outiltec
Member IMC Group

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IMC
INT'L METALWORKING COMPANIES

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Outiltec Eurl was established in 1981. Today the IMC company operates in a modern facility in the heart of Europe, in the small French town of Soufflenheim near Strasbourg.
The company produces a range of standard and special cutting tools including reamers, drills and profiling tools.
Outiltec is best known for its gundrills used for drilling deep holes. The **Outiltec** gundrills come in a range of standard sizes and designs. Also available are specially tailored tools according to the customer's specifications.

Brazed Special Reamers

Outiltec has a wide range of solutions for tailor made reamers, carbide or cermet brazed inserts.
Range Ø6-220 mm

Brazed Combined Reamers

Solutions of reamers combined with drills or with carbide or cermet inserts.
Range up to Ø250 mm

Solid Carbide Special Reamers

Designed with or without coolant holes,
coated or uncoated, straight or helical.
Range Ø3-60 mm

Brazed Counter Bores

Counter bores are common in the
hydraulic engines or pumps industries.
A standard SAE counter bore is available
by **Outiltec.**

Solid Carbide Milling Cutters

For finishing with special shape, cylindrical, tapered, stepped, coated or uncoated.
Range Ø3-60 mm

Brazed Milling Cutters

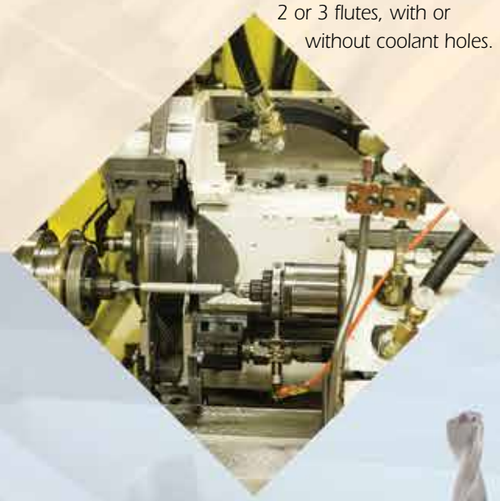
The aerospace industry is well-known for its exotic materials applications.
Range up to Ø200 mm

Extra Long Drills

Dedicated design of extra long drills.
Range:
Ø5 and up
Length up to 330 mm

Solid Carbide Drills

All kinds of drilling application solutions. Coated or uncoated, stepped, straight or helical, with 2 or 3 flutes, with or without coolant holes.



Profiling Tools

Solid carbide or brazed profiling tools are popular in applications where the indexable solution is not possible. Economical solutions for the bearing industry. This family includes recessing tools.

Indexable Milling Cutter Heads

High accuracy of tailor made indexable milling heads.

Solid Carbide Gundrills

Stronger than the brazed solution, the solid carbide gundrill can achieve much better straightness and quality surface with 1,5 to 3 times faster feed rate.
Range Ø0.9-16 mm

Brazed Gundrills

Standard and special gundrills up to Ø40 mm. Short delivery time for the standard design.
Range Ø2.5-20 mm

Single Flute Gundrill

OUTILTEC's gundrill consists of a single piece carbide head, a streamlined shank and a driver through which coolant flows to the working end where it is most needed.
Chips are evacuated along the V-shaped external flute.

Drilling Head
The carbide head is tapered on its length to reduce friction. The taper angle depends on the type of material to be drilled.
For high precision drilling, the taper should be reduced to a minimum.
Note that when the head is resharpened, the diameter of the drill changes, affecting the hole tolerance.

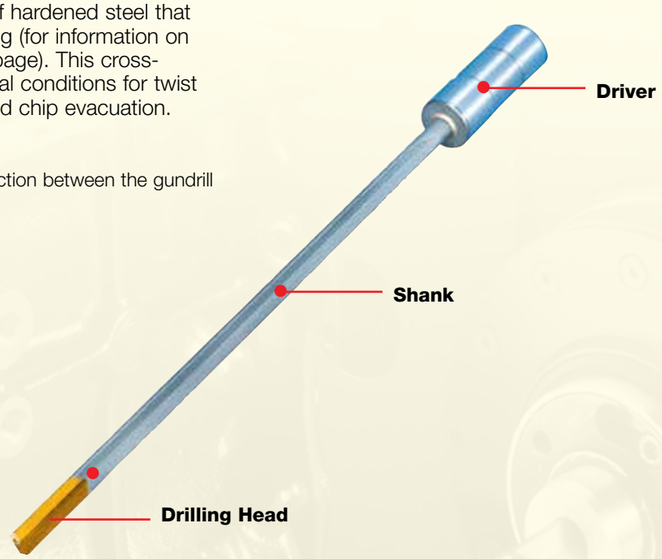
Shank
The cross-section of the shank is V-shaped with coolant holes. It is made of hardened steel that is highly resistant to twisting (for information on carbide shanks, see next page). This cross-section provides the optimal conditions for twist resistance, coolant flow and chip evacuation.

Driver
The driver ensures the connection between the gundrill and the machine tool.

Carbide Tipped Gundrill Range

Drill Diameter	Max. Flute Length
2.50 to 3.09	1100
3.10 to 5.99	2500
6.00 to 11.39	3000
11.40 to 40.00	3500

Overall length=flute length+driver length



Advantages
- Drilling precision of IT7 to IT9 tolerances can be reached.
- Excellent straightness and concentricity.
- Maintains high precision hole center alignment.
- Surface roughness of R0.4 - R1.6 is easily obtained.
- Reboring operations are often unnecessary.

OUTILTEC's advanced gundrill technology provides superior geometric and dimensional quality for both deep and shallow drilling.
The drills are available in the range of 2.5 to 40 mm.

Outiltec Single Flute Solid Carbide Gundrills

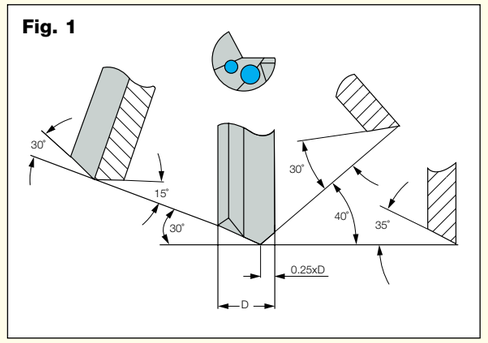
Another type of gundrill is made with integral tip and shank, made of solid carbide with either a steel or a carbide driver.
These drills are designed for conventional machines, machining centers and lathes. This style of gundrill is available from 0.9-16 mm and can be used on various types of materials. It provides superior rigidity and optimal coolant flow rates. As a result of its rigidity, up to 100% higher feed rate can be reached.
When using the small diameter drills, it is crucial to adhere closely to recommended drilling parameters.

Solid Carbide Gundrill Range
(with or without brazed steel driver)

Drill Diameter	Max. Flute Length
0.9 to 16.00	300 mm

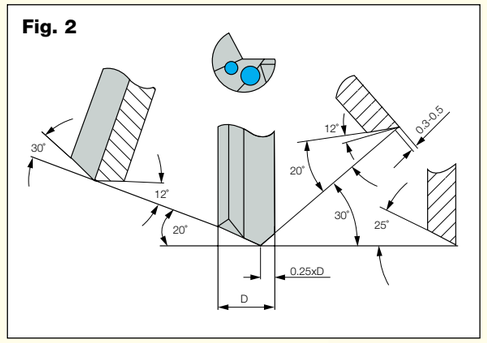
Standard Gundrill Head Sharpening Angles
Subject to the required tolerance, cutting performance and desired chip shape, the following standard sharpening angles are recommended (shown in figures 1 and 2).

Fig. 1



Standard sharpening for 0.9 to 4 mm drill diameters

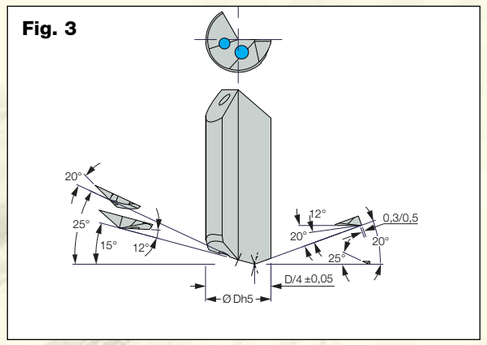
Fig. 2



Standard sharpening for 4 to 32 mm drill diameters

Note: For special or semi-standard gundrills, special geometries will be offered to match the application.

Fig. 3



Standard sharpening for 32 to 40 mm drill diameters

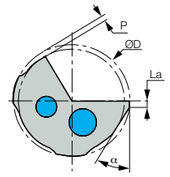
DEEP HOLE DRILLS

Outiltec Standard Gundrill Head Profiles

Drilling capacity and finish of the drilled hole are dependent on the geometrical shape of the drill head. Both the profile and the sharpening must be matched to the workpiece material. The profile is defined when the tool is manufactured. Although regrinding may change the cutting geometry, the profile should remain the same.

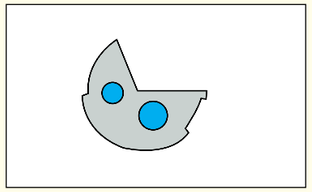
General Sketch

All cross section profile parameters such as: P, La and a must be precisely matched to the workpiece material properties.



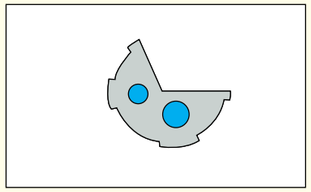
Profile G (Universal)

Standard form for most material types, particularly for materials with a tendency to shrink. Recommended for high precision bore tolerance and straightness. Maintains precise exit hole size. Recommended when extra burnishing is required.



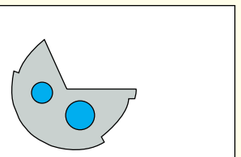
Profile A

Suitable for cast iron (usually coated) and aluminum alloys. Can be used for cross drilling, angular entry or exit and for interrupted cut. Large coolant gaps between pads.



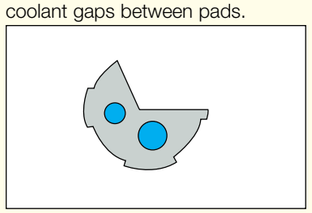
Profile B

Excellent size control, for high precision hole tolerance. Used for cast iron and aluminum alloys.



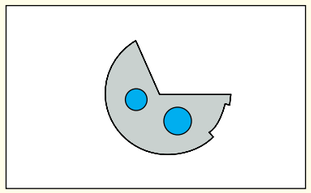
Profile C

Used for angled entry or exit. Large back taper, for shrinking materials such as some kinds of alloys and stainless steel. Large coolant gaps between pads.



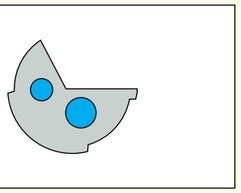
Profile D

Suitable for cast iron only. Very effective in grey cast iron (usually coated).



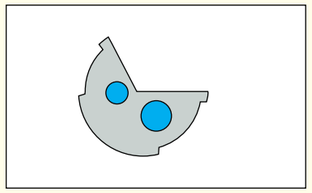
Profile E

General use, for alloys and stainless steel. This profile eliminates the problem of the tool sticking in the hole after the outer corner dulls. Especially suitable for crankshaft and other forged materials. Recommended for accurate hole straightness.



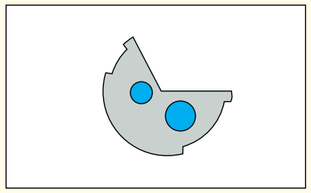
Profile H

Recommended for all nonferrous and cast iron materials up 5 mm diameter. Sometimes used for wood and plastic with larger back taper.



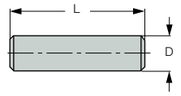
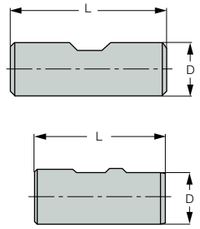
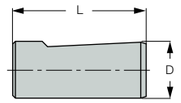
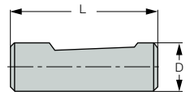
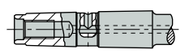
Profile I

Used for aluminum and brass for best hole finish. For intersecting holes and interrupted cut or when extra outer diameter support and burnishing is required.



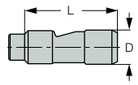
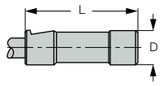
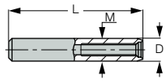
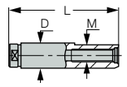
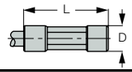
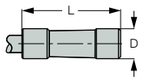
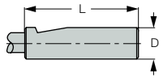
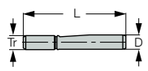
DEEP HOLE DRILLS

Standard Gundrill Drivers for Machining Centers, Lathes, etc.

Driver Type	Drawing	øD x L	Driver Code	Carbide Tipped Gundrills	Solid Carbide Gundrills
Cylindrical DIN1835A DIN6535HA		4x28	01	●	●
		5x28	02		●
		6x36	03	●	●
		8x36	04	●	●
		10x40	05	●	●
		12x45	06	●	●
		.50x1.78”	94	●	●
		14x45	07		●
		16x48	08	●	●
		18x48	09	●	●
		.75x2.03”	95	●	●
		20x50	10	●	
		25x56	11	●	
		1.00x2.28”	96	●	●
		1.25x2.28”	97	●	●
		32x60	12	●	
		40x70	13	●	
		50x80	14	●	
		63x90	15	●	
Weldon DIN1835B DIN6535HB		6x36	16	●	
		8x36	17	●	
		10x40	18	●	●
		12x45	19	●	●
		.50x1.78”	98		
		16x48	20	●	●
		18x48	21	●	●
		.75x2.03”	99	●	●
		20x50	22	●	●
		25x56	23	●	
		1.00x2.28”	100	●	●
		1.25x2.28”	101	●	●
		32x60	24	●	
		40x70	25	●	
		50x80	26	●	
		63x90	27	●	
Whistle Notch DIN1835E		6x36	28	●	
		8x36	29	●	
		10x40	30	●	●
		12x45	31	●	●
		16x48	32	●	●
		18x48	33	●	●
		20x50	34	●	●
		25x56	35	●	
		32x60	36	●	
		40x70	37	●	
Whistle Notch DIN6535HE		6x36	38	●	
		8x36	39	●	
		10x40	40	●	●
		12x45	41	●	●
		16x48	42	●	●
		18x48	43	●	●
		20x50	44	●	●
DIN228AK		CM1	45		
		CM2	46		
		CM3	47		
		CM4	48		
DIN228BK		CM1	49		
		CM2	50		
		CM3	51		
		CM4	52		

● Recommended style

Standard Drivers for Gundrill Machines

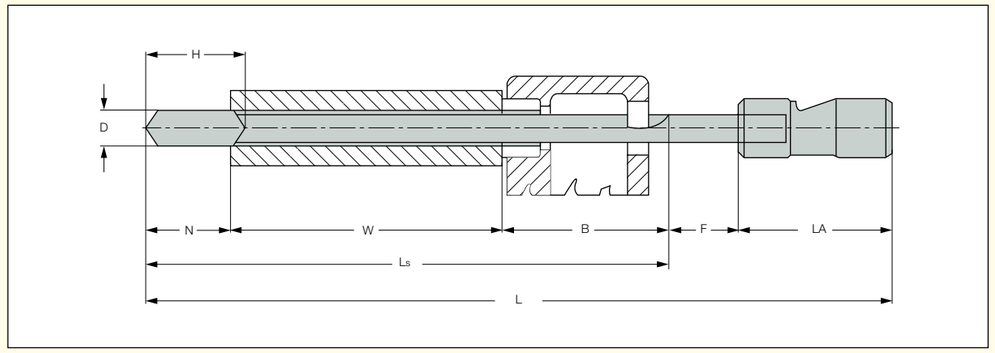
Driver Type	Drawing	øD x L	Driver Code	Carbide Tipped Gundrills	Solid Carbide Gundrills
Central Clamping Surface 15°		6x30	53		●
		10x40	54	●	●
		16x45	55	●	
		.750x2.75”	56	●	
		25x70	57	●	
		1.00x2.75”	58	●	
		1.25x2.75”	59	●	
		1.50x2.75”	60	●	
Frontal Clamping Surface 15°		16x50	61	●	
Cylindrical with Thread		10x50 M6X0.5	62		●
		10x60 M6X0.5	63	●	
		.50x1.97” M6x0.5	64		●
		16x80 M10X1	65	●	●
		25x100 M16x1.5	66	●	
		36x120 M24x1.5	67	●	
VDI Design		10x68 M6x0.5	68	●	
		16x90 M10x1	69	●	●
		25x112 M16x1.5	70	●	
		36x135 M24x1.5	71		
Central Clamping Hexagonal		25x70	72	●	
		32x70	73	●	
Central Clamping Tapered		.50x1.50”	74	●	●
		16x70	75	●	●
		.75x2.75”	76	●	
		20x70	77	●	●
Frontal Clamping Surface 2°		.50x1.50”	78	●	
		.75x2.75”	79	●	
		1.00x2.75”	80	●	
		1.00x3.94”	81	●	
		1.25x2.75”	82	●	
		1.25x3.94”	83	●	
		1.50x2.75”	84	●	
		1.50x3.94”	85	●	
Trapezoidal Thread		16x112 Tr 16x1.5	86	●	
		20x126 Tr 20x2	87	●	
		28x126 Tr 28x2	88	●	
		36x162 Tr 36x2	89	●	
Spraymist Driver		16x40	90	●	
		25x50	91	●	
		35x60	92	●	

● Recommended style

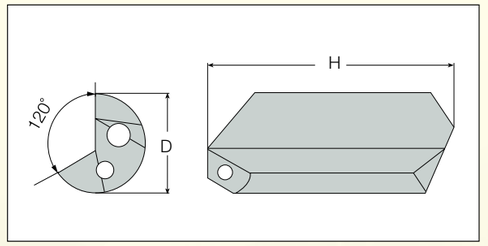
Drivers

Drivers are available for dedicated and CNC machines, for any specified diameter and length. Below are the driver codes and technical data.

Standard Gundrill Length Calculation



Standard Gundrill Carbide Head Length



Diameter Range	Head Length
2.50-3.80	20
3.80-4.05	23
4.05-5.05	25
5.05-6.55	30
6.55-11.05	35
11.05-18.35	40
18.35-21.35	45
21.35-23.35	50
23.35-26.35	55
26.35-32.00	65

Note: regrindable length=H-D

D = Cutting diameter
H = Carbide length
N = Regrinding area = H-D
W = Hole depth
B = Chip evacuation area
= For typical gundrill machines, 250 mm
= For machining centers, 2xD (minimum 15 mm)
F = 10 mm
LA = Driver length
LS = Flute length
L = Overall length

Example

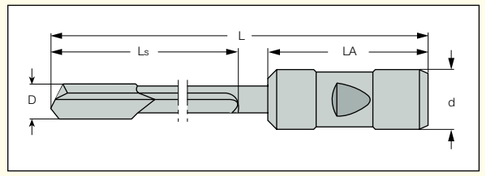
Drilling of a ø10x500 depth hole on a gundrill machine with ø25x70 mm driver code No. 57
D=10 W=500 LA=70 B=250 (or per experience)
L=N+W+B+F+LA
L=(35-10)+500+250+13+70=858 (OAL)
Ls=N+W+B=770 (flute length)

Ordering Code

For example:
D and Ls are available as standard
STGD-10000-0858-57-IC08

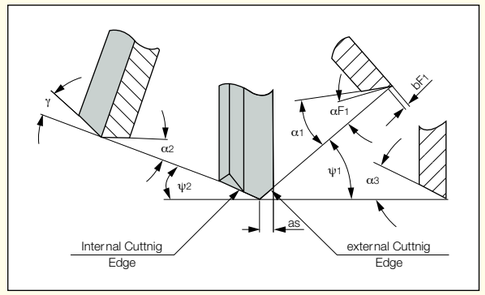
Gundrill Inquiry Form

1. Tool
Quantity.....
Nominal diameter and tolerance .....
Please fill in dimensions on the sketch below.



Driver
▫ Code No.
▫ Special, please attach sketch and specifications.

Grind:: Special (fill in the dimensions and angles below).

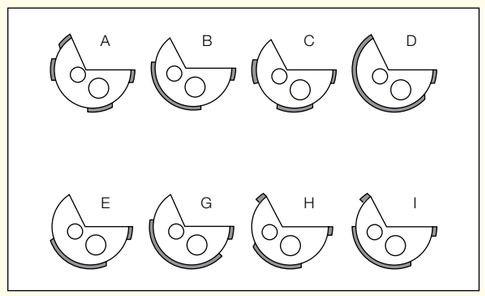


$\alpha_{1=}$ ..... $\alpha F_{1=}$ ..... $\psi_{1=}$ .....
$\alpha_{2=}$ ..... $bF_{1=}$ ..... $\psi_{2=}$ .....
$\alpha_{3=}$ ..... $as_{=}$ ..... $\gamma_{=}$ .....

▫ Standard

Coating:
▫ TiN : TiCN : TiN+TiCN : TiAlN : Other
▫ IC208 (TiN) : IC308 (TiCN) : IC508 (TiCN+TiN)
▫ IC908 (TiAlN)

Type:
Please circle the required type.



2. Workpiece
(If possible, please attach a drawing)
2.1 Material
Material description (DIN material number or any other standard):

.....
Hardness and Properties:
.....
▫ Short Chips ▫ Long Chips

2.2 Hole Type
▫ Blind Hole ▫ Drilling into Pre-hole ▫ Angled Entry
▫ Drilling into Solid ▫ Boring ▫ Angled Exit
Drilling Depth mm Hole Tolerance

2.3 Application:
Workpiece:: Stationary : Rotating
Tool : Stationary : Rotating

3. Machine
3.1 Technical Data
Machine Type.....
Power: ..... kW .....

3.2 Cutting Data:
Cutting Speed V_c ..... m/min .....
Revolutions **N**min ..... RPM, **N**max ..... RPM
Feed **F**min..... mm/rev,
Fmax..... mm/rev.....
Feed Rate **VF** ..... mm/min .....

Coolant:
▫ Oil ▫ Soluble Oil : Other
Coolant Pressure: ..... Bar .....

Sketch of drilling application

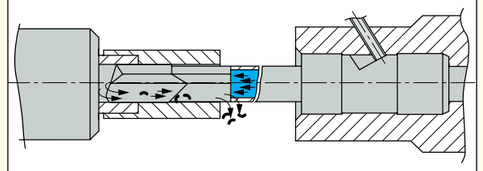
Note: It may be necessary to change several of the parameters that you indicated, based on our experience with your application.

DEEP HOLE DRILLS

Typical Gundrill Applications

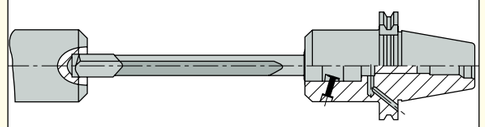
Main Drilling Methods

Figure 1



Guide Barrel

Figure 2



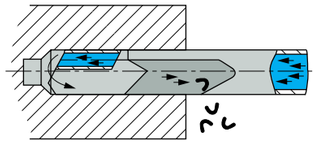
Pre-Drilled Guide Hole

User Guide

The gundrill is not a self-centering tool. Therefore an external means must be used to guide it to the point of entry into the workpiece.
It is recommended that the machine tool be equipped with a means for guiding the gundrill, preferably during the entire drilling process.
An alternative method is a pre-drilled guide hole (figure 2), which is common for machining centers. Once the drill has been fully engaged into this hole, it continues to be self-guided.
The guide pads contribute to the high degree of calibration and provide burnishing of the drilled hole.

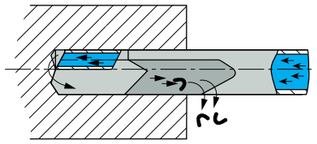
Typical Gundrill Applications - Chip Evacuation and Coolant Flow

Figure 3



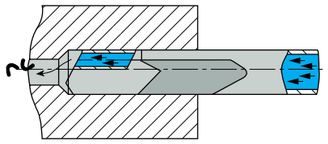
Boring with chip evacuation and coolant flowing opposite the boring direction

Figure 4



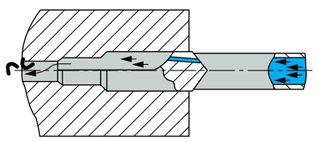
Drilling of solid material with chip evacuation and coolant flow opposite the drilling direction.

Figure 5



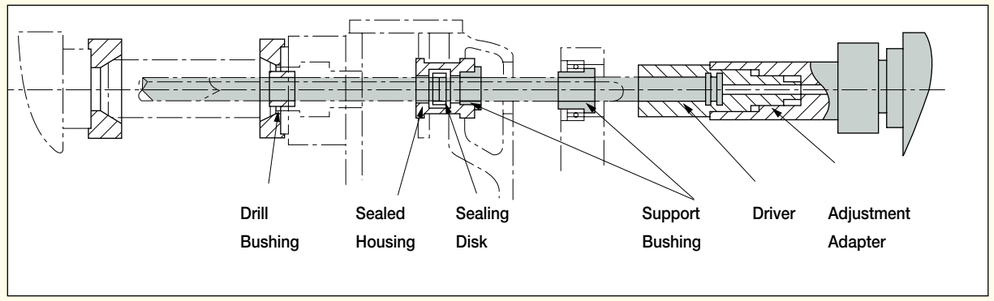
Boring with chip evacuation in the boring direction.

Figure 6



Boring with a staged tool. Chip evacuation and coolant flow in the boring direction.

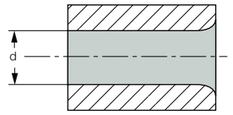
Deep Hole Machine Accessories



Bushing

Based on modified DIN 179 specify the “d” diameter of the drill. Carbide bushing is delivered only on request.

d = Drill diameter +0.02

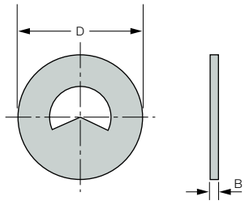


Guide Bushings

As the gundrill is not a self-centering tool and its radial rigidity is low (due to diameter to length ratio), a guide bushing is an essential component for a proper gundrill operation. The function of the guide bushing is to direct the gundrill into the material during penetration. The guide bushing’s diameter should be within 20 microns larger than the diameter of the drill. Dedicated gundrill machines are equipped with a guide bushing system.

Sealing Disk

Supplied with a single sealing disk or a protection sheet. Indicate the dimensions needed for your requirements.

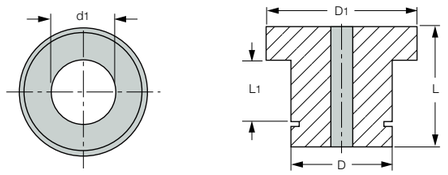


Sealing Disk		
Tool Ø “d”	Ext. Ø “D”	Thick. “ B”
2 to 6	20	3
3,1 to 15,559	32	4
15,6 to 25,999	40	4
26 to 40	90	4

Sealing Disk with Protection		
Tool Ø “d1”	Ext. Ø “D”	Thick. “ B”
2,9 - 5,249	20	7
5,25 - 14,449	32	11
14,45 - 25,999	40	12
26 - 41	90	12

Support Bushing

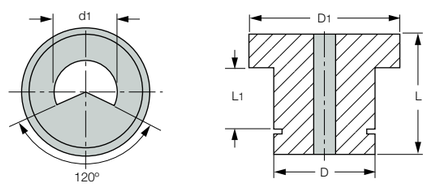
Indicate the “d” diameter of the drill.



Support Bushing				
Tool Ø “d1”	Ext. Ø “D”	Ext. Ø “D1”	Length “L”	Length “L1”
1,9 - 16,399	20	26	20	12
1,9 - 25,999	30	38	26	16
1,9 - 34	45	50	26	16

Support Bushing with “V” Form

Indicate the “d” diameter of the drill.



Support Bushing with “V” Form				
Tool Ø “d1”	Ext. Ø “D”	Ext. Ø “D1”	Length “ L”	Length “ L1”
1,9 - 16,399	20	26	20	12
1,9 - 23,799	30	38	26	16

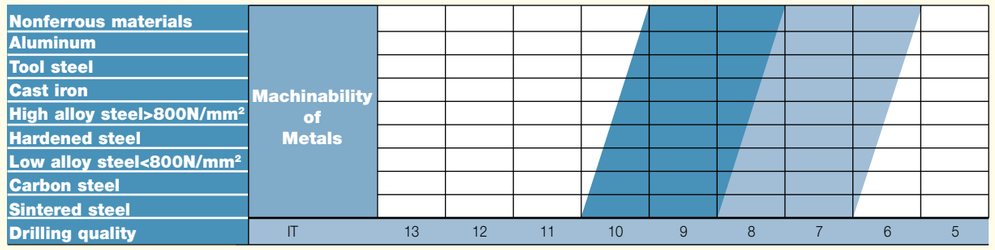
DEEP HOLE DRILLS

Drilling Tolerances Obtainable in Deep Hole Drilling

Deep Drilling Tolerances

OUTILTEC gundrill configurations when used under recommended conditions, can produce holes with tolerances of IT8-IT9.

When operating under optimal conditions, even better tolerances can be achieved.

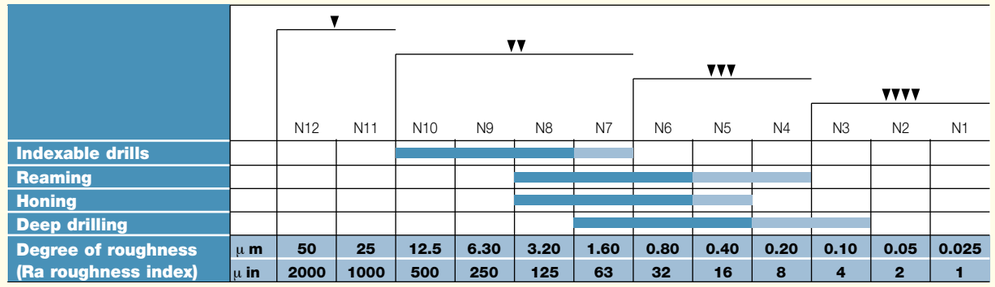


Tolerance range under normal conditions

Tolerance range under optimal conditions

Surface Quality

Surface quality of 0.2 Ra can be achieved when using gundrills under recommended conditions.



Tolerance range under normal conditions

Tolerance range under optimal conditions

Concentricity and Straightness

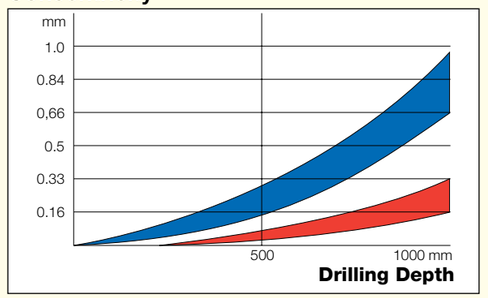
The resulting quality depends on various factors such as:

- Drilling depth and diameter
- Type of machining and cutting parameters
- Quality and uniformity of the workpiece material
- Machine tool conditions
- Gundrill support

Circularity

The geometric quality of bores obtained from deep hole drill bits is clearly higher than that obtained with the use of twist drills. It is possible to obtain precision with deviations of less than 4µm.

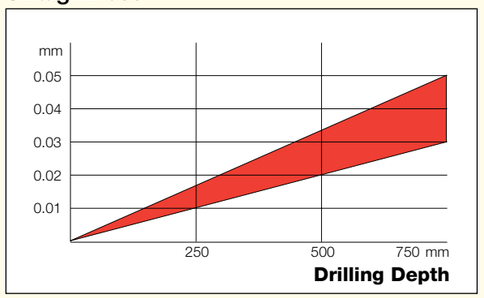
Concentricity



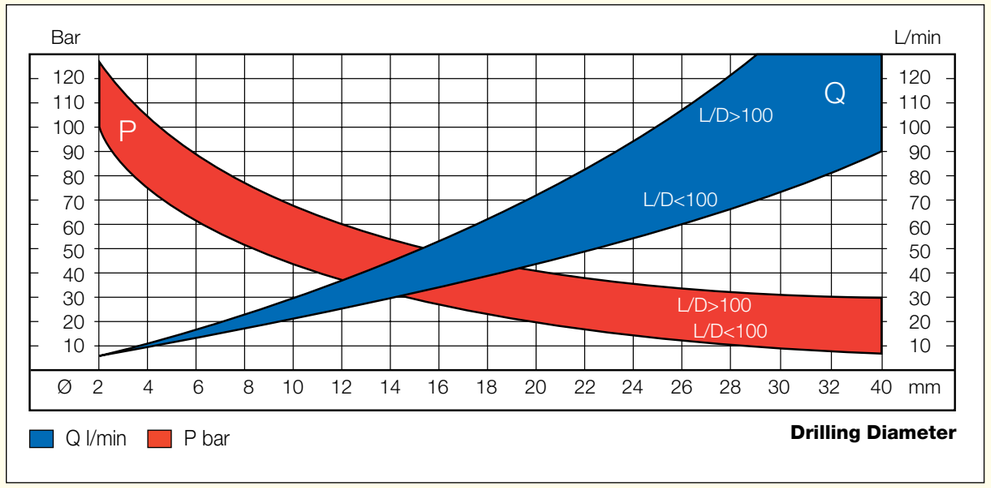
Stationary workpiece – rotating tool

Rotating workpiece – stationary tool

Straightness



Pressure and Coolant Flow Rate for Gundrills



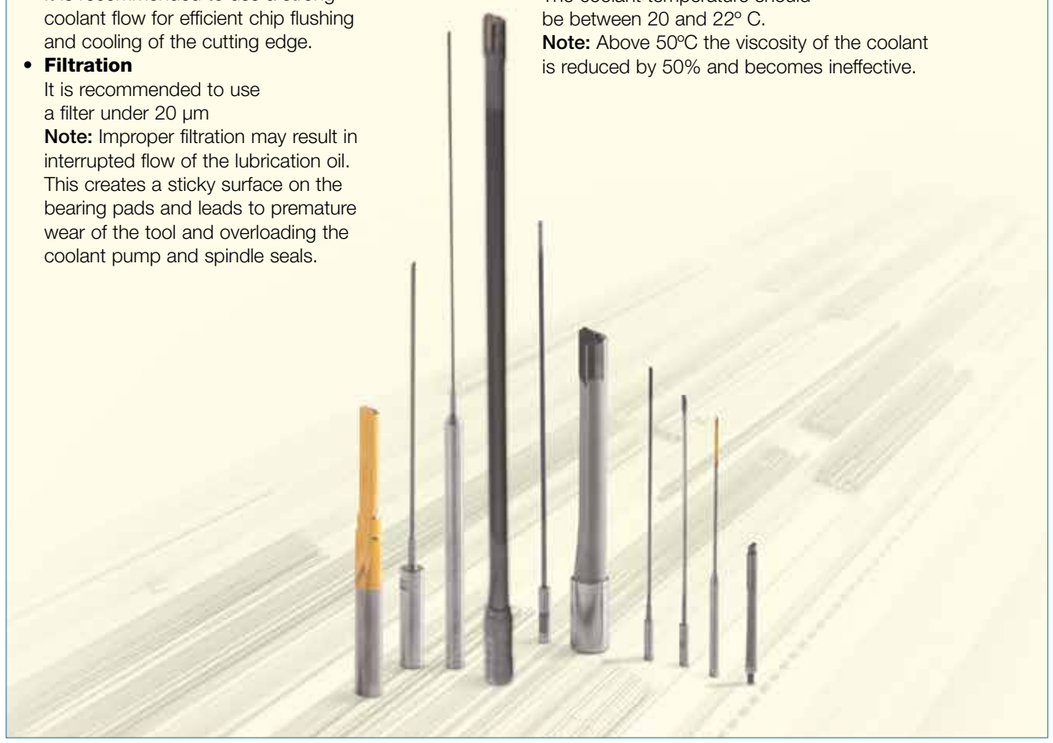
Gundrill Lubrication and Cooling

The best performance is obtained by using oil.
On equipment that uses water-soluble fluids (i.e. machining centers and CNC machines), a concentration between 10% and 15% is recommended.

Guidelines for Optimal Gundrill Performance

- **Coolant pressure and flow**
  It is recommended to use a strong coolant flow for efficient chip flushing and cooling of the cutting edge.
- **Filtration**
  It is recommended to use a filter under 20 µm
  Note: Improper filtration may result in interrupted flow of the lubrication oil. This creates a sticky surface on the bearing pads and leads to premature wear of the tool and overloading the coolant pump and spindle seals.

Temperature of the coolant
The coolant temperature should be between 20 and 22° C.
Note: Above 50ºC the viscosity of the coolant is reduced by 50% and becomes ineffective.



Material Groups

ISO	Material		Condition	Tensile Strength [N/mm2]	Hardness HB	Material No.(1)
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	1
		>= 0.25 %C	Annealed	650	190	2
		< 0.55 %C	Quenched and tempered	850	250	3
		>= 0.55 %C	Annealed	750	220	4
		>= 0.55 %C	Quenched and tempered	1000	300	5
	Low alloy steel and cast steel (less than 5% all elements)		Annealed	600	200	6
			Quenched and tempered	930	275	7
				1000	300	8
				1200	350	9
	High alloy steel, cast steel, and tool steel		Annealed	680	200	10
			Quenched and tempered	1100	325	11
M	Stainless steel and cast steel		Ferritic/martensitic	680	200	12
			Martensitic	820	240	13
			Austenitic	600	180	14
K	Grey cast iron (GG)		Pearlitic/ferritic		180	15
			Pearlitic/martensitic		260	16
	Ductile cast iron (nodular) (GGG)		Ferritic		160	17
			Pearlitic		250	18
	Malleable cast iron		Ferritic		130	19
			Pearlitic		230	20
N	Aluminum-wrought alloy		Not cureable		60	21
			Cured		100	22
	Aluminum-cast, alloyed	<=12% Si	Not cureable		75	23
			Cured		90	24
		>12% Si	High temperature		130	25
	Copper alloys	>1% Pb	Free cutting		110	26
			Brass		90	27
			Electrolitic copper		100	28
	Non-metallic		Duroplastics, fiber plastics			29
			Hard rubber			30
S	High temp. alloys	Fe based	Annealed		200	31
			Cured		280	32
		Ni or Co based	Annealed		250	33
			Cured		350	34
			Cast		320	35
	Titanium and Ti alloys			RM 400		36
			Alpha+beta alloys cured	RM 1050		37
H	Hardened steel		Hardened		55 HRc	38
			Hardened		60 HRc	39
	Chilled cast iron		Cast		400	40
	Cast iron		Hardened		55 HRc	41

Gundrill Recommended Machining Conditions

Mtl. No.	Cutting Speed vc m/min	Feed vs. mm/rev Drill Diameter mm				
		2.0-9.79	9.8-11.69	11.7-13.19	13.2-16.19	16.2-40
1	70-110	0.01-0.03	0.03-0.05	0.035-0.06	0.04-0.07	0.02-0.10
2	80-110					
3	70-100					
4	70-110					
5	70-90					
6	80-110	0.01-0.03	0.03-0.05	0.035-0.06	0.04-0.07	0.02-0.10
7	70-110					
8	60-90					
9	50-80					
10	50-70	0.01-0.03	0.025-0.04	0.03-0.045	0.035-0.05	0.12-0.10
11	40-70					
12	40-80	0.01-0.03	0.025-0.04	0.03-0.045	0.035-0.05	0.02-0.10
13						
14						
15	70-100	0.01-0.40	0.04-0.1	0.05-0.12	0.06-0.14	0.05-0.20
16	70-100					
17	80-110					
18	80-110					
19	90-115					
20	90-115					
21	80-160	0.02-0.04	0.03-0.17	0.03-0.18	0.035-0.19	0.03-0.15
22						
23						
24						
25	80-120					
26	80-180	0.02-0.04	0.02-0.13	0.03-0.16	0.04-0.18	0.03-0.15
27						
28						
29						
30						
31	25-60	0.01-0.03	0.025-0.03	0.03-0.035	0.03-0.04	0.02-0.10
32						
33						
34						
35						
36						
37						
38	20-50	0.01-0.03	0.025-0.03	0.03-0.035	0.03-0.04	0.02-0.10
39						
40						
41						

Gundrill Troubleshooting Guide

Hole problems	Possible Causes																																		
	Poor clamping	Insufficient coolant flow	Low coolant pressure	Incorrect coolant type	Feed fluctuations	Feed too high	Feed too low	Spindle speed too high	Spindle speed too low	Material structure	Material shrinking due to heat	Workpiece thin wall section	Misalignment	Undersized hole	Rough cutting edge finish	Built up edge	Worn out edge	Interrupted chip flow	Too small flute clearance	Incorrect drill profile	Incorrect head angles	Vibrations	Oversized bushing	Gap between bushing and workpiece	Undersized bushing	Loss of coolant pressure	High coolant pressure	Coolant overheating	Insufficient coolant	Head inside angle excessive wear	Head outside angle excessive wear	Too short carbide head	Tool head drag	Worn supporting pads
Oversized	+	+				+							+			+		+		+	+	+	+	+			+		+	+		+	+	+
Undersized			+								+									+	+			+	+	+					+		+		
Rough surface finish		+	+	+	+	+			+		+			+		+	+	+		+	+	+		+			+		+	+	+	+	+	
Runout	+				+	+			+	+	+	+	+		+		+	+	+	+	+	+	+	+	+				+	+	+	+	+	+
Conical entrance						+															+	+	+	+		+									
Curved hole axis	+				+	+				+		+	+		+		+	+	+	+	+	+	+	+			+		+			+	+	
Drill Problems																																			
Breakage	+	+	+		+	+		+		+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+			+	+	+
Chipping					+		+			+					+		+	+		+	+											+		
Poor drill life		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+	+	+	+	+
Excessive margin wear	+			+				+					+	+			+	+	+	+					+				+			+	+	
Excessive corner wear				+				+		+	+				+	+	+			+	+	+							+		+	+		+
Excessive flank wear		+		+		+		+					+	+				+	+					+	+				+			+	+	
Drill heat		+				+		+			+			+					+							+			+	+			+	+	+
Flute bending					+	+		+					+					+		+	+	+			+	+			+	+	+	+	+	+	+
Damaged wear pad				+				+		+	+		+	+				+	+	+		+			+	+			+	+		+		+	+
Built-up edge				+	+	+	+		+	+					+		+			+	+	+				+			+			+	+	
Cratering				+		+			+	+					+		+			+	+	+						+	+			+		+

Quality Control

Our quality assurance policy, which has been pursued consistently since 1991, was approved by the ISO certification granted in 2003. The machinery and measurement equipment we use at **Outiltec** guarantees products that correspond to the quality specifications. This ensures the production of high class precision tools made of HSS/E, carbide brazed and solid carbide qualities.

Research & Development

Research & development is an integral part of **Outiltec**. Its team of engineers work together to examine and select the best solution for the customer's requirements. Many resources are dedicated to employee training and participation in international professional exhibitions, making certain that the engineering staff stays at the forefront of world technology.

Outiltec's R & D department is constantly exploring new, more efficient and cost-effective manufacturing procedures and processes. Improvements in computerization, data flow and quality assurance are constantly being implemented.