

# Fasteners

Week 3 Lecture

# What is a fastener?

- A fastener is a device that mechanically joins two pieces of material together

# Types



Bolt



Nut



Washer



Pin



Set Screw



Rivet

# Bolts



Flat Head



Socket Head



Button Head



Hex Head



Philips Head



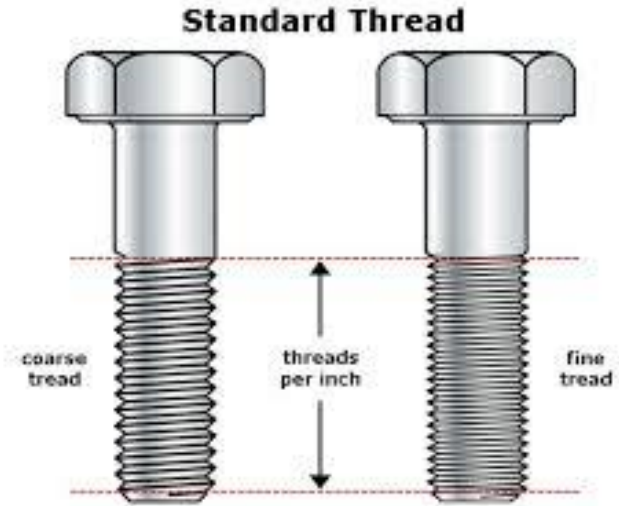
Shoulder Screw

# Bolt Naming

- Metric:
  - Ex: M4 X 0.7
    - First number is the nominal size (4mm hole)
    - Second is the pitch, or the distance between threads (0.7mm per thread)
- Imperial:
  - Ex:  $\frac{1}{4}$  - 20
    - First number is the nominal size ( $\frac{1}{4}$ " hole)
    - Second is the reciprocal of pitch (20 threads per inch)
  - Holes smaller than  $\frac{1}{4}$ " are given a number 0 - 12

# Bolts

- Bolts come in coarse and fine thread
  - Usually use coarse thread
    - Easier to obtain
  - Fine is stronger but only use if theres a good reason to
- Length of a bolt is measured by the amount of the bolt that goes into the material
  - From under the head of the bolt unless it is a flathead



# Notes on bolts

- Generally want at least the radius of the bolt in thickness around the bolt
- Generally speaking you want **at least three threads past the nut** and a **diameters worth of threads engaged.**
- Phillips heads strip easily
- Only the bottom most part (relative to the bolt) should be tapped, the rest should be clearance holes

# Is it a Bolt or Screw?

## Bolts

- Require a nut/thread to make the joint lock
- Have a consistent thread
- Requires a hole to be inserted



**Vs**



## Screw

- Always used without a nut
- Has a non-uniform cross section (many times comes to a point)
- Can be inserted without a hole



# Washers

- Washers are used to disperse the load from the bolt over a larger surface area
- Usually used under the head of the bolt and sometimes under the nut



Lock Washer



Lock Washer  
(Internal Tooth)



Washer

# Nuts

- If you tap a hole you can make it so that the bolt doesn't need a nut
- Add threadlocker, an adhesive, when there is potential for the bolt to unthread itself (makes it similar to a lock-nut)
- Want at least 3 threads sticking out of the nut



Hex Nut



Locknut



Wing Nut



Coupling  
Nut/Standoff

# Pins

- Can be used for locking two parts together
- Can be used as a first point of failure
- Can allow multiple bodies to rotate together



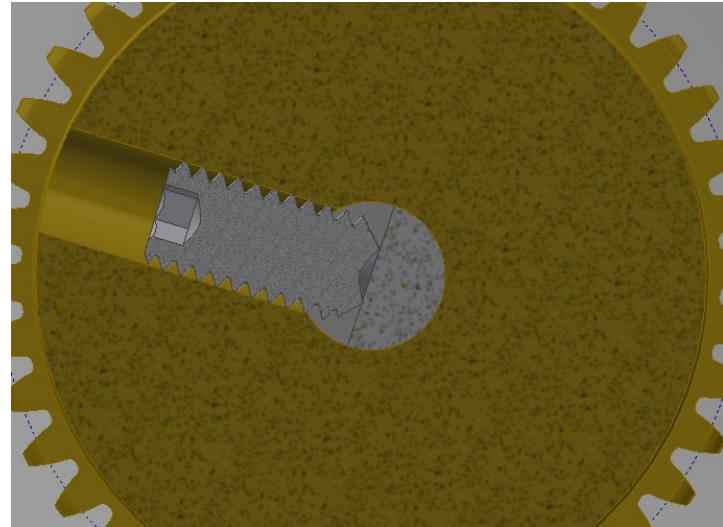
Dowel Pin



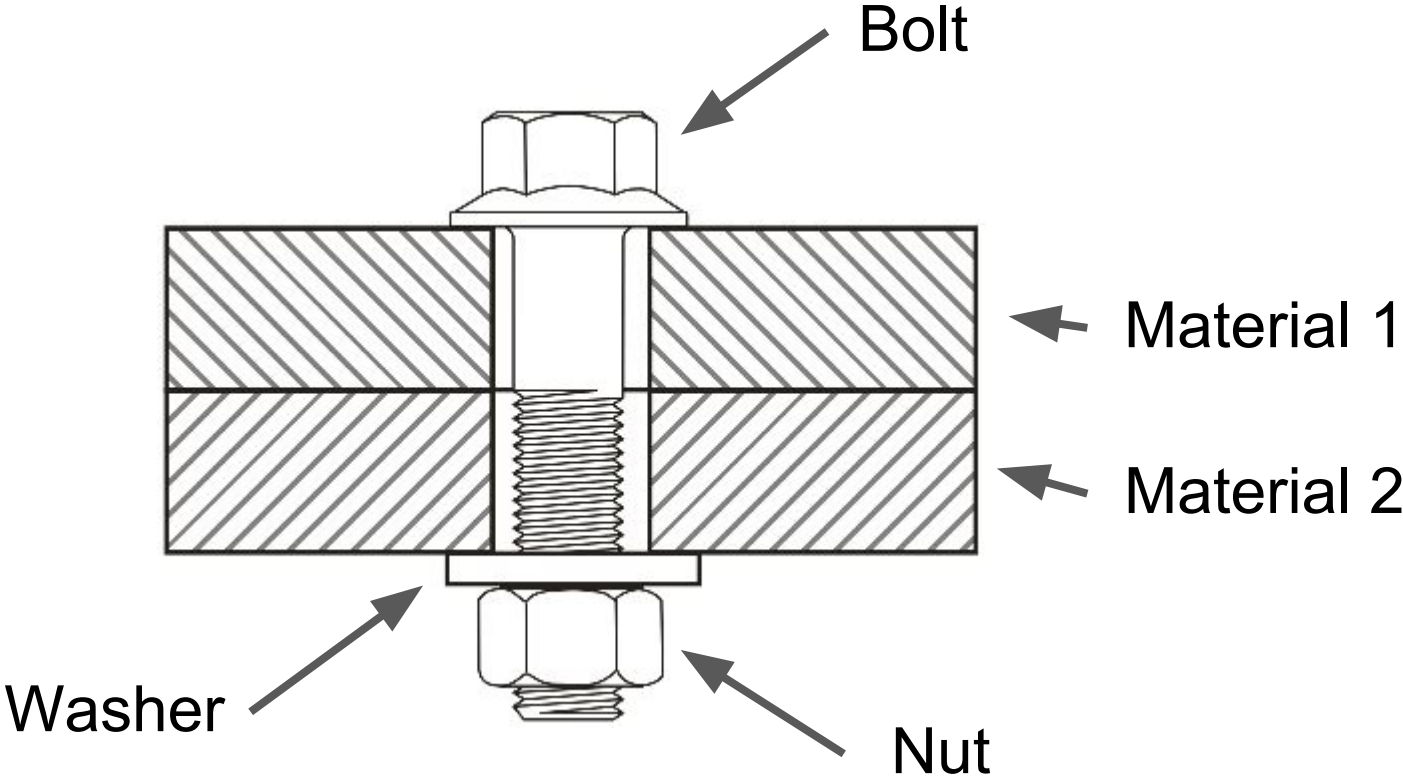
Cotter Pin

# Set Screws

- Interfaces between a shaft and an object that needs to rotate with shaft
- Requires a flat on shaft for good interface
- Comes in standard bolt sizes, Metric and Imperial

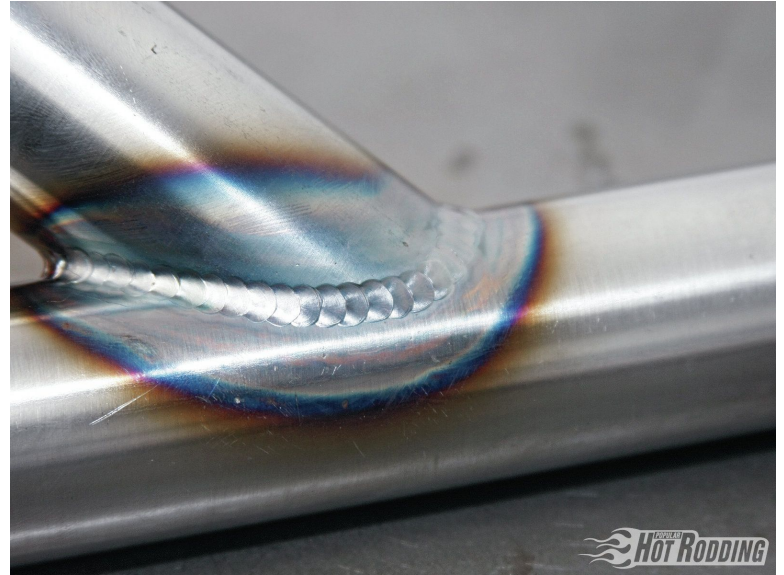


# Example



# Other Ways to Join Materials

- Welding
  - [MIG Welding](#) - cannot use on Aluminum
  - [TIG Welding](#) - can be used on Aluminum
- Friction based methods
  - Press fit
  - Puzzle fit
  - Snap fit connector
- Shaft assemblies
  - Shaft Collars
  - Retaining Rings
- Adhesives
  - Epoxy
  - Loctite
    - Red is threadlocker, green is retaining compound, etc.



# Design for Assembly

- When adding fasteners to your design, you need to think about how you will install them
- Ex. bolt holes need to be accessible for assembly and disassembly

