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A close-up photograph of several reaming tools. The tools consist of long, silver-colored metal shafts with complex, multi-fluted cutting edges. The cutting edges are a reddish-brown color, likely due to a coating. The tools are arranged in a row, with some in sharp focus and others blurred in the background. The background is a light, neutral color.

**Innovation Is
Our Tool**

SWISS  QUALITY

URMA Reaming Technology Guide

Ø 7.600 – 13.600 mm

Ø 11.900 – 140.600 mm

Ø 5.800 – 33.100 mm

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钨马铰削
RX small小径铰刀

订单示例
Order Example

孔径标注方式
Bore Diameter

ISO标准孔公差
ISO Bore Tolerances

孔公差 (μm)
Bore Tolerance in μm

刀片直径标注方式
Insert Diameter

期望的刀片尺寸 (Q标注法)
Target Size (Q-Insert)

Example	订单示例 Order Example RXsG8 H7 -A01 U2 F0512R1	订单示例 Order Example RXsG8 +20-10 -A01 U1 F0514R1	订单示例 Order Example RXsG8 8.020Q+3-3 -A01 U2 F0512R1	Example

RXs **RX small**
系统代码
RX small system designation

RXs **RX small**
系统代码
RX small system designation

RXs **RX small**
系统代码
RX small system designation

G 排屑槽型代码
(**G**=直槽; **L**=左旋槽)
Flute form (G = straight;
L = left-hand helix)

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Diameter	8 直径 (mm) Diameter (mm)	8 直径 (mm) Diameter (mm)	8.020 刀片直径标注方式 (mm) Insert diameter (mm)	Diameter
	H7 ISO标准公差 Tolerance in ISO standard	+20-10 孔公差 (μm) Bore tolerance (μm)	Q 定制直径刀片代码 Code for target size insert	
			+3-3 制造公差 (μm) Manufacturing tolerance (μm)	

A01 切削角度代码
Cutting geometry

A01 切削角度代码
Cutting geometry

A01 切削角度代码
Cutting geometry

Option	U2 理代码 详见第9页 Edge preparation For details see page 9	U1 理代码 详见第9页 Edge preparation For details see page 9	U2 理代码 详见第9页 Edge preparation For details see page 9	Option

F05 刀片材质代码
详见第11页
Cutting material
For details see page 11

F05 刀片材质代码
详见第11页
Cutting material
For details see page 11

F05 刀片材质代码
详见第11页
Cutting material
For details see page 11

12R 涂层代码
详见第11页
Coating
For details see page 11

14R 涂层代码
详见第11页
Coating
For details see page 11

12R 涂层代码
详见第11页
Coating
For details see page 11

1 **1=薄涂层**
2=厚涂层
1 = thin coating
2 = thick coating

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订货细节示例
Details Order Example

孔公差及可用涂层厚度
Bore Tolerances and Applicable Coating Thickness

孔径 Bore Diameter	孔公差范围 Bore Tolerance Range	不涂层 Uncoated	涂层厚度 Coating Thickness		紧公差额外收费 Surcharge for Tight Tolerances
			1	2	
			≥ 14 μm	x	
10 - 13 μm		x	x		-
				x	x
6 - 9 μm		x			-
			x	-	x

示例: 孔径 20H7 = 公差范围 μm = **≥ 14 μm**
Example: Bore diameter 20H7 = tolerance range 21 μm = **≥ 14 μm**

孔径 12^{+0.006}/_{-0.005} = 公差范围 11 μm = **10 - 13 μm**
Bore diameter 12^{+0.006}/_{-0.005} = tolerance range 11 μm = **10 - 13 μm**

期望的刀片尺寸 (Q标注法) 及可用涂层厚度
Target Size (Q-Inserts) and Applicable Coating Thickness

刀片直径 Insert Diameter	刀片公差 Insert Tolerance	不涂层 Uncoated	涂层厚度 Coating Thickness		紧公差额外收费 Surcharge for Tight Tolerances
			1	2	
			± 4 μm	N/A	
± 3 μm		N/A	x		-
				x	x
± 2 μm		x			-
			x	N/A	x
± 1 μm		x	N/A	N/A	x

N/A = 不适用
N/A = Not applicable

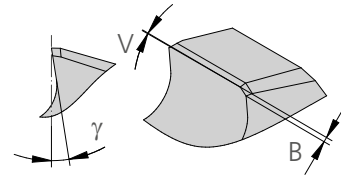
理代码 (刃口处理)
Edge preparation (Nano Finishing)

U1 细微
刃口处理
Light
edge-preparation

U2 中等
刃口处理
Medium
edge-preparation

U 其他刃口处理
按需定制
Other edge-preparations
on request

刀片角度
Cutting Geometries



vf	Geo	直槽 RXG	左旋槽 RXL	孔的类型	fz mm	Ra μm	Zyl.	Pos	FC	MD
	A0_	▲	▲	▲ (K1-K8)*	REFERENCE VALUE					
	B0_	□	▲	▲	↗	👍	👎	👎	↗	↗
	C0_	▲	▲	▲ (K1-K8)*	↗	👍	👎	👎	↗	↗
	C1_	▲	▲	▲ (K1-K8)*	↗	👍	👎	👎	↗	↗
	D0_	□	▲	▲	↗	👍	👎	👎	↗	↗
	G0_	▲	□	▲ (K1-K8)*	↘	👎	👍	👍	↘	↘
	G1_	▲	□	▲ (K1-K8)*	↘	=	👍	👍	↘	↘

Geo	γ	B	V	W	ap mm	Ra μm	Zyl.	FC	MD
STANDARD GEOMETRY (REFERENCE VALUE)									
_1	=	=	↘	=	=	=	=	↗	↗
_2	=	=	↘	=	=	=	=	↗	↗
_3	=	↘	=	=	↘	=	=	=	↘
_4	=	=	=	↘	=	👍	=	↘	↘
_5	=	=	=	↗	=	=	=	↘	↘
_6	=	=	↗	=	=	=	=	↘	↘
_7	↗	=	↗	=	=	=	=	↘	↘
_8	=	↗	=	=	↗	=	=	=	↗

非标槽型可定制
Special geometries on request

* 材料分类见88页
* See page 88 for material group

定义和基本计算公式，见第 86 页
See page 86 for definitions and basic formulas

- B = 倒角长度
- V = 背锥
- W = 刃带宽度
- FC = 切削力
- MD = 扭矩
- γ = 径向前角
- vf = 进给方向
- ▲ = 推荐的
- = 可适用的
- = 可能的
- ↗ = 更高的值
- ↘ = 更低的值
- 👍 = 有助于
- 👎 = 不利于

- B = Chamfer length
- V = Back taper
- W = Margin width
- FC = Cutting force
- MD = Torque
- γ = Radial rake angle
- vf = Feed direction
- ▲ = Recommended
- = Applicable
- = Possible
- ↗ = Higher value
- ↘ = Lower value
- 👍 = Improved
- 👎 = Worse

刀片材质概览
Cutting Materials overview

ISO材料代码	URMA材料代码	刀片材质 Cutting Materials				涂层厚度 Coating										
		URMA Code	F05	E10	00	01P_	05P_	07R_	08P_	12R_	14R_	17B_	18B_	10C	20C	21C
		每代号	硬质合金 ISO HW-K05	硬质合金 ISO HW-K35	不涂层	TiN	AlTiN	TiAlN + AlCrN	AlCrN	AlCrN	AlCrN	AlCrN	TiSiN	DLC	DLC	DLC
P	P1	▲	■	□	□	1	2	1	1	2	1	1	2	1	1	
	P2	▲	■	□	□											
	P3	▲	■	□	□											
	P4	▲	■	□	□											
	P5	▲	■	□	□											
	P6	▲	■	□	□											
	P7	▲	■	□	□											
M	M1	▲	■	□	□											
	M2	▲	■	□	□											
	M3	▲	■	□	□											
	M4	▲	■	□	□											
	M5	▲	■	□	□											
	M6	▲	■	□	□											
K	K1	▲	□	□	□											
	K2	▲	□	□	□											
	K3	▲	□	□	□											
	K4	▲	□	□	□											
	K5	▲	□	□	□											
	K6	▲	□	□	□											
	K7	▲	□	□	□											
	K8	▲	□	□	□											
N	N1	▲		□												
	N2	▲		□												
	N3	▲		□												
	N4	▲		□												
	N5	▲		□												
	N6	▲		□												
S	S1	▲	■	□	□											
	S2	▲	■	□	□											
	S3	▲	■	□	□											
	S4	▲	■	□	□											
	S11	▲	■	□	□											
	S12	▲	■	□	□											
	S13	▲	■	□	□											
	S14	▲	■	□	□											
H	H1	▲	■	□	□											
	H2	▲	■	□	□											
	H3	▲	■	□	□											
SM	SM1	▲	■	□	□											
	SM2	▲	■	□	□											
	SM3	▲	■	□	□											
O	O1	▲		□												
	O2	▲		□												
	O3	▲		□												
	O4	▲		□												

- ▲ = 推荐的
- = 可适用的
- = 可能的
- = 按需使用
- ▲ = Recommended
- = Applicable
- = Possible
- = On request

MATERIAL DETAILS PAGE 88

RX small小径铰刀切削参数

Cutting Data RX small



ISO	UMC	AC	Type	Geometry	Grade	Vc	fz		Radial / Stock Removal	
							Ø 7.600-9.600 mm	Ø 9.601-13.100 mm	ap Ø 7.600-9.600 mm	ap Ø 9.601-13.100 mm
P	P1	1	RXsL	B01	F0512R1	120-160-200	0.12-0.16-0.20	0.12-0.18-0.25	0.050-0.075	0.05-0.075-0.10
		2	RXsL	B01	F0512R1	120-150-180	0.12-0.16-0.20	0.12-0.16-0.22		
		3	RXsL	B01	F0512R1	100-120-150	0.12-0.16-0.20	0.12-0.16-0.20		
	P2	1	RXsL	B01	F0512R1	120-160-200	0.12-0.16-0.20	0.12-0.18-0.25	0.050-0.075	0.05-0.075-0.10
		2	RXsL	B01	F0512R1	120-150-180	0.12-0.16-0.20	0.12-0.16-0.22		
		3	RXsL	B01	F0512R1	100-120-150	0.12-0.16-0.20	0.12-0.16-0.20		
	P3	1	RXsL	B01	F0512R1	120-160-180	0.12-0.16-0.20	0.12-0.18-0.25	0.050-0.075	0.05-0.075-0.10
		2	RXsL	B01	F0512R1	120-150-160	0.12-0.16-0.20	0.12-0.16-0.22		
		3	RXsL	B01	F0512R1	100-120-150	0.12-0.16-0.20	0.12-0.16-0.20		
	P4	1	RXsL	B01	F0512R1	120-150-180	0.12-0.16-0.20	0.12-0.16-0.20	0.050-0.075	0.05-0.075-0.10
		2	RXsL	B01	F0512R1	120-140-160	0.12-0.16-0.20	0.12-0.16-0.20		
		3	RXsL	B01	F0512R1	100-120-150	0.12-0.16-0.20	0.12-0.16-0.20		
	P5	1	RXsL	A07	F0512R1	100-130-160	0.10-0.14-0.18	0.10-0.14-0.18	0.050-0.075	0.050-0.075
		2	RXsL	A07	F0512R1	100-125-150	0.10-0.12-0.15	0.10-0.12-0.15		
		3	RXsL	A07	F0512R1	80-100-120	0.10-0.12-0.15	0.10-0.12-0.15		
	P6	1	RXsL	A07	F0512R1	50-80-100	0.06-0.08-0.12	0.06-0.08-0.12	0.050-0.075	0.050-0.075
		2	RXsL	A07	F0512R1	40-70-90	0.06-0.08-0.12	0.06-0.08-0.12		
		3	RXsL	A07	F0512R1	25-50-70	0.06-0.08-0.12	0.06-0.08-0.12		
	P7	1	RXsL	A06	F0512R1	15-25-40	0.04-0.06-0.10	0.04-0.06-0.10	0.050-0.075	0.050-0.075
		2	RXsL	A06	F0512R1	15-20-30	0.04-0.06-0.10	0.04-0.06-0.10		
		3	RXsL	A06	F0512R1	15-20-30	0.04-0.06-0.10	0.04-0.06-0.10		
M	M1	1	RXsL	A07	F0512R1	50-80-100	0.10-0.14-0.16	0.10-0.14-0.16	0.050-0.075	0.05-0.075-0.10
		2	RXsL	A07	F0512R1	40-70-90	0.08-0.10-0.12	0.08-0.10-0.14		
		3	RXsL	A07	F0512R1	25-50-70	0.06-0.08-0.12	0.06-0.08-0.12		
	M2	1	RXsL	A07	F0512R1	50-80-100	0.10-0.14-0.16	0.10-0.14-0.16	0.050-0.075	0.05-0.075-0.10
		2	RXsL	A07	F0512R1	40-70-90	0.08-0.10-0.12	0.08-0.10-0.14		
		3	RXsL	A07	F0512R1	25-50-70	0.06-0.08-0.12	0.06-0.08-0.12		
	M3	1	RXsL	A07	F0512R1	40-60-80	0.08-0.10-0.14	0.10-0.14-0.16	0.050-0.075	0.050-0.075
		2	RXsL	A07	F0512R1	40-60-80	0.08-0.10-0.14	0.08-0.10-0.14		
		3	RXsL	A07	F0512R1	25-40-70	0.08-0.10-0.14	0.08-0.10-0.14		
	M4	1	RXsL	A07	F0512R1	25-40-60	0.08-0.10-0.14	0.08-0.10-0.14	0.050-0.075	0.050-0.075
		2	RXsL	A07	F0512R1	20-35-55	0.08-0.10-0.14	0.08-0.10-0.14		
		3	RXsL	A07	F0512R1	20-30-50	0.08-0.10-0.14	0.08-0.10-0.14		
	M5	1	RXsL	A07	F0512R1	15-25-35	0.05-0.08-0.12	0.05-0.08-0.12	0.050-0.075	0.050-0.075
		2	RXsL	A07	F0512R1	15-25-35	0.05-0.08-0.12	0.05-0.08-0.12		
		3	RXsL	A07	F0512R1	10-18-30	0.05-0.08-0.12	0.05-0.08-0.12		
	M6	1	RXsL	A07	F0512R1	15-20-30	0.05-0.08-0.12	0.05-0.08-0.12	0.050-0.075	0.050-0.075
		2	RXsL	A07	F0512R1	15-20-30	0.05-0.08-0.12	0.05-0.08-0.12		
		3	RXsL	A07	F0512R1	10-18-30	0.05-0.08-0.12	0.05-0.08-0.12		



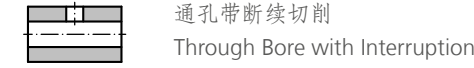
AC 应用条件

- 1 工况良好
- 夹具、机床及工件刚性良好
- 刀具长径比 ≤ 4xD
- 排屑良好
- 内冷压力大于20bar
- 2 工况一般
- 夹具、机床及工件刚性略差
- 刀具长径比 ≤ 6xD
- 排屑较差
- 有内冷
- 3 工况极差
- 夹具、机床及工件刚性差
- 刀具长径比 ≤ 8xD
- 排屑差
- 有内冷



AC Application Conditions

- 1 Optimal conditions
- Stable fixture, machine and/or workpiece
- Tool projection length ≤ 11xD
- Optimal chip removal guaranteed
- Internal coolant supply > 20 bar
- 2 Suboptimal conditions
- Slightly unstable fixture, machine and/or workpiece
- Tool projection length ≤ 15xD
- No optimal chip removal guaranteed
- Internal coolant supply available
- 3 Difficult conditions
- Unstable fixture, machine and/or workpiece
- Tool projection length ≤ 15xD
- Critical chip evacuation
- Internal coolant supply available



AC	Type	Geometry	Grade	Vc	fz 连续切削		fz 断续切削	Radial / Stock Removal				
					fz Full Cut Ø 7.600-9.600 mm	fz Full Cut Ø 9.601-13.100 mm		ap Ø 7.600-9.600 mm	ap Ø 9.601-13.100 mm			
P	4	RXsL	A01	F0512R1	120-160-200	0.12-0.16-0.20	0.12-0.18-0.25	fz 连续切削值降低30-60% reduce fz full cut 30 - 60%	0.050-0.075	0.05-0.075-0.10		
		RXsG	A01	F0512R1	100-120-150	0.12-0.16-0.20	0.12-0.16-0.20					
		5	RXsL	A01	F0512R1	120-160-200	0.12-0.16-0.20				0.12-0.18-0.25	0.050-0.075
	RXsL		A01	F0512R1	120-150-180	0.12-0.16-0.20	0.12-0.16-0.22					
	RXsG		A01	F0512R1	100-120-150	0.12-0.16-0.20	0.12-0.16-0.20					
	6	RXsL	A01	F0512R1	120-160-180	0.12-0.16-0.20	0.12-0.18-0.25		0.050-0.075	0.05-0.075-0.10		
		RXsL	A01	F0512R1	120-150-160	0.12-0.16-0.20	0.12-0.16-0.22					
		RXsG	A01	F0512R1	100-120-150	0.12-0.16-0.20	0.12-0.16-0.20					
	4	RXsL	A01	F0512R1	120-150-180	0.12-0.16-0.20	0.12-0.16-0.20		0.050-0.075	0.05-0.075-0.10		
		RXsG	A01	F0512R1	120-140-160	0.12-0.16-0.20	0.12-0.16-0.20					
		RXsG	A01	F0512R1	100-120-150	0.12-0.16-0.20	0.12-0.16-0.20					
	5	RXsL	A07	F0512R1	100-130-160	0.10-0.14-0.18	0.10-0.14-0.18		0.050-0.075	0.050-0.075		
		RXsG	A07	F0512R1	100-125-150	0.10-0.12-0.15	0.10-0.12-0.15					
		RXsG	A07	F0512R1	80-100-120	0.10-0.12-0.15	0.10-0.12-0.15					
	4	RXsL	A07	F0512R1	50-80-100	0.06-0.08-0.12	0.06-0.08-0.12		0.050-0.075	0.050-0.075		
		RXsG	A07	F0512R1	40-70-90	0.06-0.08-0.12	0.06-0.08-0.12					
		RXsG	A07	F0512R1	25-50-70	0.06-0.08-0.12	0.06-0.08-0.12					
	5	RXsL	A06	F0512R1	15-25-40	0.04-0.06-0.10	0.04-0.06-0.10		0.050-0.075	0.050-0.075		
		RXsG	A06	F0512R1	15-20-30	0.04-0.06-0.10	0.04-0.06-0.10					
		RXsG	A06	F0512R1	15-20-30	0.04-0.06-0.10	0.04-0.06-0.10					
	M	4	RXsL	A07	F0512R1	50-80-100	0.10-0.14-0.16		0.10-0.14-0.16	fz 连续切削值降低30-60% reduce fz full cut 30 - 60%	0.050-0.075	0.05-0.075-0.10
			RXsL	A07	F0512R1	40-70-90	0.08-0.10-0.12		0.08-0.10-0.14			
			RXsG	A06	F0512R1	25-50-70	0.06-0.08-0.12		0.06-0.08-0.12			
		5	RXsL	A07	F0512R1	50-80-100	0.10-0.14-0.16		0.10-0.14-0.16		0.050-0.075	0.05-0.075-0.10
RXsL			A07	F0512R1	40-70-90	0.08-0.10-0.12	0.08-0.10-0.14					
RXsG			A06	F0512R1	25-50-70	0.06-0.08-0.12	0.06-0.08-0.12					
6		RXsL	A07	F0512R1	40-60-80	0.08-0.10-0.14	0.10-0.14-0.16	0.050-0.075	0.050-0.075			
		RXsL	A07	F0512R1	40-60-80	0.08-0.10-0.14	0.08-0.10-0.14					
		RXsG	A06	F0512R1	25-40-70	0.08-0.10-0.14	0.08-0.10-0.14					
4		RXsL	A07	F0512R1	25-40-60	0.08-0.10-0.14	0.08-0.10-0.14	0.050-0.075	0.050-0.075			
		RXsG	A06	F0512R1	20-35-55	0.08-0.10-0.14	0.08-0.10-0.14					
		RXsG	A06	F0512R1	20-30-50	0.08-0.10-0.14	0.08-0.10-0.14					
5		RXsL	A07	F0512R1	15-25-35	0.05-0.08-0.12	0.05-0.08-0.12	0.050-0.075	0.050-0.075			
		RXsG	A06	F0512R1	15-25-35	0.05-0.08-0.12	0.05-0.08-0.12					
		RXsG	A06	F0512R1	10-18-30	0.05-0.08-0.12	0.05-0.08-0.12					
4		RXsL	A07	F0512R1	15-20-30	0.05-0.08-0.12	0.05-0.08-0.12	0.050-0.075	0.050-0.075			
		RXsG	A06	F0512R1	15-20-30	0.05-0.08-0.12	0.05-0.08-0.12					
		RXsG	A06	F0512R1	10-18-30	0.05-0.08-0.12	0.05-0.08-0.12					



AC 应用条件

- 4 工况良好
- 夹具、机床及工件刚性良好
- 刀具长径比 ≤ 4xD
- 排屑良好
- 轻微对称断续切削 (< 10%)
- 内冷压力大于20bar
- 5 工况一般
- 夹具、机床及工件刚性略差
- 刀具长径比 ≤ 6xD
- 排屑较差
- 中等对称断续切削 (< 30%)
- 有内冷
- 6 工况极差
- 夹具、机床及工件刚性差
- 刀具长径比 ≤ 8xD
- 排屑较差
- 中等对称断续切削 (< 30%)
- 有内冷



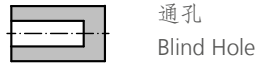
AC Application Conditions

- 4 Optimal conditions
- Stable fixture, machine and/or workpiece
- Tool projection length ≤ 11xD
- Optimal chip removal guaranteed
- Slightly symmetrical and asymmetrical interruption (< 10%)
- Internal coolant supply > 20 bar
- 5 Suboptimal conditions
- Slightly unstable fixture, machine and/or workpiece
- Tool projection length ≤ 15xD
- No optimal chip removal guaranteed
- Medium symmetrical interruptions (< 30%)
- Internal coolant supply available
- 6 Difficult conditions
- Unstable fixture, machine and/or workpiece
- Tool projection length ≤ 15xD
- No optimal chip removal guaranteed
- Medium symmetrical interruptions (< 30%)
- Internal coolant supply available

MATERIAL DETAILS PAGE 88

RX small小径铰刀切削参数

Cutting Data RX small



通孔
Blind Hole

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Sort, Vc, fz, Radial / Stock Removal ap. Contains data for groups P1-P7.

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Sort, Vc, fz, Radial / Stock Removal ap. Contains data for groups M1-M6.



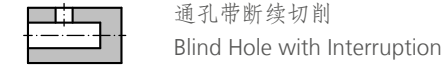
AC 应用条件

- 1 工况良好 - 夹具、机床及工件刚性良好... 2 工况一般... 3 工况极差...



AC Application Conditions

- 1 Optimal conditions - Stable fixture, machine and/or workpiece... 2 Suboptimal conditions... 3 Difficult conditions...



通孔带断续切削
Blind Hole with Interruption

Table with columns: AC, Type, Geometry, Grade, Vc, fz Full Cut, fz Interrupted, Radial / Stock Removal ap. Contains data for groups 4-6.

Table with columns: AC, Type, Geometry, Grade, Vc, fz Full Cut, fz Interrupted, Radial / Stock Removal ap. Contains data for groups 4-6.



AC 应用条件

- 4 工况良好 - 夹具、机床及工件刚性良好... 5 工况一般... 6 工况极差...



AC Application Conditions

- 4 Optimal conditions - Stable fixture, machine and/or workpiece... 5 Suboptimal conditions... 6 Difficult conditions...

MATERIAL DETAILS PAGE 88

RX small小径铰刀切削参数

Cutting Data RX small

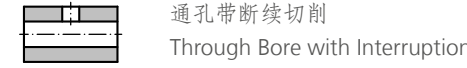


通孔 Through Bore

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal ap. Rows include categories K1-K8.

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal ap. Rows include categories N1-N6.

- AC 应用条件 1 工况良好 2 工况一般 3 工况极差 AC Application Conditions 1 Optimal conditions 2 Suboptimal conditions 3 Difficult conditions



通孔带断续切削 Through Bore with Interruption

Table with columns: AC, Type, Geometry, Grade, Vc, fz Full Cut, fz Interrupted, Radial / Stock Removal ap. Rows include categories 4-6.

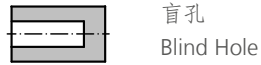
Table with columns: AC, Type, Geometry, Grade, Vc, fz Full Cut, fz Interrupted, Radial / Stock Removal ap. Rows include categories 4-6.

- AC 应用条件 4 工况良好 5 工况一般 6 工况极差 AC Application Conditions 4 Optimal conditions 5 Suboptimal conditions 6 Difficult conditions

MATERIAL DETAILS PAGE 89

RX small小径铰刀切削参数

Cutting Data RX small



盲孔 Blind Hole

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal ap. Rows include categories K1 through K8.

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal ap. Rows include categories N1 through N6.



AC 应用条件

- 1 工况良好 - 夹具、机床及工件刚性良好
2 工况一般 - 夹具、机床及工件刚性略差
3 工况较差 - 夹具、机床及工件刚性差



AC Application Conditions

- 1 Optimal conditions - Stable fixture, machine and/or workpiece
2 Suboptimal conditions - Slightly unstable fixture, machine and/or workpiece
3 Difficult conditions - Unstable fixture, machine and/or workpiece



盲孔带断续切削 Blind Hole with Interruption

Table with columns: AC, Type, Geometry, Grade, Vc, fz Full Cut, fz Interrupted, Radial / Stock Removal ap. Rows include categories 4 through 6.

Table with columns: AC, Type, Geometry, Grade, Vc, fz Full Cut, fz Interrupted, Radial / Stock Removal ap. Rows include categories 4 through 6.



AC 应用条件

- 4 工况良好 - 夹具、机床及工件刚性良好
5 工况一般 - 夹具、机床及工件刚性略差
6 工况较差 - 夹具、机床及工件刚性差



AC Application Conditions

- 4 Optimal conditions - Stable fixture, machine and/or workpiece
5 Suboptimal conditions - Slightly unstable fixture, machine and/or workpiece
6 Difficult conditions - Unstable fixture, machine and/or workpiece



MATERIAL DETAILS PAGE 89

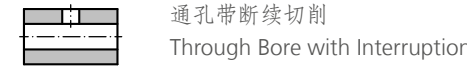
RX small小径铰刀切削参数

Cutting Data RX small



通孔
Through Bore

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz (two columns), Radial / Stock Removal ap (two columns). Rows include categories S, H, SM, and O.



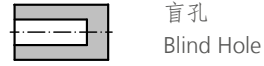
通孔带断续切削
Through Bore with Interruption

Table with columns: AC, Type, Geometry, Grade, Vc, fz Full Cut (two columns), fz Interrupted, Radial / Stock Removal ap (two columns). Rows include categories S, H, SM, and O.

MATERIAL DETAILS PAGE 90/91

RX small小径铰刀切削参数

Cutting Data RX small



盲孔
Blind Hole

ISO	UMC	! 类型		槽型 Geometry	材质 Grade	Vc	fz		Radial / Stock Removal ap		
		AC	Type				Ø 7.600-9.600 mm	Ø 9.601-13.100 mm	Ø 7.600-9.600 mm	Ø 9.601-13.100 mm	
S	S1	1	RXsG	A07	F0512R1	20-35-45	0.04-0.06-0.10	0.04-0.06-0.10	0.05-0.08-0.10	0.05-0.08-0.10	
		2	RXsG	A07	F0512R1	20-35-45	0.04-0.06-0.08	0.04-0.06-0.08			
		3	RXsG	A07	F0512R1	15-25-35	0.04-0.06-0.08	0.04-0.06-0.08			
	S2	1	RXsG	A07	F0512R1	20-30-45	0.04-0.06-0.10	0.04-0.06-0.10	0.05-0.08	0.05-0.08-0.10	
		2	RXsG	A07	F0512R1	20-30-45	0.04-0.06-0.08	0.04-0.06-0.08			
		3	RXsG	A07	F0512R1	15-25-35	0.04-0.06-0.08	0.04-0.06-0.08			
	S3	1	RXsG	A07	F0512R1	15-20-35	0.04-0.06-0.10	0.04-0.06-0.10	0.05-0.08	0.05-0.08-0.10	
		2	RXsG	A07	F0512R1	10-18-30	0.04-0.06-0.08	0.04-0.06-0.08			
		3	RXsG	A07	F0512R1	8-15-25	0.04-0.06-0.08	0.04-0.06-0.08			
	S4	1	RXsG	A07	F0512R1	12-18-25	0.04-0.06-0.08	0.04-0.06-0.08	0.05-0.08	0.05-0.08-0.10	
		2	RXsG	A07	F0512R1	8-15-20	0.04-0.06-0.08	0.04-0.06-0.08			
		3	RXsG	A07	F0512R1	5-12-20	0.04-0.06-0.08	0.04-0.06-0.08			
	H	H1	1	RXsG	A06	F0507R1	15-25-30	0.04-0.06-0.08	0.04-0.06-0.08	0.05-0.08	0.05-0.08-0.10
			2	RXsG	G06	F0507R1	10-18-25	0.04-0.06-0.08	0.04-0.06-0.08		
3			RXsG	G06	F0507R1	8-15-20	0.04-0.06-0.08	0.04-0.06-0.08			
H2		1	RXsG	A06	F0507R1	10-18-25	0.04-0.06-0.08	0.04-0.06-0.08	0.05-0.08	0.05-0.08	
		2	RXsG	G06	F0507R1	8-15-20	0.04-0.06-0.08	0.04-0.06-0.08			
		3	RXsG	G06	F0507R1	8-15-20	0.04-0.06-0.08	0.04-0.06-0.08			
H3		1	RXsG	A06	F0507R1	8-10-15	0.03-0.05-0.07	0.03-0.05-0.07	0.04-0.05-0.06	0.05-0.08	
		2	RXsG	G06	F0507R1	8-10-15	0.03-0.05-0.07	0.03-0.05-0.07			
		3	RXsG	G06	F0507R1	8-10-15	0.03-0.05-0.07	0.03-0.05-0.07			
SM		SM1	1	RXsG	G07	F0512R1	140-180-220	0.12-0.16-0.20	0.12-0.18-0.22	0.08-0.10-0.15	0.08-0.10-0.15
			2	RXsG	G07	F0512R1	110-140-170	0.12-0.16-0.20	0.12-0.16-0.20		
			3	RXsG	G07	F0512R1	80-100-120	0.10-0.14-0.18	0.10-0.14-0.18		
		SM2	1	RXsG	G07	F0512R1	120-140-160	0.10-0.14-0.18	0.12-0.16-0.20	0.08-0.10	0.08-0.10-0.15
			2	RXsG	G07	F0512R1	100-120-150	0.10-0.14-0.18	0.10-0.14-0.18		
	3		RXsG	G07	F0512R1	80-100-120	0.08-0.12-0.16	0.08-0.12-0.16			
	SM3	1	RXsG	G07	F0512R1	40-60-80	0.08-0.10-0.14	0.08-0.10-0.14	0.050-0.075	0.050-0.075	
		2	RXsG	G07	F0512R1	40-60-80	0.08-0.10-0.14	0.08-0.10-0.14			
		3	RXsG	G07	F0512R1	25-40-70	0.08-0.10-0.14	0.08-0.10-0.14			
O	O1	1	RXsG	G07	F0510C	40-60-80	0.10-0.15-0.20	0.10-0.15-0.20	0.08-0.10	0.08-0.10-0.15	
		2	RXsG	G07	F0510C	40-60-80	0.10-0.15-0.20	0.10-0.15-0.20			
		3	RXsG	G07	F0510C	40-60-80	0.10-0.13-0.16	0.10-0.13-0.16			
	O2	1	RXsG	G07	F0510C	40-60-80	0.10-0.15-0.20	0.10-0.15-0.20	0.08-0.10	0.08-0.10-0.15	
		2	RXsG	G07	F0510C	40-60-80	0.10-0.15-0.20	0.10-0.15-0.20			
		3	RXsG	G07	F0510C	40-60-80	0.10-0.13-0.16	0.10-0.13-0.16			
	O3	1	RXsG	G07	F0520C	40-50-60	0.10-0.15-0.20	0.10-0.15-0.20	0.08-0.10	0.08-0.10-0.15	
		2	RXsG	G07	F0520C	40-50-60	0.10-0.15-0.20	0.10-0.15-0.20			
		3	RXsG	G07	F0520C	40-50-60	0.10-0.13-0.16	0.10-0.13-0.16			
	O4	1	RXsG	G07	F0520C	30-50-60	0.05-0.08-0.10	0.05-0.08-0.10	0.08-0.10	0.08-0.10-0.15	
		2	RXsG	G07	F0520C	30-50-60	0.05-0.08-0.10	0.05-0.08-0.10			
		3	RXsG	G07	F0520C	30-50-60	0.05-0.08-0.10	0.05-0.08-0.10			



盲孔带断续切削
Blind Hole with Interruption

AC	Type	槽型 Geometry	材质 Grade	Vc	fz 连续切削 fz Full Cut		fz 断续切削 fz Interrupted	Radial / Stock Removal ap					
					Ø 7.600-9.600 mm	Ø 9.601-13.100 mm		Ø 7.600-9.600 mm	Ø 9.601-13.100 mm				
S	4	RXsG	A06	F0512R1	20-35-45	0.04-0.06-0.10	0.04-0.06-0.10	fz 连续切削 fz Full Cut fz 断续切削 fz Interrupted reduce fz full cut 30 - 60%	0.05-0.08-0.10	0.05-0.08-0.10			
	5	RXsG	A06	F0512R1	20-35-45	0.04-0.06-0.08	0.04-0.06-0.08						
	6	RXsG	A06	F0512R1	15-25-35	0.04-0.06-0.08	0.04-0.06-0.08						
	H	4	RXsG	A06	F0512R1	20-30-45	0.04-0.06-0.10		0.04-0.06-0.10	0.05-0.08-0.10	0.05-0.08-0.10		
		5	RXsG	A06	F0512R1	20-30-45	0.04-0.06-0.08		0.04-0.06-0.08				
		6	RXsG	A06	F0512R1	15-25-35	0.04-0.06-0.08		0.04-0.06-0.08				
	SM	4	RXsG	A06	F0512R1	15-20-35	0.04-0.06-0.10		0.04-0.06-0.10	0.05-0.08	0.05-0.08-0.10		
		5	RXsG	A06	F0512R1	10-18-30	0.04-0.06-0.08		0.04-0.06-0.08				
		6	RXsG	A06	F0512R1	8-15-25	0.04-0.06-0.08		0.04-0.06-0.08				
	O	4	RXsG	A06	F0512R1	12-18-25	0.04-0.06-0.08		0.04-0.06-0.08	0.05-0.08	0.05-0.08-0.10		
		5	RXsG	A06	F0512R1	8-15-20	0.04-0.06-0.08		0.04-0.06-0.08				
		6	RXsG	A06	F0512R1	5-12-20	0.04-0.06-0.08		0.04-0.06-0.08				
		4	RXsG	A06	F0512R1	20-40-60	0.04-0.06-0.10		0.04-0.06-0.10			0.05-0.08-0.10	0.05-0.08-0.10
		5	RXsG	A06	F0512R1	20-35-45	0.04-0.06-0.08		0.04-0.06-0.08				
		6	RXsG	A06	F0512R1	15-25-30	0.04-0.06-0.08		0.04-0.06-0.08				
	O	4	RXsG	A06	F0512R1	20-35-45	0.04-0.06-0.10		0.04-0.06-0.10	0.05-0.08-0.10	0.05-0.08-0.10		
		5	RXsG	A06	F0512R1	20-30-45	0.04-0.06-0.08		0.04-0.06-0.08				
		6	RXsG	A06	F0512R1	15-25-30	0.04-0.06-0.08		0.04-0.06-0.08				
4		RXsG	A06	F0512R1	20-30-45	0.04-0.06-0.10	0.04-0.06-0.10	0.05-0.08-0.10	0.05-0.08-0.10				
5		RXsG	A06	F0512R1	15-25-30	0.04-0.06-0.08	0.04-0.06-0.08						
6		RXsG	A06	F0512R1	10-18-30	0.04-0.06-0.08	0.04-0.06-0.08						
O	4	RXsG	A06	F0512R1	15-25-30	0.04-0.06-0.08	0.04-0.06-0.08	0.05-0.08	0.05-0.08-0.10				
	5	RXsG	A06	F0512R1	10-18-30	0.04-0.06-0.08	0.04-0.06-0.08						
	6	RXsG	A06	F0512R1	10-18-30	0.04-0.06-0.08	0.04-0.06-0.08						
	4	RXsG	A06	F0512R1	15-20-30	0.04-0.06-0.08	0.04-0.06-0.08			0.05-0.08-0.10	0.05-0.08-0.10		
	5	RXsG	A06	F0512R1	10-18-25	0.04-0.06-0.08	0.04-0.06-0.08						
	6	RXsG	A06	F0512R1	8-15-20	0.04-0.06-0.08	0.04-0.06-0.08						

MATERIAL DETAILS PAGE 90/91

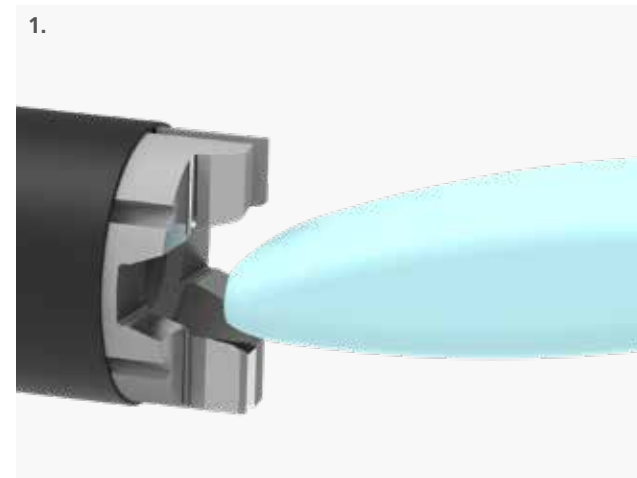
Ø 7.600 – 13.100 mm

RX small小径铰刀操作指南 Handling Instructions RX small

刀片更换 Insert Change

不要从刀柄上取出刀杆。取出锁紧螺钉和用过的铰刀片。

为确保更换刀片后的最高重复定位精度，正确清理定位面并使用特定扭矩锁紧非常重要。



1. 清洁定位面
刀片定位面可用清洁黏土快速清洁。

2. 刀片更换
将刀片放在清洁过的定位面上并用特定扭矩锁紧螺钉。

Torx®-扭矩扳手 Torx®-Torque Wrench


System Size	Clamping Torque	Torx® Size	Order Number
RXs 08	0.6 Nm	T6	G00 40 15
RXs 10	0.9 Nm	T7	G00 40 14
RXs 11	1.4 Nm	T9	G00 40 16
RXs 13	2.0 Nm	T10	G00 40 17

Do not take the shank out of the tool holder. Remove clamping screw and used reaming insert.

For highest repeatability on each insert change, proper cleaning of the interface as well as using the pre-defined tightening torque are imperative.



1. **Cleaning of the Interface**
The interface can be cleaned most effectively with the modelling clay included in the insert packaging.
2. **Insert Change**
The insert is placed on the previously cleaned interface and tightened clamping screw with the pre-defined clamping torque.

 必须使用扭矩扳手
Tighten screw with torque wrench only

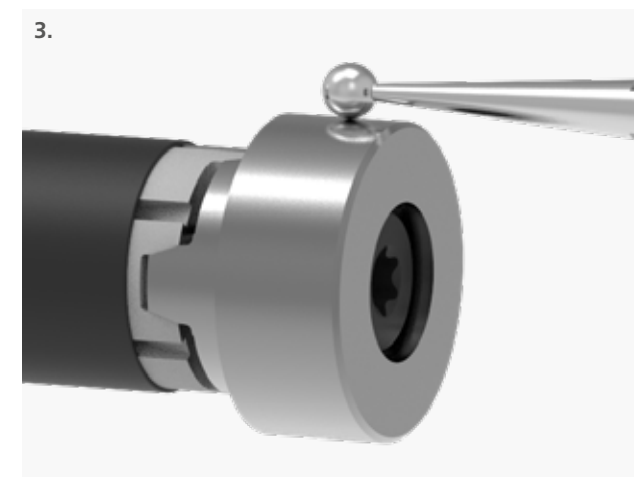
Ø 7.600 – 13.100 mm

RX small小径铰刀操作指南 Handling Instructions RX small

跳动调整 Run-Out Adjustment

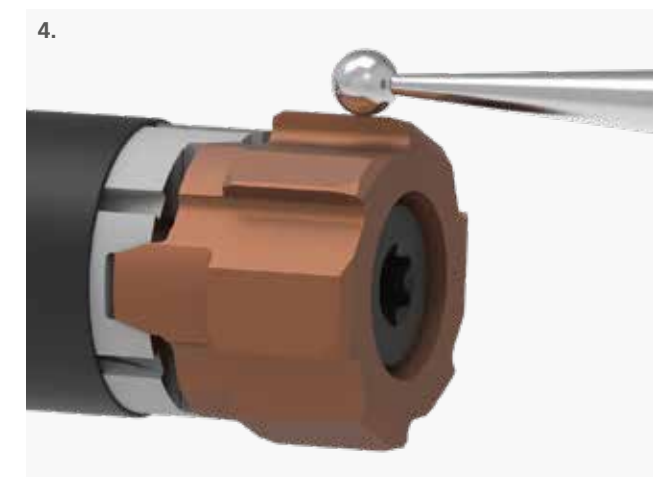
为达到最佳铰削效果，刀具跳动越小越好。为了补偿机床主轴以及刀杆等引起的任何跳动误差，我们推荐使用跳动补偿刀柄或者浮动刀柄。RX small 铰刀的跳动有以下测量方法：

3. 通过跳动检测头检测
可以使用标准检测刀头轻松调整及检测跳动。标准检测头需单独订货。订货号可以在“鸽马铰刀”样本找到。
4. 通过刀片外径检测
可以通过检测RX small刀片的刃带检测和调整铰刀跳动，但难度会更大一些。



In order to achieve the best reaming results, a tool with zero run-out is absolutely essential. To compensate any run-out error of the tool holder and the machine spindle, we recommend using a compensation holder or floating chuck. The run-out of RX small reamers can be measured with different methods:

3. **Measurement Through Run-Out Indicating Insert**
The run-out can be easily adjusted and precisely checked by using an indicating insert. It's not included in scope of delivery. Order number can be found in the "URMA Reaming" catalogue.
4. **Measurement on the External Diameter of the Insert**
The run-out can also be set up via the small margin on the insert. Its handling is, however, more difficult.



跳动补偿刀柄说明

Instruction Compensation Chuck



使用铍马跳动补偿刀柄，铰刀的跳动可以被调整到最佳状态以补偿主轴和刀具的误差。

步骤:


1. 调整前确保所有调整螺钉②彻底松开
2. 将刀柄装到机床主轴上.
3. 将千分表测头(1 μ m/0.0001 英寸精度)放在标准检测头① 或者刀片的外径上(见25页)。
4. 通过四个径向调整螺钉将跳动调整到最大5 μ m/0.0002inch (最佳状态< 3 μ m/0.0001inch) ②.

 调整完成后，四个螺钉不要顶得太紧

With the URMA compensation chuck, the run-out of reaming tools can be optimally adjusted and, thus, compensate for spindle and tool errors.

Procedure:

1. Before adjusting, make sure that all adjustment screws ② are completely loosened.
2. Load the tool in the machine spindle.
3. Set the indicator (with 1 μ m / 0,0001 inch resolution) on the run-out indicating insert ① or on the margin of the insert (see page 25).
4. Set the run-out directly in the machine spindle to max. 5 μ m / 0,0002 inch (ideal < 3 μ m / 0,0001 inch) by using the four radial adjustment screws ②.

 The adjustment screws do not have to be fully clamped against each other after adjustment.

浮动刀柄说明

Instruction Floating Chuck



车床上铰孔通常需要用浮动刀柄(有时也会用于加工中心)。位置误差可由可调浮动机构适当补偿。只能补偿水平或垂直误差(无法补偿角度误差)。推荐使用 $\leq 45^\circ$ 的刀片角度。

步骤:

1. 通过调整螺钉①调整浮动机构。

调整螺钉	浮动机构	对加工的影响
顺时针旋转	弹簧力增加/阻力增加	表面质量可能变差(印迹变浅)
逆时针旋转	弹簧力变弱/阻力减小	可能产生振动

Reaming on lathes are mainly done with floating chucks (in exceptional cases also on machining centres).

Positioning errors can be compensated by the adjustable floating mechanism. The deflection should only take place in plane-parallel (No angular error compensation).

Cutting geometries with an angle of $\leq 45^\circ$ are recommended.

Procedure:

1. Adjust the floating mechanism by using the adjustment screw ①.

Adjustment screw	Floating mechanism	Influence on machining
Clockwise rotation	Spring force increases / deflection resistance increases	The surface quality can be negatively influenced (retraction marks)
Counterclockwise rotation	Spring force becomes weaker / deflection resistance decreases	Potential vibration tendency

调整:

松: 浮动柄需要调整到最低阻力。不过, 考虑到刀具本身的重量, 应该使刀具在发生偏移后能自动回到中心位置

中等: 完全锁紧调整螺钉并退回 $1 \pm \frac{1}{4}$ 圈。

紧: 完全锁紧螺钉并退回 $\frac{1}{4} - \frac{1}{2}$ 圈。

Adjustment:

Soft: The tool should be adjusted with the lowest possible deflection resistance. Nevertheless, taking into account the weight of the tool, it must jump back automatically into the central axis after deflection.

Medium: Fully tighten the adjusting screw and turn back by $1 \pm \frac{1}{4}$ rotation.

Hard: Fully tighten the adjusting screw and turn back by $\frac{1}{4} - \frac{1}{2}$ rotation.

推荐作为基本设置:

刀具直径 Tool-Ø	松 Soft	中等 Medium	紧 Hard
7.600 – 13.100	X		

Recommendation for the basic setting:

2. 相对于Y轴, 我们特别推荐刀具跳动和主轴轴心的偏差应 $< 10\mu\text{m} / 0.0004\text{inch}$ (最佳状态 $< 5\mu\text{m} / 0.0002\text{inch}$)



-浮动机构的调整很大程度上取决于应用场合及浮动柄的类型
-通常推荐浮动刀柄进入孔口时降低切削速度
-所有数值都是参照铰马浮动柄的推荐值

2. With an existing Y-axis, we recommend additionally aligning the tool $< 10\mu\text{m} / 0.0004\text{inch}$ (ideally $< 5\mu\text{m} / 0.0002\text{inch}$) concentrically to the spindle axis.



- The setting of the floating mechanism can vary depending on the application and type of floating chuck.
- It is generally recommended to enter the bore with reduced rpm.
- All data are guide values and refer to URMA floating chucks.

钨马铰削
RX medium 中径铰刀

订单示例
Order Example

孔径标注方式 Bore diameter		刀片直径标注方式 Insert diameter	
ISO标准孔公差 ISO bore tolerances	孔公差 (μm) Bore tolerance in μm	期望的刀片尺寸 (Q标注法) Target size (Q-Insert)	
Example 订单示例 Order example RXG42.2 H7 -A01 U2 F0514R1	订单示例 Order example RXG18.2+ 20-10 -A01 U1 F0514R1 H	订单示例 Order example RXG 20.020Q + 3-3 -A01 U1 F0512R1	Example
RX RX medium 系统代码 RX medium system designation	RX RX medium 系统代码 RX medium system designation	RX RX medium 系统代码 RX medium system designation	
G 排屑槽型代码 (G =直槽; L =左旋槽) Flute form (G = straight; L = left-hand helix)	G 排屑槽型代码 (G =直槽; L =左旋槽) Flute form (G = straight; L = left-hand helix)	G 排屑槽型代码 (G =直槽; L =左旋槽) Flute form (G = straight; L = left-hand helix)	
42.2 直径 (mm) Diameter (mm)	18.2 直径 (mm) Diameter (mm)	20.020 刀片直径标注方式 (mm) Insert diameter (mm)	Diameter
H7 ISO标准公差 Tolerance in ISO standard	+20-10 孔公差 (μm) Bore tolerance (μm)	Q 定制直径刀片代码 Code for target size insert	
A01 切削角度代码 Cutting geometry	A01 切削角度代码 Cutting geometry	+3-3 制造公差 (μm) Manufacturing tolerance (μm)	
A01 切削角度代码 Cutting geometry	A01 切削角度代码 Cutting geometry	A01 切削角度代码 Cutting geometry	
Option U2 理代码 详见第33页 Edge preparation For details see page 33	U1 理代码 详见第33页 Edge preparation For details see page 33	U1 理代码 详见第33页 Edge preparation For details see page 33	Option
F05 刀片材质代码 详见第35页 Cutting material For details see page 35	F05 刀片材质代码 详见第35页 Cutting material For details see page 35	F05 刀片材质代码 详见第35页 Cutting material For details see page 35	
14R 涂层代码 详见第35页 Coating For details see page 35	14R 涂层代码 详见第35页 Coating For details see page 35	12R 涂层代码 详见第35页 Coating For details see page 35	
1 1=薄涂层 2=厚涂层 1 = thin coating 2 = thick coating	1 1=薄涂层 2=厚涂层 1 = thin coating 2 = thick coating	1 1=薄涂层 2=厚涂层 1 = thin coating 2 = thick coating	
Option H* H = SD毛坯 (没有H = 常规毛坯) H = SD blank (without H = regular blank)	H* H = SD毛坯 (没有H = 常规毛坯) H = SD blank (without H = regular blank)	H* H = SD毛坯 (没有H = 常规毛坯) H = SD blank (without H = regular blank)	Option

* SD 毛坯“H”只适用于RX016和RX019, 参见“钨马铰刀”样本
* SD blank “H” only for RX016 and RX019 see “URMA Reaming” catalogue

订货细节示例
Details Order Example

孔公差及可用涂层厚度
Bore Tolerances and Applicable Coating Thickness

孔径 Bore Diameter	孔公差范围 Bore Tolerance Range	不涂层 Uncoated	涂层厚度 Coating Thickness		紧公差额外收费 Surcharge for Tight Tolerances
			1	2	
≥ 14 μm		x	x	x	-
10 - 13 μm		x	x		-
				x	x
6 - 9 μm		x			-
			x	-	x

示例: 孔径 20H7 = 公差范围 μm = **≥ 14 μm**
Bore diameter 20H7 = tolerance range 21 μm = **≥ 14 μm**

孔径 12^{+0.006}/_{-0.005} = 公差范围 11 μm = **10 - 13 μm**
Bore diameter 12^{+0.006}/_{-0.005} = tolerance range 11 μm = **10 - 13 μm**

期望的刀片尺寸 (Q标注法) 及可用涂层厚度
Target Size (Q-Insert) and Applicable Coating Thickness

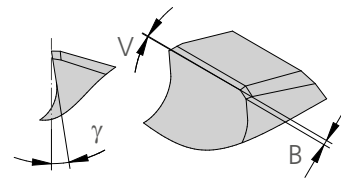
刀片直径 Insert Diameter	刀片公差 Insert Tolerance	不涂层 Uncoated	涂层厚度 Coating Thickness		紧公差额外收费 Surcharge for Tight Tolerances
			1	2	
± 4 μm		N/A	N/A	x	-
± 3 μm		N/A	x		-
				x	x
± 2 μm		x			-
			x	N/A	x
± 1 μm		x	N/A	N/A	x

N/A = 不适用
N/A = Not applicable

理代码 (刃口处理)
Edge preparation (Nano Finishing)

U1 细微 刃口处理 Light edge-preparation	U2 中等 刃口处理 Medium edge-preparation	U_ 其他刃口处理 按需定制 Other edge-preparations on request
---	--	---

刀片角度
Cutting Geometries



vf	Geo	直槽 RXG	左旋槽 RXL	孔的类型		fz mm	Ra μm	Zyl.	Pos	FC	MD			
	A0	▲		▲ (K1-K8)*	▲	REFERENCE VALUE								
	B0	□	▲	▲	□	↗	👍	👎	👎	↗	↗			
	C0	▲		▲ (K1-K8)*	▲	↗	👍	👎	👎	↗	↗			
	C1	▲	▲	▲ (K1-K8)*	▲	↗	👍	👎	👎	↗	↗			
	D0	□	▲	▲	□	↗	👍	👎	👎	↗	↗			
	G0	▲	□	▲ (K1-K8)*	▲	↘	👎	👍	👍	↘	↘			
	G1	▲	□	▲ (K1-K8)*	▲	↘	=	👍	👍	↘	↘			
Geo	γ	B	V	W	ap mm	Ra μm	Zyl.	FC	MD					
STANDARD GEOMETRY (REFERENCE VALUE)														
_1	=	=	↘	=	=	=	=	↗	↗	=	=			
_2	=	↘	=	=	↘	=	=	=	=	↘	↘			
_3	=	=	=	↘	=	👍	=	↘	↘	=	=			
_4	=	=	=	↘	=	=	=	↘	↘	=	=			
_5	=	=	=	↘	=	=	=	↘	↘	=	=			
_6	=	=	↗	=	=	=	=	↘	↘	=	=			
_7	↗	=	↗	=	=	=	=	↘	↘	=	=			
_8	=	↗	=	=	↗	=	=	=	=	↗	↗			
Geo	γ	B	V	RXG	RXL	孔的类型		ap mm	fz mm	Ra μm	Zyl.	Pos.	FC	MD
Special cutting geometries (surcharge)														
REFERENCE GEOMETRY A01														
S02	=	↗	=	■	□	▲	▲	↗	↘	=	👍	👍	↘	↘
S04	=	=	↗	■	■	▲	▲	=	↗	👍	👍	👎	↘	↘
S08	=	=	=	■	□	■	▲	↗	↘	👍	👍	👍	↘	↘
S10	=	↗	↗	■	■	▲	▲	↗	↘	=	👍	👍	↘	↘
S12	=	↗	↗	■	□	▲	▲	↗	↘	=	👍	👍	↘	↘
S13	=	↗	↗	■	■	▲	▲	↗	↘	=	👍	👍	↘	↘
S14	=	↘	↗	□	■	▲	□	↘	↘	👍	👎	👎	↘	↘
S15	=	=	↗	■	□	▲	▲	=	↘	↘	👍	👍	↘	↘
S16	↗	↗	↗	■	■	▲	▲	↗	↘	=	👍	👍	↘	↘

定义和基本计算公式，见第 86 页
See page 86 for definitions and basic formulas

* 材料分类见 88 页
* See page 88 for material group

- B = 倒角长度
- V = 背锥
- W = 刃带宽度
- FC = 切削力
- MD = 扭矩
- γ = 径向前角
- vf = 进给方向
- ▲ = 推荐的
- = 可适用的
- = 可能的
- ↗ = 更高的值
- ↘ = 更低的值
- 👍 = 有助于
- 👎 = 不利于

- B = Chamfer length
- V = Back taper
- W = Margin width
- FC = Cutting force
- MD = Torque
- γ = Radial rake angle
- vf = Feed direction
- ▲ = Recommended
- = Applicable
- = Possible
- ↗ = Higher value
- ↘ = Lower value
- 👍 = Improved
- 👎 = Worse

刀片材质概览
Cutting Materials overview

ISO 材料代码	URMA 材料代码	刀片材质 Cutting Materials							涂层厚度 Coating											
		URMA Code	F05	T15	BS10	BS20	BH15	DP30	00	01P_	05P_	07R_	08P_	12R_	14R_	17B_	18B_	10C	20C	21C
		代号	硬质合金	金属陶瓷	CBN	CBN	CBN	PKD / PCD	不涂层	TiN	AlTiN	TiAlN + AlCrN	AlCrN	AlCrN	AlCrN	AlCrN	TiSiN	DLC	DLC	DLC
P	P1	■	▲					▲	□											
	P2	■	▲					▲	□											
	P3	■	▲					▲	□											
	P4	■	▲					▲	□											
	P5	■	▲					▲	□											
	P6	▲						□	□											
	P7	▲						□	□											
M	M1	▲	□					□	□											
	M2	▲	□					□	□											
	M3	▲						□	□											
	M4	▲						□	□											
	M5	▲						□	□											
	M6	▲						□	□											
K	K1	▲		○				□												
	K2	▲		○				□												
	K3	▲	□		○			□												
	K4	▲	□		○			□												
	K5	▲			○			□												
	K6	▲			○			□												
	K7	▲						□												
	K8	▲						□												
N	N1	▲						○	□											
	N2	▲						○	□											
	N3	▲						○	□											
	N4	▲						○	□											
	N5	▲	□					○	□											
	N6	▲						○	□											
S	S1	▲						□	□											
	S2	▲						□	□											
	S3	▲						□	□											
	S4	▲						□	□											
	S11	▲						□	□											
	S12	▲						□	□											
	S14	▲						□	□											
H	H1	▲						○	□											
	H2	▲						○	□											
	H3	▲						○	□											
SM	SM1	■	▲					▲	□											
	SM2	▲	□					□	□											
	SM3	▲						□	□											
O	O1	▲	□					□												
	O2	▲	□					□												
	O3	▲						□												
	O4	▲						○	□											

- ▲ = 推荐的
- = 可适用的
- = 可能的
- = 按需使用
- ▲ = Recommended
- = Applicable
- = Possible
- = On request

MATERIAL DETAILS PAGE 88

RX medium 中径铰刀切削参数

Cutting Data RX medium



通孔
Through Bore

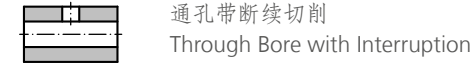
ISO	UMC	AC	Type	Geometry	Grade	Vc	fz	Radial / Stock Removal		
								ap Ø 11.900-23.600 mm	ap Ø 23.601-35.600 mm	ap Ø 35.601-140.600 mm
P	P1	1	RXL	B07	T1500	160-200-240	0.18-0.25-0.35			
		2	RXL	B01	T1500	120-150-180	0.18-0.22-0.30	0.08-0.10-0.15	0.08-0.10-0.15	0.08-0.10-0.20
		3	RXL	A07	F0512R1	80-110-140	0.12-0.16-0.20			
	P2	1	RXL	B07	T1500	160-200-240	0.18-0.25-0.35			
		2	RXL	B01	T1500	120-150-180	0.18-0.22-0.30	0.08-0.10-0.15	0.08-0.10-0.15	0.08-0.10-0.20
		3	RXL	A07	F0512R1	80-110-140	0.12-0.16-0.20			
	P3	1	RXL	B07	T1500	140-180-220	0.18-0.25-0.35			
		2	RXL	B01	T1500	110-140-170	0.18-0.22-0.30	0.08-0.10-0.15	0.08-0.10-0.15	0.08-0.10-0.20
		3	RXL	A07	F0512R1	80-100-120	0.12-0.16-0.20			
	P4	1	RXL	B01	T1500	140-180-220	0.18-0.22-0.30			
		2	RXL	B07	F0512R1	110-140-170	0.16-0.20-0.28	0.08-0.10-0.15	0.08-0.10-0.15	0.08-0.10-0.15
		3	RXL	A07	F0512R1	80-100-120	0.10-0.14-0.18			
	P5	1	RXL	B01	T1500	100-130-160	0.15-0.20-0.25			
		2	RXL	B07	F0512R1	100-125-150	0.15-0.18-0.22	0.05-0.10-0.12	0.05-0.10-0.12	0.08-0.10-0.15
		3	RXL	A01	F0512R1	80-100-120	0.10-0.14-0.18			
	P6	1	RXL	B01	F0512R1	50-80-100	0.10-0.14-0.16			
		2	RXL	A01	F0512R1	40-70-90	0.08-0.10-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXL	A01	F0512R1	25-50-70	0.06-0.08-0.12			
	P7	1	RXL	A06	F0512R1	15-25-40	0.08-0.10-0.12			
		2	RXL	A06	F0512R1	15-20-30	0.06-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXL	A06	F0512R1	15-20-30	0.06-0.08-0.10			
M	M1	1	RXL	B07	F0512R1	50-80-100	0.15-0.20-0.25			
		2	RXL	B07	F0512R1	40-70-90	0.15-0.18-0.22	0.05-0.10-0.12	0.05-0.10-0.12	0.08-0.10-0.15
		3	RXL	A07	F0512R1	25-50-70	0.12-0.14-0.18			
	M2	1	RXL	B07	F0512R1	50-80-100	0.15-0.20-0.25			
		2	RXL	B07	F0512R1	40-70-90	0.15-0.18-0.22	0.05-0.10-0.12	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXL	A07	F0512R1	25-50-70	0.12-0.14-0.18			
	M3	1	RXL	B07	F0512R1	40-60-80	0.10-0.14-0.16			
		2	RXL	B07	F0512R1	40-60-80	0.08-0.10-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXL	A07	F0512R1	25-40-70	0.06-0.08-0.12			
	M4	1	RXL	A07	F0512R1	25-40-60	0.08-0.10-0.14			
		2	RXL	A07	F0512R1	20-35-55	0.08-0.10-0.14	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXL	A07	F0512R1	20-30-50	0.08-0.10-0.14			
	M5	1	RXL	A07	F0512R1	15-25-35	0.05-0.08-0.12			
		2	RXL	A07	F0512R1	15-25-35	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXL	A07	F0512R1	10-18-30	0.05-0.08-0.12			
	M6	1	RXL	A07	F0512R1	15-20-30	0.05-0.08-0.12			
		2	RXL	A07	F0512R1	15-20-30	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXL	A07	F0512R1	10-18-30	0.05-0.08-0.12			



- AC 应用条件**
- 1 工况良好**
 - 夹具、机床及工件刚性良好
 - 刀片直径标注方式 < 35.600
 - 刀具长径比 < 6xD
 - 刀片直径标注方式 > 35.601
 - 刀具长径比 < 5xD
 - 排屑良好
 - 内冷压力大于20bar
 - 2 工况一般**
 - 夹具、机床及工件刚性略差
 - 刀片直径标注方式 < 35.600
 - 刀具长径比 < 12xD
 - 刀片直径标注方式 > 35.601
 - 刀具长径比 < 7xD
 - 排屑较差
 - 有内冷
 - 3 工况较差**
 - 夹具、机床及工件刚性差
 - 刀片直径标注方式 < 35.600
 - 刀具长径比 < 12xD
 - 刀片直径标注方式 > 35.601
 - 刀具长径比 < 9xD
 - 排屑差
 - 有内冷



- AC Application Conditions**
- 1 Optimal conditions**
 - Stable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 6xD
 - Insert diameter > 35.601 Tool projection length < 5xD
 - No optimal chip removal guaranteed
 - Internal coolant supply > 20 bar
 - 2 Suboptimal conditions**
 - Slightly unstable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 12xD
 - Insert diameter > 35.601 Tool projection length < 7xD
 - No optimal chip removal guaranteed
 - Internal coolant supply available
 - 3 Difficult conditions**
 - Unstable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 12xD
 - Insert diameter > 35.601 Tool projection length < 9xD
 - Critical chip evacuation
 - Internal coolant supply available



通孔带断续切削
Through Bore with Interruption

AC	Type	Geometry	Grade	Vc	fz 连续切削 fz Full Cut	fz 断续切削 fz Interrupted	Radial / Stock Removal		
							ap Ø 11.900-23.600 mm	ap Ø 23.601-35.600 mm	ap Ø 35.601-140.600 mm
4	RXL	A06	T1500	160-200-240	0.16-0.20-0.25	fz 连续切削降低30-50% reduce fz full cut 30 - 50%			
5	RXL	A06	F0512R1	120-140-180	0.12-0.18-0.22		0.08-0.10-0.15	0.08-0.10-0.15	0.08-0.10-0.20
6	RXL	A01	F0512R1	80-110-140	0.10-0.15-0.20				
4	RXL	A06	T1500	160-200-240	0.16-0.20-0.25				
5	RXL	A06	F0512R1	120-140-180	0.12-0.18-0.22		0.08-0.10-0.15	0.08-0.10-0.15	0.08-0.10-0.20
6	RXL	A01	F0512R1	80-110-140	0.10-0.15-0.20				
4	RXL	A06	T1500	140-180-220	0.16-0.20-0.25				
5	RXL	A06	F0512R1	110-140-170	0.12-0.18-0.22		0.08-0.10-0.15	0.08-0.10-0.15	0.08-0.10-0.20
6	RXL	A01	F0512R1	80-100-120	0.10-0.15-0.20				
4	RXL	A01	F0512R1	110-140-170	0.15-0.18-0.22				
5	RXL	A01	F0512R1	110-140-170	0.12-0.16-0.22		0.08-0.10-0.15	0.08-0.10-0.15	0.08-0.10-0.15
6	RXL	A01	F0512R1	80-100-120	0.10-0.12-0.18				
4	RXL	A01	F0512R1	100-120-160	0.15-0.18-0.22				
5	RXL	A01	F0512R1	100-120-150	0.12-0.16-0.22		0.05-0.10-0.12	0.05-0.10-0.12	0.08-0.10-0.15
6	RXL	A01	F0512R1	80-100-120	0.10-0.12-0.18				
4	RXL	A01	F0512R1	50-80-100	0.08-0.10-0.12				
5	RXL	A01	F0512R1	40-70-90	0.06-0.08-0.12		0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
6	RXL	A01	F0512R1	25-50-70	0.04-0.08-0.10				
4	RXL	A06	F0512R1	15-25-40	0.06-0.08-0.12				
5	RXL	A06	F0512R1	15-20-30	0.06-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12	
6	RXL	A06	F0512R1	15-20-30	0.04-0.08-0.10				
4	RXL	A07	F0512R1	50-80-100	0.14-0.16-0.22	fz 连续切削降低30-50% reduce fz full cut 30 - 50%			
5	RXL	A07	F0512R1	40-70-90	0.12-0.15-0.20		0.05-0.10-0.12	0.05-0.10-0.12	0.08-0.10-0.15
6	RXL	A07	F0512R1	25-50-70	0.10-0.14-0.18				
4	RXL	A07	F0512R1	50-80-100	0.14-0.16-0.22				
5	RXL	A07	F0512R1	40-70-90	0.12-0.15-0.20		0.05-0.10-0.12	0.05-0.10-0.12	0.05-0.10-0.12
6	RXL	A07	F0512R1	25-50-70	0.10-0.14-0.18				
4	RXL	A07	F0512R1	40-60-80	0.10-0.12-0.16				
5	RXL	A07	F0512R1	40-60-80	0.08-0.10-0.12		0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
6	RXL	A07	F0512R1	25-40-70	0.06-0.08-0.12				
4	RXL	A07	F0512R1	25-40-60	0.08-0.10-0.14				
5	RXL	A06	F0512R1	20-35-55	0.08-0.10-0.14		0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
6	RXL	A06	F0512R1	20-30-50	0.08-0.10-0.14				
4	RXL	A06	F0512R1	15-25-35	0.08-0.10-0.12				
5	RXL	A06	F0512R1	15-25-35	0.05-0.08-0.12		0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
6	RXL	A06	F0512R1	10-18-30	0.05-0.08-0.12				
4	RXL	A06	F0512R1	15-20-30	0.08-0.10-0.12				
5	RXL	A06	F0512R1	15-20-30	0.05-0.08-0.12		0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
6	RXL	A06	F0512R1	10-18-30	0.05-0.08-0.12				



- AC 应用条件**
- 4 工况良好**
 - 刀片直径标注方式 < 35.600
 - 刀具长径比 < 6xD
 - 刀片直径标注方式 > 35.601
 - 刀具长径比 < 5xD
 - 排屑良好
 - 轻微对称断续切削 (< 10%)
 - 内冷压力大于20bar
 - 5 工况一般**
 - 夹具、机床及工件刚性略差
 - 刀片直径标注方式 < 35.600
 - 刀具长径比 < 12xD
 - 刀片直径标注方式 > 35.601
 - 刀具长径比 < 7xD
 - 排屑较差
 - 中等对称断续切削 (< 30%)
 - 有内冷
 - 6 工况较差**
 - 夹具、机床及工件刚性差
 - 刀片直径标注方式 < 35.600
 - 刀具长径比 < 12xD
 - 刀片直径标注方式 > 35.601
 - 刀具长径比 < 9xD
 - 排屑较差
 - 中等对称断续切削 (< 30%)
 - 有内冷

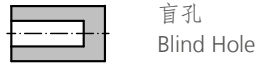


- AC Application Conditions**
- 4 Optimal conditions**
 - Stable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 6xD
 - Insert diameter > 35.601 Tool projection length < 5xD
 - No optimal chip removal guaranteed
 - Slightly symmetrical and asymmetrical interruption (< 10%)
 - Internal coolant supply > 20 bar
 - 5 Suboptimal conditions**
 - Slightly unstable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 12xD
 - Insert diameter > 35.601 Tool projection length < 7xD
 - No optimal chip removal guaranteed
 - Medium symmetrical interruptions (< 30%)
 - Internal coolant supply available
 - 6 Difficult conditions**
 - Unstable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 12xD
 - Insert diameter > 35.601 Tool projection length < 9xD
 - No optimal chip removal guaranteed
 - Medium symmetrical interruptions (< 30%)
 - Internal coolant supply available



MATERIAL DETAILS PAGE 88

RX medium中径铰刀切削参数 Cutting Data RX medium



盲孔
Blind Hole

ISO	UMC	AC	Type	槽型 Geometry	材质 Grade	Vc	fz	Radial / Stock Removal		
								ap		
								Ø 11.900-23.600 mm	Ø 23.601-35.600 mm	Ø 35.601-140.600 mm
P	P1	1	RXG	A07	T1500	140-180-220	0.16-0.20-0.25			
		2	RXG	A06	T1500	120-140-180	0.12-0.18-0.22	0.05-0.08-0.12	0.08-0.10-0.15	0.08-0.10-0.15
		3	RXG	G01	F0512R1	80-110-140	0.08-0.12-0.18			
	P2	1	RXG	A07	T1500	140-180-220	0.16-0.20-0.25			
		2	RXG	A06	T1500	120-140-180	0.12-0.18-0.22	0.05-0.08-0.12	0.08-0.10-0.15	0.08-0.10-0.15
		3	RXG	G01	F0512R1	80-110-140	0.08-0.12-0.18			
	P3	1	RXG	A07	T1500	140-160-200	0.16-0.20-0.25			
		2	RXG	A06	F0512R1	100-130-160	0.12-0.18-0.22	0.05-0.08-0.12	0.08-0.10-0.15	0.08-0.10-0.15
		3	RXG	G01	F0512R1	80-100-120	0.08-0.12-0.18			
	P4	1	RXG	A01	T1500	140-160-200	0.15-0.18-0.22			
		2	RXG	A06	F0512R1	100-130-160	0.12-0.16-0.22	0.05-0.08-0.12	0.05-0.10-0.15	0.08-0.10-0.15
		3	RXG	G01	F0512R1	80-100-120	0.08-0.12-0.18			
	P5	1	RXG	A01	F0512R1	100-120-140	0.14-0.18-0.20			
		2	RXG	G01	F0512R1	90-110-130	0.12-0.16-0.20	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXG	G01	F0512R1	80-100-120	0.08-0.12-0.18			
	P6	1	RXG	A01	F0512R1	50-80-100	0.10-0.15-0.18			
		2	RXG	G01	F0512R1	40-70-90	0.08-0.12-0.16	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXG	G01	F0512R1	25-50-70	0.06-0.08-0.12			
	P7	1	RXG	A06	F0512R1	15-25-40	0.08-0.12-0.16			
		2	RXG	G06	F0512R1	15-20-30	0.06-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXG	G06	F0512R1	15-20-30	0.06-0.08-0.12			
M	M1	1	RXG	A07	F0512R1	50-80-100	0.12-0.15-0.20			
		2	RXG	A07	F0512R1	40-70-90	0.12-0.15-0.20	0.05-0.08-0.12	0.05-0.10-0.12	0.08-0.10-0.15
		3	RXG	G07	F0512R1	25-50-70	0.10-0.14-0.18			
	M2	1	RXG	A07	F0512R1	50-80-100	0.12-0.15-0.20			
		2	RXG	A07	F0512R1	40-70-90	0.12-0.15-0.20	0.05-0.08-0.12	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXG	G07	F0512R1	25-50-70	0.10-0.14-0.18			
	M3	1	RXG	A07	F0512R1	40-60-80	0.10-0.12-0.16			
		2	RXG	A07	F0512R1	40-60-80	0.08-0.10-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXG	G07	F0512R1	25-40-70	0.06-0.08-0.12			
	M4	1	RXG	A07	F0512R1	25-40-60	0.08-0.10-0.14			
		2	RXG	A07	F0512R1	20-35-55	0.08-0.10-0.14	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXG	G07	F0512R1	20-30-50	0.08-0.10-0.14			
	M5	1	RXG	A07	F0512R1	15-25-35	0.05-0.08-0.12			
		2	RXG	A07	F0512R1	15-25-35	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXG	G07	F0512R1	15-25-35	0.05-0.08-0.12			
	M6	1	RXG	A06	F0512R1	15-20-30	0.05-0.08-0.12			
		2	RXG	A06	F0512R1	15-20-30	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.12
		3	RXG	A06	F0512R1	15-20-30	0.05-0.08-0.12			



AC 应用条件
1 工况良好
 - 夹具、机床及工件刚性良好
 - 刀片直径标注方式 < 35.600
 刀具长径比 < 6xD
 - 刀片直径标注方式 > 35.601
 刀具长径比 < 5xD
 - 排屑良好
 - 内冷压力大于20bar

2 工况一般
 - 夹具、机床及工件刚性略差
 - 刀片直径标注方式 < 35.600
 刀具长径比 < 12xD
 - 刀片直径标注方式 > 35.601
 刀具长径比 < 7xD
 - 排屑较差
 - 有内冷

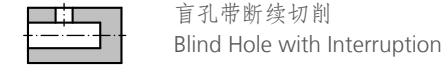
3 工况极差
 - 夹具、机床及工件刚性差
 - 刀片直径标注方式 < 35.600
 刀具长径比 < 12xD
 - 刀片直径标注方式 > 35.601
 刀具长径比 < 9xD
 - 排屑差
 - 有内冷



AC Application Conditions
1 Optimal conditions
 - Stable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 6xD
 - Insert diameter > 35.601 Tool projection length < 5xD
 - Optimal chip removal guaranteed
 - Internal coolant supply > 20 bar

2 Suboptimal conditions
 - Slightly unstable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 12xD
 - Insert diameter > 35.601 Tool projection length < 7xD
 - No optimal chip removal guaranteed
 - Internal coolant supply available

3 Difficult conditions
 - Unstable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 12xD
 - Insert diameter > 35.601 Tool projection length < 9xD
 - Critical chip evacuation
 - Internal coolant supply available



盲孔带断续切削
Blind Hole with Interruption

AC	Type	槽型 Geometry	材质 Grade	Vc	fz 连续切削 fz Full Cut	fz 断续切削 fz Interrupted	Radial / Stock Removal				
							ap				
							Ø 11.900-23.600 mm	Ø 23.601-35.600 mm	Ø 35.601-140.600 mm		
P	4	RXG	A06	T1500	140-180-220	0.16-0.20-0.25	fz 连续切削降低30-50% reduce fz full cut 30 - 50%	0.05-0.08-0.12	0.08-0.10-0.15	0.08-0.10-0.15	
		5	RXG	A06	F0512R1	120-140-180					0.12-0.18-0.22
		6	RXG	G11	F0512R1	80-110-140					0.08-0.12-0.18
		4	RXG	A06	T1500	140-180-220					0.16-0.20-0.25
		5	RXG	A06	F0512R1	120-140-180					0.12-0.18-0.22
		6	RXG	G11	F0512R1	80-110-140					0.08-0.12-0.18
	5	4	RXG	A06	T1500	140-160-200		0.16-0.20-0.25			
		5	RXG	A06	F0512R1	100-130-160		0.12-0.18-0.22			
		6	RXG	G11	F0512R1	80-100-120		0.08-0.12-0.18			
		4	RXG	A01	F0512R1	140-160-200		0.15-0.18-0.22			
		5	RXG	A06	F0512R1	100-130-160		0.12-0.16-0.22			
		6	RXG	G11	F0512R1	80-100-120		0.08-0.12-0.18			
	6	4	RXG	A01	F0512R1	100-120-140		0.14-0.18-0.20			
		5	RXG	G11	F0512R1	90-110-130		0.12-0.16-0.20			
		6	RXG	G11	F0512R1	80-100-120		0.08-0.12-0.18			
		4	RXG	A01	F0512R1	50-80-100		0.10-0.15-0.18			
		5	RXG	G11	F0512R1	40-70-90		0.08-0.12-0.16			
		6	RXG	G11	F0512R1	25-50-70		0.06-0.08-0.12			
	4	4	RXG	A06	F0512R1	15-25-40		0.08-0.12-0.16			
		5	RXG	G16	F0512R1	15-20-30		0.06-0.08-0.12			
		6	RXG	G16	F0512R1	15-20-30		0.06-0.08-0.12			
		4	RXG	A07	F0512R1	50-80-100		0.12-0.15-0.20			
		5	RXG	G17	F0512R1	40-70-90		0.10-0.14-0.18			
		6	RXG	G17	F0512R1	25-50-70		0.10-0.14-0.18			
5	4	RXG	A07	F0512R1	50-80-100	0.12-0.15-0.20					
	5	RXG	G17	F0512R1	40-70-90	0.10-0.14-0.18					
	6	RXG	G17	F0512R1	25-50-70	0.10-0.14-0.18					
	4	RXG	A07	F0512R1	40-60-80	0.10-0.12-0.16					
	5	RXG	G17	F0512R1	40-60-80	0.06-0.08-0.12					
	6	RXG	G17	F0512R1	25-40-70	0.06-0.08-0.12					
6	4	RXG	A07	F0512R1	25-40-60	0.08-0.10-0.14					
	5	RXG	G16	F0512R1	20-35-55	0.08-0.10-0.14					
	6	RXG	G16	F0512R1	20-30-50	0.08-0.10-0.14					
	4	RXG	A07	F0512R1	15-25-35	0.05-0.08-0.12					
	5	RXG	G16	F0512R1	15-25-35	0.05-0.08-0.12					
	6	RXG	G16	F0512R1	15-25-35	0.05-0.08-0.12					
4	4	RXG	A07	F0512R1	15-20-30	0.05-0.08-0.12					
	5	RXG	G16	F0512R1	15-20-30	0.05-0.08-0.12					
	6	RXG	G16	F0512R1	15-20-30	0.05-0.08-0.12					
	4	RXG	A07	F0512R1	15-20-30	0.05-0.08-0.12					
	5	RXG	G16	F0512R1	15-20-30	0.05-0.08-0.12					
	6	RXG	G16	F0512R1	15-20-30	0.05-0.08-0.12					



AC 应用条件
4 工况良好
 - 刀片直径标注方式 < 35.600
 刀具长径比 < 6xD
 - 刀片直径标注方式 > 35.601
 刀具长径比 < 5xD
 - 排屑良好
 - 轻微对称断续切削 (< 10%)
 - 内冷压力大于20bar

5 工况一般
 - 夹具、机床及工件刚性略差
 - 刀片直径标注方式 < 35.600
 刀具长径比 < 12xD
 - 刀片直径标注方式 > 35.601
 刀具长径比 < 7xD
 - 排屑较差
 - 中等对称断续切削 (< 30%)
 - 有内冷

6 工况极差
 - 夹具、机床及工件刚性差
 - 刀片直径标注方式 < 35.600
 刀具长径比 < 12xD
 - 刀片直径标注方式 > 35.601
 刀具长径比 < 9xD
 - 排屑较差
 - 中等对称断续切削 (< 30%)
 - 有内冷



AC Application Conditions
4 Optimal conditions
 - Stable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 6xD
 - Insert diameter > 35.601 Tool projection length < 5xD
 - Optimal chip removal guaranteed
 - Slightly symmetrical and asymmetrical interruption (< 10%)
 - Internal coolant supply > 20 bar

5 Suboptimal conditions
 - Slightly unstable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 12xD
 - Insert diameter > 35.601 Tool projection length < 7xD
 - No optimal chip removal guaranteed
 - Medium symmetrical interruptions (< 30%)
 - Internal coolant supply available

6 Difficult conditions
 - Unstable fixture, machine and/or workpiece
 - Insert diameter < 35.600 Tool projection length < 12xD
 - Insert diameter > 35.601 Tool projection length < 9xD
 - No optimal chip removal guaranteed
 - Medium symmetrical interruptions (< 30%)
 - Internal coolant supply available

MATERIAL DETAILS PAGE 88

RX medium 中径铰刀切削参数
Cutting Data RX medium



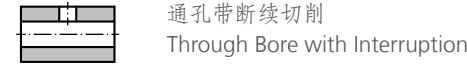
通过孔
Through Bore

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal (ap). Rows include categories K1-K8 and N1-N6.

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal (ap). Rows include categories N1-N6.

- AC 应用条件
1 工况良好
2 工况一般
3 工况较差

- AC Application Conditions
1 Optimal conditions
2 Suboptimal conditions
3 Difficult conditions



通过孔带断续切削
Through Bore with Interruption

Table with columns: AC, Type, Geometry, Grade, Vc, fz 连续切削, fz 断续切削, Radial / Stock Removal (ap). Rows include categories K1-K8 and N1-N6.

Table with columns: AC, Type, Geometry, Grade, Vc, fz 连续切削, fz 断续切削, Radial / Stock Removal (ap). Rows include categories N1-N6.

- AC 应用条件
4 工况良好
5 工况一般
6 工况较差

- AC Application Conditions
4 Optimal conditions
5 Suboptimal conditions
6 Difficult conditions

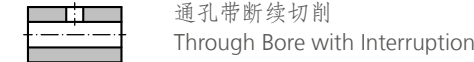
MATERIAL DETAILS PAGE 89

RX medium 中径铰刀切削参数
Cutting Data RX medium



通过孔
Through Bore

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal (ap for Ø 11.900-23.600 mm, Ø 23.601-35.600 mm, Ø 35.601-140.600 mm). Rows include categories S, H, SM, and O.



通过孔带断续切削
Through Bore with Interruption

Table with columns: AC, Type, Geometry, Grade, Vc, fz 连续切削 (Full Cut), fz 断续切削 (Interrupted), Radial / Stock Removal (ap for Ø 11.900-23.600 mm, Ø 23.601-35.600 mm, Ø 35.601-140.600 mm). Rows include categories S, H, SM, and O. Includes a vertical note: fz 连续切削降低30-50% reduce fz full cut 30 - 50%.

MATERIAL DETAILS PAGE 90/91

Ø 11.900 – 140.600 mm



RX medium 中径铰刀操作手册
Handling Manual RX medium

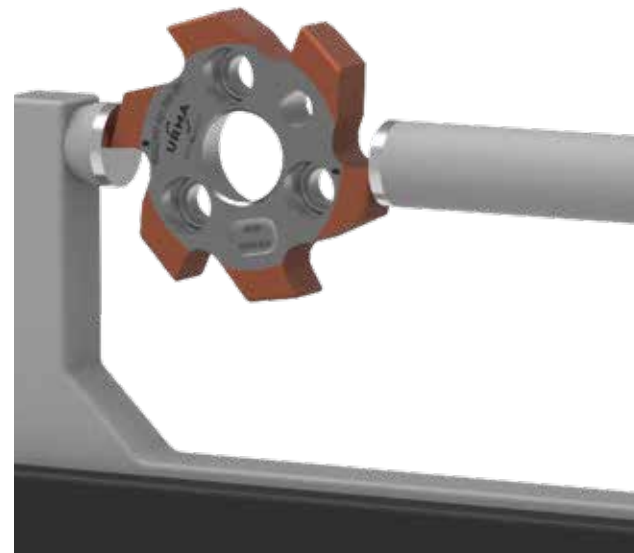
更换刀片

1. 不要从刀柄上取出刀杆。直接松开刀片螺钉，更换刀片
2. 清洁刀杆的短锥部位，检查是否有损坏
3. 将新刀片装到相应位置(注意定位销)，轻轻地锁紧
4. 如果可以，请使用扭矩扳手顺时针锁紧螺钉 (参阅扭矩表)

Inserts Change

1. Do not take the shank out of the tool holder. Remove clamping screws and used reaming insert.
2. Clean short taper of the shank carefully and check for possible damages.
3. Set new insert in position (pay attention to the positioning pin) and slightly tighten the clamping screws.
4. Use the recommended Torx®-torque screw driver to tighten the screws crosswise. (See torque chart).

RX medium Parameter	Standard Insert Holder		SD Insert Holder	
	Torx® Dimension	Torque	Torx® Dimension	Torque
RX 016	6	0.9 Nm	15	4 Nm
RX 019	6	0.9 Nm	20	6 Nm
RX 024	8	1.5 Nm	30	16 Nm
RX 029	8	1.5 Nm	30	16 Nm
RX 036	8	1.5 Nm	30	18 Nm
RX 044	8	1.5 Nm		
RX 052	8	1.5 Nm		
RX 061	8	1.5 Nm		
RX 081	15	3.5 Nm		
RX 101	15	3.5 Nm		
RX 121	15	3.5 Nm		
RX 141	15	3.5 Nm		



Measuring of Insert Diameter

RX medium inserts are unequally spaced. To measure the diameter, line up the two marked cutting edges. Measure directly at the chamfer because the inserts are ground with taper.

测量刀片直径

RX medium 铰刀刀片具有不等齿距。请对准切削刃上的标线进行测量。因为刀片带锥度，请直接在倒角上进行测量

Ø 11.900 – 140.600 mm



RX medium 中径铰刀操作手册
Handling Manual RX medium

刀片跳动
Insert run-out



跳动调整

Run-Out Adjustment

为了获得最好的铰削结果，最佳的刀具跳动非常必要。为了补偿任何来自刀柄或者机床主轴的跳动误差，推荐使用下面的刀柄：跳动补偿式弹簧夹头刀柄、热缩刀柄或者液压刀柄。跳动可以用不同的方法来进行测量：

To achieve the best reaming results, a tool with perfect run-out is absolutely essential. To compensate any run-out error of the tool holder and the machine spindle, the following compensation holders are recommended: Adjustable collet shrink fit or hydraulic chucks. The run-out can be measured with different methods:

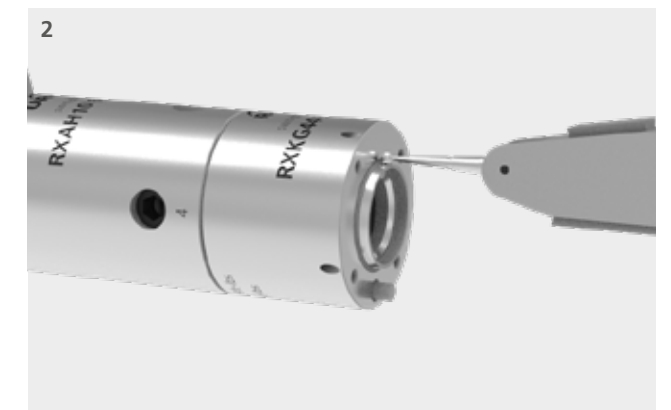


1. 在刀杆柄部外圆上测量

RX medium 刀杆在所有直径上加工精度都很高。这是个简单的测量方法，能获得较为适当的测量结果

2. 在刀杆上的短锥上测量

取下刀片，直接测量刀杆上的短锥。这种测量方法结果更精确。



1. On the External Diameter of the Insert Holder

RX medium tool holders are manufactured very accurately. This handling method is easy and offers reasonable measuring results.

2. Through Insert Holder Short Taper

With the reamer disassembled, measure directly on the insert holders short taper. This handling method offers high accuracy measuring results.

跳动补偿刀柄说明

Instruction Compensation Chuck



为了获得最好的铰削结果，最佳的刀具跳动非常必要。为了补偿任何来自刀柄或者机床主轴的跳动误差，我们推荐使用跳动补偿刀柄或者浮动刀柄。RX medium中径铰刀的跳动可以用不同的方法来进行测量：

步骤：

1. 调整前确保所有调整螺钉②彻底松开
2. 将刀柄装到机床主轴上。
3. 将千分表测头置于铰刀杆跳动检测区域①。
4. 通过四个径向调整螺钉②将跳动调整到最大5 μm /0.0002inch (最佳状态< 3 μm /0.0001inch)。

In order to achieve the best reaming results, a tool with zero run-out is absolutely essential. To compensate any run-out error of the tool holder and the machine spindle, we recommend using a compensation holder or floating chuck. The run-out of RX medium reamers can be measured with different methods:

Procedure:

1. Before adjusting, make sure that all adjustment screws ② are completely loosened.
2. Load the tool in the machine spindle.
3. Set the indicator (with 1 μm / 0,0001 inch resolution) on the marked run-out area ① on the shank.
4. Set the run-out directly in the machine spindle to max. 5 μm / 0,0002 inch (ideal < 3 μm / 0,0001 inch) by using the four radial adjustment screws ②.



调整完成后，四个螺钉不要顶得太紧



The adjustment screws do not have to be fully clamped against each other after adjustment.

浮动刀柄说明

Instruction Floating Chuck



车床上铰孔通常需要用浮动刀柄（有时也会用于加工中心）。位置误差可由可调浮动机构适当补偿。只能补偿水平或垂直误差（无法补偿角度误差）。推荐使用 $\leq 45^\circ$ 的刀片角度。

步骤：

1. 通过调整螺钉①调整浮动机构。

调整螺钉	浮动机构	对加工的影响
顺时针旋转	弹簧力增加/阻力增加	表面质量可能变差（印迹变浅）
逆时针旋转	弹簧力变弱/阻力减小	可能产生振动

Reaming on lathes are mainly done with floating chucks (in exceptional cases also on machining centres).

Positioning errors can be compensated by the adjustable floating mechanism. The deflection should only take place in plane-parallel (No angular error compensation).

Cutting geometries with an angle of $\leq 45^\circ$ are recommended.

Procedure:

1. Adjust the floating mechanism by using the adjustment screw ①.

Adjustment screw	Floating mechanism	Influence on machining
Clockwise rotation	Spring force increases / deflection resistance increases	The surface quality can be negatively influenced (retraction marks)
Counterclockwise rotation	Spring force becomes weaker / deflection resistance decreases	Potential vibration tendency

调整:

松: 浮动柄需要调整到最低阻力。不过, 考虑到刀具本身的重量, 应该使刀具在发生偏移后能自动回到中心位置

中等: 完全锁紧调整螺钉并退回 $1 \pm \frac{1}{4}$ 圈。

紧: 完全锁紧螺钉并退回 $\frac{1}{4} - \frac{1}{2}$ 圈。

Adjustment:

Soft: The tool should be adjusted with the lowest possible deflection resistance. Nevertheless, taking into account the weight of the tool, it must jump back automatically into the central axis after deflection.

Medium: Fully tighten the adjusting screw and turn back by $1 \pm \frac{1}{4}$ rotation.

Hard: Fully tighten the adjusting screw and turn back by $\frac{1}{4} - \frac{1}{2}$ rotation.

推荐作为基本设置:

刀具直径 Tool-Ø	松 Soft	中等 Medium	紧 Hard
11.900 – 15.600	X		
15.601 – 23.600	X	X	
23.601 – 35.600		X	
35.601 – 60.600		X	
60.601 – 140.600		X	X

Recommendation for the basic setting:

2. 相对于Y轴, 我们特别推荐刀具跳动和主轴轴心的偏差应 $< 10\mu\text{m} / 0.0004\text{inch}$ (最佳状态 $< 5\mu\text{m} / 0.0002\text{inch}$)



-浮动机构的调整很大程度上取决于应用场合及浮动柄的类型
-通常推荐浮动刀柄进入孔口时降低切削速度
-所有数值都是参照铍马浮动柄的推荐值

2. With an existing Y-axis, we recommend additionally aligning the tool $< 10\mu\text{m} / 0.0004\text{inch}$ (ideally $< 5\mu\text{m} / 0.0002\text{inch}$) concentrically to the spindle axis.



- The settings of the floating mechanism can vary depending on the application and type of floating chuck.
- It is generally recommended to enter the bore with reduced rpm.
- All data are guide values and refer to URMA floating chucks.



作为另一种跳动补偿的方式, 缩径刀杆也是一种方案。
(见铍削样本)

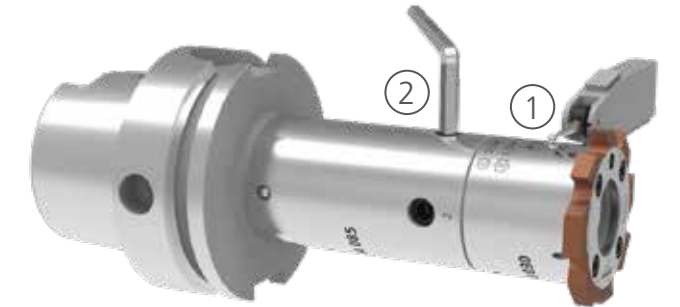
As an alternative to a floating chuck, diameter reduced insert holders can also be used (see reaming catalogue).

带内置跳动补偿装置刀杆的说明

Instruction for Shanks with Integrated Compensation Device

用于铍削直径大于35.601mm

For Reaming Diameters bigger than 35,601 mm



步骤:

1. 参照下方表格“A”值 (如果没有则参照“B”值) 锁紧中心螺钉
2. 将刀柄装到机床主轴上。
3. 将千分表测头置于铍刀杆跳动检测区域①。
4. 检测对称的两个调整螺钉对应位置的跳动, 通过调整螺钉将跳动调整到两个数值的中间值。检测所有四个调整螺钉对应位置的跳动, 如有需要, 重复前一步骤。锁紧四个螺钉, 确保径向跳动 $< 0.005\text{mm}$ 。
5. 参照表格“B”值锁紧中心螺钉。
6. 请二次锁紧后再次确认刀具跳动, 如有必要, 再次进行调整。

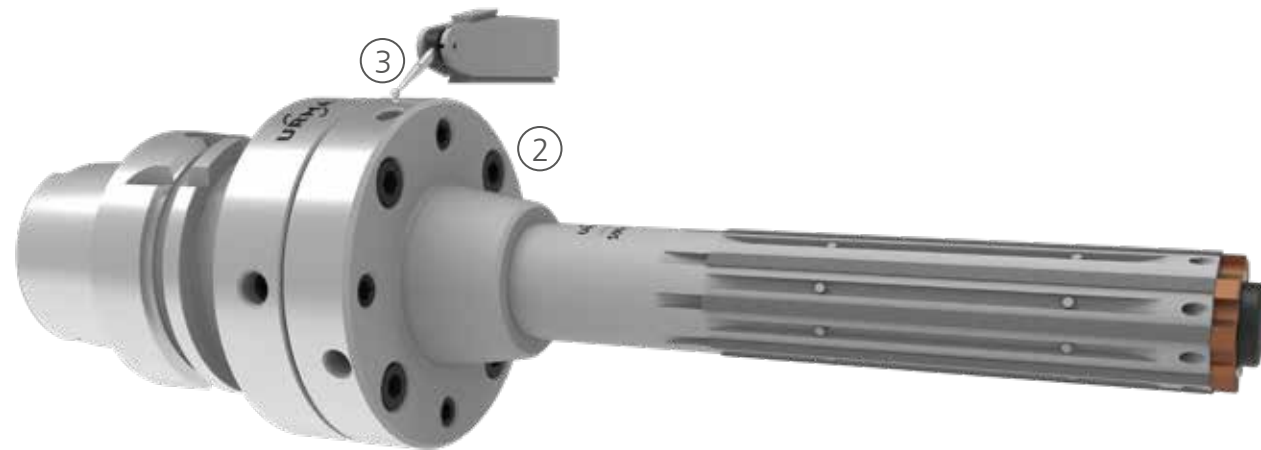
Procedure:

1. Secure central clamping screw according to value “A” in the chart below (if not available, use value “B”).
2. Load the tool into the machine spindle.
3. Set the indicator (with $1\mu\text{m} / 0.0001\text{inch}$ resolution) on the marked run-out area ① on the shank.
4. Measure run-out of the two adjustment screw ② axes. Compensate half value of the total run-out error by using the adjustment screws. Check run-out on all four axle points and repeat the adjustment if necessary. Tighten all screws that do not fit tightly, considering the run-out $< 0,005\text{mm}$ in diameter.
5. Tight the central clamping screw according to table value “B”.
6. Check the run-out again and re-adjust if necessary.

RX Parameter	A [Nm]	B [Nm]
RX 044	-	35
RX 052	-	35
RX 061	-	55
RX 081	60	85
RX 101	70	120
RX 121	70	120
RX 141	70	120

非标刀具跳动调整模块说明

Instruction for Compensation Module with Special Tools



跳动调整模块用于例如导条刀的跳动调整。轴向和角度偏差均可被修正。

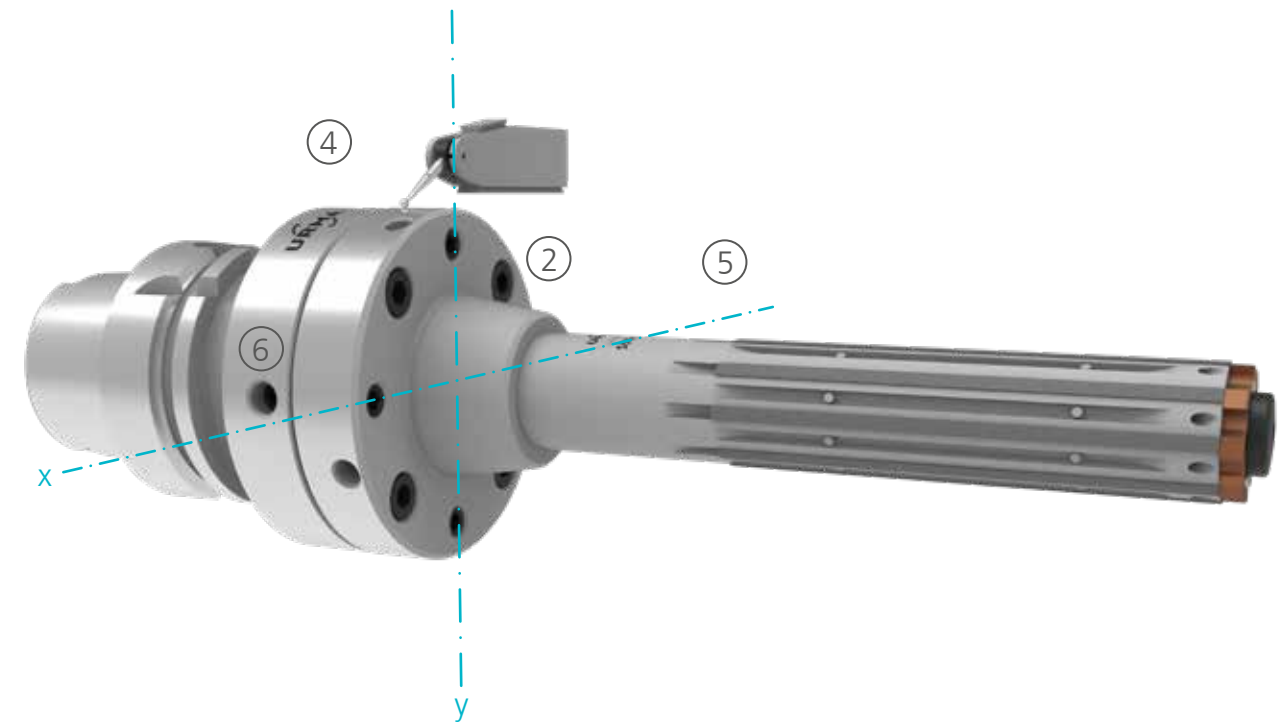
准备刀具

1. 安装之前应确保四个角度调整螺钉不会突出在接触面外。
2. 将刀具装在跳动调整模块刀柄上，轻微上紧②锁紧螺钉（即：旋紧螺钉至顶到刀体，再上紧¼圈）。
3. 将刀具装到机床主轴上。
4. 将千分表（1μm/0.0001inch精度）测头置于刀具法兰直径③处。

The compensation module is used, for example, to adjust the run-out of guide pad tools. Axis as well as angle errors can be adjusted.

Prepare the Tool:

1. Before assembling, it must be ensured that none of the pressure pads discs on the face side stick out.
2. Assemble the tool on the compensation module, tightening the clamping screws ② slightly (i.e. tighten the screw until it has contact to the face, then tighten ¼ turn).
3. Load the tool into the machine spindle.
4. Set the indicator (with 1 μm / 0,0001 inch resolution) on the tool flange diameter ③.

刀具径向调整 - 步骤一:
Radial alignment of the tool - Step 1:

5. 通过径向调整螺钉⑥将法兰模块的跳动调整到 2 μm / 0.0001inch 以内。
 - a. 检测两个对称跳动调整螺钉⑥对应位置的跳动（首先调整轴⑤）
 - b. 通过调整螺钉将刀体调整到两个跳动值的中间位置。然后松开调整螺钉。
 - c. 将千分表读数归零。
 - d. 180°旋转刀体，检测另一侧跳动。如有必要，再次调整（参见“b”）。
 - e. 按照相同步骤调整轴④。
 - f. 如有必要再次调整轴⑤。调整完成后所有调整螺钉都必须处于锁紧状态。



所有调整螺钉⑥在完成调整后必须锁紧。

6. 上紧锁紧螺钉②

7. 再次检测法兰模块的跳动，确保小于 → 3 μm / 0.0001inch。

5. Align the flange module in 2 μm / 0,0001 inch by using the radial adjustment screws ⑥.
 - a. Check run-out error with two opposing radial adjustment screws ⑥ (1st adjustment axis ⑤)
 - b. Correct the value difference of the axis by half, using the corresponding adjusting screw. Loosen the adjusting screw afterwards.
 - c. Set indicator to "0" value
 - d. Check the "0" value by turning the tool to 180° and correct if necessary (see "b").
 - e. Use the same alignment procedure for the second adjustment axis ④
 - f. If necessary readjust the first axis ⑤

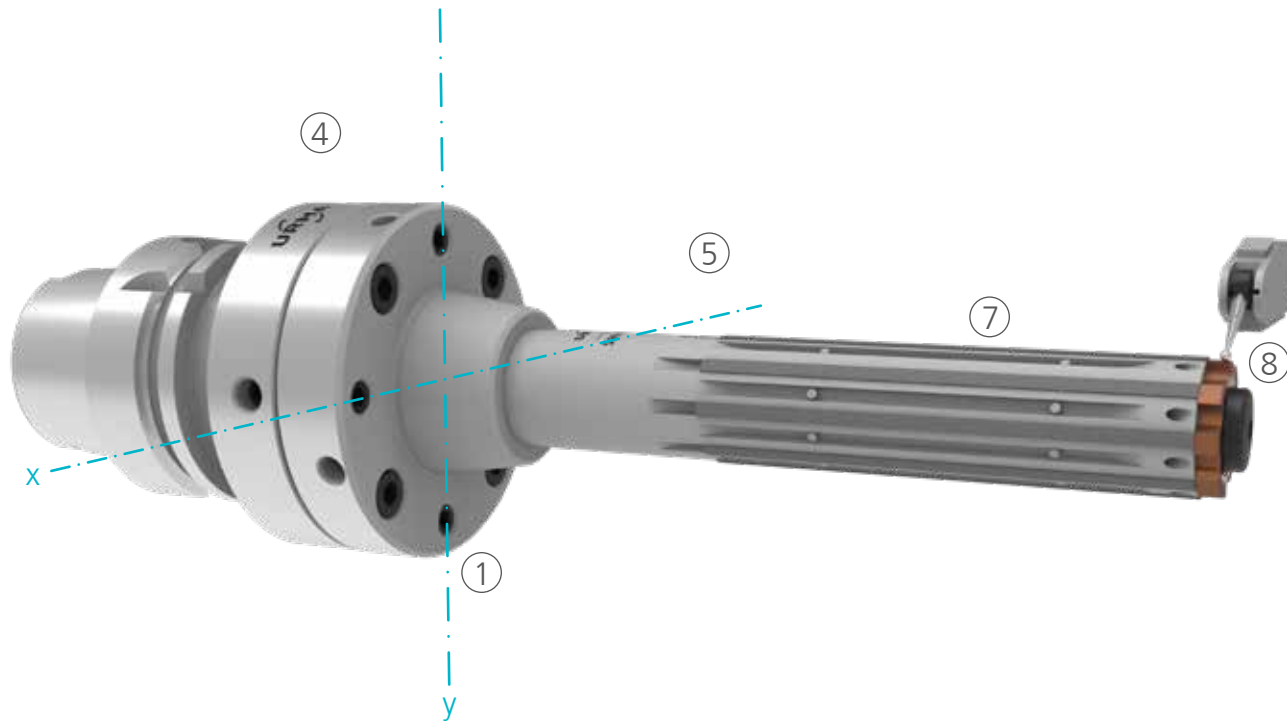


All adjustment screws ⑥ must be tightened after completion of the adjustment process.

6. Tighten the clamping screws ②.

7. Check the run-out of the flange module again → max. 3 μm / 0,0001 inch

刀具径向调整 - 步骤二:
Aligning the tool angle - Step 2:



8. 将千分表测头置于刀具前端⑧处:
a. 切削刃或者标准检测(刀片订货号可在“钨马铰刀”样本找到)
b. 刀杆RX锥面(刀片定位面)
c. 导条上
9. 通过轴向调整螺钉①将角度偏差调整到2μm以内(操作参见“5 b - f项”).



建议每个方向(0和90°)只用一个调整螺钉①来调整角度偏差。

10. 在⑦处检测导条的同心度, 最大→3 μm / 0,0001 inch.

8. Set the indicator in front ⑧:
a. on cutting edge or run-out indicating insert
(Order number can be found in the “URMA Reaming” catalogue)
b. on RX-taper of the shank (interface)
c. on guide pads

9. Set the angular error to 2 μm by using the axial adjusting screws ① (proceed as described in “point 5 b to f”).



It is recommended to use max. one adjustment screw ① per axis (0 and 90°) to adjust the angular error.

10. Check the alignment on the guide pads ⑦
→ max. 3 μm / 0,0001 inch

加工方法 Machining Strategies

引导孔
Piloting

引导孔推荐用于以下场合:

- 长径比 > 8xD
- 位置度和同心度公差小
- 避免长刀在入口处振动
- 长的导条刀(位置精度)
- 孔口为斜面或者断续切削

取决于机床和刀具, 引导孔可以由以下方式完成:

- 用短的铰刀
- 车床车削
- 铣削或者镗孔

对于短的铰刀:

对于短的铰刀:对于这种情况, 尽可能使用最短的铰刀作为引导刀。这种方法能提供非常稳定及重复性好的引导孔。主要用于加工中心。引导铰刀的刀片直径和公差应和之后的精加工刀具一样。

Piloting is recommended in the following situations:

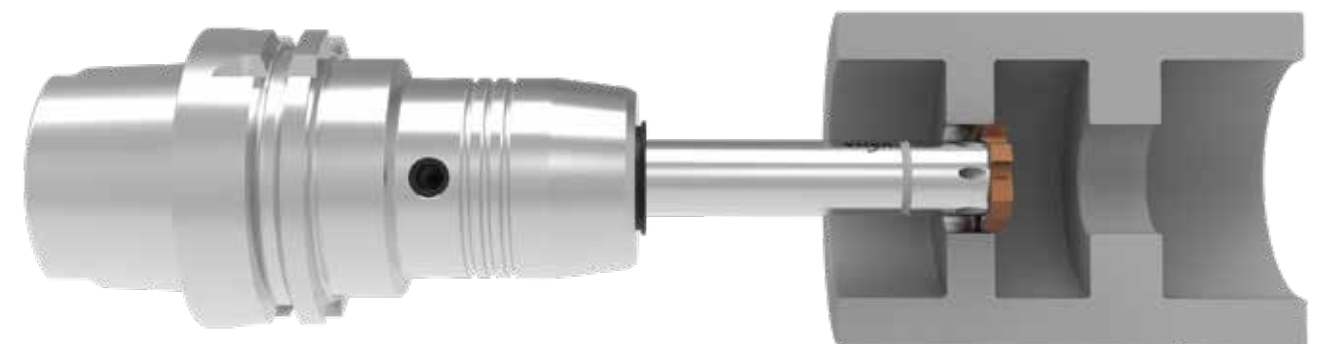
- Diameter / length ratio > 8xD
- To hold narrow position and concentricity tolerances
- Avoidance of entry vibrations with a long tool.
- Use of a long guide pad tool (positioning accuracy)
- For inclined or interrupted bore entry

Depending on the machine and the following tool, pilot holes can be made as follows:

- With a short reamer
- Pre-turning on a lathe
- Milling or boring

With a short reamer:

For this variant, use the shortest possible reamer for the pilot bore. This method provides a very stable and repeatable pilot bore. Mainly used on machining centres. The reaming insert for the pilot tool should have the same diameter and tolerance as the following finishing tool.



当铰削支承部位(如图一), 只做第一档作为引导。

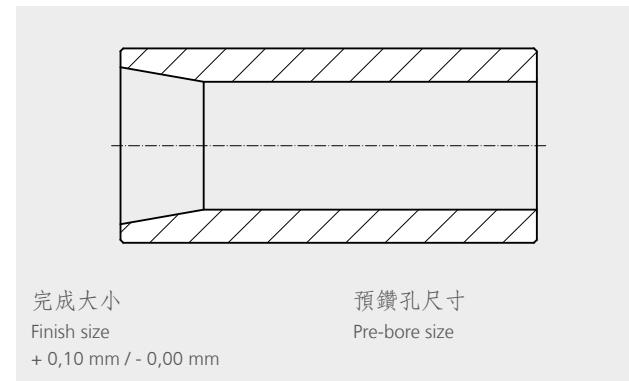
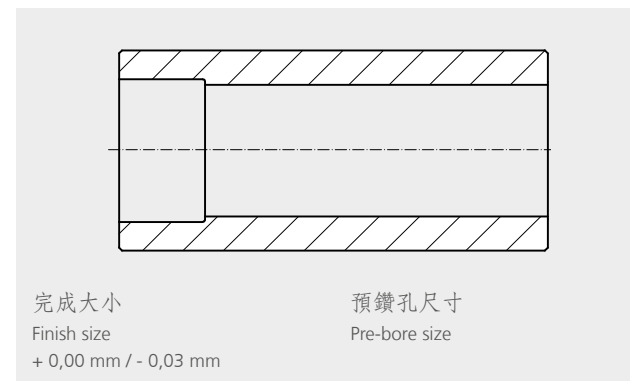


If machining spool or liner-bores (see figure), piloting only the first journal.

引导孔 Piloting

在车床上的步骤：
引导孔可以在车床上预车完成。孔可以是圆柱形或者圆锥形。

Procedure on a lathe:
The pilot bore can be pre-turned on a lathe. This can have a cylindrical or conical shape.



在加工中心上的步骤：
引导孔可以在加工中心上通过不同的方法来原因：

- 短的铰刀(详见57页)
- 镗孔
- 插补铣

Procedure on a Machining centre:
The pilot bore can be made on a machining centre using various methods:

- Short reaming tool (see page 57 for description)
- Boring tool
- Circular milling

⚠ 经常检查引导孔径是很有必要的。

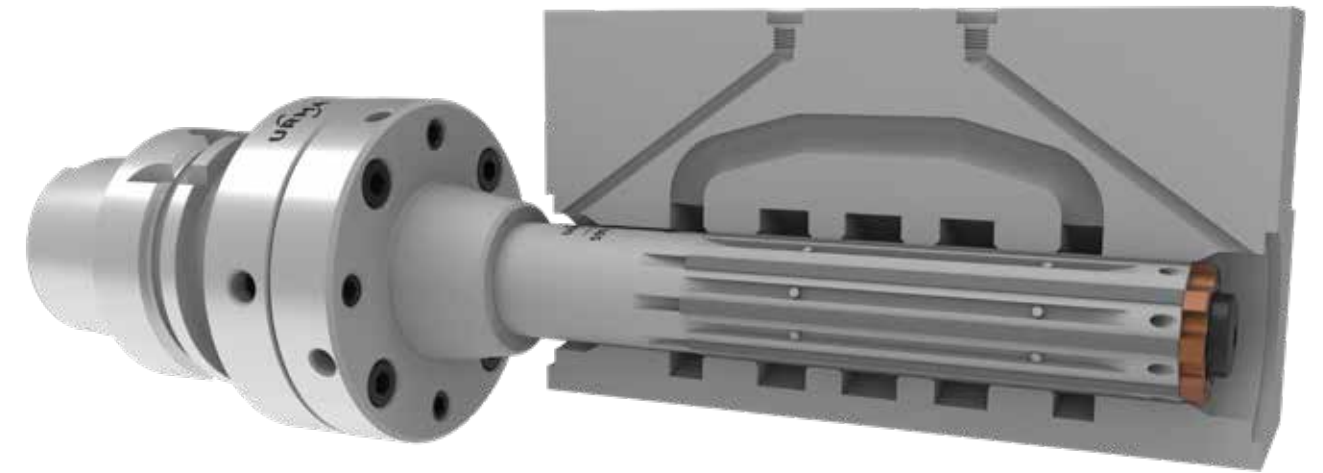
⚠ A regular check of the pilot diameter is essential.

精加工 Finish Machining

引导孔完成后的步骤：
1. 当精铰刀进入引导孔时，需要降低转速 ($n = 50-500 \text{ r/min}$) 直到整个刀片或者部分导条进入孔内。同时遵循 f_z 和加工时的 f_z 一致的原则。
2. 然后提升转速到合理的加工速度，如有可能应在不中断进给的情况下完成整个孔加工。
3. 退刀时通常降低转速(n)至50-80%而进给($v_f \text{ mm/min}$)则为加工时的3-5倍。

Procedure after piloting:

1. When entering into the pilot bore with the finishing tool, the speed must be reduced ($n = 50-500 \text{ rpm}$) until the reaming insert is completely or also parts of the guide pads are engaged. As a rule: " $f_z \text{ entering}$ " = " $f_z \text{ machining}$ ".
2. Increase rpm to the selected machining speed and if possible, finish the whole bore without interrupting the feed movement.
3. Tool retraction usually takes place at 50 – 80% reduced speed (n) and approx. 3 – 5 times the machining feed rate ($v_f \text{ mm/min}$).



⚠ 为确保导条不损坏，应保证整个加工过程有充分的内冷。

⚠ In order to not damage the guide pads, the internal coolant supply must be guaranteed all the times!

钨马钨削
RM vario 整体式铰刀

订单示例
Order Example

孔径: ISO孔公差
Bore Diameter: ISO Bore Tolerances

孔径: 孔公差 (µm)
Bore Diameter: Bore Tolerance in µm

Example	订单示例 Order Example F25N-12.2H7-A W112R	Example	订单示例 Order Example F25N-12.2+20-10-A W112R
---------	--	---------	--

F 圆柱柄
A = 整体式, 无内冷
B = 整体式, 带内冷用于通孔
C = 整体式, 带内冷用于盲孔
D = 内涨式, 无内冷
F = 内涨式, 带内冷用于通孔(内冷通到刀刃)
G = 内涨式, 带内冷用于盲孔(内冷通到刀刃)
S = 非标刀具 (以图纸为准)
Cylindrical shank
A = solid, without internal coolant supply
B = solid, with internal coolant supply for through bores
C = solid, with internal coolant supply for blind holes
D = expandable, without internal coolant supply
F = expandable, with internal coolant supply for through bores
G = expandable, with internal coolant supply for blind holes
S = special tool (bound to drawing)

2
2 = 短型
4 = 长型
2 = short version
4 = long version

5N
5N = 直槽
7N = 左旋槽
5N = flute form straight
7N = flute form left-hand helix

F 圆柱柄
A = 整体式, 无内冷
B = 整体式, 带内冷用于通孔
C = 整体式, 带内冷用于盲孔
D = 内涨式, 无内冷
F = 内涨式, 带内冷用于通孔(内冷通到刀刃)
G = 内涨式, 带内冷用于盲孔(内冷通到刀刃)
S = 非标刀具 (以图纸为准)
Cylindrical shank
A = solid, without internal coolant supply
B = solid, with internal coolant supply for through bores
C = solid, with internal coolant supply for blind holes
D = expandable, without internal coolant supply
F = expandable, with internal coolant supply for through bores
G = expandable, with internal coolant supply for blind holes
S = special tool (bound to drawing)

2
2 = 短型
4 = 长型
2 = short version
4 = long version

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5N = 直槽
7N = 左旋槽
5N = flute form straight
7N = flute form left-hand helix

Diameter	12.2 直径,以mm为单位 Diameter (mm)	12.2 定制直径,以(mm)为单位 Diameter (mm)	Diameter
Diameter	H7 公差,以ISO形式标注或者 Tolerance in ISO standard	+20-10 制造公差,以(µm)为单位 Bore tolerance (µm)	Diameter

A 倒角角度
A = 45°¹ B = 25°² C = 45/8° D = 30/4° E = 切屑缠绕 20°
F = 平面切削 20°³ G = 0.5 x 45° H = 30°
I = 60° K = 75° L = 切屑缠绕 30°³
Chamfer Angle
A = 45°¹ B = 25°² C = 45/8° D = 30/4°
E = Curling cut 20°³ F = Face cutting G = 0,5 x 45°
H = 30° I = 60° K = 75° L = Curling cut 30°³

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A = 45°¹ B = 25°² C = 45/8° D = 30/4° E = 切屑缠绕 20°
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W1 刀片材质代码
详见第63页
Cutting material
Details see page 63

W1 刀片材质代码
详见第63页
Cutting material
Details see page 63

12R 涂层代码
详见第63页
Coating
Details see page 63

12R 涂层代码
详见第63页
Coating
Details see page 63

¹ 标准仅用于直槽 ² 标准用于左旋槽刀具
¹ Standard for straight flute form

³ 仅用于直槽
² Standard for tools with left-hand flute form

³ Only for straight flute form

刀片材质概览
Cutting Materials overview

ISO材料代码	URMA材料代码	刀片材质 Cutting Materials						涂层厚度 Coating						
		URMA Code	W1	T1	B1	B2	D1	01P	05P	07R	08P	12R	14R	10C
		代号	硬质合金	金属陶瓷	CBN	CBN	PKD/PCD	不涂层	TiN	AlTiN	TiAlN + AlCrN	AlCrN	AlCrN	AlCrN
P	P1	■	▲				▲	□	□			■	■	
	P2	■	▲				▲	□	□			■	■	
	P3	■	▲				▲	□	□			■	■	
	P4	■	▲				▲	□	□			■	■	
	P5	■	▲				▲	□	□			■	■	
	P6	▲					□	□	□			▲	■	
	P7	▲					□	□	□			▲	■	
M	M1	▲	□				□	□				▲	■	
	M2	▲	□				□	□				▲	■	
	M3	▲					□	□				▲	■	
	M4	▲					□	□				▲	■	
	M5	▲					□	□				▲	■	
	M6	▲					□	□				▲	■	
K	K1	▲			□		□	□	□			■	▲	
	K2	▲			□		□	□	□			■	▲	
	K3	▲	□		□		□	□	□			■	▲	
	K4	▲	□		□		□	□	□			■	▲	
	K5	▲					□	□	□	□		■	▲	
	K6	▲					□	□	□	□		■	▲	
	K7	▲					□	□	□	□		■	▲	□
	K8	▲					□	□	□	□		■	▲	□
N	N1	▲					□	□						▲
	N2	▲					□	□						▲
	N3	▲					□	□						▲
	N4	□					▲	▲						□
	N5	▲	□				□	□						▲
	N6	▲					□	□						▲
S	S1	▲					□	□				▲	■	
	S2	▲					□	□				▲	■	
	S3	▲					□	□				▲	■	
	S4	▲					□	□				▲	■	
	S11	▲					□	□				▲	■	
	S12	▲					□	□				▲	■	
	S13	▲					□	□				▲	■	
	S14	▲					□	□				▲	■	
H	H1	▲					□	□		▲		■	■	
	H2	■				▲	▲	□		■		□	□	
	H3	■				▲	▲	□		■		□	□	
SM	SM1	■	▲				▲	□				■	■	
	SM2	▲	□				□	□				▲	■	
	SM3	▲					□	□				▲	■	
O	O1	▲	□				□							▲
	O2	▲	□				□							▲
	O3	□					▲	▲						
	O4	□					▲	▲						

▲ = 推荐的
■ = 可适用的
□ = 可能的
○ = 按需使用

▲ = Recommended
■ = Applicable
□ = Possible
○ = On request

MATERIAL DETAILS PAGE 88

RM vario整体式铰刀切削参数

Cutting Data RM vario



通孔
Through Bore

ISO	UMC	! 类型		槽型	材质	Vc	fz	Radial / Stock Removal		
		AC	Type					ap	ap	ap
								Ø 5.800-10.609 mm	Ø 10.610-18.609 mm	Ø 18.610-33.100 mm
P	P1	1	L	B	T1	120-150-180	0.10-0.18-0.30	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	B	T1	100-130-160	0.10-0.15-0.25			
		3	L	B	W112R	60-80-100	0.10-0.15-0.25			
	P2	1	L	B	T1	120-150-180	0.10-0.18-0.30	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	B	T1	100-130-160	0.10-0.15-0.25			
		3	L	B	W112R	60-80-100	0.10-0.15-0.25			
	P3	1	L	B	T1	100-130-160	0.10-0.18-0.30	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	B	T1	90-120-140	0.10-0.15-0.25			
		3	L	B	W112R	50-70-90	0.10-0.15-0.25			
	P4	1	L	B	T1	80-110-130	0.10-0.16-0.25	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	B	W112R	80-100-120	0.10-0.14-0.20			
		3	L	B	W112R	40-60-80	0.10-0.14-0.20			
	P5	1	L	B	T1	80-110-130	0.10-0.16-0.25	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	B	W112R	80-100-120	0.10-0.14-0.20			
		3	L	B	W112R	40-60-80	0.10-0.14-0.20			
	P6	1	L	B	W112R	50-70-100	0.08-0.10-0.14	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	A	W112R	40-70-90	0.08-0.10-0.14			
		3	L	A	W112R	20-35-50	0.08-0.10-0.14			
	P7	1	L	A	W112R	15-25-40	0.04-0.06-0.08	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	A	W112R	15-20-30	0.04-0.06-0.08			
		3	L	A	W112R	10-15-20	0.04-0.06-0.08			
M	M1	1	L	B	W112R	30-45-60	0.08-0.12-0.18	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	B	W112R	30-45-60	0.08-0.12-0.15			
		3	L	B	W112R	15-25-35	0.08-0.12-0.15			
	M2	1	L	B	W112R	30-45-60	0.08-0.12-0.18	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	B	W112R	30-45-60	0.08-0.12-0.15			
		3	L	B	W112R	15-25-35	0.08-0.12-0.15			
	M3	1	L	B	W112R	30-45-60	0.08-0.12-0.16	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	B	W112R	30-45-60	0.08-0.12-0.15			
		3	L	B	W112R	15-25-35	0.08-0.12-0.15			
	M4	1	L	A	W112R	20-35-55	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	A	W112R	20-35-55	0.05-0.08-0.12			
		3	L	A	W112R	10-15-25	0.05-0.08-0.12			
	M5	1	L	A	W112R	15-25-35	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	A	W112R	15-25-35	0.05-0.08-0.12			
		3	L	A	W112R	7-12-15	0.05-0.08-0.12			
	M6	1	L	A	W112R	15-20-30	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	L	A	W112R	15-20-30	0.05-0.08-0.12			
		3	L	A	W112R	5-10-12	0.05-0.08-0.12			



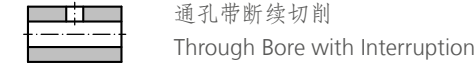
AC 应用条件

- 1 工况良好
 - 夹具、机床及工件刚性良好
 - 刀具长径比 < 3xD
 - 排屑良好
 - 内冷压力大于20bar
- 2 工况一般
 - 夹具、机床及工件刚性略差
 - 刀具长径比 < 6xD
 - 排屑较差
 - 有内冷
- 3 工况类似1和2
 - 但是没有内冷



AC Application Conditions

- 1 Optimal conditions
 - Stable fixture, machine and/or workpiece
 - Tool projection length < 3xD
 - Optimal chip removal guaranteed
 - Internal coolant supply > 20 bar
- 2 Suboptimal conditions
 - Slightly unstable fixture, machine and/or workpiece
 - Tool projection length < 6xD
 - No optimal chip removal guaranteed
 - Internal coolant supply available
- 3 Machining conditions as 1 & 2
 - But without internal coolant



通孔带断续切削
Through Bore with Interruption

AC	Type	槽型	材质	Vc	fz 连续切削	fz 断续切削	Radial / Stock Removal									
							ap	ap	ap							
							Ø 5.800-10.609 mm	Ø 10.610-18.609 mm	Ø 18.610-33.100 mm							
! 类型	4	L	A	T1	120-150-180	0.10-0.18-0.30	fz 连续切削降低30-50% reduce fz full cut 30 - 50%	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15						
											5	L	A	W112R	100-130-160	0.10-0.15-0.25
	4	L	A	T1	120-150-180	0.10-0.18-0.30										
								5	L	A	W112R	100-130-160	0.10-0.15-0.25			
														6	L	A
	4	L	A	T1	100-130-160	0.10-0.18-0.30										
								5	L	A	W112R	90-120-140	0.10-0.15-0.25			
														6	L	A
	4	L	A	W112R	80-110-130	0.10-0.16-0.25										
								5	L	A	W112R	80-100-120	0.10-0.14-0.20			
														6	L	A
	4	L	A	W112R	80-110-130	0.10-0.16-0.25										
								5	L	A	W112R	80-100-120	0.10-0.14-0.20			
														6	L	A
	4	L	A	W112R	50-70-100	0.08-0.10-0.14										
								5	L	A	W112R	40-70-90	0.08-0.10-0.14			
														6	L	A
	4	L	A	W112R	15-25-40	0.04-0.06-0.08										
								5	L	A	W112R	15-20-30	0.04-0.06-0.08			
														6	L	A
	4	L	A	W112R	30-45-60	0.08-0.12-0.15										
								5	L	A	W112R	30-45-60	0.08-0.12-0.15			
														6	G	A
4	L	A	W112R	30-45-60	0.08-0.12-0.15											
						5	L	A	W112R	30-45-60	0.08-0.12-0.15					
												6	G	A	W112R	15-25-35
4	L	A	W112R	20-35-55	0.05-0.08-0.12											
						5	L	A	W112R	20-35-55	0.05-0.08-0.12					
												6	G	A	W112R	10-15-25
4	L	A	W112R	15-25-35	0.05-0.08-0.12											
						5	L	A	W112R	15-25-35	0.05-0.08-0.12					
												6	G	A	W112R	7-12-15
4	L	A	W112R	15-20-30	0.05-0.08-0.12											
						5	L	A	W112R	15-20-30	0.05-0.08-0.12					
												6	G	A	W112R	5-10-12



AC 应用条件

- 4 工况良好
 - 夹具、机床及工件刚性良好
 - 刀具长径比 < 3xD
 - 排屑良好
 - 轻微对称断续切削 (< 10%)
 - 内冷压力大于20bar
- 5 工况一般
 - 夹具、机床及工件刚性略差
 - 刀具长径比 < 6xD
 - 排屑较差
 - 中等对称断续切削 (< 30%)
 - 有内冷
- 6 工况类似4和5
 - 但是没有内冷
 - 中等对称断续切削 (< 30%)

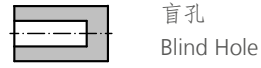


AC Application Conditions

- 4 Optimal conditions
 - Stable fixture, machine and/or workpiece
 - Tool projection length < 3xD
 - Optimal chip removal guaranteed
 - Slightly symmetrical and asymmetrical interruption (< 10%)
 - Internal coolant supply > 20 bar
- 5 Suboptimal conditions
 - Slightly unstable fixture, machine and/or workpiece
 - Tool projection length < 6xD
 - No optimal chip removal guaranteed
 - Medium symmetrical interruptions (< 30%)
 - Internal coolant supply available
- 6 Machining conditions as 4 & 5
 - But without internal coolant
 - Medium symmetrical interruptions (< 30%)

MATERIAL DETAILS PAGE 88

RM vario整体式铰刀切削参数
Cutting Data RM vario



ISO	UMC	! 类型		槽型 Geometry	材质 Grade	Vc	fz	Radial / Stock Removal		
		AC	Type					ap Ø 5.800-10.609 mm	ap Ø 10.610-18.609 mm	ap Ø 18.610-33.100 mm
P	P1	1	G	A	T1	120-150-180	0.10-0.14-0.20	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	T1	100-130-160	0.10-0.14-0.20			
		3	G	A	W112R	60-80-100	0.10-0.12-0.18			
	P2	1	G	A	T1	120-150-180	0.10-0.14-0.20	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	T1	100-130-160	0.10-0.14-0.20			
		3	G	A	W112R	60-80-100	0.10-0.12-0.18			
	P3	1	G	A	T1	100-130-160	0.10-0.14-0.20	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	90-120-140	0.10-0.14-0.20			
		3	G	A	W112R	50-70-90	0.10-0.12-0.18			
	P4	1	G	A	T1	80-110-130	0.10-0.14-0.20	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	80-100-120	0.10-0.14-0.20			
		3	G	A	W112R	40-60-80	0.10-0.12-0.18			
	P5	1	G	A	W112R	80-110-130	0.10-0.14-0.20	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	80-100-120	0.10-0.12-0.18			
		3	G	A	W112R	40-60-80	0.10-0.12-0.18			
	P6	1	G	A	W112R	50-70-100	0.08-0.12-0.16	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	40-70-90	0.06-0.08-0.12			
		3	G	A	W112R	20-35-50	0.06-0.08-0.12			
	P7	1	G	A	W112R	15-25-40	0.06-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	15-20-30	0.04-0.06-0.10			
		3	G	A	W112R	10-15-20	0.04-0.06-0.10			
M	M1	1	G	A	W112R	30-45-60	0.08-0.12-0.15	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	30-45-60	0.08-0.12-0.15			
		3	G	A	W112R	15-25-35	0.08-0.12-0.15			
	M2	1	G	A	W112R	30-45-60	0.08-0.12-0.15	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	30-45-60	0.08-0.12-0.15			
		3	G	A	W112R	15-25-35	0.08-0.12-0.15			
	M3	1	G	A	W112R	30-45-60	0.08-0.12-0.15	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	30-45-60	0.08-0.12-0.15			
		3	G	A	W112R	15-25-35	0.08-0.12-0.15			
	M4	1	G	A	W112R	20-35-55	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	20-35-55	0.05-0.08-0.12			
		3	G	A	W112R	10-15-25	0.05-0.08-0.12			
	M5	1	G	A	W112R	15-25-35	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	15-25-35	0.05-0.08-0.12			
		3	G	A	W112R	7-12-15	0.05-0.08-0.12			
	M6	1	G	A	W112R	15-20-30	0.05-0.08-0.12	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15
		2	G	A	W112R	15-20-30	0.05-0.08-0.12			
		3	G	A	W112R	5-10-12	0.05-0.08-0.12			



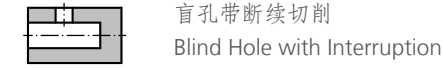
AC 应用条件

- 1 工况良好
- 夹具、机床及工件刚性良好
- 刀具长径比 < 3xD
- 排屑良好
- 内冷压力大于20bar
- 2 工况一般
- 夹具、机床及工件刚性略差
- 刀具长径比 < 6xD
- 排屑较差
- 有内冷
- 3 工况类似1和2
- 但是没有内冷



AC Application Conditions

- 1 Optimal conditions
- Stable fixture, machine and/or workpiece
- Tool projection length < 3xD
- Optimal chip removal guaranteed
- Internal coolant supply > 20 bar
- 2 Suboptimal conditions
- Slightly unstable fixture, machine and/or workpiece
- Tool projection length < 6xD
- No optimal chip removal guaranteed
- Internal coolant supply available
- 3 Machining conditions as 1 & 2
- But without internal coolant



AC	Type	槽型 Geometry	材质 Grade	Vc	fz 连续切削 fz Full Cut	fz 断续切削 fz Interrupted	Radial / Stock Removal																											
							ap Ø 5.800-10.609 mm	ap Ø 10.610-18.609 mm	ap Ø 18.610-33.100 mm																									
! 30-50%	4	G	A	T1	120-150-180	0.10-0.14-0.20	fz 连续切削值降低30-50% reduce fz full cut 30 - 50%	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15																								
											5	G	A	W112R	100-130-160	0.10-0.14-0.20																		
																	6	G	A	W112R	60-80-100	0.10-0.12-0.18												
																							4	G	A	T1	120-150-180	0.10-0.14-0.20						
																													5	G	A	W112R	100-130-160	0.10-0.14-0.20
	4	G	A	T1	100-130-160	0.10-0.14-0.20																												
								5	G	A	W112R	90-120-140	0.10-0.14-0.20																					
														6	G	A	W112R	50-70-90	0.10-0.12-0.18															
	4	G	A	W112R	80-110-130	0.10-0.14-0.20																												
								5	G	A	W112R	80-100-120	0.10-0.14-0.20																					
														6	G	A	W112R	40-60-80	0.10-0.12-0.18															
	4	G	A	W112R	80-110-130	0.10-0.14-0.20																												
								5	G	A	W112R	80-100-120	0.10-0.12-0.18																					
														6	G	A	W112R	40-60-80	0.10-0.12-0.18															
	4	G	A	W112R	50-70-100	0.08-0.12-0.16																												
								5	G	A	W112R	40-70-90	0.06-0.08-0.12																					
														6	G	A	W112R	20-35-50	0.06-0.08-0.12															
	4	G	A	W112R	15-25-40	0.06-0.08-0.12																												
								5	G	A	W112R	15-20-30	0.04-0.06-0.10																					
														6	G	A	W112R	10-15-20	0.04-0.06-0.10															
! 30-50%	4	G	A	W112R	30-45-60	0.08-0.12-0.15	fz 连续切削值降低30-50% reduce fz full cut 30 - 50%	0.05-0.08-0.10	0.05-0.10-0.12	0.05-0.10-0.15																								
											5	G	A	W112R	30-45-60	0.08-0.12-0.15																		
																	6	G	A	W112R	15-25-35	0.08-0.12-0.15												
																							4	G	A	W112R	30-45-60	0.08-0.12-0.15						
																													5	G	A	W112R	30-45-60	0.08-0.12-0.15
4	G	A	W112R	30-45-60	0.08-0.12-0.15																													
						5		G	A	W112R	30-45-60	0.08-0.12-0.15																						
													6	G	A	W112R	15-25-35	0.08-0.12-0.15																
4	G	A	W112R	20-35-55	0.05-0.08-0.12																													
						5		G	A	W112R	20-35-55	0.05-0.08-0.12																						
													6	G	A	W112R	10-15-25	0.05-0.08-0.12																
4	G	A	W112R	15-25-35	0.05-0.08-0.12																													
						5		G	A	W112R	15-25-35	0.05-0.08-0.12																						
													6	G	A	W112R	7-12-15	0.05-0.08-0.12																
4	G	A	W112R	15-20-30	0.05-0.08-0.12																													
						5		G	A	W112R	15-20-30	0.05-0.08-0.12																						
													6	G	A	W112R	5-10-12	0.05-0.08-0.12																



AC 应用条件

- 4 工况良好
- 夹具、机床及工件刚性良好
- 刀具长径比 < 3xD
- 排屑良好
- 轻微对称断续切削 (< 10%)
- 内冷压力大于20bar
- 5 工况一般
- 夹具、机床及工件刚性略差
- 刀具长径比 < 6xD
- 排屑较差
- 中等对称断续切削 (< 30%)
- 有内冷
- 6 工况类似4和5
- 但是没有内冷
- 中等对称断续切削 (< 30%)



AC Application Conditions

- 4 Optimal conditions
- Stable fixture, machine and/or workpiece
- Tool projection length < 3xD
- Optimal chip removal guaranteed
- Slightly symmetrical and asymmetrical interruption (< 10%)
- Internal coolant supply > 20 bar
- 5 Suboptimal conditions
- Slightly unstable fixture, machine and/or workpiece
- Tool projection length < 6xD
- No optimal chip removal guaranteed
- Medium symmetrical interruptions (< 30%)
- Internal coolant supply available
- 6 Machining conditions as 4 & 5
- But without internal coolant
- Medium symmetrical interruptions (< 30%)

MATERIAL DETAILS PAGE 88

RM vario整体式铰刀切削参数

Cutting Data RM vario



ISO	UMC	! 类型		槽型 Geometry	材质 Grade	Vc	fz	Radial / Stock Removal		
		AC	Type					ap		
								Ø 5.800-10.609 mm	Ø 10.610-18.609 mm	Ø 18.610-33.100 mm
K	K1	1	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	80-120-200	0.10-0.14-0.18			
		3	G	A	W114R	40-70-100	0.10-0.14-0.18			
	K2	1	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	80-120-200	0.10-0.14-0.18			
		3	G	A	W114R	40-70-100	0.10-0.14-0.18			
	K3	1	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	80-120-200	0.10-0.14-0.18			
		3	G	A	W114R	40-70-100	0.10-0.14-0.18			
	K4	1	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	80-120-200	0.10-0.14-0.18			
		3	G	A	W114R	40-70-100	0.10-0.14-0.18			
	K5	1	G	A	W114R	60-80-100	0.10-0.12-0.15	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	50-60-80	0.10-0.12-0.15			
		3	G	A	W114R	30-40-50	0.10-0.12-0.15			
	K6	1	G	A	W114R	60-80-100	0.10-0.12-0.15	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	50-60-80	0.10-0.12-0.15			
		3	G	A	W114R	30-40-50	0.10-0.12-0.15			
	K7	1	G	A	W112R	40-60-80	0.08-0.10-0.12	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W112R	30-50-70	0.08-0.10-0.12			
		3	G	A	W112R	20-30-40	0.08-0.10-0.12			
	K8	1	G	A	W112R	40-60-80	0.08-0.10-0.12	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W112R	30-50-70	0.08-0.10-0.12			
		3	G	A	W112R	20-30-40	0.08-0.10-0.12			

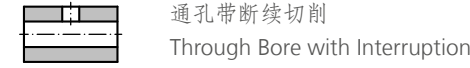
N	N1	1	L	B	W110C	100-180-250	0.12-0.18-0.25	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	L	B	W110C	80-150-220	0.12-0.18-0.25			
		3	L	B	W110C	50-90-120	0.12-0.18-0.25			
	N2	1	L	B	W110C	100-180-250	0.12-0.18-0.25	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	L	B	W110C	80-150-220	0.12-0.18-0.25			
		3	L	B	W110C	50-90-120	0.12-0.18-0.25			
	N3	1	L	B	W110C	100-180-250	0.12-0.18-0.25	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	L	B	W110C	80-150-220	0.12-0.18-0.25			
		3	L	B	W110C	50-90-120	0.12-0.18-0.25			
	N4	1	L	B	D1	150-250-350	0.10-0.15-0.20	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	L	B	D1	150-250-350	0.10-0.15-0.20			
		3	L	B	D1	100-220-300	0.10-0.15-0.20			
	N5	1	L	B	W110C	100-130-160	0.12-0.18-0.25	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	L	B	W110C	80-110-140	0.12-0.18-0.25			
		3	L	B	W110C	50-70-80	0.12-0.18-0.25			
	N6	1	L	B	W110C	50-70-100	0.10-0.15-0.20	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	L	B	W110C	40-60-80	0.10-0.15-0.20			
		3	L	B	W110C	25-35-50	0.10-0.15-0.20			



- AC 应用条件**
- 1 工况良好
- 夹具、机床及工件刚性好
- 刀具长径比 < 3xD
- 排屑良好
- 内冷压力大于20bar
 - 2 工况一般
- 夹具、机床及工件刚性略差
- 刀具长径比 < 6xD
- 排屑较差
- 有内冷
 - 3 工况类似1和2
- 但是没有内冷



- AC Application Conditions**
- 1 Optimal conditions
- Stable fixture, machine and/or workpiece
- Tool projection length < 3xD
- Optimal chip removal guaranteed
- Internal coolant supply > 20 bar
 - 2 Suboptimal conditions
- Slightly unstable fixture, machine and/or workpiece
- Tool projection length < 6xD
- No optimal chip removal guaranteed
- Internal coolant supply available
 - 3 Machining conditions as 1 & 2
- But without internal coolant



ISO	UMC	! 类型		槽型 Geometry	材质 Grade	Vc	fz 连续切削 fz Full Cut	fz 断续切削 fz Interrupted	Radial / Stock Removal		
		AC	Type						ap		
									Ø 5.800-10.609 mm	Ø 10.610-18.609 mm	Ø 18.610-33.100 mm
K	K1	4	G	A	W114R	80-140-220	0.10-0.14-0.18	fz 连续切削值降低30-50% reduce fz full cut 30 - 50%	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	G	A	W114R	80-120-200	0.10-0.14-0.18				
		6	G	A	W114R	40-70-100	0.10-0.14-0.18				
	K2	4	G	A	W114R	80-140-220	0.10-0.14-0.18		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	G	A	W114R	80-120-200	0.10-0.14-0.18				
		6	G	A	W114R	40-70-100	0.10-0.14-0.18				
	K3	4	G	A	W114R	80-140-220	0.10-0.14-0.18		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	G	A	W114R	80-120-200	0.10-0.14-0.18				
		6	G	A	W114R	40-70-100	0.10-0.14-0.18				
	K4	4	G	A	W114R	80-140-220	0.10-0.14-0.18		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	G	A	W114R	80-120-200	0.10-0.14-0.18				
		6	G	A	W114R	40-70-100	0.10-0.14-0.18				
	K5	4	G	A	W114R	60-80-100	0.10-0.12-0.15		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	G	A	W114R	50-60-80	0.10-0.12-0.15				
		6	G	A	W114R	30-40-50	0.10-0.12-0.15				
	K6	4	G	A	W114R	60-80-100	0.10-0.12-0.15		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	G	A	W114R	50-60-80	0.10-0.12-0.15				
		6	G	A	W114R	30-40-50	0.10-0.12-0.15				
	K7	4	G	A	W112R	40-60-80	0.08-0.10-0.12		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	G	A	W112R	30-50-70	0.08-0.10-0.12				
		6	G	A	W112R	20-30-40	0.08-0.10-0.12				
	K8	4	G	A	W112R	40-60-80	0.08-0.10-0.12		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	G	A	W112R	30-50-70	0.08-0.10-0.12				
		6	G	A	W112R	20-30-40	0.08-0.10-0.12				

N	N1	4	L	B	W110C	100-180-250	0.12-0.18-0.25	fz 连续切削值降低30-50% reduce fz full cut 30 - 50%	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	L	B	W110C	80-150-220	0.12-0.18-0.25				
		6	L	B	W110C	50-90-120	0.12-0.18-0.25				
	N2	4	L	B	W110C	100-180-250	0.12-0.18-0.25		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	L	B	W110C	80-150-220	0.12-0.18-0.25				
		6	L	B	W110C	50-90-120	0.12-0.18-0.25				
	N3	4	L	B	W110C	100-180-250	0.12-0.18-0.25		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	L	B	W110C	80-150-220	0.12-0.18-0.25				
		6	L	B	W110C	50-90-120	0.12-0.18-0.25				
	N4	4	L	B	D1	150-250-350	0.10-0.15-0.20		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	L	B	D1	150-250-350	0.10-0.15-0.20				
		6	L	B	D1	100-220-300	0.10-0.15-0.20				
	N5	4	L	B	W110C	100-130-160	0.12-0.18-0.25		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	L	B	W110C	80-110-140	0.12-0.18-0.25				
		6	L	B	W110C	50-70-80	0.12-0.18-0.25				
	N6	4	L	B	W110C	50-70-100	0.10-0.15-0.20		0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		5	L	B	W110C	40-60-80	0.10-0.15-0.20				
		6	L	B	W110C	25-35-50	0.10-0.15-0.20				



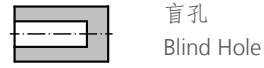
- AC 应用条件**
- 4 工况良好
- 夹具、机床及工件刚性好
- 刀具长径比 < 3xD
- 排屑良好
- 轻微对称断续切削 (< 10%)
- 内冷压力大于20bar
 - 5 工况一般
- 夹具、机床及工件刚性略差
- 刀具长径比 < 6xD
- 排屑较差
- 中等对称断续切削 (< 30%)
- 有内冷
 - 6 工况类似4和5
- 但是没有内冷
- 中等对称断续切削 (< 30%)



- AC Application Conditions**
- 4 Optimal conditions
- Stable fixture, machine and/or workpiece
- Tool projection length < 3xD
- Optimal chip removal guaranteed
- Slightly symmetrical and asymmetrical interruption (< 10%)
- Internal coolant supply > 20 bar
 - 5 Suboptimal conditions
- Slightly unstable fixture, machine and/or workpiece
- Tool projection length < 6xD
- No optimal chip removal guaranteed
- Medium symmetrical interruptions (< 30%)
- Internal coolant supply available
 - 6 Machining conditions as 4 & 5
- But without internal coolant
- Medium symmetrical interruptions (< 30%)

MATERIAL DETAILS PAGE 89

RM vario 整体式铰刀切削参数
Cutting Data RM vario



ISO	UMC	! 类型		槽型	材质	Vc	fz	Radial / Stock Removal		
		AC	Type					ap	ap	ap
						Ø 5.800-10.609 mm	Ø 10.610-18.609 mm	Ø 18.610-33.100 mm		
K	K1	1	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	80-120-200	0.10-0.14-0.18			
		3	G	A	W114R	40-70-100	0.10-0.14-0.18			
	K2	1	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	80-120-200	0.10-0.14-0.18			
		3	G	A	W114R	40-70-100	0.10-0.14-0.18			
	K3	1	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	80-120-200	0.10-0.14-0.18			
		3	G	A	W114R	40-70-100	0.10-0.14-0.18			
	K4	1	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	80-120-200	0.10-0.14-0.18			
		3	G	A	W114R	40-70-100	0.10-0.14-0.18			
	K5	1	G	A	W114R	60-80-100	0.10-0.12-0.15	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	50-60-80	0.10-0.12-0.15			
		3	G	A	W114R	30-40-50	0.10-0.12-0.15			
	K6	1	G	A	W114R	60-80-100	0.10-0.12-0.15	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W114R	50-60-80	0.10-0.12-0.15			
		3	G	A	W114R	30-40-50	0.10-0.12-0.15			
	K7	1	G	A	W112R	40-60-80	0.08-0.10-0.12	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W112R	30-50-70	0.08-0.10-0.12			
		3	G	A	W112R	20-30-40	0.08-0.10-0.12			
	K8	1	G	A	W112R	40-60-80	0.08-0.10-0.12	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W112R	30-50-70	0.08-0.10-0.12			
		3	G	A	W112R	20-30-40	0.08-0.10-0.12			

N	N1	1	G	A	W110C	100-180-250	0.10-0.15-0.22	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W110C	80-150-220	0.10-0.15-0.22			
		3	G	A	W110C	50-90-120	0.10-0.15-0.22			
	N2	1	G	A	W110C	100-180-250	0.10-0.15-0.22	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W110C	80-150-220	0.10-0.15-0.22			
		3	G	A	W110C	50-90-120	0.10-0.15-0.22			
	N3	1	G	A	W110C	100-180-250	0.10-0.15-0.22	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W110C	80-150-220	0.10-0.15-0.22			
		3	G	A	W110C	50-90-120	0.10-0.15-0.22			
	N4	1	G	A	D1	150-250-350	0.08-0.12-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	D1	150-250-350	0.08-0.12-0.18			
		3	G	A	D1	100-220-300	0.08-0.12-0.18			
	N5	1	G	A	W110C	100-130-160	0.10-0.15-0.22	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W110C	80-110-140	0.10-0.15-0.22			
		3	G	A	W110C	50-70-80	0.10-0.15-0.22			
	N6	1	G	A	W110C	50-70-100	0.08-0.12-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15
		2	G	A	W110C	40-60-80	0.08-0.12-0.18			
		3	G	A	W110C	25-35-50	0.08-0.12-0.18			



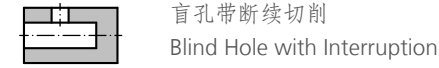
AC 应用条件

- 1 工况良好
- 夹具、机床及工件刚性良好
- 刀具长径比 < 3xD
- 排屑良好
- 内冷压力大于20bar
- 2 工况一般
- 夹具、机床及工件刚性略差
- 刀具长径比 < 6xD
- 排屑较差
- 有内冷
- 3 工况类似1和2
- 但是没有内冷



AC Application Conditions

- 1 Optimal conditions
- Stable fixture, machine and/or workpiece
- Tool projection length < 3xD
- Optimal chip removal guaranteed
- Internal coolant supply > 20 bar
- 2 Suboptimal conditions
- Slightly unstable fixture, machine and/or workpiece
- Tool projection length < 6xD
- No optimal chip removal guaranteed
- Internal coolant supply available
- 3 Machining conditions as 1 & 2
- But without internal coolant



AC	Type	槽型	材质	Vc	fz 连续切削		fz 断续切削		Radial / Stock Removal		
					fz Full Cut	fz Interrupted	ap	ap	ap		
						Ø 5.800-10.609 mm	Ø 10.610-18.609 mm	Ø 18.610-33.100 mm			
! 连续切削值降低30-50% reduce fz full cut 30 - 50%	4	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15		
		5	G	A	W114R	80-120-200				0.10-0.14-0.18	
		6	G	A	W114R	40-70-100				0.10-0.14-0.18	
	4	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15		
		5	G	A	W114R	80-120-200				0.10-0.14-0.18	
		6	G	A	W114R	40-70-100				0.10-0.14-0.18	
	4	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15		
		5	G	A	W114R	80-120-200				0.10-0.14-0.18	
		6	G	A	W114R	40-70-100				0.10-0.14-0.18	
	4	G	A	W114R	80-140-220	0.10-0.14-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15		
		5	G	A	W114R	80-120-200				0.10-0.14-0.18	
		6	G	A	W114R	40-70-100				0.10-0.14-0.18	
	4	G	A	W114R	60-80-100	0.10-0.12-0.15	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15		
		5	G	A	W114R	50-60-80				0.10-0.12-0.15	
		6	G	A	W114R	30-40-50				0.10-0.12-0.15	
	4	G	A	W114R	60-80-100	0.10-0.12-0.15	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15		
		5	G	A	W114R	50-60-80				0.10-0.12-0.15	
		6	G	A	W114R	30-40-50				0.10-0.12-0.15	
	4	G	A	W112R	40-60-80	0.08-0.10-0.12	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15		
		5	G	A	W112R	30-50-70				0.08-0.10-0.12	
		6	G	A	W112R	20-30-40				0.08-0.10-0.12	
	4	G	A	W112R	40-60-80	0.08-0.10-0.12	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15		
		5	G	A	W112R	30-50-70				0.08-0.10-0.12	
		6	G	A	W112R	20-30-40				0.08-0.10-0.12	

! 连续切削值降低30-50% reduce fz full cut 30 - 50%	4	G	A	W110C	100-180-250	0.10-0.15-0.22	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15	
		5	G	A	W110C	80-150-220				0.10-0.15-0.22
		6	G	A	W110C	50-90-120				0.10-0.15-0.22
	4	G	A	W110C	100-180-250	0.10-0.15-0.22	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15	
		5	G	A	W110C	80-150-220				0.10-0.15-0.22
		6	G	A	W110C	50-90-120				0.10-0.15-0.22
	4	G	A	W110C	100-180-250	0.10-0.15-0.22	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15	
		5	G	A	W110C	80-150-220				0.10-0.15-0.22
		6	G	A	W110C	50-90-120				0.10-0.15-0.22
	4	G	A	D1	150-250-350	0.08-0.12-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15	
		5	G	A	D1	150-250-350				0.08-0.12-0.18
		6	G	A	D1	100-220-300				0.08-0.12-0.18
	4	G	A	W110C	100-130-160	0.10-0.15-0.22	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15	
		5	G	A	W110C	80-110-140				0.10-0.15-0.22
		6	G	A	W110C	50-70-80				0.10-0.15-0.22
	4	G	A	W110C	50-70-100	0.08-0.12-0.18	0.05-0.10-0.12	0.05-0.10-0.15	0.05-0.10-0.15	
		5	G	A	W110C	40-60-80				0.08-0.12-0.18
		6	G	A	W110C	25-35-50				0.08-0.12-0.18



AC 应用条件

- 4 工况良好
- 夹具、机床及工件刚性良好
- 刀具长径比 < 3xD
- 排屑良好
- 轻微对称断续切削 (< 10%)
- 内冷压力大于20bar
- 5 工况一般
- 夹具、机床及工件刚性略差
- 刀具长径比 < 6xD
- 排屑较差
- 中等对称断续切削 (< 30%)
- 有内冷
- 6 工况类似4和5
- 但是没有内冷
- 中等对称断续切削 (< 30%)



AC Application Conditions

- 4 Optimal conditions
- Stable fixture, machine and/or workpiece
- Tool projection length < 3xD
- Optimal chip removal guaranteed
- Slightly symmetrical and asymmetrical interruption (< 10%)
- Internal coolant supply > 20 bar
- 5 Suboptimal conditions
- Slightly unstable fixture, machine and/or workpiece
- Tool projection length < 6xD
- No optimal chip removal guaranteed
- Medium symmetrical interruptions (< 30%)
- Internal coolant supply available
- 6 Machining conditions as 4 & 5
- But without internal coolant
- Medium symmetrical interruptions (< 30%)

MATERIAL DETAILS PAGE 89

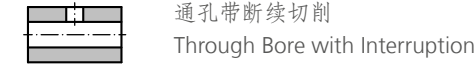
RM vario 整体式铰刀切削参数

Cutting Data RM vario



通过孔 Through Bore

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal (ap for Ø 5.800-10.609 mm, Ø 10.610-18.609 mm, Ø 18.610-33.100 mm). Rows include categories S, H, SM, and O.

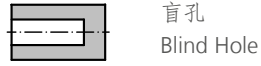


通过孔带断续切削 Through Bore with Interruption

Table with columns: AC, Type, Geometry, Grade, Vc, fz 连续切削 (Full Cut), fz 断续切削 (Interrupted), Radial / Stock Removal (ap for Ø 5.800-10.609 mm, Ø 10.610-18.609 mm, Ø 18.610-33.100 mm). Rows include categories S, H, SM, and O.

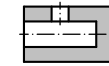
MATERIAL DETAILS PAGE 90/91

RM vario 整体式铰刀切削参数
Cutting Data RM vario



盲孔
Blind Hole

Table with columns: ISO, UMC, AC, Type, Geometry, Grade, Vc, fz, Radial / Stock Removal (ap for 5.800-10.609 mm, 10.610-18.609 mm, 18.610-33.100 mm). Rows include categories S, H, SM, and O.



盲孔带断续切削
Blind Hole with Interruption

Table with columns: AC, Type, Geometry, Grade, Vc, fz 连续切削 (Full Cut), fz 断续切削 (Interrupted), Radial / Stock Removal (ap for 5.800-10.609 mm, 10.610-18.609 mm, 18.610-33.100 mm). Rows include categories S, H, SM, and O. Includes a note: fz 连续切削降低30-50% reduce fz full cut 30 - 50%.

MATERIAL DETAILS PAGE 90/91

可调式铰“RM vario”的使用说明

Handling Instructions for Adjustable Reaming Tools “RM vario”

为什么要可调?

- 在公差范围内直径可调整(取决于工件材料)
- 补偿磨损量(如果表面质量仍然合格)

需要关注:

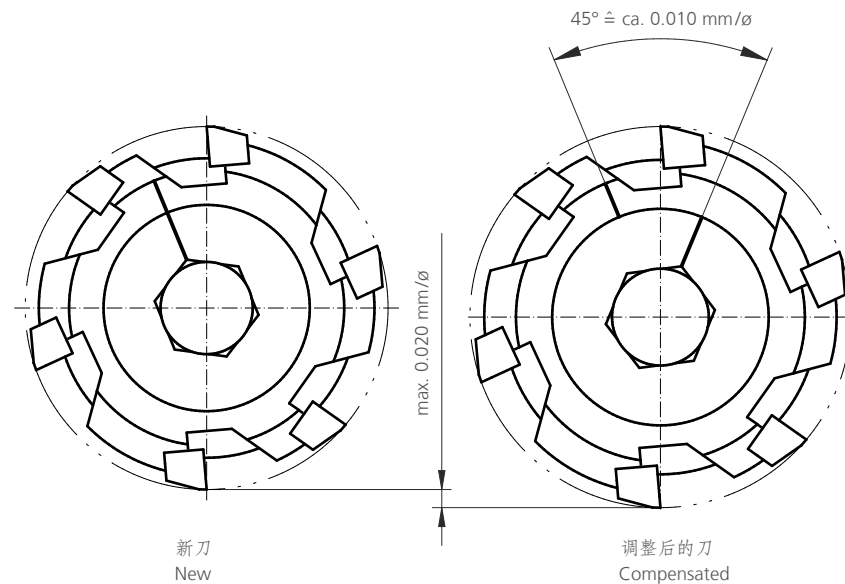
- 直接最大调整量**0.020mm**(否则调整螺丝可能超行程)
- 仔细调整-不可退回!
- 按图示角度与调整量关系调整 ($\text{mm}/^\circ$)。

Why adjustable?

- Readjustment of the diameter within the tolerance range (depending on the material to be machined)
- Possible compensation of wear (if the surface quality is still within the tolerance)

What has to be considered:

- Max. 0,020 mm in diameter may be added (otherwise the reaming head can be overstretched)
- Adjust carefully - never turn back!
- Infeed with adjustment dimension ($\text{mm}/^\circ$) according to drawing



跳动补偿刀柄说明

Instruction Compensation Chuck



为了获得最好的铰削结果，最佳的刀具跳动非常必要。为了补偿任何来自刀柄或者机床主轴的跳动误差，我们推荐使用跳动补偿刀柄或者浮动刀柄。RM vario 整体式铰刀的跳动可以用不同的方法来进行测量：

步骤:

1. 调整前确保所有调整螺钉①彻底松开
2. 将刀柄装到机床主轴上。
3. 将千分表($1 \mu\text{m} / 0,0001$ 英寸精度)测头置于铰刀杆跳动检测区域。
4. 通过四个径向调整螺钉①将跳动调整到最大 **$5\mu\text{m}/0.0002\text{inch}$** (最佳状态 **$< 3\mu\text{m}/0.0001\text{inch}$**)。



调整完成后，四个螺钉不要顶得太紧

In order to achieve the best reaming results, a tool with zero run-out is absolutely essential. To compensate any run-out error of the tool holder and the machine spindle, we recommend using a compensation holder or floating chuck. The run-out of RM vario reamers can be measured with different methods:

Procedure:

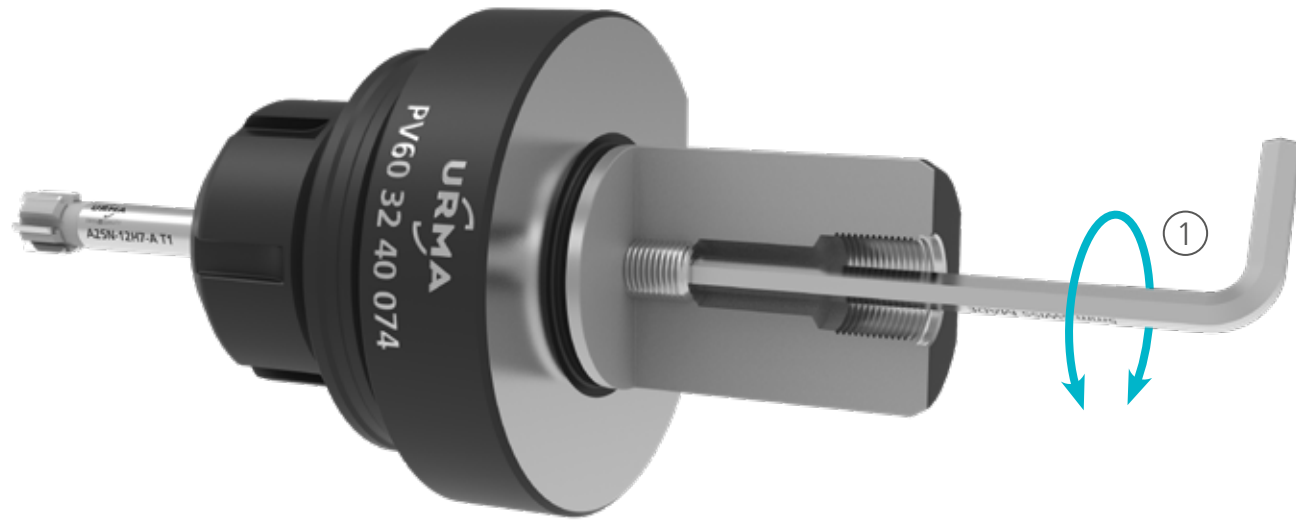
1. Before adjusting, make sure that all adjustment screws ① are completely loosened.
2. Load the tool in the machine spindle.
3. Set the indicator (with $1 \mu\text{m} / 0,0001$ inch resolution) on the marked run-out area on the shank.
4. Set the run-out directly in the machine spindle to maximum $5 \mu\text{m} / 0,0002$ inch (ideal $< 3 \mu\text{m} / 0,0001$ inch) by using the four radial adjustment screws ①.



The adjustment screws do not have to be fully clamped against each other after adjustment.

浮动刀柄说明

Instruction Floating Chuck



车床上铰孔通常需要用浮动刀柄（有时也会用于加工中心）。

位置误差可由可调浮动机构适当补偿。只能补偿水平或垂直误差（无法补偿角度误差）。

推荐使用 $\leq 45^\circ$ 的刀片角度。

步骤:

1. 通过调整螺钉①调整浮动机构。

调整螺钉	浮动机构	对加工的影响
顺时针旋转	弹簧力增加/阻力增加	表面质量可能变差（印迹变浅）
逆时针旋转	弹簧力变弱/阻力减小	可能产生振动

Reaming on lathes are mainly done with floating chucks (in exceptional cases also on machining centres).

Positioning errors can be compensated by the adjustable floating mechanism. The deflection should only take place in plane-parallel (No angular error compensation).

Cutting geometries with an angle of $\leq 45^\circ$ are recommended.

Procedure:

1. Adjust the floating mechanism by using the adjustment screw ①.

Adjustment screw	Floating mechanism	Influence on machining
Clockwise rotation	Spring force increases / deflection resistance increases	The surface quality can be negatively influenced (retraction marks)
Counterclockwise rotation	Spring force becomes weaker / deflection resistance decreases	Potential vibration tendency

调整:

松: 浮动柄需要调整到最低阻力。不过, 考虑到刀具本身的重量, 应该使刀具在发生偏移后能自动回到中心位置

中等: 完全锁紧调整螺钉并退回 $1 \pm \frac{1}{4}$ 圈。

紧: 完全锁紧螺钉并退回 $\frac{1}{4} - \frac{1}{2}$ 圈。

Adjustment:

Soft: The tool should be adjusted with the lowest possible deflection resistance. Nevertheless, taking into account the weight of the tool, it must jump back automatically into the central axis after deflection.

Medium: Fully tighten the adjusting screw and turn back by $1 \pm \frac{1}{4}$ rotation.

Hard: Fully tighten the adjusting screw and turn back by $\frac{1}{4} - \frac{1}{2}$ rotation.

推荐作为基本设置:

刀具直径 Tool-Ø	松 Soft	中等 Medium	紧 Hard
5.800 – 15.600	X		
15.601 – 23.600	X	X	
23.601 – 33.100		X	

Recommendation for the basic setting:

2. 相对于Y轴, 我们特别推荐刀具跳动和主轴轴心的偏差应 $< 10\mu\text{m} / 0.0004\text{inch}$ (最佳状态 $< 5\mu\text{m} / 0.0002\text{inch}$)



-浮动机构的调整很大程度上取决于应用场合及浮动柄的类型
-通常推荐浮动刀柄进入孔口时降低切削速度
-所有数值都是参照铰马浮动柄的推荐值

2. With an existing Y-axis, we recommend additionally aligning the tool $< 10\mu\text{m} / 0,0004\text{ inch}$ (ideally $< 5\mu\text{m} / 0,0002\text{ inch}$) concentrically to the spindle axis.



- The settings of the floating mechanism can vary depending on the application and type of floating chuck.
- It is generally recommended to enter into the bore with reduced rpm.
- All data are guide values and refer to URMA floating chucks.

钨马铰削 技术

加工中心问题解答

Troubleshooting Machining Centres



	孔太大 Hole too large				锥孔 Tapered hole				孔有振纹 Hole shows chatter marks	
	振动 Vibration	跳动偏差 Run-out error	积屑瘤 Built-up edges	单边余量 (ap) Radial depth of cut	夹紧变形 Deformation by clamping	材料厚度不均匀 Uneven material thickness	设备 Machine	排屑 Chip flow	振动 Vibration	跳动偏差 Run-out error
切削参数 Cutting Data										
进给 (fz) Feed (fz)	↑		↓					↑/↓	↑	
转速 (min ⁻¹) Spindle speed (min ⁻¹)	↓		↑						↓	
单边余量 (ap) Radial depth of cut	↑		↑	↓		⚠		↓	↑	
刀具 Tool										
倒角 Chamfer angle	↑					↑			↑	
跳动 Run out	⚠	⚠								⚠
检查连接状态 Check the connection	⚠	⚠								⚠
检查磨损/更换刀片 Check the wear / change the insert			⚠						⚠	
浮动刀柄 Floating chuck										•/⚠
缩径刀杆 Diameter reduced holder										•/⚠
跳动补偿刀柄 Compensation chuck		•/⚠								•/⚠
工件 Workpiece										
夹具/夹紧力 Workpiece fixture	⚠				⚠/↓				⚠	
夹具/夹紧力 Clamping pressure	⚠				⚠/↓				⚠	
机床 Machine										
冷却液浓度 Coolant mixture	↑		↑					⚠	↑	
主轴角偏差 Angle-error of spindle						⚠				
轴向角偏差 Angle-error of axis						⚠				
进给机构振动 Vibrations from bar-feeder										
加工 Machining										
排屑 Chip flow				⚠				⚠		
冷却液压力 Coolant pressure	⚠/↓		⚠					↑	⚠/↓	
槽型径向力 Radial pressure from geometry	↓		⚠	⚠		↓			↓	
入口转速 Spindle speed on entry	↓		⚠			⚠			↓	
进退同进给 Feed in feed out										

操作：尽可能一次只做一项调整
Handling: If possible, apply only one modification at once.

- ↑ 提升 Increase, improve
- ↓ 降低 Reduce, decrease
- ⚠ 检查、优化 Check, optimize
- 使用 Apply

	表面质量不佳 (检测) Surface quality unsatisfactory (measurable)					表面质量不佳 (目视) Surface quality unsatisfactory (optically)				纹路 Retraction marks			孔偏小或孔形缺陷 Hole too small or shape defect			
	振动 Vibration	积屑瘤 Built-up edges	跳动偏差 Run-out error	切削角度 代码 Cutting geometry	设备 Machine	进给 Feed rate	跳动偏差 Run-out error	切削角度 代码 Cutting geometry	设备 Machine	积屑瘤 Built-up edges	工件径向收缩 Radial compression of material	夹具引起的径向收缩 Radial compression through clamping	刀具磨损 Tool wear	工件径向收缩 Radial compression of material	夹具引起的径向收缩 Radial compression through clamping	单边余量 (ap) Radial depth of cut
	↑	↓														
	↓	↑														
											↓/↑			↑	↓	↑
	↑			↓				↑			↑			↑	↑	
			⚠				⚠			⚠						
			⚠													
	⚠	⚠		⚠					⚠	⚠		⚠	⚠			
			•/⚠				•/⚠		•/⚠	•/⚠						
			•/⚠				•/⚠		•/⚠	•/⚠						
			•/⚠				•/⚠		•/⚠							
	⚠								⚠			⚠/↓		⚠/↓	⚠/↓	
	⚠								⚠			⚠/↓		⚠/↓	⚠/↓	
	↑	↑							↑	↑	↓			↓		
							⚠		⚠							
							⚠		⚠							
				⚠										⚠		⚠
	⚠	⚠								⚠		⚠				
	↓							⚠	⚠	↓				↓	↓	
	↓							⚠								
										•		•		•		

车床问题解答

Troubleshooting Lathes



	孔太大 Hole too large				锥孔 Tapered hole				孔有振纹 Hole shows chatter marks	
	振动 Vibration	跳动偏差 Run-out error	积屑瘤 Built-up edges	单边余量 (ap) Radial depth of cut	夹紧变形 Deformation by clamping	材料厚度不均匀 Uneven material thickness	设备 Machine	排屑 Chip flow	振动 Vibration	跳动偏差 Run-out error
切削参数 Cutting Data										
进给 (fz) Feed (fz)	↑		↓					↑/↓	↑	
转速 (min ⁻¹) Spindle speed (min ⁻¹)	↓		↑						↓	
单边余量 (ap) Radial depth of cut	↑			↓		⚠		↓	↑	
刀具 Tool										
倒角 Chamfer angle	↑					↑			↑	
跳动 Run out		⚠								⚠
检查连接状态 Check the connection	⚠		⚠							⚠
检查磨损/更换刀片 Check the wear / change the insert	⚠	⚠	⚠						⚠	⚠
浮动刀柄 Floating chuck	⚠	●/⚠					●/⚠			●/⚠
缩径刀杆 Diameter reduced holder	⚠	●/⚠					●/⚠			●/⚠
跳动补偿刀柄 Compensation chuck										
工件 Workpiece										
夹具/夹紧力 Workpiece fixture	⚠				⚠/↓				⚠	⚠
夹具/夹紧力 Clamping pressure	⚠				⚠/↓				⚠	⚠
机床 Machine										
冷却液浓度 Coolant mixture			↑				⚠			
主轴角偏差 Angle-error of spindle	⚠	⚠					⚠		⚠	⚠
轴向角偏差 Angle-error of axis	⚠	⚠					⚠		⚠	
进料机构振动 Vibrations from bar-feeder	⚠						⚠		⚠	
加工 Machining										
排屑 Chip flow				⚠				⚠		
冷却液压力 Coolant pressure	⚠/↓		⚠					↑	⚠/↓	
槽型径向力 Radial pressure from geometry	↓		⚠	⚠			↓		↓	
入口转速 Spindle speed on entry	↓		⚠						↓	
进退同进给 Feed in feed out										

操作：尽可能一次只做一项调整
Handling: If possible, apply only one modification at once.

- ↑ 提升 Increase, improve
- ↓ 降低 Reduce, decrease
- ⚠ 检查、优化 Check, optimize
- 使用 Apply

	表面质量不佳 (检测) Surface quality unsatisfactory (measurable)					表面质量不佳 (目视) Surface quality unsatisfactory (optically)				纹路 Retraction marks			孔偏小或孔形缺陷 Hole too small or shape defect				
	振动 Vibration	积屑瘤 Built-up edges	跳动偏差 Run-out error	切削角度 代码 Cutting geometry	设备 Machine	进给 Feed rate	跳动偏差 Run-out error	切削角度 代码 Cutting geometry	设备 Machine	积屑瘤 Built-up edges	工件径向收缩 Radial compression of material	夹具引起的径向收缩 Radial compression through clamping	刀具磨损 Tool wear	工件径向收缩 Radial compression of material	夹具引起的径向收缩 Radial compression through clamping	单边余量 (ap) Radial depth of cut	
振动	↑																
积屑瘤		↓															
跳动偏差	↓	↑															
切削角度	↑			↓						↑/↓				↑	↓	↑	
设备																	
进给																	
跳动偏差			⚠							⚠							
切削角度				↓						↑				↑	↑		
设备																	
积屑瘤			⚠							⚠							
工件径向收缩										⚠	⚠		⚠	⚠			
夹具引起的径向收缩													⚠	⚠			
刀具磨损													⚠	⚠			
工件径向收缩			●/⚠						●/⚠	●/⚠			●/⚠	●/⚠			
夹具引起的径向收缩			●/⚠						●/⚠	●/⚠			●/⚠	●/⚠			
单边余量																	
工件																	
夹具/夹紧力	⚠												⚠/↓		⚠/↓	⚠/↓	
夹具/夹紧力	⚠												⚠/↓		⚠/↓	⚠/↓	
机床																	
冷却液浓度		↑															
主轴角偏差	⚠		⚠					⚠		⚠							
轴向角偏差	⚠		⚠					⚠		⚠							
进料机构振动	⚠							⚠		⚠							
加工																	
排屑															⚠		⚠
冷却液压力	⚠/↓		⚠						↑	⚠/↓				⚠			
槽型径向力	↓		⚠	⚠			↓			↓				↓	↓		
入口转速	↓		⚠							↓							
进退同进给																	

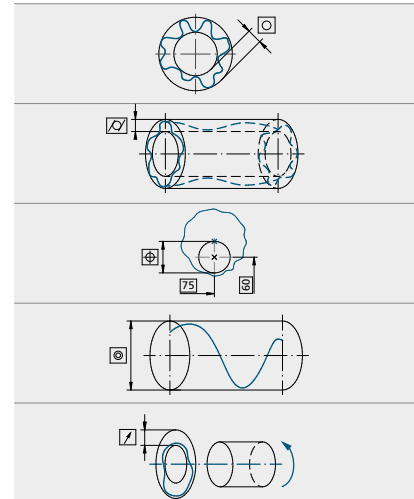
定义和基本公式

Definitions and Basic Formulas

编号	Designation	Spanungsbreite / Chip width
a_p	切削深度 Depth of cut [mm]	a_p h
n	转速 Speed [min^{-1}]	0.05 0.07
D/d	孔径 Bore diameter [mm]	0.08 0.11
v_c	切削速度 Cutting speed [m/min]	0.10 0.14
v_f	进给率 Feed rate [mm/min]	0.15 0.21
f	每转进给 Feed per rotation [mm]	0.20 0.28
f_z	每刀进给 Feed per tooth [mm]	0.25 0.35
z	齿数 Number of cutting edges	
l_f	进给距离 Feed distance [mm]	
R_a	算术中心线平均值 Arithmetic centre line average value [μm]	
R_t	峰谷高度 Peak-to-valley height [μm]	
R_z	峰谷高度平均值 Average peak-to-valley height [μm]	
R_m	拉伸强度 Tensile strength [N/mm^2]	
t_c	每件切削时间 Machining time [min]	
γ	径向前角 Radial rake angle [Degrees]	
ϵ	刀尖角 Apex angle [Degrees]	
h	铁屑厚度 Chip thickness [mm]	
mc	材料常数 Material constant	
$kc_{1.1}$	切屑力主值 Main value cutting force [N/mm^2]	
kc	特定切削力 Specific cutting force [N/mm^2]	
F_c	切削力 Cutting force [N]	
b	铁屑宽度 Chip width [mm]	
P_c	必要的驱动功率 Necessary drive power [kW]	
η	效率 Degree of efficiency	
M_d	扭矩 Torque [Nm]	

	Ra	Rz
N8	1.6 - 3.2	8.4 - 15
N7	0.8 - 1.6	4.0 - 8.4
N6	0.4 - 0.8	2.2 - 4.0
N5	0.2 - 0.4	1.6 - 2.8
N4	0.1 - 0.2	1.0 - 2.8
N3	0.05 - 0.1	0.8 - 1.1

	圆度	Circularity
	圆柱度	Cylindricity
	位置度	Position
	同轴度	Concentricity
	圆周跳动	Circular runout



切削速度 Cutting speed	$v_c = \frac{\pi \cdot d \cdot n}{1000}$	m/min
进给 Feed rate	$v_f = f \cdot n$ $v_f = f_z \cdot z \cdot n$	mm/min
切削力(每刃) Cutting force (per cutting edge)	$F_c = b \cdot h \cdot k_c$	N
速度 Speed	$n = \frac{v_c \cdot 1000}{\pi \cdot d}$	min^{-1}
加工时间 Machining time	$t_c = \frac{l_f}{f \cdot n}$	min
功率要求 Power requirement	$P_c = \frac{b \cdot h \cdot k_c \cdot v_c \cdot z}{60 \cdot 10^3 \cdot \eta}$	kW

特定切削力 Specific cutting force	$k_c = \frac{k_{c1.1}}{h^{m_c}}$	N
扭矩 Torque	$M_d = \frac{(D^2 - d^2) \cdot f \cdot k_c}{8 \cdot 10^3}$	Nm

加工分析

Machining Study

发送者 * Sender		Number	
公司 Company		铇马分销商 URMA distributor	
地址 Address		联系人 Contact	
机床 Machine-Tool			
机床类型 Machine type and manufacturer			
卧式 * Horizontal <input type="checkbox"/>	立式 * Vertical <input type="checkbox"/>	刀具旋转 * Tool rotating <input type="checkbox"/>	
主轴接口 * Spindle holder	尺寸 * Size	类别 * Execution	
DIN 69893-HSK <input type="checkbox"/>	20 <input type="checkbox"/> 25 <input type="checkbox"/>	A <input type="checkbox"/>	
DIN 69871 <input type="checkbox"/>	30 <input type="checkbox"/> 32 <input type="checkbox"/>	B <input type="checkbox"/>	
MAS-BT <input type="checkbox"/>	40 <input type="checkbox"/> 50 <input type="checkbox"/>	C <input type="checkbox"/>	
圆柱柄 DIN 1835 Cylinder shank DIN 1835 <input type="checkbox"/>	63 <input type="checkbox"/> 80 <input type="checkbox"/>	D <input type="checkbox"/>	
DIN 69880 VDI <input type="checkbox"/>	100 <input type="checkbox"/>	E <input type="checkbox"/>	
冷却液 Lubricant			
油 * Oil <input type="checkbox"/>	微量润滑 * 1) MLS 1) <input type="checkbox"/>	乳化液 * Emulsion <input type="checkbox"/>	混合比 Ratio of mixture
有内冷 * Internal coolant supply <input type="checkbox"/>			冷却液压力 (bar)* Coolant pressure (bar)
工件 Workpiece			
工件名称 Designation	材料代码 * Material number	热处理状态 (硬度) * Treatment condition (hardness)	
加工要求 Machining requirements			
孔径-Ø * Bore Ø	孔深 * Bore length	预加工孔径-Ø * Pre-machined Ø	
公差 * Tolerance	干涉长度 Interfering contours mm	预加工方式 * Method of pre-machining	
其他公差要求 Additional tolerance requirements	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	盲孔 * Blind Hole <input type="checkbox"/>	
表面质量 (µm) * Surface quality (µm)	R_a <input type="checkbox"/> R_z <input type="checkbox"/> R_t <input type="checkbox"/>	断续切削 * Cutting interruption <input type="checkbox"/>	
日期 * Date			
附件: 请附上图纸 * Attachement: your application sketch			

* 必填项
Mandatory fields

1) 微量润滑系统 (微润滑)
Minimal lubrication system (mist coolant)

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材料对照表 Material Comparison Table

钢 Steel

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
P	P1	易切钢	Free-cutting steels	< 600	< 180	1600	0.18	1.0715	11SMn30
	P2	低合金铁素体钢、C < 0.25%、低合金可焊接通用结构钢	Low-alloy ferritic steels, C < 0.25%wt, low-alloy general structural steels	< 700	< 210	1700	0.18	1.0038	S235JRG2
	P3	铁素体及铁素体、珠光体钢, C < 0.25%、可焊接通用结构钢、冷作硬化钢	Ferritic and ferritic / pearlitic steels, C < 0.25%wt, weldable general structural steels, case-hardening steels	< 800	< 240	1800	0.21	1.7131	16MnCr5
	P4	热处理钢、结构钢 C > 0.25%	Heat-treatable steels, construction steels C > 0.25%	< 1000	< 300	1800	0.23	1.1191 1.7225	C45E 42CrMo4
	P5	淬火钢、C > 0.67%、弹簧钢、轴承钢	Through-hardening steels, C > 0.67%wt, spring and bearing steels	700 - 1100	210 - 325	1700	0.27	1.1274 1.2067	C100S 100Cr6
	P6	合金工具钢	Alloyed tool steels	700 - 1200	210 - 350	2200	0.25	1.2601	X165CrMoV12
	P7	高合金工具钢、高速钢(HSS)	High alloyed tool steels, high speed steels (HSS)	> 900	> 260	2300	0.25	1.2083 1.2344	X42Cr13 X40CrMoV5-1

奥氏体及双相不锈钢 Stainless austenitic steel and duplex

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
M	M1	铁素体及马氏体不锈钢	Ferritic & martensitic stainless steels	500 - 900	150 - 260	1700	0.22	1.4005 1.4512 1.4021	X12CrS13 X5CrTi12 X20Cr13
	M2	易切奥氏体不锈钢, 容易加工	Free-cutting austenitic stainless steels, less difficult machinable	500 - 900	150 - 260	1700	0.22	1.4305	X8CrNiS18 9
	M3	低合金奥氏体不锈钢	Low-alloy austenitic stainless steels			2000	0.2	1.4301	X5CrNi18 10
	M4	中合金奥氏体不锈钢	Alloyed austenitic stainless steels			2100	0.2	1.4435	X2CrNiMo18 14 3
	M5	高合金奥氏体不锈钢及双相不锈钢	High-alloy austenitic and duplex stainless steels			2300	0.2	1.4462 1.4548	X2CrNiMoN22 5 3 X5CrNiCuNb17 4 4
	M6	奥氏体、双相及超级双相不锈钢、非常难加工	Austenite, duplex and super duplex, very difficult to machine	700 - 1000	210 - 300	2300	0.2	1.4410	X2CrNiMoN25 7 4

详细材料列表见 92 - 100 页
See pages 92 - 100 for detailed material list

材料对照表 Material Comparison Table

铸铁 Cast Irons

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
K	K1	灰铸铁	Grey cast irons	< 300	< 90	1100	0.25	0.6025	EN-GJL-250 (GG25)
	K2	灰铸铁	Grey cast irons	> 300	> 90	1300	0.27	0.6035	EN-GJL-350 (GG35)
	K3	球墨铸铁 可锻铸铁	Ductil cast irons, Malleable cast irons	< 500	< 150	900	0.25	0.7040	EN-GJS-400-15 (GGG40)
	K4	球墨铸铁 可锻铸铁	Ductil cast irons, Malleable cast irons	< 800	< 210	1400	0.28	0.7060	EN-GJS-600-3 (GGG60)
	K5	奥贝球铁	Austempered ductile irons	< 1100	< 325	1500	0.32		EN-GJS-1000-5
	K6	蠕墨铸铁	Compactet graphite irons	300 - 500	90 - 150				EN-GJV-400
	K7	层状奥氏体铸铁	Austenitic lamellar cast irons	< 400				0.6655	GGL-NiCuCr 15 6 2
	K8	球状奥氏体 蠕墨及球墨铁	Austenitic spheroidal graphite and ductil iron	300 - 600	90 - 180			0.7673	EN-GJSA- XNiMn23-4

有色金属 Non-Ferrous Metals

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
N	N1	可锻铝合金 硅含量 < 2%	Aluminum wrought alloy with Si < 2%	< 300	< 150	600	0.23	3.3535	AlMg3
	N2	铝合金, 硅含量 < 7%	Aluminum alloys, Si < 7%	< 400	< 120	700	0.25	3.2152	AlSi6Cu4
	N3	铝合金 8% < 硅含量 < 15% 及镁合金	Aluminum alloys 8% < Si < 15% and alloys Magnesium	< 400	< 120	700	0.25	3.2163	AlSi9Cu3 AlSi12
	N4	铝合金, 硅含量 > 15%	Aluminum alloys, Si > 15%	> 400	> 120	800	0.25		AlSi17Cu4Mg
	N5	铜合金易加工	Copper alloys, good machinability	< 700	< 210	800	0.2	2.0401 2.1090	CuZn39Pb3 CuSn7Zn4Pb7-C
	N6	铜合金难加工	Copper alloys, more difficult machinability	> 500	> 150	1000	0.25	2.0966	CuAl10Ni5Fe4

详细材料列表见 92 - 100 页
See pages 92 - 100 for detailed material list

材料对照表 Material Comparison Table

耐热合金 Superalloys

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
S	S1	铁基高温合金	Iron based superalloys	< 800	< 240	2400	0.23	2.4858	NiCr21Mo (Alloy 825)
	S2	铁基高温合金	Iron based superalloys	> 800	> 240	2600	0.23	1.4980	X6NiCrTi-MoVB25-15-2 (Alloy A-286)
	S3	钴基高温合金	Cobalt based superalloys	600 - 1200		2800	0.23	2.4979	CoCr28MoNi (Stellite 21)
	S4	镍基高温合金	Nickel based superalloys	700 - 1500		3100	0.23	2.4668	NiCr19NbMo (Inconel 718)

钛合金 Titanium Alloys

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
S	S11	钛, 低合金 (α)	Titanium, low alloyed (α)	< 800	< 240	1300	0.22	3.7025 3.7035 3.7055	Ti1 (Grade 1) Ti2 (Grade 2) Ti3 (Grade 3)
	S12	钛, 中合金 (近 α + β)	Titanium, medium alloyed (close to α + β)	< 1100	< 325	1500	0.22		Ti6Al2Sn 4Zr2Mo0.1Si
	S13	钛, 高合金 (α + β)	Titanium, high alloyed (α + β)	900 - 1200	265 - 355	1500	0.22	3.7165	TiAl6V4 (Grade 5)
	S14	钛, 高合金 (β)	Titanium, high alloyed (β)	> 1200	> 355	1700	0.22		Ti10V2Fe3Al Ti5Al5Mo5V3Cr

淬硬钢 Hardened Steels

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
H	H1	表面硬化钢, 可热处理钢, 轴承钢, 工具钢	Case hardening steels, heat-treatable steels, bearing steels, tool steels	1450 - 1800	< 520	3300	0.22		HRC 45 - 52
	H2	表面硬化钢, 可热处理钢, 轴承钢, 工具钢	Case hardening steels, heat-treatable steels, bearing steels, tool steels	1800 - 2100	520 - 600	4100	0.22		HRC 53 - 57
	H3	表面硬化钢, 可热处理钢, 轴承钢, 工具钢高速钢	Case hardening steels, heat-treatable steels, bearing steels, tool steels, high-speed steels	> 2100	> 600	4700	0.22		HRC 58 - 62

详细材料列表见 92 - 100 页
See pages 92 - 100 for detailed material list

材料对照表 Material Comparison Table

粉末冶金材料 Powder Metallurgical Materials

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
SM	SM1	低合金烧结材料	Low alloyed sintered materials	200 - 450	< 135				Sint-D11 / C11
	SM2	中合金烧结材料 镍含量 < 7%	Medium alloyed sintered materials with Ni < 7%	400 - 600	120 - 180				Sint-D31 / C31
	SM3	高、合金烧结材料 镍含量 > 7%	High alloyed sintered materials with Cr and Ni > 7%	400 - 600	120 - 180				Sint-D40 / C40 (AISI 316)

复合材料 Composite Materials

ISO	UMC	描述	Description	Rm [N/mm ²]	HB	Kc1.1	mc	DIN Nr.	示例 Example
O	O1	热塑性聚合物	Thermoplastic polymers			150	0.26		Polyamid 6 (PA 6) Polyoxymethylen (POM)
	O2	热固性塑料	Thermosetting plastics			150	0.26		Epoxyharze (EP)
	O3	增强塑料 玻璃纤维 < 50%	Reinforced plastics with < 50% glass fibers			300	0.26		Polyamid 6 mit 30% GF (PA 6 GF30)
	O4	玻璃纤维, 碳纤维芳纶增强塑料	Glass fiber-, carbon fiber- and aramid reinforced plastics			300	0.26		GFK CFK

详细材料列表见 92 - 100 页
See pages 92 - 100 for detailed material list

材料分类
Material Group Classification

钢
Steel

Table with 10 columns: UMC, W-Nr, DIN, EN, AFNOR, BS, UNI, JIS, SS, UNS, AISI / ASTM. Rows are grouped into P1, P2, and P3 categories.

Table with 10 columns: UMC, W-Nr, DIN, EN, AFNOR, BS, UNI, JIS, SS, UNS, AISI / ASTM. Rows are grouped into P4, P5, P6, and P7 categories.

材料分类
Material Group Classification

奥氏体及双相不锈钢
Stainless austenitic steel and duplex

UMC	W-Nr	DIN	EN	AFNOR	B5	UNI	JIS	SS	UNS	AISI / ASTM	Div.	Condition	Structure	
M1	1.4000	X 6 Cr 13	X 6 Cr 13	Z 6 C 12	403 S 17	X 6 Cr 13	SUS 403	2301	S41008	403		annealed	ferrite	
	1.4006	X 10 Cr 13	X 12 Cr 13	Z 10 C 13	410 S 21	X 12 Cr 13	SUS 410	2302	S41000	410, CA-15		annealed	martensite	
	1.4016	X 6 Cr 17	X 6 Cr 17	Z 8 C 17	430 S 15	X 8 Cr 17	SUS 430	2320	S43000	430		annealed	ferrite	
	1.4021	X 20 Cr 13	X 20 Cr 13	Z 20 C 13	420 S 37	X 20 Cr 13	SUS 420 J 1	2303	S42000	420		annealed	martensite	
	1.4031	X 40 Cr 13	X 39 Cr 13	Z 40 C 14	420 S 45	X 40 Cr 14	SUS 420	2304	S40280	420		annealed	martensite	
	1.4109	X 65 CrMo 14	X 70 CrMo 15	Z 70 D 14			SUS 440 A		S44002	440 A		annealed	martensite	
	1.4112	X 90 CrMoV 18	X 90 CrMoV 18	Z 2 CND 18 05	409 S 19	X CrTi 12	SUS 440 B	2327	S44003	440 B		annealed	martensite	
	1.4125	X 105 CrMo 17	X 105 CrMo 17	Z 100 CD 17		X 105 CrMo 17	SUS 440 C		S44004	440 C		annealed	martensite	
	1.4313	X 5 CrNi 13 4	X 3 CrNiMo 13 3	Z 5 CN 13.4	425 C 11	X 6 CrNi 13 04	SCS 5	2385	J91540		F6NM	annealed	martensite	
	1.4749	X 18 CrNi 28	X 18 CrNi 28	Z 18 C 25				2322	S44600	446		annealed	ferrite	
M2	1.4305	X 10 CrNiS 18 9	X 10 CrNiS 18 9	Z 10 CNF 18.09	303 S 31	X 10 CrNi 18 09	SUS 303	2346	S30300	303		annealed	austenite	
M3	1.4300	X 12 CrNi 18 8	X 12 CrNi 18 8	Z 12 CN 18	302 S 25		SUS 302	2331	S30200	302		annealed	austenite	
	1.4301	X 6 CrNi 18 10	X 5 CrNi 18 9	Z 6 CN 18.09	304 S 31	X 5 CrNi 18 11	SUS 304	2333	S30400	304		annealed	austenite	
	1.4306	X 2 CrNi 19 11	X 2 CrNi 19 11	Z 2 CN 18.10	304 S 12	X 3 Cr Ni 18 11	SUS 304 L	2352	S30403	304 L		annealed	austenite	
	1.4307	X 2 CrNi 18 9	X 2 CrNi 18 9	CLC 18 9 L	304 S 11		SUS 304 L		S30403	304 L		annealed	austenite	
	1.4310	X 12 CrNi 17 7	X 9 CrNi 18 8	Z 12 CN 17.07	301 S 21	X 12 CrNi 17 07	SUS 301	2331	S30100	301		annealed	austenite	
	1.4401	X 5 CrNiMo 17 12 2	X 5 CrNiMo 17 12 2	Z 3 CND 17 11 1	316 S 31	X 5 CrNiMo 17 12	SUS 316	2347	S31600	316		annealed	austenite	
	1.4404	X 2 CrNiMo 17 13 2	X 2 CrNiMo 17 13 2	Z 3 CND 19 10 M	316 S 12	X 2 CrNiMo 19 11	SUS 316 L	2348	S31603	316 L		annealed	austenite	
	1.4550	X 6 CrNiNb 18 10	X 6 CrNiNb 18 10	Z 6 CNNb 18.10	347 S 31	X 6 CrNiNb 18 11	SUS 347	2338	S34700	347		annealed	austenite	
M4	1.4311	X 2 CrNiN 19 11	X 2 CrNiN 18 10	Z 2 CN 18 10 Az	304 S 62	X 2 CrNiN 18 11	SUS 304 LN	2371	S30453	304 LN		annealed	austenite	
	1.4335	X 12 CrNi 25 21	X 12 CrNi 25 21	Z 12 CN 25 20	310 S 24	X 6 CrNi 26 20	SUH 310, SUS 310 S	2361	S31008	310 S		annealed	austenite	
	1.4429	X 2 CrNiMoN 17 13 3	X 2 CrNiMoN 17 13 3	Z 2 CND 17 13 Az	316 S 62	X 2 CrNiMoN 17 13 3	SUS 316 LN	2375	S31653	316 LN		annealed	austenite	
	1.4435	X 2 CrNiMo 18 14 3	X 2 CrNiMo 18 14 3	Z 2 CND 17 13	316 S 12	X 2 CrNiMo 17 13 2	SCS 16, SUS 316 L	2353	S31603	316 L		annealed	austenite	
	1.4441	X 2 CrNiMo 18 15 3	X 2 CrNiMo 18 15 3							316 LVM				
	1.4466	X 5 CrNi 18 15	X 3 CrNiMo 18 12 3		317 S 16	X 5 CrNi 18 15	SUS 317	2366	S31700	317		annealed	austenite	
M5	1.4893	X 9 CrNiSiN 21 11 2	X 9 CrNiSiN 21 11 2		310 S 31			2368	S30815		253 MA	annealed	austenite	
	1.4417	X 2 CrNiMoSi 19 5	X 2 CrNiMoSi 19 5	Z 2 CND 18.05.2003				2376	S31500		3RE60	annealed	duplex	
	1.4460	X 4 CrNiMo 27 5 2	X 3 CrNiMo 27 5 2	Z 3 CND 25.7 Az		X 3 CrNiMo 27 5 2	SUS 329 J 1	2324	S32900	329		annealed	duplex	
	1.4462	X 2 CrNiMoN 22 5	X 2 CrNiMoN 22 5 3	Z 2 CND 22.05 Az	332 S 15	X 2 CrNiMoN 22 5		2377	S31803	329 LN	SAF 2205		annealed	duplex
	1.4539	X 2 NiCrMoCu 25 20 5	X 2 NiCrMoCu 25 20 5	Z 2 NCDU 25 20	904 S 13			2562	N08904	904L			annealed	super austenite
M6	1.4410	X 2 CrNiMoN 25 7 4	X 2 CrNiMoN 25 7 4	Z 3 CND 25.07 Az		X 2 CrNiMoN 25 7 4		2328	S32750	F 53	SAF 2507	annealed	super duplex	
	1.4529	X 1 CrNiMoN 20 18 7	X 1 CrNiMoN 20 18 7	Z 1 CNDU 20.18.05 Az		X 1 CrNiMoN 20 18 7		2778	S31254		254 SMO	annealed	super austenite	
	1.4534	X 3 CrNiMoAl 13 8 2	X 6 NiCrTiMoV 25 15						S13800	XM-13	PH13-8Mo	solution heat treatment	austenite	
	1.4540	X 4 CrNiCuNb 16 4		Z 4 CNUNb 16.4 M					S15500	XM-12	15-5-PH	solution heat treatment	martensite	
	1.4568	X 7 CrNiAl 17 7	X 3 CrNiMoAl 13 8 2	Z 9 CAN 17.7	301 S 81	X 7 CrNiAl 17 7	SUS 631	2388	S17700	AMS 5528	17-7-PH	solution heat treatment	austenite / ferrite	
	1.4652	X 2 CrNiMoN 25 22 7	X 1 CrNiMoN 25 22 8						S32654		654 SMO	annealed	super austenite	
	1.4876	X 10 NiCrAlTi 32 20	X 10 NiCrAlTi 32 20	Z 10 NC 32.21			NCF 800		N08800		Alloy 800	annealed	austenite	
	1.4943	X 4 NiCrTi 25 15	X 5 CrNiCuNb 16 4	Z 6 NCTDV 25.15	HR 51		SUH 660	2570	S66286	660	A286	solution heat treatment	austenite	

材料分类
Material Group Classification

铸铁
Cast Irons

UMC	W-Nr	DIN	EN	AFNOR	B5	UNI	JIS	SS	UNS	AISI / ASTM
K1	0.6010	GG-10	EN-GJL-100	Ft 10 D	Grade 100	G10	FC 100	01 10-00		A48 20 B
	0.6015	GG-15	EN-GJL-150	Ft 15 D	Grade 150	G15	FC 150	01 15-00	F11601	A48 25 B
	0.6020	GG-20	EN-GJL-200	Ft 20 D	Grade 220	G20	FC 200	01 20-00	F12101	A48 30 B
	0.6025	GG-25	EN-GJL-250	Ft 25 D	Grade 260	G25	FC 250	01 25-00	F12401	A48 35 B
K2	0.6030	GG-30	EN-GJL-300	Ft 30 D	Grade 300	G30	FC 300	01 30-00	F13101	A48 45 B
	0.6035	GG-35	EN-GJL-350	Ft 35 D	Grade 350	G35	FC 350	01 35-00	F13502	A48 50 B
	0.6040	GG-40	EN-GJL-400	Ft 40 D	Grade 400	G40				
K3	0.7033	GGG-35.3	EN-GJS-350-22	FGS 370-17	Grade 350/22		FCD 350-22L	07 17-15		
	0.7040	GGG-40	EN-GJS-400-15	FGS 400-12	Grade 420/12	GS 400-12	FCD 400-18L	07 17-02	F32800	60-40-18
	0.7043	GGG-40.3	EN-GJS-400-18	FGS-370-17	Grade 370/17	GSO 42/17		07 17-12	F32800	60-40-18
	0.8035	GTW-35-04	EN-GJMW-350-4	MB 350-7	W 35-04	W 35-04	FCMW 300			
	0.8040	GTW-40-05	EN-GJMW-400-5	MB 400-5	W 40-05	GMB 40	FCMW 370			
	0.8135	GTS-35-10	EN-GJMB-350-10	MN 350-10	B 340/12					
K4	0.7050	GGG-50	EN-GJS-500-7	FGS 500-7	Grade 500/7	GS 500-7	FCD 500-7	07 27-02	F33800	A536 80-55-6
	0.7060	GGG-60	EN-GJS-600-3	FGS 600-3	Grade 600/3	GS 600-3	FCD 600-3	07 32-03	F34100	A476 80-60-03
	0.7070	GGG-70	EN-GJS-700-2	FGS 700-2	Grade 700/2	GS 700-2	FCD 700-2	07 37-01	F34800	A536 100-70-03
	0.7080	GGG-80	EN-GJS-800-2	FGS 800-2	SNG 800/2	GS 800-2	FCD 800		F36200	120-90-2
	0.8045	GTW-45-07	EN-GJMW-450-7	MB 450-7	W 45-07	GMB 45	FCMWP 440			
	0.8055	GTW-55				GMB 55				
	0.8065	GTW-65				GMB 65				
	0.8145	GTS-45-06	EN-GJMB-450-6	MN 450-6	P 440/7	P 45-06				
	0.8155	GTS-55-04	EN-GJMB-550-4	MN 550-4	P 510/4	P 55-04				
	0.8165	GTS-65-02	EN-GJMB-650-2	MN 650-3	P 570/3	P 65-02				
K5		GJS-800-8	EN-GJS-800-8							ADI grade 1 850/550/10
		GJS-1000-5	EN-GJS-1000-5							ADI grade 2 1050/700/7
		GJS-1200-2	EN-GJS-1200-2							ADI grade 3 1200/850/4
		GJS-1400-1	EN-GJS-1400-1							ADI grade 4 1400/1100/1
K6		GJV-300	EN-GJV-300							Grade 350
		GJV-350	EN-GJV-350							Grade 400
		GJV-400	EN-GJV-400							Grade 400-15
		GJV-450	EN-GJV-450							Grade 450
		GJV-500	EN-GJV-500							Grade 500
K7	0.6652	GGL-NiMn-13-7	EN-GJLA-XNiMn-13-7	L-NM 13 7	L-NM 13 7		FCA NiMn 13 7		F43000	
	0.6655	GGL-NiCuCr-15-6-2	EN-GJLA-XNiCuCr-15-6-2	L-NUC 15 6 2	Grade F1		FCA NiCuCr 15 6 2		F41000	A436 Type 1
	0.6660	GGL-NiCr-20-2	EN-GJLA-XNiCr 20-2	L-NC 20 2	Grade F2		FCA NiCr 20 2	05 23-00	F41002	A436 Type 2
	0.6667	GGL-NiSiCr-20-5-3	EN-GJLA-XNiSiCr-20-5-3	L-NSC 20 5 3			FCA NiSiCr 20 5 3			
	0.6676	GGL-NiCr 30 3	EN-GJLA-XNiCr 30-3	FGL Ni30 Cr3	Grade F3				F41004	A436 Type 3
	0.6678	GGL-NiCr-35-2								
K8	0.6680	GGL-NiSiCr30-5-5								
	0.7659	GGG-NiCrNb-20-2	EN-GJSA-XNiCrNb-20-2							
	0.7683	GGG-Ni-35	EN-GJSA-XNi35	FGS Ni35					F43006	A439 Type D-5
	0.7660	GGG-NiCr-20-2	EN-GJSA-XNiCr20-2	FGS Ni20 Cr2	Grade S2		FCDA NiCr 20 2		F43000	A436 Type D-2
	0.7665	GGG-NiSiCr20-5-2	EN-GJSA-XNiSiCr-20-5-2	S-NSC 20 5 2			FCDA NiSiCr 20 5 2			
	0.7670	GGG-Ni-22	EN-GJSA-Xni-22	S-N 22	S-Ni 22		FCDA Ni 22		F43002	A439 Type D-2C
	0.7676	GGG-NiCr-30-3	EN-GJSA-XNiCr30-3	FGS Ni30 Cr3	Grade S3				F43003	A436 Type D-3
	0.7652	GGG-NiMn-13-7	EN-GJSA-XNiMn13-7	FGS Ni13 Mn7	Grade S6		FCDA 13 7	07 72-00		
	0.7673	GGG-NiMn-23-4	EN-GJSA-XNiMn23-4	FGS Ni23 Mn4	Grade S2M		FCDA NiMn 23 4		F43010	A439 Type D-2M
	0.7680	GGG-NiSiCr30-5-5								
	0.7688	GGG-NiSiCr35-5-2								

材料分类
Material Group Classification

有色金属
Non-Ferrous Metals

UMC	W-Nr	DIN	EN	AFNOR	BS	UNI	JIS	SS	UNS	AISI / ASTM	
N1	3.0255	Al99.5	AW-1050A	A5	1B	4507		4007	AA1050A		
	3.0305	Al99.9	AW-1090								
	3.0515	AlMn1	AW-3103	A-M1	N3	3568		4054	AA3103		
	3.0517	AlMn1Cu	AW-3003	A-M1					A3003	AA3003	
	3.1255	AlCuSiMn	AW-2014	A-U45G	H15			4338	AA2014		
	3.1655	AlCuBiPb	AW-2011	A-U5PbBi	FC1			4355	AA2011		
	3.2315	AlMgSi1	AW-6082	A-SGM0.7	H30			4212	AA6082		
	3.3206	AlMgSi0.5	AW-6060	A-GS	H9			4103	AA6060		
	3.3210	AlMgSi0.7	AW-6063	A-GSUC				4104	AA6005		
	3.3241	G-AlMg3Si	AW-6061			H20					
	3.3245	AlMg3Si									
	3.3261	G-AlMg5Si									
	3.3315	AlMg1	AW-5005	A-G0.6		N41			4106	AA5005	
	3.3523	AlMg2.5				2L56				AA5052	
	3.3535	AlMg3	AW-5754	A-G3M		N5				AA5754	
	3.3541	G-AlMg3									
	3.3561	G-AlMg5									
	3.4335	AlZn4.5Mg1	AW-7020	A-Z5G		H17			4425	AA7020	
	3.4365	AlZnMgCu1.5	AW-7075	A-Z5GU		2L95/2L96	7075			AA7075	
	3.5103	G-MgSe3Zn2Zr1	MN65120	ZRE1		MAG6-TE				M12330	AMS 4442
	3.3527	AlMg2Mn0.8	AW-5049								
	3.5470	GD-MgAl4Si1			G-A451						
	3.5555	AlMg5									
	3.5612	G-MgAl6Zn	MG-P-63		G-A621	MAG-E-121				M11600	AZ61A
	3.5632	G-MgAl6Zn3									
	3.5812	G-MgAl8Zn	MG-P-61		G-A721	MAG1					AZ80A
	N2	3.1263	GK-AlCu5Si3								
		3.2131	G-AlSi5Cu1								
		3.2134	G-AlSi5Cu1Mg	AC-AlCu4Ti							
		3.2151	GK-AlSi6Cu4	AC-45000							
		3.2152	GD-AlSi6Cu4	AC-AlSi6Cu4							
		3.2153	G-AlSi7Cu3								
		3.2245	SG-AlSi5								
		3.2341	G-AlSi5Mg	AC-42000	A-57G		LM25	3599	AC 4C	4244	
	3.2371	G-AlSi7Mg	AC-42100								
N3	3.2161	G-AlSi8Cu3	AC-46200					4251	A13800	A380	
	3.2162	GD-AlSi8Cu3									
	3.2163	GK-AlSi9Cu3	AC-46200								
	3.2211	GK-AlSi11									
	3.2373	G-AlSi9Mg	AC-AlSi9Mg								
	3.2381	G-AlSi10Mg	AC-43400	A-510G		LM9		4253	A13600	B85	
	3.2382	GD-AlSi12	AC-44200							A413.2	
	3.2383	G-AlSi10MgCu	AC-43200								
	3.2581	G-AlSi12	AC-44200	A-513		LM6	3051		4261		
	3.2582	GD-AlSi15	AC-44300						4247		
3.2583	G-AlSi12Cu				LM20			4260			
3.2982	GD-AlSi12Cu	AC-47100									
N4		G-AlSi17Cu4Mg					ADC14			B390.0	
		G-AlSi18									
		GK-AlSi18CuNiMg									
		G-AlSi21CuNiMg									
	GKAlSi25CuNiMg										

材料分类
Material Group Classification

UMC	W-Nr	DIN	EN	AFNOR	BS	UNI	JIS	SS	UNS	AISI / ASTM					
N5	2.0380	CuZn39Pb2	CW612N												
	2.0401	CuZn39Pb3	CW614N						5170	C38500					
	2.0402	CuZn40Pb2	CW617N						5168	C37800					
	2.0410	CuZn44Pb2	CW622N						5272	C68700					
	2.0580	CuZn40Mn1Pb													
	2.0771	CuNi7Zn39Mn5Pb3													
	2.1061	G-CuSn11Pb2-C	CC482K								C92500				
	2.1076	CuSn4Pb4Zn4	CW456K							C5441	C54400				
	2.1080	CuSn6Zn6													
	2.1086	G-CuSn10Zn													
	2.1090	G-CuSn7Zn4Pb7-C	CC493K								C93200				
	2.1096	G-CuSn5Zn5Pb5	CC491K							BC6	C83600				
	2.1176	CuPb10Sn	CW352H							5640	C93700	CA937			
N6	2.0240	CuZn15	CW502L						C2300	5112	C23000				
	2.0250	CuZn20													
	2.0265	CuZn30							C2600		C26000				
	2.0321	CuZn37	CW508L						C2108	P-CuZn37	C2720	5150	C27200		
	2.0360	CuZn40	CW509L										C28000		
	2.0470	CuZn28Sn1	CW706R									5220	C44300		
	2.0530	CuZn38Sn1	CW717R										C46400		
	2.0561	CuZn40Al1													
	2.0790	CuNi18Zn19Pb											C76300		
	2.0872	CuNi10Fe1Mn	CW325H							CN102	Pt-CuNi10Fe1Mn		5667	C70600	
	2.0932	CuAl8Fe3	CW303G							CA106	P-CuAl8Fe3			C61400	
	2.0940	CuAl10Fe	CC331G										5710	C95200	CA952
	2.0966	CuAl10Ni5Fe4	CW307G							CA104					C63000
	2.0975	CuAl10Ni5Fe5-C	CC333G							AB2	CuAl11Fe4Ni4		5716	C95500	CA955
	2.1020	CuSn6	CW452K							PB103	CuSn7		C5191	5428	C51900
	2.1030	CuSn8	CW453K							PB104			C5210	5431	C52100
	2.1050	CuSn10	CC480K							CT1				5443	C90700
2.1087	CuSn10Zn												5458	C90500	
2.1247	CuBe2														
2.1293	CuCrZr								CC102					C18200	
2.1522	CuSi2Mn														
2.1525	CuSi3Mn														

材料分类
Material Group Classification

耐热合金
Superalloys

UMC	W-Nr	DIN	UNS	AISI / ASTM	Div.
S1			S35000	633	AM350
			S42300	619	Lapelloy
	1.4958	X5NiCrAlTi 31 20	N08010		Incoloy 800
	1.4974	X12CrCoNi 21 20	R30155	661	N 155
S2	1.4545	X5CrNiCu 15 5	S15500	XM-12	15-5PH
	1.4548	X5CrNiCuNb 17 4 4	S17400	630	17-4PH
	1.4980	X6NiCrTiMoVb 25 15 2	S66286	660	Incoloy A 286
S3	2.4683	CoCr22NiW			Haynes 25
	2.4681	CoCr26Ni9Mo5W			Alloy 188
	2.4711	CoCr20Ni15Mo			ULTIMET
	2.4778	CoCr28			ELGILOY
	2.4967	CoCr20W15Ni			Alloy 150
					Alloy 25
					H531
					Stellite 6
					Stellite 12
	2.4979	CoCr28MoNi			Stellite 21
				Stellite 31	
S4	2.4631	NiCr20TiAl	N07080		Nimonic 80A
	2.4654	NiCr20Co13Mo4Ti3Al	N07001		Waspaloy
	2.4668	NiCr19Fe19Nb5Mo3	N07718		Inconel 718
	2.4669	NiCr15Fe7TiAl	N07750		Inconel X-750
	2.4810	NiMo30	N10002		Hastelloy C
	2.4816	NiCr15Fe	N06600		Inconel 600
	2.4819	NiMo16Cr15W	N10276		Hastelloy C-276
	2.4856	NiCr22Mo9Nb	N06625		Inconel 625
	2.4983	NiCr18Co	N07500	684	Udimet 500

钛合金
Titanium Alloys

UMC	W-Nr	DIN	UNS	AISI / ASTM	Div.
S11	3.7025	Ti1			Grade 1
	3.7035	Ti2			Grade 2
	3.7055	Ti3			Grade 3
	3.7065	Ti4			Grade 4
	3.7114	TiAl5Sn2	R54520		
S12	3.7144	TiAl6Sn2Zr4Mo2	R54620	AMS 4919	Ti 6-2-4-2 / Timetal 1100
	3.7154	TiAl6Zr5			Timetal 685
	3.7195	TiAl3V2.5	R56320	AMS 4943	Grade 9
S13	3.7165	TiAl6V4	R56400	AMS 4920, Grd 5	Ti 6Al-4V
		TiAl6Sn2Zr4Mo6	R56260		Ti 6-2-4-6
		TiAl5Sn2Zr2Mo4Cr4	R58650		Ti 17
	3.7174	TiAl6V6Sn2			
	3.7185	TiAl4Mo4Sn2			Hylite 50
S14		TiV10Fe2Al3		AMS 4986	Ti 10V-2Fe-3Al
		TiAl4.5V3Mo2Fe2			SP 700
		TiMo11Zr6Sn4.5			Beta III
		TiV10Fe2Al3			Ti 10-2-3
					Ti 15-3

材料分类
Material Group Classification

淬硬钢
Hardened Steels

UMC	W-Nr	DIN	EN	AFNOR	B5	UNI	JIS	SS	UNS	AISI / ASTM	Condition
H1	1.1201	42 CrMo 4	42 CrMo 4	42 CD 4	708 M40	42 CrMo 4	SCM 440 (H)	2244	G41400	4142, 4140	hardened and tempered
	1.2312	40 CrMnMoS 8 6 4	40 CrMnNiMoS 8 6 4	40 CMD 8 S							hardened and tempered
	1.2316	X 36 CrMo 17	X 36 CrMo 17	Z 35 CD 17							hardened and tempered
	1.2343	X 38 CrMoV 5 1		Z 38 CDV 5	BH 11	X 37 CrMoV 5 1 KU	SKD 6		T 20811	H11	hardened and tempered
	1.4534	X 3 CrNiMoAl 13 8 2	X 3 CrNiMoAl 13 8 2						S13800	XM-13	hardened and tempered
	1.6582	34 CrNiMo 6	34 CrNiMo 6	35 NCD 6	817 M 40	35 NiCrMo 6 (KW)	SNCM 447	2541		4340	hardened and tempered
H2	1.7131	16 MnCr 5	16 MnCr 5	16 MC 5	527 M 17	16 MnCr 5	SCR 415	2511	G51170	5115	hardened and tempered
	1.2344	X 40 CrMoV 5 1	X 40 CrMoV 5 1	Z 40 CDV 5	BH 13	X 40 CrMo 5 1 1 KU	SKD 61	2242	T 20813	H13	hardened and tempered
	1.2550	60 WCrV 7		55 WC 20		55 WCrV 8 KU				S1	hardened and tempered
	1.2767	X 45 NiCrMo 4	X 45 NiCrMo 4	Y 35 NCD 16		42 NiCrMo 15 7 KU			T 30109	6F7	hardened and tempered
	1.4109	X 65 CrMo 14	X 70 CrMo 15	Z 70 D 14			SUS 440 A		S44002	440 A	hardened and tempered
	1.4112	X 90 CrMoV 18	X 90 CrMoV 18	Z 2 CND 18 05	409 S 19	X CrTi 12	SUS 440 B	2327	S44003	440 B	hardened and tempered
	1.7225	42 CrMo 4	42 CrMo 4	42 CD 4	708 M 40	42 CrMo 4	SCM 440 (H)	2244	G 41400	4142, 4140	hardened and tempered
	1.1191	Ck 45	C 45 E	XC 42	080 M 46	C 45	S 45 C	1672	G 10420	1045	hardened and tempered
	1.1231	Ck 67	C 67S	XC 68	060 A 67	C 70		1770	G10700	1070	hardened and tempered
	1.1248	Ck 75	C 75S	XC 75	060 A 78	C 75		1774, 1778	G10780	1078, 1080	hardened and tempered
H3	1.1274	Ck 101	C 100S		060 A 96		SUP 4	1870	G10950	1095	hardened and tempered
	1.1545	C 105 W1	C 105U	Y1 105		C 100 KU		1880		W 1	hardened and tempered
	1.2162	21 MnCr 5	21 MnCr 5	20 NC 5			SCR 420 H				hardened and tempered
	1.2210	115 CrV 3	107 CrV 3	100 C 3		107 CrV 3 KU			T 61202	L2	hardened and tempered
	1.2363	X 100 CrMoV 5 1	X 100 CrMoV 5	Z 100 CDV 5	BA 2	X 100 CrMoV 5 1 KU	SKD 12	2260	T30102	A2	hardened and tempered
	1.2379	X 155 CrVMo 12 1	X 155 CrVMo 12 1	Z 160 CDV 12	BD 2	X 155 CrVMo 12 1 KU	SKD 11		T30402	D2	hardened and tempered
	1.2436	X 210 CrW 12				X 215 CrW 12 1 KU	SKD 2	2312			hardened and tempered
	1.2510	100 MnCrW 4		90 MWCV 5	BO 1	95 MnWCr 5 KU	SKS 3	2140	T 31501	O1	hardened and tempered
	1.2842	90 MnCrV 8	90 MnCrV 8	90 MV 8	BO 2	90 MnVCr 8 KU			T 31502	O2	hardened and tempered
	1.3243	S 6-5-2-5	HS 6-5-2-5	Z 85 WDKCV 06-05-05-04-02		HS 6-5-2-5	SKH 55	2723		M35	hardened and tempered
	1.3247	S 2-10-1-8	HS 2-10-1-8	Z 110 DKCWW 09-08-04	BM 42	HS 2-9-1-8	SKH 51		T11342	M42	hardened and tempered
	1.3343	S 6-5-2	HS 6-5-2	Z 85 WDCV 06-05-04-02	BM 2	HS 6-5-2	SKH 9, SKH 51	2722	T11302	M2	hardened and tempered
	1.3355	S 18-0-1	HS 18-0-1	Z 80 WCV 18-04-01	BT 1	HS 18-0-1	SKH 2		T12001	T1	hardened and tempered
	1.3505	100 Cr 6	100 Cr 6	100 C 6	534 A 99	100 Cr 6	SUJ 2	2258	G51986	52100	hardened and tempered
	1.4125	X 105 CrMo 17	X 105 CrMo 17	Z 100 CD 17		X 105 CrMo 17	SUS 440 C		S44004	440 C	hardened and tempered
	1.5752	14 NiCr 14	14 NiCr 14	12 NC 15	655 M 13		SNC 815 (H)		G 33106	3310, 9314	hardened and tempered
	1.6587	18 CrNiMo 7 6	18 NiCrMo 7 6	18 NCD 6	820 A 16	18 NiCrMo 7					hardened and tempered

材料分类

Material Group Classification

粉末冶金材料

Powder Metallurgical Materials

UMC	W-Nr
SM1	Sint-C 00
	Sint-D 00
	Sint-E 00
	Sint-C 01
	Sint-D 01
	Sint-C 10
	Sint-D 10
	Sint-E 10
	Sint-C 11
	Sint-D 11
Sint-C 21	
SM2	Sint-C 31
	Sint-D 31
	Sint-E 31
	Sint-C 32
	Sint-D 32
	Sint-C 35
	Sint-D 35
	Sint-C 36
	Sint-D 36
	Sint-C 39
Sint-D 39	
SM3	Sint-C 40
	Sint-D 40
	Sint-C 42
	Sint-C 43

复合材料

Composite Materials

UMC	Code	Chemical Description	Trade Names
O1	PC	Polycarbonate	Makrolon, Lexan
	PMMA	Polymethylmethacrylate	Acrylite, Plexiglas
	PS	Polystyrene	Luran, Styron
	PA	Polyamide	Ertalon, Ultramid
	POM	Polyoxymethylene	Delrin, Hostaform
	PP	Polypropylene	Hostalen, Vestolen
O2	PSU	Polysulfone	Mindel, Ultrason
	PF	Phenol formaldehyde resin	Bakelite, Supraplast
	MF	Melamine formaldehyde resin	Resopal, Hornit
	UF	Urea formaldehyde resin	Resamin, Urecoll
O3	EP	Epoxy resin	Epoxy, Araldit
	PA 6 GF 10	Polyamide 6 reinforced with 10% GF	
	PA 6 GF 30	Polyamide 6 reinforced with 30% GF	
	PC GF 20	Polycarbonate reinforced with 20% GF	
	POM GF 20	Polyoxymethylene reinforced with 20% GF	
	POM GF 30	Polyoxymethylene reinforced with 30% GF	
O4	PSU GF 30	Polysulfone reinforced with 30% GF	
	GFK	Glass fibre reinforced plastic	
	CFK	Carbon fiber reinforced plastic	



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