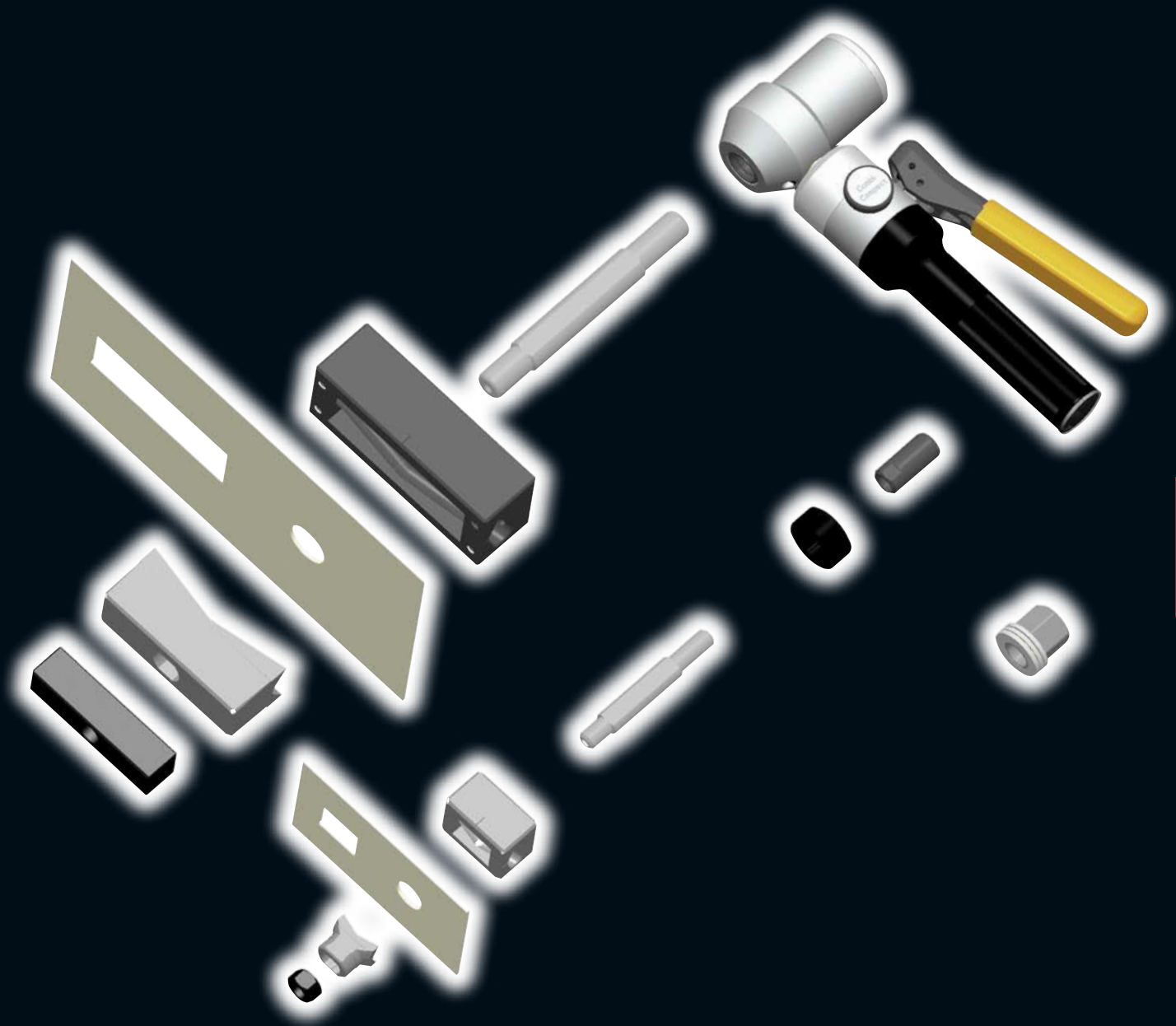
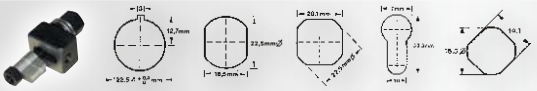


PUNCH & DIE – TABLE OF TYPES AND APPLICATION POSSIBILITIES

Punch dimension	For use with			
	Wrench	Hand-Hydraulic punch Compact, Compact-Combi, Compact Flex	Battery packed Hydraulic punch Akku Compact	Foot-and electro-hydraulic pump with hydraulic cylinder
 **STANDARD PUNCH ROUND**				
12,7 - 82,0 mm	✔	✔	✔	✔
89,0 - 120,0 mm	-	-	✔ with special screw	✔
 **SPLITTER PUNCH ROUND TRISTAR/ TRISTAR PLUS/ TRISTAR PLUS -S**				
12,5 - 63,5 mm	✔	✔	✔	✔
 **PUNCHER SQUARE**				
12,7 x 12,7 mm - 25,4 x 25,4 mm	✔	✔	✔	✔
45,5 x 45,5 mm - 68,0 x 68,0 mm	-	✔	✔	✔
92,0 x 92,0 mm	-	-	✔ with special screw	✔
125,0 x 125,0 mm - 138,0 x 138,0 mm	-	-	-	✔
 **PUNCHER SQUARE FOR STAINLESS STEEL**				
46,0 x 46,0 mm - 68,0 x 68,0 mm	-	✔	✔	✔
92,0 x 92,0 mm	-	-	✔ with special screw	✔
 **PUNCHER RECTANGULAR**				
17,0 x 19,0 mm - 25,0 x 50,0 mm	✔	✔	✔	✔
45,0 x 92,0 mm - 46,0 x 92,0 mm	-	✔	✔	✔
68,0 x 138,0 mm	-	-	-	✔
 **PUNCHER RECTANGULAR FOR HEAVY CONNECTORS**				
36,0 x 52,0 mm - 46,0 x 86,0 mm	-	✔	✔	✔
46,0 x 112,0 mm	-	-	-	✔
 **PUNCHER SPECIAL SHAPES**				
Ø 22,5 mm with 3 mm nose	✔	✔	✔	✔
Ø 22,5 mm 2-side flattened to 18,5 mm	✔	✔	✔	✔
Ø 22,5 mm 4-side flattened to 20,1 mm	✔	✔	✔	✔
BKS-Profile cylinder	✔	✔	✔	✔
Ø 16,3 mm 4-side flattened to 14,1 mm	✔	✔	✔	✔
 **PUNCHER - SUB-MIN-D**				
9 polig - 50 polig	✔	✔	✔	✔

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PUNCHER – FOR MANUAL AND HYDRAULIC OPERATION

Square, rectangular and special shapes

1. Screw draw stud ❸ with thread fully into the hydraulic cylinder ❽.
2. Die ❹ must not be canted when placed on draw stud ❸.
   Use distance bushes ❺ if necessary.
3. Insert draw stud ❸ through pre-drilled hole in the control cabinet door.
4. Set the punch ❷ squarely on the hydraulic draw stud from the rear and tighten the lock nut ❶.
5. Align the puncher ❷ on the cross-hair with the four markings.

Operating the hydraulic pump

- Draw the punch fully through the metal.
- Do not use force.
- Release the pressure on the hydraulic cylinder after the punching operation by opening the valve wheel on the pump (hydraulic cylinder body).
- Disassemble the puncher and remove the waste from the die.

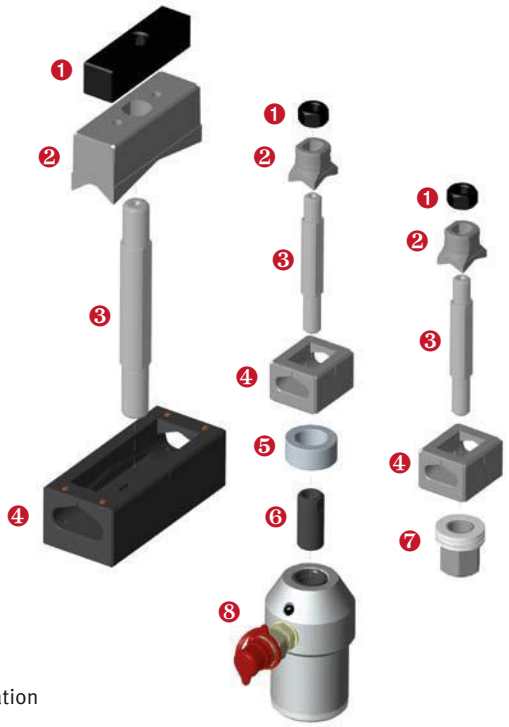
Caution:

- Only operate the puncher until the metal is cut. Avoid the punch acting against the inside of the die.
- Staggered punching (nibbling) is not possible.
- Never use force.

Important!

- Draw stud, cutter and guides should always be oiled or greased; punch and die then move more easily.
- Sharpen the punch in good time, depending on degree of bluntness.

❶ lock nut
❷ punch
❸ draw stud
❹ die
❺ distance bush
❻ adapter for hydraulic operation
❼ forcing nut for manual operation
❽ hydraulic cylinder



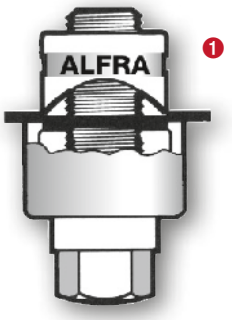
When operated with wrench, use forcing nut ❼ instead of adapter ❻

PUNCHER – DID YOU KNOW?

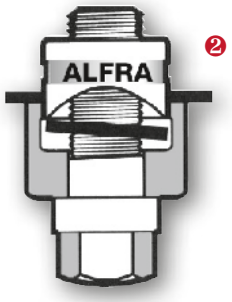
Punchers with three cutting tips as standard

The waste drops easily out of the die, if you turn the punch 2-3 turns further into the die using a spanner after the punching operation. ❶

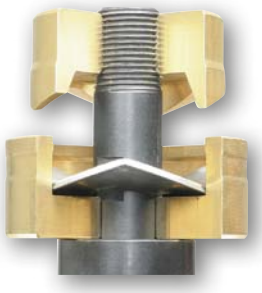
This pushes the waste piece over the edge of the die and so falls freely out of the die if you have predrilled 11 or 21 mm. ❷



❶



❷



Puncher cutting diagram

Clearance Angle

Is the angle between the TCT tooth and the material to be cut. ALFRA TCT Cutters are equipped with serveral clearance angles at a cutting edge.

Cutting Depth
Is the maximum material thickness which might be cut with the particular tool (not to be mistaken with the constructive height of the tool).

Chip Flute
Takes the generated chips and advances this out of the bore.

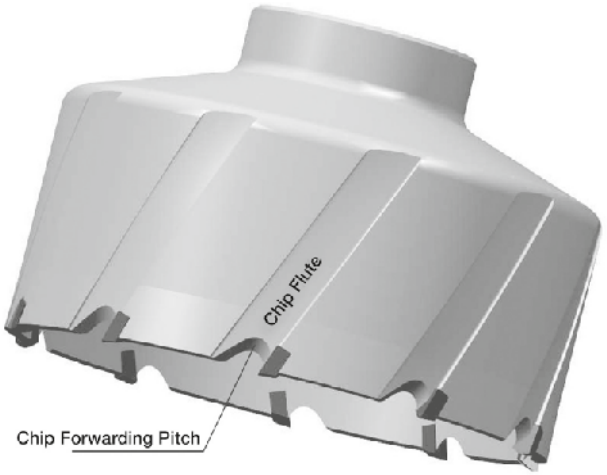
Chip Forwarding Pitch
Forwards the chips from the TCT tooth to the chip flute.

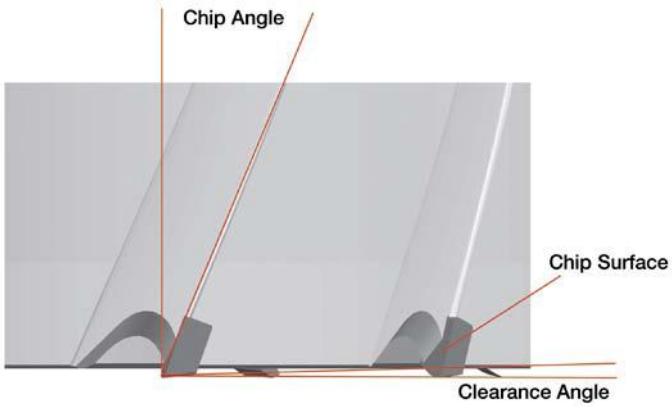
Chip Surface
On this surface the chip is formed.

Chip Angle
Is the angle between tool axis and chip surface.

Tooth Excess Length
Is the carbide excess to the basic body.

Tooth Height Difference
Acts as a chip breaker.





RPM, cutting speed and feed (approximate value)
Rotabest®-TCT cutter
Not suitable for automatic feed

Material	m/min	mm/rpm
Constructional steel 50 kp/m²	40-60	0.08-0.12
Steel 50-70 kp/m²	30-50	0.08-0.12
Stainless steel	18-45	0.8-0.10
Cast iron	65-95	0.12-0.20
Non-ferrous metals, Aluminium	100-550	0.22-0.45
Exotic alloys	10-30	0.05-0.08

Exactness (approximate value)/input/+ 0.10 mm Output /±0 mm

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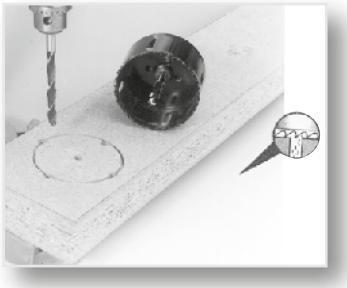
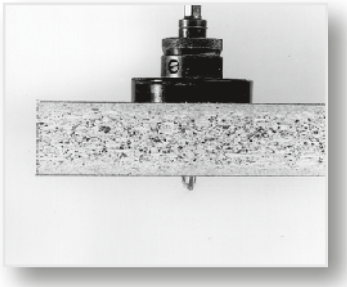
To achieve the best results:

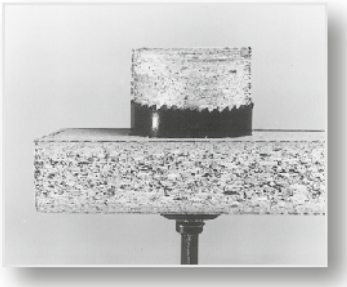
1. Use the hole saws at the recommended cutting speed, see guide table on the packaging.
2. Do not apply excess pressure. Apply a little more pressure for a harder material and less pressure for a softer material.
3. In order to achieve good centring, the centre drill must project approximately 6 mm beyond the teeth. It is recommended that the hole is first predrilled with a twist drill and then the centre drill is used in the adapter as a centring pin.
4. Use a good cutting oil when drilling metal. This extends the hole saw's service life and prevents premature blunting of the tooth tips.
5. The arbor of the adapter must be firmly clamped with the flattened sides correctly seated in the chuck.
6. The hole saw must cut into the workpiece at a right angle. Avoid tilting. Risk of accident.
7. If large hole saw diameters are used in hand-held drills, the hand-held drill must be held particularly firmly. A drill stand should be used where possible.
8. The adapter must be firmly screwed into the hole saw with all its thread and the driver pins must be firmly seated in the driver holes.
9. Secure the driver pins with the rotating ring or lock in the case of a quick-change adapter.
10. Wear protective goggles when working with the bi-metal hole saws and keep hands away in case saw runs out. Never attempt to stop with your hands a saw that is running off.
11. Lift the saw clear frequently, especially when cutting timber, chipboard and wood substitutes and remove the sawdust and chips. If this is not done, the tooth tips can burn and the hole saw will jam in the cut.
12. We recommend the following procedure when drilling timber, chipboard and wood substitutes:

Drill a number of holes immediately inside the cut. This helps carry the chips away and avoids frequent interruptions in cutting to clean the tooth tips.



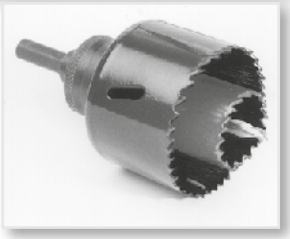
If the workpiece is especially thick ...
... it is also recommended that you cut from both sides, or drill a number of holes immediately inside the circular cut. This helps carry the chips away and avoids frequent interruptions in cutting to clean the tooth tips.





Enlarging existing holes

Existing holes 32 mm (1-1/4") or more in diameter may be enlarged with a simple trick: Take a 32 mm diameter hole saw and screw this inside the hole saw on the projecting thread of the A2 adapter. The inner hole saw then acts as a kind of guiding hole saw for extending existing holes, see photo.



What you absolutely must avoid:

1. Drilling at too fast or too slow cutting speed. The teeth will glide over the material and become prematurely blunt.
2. Avoid bringing the saw teeth abruptly down on the workpiece, the teeth will break off.
3. Never cut metallic materials dry. Always use a cutting oil.
4. Never bring the saw up to the workpiece on a slant. There is a risk of injury when hand drills are used. The saw can break up or the arbor could be damaged.
5. Ensure that the hole saw is running true. Check the chuck as necessary.
6. Never screw the adapter's guide pins only partially into the hole saw guide holes. The thread of the hole saw could be torn out.
7. Never regrind the hole saw freely by hand. Have hole saws reground by a specialist. Care must be taken to ensure sufficient residual setting and a uniform tooth height.
8. If the tool arbor is pushed into the chuck or if the arbor shears off, the advance pressure is too great.
9. If the hole saw is unevenly worn on the outside, then the saw is not running true or the material to be sawn was not correctly clamped.
10. If the tooth tips are blued, the saw has been used without cutting oil, or at too high a cutting speed.

HSS Bi-Metal Hole Saws – Speed Chart

Recommended Speed for various materials (RPM)

Diameter mm	Mild Steel	Cast Iron	Tool steel + stainless steels	Brass	Aluminium	Wood
14	580	400	300	790	900	3000
16	550	365	275	730	825	3000
17	500	330	250	665	750	3000
19	460	300	230	600	690	3000
20	440	290	220	580	660	3000
21	425	280	210	560	635	3000
22	390	260	195	520	585	3000
24	370	245	185	495	555	3000
25	350	235	175	470	525	2700
27	325	215	160	435	480	2700
29	300	200	150	400	450	2700
30	285	190	145	380	425	2400
32	275	180	140	380	410	2400
33	260	175	135	345	390	2400
35	250	165	125	330	375	2400
37	240	160	120	315	360	2400
38	230	150	115	300	345	2400
40	220	145	110	290	330	2100
41	210	140	105	280	315	2100
43	205	135	100	270	305	2100
44	195	130	95	260	295	2100
46	190	125	95	250	285	2100
48	180	120	90	240	270	2100
51	170	115	85	230	255	2000
52	165	110	80	220	245	2000
54	160	105	80	210	240	2000
57	150	100	75	200	225	2000
59	145	100	75	195	225	2000
60	140	95	70	190	220	2000
64	135	90	65	180	205	1800
65	130	85	65	175	200	1800
67	130	85	65	170	195	1800
70	125	80	60	160	185	1800
73	120	80	60	160	180	1800
76	115	75	55	150	170	1500
79	110	70	55	140	165	1500
83	105	70	50	140	155	1500
86	100	65	50	130	150	1200
89	95	65	45	130	145	1200
92	95	60	45	120	140	1200
95	90	60	45	120	135	1200
98	90	60	45	120	135	1200
102	85	55	40	110	130	1000
105	80	55	40	110	120	1000
108	80	55	40	110	120	900
111	80	50	40	100	120	900
114	75	50	35	100	105	900
121	75	50	35	95	95	900
127	65	45	30	90	90	800
133	60	40	25	86	85	800
140	60	40	25	85	85	800
146	55	35	25	75	75	800
152	55	35	25	75	75	800

These speeds are benchmarks. The speed can be higher or lower, this depends on the material type and the cutting behaviour.
Attention: Do not use cutting oil, if you are cutting cast iron. If you are cutting aluminium use paraffin wax or paraffin.

Calculation of the Cutting Speed

n = Speed (1/min)
v_c = Cutting speed (m/min)
d = Tool diameter (mm)

$$v_c = \frac{\pi \times d \times n}{1000}$$

TCT-Hole Saws – Speed Chart

Speed calculation

n = Speed (1/min)
v_c = Cutting Speed (m/min)
d = Tool diameter (mm)

$$n = \frac{v_c \times 1000}{d \bullet \pi}$$

Worked sample:

d = 20 mm
v_c = 50 m/min

$$n = \frac{50000}{20 \bullet \pi} = 795.77 \text{ 1/min}$$

Tool Ø	Cutting speed (m/min)												
		Stainless steel material				Mild steel - ST material							
	20	25	30	35	40	45	50	55	60	65	70	75	80
16	398	498	597	697	796	896	995	1095	1194	1294	1393	1493	1592
18	354	442	531	619	708	796	885	973	1062	1150	1238	1327	1415
20	318	398	478	557	637	717	796	876	955	1035	1115	1194	1274
22	290	362	434	507	579	651	724	796	869	941	1013	1086	1158
24	265	332	398	464	531	597	663	730	796	863	929	995	1062
26	245	306	367	429	490	551	612	674	735	796	857	919	980
28	227	284	341	398	455	512	569	626	682	739	796	853	910
30	212	265	318	372	425	478	531	584	637	690	743	796	849
32	199	249	299	348	398	448	498	547	597	647	697	746	796
34	187	234	281	328	375	422	468	515	562	609	656	703	749
36	177	221	265	310	354	398	442	487	531	575	619	663	708
38	168	210	251	293	335	377	419	461	503	545	587	629	670
40	159	199	239	279	318	358	398	438	478	518	557	597	637
42	152	190	227	265	303	341	379	417	455	493	531	569	607
44	145	181	217	253	290	326	362	398	434	470	507	543	579
46	138	173	208	242	277	312	346	381	415	450	485	519	554
48	133	166	199	232	265	299	332	365	398	431	464	498	531
50	127	159	191	223	255	287	318	350	382	414	446	478	510
52	122	153	184	214	245	276	306	337	367	398	429	459	490
54	118	147	177	206	236	265	295	324	354	383	413	442	472
56	114	142	171	199	227	256	284	313	341	370	398	427	455
58	110	137	165	192	220	247	275	302	329	357	384	412	439
60	106	133	159	186	212	239	265	292	318	345	372	398	425
62	103	128	154	180	205	231	257	283	308	334	360	385	411
64	100	124	149	174	199	224	249	274	299	323	348	373	398
66	97	121	145	169	193	217	241	265	290	314	338	362	386
68	94	117	141	164	187	211	234	258	281	304	328	351	375
70	91	114	136	159	182	205	227	250	273	296	318	341	364
72	88	111	133	155	177	199	221	243	265	288	310	332	354
74	86	108	129	151	172	194	215	237	258	280	301	323	344
76	84	105	126	147	168	189	210	230	251	272	293	314	335
78	82	102	122	143	163	184	204	225	245	265	286	306	327
80	80	100	119	139	159	179	199	219	239	259	279	299	318
82	78	97	117	136	155	175	194	214	233	252	272	291	311
84	76	95	114	133	152	171	190	209	227	246	265	284	303
86	74	93	111	130	148	167	185	204	222	241	259	278	296
88	72	90	109	127	145	163	181	199	217	235	253	271	290
90	71	88	106	124	142	159	177	195	212	230	248	265	283
92	69	87	104	121	138	156	173	190	208	225	242	260	277
94	68	85	102	119	136	152	169	186	203	220	237	254	271
96	66	83	100	116	133	149	166	182	199	216	232	249	265
98	65	81	97	114	130	146	162	179	195	211	227	244	260
100	64	80	96	111	127	143	159	175	191	207	223	239	255

FRP Hole Saws

Ø mm	Timber Chipboard	Plastics	Masonry	Wall tiles*
25/30/35	1000	800	800	500
40/45/50	800	600	700	400
58 to 74	600	400	600	400
80/105	400	300	300	300

* Drilling in tiles only up to a scratch hardness of 6, mark centre, set the centre drill and drill through the glaze with at a low speed, allow the saw teeth to penetrate the glazing uniformly, running as smoothly and level as possible, so that the edge of the hole is made without chipping. Continue drilling at a normal drilling speed. Tiles with a scratch hardness greater than 6 may only be cut with diamond or carbide hole saws.

Notes on use
- Use rotation only. Switch off impact or hammer drill.
- Impact and shock on the sharp, ground carbide cutters can lead to small carbide splinters and thus to a severe loss of performance.
- Do not tilt the hole saw in the hole.
- Remove the drill core after each operation. Remove the sawdust when drilling timber and timber products.

Notes on use
For multipurpose hole saw with rim countersink
- The rim countersink is placed between hole saw and adapter and the carbide cutter is used to make a countersink in timber and timber substitutes. This makes it possible to fit sockets flush.

Important notes on use
- The hole saw with rim countersink may not be stopped before it is removed.
- Advance with care, to prevent the cut edges tearing.

Speed Chart – Multi-Step Drills/Conical One-Lip Bits

ALFRA-Multi-step drills

These drills were especially made to drill perfectly round and simultaneously deburred holes in sheet metals of 4 - 6 mm. The radius transition simultaneously deburrs or bezels the holes. While conical one-lip bits drill slightly conical holes, cylindrical holes can be drilled with ALFRA Multi-step drills. The tools are axial-radially relief ground and can be resharpened at the breast of the cutting tooth.

We recommend the use of pillar drilling machines, however, the small ALFRA Multi-step drills can be used on adjustable hand drilling machines.
Imperatively use sufficient cooling **(ALFRA coolant stick or bore emulsion)?**

ALFRA HSS DM 05 precision Multistep Drill

- **Take notice of the cuttig speed**
- **Grease the cutting lips in case of application**

The holes are deburred on both sides by the multistep drills. The multistep drill drills holes in thin materials, enlarges existing holes, makes inclined holes, drills pipes, makes holes penetrating each other. Suitable for any hand drill. For steel — PVC — polystrol — polyester — Plexiglas — card — plywood and similar materials. Can be reground many times, if treated carefully.

Material	Mild steel ‹ 700	Mild steel › 700	Alloy steel ‹ 1000	Cast iron ‹ 250	Cast iron › 250	Stainless steel	CuZn alloy brittle	CuZn alloy tough	AL alloy	Thermo-plastic	Duro-plastic	Wood
	N/mm²	N/mm²	N/mm²	N/mm²	N/mm²				‹ 11% Si			
Material gauge	5.0 mm	5.0 mm	5.0 mm	5.0 mm	5.0 mm	3.0 mm	5.0 mm	5.0 mm	5.0 mm	5.0 mm	5.0 mm	25.0 mm
Lubricant	Drilling paste	Drilling paste	Drilling paste	Air	Air	Drilling paste	Air	Air	Drilling paste	H_2O	Air	Air
Vc = m/min	25	20 - 25	20	15	10	5	60	35	30	20	15	› 40
Ø mm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm
4.0 - 12.0	1900 - 600	1700 - 580	1550 - 520	1190 - 400	800 - 250	400 - 130	4700 - 1550	2750 - 920	2350 - 790	1550 - 520	1190 - 400	3000 - 1000
4.0 - 20.0	1900 - 400	1700 - 350	1550 - 300	1190 - 240	800 - 160	400 - 80	4700 - 950	2750 - 550	2350 - 470	1550 - 300	1190 - 240	3000 - 650
12.0 - 20.0	600 - 400	600 - 350	520 - 300	400 - 240	250 - 160	130 - 80	1550 - 950	920 - 550	790 - 470	520 - 300	400 - 240	1000 - 650
4.0 - 24.0	1900 - 300	1700 - 280	1550 - 250	1190 - 200	800 - 130	400 - 65	4700 - 790	2750 - 460	2350 - 400	1550 - 250	1190 - 200	3000 - 550
6.0 - 30.0	1300 - 250	1200 - 230	1000 - 200	780 - 150	530 - 100	250 - 50	3150 - 630	1850 - 370	1590 - 310	1000 - 200	780 - 150	2100 - 420
20.0 - 30.0	400 - 250	350 - 230	300 - 200	230 - 150	160 - 100	80 - 50	950 - 630	550 - 370	470 - 310	300 - 200	230 - 150	650 - 420
6.0 - 36.0	1300 - 220	1200 - 200	1000 - 170	780 - 130	530 - 90	250 - 45	3150 - 530	1850 - 300	1590 - 260	1000 - 170	780 - 130	2100 - 350
30.0 - 40.0	250 - 200	230 - 180	200 - 150	150 - 120	100 - 80	50 - 40	630 - 470	370 - 280	310 - 240	200 - 150	150 - 120	420 - 310
40.0 - 50.0	200 - 160	180 - 140	150 - 125	120 - 90	80 - 65	40 - 30	470 - 380	280 - 220	240 - 190	150 - 125	120 - 90	310 - 250
50.0 - 60.0	160 - 130	140 - 110	125 - 100	90 - 80	65 - 50	30 - 25	380 - 310	220 - 185	190 - 150	125 - 100	90 - 80	250 - 210

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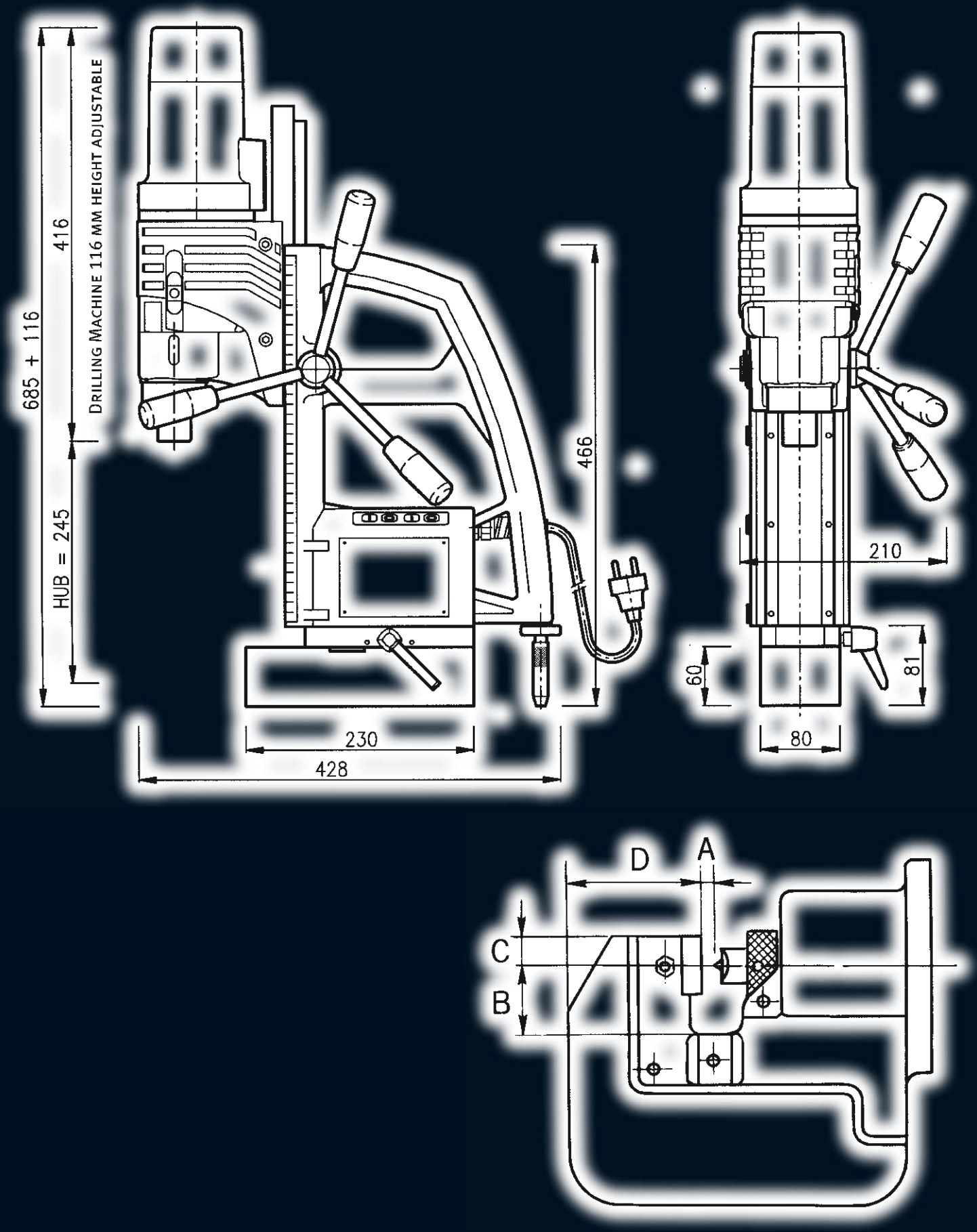
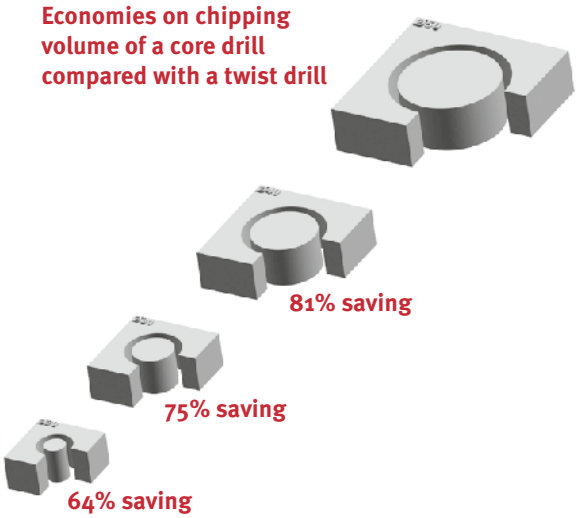

685 + 116
416
DRILLING MACHINE 116 MM HEIGHT ADJUSTABLE
HUB = 245
466
230
428
210
60
81
80
D
A
C
B

THE CORE DRILLING PRINCIPLE

Metal core drilling was introduced in Germany by ALFRA

- Core Drills machine only a fraction of the material at the same bore diameter than a twist drill
- The remaining core is ejected after finishing the drilling process.
- Thereby minor power and feed pressures are required.
- When using twist drills, it is possibly required to pre-drill. This is entirely omitted when using core drills, you can directly drill with the requested diameter.

The primary drilling time is abbreviated considerably depending on the cutting diameter.



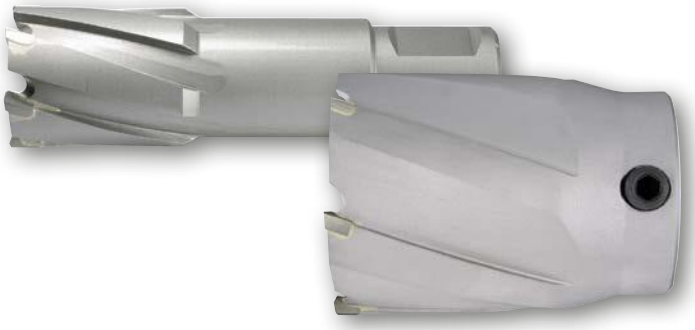
ALFRA Cutters – RPM-Chart

For HSS and HSS-Co Cutter

Material		Unalloyed steel up to 700 N/mm²	Alloyed steel up to 1000 N/mm²	Alu-alloy
Vc=m/min		30	20	30
Lubricants		Cutting oil	Cutting oil	Cutting oil
Ø mm	Ø inch	rpm	rpm	rpm
Not suitable for automatic feed!				
12	15/32	796	531	796
13	33/64	735	490	735
14	35/64	682	455	682
15	19/32	637	425	637
16	5/8	597	398	597
17	43/64	562	375	562
18	45/64	531	354	531
19	3/4	503	335	503
20	25/32	478	318	478
21	53/64	455	303	455
22	7/8	434	290	434
23	29/32	415	277	415
24	15/16	398	265	398
25	63/64	382	255	382
26	1 1/32	367	245	367
27	1 1/16	354	236	354
28	1 3/32	341	227	341
29	1 9/64	329	220	329
30	1 3/16	318	212	318
31	1 7/32	308	205	308
32	1 17/64	299	199	299
33	1 19/64	290	193	290
34	1 11/32	281	187	281
35	1 3/8	273	182	273
36	1 27/64	265	177	265
37	1 29/64	258	172	258
38	1 1/2	251	168	251
39	1 17/32	245	163	245
40	1 37/64	239	159	239
41	1 39/64	233	155	233
42	1 21/32	227	152	227
43	1 11/16	222	148	222
44	1 47/64	217	145	217
45	1 25/32	212	142	212
46	1 13/16	208	138	208
47	1 55/64	203	136	203
48	1 57/64	199	133	199
49	1 15/16	195	130	195
50	1 31/32	191	127	191
60	2 3/8	159	106	159

While drilling Hardox, we recommend the use of our ASP 30/ASP 60 cutters. Please use while drilling Hardox, pure cutting oil and reduce the rotation speed by 10%. Consult the column „alloyed steel“ until 1.000 N/mm². Please, use only magnet drilling machines with a high adhesion force or pillar drilling machines or milling machines.

For TCT Cutter



Material		Unalloyed steel up to 700 N/mm²	Alloyed steel up to 1000 N/mm²	Alu-alloy
Vc=m/min		50	35	60
Lubricants		Cutting oil	Cutting oil	Cutting oil
Ø mm	Ø inch	rpm	rpm	rpm
Not suitable for automatic feed!				
18	45/64	885	619	1062
19	3/4	838	587	1006
20	25/32	796	557	955
21	53/64	758	531	910
22	7/8	724	507	869
23	29/32	692	485	831
24	15/16	663	464	796
25	63/64	637	446	764
26	1 1/32	612	429	735
27	1 1/16	590	413	708
28	1 3/32	569	398	682
29	1 9/64	549	384	659
30	1 3/16	531	372	637
31	1 7/32	514	360	616
32	1 17/64	498	348	597
33	1 19/64	483	338	579
34	1 11/32	468	328	562
35	1 3/8	455	318	546
36	1 27/64	442	310	531
37	1 29/64	430	301	531
38	1 1/2	419	293	503
39	1 17/32	408	286	490
40	1 37/64	398	279	478
41	1 39/64	388	272	466
42	1 21/32	379	265	455
43	1 11/16	370	259	444
44	1 47/64	362	253	434
45	1 25/32	354	248	425
46	1 13/16	346	242	415
47	1 55/64	339	237	407
48	1 57/64	332	232	398
49	1 15/16	325	227	390
50	1 31/32	318	223	382
55	2 5/32	290	203	347
60	2 3/8	265	186	318
65	2 9/16	245	171	294
70	2 3/4	227	159	273
75	2 61/64	212	149	255
80	3 5/32	199	139	239
85	3 11/32	187	131	225
90	3 35/64	177	124	212
95	3 47/64	168	117	201
100	3 15/16	159	111	191

TAPPING – RECOMMENDET DIMENSIONS (ISO 26H-TOLERANCE)

Recommendet characteristics for the use of drills with tapping attachments

Tapping: the tap must be adjusted on the prepared boring in the workpiece. Put down spindle, until the tap touches the surface and the process can be started. Please comply with below chart for metric ISO thread.

Bore Hole Chart metric ISO-thread

Dimension	Thread Pitch	drill-Ø
M3	0.5	2.5
M4	0.7	3.3
M5	0.8	4.2
M6	1	5
M8	1.25	6.8
M10	1.5	8.5
M12	1.75	10.2
M14	2	12
M16	2	14
M18	2.5	15.5
M20	2.5	17.5

Metric Fine Thread

Dimension	Thread Pitch	drill-Ø
M8x1	1	7
M10x1	1	9
M12x1	1	11
M12x1.5	1.5	10.5
M14x1	1	13
M14x1.5	1.5	12.5
M16x1	1	15
M16x1.5	1.5	14.5
M20x1	1	19
M20x1.5	1.5	18.5

Tips for tapping

1. **Clearance Hole**
   For Clearance Holes we recommend alongside mentioned taps, which safely conveys the chips out of the hole. The specially shaped grinding guarantees a safe re-mounting, when the tap opted out of the thread hole and returns in left hand rotation.

2. **Tapped Blind Holes**
   For Tapped Blind Holes we recommend alongside mentioned taps. The chips are conveyed out of the hole contrary to the cutting direction. Important: do not run aground with tap, as otherwise the automatic return run won't be activated. A correspondingly larger pre-drilling depth must be carried out.

   In case of a disregard, the tap must be manually released.

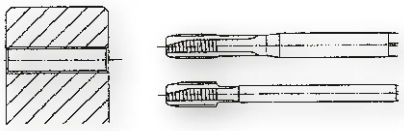
3. **Pocket Holes up to 1.5 x D**
   Taps according to alongside mentioned image are suitable. Here as well, the chips are conveyed out of the hole contrary to the cutting direction. Important: do not run aground with tap. A correspondingly larger pre-drilling depth must be carried out.

   In case of a disregard, the tap must be manually released.

Beside our taps with reinforced shanks, other taps according to DIN 376 with tapper shank are suitable as well

Please work with sufficient recommended for tapping by the corresponding manufacturer.

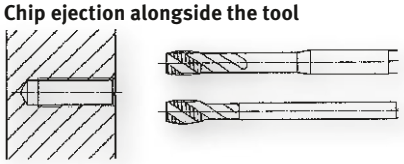
Chip ejection downwards trough the bore



DIN 371 with reinforced shank Shape B, with spiral face inclination, 3.5 to 5 convolutions.

DIN 376 with tapper shank
Tap depth 3 x D

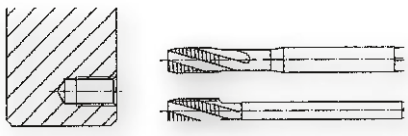
Chip ejection alongside the tool



DIN 371 with reinforced shank spiral grooved, ca. 35° right hand twist, Section chape C, ca. 3 convolutions

DIN 376 with tapper shank
Tap depth 2.5 x D

Chip ejection alongside the tool



DIN 371 with reinforced shank spiral grooved, ca. 17° right hand twist, Section chape C, ca. 3 convolutions

DIN 376 with tapper shank
Tap depth 1.5 x D

The choice of the proper tool size at a given material thickness is a usual question in daily practice.

For customary punch models, an old rule says that the minimum tool size is the material thickness.

This rule is no more valid for our hydraulically actuated punches.

The rule only still applies for fast moving mechanical presses: Thicker materials could cause the punch to break.

With our ALFRA PRESS APS-punches, the process is carried out by a smooth, slow motion allowing the punching of holes with a diameter smaller than the material thickness.

But still, a certain minimum diameter has to be respected. For that reason, we have carried out tests, and the results are demonstrated in fig.1. Example:

You want to punch holes into a steel plate made from DIN S233. Which is the correct ratio of material thickness to tool size?

The shear strength of the material is at 30 kg/mm² approx. The recommended ratio is represented by line A. The corresponding value on the ordinate is 1.3.

Result: The recommended ratio is 1.3.

The **upper** tolerance limit for that ratio is represented by line B which at this point gives an ordinate value of 1.7. Hence, it is possible to punch holes with a diameter of only 1/1.7 of the material thickness. You may use this tolerance value for exception, but the service life of the tool will be significantly reduced.

We would like to remind you only to use line A for the correct determination of the ratio of material thickness to hole size.

Minimum tool size at a given material thickness

At a given material thickness, fig. 2 can be used for the rapid determination of the tool size. The values for Al, Cu, DIN S233 and St 70 are indicated.

Example:

You want to punch holes into a steel plate of DIN S233; the material thickness is 20 mm. Which is the minimum hole diameter to be punched?

Look for the corresponding value on the solid line.

Result: Minimum hole diameter is 15 mm.

The dashed line represents the upper tolerance values, which can be used only for exception (reduced tool life).

We recommend you to select the hole size by means of the solid line.

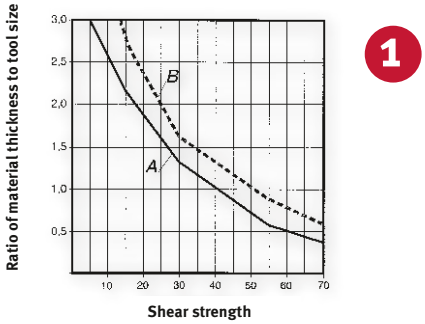
ALFRA punches and dies are made of high-quality materials. But still, sometimes a tool may break.

The following reasons have to be taken into account:

1. Incorrect selection of the ratio of tool size to material thickness.
2. The material is not aligned straight on the die.
3. Disturbing movements during the punch process.
4. The hold-down is damaged, or its height is not adjusted correctly, so that the material will be tilted during the removing of the punch.
5. The distance between hold-down and tool is too large. Thin sheets can be bended during the removing of the punch. In such cases, the tool breaks at the cutting edge in the form of thin leaves.

   In that case we recommend the hold-down to be equipped with a bridge or the utilization of a special hold-down.

Proper ratio at a given shear strength



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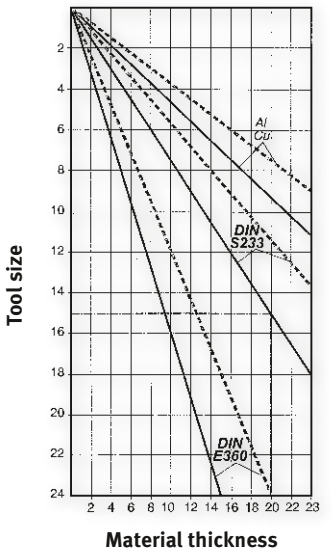


2

B

ALFRA Punching Unit APS – Working Range

Material DIN S275

	Material thickness mm	Required force for punching [kN] (10 kN ... approx. 1 ton) • Punch diameter (mm)																				
	Material DIN S233	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		APS 60											APS 70/70D				APS 120/110D						
APS 60 (DIN S275)	3	25	28	32	35	39	43	46	50	53	57	60	64	67	71	74	78	82	85	89	92	96	99
	4	33	38	43	47	52	57	61	66	71	76	80	85	90	94	99	104	109	113	118	123	128	132
	5	41	47	53	59	65	71	77	83	89	94	100	106	112	118	124	130	136	142	148	154	159	165
	6	50	57	64	71	78	85	92	99	106	113	120	128	135	142	149	156	163	170	177	184	191	198
	7	58	66	74	83	91	99	107	116	124	132	141	149	157	165	174	182	190	198	207	215	223	232
	8		76	85	94	104	113	123	132	142	151	161	170	180	189	198	208	217	227	236	246	255	265
	9			96	106	117	128	138	149	159	170	181	191	202	213	223	234	245	255	266	276	287	298
	10				118	130	142	154	165	177	189	201	213	224	236	248	260	272	283	295	307	319	331
APS 70 APS 70D (DIN S275)	11					143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351	364
	12						170	184	198	213	227	241	255	269	283	298	312	326	340	354	369	383	397
	13							200	215	230	246	261	276	292	307	322	338	353	369	384	399	415	430
APS 120 APS 110D (DIN S275)	14								232	248	265	281	298	314	331	347	364	380	397	413	430	447	463
	15									266	283	301	319	337	354	372	390	408	425	443	461	478	496
	16										302	321	340	359	378	397	416	435	454	472	491	510	529
	17											341	361	382	402	422	442	462	482	502	522	542	562
	18												383	404	425	447	468	489	510	532	553	574	595

Actual punching force

APS	60	70	120	70D	110D
in kN	225	313	470	454	508

	DIN S233	DIN S275	DIN S355	DIN E335	C 25	C 35	C 45	C 60
Rm max (sheet metal)	470	510	630	710	600	700	800	900
Tau max = 0.85 * Rm max	376	408	504	568	480	560	640	720
coef. (Steel X / DIN S233)	1.00	1.09	1.34	1.51	1.28	1.49	1.70	1.91

Example 1: **punching instrument APS 70D, F max=454 kN**
Punch diameter Ø=20 mm
Material thickness T=8 mm
Material C 45, R_m max=800 N/mm²

Calculation 1: **F = F(DIN S233) * coeff.(C 45/DIN S233)**
F = 189 * 1.70 = 321.3 kN
F is smaller than F max, punching force is sufficient

Example 2: **punching instrument APS 70, F max=313 kN**
Punch diameter Ø=21 mm
Material thickness T=12 mm
Material DIN S275, R_m max=510 N/mm²

Calculation 2: **F = F(DIN S233) * coeff.DIN S275/DIN S233)**
F = 298 * 1.09= 324.8 kN
F is smaller than F max;
Punching force is not sufficient;
Please select our APS 120

B

Conversion – Pressure

- Pascal (pa) =1 Newton (N) /m²
- 1 Bar (bar) =
  10 hoch 5 Pa = 10 hoch 5 N/m² = 10 N/m² = 750.06 Quecksilbersäule (QS)
- 1 bar = 1.019 bar = 0.1 N/mm² = 14.5 psi
- 1 kg /cm2 (atu) = 0.981 bar = 0.0981 N/mm2 = 14.2234 psi
- 1 bar = 1.02 technical atmospheres (at) = 1.02 kp/cm2 = 10 N/cm2
- 1 physical atmospheres (atm) =
  1.013 bar = 1.033 bar = 760 mm WC = 760 torr
- 1 torr = 1.332 mbar
- 1 m water column (mWC = 0.0980665 bar
- 1 mmWC = 0.0980665 mbar = 9.80655 Pa
- 1 N/mm2 = 10 bar = 10.19 bar = 145 psi
- 1 psi = 0.069 bar = 0.0703 bar 00.0069 N/mm2

Conversion Table – Units of Pressure

Converting the pressure units “bar” and “psi”

bar	psi	psi	bar
1	14.5	1	0.068965517
10	145	100	6.896551724
100	1450	100	6.896551724
500	7250	5000	344.8275862
1000	14500	10000	689.6551724
1200	17400	10500	724.137931

ALFRA – TIPS FOR RIGHT DEBURRING

Model KFH 150, KFH 250, KFT 250, KFT 500

Our precision high performance motors are continuously adjustable. We recommend to start with a low engine speed and to raise it continuously when milling.

The optimal engine speed can be detected by the running noise of the milling cutter and by the infeed.

The tool depending cutting speed, can be found out with the help of a well known formula and therefore the revolution can be adjusted in advance:

$$n = \frac{V_c \ 1000}{d \times 3.14} \text{ U/min}$$

d = cutter-Ø, n = rpm, 3.14 = Pi

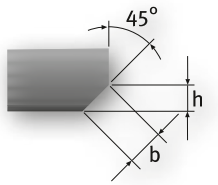
Responsible for the milling cutter speed (N) and the cutting speed (Vc) are first of all the used material, the bevel height and the cutting geometry of the solid carbide-milling cutter.

The bevel height (h)

For choosing the right solid carbide-milling cutter the bevel height is determining. When using the table based models KFT 250 and KFT 500 it must be considered, that the tool needs to be hold and controlled manually. If the milling power is too high, especially for little work pieces, the bevel height should be reached by several production steps.
Don't do bigger bevels in one go!

Bevel width (b)

The bevel width can be measured by use of the formula (b = h x 1.414)



Rotating direction

When machining the work pieces on the table based models, the rotating direction must be obeyed.

When using the hand operated models (KFH 150, KFH 250) the running direction (compare arrow) must be considered.
Synchronous milling is only applicable for a very small bevel height.

Surface finish

The surface finish of the bevel is depending on the used solid carbide milling cutter and the material as well as on the chosen infeed. If the chips start to glow, the infeed was too high or the milling cutters too thin.

Tool saving costs

In combination with the above mentioned models also standard solid carbide-end mill with face grinding can be used. By moving the milling cutter inside the arbor, the milling cutter can be consumed totally.

Cost reduction:
The bigger part of the End Mill´s cutting range can be used by moving the End Mill in the collet.

B

ALFRA BEVEL MILLING MACHINE – SKF 63-15

Material	Advance Recommendation
General construction steels up to 850 N/mm2	**0.8 - 1.0 m/min**
Hardened steels over 850 N/mm2	**0.75 m/min**
Stainless and acid-proof steels up to 600 N/mm2	**0.5 m/min**
Steel casting up to 450 N/mm2	**0.6 m/min**
Cast iron up to 400 N/mm2	**0.8 - 1.0 m/min**
Aluminium	**0.4 m/min**

(special indexable inserts required, available on separate request)

ALFRA – Carbide Milling Plates for Bevel Milling Machine SKF-63-15

	Prod.-No.
Carbide Milling plates, TiAlN/TiN-PVD multilayer coating Universal for steel and stainless steel Clearance angle 11°	25013
Carbide Milling plates, TiAlN/TiN-PVD multilayer coating for steel ‹ 850 N/mm²; stainless steel ‹› 900 N/mm² Clearance angle 20°	25010.15036B

	Prod.-No.
Carbide Milling plates, TiAlN/TiN-PVD multilayer coating for steel ‹ 1400 N/mm²; stainless steel ‹› 900 N/mm² Clearance angle 11°	25010.15036E
Carbide Milling plates, high gloss polished for aluminium and NE-metals Clearance angle 11°	25010.15036.C

Clearance Angle

Is the angle between the TCT tooth and the material to be cut. ALFRA TCT Cutters are equipped with serveral clearance angles at a cutting edge.

Cutting Depth
Is the maximum material thickness which might be cut with the particular tool (not to be mistaken with the constructive height of the tool).

Chip Flute
Takes the generated chips and advances this out of the bore.

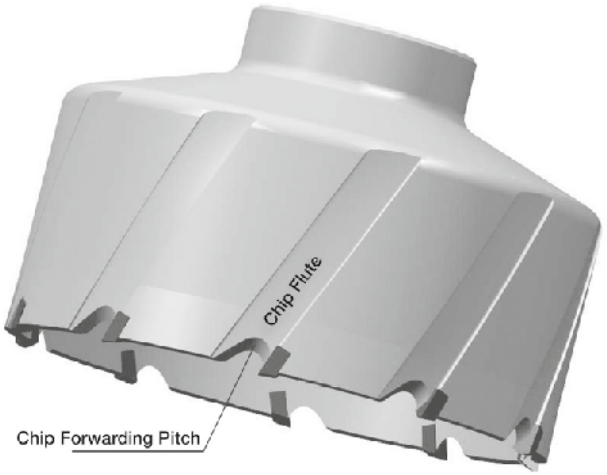
Chip Forwarding Pitch
Forwards the chips from the TCT tooth to the chip flute.

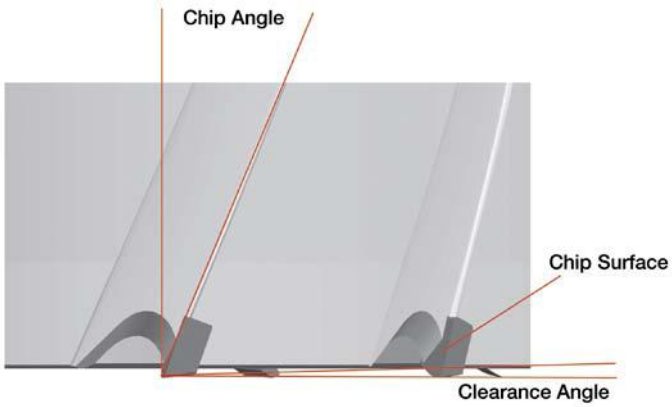
Chip Surface
On this surface the chip is formed.

Chip Angle
Is the angle between tool axis and chip surface.

Tooth Excess Length
Is the carbide excess to the basic body.

Tooth Height Difference
Acts as a chip breaker.





RPM, cutting speed and feed (approximate value)
Rotabest®-TCT cutter
Not suitable for automatic feed

Material	m/min	mm/rpm
Constructional steel 50 kp/m²	40-60	0.08-0.12
Steel 50-70 kp/m²	30-50	0.08-0.12
Stainless steel	18-45	0.8-0.10
Cast iron	65-95	0.12-0.20
Non-ferrous metals, Aluminium	100-550	0.22-0.45
Exotic alloys	10-30	0.05-0.08

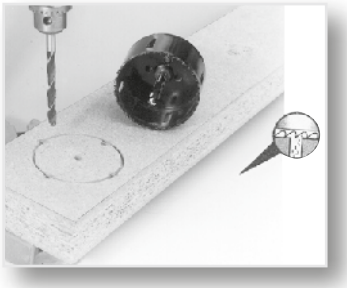
Exactness (approximate value)/input/+ 0.10 mm Output /±0 mm

HSS Bi Metal Hole Saws – Notes on use

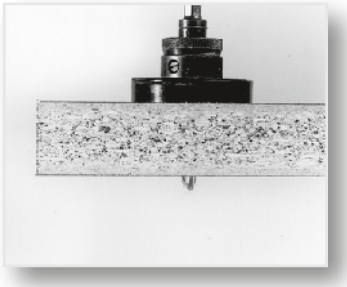
To achieve the best results:

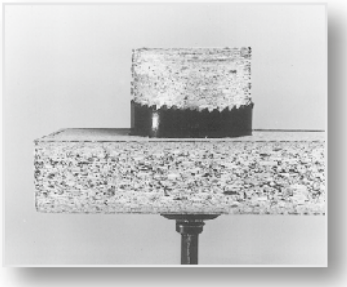
1. Use the hole saws at the recommended cutting speed, see guide table on the packaging.
2. Do not apply excess pressure. Apply a little more pressure for a harder material and less pressure for a softer material.
3. In order to achieve good centring, the centre drill must project approximately 6 mm beyond the teeth. It is recommended that the hole is first predrilled with a twist drill and then the centre drill is used in the adapter as a centring pin.
4. Use a good cutting oil when drilling metal. This extends the hole saw's service life and prevents premature blunting of the tooth tips.
5. The arbor of the adapter must be firmly clamped with the flattened sides correctly seated in the chuck.
6. The hole saw must cut into the workpiece at a right angle. Avoid tilting. Risk of accident.
7. If large hole saw diameters are used in hand-held drills, the hand-held drill must be held particularly firmly. A drill stand should be used where possible.
8. The adapter must be firmly screwed into the hole saw with all its thread and the driver pins must be firmly seated in the driver holes.
9. Secure the driver pins with the rotating ring or lock in the case of a quick-change adapter.
10. Wear protective goggles when working with the bi-metal hole saws and keep hands away in case saw runs out. Never attempt to stop with your hands a saw that is running off.
11. Lift the saw clear frequently, especially when cutting timber, chipboard and wood substitutes and remove the sawdust and chips. If this is not done, the tooth tips can burn and the hole saw will jam in the cut.
12. We recommend the following procedure when drilling timber, chipboard and wood substitutes:

Drill a number of holes immediately inside the cut. This helps carry the chips away and avoids frequent interruptions in cutting to clean the tooth tips.



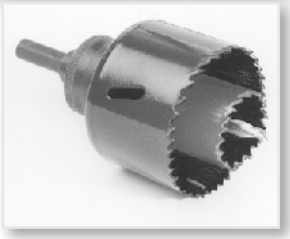
If the workpiece is especially thick ...
... it is also recommended that you cut from both sides, or drill a number of holes immediately inside the circular cut. This helps carry the chips away and avoids frequent interruptions in cutting to clean the tooth tips.





Enlarging existing holes

Existing holes 32 mm (1-1/4") or more in diameter may be enlarged with a simple trick: Take a 32 mm diameter hole saw and screw this inside the hole saw on the projecting thread of the A2 adapter. The inner hole saw then acts as a kind of guiding hole saw for extending existing holes, see photo.



What you absolutely must avoid:

1. Drilling at too fast or too slow a cutting speed. The teeth will glide over the material and become prematurely blunt.
2. Avoid bringing the saw teeth abruptly down on the workpiece, the teeth will break off.
3. Never cut metallic materials dry. Always use a cutting oil.
4. Never bring the saw up to the workpiece on a slant. There is a risk of injury when hand drills are used. The saw can break up or the arbor could be damaged.
5. Ensure that the hole saw is running true. Check the chuck as necessary.
6. Never screw the adapter's guide pins only partially into the hole saw guide holes. The thread of the hole saw could be torn out.
7. Never regrind the hole saw freely by hand. Have hole saws reground by a specialist. Care must be taken to ensure sufficient residual setting and a uniform tooth height.
8. If the tool arbor is pushed into the chuck or if the arbor shears off, the advance pressure is too great.
9. If the hole saw is unevenly worn on the outside, then the saw is not running true or the material to be sawn was not correctly clamped.
10. If the tooth tips are blued, the saw has been used without cutting oil, or at too high a cutting speed.

HSS Bi-Metal Hole Saws – Speed Chart

Recommended Speed for various materials (RPM)

Diameter mm	Mild Steel	Cast Iron	Tool steel + stainless steels	Brass	Aluminium	Wood
14	580	400	300	790	900	3000
16	550	365	275	730	825	3000
17	500	330	250	665	750	3000
19	460	300	230	600	690	3000
20	440	290	220	580	660	3000
21	425	280	210	560	635	3000
22	390	260	195	520	585	3000
24	370	245	185	495	555	3000
25	350	235	175	470	525	2700
27	325	215	160	435	480	2700
29	300	200	150	400	450	2700
30	285	190	145	380	425	2400
32	275	180	140	380	410	2400
33	260	175	135	345	390	2400
35	250	165	125	330	375	2400
37	240	160	120	315	360	2400
38	230	150	115	300	345	2400
40	220	145	110	290	330	2100
41	210	140	105	280	315	2100
43	205	135	100	270	305	2100
44	195	130	95	260	295	2100
46	190	125	95	250	285	2100
48	180	120	90	240	270	2100
51	170	115	85	230	255	2000
52	165	110	80	220	245	2000
54	160	105	80	210	240	2000
57	150	100	75	200	225	2000
59	145	100	75	195	225	2000
60	140	95	70	190	220	2000
64	135	90	65	180	205	1800
65	130	85	65	175	200	1800
67	130	85	65	170	195	1800
70	125	80	60	160	185	1800
73	120	80	60	160	180	1800
76	115	75	55	150	170	1500
79	110	70	55	140	165	1500
83	105	70	50	140	155	1500
86	100	65	50	130	150	1200
89	95	65	45	130	145	1200
92	95	60	45	120	140	1200
95	90	60	45	120	135	1200
98	90	60	45	120	135	1200
102	85	55	40	110	130	1000
105	80	55	40	110	120	1000
108	80	55	40	110	120	900
111	80	50	40	100	120	900
114	75	50	35	100	105	900
121	75	50	35	95	95	900
127	65	45	30	90	90	800
133	60	40	25	86	85	800
140	60	40	25	85	85	800
146	55	35	25	75	75	800
152	55	35	25	75	75	800

These speeds are benchmarks. The speed can we higher or lower, this depends on the material type and the cutting behaviour.
Attention: Do not use cutting oil, if you are cutting cast iron. If you are cutting aluminium use paraffin wax or paraffin.

Calculation of the Cutting Speed

n = Speed (1/min)
v_c = Cutting speed (m/min)
d = Tool diameter (mm)

$$v_c = \frac{\pi \times d \times n}{1000}$$

Speed calculation

n = Speed (1/min)
v_c = Cutting Speed (m/min)
d = Tool diameter (mm)

$$n = \frac{v_c \times 1000}{d \bullet \pi}$$

Worked sample:

d = 20 mm
v_c = 50 m/min

$$n = \frac{50000}{20 \bullet \pi} = 795.77 \text{ 1/min}$$

Tool Ø	Cutting speed (m/min)												
		Stainless steel material				Mild steel - ST material							
	20	25	30	35	40	45	50	55	60	65	70	75	80
16	398	498	597	697	796	896	995	1095	1194	1294	1393	1493	1592
18	354	442	531	619	708	796	885	973	1062	1150	1238	1327	1415
20	318	398	478	557	637	717	796	876	955	1035	1115	1194	1274
22	290	362	434	507	579	651	724	796	869	941	1013	1086	1158
24	265	332	398	464	531	597	663	730	796	863	929	995	1062
26	245	306	367	429	490	551	612	674	735	796	857	919	980
28	227	284	341	398	455	512	569	626	682	739	796	853	910
30	212	265	318	372	425	478	531	584	637	690	743	796	849
32	199	249	299	348	398	448	498	547	597	647	697	746	796
34	187	234	281	328	375	422	468	515	562	609	656	703	749
36	177	221	265	310	354	398	442	487	531	575	619	663	708
38	168	210	251	293	335	377	419	461	503	545	587	629	670
40	159	199	239	279	318	358	398	438	478	518	557	597	637
42	152	190	227	265	303	341	379	417	455	493	531	569	607
44	145	181	217	253	290	326	362	398	434	470	507	543	579
46	138	173	208	242	277	312	346	381	415	450	485	519	554
48	133	166	199	232	265	299	332	365	398	431	464	498	531
50	127	159	191	223	255	287	318	350	382	414	446	478	510
52	122	153	184	214	245	276	306	337	367	398	429	459	490
54	118	147	177	206	236	265	295	324	354	383	413	442	472
56	114	142	171	199	227	256	284	313	341	370	398	427	455
58	110	137	165	192	220	247	275	302	329	357	384	412	439
60	106	133	159	186	212	239	265	292	318	345	372	398	425
62	103	128	154	180	205	231	257	283	308	334	360	385	411
64	100	124	149	174	199	224	249	274	299	323	348	373	398
66	97	121	145	169	193	217	241	265	290	314	338	362	386
68	94	117	141	164	187	211	234	258	281	304	328	351	375
70	91	114	136	159	182	205	227	250	273	296	318	341	364
72	88	111	133	155	177	199	221	243	265	288	310	332	354
74	86	108	129	151	172	194	215	237	258	280	301	323	344
76	84	105	126	147	168	189	210	230	251	272	293	314	335
78	82	102	122	143	163	184	204	225	245	265	286	306	327
80	80	100	119	139	159	179	199	219	239	259	279	299	318
82	78	97	117	136	155	175	194	214	233	252	272	291	311
84	76	95	114	133	152	171	190	209	227	246	265	284	303
86	74	93	111	130	148	167	185	204	222	241	259	278	296
88	72	90	109	127	145	163	181	199	217	235	253	271	290
90	71	88	106	124	142	159	177	195	212	230	248	265	283
92	69	87	104	121	138	156	173	190	208	225	242	260	277
94	68	85	102	119	136	152	169	186	203	220	237	254	271
96	66	83	100	116	133	149	166	182	199	216	232	249	265
98	65	81	97	114	130	146	162	179	195	211	227	244	260
100	64	80	96	111	127	143	159	175	191	207	223	239	255

FRP Hole Saws

Ø mm	Timber Chipboard	Plastics	Masonry	Wall tiles*
25/30/35	1000	800	800	500
40/45/50	800	600	700	400
58 to 74	600	400	600	400
80/105	400	300	300	300

* Drilling in tiles only up to a scratch hardness of 6, mark centre, set the centre drill and drill through the glaze with at a low speed, allow the saw teeth to penetrate the glazing uniformly, running as smoothly and level as possible, so that the edge of the hole is made without chipping. Continue drilling at a normal drilling speed. Tiles with a scratch hardness greater than 6 may only be cut with diamond or carbide hole saws.

Notes on use
- Use rotation only. Switch off impact or hammer drill.
- Impact and shock on the sharp, ground carbide cutters can lead to small carbide splinters and thus to a severe loss of performance.
- Do not tilt the hole saw in the hole.
- Remove the drill core after each operation. Remove the sawdust when drilling timber and timber products.

Notes on use
For multipurpose hole saw with rim countersink
- The rim countersink is placed between hole saw and adapter and the carbide cutter is used to make a countersink in timber and timber substitutes. This makes it possible to fit sockets flush.

Important notes on use
- The hole saw with rim countersink may not be stopped before it is removed.
- Advance with care, to prevent the cut edges tearing.

Speed Chart – Multi-Step Drills/Conical One-Lip Bits

ALFRA-Multi-step drills

These drills were especially to drill perfectly round and simultaneously deburred holes insheet metals of 4 - 6 mm. The radius transition simultaneously deburrs or bezels the holes. While conical one-lip bits drill slightly conical holes, cylindrical holes can be drilled with ALFRA Multi-step drills. The tools are axial-radially relief ground and ccan be resharpened at the breast of the cutting tooth.

We recommend the use of pillar drilling machines, however, the small ALFRA Multi-step drills can be used on adjustable hand drilling machines.
Imperatively use sufficient cooling **(ALFRA coolant stick or bore emulsion)?**

ALFRA HSS DM 05 precision Multistep Drill

- **Take notice of the cuttig speed**
- **Grease the cutting lips in case of application**

The holes are deburred on both sides by the multistep drills. The multistep drill drills holes in thin materials, enlarges existing holes, makes inclined holes, drills pipes, makes holes penetrating each other. Suitable for any hand drill. For steel — PVC — polystrol — polyester — Plexiglas — card — plywood and similar materials. Can be reground many times, if treated carefully.

Material	Mild steel ‹ 700	Mild steel › 700	Alloy steel ‹ 1000	Cast iron ‹ 250	Cast iron › 250	Stainless steel	CuZn alloy brittle	CuZn alloy tough	AL alloy	Thermo-plastic	Duro-plastic	Wood
	N/mm²	N/mm²	N/mm²	N/mm²	N/mm²				‹ 11% Si			
Material gauge	5.0 mm	5.0 mm	5.0 mm	5.0 mm	5.0 mm	3.0 mm	5.0 mm	5.0 mm	5.0 mm	5.0 mm	5.0 mm	25.0 mm
Lubricant	Drilling paste	Drilling paste	Drilling paste	Air	Air	Drilling paste	Air	Air	Drilling paste	H_2O	Air	Air
Vc = m/min	25	20 - 25	20	15	10	5	60	35	30	20	15	› 40
Ø mm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm	rpm
4.0 - 12.0	1900 - 600	1700 - 580	1550 - 520	1190 - 400	800 - 250	400 - 130	4700 - 1550	2750 - 920	2350 - 790	1550 - 520	1190 - 400	3000 - 1000
4.0 - 20.0	1900 - 400	1700 - 350	1550 - 300	1190 - 240	800 - 160	400 - 80	4700 - 950	2750 - 550	2350 - 470	1550 - 300	1190 - 240	3000 - 650
12.0 - 20.0	600 - 400	600 - 350	520 - 300	400 - 240	250 - 160	130 - 80	1550 - 950	920 - 550	790 - 470	520 - 300	400 - 240	1000 - 650
4.0 - 24.0	1900 - 300	1700 - 280	1550 - 250	1190 - 200	800 - 130	400 - 65	4700 - 790	2750 - 460	2350 - 400	1550 - 250	1190 - 200	3000 - 550
6.0 - 30.0	1300 - 250	1200 - 230	1000 - 200	780 - 150	530 - 100	250 - 50	3150 - 630	1850 - 370	1590 - 310	1000 - 200	780 - 150	2100 - 420
20.0 - 30.0	400 - 250	350 - 230	300 - 200	230 - 150	160 - 100	80 - 50	950 - 630	550 - 370	470 - 310	300 - 200	230 - 150	650 - 420
6.0 - 36.0	1300 - 220	1200 - 200	1000 - 170	780 - 130	530 - 90	250 - 45	3150 - 530	1850 - 300	1590 - 260	1000 - 170	780 - 130	2100 - 350
30.0 - 40.0	250 - 200	230 - 180	200 - 150	150 - 120	100 - 80	50 - 40	630 - 470	370 - 280	310 - 240	200 - 150	150 - 120	420 - 310
40.0 - 50.0	200 - 160	180 - 140	150 - 125	120 - 90	80 - 65	40 - 30	470 - 380	280 - 220	240 - 190	150 - 125	120 - 90	310 - 250
50.0 - 60.0	160 - 130	140 - 110	125 - 100	90 - 80	65 - 50	30 - 25	380 - 310	220 - 185	190 - 150	125 - 100	90 - 80	250 - 210

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