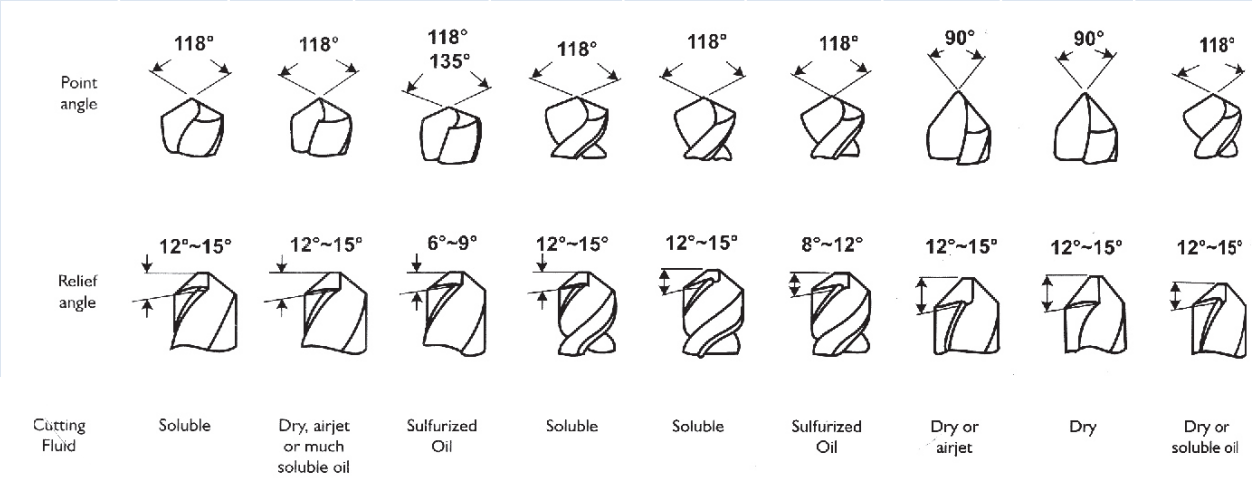
Drill Selection Guide

DRILL SERIES Helix angle	STANDARD DRILLS	HIGH HELIX DRILLS	LOW HELIX DRILLS
	STANDARD (25° - 30°)	HIGH (34°-40°)	LOW (17°-23°)
Web Thickness	STANDARD	LOWER THAN STANDARD	LOWER THAN STANDARD
Choice standard	it is most suitable for drilling of steel cast iron, alloy steel, and malleable cast iron and possible to drill stainless drill, brass shallow hole of aluminium alloy, nickel and almostall kind of material.	This is most suitable for drilling of non-ferrous metal of aluminium, die casted alloy, magnesium alloy, zinc, copper etc., and deep hole of them and possible to get fine result of normal drilling and deep-hole drilling for stainless steel having good machinability.	This is most suitable for drilling of Bakelite, molded plastics, fiber, hard rubber and suitable for drilling of soft type BRASS and magnesium alloy.

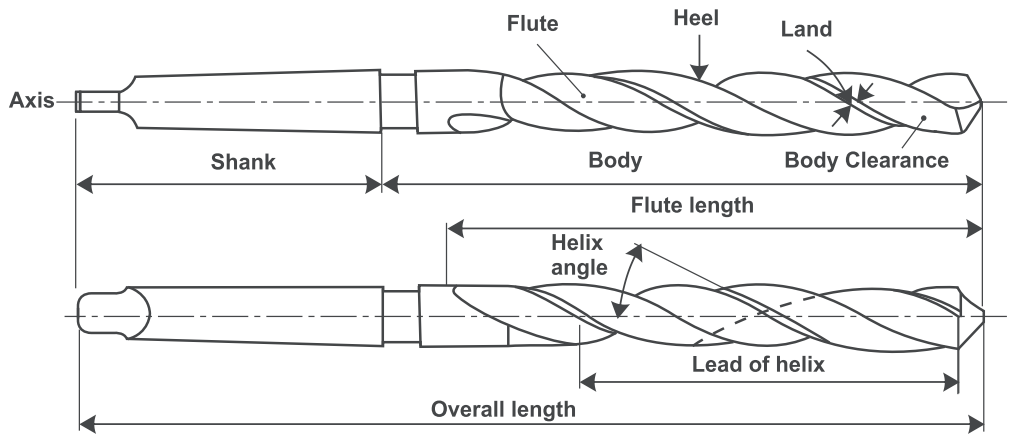
Work material / Cutting condition Dia. (mm)	Steels		Cast iron		Alloy steel		Aluminium		Copper		Stainless Steel		Plastics		Magnesium alloy		Brass	
	rpm	mm/rev	rpm	mm/rev	rpm	mm/rev	rpm	mm/rev	rpm	mm/rev	rpm	mm/rev	rpm	mm/rev	rpm	mm/rev	rpm	mm/rev
2	3550	0.03	3550	0.03	1800	0.02	10000	0.03	2800	0.03	1800	0.03	8000	0.03	14000	0.03	5000	0.04
3	2240	0.06	2240	0.06	1120	0.03	6300	0.06	1800	0.06	1120	0.06	5000	0.06	9000	0.06	3150	0.08
5	1400	0.11	1400	0.11	710	0.05	4000	0.11	1120	0.11	710	0.11	3150	0.11	5600	0.11	2000	0.14
8	900	0.16	900	0.16	450	0.08	2500	0.16	710	0.16	450	0.16	2000	0.16	3550	0.16	1250	0.20
12	560	0.22	560	0.22	280	0.11	1600	0.22	450	0.22	280	0.22	1250	0.22	2240	0.22	800	0.28
16	450	0.26	450	0.26	224	0.13	1250	0.26	355	0.26	224	0.26	1000	0.26	1800	0.26	630	0.33
20	355	0.30	355	0.30	180	0.15	1000	0.30	280	0.30	180	0.30	800	0.30	1400	0.30	500	0.38
25	280	0.34	280	0.34	140	0.17	800	0.34	224	0.34	140	0.34	630	0.34	1120	0.34	400	0.42
32	224	0.38	224	0.38	112	0.19	630	0.38	180	0.38	112	0.38	500	0.38	900	0.38	315	0.48
40	180	0.42	180	0.42	90	0.21	500	0.42	140	0.42	90	0.42	400	0.42	710	0.42	250	0.53
50	140	0.45	140	0.45	71	0.23	400	0.45	112	0.45	71	0.45	315	0.45	560	0.45	200	0.56

Pointing

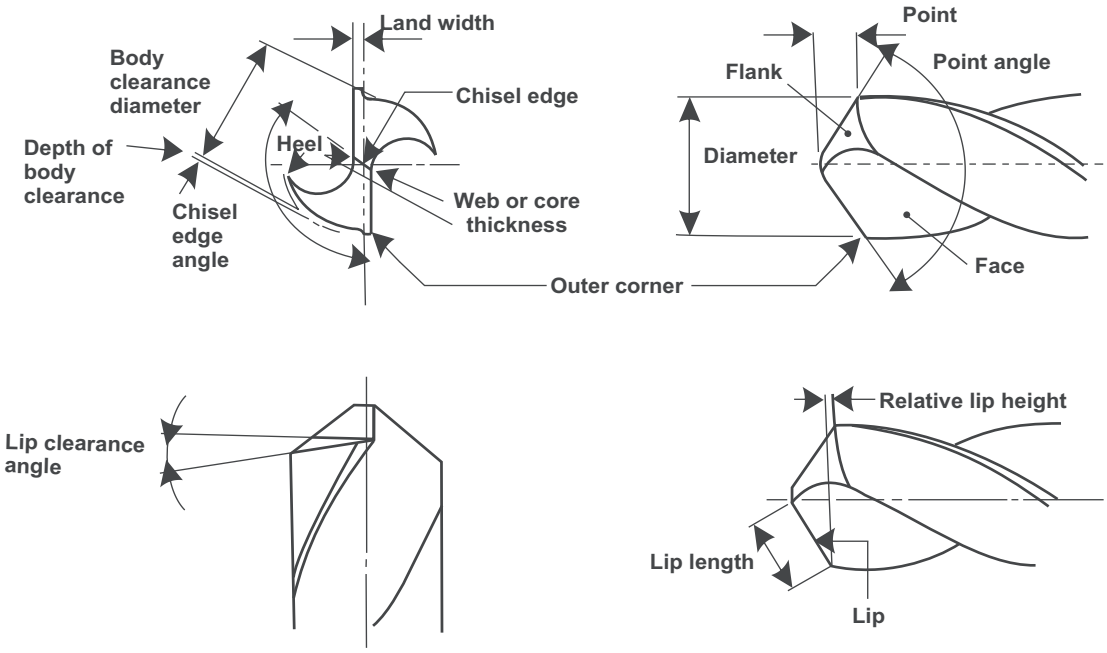


Cutting Fluid	Soluble	Dry, airjet or much soluble oil	Sulfurized Oil	Soluble	Soluble	Sulfurized Oil	Dry or airjet	Dry	Dry or soluble oil

Twist Drill Terms - General Features



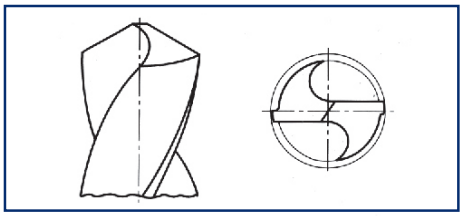
Twist Drill Terms - Point Geometry



Drill Point Styles

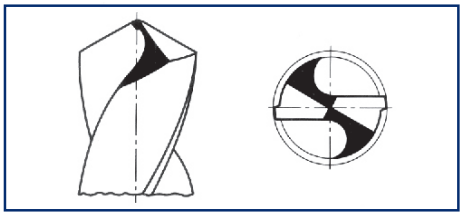
I. GENERAL PURPOSE DRILL

The II8° drill point is the most commonly used drill point. It will give satisfactory results in a wide variety of materials. This point style is supplied on all of out standard special drills unless specified otherwise except Spot Drills.



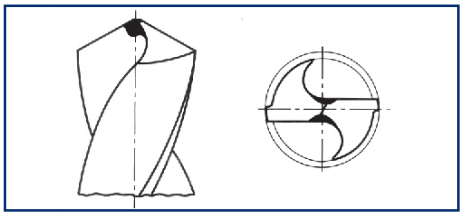
2. SPLIT POINT

II8° or 135° split points are self-centering drill points that require less torque and thrust in hand or machine drilling. This point helps break up chips in deep hole drilling and is an excellent choice when used on drills for CNC equipment.



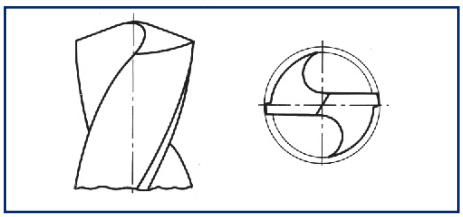
3. NOTCH THINNED POINT

This particular point style was developed to be use in heavy duty drilling applications. It produces excellent results in the drilling of high tensile alloys and steel forgings.



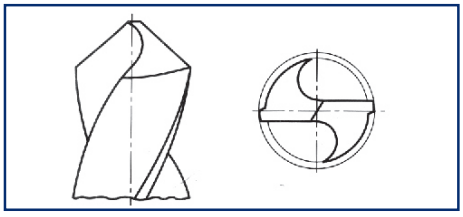
4. 135° POINT

Since the I35° drill point has a short cutting lip than a conventional II8° point and has less lip relief, it has the needed strength to drill tough, hard material. This point style can reduce or minimize the burr on breakthrough on many applications.



5. 90° POINT

The 90° drill point angle is most commonly used in wood, plastic and low density non-ferrous metals. This point will dramatically reduce cracking in drilling plastics. This point is also excellent for accurate spotting. All our standard spot drills are manufactured with this point style.



DRILLING PRACTICE

The flute form, web thickness and helix angle of the standard drill are suitable for most materials producing semi-continuous chips.

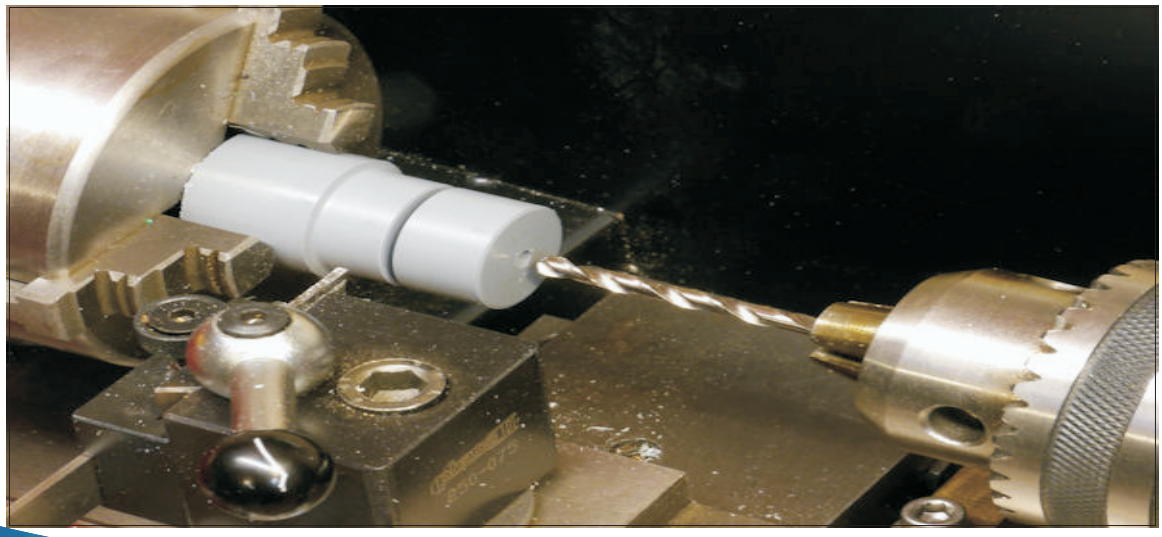
Drilling sizes of 13mm and smaller in soft materials which produce continuous chips, e.g copper aluminium, a bright finish fast helix drill may be required to remove the swarf more effectively. Conversely on materials producing discontinuous chips like brass, gunmetal and some plastics, a slow spiral is preferable.

For effective drilling, the rigidity of the drill and work piece are most important. The shorter the flute length the more rigid the drill. Long drills must be adequately supported to reduce vibration, or stage drill as opposite.

Heavy duty thick web drills may be necessary on the more difficult materials, or when work lacks rigidity. These drills must be point thinned or have split points.

The following are important in drill use:-

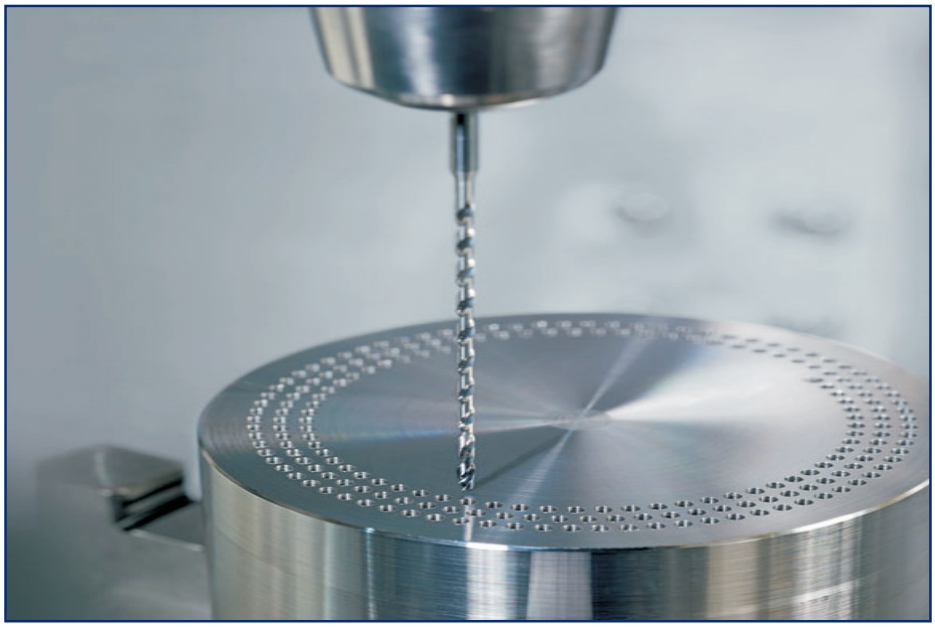
1. Clamp the work-piece securely
2. Select the correct speed and feed
3. Use an appropriate coolant and lubrication
4. When using a taper shank drill use a soft face hammer or wood block for insertion
5. Ensure the shank is securely held. Avoid using worn sockets or drill chucks as the drill may slip during use.
6. Regrind the point before it dulls, do not force worn drill.
7. Deep hole drilling, withdraw frequently to clear the chips deep holes start a 4 times diameter.
8. Opening out existing hole, **do not use a** 2 flute twist drill, use a 3 or 4 flute core drill. Pilot holes should be I.5 times the chisel edge length.
9. Stainless, Manganese and high tensile steels, use an automatic feed through out the drilling cycle. Do not allow the drill to dwell as it will cause work hardening use a slower speed and heavier feed than on easier machined materials.



DRILLING DEEP HOLE

Holes deeper than nominally three times the drill diameter may need special methods to clear the swarf especially when drilling horizontally with standard flute design.

Series Drilling



A series of longer drills may be used successively

FIRST DRILL

This should be either a stub drill or a jobber drill used down to the flute length and pecking at intervals after 3 times diameter in depth to clear the swarf. Alignment of the first drill is very important as all subsequent drills will wander further from this location.

SECOND DRILL

A long series drill to be used as above with pecking about every diameter in depth

THIRD & SUCCESSIVE DRILLS

Extra length drill of increasing flute lengths may be used successively to the required depth, pecking may be required at only half the diameter on extreme depth

PARABOLIC FLUTE DRILLS

Are specifically designed for deep hole drilling and clearing the swarf without pecking down 10 times the diameter on materials that produce long continuous swarf. Parabolic drills are stocked from stub to extra length drills.

RESHARPENING OF TWIST DRILLS

Unless a drill is correctly resharpened the efficiency is greatly reduced. The general features to be observed are:

1. Resharpen before the drill becomes too dull

2. Maintain
   a. The correct point angle
   b. Correct lip clearance
   c. Equal cutting edge length
   d. Correct web thickness
   e. Relative lip height to a close tolerance
   f. Relative lip height to a close tolerance
   g. Never quench the drilling water to cool it. Never grind using a trickle of water. These two methods are likely to produce hair line surface cracks owing to the local heating and quenching. Grind either under a gush of water. or perfectly dry and allow to air cool.

Web Thinning

The thickness of the web increases from the point back to the flute run out. As the drill is pointed back the web should be thinned to approx. 10% of the drill diameter using a grinding' wheel of half the flute width stop. Excessive thinning may weaken the drill causing splitting up the web.

Chipbreaking

A thin radiused wheel can be used to grind grooves across the cutting face which assists chipbreaking. Reducing the peripheral speed and increasing the feed rate, where conditions allow, can also produce a discontinuous chip

RESHARPENING OF TWIST DRILLS

Acute Point Angle

Point angles down to 60° can be used to reduce the tendency of brittle materials such as Bakelite, to flake away on the undersurface as the drill breaks through. The acute angles when applied to standard drills result in convex cutting edges, see point correction.

More Obtuse Point angle

A flatter point angle up to 140° inclusive can be advantageous on high tensile steel and work hardening materials. This angle causes the cutting lips to become concave which weakens the outer corners. It is preferable to use specially designed drills for more difficult materials.

Point Correction

The face of the flute along the cutting lip is ground to reduce the helix angle for brittle materials. A similar technique can be used to correct convex cutting edges. It is important that the circular land is not ground away
This flat cutting edge will assist when a two flute drill to open out an existing hole.

Double Angle Point

The standard II8° point is maintained on the drill for half the lip length. The outer half is then ground at 90 to give reinforced cutting edge, thus ensuring the corner is not destroyed in abrasive materials, such as cast iron.

Split Point

On thick web, heavy duty drill the chisel edge may be too wide to use web thinning, consequently a split point is required to produce an additional cutting edge at the centre.

Common Drill Trouble, Shooting and Remedies

INDICATIONS	CAUSES	REMEDIES
Outer corners breakdown	Rpm Too High, Poor Lubrication, Clogging, Too Much Feed, Poor Lip Relief.	Reduce Speed And Feed Check Lip Relief.
Cutting lips Chip	Feed Too High, Too High Lip Relief.	Reduce Feed, Check Lip Relief.
Cracks in Cutting lips	Running Too Hot, Too Quickly Cooled While Sharpening.	Repoint Drill, Check Speed. Feed Check Lubricants.
Drill breaks	Point Improperly Ground, Too Much Feed, Drill Is Dull, Flutes Clogging, Backlash In Drill Machine.	Check For Proper Point, Check Feed, Inspect Drill Machine.
Tang breaks	Imperfect Fit Between Taper Shank & Socket, Flutes Clogged.	Check For Worn Socket Check For Proper Drill.
Drill breaks when drilling brass	Flutes Clogging, Wrong Drill.	Replace With Proper Drill.
Drill splits up center	Too Much Feed, Not Enough Lip Relief.	Reduce Feed, Check For Proper Lip Relief.
Drill will not enter work	Dull Drill, Not Enough Lip Relief, Web Too Heavy, Reverse Chisel.	Resharpen Drill, Check Lip Relief, Thin Web, Check Chisel Angle.
ROUGH HOLE	Dull Point, No Lubricant, Loose Fixture, Feed Too High.	Repoint Drill, Check For Proper Cutting Lips, Inspect Spindle.
Oversize hole	Unequal Length On Cutting Lips, Loose Spindle.	Repoint, Measure For Equal Length Cutting Lips, Inspect Spindle.
Unequal Chip Size One flute to the other	Drill Becoming Dull Unequal Lips.	Resharpen Drill, Check For Proper Drill.
Chips change while drilling	Point Is Not Ground Properly, One Lip Is Cutting More THan The Other.	Repoint Drill, Measure For Equal Length Cutting Lips Check For Equal Lip Relief.
Drill corners burning (blue-black colour)	Speed Too High, Lack Of Coolant, Hard Spots.	Reduce Cutting Speed, Chamfer Drill Corners Increase Coolant Flow, Place Nozzle Nearer Drill.