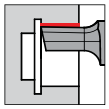
Cutting insert for broaching longitudinal slots

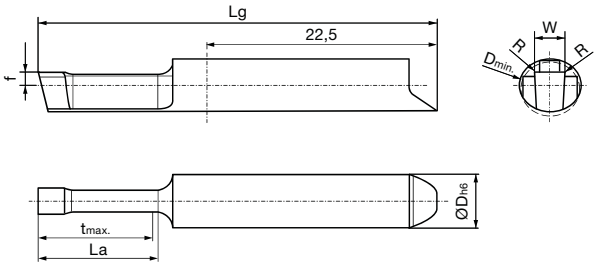


- **tolerance class C11, P9, JS9**

for tool holders type GB108 Series No. 27015 see page 170

	Series no.	27140	27141
Tool material		Solid Carbide	
Type		GN 108	GN 108
Coating		a	○
		nano-A	uncoated

Cutting data page 214



Code no.	Description	for slot width	D min	W	R	f	t max	La	Lg	D h6
			mm	mm	mm	mm	mm	mm	mm	mm
8.001	GN108.0498.020.12.09.N	5 P9	9.00	4.98	0.20	1.50	11.50	12.00	42.00	8.00
8.002	GN108.0498.020.24.09.N	5 P9	9.00	4.98	0.20	1.50	23.50	24.00	52.00	8.00
8.003	GN108.0598.020.12.10.N	6 P9	10.00	5.98	0.20	1.50	11.50	12.00	42.00	8.00
8.004	GN108.0598.020.24.10.N	6 P9	10.00	5.98	0.20	1.50	23.50	24.00	52.00	8.00

Series no. **27142** **27143**

Code no.	Description	for slot width	D min	W	R	f	t max	La	Lg	D h6
			mm	mm	mm	mm	mm	mm	mm	mm
8.001	GN108.0500.020.12.09.N	5 JS9	9.00	5.00	0.20	1.50	11.50	12.00	42.00	8.00
8.002	GN108.0500.020.24.09.N	5 JS9	9.00	5.00	0.20	1.50	23.50	24.00	52.00	8.00
8.003	GN108.0600.020.12.10.N	6 JS9	10.00	6.00	0.20	1.50	11.50	12.00	42.00	8.00
8.004	GN108.0600.020.24.10.N	6 JS9	10.00	6.00	0.20	1.50	23.50	24.00	52.00	8.00

Series no. **27144** **27145**

Code no.	Description	for slot width	D min	W	R	f	t max	La	Lg	D h6
			mm	mm	mm	mm	mm	mm	mm	mm
8.001	GN108.0513.050.12.09.N	5 C11	9.00	5.13	0.50	1.50	11.50	12.00	42.00	8.00
8.002	GN108.0513.050.24.09.N	5 C11	9.00	5.13	0.50	1.50	23.50	24.00	52.00	8.00
8.003	GN108.0613.050.12.10.N	6 C11	10.00	6.13	0.50	1.50	11.50	12.00	42.00	8.00
8.004	GN108.0613.050.24.10.N	6 C11	10.00	6.13	0.50	1.50	23.50	24.00	52.00	8.00

SYSTEM 108

MICRO-PRECISION TOOLS

Tool holder

Round shank holder

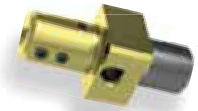
from page 134

Square shank holder

from page 140

Modular holder

from page 142

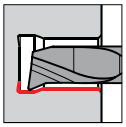


Star holder

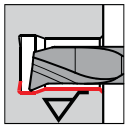
page 145

Round shank holder
Broaching
page 170

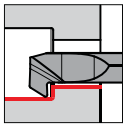
Cutting inserts from hole-Ø 7 mm



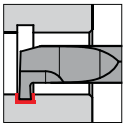
Boring out
and profiling, Type GT
from page 146



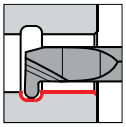
Boring out,
with Wiper, Type GJ
page 152



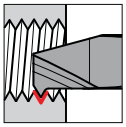
Back boring
and profiling, Type GT
page 154



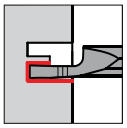
Internal grooving,
straight slots, Type GE
from page 156



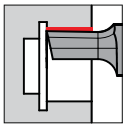
Internal grooving,
full radius slots, Type GE
from page 160



Internal threading,
Type GG
from page 164

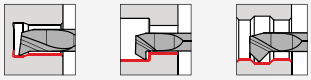
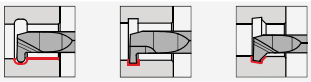
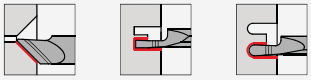


Axial grooving bores,
Type GA
from page 166



Broaching,
Type GN
page 171

SYSTEM 104/106/108/110

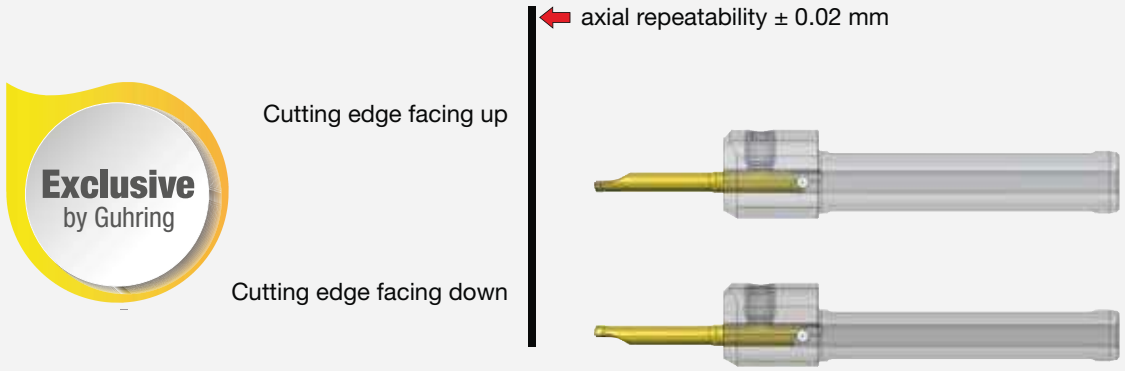
Machining	Feed range f (IPR)	Point radius R (mm)	Cutting depth a_p (in)	General formulas
	0.0008 - 0.0031	R 0.05 (0.002in) R 0.10 (0.004in) R 0.15 (0.006in) R 0.20 (0.008in) R 0.25 (0.010in) R 0.30 (0.012in)	0.0008 - 0.0028 0.0020 - 0.0059 0.0031 - 0.0079 0.0047 - 0.0098 0.0051 - 0.0110 0.0067 - 0.0138	Cutting speed (SFM) RPM x Dia. / 3.82 = SFM
	0.0004 - 0.0012			Revolutions per minute (RPM) SFM x 3.82 / Dia. = RPM
	0.0004 - 0.0020		Rule of thumb: ap ~ r	Feed rate (IPM) IPR x RPM = IPM

Guide values for feed and cutting depths

ISO	Material		Material examples/ material number	Tensile strength (N/mm²)	Brinell hardness (HB)	Cutting speed SFM (surface feet / min) TiN (S)	nano-A (a)	uncoated
P	Carbon steel	C < = 0.15 %	11SMn30+C / 1.0715 C15 / 1.0401	500 600	150 180	65-525	165-655	50-295
		C ≥ 0.15 - 0.45 %	S235JR (ST37-2) / 1.0037 Ck22 / 1.1151	400 600	120 180			
		C > 0.45 %	S355JO (St52-3) / 1.0553 C60 / 1.0601	600 900	180 270	65-295	165-525	-
	Low-alloyed steel (alloy content ≤5%)	annealed	16MnCr5 / 1.7131 18CrNi8 / 1.5920	650 650	200 200	65-525	165-590	50-230
		heat-treatable	25CrMoV4 / 1.7218 42CrMo4V / 1.7225	900 1100	270 320	-	100-395	-
	High-alloyed steel (alloy content >5%)	annealed	X37CrMoV5-1 / 1.2343 X153CrMoV12 / 1.2379	750 850	220 250	80-295	130-460	-
		heat-treatable	55NiCrMoV7 / 1.2714	1200	350	-	100-330	
	Cast steel	un-alloyed, low-alloyed	GS52 / 1.0552	600	180	65-395	100-590	-
		high-alloyed	GX40CrNiSi22-10 / 1.4826	750	220	-	100-295	
M	Stainless steel	martensitic, ferritic, tempered	X14CrMoS17 / 1.4104 X4CrNiMo16-5-1 / 1.4418	800 1000	240 300	65-230	100-295	-
		austenitic, Ni > 8%	X5CrNi18-10 / 1.4301 X2CrNiMo17-12-2 / 1.4404	650	200	65-300	100-360	-
		austenitic, ferritic (Duplex)	X2CrNiMoCuN25-6-3 / 1.4507 X2CrNiMoN25-7-4 / 1.4410	850	250	-	100-330	-
K	Grey cast iron	low tensile strength	EN-GJL-200 (GG20) / 0.6020		180	100-490	100-590	100-295
		high tensile strength	EN-GJL-400 (GG40) / 0.6040		260	100-395	100-490	100-230
	Spheroidal graphite iron	low tensile strength	EN-GJS-400-15 (GGG40) / 0.7040		160	100-425	100-525	-
		high tensile strength	EN-GJS-700-2 (GGG70) / 0.7070		260	100-360	100-460	
	Malleable cast iron	low tensile strength	EN-GJMW-350-4 (GTW35) / 0.8035		125	100-425	100-525	-
		high tensile strength	EN-GJMB-550-4 (GTS55) / 0.8155		250	100-360	100-460	
N	Al-alloys	non-heat-treatable <12% Si	EN-AW-2017 (AlCuMg1) / 3.1325		60	100-1805	100-1805	100-820
		heat-treatable <12% Si	EN-AW-6082 (AlMgSi1) / 3.2315		100	100-1310	100-1310	100-590
	Al-cast-alloys	non-heat-treatable <12% Si	AlSi9Cu3 / 3.2163		80	100-1805	100-1805	100-820
		heat-treatable <12% Si	AlSi10Mg / 3.2383		100	100-1310	100-1310	100-590
	Copper alloys	brass, lead alloy	CuZn39Pb2 (MS58) / 2.0380	400	120	100-1310	100-1310	100-590
		bronze	CuSn6 / 2.1020	500	150	100-240	100-240	100-590
S	Heat resistant alloys, super alloys	NiFe-base, annealed	NiCr15Fe (Alloy600) / 2.4816	700		-	50-230	-
		NiFe-base, hardened		950		-	50-165	
		NiCo-base, annealed	NiMo16Cr15W (Alloy C-276) / 2.4819	800		-	50-165	
		NiCo-base, cast		1100		-	30-130	
		NiCo-base, hardened	NiCr19NbMo (Alloy718) / 2.4668	1200		-	30-115	
	Titanium-alloys	annealed	Ti6Al4V / 3.7164	900		-	15-165	
		hardened		1200		-	30-115	
H	Hardened steels		Heat-treatable steel		> 52 HRC	-	65-130	-
			Heat-treatable/case hardened steel		> 59 HRC	-	30-100	-
			Heat-treatable/case hardened steel		> 62 HRC	-	(CBN)	-

The specified values must be adapted to the machine and machining conditions.

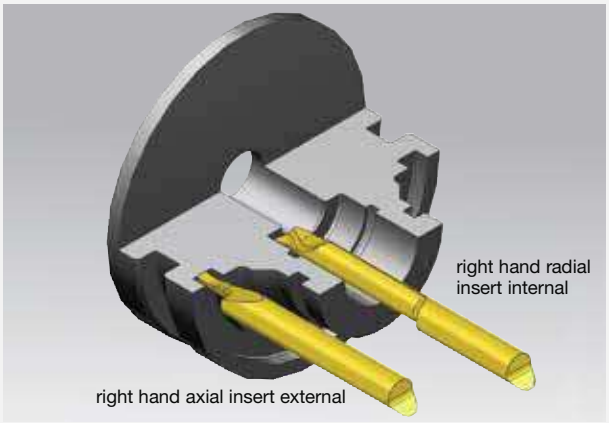
System 104/106/108/110
Positioning and clamping



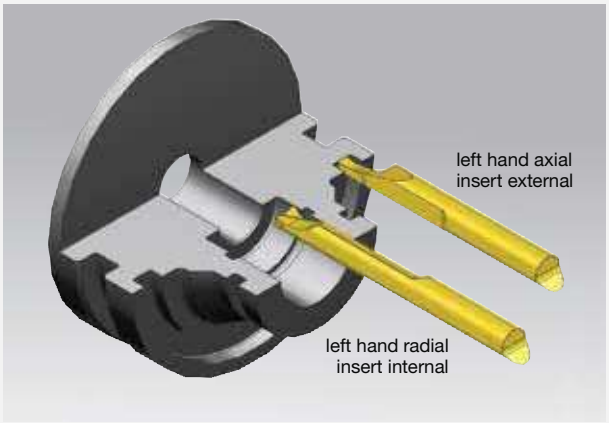
Guhring´s system 104/106/108/110 is unique in terms of insert positioning and clamping: The position between cutting edge facing up and cutting edge facing down can be changed by keeping the same length position without loosening the holder.

Definition of the cutting edge position

Main spindle clockwise



Main spindle counterclockwise



Troubleshooting

Subject		Solution											
		Feed	Feed at centre	Cutting speed	RH/LH edge orientation	Corner radius	Wiper	Width of groove	Tool clamping	Workpiece clamping	Tool overhang	Centre height of cutting edge	Coolant
Related to wear	Edge chipping	⬇	⬇			⬆			🔍	🔍	🔍	🔍	
	Build up edge			⬆									👍
	Flank wear	🔍	⇩	⬇		⬆						🔍	👍
	Plastic deformation	⇩	⇧	⬇		⬆							👍
Related to the component	Vibrations	⇧		⇩		⇩		⬇	🔍	🔍	⇩	🔍	
	Burrs		⬇		👍	⬇						🔍	👍
	Surface	⬇	⇩	⇧		⇧	👍	⇧	🔍	🔍	⇩	🔍	👍
	Long chips (no chip breakage)	⬆		⇧									👍
	(too) short chips, compressed chips	⬇											

⬇ decrease values (large impact)

⬆ increase values (large impact)

⇩ decrease values (low impact)

⇧ increase values (low impact)

🔍 check

👍 apply

Broaching
System GN 104/106/108/110

General hints

Please align the tool accurately.
The alignment surface on the tool holder GB104/106/108/110 provides a significant benefit.

Application instructions

- For blind holes there must be an undercut or cross hole at the bottom of the broach profile to allow chip evacuation.
- As a general rule the delivery of coolant (soluble or neat oil) helps the broaching process. It promotes chip evacuation, increases tool life, and improves surface finish.
- On the return stroke the tool must travel completely out of the hole.
- Pay attention to the feed Ø when programming the first stroke (load on the cutting corners).

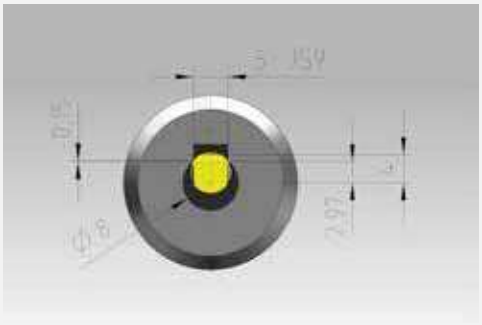
Calculating the feed diameter Ø d1 for the first stroke

Example: Hole Ø: 8 mm
Groove width: 5 mm
Safety distance between cutting corners and workpiece Ø: 0.15 mm

r = radius workpiece (hole Ø 8/2) = 4
b = Cutting edge / 2 (5/2) = 2.5

Feed radius = $\sqrt{r^2 - b^2}$ - safety distance

Feed radius = $\sqrt{4^2 - 2.5^2}$ - 0.15 = 2.97



Feed diameter Ø d1 = 2.97 x 2 = Ø 5.94

The feed diameter for the first stroke in the machining example above is Ø 5.94

Feed and feed rate

- The feed per stroke is dependent on the tensile strength of the material to be machined.
- The feed rate when broaching corresponds to the cutting speed and is controlled by the Z-axis of the machine.
- Achievable speeds are partly limited by the machine conditions.

	Tensile strength (N/mm²)					
	300	**400**	**600**	**800**	**1000**	**1200**
Feed rate (mm/min)	10000	8000	7000	6000	5000	4000
Feed per stroke (mm)	0.1	0.08	0.07	0.06	0.05	0.04

* Values are for guidance only. The machine condition, rigidity of component clamping as well as the workpiece material influence the cutting parameters.

Broaching
System GN 104/106/108/110

Sequence of machining

Broaching square profile:
- The broaching inserts generate a 90° corner
- The component must be repositioned 4 times each 90° to complete the square profile

Broaching hexagon profile:
- The broaching inserts generate a 60° corner
- The component must be repositioned 6 times each 60° to complete the hexagon profile

Broaching Torx profile:
- The broaching inserts generate one section of the torx profile
- The component must be repositioned 6 times each 60° to complete the torx profile

Application example

Application: Hexagon broaching		Tool selection		Customer benefit
Component:	Sleeve	System:	106 Special tool	The current process required a high amount of manual rework. Also the tool life was low. With the Guhring tool the customer achieves a very good surface with high tool life. Also there is no more manual rework required.
Material:	X 10 CrNiS 18 9	Holder:	GB106.0025.075.00.22.S.IK	
	1.4305	Insert:	Special insert	
Machine:	Spinner TC 65		nano-A	
Cooling:	20 bar			
Operat. step:	Semifinishing & fnishing			
vc:	-			
f:	3200 mm			
ap:	0,06			
Groov. depth:	SW 9.3 (special)			