

“ADVANCE TYPES OF DRILL BIT - A REVIEW”

Chandresh P. Rana ¹, Pankaj D Pandey², Akshar Y Parmar³, Pradipsinh A Parmar⁴

¹Asst. Professor, Mechanical Engineering Department, Vadodara Institute of Engineering, Gujarat, India

^{2,3,4}Mechanical Student Mechanical Engineering Department, Vadodara Institute of Engg. Gujarat, India

ABSTRACT

The growth of Indian manufacturing sector depends largely on its productivity & quality. Drilling is the most common machining operation and it forms the highest machining cost in many manufacturing activities. In this paper, in-depth review on advancement in drill bit with the availability of a large array of tool geometries, materials and coatings. It is has become a challenging task to select the best tool and cutting parameters that would result in the lowest machining cost or highest profit rate.

Furthermore, to drill a satisfactory hole in any material, the correct type of drill bit must be used, it must be used correctly and be sharpened as appropriate. For basic requirements, a set of high-speed steel twist drills and some masonry bits will probably be sufficient for the average handyman. But for more sophisticated jobs/material, others bits will be required - perhaps larger, or designed for a specific material/purpose.

Keyword:- Drill bit, Productivity, Sophisticated, Masonry

1. INTRODUCTION

The challenged of new modern machining industries is focusing on the gaining of high quality, in term of work piece dimensional accuracy, surface finishing, very high production rate, less wear on the cutting tools and In the term of economy of the cost saving^[1]. Manufacturing enterprises presently have to deal with increasing demands for improved product quality, tool life, less wear and cutting force. In today's fast changing situation in manufacturing industries, applications of optimization techniques in metal cutting processes is necessary for a manufacturing unit to work effectively to severe competitiveness and growing demand of quality product in the market. The growth of Indian manufacturing sector depends largely on its productivity & quality^[2]. Drilling is the most common machining operation and it forms the highest machining cost in many manufacturing activities^[3]. It is has become a challenging task to select the best tool and cutting parameters that would result in the lowest machining cost or highest profit rate^[4].

Drilling, the standard process for producing holes, is among the most common material removal process. Drilling is performed by a tool which is rotated by the spindle of a machine. Drilling is an important operation in manufacturing industry which is the process of producing round holes in solid materials or enlarging existing holes by use of multi-tooth cutting tools such as drills, drill bits. In order to make a hole on the workpiece either the drill is rotated and the workpiece stays fixed but in some cases for example, lathe, the drill stays stationary and the workpiece rotates. Fig. 1 represents terminology of Twist drill bit.

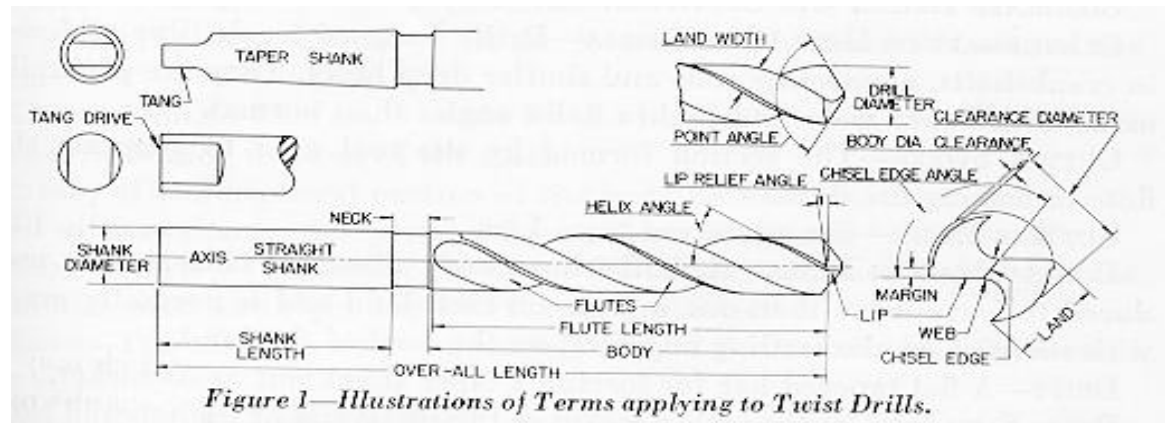


Figure 1—Illustrations of Terms applying to Twist Drills.

1.1 Length Designations

The length of a twist drill has much to do with its rigidity - a shorter bit will be stronger and less likely to wander or break but may not have the reach needed for all jobs. Twist drill bits for use in automated machinery have an actual length specification (e.g. 4-1/2") while most twist drills for use in portable drills are graduated length and use a name to specify the length range.

1.1.1 Jobber Length

These are the most common twist drills and are a good compromise between length and strength. Jobber drills vary in length according to their diameter and typically have a flute length of 9-14 times the cutting diameter, i.e. a 1/2" jobber drill has a flute length of 4-1/2" (nine times the diameter) with smaller drills having a larger ratio.

1.1.2 Mechanics Length

Shorter than jobber drills, mechanics length drills are named as such because they fit into tighter spaces and are less likely to break while still allowing a reasonable flute length.

1.1.3 Screw Machine Length

Also called "stubby length", these are the shortest common drill bits. Originally designed for screw machines, many people prefer these due to their high strength and added working clearance.

1.1.4 Extra Length

These are extra long drill bits (up to 18") with flutes extending the entire length of the bit. Extra length drills can be very fragile and easily broken so it's usually best to drill as deep as possible with a jobber or shorter bit before switching to an extra length drill bit.

1.1.5 Aircraft Extension

Similar in length to extra length bits, aircraft extension drill bits emphasize reach over cutting depth and have a shorter flute length (about the same as a jobber drill). This makes the bit much stronger and less susceptible to bending and breaking.

1.1.6 Silver and Deming

More than a length specification, Silver and Deming drill bits are 6" long with a 3" flute length and a 1/2" diameter shank. All Silver and Deming bits are over 1/2" cutting diameter, ranging from 33/64" to 1-1/2", and are primarily intended for use in a drill press.

1.2 Size Designations

Common twist drills for use in portable drills, etc. are available in fractional inch, wire sizes, letter sizes, and metric decimal millimeter. Twist drills for use in automated machinery are only available in fractional inch and decimal millimeter.

1.3 Tip Styles

1.3.1 Conventional Drill Point

This is the most common tip style as seen on everyday general purpose drills. The tip angle is usually 118 degrees but can vary from 90° to high angle "Plexi Point" for use in acrylics. Conventional drill point drills are the most economical and are easily re-sharpened. Suitable for wood, non-ferrous metals and mild steel.



1.3.2 Split Drill Point

This is an advanced drill point that prevents walking and provides improved penetration with less effort. Available in 118 or 135 degree angles, split point drill bits are better for drilling in curved surfaces or in alloy steels. They are more expensive and more difficult to re-sharpen than standard drill points.



1.3.3 V-Point

This is a special high angle tip used on drill bits for automated wood boring machines. V-point drills are used to create thru-holes in sheet stock for dowels or other assembly hardware.



1.3.4 Brad Point

Designed for creating blind holes in wood and other soft materials for shelf pins, dowels, Bradpoints are also used for thru-holes in CNC applications where a conventional drill point would penetrate the table below the panel. Bradpoints have spurs on the outer edges to prevent splintering and chipping of the surface material as well as a center spur to prevent walking as the bit penetrates the surface.



1.3.5 Fishtail Point

These special drill points form a reverse "V" in the tip and are designed for drilling into a surface at an angle without walking. They are commonly used as center drills in counterbores for furniture assembly where panels must be joined at right angles.



1.3.6 Taper Point

These drill bits have a very large taper, extending far up the drill which creates a tapered hole. Primarily used for old style wood screws.

1.4 Flute Styles

Most twist drills have flutes to evacuate the chips at an unspecified angle, and are suitable for the majority of applications. Some specialty twist drills may be designated as "High Helix", "Fast Spiral" or "Low Helix", "Slow Spiral" for specific applications requiring higher or lower spindle speeds or feed rates.

1.5 Shank Styles

Twist drill bits designed for use in automated machinery have fixed diameter (usually 1/2" or 10mm) shanks, threaded shanks, or specialty shanks designed for certain machines. General purpose twist drills for use in portable drills have shanks the same diameter as the bit size (up to a certain diameter), larger diameter bits incorporate a reduced shank (either 1/4", 3/8" or 1/2") to fit into a standard drill chuck. Some bits have 3 flats on the shank to prevent spinning under high torque loads. Others have 1/4" hex shanks for use in a portable drill with a hex bit holder.

1.6 Materials

General purpose twist drills for use in portable drills are available in different grades of high speed steel as well as cobalt steel and solid carbide. Twist drill bits for automated machinery are available in carbon steel, high speed steel, carbide tipped, and solid carbide.

1.6 Coatings

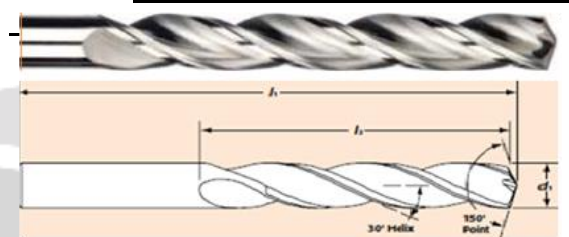
General purpose drill bits are available with black oxide, bronze oxide, a combination of black and bronze oxide, and TiN coatings. Twist drills for automated machinery on our site are primarily for use in wood or plastics and are not coated.

2. ADVANCEMENT OF DIFFERENT TYPE OF DRILL BITS

2.1 Solid carbide jobber lengths

- 3-Flute drill, 150° Point
- For superior hole roundness in cast irons, carbon and tool steels, stainless steels, super alloys and titanium.
- Three flutes for higher cutting edge engagement, smaller chip load. Self-centering geometries for easy metal penetration, minimal deflection.
- Maximum hole depth should not exceed 75% of the length of flute.

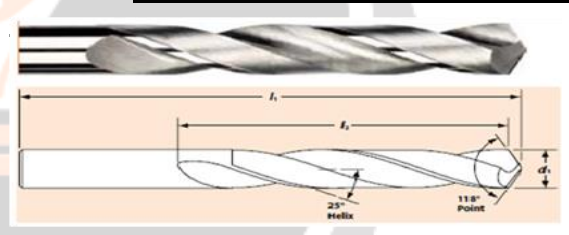
Non-Ferrous	Cast Iron	Carbon & Tool Steels	Stainless Steels	Hard Steel >48HRC	Super Alloys
	XXX	XX	X		X



2.2 Solid carbide jobber length

- 2-Flute, 118° Point
- Excels in aluminum and nonferrous materials.
- Stands up to high drilling temperatures and high torsional stresses.
- Optimized for abrasive and easily machined materials.
- High feed rates, good chip disposal in most applications.
- Maximum hole depth should not exceed 75% of the length of flute.

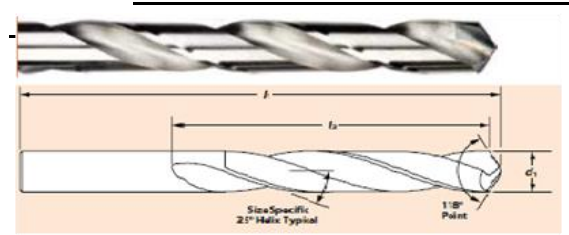
Non-Ferrous	Cast Iron	Carbon & Tool Steels	Stainless Steels	Hard Steel >48HRC	Super Alloys
XXX	X	XX	X		



2.3 Carbide tipped jobber length

- 2-Flute • 118° Point
- Designed for production drilling of cast iron, non-ferrous metals, composites, plastics and other nonmetals.
- Hardened high-strength steel body.
- Carbide tips high-temperature brazed for economical tools and long life.
- Maximum hole depth should not exceed 75% of the length of flute.

Non-Ferrous	Cast Iron	Carbon & Tool Steels	Stainless Steels	Hard Steel >48HRC	Super Alloys
XXX	XX	X		X	

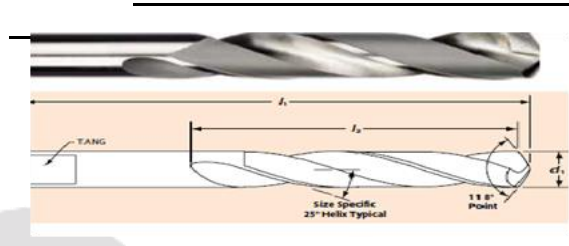


2.4 Carbide tipped taper length

- 2-Flute 118° Point
- Designed with a longer flute length than jobber-length drills for drilling deeper holes faster.

- Best applications include production drilling in cast iron, non-ferrous metals, composites, plastics.
- Hardened high-strength steel body.
- Carbide tips high-temperature brazed for economical tools and long life.
- Tanged shank allows faster deep drilling.
- Maximum hole depth should not exceed 75% of the length of flute.

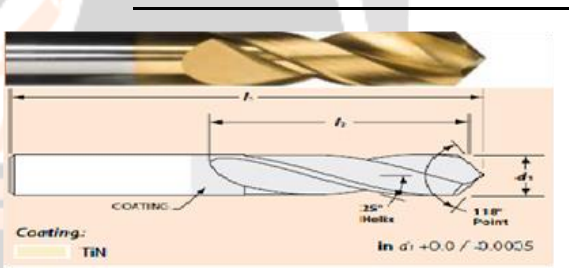
Non-Ferrous	Cast Iron	Carbon & Tool Steels	Stainless Steels	Hard Steel >48HRC	Super Alloys
XXX	XX	X		X	



2.5 Solid carbide stub length

- 2-Flute • 118° Point
- For general-purpose drilling work in abrasive materials – aluminum, non-ferrous metals, carbon steels, tool steels, stainless steels and cast irons.
- TiN coating keeps tool running cooler, longer.
- Maximum hole depth should not exceed 75% of the length of flute.

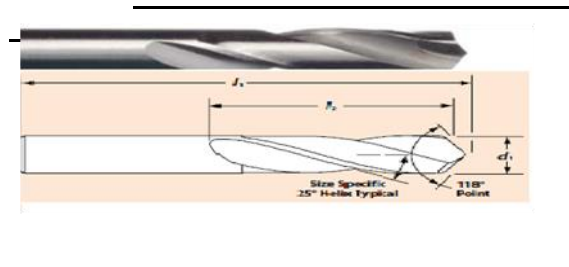
Non-Ferrous	Cast Iron	Carbon & Tool Steels	Stainless Steels	Hard Steel >48HRC	Super Alloys
		XX	XX	XX	



2.6 Carbide tipped stub length

- 2-Flute • 118° Point
- Best performance in aluminum and nonferrous materials. Stub length provides extra rigidity for better stability and precision.
- Hardened high-strength steel body.
- Carbide tips high-temperature brazed for economical tools and long life.
- Maximum hole depth should not exceed 75% of the length of flute.

Non-Ferrous	Cast Iron	Carbon & Tool Steels	Stainless Steels	Hard Steel >48HRC	Super Alloys
		XX	XX	XX	



2.7 Solid carbide straight flute

- 2-Flute • 140° Point
- Great results in hardened steels, in addition to carbon and tool steels, super alloys and titanium.
- Extra web thickness for improved strength; thinned point optimized with high-strength edge.
- Maximum hole depth should not exceed 75% of the length of flute.

Non-Ferrous	Cast Iron	Carbon &	Stainless Steels	Hard Steel	Super Alloys
		Tool Steels		>48HRC	
	X	XX	X	XXX	X

2.8 carbide tipped

- 2-Flute 118° Point
- Great results in hardened, treated or abrasive materials and stainless steels.
- Cam-relieved, thinned point with high-strength edge.
- Extra web thickness adds strength for longer life in hard metals.
- Hardened high-strength steel body.
- Carbide tips high-temperature brazed for economical drilling, long tool life.
- Maximum hole depth should not exceed 75% of the length of flute.

Non-Ferrous	Cast Iron	Carbon &	Stainless Steels	Hard Steel	Super Alloys
		Tool Steels		>48HRC	
	X	X		XX	X

2.9 Solid carbide spad (flat) style

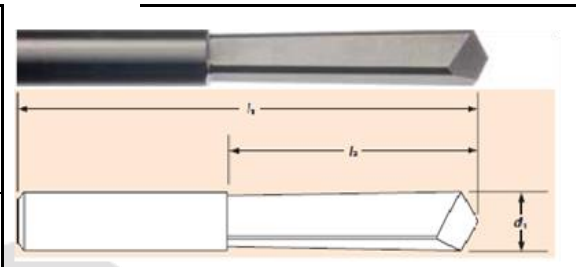
- 118° Point
- The strongest drill style for producing shallow holes (to 2x the tool diameter).
- Doubles as a spotting drill.
- Clean performance in carbon and tool steels cast iron and 300 series stainless steels.
- Maximum hole depth should not exceed 75% of the length of flute.

Non-Ferrous	Cast Iron	Carbon &	Stainless Steels	Hard Steel	Super Alloys
		Tool Steels		>48HRC	
	X	X		XX	X

2.10 Solid Carbide Spotting Drill

- 2-Flute • 90° / 120° Points
- Excellent tool for removing broken taps.

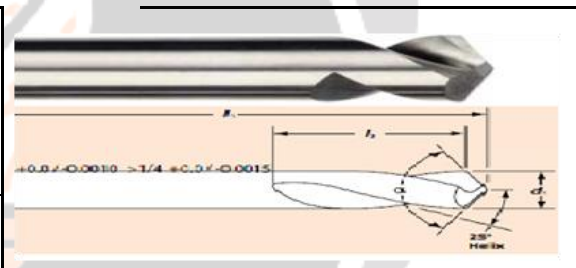
Non-Ferrous	Cast Iron	Carbon &	Stainless Steels	Hard Steel	Super Alloys
		Tool Steels		>48HRC	
XX	XX	XX	XX		XX



2.11 Solid Carbide Combined Drill and Countersink

- Double End
- 118° Point, 60° Countersink
- Specially designed to make every starting location true and accurate.
- Narrow chisel edge, small web for spot-on starting locations in secondary drilling operations.
- Available with 90° and 120° point angle.

Non-Ferrous	Cast Iron	Carbon &	Stainless Steels	Hard Steel	Super Alloys
		Tool Steels		>48HRC	
XX	X	XX	X		X



2.13 Masonry bit

As the name suggests, these are designed for drilling into brick, block, stone, quarry tiles or concrete. The cutting tip is often made from tungsten carbide bonded to a spiralled steel shaft. Some masonry drills are described as 'durium tipped', this term refers to a highly durable silicon bronze alloy used instead of tungsten as the cutting point. Masonry drills are usually used in a power drill; although they can be used with a lot of effort in a hand brace.



2.14 Spur point bit

Also known as a wood or dowel bit, they have a central point and two raised spurs that help keep the bit drilling straight. Sizes range from 3 to 10mm. Spur point bits should only be used for drilling wood or some plastics.



2.15 Tile Bit

A bit for drilling ceramic tiles and glass, it has a ground tungsten carbide tip. They can be used with a hand drill, but



are best used in a variable speed power drill on a slow speed. When drilling glass, some form of lubricant (i.e. turpentine or white spirit) should be used to keep the tip cool.

2.16 Flat wood bit

Intended for power drill use only, the centre point locates the bit and the flat steel on either side cuts away the timber. These bits are used to drill fairly large holes and they give a flat bottomed hole (with a central point) so are ideal where the head of a screw/bolt needs to be recessed into the timber - always use this bit before drilling the clearance hole for the bolt.



2.17 Hole saw

Used for cutting large, fixed, diameter holes in wood or plastic. They will usually cut up to a depth of 18mm - deeper versions are available. Best used in a power drill at low speed as the blade saws it's way through the material.



2.18 Forstner bit

Used to form holes with a flat bottom, such as for kitchen cupboard hinges. Best used in a power drill held in a drill stand as there's little in the way of a central point. If used freehand, the positioning is difficult to control as there is no central pilot bit.



2.19 Wood Auger bit

This is ideal when drilling large-diameter, deep holes in wood or thick man-made boards. Generally an Auger bit should only be used in a hand brace. The bit will cut a clean and deep, flat bottomed holes. The single spur cuts and defines the edge of the hole while the chisel-like cutting edge removes the waste within the previously cut circle. This 'pulling' action means that the bit is really unsuitable for use in a power drill.



3. CONCLUSIONS

By referring number of research paper , I have found that the what are the advance drill bit used now a days in industry for the different operations depends of machining parameters and materials of the work piece. Also come to know the there are many advance drill bit material with coating materials. I have also conclude that different geometry of twist drill bit used for the requirement of machining. This paper will help for the selection of proper drill bit for machining for different material and applications. I have also find out different types of Tip Styles, Flute Styles and Shank Styles used in drill bit.

4. REFERENCES

1. Chandreshkumar P Rana- "Enhancing the working of Journal Bearing" VIER Journal of Engineering Research, Volume-1, Issue-3, August 2016
2. Yogendar singh chouhan¹, M. A. Saloda², S. Jindal³, Chitranjan Agarwal⁴ - :Experimental Investigation of Thrust Force in Drilling Operation" International Journal of Advance Engineering and Research Development, Volume-3, Issue- 4, April -2016

3. Majid Tolouei-Rad, and Ankit Shah- “Development of a Methodology for Processing of Drilling Operations” International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering ,*Volume-6, No.-12, 2012*

4. Manish Kale¹, Prof. D. A. Mahajan², Prof. (Dr.) S. Y. Gajjal³- “A Review Paper on Development of SPM for Drilling and riveting operations” International Journal of Emerging Technology and Advanced Engineering ,Volume 5, Issue 4, April 2015

5. Catalog of Turn hole technology into productivity with IMCO ,IMCO Carbide Tool Inc. 28170 Cedar Park Blvd., Perrysburg, OH 43551.

