

Indexable Drills – Cutting Forces – DRILL FIX – Inch

Power: These charts are based on machining experiences using steels with a hardness of 200-250 HB, and on a cutting speed of 650 sfm.

Coolant Application: DRILL-FIX drills must always be applied with coolant lubricant. The higher the coolant rate, the better the drilling performance.

SOLID CARBIDE DRILLS

MODULAR DRILLS

COMBINATION TOOLS

HSS AND CARBIDE TAPS

INDEXABLE DRILLS

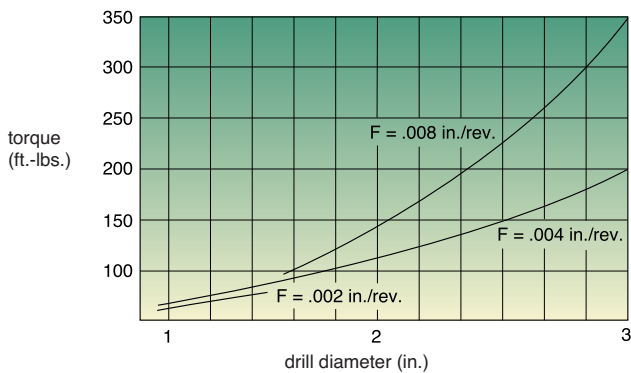
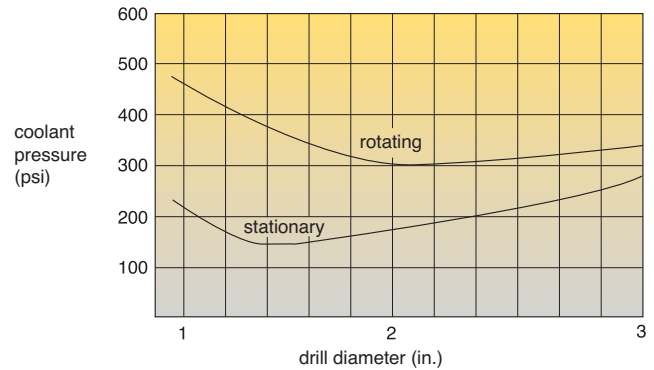
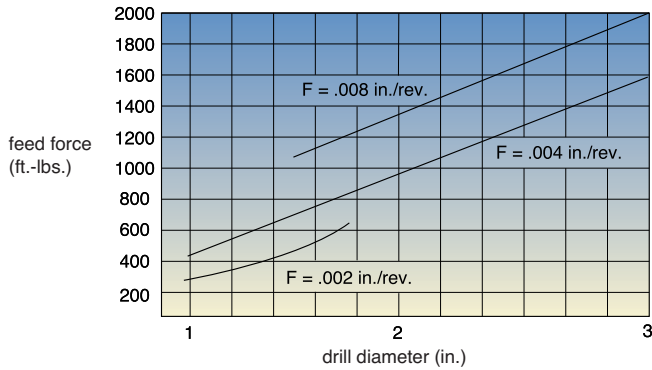
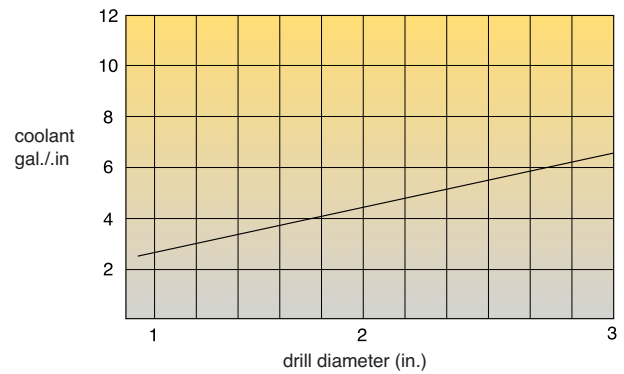
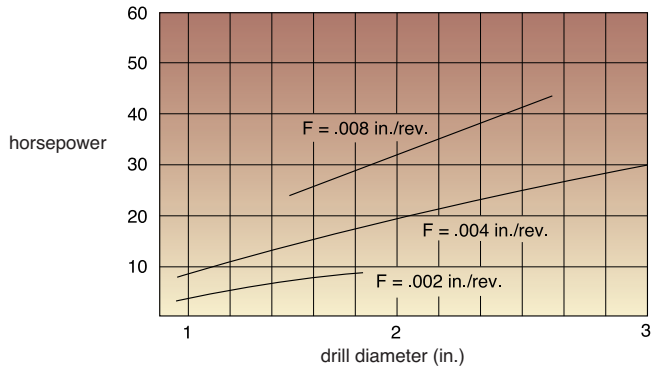
COUNTERBORING TOOLS

PRECISION HOLE FINISHING

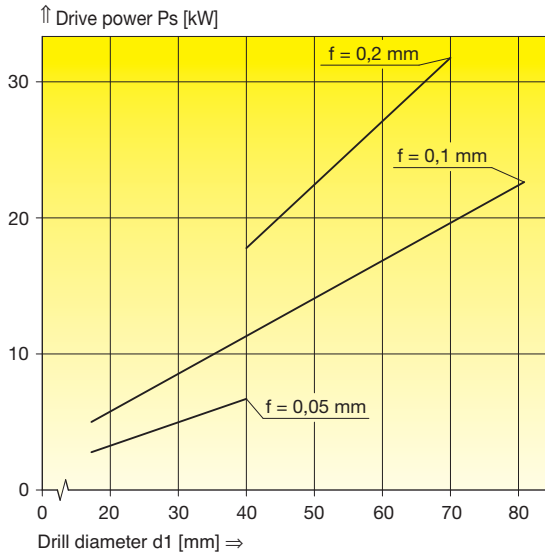
INSERTS

TECHNICAL DATA

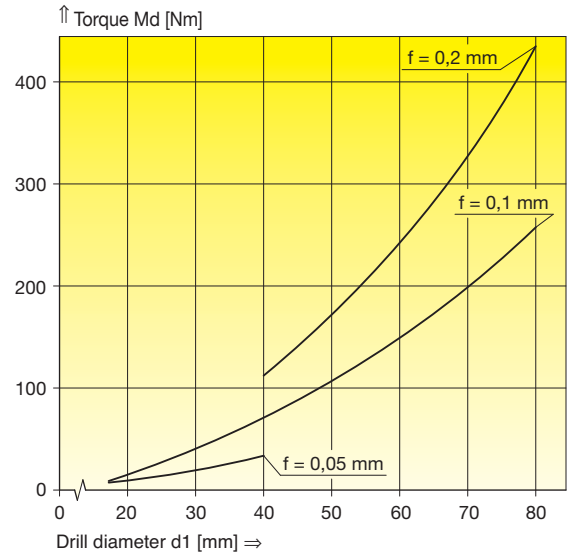
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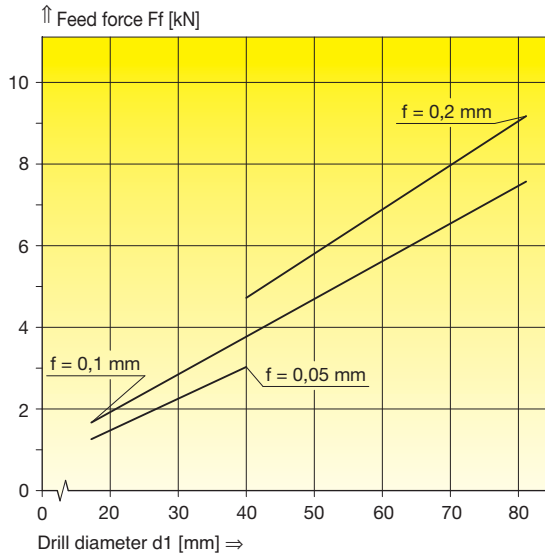
Drive power



Torque



Feed force

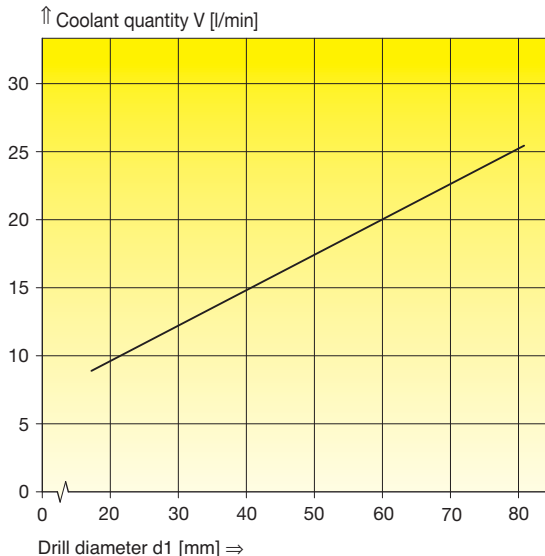


NOTE: The diagrams are based on empirical values and apply to drilling steel materials with a strength of: $R_m = 600 - 900 \text{ N/mm}^2$.
The cutting speed taken as a basis is: $vc = 200 \text{ m/min}$.

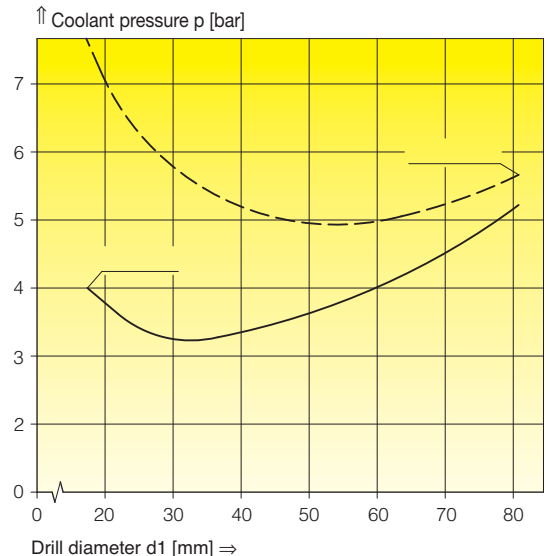
Guidelines for coolant pressure and quantity.

NOTE: DRILL-FIX drills should always be used with cooling lubricant. The more intensive the cooling, the better the drilling performance.

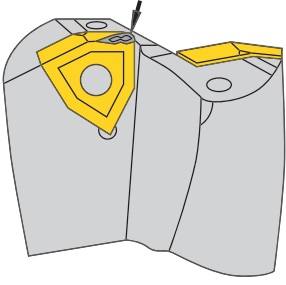

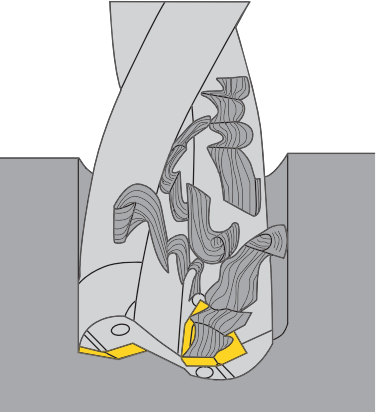

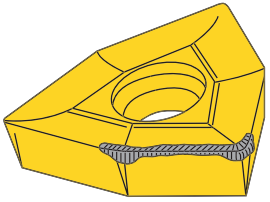
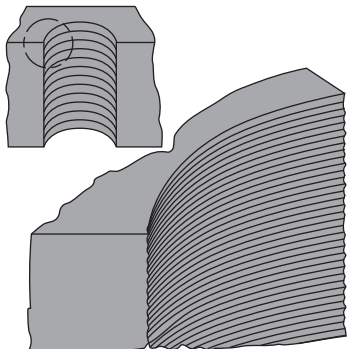
Coolant quantity

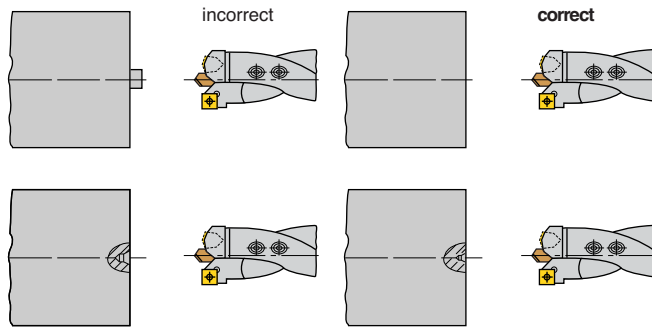


Coolant pressure



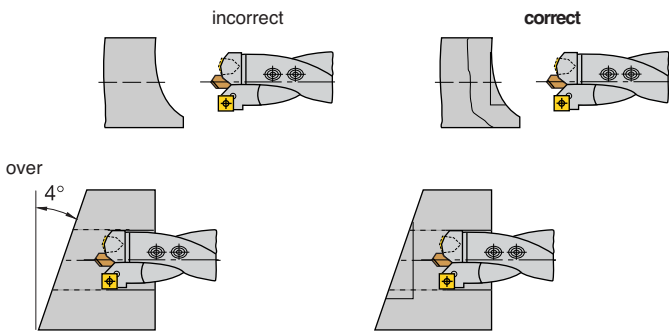
Indexable Drills – Troubleshooting Guide for DRILL-FIX

SOLID CARBIDE DRILLS	MODULAR DRILLS	COMBINATION TOOLS	HSS AND CARBIDE TAPS	INDEXABLE DRILLS	COUNTERBORING TOOLS	PRECISION HOLE FINISHING	INSERTS	TECHNICAL DATA	INDEX
problem		solution							
<p>inner cutting edge cracking</p> 		<p>On lathes:</p> <ul style="list-style-type: none"> • Check machine alignment. • Check clamping accuracy. If tool clamping cannot be improved and/or optimum machine stability is doubtful, reduce feed by 30%. • Use tougher carbide grade. <p>TIP: Grades can be mixed to achieve optimum performance.</p> <p>EXAMPLE: Use grade KC7225 in the inside pocket with KC7140 in the outside pocket.</p> 							
<p>chip evacuation not optimal</p> 		<ul style="list-style-type: none"> • Increase coolant pressure and volume (coolant helps support chip evacuation as well as cooling the cutting edges). • Optimize chip control for a given application. • Increase cutting speed by 20%. 							
<p>excessive insert wear</p> 		<ul style="list-style-type: none"> • Increase coolant pressure and volume. • Reduce cutting speed by 20% • Use a more wear-resistant grade. 							
<p>poor drill hole quality</p> 		<ul style="list-style-type: none"> • Increase coolant pressure and volume. • Increase cutting speed by 20%. • Check clamping accuracy (tool and workpiece) for possible improvement. <p>TIP: Use higher speed with lighter feed to produce better hole quality.</p>							



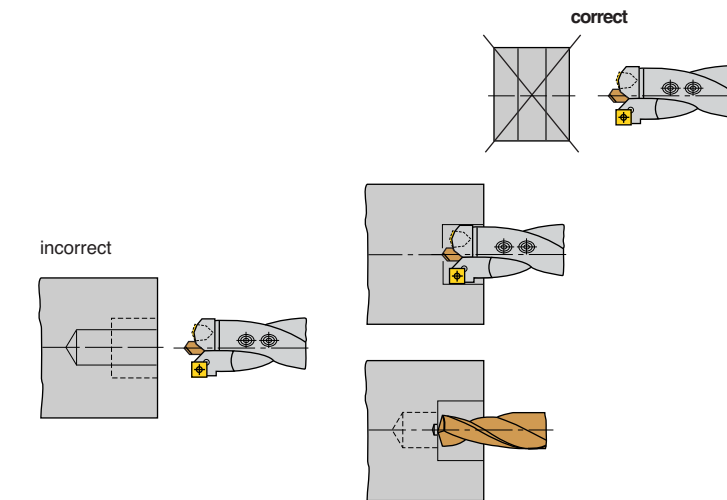
Spot drilling

For plain/straight surfaces, no spot drilling is required. For centering, the center drill diameter should be considerably smaller than the pilot drill diameter.



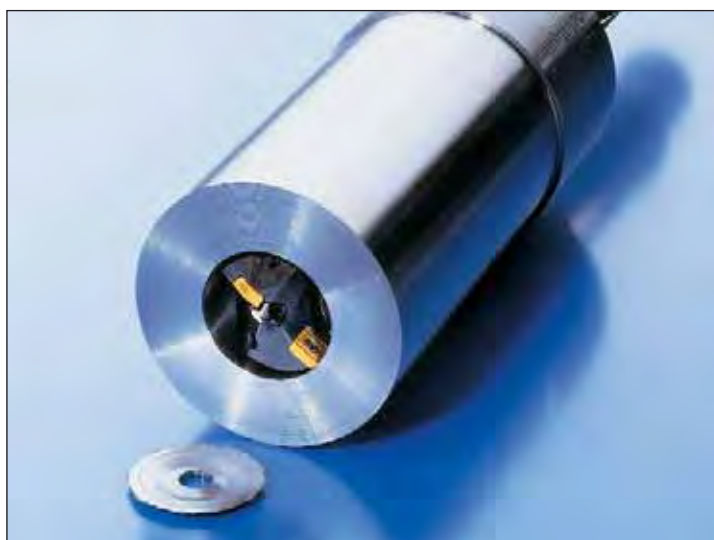
Spot drilling and drilling through on inclined surfaces

Up to an 8° inclination angle is possible. Drilling through at a maximum of 4° is possible, otherwise, a pre-facing operation is necessary.



Multi-stage drill hole

HTS-C series drills are not recommended for boring operations. First, use the HTS-C drill to drill a larger diameter hole. Then, use a solid carbide drill for smaller holes. Optimum centering of the solid carbide drill is possible on the drill hole of the pilot drill.



Drilling of stacked plates

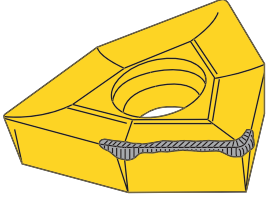
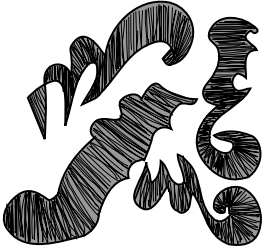
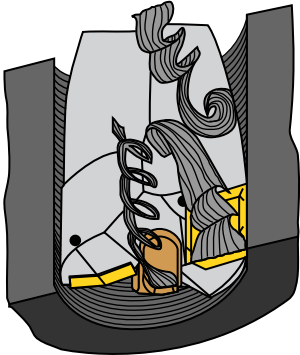
This is not possible with HTS-C series drills because a final disc forms when the drill breaks through.

CAUTION

During through-hole operations, a slug or disc is produced as the tool breaks through the workpiece. When the drill is stationary and the workpiece is rotating, this slug may be hurled from the chuck by centrifugal force. Provide adequate shielding to protect all bystanders.

Indexable Drills – Troubleshooting Guide for HTS-C Drills

SOLID CARBIDE DRILLS	problem	solution
MODULAR DRILLS	pilot drill cracking	<p>On lathes:</p> <ul style="list-style-type: none"> • Verify that the tool is centered correctly. Readjust machine, if necessary. • Check clamping accuracy (tool and workpiece) for possible improvement. • Use pilot drill B503 in HSS grade AS3.
COMBINATION TOOLS		
HSS AND CARBIDE TAPS	inner insert cracking	<ul style="list-style-type: none"> • Use tougher carbide grade. • Reduce feed by 20%. • Check clamping accuracy (tool and workpiece) for possible improvement.
INDEXABLE DRILLS		
COUNTERBORING TOOLS	outer insert cracking	<ul style="list-style-type: none"> • Use tougher carbide grade and/or stronger insert geometry. • Reduce feed by 20%. • When drilling through, reduce feed by 50%. • Check clamping accuracy (tool and workpiece) for possible improvement.
PRECISION HOLE FINISHING		
INSERTS	extensive pilot drill wear	<ul style="list-style-type: none"> • Use coated carbide pilot drill B504 in grade CS3. • Increase coolant pressure and volume. • Reduce cutting speed by 20%.
TECHNICAL DATA		
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problem	solution
<p>excessive insert wear</p> 	<p>On lathes:</p> <ul style="list-style-type: none"> • Use a more wear-resistant carbide grade. • Increase coolant pressure and volume. • Reduce cutting speed by 20%.
<p>chip breaking not optimal</p> 	<ul style="list-style-type: none"> • Optimize chip control for given application. • Increase cutting speed by 20%; reduce feed by 20%.
<p>chip evacuation not optimal, poor drill hole quality</p> 	<ul style="list-style-type: none"> • Increase coolant pressure and volume. • Increase cutting speed by 20%.

SOLID CARBIDE DRILLS

MODULAR DRILLS

COMBINATION TOOLS

HSS AND CARBIDE TAPS

INDEXABLE DRILLS

COUNTERBORING TOOLS

PRECISION HOLE FINISHING

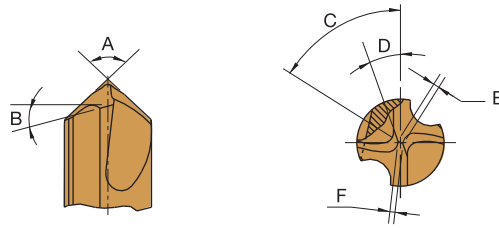
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Indexable Drills — Cutting Forces — HTS-C Series Drills — Inch

HTS-C Pilot Drill Repointing Data

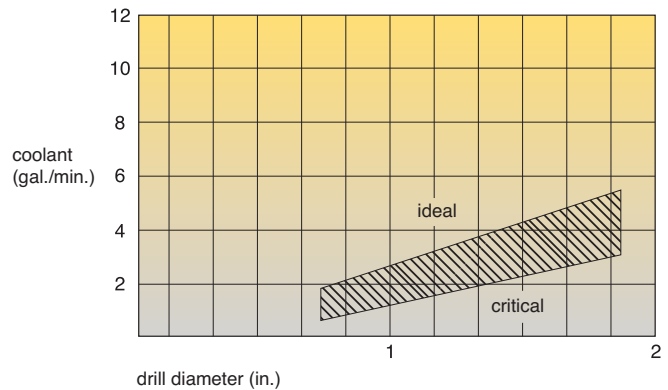
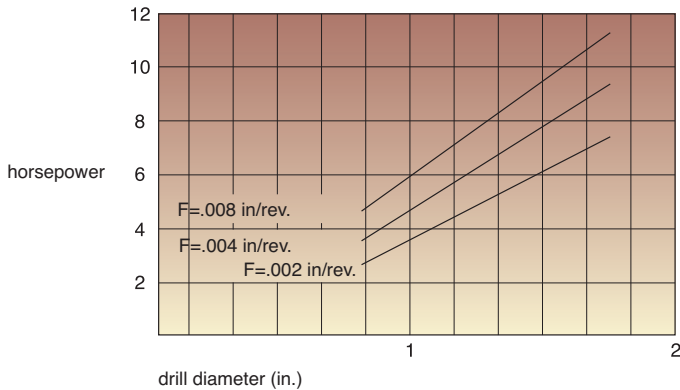


catalog number	grade	included angle A	primary relief angle B	chisel angle C	gash angle D	web thickness E	gash depth F
B504S04000	G13	130°	14°	58° ± 3°	20° ± 2°	.0118 - .004	.0196 ± .004
B504S05000	G13	130°	14°	58° ± 3°	20° ± 2°	.0114 ± .004	.0224 ± .004
B504S06000	G13	130°	14°	58° ± 3°	20° ± 2°	.0129 ± .004	.0129 ± .004
B504S08000	G13	130°	14°	58° ± 3°	20° ± 2°	.0196 ± .004	.0338 ± .004
B504S10000	G13	130°	14°	58° ± 3°	20° ± 2°	.0267 ± .004	.0452 ± .004
B504S04000	CS3	130°	14°	58° ± 3°	20° ± 2°	.0118 - .004	.0196 ± .004
B504S05000	CS3	130°	14°	58° ± 3°	20° ± 2°	.0114 ± .004	.0224 ± .004
B504S06000	CS3	130°	14°	58° ± 3°	20° ± 2°	.0129 ± .004	.0129 ± .004
B504S08000	CS3	130°	14°	58° ± 3°	20° ± 2°	.0196 ± .004	.0338 ± .004
B504S10000	CS3	130°	14°	58° ± 3°	20° ± 2°	.0267 ± .004	.0452 ± .004

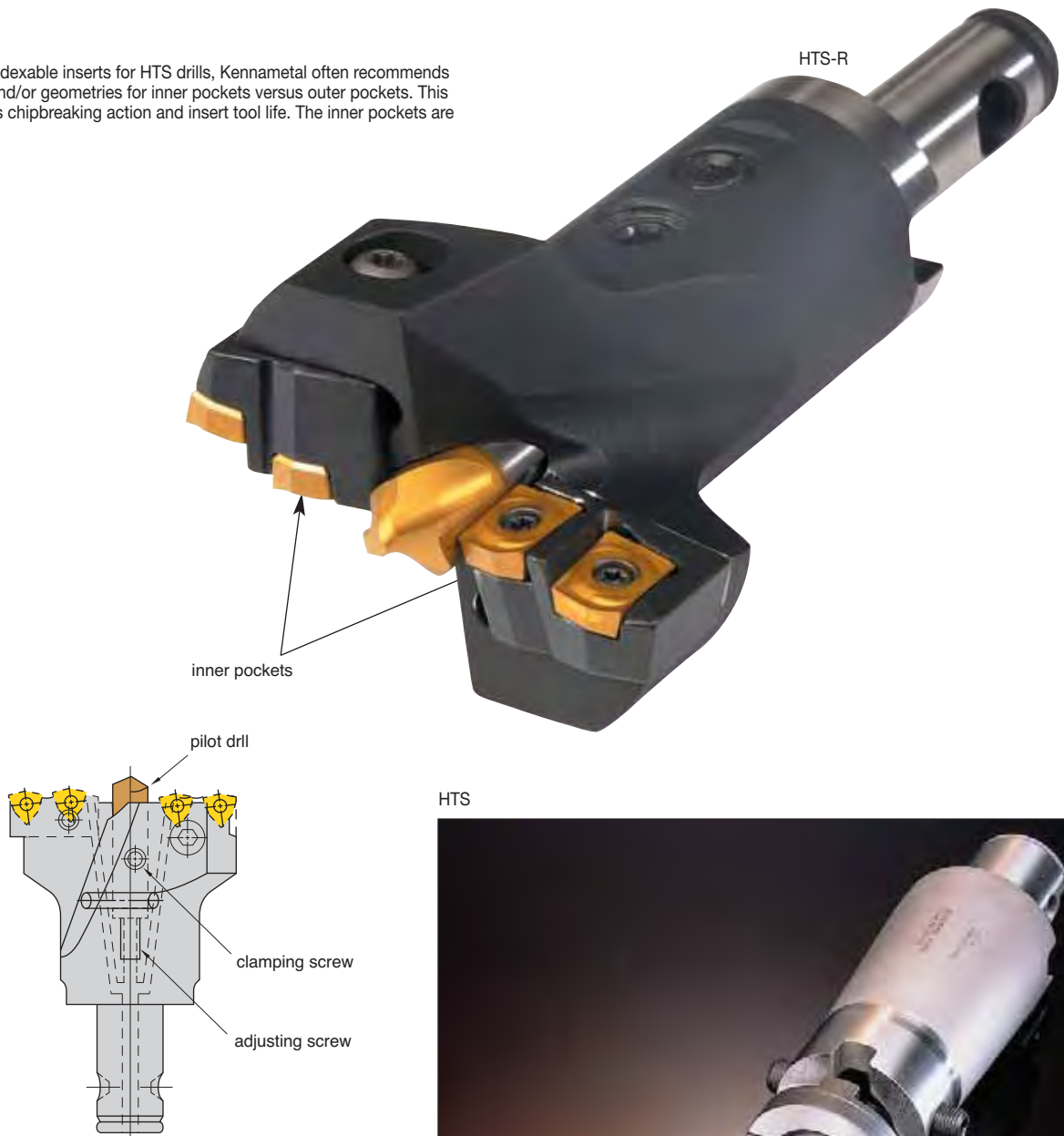
Power: This chart is based on machining experiences using steels with a hardness of 200-250 HB, and on a cutting speed of 350 sfm.

Coolant Application: Efficient cooling of HTS-C drills is ensured by an internal coolant capability.

recommended coolant:	emulsion	6-8%
minimum coolant pressure:	stationary drill	30 psi
	rotating drill	90 psi



When choosing indexable inserts for HTS drills, Kennametal often recommends different grades and/or geometries for inner pockets versus outer pockets. This practice optimizes chipbreaking action and insert tool life. The inner pockets are defined below.

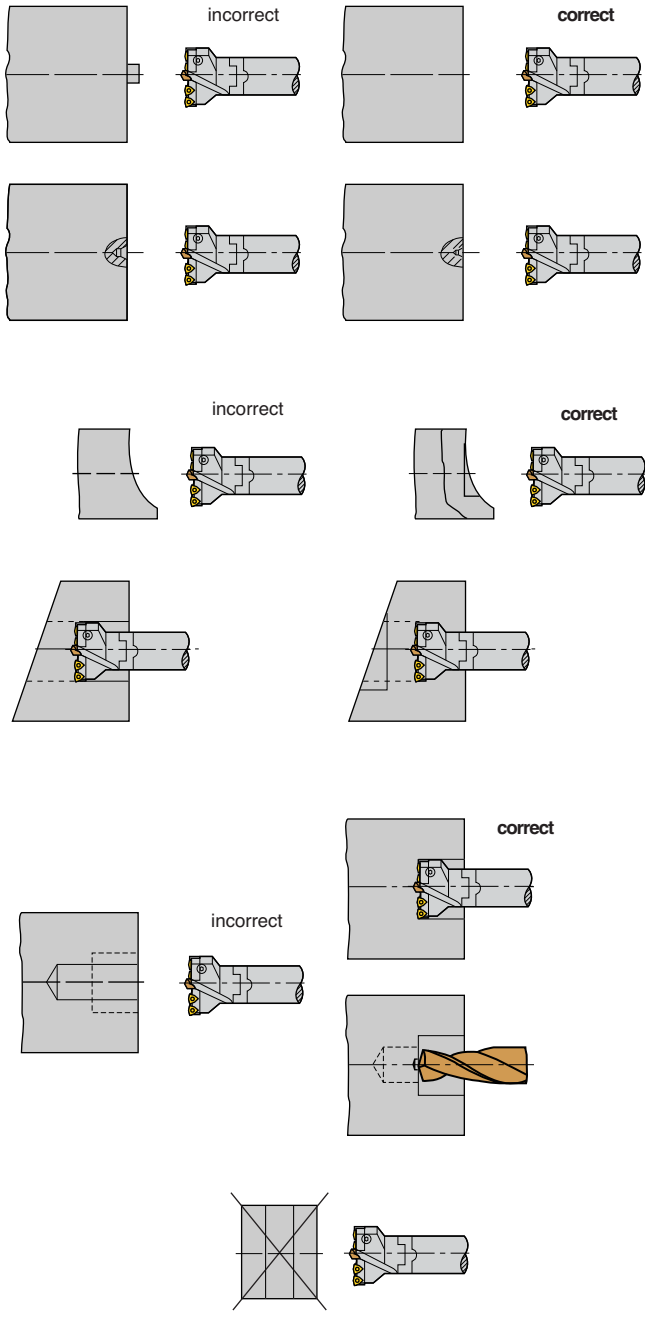


HTS-C and HTS-R, HTS Adjustable Pilot Drills

The pilot drill used the HTS, HTS-R and HTS-C modular drilling systems can be adjusted to accommodate changes in either machining conditions or length alterations due to resharpening. The pilot drill is adjusted from the rear of the drill head via an axial adjusting screw. Once the appropriate length is established, the drill is secured in position using the set screw located on the side of the drill head. The HTS-C pilot drill can be adjusted with the head mounted on the drill shank, using the side adjusting screw. The HTS-C pilot drill is secured using a radial clamping screw. See the HTS and HTS-C product pages in this catalog for the appropriate pilot drill set length.

Indexable Drills — Application Guidelines — HTS Drills

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- MODULAR DRILLS
- COMBINATION TOOLS
- HSS AND CARBIDE TAPS
- INDEXABLE DRILLS
- COUNTERBORING TOOLS
- PRECISION HOLE FINISHING
- INSERTS
- TECHNICAL DATA
- INDEX



Spot drilling
 For plain/straight surfaces, no spot drilling is required. Spot drilling is recommended when using HTS at a long L/D ratio, especially for horizontal applications. In this case, the center drill diameter should be considerably smaller than the pilot drill diameter.

Spot drilling and drilling through* on inclined surfaces
 Spot drilling on inclined surfaces is not possible. A pre-facing operation is required for spot drilling and drilling through on inclined surfaces.

Multi-stage drill hole
 HTS drills are not recommended for boring operations. First, use the HTS drill to drill a larger diameter hole. Then, use a solid carbide Dynapoint drill, KSEM, or HTS-C drill to drill the smaller holes.

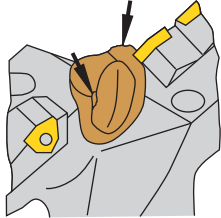
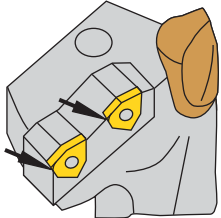
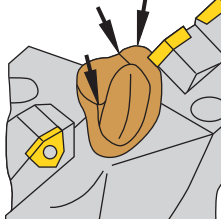
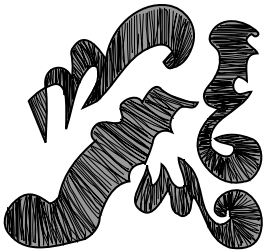
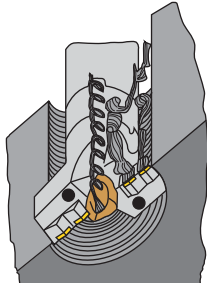
Drilling of stacked plates
 Not possible with HTS drills — a final disc forms when the drill breaks through.

CAUTION

During through-hole operations, a slug or disc is produced as the tool breaks through the workpiece. When the drill is stationary and the workpiece is rotating, this slug may be hurled from the chuck by centrifugal force. Provide adequate shielding to protect all bystanders.

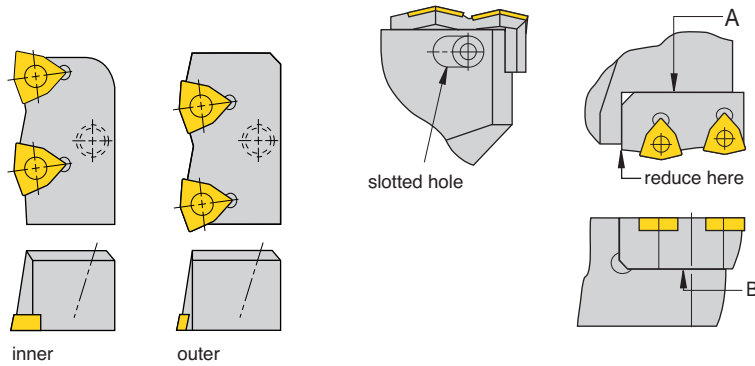


*When drilling through, a small shoulder will be produced on breakthrough as the pilot drill is no longer cutting.

problem	solution
<p>pilot drill cracking</p> 	<p>On lathes:</p> <ul style="list-style-type: none"> • Verify that the tool is centered correctly. Readjust machine, if necessary. • Check clamping accuracy (tool and workpiece) for possible runout.
<p>insert cracking</p> 	<ul style="list-style-type: none"> • Use tougher carbide grade. • Check clamping accuracy (tool and workpiece) for possible runout.
<p>excessive insert wear</p> 	<ul style="list-style-type: none"> • Use coated pilot drill AS3. • Increase coolant pressure and volume. • Reduce speed by 20%. • Use wear & resistant carbide grade.
<p>chip breaking not optimal</p> 	<ul style="list-style-type: none"> • Optimize chip control for given application by using chipbreaker geometry such as HP or MD. • Increase cutting speed by 20%; reduce feed by 20%.
<p>chip evacuation not optimal, poor hole quality</p> 	<ul style="list-style-type: none"> • Increase coolant pressure and volume. • Increase cutting speed by 20%.

Indexable Drills — HTS Deep-Hole Drilling System — Inch

Adjusting the HTS Drill Diameter



- Change drill diameter by adjusting the outer cartridge. The outer cartridge is bolted to the head and can be shortened to drill smaller diameters.
- Shorten at 90° to the contact face “A” and the support face “B.”
- Shortening reduces the effective drill diameter by double the length removed.

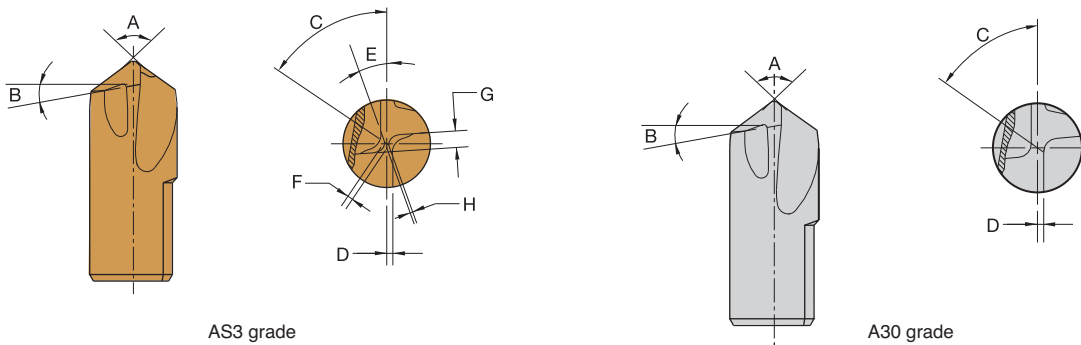
The HTS deep-hole drilling system offers a precise method of adjusting the hole diameter. The cartridges supplied with each HTS system are designed to cut the largest diameter in its range.

To adjust the HTS cutting diameter, make a trial cut, calculate the adjustment needed, remove the outer cartridge, and grind off one-half of the difference obtained by the calculation of the cut diameter to the required diameter.

Example: If the standard drill cuts 3.400" and the required diameter is 3.350", the difference is .050. Grind .025 from the inner side of the outer cartridge.

Caution must be taken when altering a cartridge. It's critical that the chamfers are reground on the cartridge. If the chamfers are not ground, the cartridge will not seat properly in the pocket; thus the tool will not cut the correct diameter.

HTS Pilot Drill Repointing Data



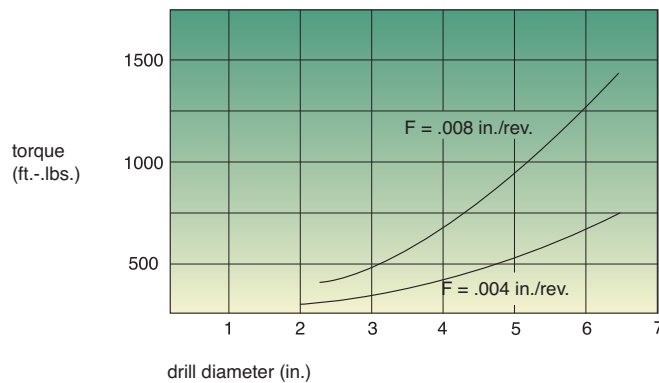
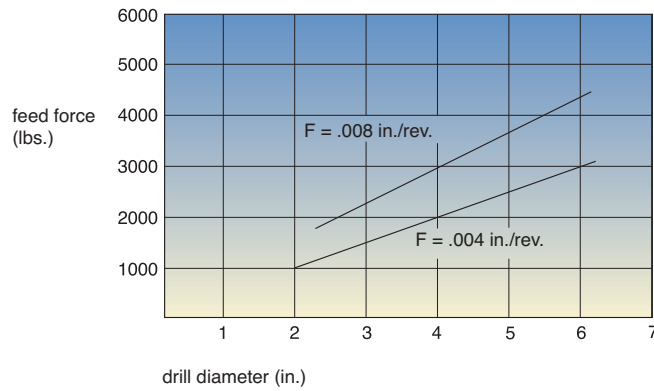
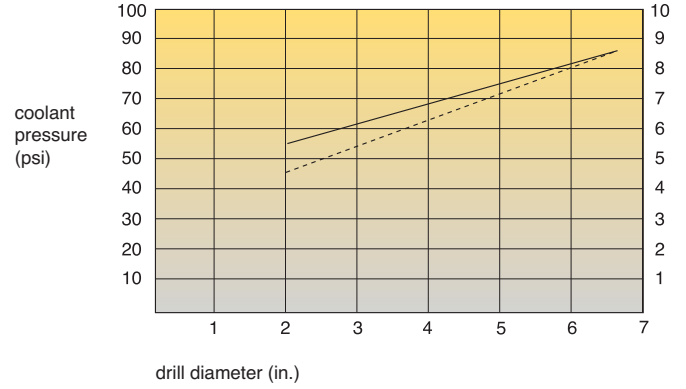
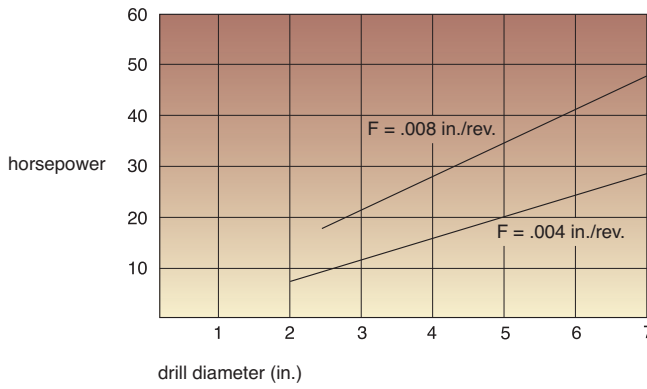
AS3 grade

A30 grade

catalog number	grade	included angle A	primary relief angle B	chisel angle C	primary relief D	gash angle E	web thickness F	gash depth G	thickness H
B510S08000	AS3	118°	8° + 2°	55° ± 3°	.0275 ± .004	20° - 2°	.0196 ± .004	.0314 ± .004	.0098 ± .002
B510S10000	AS3	118°	8° + 2°	55° ± 3°	.0314 ± .004	20° - 2°	.0236 ± .004	.0393 ± .004	.0118 ± .002
B510S15000	AS3	118°	8° + 2°	55° ± 3°	.0433 ± .004	20° - 2°	.0354 ± .004	.0590 ± .004	.0177 ± .002
B510S20000	AS3	118°	8° + 2°	55° ± 3°	.0551 ± .004	20° - 2°	.0472 ± .004	.0787 ± .004	.0236 ± .002
B510S25000	AS3	118°	8° + 2°	55° ± 3°	.0629 ± .004	20° - 2°	.0590 ± .004	.0984 ± .004	.0291 ± .004
B510S30000	AS3	118°	8° + 2°	55° ± 3°	.0708 ± .004	20° - 2°	.0708 ± .001	.1181 ± .001	.0354 ± .004
B510S08000	A30	118°	8° + 2°	55° ± 3°	.0275 ± .004				
B510S10000	A30	118°	8° + 2°	55° ± 3°	.0314 ± .004				
B510S15000	A30	118°	8° + 2°	55° ± 3°	.0433 ± .004				
B510S20000	A30	118°	8° + 2°	55° ± 3°	.0551 ± .004				
B510S25000	A30	118°	8° + 2°	55° ± 3°	.0629 ± .004				
B510S30000	A30	118°	8° + 2°	55° ± 3°	.0708 ± .004				

Power: These charts are based on machining experiences using steels with a hardness of 200-250 HB, and on a cutting speed of 350 sfm.

Coolant Application: HTS drills must always be applied with coolant lubricant. The higher the coolant rate, the better the drilling performance.

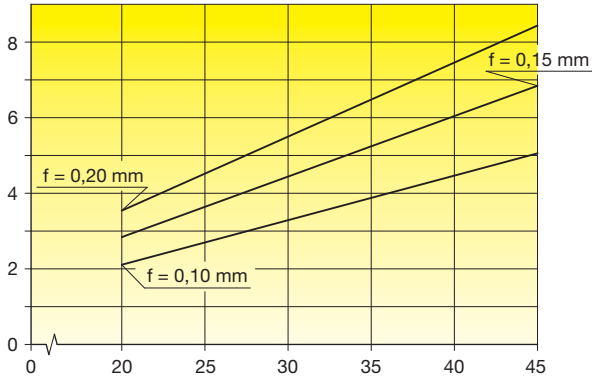


Indexable Drills – Cutting Forces – HTS-C Series Drills – Metric

SOLID CARBIDE DRILLS

Drive power

→ Drive power P_s [kW]



Drill diameter [mm] ↑

MODULAR DRILLS

COMBINATION TOOLS

HSS AND CARBIDE TAPS

INDEXABLE DRILLS

Calculating the drive power
 The diagram is based on empirical values.
 It applies to drilling steels of strength:
 700–900 N/mm²
 The cutting speed taken as a basis is:
 $v_c = 100$ m/min

COUNTERBORING TOOLS

PRECISION HOLE FINISHING

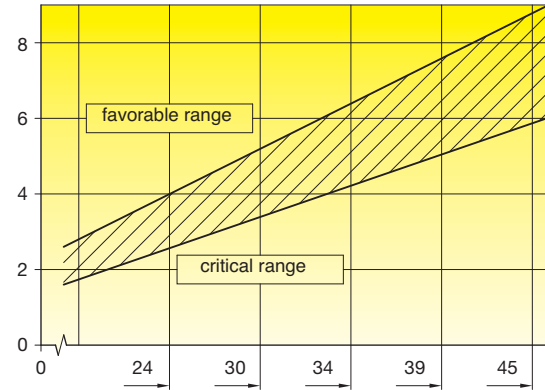
INSERTS

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Minimum coolant quantities

→ Minimum coolant quantities V . [l/min]



Drill diameter d_1 [mm] ↑

Coolant usage
 Powerful cooling is provided for the HTS-C drill tools thanks to an internal coolant supply.
 Recommendation: Emulsion 6–8%
 Minimum coolant pressure: 6 bar