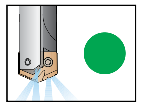
Deep Hole Drilling Guidelines

T-A Pro | 10xD, 12xD, 15xD Holders

1. Pilot Hole
100 % RPM
100% mm/rev (IPR)

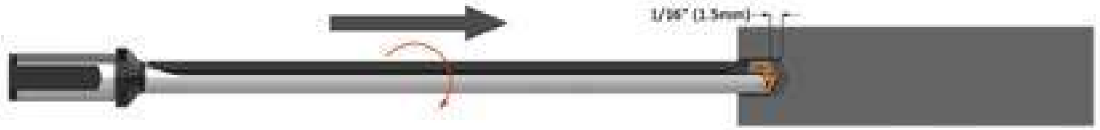
Establish the pilot hole using the same diameter short drill to a depth of 2xD minimum.
Utilise a pilot drill with the same or larger included point angle.

Coolant ON



⚠ **2. Feed-in**
50 RPM max
300 mm/min (12 IPM)

Feed the longer drill within 1.5mm (1/16") short of the established pilot hole bottom at a **maximum of 50 RPM** and 300 mm/min (12 IPM) feed rate.



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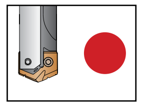
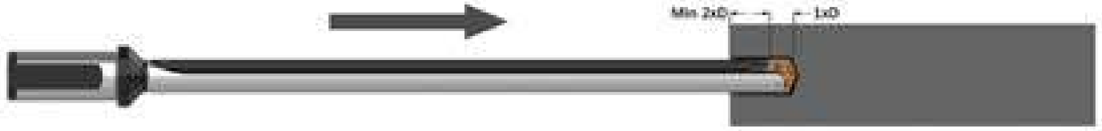


3. Deep Hole Transition Drilling
50 % RPM
75% mm/rev (IPR)

Drill additional 1xD past the bottom of the pilot hole at 50% reduction of recommended speed and 25% reduction of recommended feed.
Minimum of one second dwell is required to meet full speed before feeding.



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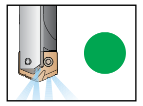
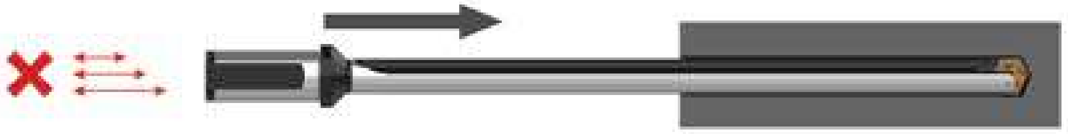


4. Deep Hole Drilling - Blind
100% RPM
100% mm/rev (IPR)

Drill to full depth at recommended speed and feed for longer drill according to Allied speed and feed charts.
No peck cycle recommended.



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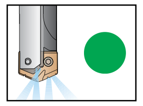
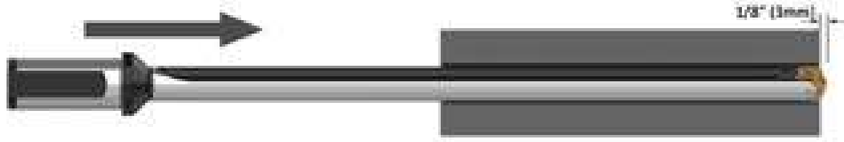


5. Deep Hole Drilling - at Breakout
50% RPM
75% mm/rev (IPR)

For through holes only:
Reduce speed by 50% and feed by 25% prior to breakout.
Do not break out more than 3mm (1/8") past the full diameter of the drill.



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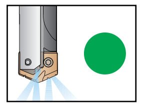
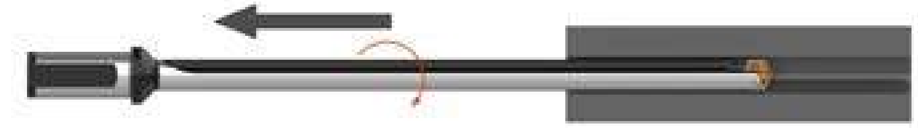


⚠ **6. Drill Retract**
50 RPM max

Reduce speed to a **maximum of 50 RPM** before retracting from the hole.



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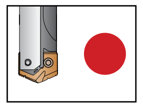

⚠ **WARNING** **Tool failure can cause serious injury. To prevent:**
- When using holders without support bushing, use a short T-A Pro holder to establish an initial hole that is a minimum of 2 diameters deep.
- Do not rotate tool holders more than 50 RPM unless it is engaged with the workpiece or fixture.

Visit **www.alliedmachine.com/DeepHoleGuidelines** for the most up-to-date information and procedures.
Factory technical assistance is available for your specific applications through our Application Engineering department. ***email: engineering.eu@alliedmachine.com***

Tap Drill Information and Formulas | Metric (mm)

Tap Size	Tap Drill Size	Decimal Equivalent (inch)	* Theo % Thread	Probable Mean Oversize	Probable Hole Size	** Probable % Thread
12 X 1.25	27/64	0.4219	79%	0.075mm	10.79mm	74%
	10.8mm	0.4252	74%	0.075mm	10.88mm	69%
14 X 2.0	15/32	0.4688	81%	0.075mm	11.98mm	78%
	12.0mm	0.4724	77%	0.075mm	12.08mm	74%
14 X 1.5	12.5mm	0.4921	77%	0.075mm	12.58mm	73%
16 X 2.0	14.0mm	0.5512	77%	0.075mm	14.08mm	74%
16 X 1.5	14.5mm	0.5709	77%	0.075mm	14.58mm	73%
	37/64	0.5781	68%	0.075mm	14.76mm	64%
18 X 2.5	15.5 mm	0.6102	77%	0.075mm	15.58mm	75%
18 X 1.5	16.5mm	0.6496	77%	0.075mm	16.58mm	73%
	21/32	0.6563	68%	0.075mm	16.75mm	64%
20 X 2.5	11/16	0.6875	78%	0.075mm	17.54mm	76%
	17.5 mm	0.6890	77%	0.075mm	17.58mm	74%
20 X 1.5	18.5mm	0.7283	77%	0.075mm	18.58mm	73%
	47/64	0.7344	69%	0.075mm	18.66mm	65%
22 X 2.5	49/64	0.7656	79%	0.075mm	19.52mm	76%
	19.5 mm	0.7677	77%	0.075mm	19.58mm	75%
22 X 1.5	20.5mm	0.8071	77%	0.075mm	20.58mm	73%
	13/16	0.8125	70%	0.075mm	20.71mm	66%
24 X 3	13/16	0.8125	86%	0.075mm	20.71mm	84%
	21.0 mm	0.8268	76%	0.075mm	21.08mm	75%
24 X 2	22.0mm	0.8661	77%	0.075mm	22.08mm	74%
	7/8	0.8750	68%	0.075mm	22.30mm	65%
27 X 3	24.0mm	0.9449	77%	0.075mm	24.08mm	75%

Formulas

1. **RPM** = (318.47 • M/min) / DIA
   where:
   RPM = revolutions per minute (rev/min)
   M/min = speed (M/min)
   DIA = diameter of drill (mm)

2. **mm/min** = RPM • mm/rev
   where:
   mm/min = mm per minute (mm/min)
   RPM = revolutions per minute (rev/min)
   mm/rev = feed rate (mm/rev)

3. **M/min** = RPM • 0.003 • DIA
   where:
   M/min = speed (M/min)
   RPM = revolutions per minute (rev/min)
   DIA = diameter of drill (mm)

4. **Thrust** = 154 • (mm/rev) • DIA • K_m
   where:
   Thrust = axial thrust (N)
   mm/rev = feed rate (mm/rev)
   DIA = diameter of drill (mm)
   K_m = specific cutting energy (kPa)

5. **Tool Power** = ((mm/rev) • RPM • K_m • DIA^2) / 218604.8
   where:
   Tool Power = tool power (HP)
   mm/rev = feed rate (mm/rev)
   RPM = revolutions per minute (rev/min)
   K_m = specific cutting energy (kPa)
   DIA = diameter of drill (mm)

BSP and ISO 7-1

Tap Size	Tap Drill Size	Decimal Equivalent	* Theo % Thread	Probable Mean Oversize	Probable Hole Size	** Probable % Thread
1/4-19	7/16"	0.4375"	–	0.075mm	11.19 mm	–
3/8-19	37/64"	0.5781"	–	0.075mm	14.76 mm	–
1/2-14	23/32"	0.7188"	–	0.075mm	18.33 mm	–
3/4-14	15/16"	0.9375"	–	0.075mm	23.89 mm	–

* Based on nominal tap drill diameter
** Based on 0.075mm probable mean oversize

To calculate the percent of full thread for a given hole diameter:

$$\% \text{ Thread} = \frac{76.93}{\text{Pitch (mm)}} \cdot (\text{Basic major diameter - Drill hole size})$$

Material Constants

Type of Material	Hardness	Km (kPa)
Plain Carbon and Alloy Steel	85 - 200 BHN	5.45
	200 - 275 BHN	6.48
	275 - 375 BHN	6.89
	375 - 425 BHN	7.93
High Temperature Alloys	–	9.93
Titanium Alloy	–	4.96
Stainless Steels	135 - 275 BHN	6.48
	30 - 45 RC	7.45
Cast Iron	100 - 200 BHN	3.45
	200 - 300 BHN	7.45
Copper Alloy	20 - 80 RB	2.96
	80 - 100 RB	4.96
Aluminum Alloy	–	1.52
Magnesium Alloy	–	1.10

Notes

- The above tap drill information represents probable thread percentages for the standard tap drills stocked at Allied Machine. Special insert diameters may be required in order to meet a user specific percentage of thread requirement.
- The .075mm probable mean oversize hole condition is based on optimum cutting conditions. Probable percent of full thread may vary based on less ideal cutting conditions.
- The table and equations on this page are found in the *Machinery's Handbook*. Permission to simplify and print the equations is granted by the Editor of the *Machinery's Handbook*.

A DRILLING
B BORING
C REAMING
D BURNISHING
E THREADING
X SPECIALS

Troubleshooting Guide

Setup Condition	1 Accelerated corner wear	2 Barber pole	3 Bell mouth hole	4 Insert chipping	5 Blue chips	6 Build Up Edge (BUE)	7 Chatter	8 Chip packing	9 Chipping of point	10 Damaged or broken tools	11 Excessive margin wear	12 High flank wear	13 Hole lead off	14 Hole out of position	15 Hole out of round	16 Oversize hole	17 Poor hole finish	18 Poor tool life	19 Power spikes - Load meter	20 Retract spiral	Possible Solutions
Worn or misaligned spindle (lathe, screw machine, chucker)	1		3				7		9	10	11		13			16	17			20	• Align spindle and turret or tailstock. • Repair spindle.
Use of low rigidity machine tools		2	3	4			7		9	10			13	14						20	• Reduce penetration rate to fall within the physical limits of the machine or setup (**NOTICE:** Do not reduce feed below threshold of good chip formation).
Poor work piece support		2		4			7			10	11				15		17			20	• Provide additional support for the work piece. • Reduce penetration rate to fall within the physical limits of the machine or setup (**NOTICE:** Do not reduce feed below threshold of good chip formation).
Flood coolant, low coolant pressure, or low coolant volume	1				5	6		8		10		12				16	17	18	19		• Run coolant through tool holder when drilling greater than 1xD. • Increase coolant pressure and volume through the tool holder. • Reduce penetration rate to fall within the coolant limitations (**NOTICE:** Do not reduce feed below threshold of good chip formation). • Add a peck cycle to help clear chips.
Interrupted cuts. Entry or exit surfaces that are not perpendicular to the spindle (draft angles, parting lines, curved or stepped surfaces, cross holes, and cast or forged surfaces)				4			7		9	10	11		13	14	15	16	17	18			• Pre-mill (spot face) entry or exit surface to remove interruption. • Decrease feed as much as 50% through entry or exit interruption. • Use short holders in low impact entry cuts.
Material harder than expected or running tools beyond recommended speed	1				5	6				10		12						18			• Reduce speed. • Increase coolant pressure and volume. • Improve coolant condition by use of quality products and regular maintenance.
Poor material micro-structure or foreign particles (forgings and castings that have not been normalised or annealed, poorly prepared steel, flame cut parts, and sand casting)				4		6				10		12	13					18			• Compare performance of other tools for similar wear problems, which may indicate poor micro-structure. Anneal or normalise parts to improve micro-structure for machining. • Reduce feeds (**NOTICE:** Do not reduce feed below threshold of good chip formation).
Poor chip control								8		10	11		13			16	17	18	19		• Increase feed to recommended levels. Contact Allied Application Engineering group for technical recommendations. • Increase coolant pressure and volume. • Improve coolant condition by use of quality products and regular maintenance.
Spot drilled holes with included angle less than that matching T-A Pro or cored holes	1			4			7						13					18			• Spot hole with short tool of same or greater included angle as T-A Pro drill insert. • Reduce feed (**NOTICE:** Do not reduce feed below threshold of good chip formation). If possible, drill from solid.

Guaranteed Application Form

Distributor PO #

The Followig must be filled out completely before your test will be considered

CONTACT DETAILS

Trial P.O No*...................... Date*...................... Proposed Test Date*......................

Distributor*...................... Distributor Contact*......................

Customer Name*...................... Industry...................... Contact Name*......................

APPLICATION INFORMATION

ATTENTION: The following Information is required to enable the best combination of tooling to be recommended. Please complete all that apply.

Material Type*...................... Specification*...................... Material Hardness .... ☐ Kg ☐ BRN ☐ RC ☐ N/mm²

Material Condition ☐ Flat Stock ☐ Round Stock ☐ Tubular Stock ☐ Plate ☐ Stacked Plate ☐ Hot Rolled ☐ Cold Rolled ☐ Casting ☐ Forging

Hole Diameter .... ☐ mm ☐ Inch ☐ Hole Depth...................... ☐ Thru Hole ☐ Blind Hole

Drilled Hole Tolerance Req'd .... Drilled Hole RMS Finished Req'd .... ☐ µInch ☐ µMetre

APPLICATION INFORMATION

Material Condition ☐ Machining Centre ☐ Round Stock ☐ Boring Mill ☐ Multi-spindle auto ☐ Multi spindle drill ☐ Transfer Line ☐ Gantry machine ☐ Dial Index Machine ☐ Radial Arm ☐ Gun Drilling Machine ☐ Pedestal Drill ☐ Other

Machine Tool Builder* .... Model ....

Machine Tool Control* ☐ CNC ☐ NC ☐ Mannual ☐ Other ....

Spindle Orientation* ☐ Vertical ☐ Horizontal ☐ Other ....

Tool* ☐ Stationary ☐ Revolves

Available Power* ☐ KW ☐ HP Available Feed Trust .... ☐ Newtons ☐ Lbs

Available Speed* ☐ Variable ☐ Fixed ☐ RPM ☐ m/Min

Preferred Shank Type* ☐ Flanged ☐ Morse No ☐ RCA ☐ Lathe ☐ Diameter .... ☐ mm ☐ Inch

Coolant Type* ☐ Cutting Oil ☐ Water Soluble Oil ☐ Air Mist ☐ Air ☐ Dry

Coolant Pressure* ☐ Bar ☐ PSI

Coolant Flow Rate* ☐ L/min ☐ GPM Coolant Supply ☐ Through Tool ☐ External

CURRENT DRILL INFORMATION

Drill Manufacturer .... Part Nuber ....

Drill Type .... ☐ Twist ☐ Brazed ☐ Indexable Insert ☐ Gun Drill ☐ Removable Tip ☐ Other ....

Tool Grade ☐ HSS ☐ Carbide ☐ Ceramic ☐ Other ....

Tool Coating ☐ Uncoated ☐ TiN ☐ TiCN ☐ TiAlN ☐ Other ....

Current Speed .... ☐ RPM ☐ m/Min ☐ Current Feed Rate .... ☐ mm/rev ☐ mm/min

Average Number of Holes Drilled New .... After Regrind? ....

Reason(s) for Tool change ☐ Wear ☐ Fracture ☐ Chipping ☐ Losing Hole Tolerance ☐ Losing Chip Control ☐ Burr ☐ Other .... ☐ Chatter ☐ New Application

What Criteria defines a successful test* ☐ Decreased Cycle Time ☐ Better Chip Control ☐ Safer Process ☐ Longer Tool Life ☐ Reduced Cost per Hole ☐ Other ....

Potential this application: Current Annual Usage €/£: Tools per Annum?

*Required Fields where applicable

FOR OFFICE USE ONLY

Application Engineer: Number: Status: