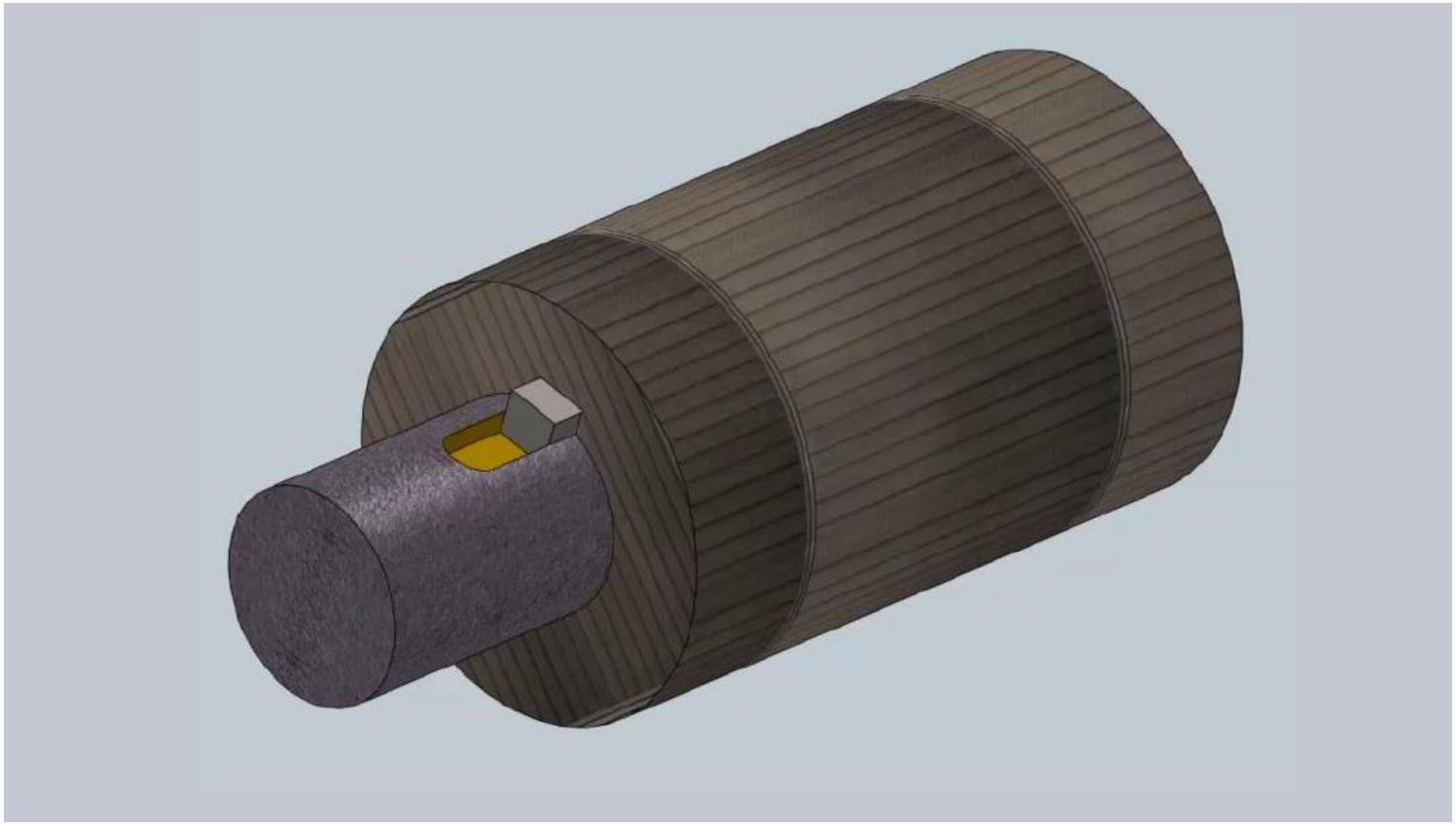
Machine Drawing
Lecture 6

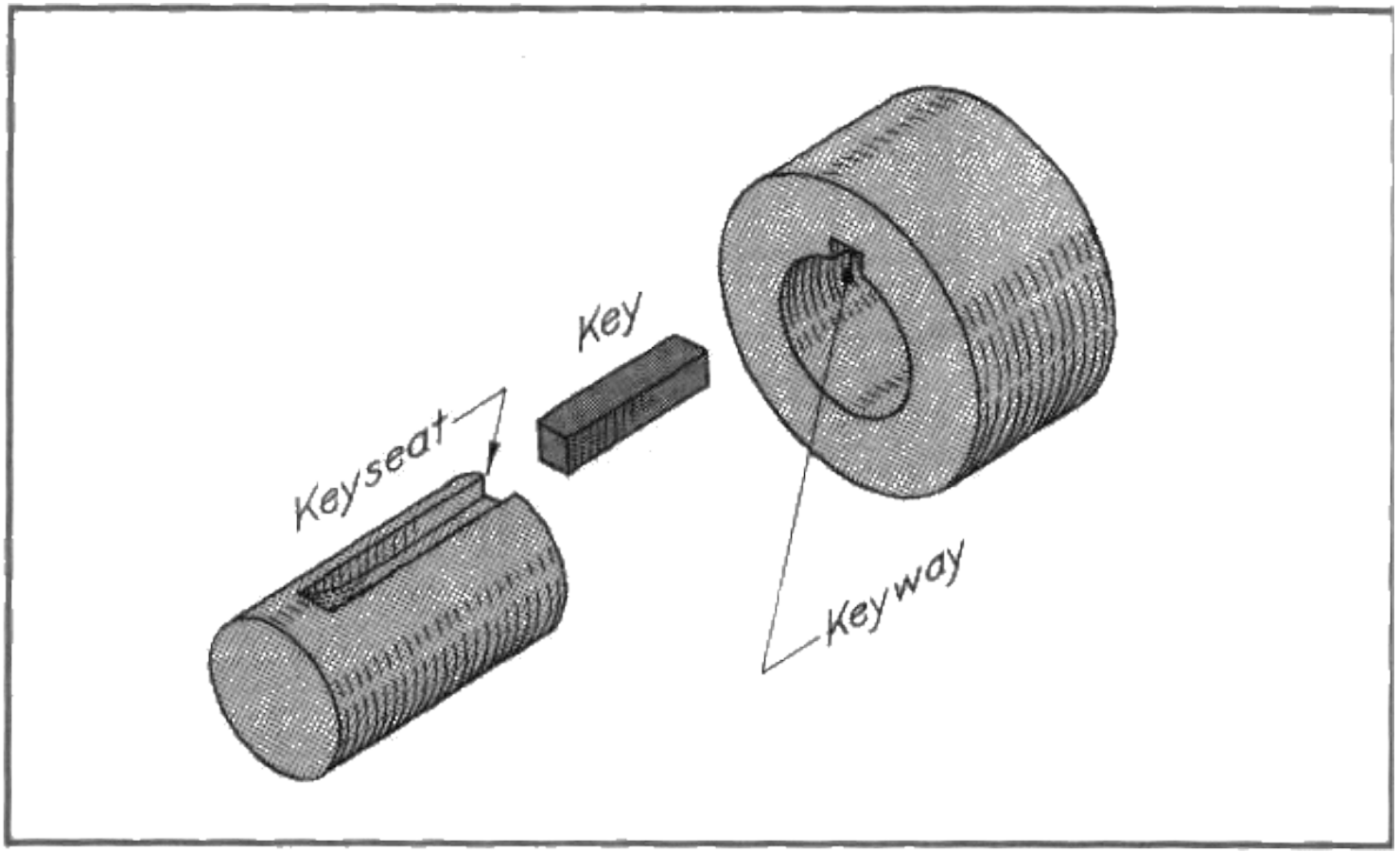
Dr./ Ahmed Nagib

Keys

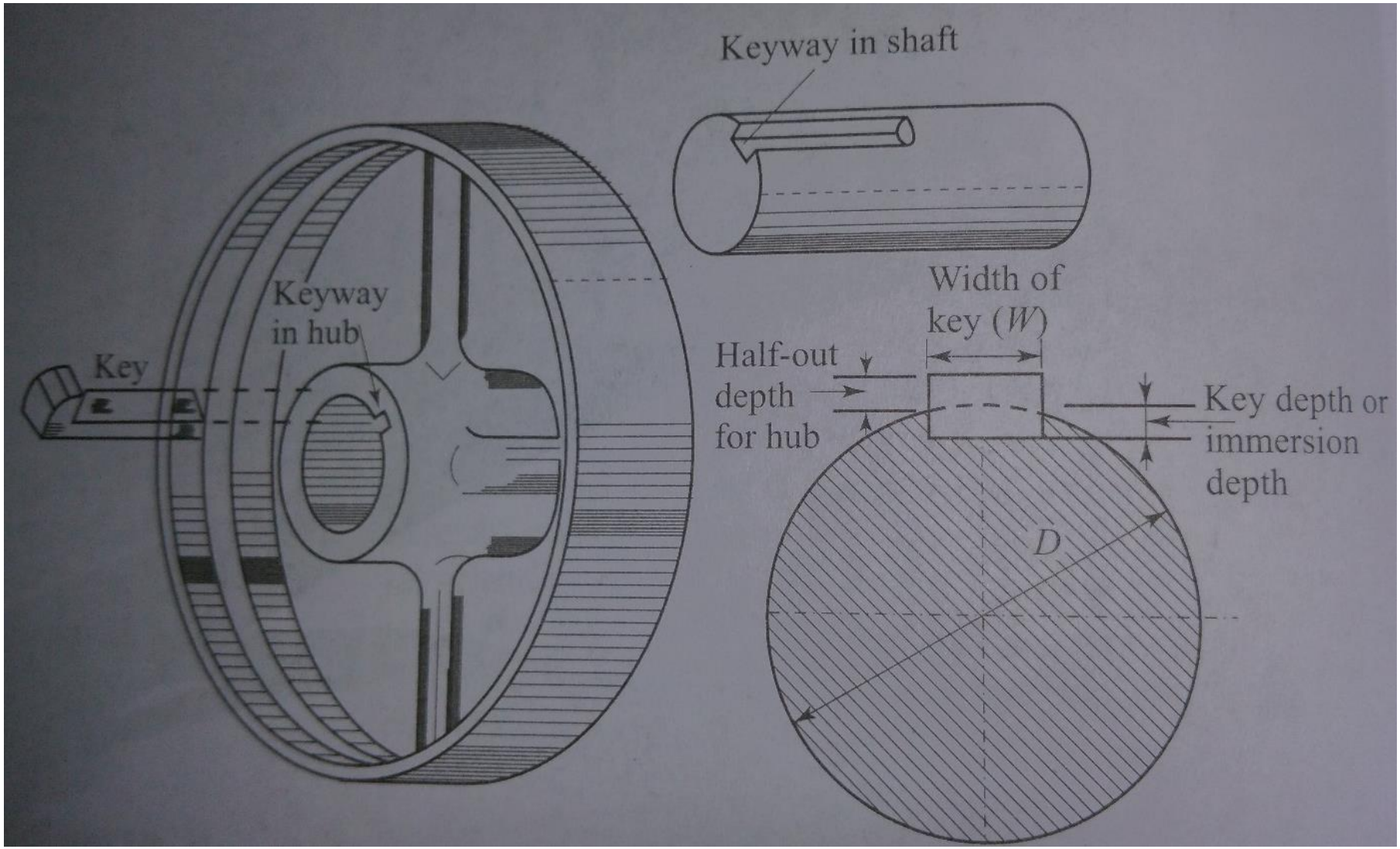
A key is a fastening component required to connect a rotational machine element to a shaft.



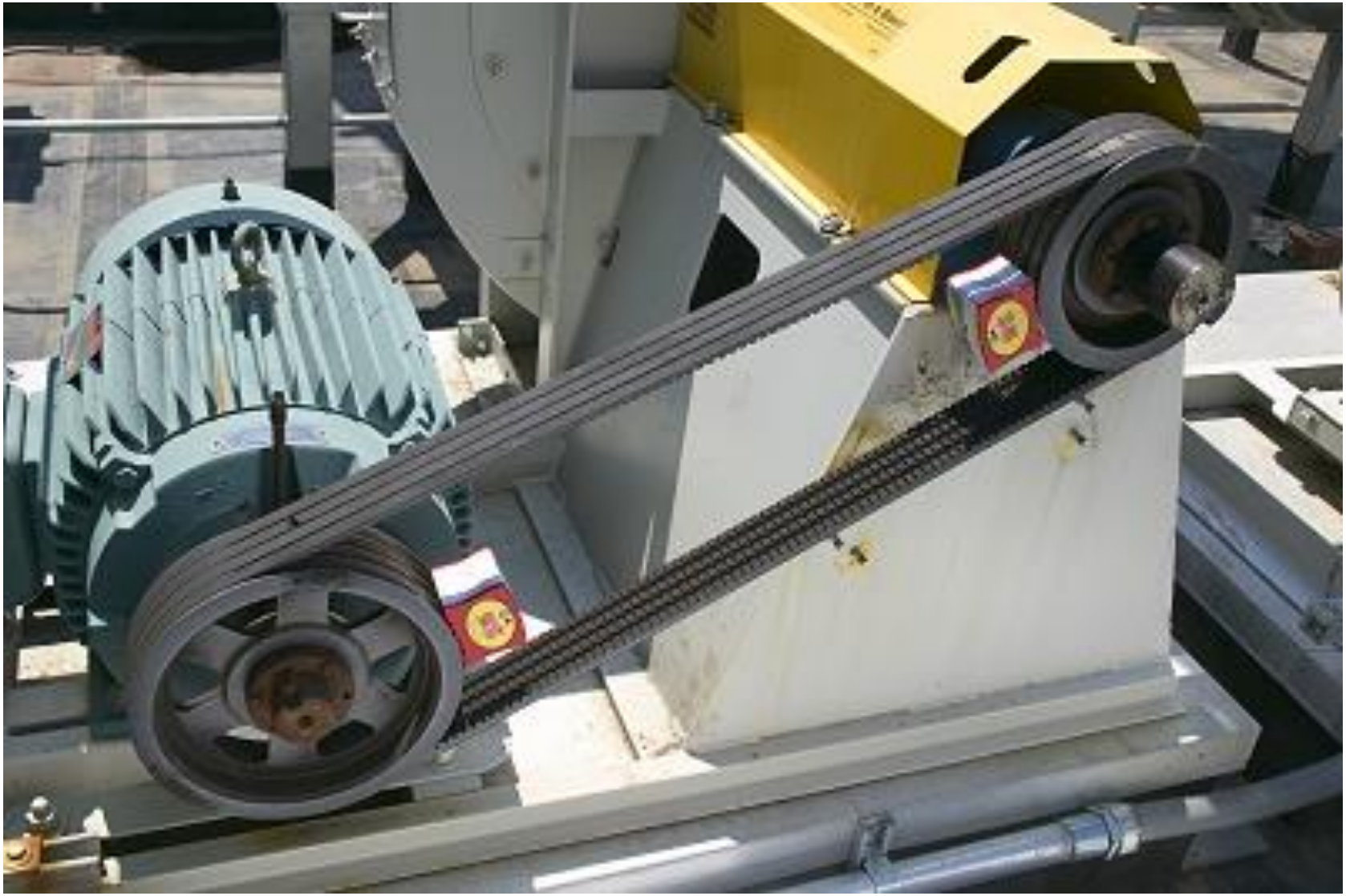
Keys



Keys


Keyway in shaft
Keyway in hub
Key
Width of key (W)
Half-out depth for hub
Key depth or immersion depth
D

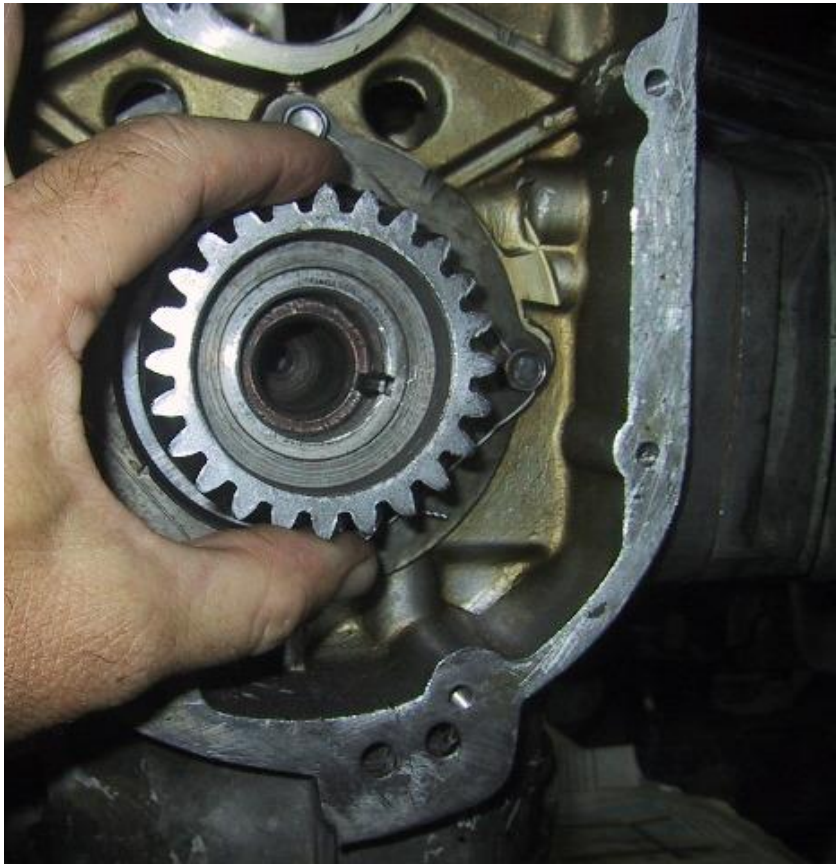
Keys – Belt Pulley



Keys – Belt Pulley

Keys – Flange Coupling

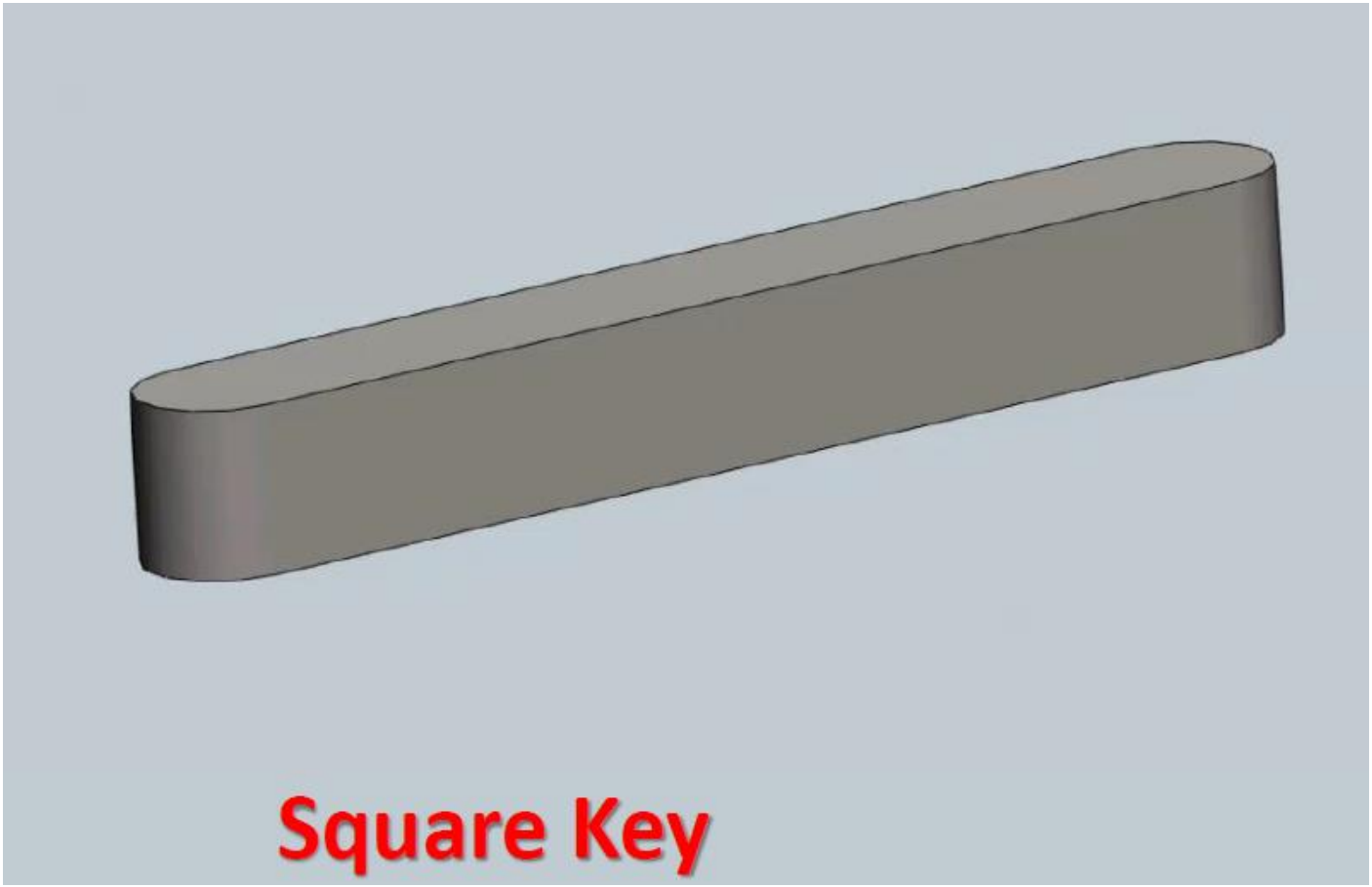
Keys – Gears



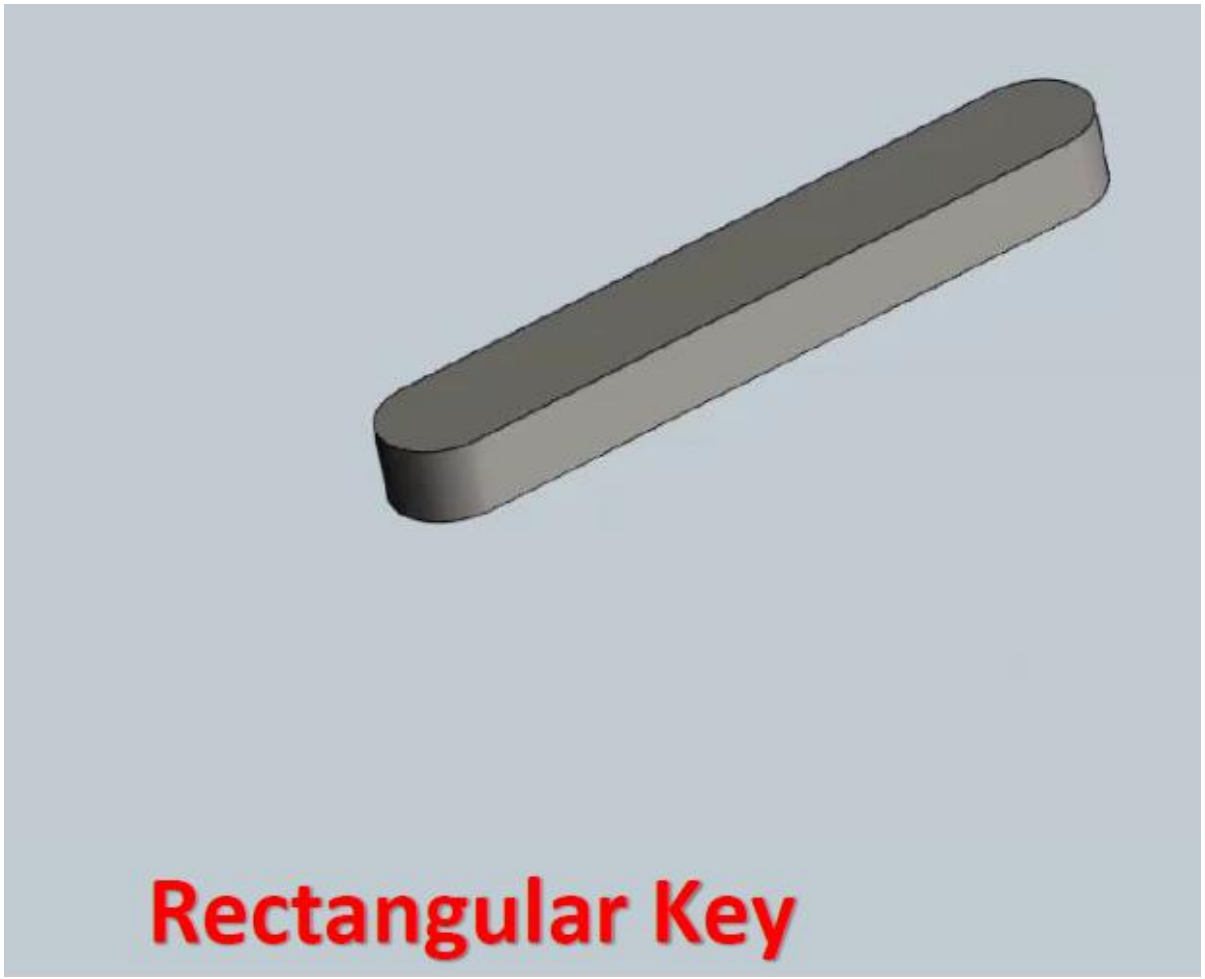
Type of Keys

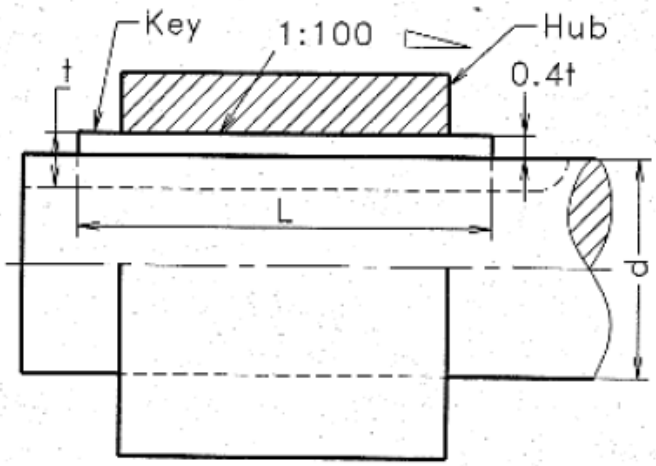
1. Square Key
2. Rectangular Key
3. Gib Head Key (Square)
4. Gib Head Key (Rectangle)
5. Feather Key
6. Woodruff Key
7. Hollow Saddle Key
8. Flat Saddle Key
9. Round Key
10. Taper Key

Square cross section



Rectangular cross section

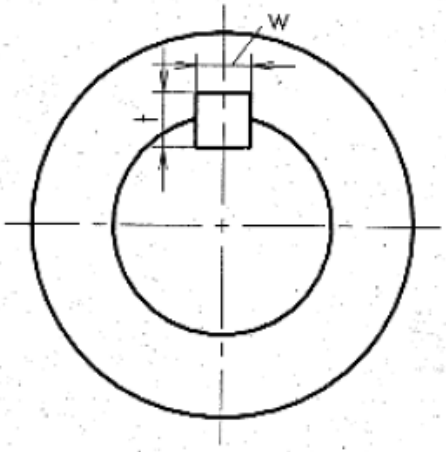




L = d to 3.5d

(i) Elevation
(Top half in section)

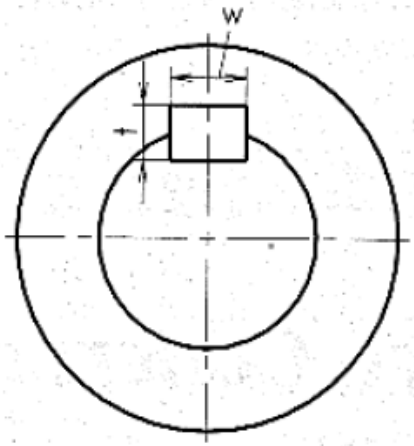
Square Key



w = t = 0.25d + 1 mm
for d = 10 to 22 mm

(ii) Side view
(Square key)

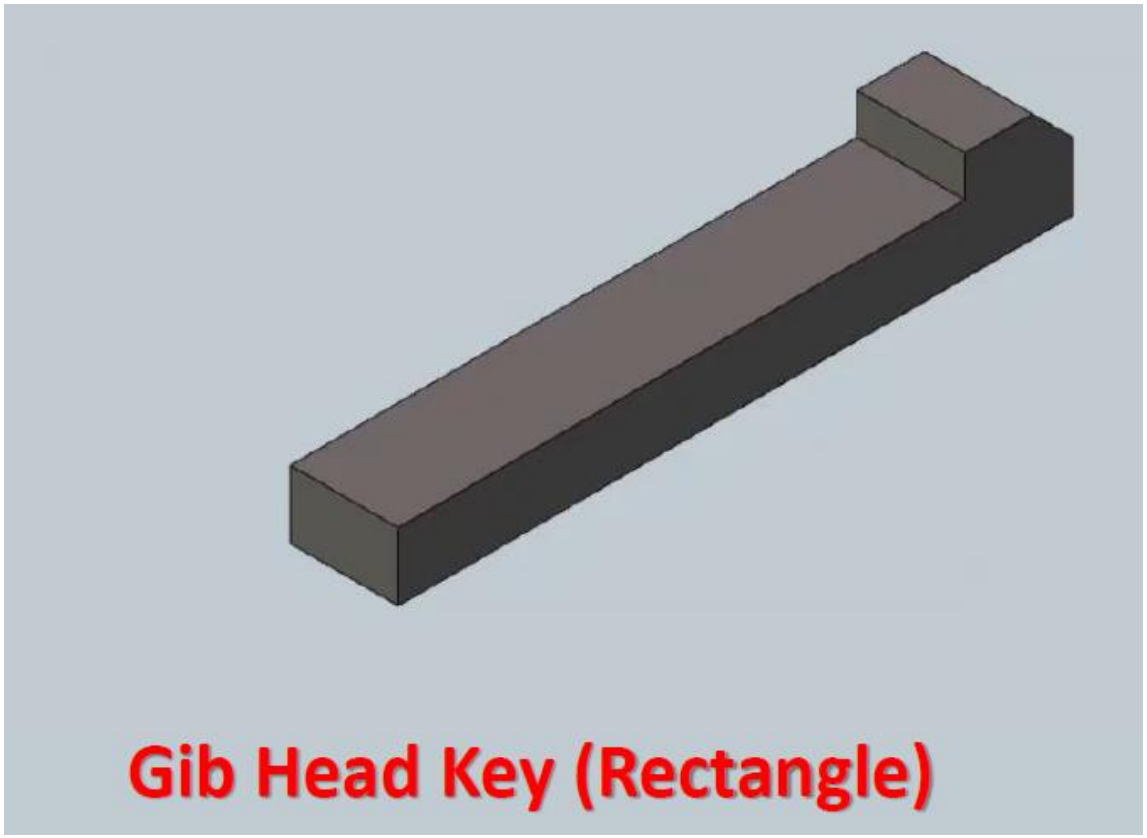
Rectangular Key



w = 0.25d + 2 mm, t = 0.67w
for d = 22 to 75 mm

(iii) Side view
(Rectangular key)

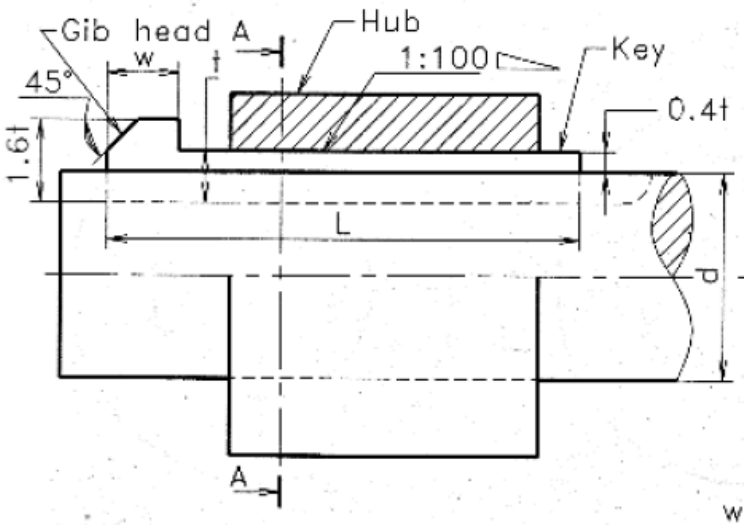
Taper sunk keys.



Gib Head Key (Rectangle)

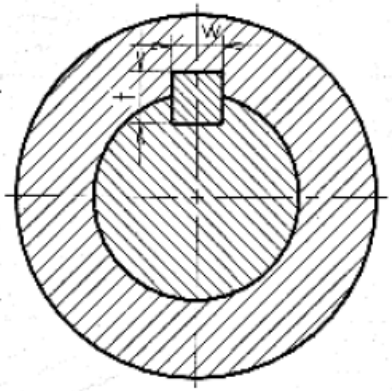
Gib Head Key (Square)

Gib Head Key (Rectangle)



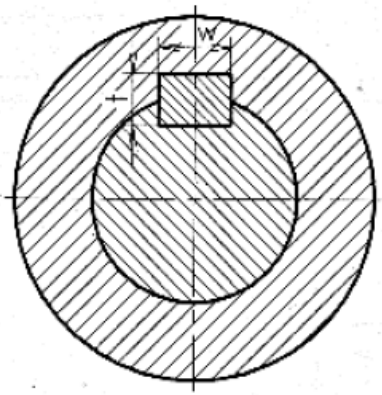
L = d to 3.5d

(i) Elevation
(Top half in section)



w = t = 0.25d + 1 mm
for d = 10 to 22 mm

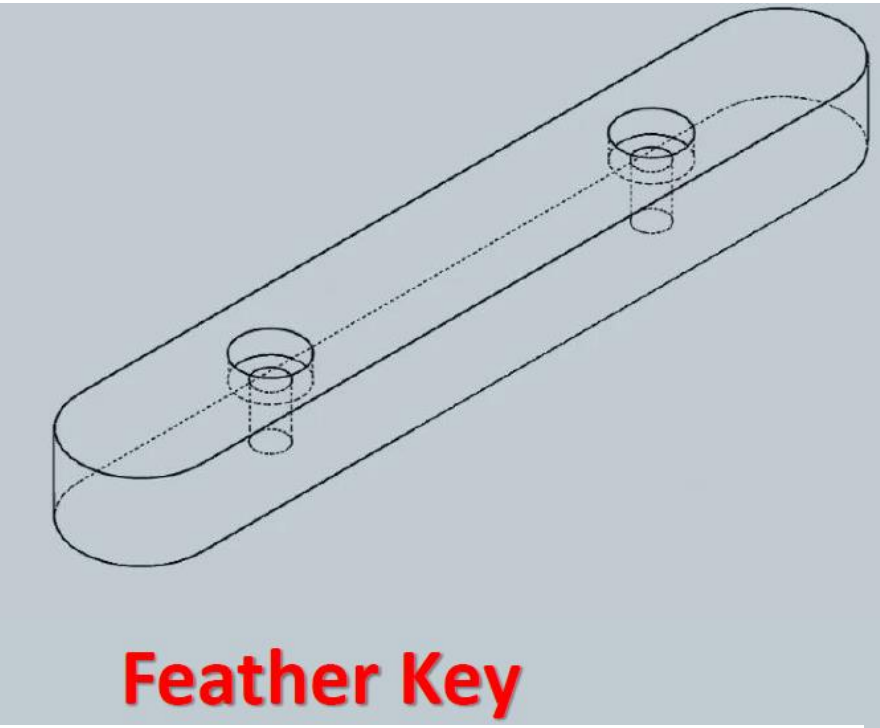
(ii) Side view
(Square key)



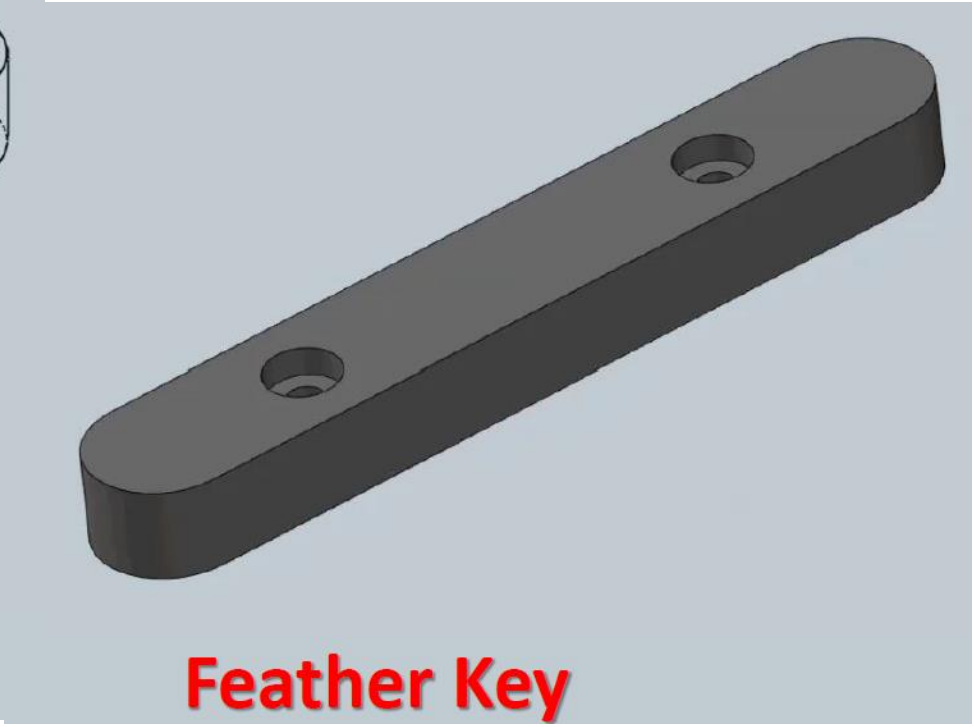
w = 0.25d + 2 mm,
t = 0.67w
for d = 22 to 75 mm

(iii) Side view
(Rectangular key)

Taper sunk keys with gib head.

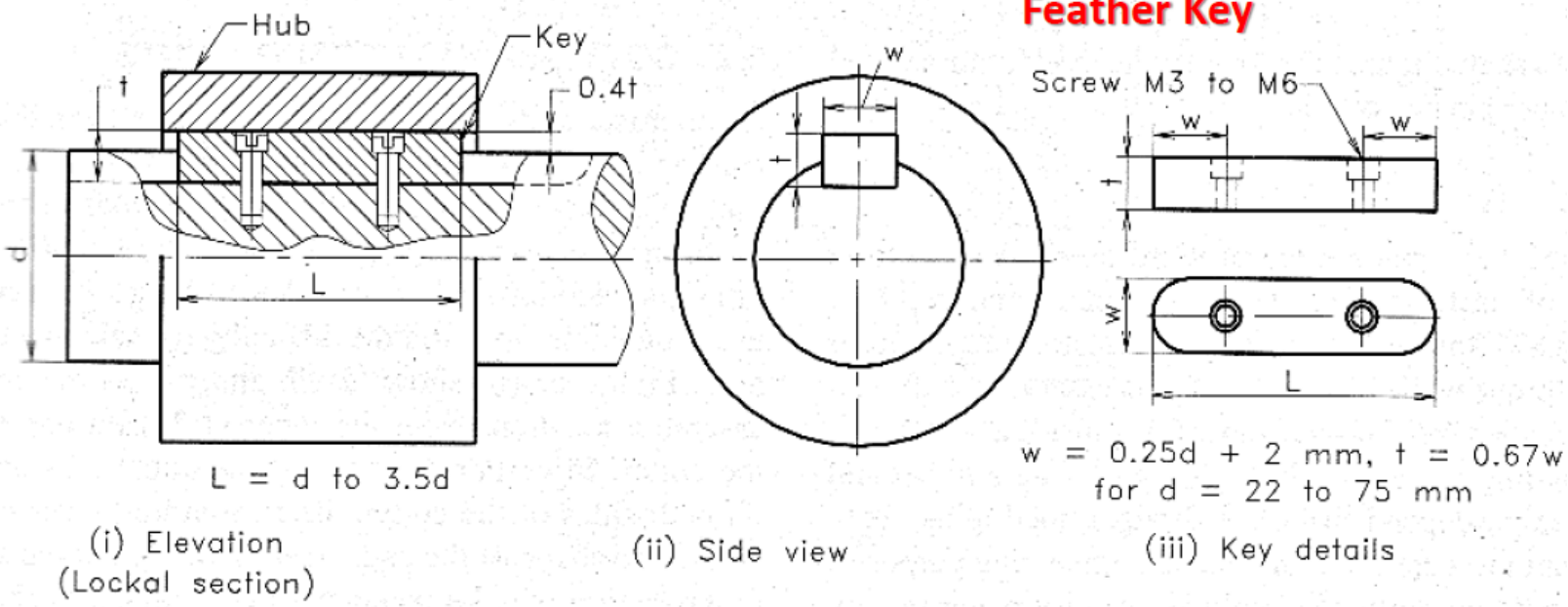


Feather Key

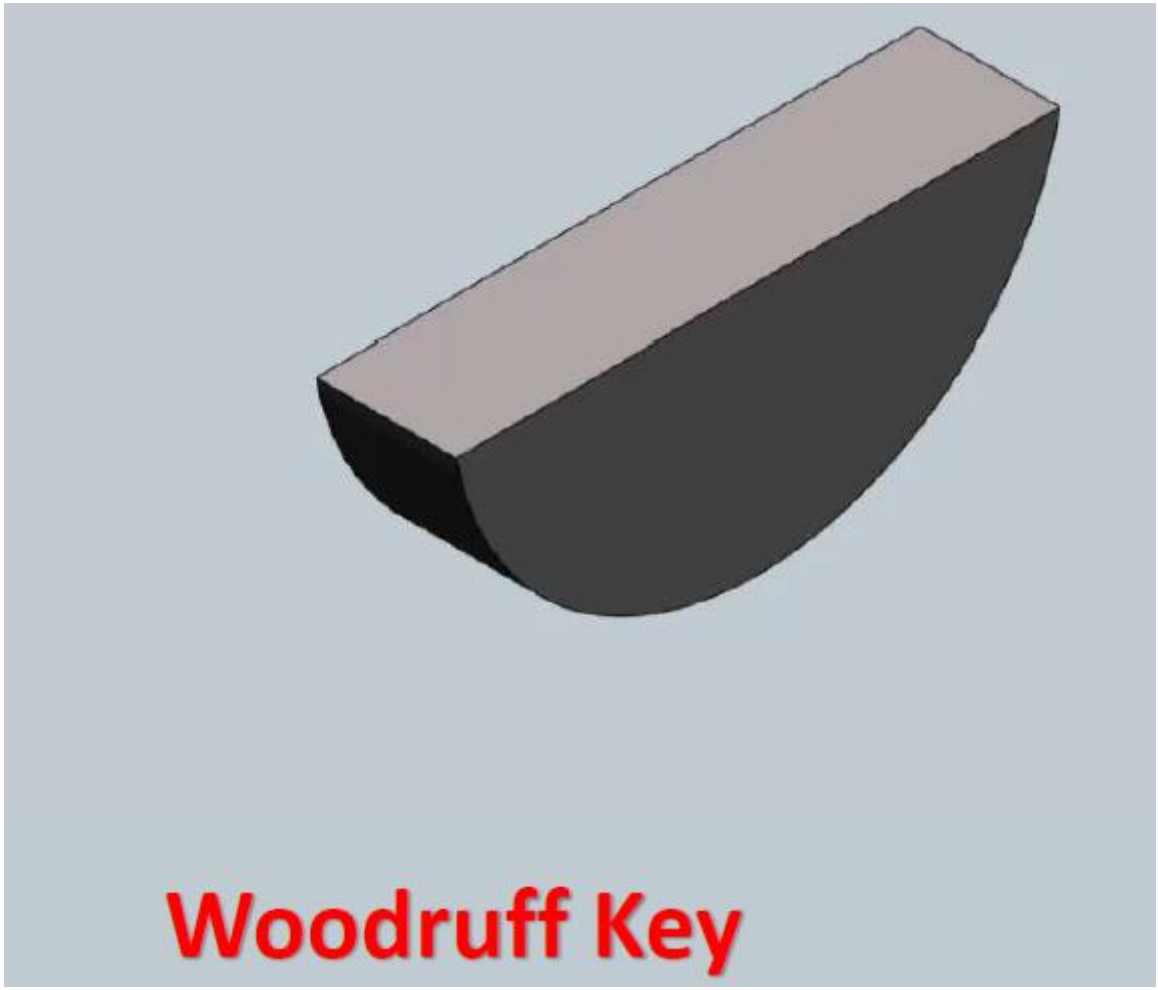


Feather Key

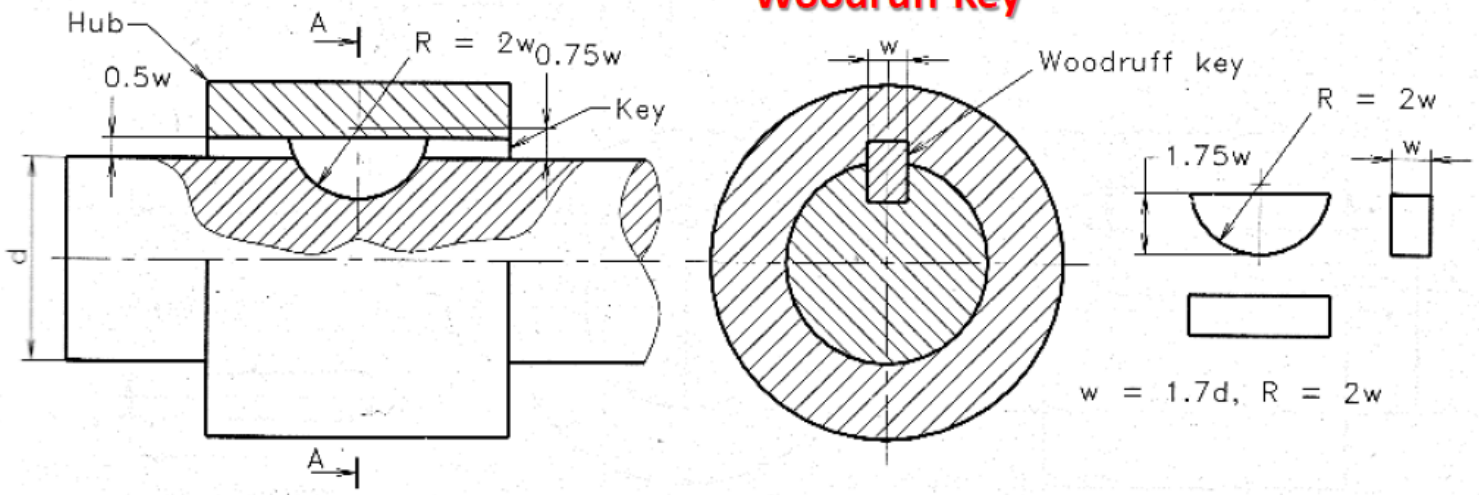
Feather Key



Parallel (feather) sunk keys.


Woodruff Key

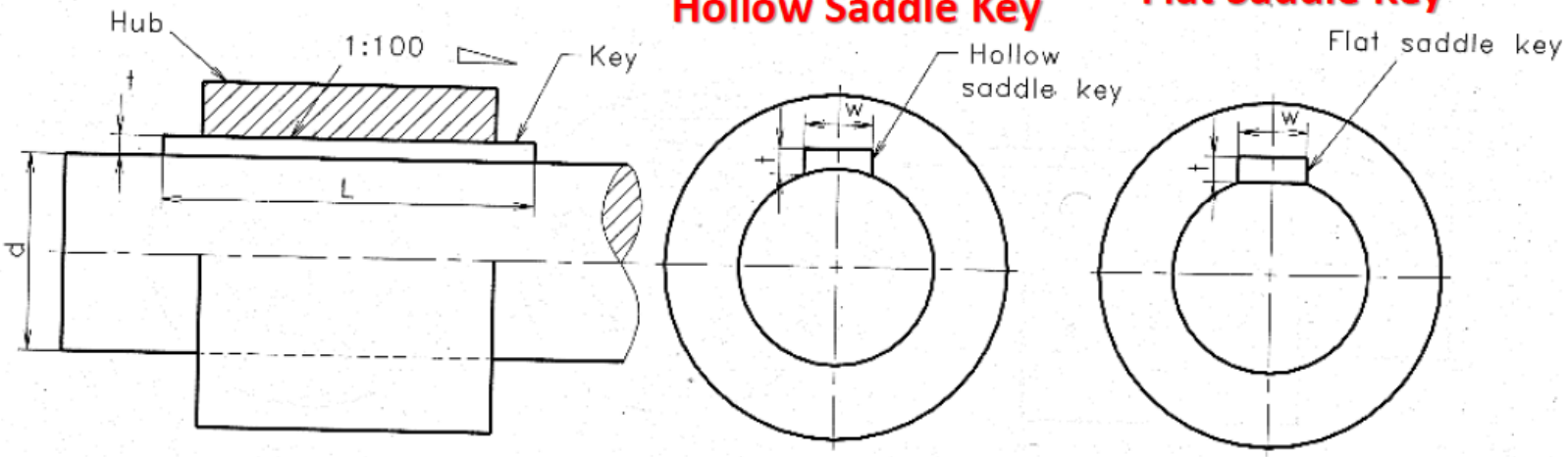
Woodruff Key



Woodruff key.

Hollow Saddle Key

Flat Saddle Key



L = d to 3.5d

(i) Elevation
(Top half in section)

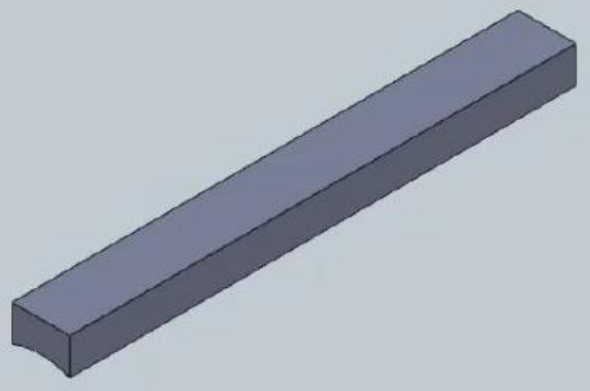
w = 0.25d + 2 mm, t = 0.4w
for d = 10 to 75 mm

(ii) Hollow saddle key
(Side view)

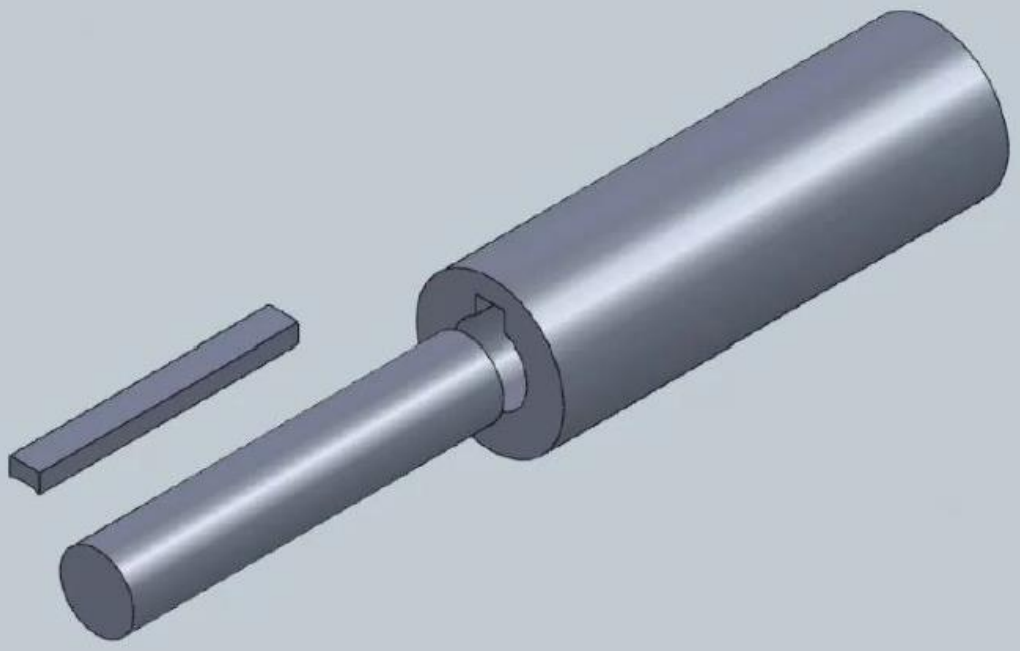
w = 0.25d + 2 mm, t = 0.4w
for d = 10 to 75 mm

(iii) Flat saddle key
(Side view)

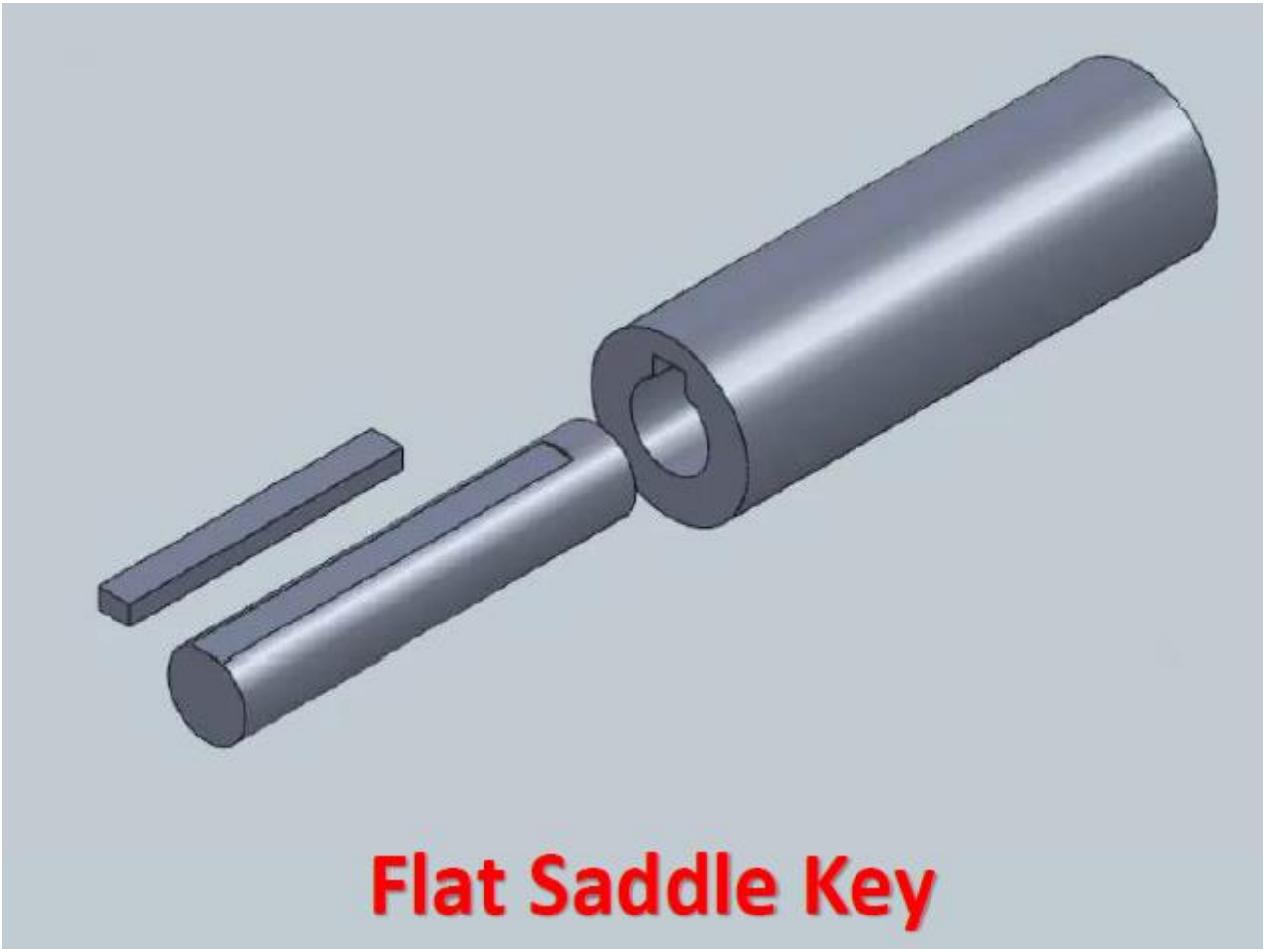
Saddle keys.

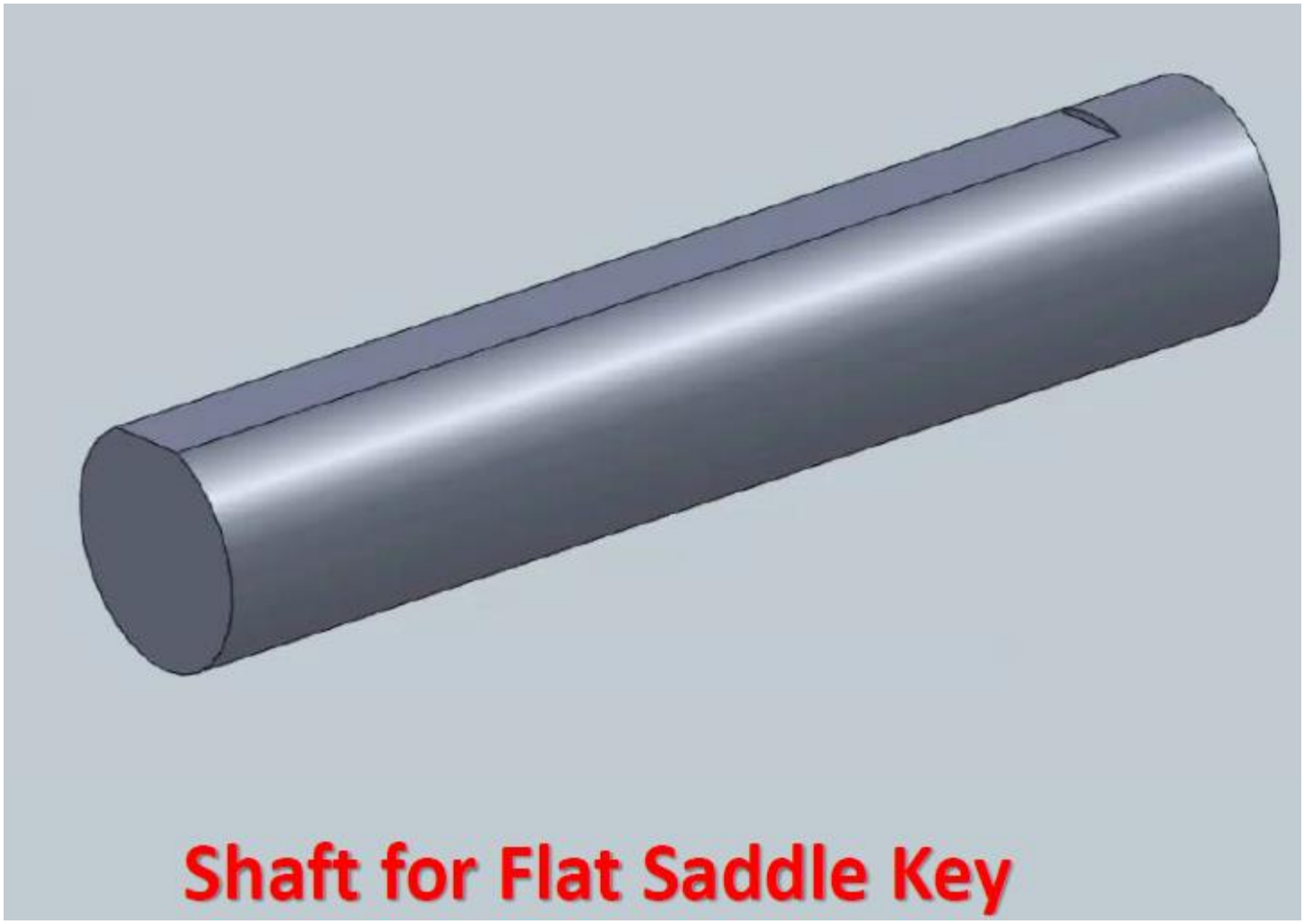


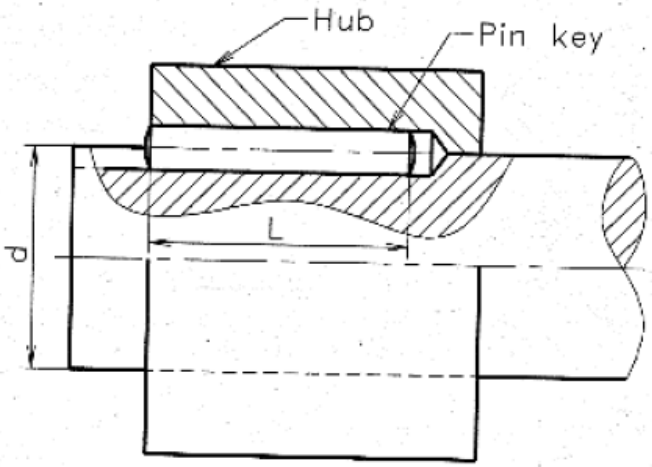
Hollow Saddle Key



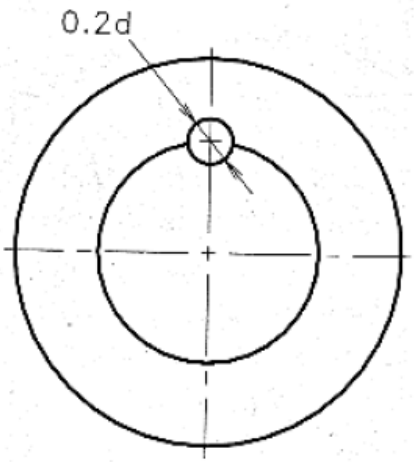
Hollow Saddle Key


Flat Saddle Key


Shaft for Flat Saddle Key

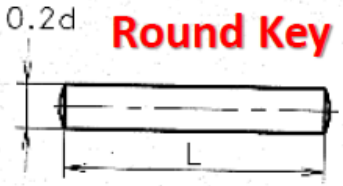


(i) Elevation (lockal section)



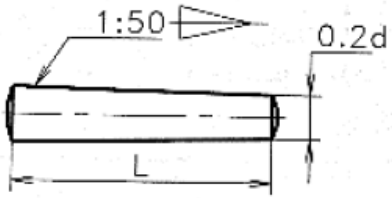
(ii) End view

Round or pin keys.



Round Key

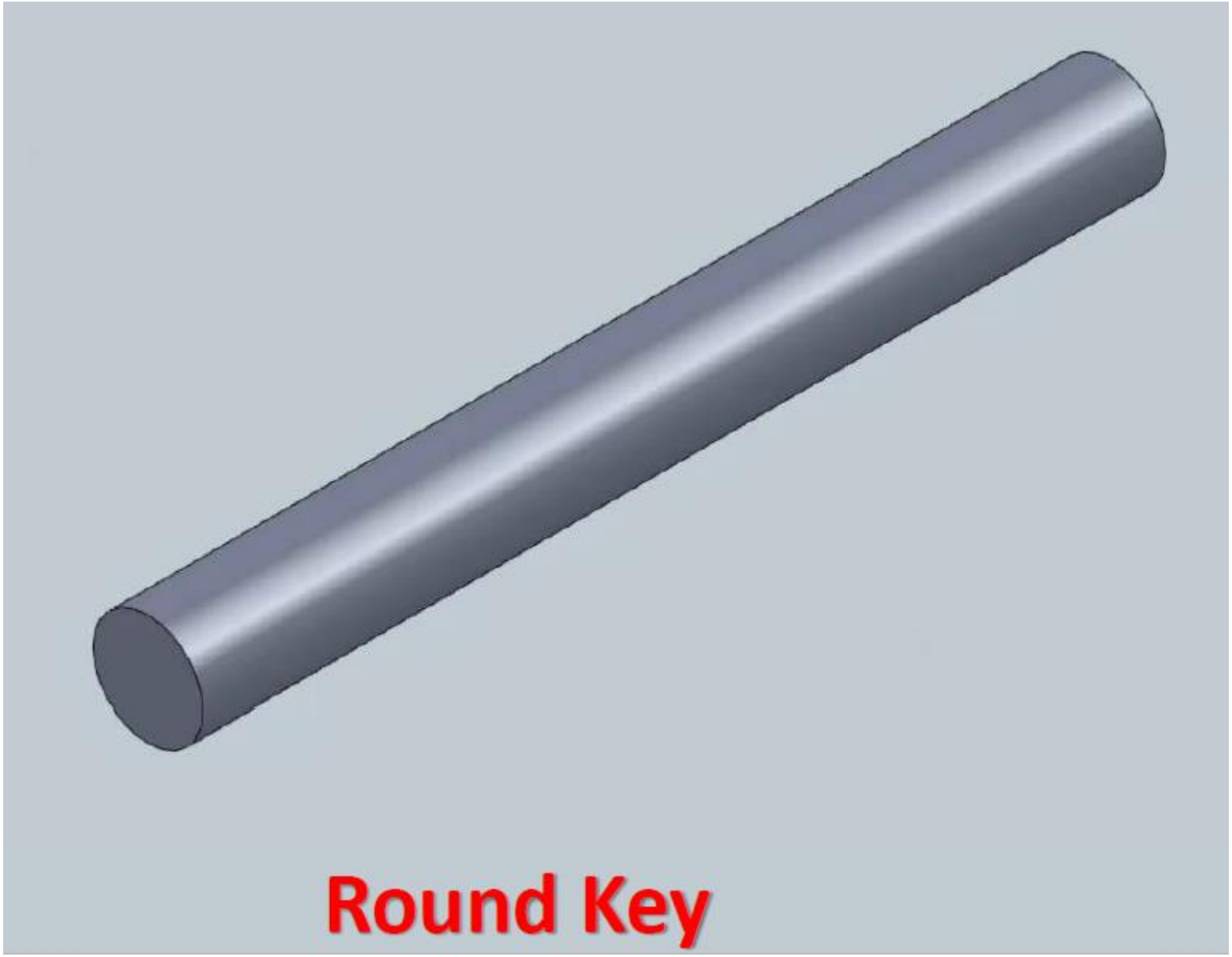
Round key

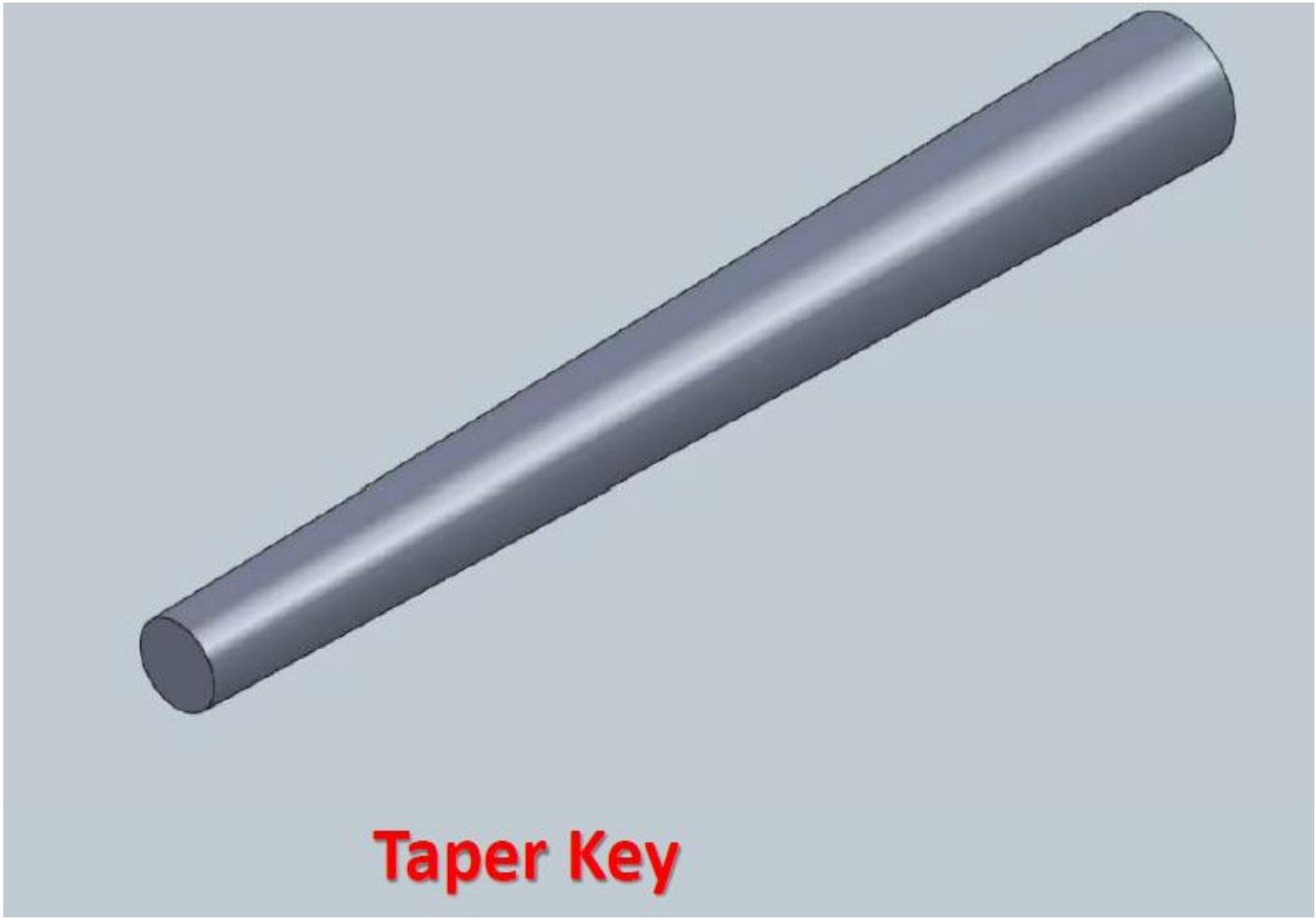


Taper pin key

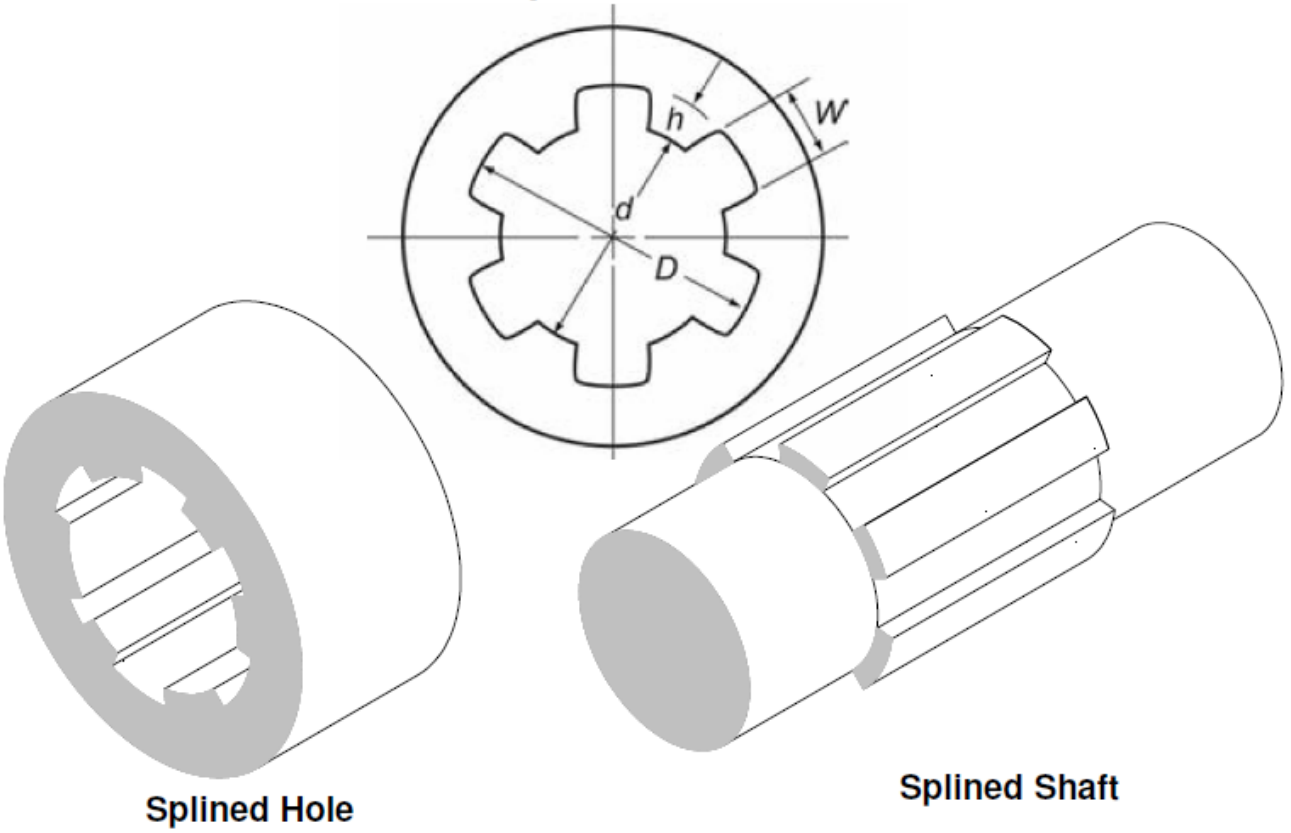
(iii) Key details

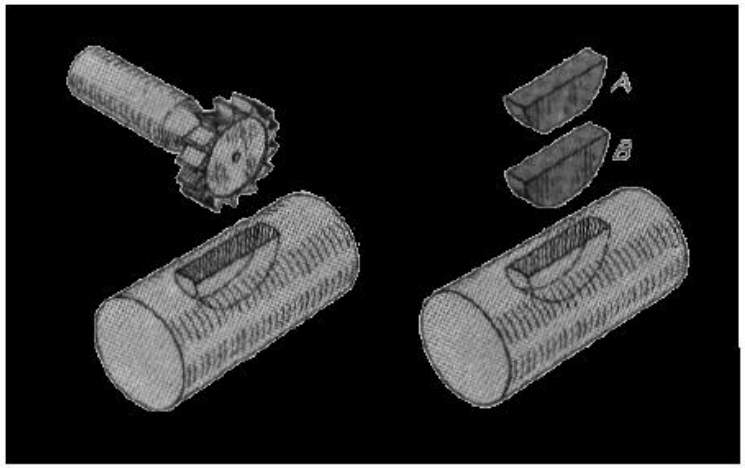
Taper Key

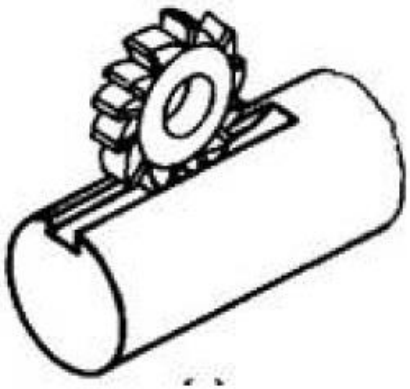

Round Key

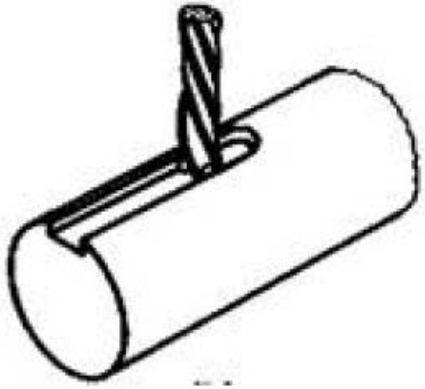

Taper Key

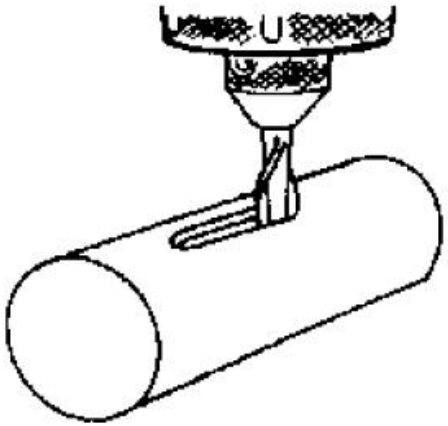
Splines




A
B



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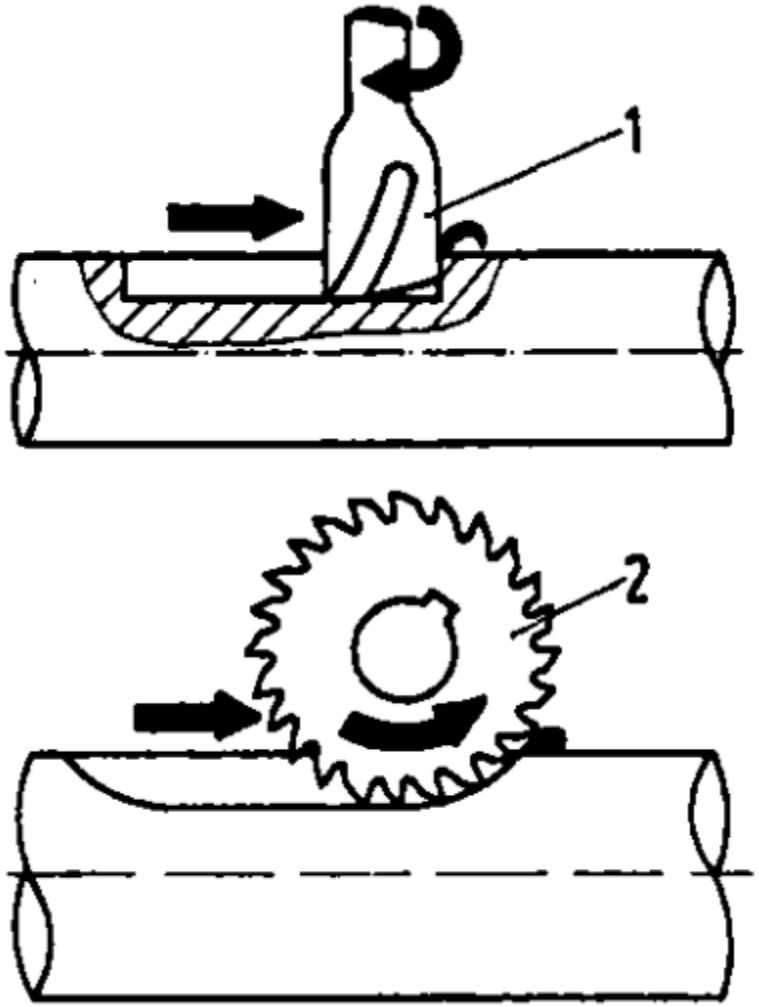


Figure 12 – Making of shaft keyways with the help of

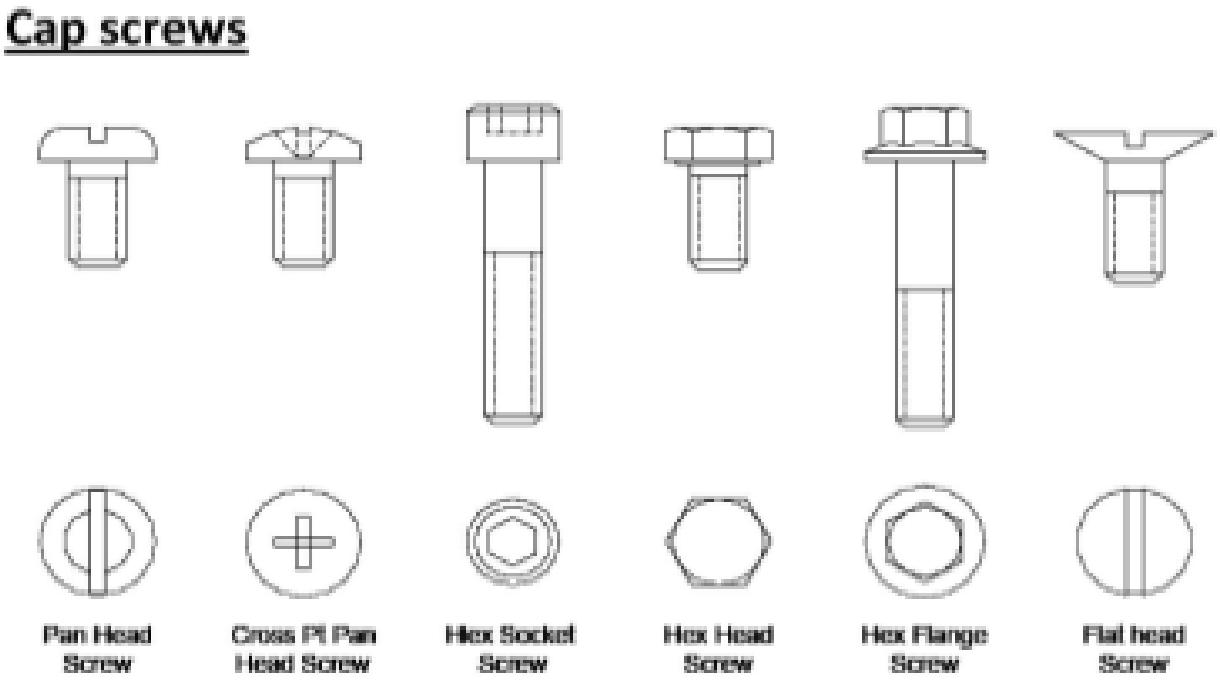
1 end mill cutter, 2 cylindrical cutter

Key Material

Steel, since they are subjected to heavy shear and crushing loads.

Set Screws

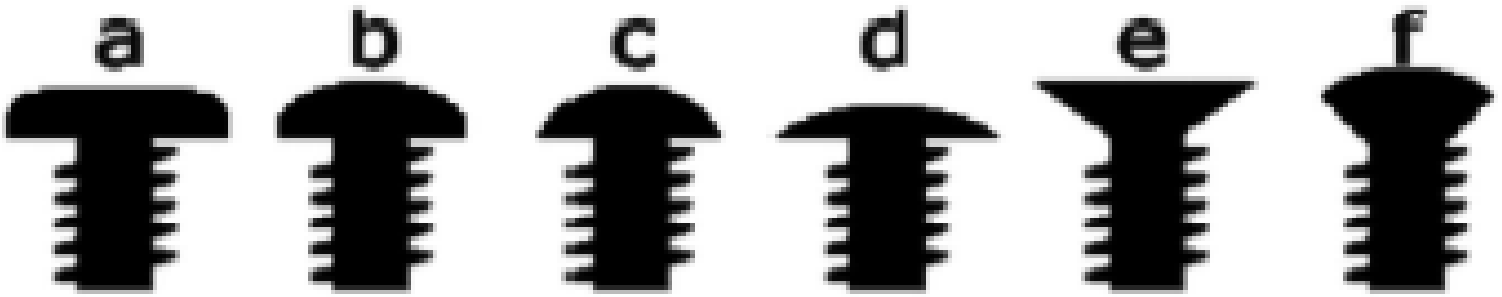
Set Screws


Cap screws
Pan Head Screw
Cross Pt Pan Head Screw
Hex Socket Screw
Hex Head Screw
Hex Flange Screw
Flat head Screw

Set Screws

Screws head

Set Screws



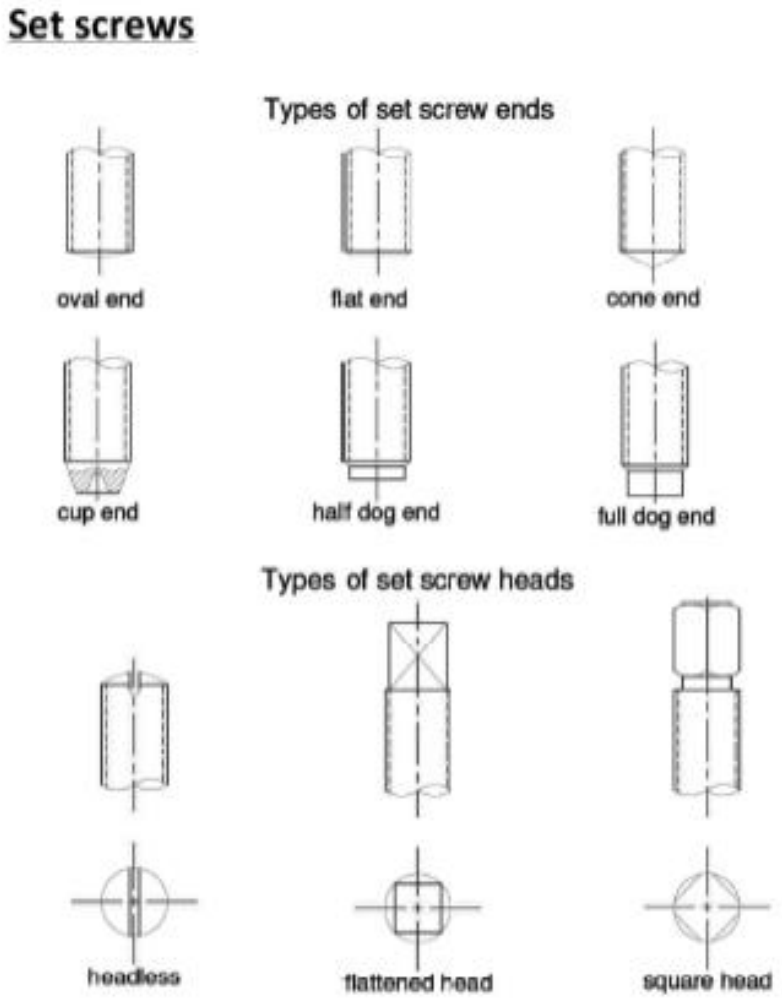
(a) pan, (b) button, (c) round, (d) truss, (e) flat, (f) oval

Set Screws

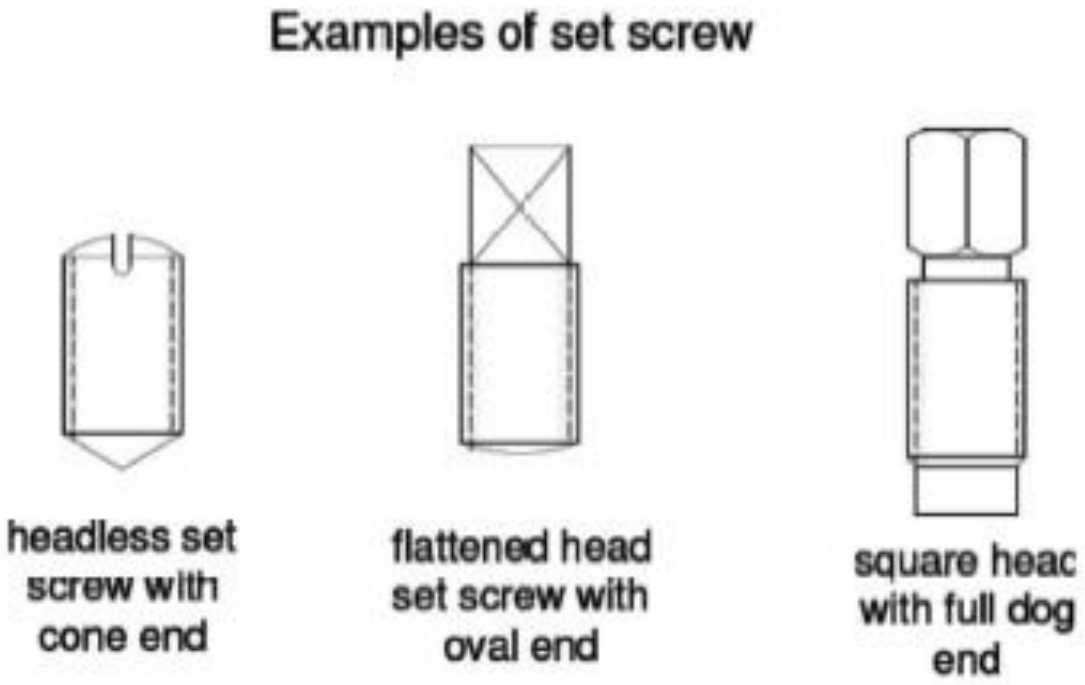

© 2007 CuriousInventor.com
socket shoulder screw
socket head button screw (shbs)
hex head cap screw (hhcs)
round head slotted
flat head torx screw
socket set screw (sss)
socket head cap screw (shcs)

Set Screws

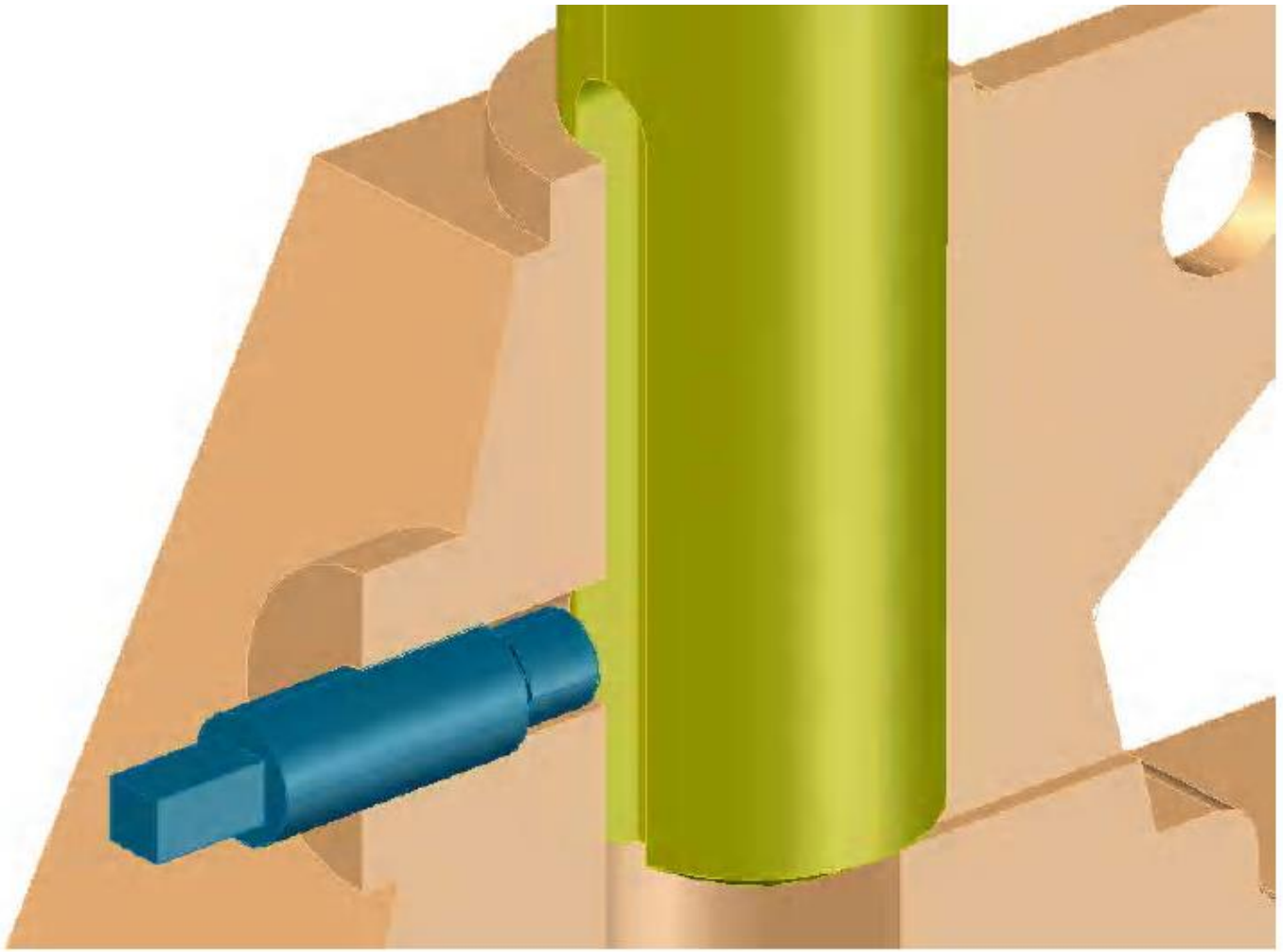
Set Screws


Set screws
Types of set screw ends
oval end
flat end
cone end
cup end
half dog end
full dog end
Types of set screw heads
headless
flattened head
square head

Set Screws


Examples of set screw
headless set screw with cone end
flattened head set screw with oval end
square heac with full dog end

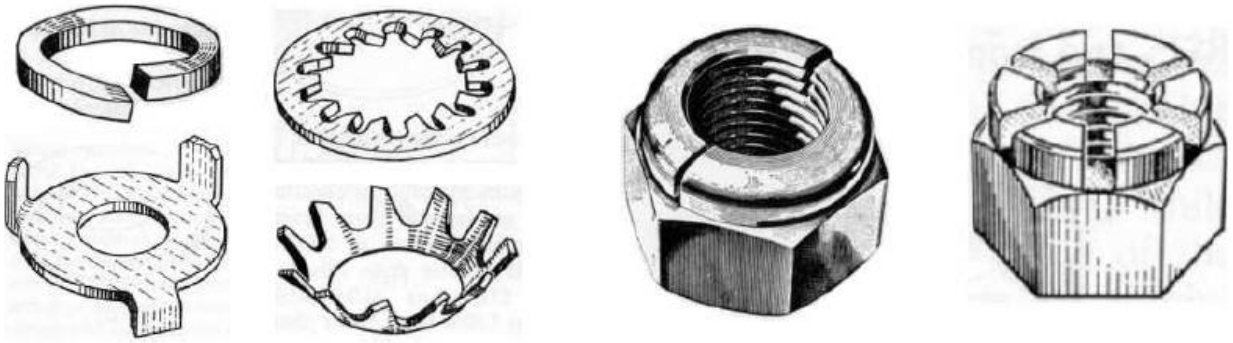
Set Screws



Locking Devices

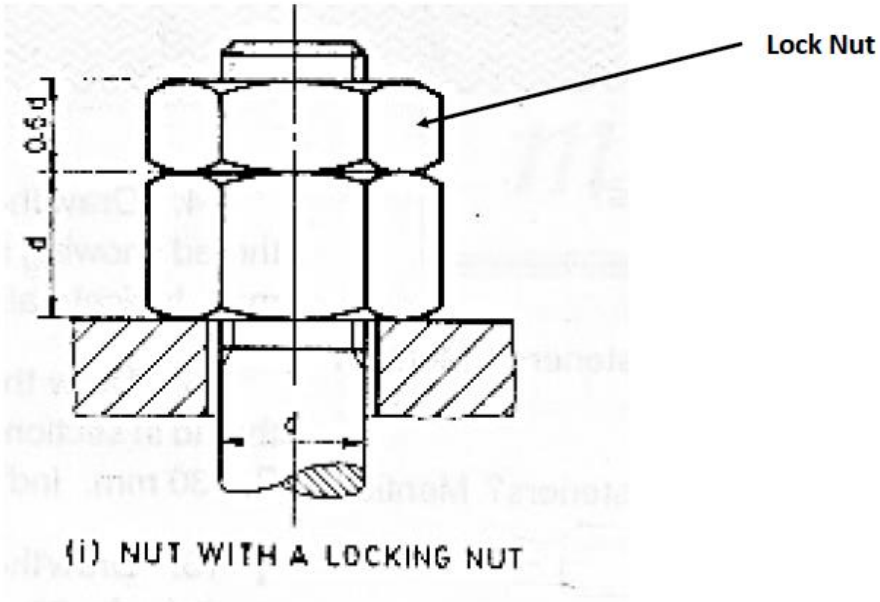
Many different locking devices are used to prevent nuts from working loose. The following figure illustrates various locking devices. A screw thread holds securely unless the parts are subject to impact and vibration (e.g. as in a car engine).

Special Washers & Nuts



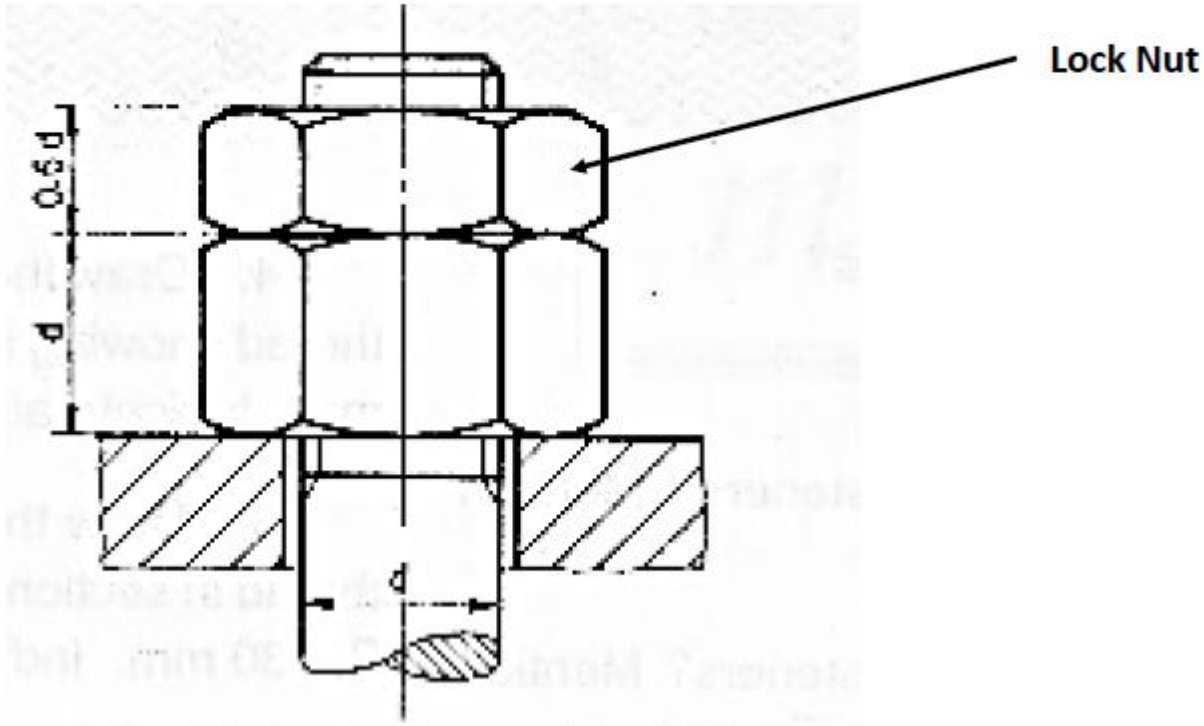
Locking Devices – Locking Nut

NUT WITH A LOCKING NUT



Locking Devices – Locking Nut

NUT WITH A LOCKING NUT



(i) NUT WITH A LOCKING NUT

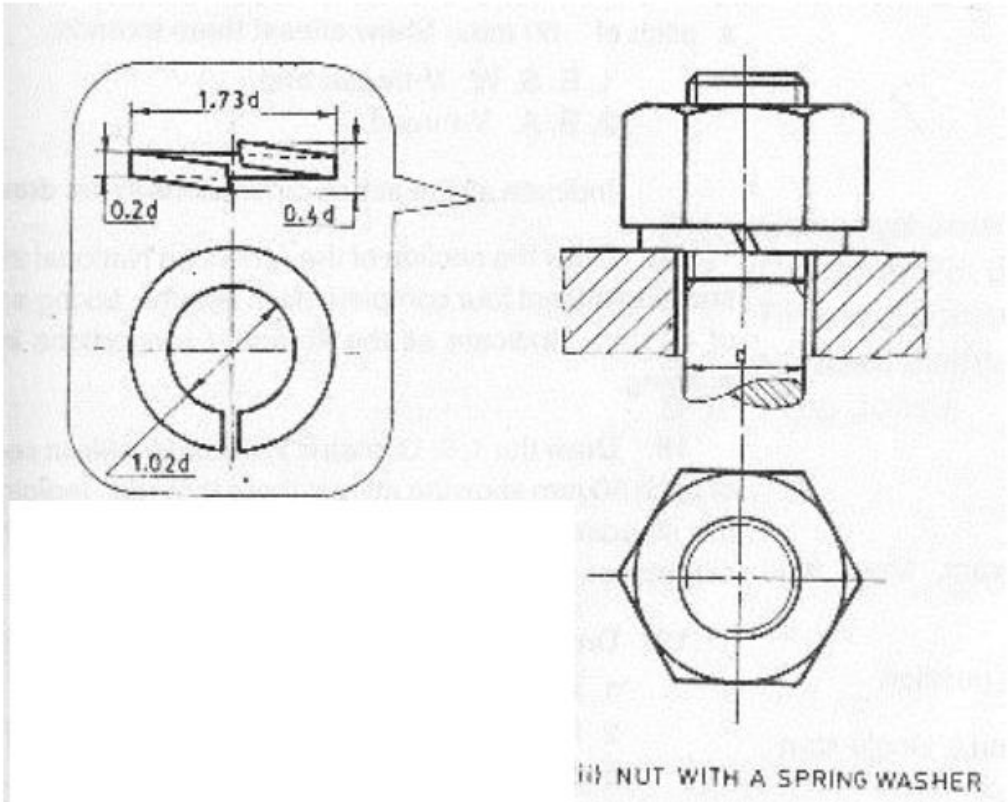
Locking Devices – Spring Washer

These are low cost items with questionable reliability generally considered only suitable for non-critical consumer items.
These are double or single coils of rectangular section spring steel. These washers are used in place of plain washers. The washers prevent rotation of the nut or bolt by the two ends digging into the surface of the two adjacent faces. The free height of the coil washer is about 5 times the compressed height.

NUT WITH A SPRING WASHER

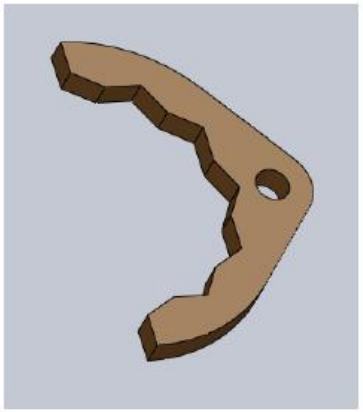
Locking Devices – Spring Washer

NUT WITH A SPRING WASHER

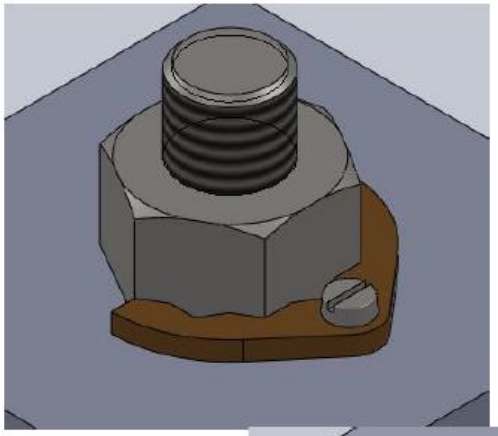


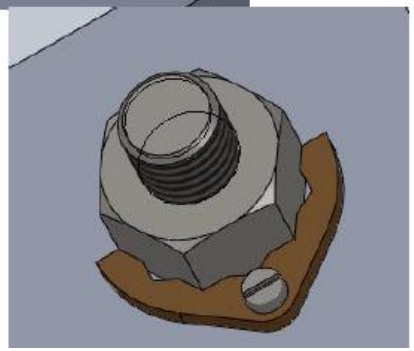
Locking Devices – Locking Plate

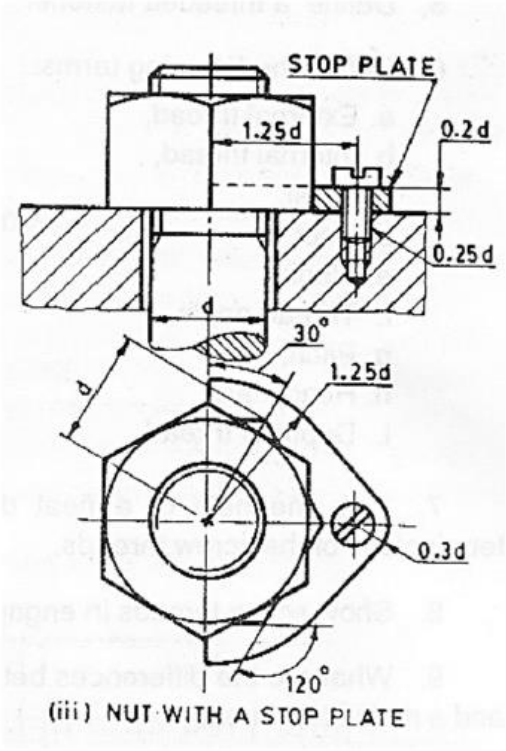
NUT WITH A STOP PLATE



STOP PLATE







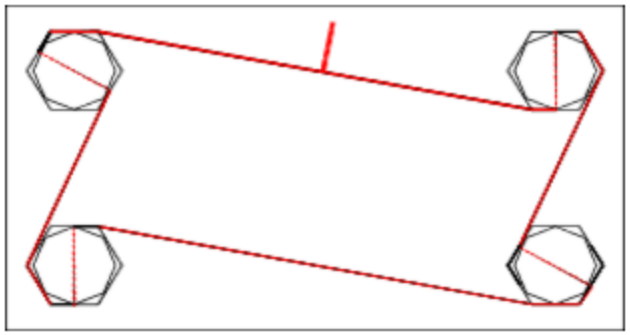
(iii) NUT WITH A STOP PLATE

Locking Devices – Wire Locking

Wire locking is a very low cost and entirely effective method locking nuts or hex headed screws and bolts screwed into surfaces. It is mainly used when a number of screws have to be locked. Holes are predrilled in the items being locked and when all of the items have been fully tightened the wire is threaded through the holes and the ends are twisted to prevent loosening.. The routing of the wire is such that it prevents the screws from unscrewing.

The wire is selected as non-corrodible ductile steel or brass wire of suitable small gauge is used for this purpose.

The method is labour intensive and inhibits maintenance activities...



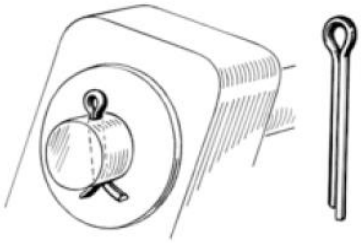
Locking Devices – Wire Locking

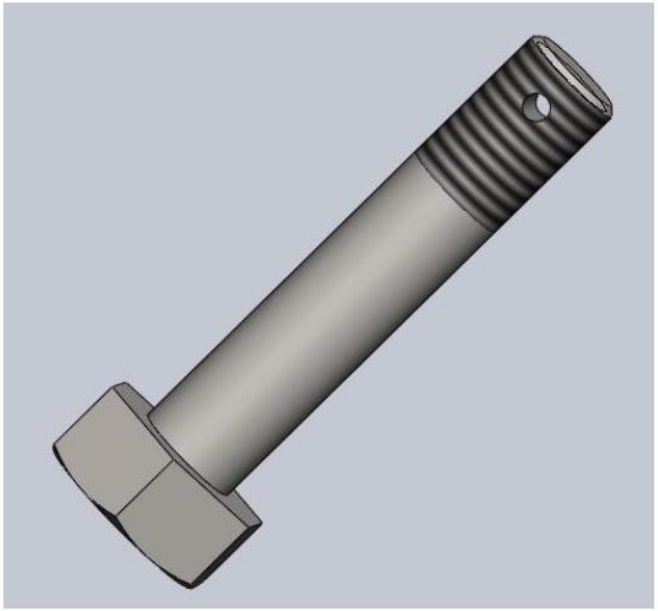
Locking Devices – Slotted/Castle Nut

These nuts have slots in the top face. The nuts are fully tightened and a hole is drilled through the male thread to align with one of the slots. Split cotter pins are then inserted through the nut and the male thread and bent to hold it in position. This is a very effective and positive locking device but is expensive to install. It can also be difficult to install due to poor accessibility.

NUT WITH A SPLIT PIN

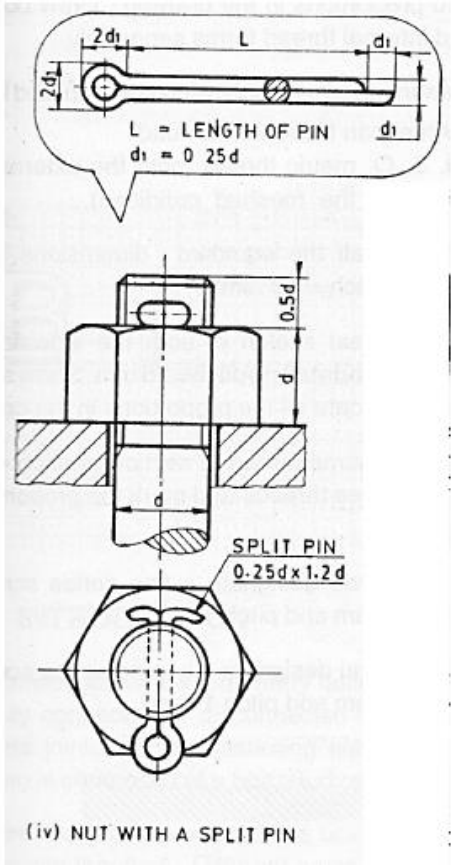
SPLIT PIN





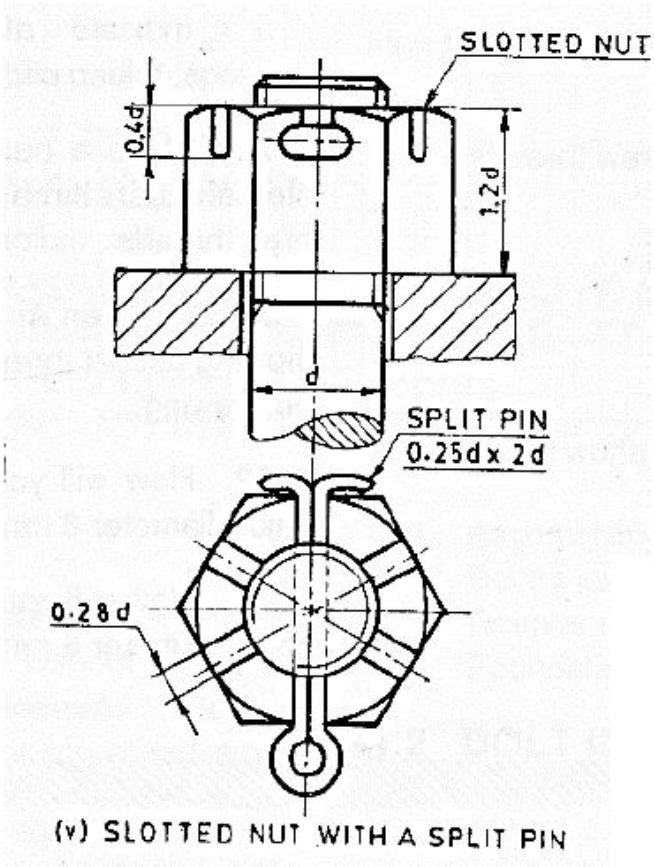
Locking Devices – Slotted/Castle Nut

NUT WITH A SPLIT PIN



Locking Devices – Slotted/Castle Nut

SLOTTED NUT WITH A SPLIT PIN



(v) SLOTTED NUT WITH A SPLIT PIN

Locking Devices – Slotted/Castle Nut

SLOTTED NUT WITH A SPLIT PIN

Locking Devices – Slotted/Castle Nut

CASTLE NUT WITH A SPLIT PIN