MOLDINO
The Edge To Innovation

High Efficiency Finishing Special Shape Tool Series

GALLEA

GALLEA series

Added corner-connected R insert for GP1LB that easy to use for 3-axis machining.

Mitsubishi Hitachi Tool Engineering, Ltd.

New Product News | No.1711E-1 | 2018-9

GALLEA Series

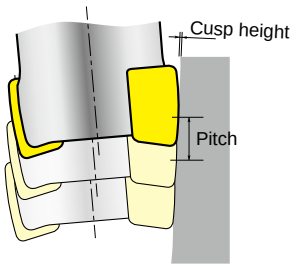
Combination of
lens tool and barrel tool

Concept of GALLEA series

Comparison of barrel tool and ball-radius end mill

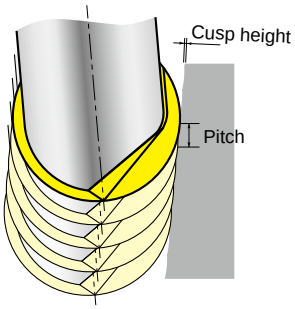
Barrel tool

Tool dia. 20mm Peripheral flute R30



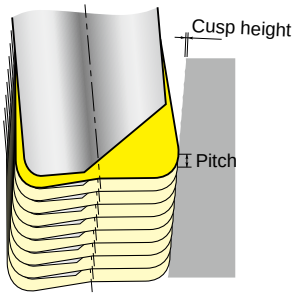
Ball end mill

Tool dia. 20mm R10



Corner radius end mill

Tool dia. 20mm Corner radius R3

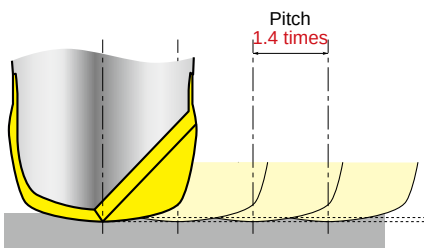


When contour milling with the same theoretical cusp height, the barrel tool can be machined with a pitch of about 1.7 times compared with the ball end mill of the same diameter, and about 3 times as compared with the R3 radius end mill.

Comparison of lens tool and ball end mill

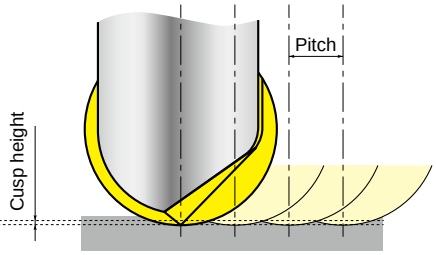
Lens tool

Tool dia. 30mm Lens R 30



Ball end mill

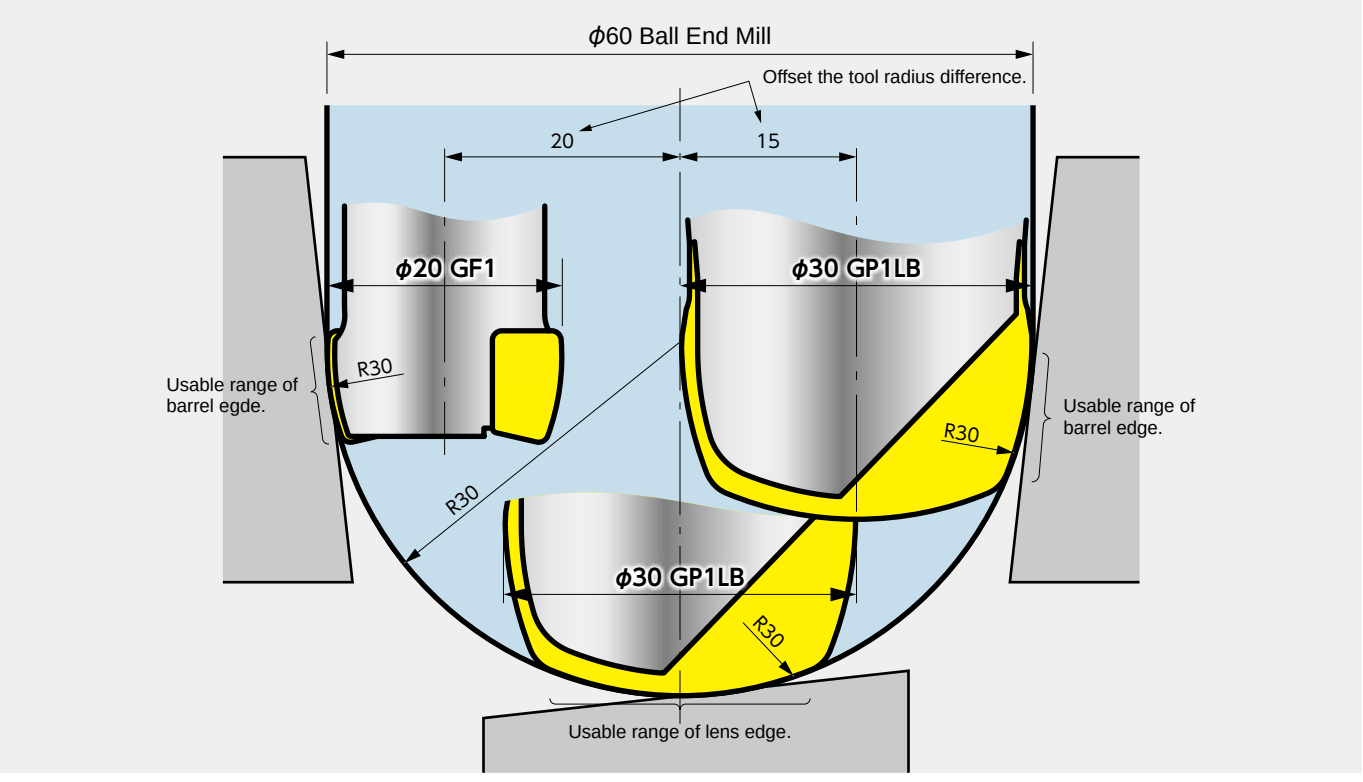
Tool dia. 30mm R15



Can be machined with pitch of about 1.4 times compared with the ball end mill of same diameter.

Because of be able to increase the pitch, Machining time can be reduced regardless of feed speed.

The same R size GALLEA series as ϕ60 ball end mill.



How can finishing time be reduced? **Large pitch! Small cusp!**

Conventional pitch and cusp height

Pitch of GALLEA series

Possible to reduce the polishing time in case of same pitch condition

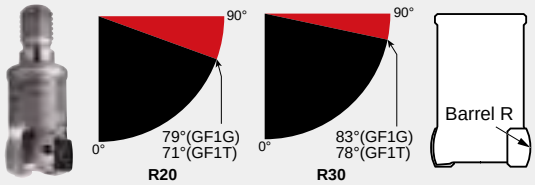
List of GALLEA series

Red In 3-axis machining usable range of Barrel edge

Blue In 3-axis machining usable range of Lens edge / Tip edge

Green In 3-axis machining usable range of corner-connected R

GF1 Barrel P.6

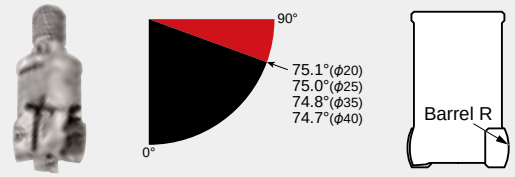


For tilted wall finishing

φ20mm R1 Corner radius end mill
【Cutting conditions】
v_f=2000mm/min n=4500min^{-1} a_p=0.2mm
Machining time simulation = Approx. 150 min.

GALLEA GF1
Max. external diameter ϕ20mm
Outer peripheral flute 30R
【Cutting conditions】
v_f=2000mm/min n=4500min^{-1} a_p=0.6mm
Cutting time = Approx. 40min.

GF2T Barrel P.8



For tilted wall finishing

High-performance tilted wall finishing!

Enables machining at a larger pitch than ball end mills or radius end mills.

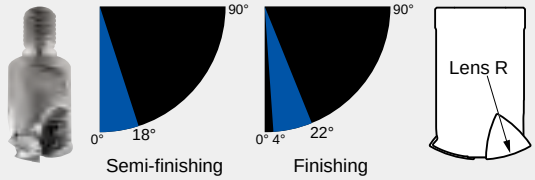
Series expansion toward larger diameters

ϕ20 ϕ25 ϕ35 ϕ40

Economical 2-corner specification

Unique insert holding surface enables realization of 2-corner specification.

GF3L Lens P.10



For gentle curved surfaces and gentle sloped surfaces

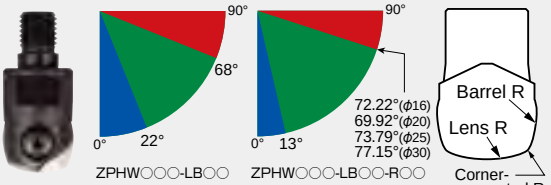
01 Using GALLEA series together it is possible to process from semi-finishing to finishing with high efficiency

02 Good sharpness positive design

03 High efficiency cutting tool with three edge specification

04 Unique insert restraining surface realizes strong insert clamping.

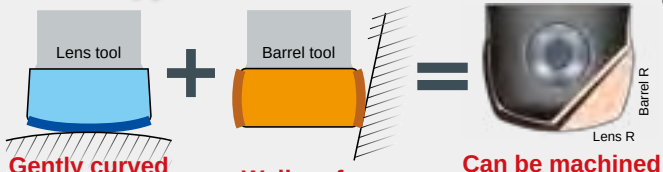
GP1LB Barrel, Lens P.12



For tilted wall and curved surface finishing

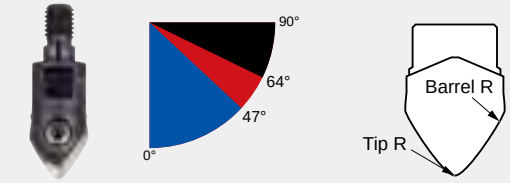
Combination of lens tool and barrel tool. GP1LB type

Precision type



Gently curved surface | **Wall surface** | **Can be machined with a single tool.**

GP1T Taper Barrel P.14



For tilted wall, curved surface and corner finishing

Two types of process are possible with one tool that can fully utilize the merit of 5-axis machining

Since it can work for 2 types of process without tool change, machining surface steps can be minimized.

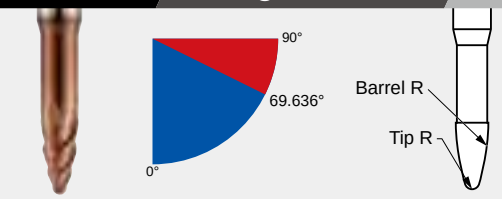
Barrel R

This tool can take a larger pitch with a barrel R which larger than the tool radius.

Tip R

The tip can be used as a ball end mill for corner processing.

GS4TN Tangent Barrel P.18



For tilted wall, curved surface and corner finishing

- Barrel R achieves high-efficiency and high-quality machining for tilted section
- Tip R can finish curved connecting faces to high quality
- Employs unique high helix shape and realizes low cutting force

Overview of GALLEA series

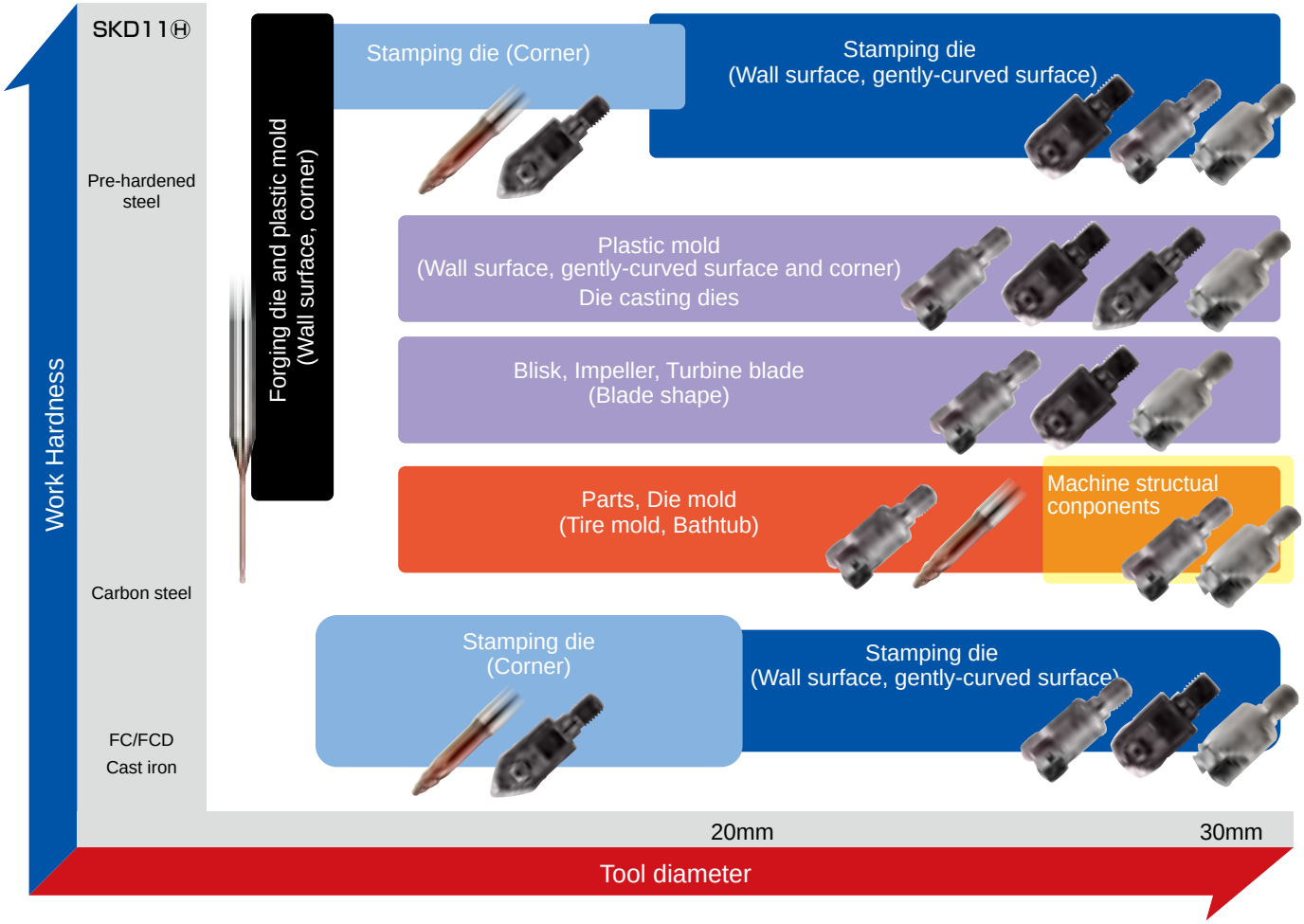


Chart of tool dia. and barrel for GALLEA series

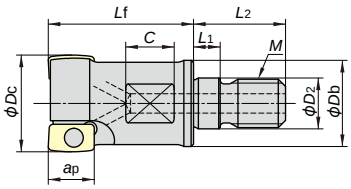
Barrel R (mm) \ Tool dia. (mm)	2.5	3.75	5.0	7.5	10.0	12.0	16.0	20.0	25.0	30.0	35.0	40.0
12.5	GS4TN											
16.0							GP1LB					
18.75		GS4TN										
19.91									GF1T			
19.93									GF1G			
20.0								GF1T/GF1G GP1LB				
20.14							GF1G					
20.18							GF1T					
25.0			GS4TN						GP1LB			
29.78												GF2T
29.81									GF1T			
29.82									GF1G			
29.84											GF2T	
30.0						GP1T		GF1T/GF1G	GF2T	GP1LB		
30.24								GF2T				
30.33							GF1T					
30.38							GF1G					
37.5				GS4TN								
40.0							GP1T					
50.0					GS4TN			GP1T				
62.5									GP1T			
75.0										GP1T		

Design Registration GF1G type：1581351
GF1T type ：1582151

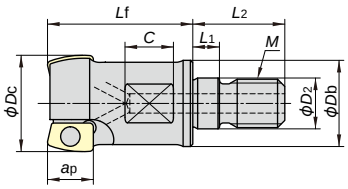
Modular type

GF1□20○○M-○-M○○

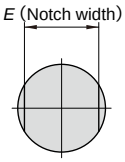
Numeric figure in a circle ○ and Alphabetical character comes in a square □



Basic type



Offset type



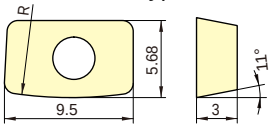
Type	Item code	Stock	No.of flutes	Size (mm)										Insert
				ϕDc	Lf	ap	ϕD2	M	ϕDb	L1	L2	C	E	
Basic type	GF1G2016M-2-M8	●	2	16	25	9.5	8.5	M8	14	5.5	17	8	10	XPHW0903R-20 XPHW0903R-30
	GF1G2020M-3-M10	●	3	20	30	9.5	10.5	M10	17.8	5.5	19	10	15	
	GF1G2025M-4-M10	●	4	25	30	9.5	10.5	M10	17.8	5.5	19	10	15	
	GF1G2025M-4-M12	●	4	25	35	9.5	12.5	M12	22.5	5.5	22	10	17	
Offset type	GF1T2016M-2-M8	●	2	16	25	9.5	8.5	M8	14	5.5	17	8	10	YPHW0903R-20 YPHW0903R-30
	GF1T2020M-3-M10	●	3	20	30	9.5	10.5	M10	17.8	5.5	19	10	15	
	GF1T2025M-4-M12	●	4	25	35	9.5	12.5	M12	22.5	5.5	22	10	17	

●：Stocked Items.

【Note】Do not apply lubricants such as grease, etc. to the “contact faces” and “modular screws” of the “modular mill”, “special shanks” and “special arbor”.

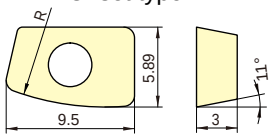
Inserts

Basic type



XPHW0903R-○○

Offset type



YPHW0903R-○○

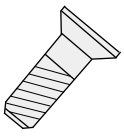
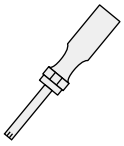
P	Carbon steels	■	⊔	■：General cutting, First recommended
M	SUS, etc.	■		⊔：General cutting, Second recommended
K	FC・FCD	⊔	■	
H	Hardened steels		■	

Type	Item code	PN215	TH315	Size (mm) R
Basic type	XPHW0903R-20	●	●	20
	XPHW0903R-30	●	●	30
Offset type	YPHW0903R-20	●	●	20
	YPHW0903R-30	●	●	30

●：Stocked Items.

Parts

To reduce environmental loads, drivers and screw anti-seizure agent are sold separately.
We ask for your understanding and cooperation.

	Clamp screw		Not included with product (sold separately)	
			Screw driver	Screw anti-seizure agent
Shape / Cutter body		Fastening torque (N･m)		
GF1□20○○M-○-M○○	250-141	1.1	104-T8	P-37

Recommended cutting conditions

※Red indicates primary recommended grade.

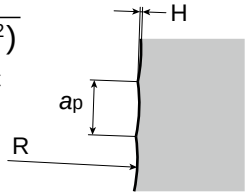
Work material	Recommended grade	Cutting condition	φ16	φ20	φ25
Carbon steels Alloy steels (<30HRC)	※ PN215	n (min-1)	11,950	9,560	7,650
		vc (m/min)	600	600	600
		vf (mm/min)	4,780	5,740	6,120
		fz (mm/t)	0.2	0.2	0.2
		ap (mm)	Refer right table		
		ae (mm)	~0.1	~0.1	~0.1
Carbon steels Alloy steels (30~45HRC)	PN215 TH315	n (min-1)	7,970	6,370	5,100
		vc (m/min)	400	400	400
		vf (mm/min)	3,190	3,830	4,080
		fz (mm/t)	0.2	0.2	0.2
		ap (mm)	Refer right table		
		ae (mm)	~0.1	~0.1	~0.1
Stainless steels SUS	PN215	n (min-1)	9,960	7,970	6,370
		vc (m/min)	500	500	500
		vf (mm/min)	3,990	4,790	5,100
		fz (mm/t)	0.2	0.2	0.2
		ap (mm)	Refer right table		
		ae (mm)	~0.1	~0.1	~0.1
Cast iron FC FCD	TH315 PN215	n (min-1)	11,950	9,560	7,650
		vc (m/min)	600	600	600
		vf (mm/min)	5,980	7,170	7,650
		fz (mm/t)	0.25	0.25	0.25
		ap (mm)	Refer right table		
		ae (mm)	~0.1	~0.1	~0.1
Hardened steels (45~55HRC)	TH315 PN215	n (min-1)	4,980	3,990	3,190
		vc (m/min)	250	250	250
		vf (mm/min)	1,500	1,800	1,920
		fz (mm/t)	0.15	0.15	0.15
		ap (mm)	Refer right table		
		ae (mm)	~0.08	~0.08	~0.08

Determine the a_p value based on the desired cusp height by selecting it from the table below or by calculating it using the equation below.

Insert		Cusp height (mm)					
Item code	R	0.001	0.002	0.003	0.004	0.005	0.01
XPHW0903R-20	20	0.4	0.57	0.69	0.8	0.89	1.26
XPHW0903R-30	30	0.49	0.69	0.85	0.98	1.1	1.55

$$a_p = 2\sqrt{(R^2-(R-H)^2)}$$

R : Tool R　H : Cusp height



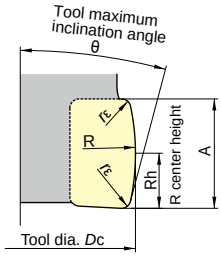
※When overhang length is 3*D*c or greater, adjust the values shown in the table at left according to the table below.

Overhang ratio	vc (m/min)	vf (mm/min)
<3*D*c	100%	100%
3*D*c ~ 5*D*c	70%	70%
5*D*c ~ 6*D*c	60%	60%
6*D*c ~ 7*D*c	50%	50%
7*D*c~	45%	45%

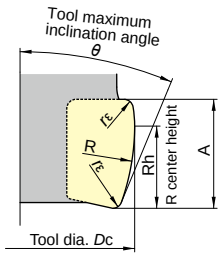
【Note】

①Use the appropriate coolant for the work material and machining shape.
②These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
③To prevent tool breakage due to chips clogging tool flutes, always be sure to use an air blower, etc. to remove chips.
④Ensure to index the insert at the correct time to ensure safety of the tool-body.

Flute tip shape definitions for programing



Basic type



Offset type

Rotation locus shape will be different depending on the combination of insert and tool diameter. Refer to the table below.

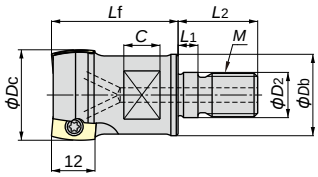
	Basic type						Offset type					
Insert item code	XPHW0903R-20			XPHW0903R-30			YPHW0903R-20			YPHW0903R-30		
Tool dia. *D*c (mm)	φ16	φ20	φ25	φ16	φ20	φ25	φ16	φ20	φ25	φ16	φ20	φ25
R (mm)	20.14	20	19.93	30.38	30	29.82	20.18	20	19.91	30.33	30	29.81
Rh (mm)	4.75	4.75	4.75	4.75	4.75	4.75	7.25	7.25	7.25	7.25	7.25	7.25
rε (mm)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
A (mm)	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
θ	11°	11°	11°	7°	7°	7°	19°	19°	19°	12°	12°	12°

Design Registration GF2T type：1581372

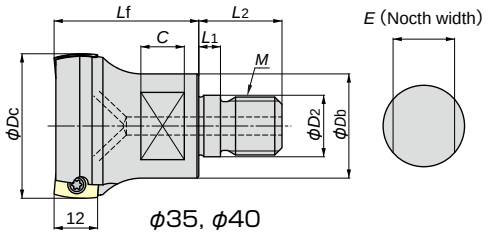
Modular type

GF2T30○○M-○

Numeric figure in a circle ○ and Alphabetical character comes in a square□



ϕ20, ϕ25



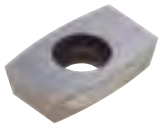
ϕ35, ϕ40

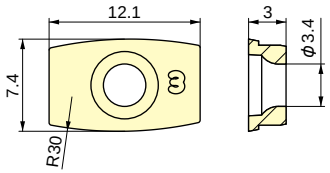
Type	Item code	Stock	No. of flutes	Size (mm)									Insert
				ϕDc	Lf	ϕD2	M	ϕDb	L1	L2	C	E	
Offset type	GF2T3020M-3	●	3	20	30	10.5	M10	17.8	5.5	19	10	15	YPHW1203R-30
	GF2T3025M-4	●	4	25	35	12.5	M12	22.5	5.5	22	10	17	
	GF2T3035M-5	●	5	35	40	17	M16	28.8	6	23	12	22	
	GF2T3040M-6	●	6	40	40	17	M16	28.8	6	23	12	22	

●：Stocked Items.

【Note】Do not apply lubricants such as grease, etc. to the “contact faces” and “modular screws” of the “modular mill”, “special shanks” and “special arbor”.

Inserts





P	Carbon steels	■	⊔
M	SUS, etc.	■	
K	FC・FCD	⊔	■
H	Hardened steels		■

商品コード Item code	精度 Tolerance class	材種 Grade PN215	材種 Grade TH315
YPHW1203R-30	H	●	●

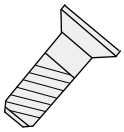
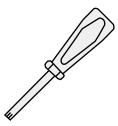
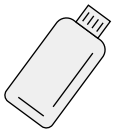
■：General cutting, First recommended

⊔：General cutting, Second recommended

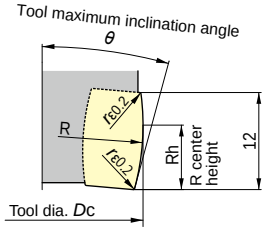
●：Stocked Items.

Parts

To reduce environmental loads, drivers and screw anti-seizure agent are sold separately.
We ask for your understanding and cooperation.

Shape / Cutter body	Clamp screw	Fastening torque (N·m)	Not included with product (sold separately): Screw driver	Not included with product (sold separately): Screw anti-seizure agent
				
GF2T30○○M-○	265-143	2.0	104-T10	P-37

Flute tip shape definitions for programing



Offset type

Rotation locus shape will be different depending on the combination of insert and tool diameter.
Refer to the table below.

	Offset type			
Insert item code	YPHW1203-R30			
Tool dia. Dc (mm)	ϕ20	ϕ25	ϕ35	ϕ40
R (mm)	30.24	30	29.84	29.78
Rh (mm)	8	8	8	8
θ	14.9°	15°	15.2°	15.3°

Recommended cutting conditions

※Red indicates primary recommended grade.

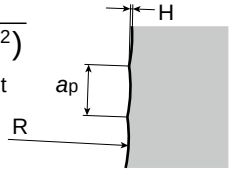
Work material	Recommended grade	Cutting conditions	φ20	φ25	φ35	φ40
Carbon steels Alloy steels (<30HRC)	PN215	*n* (min^{-1})	9,560	7,650	5,460	4,780
		vc (m/min)	600	600	600	600
		vf (mm/min)	5,740	6,120	5,460	5,740
		fz (mm/t)	0.2	0.2	0.2	0.2
		ap (mm)	Refer to the table at right.			
		ae (mm)	<0.1	<0.1	<0.1	<0.1
Carbon steels Alloy steels (30～45HRC)	PN215 TH315	*n* (min^{-1})	6,370	5,100	3,640	3,190
		vc (m/min)	400	400	400	400
		vf (mm/min)	3,830	4,080	3,640	3,830
		fz (mm/t)	0.2	0.2	0.2	0.2
		ap (mm)	Refer to the table at right.			
		ae (mm)	<0.1	<0.1	<0.1	<0.1
Stainless steels SUS	PN215	*n* (min^{-1})	7,970	6,370	4,550	3,990
		vc (m/min)	500	500	500	500
		vf (mm/min)	4,790	5,100	4,550	4,790
		fz (mm/t)	0.2	0.2	0.2	0.2
		ap (mm)	Refer to the table at right.			
		ae (mm)	<0.1	<0.1	<0.1	<0.1
Cast iron FC FCD	TH315 PN215	*n* (min^{-1})	9,560	7,650	5,460	4,780
		vc (m/min)	600	600	600	600
		vf (mm/min)	7,170	7,650	6,830	7,170
		fz (mm/t)	0.25	0.25	0.25	0.25
		ap (mm)	Refer to the table at right.			
		ae (mm)	<0.1	<0.1	<0.1	<0.1
Hardened steels (45～55HRC)	TH315 PN215	*n* (min^{-1})	3,990	3,190	2,280	2,000
		vc (m/min)	250	250	250	250
		vf (mm/min)	1,800	1,920	1,710	1,800
		fz (mm/t)	0.15	0.15	0.15	0.15
		ap (mm)	Refer to the table at right.			
		ae (mm)	<0.08	<0.08	<0.08	<0.08

Determine the *ap* value based on the desired cusp height by selecting it from the table below or by calculating it using the equation below.

Insert		Cusp height (mm)					
Item code	R	0.001	0.002	0.003	0.004	0.005	0.01
YPHW1203R-30	30	0.49	0.69	0.85	0.98	1.1	1.55

$$a_p = 2\sqrt{(R^2-(R-H)^2)}$$

R : Tool R　H : Cusp height



※When overhang length is 3*Dc* or greater, adjust the values shown in the table at left according to the table below.

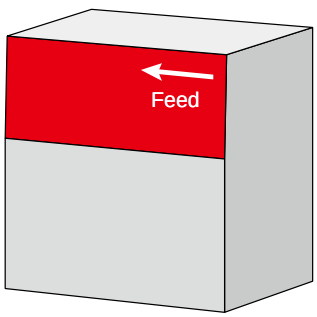
Overhang ratio	*vc* (m/min)	*vf* (mm/min)
<3*Dc*	100%	100%
3*Dc* ～ 5*Dc*	70%	70%
5*Dc* ～ 6*Dc*	60%	60%
6*Dc* ～ 7*Dc*	50%	50%
7*Dc*～	45%	45%

【Note】

①Use the appropriate coolant for the work material and machining shape.
②These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
③To prevent tool breakage due to chips clogging tool flutes, always be sure to use an air blower, etc. to remove chips.
④Ensure to index the insert at the correct time to ensure safety of the tool-body.

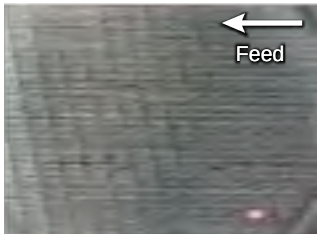
Field Data

Cutting of a 1°incline face



Work material：NAK80

Achieves same surface roughness at 3 times the pitch of conventional tools.



Conventional radius mill
Ra0.54μm
ap=0.2mm

GF2T3040M-6
Ra0.54μm
ap=0.6mm

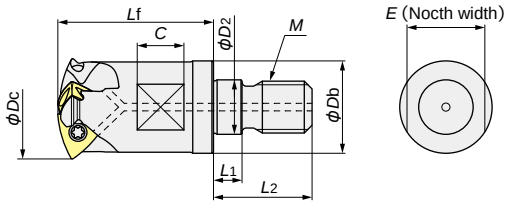
Tool	Overhang length (mm)	Tool dia. (mm)	Cutting speed (m/min)	Revolution (min^{-1})	Feed per tooth (mm/t)	Feed rate (mm/min)	*ap* (mm)	*ae* (mm)	Coolant
GF2T3040M-6 YPHW1203R-30 PN215	245	40	160	1,273	0.1	765	0.6	0.1	Air blow
Conventional R2 radius mill							0.2		

Design Registration GF3L type：1581858

Modular type

GF3L○○M-3-M○○

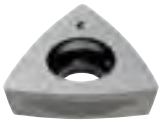
Numeric figure in a circle ◌

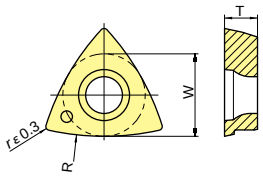


Item code	Stock	No. of Inserts	Size (mm)									Insert
			φDc	Lf	φD2	M	φDb	L1	L2	C	E	
GF3L20M-3-M10	●	3	20	30	10.5	M10	17.8	5.5	19	10	15	TPHW0902-20
GF3L25M-3-M12	●	3	25	35	12.5	M12	22.5	5.5	22	10	17	TPHW1303-25
GF3L30M-3-M16	●	3	30	40	17	M16	28.8	6	23	12	22	TPHW1403-30

【Note】Do not apply lubricants such as grease, etc. to the “contact faces” and “modular screws” of the “modular mill”, “special shanks” and “special arbor”.

Inserts





P	Carbon steels	■	⌴
M	SUS, etc.	■	
K	FC・FCD	⌴	■
H	Hardened steels		■

■ : General cutting, First recommended

⌴ : General cutting, Second recommended

Item code	Tolerance class	Grade		Size(mm)		
		PN215	TH315	W	T	R
TPHW0902-20	H	●	●	6.5	2.6	20
TPHW1303-25		●	●	8.2	3.0	25
TPHW1403-30		●	●	9.8	3.2	30

※For information on the detailed tool shape, download the DXF data from the Mitsubishi Hitachi Tool Engineering home page. (Mitsubishi Hitachi Tool Engineering tool selection database TOOL SEARCH: http://data.mmc-hitachitool.co.jp/toolsearch/)

●：Stocked Items.

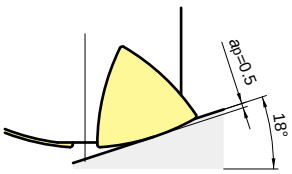
Parts

To reduce environmental loads, drivers and screw anti-seizure agent are sold separately.
We ask for your understanding and cooperation.

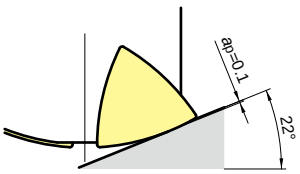
Parts	Clamp screw		Not included with product (sold separately)	
			Wrench	Screw anti-seizure agent
Shape / Cutter body		Fastening torque (N·m)		
GF3L20M-3-M10	251-141	1.1	104-T8	P-37
GF3L25M-3-M12	265-143	2.0	104-T10	
GF3L30M-3-M16	412-141	2.9	104-T15	

Usable range of cutting edge for GF3L type

Semi-finishing



Finishing

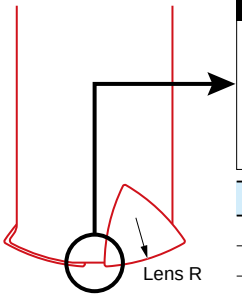


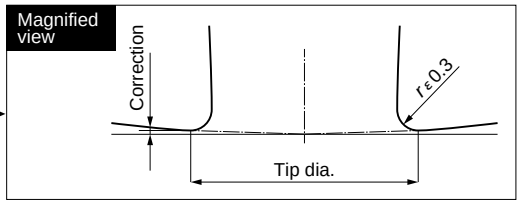
	a_p max finishing allowance	Available cutting range
Semi-finishing	0.5mm	18°
Finishing	0.1mm	22°

Because of GF3L type does not have a peripheral cutting edge, cutting range changes according to cutting depth (a_p).

Correction of tool length measurement value

GF3L type does not have cutting edge in the tool center. When create toolpath with lens tool definition, correct the measurement value of tool length. When using a CAM that can define a tool shape with CAM and DXF data that can define a tool shape, it is unnecessary to correct the tool length measurement value.





	Correction (mm)	Tip dia.(mm)
GF3L20M-3-M10	0.058	3.0
GF3L25M-3-M12	0.056	3.4
GF3L30M-3-M16	0.062	3.9

Recommended cutting conditions

※Red indicates primary recommended grade.

Work material	Recommended grade	Cutting condition	Finishing			Semi-finishing		
			φ20	φ25	φ30	φ20	φ25	φ30
Carbon steels Alloy steels (<30HRC)	PN215	n (min^{-1})	11,470	9,180	7,650	4,780	3,830	3,190
		v_c (m/min)	720	720	720	300	300	300
		v_f (mm/min)	6,890	5,510	4,590	7,170	5,750	4,790
		f_z (mm/t)	0.2	0.2	0.2	0.5	0.5	0.5
		a_p (mm)	0.1	0.1	0.1	0.5	0.5	0.5
		a_e (mm)	Refer below table			Refer below table		
Carbon steels Alloy steels (30～45HRC)	PN215 TH315	n (min^{-1})	8,290	6,630	5,530	3,190	2,550	2,130
		v_c (m/min)	520	520	520	200	200	200
		v_f (mm/min)	4,980	3,980	3,320	4,790	3,830	3,200
		f_z (mm/t)	0.2	0.2	0.2	0.5	0.5	0.5
		a_p (mm)	0.1	0.1	0.1	0.5	0.5	0.5
		a_e (mm)	Refer below table			Refer below table		
Stainless steels SUS	PN215	n (min^{-1})	7,970	6,370	5,310	4,780	3,830	3,190
		v_c (m/min)	500	500	500	300	300	300
		v_f (mm/min)	4,790	3,830	3,190	7,170	5,750	4,790
		f_z (mm/t)	0.2	0.2	0.2	0.5	0.5	0.5
		a_p (mm)	0.1	0.1	0.1	0.5	0.5	0.5
		a_e (mm)	Refer below table			Refer below table		
Cast iron FC FCD	TH315 PN215	n (min^{-1})	10,360	8,290	6,910	6,370	5,100	4,250
		v_c (m/min)	650	650	650	400	400	400
		v_f (mm/min)	9,330	7,470	6,220	9,560	7,650	6,380
		f_z (mm/t)	0.3	0.3	0.3	0.5	0.5	0.5
		a_p (mm)	0.1	0.1	0.1	0.5	0.5	0.5
		a_e (mm)	Refer below table			Refer below table		
Hardened steels (45～55HRC)	TH315	n (min^{-1})	3,990	3,190	2,660	1,920	1,530	1,280
		v_c (m/min)	250	250	250	120	120	120
		v_f (mm/min)	2,400	1,920	1,600	580	460	390
		f_z (mm/t)	0.2	0.2	0.2	0.15	0.15	0.15
		a_p (mm)	0.08	0.08	0.08	0.2	0.2	0.2
		a_e (mm)	Refer below table			Refer below table		

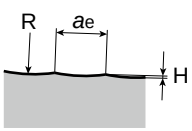
How to calculate "a_e"

Determine the *ae* value based on the desired cusp height by selecting it from the table below or by calculating it using the equation below.

Insert	R	Cusp height (mm)						
		0.001	0.002	0.003	0.004	0.005	0.01	0.02
TPHW0902-20	20	0.4	0.57	0.69	0.8	0.89	1.26	1.79
TPHW1303-25	25	0.45	0.63	0.77	0.89	1	1.41	2
TPHW1403-30	30	0.49	0.69	0.85	0.98	1.1	1.55	2.19

$$a_e = 2\sqrt{(R^2-(R-H)^2)}$$

R：Tool R　H：Cusp height



【Note】
①Use the appropriate coolant for the work material and machining shape.
②These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
③To prevent tool breakage due to chips clogging tool flutes, always be sure to use an air blower, etc. to remove chips.
④Ensure to index the insert at the correct time to ensure safety of the tool-body.

Ajustment ratio of cutting conditions by overhang length.

When overhang length is 3*Dc* or more, please adjust the values in the above cutting condition table referring to the right table.

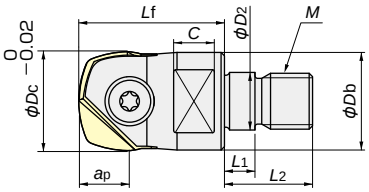
Overhang ratio	*Vc* (m/min)	*Vf* (mm/min)
<3*Dc*	100%	100%
3*Dc* ～ 5*Dc*	70%	70%
5*Dc* ～ 6*Dc*	60%	60%
6*Dc* ～ 7*Dc*	50%	50%
7*Dc* ～	45%	45%

Design Registration GP1LB type：1586769

Modular type

GP1LB○○M-M○○

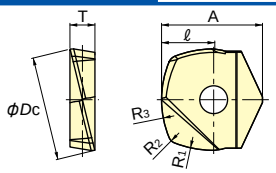
Numeric figure in a circle ○ and Alphabetical character comes in a square□



Item code	Stock	No. of Inserts	Size (mm)										Insert
			φDc	Lf	ap	φD2	M	φDb	L1	L2	C	E	
GP1LB16M-M8	●	1	16	32	8	8.5	M8	12.8	5.5	17	8	10	ZPHW160-LB16
GP1LB20M-M10	●	1	20	38	10	10.5	M10	17.8	5.5	19	10	15	ZPHW200-LB20
GP1LB25M-M12	●	1	25	38	12.5	12.5	M12	20.8	5.5	22	10	17	ZPHW250-LB25
GP1LB30M-M16	●	1	30	43	15	17	M16	28.8	6	23	12	22	ZPHW300-LB30

【Note】Do not apply lubricants such as grease, etc. to the “contact faces” and “modular screws” of the “modular mill”, “special shanks” and “special arbor”.

Inserts



Sizes are added.

P	Carbon steels	■	□
M	SUS, etc.	■	
K	FC・FCD	□	■
H	Hardened steels		■

■：General cutting, First recommended
□：General cutting, Second recommended

Item code	Tolerance class	Grade		Size (mm)						
		PN215	TH308	R1	R2	R3	ℓ	A	φDc	T
ZPHW160-LB16	H	●	●	16	1.5	16	8	16.6	16	4.2
NEW ZPHW160-LB16-R5		★	★	16	5	16	8	16.6	16	4.2
ZPHW200-LB20		●	●	20	1.9	20	10	20.3	20	5.2
NEW ZPHW200-LB20-R6		★	★	20	6	20	10	20.3	20	5.2
ZPHW250-LB25		●	●	25	2.38	25	12.5	24.1	25	6.2
NEW ZPHW250-LB25-R8		★	★	25	8	25	12.5	24.1	25	6.2
ZPHW300-LB30		●	●	30	2.85	30	15	29.1	30	7.2
NEW ZPHW300-LB30-R10		★	★	30	10	30	15	29.1	30	7.2

★:Stocked Items of New Products. ●:Stocked Items.

Parts

To reduce environmental loads, drivers and screw anti-seizure agent are sold separately.
We ask for your understanding and cooperation.

Parts	Clamp screw		Not included with product (sold separately)	
			Wrench	Screw anti-seizure agent
Shape / Cutter body		Fastening torque (N·m)		
GP1LB16M-M8	581-144	4.9	105-T20	P-37
GP1LB20M-M10	581-145	6.9	101-T25S	
GP1LB25M-M12	581-146	9.8	105-T30A	
GP1LB30M-M16	581-147	9.8		

※The insert can be attached to Ball Precision F (ABPF type) holders.
※For information on the detailed tool shape, download the DXF data from the Mitsubishi Hitachi Tool Engineering home page.
(Mitsubishi Hitachi Tool Engineering tool selection database
TOOL SEARCH: http://data.mmc-hitachitool.co.jp/toolsearch/)

Insert of GP1LB, regrinding can be performed up to a maximum of 2 times.
Please inquire insert re-grinding / re-coating to sales office.

How to select GP1LB inserts

Comparison of cutting efficiency of 3-axis machining with φ30 tool. ※Set the cusp-height of each edge of barrel R, lens R and corner-connected R same as ball end mill

Ball end mill (φ30)

Ball end mill is recommended for shapes with large undulations

GP1LB ZPHW300-LB30-R10

1.4 times cutting efficiency than ball end mill

Cutting efficiency Compared with the ball end mill 0.8 times

High efficiency machining on undulating curved surface.

If the barrel R and lens R can be used more than 47% of the whole machining, more efficient than ball end mill of same diameter.

GP1LB ZPHW300-LB30

1.4 times cutting efficiency than ball end mill

Cutting efficiency Compared with the ball end mill 0.4 times

High efficiency machining with gentle curved surface with less undulation.

If the barrel R and lens R can be used more than 84% of the whole machining, more efficient than ball end mill of same diameter.

※Checking the usage rate of barrel R edge and lens R edge in model shape to be processed and choosing an insert, possible more efficient machining.

Recommended cutting conditions

※Red indicates primary recommended grade.

Work material	Recommended grade	Cutting condition	Lens part				Barrel part			
			φ16	φ20	φ25	φ30	φ16	φ20	φ25	φ30
Carbon steels Alloy steels (<30HRC)	PN215	*n* (min^{-1})	14,340	11,470	9,180	7,650	11,950	9,560	7,650	6,370
		vc (m/min)	720	720	720	720	600	600	600	600
		vf (mm/min)	7,170	5,740	4,590	3,830	4780	3,830	3,060	2,550
		fz (mm/t)	0.25	0.25	0.25	0.25	0.2	0.2	0.2	0.2
		ap (mm)	0.1	0.1	0.1	0.1	Refer below table			
		ae (mm)	Refer below table				0.1	0.1	0.1	0.1
Carbon steels Alloy steels (30～45HRC)	PN215 TH308	*n* (min^{-1})	10,360	8,290	6,630	5,530	7,970	6,370	5,100	4,250
		vc (m/min)	520	520	520	520	400	400	400	400
		vf (mm/min)	5,180	4,150	3,320	2,770	3,190	2,550	2,040	1,700
		fz (mm/t)	0.25	0.25	0.25	0.25	0.2	0.2	0.2	0.2
		ap (mm)	0.1	0.1	0.1	0.1	Refer below table			
		ae (mm)	Refer below table				0.1	0.1	0.1	0.1
Stainless steels SUS	PN215	*n* (min^{-1})	12,940	10,360	8,290	6,910	9,960	7,970	6,370	5,310
		vc (m/min)	650	650	650	650	500	500	500	500
		vf (mm/min)	6,470	5,180	4,150	3,460	3,990	3,190	2,550	2,130
		fz (mm/t)	0.25	0.25	0.25	0.25	0.2	0.2	0.2	0.2
		ap (mm)	0.1	0.1	0.1	0.1	Refer below table			
		ae (mm)	Refer below table				0.1	0.1	0.1	0.1
Cast iron FC FCD	TH308 PN215	*n* (min^{-1})	14,340	11,470	9,180	7,650	11,950	9,560	7,650	6,370
		vc (m/min)	720	720	720	720	600	600	600	600
		vf (mm/min)	11,480	9,180	7,350	6,120	5,980	4,780	3,830	3,190
		fz (mm/t)	0.4	0.4	0.4	0.4	0.25	0.25	0.25	0.25
		ap (mm)	0.1	0.1	0.1	0.1	Refer below table			
		ae (mm)	Refer below table				0.1	0.1	0.1	0.1
Hardened steels (45～55HRC)	TH308	*n* (min^{-1})	6,370	5,100	4,080	3,400	4,980	3,990	3,190	2,660
		vc (m/min)	320	320	320	320	250	250	250	250
		vf (mm/min)	2,550	2,040	1,640	1,360	1,500	1,200	960	800
		fz (mm/t)	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15
		ap (mm)	0.08	0.08	0.08	0.08	Refer below table			
		ae (mm)	Refer below table				0.08	0.08	0.08	0.08
Hardened steels (55～62HRC)	TH308	*n* (min^{-1})	5,580	4,460	3,570	2,980	4,380	3,510	2,810	2,340
		vc (m/min)	280	280	280	280	220	220	220	220
		vf (mm/min)	2,240	1,790	1,430	1,200	1,320	1,060	850	710
		fz (mm/t)	0.20	0.20	0.20	0.20	0.15	0.15	0.15	0.15
		ap (mm)	0.05	0.05	0.05	0.05	Refer below table			
		ae (mm)	Refer below table				0.05	0.05	0.05	0.05

- For machining shapes that make heavy use of lens R, refer to the "Lens part cutting conditions" in the above table.
- For machining shapes that make heavy use of barrel R, refer to the "Barrel part cutting conditions" in the above table.
- For machining shapes that use both lens R and barrel R equally, refer to the "Lens part cutting conditions" in the table at left.

When overhang length is 3*Dc* or greater, adjust the values shown in the below table according to the above table.

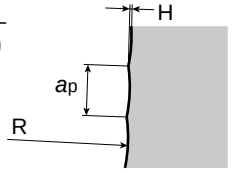
Overhang ratio	*Vc* (m/min)	*Vf* (mm/min)
<3*Dc*	100%	100%
3*Dc* ～ 5*Dc*	70%	70%
5*Dc* ～ 6*Dc*	60%	60%
6*Dc* ～ 7*Dc*	50%	50%
7*Dc* ～	45%	45%

Determine the *ap* or *ae* value based on the desired cusp height by selecting it from the table below or by calculating it using the equation below.

Insert		Cusp height (mm)					
Item code	R	0.001	0.002	0.003	0.004	0.005	0.01
ZPHW160-LB16	16	0.36	0.51	0.62	0.72	0.8	1.13
ZPHW200-LB20	20	0.4	0.57	0.69	0.8	0.89	1.26
ZPHW250-LB25	25	0.45	0.63	0.77	0.89	1	1.41
ZPHW300-LB30	30	0.49	0.69	0.85	0.98	1.1	1.55

$$a_p = 2\sqrt{(R^2-(R-H)^2)}$$
$$(a_e)$$

R : Tool R　H : Cusp height



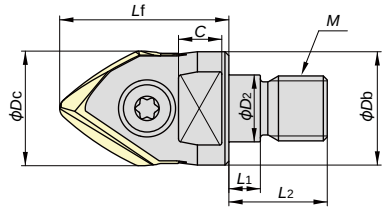
【Note】
①Use the appropriate coolant for the work material and machining shape.
②These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
③To prevent tool breakage due to chips clogging tool flutes, always be sure to use an air blower, etc. to remove chips.
④Ensure to index the insert at the correct time to ensure safety of the tool-body.

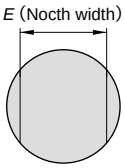
Design Registration GP1T type：1580907
Registered patent Cutting insert GP1T：6278170

Modular type

GP1T○○M-M○○

Numeric figure in a circle ◌ and Alphabetical character comes in a square ⬚

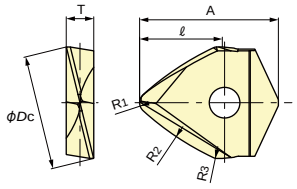




Item code	Stock	No. of flutes	Size (mm)									Insert
			φDc	Lf	φD2	M	φDb	L1	L2	C	E	
GP1T12M-M6	●	1	12	26	6.5	M6	9.8	5.5	14.5	5	7	ZDHW120-T43R1.2-30
GP1T16M-M8	●	1	16	32	8.5	M8	12.8	5.5	17	8	10	ZDHW160-T43R1.6-40
GP1T20M-M10	●	1	20	38	10.5	M10	17.8	5.5	19	10	15	ZDHW200-T43R2-50
GP1T25M-M12	●	1	25	38	12.5	M12	20.8	5.5	22	9	17	ZDHW250-T43R2.5-62.5
GP1T30M-M16	●	1	30	43	17	M16	28.8	6	23	11	22	ZDHW300-T43R3-75

【Note】Do not apply lubricants such as grease, etc. to the “contact faces” and “modular screws” of the “modular mill”, “special shanks” and “special arbor”.

Inserts



R accuracy：±0.01(Insert itself)

P	Carbon steels	■	⌐
M	SUS, etc.	■	
K	FC・FCD	⌐	■
H	Hardened steels		■

■：General cutting, First recommended
⌐：General cutting, Second recommended

Item code	Tolerance class	Grade		Size(mm)						
		PN215	TH308	R1	R2	R3	ℓ	A	φDc	T
ZDHW120-T43R1.2-30	H	●	●	1.2	30	0.98	8.6	17.6	12	3.2
ZDHW160-T43R1.6-40		●	●	1.6	40	1.3	11.3	20.6	16	4.2
ZDHW200-T43R2-50		●	●	2.0	50	1.63	14.3	25.4	20	5.2
ZDHW250-T43R2.5-62.5		●	●	2.5	62.5	2.04	17.9	30.1	25	6.2
ZDHW300-T43R3-75		●	●	3.0	75	2.45	21.6	36.3	30	7.2

●：Stocked Items.

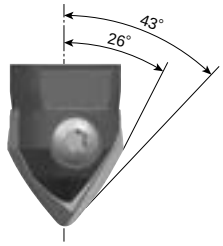
- The insert can be set with "ABPF-type" cutter body
- Use solid barrel end mill, "GS4TN-type" for smaller diameter in size

Parts

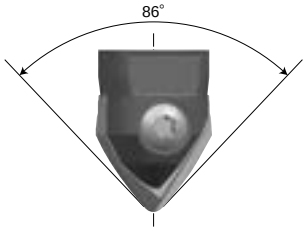
To reduce environmental loads, drivers and screw anti-seizure agent are sold separately.
We ask for your understanding and cooperation.

Parts	Clamp screw		Not included with product (sold separately)	
			Wrench	Screw anti-seizure agent
Shape / Cutter body		Fastening torque (N･m)		
GP1T12M-M6	581-143	4.9	105-T20	P-37
GP1T16M-M8	581-144	4.9		
GP1T20M-M10	581-145	6.9	101-T25S	
GP1T25M-M12	581-146	9.8	105-T30A	
GP1T30M-M16	581-147	9.8		

Angle range of barrel R and tip R



Tilt angle range of barrel R and tip R



Angle range of tip R that can be used as a ball end mill

※For information on the detailed tool shape, download the DXF data from the Mitsubishi Hitachi Tool Engineering home page.
(Mitsubishi Hitachi Tool Engineering tool selection database
TOOL SEARCH: http://data.mmc-hitachitool.co.jp/toolsearch/)

Recommended cutting conditions

※Red indicates primary recommended grade.

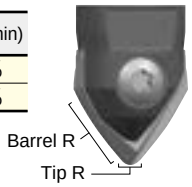
Work material	Recommended grade	Cutting conditions	Tip R					Barrel R				
			φ12(R1.2)	φ16(R1.6)	φ20(R2)	φ25(R2.5)	φ30(R3)	φ12	φ16	φ20	φ25	φ30
Carbon steels Alloy steels (<30HRC)	PN215	n (min-1)	19,910	14,930	11,950	9,560	7,970	19,110	14,340	11,470	9,180	7,650
		vc (m/min)	750(150)	750(150)	750(150)	750(150)	750(150)	720	720	720	720	720
		vf (mm/min)	1,600	1,500	1,440	1,340	1,280	5,740	4,310	3,450	2,760	2,300
		fz (mm/t)	0.04	0.05	0.06	0.07	0.08	0.15	0.15	0.15	0.15	0.15
		ap (mm)	0.1	0.1	0.1	0.1	0.1	Refer to the blow table				
		ae (mm)	Refer to the blow table					0.1	0.1	0.1	0.1	0.1
Carbon steels Alloy steels (30~45HRC)	PN215 TH308	n (min-1)	18,580	13,940	11,150	8,920	7,440	13,810	10,360	8,290	6,630	5,530
		vc (m/min)	700(140)	700(140)	700(140)	700(140)	700(140)	520	520	520	520	520
		vf (mm/min)	1,490	1,400	1,340	1,250	1,200	4,150	3,110	2,490	1,990	1,660
		fz (mm/t)	0.04	0.05	0.06	0.07	0.08	0.15	0.15	0.15	0.15	0.15
		ap (mm)	0.1	0.1	0.1	0.1	0.1	Refer to the blow table				
		ae (mm)	Refer to the blow table					0.1	0.1	0.1	0.1	0.1
Stainless steels SUS	PN215	n (min-1)	19,910	14,930	11,950	9,560	7,970	17,260	12,940	10,360	8,290	6,910
		vc (m/min)	750(150)	750(150)	750(150)	750(150)	750(150)	650	650	650	650	650
		vf (mm/min)	1,600	1,500	1,440	1,340	1,280	5,180	3,890	3,110	2,490	2,080
		fz (mm/t)	0.04	0.05	0.06	0.07	0.08	0.15	0.15	0.15	0.15	0.15
		ap (mm)	0.1	0.1	0.1	0.1	0.1	Refer to the blow table				
		ae (mm)	Refer to the blow table					0.1	0.1	0.1	0.1	0.1
Cast iron FC FCD	TH308 PN215	n (min-1)	19,910	14,930	11,950	9,560	7,970	19,110	14,340	11,470	9,180	7,650
		vc (m/min)	750(150)	750(150)	750(150)	750(150)	750(150)	720	720	720	720	720
		vf (mm/min)	1,600	1,500	1,440	1,340	1,280	7,650	5,740	4,590	3,680	3,060
		fz (mm/t)	0.04	0.05	0.06	0.07	0.08	0.2	0.2	0.2	0.2	0.2
		ap (mm)	0.1	0.1	0.1	0.1	0.1	Refer to the blow table				
		ae (mm)	Refer to the blow table					0.1	0.1	0.1	0.1	0.1
Hardened steels (45~55HRC)	TH308	n (min-1)	13,270	9,960	7,970	6,370	5,310	8,500	6,370	5,100	4,080	3,400
		vc (m/min)	500(100)	500(100)	500(100)	500(100)	500(100)	320	320	320	320	320
		vf (mm/min)	1,070	1,000	960	900	850	1,700	1,280	1,020	820	680
		fz (mm/t)	0.04	0.05	0.06	0.07	0.08	0.1	0.1	0.1	0.1	0.1
		ap (mm)	0.08	0.08	0.08	0.08	0.08	Refer to the blow table				
		ae (mm)	Refer to the blow table					0.08	0.08	0.08	0.08	0.08
Hardened steels (55~62HRC)	TH308	n (min-1)	11,950	8,960	7,170	5,740	4,780	7,440	5,580	4,460	3,570	2,980
		vc (m/min)	450(90)	450(90)	450(90)	450(90)	450(90)	280	280	280	280	280
		vf (mm/min)	960	900	870	810	770	1,490	1,120	900	720	600
		fz (mm/t)	0.04	0.05	0.06	0.07	0.08	0.1	0.1	0.1	0.1	0.1
		ap (mm)	0.05	0.05	0.05	0.05	0.05	Refer to the blow table				
		ae (mm)	Refer to the blow table					0.05	0.05	0.05	0.05	0.05

※The ( ) values of *vc* indicate the cutting speed of the tip R part.

When overhang length is 3*Dc* or greater, adjust the values shown in the table at right according to the above table.

Overhang ratio	*Vc* (m/min)	*Vf* (mm/min)
<3*Dc*	100%	100%
3*Dc* ~ 5*Dc*	70%	70%
5*Dc* ~ 6*Dc*	60%	60%

Overhang ratio	*Vc* (m/min)	*Vf* (mm/min)
6*Dc* ~ 7*Dc*	50%	50%
7*Dc* ~	45%	45%

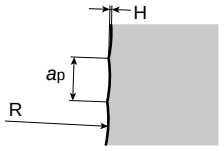


Determine the *ap* or *ae* value based on the desired cusp height by selecting it from the table below or by calculating it using the equation below.

Insert Item code	Barrel R	Cutting depth using barrel R *ap*(mm) Cusp height (mm) 0.0005	0.001	0.002	0.003	0.004	0.005	0.01	Tip R	Cutting depth using tip R *ae*(mm) Cusp height (mm) 0.0005	0.001	0.002	0.003	0.004	0.005	0.01
ZDHW120-T43R1.2-30	30	0.35	0.49	0.69	0.85	0.98	1.1	1.55	1.2	0.07	0.1	0.14	0.17	0.2	0.22	0.31
ZDHW160-T43R1.6-40	40	0.4	0.57	0.8	0.98	1.13	1.26	1.79	1.6	0.08	0.11	0.16	0.2	0.23	0.25	0.36
ZDHW200-T43R2-50	50	0.45	0.63	0.89	1.1	1.26	1.41	2	2	0.09	0.13	0.18	0.22	0.25	0.28	0.4
ZDHW250-T43R2.5-62.5	62.5	0.5	0.71	1	1.22	1.41	1.58	2.24	2.5	0.1	0.14	0.2	0.24	0.28	0.32	0.45
ZDHW300-T43R3-75	75	0.55	0.77	1.1	1.34	1.55	1.73	2.45	3	0.11	0.15	0.22	0.27	0.31	0.35	0.49

$$a_p = 2\sqrt{(R^2-(R-H)^2)} \quad (a_e)$$

R: Tool R H: Cusp height



【Note】
①Use the appropriate coolant for the work material and machining shape.
②These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
③To prevent tool breakage due to chips clogging tool flutes, always be sure to use an air blower, etc. to remove chips.
④Ensure to index the insert at the correct time to ensure safety of the tool-body.

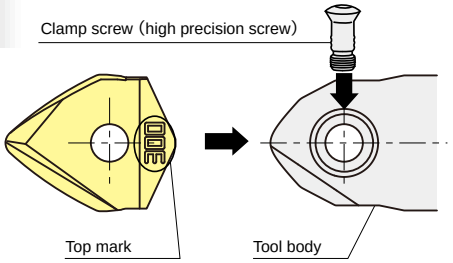
Set-up Procedures of Inserts

1 Clean the insert seat:
Using air-blow or alike, clean the seat.

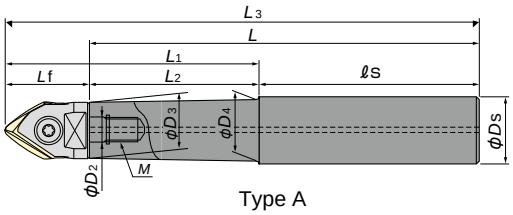
2 Put in the insert with its top positioned to the screw-tightening side of the tool body.

3 Tighten the clamp screw with the special wrench. Please do not press down the insert during this tightening process.

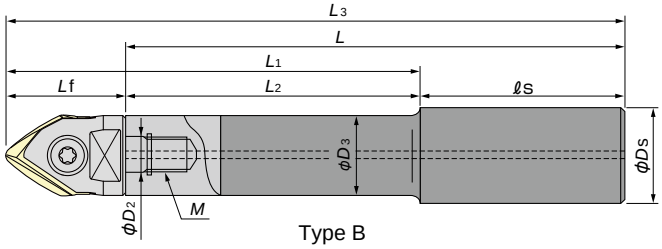
4 This is the end of insert set-up.



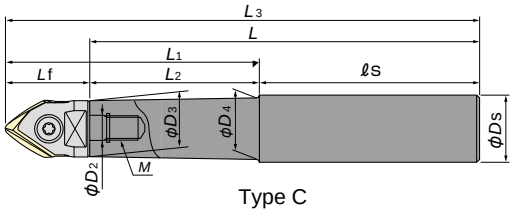
Carbide Shank



Type A



Type B



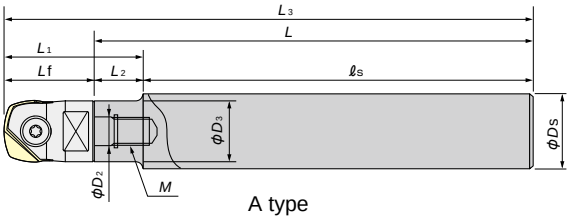
Type C

Item Code	Stock	Size (mm)											Type	Cutter body
		ϕD_2	M	L_3	L	Lf	L_2	L_1	ℓs	ϕD_3	ϕDs	ϕD_4		
ASC12-6.5-74-24	●	6.5	M6	(100)	74	(26)	24	(50)	50	11	12	11.5	C	GP1T12M-M6
ASC12-6.5-94-44	●			(120)	94		44	(70)	50					
ASC12-6.5-129-64	●			(155)	129		64	(90)	65					
ASC12-6.5-129-24	●			(155)	129		24	(50)	105					
ASC16-8.5-95-30	●	8.5	M8	120(127)	95	25(32)	30	55 (62)	65	14.5	16	15.5	A	GF1G2016M-2-M8 GF1T2016M-2-M8 GP1LB16M-M8 GP1T16M-M8
ASC16-8.5-120-55	●			145(152)	120		55	80 (87)	65					
ASC16-8.5-140-75	●			165(172)	140		75	100(107)	65					
ASC16-8.5-160-95	●			185(192)	160		95	120(127)	65					
ASC16-8.5-160-30	●			185(192)	160		30	55 (62)	130					
ASC20-10.5-120-50Z	●	10.5	M10	150(158)	120	30(38)	50	80 (88)	70	18.5	20	19.5	A	GF1G2020M-3-M10 GF1T2020M-3-M10 GF1G2025M-4-M10 GF2T3020M-3 GF3L20M-3-M10 GP1LB20M-M10 GP1T20M-M10
ASC20-10.5-170-90Z	●			200(208)	170		90	120(128)	80					
ASC20-10.5-220-120Z	●			250(258)	220		120	150(158)	100					
ASC20-10.5-270-150Z	●			300(308)	270		150	180(188)	120					
ASC20-10.5-220-50Z	●	10.5	M10	250(258)	220	30(38)	50	80 (88)	170	18.5	20	19.5	A	
ASC20-10.5-270-50Z	●			300(308)	270				220					
ASC25-12.5-145-65	●	12.5	M12	180(183)	145	35(38)	65	100(103)	80	23	25	-	B	GF1G2025M-4-M12 GF1T2025M-4-M12 GF2T3025M-4 GF3L25M-3-M12 GP1LB25M-M12 GP1T25M-M12
ASC25-12.5-215-115	●			250(253)	215		115	150(153)	100					
ASC25-12.5-265-145	●			300(303)	265		145	180(183)	120					
ASC25-12.5-315-195	●			350(353)	315		195	230(233)	120					
ASC25-12.5-265-65	●	12.5	M12	300(303)	265	35(38)	65	100(103)	200	23	25	-	B	
ASC25-12.5-315-65	●			350(353)	315				250					
ASC32-17-160-80	●	17	M16	200(203)	160	40(43)	80	120(123)	80	28	32	-	B	GF2T3035M-5 GF2T3040M-6 GF3L30M-3-M16 GP1T30M-M16 GP1LB30M-M16
ASC32-17-210-110	●			250(253)	210		110	150(153)	100					
ASC32-17-260-140	●			300(303)	260		140	180(183)	120					
ASC32-17-310-190	●			350(353)	310		190	230(233)	120					
ASC32-17-360-240	●			400(403)	360		240	280(283)	120					
ASC32-17-260-80	●	17	M16	300(303)	260	40(43)	80	120(123)	180	28	32	-	B	
ASC32-17-310-80	●			350(353)	310				230					
ASC32-17-360-80	●			400(403)	360				280					

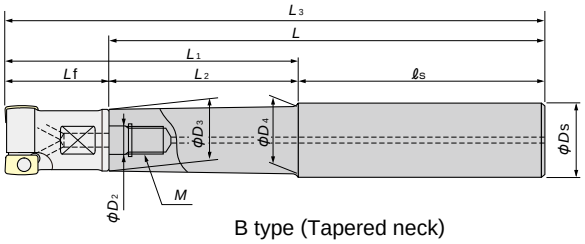
●: Stocked Items.

- Dimensions in ( ) are when GP1LB or GP1T is attached.
- Other shanks for modular mill, arbor can also be used. Please refer to pages D6 to D12 of the total catalog 2017-2018.
- Use steel shank for short projection application.

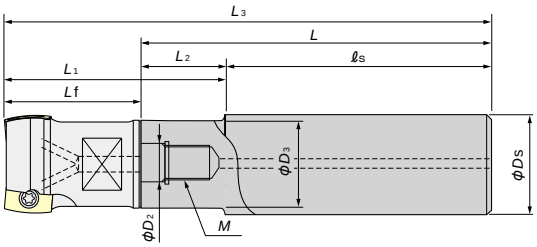
Steel Shank



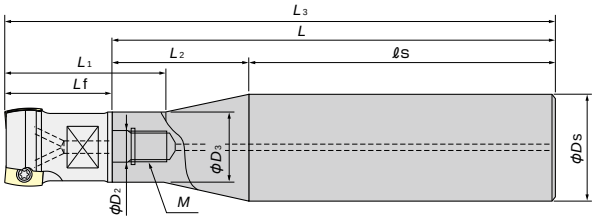
A type



B type (Tapered neck)



C type

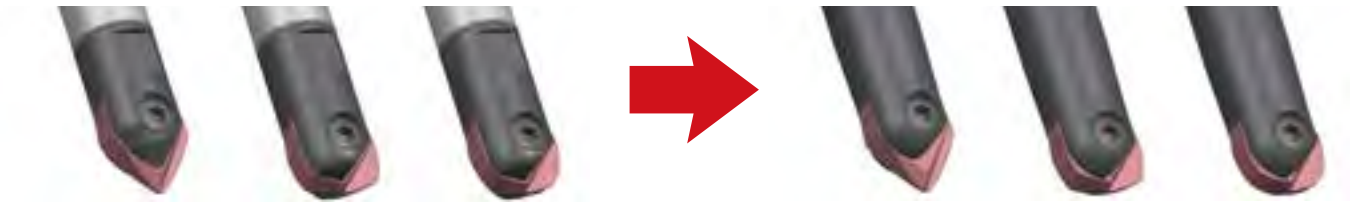


D type

Item Code	Stock	Size (mm)											Shape	Cutter body
		φD2	M	L3	L	Lf	L2	L1	ℓs	φD3	φDs	φD4		
AS12-6.5-84-4	●	6.5	M6	104 (110)	84	20 (26)	4	24 (30)	80	11	12	-	A	GP1T12M-M6
AS16-8.5-95-15	●	8.5	M8	120 (127)	95	25 (32)	15	40 (47)	80	14.5	16	15.5	B	GF1G2016M-2-M8 GF1T2016M-2-M8 GP1LB16M-M8 GP1T16M-M8
AS20-10.5-100-20	●	10.5	M10	130 (138)	100	30 (38)	20	50 (58)	80	18	20	-	C	GF1G2020M-3-M10 GF1T2020M-3-M10 GF1G2025M-4-M10 GF2T3020M-3 GF3L20M-3-M10 GP1LB20M-M10 GP1T20M-M10
AS25-12.5-115-35	●	12.5	M12	150 (153)	115	35 (38)	35	70 (73)	80	23	25	-	C	GF1G2025M-4-M12 GF1T2025M-4-M12 GF2T3025M-4 GF3L25M-3-M12 GP1LB25M-M12 GP1T25M-M12
AS32-17-110-30	●	17	M16	150 (153)	110	40 (43)	30	70 (73)	80	28	32	-	C	GF2T3035M-5 GF2T3040M-6 GF3L30M-3-M16 GP1T30M-M16 GP1LB30M-M16
AS42-17-360-90	●	17	M16	400 (403)	360	40 (43)	90	67 (70)	270	28	42	-	D	GF2T3035M-5 GF2T3040M-6 GF3L30M-3-M16 GP1T30M-M16 GP1LB30M-M16

- Commercial milling chucks can be used.
- Dimensions in ( ) are when GP1LB or GP1T is attached.
- For AS42-17-360-90 neck section or total length, additional machining to user specifications is possible.

GP1LB and GP1T inserts can be set in ABPF cutter body.



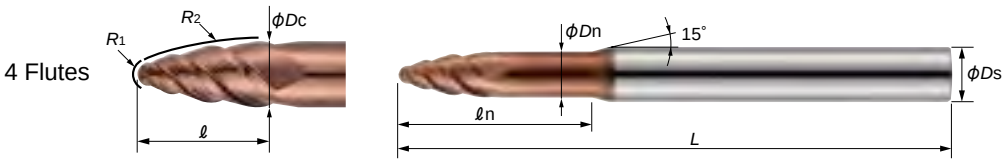
Set to original cutter body

Can be set in ABPF cutter body

The insert of GP1LB and GP1T are able to set in ABPF cutter body.
Please check “Multi purpose usage list of ABPF type cutter body” (No.1708)

Please check here

Solid type



GS4TN○○.○○-○○.○○R-TH3

Carbide TH3 Coated 72 HRC Helix 45° h5

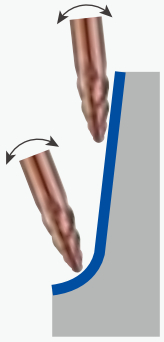
Form tolerance：±0.01

Item code	Stock	Size (mm)							
		Tip R R_1	Barrel R R_2	Tool dia. Dc	Flute length ℓ	Under neck length ℓn	Neck dia. Dn	Overall length L	Shank dia. Ds
GS4TN2.5-12.5R-TH3	◎	0.5	12.5	2.5	4.68	10	2.4	50	4
GS4TN3.75-18.75R-TH3	◎	0.75	18.75	3.75	7.01	15	3.65	50	4
GS4TN5-25R-TH3	◎	1	25	5	9.35	20	4.8	60	6
GS4TN7.5-37.5R-TH3	◎	1.5	37.5	7.5	14.03	30	7.3	75	8
GS4TN10-50R-TH3	◎	2	50	10	18.70	40	9.5	100	12

◎：manufacturer stocked items. Contact with our sales office.
・There is no regrinding compatibility for this tool.
・For the large diameter in size, use the indexable end mill "GP1T".
※For information on the detailed tool shape, download the DXF data from the Mitsubishi Hitachi Tool Engineering home page.
(Mitsubishi Hitachi Tool Engineering tool selection database TOOL SEARCH: http://data.mmc-hitachitool.co.jp/toolsearch/)

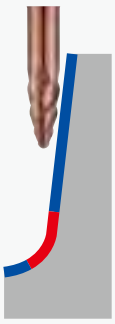
Machining method of GS4TN

When using with 5-axis machine



By using the barrel R with tilted tool axis, tilted section can be cut with large pitch.
Furthermore, it is possible to cut with less machining steps by using the tip R.

When using with 3-axis machine



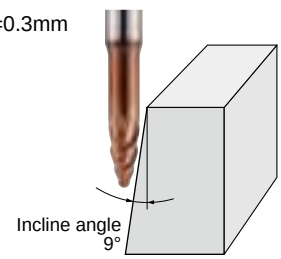
Barrel R enables to cut steep face with large pitch.
However, it is necessary to process the bottom corner section with a separate tool.

Processable with GS4TN　Needs separate tool

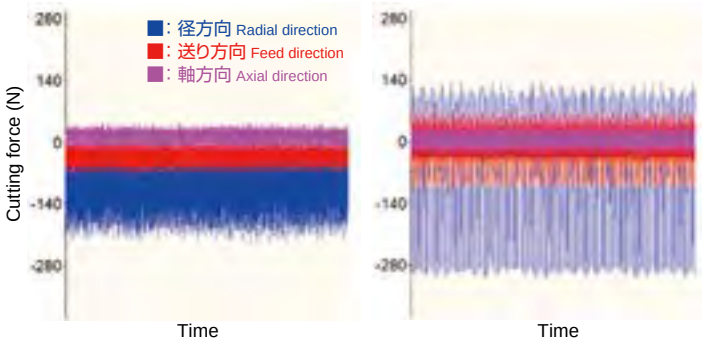
High helix shape realized low cutting force

Cutting conditions

Work material：YXR33(58HRC)
Tool：GS4TN10-50R-TH3
　　2 flutes Ball End Mill
Shape：See the figure right
Condition：　n=4780min^{-1}
　　v_f=956mm/min
　　(Ball：v_f=478)
　　a_p=0.5mm　a_e=0.3mm
　　Contouring
　　Down cut



GS4TN　2 flutes Ball End mill



High helix shape reduces cutting force,
4 flutes improve efficiency

Recommended cutting conditions

●Barrel R　cutting condition

Work material		Carbon steel, Alloy steel (<35HRC)				Pre-hardened steel (35～45HRC)				Hardened steel (45～55HRC)				Hardened steel (55～65HRC)				Hardened steel (65～72HRC)			
Tip R R_1 (mm)	Barrel R R_2 (mm)	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm
0.5	12.5	23,550	3,060	0.22	0.05～0.1	19,100	2,480	0.22	0.05～0.1	17,830	1,960	0.22	0.05～0.1	16,550	1,820	0.22	0.01～0.05	12,730	1,400	0.22	0.01～0.05
0.75	18.75	15,700	2,670	0.27	0.05～0.1	13,840	2,460	0.27	0.05～0.1	11,880	1,780	0.27	0.05～0.1	11,370	1,640	0.27	0.01～0.05	8,570	1,230	0.27	0.01～0.05
1	25	11,780	2,540	0.32	0.05～0.1	10,500	2,260	0.32	0.05～0.1	9,130	1,670	0.32	0.05～0.1	7,040	1,440	0.32	0.01～0.05	6,490	1,100	0.32	0.01～0.05
1.5	37.5	7,850	1,990	0.39	0.05～0.1	6,930	1,780	0.39	0.05～0.1	6,190	1,390	0.39	0.05～0.1	4,460	1,230	0.39	0.01～0.05	4,290	920	0.39	0.01～0.05
2	50	5,890	1,680	0.45	0.05～0.1	5,100	1,460	0.45	0.05～0.1	4,510	1,130	0.45	0.05～0.1	3,520	1,000	0.45	0.01～0.05	3,190	770	0.45	0.01～0.05

●Tip R　cutting condition

Work material		Carbon steel, Alloy steel (<35HRC)				Pre-hardened steel (35～45HRC)				Hardened steel (45～55HRC)				Hardened steel (55～65HRC)				Hardened steel (65～72HRC)			
Tip R R_1 (mm)	Barrel R R_2 (mm)	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm	Revolution n min^{-1}	Feed rate v_f mm/min	a_p mm	a_e mm
0.5	12.5	34,320	2,580	0.09	0.29	28,600	2,060	0.08	0.24	26,000	1,870	0.06	0.18	24,700	1,600	0.06	0.18	20,800	1,120	0.05	0.15
0.75	18.75	25,680	2,890	0.10	0.31	21,400	2,310	0.09	0.26	19,500	2,110	0.07	0.21	18,500	1,800	0.07	0.21	15,600	1,260	0.06	0.18
1	25	22,080	3,310	0.19	0.58	18,400	2,650	0.16	0.48	16,700	2,400	0.13	0.39	15,900	2,060	0.12	0.36	13,400	1,450	0.10	0.30
1.5	37.5	20,400	3,280	0.28	0.86	17,000	2,620	0.24	0.72	15,400	1,850	0.20	0.60	14,300	1,720	0.19	0.57	11,000	1,320	0.15	0.45
2	50	15,600	3,040	0.38	1.15	13,000	2,430	0.32	0.96	11,000	1,760	0.27	0.81	10,560	1,580	0.25	0.75	7,920	1,190	0.20	0.60

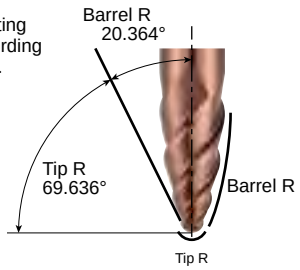
●Cutting condition for using both barrel R and tip R

Work material		Carbon steel, Alloy steel (<35HRC)		Pre-hardened steel (35～45HRC)		Hardened steel (45～55HRC)		Hardened steel (55～65HRC)		Hardened steel (65～72HRC)	
Tip R R_1 (mm)	Barrel R R_2 (mm)	Revolution n min^{-1}	Feed rate v_f mm/min	Revolution n min^{-1}	Feed rate v_f mm/min	Revolution n min^{-1}	Feed rate v_f mm/min	Revolution n min^{-1}	Feed rate v_f mm/min	Revolution n min^{-1}	Feed rate v_f mm/min
0.5	12.5	28,940	2,820	23,850	2,270	21,920	1,920	20,630	1,710	16,770	1,260
0.75	18.75	20,690	2,780	17,620	2,390	15,690	1,950	14,940	1,720	12,090	1,250
1	25	16,930	2,930	14,450	2,460	12,920	2,040	11,470	1,750	9,950	1,280
1.5	37.5	14,130	2,640	11,970	2,200	10,800	1,620	9,380	1,480	7,650	1,120
2	50	10,750	2,360	9,050	1,950	7,760	1,450	7,040	1,290	5,560	980

※For cutting depth (a_p, a_e), refer to the above conditions for each section.

■Angle range of barrel R and tip R

Depending on the cutting shape, the contact section is divided into barrel R and tip R. Check the contact section and select the appropriate cutting conditions according to each section.

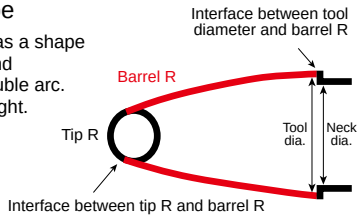


Determine the a_p value based on the desired cusp height by selecting it from the table below.

Tool		Cusp height (mm)					
Item code	Barrel R	0.0001	0.0003	0.0005	0.001	0.003	0.005
GS4TN2.5-12.5R-TH3	12.5	0.10	0.17	0.22	0.32	0.55	0.71
GS4TN3.75-18.75R-TH3	18.75	0.12	0.21	0.27	0.39	0.67	0.87
GS4TN5-25R-TH3	25	0.14	0.24	0.32	0.45	0.77	1.00
GS4TN7.5-37.5R-TH3	37.5	0.17	0.30	0.39	0.55	0.95	1.22
GS4TN10-50R-TH3	50	0.20	0.35	0.45	0.63	1.10	1.41

■ About tool shape

"Barrel R" of GS4TN has a shape that connects "tip R" and "tool diameter" with double arc. See the figure on the right.



【Note】

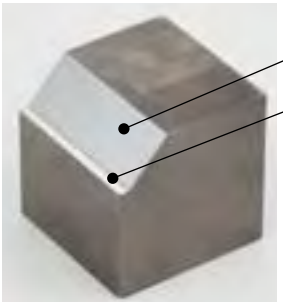
①Use the appropriate coolant for the work material and machining shape.
②Use a machine having as high rigidity and high accuracy as possible.
③These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④If the rpm of the machine is low, lower the feed rate also to put the rpm and feed rate in the same ratio.

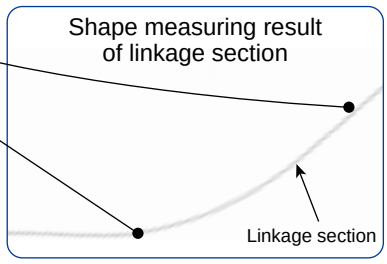
Field data

In 3-axis machining evaluation test of machining surface step between barrel R and tip R — GP1T

Cutting conditions

Work material：SKD61(52HRC)
GP1Tϕ20-TH308
OH=88mm
n=7,970min^{-1}
v_f=960mm/min
Cusp height setting value：0.001mm
Air-blow, Down cut





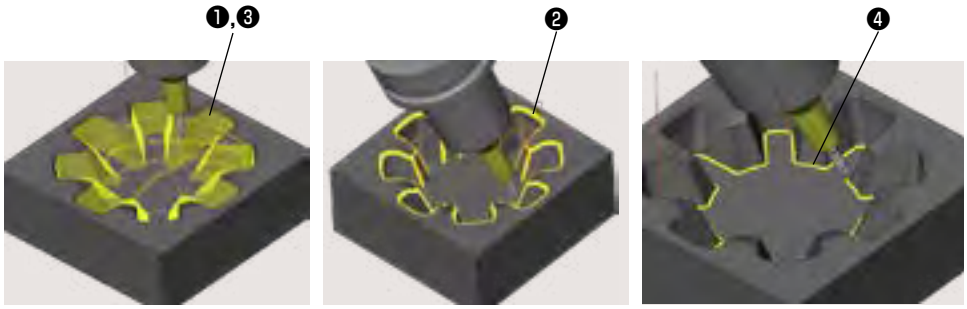
Good machined surface without machining step.

Model machining of YXR 33 with 5-axis machine — Hi-Pre² — GS4TN

Tool：GS4TN10-50R-TH3　Machine：5-axis machine,　Air blow　Work material：YXR33(58HRC)　Machining depth：30mm
Work size：About 90mm　Finishing time：**About 2 hours.**　CAD/CAM：hyperMILL

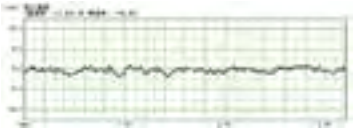
Process	Tool	Working area	Flute shape	Revolution n (min^{-1})	Cutting speed v_c (m/min)	Feed rate v_f (mm/min)	Feed per tooth f_z (mm/t)	Depth of cut a_p (mm)	Depth of cut a_e (mm)	Cutting time (min)
Roughing	HGOF4100-20-TH		Radius	2,200	69.1	1,760	0.2	0.4	3	92
Finishing	ETM4060-15-H		Radius	3,700	69.7	1,780	0.12	0.24	3	13
Semi-finishing	GS4TN5-25R-TH3 (O/H:30mm)	❶	Barrel edge	10,560	165.8	1,440	0.034	0.6	0	46
								0.2	0	
		❷	Tip edge	15,900	249.6	2,060	0.032	0	0.15	
Finishing	GS4TN3.75-18.75R-TH3 (O/H:25mm)	❸	Barrel edge	11,370	127.5	1,640	0.036	0.5	0	92
								0.5	0	
		❹	Tip edge	18,500	207.4	1,800	0.024	0	0.7	

Possible to finish tilted section and fillet section (connection surface) with one tool.
Good machined surface without machining steps which caused by tool change.



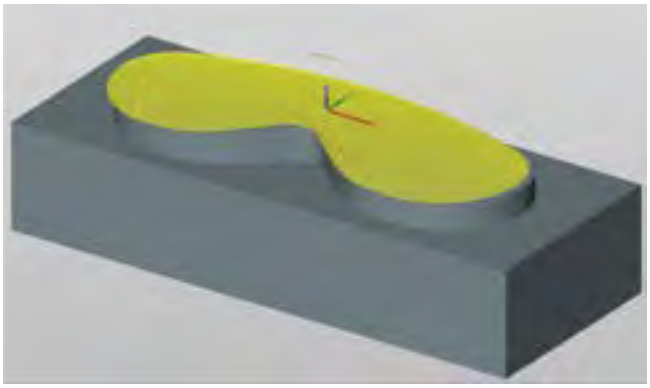
The same tool could finish even fillet section.

Surface roughness is good even when cutting with large pitch

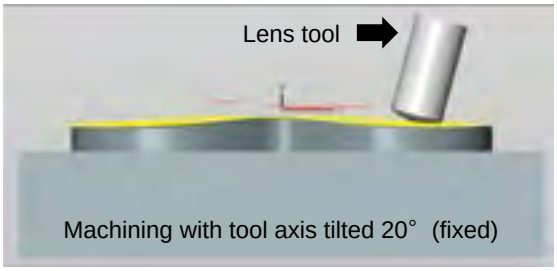


Ra:0.515μm　Rz:2.574μm

Curved surface finishing of eyeglass shape GF3L



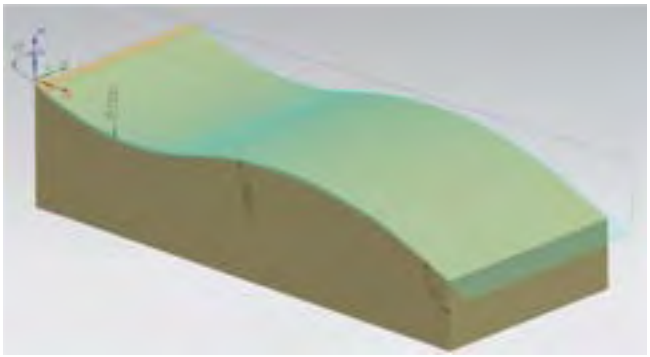
Work material : STAVAX　Machine : 5 axis M/C (HSK-A63)



v_c=392m/min、f_z=0.17mm/t、a_p=0.1mm、
Cusp height =0.003mm、wet、D_c=25mm, 3NT

Cutting efficiency about doubled with the similar surface roughness as ball end mill.

Semi-finishing of gentle sloped surface. (3 axis M/C) GF3L



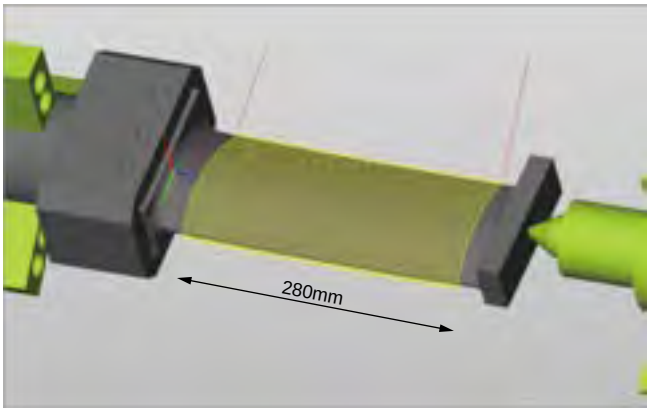
Work material : HPM(P20)　Machine : 3 axis vertical M/C (HSK-A63)

By utillizing GF3L type for semi-finishing after contouring roughing by radius mill, it is possible to the cutting about double efficiency of the ball end mill.

Using the GALLEA series (GF3L, GP1LB) it is possible to process from semi-finishing to finishing with high efficiency

Process	Tool	Grade	Cutting conditions									Cutting time
			v_c (m/min)	n (mm^{-1})	v_f (mm/min)	f_z (mm/t)	a_p (mm)	a_e (mm)	Cusp height (mm)	Removal stock (mm)	Method	
Roughing	RD16B4032S32	GX2160	200	2000	2400	0.4	0.8	10	–	0.6	Contouring	27' 28"
Semi-roughing	GF3L25M-3-M12	PN215	200	2546	3820	0.5	0.5	(2)	0.02	0.1	Surface machining	3' 57"
Finishing	GP1LB25M-M12	PN215	720	9180	4590	0.25	0.1	–	0.003	0	Surface machining	6' 30"

Turbine blade finishing GF3L



Work material : SUS420J2
Machine : Multi-function machine (HSK-A63)

Surface roughness

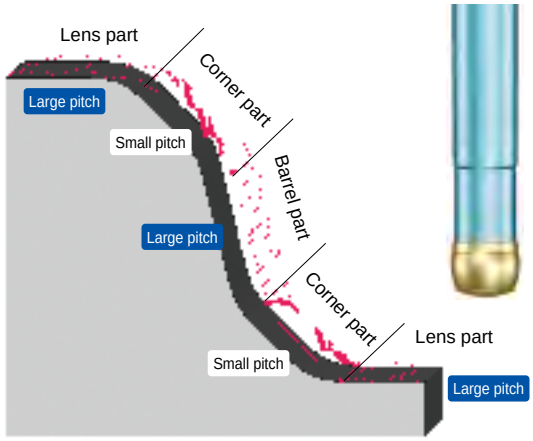
Ra=0.71μm
Rz=3.52μm

Ra=9.74μm
Rz=34.6μm

v_c=500m/min、f_z=0.4mm/t、v_f=7,640mm/min、
a_p=0.5mm、Cusp height=0.02mm、wet、
D_c=25mm、Simultaneous 5-axis machining
Heal angle：10° Fixed
GF3L25M-3-M12／TPHW1303-25 PN215

Possible to high efficiency finishing by using GF3L type.

Three-axis machining of auto mobile C pillar outer plate model GP1LB



Combining high efficiency and high quality machining

Work material : DAC (43HRC) Machine : BT50 class
CAD/CAM : tebis

After roughing

Unequal part after roughing process can be machined with efficiency of 1.4 times the conventional ball end mill.

Surface roughness improved by 40% with the same processing time as conventional ball end mill.

After finishing

Roughing①: About 4 hours.

- ϕ42mm High feed tool TD4N type

Roughing②: About 50 min.

- ϕ20mm Ball end mill BCF type

Semi-finishing・finishing: About 8 hours.

- ϕ20mm Ball end mill ABPF type
- ϕ20mm GALLEA GP1LB type ZPHW200-LB PN215
- ϕ16mm Ball end mill ABPF type
- ϕ10mm Ball end mill EMBE
- ϕ6mm Ball end mill EMBE

Total cutting time : About 13 hours

Three-axis machining of automobile door panel model GP1LB

By separately using the GALLEA series and conventional tool, you can process the rest of fillets speedy and with high quality.
For high hardened steel, GP1LB can be processed with efficiency of about 1.4 times that of a conventional ball end mill of same diameter.

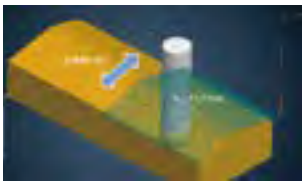
Work material : SLD-MAGIC (60HRC) Machine : BT40 class
CAD/CAM : WorkNC

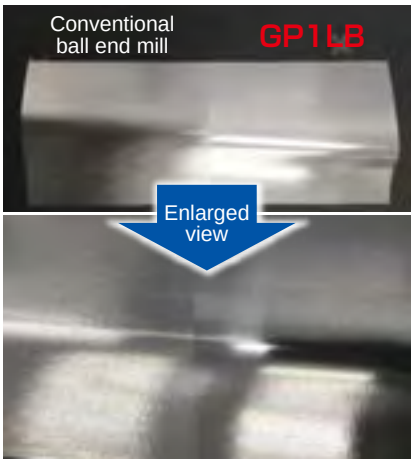
Process		Tool	Cutting speed *Vc* (m/min)	Revolution *n* (min^{-1})	Feed per tooth *fz* (mm/t)	Feed rate *vf* (mm/min)	Depth of cut *ap* (mm)	Depth of cut *ae* (mm)	Cusp height (μm)	Removal stock (mm)	Coolant
Roughing		RH2P1016S-4 EPHW0402TN-2 JP4105	65	1,290	0.3	1,540	0.1	6.5	–	0.2	Air-blow
Semi-finishing	All	GP1LB20M-M10 ZPHW200-LB20 TH308	200	3,183	0.2	1,273	0.05	1.0	6	0.1	Air-blow
	Corner etc.	EHHB4080-ATH	136	5,400	0.09	1,905	0.3	0.6	11	0.1	Air-blow
	Corner etc.	EHHB4050-ATH	135	8,600	0.05	1,840	0.2	0.4	8	0.1	Air-blow
Finishing	All	GP1LB20M-M10 ZPHW200-LB20 TH308	200	3,183	0.2	1,273	0.05	0.57	2	0	Air-blow
	Corner etc.	EHHB4080-ATH	161	6,400	0.08	2,050	0.05	0.25	2	0	Air-blow
	Corner etc.	EHHB4050-ATH	160	10,200	0.05	1,980	0.05	0.20	2	0	Air-blow

Total cutting time : About 4 hours

Comparison of machined surface with the same pick. GP1LB

Work material：FCD600
Tool：GP1LB30M-M16　ZPHW300-LB TH308
　　Conventional ball end mill φ30mm
n=6,000min^{-1} v_c=565m/min
v_f=6,000mm/min
Pitch=0.6mm　Removal stock=0.1mm





Conventional ball end mill	GP1LB
Ra:0.8μm　Rz:4.66μm	Ra:0.36μm　Rz:2.42μm

Surface roughness is about 1/2 of the ball end mill.

Part of door-inner model for automobile (3-Axis) GP1LB

POINT

Combination of lens tool and barrel tool steep-slope and gentle-slope can be finished with single tool

About 1.3 times as compared with conventional ball end mill

Work material：NAK80(42HRC)
Machine：BT40 class　CAD/CAM：FF CAM

For fillet processing, use connection-R edge.

Corner R was processed using ball end mill.
Processing is completed. there is no connecting step on the surface.

Process		Tool	Tool dia.	Cutting conditions						
				v_c (m/min)	n (mm^{-1})	v_f (mm/min)	f_z (mm/t)	Pitch (mm)	Cutting amount (mm/t)	Coolant
Semi-finishing	Gentle sloped surface	GP1LB16M-M8 ZPHW160-LB16 PN215 (Lens R:16, Barrel R:16)	16	231	4,600	1,840	0.2	1.6	0.15	Mist
	Steep sloped surface		16	181	3,600	1,440	0.2	1.6	0.15	Mist
Finishing	Gentle sloped surface		16	231	4,600	1,840	0.2	0.25	0.05	Mist
	Steep sloped surface		16	181	3,600	1,440	0.2	0.25	0.05	Mist

MOLDINO

The Edge To Innovation

The diagrams and table data are examples of test results, and are not guaranteed values.

⚠ Attentions on Safety

1. Cautions regarding handling

(1) When removing the tool from its case (packaging), be careful that the tool does not pop out or is dropped. Be particularly careful regarding contact with the tool flutes.
(2) When handling tools with sharp cutting flutes, be careful not to touch the cutting flutes directly with your bare hands.

2. Cautions regarding mounting

(1) Before use, check the outside appearance of the tool for scratches, cracks, etc. and that it is firmly mounted in the collet chuck, etc.
(2) When preparing for use, be sure that the inserts are firmly mounted in place and that they are firmly mounted on the arbor, etc.
(3) If abnormal chattering, etc. occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Cautions during use

(1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
(2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
(3) Cutting tools are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be attached when work is performed and safety equipment such as safety goggles should be worn to create a safe environment for work.
(4) There is a risk of fire or inflammation due to sparks, heat due to breakage, and cutting chips. Do not use where there is a risk of fire or explosion. **Please caution of fire while using oil base coolant, fire prevention is necessary.**
(5) Do not use the tool for any purpose other than that for which it is intended.

4. Cautions regarding regrinding

(1) If regrinding is not performed at the proper time, there is a risk of the tool breaking. Replace the tool with one in good condition, or perform regrinding.
(2) Grinding dust will be created when regrinding a tool. When regrinding, be sure to attach a safety cover over the work area and wear safety clothes such as safety goggles, etc.
(3) This product contains the specified chemical substance cobalt and its inorganic compounds. When performing regrinding or similar processing, be sure to handle the processing in accordance with thelocal laws and regulations regarding prevention of hazards due to specified chemical substances.

Mitsubishi Hitachi Tool Engineering, Ltd.

Head Office
Hulic Ryogoku Bldg. 8F, 4-31-11, Ryogoku, Sumida-ku, Tokyo, Japan 130-0026
International Sales Dept. : TEL +81-3-6890-5103 FAX +81-3-6890-5128

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