THE NEW VALUE FRONTIER

KYOCERA

고능률 다날·주철가공용 커터

MFK형

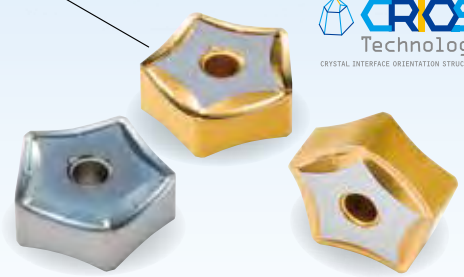
High Efficiency Multi-edge Cutter for Cast Iron

- **떨림을 억제**해 우수한 정삭면
  Excellent surface finish by controlling chattering
- 안정가공과 높은 경제성을 양립한
  양면 10코너 사양 팁
  10-cornered pentagonal inserts for stable and economical machining
- 2가지의 특수 팁 구조로
  저저항의 강인 절삭날을 실현
  Two special insert structures reduce cutting force and improve edge strength
- 초다날사양으로 주철가공의
  고능률 · 고이송가공에 대응 Applicable to high efficiency and high feed cast iron machining with multi-edge design

네가티브 팁이지만
절삭성이 우수, 떨림에 강하다!
Resistant to chattering with sharpness even with negative type insert

긴수명 가공을 실현하는
New CVD재종 **CA420M**
New CVD grade CA420M for longer tool life

CRIOS Technology
CRYSTAL INTERFACE ORIENTATION STRUCTURE



NEW

고속 · 고능률
가공을 실현하는
세라믹 재종
KS6050/CS7050
Ceramic grades for high speed and high efficiency machining

정삭가공용
와이퍼팁
레파토리
Wiper insert for finishing is available

ADVANCING PRODUCTIVITY

생산성 향상에 기여하는 교세라

MFK형

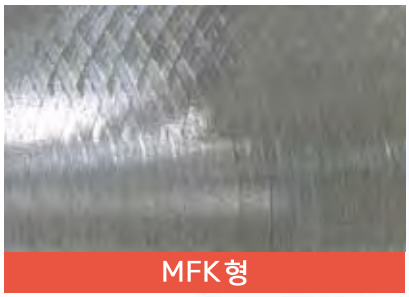
초다날사양 커터로 주철의 고능률 가공을 실현
안정가공과 높은 경제성을 양립
양면 10코너 사양 팁을 채용

Multi-edge cutter realizes the high efficiency cast iron machining
10-cornered pentagonal inserts for stable and economical machining

MFK형은 우수한 밸런스 설계에 의해 저저항 가공이 가능 떨림에 강하고 우수한 정삭면을 얻을 수 있습니다.

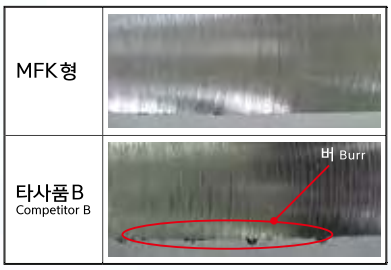
MFK reduces cutting force by good balanced design
Excellent surface finish by controlling chattering

■ 가공면 비교 Surface finish comparison



<절삭조건> Cutting Conditions
피삭재 Workpiece : FCD600, 건식 Dry, Vc=180m/min, fz=0.3mm/t, ap×ae=3×78mm

■ 버 비교 Burr comparison



← 절삭방향 Cutting direction

절삭성이 우수하고 버를 억제
Sharp cutting prevents burr formation

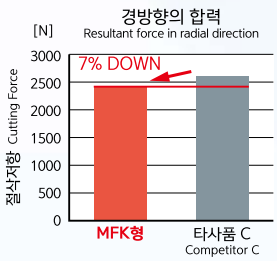
2가지의 포인트 Two points
2가지의 특수 팁 구조가 저저항의 강인 절삭날을 실현

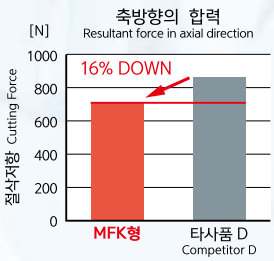
Two special insert structures reduce cutting force and improve edge strength

POINT. 1 헬리컬 절삭날 구조로 저저항

Low cutting force with helical cutting edge design

• 절삭저항 비교 Cutting Force Comparison



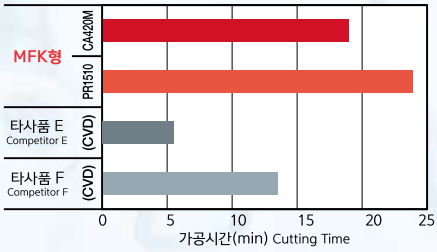


<절삭조건> Cutting Conditions
피삭재 Workpiece : FCD600, 건식 Dry, ø125
Vc=180m/min, fz=0.3mm/t, ap×ae=3.0×62mm

POINT. 2 더블에지 구조로 결손을 억제

Fractures suppressed with double edge position

• 내결손성 비교 Fracture Resistance Comparison



<절삭조건>
Cutting Conditions
피삭재 Workpiece: FCD450(4개 홀) with 4 bores
Vc=300m/min
fz=0.5mm/t
ap=2.0mm
습식 Wet

절입시의 충격 부하 감소를 실현
Reducing impact load when approaching workpiece

■ 가공에 따라 선택하는 홀더 레파토리 Holder lineup to meet various applications

크로스피치(다날사양)과 엑스트라 크로스피치(초다날사양)을 레파토리 가공에 따라 최적인 커터 선택이 가능

Fine pitch type and extra fine pitch type are available
Choose most suitable cutter for your application

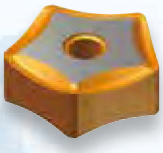
크로스피치 (예 : ø125 12날)
Fine Pitch (Example : ø125 12 inserts)

- 워크 강성이 낮은 경우에 추천
  Recommended for low rigid workpiece
- 폭 넓은 가공 영역에 대응 가능
  For wide application range

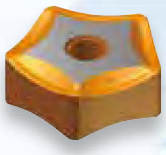
엑스트라 크로스피치 (예 : ø125 18날)
Extra Fine Pitch (Example : ø125 18 inserts)

- 워크 강성이 높은 경우에 추천
  Recommended for high rigid workpiece
- 고능률 가공이 가능
  For high efficiency machining

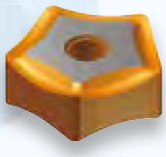
■ 풍부한 브레이커 라인업으로 다양한 가공에 대응 Applicable to various applications with wide range lineup of chipbreakers



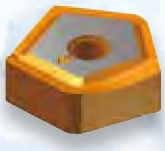
범용 :
GM브레이커
General use:
GM Chipbreaker



인선강화형 :
GH브레이커
Strong edge:
GH Chipbreaker



정삭용:
GL브레이커
(연마급)
Finishing:
GL Chipbreaker
Ground



와이퍼 :
W브레이커
(연마급)
Wiper edge:
W Chipbreaker
Ground

■ 신 밀링용 CVD 재종 "CA420M"이 긴수명 · 안정가공을 실현

New milling CVD grade CA420M realizes long tool life and stable machining

CRIOS Technology
CRYSTAL INTERFACE ORIENTATION STRUCTURE

진보된 CVD코팅 CRIOS Technology 가 상식을 바꿨습니다.

Advanced CVD coating CRIOS Technology revolutionizes common sense

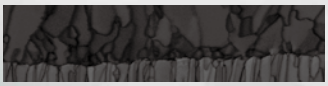
교세라 독자의 결정 제어 기술과 피막 밀착 강도의 향상에 의한 CVD코팅은 새로운 단계로

Kyocera's unique crystal control technology and advanced film adhesion lead CVD coating to the next stage

수명을 길게
Longer tool life

α-Al_2O_3(알루미나)의 결정 성장을
내마모성과 내결손성이 높아지는 방향으로 제어
Control α-Al_2O_3 crystal growth for improving
wear resistance and fracture resistance

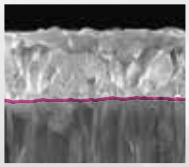
CRIOS Technology



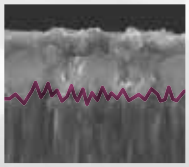
기 존 품 Conventional

막박리 억제
Prevent film peeling

경계면 최적화에 의한,
피막 밀착 강도를 기존대비 40% 향상
40% improved film adhesion
by optimized interface



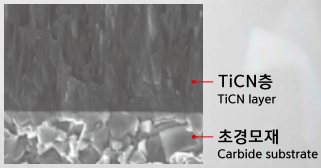
CRIOS Technology



기 존 품
Conventional

칩핑을 방지
Control chipping

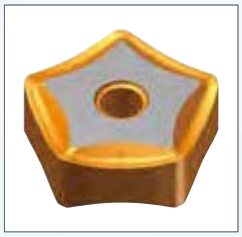
높은 종횡비 TiCN층에 의한
피막 강도·내결손성을 향상
Higher film strength and fracture resistance
with high aspect ratio TiCN



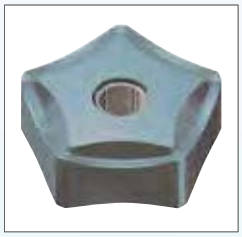
CRIOS Technology

"CRIOS Technology"는 교세라 독자의 CVD코팅 기술의 명칭입니다. CRIOS Technology is Kyocera's original CVD coating technology

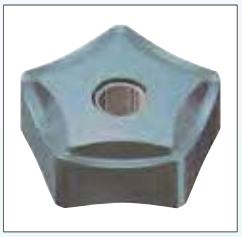
■ 팁 재종의 사용분류 Insert grade lineup



긴수명 · 제1추천
CA420M
Long tool life (1st recommendation)

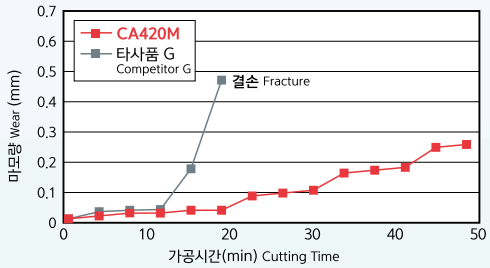


안전가공 중시
PR1510
Stable machining



내결손성 중시
PR1525
Fracture resistance

■ 내마모 비교 Wear resistance comparison



<절삭조건> Cutting Conditions
피삭재 Workpiece : FCD450, 건식 Dry
Vc=200m/min, fz=0.3mm/t, ap×ae=2.0×80

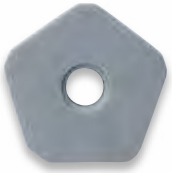
■ 고속 · 고능률 가공을 실현하는 세라믹 재종 Ceramic grades for high speed and high efficiency machining

주철가공용 질화규소 세라믹 KS6050/CS7050

Si_3N_4 ceramic insert grades for cutting cast iron

주철가공의 제 1 추천 KS6050

First recommendation for cast iron



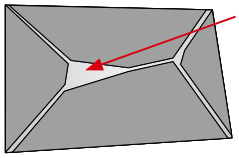
POINT. 1 내마모성이 우수하여 안정가공이 가능

High wear resistance enables stable machining

절삭성능에 악영향을 미치는 입계상을 감소

Reduces grain boundary phase that generates negative impact on the cutting performance

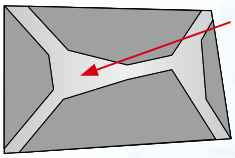
입계상이 적음
Less grain boundary phase



KS6050
입계상을 억제해
기계적 성능과 열적성능을 향상
Mechanical and thermal property will be improved by controlling grain boundary phase

→ 칩핑을 억제해 안정가공이 가능
Stable machining by controlling chipping

입계상이 많음
More grain boundary phase

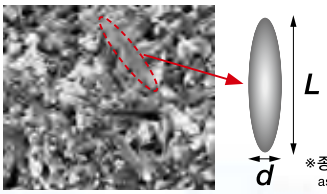


기존 재종 Conventional Grade
입계상(glass)이 많아 절삭열의 영향으로 강도 저하 발생
The grain boundary phase contained a high proportion of glass, therefore its toughness will be weakened by cutting heat

→ 칩핑이 발생해 불안정
Unstable machining due to chipping

POINT. 2 돌발 결손을 억제

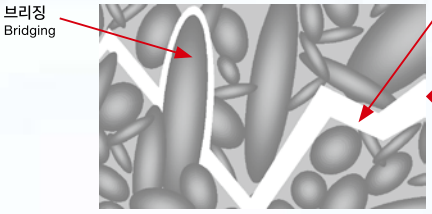
Prevention of sudden fracture



KS6050는 기존품에 비해 종횡비가 큽니다.
KS6050 has high aspect ratio compared with conventional grade

※종횡비= L/d
aspect ratio

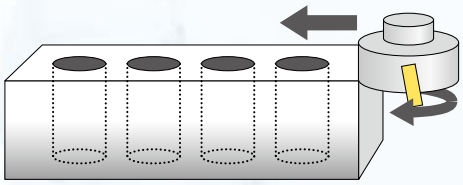
크랙의 확산 Crack propagation



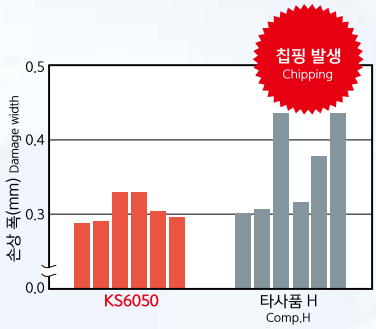
종횡비 : 큼 ⇒ 크랙의 확산을 억제
Large aspect ratio ⇒ Controls crack propagation

내결손성 향상
Fracture resistance improvement

• 내결손성 비교 Fracture Resistance Comparison



<절삭조건> Cutting Conditions
Vc=500m/min, ap=2mm, fz=0.5mm/t, 건식 Dry
피삭재 Workpiece Material : FCD450 (4홀 블럭 4-hole block)
팁 Insert : SNGN120412T02025

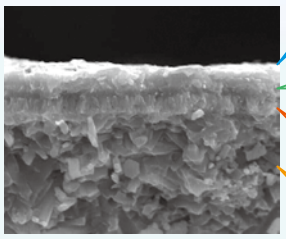


단속가공시에 있어서도 손상 폭이 작음
Less damage at interrupted cutting

→ **우수한 내결손성**
High fracture resistance

덕타일 주철 가공의 제 1 추천 CS7050

First recommendation for ductile cast iron



높은 코팅 밀착력에 의한 내마모성 향상, 고속가공에도 대응

Wear resistance improvement due to high coating adhesion.
Suitable for high speed cutting.

■ MFK형 페이스밀 MFK Face Mill

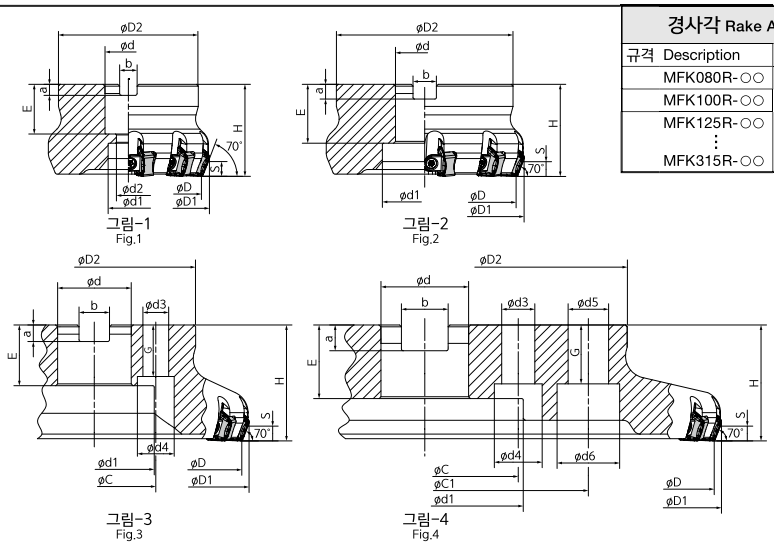


그림-1 Fig.1 · 그림-2 Fig.2 · 그림-3 Fig.3 · 그림-4 Fig.4

경사각 Rake Angle(°)		
규격 Description	A.R.	R.R.
MFK080R-○○	(MAX.) +15°	-7°
MFK100R-○○		-6°
MFK125R-○○ ⋮ MFK315R-○○		-5°

홀더 치수 Toolholder Dimensions

타입 Type		규 격 Description	재고 Stock	날수 No. of inserts	치수(mm) Dimension øD	øD1	øD2	ød	ød1	ød2	H	E	a	b	s	ød3	ød4	ød5	ød6	øC	øC1	G	형 상 Drawing	중량(kg) Weight
인치 사양 Inch Spec	크로스 피치 Fine pitch	MFK 080R-11-8T	●	8	80	89	76	31.75	26	17	63	32	8	12.7	6.0	–	–	–	–	–	–	–	그림-1 fig.1	1.76
		100R-11-10T	●	10	100	109	96																	2.98
		125R-11-12T	●	12	125	134	100	38.1	55	–		38	10	15.9									그림-2 fig.2	3.65
		160R-11-16T	●	16	160	169		50.8	70				11	19.1										4.62
		200R-11-20T	●	20	200	209	142	47.625	110			40	14	25.4		18	26			101.6		32	그림-3 fig.3	7.65
		250R-11-24T	●	24	250	259																		10.73
		315R-11-28T	수	28	315	324	220											22	32		177.8		그림-4 fig.4	19.71
	엑스트라 크로스 피치 Extra Fine pitch	MFK 080R-11-10T	●	10	80	89	76	31.75	26	17	63	32	8	12.7	6.0	–	–	–	–	–	–	–	그림-1 fig.1	1.70
		100R-11-14T	●	14	100	109	96																	2.85
		125R-11-18T	●	18	125	134	100	38.1	55	–		38	10	15.9									그림-2 fig.2	3.44
		160R-11-22T	●	22	160	169		50.8	70				11	19.1										4.44
		200R-11-28T	●	28	200	209	142	47.625	110			40	14	25.4		18	26			101.6		32	그림-3 fig.3	7.40
		250R-11-36T	●	36	250	259																		10.36
		315R-11-44T	수	44	315	324	220											22	32		177.8		그림-4 fig.4	19.21
미리 사양 Metric Spec	크로스 피치 Fine pitch	MFK 080R-11-8T-M	●	8	80	89	76	27	20	13	63	24	7	12.4	6.0	–	–	–	–	–	–	–	그림-1 fig.1	1.87
		100R-11-10T-M	●	10	100	109	96	32	26	17		28	8	14.4										2.99
		125R-11-12T-M	●	12	125	134	100	40	55	–		33	9	16.4									그림-2 fig.2	3.56
		160R-11-16T-M	●	16	160	169			70							14	20			66.7		28	그림-3 fig.3	4.51
		200R-11-20T-M	●	20	200	209	142	60	110			40	14	25.7		18	26			101.6		32		7.35
		250R-11-24T-M	●	24	250	259																		10.43
		315R-11-28T-M	수	28	315	324	220											22	32		177.8		그림-4 fig.4	19.41
	엑스트라 크로스 피치 Extra Fine pitch	MFK 080R-11-10T-M	●	10	80	89	76	27	20	13	63	24	7	12.4	6.0	–	–	–	–	–	–	–	그림-1 fig.1	1.81
		100R-11-14T-M	●	14	100	109	96	32	26	17		28	8	14.4										2.86
		125R-11-18T-M	●	18	125	134	100	40	55	–		33	9	16.4									그림-2 fig.2	3.38
		160R-11-22T-M	●	22	160	169			70							14	20			66.7		28	그림-3 fig.3	4.32
		200R-11-28T-M	●	28	200	209	142	60	110			40	14	25.7		18	26			101.6		32		7.10
		250R-11-36T-M	●	36	250	259																		10.07
		315R-11-44T-M	수	44	315	324	220											22	32		177.8		그림-4 fig.4	18.92

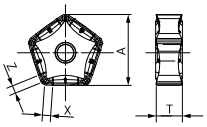
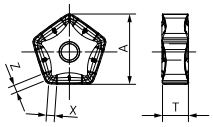
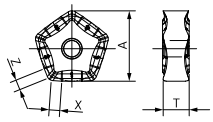
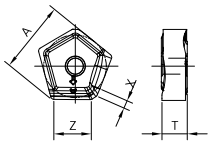
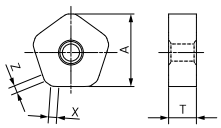
● : 표준사양 Std. Item 수 : 주문생산 Made To Order

부품과 적합 팁 Spare Parts and Applicable Inserts

규 격 Description	부품 Spare Parts: 웨지 Wedge	웨지 스크류 Wedge screw	렌치 Wrench	아바 체결용 볼트 Mounting Bolt	적합 팁 Applicable Inserts
MFK 080R-11-8T	C09N	W6X18N	TT-15	HH16X40	PNMG1106XNEN-GM PNMG1106XNEN-GH PNEG1106XNEN-GL PNEG1106XNER-W PNEA1106XNTN-T01020
100R-11-10T					
125R-11-12T				–	
160R-11-16T					
200R-11-20T					
250R-11-24T					
315R-11-28T					
MFK 080R-11-10T	C09N	W6X18N	TT-15	HH16X40	PNMG1106XNEN-GM PNMG1106XNEN-GH PNEG1106XNEN-GL PNEG1106XNER-W PNEA1106XNTN-T01020
100R-11-14T					
125R-11-18T				–	
160R-11-22T					
200R-11-28T					
250R-11-36T					
315R-11-44T					

규 격 Description	부품 Spare Parts: 웨지 Wedge	웨지 스크류 Wedge screw	렌치 Wrench	아바 체결용 볼트 Mounting Bolt	적합 팁 Applicable Inserts
MFK 080R-11-8T-M	C09N	W6X18N	TT-15	HH12X35	PNMG1106XNEN-GM PNMG1106XNEN-GH PNEG1106XNEN-GL PNEG1106XNER-W PNEA1106XNTN-T01020
100R-11-10T-M				HH16X40	
125R-11-12T-M				–	
160R-11-16T-M					
200R-11-20T-M					
250R-11-24T-M					
315R-11-28T-M					
MFK 080R-11-10T-M	C09N	W6X18N	TT-15	HH12X35	PNMG1106XNEN-GM PNMG1106XNEN-GH PNEG1106XNEN-GL PNEG1106XNER-W PNEA1106XNTN-T01020
100R-11-14T-M				HH16X40	
125R-11-18T-M				–	
160R-11-22T-M					
200R-11-28T-M					
250R-11-36T-M					
315R-11-44T-M					

적합 팁 Applicable Inserts

형 상 Insert		규 격 Description	치수(mm) Dimension				CVD 코팅 CVD Coated Carbide	MEGACOAT NANO		세라믹 Ceramic	
			A	T	X	Z	CA420M	PR1510	PR1525	KS6050	CS7050
범용 General		PNMG1106XNEN-GM	17.23	6.35	2.0	2.0	●	●	●	–	–
인선강화형 Tough edge		PNMG1106XNEN-GH					●	●	●	–	–
면조도 중시 Sarface-finish Oriented		PNEG1106XNEN-GL	17.18		2.6	2.6	●	●	●	–	–
와이퍼 팁 (2코너 사양) Wiper insert (2-edge)		PNEG1106XNER-W	18.02		2.0	10.0	●	●	●	–	–
고속가공용 High Speed		PNEA1106XNTN-T01020	16.94	6.5	1.5	1.5	–	–	–	●	●

● : 표준재고 Std. Item

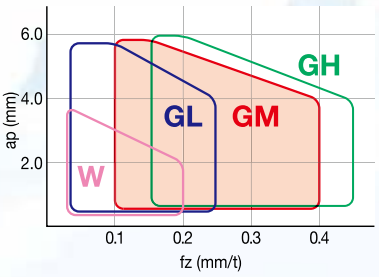
절삭조건 Recommended Conditions

피삭재 Workpiece Material	팁 재종 Insert Grade	절삭속도 Cuting Speed (m/min)	브레이커 형식 Chipbreakers	1날당의 이송(mm/t) fz(mm/t) Feed per tooth (0.06 0.1 0.2 0.3 0.4)
주철 Gray Cast Iron FC	CA420M	170～230～300	GM★	0.25
	PR1510 PR1525	120～180～250	GH☆	0.3
			GL	0.12
덕타일 주철 Nodular Cast Iron FCD	CA420M	150～200～250	GM★	0.2
	PR1510 PR1525	100～150～200	GH☆	0.25
			GL	0.1

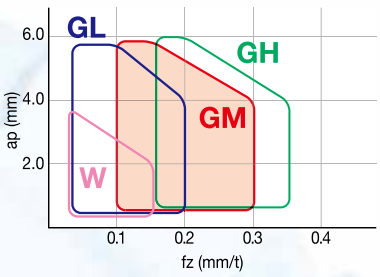
★ : 제1추천 1st recommendation ☆ : 제2추천 2nd recommendation

■ 추천 영역 Recommended application range

피삭재 Workpiece : FC



피삭재 Workpiece : FCD



※주의
1.W를 사용하는 경우에는「GM+W」「GH+W」의 조합으로 사용하여 주십시오.
2.fz=0.2 이상으로 사용하면 코너부의 손상이 큽니다. W의 주절삭날은 GM, GH 보다 아래에 있습니다.
그에 따라, W의 다음에 가공을 하는 절삭날은 설정의 2배 이송으로 가공하게 됩니다.

Notes
When using W type, please use together with GM or GH.
If machining over fz=0.2, insert corner will be damaged. The main cutting edge of W type insert is receding from that of GM and GH.
Therefore, the feed rate for the insert next to W type is double of the other inserts.

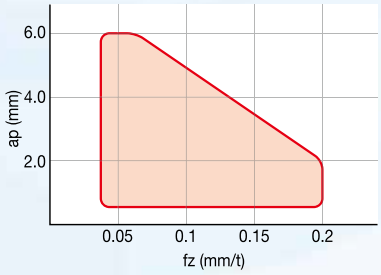
■ 절삭조건(세라믹 재종) Recommended Conditions(Ceramic)

피삭재 Workpiece Material	팁 재종 Insert Grade	절삭속도 Cuting Speed (m/min)	인선사양 Edge Preparation	1날당의 이송(mm/t) fz(mm/t) Feed per tooth (0.05 0.1 0.2 0.3 0.4)
주철 Gray Cast Iron FC	KS6050★ CS7050☆	600～**900**～1200	0.10×20°	0.1
덕타일 주철 Nodular Cast Iron FCD	KS6050☆ CS7050★	400～**600**～900		

★ : 제1추천 1st recommendation ☆ : 제2추천 2nd recommendation

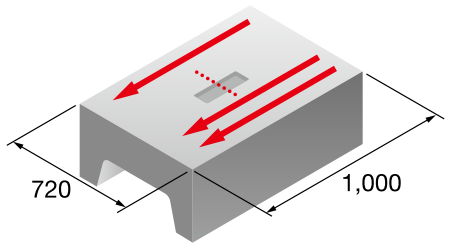
■ 추천영역(세라믹 재종) Recommended application range(Ceramic)

피삭재 Workpiece : FC/FCD



■ 가공 사례 Case Studies

FC250



·기계용 베이스 Machine base
·Vc=160m/min
·fz=0.16mm/t(Vf=782mm/min)
·ap×ae=3×100mm

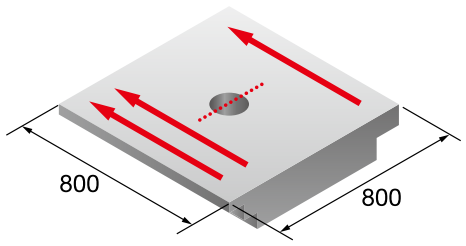
·건식 Dry
·MFK125R-11-12T(12날) 12 inserts
·PNMG1106XNEN-GM(PR1510)

PR1510	칩 배출량 = 235cc/분 Chip Removal Rate = 235cc/min 가공능률 약2배 Efficiency 2 times	
타사품 H(12날) Competitor H (12 inserts)		칩 배출량 = 125cc/분 Chip Removal Rate = 125cc/min

절삭속도 및 이송을 올려도 경쾌한 절삭음으로 진동이 적고, 안정가공이 가능
Light noise and small vibration even increasing cutting speed and feed rate

(고객평가) User Evaluation

FC250



·베이스 Base
·Vc=160m/min
·fz=0.18mm/t(Vf=917mm/min)
·ap×ae=3×140mm

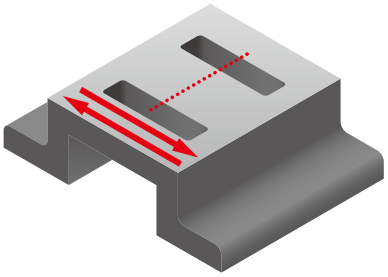
·건식 Dry
·MFK200R-11-20T(20날) 20 inserts
·PNMG1106XNEN-GM(CA420M)

CA420M	칩 배출량 = 385cc/분 Chip Removal Rate = 385cc/min 가공능률 약2배 Efficiency 2 times	
타사품 I(12날) Competitor I (12 inserts)		칩 배출량 = 167cc/분 Chip Removal Rate = 167cc/min

타사품 I에 비해 가공능률이 2.3배로 올랐고, 절삭음은 작으며 안정가공이 가능
CA420M improved the efficiency by 2.3 times. Small noise and stable machining.

(고객평가) User Evaluation

FCD600



·금형부품 Mold part
·Vc=90m/min
·fz=0.34mm/t(Vf=974mm/min)
·ap×ae=2×~60mm

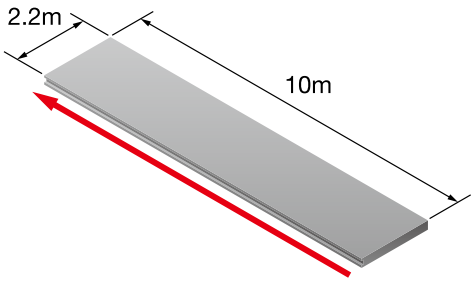
·건식 Dry
·MFK080R-11-8T(8날) 8 inserts
·PNMG1106XNEN-GM(PR1525)

PR1525	가공개수 3개/코너 Machining efficiency: 3 pcs/edge 수명 3배 Tool life 3 times	
타사품 J(8날) Competitor J (8 inserts)		가공개수 1개/코너 Machining efficiency: 1 pcs/edge

타사품 J는 1개 가공 후 칩핑이 발생한 것에 비해, PR1525는 3개 가공 후에도 인선 형상이 우수하여 안정가공이 가능
Competitor J had chipping after machining 1pc. PR1525 kept good edge condition and stable machining after machining 3 pcs.

(고객평가) User Evaluation

FC300



·베드 Bed
·Vc=150m/min
·fz=0.26mm/t(Vf=1,242mm/min)
·ap×ae=3×100mm

·건식 Dry
·MFK160R-11-16T(16날) 16 inserts
·PNMG1106XNEN-GM(CA420M)

CA420M	칩 배출량 = 372cc/분 Chip Removal Rate = 372cc/min 가공능률 4배 Efficiency 4 times	
기존품 K(8날) Conventional K (8 inserts)		칩 배출량=93cc/분 Chip Removal Rate = 93cc/min

CA420M은 기존품 K에 비해, 가공능률이 4배로 향상됨
CA420M improved the efficiency by 4 times compared with Conventional K

(고객평가) User Evaluation

절삭공구에 관한 기술적인 상담은
032-821-8365
FAX:032-821-8369
●근무시간 9:00~12:30 · 13:30~17:30
●토요일 · 일요일 · 공휴일 등은 쉽니다.
한국교세라정공(주) 영업본부

KYOCERA
한국교세라정공(주)
인천광역시 남동구 남동대로215번길 11 (고잔동)
구) 인천광역시 남동구 고잔동 638-1, 남동공단 69BL 2LT
TEL:032-821-8365 FAX:032-821-8369
우:405-817 http://www.kptk.co.kr