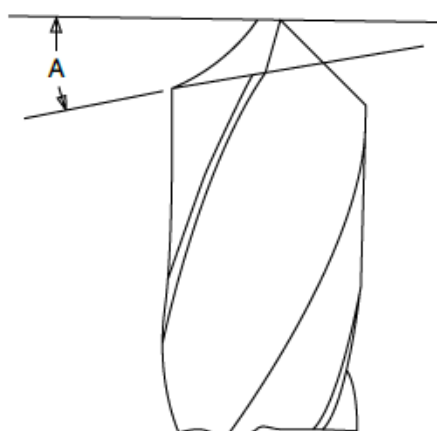


LIP RELIEF ANGLES FOR DRILLS

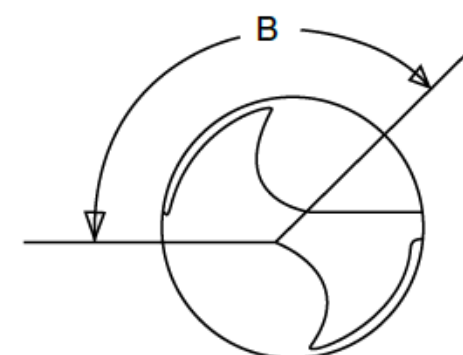


The lip relief angle "A" should vary according to the material to be drilled and according to the drill diameter. Hard and tough material call for lesser relief angles than do the soft, free machining materials.

Smaller diameter drills require a greater amount of relief than do the larger diameters.

The chisel point angle "B" will increase or decrease with the relief angle "A," but should be held in the range of 115° to 135°.

The accompanying table of suggested relief angles for various drill diameters and materials to be drilled will be found useful as a guide.



Causes of Failures of Twist Drills

Indications	Causes
Outer corners breakdown	Cutting speed too high. Hard spots in material. No cutting compound at drill point.
Cutting edges chip	Too much feed. Lip clearance too great.
Checks or cracks in cutting edges	Overheated or too quickly cooled while sharpening or drilling.
Margin chips	Oversize jig bushing.
Drill breaks	Point improperly ground. Feed too heavy. Spring or backlash in drill press, fixture or work. Drill is dull. Flutes clogged with chips.
Tang breaks	Imperfect fit between taper shank and socket caused by dirt or chips, or burred or badly worn sockets.
Drill breaks when drilling brass or wood	Flutes clogged with chips. Improper type drill.
Drill splits up center	Lip clearance too small. Too much feed.
Drill will not enter work	Drill is dull. Lip clearance too small. Too heavy a web.
Hole rough	Point improperly ground or dull. No cutting compound at drill point. Feed too great. Fixture not rigid.
Hole oversize	Drill point improperly ground.
Chip shape changes while drilling	Drill becomes dull or cutting edges chipped.
Large chip coming out of one flute, small chip out of other flute	Point improperly ground, one lip doing all the cutting.

Suggested Lip Relief Angles at Periphery

Drill Diameters	For General Purpose	Hard and Tough Materials	Soft and Free Machining Materials
No. 80 to No. 61	24°	20°	26°
No. 60 to No. 41	21°	18°	24°
No. 40 to No. 31	18°	16°	22°
No. 30 to 1/4"	16°	14°	20°
F to 11/32"	14°	12°	18°
S to 1/2"	12°	10°	16°
33/64" to 3/4"	10°	8°	14°
49/64" and Larger	8°	7°	12°

Diameter Tolerance at Point

Drill Diameter Range	Tolerance
#97 to #81 inclusive (.0059 to .0130)	+0.0002 to -0.0002
Over #81 to 1/8" inclusive (.0130 to .1250)	+0.0000 to -0.0005
Over 1/8" to 1/4" inclusive (.1250 to .2500)	+0.0000 to -0.0007
Over 1/4" to 1/2" inclusive (.2500 to .5000)	+0.0000 to -0.0010
Over 1/2" to 1" inclusive (.5000 to 1.0000)	+0.0000 to -0.0012
Over 1" to 2" inclusive (1.0000 to 2.0000)	+0.0000 to -0.0015
Over 2" to 3-1/2" inclusive (2.0000 to 3.5000)	+0.0000 to -0.0020

Lip Height Variation

Drill Diameter Range	TIV (Total Indicator Variation)
1/16" to 1/8" inclusive (.0625 to .1250)	.0020
Over 1/8" to 1/4" inclusive (.1250 to .2500)	.0030
Over 1/4" to 1/2" inclusive (.2500 to .5000)	.0040
Over 1/2" to 1" inclusive (.5000 to 1.0000)	.0050
Over 1" to 3-1/2" inclusive (1.0000 to 3.5000)	.0060

95% of drills in any one lot to fall within above tolerances.

Suggested Method of Measurement – Rotate the drill in a V-block against a back end stop. Measure the cutting lip height variation on a comparator, or with an indicator set at a location approximately 75% of the distance from the center to the periphery of the drill.