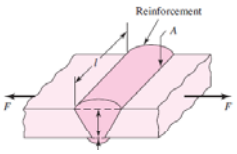
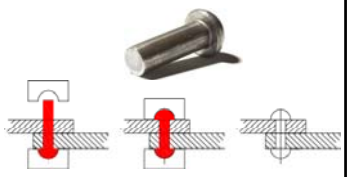
ME251A- Engineering Design and Graphics

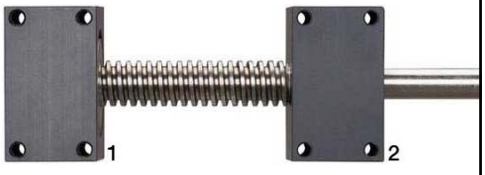
Threaded Fasteners

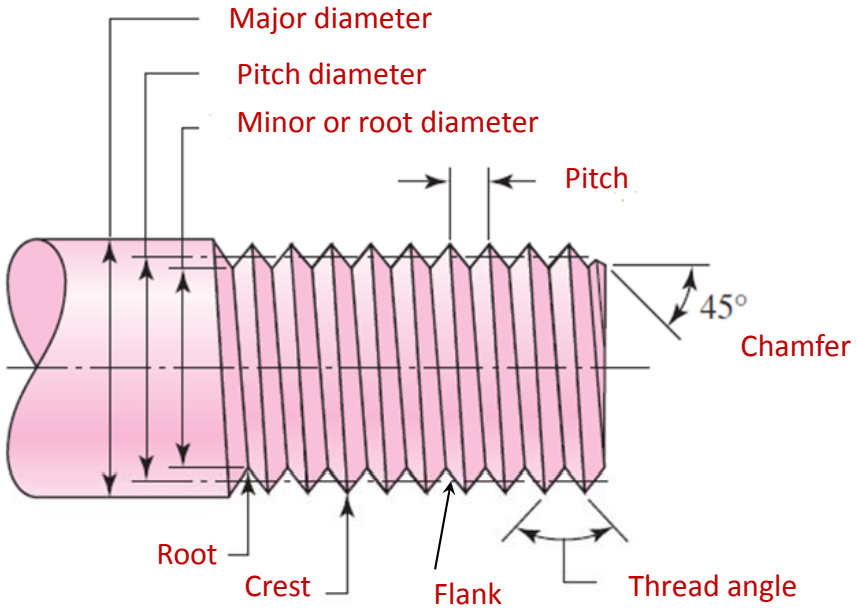
- Engineering systems are composed of parts which are joined together
- Methods of joining
  - Welding
  - Riveting
  - Adhesive bonding
  - Using threaded fasteners





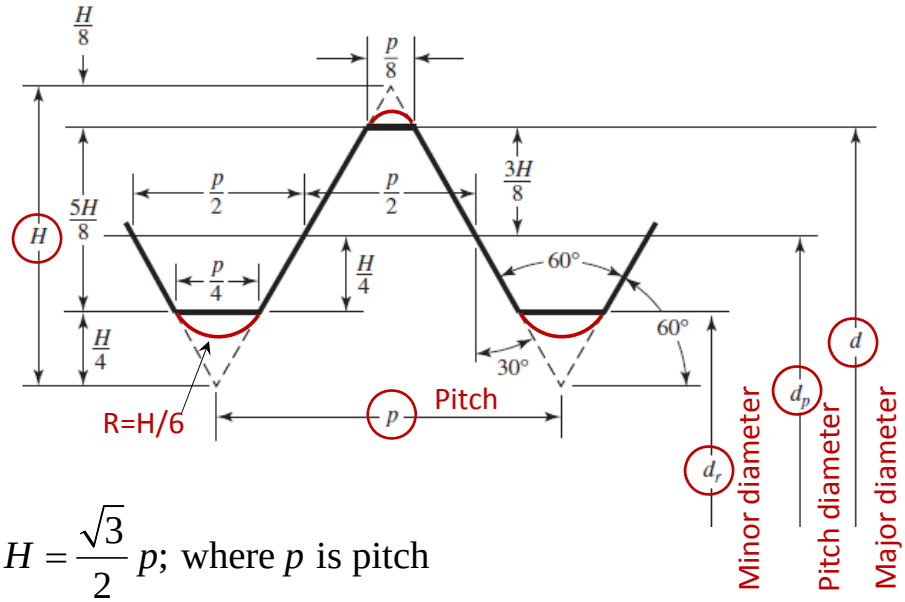
- Threads
  - Helical feature made on the outer surface of a cylindrical part





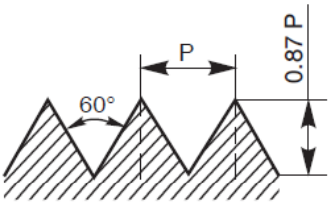
Pitch is distance measured parallel to axis between corresponding points on adjacent threads

Standard ISO Metric thread profile

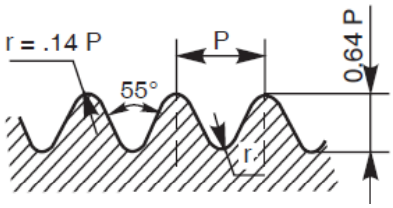


$$H = \frac{\sqrt{3}}{2} p;\ \text{where } p \text{ is pitch}$$

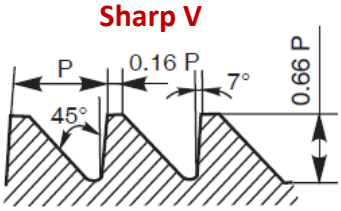
Other Thread Profiles



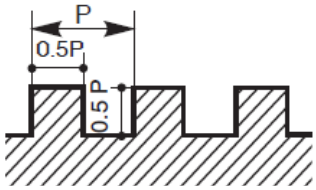
Sharp V



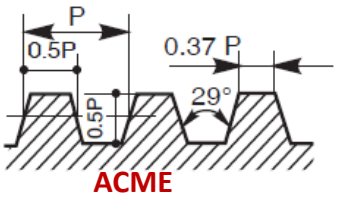
White worth



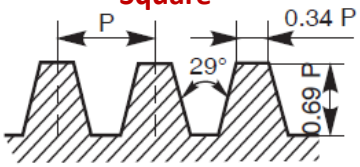
Buttress



Square



ACME



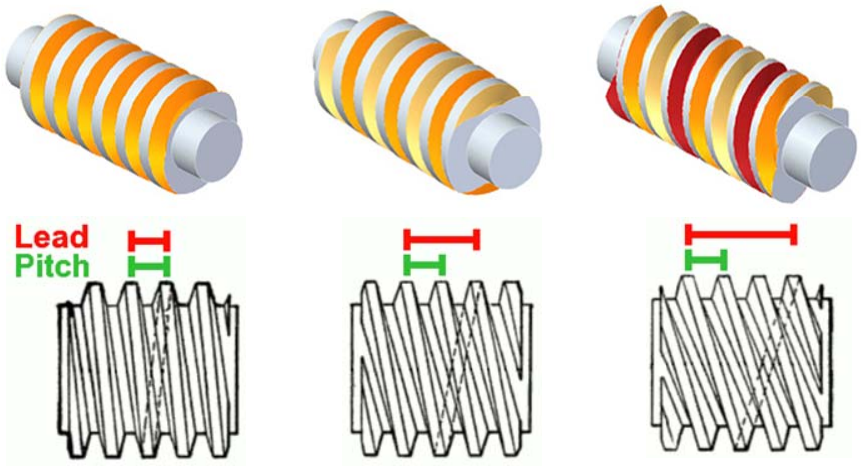
Worm

Why so many profiles?

- V threads:
  - Large flank area and hence more friction. Used in effective positioning
  - Difficult to make. Relatively weak
- Whiteworh thread: Radius at crest and root reduces stress concentration
- Square thread:
  - Good for power transmission
  - Flanks are perpendicular to thread axis allowing high load capacity
- ACME thread: More stronger than square thread and easier to cut compared to square thread
- Buttress thread: Used for transmitting power in one direction
- Worm: Used in power transmission with speed reduction

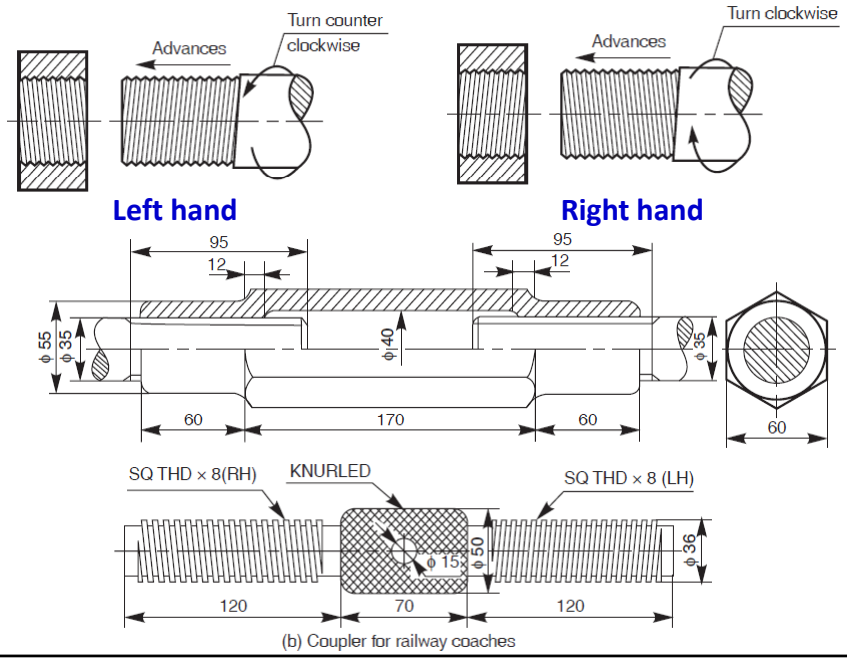
Single start and Multi-start threads

Single start **Double start** **Triple start**



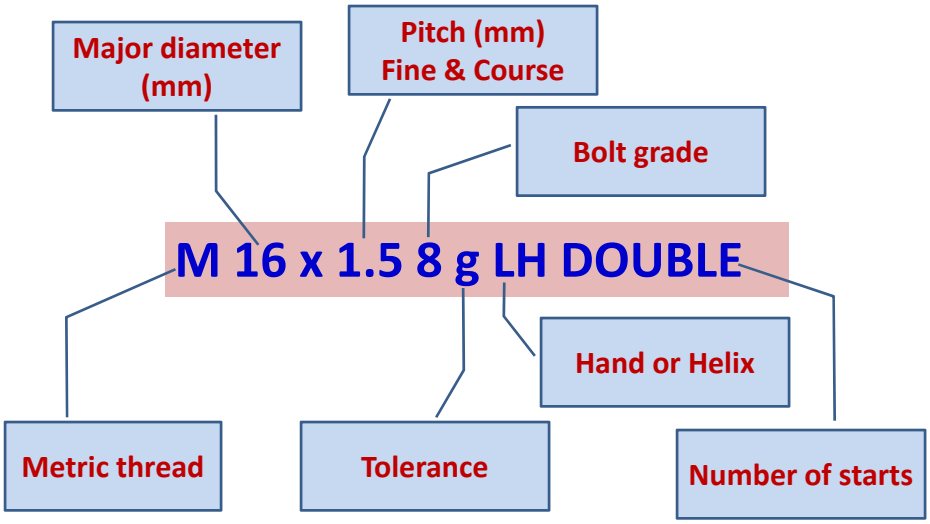
- Used when fast action is required

Left and Right hand threads

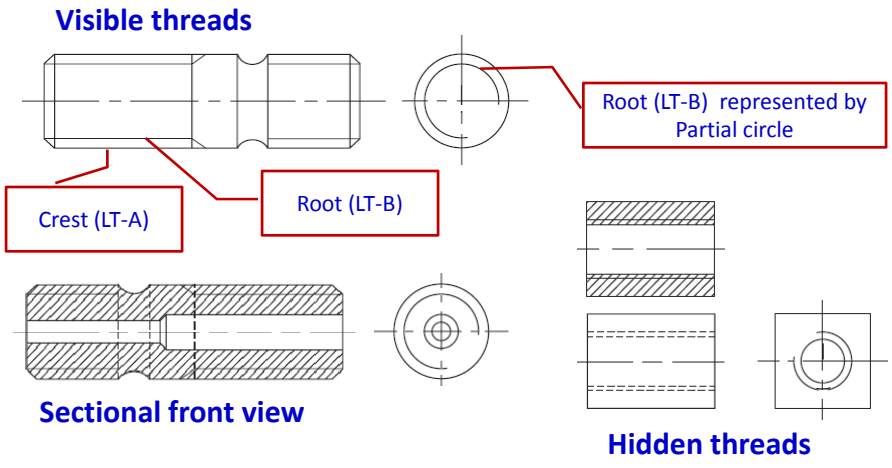


(b) Coupler for railway coaches

Thread designation

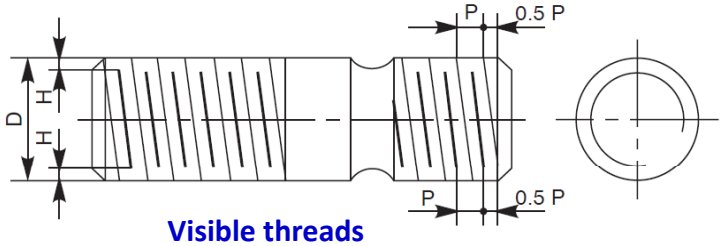


Conventional representation of threads in drawings

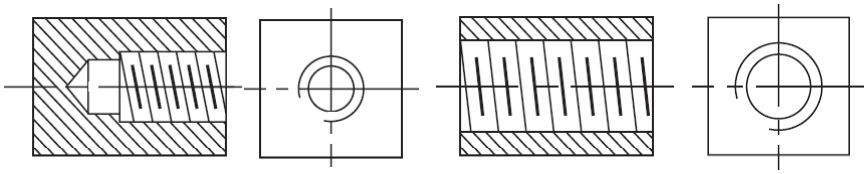


- The distance between the line representing crest and root should be close to the actual distance but not less than 0.7 mm
- In the sectional view, the hatching lines should extend till the crest of the thread

Schematic representation of V threads in drawings



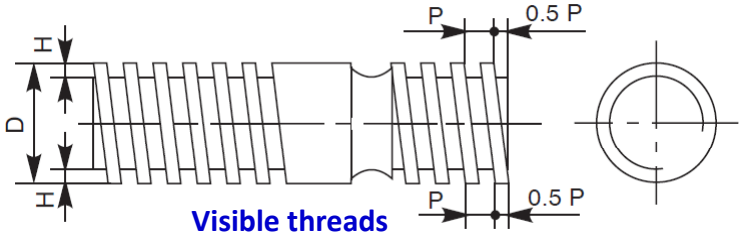
Visible threads



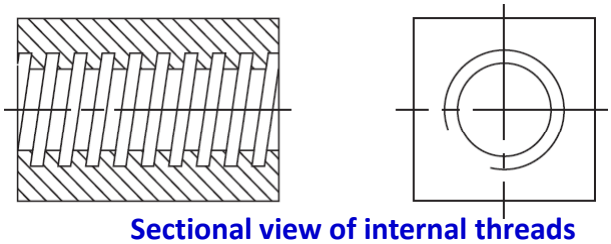
Sectional view of internal threads

- Gives more details than the simplified representation
- Used only for visible external threads or sectional view of internal threads- hatching ends at the root line in sectional view

Schematic representation of square threads



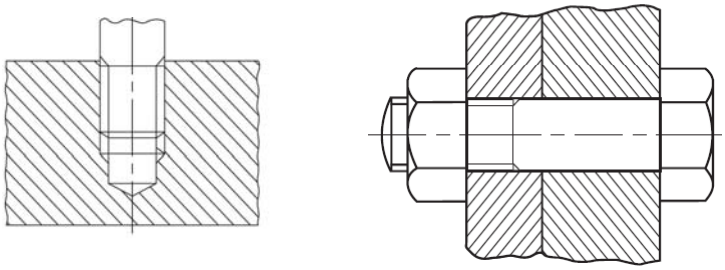
Visible threads



Sectional view of internal threads

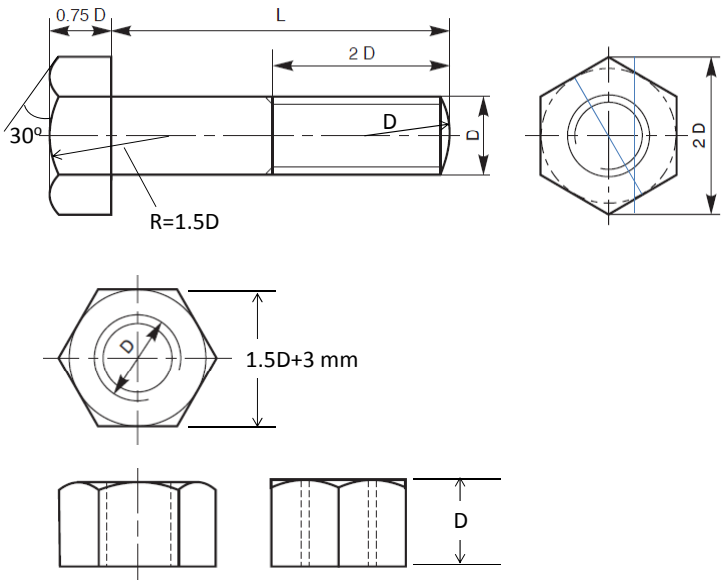
- Note the hatching in the sectional view

Representation of threads in an assepmbly

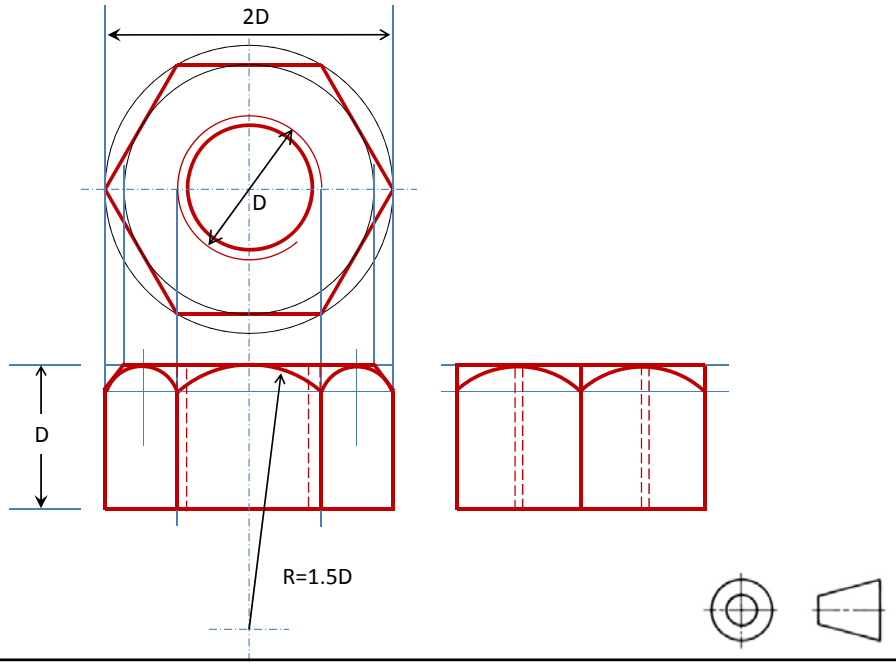


- Bolts and threads are not sectioned in a sectional view

Bolts and nuts- size and proportions

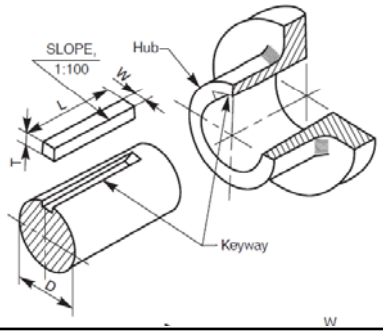


Drawing a hexagonal nut

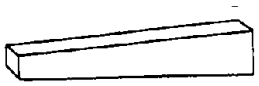


Keys, Cotters and Pins

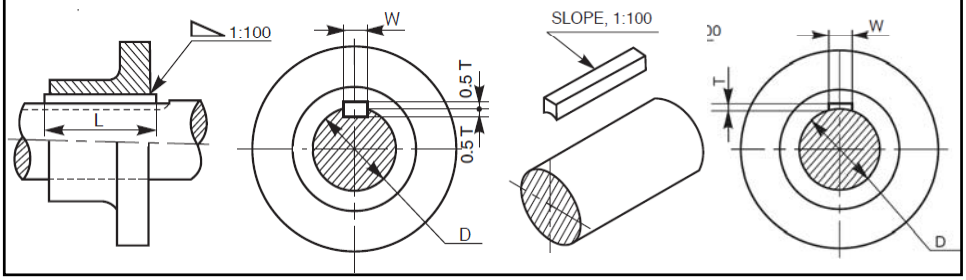
- Keys, Cotters and Pins are used as fasteners for transmitting force or torque
- A shaft and a hub connected by a key
- Both shaft and hub has key ways
- As the shaft rotates, the hub also rotates
- Key experiences shear stresses
- Rigid connection



Keys

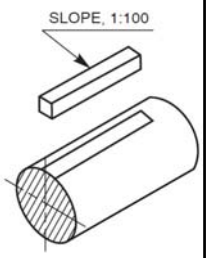


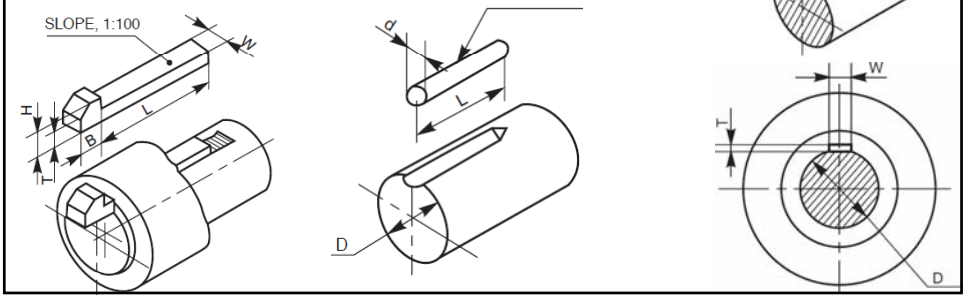
- Sunk taper keys
  - Has uniform width but taper in thickness
  - Half of key depth is in the shaft key way and the other half in the key way in hub which has taper
  - The taper is on the top surface which is inside the key way in hub
- Hollow saddle key
  - The key surface in contact with the shaft has same curvature
  - Torque is transferred by friction



Keys

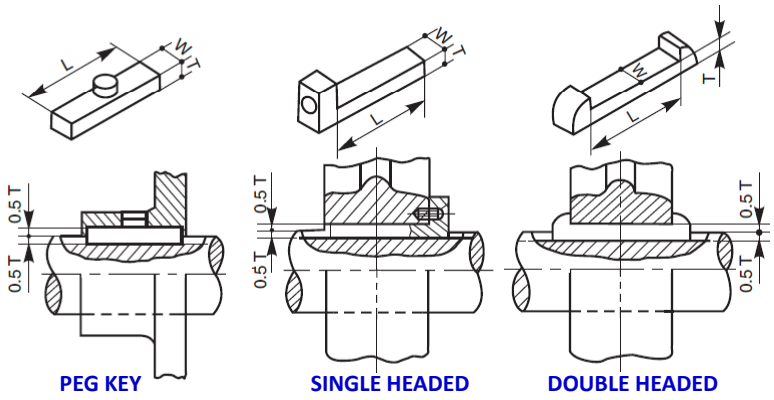
- Flat saddle key
  - The shaft has a flat portion on which the key sits
  - Torque transferred by friction
- Round keys (straight and taper)
- Gib-head key
  - Taper keys are removed by hammering from other end
  - Gib-key can be removed by holding the gib-head



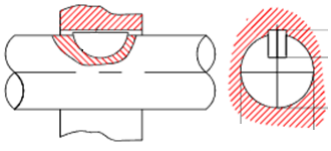


Keys

- **Feather key**: It is a sunk in key which prevents relative rotation but allows axial relative motion between the shaft and hub

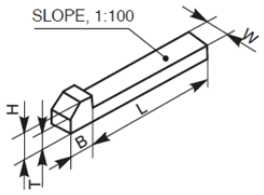


- Woodruff key
  - Weakens the shaft as it is deeper



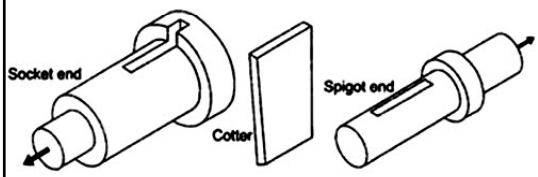
Key size

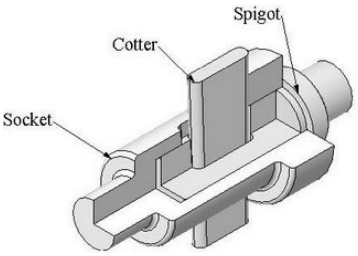
- Taper keys
  - W = 0.25D + 2 mm, T = 0.2D + 2 mm
- Saddle keys
  - W = 0.25D + 2 mm, T = 0.08D + 1 mm
- Gib-head keys
  - W = 0.2D + 2 mm, T = 0.2D + 2 mm
  - L = D to 1.5D, H = 0.288 D, B = .02475D
- Woodruff keys
  - R = D/3, T = D/6



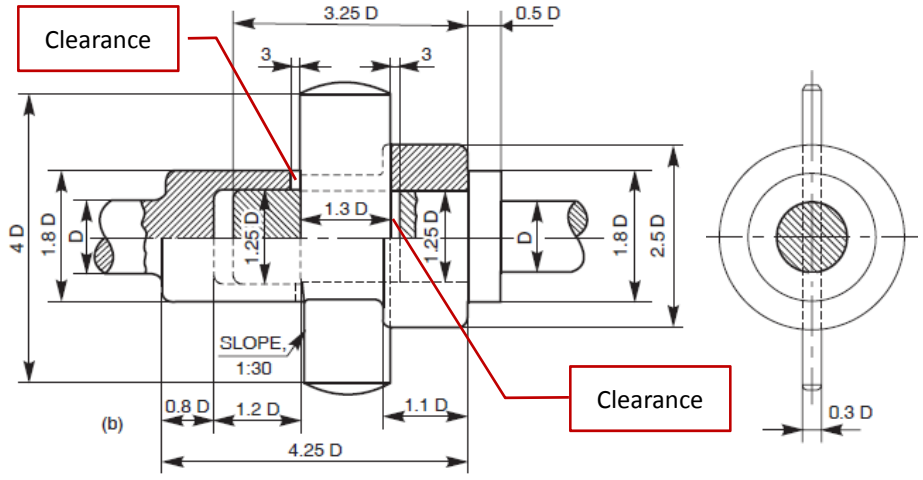
Cotter joints

- A cotter is flat wedge shaped piece of steel having rectangular cross-section
- Used for rigidly connecting **two collinear rods** to **transmit axial force**
- Socket and spigot joint:
  - The spigot is inserted into the socket and with the slots aligned
  - The cotter is driven into the slot resulting in a tight and rigid joint



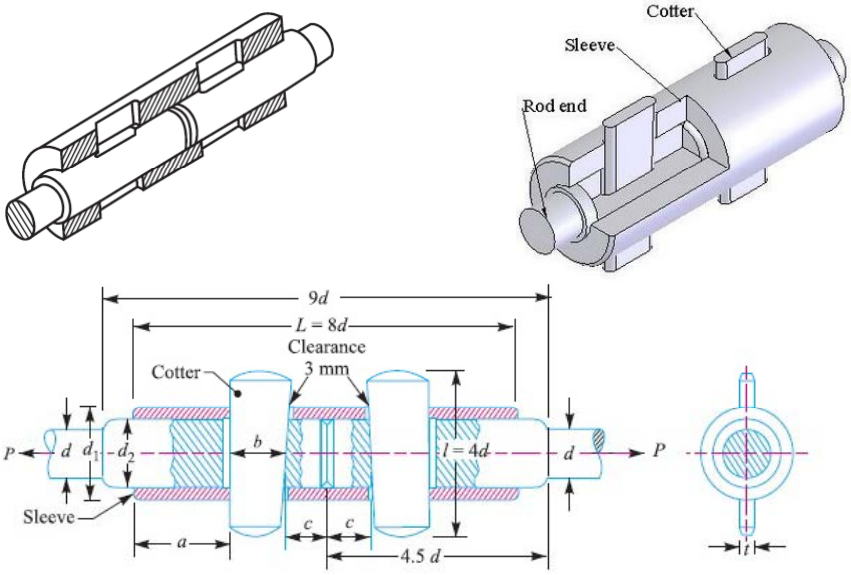


Socket and spigot joint



- These clearances are important for proper functioning of the joint

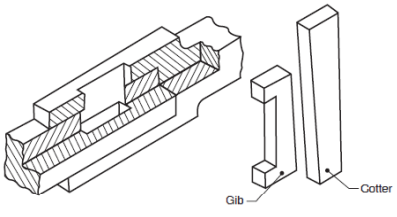
Cotter joint with sleeve

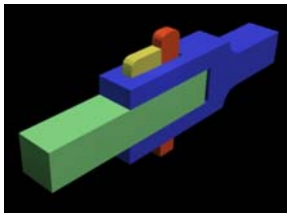


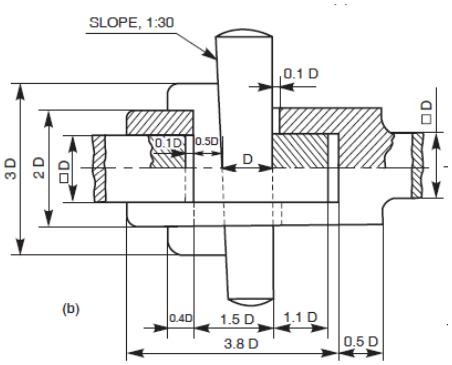
- Note the clearances

Cotter joint with gib

- Used for joining rods or square or rectangular cross-section
- End of one rod is made into the form of a U fork into which the other rod fits in
- The gib-ends prevent the fork end from opening







Knuckle joint

- Used for transmitting force (tension or compression) between two rods whose axis are not aligned
- The joint permits angular movement about the pin axis