

Drilling

Definition of Drilling

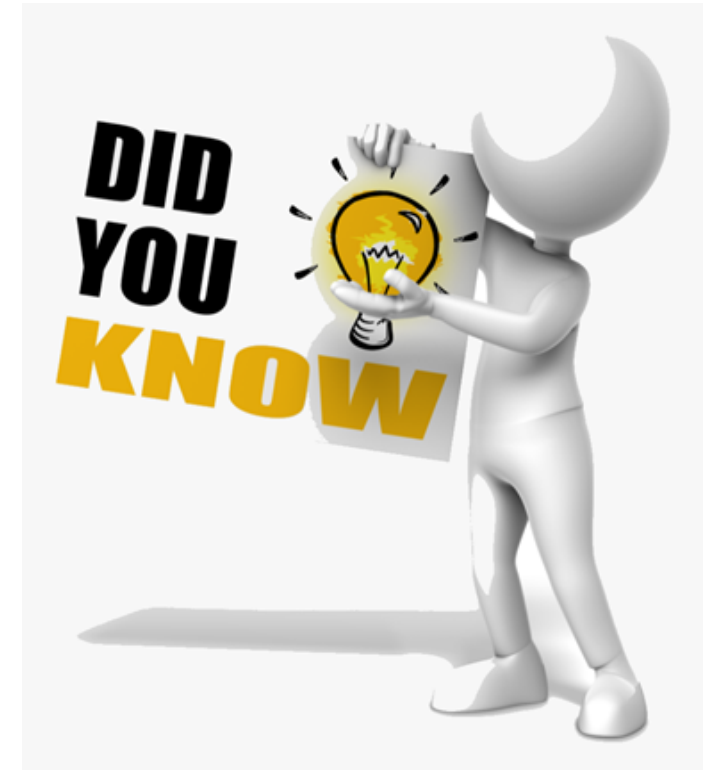
Objective

Upon completion of the course the student shall be able to:

- Understand the process of Drilling.
- Parts of Drilling machines.
- Application of Drilling.

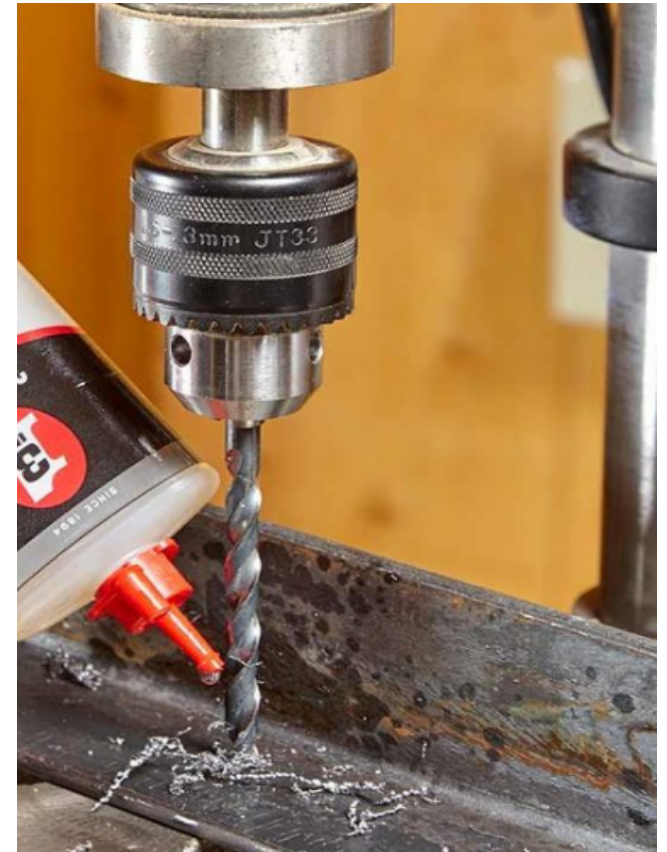
Did you Know?

- Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials. The drill bit is usually a rotary cutting tool, often multi-point.



Introduction to Drilling

- The drill bit is usually a rotary and multipoint cutting tool made up of high speed steel.
- The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute.
- This forces the cutting edge against the work-piece, cutting off chips (swarf) from the hole as it is drilled.



Different types of Drilling

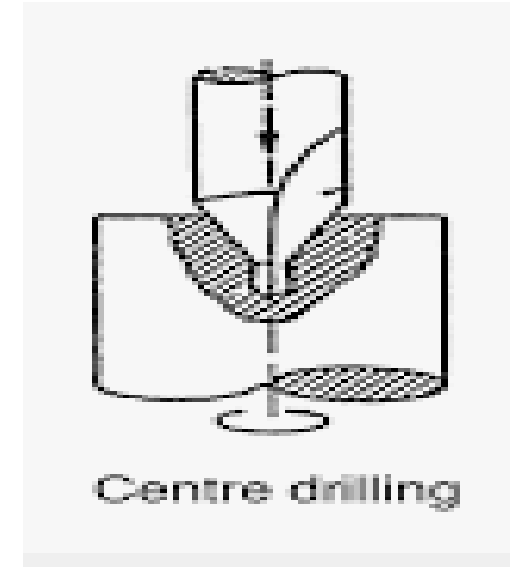
1. Spot drilling :

- The purpose of spot drilling is to drill a hole that will act as a guide for drilling the final hole.
- The hole is only drilled part way into the workpiece because it is only used to guide the beginning of the next drilling process.



2. Centre drilling :

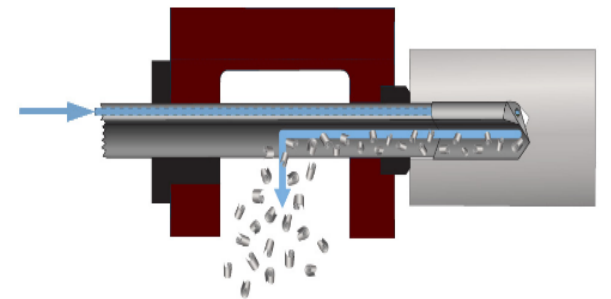
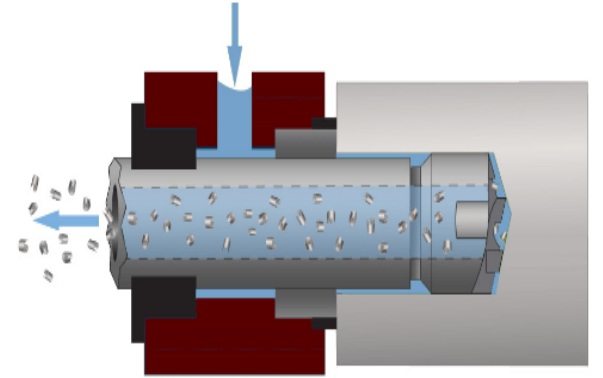
- Centre drill is a two-fluted tool consisting of a twist drill with a 60° countersink; used to drill countersink center holes in a workpiece.



Different types of Drilling

3. Deep hole drilling :

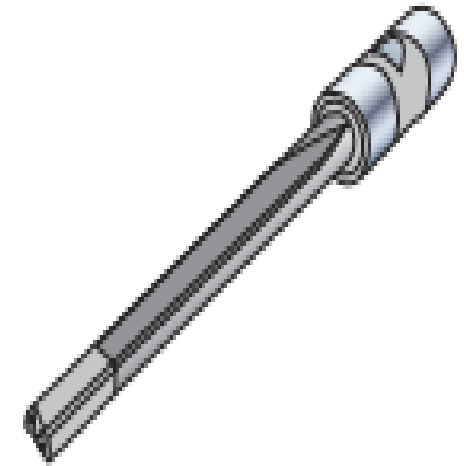
- Deep hole drilling is defined as drilling a hole of depth greater than ten times the diameter of the hole.
- These types of holes require special equipment to maintain the straightness and tolerances.
- Other considerations are roundness and surface finish.
- Deep hole drilling is generally achievable with a few tooling methods, usually gun drilling or BTA drilling.



Different types of Drilling

4. Gun drilling :

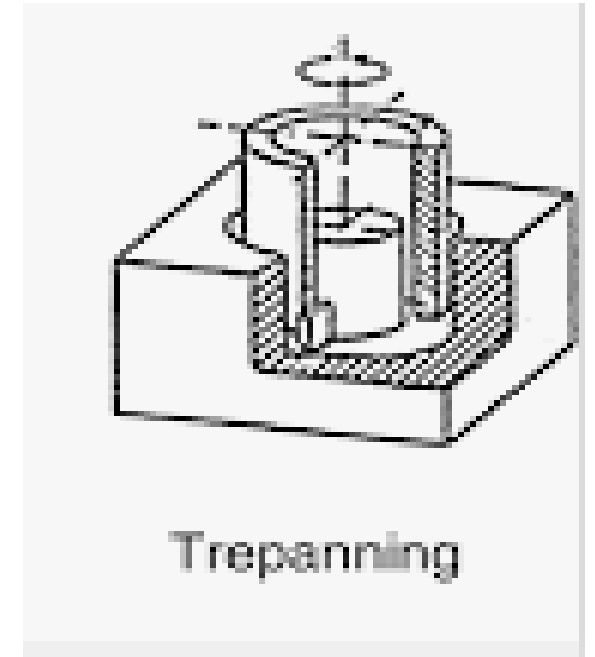
- Gun drilling was originally developed to drill out gun barrels and is used commonly for drilling smaller diameter deep holes.
- The depth-to-diameter ratio can be even greater than 300:1. The key feature of gun drilling is that the bits are self-centering; this is what allows for such deep accurate holes.
- Gun drilling is usually done at high speeds and low feed rates.



Different types of Drilling

5. Trepanning :

- Trepanning is commonly used for creating larger diameter holes (up to 915 mm (36.0 in)) where a standard drill bit is not feasible or economical.
- Trepanning removes the desired diameter by cutting out a solid disk similar to the workings of a drafting compass.
- Trepanning can also be useful to make grooves for inserting seals, such as O-rings.



Different types of Drilling

6. Microdrilling :

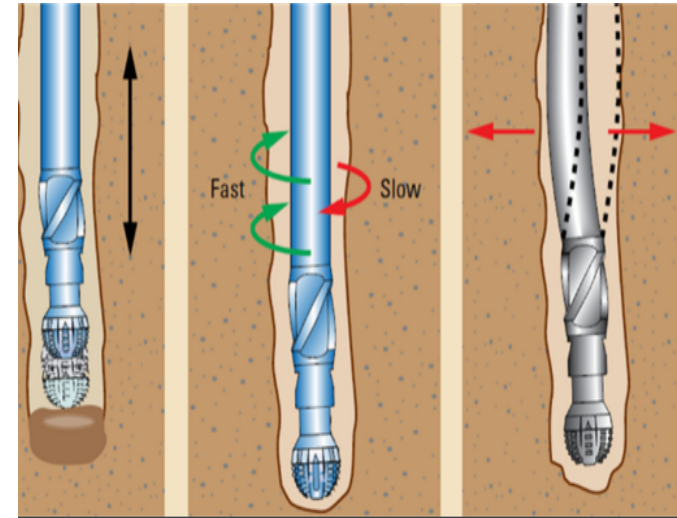
- Microdrilling refers to the drilling of holes less than 0.5 mm (0.020 in). Drilling of holes at this small diameter presents greater problems since coolant fed drills cannot be used and high spindle speeds are required.
- High spindle speeds that exceed 10,000 RPM also require the use of balanced tool holders.



Different types of Drilling

7. Vibration drilling :

- The main principle consists in generating axial vibrations or oscillations in addition to the feed movement of the drill so that the chips break up and are then easily removed from the cutting zone.
- There are two main technologies of vibration drilling: self-maintained vibration systems and forced vibration systems.



Different types of Drilling

8. Circle interpolating :

- Orbital drilling is based on rotating a cutting tool around its own axis and simultaneously about a centre axis which is off-set from the axis of the cutting tool.
- The cutting tool can then be moved simultaneously in an axial direction to drill or machine a hole – and/or combined with an arbitrary sideward motion to machine an opening or cavity.



Application of Drilling

- Drilling is used in metal as well as wood workshop.
- For domestic use also we use drilling like making hole in concrete to fix any object.

From the above Topic we learnt about :

- The types of Drilling
- Uses of drilling

Check Your Understanding

1. What is the name of the cutting tool used for drilling ?
 - A. Drill Chuck
 - B. Drill bit
 - C. Spindle
 - D. Table
2. The space provided to eliminate undesirable contact between the drill and the workpiece ?
 - A. Clearance
 - B. Clearance diameter
 - C. Cutter sweep
 - D. None of the above

Check Your Understanding

3. Gun drilling was originally developed to drill out gun barrels.

- A. True
- B. False

4. There are two main technologies of vibration drilling: self-maintained vibration systems and forced vibration systems.

- A. False
- B. True

Check Your Understanding

5. Drill bit is made up of ?

- A. Mild steel
- B. High speed steel
- C. Carbon steel
- D. None

6. The purpose of spot drilling is to drill a hole that will act as a for drilling the final hole?

- A. Startor
- B. Drive
- C. Guide
- D. Depth of cut

Check Your Understanding

7. Which of the following is a type of drilling?

- A. Centre drilling
- B. Spot drilling
- C. stamping
- D. Both B and A

8. Drilling can be performed on which of the following object ?

- A. Concrete
- B. All of the given options
- C. Wood
- D. Metal

Answer Key

1. B. Drill bit
2. A. Clearance
3. A. True
4. B. True
5. B. High speed steel
6. C. Guide
7. D. Both B and A
8. B. All of the given options

Drilling

Types of Drilling Machines

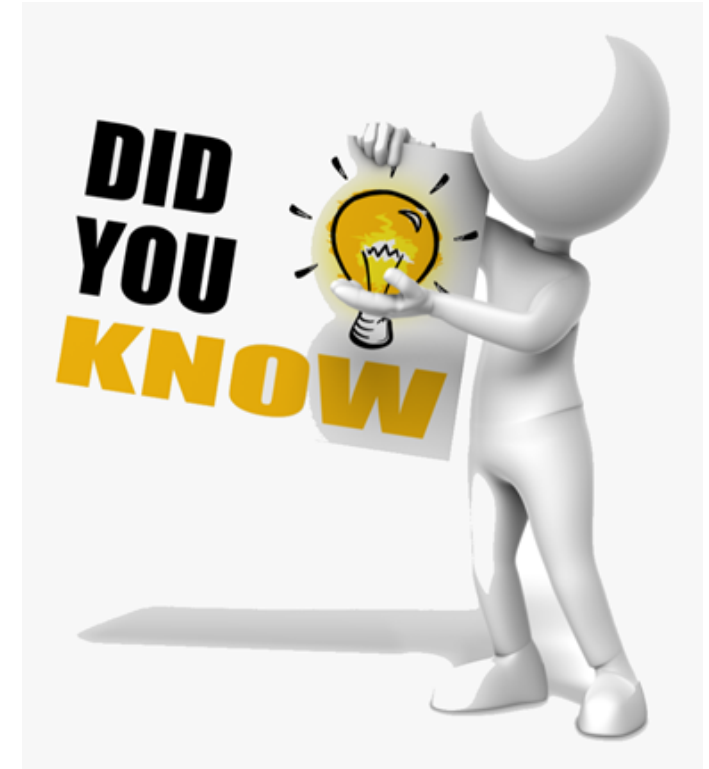
Objective

Upon completion of the course the student shall be able to:

- Identify different types of Drilling machine.
- Know the application of Drilling machines.

Did you Know?

- Drilling is defined as a material cutting process to create a hole or to dig deep into a material. According to the research 75% of all metal cutting material i.e. removed originates from the drilling process.



Introduction to Drilling machine

- Drilling machines are designed according to the depth of the surface.
- The attachment of drill is attached to a chuck at one end and then rotated around while high pressure is imposed against the target material.
- The tip of the cutting instrument and its edges play a vital role in the work of cutting.
- Drilling machines are classified according to their type of applications.



Different parts of Drilling machine

Following are the main parts of drilling machine:

- Base : Structural support to the machine
- Column : A straight bar which holding all the parts on it.
- Table : Working area of the machine on which work is clamped.
- Radial Arm : By this The drilling point Can be swiveled.
- Drill head : Top portion of the machine
- Spindle speed and Feed mechanism : Steeped pulley Used for speed and rack and pinion used for feed.



Parts of Drilling Machine

Different types of Drilling machines

1. Portable Drilling Machine :

- These types of a drilling machine are commonly used in all the workshops. Used to drill small sized holes.
- It is operated by holding in a hand. The workpiece where the hole is to be drilled is held in a vice.



Different types of Drilling machines

2. Sensitive Drilling Machine :

- This types of drilling machine used to drill small holes at high speeds in lighter jobs or workpieces .
- Hand-feed permits the operator to sense the progress of the drill into the workpiece. Since the operator senses the cutting action at any instant it is called as the sensitive drilling machine.
- These machines are capable of drilling small holes of diameter as small as 0.35 mm to 15 mm.



Different types of Drilling machines

3. Upright Drilling Machine :

- It is larger in size and stronger than sensitive drilling machine. It is used for drilling medium and large-sized holes.
- Based on the type of column used it is classified as a round column and box column upright drilling machines.



Different types of Drilling machines

4. Radial Drilling Machine :

- Radial drilling machines are used to drill mediums to large and heavy workpieces. these machines are used to drill holes in a given radial distance.
- It is mainly used when the component's size is larges in height.
- Radial drilling machines are primarily designed for drilling holes in heavy jobs or workpieces.



Different types of Drilling machines

5. Gang Drilling Machine :

- This machine consists of the number of drill heads placed side by side so that more than one hole of same or different sizes can be drilled at a time on the same job or on different jobs.
- The space between drill spindles is varied to suit the gap between the holes.
- This type of machine tool is used to drill a large number of holes in the same job at a faster rate.



Different types of Drilling machines

6. Multi Spindle Drilling Machine :

- This machine tool is similar to a gang drilling machine in construction. It is used to drill the number of hole in the same workpiece simultaneously and to reproduce the same work in a number of similar jobs.
- All the spindle are driven by a single motor and fed continuously.
- During the feeding table with the workpiece is raised or lowered and the drill head position is not varied.



Different types of Drilling machines

7. Automatic Drilling Machine :

- This types of drilling machine can perform a series of machining operations at successive units and transfer the work from one unit to the other automatically.
- Once the work is loaded at the first machine, the work will move from one machine to the other where different operations can be performed and the finished work comes out from the last unit without any manual handling.



Automatic Drilling Machine

Different types of Drilling machines

8. Deep Hole Drilling Machine :

- This may be the either horizontal or vertical type of machine. In this drilling machine, the part to be drilled is rotated and the drill bit that makes the hole is kept stationary. Deep hole drilling is done in components like rifle barrels, crankshafts, long shafts etc.



Specification of Drilling Machine

A Drilling machine can be specified as per :

- Maximum size of drill
- Table diameter
- Maximum spindle travel
- Number of spindle speeds and feeds
- Morse taper number of the spindle
- Power input
- Floor space required
- Weight of the machine.

No.	SPECIFICATION	20 MM
1	Drilling Capacity n Steel	20 mm
2	No. Of Spindle Speed	85-154-260-460-617- 1100-1880-3360
3	Spindle Nose Taper	MT - 2
4	Spindle Center to Columm	203 mm
5	Spindle Travel	130 mm
6	Maximum distance Between Spindle to Table	340 mm
7	Maximum distance Between Spindle to Base	645 mm
8	Working Surface of Table	225 x 250 mm
9	Working Surface of Base	275 x 275 mm
10	Column Diameter	73.8 mm
11	Base of Machine	490 x 330 mm
12	Overall Dimension of M/c.	1170 x 390 x 710
13	Motor Speed	1440 RPM
14	Motor 3 Phase Induction A.C.	1 H.P.
15	Weight of Machine. (Approx)	100 Kg.

Drilling Machine



20MM

Application of Drilling Machine

- These machines are used in industries like manufacturing, metalworking, woodworking, masonry and construction as well.
- Apart from drilling holes, drill machine is featured of performing a variety of tasks like tapping, spot facing, reaming, counter sinking and counter boring etc.

From the above Topic we learnt about :

- The types of Drilling machine
- The specification of Drilling machine
- The application of Drilling machine

Check Your Understanding

1. The standard point angle of drill used for drilling wood and fiber is ?
 - A. 116° to 118°
 - B. 130° to 140°
 - C. 60°
 - D. 125°

2. In Drilling Machine,
 - A. Drill is stationary and workpiece is rotating
 - B. Drill is rotating and workpiece is stationary
 - C. Drill is rotating and workpiece is rotating
 - D. Drill is moving and workpiece is moving

Check Your Understanding

3. In Drilling Machine, the drill head is supported by column.

A. True

B. False

4. In Drilling Machine, the chuck is mounted on spindle.

A. False

B. True

Check Your Understanding

5. In Drilling Machine, the drill is a..... ?

- A. Single point cutting tool
- B. Two point cutting tool
- C. Line cutting tool
- D. Multipoint cutting tool

6. In Drilling Machine, the linear motion of drill is ?

- A. Speed
- B. Drive
- C. Feed
- D. Depth of cut

Check Your Understanding

7. The end of drill bit is in which shape ?

- A. Semi-circular
- B. Flat
- C. Conical
- D. Both B and C

8. In Drilling Machine, the work table has which of the following motion ?

- A. Rotary motion about base
- B. Both C and D
- C. Up and down motion along the column
- D. swing about the axis of the column

Answer Key

1. C. 60°
2. B. Drill is rotating and workpiece is stationary
3. A. True
4. B. True
5. D. Multipoint cutting tool
6. C. Feed
7. D. Both B and C
8. B. Both C and D

Drilling

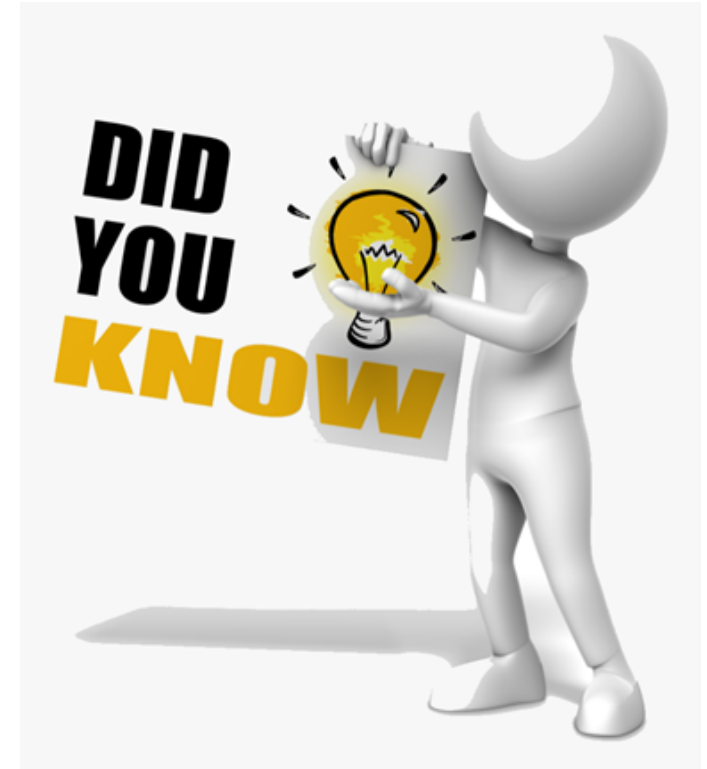
Drill bits

Upon completion of the course the student shall be able to:

- Understand the types of Drill bits.
- Application of Drill bits.
- Specification of Drill bits.

Did you Know?

- A drill bit is a fluted cutting tool used to originate or enlarge a hole in a solid material.
- Drills are manufactured in a wide variety of types and sizes.



Introduction to Drill bits

- Drill bits are cutting tools used to remove material to create holes, almost always of circular cross-section.
- Drills come in many sizes and shapes and can create different kinds of holes in many different materials.
- In order to create holes drill bits are usually attached to a drill, which powers them to cut through the workpiece, typically by rotation.



Different types of Drill bits

Following are the different types of tools used in drilling machine:

1. Flat or Spade Drill :

- A flat drill is sometimes used when the same sized twist drill is not available. It is usually made from a piece of round tool steel which is forged to shape and ground to size, then hardened and tempered.
- The cutting angle varies from 90 to 120 and the relief or clearance at the cutting edge is 3 to 8.
- The disadvantage of this type of drill is that each time the drill is ground the diameter is reduced.



Different types of Drill bits

2. Straight Fluted Drill :

- A straight-fluted drill has grooves or flutes running parallel to the drill axis. A straight-fluted drill may be considered as a cutting tool having zero rakes.
- This type of drill is inconvenient in standard practice as the chips do not come out from the hole automatically.
- It is mainly used in drilling brass, copper or other softer materials.



Different types of Drill bits

3. Twist Drill :

- This is the most common type of drill used today is the twist drill.
- It was originally manufactured by twisting a flat piece of tool steel longitudinally for several revolutions, then grinding the diameter and the point.
- The present-day twist drills are made by machining two spiral flutes or grooves that run lengthwise around the body of the drill.



Different types of Drill bits

3.1 Parallel Shank (short series or “jobbers” twist drill) :

- The drill has two helical flutes with a parallel shank of approximately the same diameter as the cutting end.
- The diameter of the drill ranges from 02 to 16 mm increasing by 02 to 03 mm in lower series to 025 mm in higher series.



3.2 Parallel Shank (stub series) twist drill

- The drill is a shortened form of the parallel shank twist drill, the shortening being on the flute length.
- The diameter of the drill ranges from 05 to 40 mm increasing by 03 mm in lower series to 025 to 05 mm in higher series.



Different types of Drill bits

3.3 Parallel Shank (long series) Twist Drill :

- The drill has two helical flutes with a parallel shank of approximately the shank diameter as the cutting end, which however does not exceed the diameter at the drill point.
- The overall length of the drill is the same as that of a taper shank twist drill of the corresponding diameter.



3.4 Taper Shank Twist Drill

- The drills have two helical flutes with a tapered shank for holding and driving the drill.
- The shank for these drills conforms to Morse tapers.



Different types of Drill bits

4. Taper Shank Core Drill (three or four fluted) :

- These drills are intended for enlarging cored, punched or drilled holes.
- These drills cannot originate a hole in a solid material because the cutting edges do not extend to the centre of the drill.
- The metal is removed by a chamfered edge at the end of each flute. Cored drills produce better-finished holes than those cut by ordinary two fluted drills.



Different types of Drill bits

5. Oil Tube Drill :

- The oil tube drills are used for drilling deep holes.
- Oil tubes run lengthwise spirally through the body to carry oil directly to the cutting edges.
- Cutting fluid or compressed air is forced through the holes to the cutting point of the drill to remove the chips, cool the cutting edge and lubricate the machined surface.
- These are used for Petroleum drilling industry



Different types of Drill bits

6. Centre Drill :

- The centre drills are a straight shank, two fluted twist drills used when centre holes are drilled on the ends of a shaft.
- They are made in finer sizes.
- Both ends can be used.
- We can call it as a primary tool which is used before using any kind of tool.



Drill bit materials

Here are the four materials frequently used in making drill bits:

High speed steel (HSS): High-speed steel is widely used for general purpose drilling. Suitable materials are wood, soft metals and plastics. HSS bits contain carbon steel with some additives of chromium and vanadium.

Cobalt: Tougher work like drilling into stainless steel needs a tougher bit material to withstand the resistance and generated heat. This is where cobalt alloys excel.



Drill bit materials

Carbide tipped: Carbide is an extremely strong metal that withstands enormous force. Carbide is also expensive, so tool manufacturers often use HSS for the shank, flutes and leads but add a piece of carbide to the point. Carbide tip bits are popular for masonry, concrete and tile drilling.

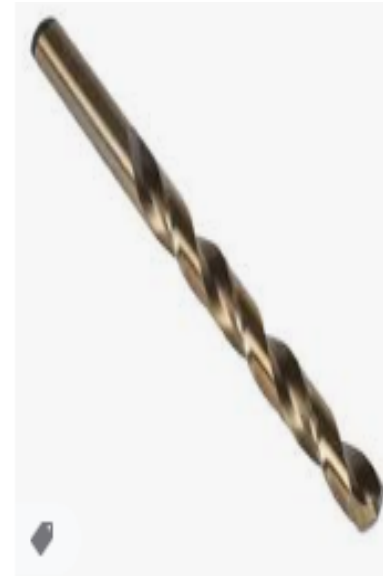
Solid carbide: For maximum duty drilling into the hardest materials, it pays to invest in solid carbide bits. This means the entire bit has carbide construction, not just the tip. Solid carbide bits work well on nonferrous metals, and they do a great job on abrasive surfaces such as fiberglass.



Specification of Drill bits

Drill bits are specified as per :

- Diameter of Drill bits.
- Type of material.
- Pitch size
- Flutes
- Helix angle



Specifications	Values
Drill diameter	3.2 mm
Total length	50 mm
Pitch	30 mm
Flute	2 flute
Helix angle	28°
Point angle	118°

Application of Drill bits

- Drill bits are used to make holes in domestic as well as in workshops.
- Drill bits are also used for industrial applications.
- To take out the locked screws those all are worn out due to improper handling can be taken out by drilling.

From the above Topic we learnt about :

- The types of Drill bits.
- Uses of different Drill bits.
- Specification of Drill bits

Check Your Understanding

1. Which of the following tool used before final size drill bit used ?

- A. Centre drill
- B. Reamer
- C. Tap set
- D. None

2. Which is mainly used in drilling for brass, copper or other softer materials ?

- A. Twist drill
- B. Oil-tube drill
- C. Straight-fluted drill
- D. None of the above

Check Your Understanding

3. The oil tube drills are used for drilling deep holes.

A. True

B. False

4. High-speed steel is widely used for general purpose drilling.

A. False

B. True

Check Your Understanding

5. is used for Petroleum drilling industry?

- A. Twist drill
- B. Flat drill
- C. Oil tube drill
- D. None

6. A straight-fluted drill may be considered as a cutting tool having rakes ?

- A. Negative
- B. Positive
- C. Zero
- D. None

Check Your Understanding

7. Carbide tip bits are popular for which of the following operation?

- A. Masonry
- B. concrete
- C. Tile drilling
- D. All of these

8. Which of the following is a drill bit material ?

- A. HSS
- B. Solid carbide
- C. Cobalt
- D. All of these

Answer Key

1. A. Centre drill
2. C. Straight-fluted drill
3. A. True
4. B. True
5. C. Oil tube drill
6. C. Zero
7. D. All of these
8. D. All of these

Drilling

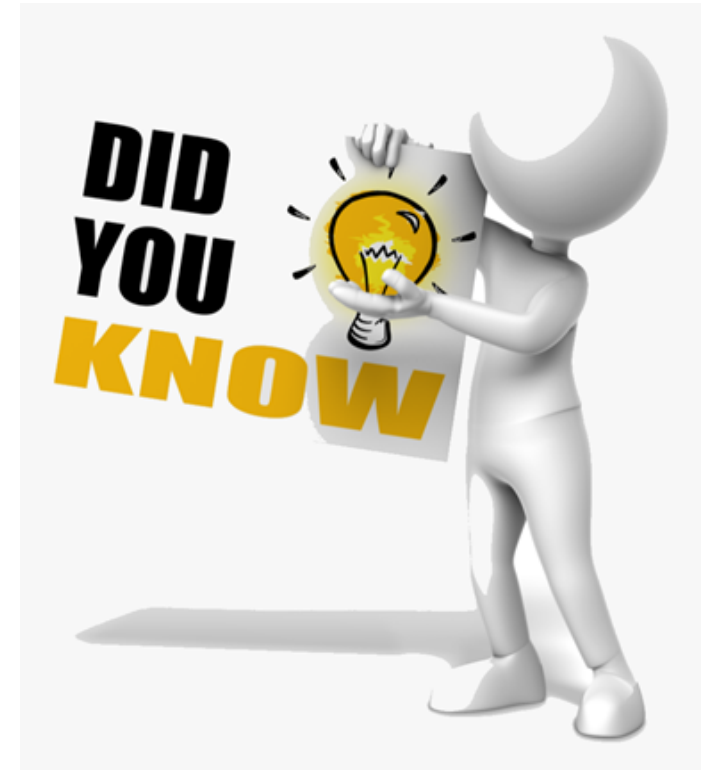
Drilling Operations

Upon completion of the course the student shall be able to:

- Understand the Drilling operations.
- Application of Drilling operations.
- Concept of the Drilling operations.

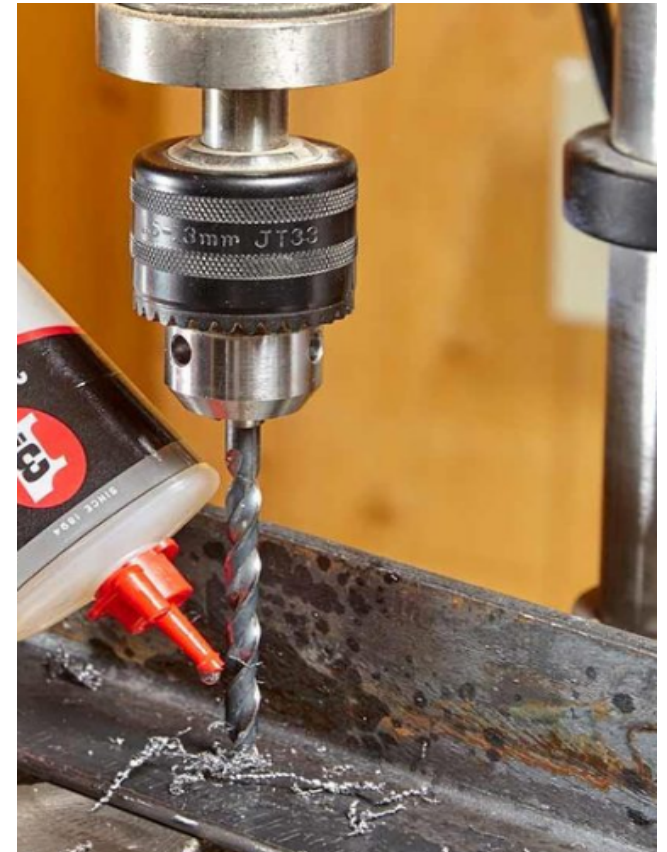
Did you Know?

- We all know the most common operations performed by the drilling machine is nothing but drilling. Though drilling is an important application, many other applications can be easily performed by the drilling machine.
- This all operation can also perform in a lathe machine.



Introduction to Drilling Operations

- Generally drilling is used for making hole in workpiece or we can say just making a cylindrical hole.
- Other forms of drilling operations are also can be performed according to type of application we required.
- Like drill bit some other tools also we are going to use in those operations.

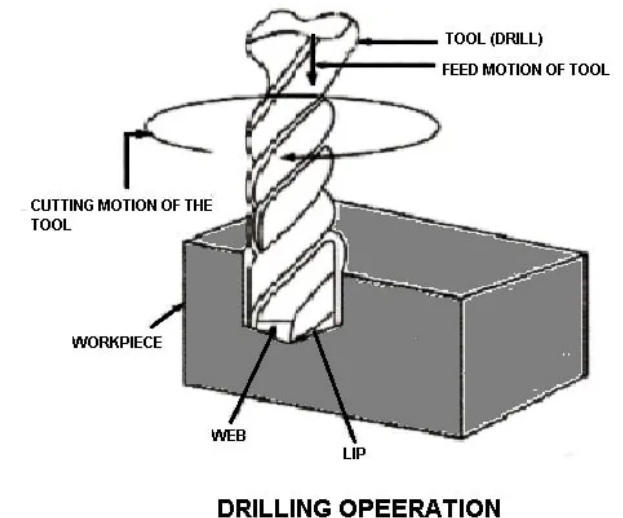


Different types of Drilling operations

Following are the different operations performed on the drilling machine:

1. Drilling :

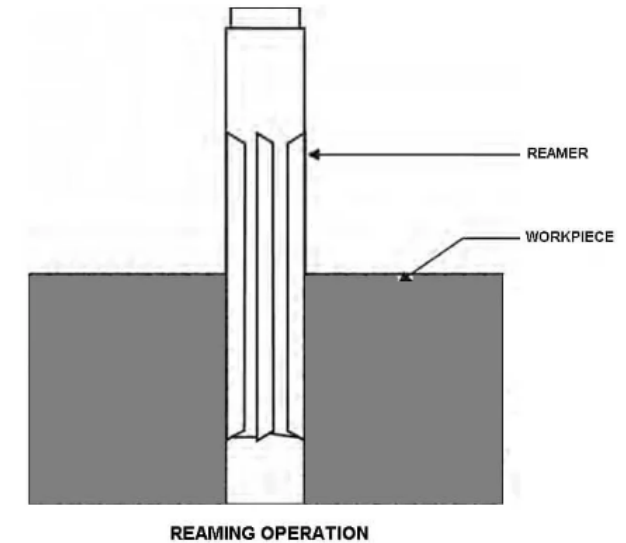
- Drilling is the operation of producing a cylindrical hole by removing metal from the rotating edge of a cutting tool called the drill.
- Before drilling the centre of the hole is located on the workpiece by drawing two lines at right angles to each other and then a centre punch is used to produce an indentation at the centre.



Different types of Drilling operations

2. Reaming :

- Reaming is an accurate way of sizing and finishing a hole which has been previously drilled. In order to finish a hole and to bring it to the accurate size, the hole is drilled slightly undersize.
- The speed of the spindle is made half that of drilling and automatic feed may be employed. The tool used for reaming is known as reamer which has multiple cutting edges.

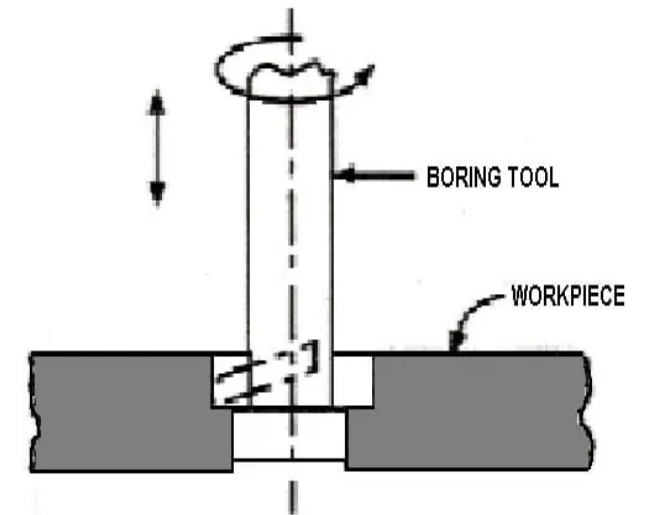


Different types of Drilling operations

3. Boring :

Boring is performed in a drilling machine for reasons stated below:

- To enlarge a hole by means of an adjustable cutting tool with only one cutting edge.
- Used to finish a hole accurately and to bring it to the required size.
- To machine the internal surface of a hole already produced in casting.
- Used to correct out of roundness of the hole.

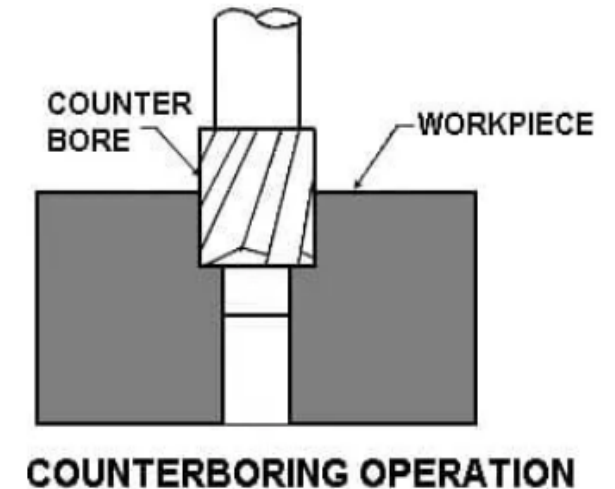


BORING OPERATION

Different types of Drilling operations

4. Counter Boring :

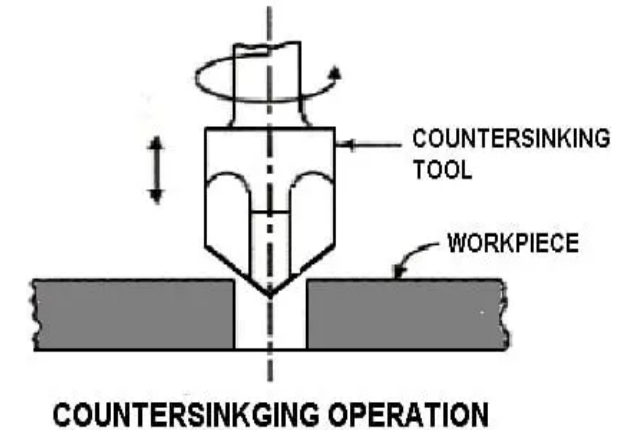
- Counterboring is the operation of enlarging the end of a hole cylindrically. The enlarged hole forms a square shoulder with the original hole.
- This is necessary in some cases to accommodate the heads of bolts, studs and pins.
- A tool used for counterboring is called a counterbore.
- The counterbores are made with a straight or tapered shank to fit in the drill spindle. The cutting edges may have straight or spiral teeth.



Different types of Drilling operations

5. Counter Sinking :

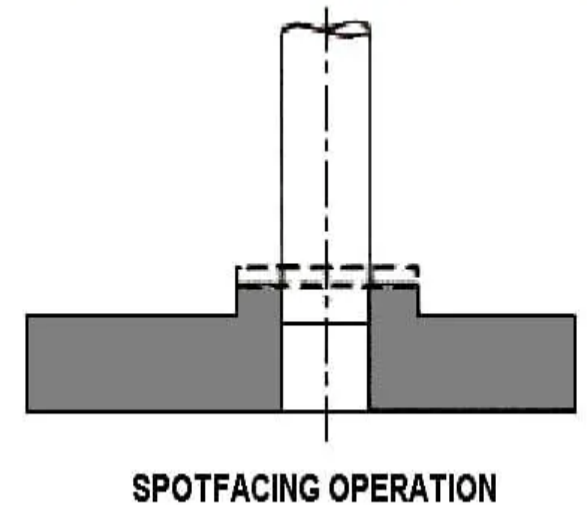
- Countersinking is the operation of making a cone-shaped enlargement of the end of a hole to provide a recess for a flat head screw or countersunk rivet fitted into the hole.
- The tool used for countersinking is called a countersink.
- Standard countersinks have 60, 82 or 90 inclined angle and the cutting edges of the tool are formed at the conical surface. The cutting speed in countersinking is 25% less than that of drilling.



Different types of Drilling operations

6. Spot facing :

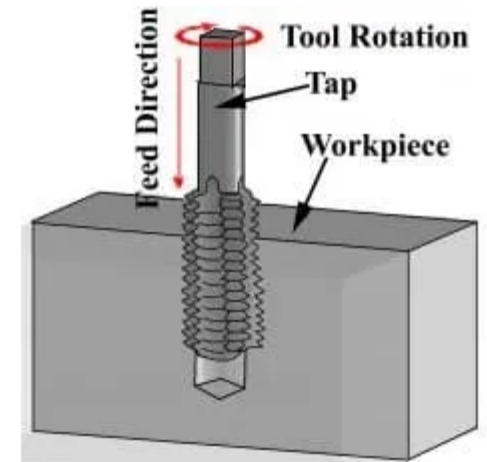
- Spot facing is the operation of smoothing and squaring the surface around a hole for the seat for a nut or the head of a screw.
- A counterbore or a special spot facing tool may be employed for this purpose.



Different types of Drilling operations

7. Tapping :

- It is the operation of cutting internal threads by means of a cutting tool called a tap.
- Tapping in a drilling machine may be performed by hand or by machine.
- A tap may be considered as a bolt with accurate threads cut on it.
- The threads act as cutting edges which are hardened and ground.



Different types of Drilling operations

8. Lapping :

- Lapping is the operation of sizing and finishing a small diameter hole already hardened by removing a very small amount of material by using a lap.
- There are many kinds of lapping tools.
- The copper head laps are commonly used.
- The lap fits in the hole and is moved up and down while it revolves.



Different types of Drilling operations

9. Grinding :

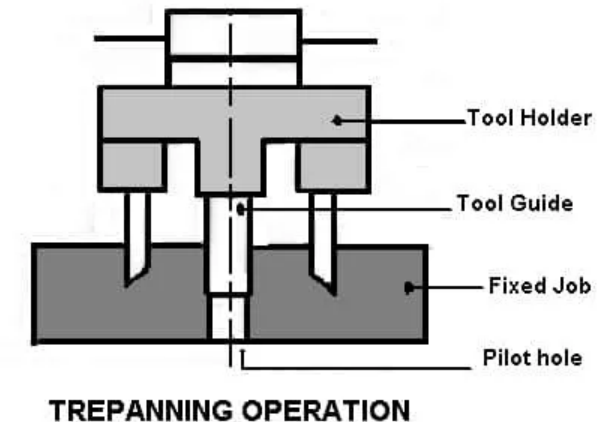
- Grinding operation may be performed in a drilling machine to finish a hardened hole.
- The grinding wheel is made to revolve with the spindle and is fed up and down.
- A suitable grinding wheel may be selected for surface grinding operation.
- Grinding can also be done correctly out of roundness of the hole.



Different types of Drilling operations

10. Trepanning :

- Trepanning is the operation of producing a hole by removing metal along the circumference of a hollow cutting tool.
- This operation is performed for producing large holes.
- Fewer chips are removed and much of the material is saved while the hole is produced.



Application of Drilling operations

- Drilling operations are formed for fixing screws and bolts.
- Reaming used for cleaning the hole.
- Tapping is generally performed for internal thread.

From the above Topic we learnt about :

- The types of Drilling operations.
- Uses of different drilling operation tools.

Check Your Understanding

1. Which of the following operation is used for producing a hole by removing metal along the circumference of a hollow cutting tool?
 - A. Boring
 - B. Spot facing
 - C. Trepanning
 - D. Grinding
2. The operation of sizing and finishing a small diameter hole already hardened by removing a very small amount of material by using a lap is called as ?
 - A. Lapping
 - B. Grinding
 - C. Testing
 - D. None of the above

Check Your Understanding

3. Tapping in a drilling machine may be performed by hand or by machine.

A. True

B. False

4. Reaming is an accurate way of sizing and finishing a hole which has been previously drilled.

A. False

B. True

Check Your Understanding

5. Beveling a drilled hole is called as ?

- A. Boring
- B. Counter boring
- C. Turning
- D. Counter sinking

6. Enlarging a drilled hole is called as.....?

- A. Counter Boring
- B. Counter Sinking
- C. Grinding
- D. Lapping

Check Your Understanding

7. Which of the following is a type of drilling operations?

- A. Lapping
- B. Spot Facing
- C. stamping
- D. Both B and A

8. Which statement is correct about Trepanning?

- A. Chip removal is low
- B. All of the given options
- C. Uses hollow cutting tool
- D. Used for making large holes.

Answer Key

1. C. Trepanning
2. A. Lapping
3. A. True
4. B. True
5. D. Counter sinking
6. A. Counter Boring
7. D. Both B and A
8. B. All of the given options