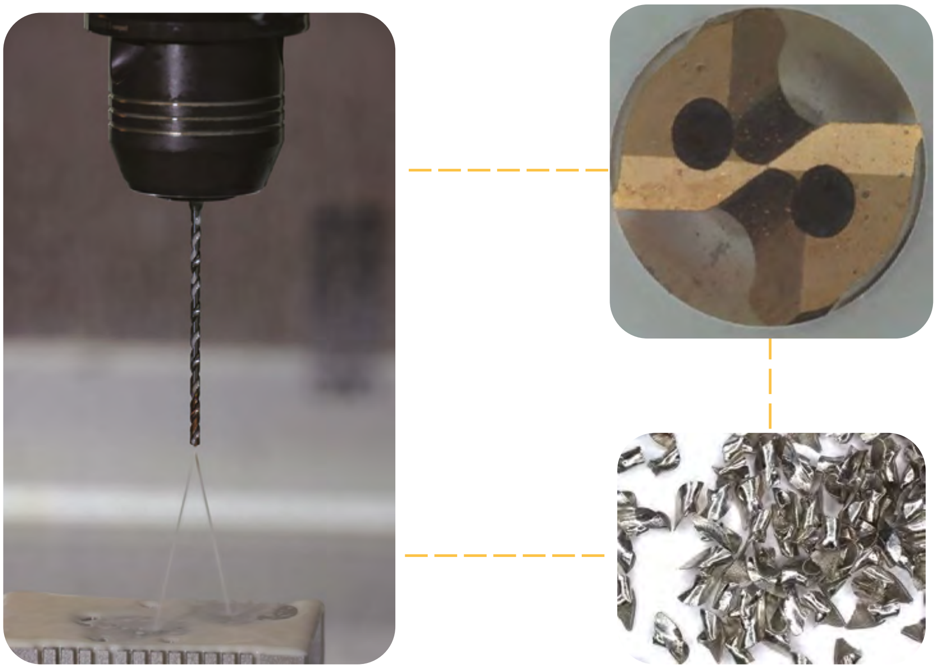
New drills for deep drilling
DIXI 1410-HH & DIXI 1448-HH

Fast, precise deep drilling.

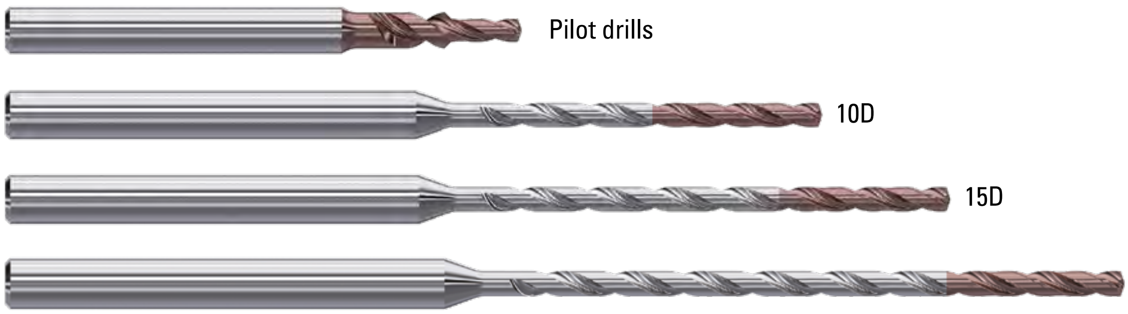
New drills available in 10xD, 15xD and 20xD

CONTENTS



High-pressure pump
+
Filtration

1.A NEW RANGES OF DRILLS WITH CENTRAL COOLANT - Ø1 TO Ø3 MM



1.B SPEED, EFFICIENCY, PRECISION, QUALITY OF SURFACE FINISH

Deep drilling with central lubrication in conventional geometries is a relatively slow process.
Conventional drills tend to bend and deflect, compromising drilling accuracy. Generally manufactured with small Ø coolant holes, the cutting fluid does not cool the cutting area sufficiently and does not evacuate the swarf properly.

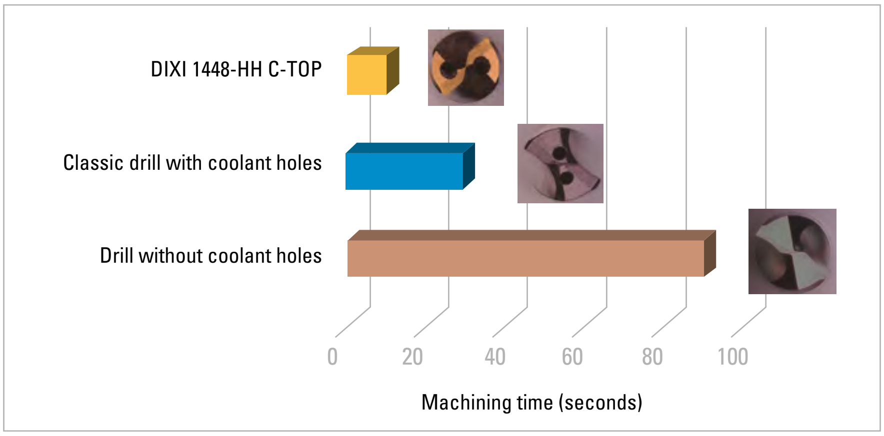
The new DIXI 1410-HH pilot drills and DIXI 1448-HH drills, with their oversized coolant holes and exceptional geometry:

- Allow higher speeds and feeds in all materials.
- In stainless steels and chrome-cobalt, they guarantee extraordinary time savings.
  The point geometry breaks up the material into short chips. After pre-drilling with a pilot drill, the bottom of the hole is reached in a single pass.
- For drilling with greater precision and minimal deviation.
- Improve surface finishes.
- Offer a much longer tool life than the usual standards.

1.B.1 SPEED, EFFICIENCY

Comparison between the new DIXI 1448-HH drill with optimised geometry,
a drill with conventional geometry and a drill without coolant holes.

Drilling time per hole in seconds - twist drill Ø3 mm, depth 60 mm in 1.4441 stainless steel.



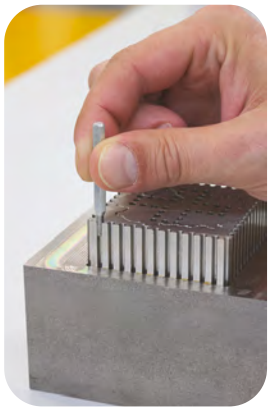
Details of the cutting conditions used to compare the 3 drills.

	DIXI 1448-HH Ø3 C-TOP	Classic oil hole drill	Drill without oil hole
Material	Stainless steel 1.4441 - X2CrNiMo18-15-3 - 316LVM		
Depth (mm)	60 mm		
Cutting speed (m/min)	60	45	30
Lubrication	Internal	Internal	External
Method	Without retraction G81	Without short retraction G73 (every 1.50mm)	With full retraction G83 (every 0.50mm)
Feed rate (mm/min)	769	238	160
Time / hole (sec.)	10	28	90

1.B.2 PRECISION

Accuracy of Ø drilled at 20xD Pilot drill+ 20D drill:

Example for blind holes

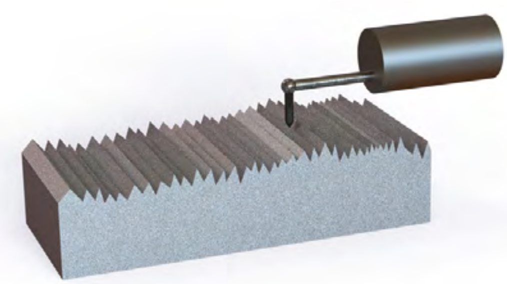


Material	DIXI 1448-HH C-TOP	Ø measured on the pilot hole side with a gauge pin
Stainless steel 1.4441 X2CrNiMo18-15-3 316LVM	Ø2.00	Ø2.002
Stainless steel 1.4435 X2CrNiMo18-14-3	Ø1.50	Ø1.502
Chrome Cobalt 2.4964	Ø1.50	Ø1.503

Example for through holes

Material	DIXI 1448-HH C-TOP	Ø measured on the pilot hole side with a gauge pin
Grade 5 titanium	Ø1.50	Ø1.505 (inlet) - Ø1.499 (outlet)

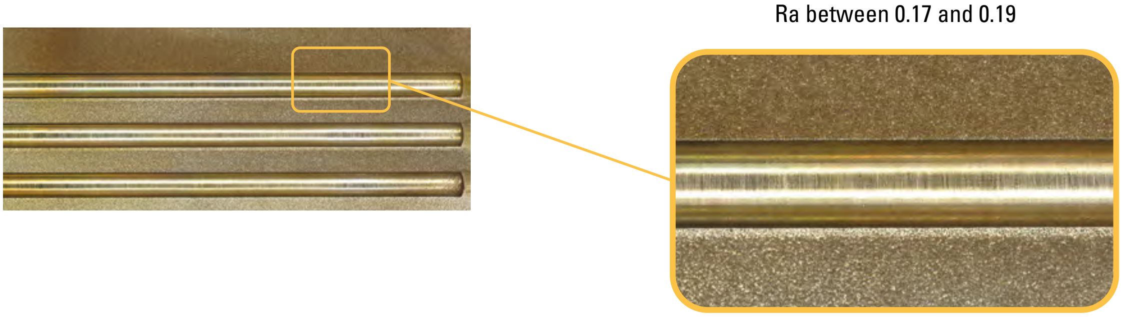
1.B.3 SURFACE QUALITY



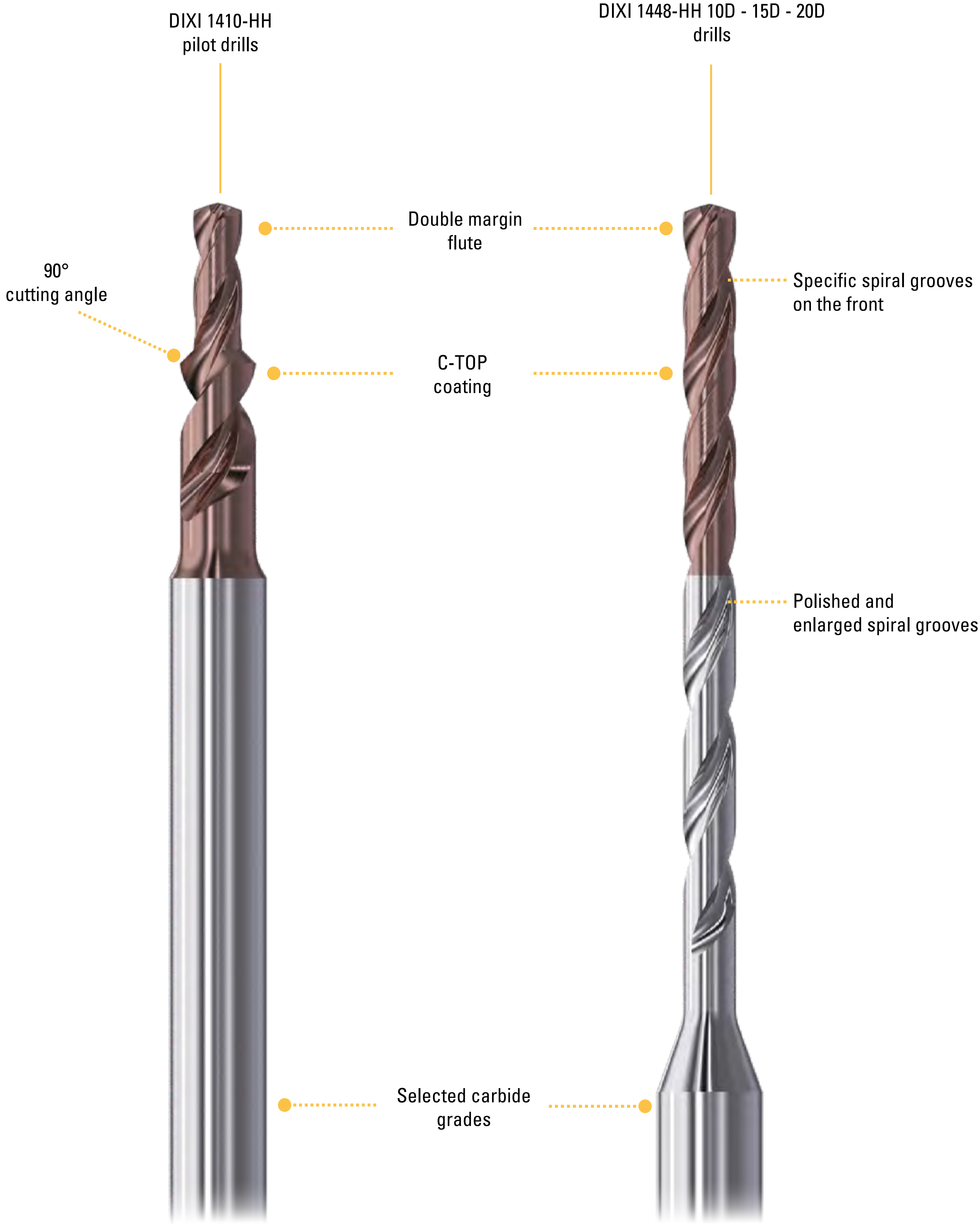
Example of Ra measurement:

- 1.4441 stainless steel
- Ø3 blind holes, 60 mm deep

Ra between 0.17 and 0.19

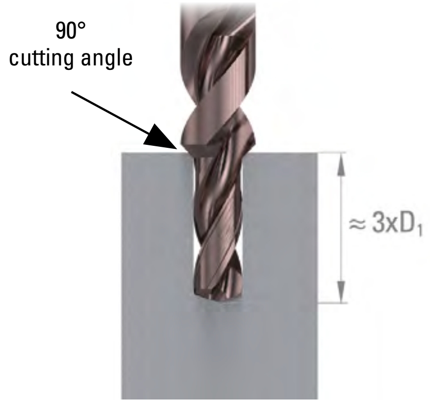


2.C GEOMETRIC CHARACTERISTICS OF PILOT DRILLS AND DEEP HOLE DRILLS



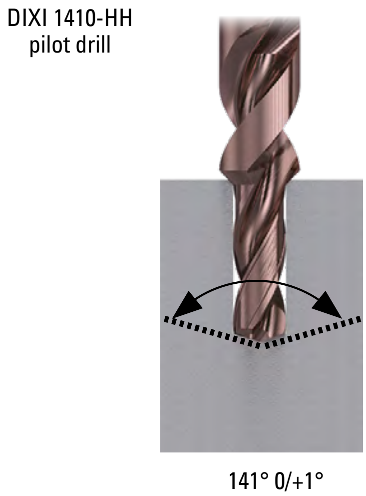
2.A DIXI 1410-HH PILOT DRILL, THE ESSENTIAL TOOL

The pilot drill is necessary for drilling longer 10D, and plays an essential role in guiding the main drill for deep drilling.
The point cut and double margin flute ensure precise pre-drilling, guaranteeing optimum positioning of the holes.
For shallow drilling, the use of a DIXI 1105 C-TOP point drill with a point angle of 145° is an alternative solution.

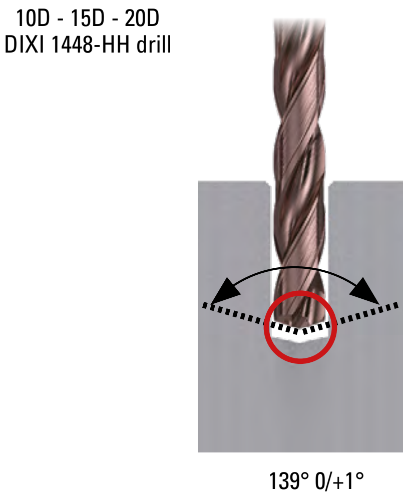


The 90° cutting angle allows the hole to be chamfered if required on the workpiece drawing. This feature is optional, as pre-drilling to 2.5 times the diameter is sufficient to ensure accurate location.

Difference between the tip angle of pilot drills and deep hole drills



The angle of the tip is slightly greater (between 1 and 2°) on the pilot drill than on the deep hole drill.



Drilling starts with the tip of the tool and not with the «corners» (the fragile part of a drill).

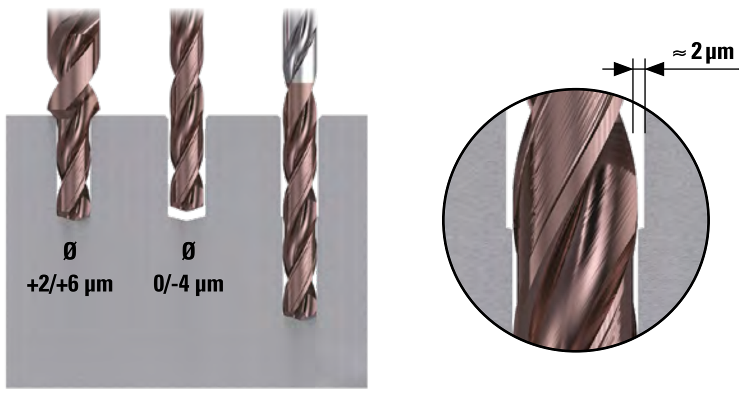
Difference in diameter between the pilot drill and the long drill

The pilot drill is a few microns larger in diameter than the deep hole drill.

This difference in Ø is necessary to allow the deep drill bit to be inserted without chipping its guide strips.

The pilot drill creates a hole very close to its manufacturing diameter.

An insignificant gap of a few microns remains after the deep hole drill has been used.



2.B LUBRICATION

2.B.1 FILTRATION, AN INTEGRAL PART OF LUBRICATION

To ensure optimum coolant flow and avoid the introduction of micro-particles or micro-chips into the channels of internally cooled drills, it is essential to use fine-mesh filters as a preventive measure.
The filtration requirements vary depending on the drill diameter:

- Drills with a diameter of< 2 mm: recommended filtration ≤ 0.010 mm
- Drills with a diameter of< 3 mm: recommended filtration ≤ 0.020 mm

2.B.2 PRESSURE, THE KEY TO SUCCESS

Overall, the pressure required for effective drilling will be high, especially for the smallest Ø at a significant depth. Oversized coolant holes ensure that the cutting area is kept cool and short chips are evacuated.

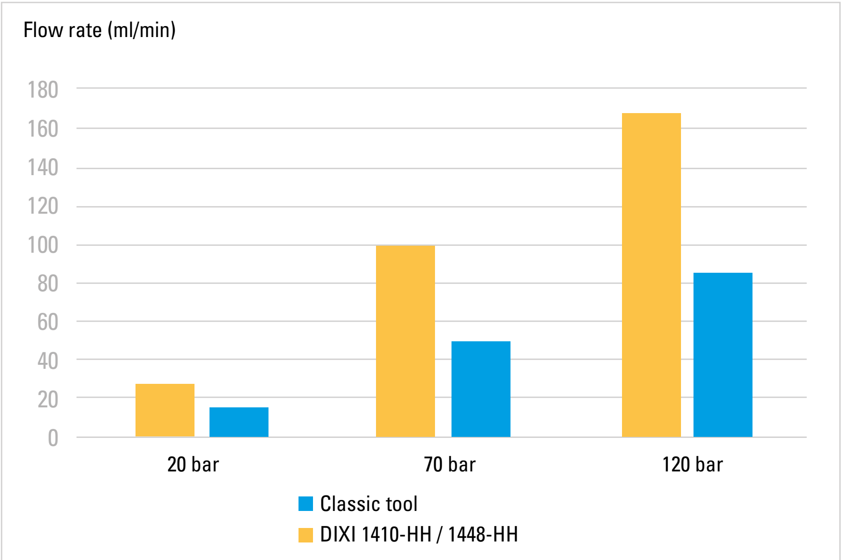
The coolant pressure must be greater than 70 bar; a lower pressure will require a chip-breaking cycle with a pitch of 0.10 to 1x the Ø for all materials.

The comparative table below highlights the importance of applying a pressure of at least 70 bar for drills with a diameter of less than 2 mm.

Example: lubricant flow between 3 different pressures (20 bar, 70 bar and 120 bar) for a Ø1.10 drill.

Holes Ø 0.23
DIXI 1410-HH et DIXI 1448-HH

Holes Ø 0.15
Conventional drill

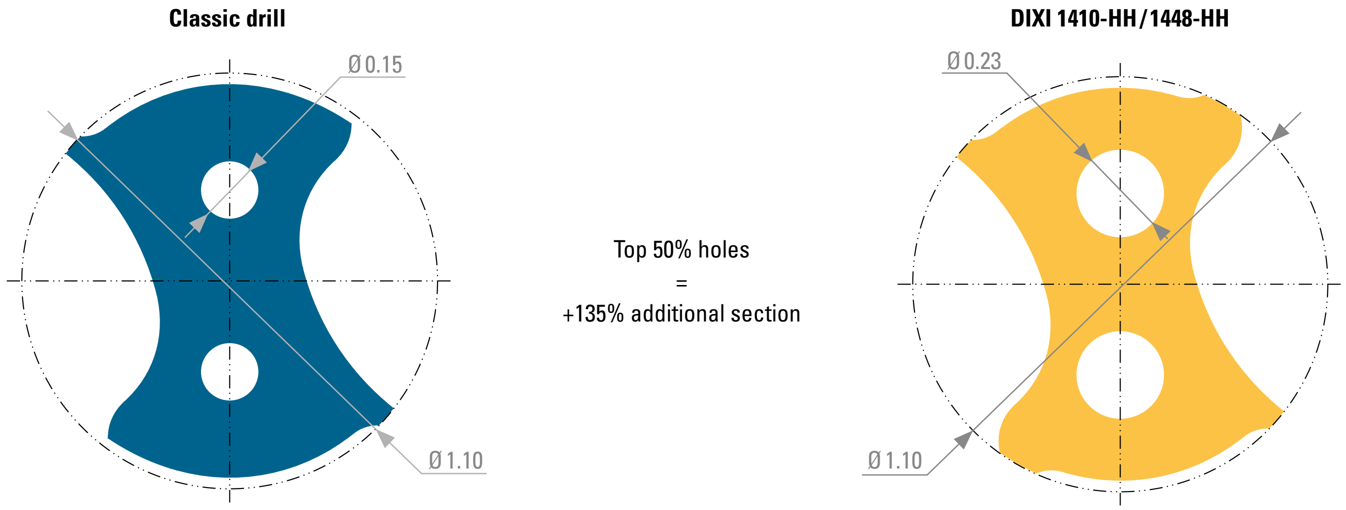


2.B.3 LUBRICANT FLOW

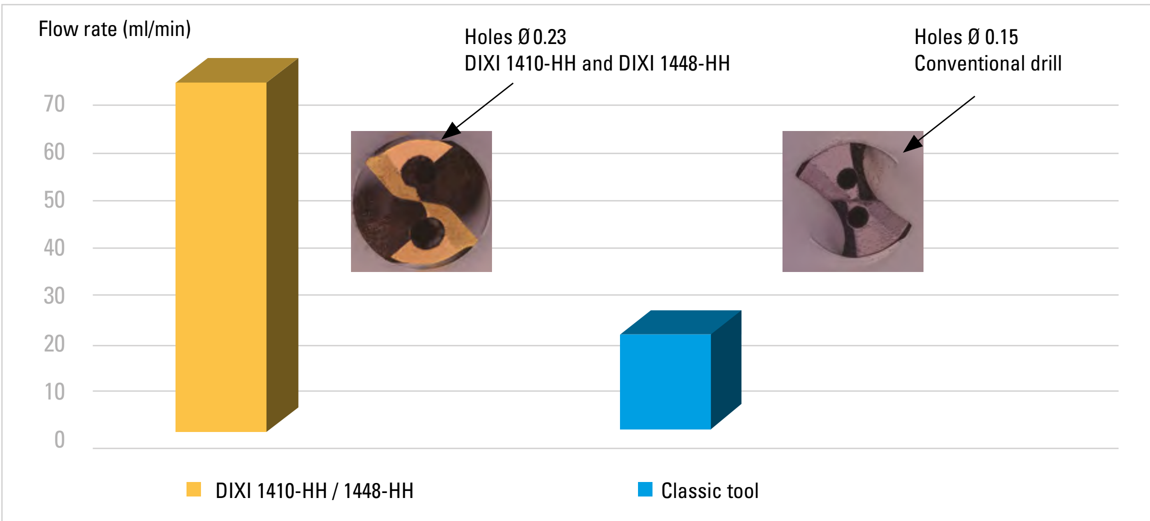
To ensure fast chip evacuation, a number of geometric features are required:

Oversized coolant holes provide abundant coolant= more fluid at high pressure, with a minimum of 70 bar = swarf is extracted at high speed.

Example for a Ø1.10 drill



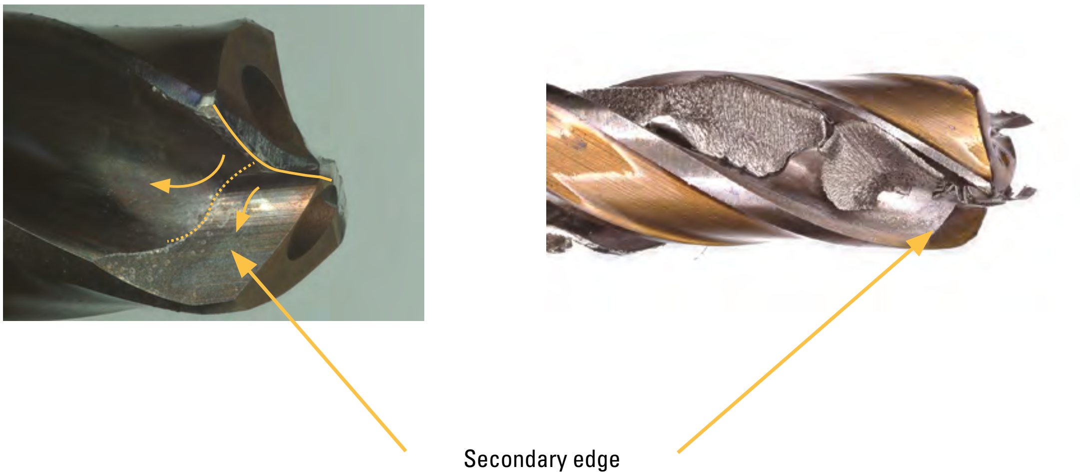
Volume of liquid between different hole diameters (in ml / min)



2.C CHIP BREAKING, THE GUARANTEE OF SUCCESS

The new cutting-edge geometry, developed by our R&D department, makes it possible to break and create short chips in materials such as stainless steels type 1.4441, 1.4435 and chrome-cobalt.
You can drill to the bottom of the hole in a single operation, after pre-drilling with the pilot drill.

Chip breaking process: The chip is rolled along the cutting edge, then bent and broken along the secondary edge.

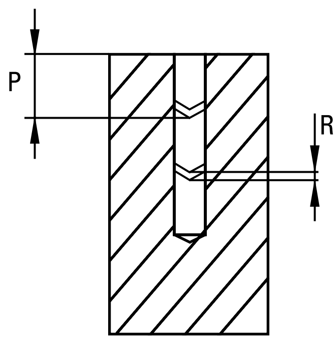


Second possibility:

Many materials, because of their composition or manufacturing method (drawn, forged, stamped, etc.), cannot be drilled in a single operation. The chips obtained are of varying lengths and risk getting stuck in the grooves or curling up behind the cut part.

The drill penetrates the material, stops its progress, moves back a few tenths of a mm «R», and the chip is broken up and evacuated.

The recommended step size «P» is 0.10 to 1xØ. Drills with small diameters and 20D lengths are of course the most sensitive.

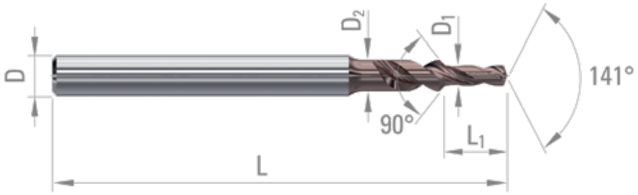


DIXI 1410-HH

Z = 2

P.14

PILOT DRILLS
WITH THROUGH COOLANT



- High-performance pilot drills with reinforced shank and through coolant developed for guiding deep-hole drills.
- C-TOP coating improves tool life in difficult to machine materials.

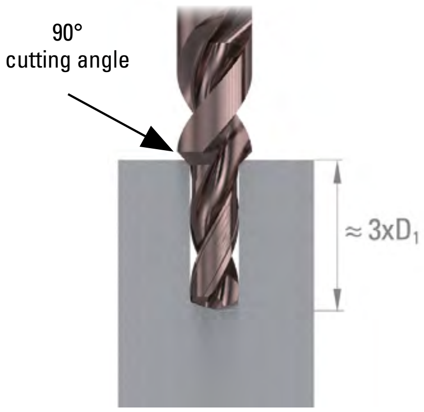
○ good ◎ excellent

ISO	P													M				K					
Materials description	Unalloyed steel					Low alloyed steel				High alloyed steel		Martensitic stainless steel		Austenitic stainless steel (DUPLEX/PH)				Grey cast iron		Nodular cast iron		Malleable cast iron	
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	14.4	15	16	17	18	19	20
Recommendations	○	○	○	○	○	○	○	○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎

ISO	N												S					H			
Materials description	Wrought aluminium alloy		Cast aluminium alloy			Cu + Pb alloy	Cu alloy difficult		Gold, Silver	Graphite	Plastic	Wood	Refractory alloy Chrome Cobalt			Titanium, titanium alloy		Hardened steel		Hard cast iron	
VDI 3323	21	22	23	24	25	26	27	28	-	-	29	30	31	32	33-35	36	37	38	39	40	41
Recommendations	○	○	○	○	○	○	○	○	○				○	○	◎	◎	◎				

D_1 +0.002/+0.006	L_1	D_2	L_2	D_{h5}	L	Z	C-TOP
1.00	3.00	1.55	6.50	4	50	2	445068
1.05	3.15	1.65	6.85	4	50	2	445069
1.10	3.30	1.75	7.15	4	51	2	445070
1.15	3.45	1.80	7.50	4	51	2	445071
1.20	3.60	1.90	7.80	4	51	2	445072
1.25	3.75	1.95	8.15	4	51	2	445073
1.30	3.90	2.05	8.45	4	51	2	445074
1.35	4.05	2.10	8.80	4	51	2	445075
1.40	4.20	2.20	9.10	4	52	2	445076
1.45	4.35	2.25	9.45	4	52	2	445077
1.50	4.50	2.35	9.75	4	52	2	445078
1.55	4.65	2.45	10.10	4	53	2	445079
1.60	4.80	2.50	10.40	4	53	2	445080
1.65	4.95	2.60	10.75	4	53	2	445081
1.70	5.10	2.65	11.05	4	53	2	445082
1.75	5.25	2.75	11.40	4	54	2	445083
1.80	5.40	2.80	11.70	4	54	2	445084
1.85	5.55	2.90	12.05	4	54	2	445085
1.90	5.70	2.95	12.35	4	54	2	445086
1.95	5.85	3.05	12.70	4	54	2	445087
2.00	6.00	3.10	13.00	4	56	2	445088
2.05	6.15	3.20	13.35	4	56	2	445089
2.10	6.30	3.30	13.65	4	56	2	445090
2.15	6.45	3.35	14.00	4	56	2	445091
2.20	6.60	3.45	14.30	4	56	2	445092
2.25	6.75	3.50	14.65	4	57	2	445093
2.30	6.90	3.60	14.95	4	57	2	445094

D_1 +0.002/+0.006	L_1	D_2	L_2	D_{h5}	L	Z	C-TOP
2.35	7.05	3.65	15.30	4	57	2	445095
2.40	7.20	3.75	15.60	4	57	2	445096
2.45	7.35	3.80	15.95	4	57	2	445097
2.50	7.50	3.90	16.25	4	59	2	445098
2.55	7.65	4.00	16.60	4	59	2	445099
2.60	7.80	4.00	16.90	4	59	2	445100
2.65	7.95	4.00	17.25	4	59	2	445101
2.70	8.10	4.00	17.55	4	59	2	445102
2.75	8.25	4.00	17.90	4	59	2	445103
2.80	8.40	4.00	18.20	4	59	2	445104
2.85	8.55	4.45	18.55	6	66	2	445105
2.90	8.70	4.50	18.85	6	66	2	445106
2.95	8.85	4.60	19.20	6	66	2	445107
3.00	9.00	4.65	19.50	6	66	2	445108

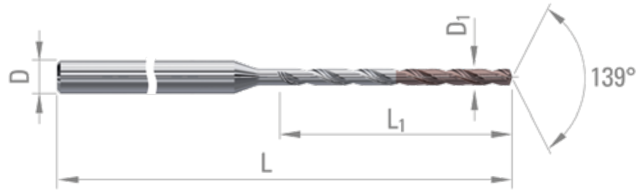


DIXI 1448-10D-HH

Z = 2

TWIST DRILLS
WITH THROUGH COOLANT

P.14



- High-performance twist drills with reinforced shank and through coolant developed for deep drilling 10xD_1.
- The use of a point drill or pilot drill is recommende before drilling.
- C-TOP coating improves tool life in difficult to machine materials.

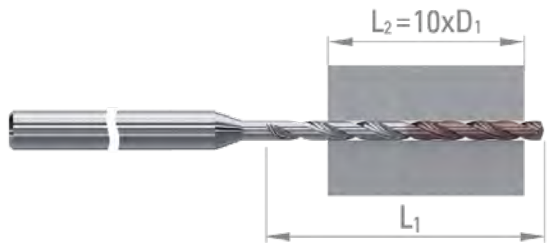
◯ good ◎ excellent

ISO	P													M				K					
Materials description	Unalloyed steel					Low alloyed steel				High alloyed steel		Martensitic stainless steel		Austenitic stainless steel (DUPLEX/PH)				Grey cast iron		Nodular cast iron		Malleable cast iron	
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	14.4	15	16	17	18	19	20
Recommendations	◯	◯	◯	◯	◯	◯	◯	◯	◯	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎

ISO	N												S					H			
Materials description	Wrought aluminium alloy		Cast aluminium alloy			Cu + Pb alloy	Cu alloy difficult		Gold, Silver	Graphite	Plastic	Wood	Refractory alloy Chrome Cobalt			Titanium, titanium alloy		Hardened steel		Hard cast iron	
VDI 3323	21	22	23	24	25	26	27	28	-	-	29	30	31	32	33-35	36	37	38	39	40	41
Recommendations	◯	◯	◯	◯	◯	◯	◯	◯	◯				◯	◯	◎	◎	◎				

$D_{1\ 0/-0.004}$	L_1	L_2	D_{h5}	L	Z	C-TOP
1.00	13.00	10.00	4	55	2	445150
1.05	13.65	10.50	4	55	2	445151
1.10	14.30	11.00	4	57	2	445152
1.15	14.95	11.50	4	57	2	445153
1.20	15.60	12.00	4	57	2	445154
1.25	16.25	12.50	4	60	2	445155
1.30	16.90	13.00	4	60	2	445156
1.35	17.55	13.50	4	60	2	445157
1.40	18.20	14.00	4	62	2	445158
1.45	18.85	14.50	4	62	2	445159
1.50	19.50	15.00	4	62	2	445160
1.55	20.15	15.50	4	65	2	445161
1.60	20.80	16.00	4	65	2	445162
1.65	21.45	16.50	4	65	2	445163
1.70	22.10	17.00	4	65	2	445164
1.75	22.75	17.50	4	69	2	445165
1.80	23.40	18.00	4	69	2	445166
1.85	24.05	18.50	4	69	2	445167
1.90	24.70	19.00	4	69	2	445168
1.95	25.35	19.50	4	69	2	445169
2.00	26.00	20.00	4	73	2	445170
2.05	26.65	20.50	4	73	2	445171
2.10	27.30	21.00	4	73	2	445172
2.15	27.95	21.50	4	73	2	445173
2.20	28.60	22.00	4	73	2	445174
2.25	29.25	22.50	4	77	2	445175
2.30	29.90	23.00	4	77	2	445176

$D_{1\ 0/-0.004}$	L_1	L_2	D_{h5}	L	Z	C-TOP
2.35	30.55	23.50	4	77	2	445177
2.40	31.20	24.00	4	77	2	445178
2.45	31.85	24.50	4	77	2	445179
2.50	32.50	25.00	4	82	2	445180
2.55	33.15	25.50	4	82	2	445181
2.60	33.80	26.00	4	82	2	445182
2.65	34.45	26.50	4	82	2	445183
2.70	35.10	27.00	4	82	2	445184
2.75	35.75	27.50	4	82	2	445185
2.80	36.40	28.00	4	82	2	445186
2.85	37.05	28.50	6	101	2	445187
2.90	37.70	29.00	6	101	2	445188
2.95	38.35	29.50	6	101	2	445189
3.00	39.00	30.00	6	101	2	445190

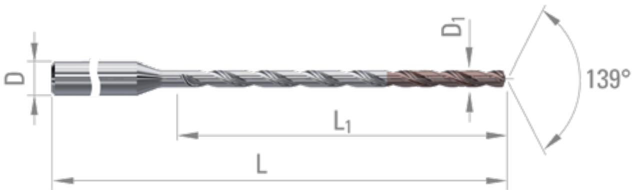


DIXI 1448-15D-HH

Z = 2

P.14

TWIST DRILLS
WITH THROUGH COOLANT



- High-performance twist drills with reinforced shank and through coolant developed for deep drilling 15xD_1.
- The use of a point drill or pilot drill is recommende before drilling.
- C-TOP coating improves tool life in difficult to machine materials.

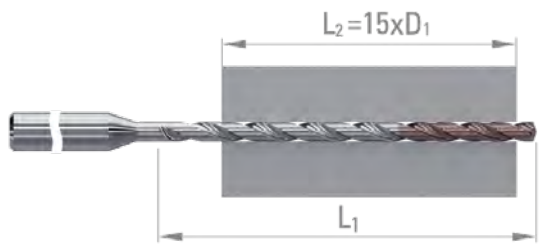
○ good ◎ excellent

ISO	P													M				K					
Materials description	Unalloyed steel					Low alloyed steel				High alloyed steel		Martensitic stainless steel		Austenitic stainless steel (DUPLEX/PH)				Grey cast iron		Nodular cast iron		Malleable cast iron	
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	14.4	15	16	17	18	19	20
Recommendations	○	○	○	○	○	○	○	○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎

ISO	N												S					H			
Materials description	Wrought aluminium alloy		Cast aluminium alloy			Cu + Pb alloy	Cu alloy difficult		Gold, Silver	Graphite	Plastic	Wood	Refractory alloy Chrome Cobalt			Titanium, titanium alloy		Hardened steel		Hard cast iron	
VDI 3323	21	22	23	24	25	26	27	28	-	-	29	30	31	32	33-35	36	37	38	39	40	41
Recommendations	○	○	○	○	○	○	○	○	○				○	○	◎	◎	◎				

$D_{1\ 0/-0.004}$	L_1	L_2	D_{h5}	L	Z	C-TOP
1.00	18.00	15.00	4	60	2	445191
1.05	18.90	15.75	4	60	2	445192
1.10	19.80	16.50	4	63	2	445193
1.15	20.70	17.25	4	63	2	445194
1.20	21.60	18.00	4	63	2	445195
1.25	22.50	18.75	4	66	2	445196
1.30	23.40	19.50	4	66	2	445197
1.35	24.30	20.25	4	66	2	445198
1.40	25.20	21.00	4	69	2	445199
1.45	26.10	21.75	4	69	2	445200
1.50	27.00	22.50	4	69	2	445201
1.55	27.90	23.25	4	73	2	445202
1.60	28.80	24.00	4	73	2	445203
1.65	29.70	24.75	4	73	2	445204
1.70	30.60	25.50	4	73	2	445205
1.75	31.50	26.25	4	79	2	445206
1.80	32.40	27.00	4	79	2	445207
1.85	33.30	27.75	4	79	2	445208
1.90	34.20	28.50	4	79	2	445209
1.95	35.10	29.25	4	79	2	445210
2.00	36.00	30.00	4	84	2	445211
2.05	36.90	30.75	4	84	2	445212
2.10	37.80	31.50	4	84	2	445213
2.15	38.70	32.25	4	84	2	445214
2.20	39.60	33.00	4	84	2	445215
2.25	40.50	33.75	4	89	2	445216
2.30	41.40	34.50	4	89	2	445217

$D_{1\ 0/-0.004}$	L_1	L_2	D_{h5}	L	Z	C-TOP
2.35	42.30	35.25	4	89	2	445218
2.40	43.20	36.00	4	89	2	445219
2.45	44.10	36.75	4	89	2	445220
2.50	45.00	37.50	4	96	2	445221
2.55	45.90	38.25	4	96	2	445222
2.60	46.80	39.00	4	96	2	445223
2.65	47.70	39.75	4	96	2	445224
2.70	48.60	40.50	4	96	2	445225
2.75	49.50	41.25	4	96	2	445226
2.80	50.40	42.00	4	96	2	445227
2.85	51.30	42.75	6	116	2	445228
2.90	52.20	43.50	6	116	2	445229
2.95	53.10	44.25	6	116	2	445230
3.00	54.00	45.00	6	116	2	445231

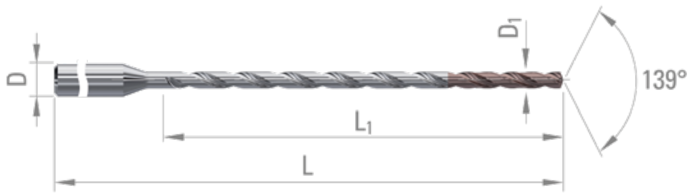


DIXI 1448-20D-HH

Z = 2

P.14

TWIST DRILLS
WITH THROUGH COOLANT



- High-performance twist drills with reinforced shank and through coolant developed for deep drilling 20xD_1.
- The use of a point drill or pilot drill is recommende before drilling.
- C-TOP coating improves tool life in difficult to machine materials.

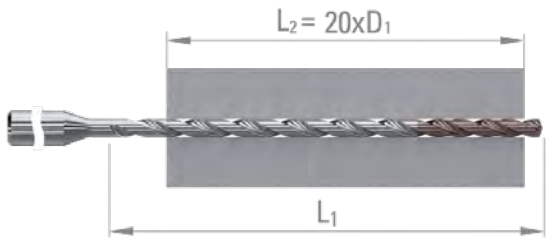
○ good ◎ excellent

ISO	P													M				K					
Materials description	Unalloyed steel					Low alloyed steel				High alloyed steel		Martensitic stainless steel		Austenitic stainless steel (DUPLEX/PH)				Grey cast iron		Nodular cast iron		Malleable cast iron	
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	14.4	15	16	17	18	19	20
Recommendations	○	○	○	○	○	○	○	○	○	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎

ISO	N												S					H			
Materials description	Wrought aluminium alloy		Cast aluminium alloy			Cu + Pb alloy	Cu alloy difficult		Gold, Silver	Graphite	Plastic	Wood	Refractory alloy Chrome Cobalt			Titanium, titanium alloy		Hardened steel		Hard cast iron	
VDI 3323	21	22	23	24	25	26	27	28	-	-	29	30	31	32	33-35	36	37	38	39	40	41
Recommendations	○	○	○	○	○	○	○	○	○				○	○	◎	◎	◎				

$D_{1\ 0/-0.004}$	L_1	L_2	D_{h5}	L	Z	C-TOP
1.00	23.00	20.00	4	65	2	445232
1.05	24.15	21.00	4	65	2	445233
1.10	25.30	22.00	4	69	2	445234
1.15	26.45	23.00	4	69	2	445235
1.20	27.60	24.00	4	69	2	445236
1.25	28.75	25.00	4	73	2	445237
1.30	29.90	26.00	4	73	2	445238
1.35	31.05	27.00	4	73	2	445239
1.40	32.20	28.00	4	77	2	445240
1.45	33.35	29.00	4	77	2	445241
1.50	34.50	30.00	4	77	2	445242
1.55	35.65	31.00	4	82	2	445243
1.60	36.80	32.00	4	82	2	445244
1.65	37.95	33.00	4	82	2	445245
1.70	39.10	34.00	4	82	2	445246
1.75	40.25	35.00	4	89	2	445247
1.80	41.40	36.00	4	89	2	445248
1.85	42.55	37.00	4	89	2	445249
1.90	43.70	38.00	4	89	2	445250
1.95	44.85	39.00	4	89	2	445251
2.00	46.00	40.00	4	95	2	445252
2.05	47.15	41.00	4	95	2	445253
2.10	48.30	42.00	4	95	2	445254
2.15	49.45	43.00	4	95	2	445255
2.20	50.60	44.00	4	95	2	445256
2.25	51.75	45.00	4	101	2	445257
2.30	52.90	46.00	4	101	2	445258

$D_{1\ 0/-0.004}$	L_1	L_2	D_{h5}	L	Z	C-TOP
2.35	54.05	47.00	4	101	2	445259
2.40	55.20	48.00	4	101	2	445260
2.45	56.35	49.00	4	101	2	445261
2.50	57.50	50.00	4	110	2	445262
2.55	58.65	51.00	4	110	2	445263
2.60	59.80	52.00	4	110	2	445264
2.65	60.95	53.00	4	110	2	445265
2.70	62.10	54.00	4	110	2	445266
2.75	63.25	55.00	4	110	2	445267
2.80	64.40	56.00	4	110	2	445268
2.85	65.55	57.00	6	132	2	445269
2.90	66.70	58.00	6	132	2	445270
2.95	67.85	59.00	6	132	2	445271
3.00	69.00	60.00	6	132	2	445272



4. CUTTING CONDITIONS

		VDI 3323	C-TOP Vc [m/min]
P	Unalloyed steel, leaded steel	1 - 5	30 - **50** - 70
	Low alloyed steel < 800 N/mm2	6 - 9	30 - **50** - 70
	High-alloy steel > 800 N/mm2, stainless steel ferr.- marten.	10 - 13	20 - **40** - 60
M	Austenitic stainless steel < 700 N/mm2	14.1 - 14.2	20 - **30** - 60
	Nickel-free stainless steel / DUPLEX > 700 N/mm2	14.3 - 14.4	20 - **30** - 60
K	Grey cast iron < 250 HB	15 - 16	30 - **50** - 70
	Ductile, malleable, nodular cast iron > 250 HB	17 - 20	30 - **40** - 50
N	Wrought aluminium alloy < 12% Si	21 - 22	50 - **80** - 120
	Cast aluminium alloy >12% Si	23 - 25	30 - **50** - 70
	Copper alloy good machinability with Pb	26	50 - **80** - 120
	Copper alloy with difficult machinability	27 - 28	30 - **50** - 70
	Gold, silver	-	30 - **50** - 70
S	Refractory alloy, Fe, Ni, Co base	31 - 32	10 - **20** - 30
	Refractory alloy, Ni, Co, Chrome Cobalt base	32 - 35	20 - **40** - 50
	Titanium, titanium alloy	36 - 37	20 - **40** - 60

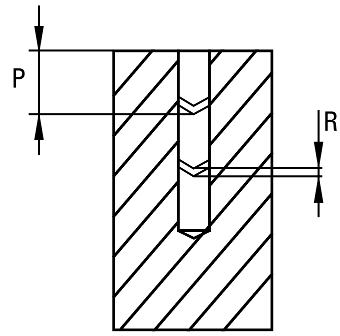
Drilling recommendations

For materials such as stainless steels 1.4441, 1.4435, AISI 304 and chrome-cobalt alloys, the geometry of the tool enables efficient chip breaking. After pre-drilling with a pilot drill, drilling can generally be carried out in a single pass, right down to the bottom of the hole.

Caution: Some materials (drawn, forged, stamped steels, etc.), because of their mechanical properties, structure or composition, generate longer chips that are likely to get stuck in the flutes or curl up behind the cut part. In these cases, an interruption cycle is recommended: The drill advances, stops and moves back slightly (a few tenths, «R»), which encourages the breaking and evacuation of the chip.

The recommended step size «P» is between 0.10 and 1×D. Drills with small diameters and long lengths - 20D - are the most sensitive.

Advice: By observing the chips formed by the pilot drill, you can anticipate how the material will behave during final drilling.



$$n\,[rpm] = \frac{Vc\,[m/min] \times 1000}{\pi \times D_1\,[mm]}$$

$$Vf\,[mm/min] = n\,[rpm] \times f\,[mm]$$

Feed per revolution f [mm]

Ø D_1 1.00 -1.20	Ø D_1 1.30 -1.50	Ø D_1 1.50 -1.80	Ø D_1 1.80 -2.20	Ø D_1 2.20 -2.50	Ø D_1 2.50 -3.00
0.015-0.040	0.020-0.050	0.022 - 0.060	0.040-0.070	0.040-0.080	0.050-0.100
0.010-0.030	0.013-0.039	0.015 - 0.045	0.018-0.055	0.022-0.060	0.030-0.080
0.010-0.030	0.013-0.039	0.015-0.045	0.018-0.055	0.022-0.060	0.030-0.080
0.010-0.030	0.013-0.039	0.015-0.045	0.018-0.055	0.022-0.060	0.030-0.080
0.010-0.020	0.013-0.026	0.015-0.030	0.018-0.036	0.022-0.044	0.030-0.060
0.015-0.040	0.020-0.050	0.022-0.060	0.040-0.070	0.040-0.080	0.050-0.100
0.010-0.030	0.013-0.039	0.015-0.045	0.018-0.055	0.022-0.060	0.030-0.080
0.015-0.040	0.020-0.050	0.022-0.060	0.040-0.070	0.040-0.080	0.050-0.100
0.015-0.040	0.020-0.050	0.022-0.060	0.040-0.070	0.040-0.080	0.050-0.100
0.015-0.040	0.020-0.050	0.022-0.060	0.040-0.070	0.040-0.080	0.050-0.100
0.015-0.040	0.020-0.050	0.022-0.060	0.040-0.070	0.040-0.080	0.050-0.100
0.015-0.040	0.020-0.050	0.022-0.060	0.040-0.070	0.040-0.080	0.050-0.100
0.010-0.020	0.013-0.026	0.015-0.030	0.018-0.036	0.022-0.044	0.030-0.060
0.010-0.030	0.013-0.039	0.015-0.045	0.018-0.055	0.022-0.060	0.030-0.080
0.010-0.030	0.013-0.039	0.015-0.045	0.018-0.055	0.022-0.050	0.030-0.070

For accurate fitting, the concentricity tolerance of the cylindrical part at the end of the drill, should be always checked as shown on the figure.

The runout should be lower than :

- 0.005 mm for 10xD
- 0.008 mm for 15xD
- 0.010 mm for 20xD

The coolant pressure must be greater than 70 bar; lower pressure will require a chipbreaking cycle with a pitch of 0.10 to 1x the Ø for all materials.

Use fine-mesh filtration to avoid clogging the oil holes with chip microparticles.
Filtration requirements vary according to drill diameter:

- **Drills with a diameter of < 2 mm**: recommended filtration ≤ 0.010 mm
- **Drills with a diameter of < 3 mm**: recommended filtration ≤ 0.020 mm

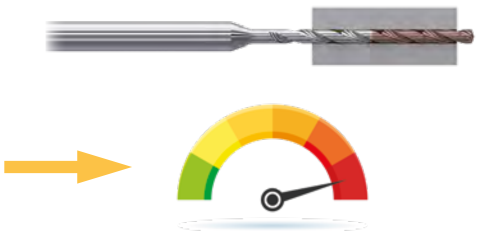
5. MACHINING PROCESSES, ADVICE ON USE

DRILLING < 15XD

1 **PILOT HOLE:**

Drilling can be carried out in a single pass or with interruptions to the G73 machine cutting cycle, depending on the condition of the material and the formation of chips.
Stainless steels and chrome-cobalt alloys generally allow continuous drilling without interruption.

2 **FULL DEPTH DRILLING:**



depending on the material and type of swarf obtained. The use of the G73 cycle is very useful for breaking swarf, guaranteeing short swarf without completely rising to the surface of the workpiece. Stainless steels and chrome-cobalt alloys can generally be drilled in a single pass.

3 **RETRACTING THE DRILL:**

Once the drilling depth has been reached, move the drill backwards at rapid feed.

DRILLING ≥ 15XD

1 **PILOT HOLE:**

Drilling can be carried out in a single pass or with interruptions to the G73 machine cutting cycle, depending on the condition of the material and the formation of chips.
Stainless steels and chrome-cobalt alloys generally allow continuous drilling without interruption.

2 **ENTRY INTO THE PILOT HOLE:**

High rotations associated with long projecting length create a run-out at the end of the drill. To enter into the pilot hole and protecting the drill margin flutes, start machining by entering at a reduced rotation and feed speed, for example at 500 rpm with a feed of 800 mm/min.

3 **FULL DEPTH DRILLING:**

Drilling can be carried out in a single pass or with interruptions, depending on the material and type of swarf obtained. The use of the G73 cycle is very useful for breaking swarf, guaranteeing short swarf without completely rising to the surface of the workpiece. Stainless steels and chrome-cobalt alloys can generally be drilled in a single pass.

4 **RETRACTING THE DRILL:**

Once the drilling depth has been reached, move the drill back a few tenths, return to the reduced speed of 500 rpm and then remove the drill from the hole at a moderate feed rate of around 800 mm/min.

Example of a programme with adaptation of spindle rotation and drilling with interrupted cutting.

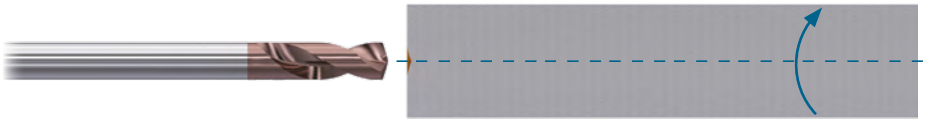
- DIXI 1448-20D-HH Ø3 C-TOP drill
- Drilling depth ap = 60 mm
- Cutting interruption every 0.5xØ
- High-alloy forged steel

```
N20 M6 T13 (DIXI 1448 Ø3 C-TOP drill)
N30 G0 X0 Y0 (Drilling position)
N40 M3 S500 (reduced spindle rotation to enter pilot hole)
N50 M88 (central coolant activation)
N60 G4 P2 (sec. timer for lubricant supply)
N80 G0 Z1
N90 G1 Z-7.5 F500 (entry into pilot hole at 2.5XØ)
N100 M3 S4500 (spindle rotation for drilling)
N110 G4 P2 (Tempo to ensure spindle rotation)
N140 G1 Z-10.5 F360 (feed for drilling)
N150 G0 Z-10.3 (Return «R» of 0.2 to split the chip)
N160 G1 Z-11
N170 G0 Z-10.8
N180 G1 Z-12.5
N190 G0 Z-12.3
.......
N980 G1 Z-58.5
N990 G0 Z-58.3
N1000 G1 Z-60 (end of drilling position)
N1010 G1 Z-58.5 (drill retracting point)
N1020 M3 S500 (reduced rotation speed)
N1030 G4 P1 (speed reduction time)
N1040 G1 Z10 F800 (drill output)
N1060 M89 (internal coolant stop)
N1150 M30
%
```

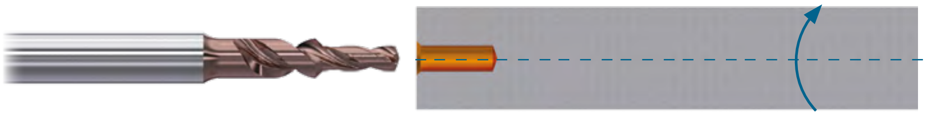
TURNING - LATHE TURNING:

When the part is rotating and the tool remains stationary, a 145° pointing is recommended before machining with a pilot drill, particularly for holes 15 to 20 times the diameter (XD), depending on the hole tolerances required.

DIXI 1105 centring



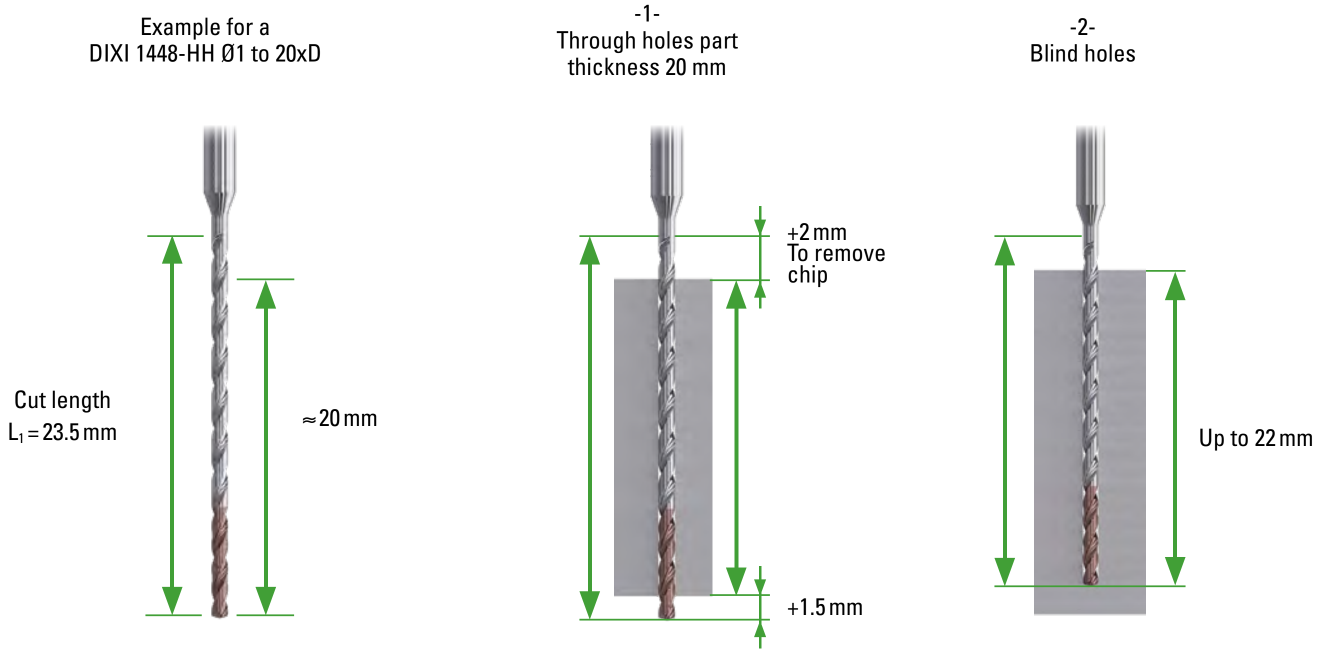
DIXI 1410-HH pilot drill



DIXI 1448-HH long drill

THE «CUT» LENGTH L1 AND THE «USEFUL» LENGTH:

Through holes (see sketch 1) require a greater cutting length than blind holes (see sketch 2). For blind holes, the flute length should be longer than the depth of the hole. At least twice the drilling diameter to ensure efficient chip evacuation and avoid any risk of jamming.



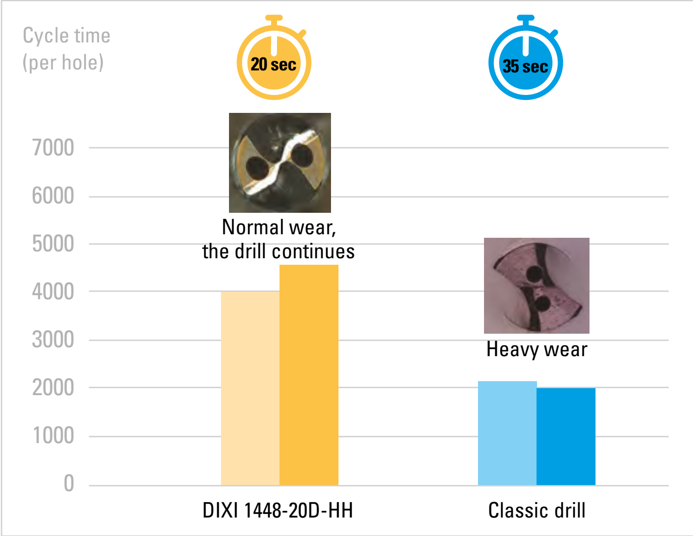
6. APPLICATION EXAMPLE - WATCH INDUSTRY

20D drilling of 1.4441 stainless steel

Holes drilled with pilot drill followed by 20D drilling at 40 mm without deburring cycle using the same cutting conditions.

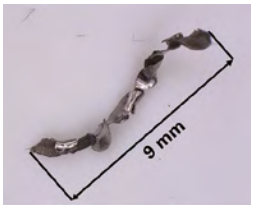
Tools:
DIXI 1410-HH Ø2 C-TOP pilot drill
DIXI 1448-20D-HH Ø2x46 C-TOP drill

Cutting conditions:
n = 9'550 rpm (Vc = 60 m/min)
Vf = 764 mm/min (f = 0.03 mm/rev)
10 µm filtration - 7% emulsion
Pressure: 80 bar



Low wear after 1'800 holes

DIXI 1448-20D-HH



Classic drill

- ✓ Significantly improved drilling speed.
- ✓ Significant reduction in cycle times.
- ✓ Ability to drill more holes in a row.
- ✓ Superior performance compared with standard internal coolant drills.
- ✓ Better control of the heat development.
- ✓ Extended tool life.
- ✓ Increased precision for serial drilling.
- ✓ Ideal solution for high productivity solution.

APPLICATION EXAMPLE - SUBCONTRACTOR MACHINE CONSTRUCTION

20D drilling of 1.4441 stainless steel

Holes drilled with pilot drill followed by 20D drilling at 30 mm without deburring cycle using the same cutting conditions.

Tools:
DIXI 1410-HH Ø1.5 C-TOP pilot drill
1448-20D-HH Ø1.5 x 34.5 C-TOP drill

Cutting conditions:
n = 12'733 rpm (Vc = 60 m/min)
Vf = 390 mm/min (f = 0.03 mm/rev)
Filtration 10 µm - Emulsion 7%
Pressure: 80 bar

Short chips

Wear after 1'000 holes

APPLICATION EXAMPLE - SUBCONTRACTOR MEDICAL

20D drilling of titanium grade 5

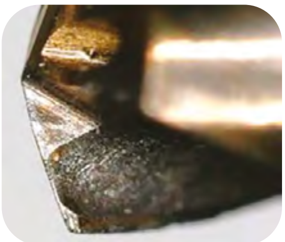
Holes drilled with pilot drill followed by 20D drilling at 40mm with interrupted cutting cycle and the same cutting conditions.

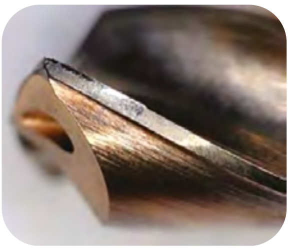
Tools:
DIXI 1410-HH Ø2 C-TOP pilot drill
DIXI 1448-20D-HH Ø2 x 46 C-TOP drill

Cutting conditions:
n = 4'775 rpm (Vc = 30 m/min)
Vf = 190 mm/min (f = 0.04 mm/rev)
Flow cycle: 2 mm
Filtration 10 µm - Emulsion 7%
Pressure: 80 bar

Short chips

Wear after 2'200 holes





APPLICATION EXAMPLE - AERONAUTICS SECTOR

20D drilling of Inconel 718

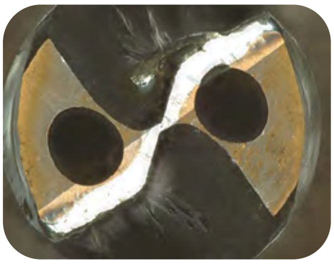
Holes drilled with pilot drill followed by 20D drilling at 56 mm with interrupted cutting cycle and the same cutting conditions.

Tools:
DIXI 1410-HH Ø2.8 C-TOP pilot drill DIXI 1448-20D-HH Ø2.8 x 64.4 C-TOP drill

Cutting conditions:
n = 2'274 rpm (Vc = 20 m/min)
Vf = 46 mm/min (f = 0.02 mm/rev)
Deburring cycle: 0.2 x Ø = 0.56 mm
Filtration 10 µm - Emulsion 7%
Pressure: 80 bar

Non-breaking chips

Significant wear after 60 holes



APPLICATION EXAMPLE - SUBCONTRACTOR MEDICAL

20D Chrome-Cobalt drilling

Holes drilled with pilot drill followed by 20D drilling at 30 mm without deburring cycle using the same cutting conditions.

Tools:
DIXI 1410-HH Ø1.5 C-TOP pilot drill DIXI 1448-20D-HH Ø1.5 x 34.5 C-TOP drill

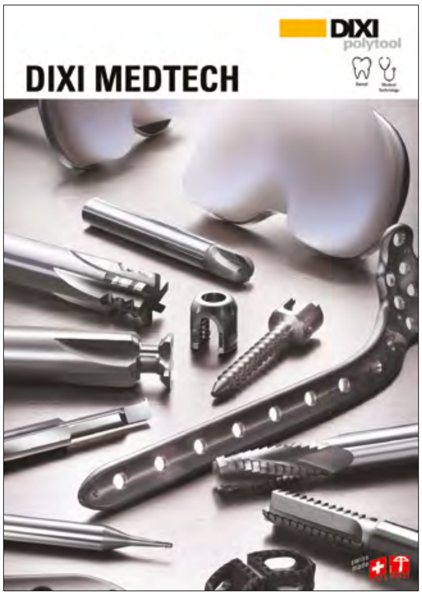
Cutting conditions:
n = 5’305 rpm (Vc = 25 m/min)
Vf = 65 mm/min (f = 0.012 mm/rev)
Filtration 10 µm - Emulsion 7%
Pressure: 80 bar

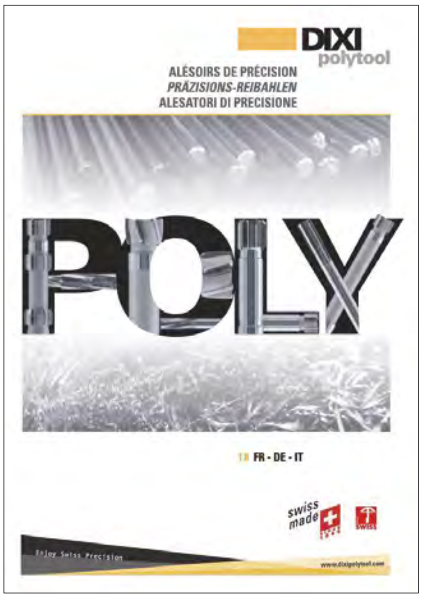
Holes drilled with pilot drill followed by 20D drilling at 60mm without deburring cycle using the same cutting conditions.

Tools:
DIXI 1410-HH Ø3 C-TOP pilot drill
DIXI 1448-20D-HH Ø3 x 69 C-TOP drill

Cutting conditions:
n = 2’650 rpm (Vc = 25 m/min)
Vf = 66 mm/min (f = 0.025 mm/rev)
Filtration 10 µm - Emulsion 7%
Pressure: 80 bar

AVAILABLE DOCUMENTATION





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