

**PRODUCT
NEWS**

PN-E-006

Generation 2020's



MIRROR series

BNM/RNM type



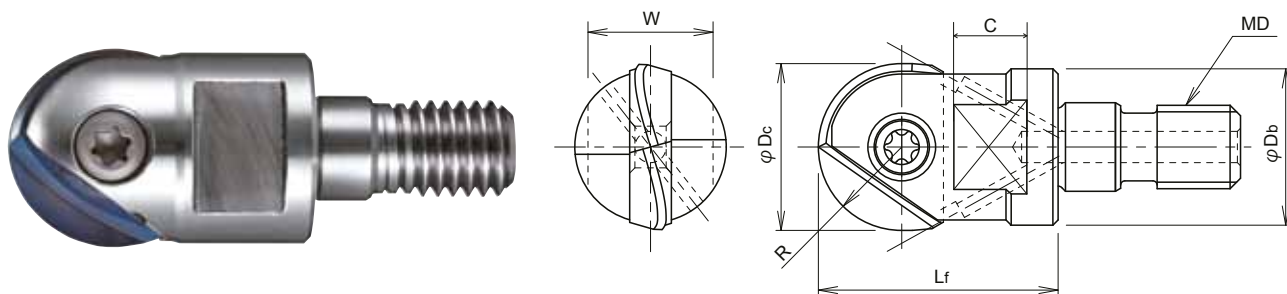
DIJET GmbH www.dijet.de

Mirror Ball

MBX_{TYPE}

Through Coolant Hole

Accuracy of MBX type modular head mounted on MSN carbide shank holder:
O.D. run out **below 15 μ m** (Target **below 10 μ m**)



■ BODY

Cat. No.	Stock	Dimensions (mm)							Inserts	Parts	
		R	ϕD_c	L_f	ϕD_b	MD	C	W		Clamp Screw	Wrench
MBX-100-M6	●	5	10	18	9.7	M6	6.5	8			
MBX-120-M6	●	6	12	20	11.5	M6	6.5	8			
MBX-160-M8	●	8	16	23	15	M8	8	12			
MBX-200-M10	●	10	20	30	18.5	M10	8	14			
MBX-250-M12	●	12.5	25	35	24	M12	10	17			
MBX-300-M16	●	15	30	43 (44)	29	M16	12.5	22			

- Note)
1. Please refer page 7-10 for recommended cutting conditions.
 2. All cutters are supplied without inserts.
 3. Please refer page 7-10 for recommended tightening torque
 4. The number in parentheses shows the dimensions when BNM-320 Type is mounted.
 5. All cutters are supplied without wrench & moly.

Clamp Screw	Recommended Torque (N·m)
FSW-3007H	1.2
FSW-3509H	2.0
FSW-4013H	3.0
FSW-5016H	4.0
FSW-6020	5.0
FSW-8025	6.0

Mirror Ball



BNM_{TYPE}

Mirror Ball Carbide Shanks

1. It is possible to machine deeper mold with high quality and high accuracy at higher cutting parameters due to increased tool rigidity and minimize the vibration.
2. By adopting carbide shank, tool rigidity is equal to solid carbide ball nose end mill.
3. Compared with steel shank, the tool life is almost more than double.
4. Carbide shank can be used on shrink-fit type holders.
5. In case of super finishing application (removal stock below Dc/40), MIRROR RADIUS Insert can be mounted on MIRROR BALL Bodies.



Radius form accuracy of insert mounted on holder:
within $\pm 0.010\text{mm}$

BNM-S-C type (Straight Neck)



BNM-T-C type (Taper Neck)



■ BODY

Cat. No.	Stock	Fig.	Dimensions (mm)								Parts		Inserts		
			R	φD_c	l_1	l_2	L	φD_1	φD_s	$\theta \kappa^\circ$	θn° Taper angle	Clamp Screw	Wrench		
BNMS-060017S-S06C	●	1			-	17	60		6	-	-				
BNMS-060030T-S10C	●	2	3	6	15	30	80	5.4	10	4°14'	6°	FSW-2005H	A-06	BNM-060... (BNM-070)	
BNMM-060035S-S06C	●	1			-	35	92								-
BNML-060017S-S06C	●	1			-	17	120								
BNMS-080025S-S08C	●				-	25	90								
BNMM-080035S-S08C	●				-	35	92								
BNML-080075S-S08C	●	1	4	8	-	75	140	7.2	8			FSW-2506H	A-07	BNM-080... RNM-080...	
BNML-080095S-S08C	●				-	95	160								
BNML-080075T-S12C	●	2			20	75	132		12	1°37'	2°				
BNMS-100030S-S10C	●				-	30	100								
BNMM-100043S-S10C	●				-	43	100								
BNML-100075S-S10C	●	1	5	10	-	75	140	9	10			FSW-3007H	A-08	BNM-100... (BNM-110)	RNM-100...
BNML-100095S-S10C	●				-	95	160								
BNML-100140S-S10C	●				-	140	220								
BNML-100075T-S12C	●	2			23	75	132		12	0°49'	1°30'				
BNMS-120028S-S12C	●				-	28	84								
BNMM-120053S-S12C	●	1			-	53	110	11	12						
BNML-120095S-S12C	●		6	12	-	95	160					FSW-3509H	A-10	BNM-120... RNM-120...	
BNML-120085T-S16C	●	2			27	85	145	10	16	1°27'	2°30'				
BNML-120150S-S12C	□	1			-	150	220	11	12						
BNMS-160033S-S16C	●	1			-	33	93	15	16						
BNMM-160063T-S20C	●	2			30.5	63	123	14	20	2°5'	4°				
BNML-160070S-S16C	●				-	70	140	15	16			FSW-4013H	A-15	BNM-160... RNM-160...	
BNML-160090S-S16C	●	1	8	16	-	90	160								
BNML-160100T-S20C	●	2			30.5	100	166	14	20	1°15'	2°				
BNML-160110S-S16C	●				-	110	180	15	16						
BNML-160150S-S16C	●	1			-	150	220								

- Note) 1. All cutters are supplied without inserts.
2. Please refer page 13 & 14 for recommended cutting conditions.

Please refer page 3 for ★ Caution for the mounting on shrink-fit holder

Mirror Ball



BNM_{TYPE}

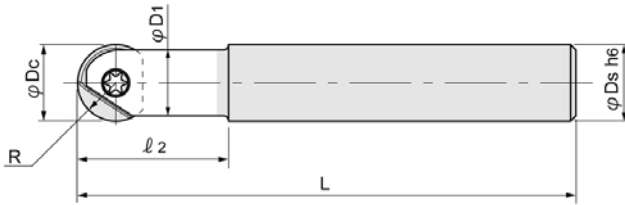


Fig.1 (Straight Neck)

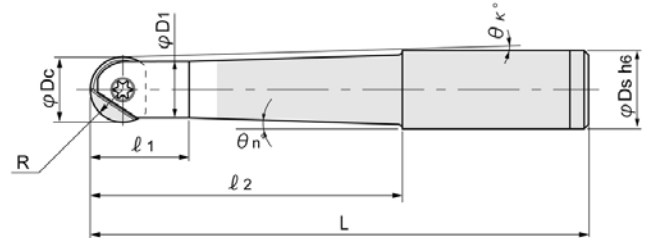


Fig.2 (Taper Neck)

■ BODY

Cat. No.	Stock	Fig.	Dimensions (mm)								Parts		Inserts				
			R	φDc	l ₁	l ₂	L	φD ₁	φD _s	θ _κ [°]	θ _n [°] Taper angle	Clamp Screw	Wrench				
BNMS-200039S-S20C	●				–	39	105			–	–						
BNMM-200075S-S20C	●	1			–	75	141	19	20	–	–						
BNML-200105S-S20C	●		10	20	–	105	180			–	–	FSW-5016H	A-20W	BNM-200...	RNM-200...		
BNML-200115T-S25C	●	2			36	115	191	17	25	1°22'	2°						
BNML-200125S-S20C	●				–	125	200	19	20	–	–						
BNML-200170S-S20C	●	1			–	170	250			–	–						
BNMM-250090S-S25C	●		12.5	25	–	90	166	24	25	–	–	FSW-6020	A-30	BNM-250...	RNM-250...		
BNML-250140S-S25C	●	1			–	140	220			–	–						

Note) 1. All cutters are supplied without inserts.
2. Please refer page 13 & 14 for recommended cutting conditions.

Clamp Screw	Recommended torque (N·m)	Clamp Screw	Recommended torque (N·m)
FSW-2005H	0.5	FSW-4013H	3.0
FSW-2506H	0.9	FSW-5016H	4.0
FSW-3007H	1.2	FSW-6020	5.0
FSW-3509H	2.0	FSW-8025	6.0

★ Caution for the mounting on shrink-fit holder (In case of BNM-C Body, RNM-C Body)

When you use a carbide shank (C Body) on the shrink-fit holder, please shrink-fit only carbide shank without putting insert and clamp screw.

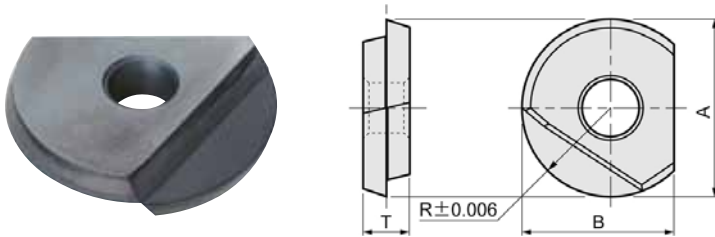
Please mount the insert and tighten the clamp screw after shrink-fit.

Note) If it shrink-fits with the insert and clamp screw, it will be difficult to loose the clamp screw.

Mirror Ball BNM_{TYPE}

Mirror Ball Insert

■ INSERTS



Radius form accuracy
of inserts:
within $\pm 0.006\text{mm}$

Cat. No.	PVD coated	Diamond coated	Uncoated	Dimensions (mm)			
	DH111 (Z10)	JC10000	KT9 (K10)	R	A	B	T
BNM-060	●	●	●	3	6	5	2
BNM-080	●	□	●	4	8	7	2.4
BNM-100	●	□	●	5	10	8.5	2.6
BNM-120	●	●	●	6	12	10	3
BNM-160	●	□	●	8	16	12	4
BNM-200	●	●	●	10	20	15	5
BNM-250	●		□	12.5	25	18.5	6
BNM-300	●		□	15	30	22.5	7
BNM-320	●		□	16	32	23.5	7

2 inserts per case, but in case of grade JC10000: 1 piece per case.

Cat. No.	Uncoated	DLC	Dimensions (mm)				
	FZ05 (Z01)	JC20003	R	A	B	C	T
BNM-060-S	●	□	3	6	5	—	2
BNM-080-S	●	□	4	8	7	0.5	2.4
BNM-100-S	●	□	5	10	8.5	1	2.6
BNM-120-S	●	□	6	12	10	1	3
BNM-160-S	●	□	8	16	12	1	4
BNM-200-S	●	□	10	20	15	1	5
BNM-250-S	●	□	12.5	25	18.5	1	6
BNM-300-S	●	□	15	30	22.5	1	7

2 inserts per case.

★ Instructions for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Refer the right table for recommended tightening torque.

Dimensions (mm)	Recommended torque
φDc	(N·m)
6	0.5
8	0.9
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Ball

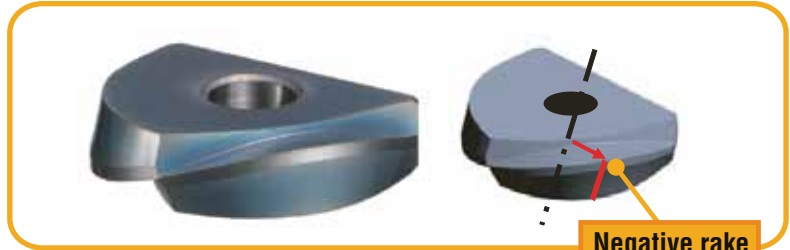
BNM_{TYPE}

■ INSERT (S type, TG type) **Mirror S**

BNM-S: Standard type



BNM-TG: Stronger cutting edge type



Negative rake

BNM-SS Type

Fig. 1 Below R8
(Tool dia. Below 16mm)

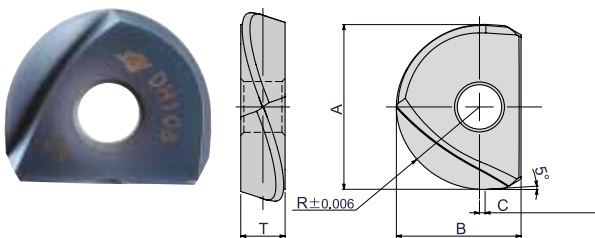
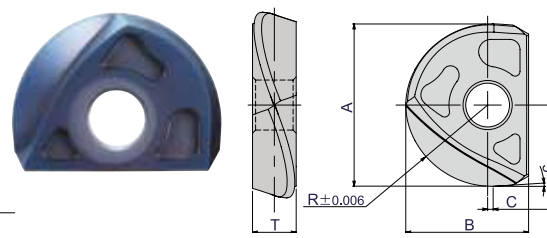


Fig. 2 Above R10
(Tool dia. Above 20mm)



Radius form accuracy of inserts:
within $\pm 0.006\text{mm}$



Cat. No.	PVD coated	Dimensions (mm)				
	DH108 (Z10)	R	A	B	C	T
BNM-060-SS	●	3	6	5	—	2
BNM-080-SS	●	4	8	7	0.5	2.4
BNM-100-SS	●	5	10	8.5	1	2.6
BNM-120-SS	●	6	12	10	1	3
BNM-160-SS	●	8	16	12	1	4
BNM-200-SS	●	10	20	15	1	5
BNM-250-SS	●	12.5	25	18.5	1	6
BNM-300-SS	□	15	30	22.5	1	7
BNM-320-SS	●	16	32	23.5	1	7

Cat. No.	PVD coated	Dimensions (mm)				
	DH102 (Z01)	R	A	B	C	T
BNM-060-TG	●	3	6	5	—	2
BNM-080-TG	●	4	8	7	0.5	2.4
BNM-100-TG	●	5	10	8.5	1	2.6
BNM-120-TG	●	6	12	10	1.5	3
BNM-160-TG	●	8	16	12	1.5	4
BNM-200-TG	●	10	20	15	2	5
BNM-250-TG	●	12.5	25	18.5	2	6
BNM-300-TG	●	15	30	22.5	2	7
BNM-320-TG	□	16	32	23.5	2	7

2 inserts per case.

- Note) 1. "Mirror S, Mirror TG" inserts are exclusive use of MIRROR BALL.
Please use only in MIRROR BALL body and modular head.
2. BNM-060-SS and BNM-060-TG don't have straight cutting edge.

Please refer page 4 for "Instructions for mounting insert"

Mirror Ball

BNM_{TYPE}

■ CONTROLLED TORQUE WRENCH (WITH REPLACEABLE BLADE)

● Tightening a screw is controlled with proper torque wrench

Wrenches are pre-set to protect screws and tools against damage during tightening and loosening processes. This wrench is recommended to use especially with Mirror ball.

- Size: T6, T7, T8, T10
- Replaceable blades



● Controlled torque wrench (with replaceable blade)

Cat. No.	Torx No.	Torque value	Applicable blades	Applicable holders
TQC-06	T6	0.5Nm	B-06	BNM○-06...type RNM○-06...type
TQC-07	T7	0.9Nm	B-07	BNM○-08...type RNM○-08...type
TQC-08	T8	1.2Nm	B-08	BNM○-10...type RNM○-10...type
TQC-10	T10	2.0Nm	B-10	BNM○-12...type RNM○-12...type

● Blades

Cat. No.	Torx No.	Applicable torque control wrench
B-06	T6	TQC-06
B-07	T7	TQC-07
B-08	T8	TQC-08
B-10	T10	TQC-10

RECOMMENDED CUTTING CONDITIONS / HIGH SPEED MACHINING

MBX type + MSN Carbide Shank Holder

Work Materials	Insert Grades		Cutting speed Vc (m/min)	Tool dia. (mm)						Max. Depth of cut ap (mm)	Max. Pick feed ae (mm)
	BNM	BNM-SS BNM-TG		10		12		16			
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)		
Grey cast iron 160-260 HB	DH111	DH102 DH108	750	24,000	9,600	20,000	10,000	15,000	10,000	0.1-0.3	0.02Dc
Nodular cast iron 170-300 HB		DH102 DH108	600	19,000	7,000	16,000	7,000	12,000	7,000	0.1-0.3	0.02Dc
Carbon steel 180-280 HB	DH111	DH108	600	19,000	7,000	16,000	7,000	12,000	7,000	0.1-0.3	0.02Dc
Low alloy steel 180-280 HB		DH108	600	19,000	7,000	16,000	7,000	12,000	7,000	0.1-0.2	0.015Dc
Tool & Die steel 180-255 HB		DH108	600	19,000	7,000	16,000	7,000	12,000	7,000	0.1-0.2	0.015Dc
Hardened die steel 40-55 HRC	DH111	DH102 DH108	450	14,500	4,300	12,000	4,800	9,000	4,500	0.1-0.2	0.015Dc
Hardened die steel 56-63 HRC		DH102 DH108	300	9,500	2,800	8,000	3,200	6,000	3,000	0.05-0.1	0.015Dc
Stainless steel 150-250 HB	DH111	DH108	500	16,000	6,000	13,500	6,000	10,000	6,000	0.1-0.2	0.015Dc
Copper alloy 80-150 HB	KT9	FZ05	600	19,000	9,000	16,000	9,600	12,000	8,400	0.1-0.3	0.02Dc
Aluminium alloy 30-100 HB			800	25,000	12,500	21,000	12,600	16,000	11,200	0.1-0.5	0.02Dc

n: Spindlespeed, Vf: Feedspeed

★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)
Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
φDc	N~m
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Ball

MBX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / HIGH SPEED MACHINING

● MBX type + MSN Carbide Shank Holder

Work Materials	Insert Grades		Cutting speed Vc (m/min)	Tool dia. (mm)						Max. Depth of cut ap (mm)	Max. Pick feed ae (mm)
	BNM	BNM-SS BNM-TG		20		25		30/32			
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)		
Grey cast iron 160-260 HB	DH111	DH102 DH108	750	12,000	9,000	9,600	8,000	8,000	8,000	0.1-0.3	0.02Dc
Nodular cast iron 170-300 HB		DH102 DH108	600	9,600	6,700	7,700	6,000	6,500	6,000	0.1-0.3	0.02Dc
Carbon steel 180-280 HB	DH111	DH108	600	9,600	6,700	7,700	6,000	6,500	6,000	0.1-0.3	0.02Dc
Low alloy steel 180-280 HB		DH108	600	9,600	6,700	7,700	6,000	6,500	6,000	0.1-0.2	0.015Dc
Tool & Die steel 180-255 HB		DH108	600	9,600	6,700	7,700	6,000	6,500	6,000	0.1-0.2	0.015Dc
Hardened die steel 40-55 HRC	DH111	DH102 DH108	450	7,200	3,600	5,750	3,450	4,800	3,360	0.1-0.2	0.015Dc
Hardened die steel 56-63 HRC		DH102 DH108	300	4,800	2,400	3,850	2,300	3,200	2,200	0.05-0.1	0.015Dc
Stainless steel 150-250 HB	DH111	DH108	500	8,000	4,800	6,400	4,500	5,300	4,200	0.1-0.2	0.015Dc
Copper alloy 80-150 HB	KT9	FZ05	600	9,600	7,600	7,700	6,200	6,500	6,500	0.1-0.3	0.02Dc
Aluminium alloy 30-100 HB			800	12,700	10,000	10,200	8,200	8,500	8,500	0.1-0.5	0.02Dc

n: Spindle speed, Vf: Feed speed

★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)
Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
φ Dc	N~m
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Ball

MBX_{TYPE}

RECOMMENDED CUTTING CONDITIONS

MBX type + MSN Carbide Shank Holder

Work Materials	Insert Grades		Cutting speed Vc (m/min)	Tool dia. (mm)						Max. Depth of cut ap (mm)	Max. Pick feed ae (mm)
	BNM	BNM-SS BNM-TG		10		12		16			
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)		
Grey cast iron 160-260 HB	DH111	DH102 DH108	450	14,500	4,400	12,000	4,800	9,000	4,500	0.02Dc	0.025Dc
Nodular cast iron 170-300 HB		DH102 DH108	350	11,000	3,300	9,200	3,700	7,000	3,500	0.02Dc	0.025Dc
Carbonsteel 180-280HB	DH111	DH108	350	11,000	3,300	9,200	3,700	7,000	3,500	0.02Dc	0.02Dc
Low alloy steel 180-280 HB		DH108	350	11,000	3,300	9,200	3,700	7,000	3,500	0.02Dc	0.02Dc
Tool & Die steel 180-255 HB		JC8008	350	11,000	3,300	9,200	3,700	7,000	3,500	0.02Dc	0.02Dc
Hardened die steel 40-55 HRC	DH111	DH102 DH108	250	8,000	2,000	6,700	2,000	5,000	2,000	0.015Dc	0.02Dc
Hardened die steel 56-63 HRC		DH102 DH108	200	6,400	1,300	5,300	1,500	4,000	1,400	0.01Dc	0.02Dc
Stainless steel 150-250HB	DH111	DH108	300	9,600	3,000	8,000	3,200	6,000	3,000	0.02Dc	0.02Dc
Copperalloy 80-150HB	KT9	FZ05	350	11,000	3,800	9,200	4,000	7,000	3,850	0.02Dc	0.025Dc
Aluminium alloy 30-100 HB			500	16,000	6,400	13,500	6,800	10,000	6,000	0.03Dc	0.03Dc

n: Spindle speed, Vf: Feed speed

★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)
Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
φ Dc	N~m
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Ball

MBX_{TYPE}

RECOMMENDED CUTTING CONDITIONS

● MBX type + MSN Carbide Shank Holder

Work Materials	Insert Grades		Cutting speed Vc (m/min)	Tool dia. (mm)						Max. Depth of cut ap (mm)	Max. Pick feed ae (mm)
	BNM	BNM-SS BNM-TG		20		25		30/32			
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)		
Grey cast iron 160-260 HB	DH111	DH102 DH108	450	7,200	4,300	6,000	4,000	5,000	4,000	0.02Dc	0.025Dc
Nodular cast iron 170-300 HB		DH102 DH108	350	5,600	3,000	4,500	2,700	4,000	2,800	0.02Dc	0.025Dc
Carbon steel 180-280 HB	DH111	DH108	350	5,600	3,000	4,500	2,700	4,000	2,800	0.02Dc	0.02Dc
Low alloy steel 180-280 HB		DH108	350	5,600	3,000	4,500	2,700	4,000	2,800	0.02Dc	0.02Dc
Tool & Die steel 180-255 HB		DH108	350	5,600	3,000	4,500	2,700	4,000	2,800	0.02Dc	0.02Dc
Hardened die steel 40-55HRC	DH111	DH102 DH108	250	4,000	1,800	3,200	1,600	2,700	1,400	0.015Dc	0.02Dc
Hardened die steel 56-63 HRC		DH102 DH108	200	3,200	1,300	2,600	1,300	2,000	1,000	0.01Dc	0.02Dc
Stainless steel 150-250 HB	DH111	DH108	300	4,800	2,400	3,850	2,100	3,200	2,000	0.02Dc	0.02Dc
Copper alloy 80-150 HB	KT9	FZ05	350	5,600	3,400	4,500	3,150	4,000	3,200	0.02Dc	0.025Dc
Aluminium alloy 30-100 HB			500	8,000	5,600	6,400	4,500	5,300	4,800	0.03Dc	0.03Dc

n: Spindle speed, Vf: Feed speed

★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)
Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
φ Dc	N~m
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

GENERAL RECOMMENDED CUTTING CONDITIONS

● Calculation of cutting conditions

1. Spindle speed

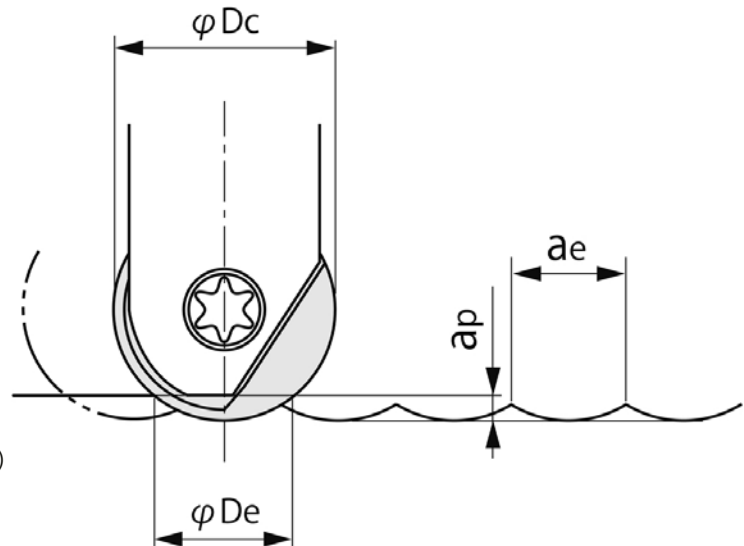
$$n = \frac{V_c \times 1000}{\pi \times D_e} \text{ (min}^{-1}\text{)}$$

$$D_e = 2 \times \sqrt{a_p \times (D_c - a_p)} \text{ (mm)}$$

2. Feed speed

$$V_f = n \times f \text{ (mm/min)}$$

$$f = h_{\text{max}} \times \frac{D_c}{\sqrt{a_p \times (D_c - a_p)}} \text{ (mm/rev)}$$



- n = Spindle speed (min⁻¹)
- V_c = Cutting speed (m/min), refer Table 1.
- D_e = Effective tool diameter (mm), refer Table 2.
- a_p = Axial depth of cut (mm)
- a_e = Pick feed, radial depth of cut (mm)
- V_f = Feed speed (mm/min)
- f = feed per revolution (mm/rev), refer Table 1.
- h_{max} = Max. chip thickness (mm), refer Table 3.

Table 1. Nominal cutting speed and feed values

Work Materials	Hardness	Insert Grades			Cutting speed V _c (m/min)	Nominal feed rate: f (mm/rev)										Max depth of cut a _p (mm)	Max pick feed a _e (mm)
		DH111	JC10000	KT9		Tool dia. D _c (mm)											
						6	8	10	12	16	20	25	30	32			
Grey cast iron (FC250, FC300)	160~260HB	◎			200~400	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.7	D _c /10	D _c /10	
Nodular cast iron (FCD600, FCD700)	170~300HB	◎			150~350	0.2	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.7	D _c /15	D _c /15	
Carbon steel (S50C, S55C)	180~280HB	○			180~230	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	D _c /15	D _c /15	
Low alloy steel (SCM440)	180~280HB	○			150~200	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	D _c /15	D _c /15	
Mold steel (HPM, NAK)	280~400HB	◎			110~170	0.15	0.25	0.3	0.4	0.4	0.4	0.5	0.5	0.5	D _c /20	D _c /20	
Tool & Die steel (SKD61, SKD11)	180~255HB	○			130~180	0.15	0.25	0.3	0.4	0.5	0.5	0.6	0.6	0.6	D _c /20	D _c /20	
Hardened steel (SKD61, SKD11)	40~55HRC	◎			70~90	0.15	0.25	0.3	0.4	0.5	0.5	0.6	0.6	0.6	D _c /30	D _c /30	
Stainless steel (SUS304, SUS316)	150~250HB	○			90~130	0.15	0.25	0.3	0.4	0.4	0.4	0.5	0.5	0.5	D _c /20	D _c /20	
Copper alloy	80~150HB			◎	150~200	0.25	0.4	0.5	0.6	0.7	0.7	0.8	0.8	0.8	D _c /10	D _c /10	
Aluminium alloy	30~100HB			◎	200~300	0.25	0.4	0.5	0.6	0.7	0.7	0.8	0.8	0.8	D _c /6	D _c /6	
Graphite			◎		200~400	0.3	0.5	0.6	0.7	0.8	0.8	0.9	0.9	0.9	D _c /5	D _c /5	

Note) 1. Data is applicable to short series tools and over φ 12mm middle series tools.

2. Refer table 4 for additional data in case of using long series tools and up to φ 12mm middle series tools.

◎: First choice
○: Second choice

Mirror Ball

BNM_{TYPE}

Table 2. Effective tool diameter chart

Tool dia. φD_c (mm)	Effective tool diameter: D_e (mm)													
	Axial depth of cut: a_p (mm)													
	0.2	0.3	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
6	2.2	2.6	3.3	4.5										
8	2.5	3	3.9	5.3	6.2									
10	2.8	3.4	4.4	6	7.1	8								
12	3.1	3.7	4.8	6.6	7.9	8.9	9.7							
16	3.6	4.3	5.6	7.7	9.3	10.6	11.6	12.5						
20	4	4.9	6.2	8.7	10.5	12	13.2	14.3	15.2	16				
25	4.5	5.4	7	9.8	11.9	13.6	15	16.2	17.3	18.3	19.2	20		
30	4.9	6	7.7	10.8	13.1	15	16.6	18	19.3	20.4	21.4	22.4	23.2	24
32	5	6.2	7.9	11.1	13.5	15.5	17.2	18.7	20	21.2	22.2	23.2	24.1	25

Table 3. Maximum chip thickness chart

Work Materials	Hardness	Max. chip thickness: h_{max} (mm)								
		Tool dia.: D_c (mm)								
		6	8	10	12	16	20	25	30	32
Grey cast iron (FC250, FC300)	160~260HB	0.07	0.09	0.12	0.15	0.18	0.18	0.21	0.21	0.21
Nodular cast iron (FCD600, FCD700)	170~300HB	0.05	0.07	0.10	0.12	0.15	0.15	0.17	0.17	0.17
Carbon steel (S50C, S55C)	180~280HB	0.05	0.07	0.10	0.10	0.12	0.12	0.15	0.15	0.15
Low alloy steel (SCM440)	180~280HB	0.05	0.07	0.10	0.10	0.12	0.12	0.15	0.15	0.15
Mold steel (HPM, NAK)	280~400HB	0.03	0.05	0.065	0.09	0.09	0.09	0.11	0.11	0.11
Tool & Die steel (SKD61, SKD11)	180~255HB	0.03	0.05	0.065	0.09	0.11	0.11	0.13	0.13	0.13
Hardened die steel (SKD61, SKD11)	40~55HRC	0.02	0.04	0.05	0.07	0.09	0.09	0.11	0.11	0.11
Stainless steel (SUS304, SUS316)	150~250HB	0.03	0.05	0.065	0.09	0.09	0.09	0.11	0.11	0.11
Copper alloy	80~150HB	0.10	0.12	0.15	0.18	0.21	0.21	0.24	0.24	0.24
Aluminium alloy	30~100HB	0.12	0.15	0.18	0.22	0.26	0.26	0.30	0.30	0.30
Graphite		0.15	0.20	0.24	0.28	0.32	0.32	0.36	0.36	0.36

Table 4. Reduction ratio of recommended cutting conditions

Tool dia. φD_c (mm)	Short series				Middle series				Long series			
	l_2	l_2/D_c	$min^{-1} \%$	Feed %	l_2	l_2/D_c	$min^{-1} \%$	Feed %	l_2	l_2/D_c	$min^{-1} \%$	Feed %
6	30	5.0	100	100	35	5.8	100	100	70	11.7	45	45
8	35	4.4	100	100	53	6.6	60	65	75	9.4	50	50
10	35	3.5	100	100	53	5.3	70	80	75	7.5	60	65
12	26	2.2	100	100	53	4.4	90	90	85	7.1	65	65
16	32	2.0	100	100	63	3.9	100	100	100	6.3	70	70
20	38	1.9	100	100	75	3.8	100	100	115	5.8	75	75
25	45	1.8	100	100	90	3.6	100	100	135	5.4	80	80
30	53	1.8	100	100	106	3.5	100	100	160	5.3	80	90
32	53	1.7	100	100	106	3.3	100	100	160	5.0	80	90

Note) In case of using long series tools, recommend to reduce cutting conditions as per the above percentages.

RECOMMENDED CUTTING CONDITIONS/HIGH SPEED MACHINING

BNM type insert + Carbide shank holder (C-Body)

Work Materials	Hardness	Insert Grades	Cutting speed V_c (m/min)	Nominal feed rate f (mm/rev)									Max depth of cut a_p (mm)	Max depth of cut a_p (mm)
				Tool dia. D_c (mm)										
				6	8	10	12	16	20	25	30	32		
Grey cast iron (FC250, FC300)	160~260HB	DH111	400~500	0.4	0.5	0.5	0.6	0.8	0.8	1.0	1.0	1.0	0.1~0.3	Dc/40
Nodular cast iron (FCD600, FCD700)	170~300HB	DH111	300~400	0.3	0.4	0.4	0.5	0.6	0.6	0.8	0.8	0.8	0.1~0.3	Dc/40
Carbon steel (S50C, S55C)	180~280HB	DH111	300~400	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.7	0.1~0.3	Dc/50
Low alloy steel (SCM440)	180~280HB	DH111	300~400	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.7	0.1~0.3	Dc/50
Mold steel (HPM, NAK)	280~400HB	DH111	300~350	0.25	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.1~0.2	Dc/50
Tool & Die steel (SKD61, SKD11)	180~255HB	DH111	300~350	0.25	0.3	0.3	0.4	0.4	0.4	0.6	0.6	0.6	0.1~0.2	Dc/50
Hardened die steel (SKD61, SKD11)	40~55HRC	DH111	250~350	0.25	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.1~0.2	Dc/50
Hardened die steel (SKD61, SKD11)	55HRC~	DH111	150~250	0.2	0.25	0.3	0.4	0.5	0.5	0.6	0.6	0.6	0.1~0.2	Dc/50
Stainless steel (SUS304, SUS316)	150~250HB	DH111	200~300	0.25	0.35	0.45	0.6	0.65	0.7	0.8	0.8	0.8	0.1~0.2	Dc/50
Copper alloy	80~150HB	KT9	300~400	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.7	0.1~0.5	Dc/40
Aluminium alloy	30~100HB	KT9	400~500	0.35	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.1~0.5	Dc/40
Graphite		JC10000	600~800	0.4	0.6	0.6	0.7	0.8	0.8	0.9	0.9	0.9	0.1~0.5	Dc/40

Note) This data is applicable to short series tools and middle series tools.

Mirror Ball

BNM_{TYPE}

RECOMMENDED CUTTING CONDITIONS

BNM-SS, BNM-TG type insert Carbide shank holder (C-Body)

Work Materials	Insert Grades	Cutting speed Vc (m/min)	Nominal feed rate f (mm/rev)									Max depth of cut ap (mm)	Max pick feed ae (mm)
			Tool dia. Dc (mm)										
			6	8	10	12	16	20	25	30	32		
Greycast iron (FC250, FC300) 160~260HB	DH102 DH108	400~500	0.2~ 0.35	0.25~ 0.4	0.3~ 0.5	0.4~ 0.6	0.5~ 0.7	0.6~ 0.8	0.6~ 0.8	0.8~ 1.0	0.8~ 1.0	0.02Dc	0.025Dc
Nodular cast iron (FCD600, FCD700) 170~300HB	DH102 DH108	300~400	0.2~ 0.3	0.25~ 0.35	0.3~ 0.4	0.4~ 0.5	0.5~ 0.6	0.5~ 0.7	0.5~ 0.7	0.6~ 0.8	0.6~ 0.8	0.02Dc	0.025Dc
Carbon steel (S50C, S55C) 180~280HB	DH108	300~400	0.2~ 0.3	0.25~ 0.35	0.3~ 0.4	0.3~ 0.5	0.4~ 0.6	0.4~ 0.6	0.4~ 0.7	0.5~ 0.8	0.5~ 0.8	0.02Dc	0.02Dc
Low alloy steel (SCM440) 180~280HB	DH108	300~400	0.2~ 0.3	0.25~ 0.35	0.3~ 0.4	0.3~ 0.5	0.4~ 0.6	0.4~ 0.6	0.4~ 0.7	0.5~ 0.8	0.5~ 0.8	0.02Dc	0.02Dc
Mold steel (HPM, NAK) 280~400HB	DH108	300~400	0.2~ 0.3	0.25~ 0.35	0.3~ 0.4	0.3~ 0.5	0.4~ 0.6	0.4~ 0.6	0.4~ 0.7	0.5~ 0.8	0.5~ 0.8	0.02Dc	0.02Dc
Tool & Die steel (SKD61, SKD11) 180~255HB	DH108	300~400	0.2~ 0.3	0.25~ 0.35	0.3~ 0.4	0.3~ 0.5	0.4~ 0.6	0.4~ 0.6	0.4~ 0.7	0.5~ 0.8	0.5~ 0.8	0.02Dc	0.02Dc
Hardened die steel (SKD61, SKD11) 40~55HRC	DH102 DH108	200~300	0.15~ 0.25	0.2~ 0.3	0.25~ 0.3	0.3~ 0.4	0.4~ 0.5	0.4~ 0.5	0.4~ 0.6	0.4~ 0.7	0.4~ 0.7	0.015Dc	0.02Dc
Hardened die steel (SKD61, SKD11) 56~63HRC	DH102 DH108	150~250	0.15~ 0.25	0.2~ 0.3	0.25~ 0.3	0.3~ 0.4	0.4~ 0.5	0.4~ 0.5	0.4~ 0.6	0.4~ 0.7	0.4~ 0.7	0.01Dc	0.02Dc
Stainless steel (SUS304, SUS316) 150~250HB	DH108	250~350	0.2~ 0.3	0.25~ 0.35	0.3~ 0.4	0.3~ 0.5	0.4~ 0.6	0.4~ 0.6	0.4~ 0.7	0.5~ 0.8	0.5~ 0.8	0.02Dc	0.02Dc
Copper alloy 80~150HB	JC20003	300~400	0.2~ 0.35	0.25~ 0.4	0.3~ 0.5	0.4~ 0.6	0.5~ 0.7	0.6~ 0.8	0.6~ 0.8	0.8~ 1.0	0.8~ 1.0	0.02Dc	0.025Dc
Aluminium alloy 30~100HB	FZ05	400~500	0.2~ 0.35	0.25~ 0.4	0.3~ 0.5	0.4~ 0.6	0.5~ 0.7	0.6~ 0.8	0.6~ 0.8	0.8~ 1.0	0.8~ 1.0	0.03Dc	0.03Dc
Graphite	JC20003	600~800	0.2~ 0.35	0.25~ 0.4	0.3~ 0.5	0.4~ 0.6	0.5~ 0.7	0.6~ 0.8	0.6~ 0.8	0.8~ 1.0	0.8~ 1.0	0.03Dc	0.03Dc

Note) This data is applicable to short series tools and middle series tools.

Mirror Radius

MRX_{TYPE}

Through Coolant Hole

Accuracy of MRX type modular head mounted on MSN carbide shank holder:

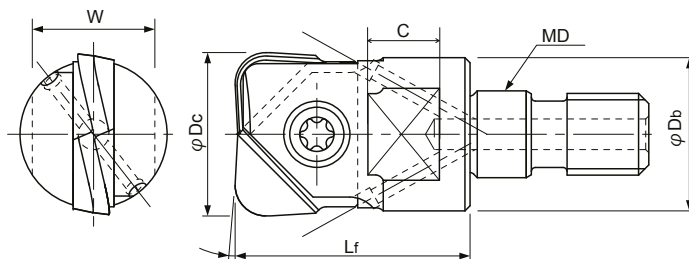
☆ HRM type: O.D. run out: **below 15 μ m** (Target **below 10 μ m**)

Corner radius accuracy: **within ± 0.015 mm**

☆ RNM type: O.D. run out: **below 15 μ m** (Target **below 10 μ m**)

Face run out: **below 5 μ m**

Corner radius accuracy: **within ± 0.010 mm**



3° (HRM type insert)
1° (RNM type insert)

■ BODY

Cat. No.	Stock	Dimensions (mm)						Inserts	Parts	
		ϕD_c	Lf	ϕD_b	MD	C	W		Clamp screw	Wrench
MRX-100-M6	●	10	18	9.7	M6	6.5	8	RNM-100-...,HRM-100/110-...	FSW-3007H	A-08
MRX-120-M6	●	12	20	11.5	M6	6.5	8	RNM-120-/130-...,HRM-120/130-...	FSW-3509H	A-10
MRX-160-M8	●	16	23	15	M8	8	12	RNM-160-/170-...,HRM-160/170-...	FSW-4013H	A-15
MRX-200-M10	●	20	30	19	M10	8	14	RNM-200-/210-...,HRM-200/220-...	FSW-5016H	A-20W
MRX-250-M12	●	25	35	24	M12	10	17	RNM-250-/260-...	FSW-6020	A-30
MRX-300-M16	□	30	43	29	M16	12.5	22	RNM-300-...	FSW-8025	A-40
MRX-320-M16	●	32	43	30	M16	12.5	22	RNM-320-...	FSW-8025	A-40

Note) 1. Please refer page 22 & 23 for recommended cutting conditions.
2. All cutters are supplied without inserts and wrench.

Clamp Screw	Recommended Torque (N·m)
FSW-3007H	1.2
FSW-3509H	2.0
FSW-4013H	3.0
FSW-5016H	4.0
FSW-6020	5.0
FSW-8025	6.0

Mirror Radius

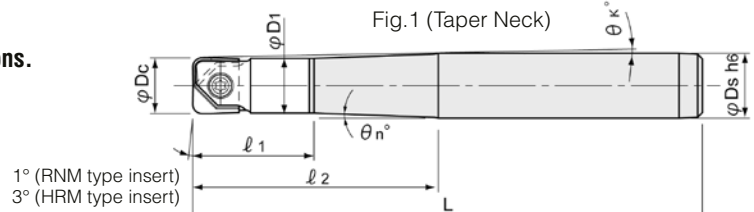


RNM_{TYPE}

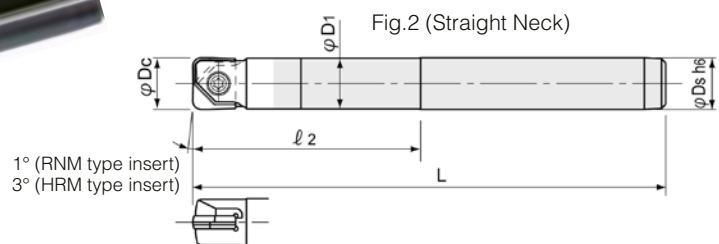
1. By adopting carbide shank, tool rigidity is equal to solid carbide radius end mill.
2. Tool life increased to twice compared with MIRROR RADIUS steel shank.
3. Carbide shank can be used on shrink-fit type holders.
4. Insert locates accurately in any of the two radial positions. It is mounted into the cutter body.



RNM-S-C type (Straight Neck)
RNM-T-C type (Taper Neck)



1° (RNM type insert)
 3° (HRM type insert)



1° (RNM type insert)
 3° (HRM type insert)

■ BODY

Cat. No.	Stock	Dimensions (mm)								Parts			Fig.
		ϕDc	L	l_1	l_2	$\phi D1$	ϕDs	θ_k°	θ_n°	Inserts	Clamp screw	Wrench	
RNMS-060015U-S06C	●	6	60	-	15	5.7	6	-	-	RNM-060...	FSW-2005H	A-06	2
RNMM-060030U-S06C	●		80	-	30					HRM-060...			
RNMS-080020U-S08C	●	8	70	-	20	7.6	8	-	-	RNM-080...	FSW-2506H	A-07	2
RNMM-080040U-S08C	●		90	-	40					HRM-080/090...			
RNMM-080053T-S12C	●		110	20	53	7.8	12	2°12'	2°	FRM-080...			
RNML-080075S-S08C	●		140	-	75					8			
RNMS-100025U-S10C	●	10	75	-	25	9.5	10	-	-	RNM-100...	FSW-3007H	A-08	2
RNMM-100050U-S10C	●		100	-	50					HRM-100/110...			
RNMM-100050S-S10C	●		110	-	50	9.8	12	1°7'	1°	FRM-100...			
RNMM-100053T-S12C	●		110	22.5	53					10			
RNML-100075S-S10C	●	140	-	75									2
RNMS-120030U-S12C	●	12	80	-	30	11.5	12	-	-	RNM-120...	FSW-3509H	A-10	2
RNMM-120060U-S12C	●		110	-	60					RNM-130...			
RNMM-120053S-S12C	●		110	-	53	11.8	-	-	HRM-120/130...				
RNML-120095S-S12C	●		160	-	95				FRM-120...				
RNMS-160035U-S16C	●	16	90	-	35	15.5	16	-	-	RNM-160...	FSW-4013H	A-15	2
RNMM-160070S-S16C	●		140	-	70					RNM-170...			
RNMM-160090S-S16C	●		160	-	90	15.8	-	-	HRM-160/170...				
RNML-160120S-S16C	●		210	-	120				FRM-160...				
RNML-160150S-S16C	●	220	-	150					FRM-170...				2

Note) 1. All cutters are supplied without inserts.
 2. Please refer page 33 & 42 for recommended cutting conditions.

Clamp Screw	Recommended torque (N·m)	Clamp Screw	Recommended torque (N·m)
FSW-2005H	0.5	FSW-4013H	3.0
FSW-2506H	0.9	FSW-5016H	4.0
FSW-3007H	1.2	FSW-6020	5.0
FSW-3509H	2.0	FSW-8025	6.0

Please refer page 17 for
"Caution for the mounting on shrink-fit holder"

Mirror Radius

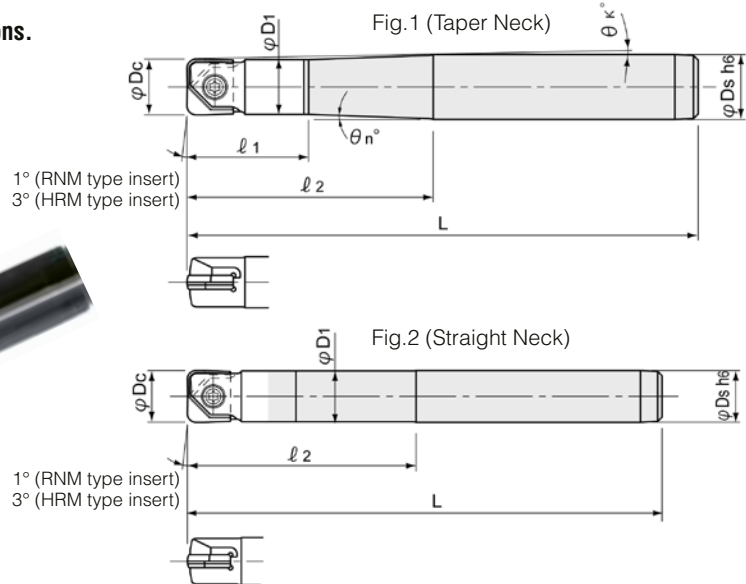


RNM_{TYPE}

1. By adopting carbide shank, tool rigidity is equal to solid carbide radius end mill.
2. Tool life increased to twice compared with MIRROR RADIUS steel shank.
3. Carbide shank can be used on shrink-fit type holders.
4. Insert locates accurately in any of the two radial positions. It is mounted into the cutter body.



RNM-S-Ctype (Straight Neck)
RNM-T-Ctype (Taper Neck)



■ BODY

Cat. No.	Stock	Dimensions (mm)								Parts			Fig.
		φD_c	L	l_1	l_2	φD_1	φD_s	θ_k°	θ_n° Taper angle	Inserts	Clamp screw	Wrench	
RNMS-200040U-S20C	●		105	—	40	19.5		—	—	RNM-200...			2
RNMM-200075S-S20C	●		141	—	75			—	—	RNM-210...			
RNMM-200105S-S20C	●	20	180	—	105	19.8	20	—	—	HRM-200/ 220...	FSW-5016H	A-20W	2
RNML-200150S-S20C	●		220	—	150			—	—	FRM-200/ 210...			
RNML-200170S-S20C	●		250	—	170			—	—				
RNMM-250090S-S25C	●		166	—	90			—	—	RNM-250...			
RNMM-250140S-S25C	●	25	220	—	140	24.8	25	—	—	RNM-260...	FSW-6020	A-30	2
RNML-250190S-S25C	□		260	—	190			—	—	FRM-250...			
RNMM-300106S-S32C	●	30	186	—	106	29.8	32	—	—	RNM-300...	FSW-8025	A-40	2
RNMM-320106S-S32C	□	32	186	—	106	31.8	32	—	—	RNM-320...	FSW-8025	A-40	2

Note) 1. All cutters are supplied without inserts.
 2. Please refer page 33-42 for recommended cutting conditions.

Clamp Screw	Recommended torque (N·m)	Clamp Screw	Recommended torque (N·m)
FSW-2005H	0.5	FSW-4013H	3.0
FSW-2506H	0.9	FSW-5016H	4.0
FSW-3007H	1.2	FSW-6020	5.0
FSW-3509H	2.0	FSW-8025	6.0

★ Caution for the mounting on shrink-fit holder (In case of BNM-C Body, RNM-C Body)

When you use a carbide shank (C Body) on the shrink-fit holder, please shrink-fit only carbide shank without putting insert and clamp screw.

Please mount the insert and tighten the clamp screw after shrink-fit.

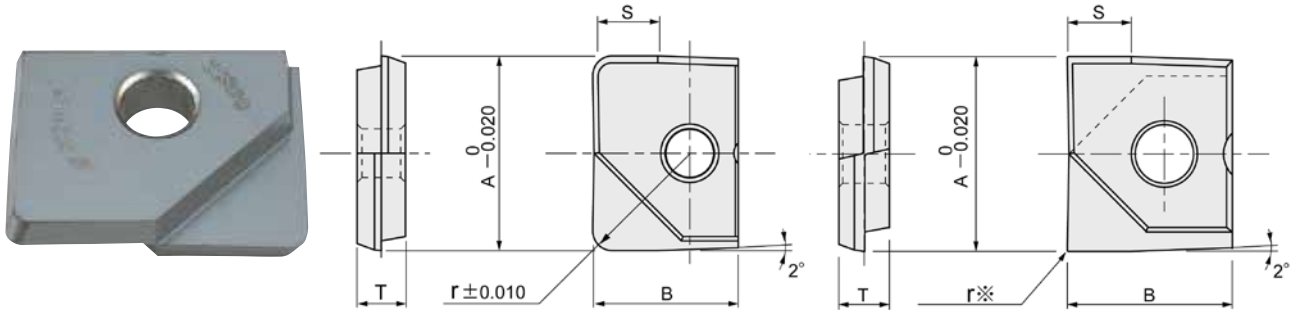
Note) If it shrink-fits with the insert and clamp screw, it will be difficult to loose the clamp screw.

Mirror Radius RNM_{TYPE}

Radius form accuracy
of insert:
within $\pm 0.010\text{mm}$

■ INSERTS

● RNM-□□□-R0



Cat. No.	PVD coated		Diamond coated	Uncoated	Dimensions (mm)				
	JC8015 (Z10~20)	DH103 (Z05)	JC10000	KT9 (K10)	r	S	A	B	T
RNM-060-R03	●	●			0.3				
RNM-060-R05	●	●			0.5	2	6	5	2
RNM-060-R10	●	●			1				
RNM-080-R03	●	●		□	0.3				
RNM-080-R05	●	●	●	●	0.5	2.7	8	7	2.4
RNM-080-R10	●	●	□	●	1				
RNM-100-R0	●				※				
RNM-100-R03	●	●		□	0.3				
RNM-100-R05	●	●	●	●	0.5	3.3	10	8.5	2.6
RNM-100-R10	●	●	□	●	1				
RNM-100-R15	□			□	1.5				
RNM-100-R20	●	●		□	2				
RNM-120-R0	●				※				
RNM-120-R03	●	●		□	0.3				
RNM-120-R05	●	●	□	●	0.5	4	12	10	3
RNM-120-R10	●	●	□	●	1				
RNM-120-R15	●	●		□	1.5				
RNM-120-R20	●	●		●	2				
RNM-160-R0	●				※				
RNM-160-R03	●	●		●	0.3				
RNM-160-R05	●	●		●	0.5	5.3	16	12	4
RNM-160-R10	●	●		●	1				
RNM-160-R15	●	●		□	1.5				
RNM-160-R20	●	●		□	2				
RNM-200-R0	●				※				
RNM-200-R03	●	●		□	0.3	6.7	20	15	5
RNM-200-R05	●	●		□	0.5				
RNM-200-R10	●	●		●	1				

2 inserts per case, but grade JC10000 insert is packed in 1 piece per case.

※ Corner radius: Below 0.1mm

Note) Please refer page 22 for "Instructions for mounting insert."

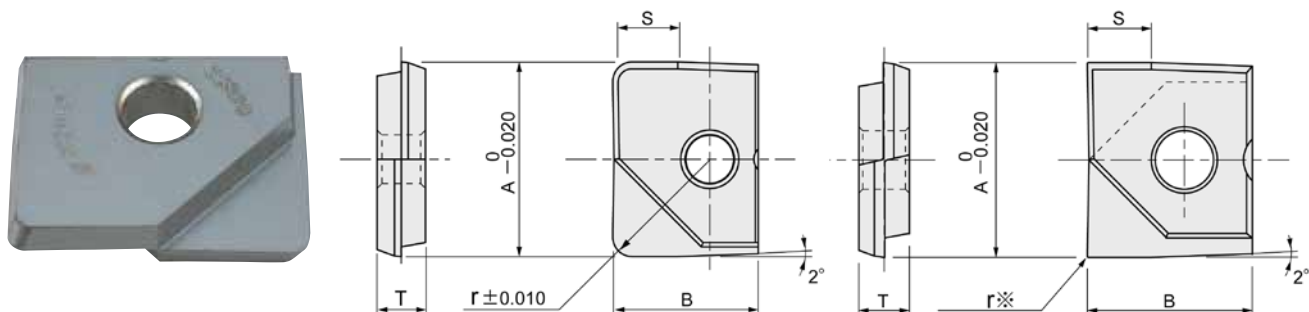
Mirror Radius

RNM_{TYPE}

Radius form accuracy
of insert:
within $\pm 0.010\text{mm}$

■ INSERTS

● RNM-□□□-R0



Cat. No.	PVD coated		Diamond coated	Uncoated	Dimensions (mm)				
	JC8015 (Z10~20)	DH103 (Z05)	JC10000	KT9 (K10)	r	S	A	B	T
RNM-200-R15	●	●		□	1.5				
RNM-200-R20	●	●		□	2	6.7	20	15	5
RNM-200-R30	●				3				
RNM-250-R0	□				※				
RNM-250-R03	●	●			0.3				
RNM-250-R05	●	●			0.5				
RNM-250-R10	●	●			1	8.3	25	18.5	6
RNM-250-R15	□	□			1.5				
RNM-250-R20	●	●			2				
RNM-250-R30	●				3				
RNM-300-R03	□	□			0.3				
RNM-300-R05	□	□			0.5				
RNM-300-R10	□	□			1	10	30	22.5	7
RNM-300-R15	□				2				
RNM-300-R20	□	□			2				
RNM-300-R30	□				3				
RNM-320-R03	●	●			0.3				
RNM-320-R05	●	●			0.5				
RNM-320-R10	●	●			1	10.7	32	23.5	7
RNM-320-R15	●				1.5				
RNM-320-R20	●	●			2				
RNM-320-R30	□				3				

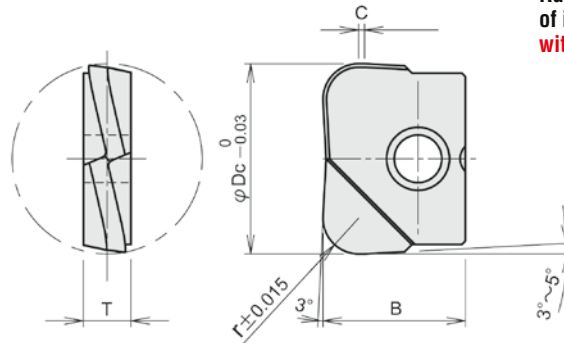
2 inserts per case, but grade JC10000 insert is packed in 1 piece per case.

※ Corner radius: Below 0.1mm

Note) Please refer page 22 for "Instructions for mounting insert."

Mirror Radius HRM_{TYPE}

■ INSERTS



Radius form accuracy of insert:
within $\pm 0.015\text{mm}$

Cat. No.	PVD coated	Dimensions (mm)				
	JC8015 (Z10~20)	ϕDc	r	B	C	T
HRM-060-R05	●		0.5			
HRM-060-R10	●	6	1	5	-	2
HRM-060-R15	●		1.5			
HRM-080-R20	●	8	2	7	0.3	2.4
HRM-090-R20	●	9	2	7	0.3	2.4
HRM-100-R20	●	10	2	8.5	0.3	2.6
HRM-110-R20	●	11	2	8.5	0.3	2.6
HRM-120-R20	●	12	2	10	0.5	3

Cat. No.	PVD coated	Dimensions (mm)				
	JC8015 (Z10~20)	ϕDc	r	B	C	T
HRM-130-R20	●	13	2	10	0.5	3
HRM-160-R20	●	16	2	12	0.5	4
HRM-160-R30	●		3			
HRM-170-R30	●	17	3	12	0.5	4
HRM-200-R20	●	20	2	15	0.5	5
HRM-200-R30	●		3			
HRM-220-R30	□	22	3	15	0.5	5

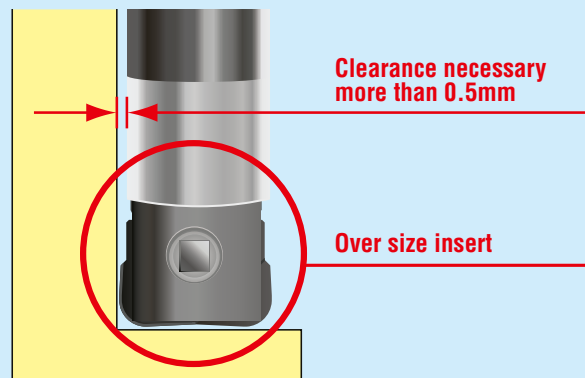
2 inserts per case

Note) "HRM" insert is exclusive use of MIRROR RADIUS carbide shank body.
Please use only in MIRROR RADIUS carbide shank body and modular head.

Features of "MIRROR RADIUS" Over size inserts

In case of using HRM inserts, recommend to use over size inserts for increasing side clearance to prevent the damage of shank by sticking chips

(※) HRM-090-R20, HRM-110-R20, HRM-130-R20, HRM-170-R30, HRM-220-R30



Please refer page 22 for "Instructions for mounting insert"



FRM

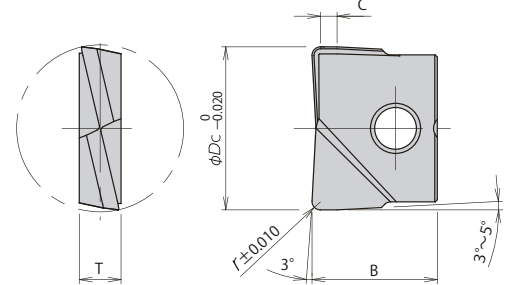
FRM type insert for MIRROR RADIUS RNM / MRN type.

- Adopted new PVD coated grade "DH102" suitable for high hardened material, and PVD coated grade "JC8015" suitable for general steel.
- Adopting positive rake cutting edge achieved low cutting force and sharpness. And available large size over 25mm.
- Intensive tool management can be possible from roughing to finishing with same body by using inserts properly.

Side & bottom face finishing for high hardened steel, etc.



Corner radius accuracy of inserts: below $\pm 0.010\text{mm}$



Longer periphery straight edge achieved longer tool life, better surface roughness and deflection on vertical wall application.

Cat. No.	PVD coated		Dimensions (mm)				
	JC8015	DH102	ϕDc	r	B	C	T
FRM-060-R05	●	●	6	0.5	5	0.8	2
FRM-060-R10	●	●		1			
FRM-080-R05	●	●	8	0.5	7	1.2	2.4
FRM-080-R10	●	●		1			
FRM-100-R05	●	●	10	0.5	8.5	1.5	2.6
FRM-100-R10	●	●		1			
FRM-100-R20	●	●		2			
FRM-120-R05	●	●	12	0.5	10	1.5	3
FRM-120-R10	●	●		1			
FRM-120-R20	●	●		2			
FRM-120-R30	●	●		3			
FRM-160-R05	●	●	16	0.5	12	2	4
FRM-160-R10	●	●		1			
FRM-160-R15	●	●		1.5			
FRM-160-R20	●	●	2				
FRM-160-R30	●	●	3				
FRM-170-R10	□	□	17	1	12	2	4
FRM-200-R05	●	●	20	0.5	15	2	5
FRM-200-R10	●	●		1			
FRM-200-R15	●	●		1.5			
FRM-200-R20	●	●		2			
FRM-200-R30	●	●	3				
FRM-210-R10	●	□	21	1	15	2	5
FRM-250-R05	●	●	25	0.5	18.5	2.5	6
FRM-250-R10	●	●		1			
FRM-250-R20	●	●		2			
FRM-250-R30	●	●		3			
FRM-300-R05	●	□	30	0.5	22.5	3	7
FRM-300-R10	□	□		1			
FRM-300-R20	□	□		2			
FRM-300-R30	□	□		3			
FRM-320-R05	●	□	32	0.5	23.5	3	7
FRM-320-R10	●	●		1			
FRM-320-R20	●	●		2			
FRM-320-R30	●	●		3			

2 inserts per case

Note) Recommend to use FRM inserts combined with Mirror Radius End Mill carbide shank body (page 16 & 17) or Mirror Radius modular heads (page 15).

Please see page 22 for Attention to mounting insert.

Mirror Radius MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / HIGH SPEED MACHINING

MRX type with RNM insert + MSN Carbide Shank Holder

Work Materials	Insert Grades	Cutting speed V _c (m/min)	Tool dia. (mm)					
			10		12/13		16/17	
			n (min ⁻¹)	V _f (mm/min)	n (min ⁻¹)	V _f (mm/min)	n (min ⁻¹)	V _f (mm/min)
			Max. D.O.C. & Max. Pick feed (mm)					
Grey cast iron 160-260 HB	DH103	500	16,000	6,400	13,500	6,100	10,000	5,000
			Max.ap=0.3, Max. ae=0.1 × Dc					
Nodular cast iron 170-300 HB	DH103	400	12,700	4,400	10,600	3,700	8,000	3,200
			Max.ap=0.3, Max. ae=0.1 × Dc					
Carbon steel 180-280 HB	DH103	400	12,700	4,400	10,600	3,700	8,000	3,200
			Max.ap=0.3, Max. ae=0.1 × Dc					
Low alloy steel 180-280 HB	DH103	350	11,000	3,500	9,200	2,900	7,000	2,660
			Max.ap=0.3, Max. ae=0.1 × Dc					
Mold steel 280-400 HB	DH103	350	11,000	3,100	9,200	2,600	7,000	2,300
			Max.ap=0.3, Max. ae=0.1 × Dc					
Tool & Die steel 180-255 HB	DH103	350	11,000	3,100	9,200	2,600	7,000	2,300
			Max.ap=0.25, Max. ae=0.1 × Dc					
Hardened die steel 40-55 HRC	DH103	200	6,400	1,500	5,300	1,200	4,000	1,000
			Max.ap=0.2, Max. ae=0.05 × Dc					
Hardened die steel 56-63 HRC	DH103	100	3,200	600	2,700	500	2,000	400
			Max.ap=0.15, Max. ae=0.02 × Dc					
Stainless steel 150-250 HB	DH103	350	11,000	2,500	9,200	2,100	7,000	1,750
			Max.ap=0.25, Max. ae=0.1 × Dc					
Inconel Titanium alloy 30-40 HRC	DH103	90	2,900	700	2,400	600	1,790	450
			Max.ap=0.2, Max. ae=0.05 × Dc					
Copper alloy 80-150 HB	DH103	350	11,000	4,400	9,200	3,700	7,000	3,500
			Max.ap=0.3, Max. ae=0.1 × Dc					
Aluminium alloy 30-100HB	DH103 KT9	600	19,000	7,600	16,000	6,400	12,000	6,000
			Max.ap=0.4, Max. ae=0.1 × Dc					
Graphite	DH103 JC10000	600	19,000	7,600	16,000	6,400	12,000	6,000
			Max.ap=0.4, Max. ae=0.1 × Dc					

n: Spindle speed, Vf: Feed speed

★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)

Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
∅ Dc	N~m
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Radius

MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / HIGH SPEED MACHINING

MRX type with RNM insert + MSN Carbide Shank Holder

Work Materials	Insert Grades	Cutting speed V _c (m/min)	Tool dia. (mm)					
			20/21		25/26		30/32	
			n (min ⁻¹)	V _f (mm/min)	n (min ⁻¹)	V _f (mm/min)	n (min ⁻¹)	V _f (mm/min)
			Max. D.O.C. & Max. Pick feed (mm)					
Grey cast iron 160-260 HB	DH103	500	8,000	4,000	6,400	3,200	5,300	2,650
			Max.ap=0.3,Max. ae=0.1 × Dc					
Nodular cast iron 170-300 HB	DH103	400	6,400	2,560	5,100	2,040	4,200	1,700
			Max.ap=0.3,Max. ae=0.1 × Dc					
Carbon steel 180-280 HB	DH103	400	6,400	2,560	5,100	2,040	4,200	1,700
			Max.ap=0.3,Max. ae=0.1 × Dc					
Low alloy steel 180-280 HB	DH103	350	5,600	2,130	4,500	1,710	3,700	1,400
			Max.ap=0.3,Max. ae=0.1 × Dc					
Mold steel 280-400 HB	DH103	350	5,600	1,850	4,500	1,490	3,700	1,220
			Max.ap=0.3,Max. ae=0.1 × Dc					
Tool & Die steel 180-255 HB	DH103	350	5,600	1,850	4,500	1,490	3,700	1,220
			Max.ap=0.25,Max. ae=0.1 × Dc					
Hardened die steel 40-55 HRC	DH103	200	3,180	800	2,550	640	2,100	525
			Max.ap=0.2,Max. ae=0.05 × Dc					
Hardened die steel 56-63 HRC	DH103	100	1,590	320	1,270	250	1,060	210
			Max.ap=0.15,Max. ae=0.02 × Dc					
Stainless steel 150-250 HB	DH103	350	5,600	1,400	4,500	1,130	3,700	925
			Max.ap=0.25,Max. ae=0.1 × Dc					
Inconel Titanium alloy 30-40 HRC	DH103	90	1,430	360	1,150	290	955	240
			Max.ap=0.2,Max. ae=0.05 × Dc					
Copper alloy 80-150 HB	DH103	350	5,600	2,800	4,500	2,250	3,700	1,850
			Max.ap=0.3,Max. ae=0.1 × Dc					
Aluminium alloy 30-100HB	DH103 KT9	600	9,600	4,800	7,650	3,800	6,350	3,200
			Max.ap=0.4,Max. ae=0.1 × Dc					
Graphite	DH103 JC10000	600	9,600	4,800	7,650	3,800	6,350	3,200
			Max.ap=0.4,Max. ae=0.1 × Dc					

n: Spindle speed, V_f: Feed speed

★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)

Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
φ Dc	N~m
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Radius

MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS

MRX type with RNM insert + MSN Carbide Shank Holder

Work Materials	Insert Grades	Cutting speed V _c (m/min)	Tool dia. (mm)					
			10		12/13		16/17	
			n (min ⁻¹)	V _f (mm/min)	n (min ⁻¹)	V _f (mm/min)	n (min ⁻¹)	V _f (mm/min)
Max. D.O.C. & Max. Pick feed (mm)								
Grey cast iron 160-260 HB	DH103	300	9,500	3,800	8,000	3,600	6,000	3,000
			0.3		0.4		0.5	
Nodular cast iron 170-300 HB	DH103	250	8,000	2,800	6,700	2,300	5,000	2,000
			0.3		0.3		0.4	
Carbon steel 180-280 HB	DH103 JC8015	250	8,000	2,800	6,700	2,300	5,000	2,000
			0.3		0.3		0.4	
Low alloy steel 180-280 HB	DH103 JC8015	250	8,000	2,600	6,700	2,100	5,000	1,900
			0.3		0.3		0.4	
Mold steel 280-400 HB	DH103 JC8015	250	8,000	2,200	6,700	1,900	5,000	1,650
			0.3		0.3		0.4	
Tool & Die steel 180-255 HB	DH103 JC8015	250	8,000	2,200	6,700	1,900	5,000	1,650
			0.3		0.3		0.4	
Hardened die steel 40-55 HRC	DH103	135	4,300	1,000	3,600	800	2,700	675
			0.3		0.3		0.3	
Hardened die steel 56-63 HRC	DH103	75	2,400	500	2,000	400	1,500	300
			0.15		0.15		0.18	
Stainless steel 150-250 HB	DH103 JC8015	250	8,000	1,800	6,700	1,500	5,000	1250
			0.3		0.3		0.4	
Inconel Titanium alloy 30-40 HRC	DH103 JC8015	55	1,700	400	1,500	300	1,100	275
			0.25		0.25		0.25	
Copper alloy 80-150 HB	DH103 KT9	250	8,000	3,200	6,700	2,700	5,000	2,500
			0.3		0.4		0.5	
Aluminium alloy 30-100HB	DH103 KT9	350	11,000	4,400	9,200	3,700	7,000	3,500
			0.5		0.6		0.8	
Graphite	DH103 JC10000	350	11,000	4,400	9,200	3,700	7,000	3,500
			0.5		0.6		0.8	

n: Spindle speed, V_f: Feed speed

★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)
Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
φDc	N~m
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Radius

MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS

● **MRX type with RNM insert** + MSN Carbide Shank Holder

Work Materials	Insert Grades	Cutting speed V _c (m/min)	Tool dia. (mm)					
			20/21		25/26		30/32	
			n (min ⁻¹)	V _f (mm/min)	n (min ⁻¹)	V _f (mm/min)	n (min ⁻¹)	V _f (mm/min)
			Max. D.O.C. & Max. Pick feed (mm)					
Grey cast iron 160-260 HB	DH103	300	4,800	2,400	3,800	1,900	3,180	1,590
			0.7		0.8		1.0	
Nodular cast iron 170-300 HB	DH103	250	4,000	1,600	3,200	1,280	2,650	1,060
			0.5		0.6		0.8	
Carbon steel 180-280 HB	DH103 JC8015	250	4,000	1,600	3,200	1,280	2,650	1,060
			0.5		0.6		0.8	
Low alloy steel 180-280 HB	DH103 JC8015	250	4,000	1,520	3,200	1,210	2,650	1,000
			0.5		0.6		0.8	
Mold steel 280-400 HB	DH103 JC8015	250	4,000	1,320	3,200	1,060	2,650	880
			0.5		0.6		0.8	
Tool & Die steel 180-255 HB	DH103 JC8015	250	4,000	1,320	3,200	1,060	2,650	880
			0.5		0.6		0.8	
Hardened die steel 40-55 HRC	DH103	135	2,150	540	1,720	430	1,430	360
			0.4		0.5		0.6	
Hardened die steel 56-63 HRC	DH103	75	1,200	240	950	190	800	160
			0.2		0.25		0.3	
Stainless steel 150-250 HB	DH103 JC8015	250	4,000	1,000	3,200	800	2,650	660
			0.5		0.6		0.8	
Inconel Titanium alloy 30-40 HRC	DH103 JC8015	55	875	220	700	175	580	145
			0.3		0.35		0.4	
Copper alloy 80-150 HB	DH103 KT9	250	4,000	2,000	3,200	1,600	2,650	1,325
			0.7		0.8		1.0	
Aluminium alloy 30-100HB	DH103 KT9	350	5,600	2,800	4,500	2,250	3,700	1,850
			1.0		1.2		1.6	
Graphite	DH103 JC10000	350	5,600	2,800	4,500	2,250	3,700	1,850
			1.0		1.2		1.6	

n: Spindle speed, V_f: Feed speed

★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)

Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
φDc	N~m
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Radius

MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / HIGH FEED MACHINING

MRX type with HRM/FRM insert + MSN Carbide Shank Holder

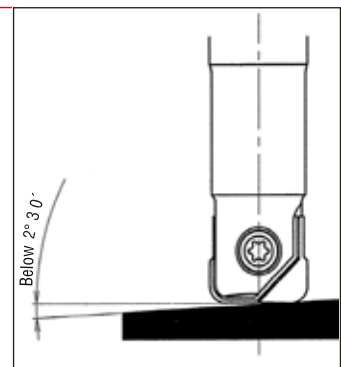
※ Recommended to reduce depth of cut a_p by corner radius with keeping feed speed V_f . (Refer the below table)

Work Materials	Insert Grades	Tool dia. (mm)									
		$\phi 10 \times R2 / \phi 11 \times R2$					$\phi 12 \times R2 / \phi 13 \times R2$				
		l (mm)	a_e (mm)	a_p (mm)	n (min^{-1})	V_f (mm/min)	l (mm)	a_e (mm)	a_p (mm)	n (min^{-1})	V_f (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015	50	4.2	0.40	6,000	6,000	60	5.6	0.40	5,000	5,000
		75	4.2	0.25	6,000	6,000	80	5.6	0.25	5,000	5,000
		100	4.2	0.20	6,000	6,000	110	5.6	0.20	5,000	5,000
Mold steel HPM7, PX5, NAK80, P20 (1.2311, P20) 30-43HRC	JC8015	50	4.2	0.40	5,700	5,700	60	5.6	0.40	4,700	4,700
		75	4.2	0.25	5,700	5,700	80	5.6	0.25	4,700	4,700
		100	4.2	0.20	5,700	5,700	110	5.6	0.20	4,700	4,700
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015	50	4.2	0.40	5,700	5,700	60	5.6	0.40	4,700	4,700
		75	4.2	0.25	5,700	5,700	80	5.6	0.25	4,700	4,700
		100	4.2	0.20	5,700	5,700	110	5.6	0.20	4,700	4,700
Stainless steel SUS304 Below 250HB	JC8015	50	4.2	0.40	5,400	5,400	60	5.6	0.40	4,500	4,500
		75	4.2	0.25	5,400	5,400	80	5.6	0.25	4,500	4,500
		100	4.2	0.20	5,400	5,400	110	5.6	0.20	4,500	4,500
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 40-50HRC	JC8015	50	4.2	0.20	4,700	4,700	60	5.6	0.20	4,000	4,000
		75	4.2	0.15	4,700	4,700	80	5.6	0.15	4,000	4,000
		100	4.2	0.10	4,700	4,700	110	5.6	0.10	4,000	4,000
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015	50	4.2	0.40	5,100	5,100	60	5.6	0.40	4,200	4,200
		75	4.2	0.25	5,100	5,100	80	5.6	0.25	4,200	4,200
		100	4.2	0.20	5,100	5,100	110	5.6	0.20	4,200	4,200
Depth of cut adjustment by corner radius ($a_p \times$ ratio)	Corner radius	R0.5	$a_p \times 0.60$			Corner radius	R0.5	$a_p \times 0.60$			
		R1	$a_p \times 0.70$				R1	$a_p \times 0.70$			
		R2	$a_p \times 1.0$				R1.5	$a_p \times 0.85$			
							R2	$a_p \times 1.0$			
		※ Recommend to reduce depth of cut a_p according to above table with keeping feed speed									

l : Overhung length, a_p : Depth of cut, a_e : Pick feed, n : Spindle speed, V_f : Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) If machine does not have enough power, recommend to reduce depth of cut first and reduce spindle speed and feed speed.
- 4) Use air blow to flush the chips out.
- 5) In case of 50-55 HRC (Hardened die steel), recommend to reduce a_p , n , V_f by 30% on above table.
- 6) In case of good surface requirement, recommend to reduce feed speed.
- 7) In case of ramping, ramping angle up to $2^\circ 30'$ is recommended.
- 8) In case of ramping and helical interpolation, apply 70% or less feed speed from above table.



★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)
Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
ϕD_c	N~m
10	1.2
12	2.0
16	3.0
20	4.0

Mirror Radius

MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / HIGH FEED MACHINING

MRX type with HRM/FRM insert + MSN Carbide Shank Holder

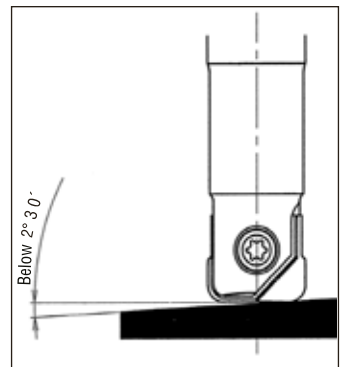
※ Recommended to reduce depth of cut a_p by corner radius with keeping feed speed V_f . (Refer the below table)

Work Materials	Insert Grades	Tool dia. (mm)										
		$\varnothing 16 \times R3 / \varnothing 17 \times R3$					$\varnothing 20 \times R3 / \varnothing 22 \times R3$					
		ℓ (mm)	a_e (mm)	a_p (mm)	n (min ⁻¹)	V_f (mm/min)	ℓ (mm)	a_e (mm)	a_p (mm)	n (min ⁻¹)	V_f (mm/min)	
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015	80	7.0	0.60	3,800	3,800	100	9.8	0.60	3,000	3,000	
		120	7.0	0.40	3,800	3,800	150	9.8	0.40	3,000	3,000	
		160	7.0	0.30	3,800	3,800	200	9.8	0.30	3,000	3,000	
Mold steel HPM7, PX5, NAK80, P20 (1.2311, P20) 30-43HRC	JC8015	80	7.0	0.60	3,500	3,500	100	9.8	0.60	2,800	2,800	
		120	7.0	0.40	3,500	3,500	150	9.8	0.40	2,800	2,800	
		160	7.0	0.30	3,500	3,500	200	9.8	0.30	2,800	2,800	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015	80	7.0	0.60	3,500	3,500	100	9.8	0.60	2,800	2,800	
		120	7.0	0.40	3,500	3,500	150	9.8	0.40	2,800	2,800	
		160	7.0	0.30	3,500	3,500	200	9.8	0.30	2,800	2,800	
Stainless steel SUS304 Below 250HB	JC8015	80	7.0	0.60	3,400	3,400	100	9.8	0.60	2,700	2,700	
		120	7.0	0.40	3,400	3,400	150	9.8	0.40	2,700	2,700	
		160	7.0	0.30	3,400	3,400	200	9.8	0.30	2,700	2,700	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 40-50HRC	JC8015	80	7.0	0.60	3,000	3,000	100	9.8	0.60	2,400	2,400	
		120	7.0	0.40	3,000	3,000	150	9.8	0.40	2,400	2,400	
		160	7.0	0.30	3,000	3,000	200	9.8	0.30	2,400	2,400	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015	80	7.0	0.60	3,200	3,200	100	9.8	0.60	2,500	2,500	
		120	7.0	0.40	3,200	3,200	150	9.8	0.40	2,500	2,500	
		160	7.0	0.30	3,200	3,200	200	9.8	0.30	2,500	2,500	
Depth of cut adjustment by corner radius ($a_p \times$ ratio)	Corner radius	R1	$a_p \times 0.50$				Corner radius	R1	$a_p \times 0.50$			
		R1.5	$a_p \times 0.60$					R1.5	$a_p \times 0.60$			
		R2	$a_p \times 0.75$					R2	$a_p \times 0.75$			
		R3	$a_p \times 1.0$					R3	$a_p \times 1.0$			
		※ Recommend to reduce depth of cut a_p according to above table with keeping feed speed										

ℓ : Overhung length, a_p : Depth of cut, a_e : Pick feed, n : Spindle speed, V_f : Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) If machine does not have enough power, recommend to reduce depth of cut first and reduce spindle speed and feed speed.
- 4) Use air blow to flush the chips out.
- 5) In case of 50-55 HRC (Hardened die steel), recommend to reduce a_p , n , V_f by 30% on above table.
- 6) In case of good surface requirement, recommend to reduce feed speed.
- 7) In case of ramping, ramping angle up to $2^\circ 30'$ is recommended.
- 8) In case of ramping and helical interpolation, apply 70% or less feed speed from above table.



★ Instruction for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Do not tighten the clamp screw too hard.

Recommend to use Torque control wrenches (Page 6)

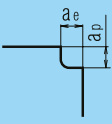
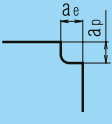
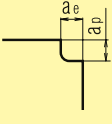
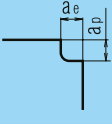
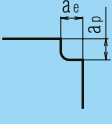
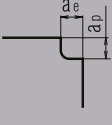
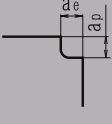
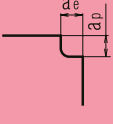
Refer the right table for recommended tightening torque.

Dimensions	Recommended Torque
$\varnothing D_c$	N~m
10	1.2
12	2.0
16	3.0
20	4.0

Mirror Radius MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / SIDE FACE FINISHING

MRX type with FRM insert + MSN Carbide Shank Holder

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)			
				φ 10		φ 12	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		300	9,550	2,860	7,960	2,380
			a _p (mm)	0.25		0.30	
			a _e (mm)	0.10		0.12	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		300	9,550	2,860	7,960	2,380
			a _p (mm)	0.25		0.30	
			a _e (mm)	0.10		0.12	
Stainless steel SUS304 Below 250HB	JC8015		280	8,910	2,670	7,420	2,220
			a _p (mm)	0.25		0.30	
			a _e (mm)	0.10		0.12	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		300	9,550	2,860	7,960	2,380
			a _p (mm)	0.25		0.30	
			a _e (mm)	0.10		0.12	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		280	8,910	2,670	7,420	2,220
			a _p (mm)	0.25		0.30	
			a _e (mm)	0.10		0.12	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		250	7,960	800	6,630	800
			a _p (mm)	0.25		0.30	
			a _e (mm)	0.10		0.12	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		200	6,360	640	5,300	640
			a _p (mm)	0.25		0.30	
			a _e (mm)	0.10		0.12	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		350	11,140	3,900	9,280	3,710
			a _p (mm)	0.25		0.30	
			a _e (mm)	0.15		0.20	

a_p: Axial depth of cut, a_e: Radial depth of cut, N: Spindle speed, Vf: Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) In case of overhung length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- 4) Use air blow to flush the chips out.

Overhung length L/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, up to 5Dc	70%	70%
5Dc~10Dc Over 5Dc, up to 10Dc	50%	50%

Mirror Radius

MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / SIDE FACE FINISHING

MRX type with FRM insert + MSN Carbide Shank Holder

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)			
				φ 16		φ 20	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		300	5,970	2,390	4,770	1,910
			a _p (mm)	0.40		0.50	
			a _e (mm)	0.16		0.20	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		300	5,970	2,390	4,770	1,910
			a _p (mm)	0.40		0.50	
			a _e (mm)	0.16		0.20	
Stainless steel SUS304 Below 250HB	JC8015		280	5,570	2,230	4,560	1,820
			a _p (mm)	0.40		0.50	
			a _e (mm)	0.16		0.20	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		300	5,970	2,390	4,770	1,910
			a _p (mm)	0.40		0.50	
			a _e (mm)	0.16		0.20	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		280	5,570	1,670	4,560	1,370
			a _p (mm)	0.40		0.50	
			a _e (mm)	0.16		0.20	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		250	4,970	750	3,980	600
			a _p (mm)	0.40		0.50	
			a _e (mm)	0.16		0.20	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		200	3,980	600	3,180	480
			a _p (mm)	0.40		0.50	
			a _e (mm)	0.16		0.20	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		350	6,960	3,480	5,570	3,340
			a _p (mm)	0.40		0.50	
			a _e (mm)	0.20		0.25	

a_p: Axial depth of cut, a_e: Radial depth of cut, n: Spindle speed, Vf: Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) In case of overhung length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- 4) Use air blow to flush the chips out.

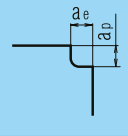
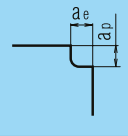
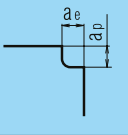
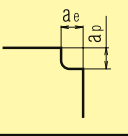
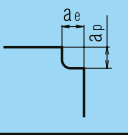
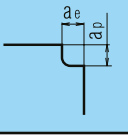
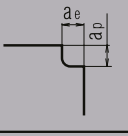
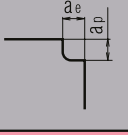
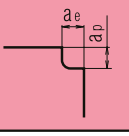
Overhung length L/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, up to 5Dc	70%	70%
5Dc~10Dc Over 5Dc, up to 10Dc	50%	50%

Mirror Radius

MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / SIDE FACE FINISHING

MRX type with FRM insert + MSN Carbide Shank Holder

Work Materials	Insert Grades	Type of machining 	Cutting speed Vc (m/min)	Tool dia. (mm)							
				φ 21		φ 25		φ 30		φ 32	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8015		300	4,550	1,820	3,820	1,530	3,180	1,270	2,980	1,190
			ap(mm)	0.50		0.80		1.0		1.2	
			ae(mm)	0.10		0.10		0.10		0.10	
Die steel (1.2344, 1.2379) Below 255HB	JC8015		300	4,550	1,820	3,820	1,530	3,180	1,270	2,980	1,190
			ap(mm)	0.50		0.80		1.0		1.2	
			ae(mm)	0.10		0.10		0.10		0.10	
Stainless steel Below 250HB	JC8015		280	4,240	1,700	3,560	1,420	2,970	1,190	2,780	1,110
			ap(mm)	0.50		0.80		1.0		1.2	
			ae(mm)	0.10		0.10		0.10		0.10	
Mold steel (1.2311, P20) 30-36HRC	JC8015 DH102		300	4,550	1,820	3,820	1,530	3,180	1,270	2,980	1,190
			ap(mm)	0.50		0.80		1.0		1.2	
			ae(mm)	0.10		0.10		0.10		0.10	
Mold steel (1.2311, P21) 38-43HRC	DH102		280	4,240	1,270	3,560	1,070	2,970	890	2,780	830
			ap(mm)	0.50		0.80		1.0		1.2	
			ae(mm)	0.10		0.10		0.10		0.10	
Hardened die steel (1.2344, 1.2379) 42-52HRC	DH102		250	3,790	570	3,180	480	2,650	400	2,480	370
			ap(mm)	0.50		0.80		1.0		1.2	
			ae(mm)	0.10		0.10		0.10		0.10	
Hardened die steel (1.2344, 1.2379) 55-62HRC	DH102		200	3,000	450	2,540	380	2,120	320	1,990	300
			ap(mm)	0.50		0.80		1.0		1.2	
			ae(mm)	0.10		0.10		0.10		0.10	
Grey & Nodular cast iron (GG, GGG) Below 300HB	JC8015 DH102		350	5,300	3,180	4,450	2,670	3,710	2,230	3,480	2,090
			ap(mm)	0.50		0.80		1.0		1.2	
			ae(mm)	0.10		0.10		0.10		0.10	

ap: Axial depth of cut, ae: Radial depth of cut, n: Spindle speed, Vf: Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) In case of overhung length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- 4) Use air blow to flush the chips out.

l / Dc	Vc (m/min)	Vf (mm/min)
3Dc or less	100%	100%
Over 3Dc, up to 5Dc	70%	70%
Over 5Dc, up to 10Dc	50%	50%

RECOMMENDED CUTTING CONDITIONS / BOTTOM FACE FINISHING

MRX type with FRM insert + MSN Carbide Shank Holder

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)							
				φ 10		φ 12		φ 16		φ 20	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		260	8,280	2,480	6,900	2,070	5,170	2,070	4,140	1,660
			ap(mm)	0.15		0.20		0.20		0.20	
			ae(mm)	1.2		1.5		2.0		2.5	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		260	8,280	2,480	6,900	2,070	5,170	2,070	4,140	1,660
			ap(mm)	0.15		0.20		0.20		0.20	
			ae(mm)	1.2		1.5		2.0		2.5	
Stainless steel SUS304 Below 250HB	JC8015		240	7,640	2,290	6,360	1,900	4,770	1,910	3,810	1,520
			ap(mm)	0.15		0.20		0.20		0.20	
			ae(mm)	1.2		1.5		2.0		2.5	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		260	8,280	2,480	6,900	2,060	5,170	2,070	4,140	1,660
			ap(mm)	0.15		0.20		0.20		0.20	
			ae(mm)	1.2		1.5		2.0		2.5	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		240	7,640	2,290	6,360	1,900	4,770	1,430	3,810	1,140
			ap(mm)	0.15		0.20		0.20		0.20	
			ae(mm)	1.2		1.5		2.0		2.5	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		190	6,050	610	5,040	600	3,780	570	3,020	450
			ap(mm)	0.10		0.15		0.15		0.15	
			ae(mm)	0.90		1.1		1.4		1.8	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		130	4,140	410	3,450	410	2,590	390	2,070	310
			ap(mm)	0.10		0.15		0.15		0.15	
			ae(mm)	0.90		1.0		1.2		1.5	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		300	9,450	3,310	7,960	3,180	5,970	2,390	4,770	1,910
			ap(mm)	0.15		0.20		0.20		0.20	
			ae(mm)	1.5		1.8		2.4		3.0	

ap: Depth of cut, ae: Pick feed, n: Spindle speed, Vf: Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) In case of overhung length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- 4) Use air blow to flush the chips out.

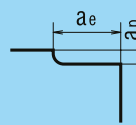
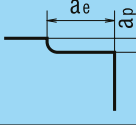
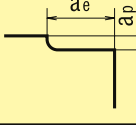
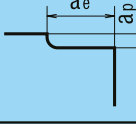
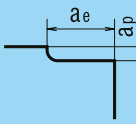
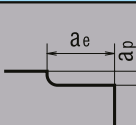
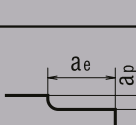
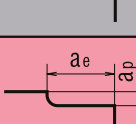
Overhung length L/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, up to 5Dc	70%	70%
5Dc~10Dc Over 5Dc, up to 10Dc	50%	50%

Mirror Radius

MRX_{TYPE}

RECOMMENDED CUTTING CONDITIONS / BOTTOM FACE FINISHING

MRX type with FRM insert + MSN Carbide Shank Holder

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)							
				φ 21		φ 25		φ 30		φ 32	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8015		260	3,940	1,570	3,310	1,320	2,750	1,100	2,580	1,030
			ap(mm)	0.20		0.20		0.20		0.20	
			ae(mm)	2.5		3.0		4.0		4.2	
Die steel (1.2344, 1.2379) Below 255HB	JC8015		260	3,940	1,570	3,310	1,320	2,750	1,100	2,580	1,030
			ap(mm)	0.20		0.20		0.20		0.20	
			ae(mm)	2.5		3.0		4.0		4.2	
Stainless steel Below 250HB	JC8015		240	3,640	1,450	3,050	1,220	2,540	1,020	2,380	950
			ap(mm)	0.20		0.20		0.20		0.20	
			ae(mm)	2.5		3.0		4.0		4.2	
Mold steel (1.2311, P20) 30-36HRC	JC8015 DH102		260	3,940	1,570	3,310	1,320	2,750	1,100	2,580	1,030
			ap(mm)	0.20		0.20		0.20		0.20	
			ae(mm)	2.5		3.0		4.0		4.2	
Mold steel (1.2311, P21) 38-43HRC	DH102		240	3,640	1,090	3,050	910	2,540	760	2,380	710
			ap(mm)	0.20		0.20		0.20		0.20	
			ae(mm)	2.5		3.0		4.0		4.2	
Hardened die steel (1.2344, 1.2379) 42-52HRC	DH102		190	2,880	430	2,420	360	2,010	300	1,890	280
			ap(mm)	0.15		0.15		0.15		0.15	
			ae(mm)	1.8		2.2		2.7		2.8	
Hardened die steel (1.2344, 1.2379) 55-62HRC	DH102		130	1,970	290	1,650	250	1,380	200	1,290	190
			ap(mm)	0.15		0.15		0.15		0.15	
			ae(mm)	1.5		1.8		2.2		2.3	
Grey & Nodular cast iron (GG, GGG) Below 300HB	JC8015 DH102		300	4,550	1,820	3,820	1,900	3,180	1,590	2,980	1,490
			ap(mm)	0.20		0.20		0.20		0.20	
			ae(mm)	3.0		3.0		4.0		4.2	

ap: Axial depth of cut, ae: Radial depth of cut, N: Spindle speed, Vf: Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) In case of overhung length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- 4) Use air blow to flush the chips out.

l / Dc	Vc (m/min)	Vf (mm/min)
3Dc or less	100%	100%
Over 3Dc, up to 5Dc	70%	70%
Over 5Dc, up to 10Dc	50%	50%

Mirror Radius

RNM_{TYPE}

RECOMMENDED CUTTING CONDITIONS

RNM type insert

Work Materials	Insert Grades	Cutting speed V _c (m/min)	Nominal feed rate: f (mm/rev)								
			Maximum a _p or a _e (mm)								
			Tool dia. D _c (mm)								
			6	8	10	12/13	16/17	20/21	25/26	30	32
Grey cast iron (FC250, FC300) 160~260HB	JC8003 DH103 JC8015	250	0.25	0.35	0.4	0.45	0.5	0.5	0.5	0.5	0.5
			0.2	0.3	0.3	0.4	0.5	0.7	0.8	1.0	1.0
Nodular cast iron (FCD600, FCD700) 170~300HB	JC8003 DH103 JC8015	200	0.2	0.3	0.35	0.35	0.4	0.4	0.4	0.4	0.4
			0.2	0.3	0.3	0.3	0.4	0.5	0.6	0.8	0.8
Carbon steel (S50C, S55C) 180~280HB	JC8003 DH103 JC8015	200	0.2	0.3	0.35	0.35	0.4	0.4	0.4	0.4	0.4
			0.2	0.3	0.3	0.3	0.4	0.5	0.6	0.8	0.8
Low alloy steel (SCM440) 180~280HB	JC8003 DH103 JC8015	180	0.26	0.28	0.32	0.32	0.36	0.36	0.36	0.36	0.36
			0.2	0.3	0.3	0.3	0.4	0.5	0.6	0.8	0.8
Mold steel (HPM, NAK) 280~400HB	JC8003 DH103 JC8015	150	0.18	0.25	0.28	0.28	0.32	0.32	0.32	0.32	0.32
			0.2	0.3	0.3	0.3	0.4	0.5	0.6	0.8	0.8
Tool & Die steel (SKD61, SKD11) 180~255HB	JC8003 DH103 JC8015	150	0.18	0.25	0.28	0.28	0.32	0.32	0.32	0.32	0.32
			0.2	0.3	0.3	0.3	0.4	0.5	0.6	0.8	0.8
Hardened die steel (SKD61, SKD11) 40~55HRC	JC8003 DH103	80	0.13	0.2	0.23	0.23	0.25	0.25	0.25	0.25	0.25
			0.2	0.3	0.3	0.3	0.3	0.4	0.5	0.6	0.6
Stainless steel (SUS304, SUS316) 150~250HB	JC8003 DH103 JC8015	130	0.13	0.2	0.23	0.23	0.25	0.25	0.25	0.25	0.25
			0.2	0.3	0.3	0.3	0.4	0.5	0.6	0.8	0.8
Copper alloy 80~150HB	JC8003 DH103 KT9	250	0.25	0.35	0.4	0.4	0.5	0.5	0.5	0.5	0.5
			0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.6	1.6
Aluminium alloy 30~100HB	JC8003 DH103 KT9	300	0.25	0.35	0.4	0.4	0.5	0.5	0.5	0.5	0.5
			0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.6	1.6
Graphite	JC8003 DH103 JC10000	300	0.25	0.35	0.4	0.4	0.5	0.5	0.5	0.5	0.5
			0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.6	1.6

Note) This data is applicable to short series tools and middle series tools.

★ Instructions for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Please use torque wrenches to tighten the clamp screw.

Recommend to use Torque control wrenches (6)

See the right table for recommended tightening torque.

Dimensions (mm)	Recommended torque
φ D _c	(N·m)
6	0.5
8	0.9
10	1.2
12	2.0
16	3.0
20	4.0
25	5.0
30	6.0
32	6.0

Mirror Radius HRM/FRM_{TYPE}

■ **RECOMMENDED CUTTING CONDITIONS**
 ● **HRM, FRM type insert + Carbide shank holder (C-Body)**

※ Recommended to reduce depth of cut a_p by corner radius with keeping feed speed V_f . (Refer the below table)

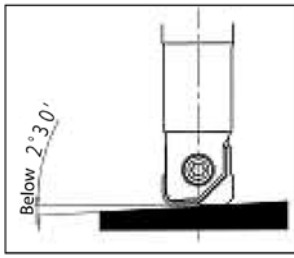
Work Materials	Insert Grades	Tool dia. (mm)									
		$\phi 6 \times R1.5$					$\phi 8 \times R2 / \phi 9 \times R2$				
		l (mm)	a_e (mm)	a_p (mm)	n (min ⁻¹)	V_f (mm/min)	l (mm)	a_e (mm)	a_p (mm)	n (min ⁻¹)	V_f (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015	15	2.1	0.20	9,000	8,000	20	2.8	0.40	7,500	8,200
		30	2.1	0.15	9,000	7,200	40	2.8	0.40	7,500	6,750
		—	—	—	—	—	60	2.8	0.25	7,500	6,750
		—	—	—	—	—	80	2.8	0.20	7,500	6,750
Mold steel HPM7, PX5, NAK80, P20 (1.2311, P20) 30-43HRC	JC8015	15	2.1	0.20	8,500	7,600	20	2.8	0.40	7,100	7,800
		30	2.1	0.15	8,500	6,800	40	2.8	0.40	7,100	6,400
		—	—	—	—	—	60	2.8	0.25	7,100	6,400
		—	—	—	—	—	80	2.8	0.20	7,100	6,400
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015	15	2.1	0.20	8,500	7,600	20	2.8	0.40	7,100	7,800
		30	2.1	0.15	8,500	6,800	40	2.8	0.40	7,100	6,400
		—	—	—	—	—	60	2.8	0.25	7,100	6,400
		—	—	—	—	—	80	2.8	0.20	7,100	6,400
Stainless steel SUS304 Below 250HB	JC8015	15	2.1	0.20	8,000	6,400	20	2.8	0.40	6,700	7,300
		30	2.1	0.15	8,000	5,600	40	2.8	0.40	6,700	6,000
		—	—	—	—	—	60	2.8	0.25	6,700	6,000
		—	—	—	—	—	80	2.8	0.20	6,700	6,000
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 40-50HRC	JC8015	15	2.1	0.15	6,900	5,500	20	2.8	0.20	6,000	6,600
		30	2.1	0.10	6,900	4,800	40	2.8	0.20	6,000	4,800
		—	—	—	—	—	60	2.8	0.15	6,000	4,800
		—	—	—	—	—	80	2.8	0.10	6,000	4,800
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015	15	2.1	0.20	7,400	6,600	20	2.8	0.40	6,400	7,600
		30	2.1	0.15	7,400	5,900	40	2.8	0.40	6,400	5,700
		—	—	—	—	—	60	2.8	0.25	6,400	5,700
		—	—	—	—	—	80	2.8	0.20	6,400	5,700

Depth of cut adjustment by corner radius $a_p \times$ ratio	Corner radius	R0.5	$a_p \times 0.65$	Corner radius	R0.5	$a_p \times 0.60$
		R1	$a_p \times 0.80$		R1	$a_p \times 0.70$
		R1.5	$a_p \times 1.0$		R2	$a_p \times 1.0$
		※ Recommend to reduce depth of cut a_p according to above table with keeping feed speed				

l : Overhung length, a_p : Depth of cut, a_e : Pick feed, n : Spindle speed, V_f : Feed speed

■ **NOTE**

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) If machine does not have enough power, recommend to reduce depth of cut first and reduce spindle speed and feed speed.
- 4) Use air blow to flush the chips out.
- 5) In case of 50-55HRC (Hardened die steel), recommend to reduce 30% above a_p , n , V_f .
- 6) In case of good surface requirement, recommend to reduce feed speed.
- 7) In case of ramping, ramping angle up to $2^\circ 30'$ is recommended.
- 8) In case of slotting with overhung length exceeding $5 \times D_c$, recommend to reduce depth of cut and feed speed.



★ **Instructions for mounting insert**

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Please use torque wrenches to tighten the clamp screw.

Recommend to use Torque control wrenches (xxx)
See the right table for recommended tightening torque.

Dimensions (mm)	Recommended torque
ϕD_c	(N·m)
6	0.5
8	0.9
10	1.2
12	2.0
16	3.0
20	4.0

Mirror Radius

HRM/FRM_{TYPE}

RECOMMENDED CUTTING CONDITIONS

● HRM, FRM type insert + Carbide shank holder (C-Body)

※ Recommended to reduce depth of cut a_p by corner radius with keeping feed speed V_f . (Refer the below table)

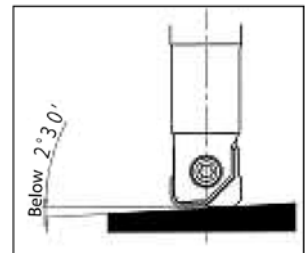
Work Materials	Insert Grades	Tool dia. (mm)									
		$\phi 10 \times R2 / \phi 11 \times R2$					$\phi 12 \times R2 / \phi 13 \times R2$				
		l (mm)	a_e (mm)	a_p (mm)	n (min^{-1})	V_f (mm/min)	l (mm)	a_e (mm)	a_p (mm)	n (min^{-1})	V_f (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015	25	4.2	0.40	6,000	7,200	30	5.6	0.50	5,000	6,000
		50	4.2	0.40	6,000	6,000	60	5.6	0.40	5,000	5,000
		75	4.2	0.25	6,000	6,000	90	5.6	0.25	5,000	5,000
		100	4.2	0.20	6,000	6,000	120	5.6	0.20	5,000	5,000
Mold steel HPM7, PX5, NAK80, P20 (1.2311, P20) 30-43HRC	JC8015	25	4.2	0.40	5,700	6,800	30	5.6	0.40	4,700	5,600
		50	4.2	0.40	5,700	5,700	60	5.6	0.40	4,700	4,700
		75	4.2	0.25	5,700	5,700	90	5.6	0.25	4,700	4,700
		100	4.2	0.20	5,700	5,700	120	5.6	0.20	4,700	4,700
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015	25	4.2	0.40	5,700	6,800	30	5.6	0.40	4,700	5,600
		50	4.2	0.40	5,700	5,700	60	5.6	0.40	4,700	4,700
		75	4.2	0.25	5,700	5,700	90	5.6	0.25	4,700	4,700
		100	4.2	0.20	5,700	5,700	120	5.6	0.20	4,700	4,700
Stainless steel SUS304 Below 250HB	JC8015	25	4.2	0.40	5,400	6,400	30	5.6	0.40	4,500	5,400
		50	4.2	0.40	5,400	5,400	60	5.6	0.40	4,500	4,500
		75	4.2	0.25	5,400	5,400	90	5.6	0.25	4,500	4,500
		100	4.2	0.20	5,400	5,400	120	5.6	0.20	4,500	4,500
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 40-50HRC	JC8015	25	4.2	0.20	4,700	5,600	30	5.6	0.20	4,000	4,800
		50	4.2	0.20	4,700	4,700	60	5.6	0.20	4,000	4,000
		75	4.2	0.15	4,700	4,700	90	5.6	0.15	4,000	4,000
		100	4.2	0.10	4,700	4,700	120	5.6	0.10	4,000	4,000
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015	25	4.2	0.40	5,100	6,100	30	5.6	0.40	4,200	5,000
		50	4.2	0.40	5,100	5,100	60	5.6	0.40	4,200	4,200
		75	4.2	0.25	5,100	5,100	90	5.6	0.25	4,200	4,200
		100	4.2	0.20	5,100	5,100	120	5.6	0.20	4,200	4,200

Depth of cut adjustment by corner radius ($a_p \times$ ratio)	Corner radius	R0.5	$a_p \times 0.60$	Corner radius	R0.5	$a_p \times 0.60$
		R1	$a_p \times 0.70$		R1	$a_p \times 0.70$
		R2	$a_p \times 1.0$		R1.5	$a_p \times 0.85$
					R2	$a_p \times 1.0$
	※ Recommend to reduce depth of cut a_p according to above table with keeping feed speed					

l : Overhung length, a_p : Depth of cut, a_e : Pick feed, n : Spindle speed, V_f : Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) If machine does not have enough power, recommend to reduce depth of cut first and reduce spindle speed and feed speed.
- 4) Use air blow to flush the chips out.
- 5) In case of 50-55HRC (Hardened die steel), recommend to reduce 30% above a_p , n , V_f .
- 6) In case of good surface requirement, recommend to reduce feed speed.
- 7) In case of ramping, ramping angle up to $2^\circ 30'$ is recommended.
- 8) In case of slotting with overhung length exceeding $5 \times D_c$, recommend to reduce depth of cut and feed speed.



★ Instructions for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Please use torque wrenches to tighten the clamp screw.

Recommend to use Torque control wrenches (xxx)

See the right table for recommended tightening torque.

Dimensions (mm)	Recommended torque
ϕD_c	(N·m)
6	0.5
8	0.9
10	1.2
12	2.0
16	3.0
20	4.0

Mirror Radius HRM/FRM_{TYPE}

RECOMMENDED CUTTING CONDITIONS
HRM, FRM type insert + Carbide shank holder (C-Body)

※ Recommended to reduce depth of cut a_p by corner radius with keeping feed speed V_f . (Refer the below table)

Work Materials	Insert Grades	Tool dia. (mm)									
		$\phi 16 \times R3 / \phi 17 \times R3$					$\phi 20 \times R3 / \phi 22 \times R3$				
		l (mm)	a_e (mm)	a_p (mm)	n (min^{-1})	V_f (mm/min)	l (mm)	a_e (mm)	a_p (mm)	n (min^{-1})	V_f (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015	35	7.0	0.60	3,800	4,500	40	9.8	0.60	3,000	3,600
		80	7.0	0.60	3,800	3,800	100	9.8	0.60	3,000	3,000
		120	7.0	0.40	3,800	3,800	150	9.8	0.40	3,000	3,000
		160	7.0	0.30	3,800	3,800	200	9.8	0.30	3,000	3,000
Mold steel HPM7, PX5, NAK80, P20 (1.2311, P20) 30-43HRC	JC8015	35	7.0	0.60	3,500	4,200	40	9.8	0.60	2,800	3,300
		80	7.0	0.60	3,500	3,500	100	9.8	0.60	2,800	2,800
		120	7.0	0.40	3,500	3,500	150	9.8	0.40	2,800	2,800
		160	7.0	0.30	3,500	3,500	200	9.8	0.30	2,800	2,800
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015	35	7.0	0.60	3,500	4,200	40	9.8	0.60	2,800	3,300
		80	7.0	0.60	3,500	3,500	100	9.8	0.60	2,800	2,800
		120	7.0	0.40	3,500	3,500	150	9.8	0.40	2,800	2,800
		160	7.0	0.30	3,500	3,500	200	9.8	0.30	2,800	2,800
Stainless steel SUS304 Below 250HB	JC8015	35	7.0	0.60	3,400	4,000	40	9.8	0.60	2,700	3,200
		80	7.0	0.60	3,400	3,400	100	9.8	0.60	2,700	2,700
		120	7.0	0.40	3,400	3,400	150	9.8	0.40	2,700	2,700
		160	7.0	0.30	3,400	3,400	200	9.8	0.30	2,700	2,700
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 40-50HRC	JC8015	35	7.0	0.30	3,000	3,600	40	9.8	0.30	2,400	2,800
		80	7.0	0.30	3,000	3,000	100	9.8	0.30	2,400	2,400
		120	7.0	0.25	3,000	3,000	150	9.8	0.25	2,400	2,400
		160	7.0	0.20	3,000	3,000	200	9.8	0.20	2,400	2,400
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015	35	7.0	0.60	3,200	3,800	40	9.8	0.60	2,500	3,000
		80	7.0	0.60	3,200	3,200	100	9.8	0.60	2,500	2,500
		120	7.0	0.40	3,200	3,200	150	9.8	0.40	2,500	2,500
		160	7.0	0.30	3,200	3,200	200	9.8	0.30	2,500	2,500

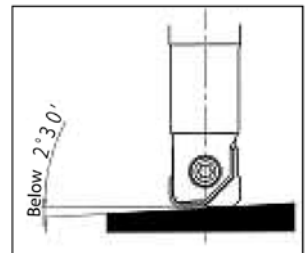
Depth of cut adjustment by corner radius ($a_p \times$ ratio)	Corner radius	R1	$a_p \times 0.50$	Corner radius	R1	$a_p \times 0.50$
		R1.5	$a_p \times 0.60$		R1.5	$a_p \times 0.60$
	R2	$a_p \times 0.75$	R2	$a_p \times 0.75$		
	R3	$a_p \times 1.0$	R3	$a_p \times 1.0$		

※ Recommend to reduce depth of cut a_p according to above table with keeping feed speed

l : Overhung length, a_p : Depth of cut, a_e : Pick feed, n : Spindle speed, V_f : Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) If machine does not have enough power, recommend to reduce depth of cut first and reduce spindle speed and feed speed.
- 4) Use air blow to flush the chips out.
- 5) In case of 50-55HRC (Hardened die steel), recommend to reduce 30% above a_p , n , V_f .
- 6) In case of good surface requirement, recommend to reduce feed speed.
- 7) In case of ramping, ramping angle up to $2^\circ 30'$ is recommended.
- 8) In case of slotting with overhung length exceeding $5 \times D_c$, recommend to reduce depth of cut and feed speed.



★ Instructions for mounting insert

1. Clean the insert seat carefully.
2. Clean the insert, especially hole and location face.
3. Change the clamp screw when the screw gets worn out.
4. Please use torque wrenches to tighten the clamp screw.

Recommend to use Torque control wrenches (xxx)
See the right table for recommended tightening torque.

Dimensions (mm)	Recommended torque
ϕD_c	(N·m)
6	0.5
8	0.9
10	1.2
12	2.0
16	3.0
20	4.0

Mirror Radius

FRM_{TYPE}

RECOMMENDED CUTTING CONDITIONS/SIDE FACE FINISHING

FRM type insert + Carbide shank holder (C-Body)

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)					
				φ8		φ10		φ12	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		300	11,940	3,580	9,550	2,860	7,960	2,380
			ap (mm)	0.20		0.25		0.30	
			ae (mm)	0.08		0.10		0.12	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		300	11,940	3,580	9,550	2,860	7,960	2,380
			ap (mm)	0.20		0.25		0.30	
			ae (mm)	0.08		0.10		0.12	
Stainless steel SUS304 Below 250HB	JC8015		280	11,150	3,350	8,910	2,670	7,420	2,220
			ap (mm)	0.20		0.25		0.30	
			ae (mm)	0.08		0.10		0.12	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		300	11,940	3,580	9,550	2,860	7,960	2,380
			ap (mm)	0.20		0.25		0.30	
			ae (mm)	0.08		0.10		0.12	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		280	11,150	3,350	8,910	2,670	7,420	2,220
			ap (mm)	0.20		0.25		0.30	
			ae (mm)	0.08		0.10		0.12	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		250	9,950	1,000	7,960	800	6,630	800
			ap (mm)	0.20		0.25		0.30	
			ae (mm)	0.08		0.10		0.12	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		200	7,950	800	6,360	640	5,300	640
			ap (mm)	0.20		0.25		0.30	
			ae (mm)	0.08		0.10		0.12	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		350	13,930	4,180	11,140	3,900	9,280	3,710
			ap (mm)	0.20		0.25		0.30	
			ae (mm)	0.10		0.15		0.20	

ℓ: Overhung length, ap: Depth of cut, ae: Pick feed, Vc: Cutting speed, n: Spindle speed, Vf: Feed speed

NOTE

- The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- In case chatter occurs, recommend to reduce depth of cut or feed speed.
- In case of overhung length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- Use air blow to flash out the chips out.

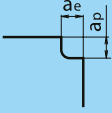
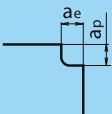
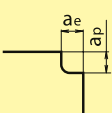
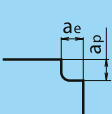
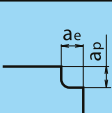
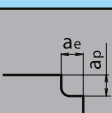
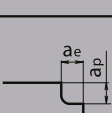
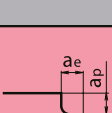
Overhung length ℓ/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, up to 5Dc	70%	70%
5Dc~10Dc Over 5Dc, up to 10Dc	50%	50%

Mirror Radius

FRM_{TYPE}

RECOMMENDED CUTTING CONDITIONS/SIDE FACE FINISHING

FRM type insert + Carbide shank holder (C-Body)

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)					
				φ 16		φ 20		φ 21	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		300	5,970	2,390	4,770	1,910	4,550	1,820
			ap (mm)	0.40		0.50		0.50	
			ae (mm)	0.16		0.20		0.10	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		300	5,970	2,390	4,770	1,910	4,550	1,820
			ap (mm)	0.40		0.50		0.50	
			ae (mm)	0.16		0.20		0.10	
Stainless steel SUS304 Below 250HB	JC8015		280	5,570	2,230	4,560	1,820	4,240	1,700
			ap (mm)	0.40		0.50		0.50	
			ae (mm)	0.16		0.20		0.10	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		300	5,970	2,390	4,770	1,910	4,550	1,820
			ap (mm)	0.40		0.50		0.50	
			ae (mm)	0.16		0.20		0.10	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		280	5,570	1,670	4,560	1,370	4,240	1,270
			ap (mm)	0.40		0.50		0.50	
			ae (mm)	0.16		0.20		0.10	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		250	4,970	750	3,980	600	3,790	570
			ap (mm)	0.40		0.50		0.50	
			ae (mm)	0.16		0.20		0.10	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		200	3,980	600	3,180	480	3,000	450
			ap (mm)	0.40		0.50		0.50	
			ae (mm)	0.16		0.20		0.10	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		350	6,960	3,480	5,570	3,340	5,300	3,180
			ap (mm)	0.40		0.50		0.50	
			ae (mm)	0.20		0.25		0.20	

ℓ: Overhang length, ap: Depth of cut, ae: Pick feed, Vc: Cutting speed, n: Spindle speed, Vf: Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) In case of overhang length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- 4) Use air blow to flash out the chips out.

Overhang length ℓ/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, upto 5Dc	70%	70%
5Dc~10Dc Over 5Dc, upto 10Dc	50%	50%

RECOMMENDED CUTTING CONDITIONS/SIDE FACE FINISHING

FRM type insert + Carbide shank holder (C-Body)

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)					
				φ25		φ30		φ32	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		300	3,820	1,530	3,180	1,270	2,980	1,190
			ap (mm)	0.80		1.0		1.2	
			ae (mm)	0.10		0.10		0.10	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		300	3,820	1,530	3,180	1,270	2,980	1,190
			ap (mm)	0.80		1.0		1.2	
			ae (mm)	0.10		0.10		0.10	
Stainless steel SUS304 Below 250HB	JC8015		280	3,560	1,420	2,970	1,190	2,780	1,110
			ap (mm)	0.80		1.0		1.2	
			ae (mm)	0.10		0.10		0.10	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		300	3,820	1,530	3,180	1,270	2,980	1,190
			ap (mm)	0.80		1.0		1.2	
			ae (mm)	0.10		0.10		0.10	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		280	3,560	1,070	2,970	890	2,780	830
			ap (mm)	0.80		1.0		1.2	
			ae (mm)	0.10		0.10		0.10	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		250	3,180	480	2,650	400	2,480	370
			ap (mm)	0.60		0.80		1.0	
			ae (mm)	0.10		0.10		0.10	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		200	2,540	380	2,120	320	1,990	300
			ap (mm)	0.60		0.80		1.0	
			ae (mm)	0.10		0.10		0.10	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		350	4,450	2,670	3,710	2,230	3,480	2,090
			ap (mm)	0.80		1.0		1.2	
			ae (mm)	0.20		0.20		0.20	

ℓ: Overhung length, ap: Depth of cut, ae: Pick feed, Vc: Cutting speed, n: Spindle speed, Vf: Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) In case of overhung length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- 4) Use air blow to flash out the chips out.

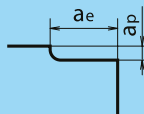
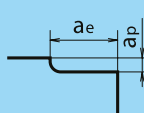
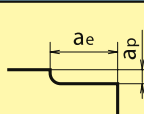
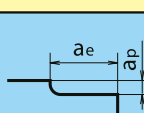
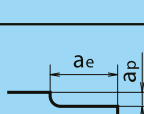
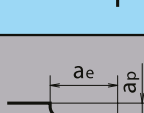
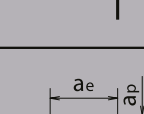

Overhung length ℓ/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, up to 5Dc	70%	70%
5Dc~10Dc Over 5Dc, up to 10Dc	50%	50%

Mirror Radius

FRM_{TYPE}

RECOMMENDED CUTTING CONDITIONS / BOTTOM FACE FINISHING

FRM type insert + Carbide shank holder (C-Body)

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)					
				φ8		φ10		φ12	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		260	10,340	3,100	8,280	2,480	6,900	2,070
			ap (mm)	0.15		0.15		0.20	
			ae (mm)	1.0		1.2		1.5	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		260	10,340	3,100	8,280	2,480	6,900	2,070
			ap (mm)	0.15		0.15		0.20	
			ae (mm)	1.0		1.2		1.5	
Stainless steel SUS304 Below 250HB	JC8015		240	9,550	2,860	7,640	2,290	6,360	1,900
			ap (mm)	0.15		0.15		0.20	
			ae (mm)	1.0		1.2		1.5	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		260	10,340	3,100	8,280	2,480	6,900	2,060
			ap (mm)	0.15		0.15		0.20	
			ae (mm)	1.0		1.2		1.5	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		240	9,550	2,860	7,640	2,290	6,360	1,900
			ap (mm)	0.15		0.15		0.20	
			ae (mm)	1.0		1.2		1.5	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		190	7,560	760	6,050	610	5,040	600
			ap (mm)	0.10		0.10		0.15	
			ae (mm)	0.70		0.90		1.1	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		130	5,170	520	4,140	410	3,450	410
			ap (mm)	0.10		0.10		0.15	
			ae (mm)	0.60		0.90		1.2	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		300	11,940	3,580	9,450	3,310	7,960	3,180
			ap (mm)	0.15		0.15		0.20	
			ae (mm)	1.2		1.5		1.8	

ℓ: Overhang length, ap: Depth of cut, ae: Pick feed, Vc: Cutting speed, N: Spindle speed, Vf: Feed speed

NOTE

- 1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- 2) In case chatter occurs, recommend to reduce depth of cut or feed speed.
- 3) In case of overhang length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- 4) Use air blow to flash out the chips out.

Overhang length ℓ/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, up to 5Dc	70%	70%
5Dc~10Dc Over 5Dc, up to 10Dc	50%	50%

RECOMMENDED CUTTING CONDITIONS / BOTTOM FACE FINISHING

FRM type insert + Carbide shank holder (C-Body)

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)					
				φ16		φ20		φ21	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		260	5,170	2,070	4,140	1,660	3,940	1,570
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	2.0		2.5		2.5	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		260	5,170	2,070	4,140	1,660	3,940	1,570
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	2.0		2.5		2.5	
Stainless steel SUS304 Below 250HB	JC8015		240	4,770	1,910	3,810	1,520	3,640	1,450
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	2.0		2.5		2.5	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		260	5,170	2,070	4,140	1,660	3,940	1,570
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	2.0		2.5		2.5	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		240	4,770	1,430	3,810	1,140	3,640	1,090
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	2.0		2.5		2.5	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		190	3,780	570	3,020	450	2,880	430
			ap (mm)	0.15		0.15		0.15	
			ae (mm)	1.4		1.8		1.8	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		130	2,590	390	2,070	310	1,970	290
			ap (mm)	0.15		0.15		0.15	
			ae (mm)	1.2		1.5		1.5	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		300	5,970	2,390	4,770	1,910	4,550	1,820
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	2.4		3.0		3.0	

l: Overhang length, ap: Depth of cut, ae: Pick feed, Vc: Cutting speed, n: Spindle speed, Vf: Feed speed

NOTE

- The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
- In case chatter occurs, recommend to reduce depth of cut or feed speed.
- In case of overhang length over 3 x Dc, cutting speed and feed speed to be reduced according to the right table.
- Use air blow to flash out the chips out.

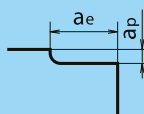
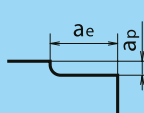
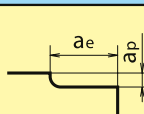
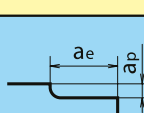
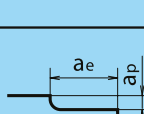
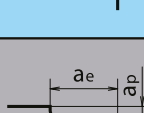
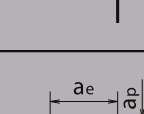

Overhang length l/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, up to 5Dc	70%	70%
5Dc~10Dc Over 5Dc, up to 10Dc	50%	50%

Mirror Radius

FRM_{TYPE}

RECOMMENDED CUTTING CONDITIONS / BOTTOM FACE FINISHING

FRM type insert + Carbide shank holder (C-Body)

Work Materials	Insert Grades	Type of machining	Cutting speed Vc (m/min)	Tool dia. (mm)					
				φ25		φ30		φ32	
				n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)	n (min ⁻¹)	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	JC8015		260	3,310	1,320	2,750	1,100	2,580	1,030
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	3.0		4.0		4.2	
Die steel SKD61, SKD11 (1.2344, 1.2379) Below 255HB	JC8015		260	3,310	1,320	2,750	1,100	2,580	1,030
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	3.0		4.0		4.2	
Stainless steel SUS304 Below 250HB	JC8015		240	3,050	1,220	2,540	1,020	2,380	950
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	3.0		4.0		4.2	
Mold steel HPM7, PX5, P20 (1.2311, P20) 30-36HRC	JC8015 DH102		260	3,310	1,320	2,750	1,100	2,580	1,030
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	3.0		4.0		4.2	
Mold steel NAK80, HPM1, P21 (1.2311, P21) 38-43HRC	DH102		240	3,050	910	2,540	760	2,380	710
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	3.0		4.0		4.2	
Hardened die steel SKD61, DAC, DHA (1.2344, 1.2379) 42-52HRC	DH102		190	2,420	360	2,010	300	1,890	280
			ap (mm)	0.15		0.15		0.15	
			ae (mm)	2.2		2.7		2.8	
Hardened die steel SKD11, SLD, DC11 (1.2344, 1.2379) 55-62HRC	DH102		130	1,650	250	1,380	200	1,290	190
			ap (mm)	0.15		0.15		0.15	
			ae (mm)	1.8		2.2		2.3	
Grey & Nodular cast iron FC, FCD (GG, GGG) Below 300HB	JC8015 DH102		300	3,820	1,900	3,180	1,590	2,980	1,490
			ap (mm)	0.20		0.20		0.20	
			ae (mm)	3.0		4.0		4.2	

l: Overhang length, ap: Depth of cut, ae: Pick feed, Vc: Cutting speed, n: Spindle speed, Vf: Feed speed

NOTE

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Overhang length l/Dc	Vc (m/min)	Vf (mm/min)
~3Dc 3Dc or less	100%	100%
3Dc~5Dc Over 3Dc, up to 5Dc	70%	70%
5Dc~10Dc Over 5Dc, up to 10Dc	50%	50%



JQA-2089



JQA-EM1580

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