Knowledge domain: **Mechanical**
Unit: Attachment
Skill: Drilling holes

Tools and Parts Required:

1) **Hand Drill**
2) **Selection of drill bits**
3) **Piece of wood/metal**
4) **Clamp**
5) **Kerosene/ rubbing alcohol/WD-40 lubricant**

Introduction

A drill is a tool that creates cylindrical holes in materials. Drills are commonly used to create holes in wood and metal. There are many different types of drills. A manual hand drill must be driven by hand. A handle is rotated to create the torque needed to drill a hole with a manual drill. Manual drills should not be used to drill very hard materials. A cordless hand drill is a type of electric drill that uses rechargeable batteries. A drill press is a fixed drill. A drill press has a mounted drill on a stand. A drill includes a rotating cutting tool called a drill bit. Drill bits are available in many different style and sizes. Therefore, you can drill many different sized holes into different types of materials. Drill bits of different materials have different hardness. Select the appropriate drill bit to drill into materials of different hardness.

Selection of drill bits

Steel

Steel bits are cheap and can be used on soft wood. Steel bits will dull quickly and may not work on harder materials like metals or harder wood. High speed steel bits are stronger than steel. High speed steel bits will also last longer.

Titanium

Titanium bits are expensive. Titanium bits are much longer lasting and suited to harder materials.

Polycrystalline diamond (PCD)

PCD is among the hardest of all tool materials available and is extremely wear-resistant. PCD drill bits can be used to machine extremely hard materials.

Others

Carbide-tipped bits stay sharp and can cut hard materials. Cobalt bits are the hardest bits available for use in metals. Cobalt bits are more expensive but do not tend to overheat.

Twist bits are the most common drill bits. Twist bits are used for drilling in wood, plastic and light metal. Twist bits are primarily for drilling small holes. Twist bits range in diameter sizes from 0.8 to 12 mm.

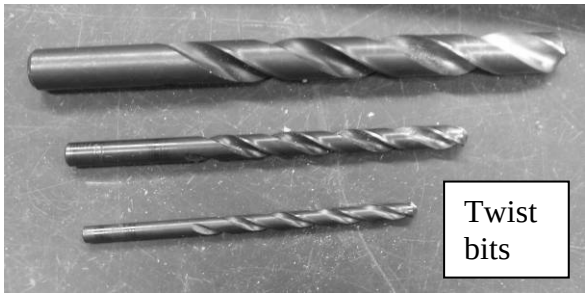
Masonry bits are designed for drilling in concrete, quarry tile, brick and stone. Masonry bits are available from 4 to 16 mm. Use a slower rotational speed when using masonry bits helps prevent overheating of the tip of the bit.

Most likely, you will only need to use twist bits or masonry bits in your work.

Example
Below is a picture of a manual hand drill, an electric hand drill, several drill bits, and a drill press.


Manual
Hand Drill

Electric
hand drill


Twist
bits

Identification and Diagnosis
To drill large or deep holes, or to drill holes in metal, use a drill press. If you are drilling a small hole in wood or plastic, a hand drill can be used.

Procedure

Always wear safety glasses when drilling to prevent injury from debris.

*Drilling in meta*l
When drilling holes in metal, metal shavings are produced. Heat is also generated. The scraps and the bit will be hot. Do not touch the scraps or the bit immediately after drilling. Normally, the spinning motion of the drill bit carries scraps away. Sometimes the scraps accumulate. Accumulation may occur while drilling a very small diameter hole or drilling a brittle material. Brittle materials tend to create powder instead of creating shavings. Cutting fluid is sometimes used to prevent this accumulation and to cool the bit.

Cutting fluid
Cutting fluid functions as a coolant and lubricant. Cutting fluids perform functions like keeping the machined metal at a stable temperature and prevent rust. Temperature instability or steep increase or decrease of temperature may cause the metal to crack or develop a fault. Cutting fluids are available in different types. Cutting fluids may be oils, oil-water emulsions, gels, aerosols etc. Cutting fluids can help in cutting various metals. However, iron and brass must be machined dry.

Cutting fluids act as irrigation to reduce the heat sustained as well as lubrication to prevent heat generation. Do not let the bit get too hot. Extreme heat will rapidly dull the drill bit.

Apply cutting fluid by dripping or spraying. Any mechanism of application is applicable as long as the cutting fluid accesses the cutting interface.

Cutting fluid compatibility

Kerosene, rubbing alcohol
Kerosene or cutting alcohol gives good results on aluminum.

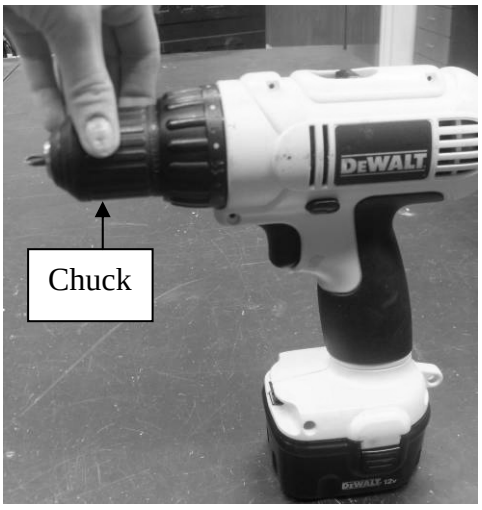
WD-40 etc
Commercial cutting fluid gives good results with most metals. Check the can for compatibility.

Motor oils
Motor oils can be used with most metals. However, it is best to avoid motor oils with additives like detergents etc. Such additives can change cutting interface properties and cause corrosion.

Drilling in wood: Wood is easier and faster to drill. You do not need cutting fluids.

Drilling in other materials: The heat of the drill causes some materials, like plastics, to expand. When the plastic cools, it contracts, making the hole smaller than desired. When drilling in plastics, select a drill bit slightly larger than the desired hole.

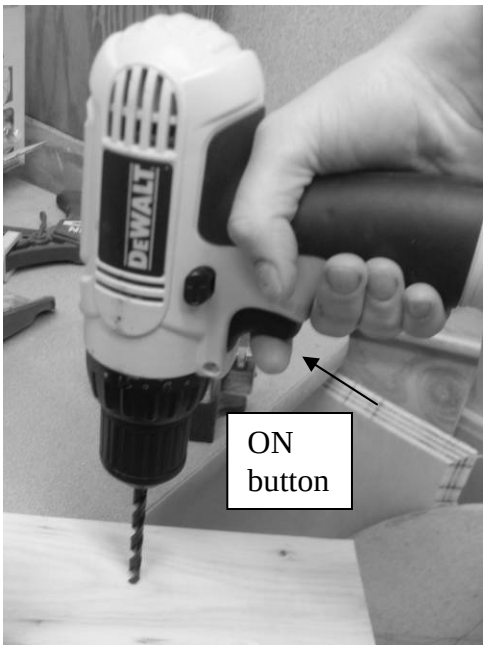
Electric Hand Drill: Twist the chuck to the left to open it.



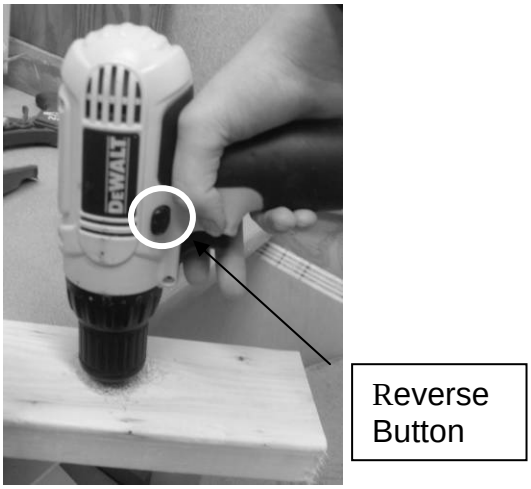
Insert the drill bit. Twist the chuck to the right to tighten it.

A clamp or vise holds the material firmly. A clamp prevents slipping. There are many types of clamps. Use a clamp to secure the drilling material to a table.

Identify the desired location of the hole. Position the drill above the desired located. Press the ON button when you are ready to drill.



Continue holding the ON button. Gently push the drill bit through the material. Release the ON button once the drill bit goes through the other end.



Locate the Reverse button. Usually the Reverse button will be on the side of the drill. Press the Reverse button.

Press the ON button. Slowly lift the drill away from the material. Release the ON button once the drill bit is out of the material.

Manual Hand Drill: A manual hand drill works similarly to the electric hand drill. Always use a clamp to secure the material you are drilling. Rotate the chuck to the left to open it. Insert a drill bit. Rotate the chuck to the right to tighten it. Position the drill bit above the desired located. Rotate the handle of the manual hand drill. Continue rotating the handle until you have drilled completely through the material. Rotate the handle in the reverse direction to remove the drill bit.

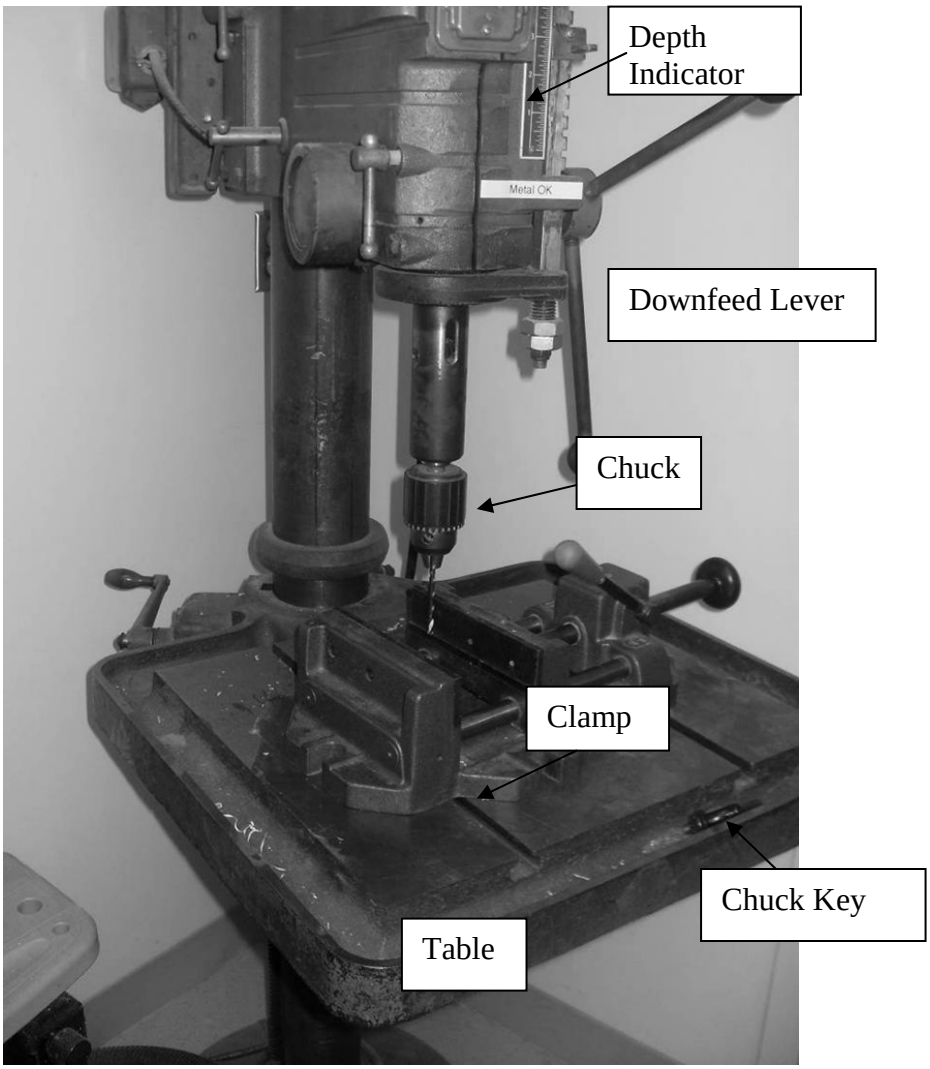
Drill Press: *WARNING* A drill press is a very dangerous machine if not operated with extreme care. DO NOT use a drill press until you read the safety procedures. DO NOT operate a drill press alone until someone has trained you.

Safety Procedure for Drill Press:

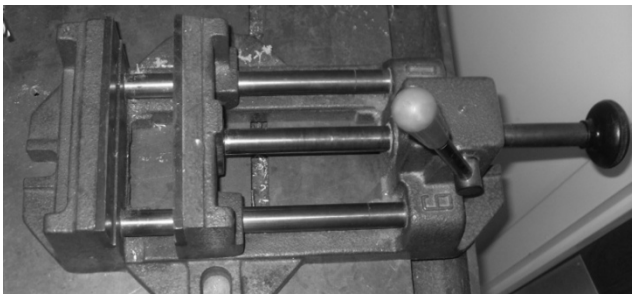
1. Wear safety glasses and hearing protection
2. Remove loose fitting clothing, jewelry, and tie back long hair.
3. Focus only on the drill press. Eliminate any distractions.
4. Shut off the power of the drill press before adjusting the machine.
5. Keep hands and fingers away from rotating drill bits.
6. Never reach around or under a rotating drill bit. Never grab the chuck to stop a drill press. This can result in serious injury.
7. Turn off the drill press immediately when finished.
8. Never stop the rotation of the drill chuck or drill bit with your hands.
9. Don’t touch the drill bit and shavings. They are hot immediately after drilling.
10. Always clean the drill press table and work area when you are finished.

If your hospital has a drill press, determine the most frequent user. This may be the head technician, or another mechanic. Ask the main user of the drill press to train you.

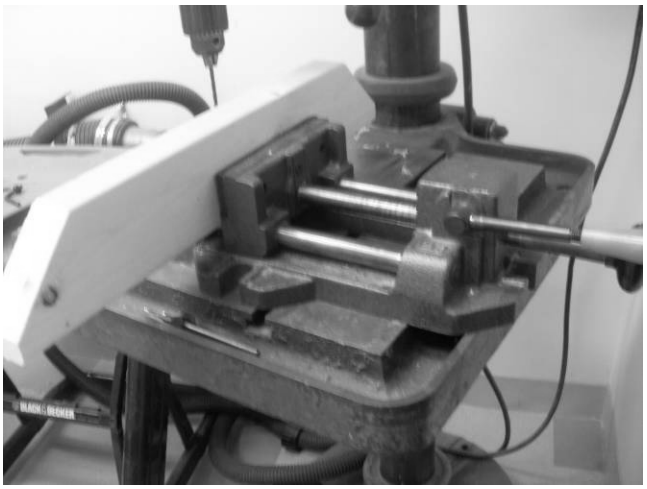
Overview of Procedure:



A clamp or vise holds the material firmly. A clamp prevents slipping. There are many types of clamps. Use a clamp to secure the drilling material.



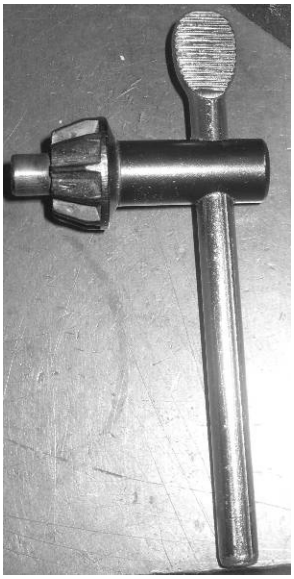
Place the material in the clamp. Close the clamp. Verify that the clamp is secure.



Twist the chuck to the left to open it.

Insert the drill bit into the chuck. Twist the chuck to the right to tighten it.

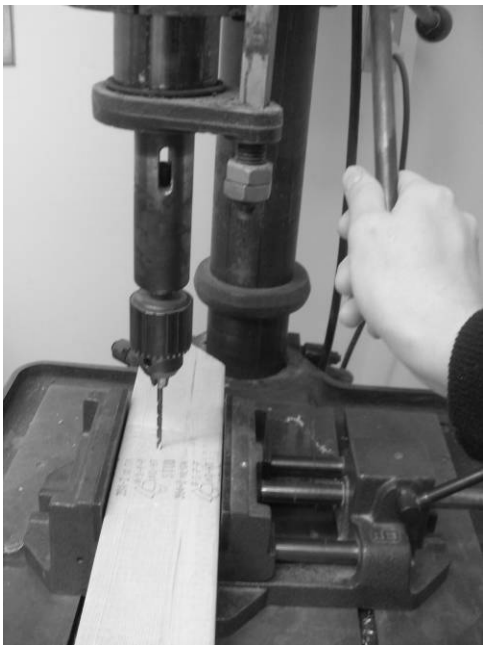
Use the chuck key to tighten the chuck completely. Insert the chuck key into the hole on the chuck. Rotate the chuck key to the right.



Verify that the drill bit is secure. The threaded section of the drill bit should be completely visible. Verify that the drill bit is in the chuck straight.

Use the handle to raise or lower the table to the correct height.

Position the material and clamp under the drill bit. Use the downfeed lever to lower the drill bit. Do not turn the machine on yet. Verify that the drill bit will hit the desired spot.



Lower the drill bit close to the material. Turn the machine on. Use cutting fluid in appropriate quantities. Use the downfeed lever to lower the drill bit through the material. Do not push too hard. You will feel the drill bit go through the other side. Slowly and gently lift the downfeed lever up. One the drill bit is out of the material, turn the machine off.

Exercise

Your instructor will give you a piece of wood or metal and a hand drill. Select an appropriate drill bit. Insert the drill bit into the hand drill. Drill a hole in the piece of wood with the hand drill. If working with metal, use appropriate amounts of cutting fluid.

Your instructor must verify your work before you continue.

Preventative Maintenance and Calibration

Always calibrate every medical device before returning it to use.