RECOMMENDED CUTTING CONDITIONS

■Cutting Speed

	Workpiece Material		Greade	Breaker	Cutting Speed **vc** (m/min)
P	Mild Steel (JIS SS400, S10C etc)	**≤180HB**	**MP6120**	**GLA**	200 (150—220)
	Carbon Steel Alloy Steel (JIS S45C, SCM440 etc)	**180—280HB**	**MP6120**	**GLA**	200 (150—220)
N	Aluminium Alloy (A6061, A7075 etc)	**Si<5%**	**LC15TF**	**GL**	1000 (200—3000)
			TF15	**GL**	1000 (200—3000)
	Aluminium Alloy (AC4B, ADC12, A390 etc)	**5%≤Si≤10% Si>10%**	**LC15TF**	**GL**	1000 (200—3000)
S	Titanium Alloy (Ti-6Al-4V etc)	—	**MP9120**	**GLA**	40 (30—60)

■Depth of Cut / Feed per Tooth

	Workpiece Material		Breaker	Cutting Width **ae** (mm)	Depth of Cut **ap** (mm)	Feed per Tooth (mm/t)			
						Cutting Edge Diameter **DC** (mm)			
						32	**40**	**50, 63, 80**	**100, 125**
P	Mild Steel (JIS SS400, S10C etc)	**≤180HB**	**GLA**	≤0.25 DC	≤ 5	≤ 0.18	≤ 0.2	≤ 0.2	≤ 0.2
					≤ 10	≤ 0.15	≤ 0.18	≤ 0.18	≤ 0.18
					≤ 15	≤ 0.12	≤ 0.15	≤ 0.15	≤ 0.15
					≤ 20	≤ 0.1	≤ 0.12	≤ 0.12	—
				≤0.5 DC	≤ 5	≤ 0.18	≤ 0.2	≤ 0.2	≤ 0.2
					≤ 10	≤ 0.15	≤ 0.18	≤ 0.18	≤ 0.18
					≤ 15	≤ 0.12	≤ 0.15	≤ 0.15	≤ 0.15
					≤ 20	≤ 0.1	≤ 0.12	≤ 0.12	—
				≤0.75 DC	≤ 5	≤ 0.15	≤ 0.15	≤ 0.18	≤ 0.18
					≤ 10	≤ 0.12	≤ 0.12	≤ 0.15	≤ 0.15
					≤ 15	≤ 0.1	≤ 0.1	≤ 0.12	≤ 0.12
				DC (Slot)	≤ 5	≤ 0.12	≤ 0.15	≤ 0.18	≤ 0.18
					≤ 10	≤ 0.1	≤ 0.12	≤ 0.15	≤ 0.15
	Carbon Steel Alloy Steel (JIS S45C, SCM440 etc)	**180—280HB**	**GLA**	≤0.25 DC	≤ 5	≤ 0.18	≤ 0.2	≤ 0.2	≤ 0.2
					≤ 10	≤ 0.15	≤ 0.18	≤ 0.18	≤ 0.18
					≤ 15	≤ 0.12	≤ 0.15	≤ 0.15	≤ 0.15
					≤ 20	≤ 0.1	≤ 0.12	≤ 0.12	—
				≤0.5 DC	≤ 5	≤ 0.18	≤ 0.2	≤ 0.2	≤ 0.2
					≤ 10	≤ 0.15	≤ 0.18	≤ 0.18	≤ 0.18
					≤ 15	≤ 0.12	≤ 0.15	≤ 0.15	≤ 0.15
					≤ 20	≤ 0.1	≤ 0.12	≤ 0.12	—
				≤0.75 DC	≤ 5	≤ 0.15	≤ 0.15	≤ 0.18	≤ 0.18
					≤ 10	≤ 0.12	≤ 0.12	≤ 0.15	≤ 0.15
					≤ 15	≤ 0.1	≤ 0.1	≤ 0.12	≤ 0.12
				DC (Slot)	≤ 5	≤ 0.12	≤ 0.15	≤ 0.18	≤ 0.18
					≤ 10	≤ 0.1	≤ 0.12	≤ 0.15	≤ 0.15

Note 1) The above cutting conditions are determined based on high workpiece and machine rigidity, where no vibration occurred. If vibrations occur make adjustments according to the machining conditions.

Note 2) Note, vibrations may occur in the following conditions.
- When using long tool overhang.
- When pocket machining corner radii.
- When the workpiece has poor clamping rigidity or when the machine rigidity or workpiece rigidity is low, vibrations can occur easily, if so, reduce cutting conditions such as width and depth of cut and feed per tooth.

RECOMMENDED CUTTING CONDITIONS

■ Depth of Cut / Feed per Tooth

Workpiece Material			Breaker	Cutting Width **ae** (mm)	Depth of Cut **ap** (mm)	Feed per Tooth (mm/t)			
						Cutting Edge Diameter **DC** (mm)			
						32	**40**	**50, 63, 80**	**100, 125**
N	Aluminium Alloy (A6061, A7075 etc)	**Si<5%**	**GL**	≤0.25 DC	≦ 5	≦ 0.35	≦ 0.4	≦ 0.4	≦ 0.4
					≦ 10	≦ 0.3	≦ 0.35	≦ 0.35	≦ 0.35
					≦ 15	≦ 0.25	≦ 0.3	≦ 0.3	≦ 0.3
					≦ 20	≦ 0.2	≦ 0.25	≦ 0.25	≦ 0.25
				≤0.5 DC	≦ 5	≦ 0.35	≦ 0.35	≦ 0.4	≦ 0.4
					≦ 10	≦ 0.3	≦ 0.3	≦ 0.35	≦ 0.35
					≦ 15	≦ 0.25	≦ 0.25	≦ 0.3	≦ 0.3
					≦ 20	≦ 0.2	≦ 0.2	≦ 0.25	≦ 0.25
				≤0.75 DC	≦ 5	≦ 0.3	≦ 0.3	≦ 0.35	≦ 0.35
					≦ 10	≦ 0.25	≦ 0.25	≦ 0.3	≦ 0.3
					≦ 15	≦ 0.2	≦ 0.2	≦ 0.25	≦ 0.25
					≦ 20	≦ 0.15	≦ 0.15	≦ 0.2	≦ 0.2
				DC (Slot)	≦ 5	≦ 0.25	≦ 0.3	≦ 0.35	≦ 0.35
					≦ 10	≦ 0.2	≦ 0.25	≦ 0.3	≦ 0.3
					≦ 15	≦ 0.15	≦ 0.2	≦ 0.25	≦ 0.25
					≦ 20	≦ 0.1	≦ 0.15	≦ 0.2	≦ 0.2
	Aluminium Alloy (AC4B etc) Aluminium Alloy (ADC12, A390 etc)	**5%≦Si≦10%** **Si>10%**	**GL**	≤0.25 DC	≦ 5	≦ 0.35	≦ 0.4	≦ 0.4	≦ 0.4
					≦ 10	≦ 0.3	≦ 0.35	≦ 0.35	≦ 0.35
					≦ 15	≦ 0.25	≦ 0.3	≦ 0.3	≦ 0.3
					≦ 20	≦ 0.2	≦ 0.25	≦ 0.25	≦ 0.25
				≤0.5 DC	≦ 5	≦ 0.35	≦ 0.35	≦ 0.4	≦ 0.4
					≦ 10	≦ 0.3	≦ 0.3	≦ 0.35	≦ 0.35
					≦ 15	≦ 0.25	≦ 0.25	≦ 0.3	≦ 0.3
					≦ 20	≦ 0.2	≦ 0.2	≦ 0.25	≦ 0.25
				≤0.75 DC	≦ 5	≦ 0.3	≦ 0.3	≦ 0.35	≦ 0.35
					≦ 10	≦ 0.25	≦ 0.25	≦ 0.3	≦ 0.3
					≦ 15	≦ 0.2	≦ 0.2	≦ 0.25	≦ 0.25
					≦ 20	≦ 0.15	≦ 0.15	≦ 0.2	≦ 0.2
				DC (Slot)	≦ 5	≦ 0.25	≦ 0.3	≦ 0.35	≦ 0.35
					≦ 10	≦ 0.2	≦ 0.25	≦ 0.3	≦ 0.3
					≦ 15	≦ 0.15	≦ 0.2	≦ 0.25	≦ 0.25
					≦ 20	≦ 0.1	≦ 0.15	≦ 0.2	≦ 0.2
S	Titanium Alloy (Ti-6Al-4V etc)	–	**GLA**	≤0.25 DC	≦ 5	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 10	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 15	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 20	≦ 0.1	≦ 0.12	≦ 0.12	–
				≤0.5 DC	≦ 5	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 10	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 15	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 20	–	≦ 0.1	≦ 0.1	–
				≤0.75 DC	≦ 5	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 10	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 15	≦ 0.1	≦ 0.12	≦ 0.12	–
					≦ 20	–	≦ 0.1	≦ 0.1	–
				DC (Slot)	≦ 5	≦ 0.08	≦ 0.08	≦ 0.08	–
					≦ 10	≦ 0.05	≦ 0.08	≦ 0.08	–

Note 1) The above cutting conditions are determined based on high workpiece and machine rigidity, where no vibration occurred.
If vibrations occur make adjustments according to the machining conditions.

Note 2) Note, vibrations may occur in the following conditions.
- When using long tool overhang.
- When pocket machining corner radii.
- When the workpiece has poor clamping rigidity or when the machine rigidity or workpiece rigidity is low, vibrations can occur easily, if so, reduce cutting conditions such as width and depth of cut and feed per tooth.

■CAUTION FOR USE

Procedure for attaching inserts

1) Clean the seat by air blowing or with a brush before installing the insert.
2) Tighten the clamp screw using the accessory wrench while pressing the insert against the seat.
3) Tighten the clamp screw as shown in Figure 1.
4) Coat the clamp screw with anti-seize compound and tighten it to the specified tightening torque.
   The tightening torque is shown below.
   AXD7000 3.5N•m(2.58ft•lb)
   AXD4000 1.5N•m(1.11ft•lb)
5) The clamp screw is an important part in ensuring safety.
   Purchase an official product from Mitsubishi Materials.
   When using over the revolution shown in Table 2, replacing the clamp screw simultaneously with insert replacement is recommended.

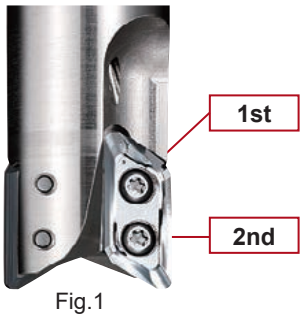
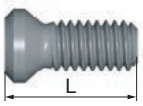


Fig.1

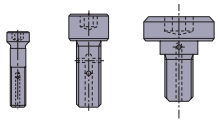
Type	AXD4000		AXD7000		
Cutting Edge Diameter **DC**(mm)	ø20	ø25–ø125	ø32	ø40–ø125	
Clamp Screw Number	TS3SBS	TS3SB	TS4SB	TS4SBL	
Overall Length **L**(mm)	6.5	8	9	10.5	

6) Check that there is no clearance at the insert seat surface.

Installation of arbor type

1) Clean carefully the inside and face of the hole and the arbor face before installing the body to the arbor.
2) Set the body at the arbor and tighten it with the accessory. Refer to the table shown below for the tightening torque.
3) The set bolt supplied with the AXD is a special coolant through compatible nozzle. Be careful not to lose it.

AXD4000

Geometry	Set Bolt	Clamp Torque (N • m)	Cutting Edge Diameter **DC**(mm)	Fig
Fig.1 Fig.2 Fig.3  With Coolant Hole	HFF08043H	11	ø40	1
	HSC10030H	40	ø50, ø63	2
	HSC12035H	80	ø80	2
	HSC16040H	150	ø100	2
	MBA20040H	320	ø120	3

AXD7000

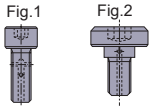
Geometry	Set Bolt	Clamp Torque (N•m)	Cutting Edge Diameter **DC**(mm)	Fig
Fig.1 Fig.2  With Coolant Hole	HSC10030H	40	ø50, ø63	1
	HSC12035H	80	ø80	1
	HSC16040H	150	ø100	1
	MBA20040H	320	ø120	2

Table 1 Max. Allowable Revolution

AXD4000

Cutting Edge Diameter **DC**(mm)	ø25	ø32	ø40	ø50	ø63	ø80	ø100	ø125
Max. Allowable Revolution (min^{-1})	49000	48000	41000	35000	30000	27000	23000	20000

AXD7000

Cutting Edge Diameter **DC**(mm)	ø32	ø40	ø50	ø63	ø80	ø100	ø125
Max. Allowable Revolution (min^{-1})	41000	36000	30000	25000	23000	19000	16000

● Even when operating under the maximum allowable spindle speed, if the spindle speed is equal to or higher than the values shown in table 2, it is recommended that the balance quality (with the arbor or milling chuck) conforms to G6.3 or betterbased on ISO1940. It is also recommended to replace the clamp screws with new ones when changing inserts. Furthermore,ensure to use machines that are provided with safety measures in case of cutter breakage.

Note 1) The balance quality of the holder (without inserts and clamp screws) is G6.3 or better at 10,000min^{-1}.

Table 2 Maximum spindle speed when balancing with the arbor or milling chuck has not been achieved

AXD4000

Cutting Edge Diameter **DC**(mm)	ø25	ø32	ø40	ø50	ø63	ø80	ø100	ø125
Max. Allowable Revolution (min^{-1})	12000	9500	7600	6000	4800	3800	3000	2400

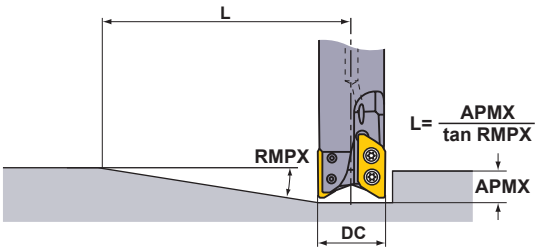
AXD7000

Cutting Edge Diameter **DC**(mm)	ø32	ø40	ø50	ø63	ø80	ø100	ø125
Max. Allowable Revolution (min^{-1})	9500	7600	6000	4800	3800	3000	2400

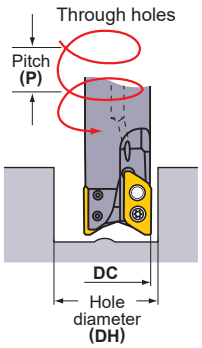
● When setting the spindle speed, take into consideration the maximum allowable spindle speed of the arbor or milling chuck.
● Use the specified set bolt when using the arbor type with through coolant.
● The inserts have sharp cutting edges and handling them with bare hands may cause injuries.
   Always wear safety gloves whenhandling the indexable inserts.

■RAMPING/HELICAL CUTTING

● **RAMPING**



● **HELICAL CUTTING**



RAMPING/HELICAL CUTTING (ALUMINIUM ALLOY)

Type	DC (mm)	RE (mm)	Ramping	
			RMPX	L (mm) ∗1
A type	32	0.8 - 2.4	19°	61
		3,3.2	18°	65
	40	0.8 - 2.4	14°	85
		3, 3.2	13°	91
	50	0.8 - 2.4	10°	120
		3, 3.2	9°	133
	63	0.8 - 2.4	8°	150
		3, 3.2	7°	172
	80	0.8 - 2.4	6°	200
		3, 3.2	5°	241
	100	0.8 - 2.4	4°	301
		3, 3.2	4°	301
	125	0.8 - 2.4	3°	401
		3, 3.2	3°	401
B type	32	4, 5	18°	63
	40	4, 5	11°	105
	50	4, 5	8°	146
	63	4, 5	6°	195
	80	4, 5	4°	292
	100	4, 5	3°	390
	125	4, 5	2°	585

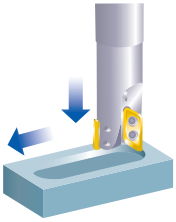
Type	DC (mm)	RE (mm)	Helical Milling	
			DH min. (mm)	P max. (mm)
A type	32	0.8 - 2.4	41	8
		3, 3.2	41	7
	40	0.8 - 2.4	57	10
		3, 3.2	57	9
	50	0.8 - 2.4	77	12
		3, 3.2	77	11
	63	0.8 - 2.4	103	13
		3, 3.2	103	12
	80	0.8 - 2.4	137	14
		3, 3.2	137	12
	100	0.8 - 2.4	177	14
		3, 3.2	177	13
	125	0.8 - 2.4	227	15
		3, 3.2	227	13
B type	32	4	41	7
		5	41	6
	40	4	57	9
		5	57	8
	50	4	77	10
		5	77	9
	63	4	103	10
		5	103	10
	80	4	137	11
		5	137	10
	100	4	177	11
		5	177	10
	125	4	227	11
		5	227	11

Note 1) The recommended ramping feed is 0.05mm/t or under.
Ramping, helical, and drilling are not recommended for machining of steel and titanium alloys.
∗1 L= (Max. Depth of Cut / tan RMPX) until the maximum depth of cut (APMX) is reached at the maximum ramping angle.
Maximum depth of cut A type is 21mm, B type is 20.4mm.
∗2 The maximum diameter when machining a blind hole with a flat face using a corner radius of 0.8mm for A type and 4mm for B type.
Other than that, find with the below formula.
{(cutting edge diameter DC)−(corner radius)−0.3}×2
∗3 The minimum diameter when machining a blind hole with a flat face using a corner radius of 0.8mm for A type and 4mm for B type.
Other than that, find with the below formula.
{(cutting edge diameter DC)−(corner radius)−(Width of wiper edge BS)−0.1}×2

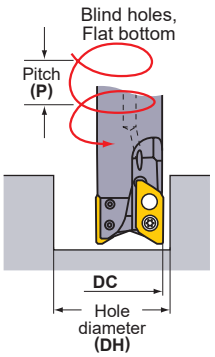
■Max. Drilling Depth (Aluminium Alloy)

Type	Insert corner radius RE (mm)	Max. Drilling Depth (mm)
Type A	0.8−2.4	5
	3, 3.2	4.5
Type B	4	4
	5	3.5

AXD7000 can be effectively used for pocket machining without the need for a prepared hole.



● **HELICAL CUTTING**



RAMPING/HELICAL CUTTING (ALUMINIUM ALLOY)

Type	DC (mm)	RE (mm)	BS (mm)	Helical Cutting (Blind Hole, Flat Bottom)			
				DH max. (mm) *2	P max. (mm)	DH min. (mm) *3	P max. (mm)
A type	32	0.8	2	61.9	20	58.3	20
		1.6	1.2	60.3	19	58.3	19
		2	0.8	59.5	18	58.3	18
		2.4	0.4	58.7	18	58.3	18
		3	0.8	57.5	17	56.2	17
		3.2	0.6	57.1	17	56.2	17
	40	0.8	2	77.9	20	74.3	20
		1.6	1.2	76.3	19	74.3	19
		2	0.8	75.5	18	74.3	18
		2.4	0.4	74.7	18	74.3	18
		3	0.8	73.5	17	72.2	17
		3.2	0.6	73.1	17	72.2	17
	50	0.8	2	97.5	20	94.1	20
		1.6	1.2	95.9	19	94.1	19
		2	0.8	95.1	18	94.1	18
		2.4	0.4	94.3	18	94.1	18
		3	0.8	93.1	17	92.1	17
		3.2	0.6	92.7	17	92.1	17
	63	0.8	2	123.5	20	120.1	19
		1.6	1.2	121.9	19	120.1	19
		2	0.8	121.1	18	120.1	18
		2.4	0.4	120.3	18	120.1	18
		3	0.8	119.1	17	118	16
		3.2	0.6	118.7	17	118	16
	80	0.8	2	157.5	19	154.1	18
		1.6	1.2	155.9	19	154.1	18
		2	0.8	155.1	18	154.1	18
		2.4	0.4	154.3	18	154.1	18
		3	0.8	153.1	16	152	16
		3.2	0.6	152.7	16	152	16
	100	0.8	2	197.5	18	194.1	18
		1.6	1.2	195.9	18	194.1	18
		2	0.8	195.1	18	194.1	18
		2.4	0.4	194.3	18	194.1	18
		3	0.8	193.1	15	192	15
		3.2	0.6	192.7	15	192	15
	125	0.8	2	247.5	18	244.1	17
		1.6	1.2	245.9	17	244.1	17
		2	0.8	245.1	17	244.1	17
		2.4	0.4	244.3	17	244.1	17
		3	0.8	243.1	15	242	15
		3.2	0.6	242.7	15	242	15
B type	32	4	0.9	55.5	16	54	16
		5	0.4	53.5	15	53.1	15
	40	4	0.9	71.5	16	70	16
		5	0.4	69.5	15	69	14
	50	4	0.9	91.1	15	89.8	15
		5	0.4	89.1	14	88.9	14
	63	4	0.9	117.1	14	115.8	14
		5	0.4	115.1	13	114.9	13
	80	4	0.9	151.1	14	149.8	13
		5	0.4	149.1	12	148.9	12
	100	4	0.9	191.1	13	189.8	13
		5	0.4	189.1	12	188.8	12
	125	4	0.9	241.1	13	239.8	13
		5	0.4	239.1	12	238.8	12

Note 1) The recommended ramping feed is 0.05mm/t or under.

*1 L= (Max. Depth of Cut / tan RMPX) until the maximum depth of cut (APMX) is reached at the maximum ramping angle.
Maximum depth of cut A type is 21mm, B type is 20.4mm.

*2 The maximum diameter when machining a blind hole with a flat face using a corner radius of 0.8mm for A type and 4mm for B type.Other than that, find with the below formula.
{(cutting edge diameter DC)−(corner radius)−0.3}×2

*3 The minimum diameter when machining a blind hole with a flat face using a corner radius of 0.8mm for A type and 4mm for B type.Other than that, find with the below formula.
{(cutting edge diameter DC)−(corner radius)−(Width of wiper edge BS)−0.1}×2