enutre Conemo Intro

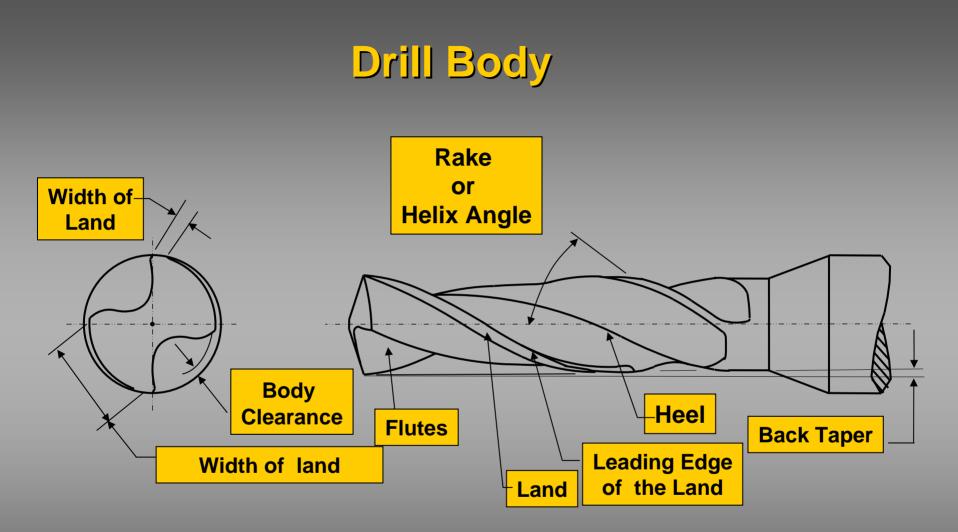




Drill Construction:

A twist drill is made up of three components:

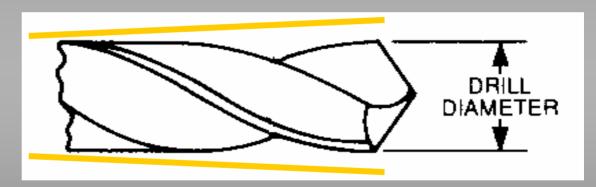
- Shank
- Body
- Drill point





• Cutting Diameter:

"Largest diameter measured across the top of the lands behind the point"



> Back Taper

- The diameter reduces slightly toward the shank end of the drill, this is known as "back taper"
- Back taper provides clearance between the drill and workpiece preventing friction and heat

Drill Flutes

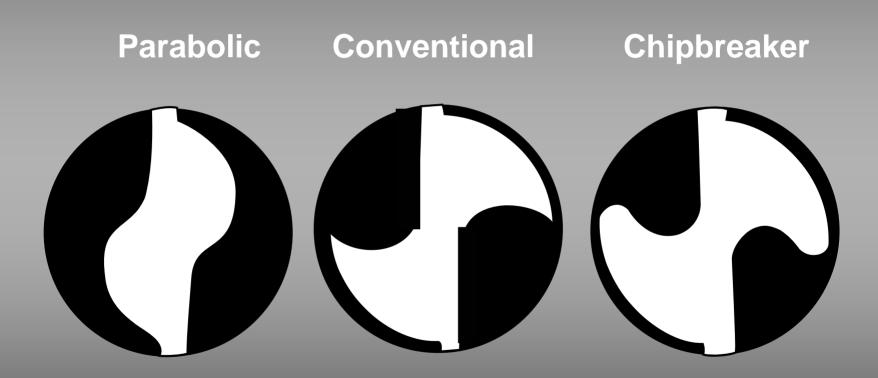


Flute Length:

"The length of flute measured from the drill point to the end of the flute runout"



 Flute length determines the maximum depth of drilling Drill Nomenclature- Flute Construction



Drill Nomenclature- Flute Construction

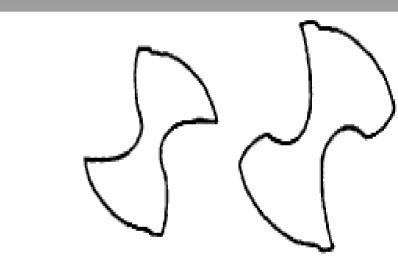
Conventional:

- Has "J" shaped flute geometry
- Used in a wide variety of soft and hard drilling applications
- Drill up to 3 to 4 diameters before pecking
- Most drills in the industry have this type of construction

Drill Nomenclature -Flute Construction

<u>Chipbreaker</u>

- Has special tight radius
 "J" shaped flute
- Tight radius helps to break up chips
- Heel is rolled for increased chip space
- Used in equipment with fixed feeds where long stingy chips are produced



Drill Nomenclature- Flute Construction

Parabolic:

"Compound radius, cleared heel flute shape"



Parabolic flutes substantially increase available flute space for chips!



<u>Land:</u> "The part of the drill body between the flutes"

 The lands provide the drill with much of its <u>torsional strength</u>

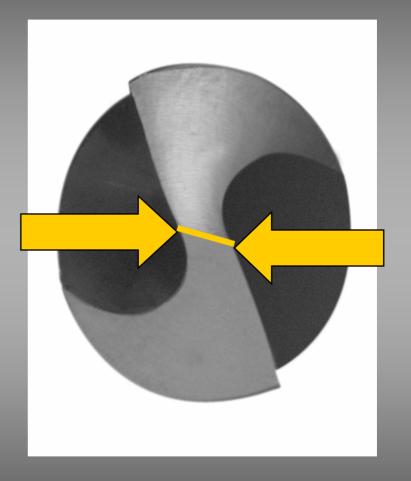
 Reducing the land width increases chip space, but reduces strength

Drill Webs

Drill Nomenclature -Webs

"The thickness measured across the base of the flutes"

Contributes
 to the
 torsional
 strength of
 the drill



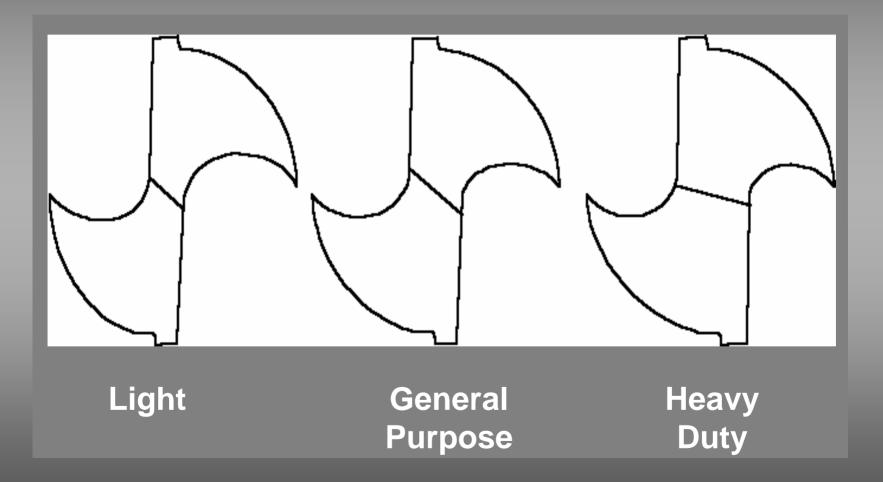


Web Thickness

Webs normally fall into three categories:

- Light
- Medium
- -Heavy

Web Construction



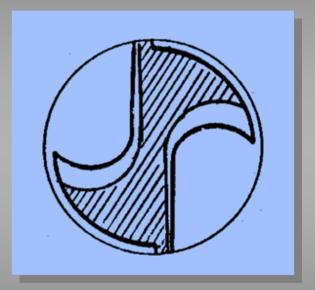
Drill Nomenclature- Web Thickness

• <u>Light:</u>

 Generally 14 to 16 % of the cutting diameter

 Found on fast helix general purpose drills

- Weakest of the drill webs





<u>muibelli</u>

Typically 17 % to 22% of the cutting diameter *Found on all GP drills*

Drill Nomenclature- Web Thickness

- Heavy

- Generally 25 % to 40% of the cutting diameter
- Used on cobalt, coolant hole, parabolic, and other heavy duty drills

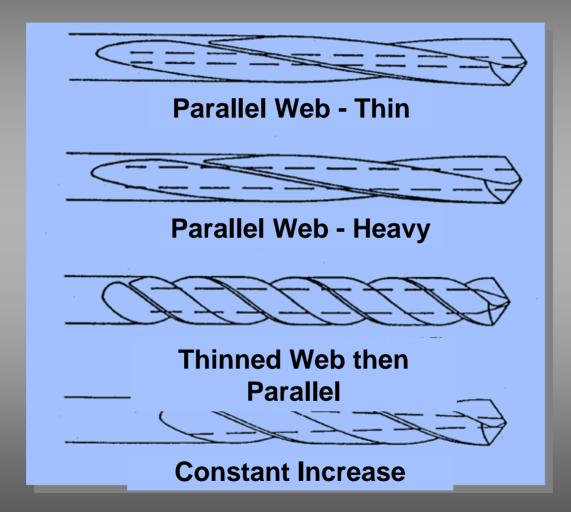
Drill Nomenclature- Web Construction

There are three common web
 contructions:

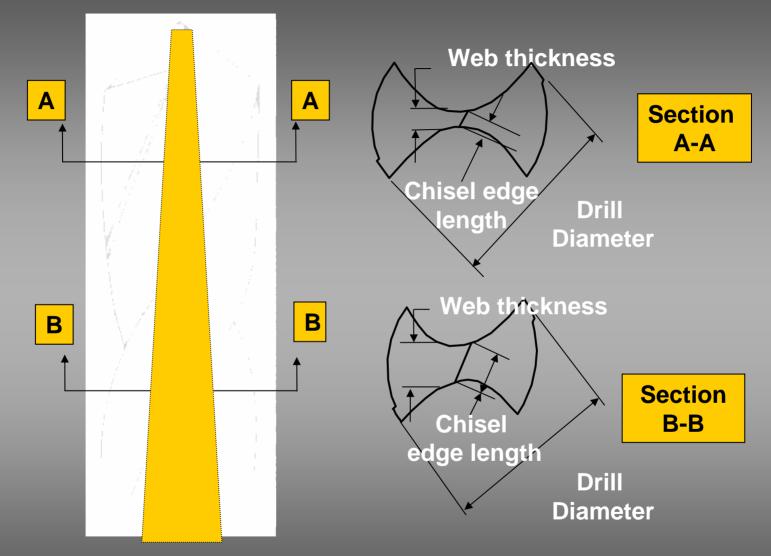
- Tapered

- Parallel (Pre-thinned)
- Parallel-Tapered

Web Constructions



Effects of Drill Re-Sharpening



Web Thinning

- Drill webs are non-cutting
 - Don't contribute to the cutting process
 - They consume power and torque to move through the work piece
 - Must reduce the chisel edge length to be as short as possible in length!

Ground notch to thin web and reduce chisel edge length

Web/Point Thinning

No Thinning



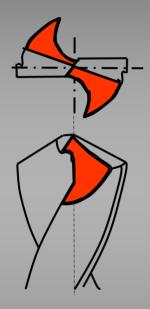
No thinning as received from the manufacture. Conventional



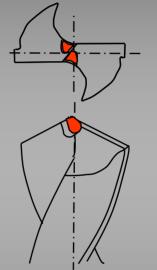
Stock is removed in such a way as to follow the flute contour.

Web/Point Thinning

Split Point



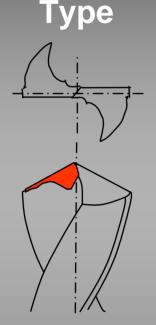
High Tensile Notched



Two secondary back-off grinds, adjacent to the chisel and almost to center Notched point results in centering ability and reduction of forces

Web/Point Thinning

Flatted Lip



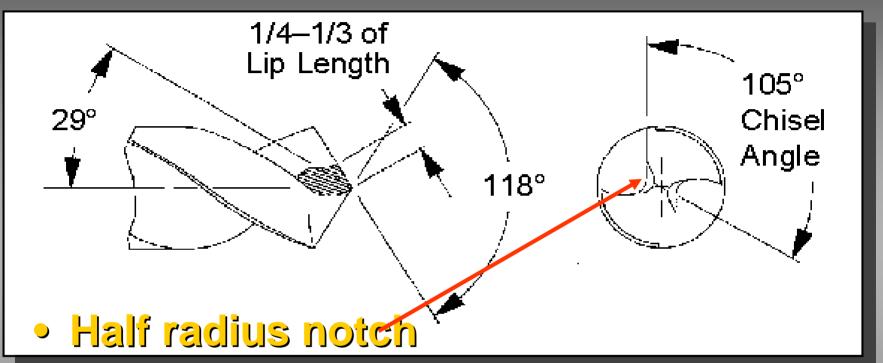
Flatting the face of the flute, Eliminates "hogging-in" Gash Type



Grinding two half-round gashes near the center of the drill

Web Thinning

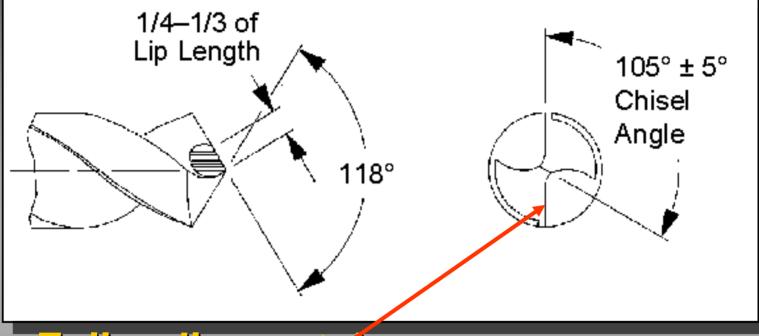
"K"Notch



- Web is typically thinned to 8% to 12 % of the drill diameter
- Shortens chisel edge length reducing thrust
- Improves chip evacuation
- Used in tougher materials and some large diameter drills

Web Thinning

<u>"R" Notch</u>



Full radius noten

- Web is typically thinned to 8% to 12 % of the drill diameter
- Shortens chisel edge length reducing thrust
- Improves chip evacuation
- Used primarily on coolant hole drills

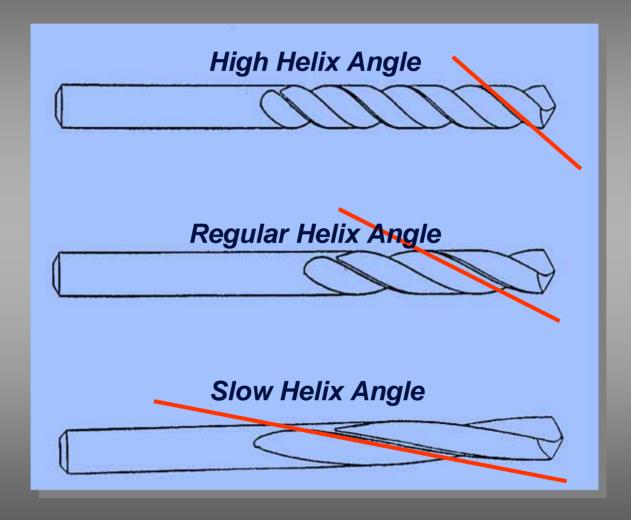
Drill Helix Angles



Helix Angle:

"Angle formed between a line drawn parallel to the axis of the drill and the edge of the land"

Various Helix Angles





Helix angles generally fall into three categories:

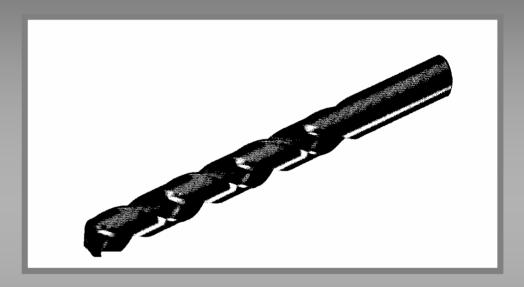
- Slow Spiral
- Regular Spiral
- Fast Spiral



- 12° to 22° helix angle

Slow Spiral

- Used in materials producing broken chips such as brass or bronze, or cast iron
- Also used in horizontal applications where the drill is <u>not</u> rotating





- 28° to 32° helix angle
- Found on most general purpose and cobalt drills
- Used in a wide variety of drilling applications





- 34° to 38° helix angle
- Used on high helix general purpose and deep hole parabolic drills
- For softer ferrous and non-ferrous materials producing stringy chips

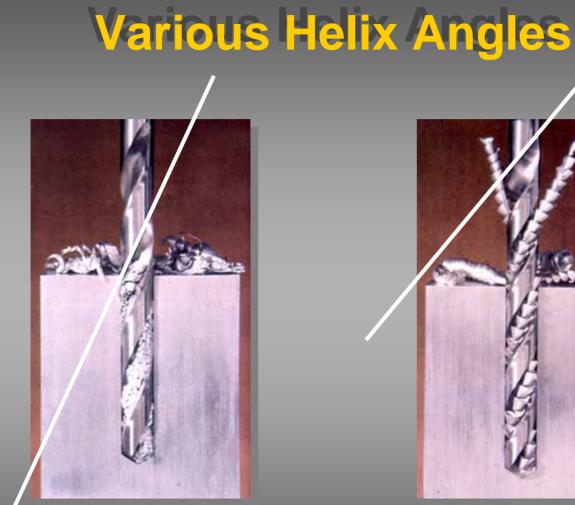
 How does changing the helix angle effect performance?

Fast Spiral Drills

- Provides greater lifting power for chips, but are weaker
- Generally used in deep holes

Slow Spiral Drills

- Are stronger, but have less lifting power for chips
- Generally limited to shallow holes





Regular Helix Drill

High Helix Drill

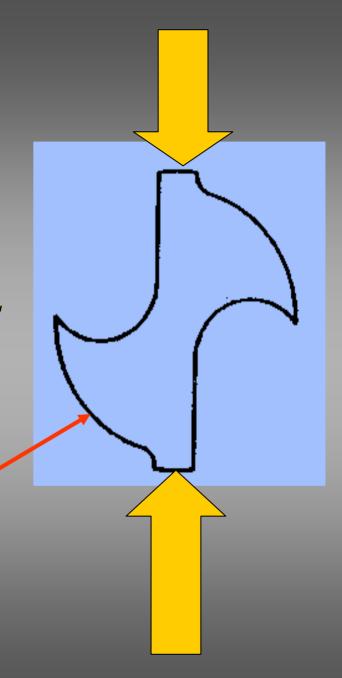
Drill Margins

Drill Nomenclature

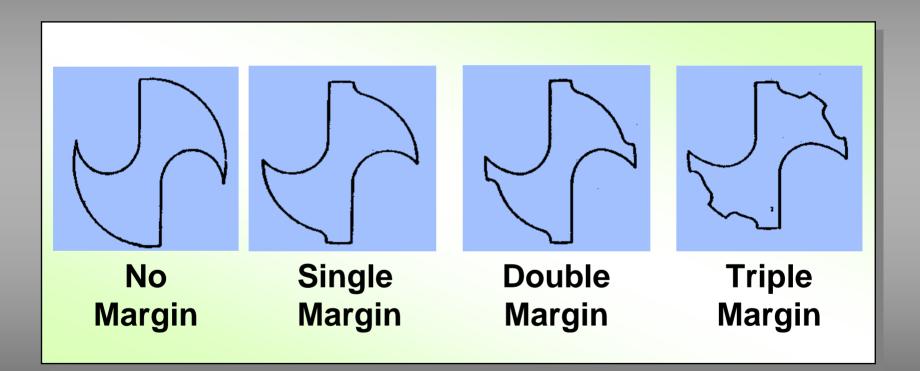
• <u>Margins:</u>

"The cylindrical portion of the land that is <u>not cut</u> <u>away</u> to provide clearance"

- The balance of the land is reduced in diameter, known as "cleared diameter" or "body clearance"
- Body clearance prevents excessive rubbing and friction



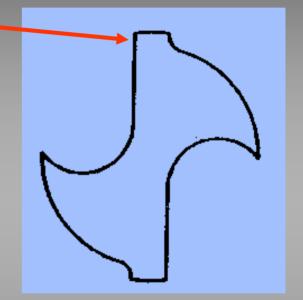




Drill Nomenclature- Margins

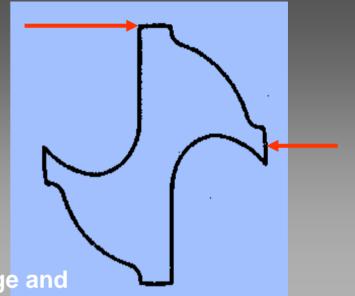
- <u>Single Margin:</u>

- Has one margin adjacent to the cutting edge
- Single margins create the least amount of rubbing and friction with minimal support in the hole



 Most standard tools are single margin

Drill Nomenclature

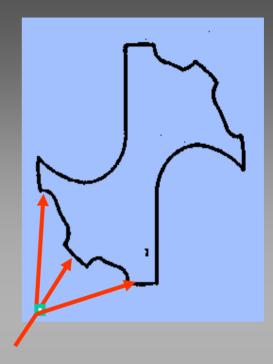


<u>Double Margin:</u>

- Has a margin at both the cutting edge and heel
- Used in specialized applications where precision hole size, and finish are required
- The additional margin adds stability and reduced the possibility of chatter, but creates more friction
- Often used when drilling through a bushing for support



<u>Triple Margint</u>



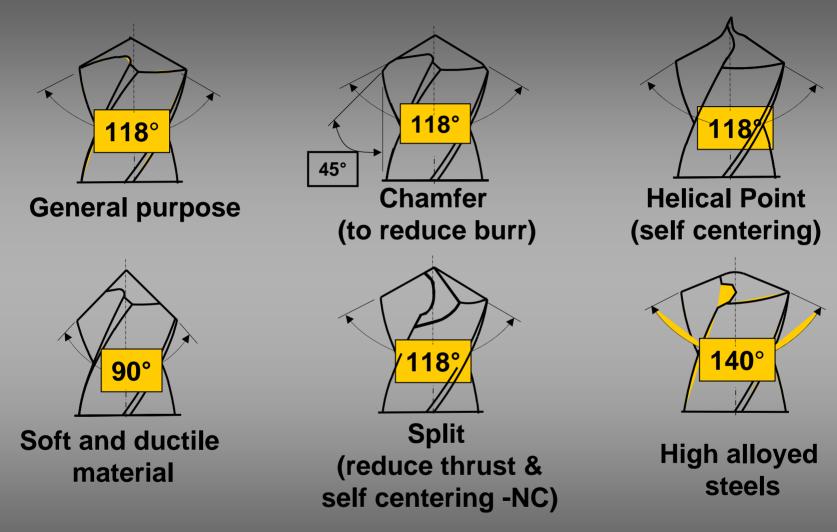
- Has three margins per land, one at the cutting and heel and one in the middle of the land
- Used where very high precision and hole size is required
- Provides the greatest amount of stability and the greatest amount of friction and rubbing

Drill Points

The drill points has four main features:

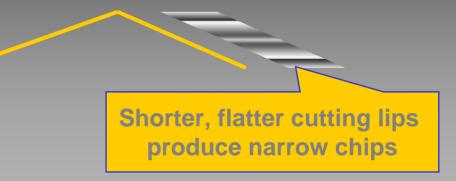
- Point Angle
- Cutting Lips
- Chisel Edge
- -Lip Relief

Drill Point Angles



Driii Nomenclature

Point Angle

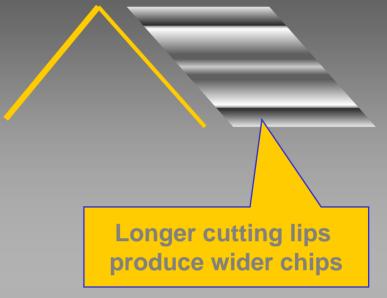


High Point Angle (Flatter Point)

- Recommend for harder and tougher materials
- Stronger cutting edges
- Shorter cutting lip produces a narrower chip
- Point angle greater than 130° are generally used in materials that have been hardened or are extremely tough

Driii Nomenclature

Point Angle



Lower Point Angle (Sharper Point)

- For softer materials

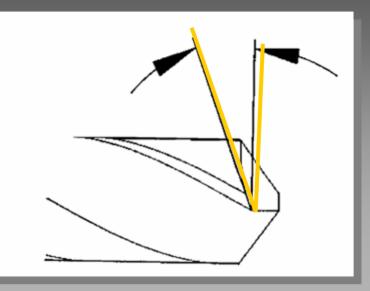
 Points sharper than 118° are generally used for soft non-ferrous materials and non-metallic

Drill Nomenclature

Cutting Lips

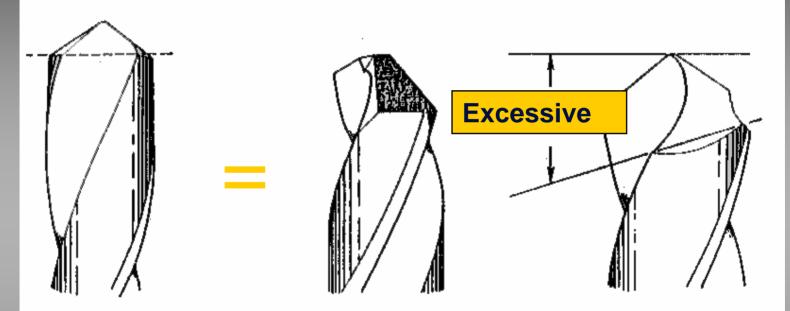
"Cutting edges that extend from the center of the drill to the outer diameter"

- On most standard drills, the cutting edge should form a straight line
- Some specialty and high performance drills have curved cutting lips



- <u>Elements of Drill Points</u>
 - <u>Lip Relief Angle</u>
 - Varies with the diameter of the drill and hardness of the material
 - On larger diameters and drills for harder materials, lip relief is decreased to as low as 8°
 - Drills for soft materials and small diameters have high relief angles up to 24°
 - Lip relief angles are measured across the margin width

Incorrect Lip Clearance



No lip clearance Extreme pressure required to make drill cut; top of drill shows signs of rubbing and heat caused by little or no lip clearance Corners of drill broken due to excessive lip clearance

Suggested Lip Relief Angles

| Drill Diameter Range | Lip Relief Angle |
|--|------------------|
| #80 to #61 | 24° |
| #60 to #41 | 21° |
| #40 to #31 | 18° |
| 1/8´´ to 1/4´´ | |
| F to 11/32 | 14° |
| S to 1/2 | 12° |
| 33/64 ⁷ to 3/4 ⁷ | 10° |
| 49/64 and larger | 8 ° |

Drill Nomenclature

Chisel Edge

"The edge at the end of th<mark>e web, that connects the cutting lips</mark>"

 The chisel edge does not cut - it penetrates displacing the workpiece material

The chisel edge consumes 60% to 70% of the thrust required!

Drill Nomenclature

Chisel Edge Angle

"The angle formed betwe<mark>en the chisel edge and the cutting lips"</mark>

4:00

The chisel edge angle is generally 125° to 135°

"Chisel edge angle is an indication of lip relief"

• <u>118° Degree</u>

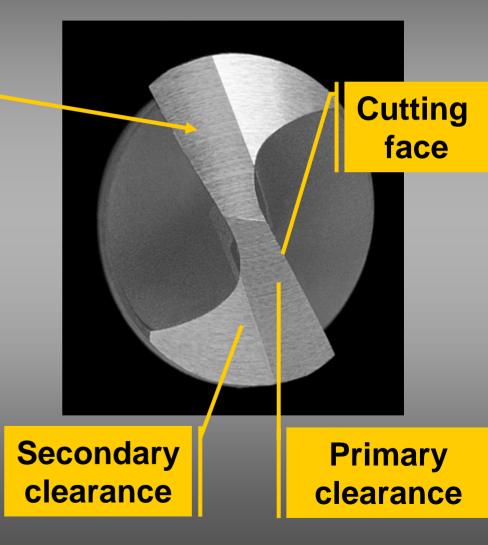
- General purpose point
- Used in a wide variety of non-hardened Materials
- Most common drill point used in the industry

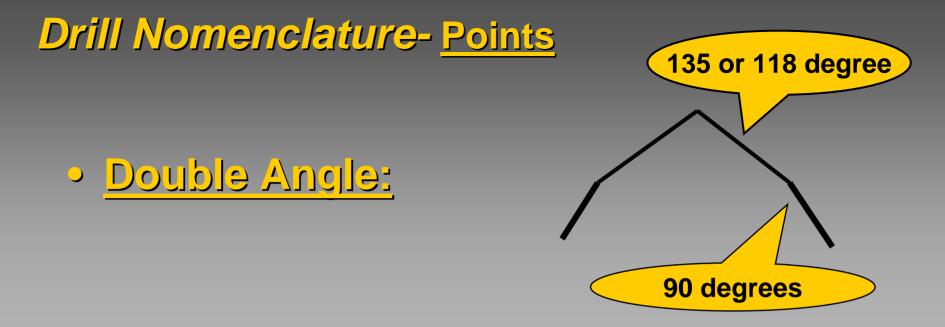
Single primary clearance ground in one operation Cutting

lips

• <u>118° Four Facet</u>

- General purpose point
- Used primarily on solid carbide drills
- Facets provide primary and secondary relief grinds to maintain edge strength





- 118° or 135° point with a 90° outer chamfer
- Similar to a Racon, but is easier to regrind
- Minimizes outer corner wear
- Helps to eliminate burrs on breakthrough



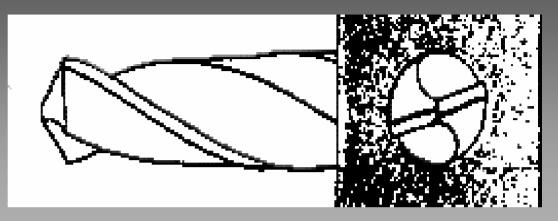




90 degrees included

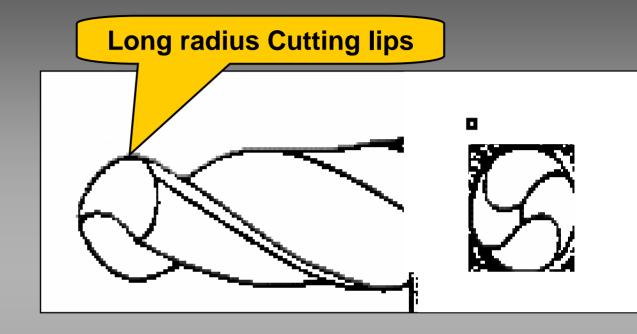
 Generally used for soft non-ferrous materials and non-metallic

- Occasionally used in soft cast iron



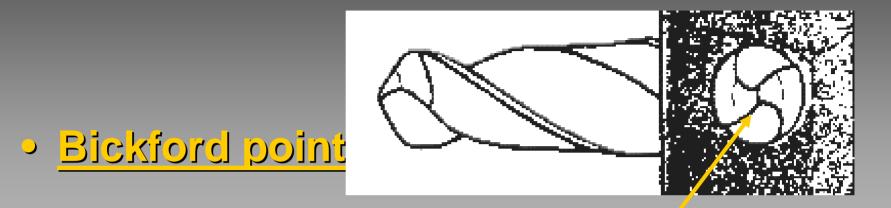


- Superior self centering point
- Chisel has "S" shape and crown to produce the self centering feature
- Produce accurate hole size with good finish
- Excellent for producing straight holes in deep hole applications
- Minimizes burrs on breakthrough





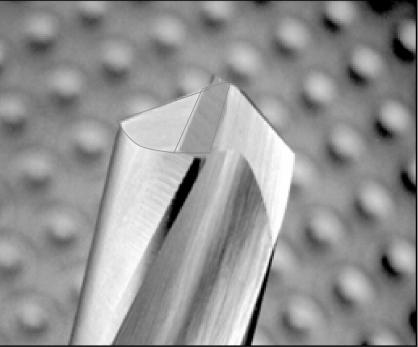
- 118° point with corner radius
- Prevents "grabbing" when exiting angled or curved surfaces
- Reduces outer corner wear
- Minimizes burrs on breakthrough
- Allows for increased feed rates



- Combination Helical and Racon point
- Has helical "S" chisel with corner radius
- Self centering point
- Prevents "grabbing" when exiting angled or curved surfaces
- Reduces outer corner wear
- Reduces burrs on breakthrough

Drill Nomenclature- Points **Secondary** clearance Split Point: (Crankshaft) - Self centering point - Minimizes chisel length, reduces thrust **Primary** Split produces positive rake clearance angle improving the chip cutting ability at the center of the drill point - 118° and 135° are the two most common split points Extremely good for off hand operations **Cutting lip**

- <u>135° Four Facet Split</u>
 <u>Point</u>
 - Heavy duty point for hard and tough materials
 - Used primarily on solid carbide drills
 - Facets provide primary and secondary relief grinds to maintain edge strength
 - Split self centers and reduces thrust







• Has 150-180° end to create flat bottom holes

- Bushings
- "Press fit" parts
- Generally used with drill bushings to prevent "wandering" and chatter

Drill styles-

• Drill Lengths: Common standard lengths

- Screw Machine: (Short flute, short OAL)
- Jobber Length: (Longer flute, longer OAL)
- Taper Length: (Longer flute, longer OAL)
- Extension Length: (Standard shank, long length flutes)
- Aircraft Extension Length: (6 or 12 inch OAL, jobber length flutes)

Always use the shortest drill possible!