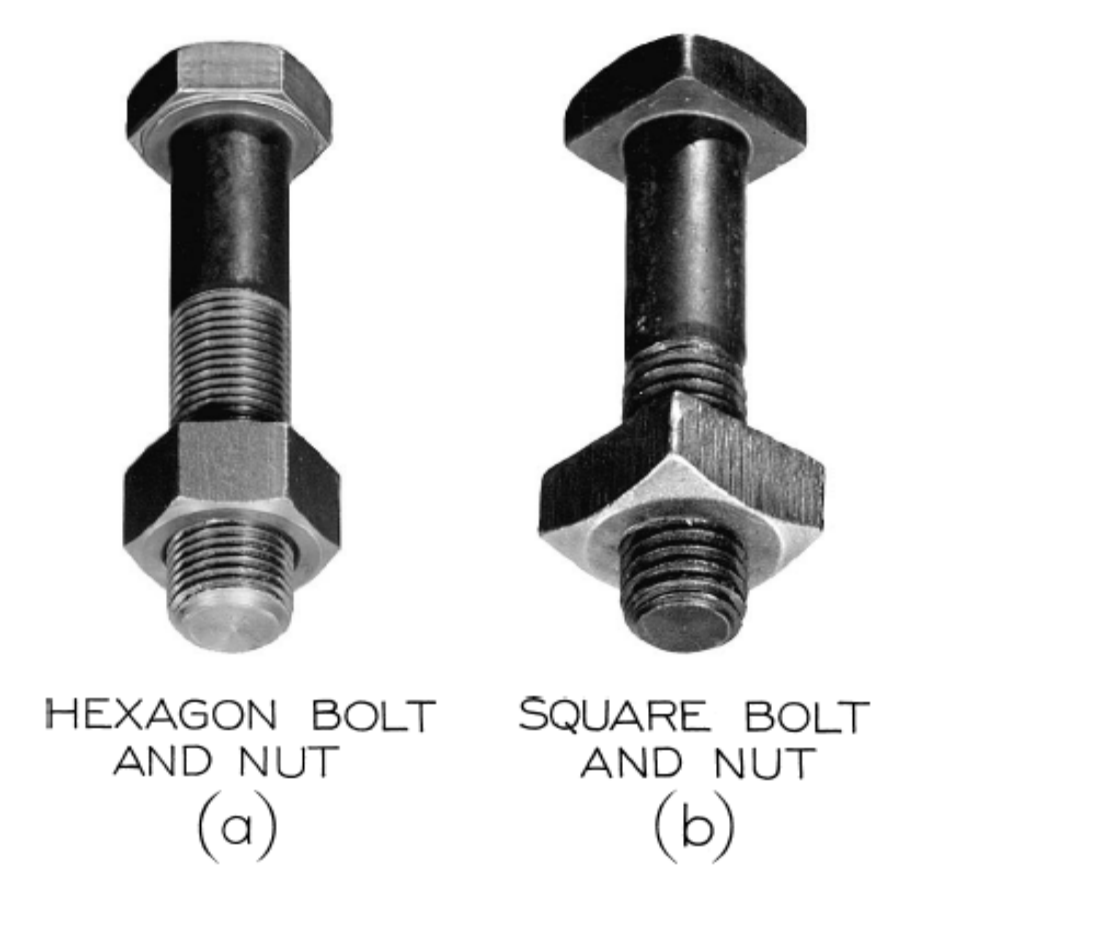
SINGLE THREAD

Threaded fasteners:





Applications



Applications

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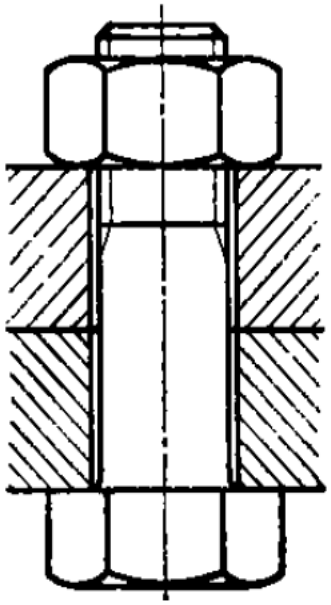
Drawing of Bolted Connections on the Assembly Drawings

There are used **bolted connections** on all assembly constructions, electromotors, computers etc.



Bolted connection by the screw with the hexagon head and the hexagon nut which pass through the free holes, and draw two thin materials together

The holes must be bigger than the screw. **Between the screw and the holes there must be drawn gaps on both sides. There are drawn two thick lines.**

Between the head of the screw **and the first material, between both materials** and **between the second material and the nut, there must not be the gap**, because in this direction screw and nut draw materials together. **There must be drawn only one line.**

Applications

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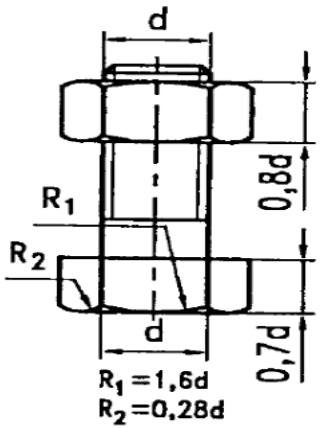
Two Versions of Simplification of Hexagonal Heads and Nuts Drawing

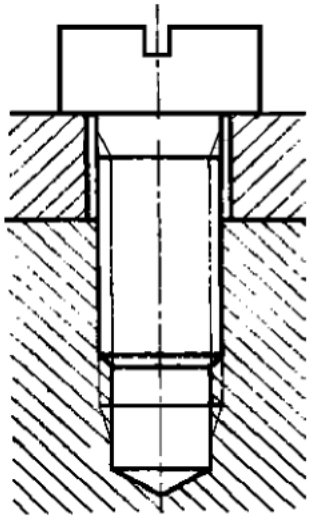
If there is place enough around the screw head or the nut, we usually use the **simplificated drawing** of screws with hexagon heads and nuts. In this case we draw **most of sizes approximately according to the standardised empirical formulae**, not precise according to the real dimensions of screws and nuts. All **dimensions** we **derive from the diameter of a screw**.



We draw:			
Height of the head of screw	=	**0.7d**	of a screw diameter
Height of the nut	=	**0.8d**	of a screw diameter
Width of a middle flat	=	**1d**	the same size as a screw diameter
Circumscribed dimension of the hexagon	=	**2d**	of a screw diameter
Big radius R_1 of the middle arc	=	**1.6d**	of a screw diameter
Small radius R_2 of the side arcs	=	**0.28d**	of a screw diameter

If there is not place enough around the screw head or around the nut, we must use the **precise drafting.** All **sizes** of screws and nuts **are drawn precisely according to the standards**. Only **hyperbolas are simplified to the arc**.

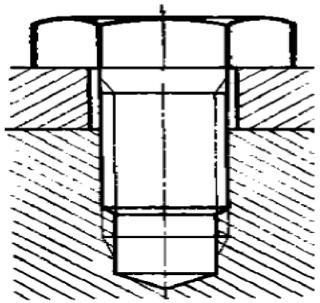
Applications



Bolted connection by the screw with the cylindrical slotted-head, which draw the thin material to the thick material with the blind thread hole

The hole is bigger then the screw in the thin material (upper part of a picture) because there is no thread. There must be drawn gaps on both sides. There is screw screwed into the thread hole in the thick material (lower part of a picture) with the blind thread hole.

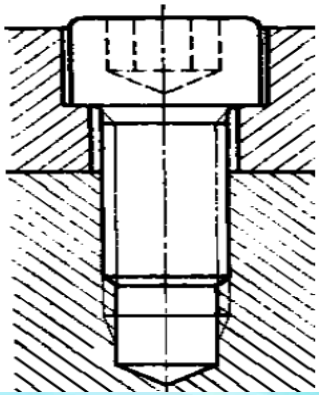
Simplified drawing of threads we may use in the **assembly drawings for mounting only**. Because we must know engineering's job perfectly, **we will use completely drafting of a blind thread holes** in our subject **only** – in the second test and during the examination.



Bolted connection by the screw with the hexagonal head, which draw the thin material to the thick material with the blind thread hole

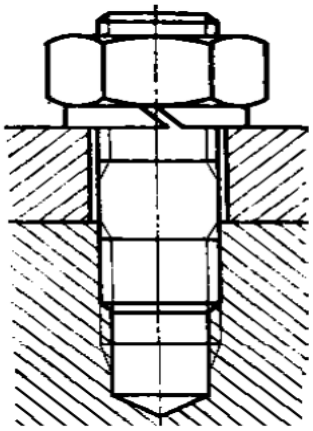
The hole is bigger then the screw in the thin material (upper part of a picture) because there is no thread. There must be drawn gaps on both sides. There is screw screwed into the thread hole in the thick material (lower part of a picture) with the blind thread hole.

Applications



Bolted connection by the screw with the cylindrical head with inner hexagon – hexagon socket head, which draw the thin material to the thick material with a blind thread hole

The hole where is not the thread, is bigger than the screw. The hole in which is head of a screw is bigger than the screw's head as well. Between the screw head and this hole must be drawn gaps on both sides.



The stud with the hexagon nut, which draw the thin material to the thick material with the blind thread hole

The upper part of the connection we draw by the same way as the **Bolted connection by the screw with the hexagon head and the hexagon nut which pass through the free holes**. The hole must be bigger than the screw. The washer need not be drawn. The lower part (screwed in the blind thread hole) we draw by similar way as on the other pictures, but the **lower thread is screwed in the blind hole to the end of the run-out**. On the construction assembly drawing we draw threads with the run-out of the thread on the screw and in the thread hole as well.