### Fasteners for wood

<table>
<thead>
<tr>
<th>Wood screw</th>
<th>Drywall screw</th>
<th>Nail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joining wood to wood</td>
<td>Joining wood to wood</td>
<td>Joining wood to wood</td>
</tr>
<tr>
<td>Joining thin to thick materials</td>
<td>Joining thin to thick materials</td>
<td>Joining thin to thick materials</td>
</tr>
</tbody>
</table>

**Composition**
- Steel or brass
- Steel
- Steel

**Preparation**
- First layer: Clearance hole and countersink
- Second layer: Pilot hole

**Key characteristics**
- Stronger hold than a drywall screw or nail
- Slower install because of required preparation
- More expensive than drywall screw

**Fasten install**
- Because no preparation is required (however, pre-drilling is always a good idea)
- Cheaper than a wood screw
- Weaker than a wood screw
- Not as aesthetically pleasing as a wood screw
- Not as common in developing countries

**Protip**
- Do not drill the pilot hole all the way through, because of **chips** and makes sure the tapped hole is cut properly.

### Fasteners for metal

<table>
<thead>
<tr>
<th>Sheet metal screw</th>
<th>Pop rivet</th>
<th>Machine screw</th>
<th>Hex bolt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joining relatively thin metal</td>
<td>Joining relatively thin metal</td>
<td>General assembly of medium pieces of metal or wood</td>
<td>General assembly of larger pieces of metal or wood</td>
</tr>
</tbody>
</table>

**Composition**
- Steel
- Aluminum or steel
- Use with similar metal to reduce corrosion
- Steel
- Steel

**Preparation**
- Clearance hole through the first layer, pilot hole in the second layer
- Clearance hole
- Tapped hole
- Clearance hole

**Key characteristics**
- Self-tapping tip
- No countersink required
- Repeated assembly wears the hole
- Self-tapping tip
- No countersink required
- Repeated assembly wears the hole
- Typically fully threaded
- Some not fully threaded
- Used on a thread or blind hole
- Can be used on a machine screw
- Sizes vary immensely

### Preparatory holes in wood

**Pilot hole**
- A hole that is a bit smaller than the fastener, so the threads grip the wood but do not split it apart

**Clearance hole**
- A hole that is a bit bigger than the fastener so the threads can slip past the hole

**Countersink**
- An enlarged ring of a pilot or clearance hole so the fastener can be flush with the wood

**How do I make pilot and clearance holes?**
- Use a drill, there are many kinds:
  - Twist: manual, for large holes
  - Hand drill: manual, for small holes
  - Power drill: portable, for table-top work, for hardened steels
  - Drill press: large machine, precise, for small parts

**How do I countersink holes?**
- Use one of these countersink bits, drilling very slowly

**Clearance hole types**
- A hole that is a bit bigger than the fastener so the threads can slip past the hole
- The hole size is meant to use a particular washer size.

**Tapped hole**
- A hole that has threads cut into its sides so the fastener grips the metal directly instead of onto a nut

### Preparatory holes in metal

**Pilot hole**
- A small hole that is drilled into the metal in preparation for a larger hole - this way, the larger drill bit will not slip on the metal piece and drill in the wrong location

**Clearance hole**
- A hole that is a bit bigger than the fastener so the threads can slip past the hole

**How do I make pilot and clearance holes?**
- Use a drill, there are many kinds:
  - Twist: manual, for large holes
  - Hand drill: manual, for small holes
  - Power drill: portable, for table-top work, for hardened steels
  - Drill press: large machine, precise, for small parts

**How do I countersink holes?**
- Use one of these countersink bits, drilling very slowly

**Tapped hole**
- A hole that has threads cut into its sides so the fastener grips the metal directly instead of onto a nut

### What else should I know?

#### Drive types and tools

<table>
<thead>
<tr>
<th>Phillips head</th>
<th>Flat/sloated head</th>
<th>Hex head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use the right bit size!</td>
<td>Use the right tap bit</td>
<td>Do NOT use the tapping tip!</td>
</tr>
</tbody>
</table>

**Socket head**
- It is more difficult for people to unscrew and metal parts when screws into an area key is required

#### Fasteners materials

<table>
<thead>
<tr>
<th>Steel (uncoated)</th>
<th>Stainless, pliable</th>
<th>Steel (zinc-plated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong, pliable</td>
<td>Strong, corrosion resistant</td>
<td>Strong, corrosion resistant</td>
</tr>
</tbody>
</table>

**Brass**
- Aesthetically nice, corrosion resistant

**Aluminum**
- Softer than steel

**Stainless steel**
- Excellent corrosion resistance

**Cheap**
- Not as common in developing countries

#### Washers

**Washers distribute the force of the fastener and prevent damage to the material being fastened**

**Main washer types**

- A flat washer distributes the force of the fastener

**Sizing a washer**
- Washer sizes are not one-size-fits-all – a fastener is meant to use a particular washer size
- The fastener should slip through the washer; the fastener head catches the washer

**Washers can be used as spacers**
- Beware because if they will be difficult to put in or out when you adjust/disassemble your parts.

### Machine screw notation

<table>
<thead>
<tr>
<th>Fractional</th>
<th>Decimal</th>
<th>TPI</th>
<th>Fractional</th>
<th>TPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16</td>
<td>0.4</td>
<td>0</td>
<td>1/16</td>
<td>0.4</td>
</tr>
<tr>
<td>1/16</td>
<td>0.5</td>
<td>0</td>
<td>1/16</td>
<td>0.5</td>
</tr>
<tr>
<td>1/16</td>
<td>0.6</td>
<td>0</td>
<td>1/16</td>
<td>0.6</td>
</tr>
<tr>
<td>1/16</td>
<td>0.7</td>
<td>0</td>
<td>1/16</td>
<td>0.7</td>
</tr>
<tr>
<td>1/16</td>
<td>0.8</td>
<td>0</td>
<td>1/16</td>
<td>0.8</td>
</tr>
<tr>
<td>1/16</td>
<td>0.9</td>
<td>0</td>
<td>1/16</td>
<td>0.9</td>
</tr>
<tr>
<td>1/16</td>
<td>1.0</td>
<td>0</td>
<td>1/16</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Oops!**
- Wood is composed of fibers which can split apart and splinter your piece
- Don’t place a fastener too close to the edge - it could split the wood
- Don’t nail into the end grain - it could split the wood

**Medium or hard woods**
- May require a pilot hole, even with drywall screws
- Otherwise, it may split the wood