



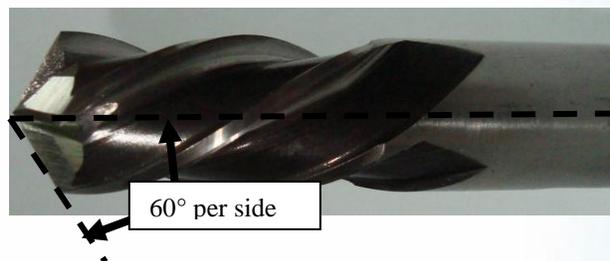
## *Superior Tool Service, Inc.* Customer Guide to our Services

This guide was created to help our customers get the most for their money and to avoid costly mistakes on our part as well as theirs. Precision tool grinding and machined part manufacturing have a lot of similarities, one of which is we both need good and accurate sketches or prints to do our work to the customer's satisfaction the first time, every time. We have years of experience in making cutting tools of all types and sizes, for a wide variety of machinery, from a 5 axis CNC machine to a drill press and everything in between. While this is one of our greatest strengths, it also creates a few challenges. The first is tool orientation to the part. So many times we get a print that shows a great view of the area to be cut but nothing to show the tool orientation with the part.

Second, when someone says "standard length" in our business we really don't have a "standard". We manufacture many lengths of tools. What's standard to one person may not be standard to another. We prefer to be told what length you need, that way we will be sure you get what you want. Third, please use  $\pm$  tolerance on your dimensions whenever possible.

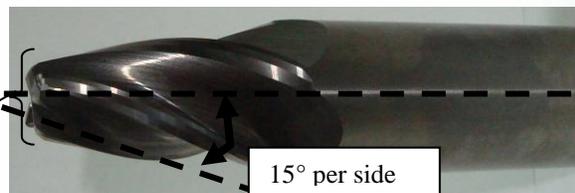
Another area of great confusion is angle cutting tools. There are more mistakes made on this than any other item in our shop. Here are some ways to eliminate the confusion: The best way to call out an angle (also the most standardized through our industry) is "included angles". What this means is both sides of the tool are included in the call out. For example a tool with  $45^\circ$  angle on both sides is a  $90^\circ$  included tool (ICL). The angle is measured from the centerline of the tool to the cutting edge, then the other side is *included*, making it  $90^\circ$  ICL. The centerline is an imaginary line that passes through the center of the shank, lengthwise from end to end. You may also have a called out tip diameter so be sure to tell us that too.

This tool is  $120^\circ$  ICL  
( $60^\circ$  per side, called from centerline)



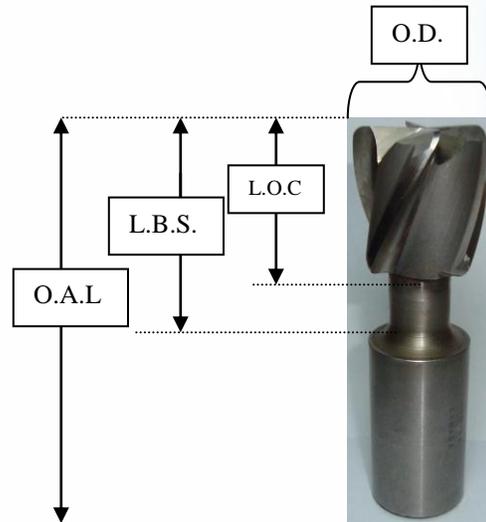
This tool is  $30^\circ$  ICL  
( $15^\circ$  per side, called from centerline  
with a .350 tip diameter and radius)

.350 tip  
diameter



# Standard Abbreviations & Cutting Tool Nomenclature for End Mills

O.A.L. = Over all length  
 L.O.C. = Length of cut (flute length)  
 L.B.S. = Length before shank (usually relief)  
 Flt. = Flute (2 flt. /4flt)  
 R. or Rad. = Radius  
 E.M. = End mill (Hi Speed Steel)  
 C.E.M. = Carbide end mill  
 CCEM = Crest cut roughing end mill  
 REM = Roughing end mill  
 O.D. = Outside diameter  
 Dia. = Diameter  
 B.R. = Ball Radius  
 R/C = Resharpen complete (Outside diameter & end of tool)  
 D.E. = Double ended.  
 EX = Excessive (wear)  
 I.D. = Inside diameter.  
 C/O = Cut off  
 ICL = Included angle



Back Tapered =  
(or dovetail)



Plug Tapered =



L.H.C. = Left hand cutting (Left Hand Spiral)  
 R.H.C. = Right hand cutting (If you ask for an end mill we assume it is right hand cut unless you specify otherwise)  
 L.H.S/R.H.C = Left hand spiral & Right hand cut (Down cut)