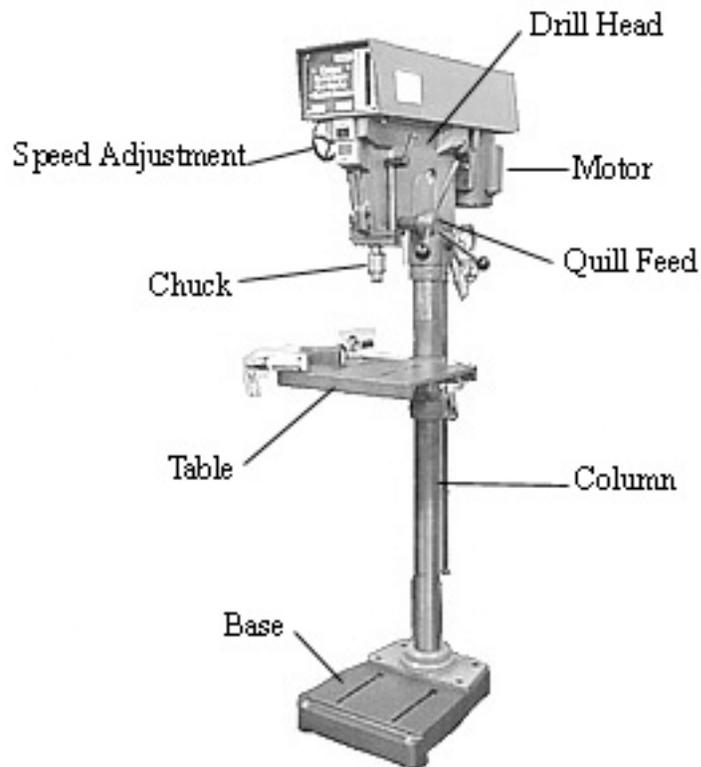


## Drill Presses

Drilling machines, or drill presses, are primarily used to drill or enlarge a cylindrical hole in a workpiece or part. The chief operation performed on the drill press is drilling, but other possible operations include: reaming, countersinking, counterboring, and tapping.

The floor type drill press used in the Student Shop is a very common machine, found in both home and industrial workshops. This style drill press is composed of four major groups of assemblies: the head, table, column, and base.

The head contains the motor and variable speed mechanism used to drive the spindle. The spindle is housed within the quill, which can be moved up or down by either manual or automatic feed. The table is mounted on the column, and is used to support the workpiece. The table may be raised or lowered on the column, depending upon the machining needs. The column is the backbone of the drill press. The head and base are clamped to it, and it serves as a guide for the table. The cast-iron base is the supporting member of the entire structure.



**Drill Press**

## ***Procedures;***

Successful operation of the drill press requires the operator to be familiar with the machine and the desired operation. The following are some good observations to follow when drilling a hole:

1. Prior to drilling a hole, locate the hole by drawing two crossing lines. Use a center punch to make an indentation for the drill point to aid the drill in starting the hole.
2. Select the proper drill bit according to the size needed.
3. Select an appropriate size center drill.
4. Select a cutting fluid.
5. Properly secure the workpiece to the table.
6. Select the correct *RPM* for the drill bit. Take into account: size of bit, material, and depth of hole to be drilled.
7. Use an interrupted feed, called peck drilling, to break up the chips being produced.
8. Pilot holes should be used on holes larger than 3/8" dia. Holes are to be enlarged in no more than 1/4" increments.
9. Clean the drill press and surrounding area when finished.

\*\*\* Hard and fast rules are not always practical for every operation performed in a drill press, since many factors can influence the speed and feed at which a material can be worked. The above suggestions, combined with knowledge of the tool being used, will provide a reasonable guideline for the operator using a drill press.

## ***Tooling;***

*Twist drills-* A twist drill is a pointed cutting tool used for making cylindrical holes in the workpiece. It has helical flutes along its length for clearing chips from the holes. Twist drills are the most common used today, but there are many other styles with different purposes. A twist drill is composed of three major parts: a shank, body, and point. The shank is the part of the drill bit held in the spindle of the drill press. The drill press' power is transferred through the shank. Shanks are either one of two styles, straight or tapered. Straight shank drills are held in a friction chuck. Slippage between the drill bit and the chuck is often a problem, especially for larger drills. When using drill bits larger than 1/2" dia., tapered shank drill bits are often used. These provide greater torque with less slippage than straight shank drill bits. The body, as described above, generally has two flutes to clear chips. These flutes are not cutting edges and should not be used for side cutting as an end mill. The point of the drill bit does all of the cutting action, which produces the cut chips. The point is ground on the end of the drill bit.

Holes produced by twist drill bits are generally oversize by as much as up to 1% of the bit's dia. The accuracy of the hole is dependent on the following factors: size of the bit, accuracy of the bit's point, accuracy of the chuck, accuracy and rigidity of the spindle, rigidity of the press, and rigidity of the workpiece in its setup. All holes to be drilled should be started with a centerpunch, centerdrill, or both.

### ***Twist Drill Formats;***

1. Number sizes: #80 (.0135") to #1 (.228")
2. Letter sizes: A (.234") to Z (.413")
3. Fractional sizes: 1/64" (.0156") upwards by 64ths/inch

Reamers- A reamer is a precision cutting tool designed to finish a hole to a specific dia. Since drill bits produce slightly oversized holes, reamers are used where precision tolerances are required, .001". Reamers have little if no cutting action on their ends, so a pilot hole is required as a preoperation to reaming. Some general guidelines for using reamers are:

1. The cutting speed for reaming should be about 1/3 of the speed used for drilling operation of the same material.
2. Before reaming, leave about .010" of material on holes up to 1/2", and about .020" of material on larger holes.
3. Never rotate a reamer in the reverse direction.
4. Use the proper cutting fluid for the material.
5. Remove the reamer from the hole occasionally while cutting to clear chips, which can cause galling on the surface of the precision hole.
6. Never stop the machine with the reamer in the hole.
7. Clean and return the reamer to its proper storage place.

Countersinks- Countersinking is an operation in which a cone-shaped enlargement is cut at the top of a hole to form a recess below the surface. A conical cutting tool is used to produce this chamfer. When countersinking, the cutter must be properly aligned with the existing hole, and should be rotated about 1/3 the cutting speed of the drilling operation for the hole. Countersinking is useful in removing burrs from edges of holes, as well as providing a flush fit for flat-headed fasteners.

Counterbores- Counterboring is the process of cylindrically enlarging a hole part way along its length. A counterbore cutter is similar to a drill bit in that it has a shank and fluted body, but instead of a point, it has a smaller diameter pilot portion. The pilot fits into a pre-drilled hole, and guides the counterbore. Therefore the counterbore must be aligned with the original hole, so the pilot will follow the hole properly. Counterbores are used to accommodate studs, bolts, or socket head capscrews where a flush surface application is required.

Tapping- A tap is a tool used to cut internal threads in a cylindrical hole. A tap is fluted like a drill, but the flutes actually perform the cutting operation. The flutes extend the length of the threaded section and also serve to remove the chips being produced. The most common taps used are:

1. The starting or tapered tap. This tap is used to start threads. At least the first six threads of this tap are tapered before the full diameter of the thread is reached.
2. The plug tap. This is the general use tap, and is used to cut threads after the taper tap has been used and removed. Three to five of its first threads are tapered. This is the last tap used if the hole extends all the way through the workpiece.

Cutting fluids should always be used when tapping holes. It is also recommended to advance the tap one full turn and the reverse it 1/4 turn to break the chip being formed. Always use a tap handle, not pliers or a crescent wrench to turn the tap. They can damage the tap, and the unequal torque provided can cause a thread to be cut poorly.

### ***Safety;***

The drill press can be a safe machine, but only as long as the student is aware of the hazards involved. Chips are produced in great quantities, and must be safety handled. The rotating chuck and cutter can also be a hazard. Develop safe working habits in the use of protective clothes, set-ups, and tools. The following rules must be observed when working on any drill press in the Student Shop:

1. No attempt should be made to operate a drill press until you are certain you understand the proper procedures for its use.
2. Dress appropriately. Remove all watches and jewelry. *Safety glasses or goggles are a must.*
3. Plan out your work thoroughly before starting.
4. Know the location of the OFF button.
5. Clamp all work securely to the table.
6. Always remove the chuck key immediately after using it. A key left in the chuck will be thrown out at a high velocity when the machine is turned on. Never let the chuck key leave your hand except to put it back into its holder.
7. Never stop a drill press spindle with your hand after you have turned off the machine. Chips often build up around the chuck.
8. Use a brush, not your hands, to remove chips from the machine. Do not clean up while the machine is running.
9. Remove burrs from drilled workpieces as soon as possible.
10. Keep the floor area clean. Immediately wipe up any oil spills.