高硬度钢用硬质合金中等刃长型钻头

CARBIDE MEDIUM FOR HARDENED STEELS

FH-GDN

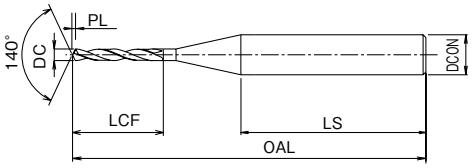
切削条件 Cutting Conditions | P.399

专为淬火钢的小孔加工而开发，特别是深孔(7D)加工中可发挥出巨大威力。

This drill is developed for small size drilling in hardened steel. It is applied to deep hole (around 7 × D) .

四棱式横刃
Four Facet point
(DC<1.2)

X 型横刃
X thinning
(1.2≦DC)



CARBIDE | FX | h8 | 20° | SHRINK FIT

单位:mm Unit:mm

商品号 EDP NO.	直径 DC	槽长 LCF	全长 OAL	柄径 DCON	柄长 LS	先端 PL	库存 Stock	重量 (g)
8562030	**0.3**	2.5	38	3	30	0.05	●	8
8562040	**0.4**	4			28.7	0.07		8
8562050	**0.5**	5			27.8	0.09		8
8562060	**0.6**	5.5			27.5	0.11		8
8562070	**0.7**	7			26.2	0.13		8
8562080	**0.8**	7.5	42		29.4	0.15		8
8562090	**0.9**	8.5			28.6	0.16		9
8562100	**1**	9			28.3	0.2		5
8562110	**1.1**	10.5	48		33	0.2		5

商品号 EDP NO.	直径 DC	槽长 LCF	全长 OAL	柄径 DCON	柄长 LS	先端 PL	库存 Stock	重量 (g)
8562120	**1.2**	12	48	3	31.6	0.2	●	5
8562130	**1.3**				31.8	0.2		5
8562140	**1.4**	13.5			30.5	0.3		5
8562150	**1.5**				30.7	0.3		5
8562160	**1.6**	15			29.4	0.3		5
8562170	**1.7**				29.6	0.3		5
8562180	**1.8**	16.5			28.3	0.3		5
8562190	**1.9**				28.5	0.3		5
8562200	**2**	18	50		29.1	0.4		6

加工材料 Work Material / 商品记号 Abbreviation	低碳素钢 软钢 Low Carbon Steel Mild Steel	中碳素钢 Medium Carbon Steel	高碳素钢 High Carbon Steel	合金钢 Alloy Steel	调质钢 Hardened Steel		淬火钢 Quenched and Tempered Steel			不锈钢 Stainless Steel	工具钢 Tool Steel	铸铁 Cast Iron	球墨铸铁 Ductile Cast Iron	铜合金 Copper Alloy	变形铝 Aluminum	铸造铝合金 Aluminum Alloy Casting	钛合金 Titanium Alloy	镍基合金 Inconel	复合材料 CFRP Composite Material	镁合金 Magnesium Alloy	金属基复合材料 (MMC) Metal Matrix Composites
	C~0.25%	C0.25~0.45%	C0.45% ~	SCM	~ 35 HRC	35 ~ 45 HRC	45 ~ 50 HRC	50 ~ 62 HRC	62 ~ 70 HRC	SUS	SKD SKS	FC	FCD	Cu	AL	AC			CFRP	AZ91D	
FH-GDN						○	◎	◎	○												

●=标准库存品 ●=Standard stock item. □=特定代理店库存品 □=Stocked by specific distributors. Contact us for price & availability.

难切削材料的钻孔 DRILLING DIFFICULT TO MACHINE MATERIALS

所谓难切削材料就如下所示具有不同种材料特性所组合，为此加工难度非常高，切削材料上钻孔，不仅要把握其特性，选择适当的工具，还需参考下面的注意事项，寻找出合适的切削条件。

Certain materials have special characteristics (listed below), that make drilling difficult. In order to successfully drill these materials, it is critical to use proper cutting conditions based on information about the material and the tool, and to understand how variations of these characteristics can influence the final outcome.

■难切削材料的特性 Characteristics of Difficult to Machine Materials

材料特性 Characteristics	对加工时的影响 Effect(s)
①高硬度 High hardness	刀刃的崩损 Chipping of the cutting edge
②高强度 High tensile strength	刀具的磨损 Tool wear
③热传导率小 Low heat conductivity	刀具切削热集中 High temperature at cutting edge
④加工硬化性大 High work hardening	扭距大轴向阻力大 High thrust force and torque
⑤含有高硬度粒子 Contains hardened grain	易引起切屑问题 Chip trouble (discharging, shape)
⑥延伸性大 High ductility	加工表面质量差 Bad surface finish
⑦亲和性大 High affinity	

■具有代表性的难切削材料的加工注意事项 Machining Recommendations for Difficult to Machine Materials

加工材料 Work Material	材料特性 Characteristics	加工建议 Machining Recommendations	推荐钻头 Recommended drills
奥氏体系不锈钢 Austenitic Stainless Steel SUS304、SUS316	●加工硬质大 ●高温强度大 ●热传导率小 ●易延展，易生成刀瘤 ● High work hardening ● High tensile strength at high temperatures ● Low heat conductivity ● High ductility. Easy to get build up at the edge. => chipping	●应选用高韧性的工具及切削刀刃锋利的涂层工具。 ●加快进给速度 ●加中切削油 ● Use tough drill material with sharp cutting edge and coating ● High feed rate ● High coolant supply	ADO-3D ADO-5D EX-SUS-GDS EX-SUS-GDR VP-HO-GDS EX-HO-GDR NEXUS-GDS NEXUS-GDR EX-SUS-GDN MT-SUS-GDR VP-HO-GDR
模具钢 Die Steel SKD11	●含有大而硬的碳化物 ● Made of hard carbide grain (under 0.4%C =>carbide grain is melted)	●应选用高刚性高速工具 ●降低传速，加快进给速度 ● Use high rigid HSS coated tools ● Use lower cutting speed and higher feed rate	AD-2D AD-4D EX-GDS EX-GDN ADO-3D ADO-5D VPH-GDS EX-GDR
高锰钢 High Manganese Steel SCMnH	●强度高，强韧大 ●加工硬化性大 ● High tensile strength and high toughness High work hardening	●提高工具和机械的刚性，固定夹具 ● Use rigid tools, machine and work clamping device	AD-2D AD-4D VP-HO-GDS EX-GDS VPH-GDS
钛合金 Titanium Alloy Ti-6Al-4V	●强度高 ●热传导率小 ●与工具的化学亲和力高 ● High tensile strength per Lower case ● Low heat conductivity ● Chemically active High affinity with tools	●充分冷却，控制发热 ● Use sufficient coolant and low cutting speed to maintain low cutting temperature.	VP-HO-GDS EX-SUS-GDS EX-GDR ADO-3D ADO-5D VP-HO-GDR EX-HO-GDR
耐热合金 Heat Resistant Alloy Inconel、Hastelloy	●高硬度 ●韧性大，加工硬化大 ● High hardness ● High work hardening Tough Diifficult to machine	●提高工具和机械的刚性 ●使用有刚性的短刃涂层工具 ● Improve rigidity of tools and machines ● Use an Stub Drill with coating and rigidity	FT-GDS VPH-GDS ADO-3D ADO-5D FT-GDN EX-GDS
高硬度淬火钢 High Hardened Quenched and Tempered Steels	●高硬度剪断应力高，抗切削性大 ● High hardness High shearing stress High cutting resistance	●请选用高硬度的工具和高刚性的工具 ● Use a drill made from high hardened and rigid materialif the work material is over 45 HRC, use a carbide drill.	FHL-GDTS AD-2D AD-4D FH-GDN VPH-GDS FTO-M-GDXL FTO-H-GDXL
高硅铝合金 High Silicon Aluminum Alloy AC9A、A390	●含有高硬度粒子，易引起强烈工具磨损 ● High hardened grain causes large wear on tools	●请选用高硬度的工具 ●供足切削油 ● Use a drill made from high hardened material ● Provide sufficient coolant supply	D-GDN NF-GDN
铁镍钴合金 Kovar Fe-Ni-Co合金	●低热膨胀材料 ●凝着力高易加工 ● Low thermal Expansion material ● Tend to Build-up, but easy to machine	●请选用大螺旋角切削刃锋利的钻头 ● Use high helix and sharp edge drill	WX-MS-GDS EX-SUS-GDS EX-SUS-GDR EX-SUS-GDN NEXUS-GDS NEXUS-GDR
钴铬合金 Co-Cr Alloy	●耐蚀好，韧性好 ●和谐性好 ● Better anti-rust, Better rigidity ● Harmonize with organism	●使用切屑分断性好，耐磨损的钻头 ● Easy to break chips, but recommended to use better drill on wear resistance	FT-GDN ADO-3D ADO-5D
复合材料 Composite CFRP GFRP	●内部的硬纤维物质导致强烈磨损 ●易产生细毛和剥离 ● Tough fiber causes extrame wear ● Tend to have naps and peel off	●请使用锋利且耐磨损的工具 ●防止产生毛刺及毛刺剥离的设计要求 ● Use sharp and wear resistant tools ● Design the tool to prevent naps and peeling	D-STAD PCD-CF-GDN

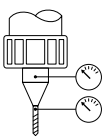
形状尺寸表 SPECIFICATION CHARTS FH-GDS ▶ P.213
形状尺寸表 SPECIFICATION CHARTS FH-GDN ▶ P.214

硬质合金钻头切削条件基准表 CARBIDE DRILLS CUTTING CONDITIONS

FH-GDS• FH-GDN

加工材料 Work Material	调质钢·预硬钢 Hardened Steel· Prehardened Steel 40 ～50HRC			SKT· SKD61 50 ～55HRC			SKD11 · SKT· SUS440 55 ～62HRC		
切削速度 Cutting Speed	50 ～54m/min			50 ～54m/min			50 ～54m/min		
直径 Drill Dia. (mm)	转速 Speed (min^{-1})	进给量 Feed Rate (mm/rev)	停顿量 Step Feed (mm)	转速 Speed (min^{-1})	进给量 Feed Rate (mm/rev)	停顿量 Step Feed (mm)	转速 Speed (min^{-1})	进给量 Feed Rate (mm/rev)	停顿量 Step Feed (mm)
0.3	注1 (Note1)	0.006	0.03	注1 (Note1)	0.006	0.03	注1 (Note1)	0.006	0.03
0.4	注1 (Note1)	0.008	0.04	注1 (Note1)	0.008	0.04	注1 (Note1)	0.008	0.04
0.5	注1 (Note1)	0.015	0.15	注1 (Note1)	0.01	0.1	注1 (Note1)	0.01	0.05
0.6	注1 (Note1)	0.018	0.18	注1 (Note1)	0.012	0.12	注1 (Note1)	0.012	0.06
0.7	24,000	0.021	0.21	24,000	0.014	0.14	24,000	0.014	0.07
0.8	21,000	0.024	0.24	21,000	0.016	0.16	21,000	0.016	0.08
0.9	18,000	0.027	0.27	18,000	0.018	0.18	18,000	0.018	0.09
1	17,000	0.03	0.3	17,000	0.02	0.2	17,000	0.02	0.1
1.1	15,000	0.033	0.33	15,000	0.022	0.22	15,000	0.022	0.11
1.2	14,000	0.036	0.36	14,000	0.024	0.24	14,000	0.024	0.12
1.3	13,000	0.039	0.39	13,000	0.026	0.26	13,000	0.026	0.13
1.4	12,000	0.042	0.42	12,000	0.028	0.28	12,000	0.028	0.14
1.5	11,000	0.045	0.45	11,000	0.03	0.3	11,000	0.03	0.15
1.6	10,000	0.048	0.48	10,000	0.032	0.32	10,000	0.032	0.16
1.7	10,000	0.051	0.51	10,000	0.034	0.34	10,000	0.034	0.17
1.8	9,000	0.054	0.54	9,000	0.036	0.36	9,000	0.036	0.18
1.9	9,000	0.057	0.57	9,000	0.038	0.38	9,000	0.038	0.19
2	8,000	0.06	0.6	8,000	0.04	0.4	8,000	0.04	0.2

1. 请使用回转精度好的机械。
2. 此切削条件标准表适用于使用水溶性切削油剂的场合。
3. 请使用稀释倍率20倍左右的优质水溶性切削油剂。
4. 此切削条件基准表适用于FH-GDS加工孔深3D以下、FH-GDN加工孔深7D以下。
5. 进行FH-GDN的导向孔加工时，推荐使用FH-GDS、FX-MG-EBD。
6. 装夹后的径向跳动精度请如右图所示使夹头本体圆筒部或柄部控制在0.002mm以下。
7. 热膨胀装夹系统较为有效。



注1: 机械转速未达到上述切削速度时，请尽可能使用高转速。但是，可能会降低刀具寿命。

1. Please use a carbide drill in a machine with precise spindle rotation.
2. The indicated speeds and feeds are for drilling with water-soluble coolant.
3. Please use water-soluble high density coolant (20 times dilution).
4. This cutting condition chart is made for the following: depth of cut less than 3 x drill dia. for FH-GDS and less than 7 x drill dia. for FH-GDN.
5. We recommend FH-GDS and FX-MG-EBD for the pilot hole operation prior to FH-GDN.
6. The run out with a drill in a spindle should be less than 0.002mm as in the picture.
7. The shrink fit system is effective holder.

Note 1. For machines that cannot achieve the speeds indicated in the table please set rotation as high as possible. Tool life may be decreased.