Drill Press

This document provides a step by step walkthrough for using the drill press located in the Inworks prototyping lab. By following this walkthrough, you will become comfortable with the safety requirements and proper use of this machine. To receive credentials on this machine you will be required to demonstrate proficiency by properly adjusting the bed, securing a workpiece, selecting a bit, setting the drill depth, choosing the proper speed, and drilling a hole.

Machine Functionality & Limits

Our Powermatic drill press can be set up to drill holes in a wide range of materials types and sizes. The Spindle RPM ranges between 250-3000rpm, depending on type of bit and material being used. The maximum plunge depth is 6”, and the drilling table is 20” wide by 14” long, and has about 26” of vertical range.

Workshop Content

Drill Press Safety Requirements
Machine Anatomy
Types of Drill Bits
Feeds & Speeds
Setting the Drill Depth
Selecting and Securing Material
Table Position
Drilling Operation
Drill Press Safety Requirements

To use the drill press, you will need safety glasses, hair tied back (if long), close toed shoes, and you must not be wearing loose clothing or gloves. Ear plugs are available if you are using loud equipment. If you are creating a lot of sawdust, wear a dust mask.

Machine Anatomy

- Spindle Speed Adjustment
- E-Stop
- Drilling Depth Adjustment
- Self Centering Drill Chuck
- Table Height Adjustment
- Table Angle Adjustment
- Drilling Table
Types of Drill Bits

Always use the appropriate drill bit for the operation that you’re going to perform. Keep in mind what material you’re using, and what size of hole you’re trying to cut. In the Inworks prototyping lab, we use the following types of bits in our drill press:

- **Twist Drill bit**
  Most commonly used bit, used for general purpose operations.
  
  There are twist drill bits for cutting wood OR metal. Make sure you’ve selected the appropriate bit for the material being used.

- **Boring/Spade bit**
  Used to drill large diameter holes. These bits should be used on wood and soft materials only - NEVER on metal.

  Always drill a pilot hole with a smaller diameter drill bit before using a boring bit

- **Countersink bit**
  Used to drill a primary pilot hole and secondary hole to allow fastener heads to sit flush with the top surface of material.

- **Holesaw**
  Comprised of an outer circular saw blade and an inner shank drill bit. Used to drill large diameter holes. These bits should be used on wood and soft materials only. NEVER on metal.

  Always drill a pilot hole with a smaller diameter drill bit before using a holesaw

Always check your drill bits for excessive wear, bowing, or other defects before using them. NEVER ASSUME THAT THE LAST PERSON TO USE THIS EQUIPMENT HAS LEFT IT IN AN IDEAL CONDITION.

- It is important to **never use excessive force while drilling into material** doing so can cause premature wear on the drill bit, and you risk damaging equipment and hurting yourself. This is especially true when drilling into metal and hard materials. **If your material begins to emit smoke or sparks, use less drilling force. If drilling into metal, use a lubricant such as cutting oil or WD-40.**

- Each type of drill bit will require a different spindle speed, which is also dependent on what type of material you’re cutting. In the next step, we will use a feeds and speeds chart to determine optimal drilling speed.
Use the following chart to determine the appropriate drilling speed for the bit and material you’re working with. Our drill press operating speed is adjustable, and can range from 250rpm - 3000rpm.

The spindle speed can be adjusted by rotating the crank handle on the left side of the machine. The spindle should be adjusted after you’ve chosen a bit, and before you begin drilling into your material. Make sure the machine is turned ON while adjusting the spindle speed.

**Twist drill bits**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Softwood (Pine)</th>
<th>Hardwood (Hard Maple)</th>
<th>Acrylic</th>
<th>Brass</th>
<th>Aluminum</th>
<th>Steel</th>
<th>Shop Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16&quot; - 1/32&quot;</td>
<td>3000</td>
<td>3000</td>
<td>2500</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>Lubricate drill with oil when cutting steel 1/16&quot; or thicker. Use center punch on all holes to prevent drill from wandering.</td>
</tr>
<tr>
<td>1/16&quot; - 1/16&quot;</td>
<td>1500</td>
<td>750</td>
<td>1500</td>
<td>750</td>
<td>1500</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>1/16&quot; - 1/8&quot;</td>
<td>750</td>
<td>500</td>
<td>400</td>
<td>1000</td>
<td>350</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Black & Decker Bullet pilot-point bits**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Softwood (Pine)</th>
<th>Hardwood (Hard Maple)</th>
<th>Acrylic</th>
<th>Brass</th>
<th>Aluminum</th>
<th>Steel</th>
<th>Shop Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16&quot; - 3/32&quot;</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
<td>2000</td>
<td>1500</td>
<td>3000</td>
<td>Good all-around bit. These cut more quickly than brad points and twist drills.</td>
</tr>
<tr>
<td>1/16&quot; - 1/8&quot;</td>
<td>3000</td>
<td>3000</td>
<td>2400</td>
<td>1500</td>
<td>1000</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>1/16&quot; - 1/4&quot;</td>
<td>3000</td>
<td>1500</td>
<td>1600</td>
<td>1500</td>
<td>750</td>
<td>1200</td>
<td></td>
</tr>
</tbody>
</table>

**Hole saws**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Softwood (Pine)</th>
<th>Hardwood (Hard Maple)</th>
<th>Acrylic</th>
<th>Brass</th>
<th>Aluminum</th>
<th>Steel</th>
<th>Shop Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; - 1 1/4&quot;</td>
<td>500</td>
<td>350</td>
<td>NR</td>
<td>250</td>
<td>250</td>
<td>NR</td>
<td>Do not use with brass or aluminum thicker than 1/16&quot;. Avoid dense hardwoods such as hard maple.</td>
</tr>
<tr>
<td>1 1/4&quot; - 2&quot;</td>
<td>500</td>
<td>230</td>
<td>NR</td>
<td>150</td>
<td>250</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>2 1/4&quot; - 2 1/2&quot;</td>
<td>250-500</td>
<td>NR</td>
<td>NR</td>
<td>250</td>
<td>250</td>
<td>NR</td>
<td></td>
</tr>
</tbody>
</table>

**Multi spur bits**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Softwood (Pine)</th>
<th>Hardwood (Hard Maple)</th>
<th>Acrylic</th>
<th>Brass</th>
<th>Aluminum</th>
<th>Steel</th>
<th>Shop Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1/2&quot; - 4&quot;</td>
<td>250</td>
<td>250</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Smaller sizes also available; use Forstner speeds.</td>
</tr>
</tbody>
</table>

**Spade bits**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Softwood (Pine)</th>
<th>Hardwood (Hard Maple)</th>
<th>Acrylic</th>
<th>Brass</th>
<th>Aluminum</th>
<th>Steel</th>
<th>Shop Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot; - 1/2&quot;</td>
<td>2000</td>
<td>1500</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Clamp work to table to improve quality of hole.</td>
</tr>
<tr>
<td>9/32&quot; - 1/2&quot;</td>
<td>1750</td>
<td>1500</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>1/2&quot; - 1 1/8&quot;</td>
<td>1500</td>
<td>1000</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
</tbody>
</table>

**Spade bits with spurs**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Softwood (Pine)</th>
<th>Hardwood (Hard Maple)</th>
<th>Acrylic</th>
<th>Brass</th>
<th>Aluminum</th>
<th>Steel</th>
<th>Shop Notes</th>
</tr>
</thead>
</table>
Once the jaws are tight enough to hold the bit in place, tighten both jaw grips with both hands to set the drill bit.

Spin the chuck by hand and observe the drill bit to make sure it is not bowed or off center. If the bit is not centered, loosen the chuck jaws and re-center the bit. This can be a bit tricky to do by yourself at first, so grab someone to assist you if needed.

Insert the smooth side of your bit into the chuck. Leave about 1/8” between the end of the chuck jaws and the beginning of the cutting edge of your bit.

While holding the bit with your hand, turn the lower jaw grip clockwise to begin tightening the chuck around your drill bit.

Double check to make sure your drill bit is long enough to achieve the desired drilling depth. If you are drilling all the way through your material, make sure that your drill bit is longer than the material thickness. There is a laser guide on the drill press that can give you a preview of the drilling location. You can turn the laser on by pressing the small red button on the front of the machine.
Once the upper and lower range of your drilling depth is set, you can verify your setup by gently pulling down the handle on the right side of the drill press and observing how the machine responds.

Drilling several holes? You can set the drill press to a specific drilling depth for repeated operations. To do this, use the depth indicator located on the left side of the machine.

The depth indicator can be adjusted for up to a 6” drilling depth. Make sure your drill bit is long enough for the drill depth you are specifying.

The upper stop will dictate how deep you will be able to drill. To set the upper stop, squeeze the button on the side and move the stop up or down to the desired distance.

The lower stop will dictate how low the drill bit sits in its resting position, before you begin drilling. Set the lower stop so that it positions your drill bit close to the top surface of your material. Make sure there is about 1/2” of clearance between the end of your drill bit and the surface of your material.
Selecting and Securing Material

1. Use clamps to secure your workpiece. If it's small, screw it to a large piece and clamp that to the bed.

2. If possible, position your table and material so that the spindle is located directly above the spoil pad in the center of the drill press table.

3. If you cannot center your drilling site over the center pad, use a piece of scrap wood to place underneath your work piece, in order to avoid drilling into the drill press table.

4. Clamp your workpiece and scrap wood to the drill press table to make sure that nothing moves around or gets caught on the drill bit when the machine is being operated. Clamps are located in the drawers of the miter saw table.

For long pieces use the left side of the drill press along with a clamp to hold material.
Table Position

1. The drill table angle can rotate along the Y axis to perform an angled drilling operation. To adjust the table angle, loosen the clamp on the backside of the drill press stand. Turn the knob counter clockwise two full turns. Do not back the set screw out too far.

2. To adjust the height of the drilling table, loosen the clamp on the backside of the drill press stand. Turn the knob counter clockwise two full turns. Do not back the set screw out too far.

3. The drill table angle can rotate along the Y axis to perform an angled drilling operation. To adjust the table angle, loosen the clamp underneath the table. Do not back the set screw out too far.

4. You can verify what angle you’re setting by checking the angle indicator on the top rear of the table. Tighten the clamp underneath once the table is set to the desired angle.
Once the alignment is verified, pull out the red button on the front of the drill press to start the spindle.

You can now use the handle on the right side of the machine to drill your hole. Pay attention to the amount of force you’re applying while drilling. If your material begins to smoke, reduce the amount of force being used. Make sure the material is not moving around on the bed while you are drilling.

When you are finished drilling, push in the red button on the front of the machine to stop the spindle.

Before you begin drilling, double check your setup for the following:

- Your drill bit is installed properly
- The spindle speed has been adjusted
- The drilling depth indicator has been adjusted
- The table position has been adjusted
- Your material is secured properly

With the machine OFF, use the handle on the right side of the drill press to lower the drill bit down to the drilling site to make sure it’s aligned with the laser crosshairs.

Finished? Clean up the machine with a broom and dustpan or use the vacuum located in the heavy fabrication area. If you adjusted the table angle, reset it to 0 degrees. Remove the drill bit and put it back where you found it.