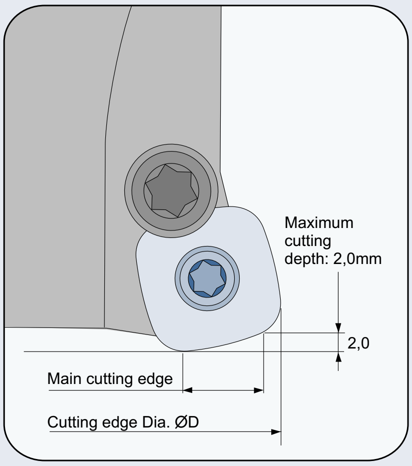
Recommended cutting conditions

Material	Cutting speed Vc (m/min)	Per-flute feed rate fz (mm/tooth)	Ø32 (2 flutes) Rotation speed min^{-1}	Ø32 Feed rate mm/min	Ø32 Q value cm^3/min	Ø40 (3 flutes) Rotation speed min^{-1}	Ø40 Feed rate mm/min	Ø40 Q value cm^3/min	Ø50 (4 flutes) Rotation speed min^{-1}	Ø50 Feed rate mm/min	Ø50 Q value cm^3/min
General Structural Steels (200 HB)	180-200	0,6-1,5	1790	5370	171	1430	6400	256	1150	6900	510
			Vc=180m/min fz=1,5mm/tooth ap=1,0mm ae=1,0D						Vc=180 fz=1,5 ap=1,5 ae=1,0		
	90-150	0,6-2,0	895	2690	86	720	3240	130	570	3420	257
			Vc=90m/min fz=1,5mm/tooth ap=1,0mm ae=1,0D						Vc=90 fz=1,5 ap=1,5 ae=1,0		
Carbon Steels Alloy Steels (30 HRC)	180-200	0,6-1,5	1790	5370	171	1430	6400	256	1150	6900	510
			Vc=180m/min fz=1,5mm/tooth ap=1,0mm ae=1,0D						Vc=180 fz=1,5 ap=1,5 ae=1,0		
	90-150	0,6-2,0	895	2690	86	720	3240	130	570	3420	257
			Vc=90m/min fz=1,5mm/tooth ap=1,0mm ae=1,0D						Vc=90 fz=1,5 ap=1,5 ae=1,0		
Carbon Steels Alloy Steels (30-45 HRC)	80-120	0,4-0,8	895	1430	45	720	1730	69	570	1820	130
			Vc=90m/min fz=0,8mm/tooth ap=1,0mm ae=1,0D						Vc=90 fz=0,8 ap=1,5 ae=1,0		
Alloy Steels (45-50 HRC)	70-120	0,02-0,6	995	600	19	790	710	28	630	760	38
			Vc=100m/min fz=0,3mm/tooth ap=1,0mm ae=1,0D						Vc=100 fz=0,3 ap=1,0 ae=1,0		
			700	280	9	550	330	13	440	360	18
			Vc=70m/min fz=0,2mm/tooth ap=0,5mm ae=1,0D						Vc=70 fz=0,2 ap=1,0 ae=1,0		
Alloy Steels(50-55 HRC)	70-100	0,05-0,2	700	280	5	550	330	7	440	350	9
			Vc=70m/min fz=0,2mm/tooth ap=1,0mm ae=1,0D						Vc=70 fz=0,2 ap=0,5 ae=1,0		
Alloy Steels(55-60 HRC)	50-100		500	50	0,8	400	60	1	310	62	1,5
			Vc=50m/min fz=0,05mm/tooth ap=0,5mm ae=1,0D						Vc=50 fz=0,05 ap=0,5 ae=1,0		
Cast Iron	180-200	0,8-2,0	1790	7160	344	1430	8580	515	1150	9200	920
			Vc=180m/min fz=2,0mm/tooth ap=1,5mm ae=1,0D						Vc=180 fz=2,0 ap=2,0 ae=1,0		
	90-150		895	3580	172	720	4320	259	570	4560	456
			Vc=90m/min fz=2,0mm/tooth ap=1,5mm ae=1,0D						Vc=90 fz=2,0 ap=2,0 ae=1,0		

Material	Cutting speed Vc (m/min)	Per-flute feed rate fz (mm/tooth)	Ø63 (4 flutes) Rotation speed min^{-1}	Ø63 Feed rate mm/min	Ø63 Q value cm^3/min	Ø80 (5 flutes) Rotation speed min^{-1}	Ø80 Feed rate mm/min	Ø80 Q value cm^3/min	Ø100 (6 flutes) Rotation speed min^{-1}	Ø100 Feed rate mm/min	Ø100 Q value cm^3/min
General Structural Steels (200 HB)	180-200	0,6-1,5	910	5500	520	720	5400	650	570	5130	770
			Vc=180m/min fz=1,5mm/tooth ap=1,5mm ae=1,0D								
	90-150	0,6-2,0	455	2730	258	360	2700	325	290	2610	390
			Vc=90m/min fz=1,5mm/tooth ap=1,5mm ae=1,0D								
Carbon Steels Alloy Steels (30 HRC)	180-200	0,6-1,5	910	5500	520	720	5400	650	570	5130	770
			Vc=180m/min fz=1,5mm/tooth ap=1,5mm ae=1,0D								
	90-150	0,6-2,0	455	2730	258	360	2700	325	290	2610	390
			Vc=90m/min fz=1,5mm/tooth ap=1,5mm ae=1,0D								
Carbon Steels Alloy Steels (30-45 HRC)	80-120	0,4-0,8	455	1450	140	360	1440	170	290	1400	210
			Vc=90m/min fz=0,8mm/tooth ap=1,5mm ae=1,0D								
Alloy Steels (45-50 HRC)	70-120	0,02-0,6	500	600	38	400	600	48	320	576	58
			Vc=100m/min fz=0,3mm/tooth ap=1,0mm ae=1,0D								
			350	280	18	280	280	22	220	260	26
			Vc=70m/min fz=0,2mm/tooth ap=1,0mm ae=1,0D								
Alloy Steels(50-55 HRC)	70-100	0,05-0,2	350	280	9	270	270	11	220	260	13
			Vc=70m/min fz=0,2mm/tooth ap=0,5mm ae=1,0D								
Alloy Steels(55-60 HRC)	50-100		250	50	1,5	200	50	2,0	160	48	2,4
			Vc=50m/min fz=0,05mm/tooth ap=0,5mm ae=1,0D								
Cast Iron	180-200	0,8-2,0	910	7280	920	720	7200	1150	570	6840	1370
			Vc=180m/min fz=2,0mm/tooth ap=2,0mm ae=1,0D								
	90-150		455	3640	459	360	3600	576	290	3840	696
			Vc=90m/min fz=2,0mm/tooth ap=2,0mm ae=1,0D								

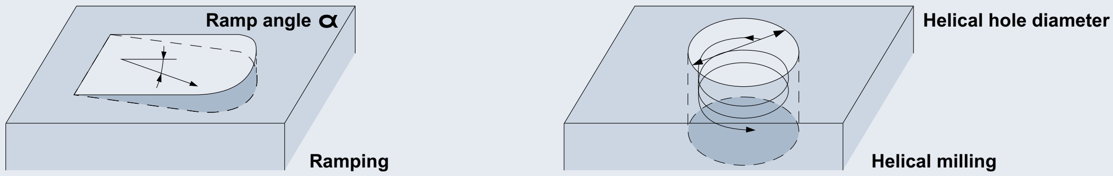
Note
- Select the best cutting condition when working, referring to above list.
  (If the overhang is 3D or less, the recommended cutting speed is Vc=180-200m/min; 3D or more: Vc=90-130m/min.)

- Thick and heavy chips are generated by using this tool. Be sure to remove them with air blow in order to avoid any breakage by blocking with chips.
  The recommended method is "Spindle center through" when blowing air. (Pay attention when removing chips in cavity work with the machining center <vertical type>.)



Processing by direct milling is also possible

Since the cutting flute do not extend to the center, there are limitations on the ramp angle and hole diameter, but as shown below, processing by direct milling without a pilot hole is possible for ramping and helical milling.



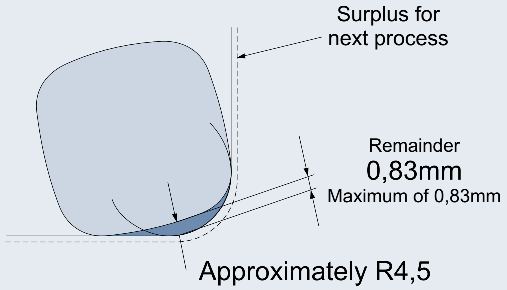
Tool diameter	Ø32	Ø40	Ø50	Ø63	Ø80	Ø100
Maximum ramp angle α	7º	4,5º	3º	1,7º	1º	1º
Hole diameter	ø44-61	ø61-76	ø80-96	ø107-122	ø142-156	ø179-195

Note -The ramp angle α should be set within the ranges listed above. Use at ramp angles of 1º or less recommended.
-For hole diameters outside the ranges listed above, a pilot hole should be drilled before milling.

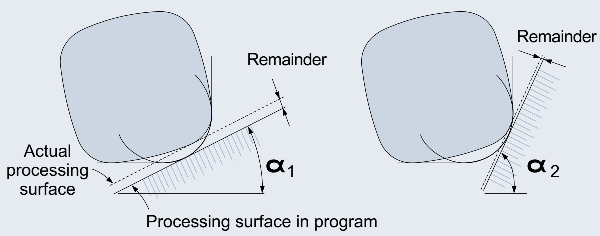
Method for defining conditions of insert tip programmatically

For roughing processing, please create a program with corner R values close to those shown as references below.

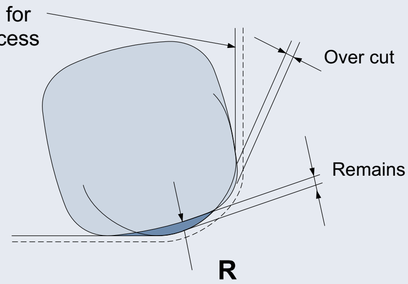
When corner R is set to 4,5



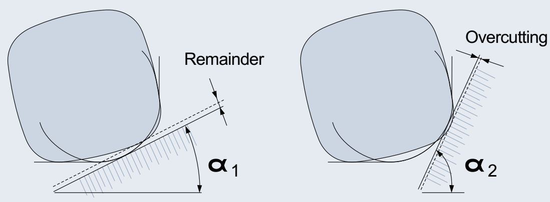
Normally, you should create a program with an input corner R of approximately 4,5.
At an approximate input corner R of 4,5, there is no overcutting.



When corner R is set larger



Although overcutting occurs when the approximate R is set to higher values, if the overcutting is with in the surplus for the next process, there is no problem with the processing shape and the amount of remainder can be supressed.



Approximate input corner R	R4,5	R5,1	R5,5	R5,8	R6,1	R6,4
Remainder	0,83 (α_1=22,1º)	0,66 (α_1=20,3º)	0,55 (α_1=19º)	0,47 (α_1=17,9º)	0,39 (α_1=16,7º)	0,32 (α_1=15,4º)
Overcuting	-	0,1 (α_2=73,4º)	0,2 (α_2=67,7º)	0,3 (α_2=64,7º)	0,4 (α_2=62,3º)	0,5 (α_2=60,5º)

Note
- Overcutting and remainder vary according to the processing shape. The values in the table above are maximum values.
- The values of α shown are the slopes of the processing surfaces when overcutting and remainder are at their maximum respective values.

For example, when a program is created with an approximate R of 5,1:
Remainder of around 0,66mm is left when the slope of the processing surface is approximately 20,3º, and when the slope of the processing surface is approximately 73,4º, about 0,1mm of overcutting occurs. At areas with other slopes, the overcutting and remainder values are below these values.