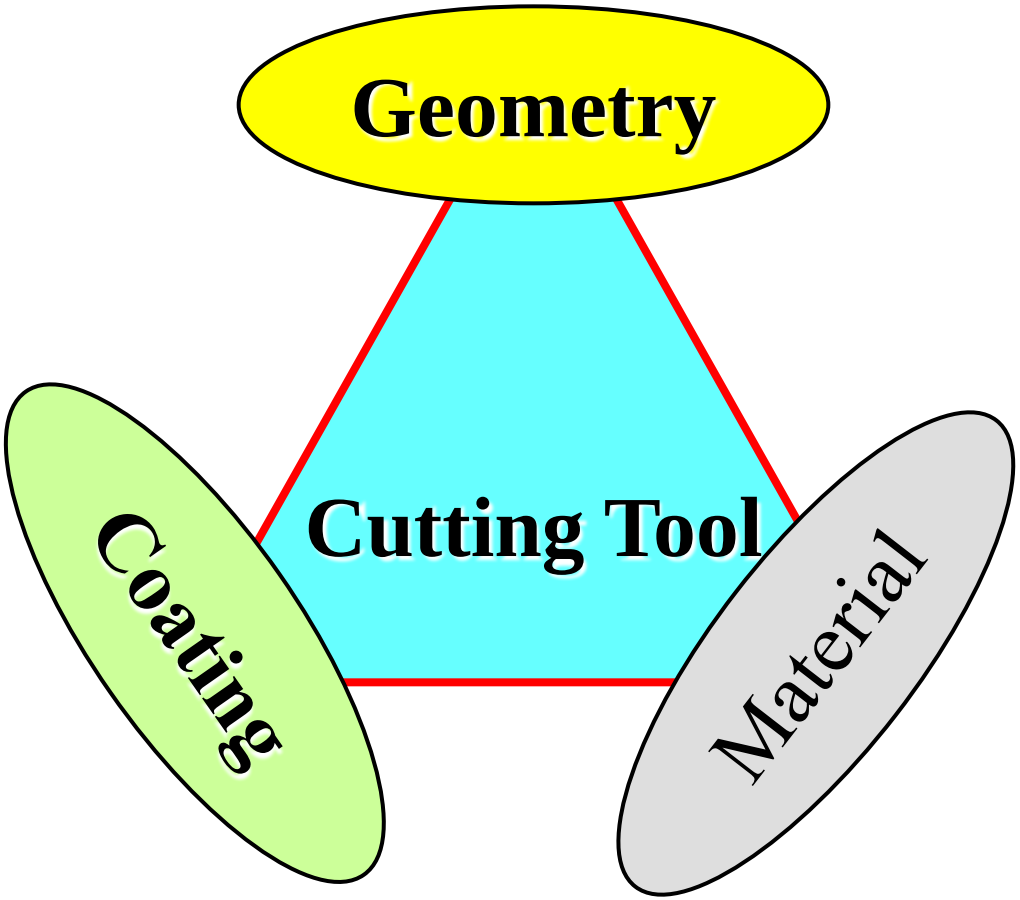
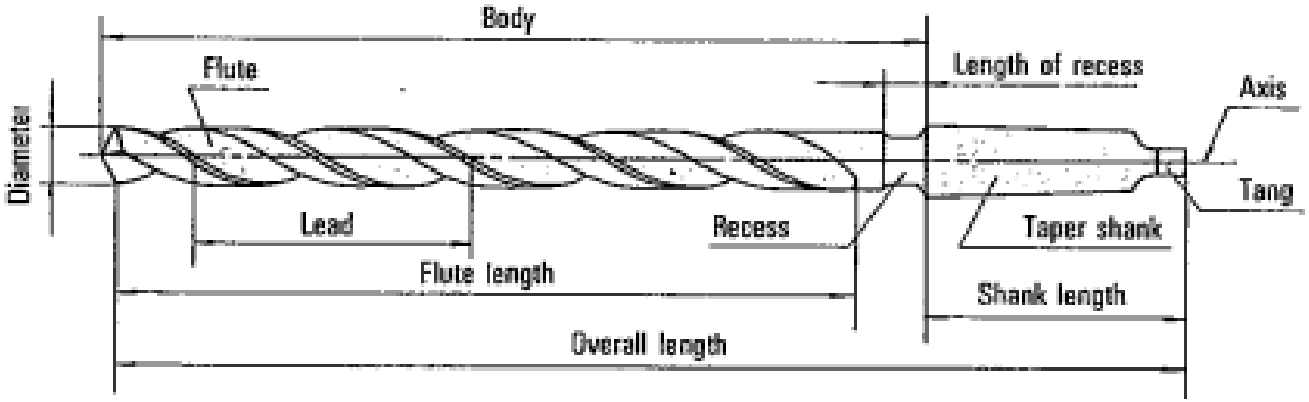
Basics of Drill

Three Key Elements of a Cutting Tool



- 3 Elements Needed in a Good Cutting Tool
- Well Balanced For Best Performance
- Only Good as the Weakest Link

Drill Terms

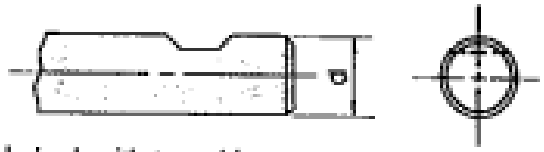


Plain parallel shank

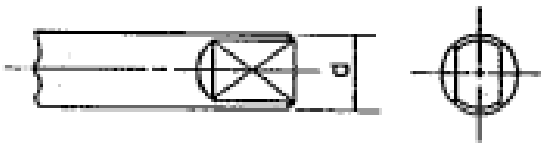
Endmill shank

Cylindrical shank

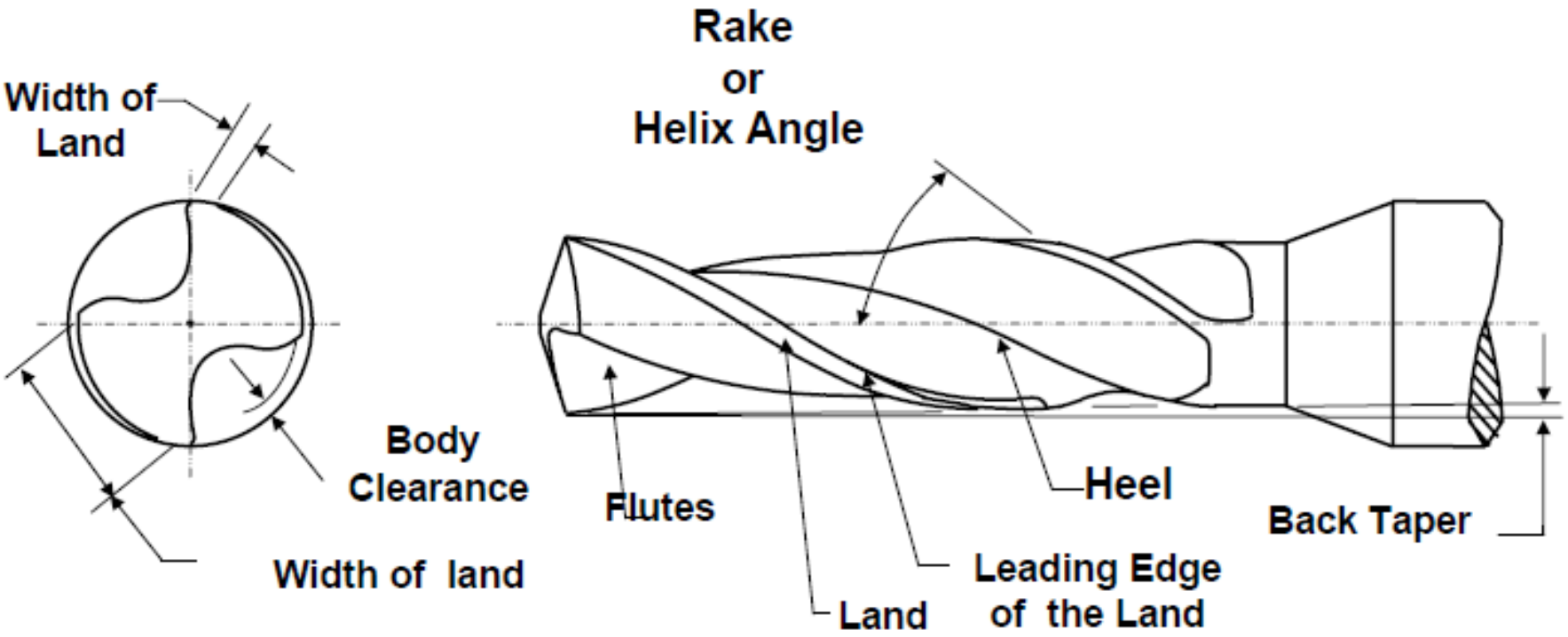
Flatted shank



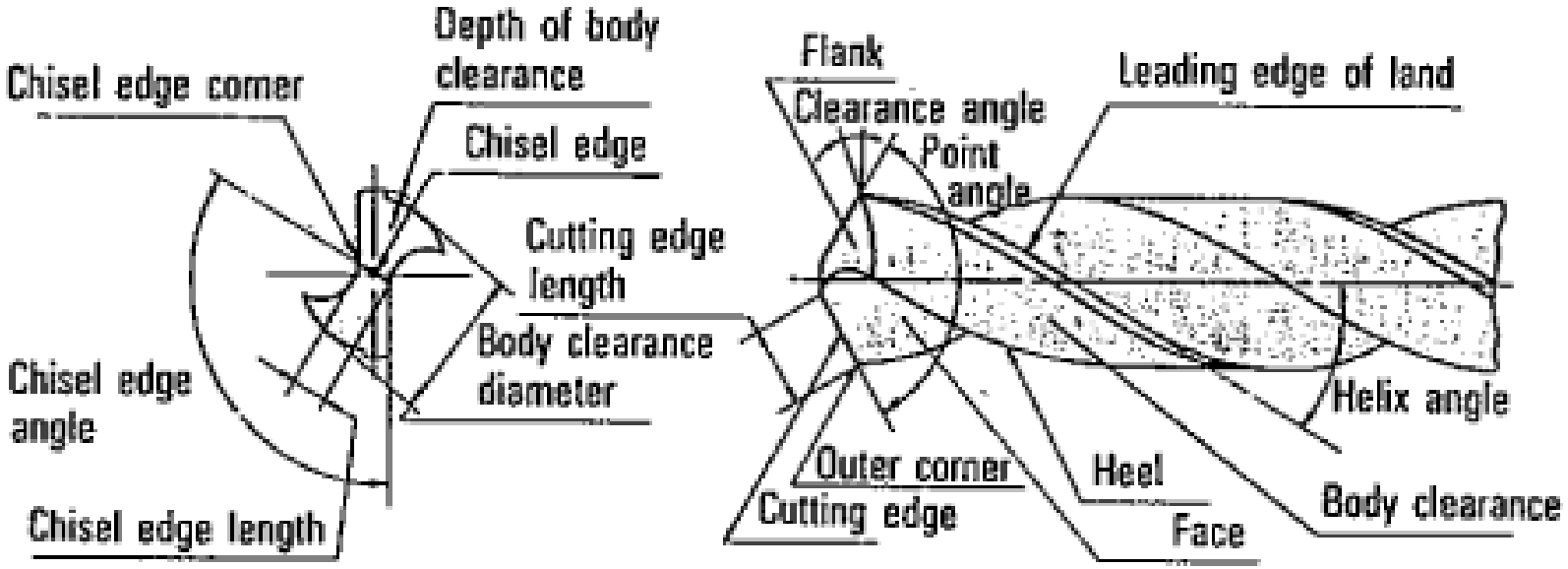
Parallel shank with tang drive

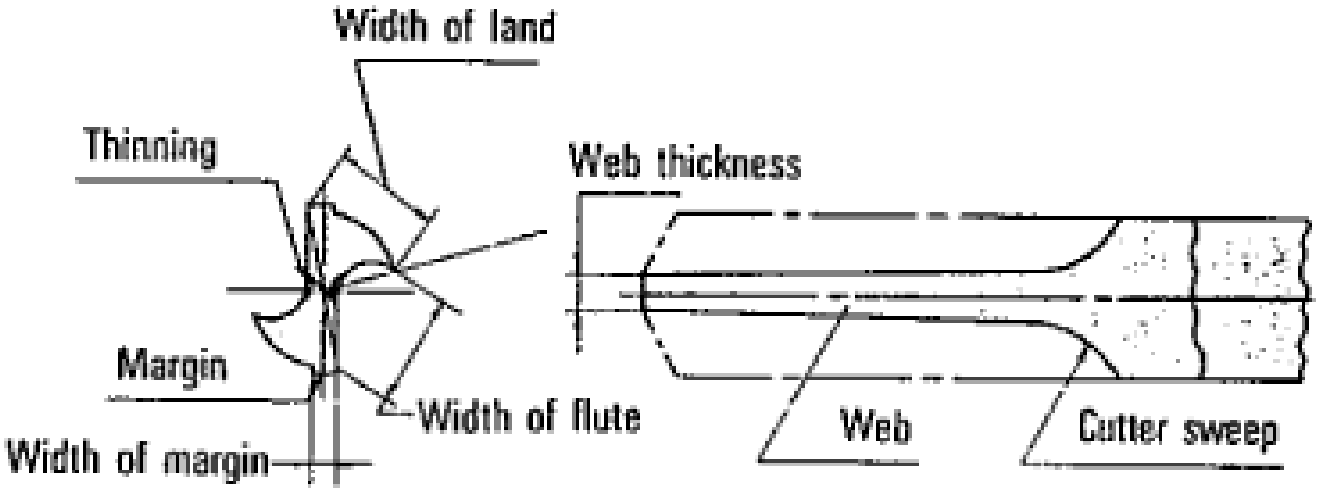


Drill Terms


Width of
Land
Rake
or
Helix Angle
Body
Clearance
Width of land
Flutes
Land
Leading Edge
of the Land
Heel
Back Taper

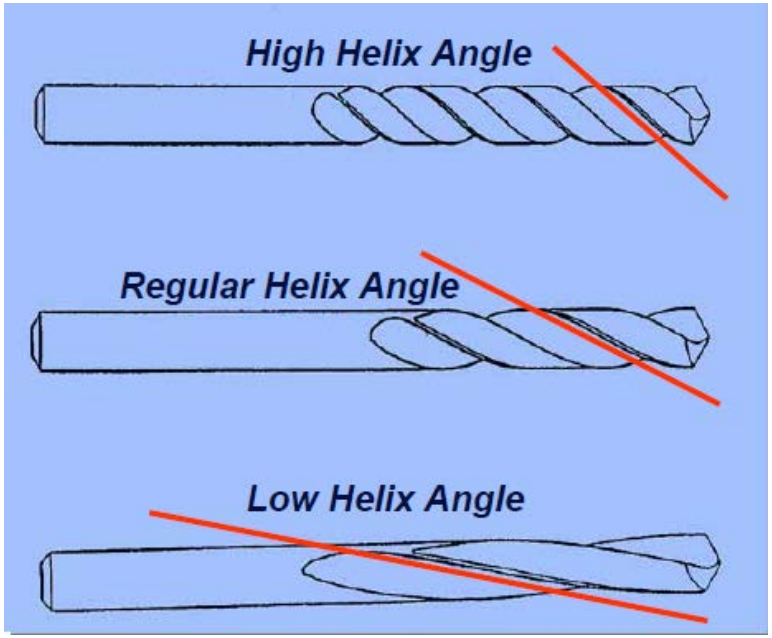
Drill Terms Continued





Drill Flutes

- Evacuate Chips
- Generally Two Flutes
- Usually Spiral Helix Shape



- Low Helix 10-20˚
  - Harder Material 35 HRC +
- Regular GP Helix 28-30˚
- High Helix 40˚ +
  - Stringy Chips

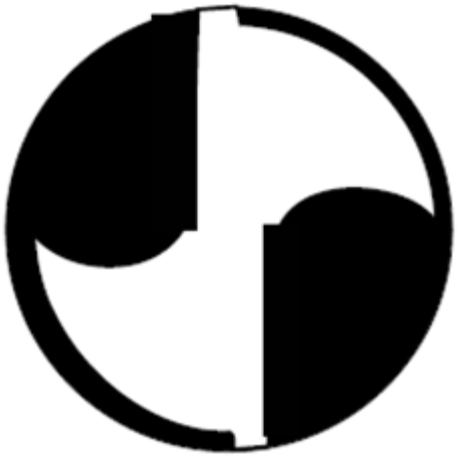
High Helix EX - UG, AG-SUS, MQL, L517P, L545P

Low Helix EX – Aqua Hard

Compare Flute Types

Conventional

- “J” Shaped
- General Purpose
- 3-4 X Ø Deep Before Pecking

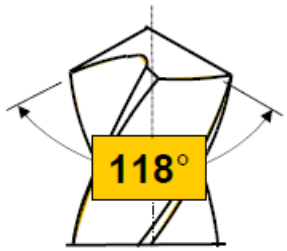


Parabolic

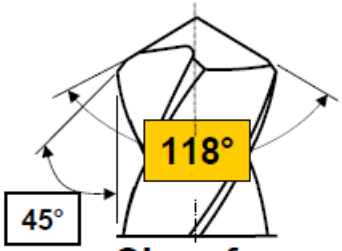
- Increased Flute Space
- Better Chip Evacuation
- Deep Hole Drilling

Point Angles

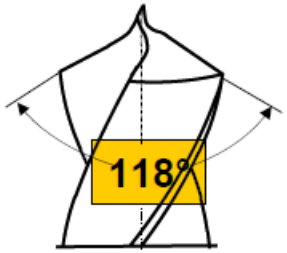
- 118˚ - General purpose point.
- 135˚ ,140˚ ,150˚ - Hi-performance points.
- Various Other Drill point angles
- Flat Bottom 180˚ (Not Pictured)



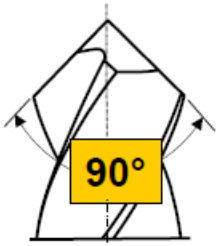
General purpose



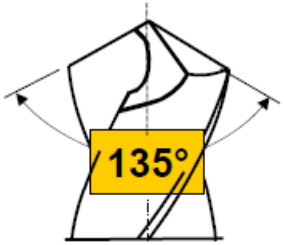
Chamfer
(to reduce burr)



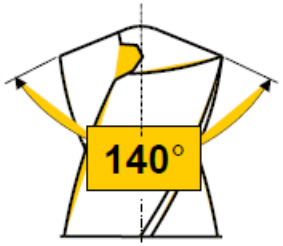
Helical Point
(self centering)



Soft and ductile material



Split
(reduce thrust & self centering -NC)



High alloyed steels

Point Angle Difference

High Point Angle (Flatter Point)

- Narrow Chips
- Harder/Tougher Materials

- EX – 135˚ & 140˚

Lower Point Angle (Sharper Point)

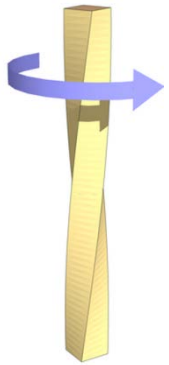
- Wider Chip
- Softer Materials

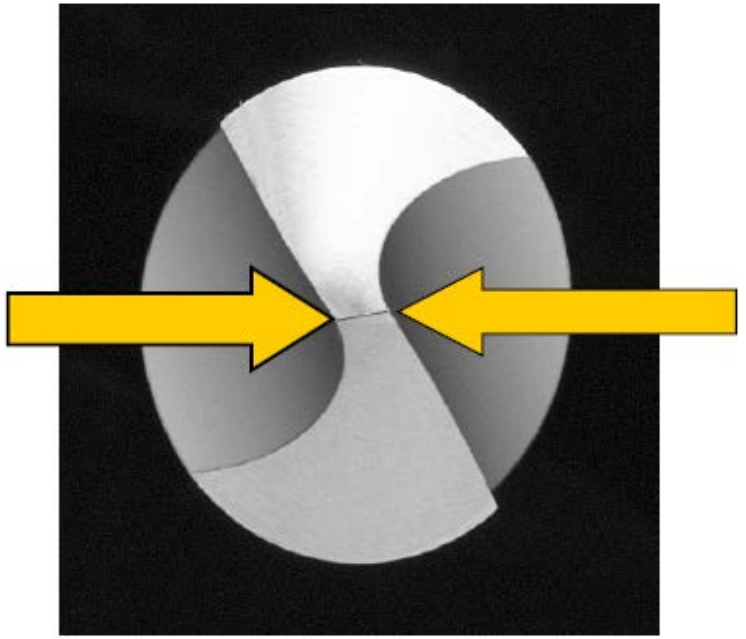
- EX – 90˚ & 118˚

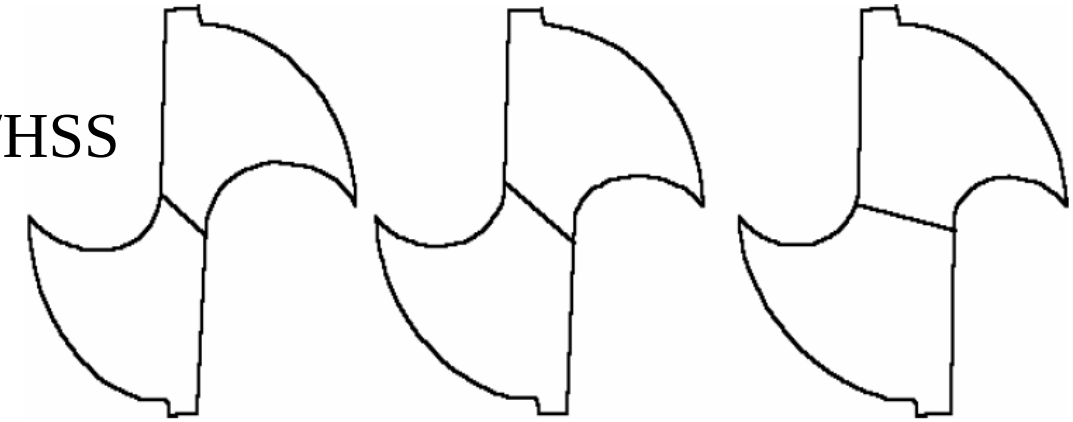
Web

- Core of Drill
- Usually Tapered for Rigidity
- Torsional Strength
- Web Examples
  - Light EX - DLC
  - Medium EX – L501/HSS
  - Heavy EX – AG

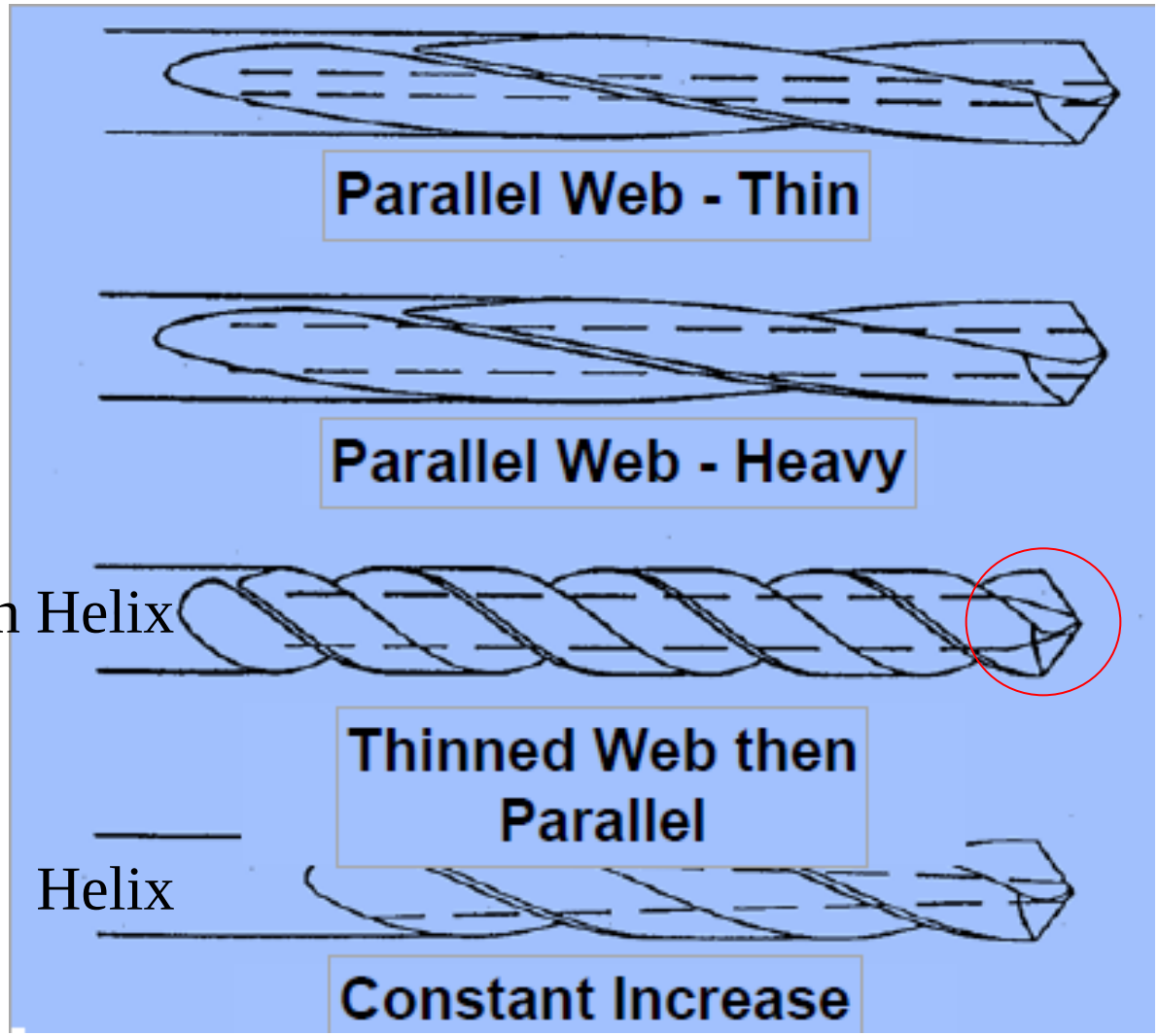
    Power Long







Web Construction



EX - Aqua Drill
Hard List 9548

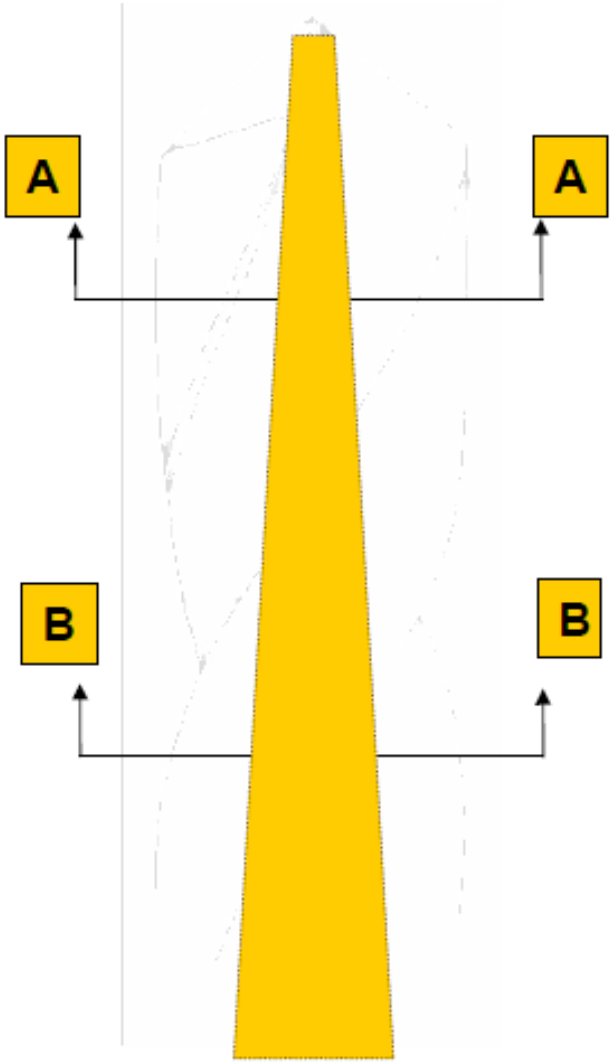
High Helix

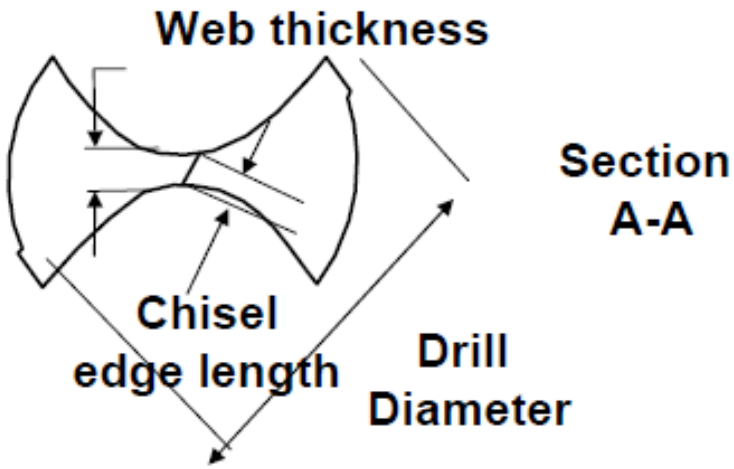
EX - AG SUS Drill
L65694P & L6596P

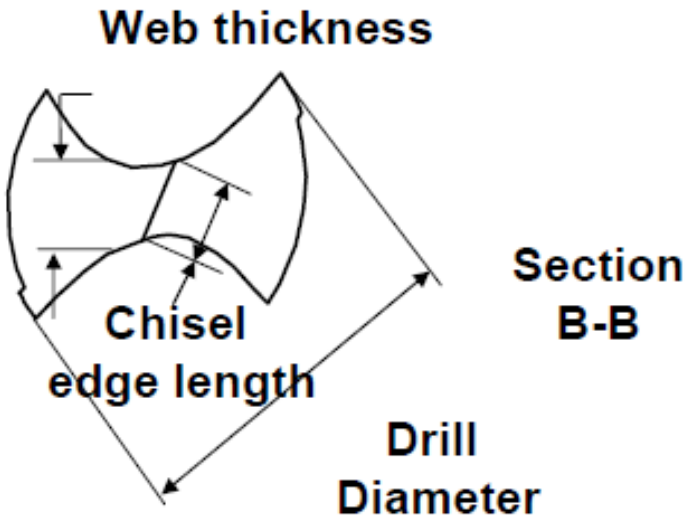
30° Helix

EX - SG Drills,
HSCO Drills

Effects of Web on Drill Re-Sharpening

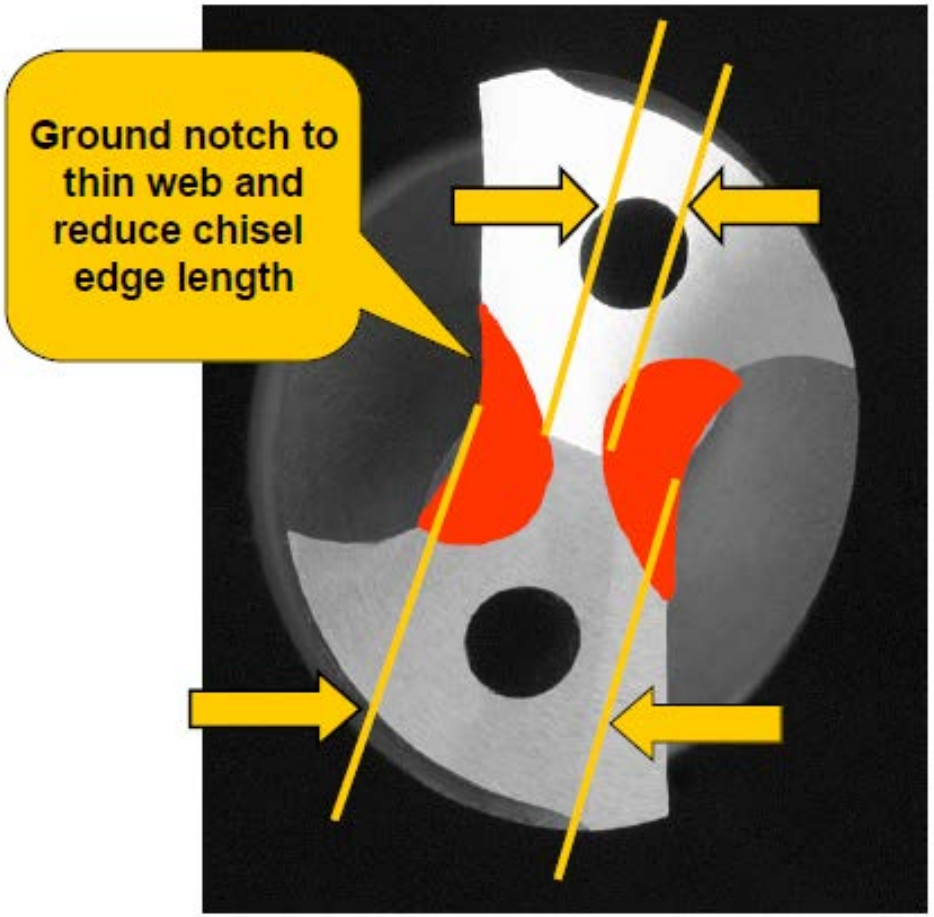






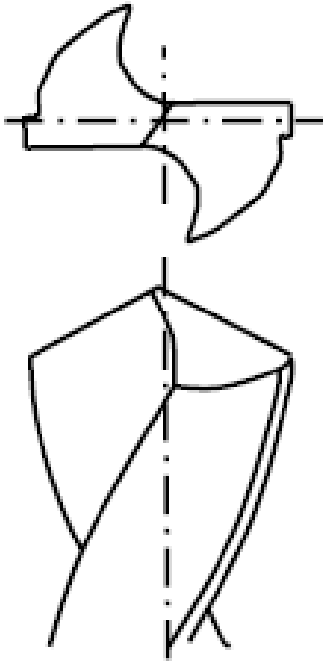
Web Thinning

- Drill Web is Non-Cutting
- Consume Power and Torque to Plow Through the Work
- Thinning Reduces These



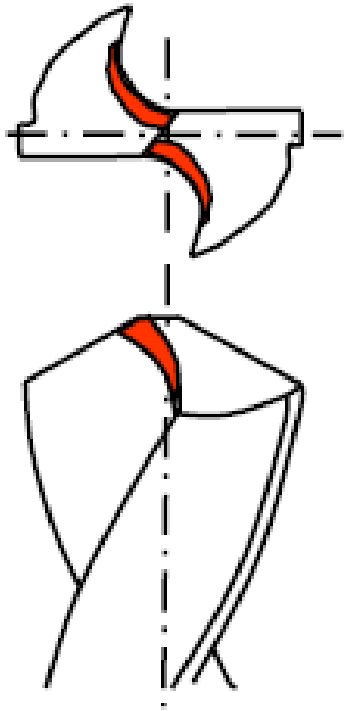
Types of Web Thinning

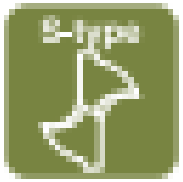
No Thinning



No Material Removed

S-Type (Conventional)



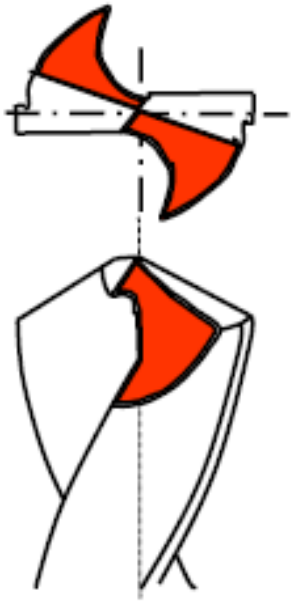


Follows the Flute Contour

Easy to Thin

Types of Web Thinning

X-Type (Split Point)

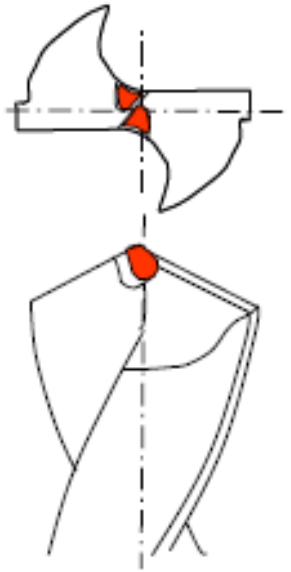


Reduce Thrust

Very Effective with Thick Web

Deep Hole Drilling

H-Type (Notched)



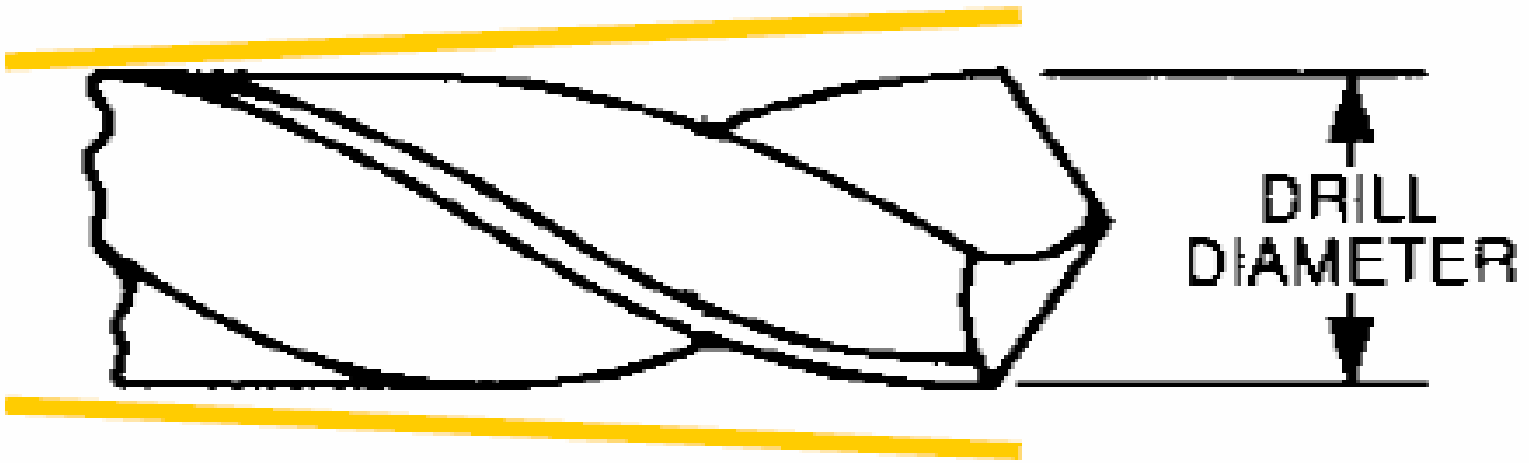
Centering and Reduced Force

Very Effective with Thick Web

Deep Hole Drilling

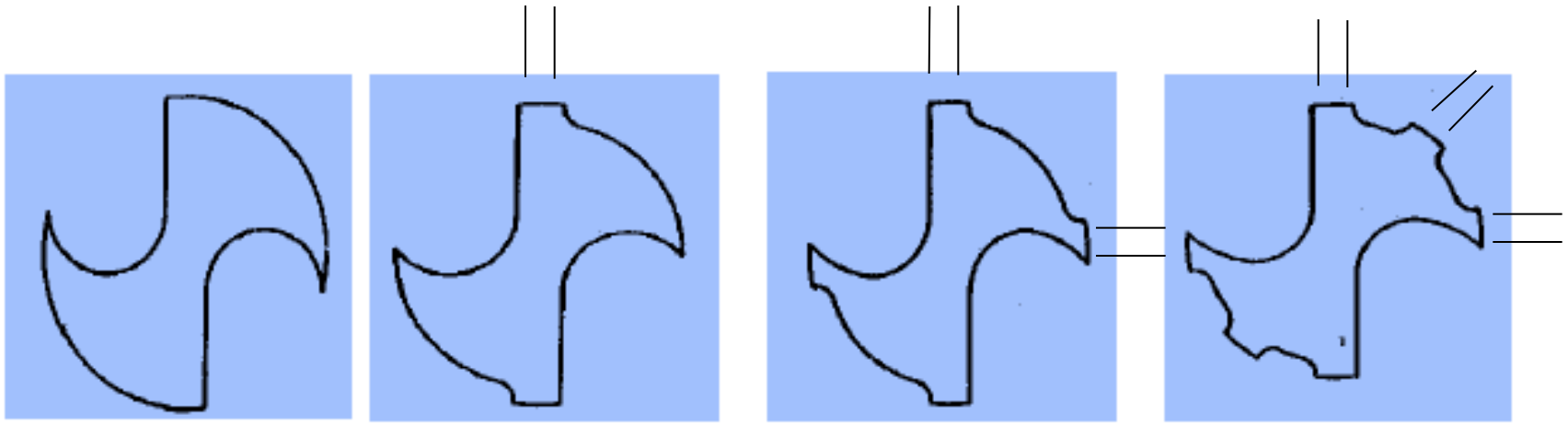
Back Taper

- Drill Ø is Tapered Towards the Shank
- Avoid Rubbing of Margin(s) and Hole Wall
  - Decrease Heat
  - Decrease Friction
- 0.04/100mm – 0.1/100mm
- A Limiting Factor in Drill Re-Sharpening



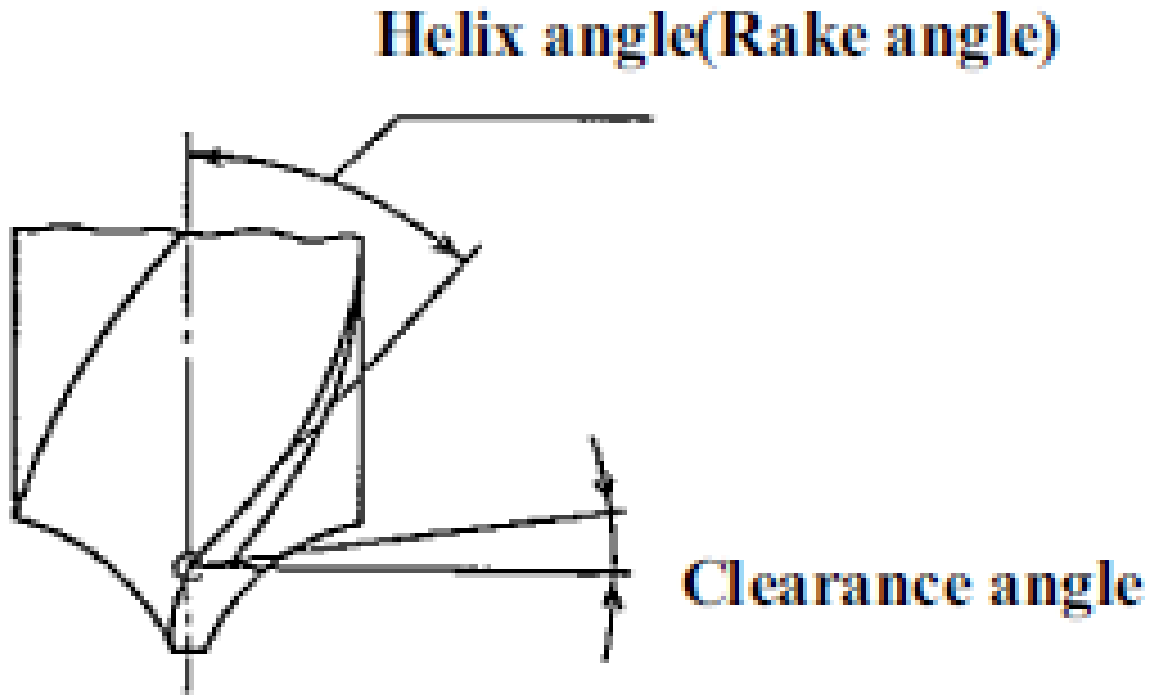
Margin(s)

- Improve Guide of Drill
- Larger/Additional Margins Increase Stability (Precision)



Clearance Angle

- The Purpose is to Avoid Rubbing of the Flank
- Too Big of an Angle Weakens the Cutting Edge



Chip Type and Tool Life

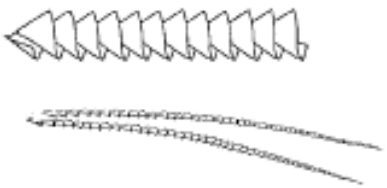
Cone and Spiral Chips

- Basic Chip Type
- Low Harness Materials
- Easily Ejected
- Increase Feed to Break Chips

Long Pitch Chips

- Ejected Straight Without Rolling
- Often Stick and Cause Jams
  - Decreased Accuracy
  - Possible Drill Breakage

1.Cone and spiral type



2.Long pitch type

Chip Type and Tool Life

Fan Type Chips

- High Feed Drilling
- Easily Ejected

3.Fan type

Zigzag Type Chip

- Low Feed
- Easily Clogged

5.Zigzag type

Cutting Off Type Chips

- Slightly High Feeds
- Low Work Material not Ductility
- Generally Unfavorable
  - Increase Vibration
  - Fluctuation of Breaking Resistance

4.Cutting off type

Chip Type and Tool Life

Needle Type Chip

- Brittle Materials
- Easily Ejected Except in Vertical Drilling

Powder Type

- Cast Iron
- Deteriorate Cutting Fluid
- Can Congeal like Concrete

- Watch for Chip Color Change
- Chips Become Darker (Brown, Violet, Black) as
  - Temperature Increases
  - Tool Life Decreases

Thank You