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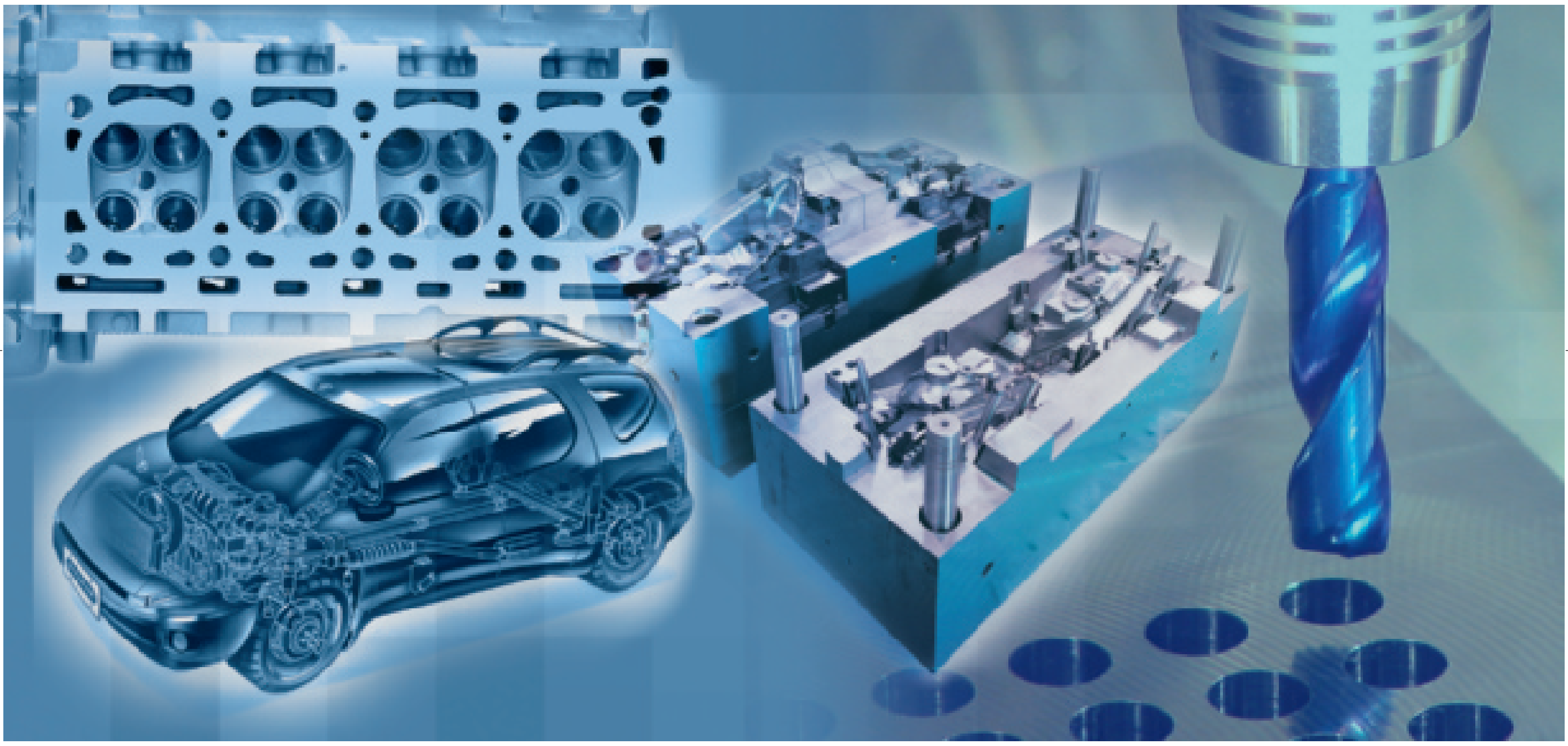
ATI Stellram
Allegheny Technologies

HardCore™ Drilling System

TECHNOLOGY BY ATI STELLRAM



ATI Stellram tooling systems for all your drilling requirements.

The Technology

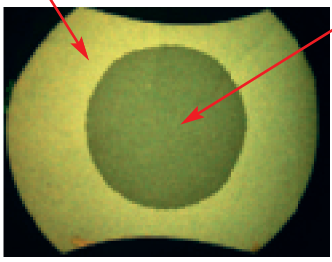
Two grades of carbide in one tool can mean as much as four times the performance.

ATI Stellram is positioned to change the way the metal cutting industry thinks, with a brand new patented technology that combines two grades of carbide into one tool. (US Patent: 6,511,265 and foreign pending)

ATI Stellram's new HARDCORE technology offers a unique design so that the optimum carbide grade is used at critical points, enhancing performance and improving tool life.

One carbide grade here

Another in the centre



HARDCORE technology eliminated the need for compromise, dramatically improving performance.

The Advantages

HARDCORE technology drills will cut faster, last longer and produce up to 4 times the number of holes, with better surface quality, than any other high performance drill available in today's market.

The Performance

The outer edges of a drill bit are running at tremendous speed, while the point is basically stationary. The carbide grade chosen had to compensate for this and there was a compromise – performance for durability. In the past, this has meant that the bit is prone to chipping at certain points, which is a critical factor in maintenance and reduced tool life.

The HARDCORE technology consists in having two grades of carbide – one tailored to the high speed of the tool's outer diameter and another resilient enough to handle the slow speed of the tool centre.

Testing shows that the new hardcore technology greatly reduces wear. And because the carbide grade is optimised for the different portions of the tool, operating speeds can be increased.

We've tested HARDCORE technology by ATI Stellram against some of the best products in the business and the results are astounding.

Figure 1. Shows chipping along the cutting edge, on a reputable high performance drill that is currently in the market, after just 8 minutes into its drilling cycle.

Figure 2. ATI Stellram HARDCORE technology drill shows uniform wear along the cutting edge after continuous use, running at a higher surface speed and feed.

Mono Block Carbide

Fig. 1

HARDCORE Technology

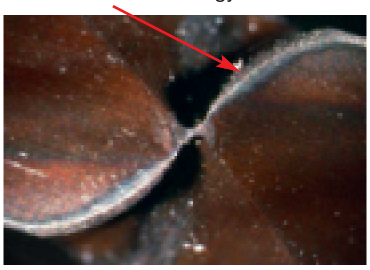


Fig. 2

HardCore – Technology

The HARDCORE Material

- Patented process for the substrate design and process, manufactured by ATI Stellram (US Patent: 6,511,265).
- Unique bonding of 2 micrograin carbides.
- ATI Stellram's patented process allows the two micrograin substrates to be co-extruded around each other to produce optimum grades positioned at the critical parts of the tool to improve durability and allow faster operation.
- This allows the HARDCORE technology drill to penetrate materials at higher feed rates than existing high performance drills available in the market today.
- The technology eliminates the risk of drill point breakage, which is typical for these at high speeds and feeds, due to the variance in surface speeds between periphery and the point.

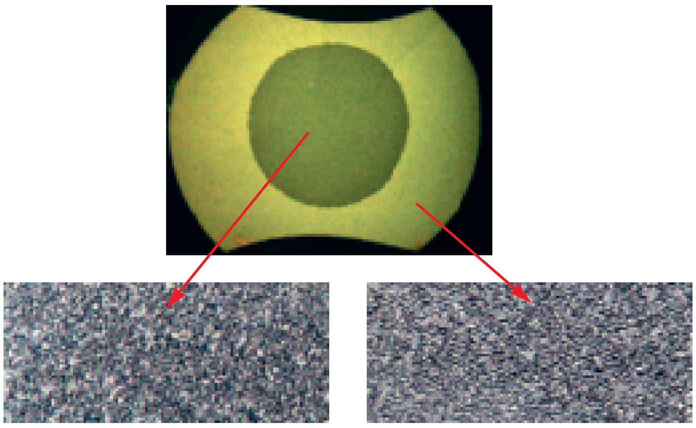
Material application example:

Customer C.
Drill: **SHD1050/0.413/301 HA HCT600**

Material 4140 300HBN, Drilling depth: 33mm

V_c: 91m/min	295fpm
f: 0.25mm/tr	0.01ipr
V_f: 680mm/min	26.8ipm

814 holes 36 minutes



Tough core ensures shock resistance

High hardness improves wear resistance

HardCore™ – Drill Description

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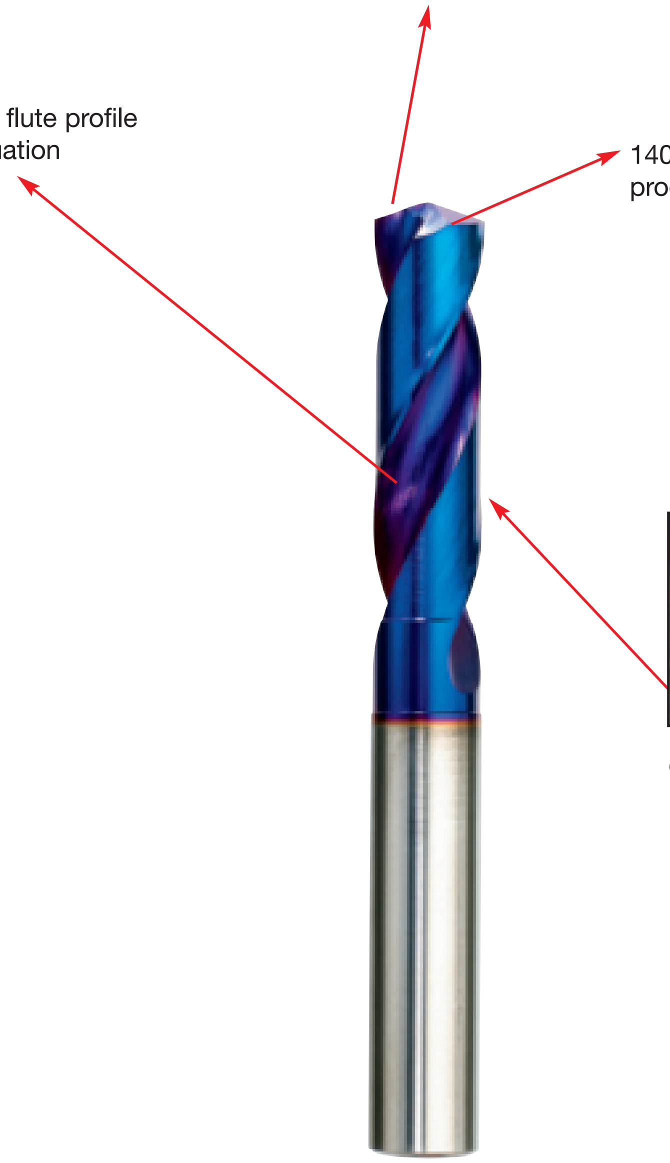
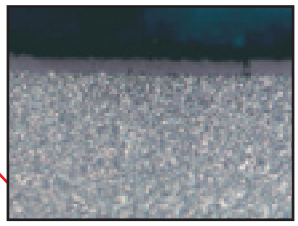
Features





Grade: HCT600

- TiAlN structure Nano
- Thickness 4 microns
- Wear resistance and limitation of the temperature diffusion

- Unique design in the market.
- The combination of the unique HARDCORE material, the specially designed tool geometry and a precise grinding process provides a tremendous productivity increase.

HardCore™ – Technical Information

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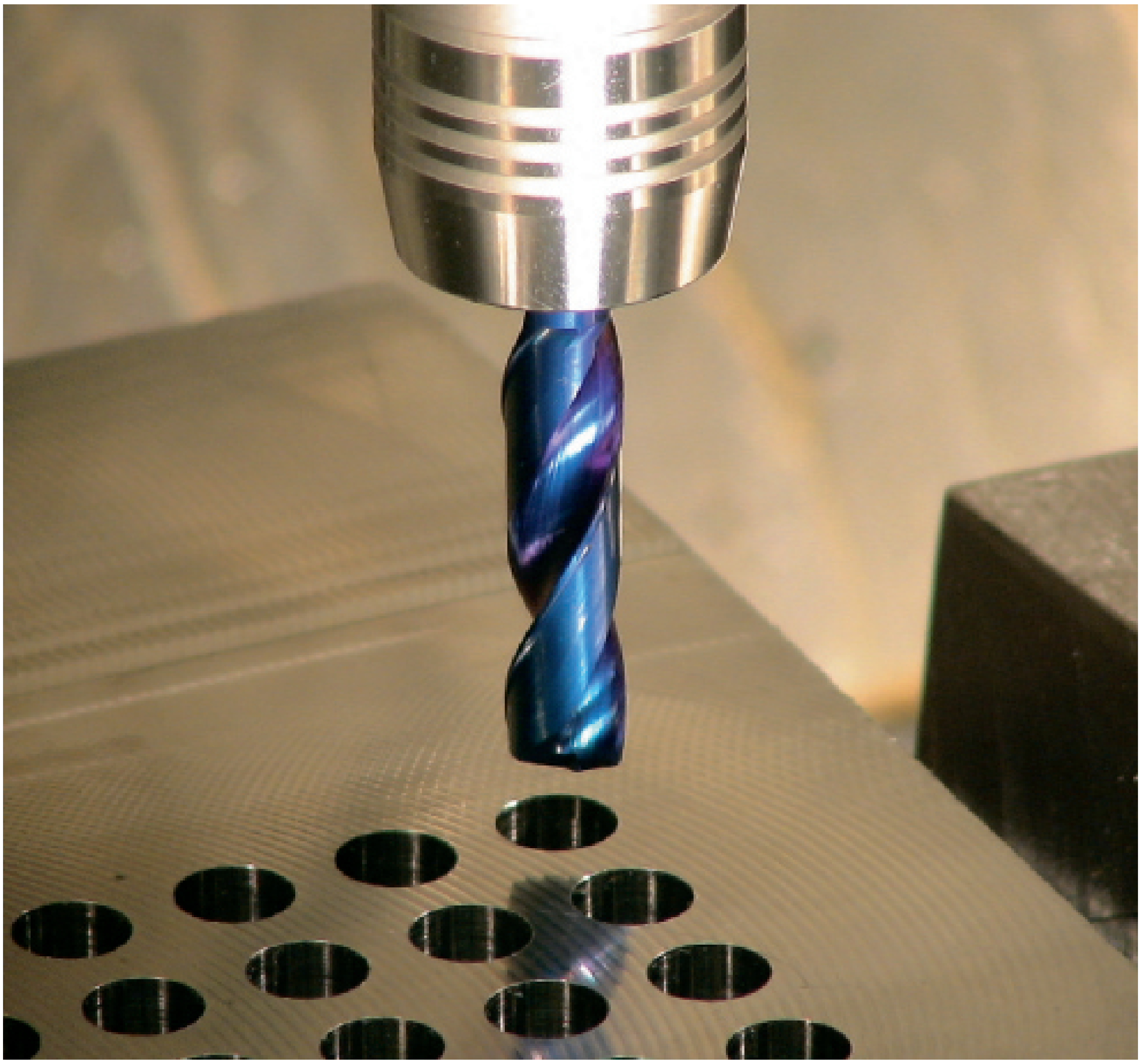

Recommended Cutting Conditions – Speed V_C and SFM

ISO	Family Material	R_m and Hardness	V_c SFM	Cutting Speed v_c (m/min) min-max/ SFM min-max			
				HCT600 301 Series		HCT600 501 Series	
				max	min	max	min
P	Unalloyed Steels	<600 N/mm² <180HBN	V_c	**150**	**74**	**131**	**65**
			SFM	492	243	430	213
		<950 N/mm² <280HBN	V_c	**132**	**60**	**116**	**53**
			SFM	433	197	379	172
	Alloyed Steels	700-950 N/mm² 200-280 HBN	V_c	**121**	**55**	**106**	**48**
			SFM	397	180	347	158
		950-1200 N/mm² 280-355 HBN	V_c	**110**	**50**	**96**	**44**
			SFM	361	164	316	144
		1200-1400 N/mm² 355-415 HBN	V_c	**75**	**34**	**66**	**30**
			SFM	247	112	216	98
K	Cast Irons	Grey GG-Ft	V_c	**150**	**68**	**132**	**60**
			SFM	493	224	431	196
		Spheroidal-Ductile GGG-FGS	V_c	**128**	**58**	**112**	**51**
			SFM	421	191	368	167
		Malleable GTS - MN/MP	V_c	**92**	**42**	**80**	**36**
			SFM	301	137	263	120
H	Hard Steels	>1400 N/mm² >415 HBN	V_c	**61**	**28**	**53**	**24**
			SFM	198	90	174	79
	Chilled Cast Irons	1400 N/mm² 400 HBN	V_c	**59**	**27**	**51**	**23**
			SFM	192	87	168	77

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Material Designations			
P Unalloyed Steels	M Stainless Steels	K Cast Irons	S High Temp. Alloys
P Alloyed Steels	M PH Stainless	N Aluminium & Alloys	H Hard Materials

HardCore – Technical Data

TECHNOLOGY BY ATI STELLRAM

Recommended Cutting Conditions – Feed Metric and Inch

ISO	Family Material	Rm and Hardness	Metric f_n = mm/min⁻¹: min. & max.													
			3	4	5	6	7	8	9	10	11	12	13	14	15	16
P	Unalloyed Steels	<600 N/mm² <180HBN	0.050 0.130	0.063 0.168	0.075 0.206	0.087 0.243	0.098 0.279	0.110 0.314	0.120 0.349	0.131 0.384	0.141 0.419	0.152 0.453	0.162 0.487	0.171 0.520	0.181 0.553	0.191 0.586
P	Unalloyed Steels	<950 N/mm² <280HBN	0.050 0.130	0.063 0.168	0.075 0.206	0.087 0.243	0.098 0.279	0.110 0.314	0.120 0.349	0.131 0.384	0.141 0.419	0.152 0.453	0.162 0.487	0.171 0.520	0.181 0.553	0.191 0.586
P	Alloyed Steels	700-950 N/mm² 200-280 HBN	0.050 0.120	0.063 0.154	0.075 0.187	0.087 0.219	0.098 0.251	0.110 0.282	0.120 0.312	0.131 0.342	0.141 0.372	0.152 0.401	0.162 0.430	0.171 0.458	0.181 0.487	0.191 0.515
P	Alloyed Steels	950-1200 N/mm² 280-355 HBN	0.050 0.110	0.061 0.140	0.071 0.170	0.081 0.198	0.090 0.226	0.099 0.253	0.108 0.280	0.116 0.306	0.124 0.332	0.132 0.357	0.140 0.383	0.147 0.407	0.154 0.432	0.161 0.456
P	Alloyed Steels	1200-1400 N/mm² 355-415 HBN	0.050 0.090	0.059 0.113	0.068 0.135	0.076 0.157	0.083 0.177	0.090 0.197	0.097 0.217	0.103 0.236	0.109 0.254	0.115 0.273	0.121 0.291	0.126 0.309	0.131 0.326	0.137 0.343
K	Cast Irons	Grey GG-Ft	0.080 0.150	0.102 0.183	0.123 0.214	0.144 0.244	0.164 0.271	0.184 0.298	0.204 0.324	0.223 0.348	0.241 0.372	0.260 0.396	0.278 0.419	0.296 0.441	0.314 0.463	0.332 0.484
K	Cast Irons	Spheroidal-Ductile GGG-FGS	0.080 0.120	0.101 0.151	0.120 0.181	0.139 0.209	0.158 0.236	0.175 0.263	0.193 0.289	0.210 0.314	0.226 0.339	0.243 0.364	0.259 0.388	0.274 0.412	0.290 0.435	0.305 0.458
K	Cast Irons	Malleable GTS - MN/MP	0.080 0.120	0.099 0.147	0.116 0.172	0.133 0.195	0.148 0.217	0.164 0.238	0.178 0.259	0.193 0.279	0.207 0.298	0.220 0.317	0.233 0.335	0.246 0.353	0.259 0.370	0.272 0.387
H	Hard Steels	>1400 N/mm² >415 HBN	0.040 0.080	0.048 0.100	0.054 0.118	0.061 0.135	0.067 0.152	0.072 0.169	0.077 0.184	0.082 0.200	0.087 0.215	0.092 0.229	0.096 0.244	0.101 0.258	0.105 0.272	0.109 0.286
H	Chilled Cast Irons	1400 N/mm² 400 HBN	0.040 0.090	0.048 0.112	0.054 0.133	0.061 0.152	0.067 0.171	0.072 0.190	0.077 0.207	0.082 0.225	0.087 0.242	0.092 0.258	0.096 0.274	0.101 0.290	0.105 0.306	0.109 0.321

ISO	Family Material	Rm and Hardness	Inch f_n = Inch/rev.													
			0.118	0.157	0.197	0.236	0.276	0.315	0.354	0.394	0.433	0.472	0.512	0.551	0.591	0.630
P	Unalloyed Steels	<600 N/mm² <180HBN	0.0020 0.0051	0.0025 0.0066	0.0030 0.0081	0.0034 0.0096	0.0039 0.0110	0.0043 0.0124	0.0047 0.0138	0.0052 0.0151	0.0056 0.0165	0.0060 0.0178	0.0064 0.0192	0.0068 0.0205	0.0071 0.0218	0.0075 0.0231
P	Unalloyed Steels	<950 N/mm² <280HBN	0.0020 0.0051	0.0025 0.0066	0.0030 0.0081	0.0034 0.0096	0.0039 0.0110	0.0043 0.0124	0.0047 0.0138	0.0052 0.0151	0.0056 0.0165	0.0060 0.0178	0.0064 0.0192	0.0068 0.0205	0.0071 0.0218	0.0075 0.0231
P	Alloyed Steels	700-950 N/mm² 200-280 HBN	0.0020 0.0047	0.0025 0.0061	0.0030 0.0074	0.0034 0.0086	0.0039 0.0099	0.0043 0.0111	0.0047 0.0123	0.0052 0.0135	0.0056 0.0146	0.0060 0.0158	0.0064 0.0169	0.0068 0.0180	0.0071 0.0192	0.0075 0.0203
P	Alloyed Steels	950-1200 N/mm² 280-355 HBN	0.0020 0.0043	0.0024 0.0055	0.0028 0.0067	0.0032 0.0078	0.0036 0.0089	0.0039 0.0100	0.0042 0.0110	0.0046 0.0121	0.0049 0.0131	0.0052 0.0141	0.0055 0.0151	0.0058 0.0160	0.0061 0.0170	0.0064 0.0180
P	Alloyed Steels	1200-1400 N/mm² 355-415 HBN	0.0020 0.0035	0.0023 0.0045	0.0027 0.0053	0.0030 0.0062	0.0033 0.0070	0.0035 0.0078	0.0038 0.0085	0.0041 0.0093	0.0043 0.0100	0.0045 0.0107	0.0047 0.0115	0.0050 0.0122	0.0052 0.0128	0.0054 0.0135
K	Cast Irons	Grey GG-Ft	0.0031 0.0059	0.0040 0.0072	0.0049 0.0084	0.0057 0.0096	0.0065 0.0107	0.0072 0.0117	0.0080 0.0127	0.0088 0.0137	0.0095 0.0147	0.0102 0.0156	0.0110 0.0165	0.0117 0.0174	0.0124 0.0182	0.0131 0.0191
K	Cast Irons	Spheroidal-Ductile GGG-FGS	0.0031 0.0047	0.0040 0.0059	0.0047 0.0071	0.0055 0.0082	0.0062 0.0093	0.0069 0.0104	0.0076 0.0114	0.0083 0.0124	0.0089 0.0134	0.0095 0.0143	0.0102 0.0153	0.0108 0.0162	0.0114 0.0171	0.0120 0.0180
K	Cast Irons	Malleable GTS - MN/MP	0.0031 0.0047	0.0039 0.0058	0.0046 0.0068	0.0052 0.0077	0.0058 0.0085	0.0064 0.0094	0.0070 0.0102	0.0076 0.0110	0.0081 0.0117	0.0087 0.0125	0.0092 0.0132	0.0097 0.0139	0.0102 0.0146	0.0107 0.0152
H	Hard Steels	>1400 N/mm² >415 HBN	0.0016 0.0031	0.0019 0.0039	0.0021 0.0046	0.0024 0.0053	0.0026 0.0060	0.0028 0.0066	0.0030 0.0073	0.0032 0.0079	0.0034 0.0085	0.0036 0.0090	0.0038 0.0096	0.0040 0.0102	0.0041 0.0107	0.0043 0.0112
H	Chilled Cast Irons	1400 N/mm² 400 HBN	0.0016 0.0035	0.0019 0.0044	0.0021 0.0052	0.0024 0.0060	0.0026 0.0067	0.0028 0.0075	0.0030 0.0082	0.0032 0.0088	0.0034 0.0095	0.0036 0.0102	0.0038 0.0108	0.0040 0.0114	0.0041 0.0120	0.0043 0.0126

Star Guide

Material Designations

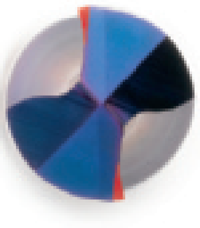
P Unalloyed Steels	M Stainless Steels	K Cast Irons	S High Temp. Alloys
P Alloyed Steels	M PH Stainless	N Aluminium & Alloys	H Hard Materials

HardCore – Drills Set Up

Tool holding:
Keep the total indicated run-out within 0,02mm (0.0008 inch) for drills with whistle notch shank.

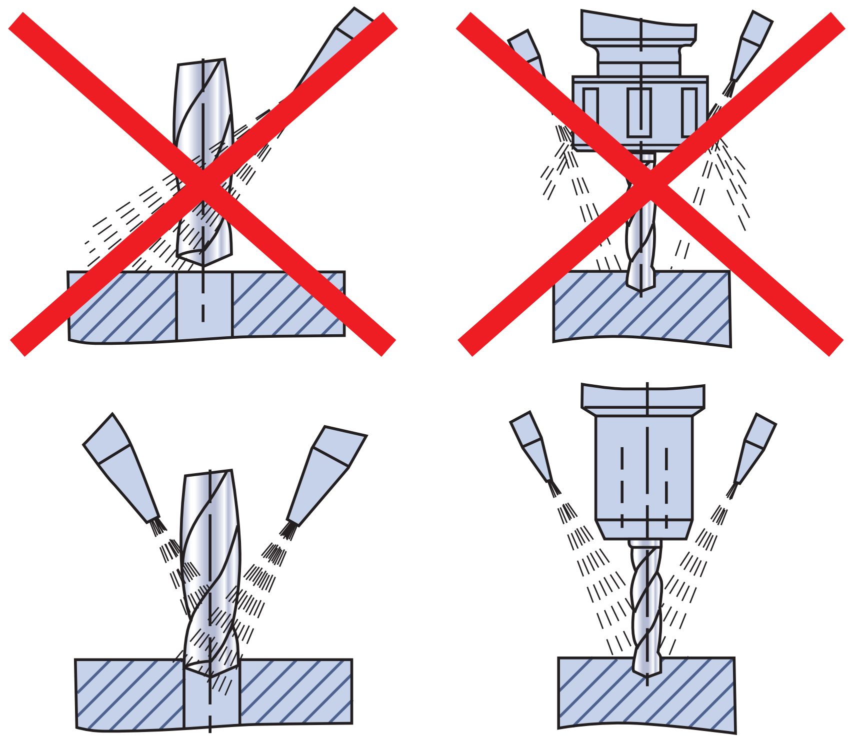
Drills with cylindrical shanks can be used with high precision collet chucks, hydraulic chucks or shrink fit holders. First choice is hydraulic chucks or shrink fit holders. For best result keep run-out < 0,02mm (0,0008 inch).

Stability:
The stability of the application is important to achieve the best performance in tool life and hole accuracy. Before starting with the drilling operation check the machine and spindle condition, the fixture of the drill and the clamping of the component to secure maximum stability and rigidity.



0,2 – 0,3 mm (0.078 – 0.011 inch)

Coolant recommendation



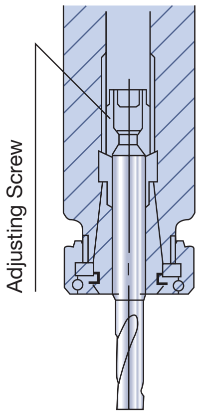
Hole depth < 3 x D min. 8 – 10 bar
Hole depth > 3 x D min. 10 – 15 bar

Minimum recommended emulsion mix strength = 6% - 8%.

For high temperature alloys and stainless steels minimum recommended emulsion mix strength = > 10%.

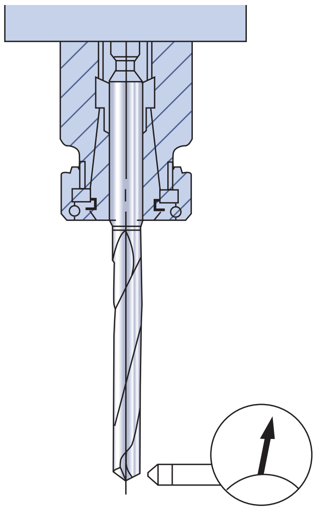
HardCore – Operational guidelines

Toolholding



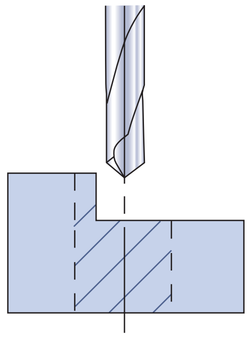
Thrust bearing type collet chuck
holds the drill securely

Run out tolerance



Runout ≤ 0,02 mm
≤ 0.0008 inch

Interrupted cut



Requires prior drilling

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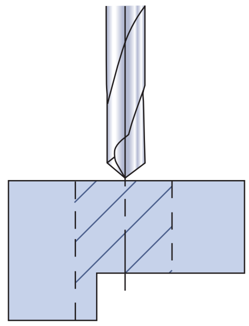
- Spot face with an end mill prior to drilling.



One Process

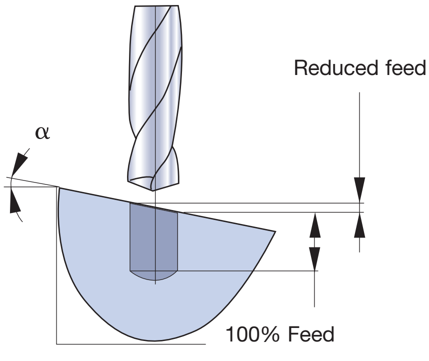
○

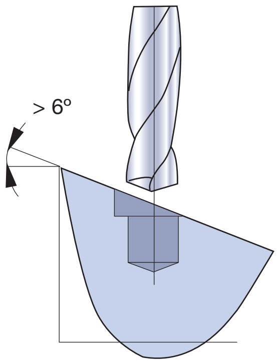
- Lower feed when drilling interupted part.

Drilling on inclined surfaces

Inclined or curved surfaces recommend a lower feed rate than the standard value.
Inclination angle of the workpiece surface (and the type of drill) have an influence on the feed reduction.

By a max. surface inclination < 4° the feed needs to be reduced by 50%.
More inclined surfaces than > 4° must be pre-machined with a mill.

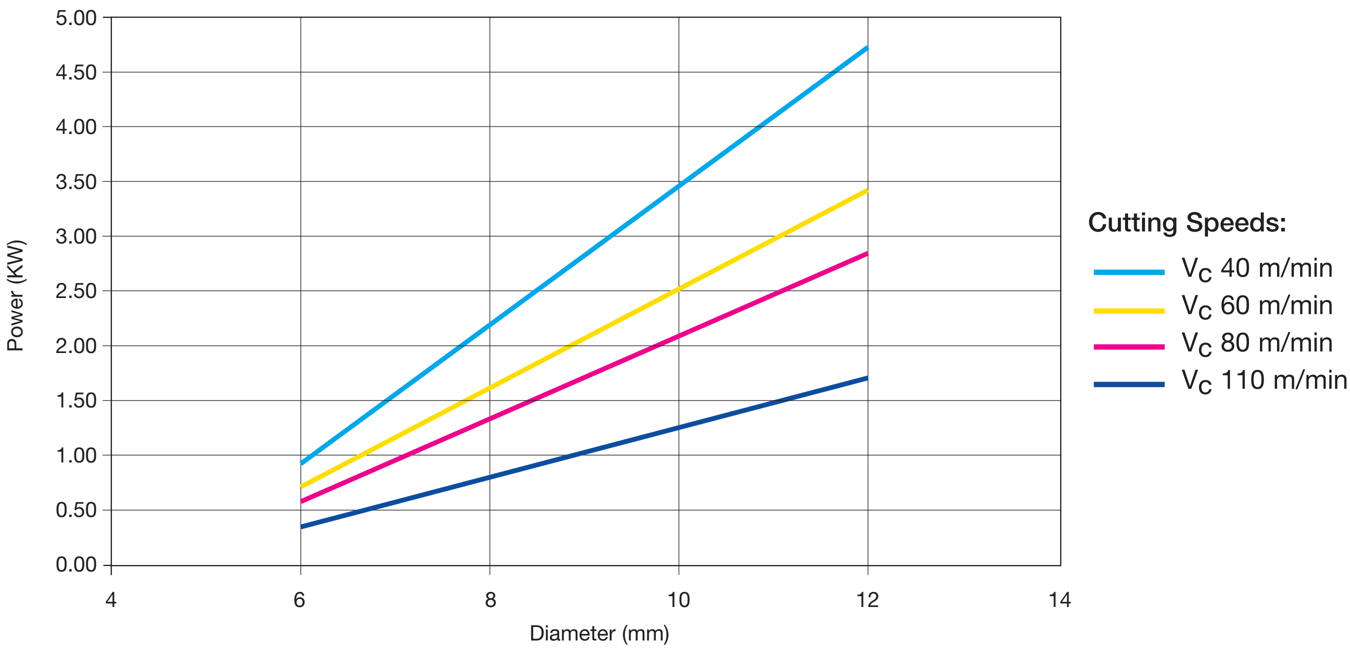




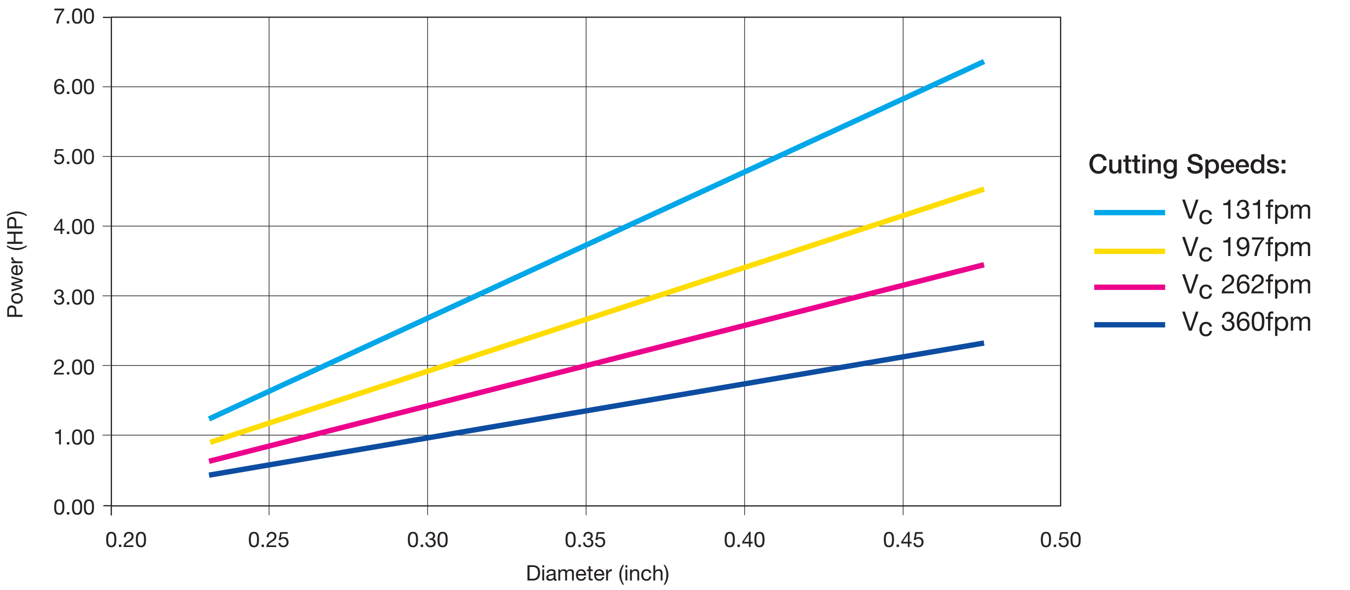
Drilling on Turning Machines

- When drilling on turning machines the drill must be on centre.
- The tolerance range of the centre position should not exceed ±0,01 mm (0.0004 inch).
- On bar-turning lathes do not drill into centre pips or test drill holes.
- Cut-off tools must be mounted precisely.

Hardcore: Power consumption for Alloyed Steel 300HBN



Hardcore: Power consumption for Alloyed Steel 300HBN



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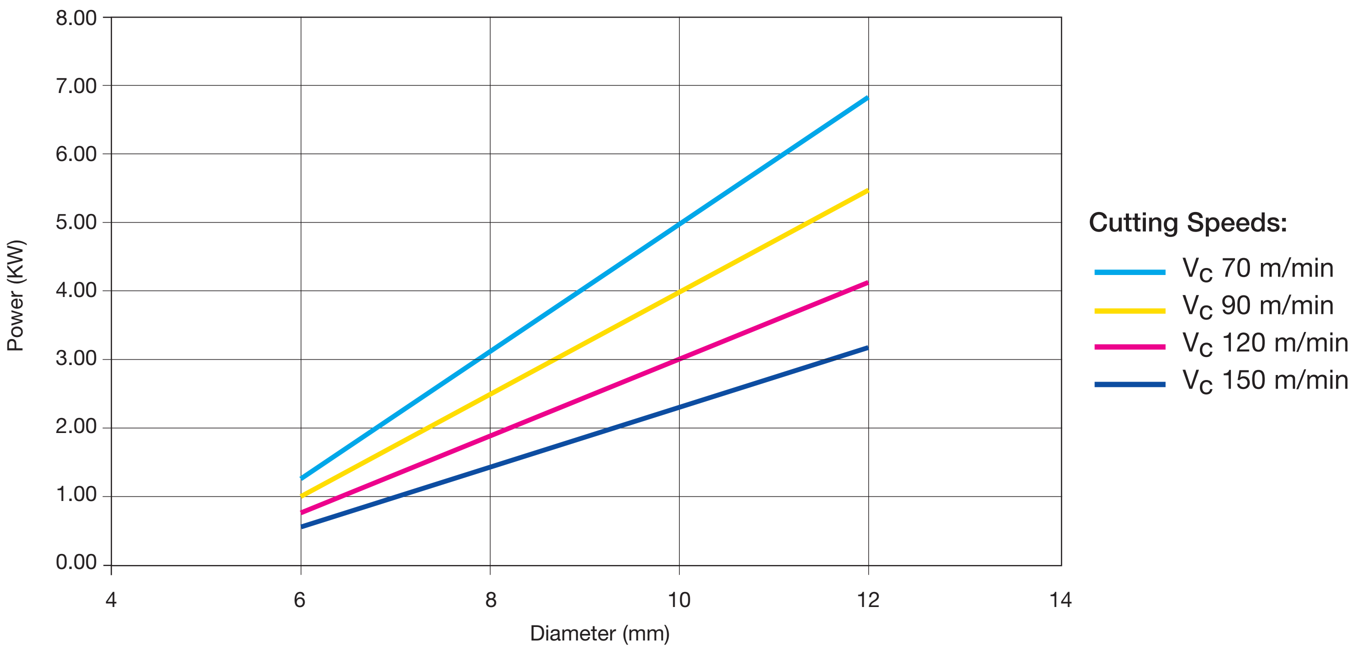
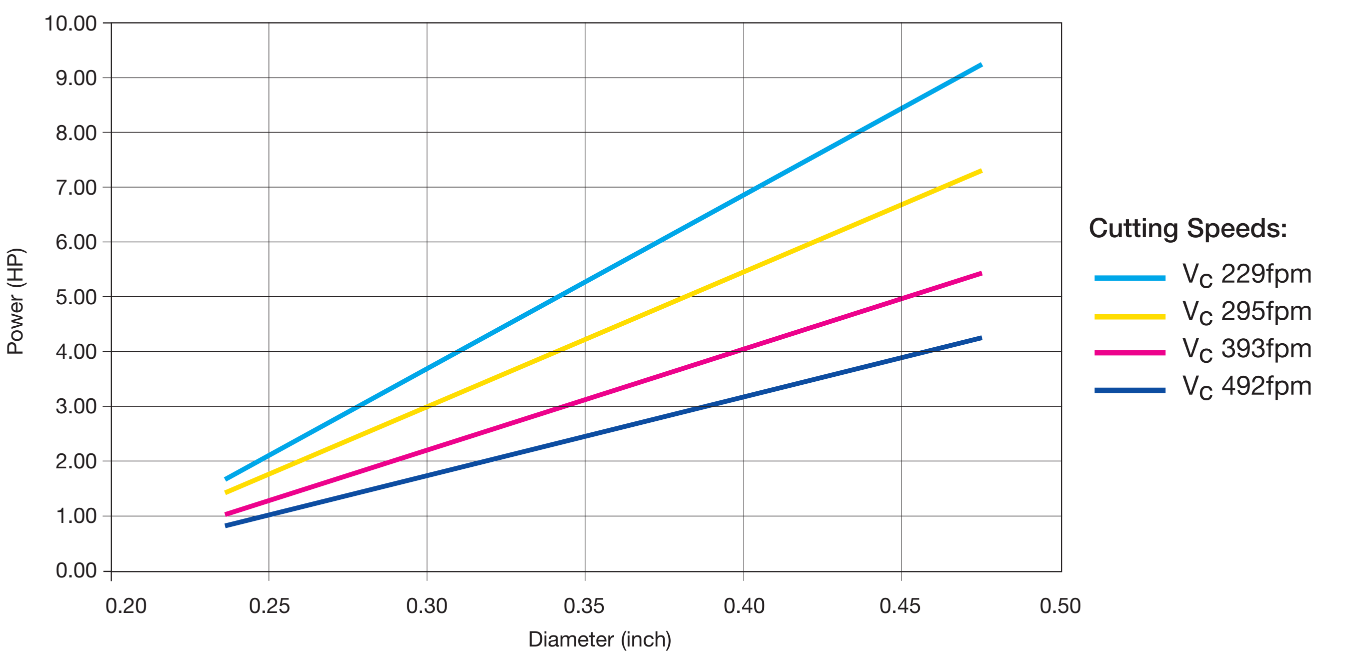
Material Designations							
P	Unalloyed Steels	M	Stainless Steels	K	Cast Irons	S	High Temp. Alloys
P	Alloyed Steels	M	PH Stainless	N	Aluminium & Alloys	H	Hard Materials

HardCore – Power Requirement Guidelines

Hardcore: Power consumption for Grey Iron 200HBN



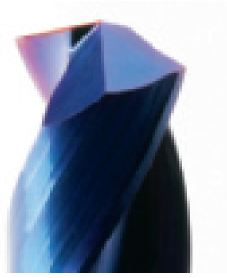
Hardcore: Power consumption for Grey Iron 200HBN



Star Guide

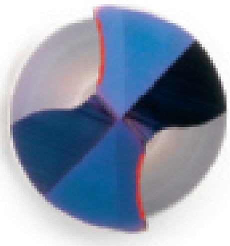
Material Designations			
P Unalloyed Steels	M Stainless Steels	K Cast Irons	S High Temp. Alloys
P Alloyed Steels	M PH Stainless	N Aluminium & Alloys	H Hard Materials

HardCore – Troubleshooting



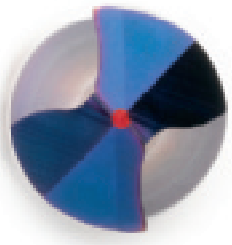
Cutting edge build up

- Increase the cutting speed
- Increase the coolant concentration
- Regrinding



Chipping on cutting face

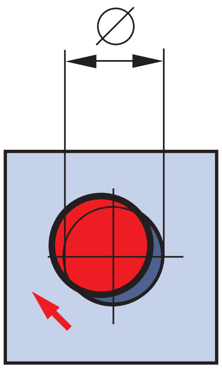
- Prove the machine spindle and tool holder quality
- Check the clamping and the fixture of the component
- Reduce the feed
- Reduce tool life change
- Regrinding



Heavy wear on chisel / centre chipping

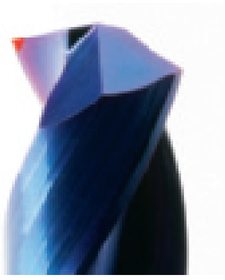
- Prove the machine spindle and tool holder quality
- Check the clamping and the fixture of the component
- Check the concentricity of the drill max.0,02mm (0.0008 inch)
- Reduce the feed during entrance
- Reduce the feed

– Troubleshooting *Continued..*



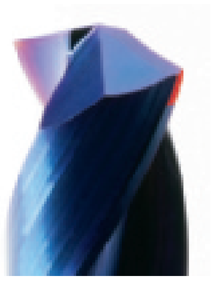
Misalignment / poor tolerance

- Prove the machine spindle and tool holder quality
- Check the clamping and the fixture of the component
- Check the concentricity of the drill maximum 0,02 mm (0.0008 inch)
- Reduce feed during entrance
- Reduce feed
- Increase the coolant concentration and pressure
- Regrinding



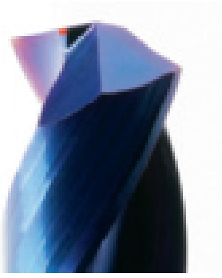
Chipping external corners

- Prove the machine spindle and tool holder quality
- Check the clamping and the fixture of the component
- Increase the coolant concentration
- Reduce the cutting speed
- Reduce the feed during entrance
- Regrinding



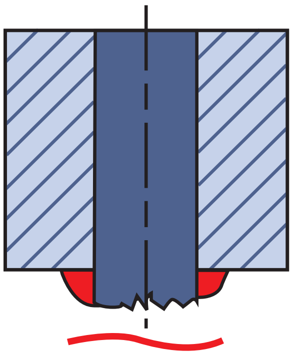
Periphery land wear

- Prove the machine spindle and tool holder quality
- Check the clamping and the fixture of the component
- Check the concentricity of the drill maximum 0,02 mm (0.0008 inch)
- Increase the coolant concentration
- Reduce the cutting speed



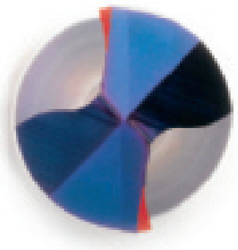
Chipping at intersection, web thinning and cutting lip

- Check the concentricity of the drill maximum 0,02 mm (0.008 inch)
- Proof the machine spindle and tool holder quality
- Regrinding



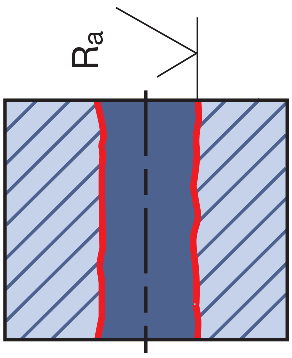
Heavy burr on breakthrough

- Reduce the feed
- Reduce tool life change
- Regrinding



Excessive flank wear

- Reduce the cutting speed
- Increase the feed
- Prove the machine spindle and tool holder quality
- Check the clamping and the fixture of the component
- Increase the coolant concentration



Poor surface quality

- Prove the machine spindle and tool holder quality
- Check the clamping and the fixture of the component
- Increase the coolant concentration and pressure
- Check the concentricity of the drill max.0,02mm (0,0008 inch)

Cutting speed (m/min)	$V_c = \frac{n \times D \times \pi}{1000}$	**SFM =** $V_c \times 3{,}28$
RPM (rev/min)	$n = \frac{V_c \times 1000}{\pi \times D}$	
Feed (mm/rev)	$f = \frac{V_f}{n}$	**Feed (inch/rev) =** $\frac{f\ (mm)}{25{,}4}$
Feed speed (mm/min)	$V_f = f \times n$	
Material removal rate (cm³/min)	$Q = \frac{V_f \times AT}{1000}$	
Cross section area of the hole (mm²)	$AT = \frac{\pi \times D^2}{4} \times \sin k_r$	
Torque (Nm)	$M_c = \frac{f \times k_c}{1000} \times \frac{D^2}{8} \times k_c \times \sin k_r$	
Power requirement (KW)	$P_c = \frac{Q}{6000 \times \eta}$	
Machining time (min/piece)	$T_c = \frac{L + h}{V_f}$	

Legend:

K_c = Specific cutting force (N/mm²)

L = Drilling depth (mm)

h = Safety Distance (mm)

η = Machine efficiency (%)

$k_r = \frac{\text{Point Angle}}{2}$