

Troubleshooting for End Mills

PROBLEM	SUGGESTIONS
Chipping	Check part rigidity
	Verify speeds and feeds
	Confirm concentricity of end mill in holder
	Decrease ramp angle or slow down approach
	Check coolant flow and location
Breakage	Decrease feed rate
	Decrease axial depth
	Use shorter tool or stub holder
	Resharpen earlier
Chattering	Too light of a cut
	Leave more stock for finish pass
	Decrease axial depth
	Adjust speeds and feeds
Part finish	Confirm concentricity of end mill in holder
	Decrease feed rate
	Use different style of end mill
	Check coolant flow and location
Burr	Check part rigidity
	Change end mill sooner / too much wear
	Verify speeds and feeds
	Increase spindle speed
	Decrease feed rate
Excessive noise	Use different style of end mill
	Check part rigidity
	Verify speeds and feeds
	Too light of a cut
Tool life	Confirm concentricity of end mill in holder
	Work material harder than expected
	Verify speeds and feeds
	Recutting chips
	Too light of a cut
Wear	Use different style of end mill
	Speed too fast
	Too light of a feed
	Confirm concentricity of end mill in holder
Chip welding	Verify speeds and feeds
	Verify speeds and feeds
	Check coolant flow and location
	Use different style of end mill
Chip packing	Check coolant flow and location
	Decrease axial depth
	Adjust speeds and feeds
	Use different style of end mill
Wall not straight	Decrease feed rate
	Decrease axial depth
	Use shorter tool or stub holder
	Use different style of end mill

Troubleshooting for Drills

PROBLEM	SUGGESTIONS
Chipping on point	Reduce feed rate
	Check part rigidity
	Constant feed rate
	Verify speeds and feeds
	Minimum drill overhang
Chipping on O.D.	Reduce number of peck cycles
	Reduce feed rate
	Confirm concentricity of drill in holder
	Check coolant flow and location
	Check part rigidity
Breakage	Reduce feed rate
	Check your program - is 'R' clearing the part
	Check coolant flow and location
	Check part rigidity
Heavy wear on corners	Increase feed rate
	Check coolant flow and location
	Confirm concentricity of drill in holder
	Check part rigidity
Long, stringy chips	Increase feed rate
	Increase hone relief
	Constant feed rate
	Increase number of peck cycles
Excessive noise	Check drill
	Check part rigidity
	Check for proper speeds and feeds
Tool life	Lower speeds and feeds
	Check coolant flow and location
	Confirm concentricity of drill in holder
	Confirm coolant concentration
Hole too small	Increase feed rate
	Confirm coolant concentration
	Confirm drill diameter
Hole too large	Reduce feed rate
	Slow feed rate to start hole
	Increase RPMs
	Spot hole
Chip welding	Increase RPMs by 20%
	Confirm coolant concentration
	Check coolant flow and location
Chip packing	Add a peck cycle to clear chips
	Increase RPMs
	Reduce feed rate
	Check coolant flow and location

Troubleshooting for Reamers

PROBLEM	SUGGESTIONS
Hole diameter too large	Check part rigidity
	Verify speeds and feeds
	Confirm concentricity of reamer in holder
	Confirm diameter of reamer
Hole diameter too small	Check coolant flow and location
	Leave more stock before reaming
	Reamer worn
	Check coolant flow and concentration
Hole not straight	Resharpen earlier
	Hole was not drilled properly
	Leave more stock before reaming
	Confirm concentricity of reamer in holder
Part finish	Check part rigidity
	Reamer worn
	Verify speeds and feeds
	Confirm concentricity of reamer in holder
	Check coolant flow and location
Tool life	Check part rigidity
	Work material harder than expected
	Verify speeds and feeds
	Not evacuating chips properly
Wear	Too light of a cut
	Speed too fast
	Too light of a feed
	Confirm concentricity of reamer in holder
Not evacuating	Check coolant flow, location, and concentration
	Verify speeds and feeds
	Reamer worn

$$SFM = \frac{\pi \times \text{Dia.} \times \text{RPM}}{12}$$

$$CPT = \frac{IPM}{\text{RPM} \times \text{Number of teeth}}$$

$$\text{RPM} = \frac{\text{SFM} \times 3.82}{\text{Dia.}}$$

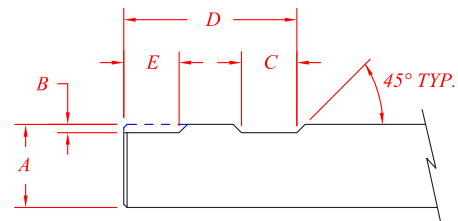
$$IPM = \text{RPM} \times \text{Number of teeth} \times \text{CPT}$$

Chip Thinning theory:

$$\left(\frac{\text{Radius of tool dia.}}{\text{Radial engagement}} \right)^2 = a$$

$$a \times \text{CPT} = \text{Actual CPT}$$

STANDARD WELDON SHANK DIMENSIONS					
Diameter (A)	B	C	D	E	
3/8"	.3750"	.050"-.065"	.280"-.282"	.921"	-
7/16"	.4375"	.050"-.065"	.312"-.314"	.991"	-
1/2"	.5000"	.060"-.075"	.330"-.332"	1.055"	-
9/16"	.5625"	.065"-.080"	.400"-.402"	1.154"	-
5/8"	.6250"	.065"-.080"	.400"-.402"	1.154"	-
3/4"	.7500"	.075"-.090"	.455"-.457"	1.242"	-
7/8"	.8750"	.065"-.080"	.455"-.457"	1.242"	.500"
1"	1.0000"	.075"-.090"	.515"-.517"	1.398"	.500"
1-1/4"	1.2500"	.094"-.109"	.515"-.517"	1.398"	.500"



h6 TOLERANCE FOR SHRINK FIT HOLDERS <i>(as taken from the Machinery's Handbook)</i>		
SHANK DIAMETER		TOLERANCE
Decimal	Nominal	
≤ .1181"	≤ 3mm	-.00000" / -.00024"
> .1181" - .2362"	> 3mm - 6mm	-.00000" / -.00032"
> .2362" - .3937"	> 6mm - 10mm	-.00000" / -.00035"
> .3937" - .7087"	> 10mm - 18mm	-.00000" / -.00043"
> .7087" - 1.1811"	> 18mm - 30mm	-.00000" / -.00050"
> 1.1811"	> 30mm	-.00000" / -.00050"

For additional help:

Check out the MC-20 machinist calculator or, if you have a smartphone, search for the feedrate calculator from the App Store.

Tool Coatings



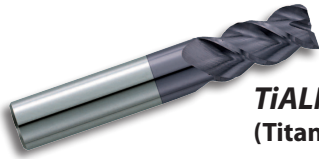
TiN
(Titanium Nitride)

General purpose coating - low heat resistance. Good lubricity.



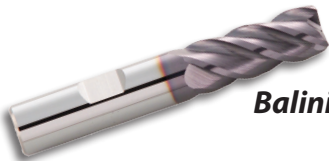
TiCN
(Titanium Carbonitride)

Good abrasion resistance. Recommended for aluminum, brass and bronze applications. Low heat resistance - good lubricity.



TiALN - Balinit® FUTURA
(Titanium Aluminum Nitride)

Multi-layer coating with good thermal stability for increased speeds and feeds. For semi-dry to dry cutting of most steels, high-nickel alloys, stainless steel and cast iron. Excellent heat resistance, good lubricity. For materials that are 40Rc and under.



Balinit® X.CEED

A single-layer coating whose hardness, oxidation resistance and thermal stability were optimized for material hardness above 52 HRC and high-speed machining of materials that are difficult to work (titanium alloys, Inconel). Competes with ALTiN.



ALUMASTAR®
(Titanium Diboride - TiB₂)

A thin film coating with a low affinity for aluminum, ideal for machining aluminum alloys. The resistance to adhesion of aluminum allows higher speeds or feeds. Coating thickness is intentionally kept lower in order to maintain a sharp edge.



CRYSTALLINE DIAMOND
(CVD)

Improved productivity in composites and non-ferrous metals. Excellent choice for cutting graphite, fiberglass, and silicon-based aluminum. Can be added to a special for milling or drilling applications.



Balinit® AlCrN-based

Aluminum Chromium-based coatings have excellent wear resistance, thermal shock stability, and hot hardness. Well suited for Titanium, Inconel, and carbon fiber.



Balinit® HARDLUBE

Multi-layer coating with thermal stability and lubricating properties needed for the drilling of steels, high-nickel alloys, stainless steel, cast iron, aluminum, brass, and bronze. Excellent heat resistance, great lubricity.



Balinit® HELICA

G6 Generation coating. Greater abrasion resistance, extra shear strength, lower adhesion tendency, maximum toughness and a very smooth surface achieve a quantum leap in drilling performance. This coating is particularly advantageous for carbide drills. Helica is part of the AlCrN-based coatings.