GUHRING

Stainless Steels

Complete solutions from one source

- drilling from Ø 0.8 mm and up to 80xD drilling depth
- HPC reaming with highest accuracy
- HPC milling with perfect surface finish
- threading tools for every application
- custom made modular tools

Stainless steels and their attributes

Stainless or acid-resistant steels have a very high chromium content > 12 %, an excellent resistance against chemically aggressive substances and corrosion. The chromium creates a micro oxygen diffusing chromium dioxide coating on the surface, that prevents in-depth corrosion.

Most stainless steels are from the austenitic group of steels. Next to chromium, nickel is the most important constituent of the structure, often molybdenum is also added to optimise the mechanical characterisics. The range of application of austenitic steels is the food industry, power plants and energy supply, ship building and the petrochemical industry, but increasingly also applications in architecture for wall cladding and roofing. Typical materials are 1.4301 (X5CrNi 18 10 / V2A), 1.4541 (X6CrNiTi 18 10), 1.4571 (X6CrNiMoTi 17 12 2 / V4A) or 1.4311 (X2CrNiN 18 10).

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Properties and attributes when machining

When machining stainless or acid-resistant steels, the following properties should be noted: These materials tend to work harden, are very poor conductors of heat and display a high toughness and shear elongation. The high toughness leads to a very heavy cutting load especially when drilling and when producing threads. In addition, the mechanical properties of stainless or acid-resistant steels produce unfavourable chips that tend to stick and jam.

Optimal machining and tool selection

Stainless or acid-resistant steels due to their properties and attributes require sharp tools with their back taper and clearance angle configured in such a way that the high elastic deformation does not lead to a jamming of the tool when machining.

High feed rates result in an optimal dissipation of heat via the chips, a very good cooling lubrication - ideally via internal cooling - supports the removal of heat as well as chip evacuation and, in addition, counteracts the work hardening. As coolant we recommend high-performance cutting oil, but at least 8 % soluble oil. In addition, pecking may be necessary during machining.

A relatively low cutting speed should be chosen and can greatly depend on the material composition. Machining tests are paramount for selecting the optimal cutting speed.

Due to the high work load particular attention must be paid to maximum rigidity of the machine as well as the workpiece and tool clamping. Always select the shortest possible tool for your machining task.

Ratio drills RT 100 VA and RT 100 T

Constant high performance and accuracy in stainless steels is provided by Guhring's Ratio drills RT 100 VA in the diameter range from 3.0 to 20.0 mm for the drilling depths 3xD and 5xD as well as Guhring's Ratio drills RT 100 T in the diameter range from 3.0 to 14.0 mm for the drilling depths 20xD, 25xD, 30xD and 40xD. The geometries, tool materials and coatings of these two Ratio drills is especially adapted for the machining of stainless steels enabling the highest cutting parameters, perfect surface quality and secure chip evacuation especially from deep holes. This is supported by numerous drilling tests and application examples:

Selected machining results RT 100 VA

Guhring no.	8511	8511	8611
Diameter	8.0	15.0	6.8
Coating	TiAlN nanoA	TiAlN nanoA	TiAlN nanoA
Material group	stainless steel	stainless steel	stainless steel
Material description	X5CrNi18 10 1.4301	X6CrNiMoTi17-12-2 1.4571	X6CrNiTi1810 1.4541
Drilling depth [mm]	34	58	28
Hole type	through hole	blind hole	blind hole
Cooling	internal	internal	internal
Lubricant	soluble oil	soluble oil	soluble oil
Machine type	machining centre	machining centre	machining centre
v_c [mm/min]	50	90	60
f [mm/rev.]	0.2	0.14	0.1
Tool life [m]	140	63	150

Selected machining results RT 100 T

Guhring no.	6511	6512	6513
Diameter	3.5	8.0	5.0
Coating	TiAlN	TiAlN	TiAlN
Material group	stainless steel	stainless steel	stainless steel
Material description	X5CrNi18 10 1.4301	X6CrNiTi1810 1.4541	X6CrNiMoTi17-12-2 1.4571
Drilling depth [mm]	15	210	150
Hole type	through hole	through hole	through hole
Cooling	internal	internal	internal
Lubricant	soluble oil	soluble oil	soluble oil
Machine type	machining centre	machining centre	machining centre
v_c [mm/min]	90	30	35
f [mm/rev.]	0.04	0.08	0.04
Tool life [m]	85	11	18

Standard	Type	Shank form	Tool description and application	Drilling depth	Tool material	Surface finish	Diameter range	Guhring no.
RT 100 VA - Ratio drills with coolant ducts								
DIN 6537 K	RT 100 VA	HA		3 x D	**solid carbide**	TiAlN nanoA	3.000 - 16.000	**8510**
DIN 6537 K	RT 100 VA	HE		3 x D	**solid carbide**	TiAlN nanoA	3.000 - 25.000	**8610**
DIN 6537 L	RT 100 VA	HA		5 x D	**solid carbide**	TiAlN nanoA	3.000 - 16.000	**8511**
DIN 6537 L	RT 100 VA	HE		5 x D	**solid carbide**	TiAlN nanoA	3.000 - 25.000	**8611**
RT 100 T - Ratio drills with coolant ducts								
Guhring standard	RT 100 T	HA		20 x D	**solid carbide**	TiAlN	3.00 - 14.00	**6511**
Guhring standard	RT 100 T	HA		25 x D	**solid carbide**	TiAlN	3.00 - 12.00	**6512**
Guhring standard	RT 100 T	HA		30 x D	**solid carbide**	TiAlN	3.00 - 10.00	**6513**
Guhring standard	RT 100 T	HA		40 x D	**solid carbide**	TiAlN	3.00 - 8.00	**6514**

Solid carbide micro-precision drills

For especially small holes in stainless steels Guhring offers solid carbide micro-precision drills with diameters between 0.8 and 3.0 mm. They are available without internal cooling for the drilling depths 4xD and 7xD as well as with internal cooling for the drilling depths 8xD and 15xD.

Selected solid carbide micro-precision drill machining results

Guhring no.	6408	6412	6408
Diameter	2.6 mm	2.1 mm	1.4 mm
Coating	TiAlN SuperA	TiAlN SuperA	TiAlN SuperA
Material group	stainless steel	stainless steel	stainless steel
Material description	105CrMo17 1.4125	X6CrNiTi18 10 1.4301	X6CrNiTi18 10 1.4301
Drilling depth	8xD	15xD	8xD
Hole type	blind hole	blind hole	blind hole
Cooling	IC 100 bar	IC 80 bar	IC 80 bar
Lubricant	neat oil	soluble oil	soluble oil
Machine type	machining centre	machining centre	machining centre
v_c [mm/min]	53	60	60
f [mm/rev.]	0.06	0.03	0.021
Tool life [m]	500 parts, end of tool life not reached!	60	50

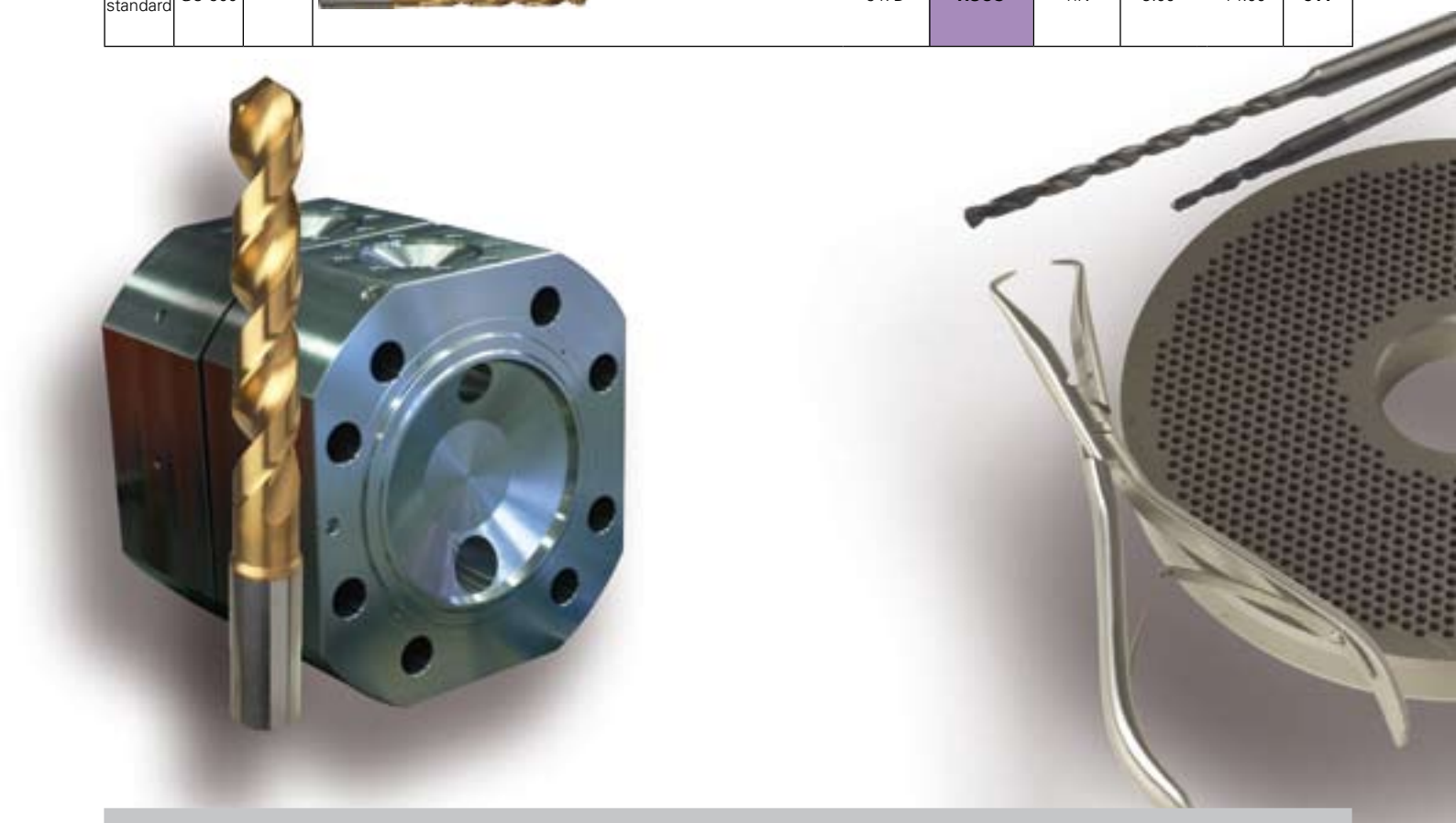
GU 500 high-speed steel drills

For smaller batch sizes as well as unstable machine conditions the application of HSCO GU 500 drills is recommended. They have a reinforced straight shank and are available in short or extra short lengths.
GU 500 high speed drills achieve excellent machining results in stainless steels:

GU 500 selected machining results

Guhring no.	511	511	512
Diameter	5.56	6.8	6.0
Coating	TiN	TiN	TiN
Material group	stainless steel	stainless steel	stainless steel
Material description	XCrNi18-10/ 1.4304	XCrNi18-10/ 1.4304	X6CrNiMoTi17-12-2 1.4571
Drilling depth [mm]	43	30.8	22.0
Hole type	through hole	through hole	blind hole
Cooling	EC	EC	EC
Lubricant	soluble oil	soluble oil	soluble oil
Machine type	machining centre	machining centre	machining centre
v_c [mm/min]	40	10	14
f [mm/rev.]	0.1	0.08	0.1
Tool life [m]	9	30.5	5

Standard	Type	Shank form	Tool description and application	Drilling depth	Tool material	Surface finish	Diameter range	Guhring no.
Solid carbide micro-precision drills without coolant ducts								
Guhring standard	N	HA		4 x D	**solid carbide**	TiAlN Super A	0.800 - 3.000	**6400**
Guhring standard	N	HA		7 x D	**solid carbide**	TiAlN Super A	0.800 - 3.000	**6401**
Solid carbide micro-precision drills with coolant ducts								
Guhring standard	N	HA		8 x D	**solid carbide**	TiAlN Super A	1.400 - 3.000	**6408**
Guhring standard	N	HA		15 x D	**solid carbide**	TiAlN Super A	1.400 - 3.000	**6412**
GU 500 twist drills with reinforced shank								
Guhring standard	GU 500			3 x D	**HSCO**	TiN	3.00 - 14.00	**512**
Guhring standard	GU 500			5 x D	**HSCO**	TiN	3.00 - 14.00	**511**



EB 80 and EB 100 single-flute gun drills

Guhring provides single-flute gun drills type EB 80 and EB 100 ex-stock especially for close tolerances or for primarily deep holes and especially for the machining of high-alloyed and stainless steels. Thanks to their special carbide grade, geometry and coating they achieve long tool life in stainless steels as the machining results listed below demonstrate.

Selected machining results EB 80 EB 100

Guhring no.	5640	5641	5637
Diameter	6.0	10.0	2.5
Coating	TiCN	TiCN	SuperA
Material group	stainless steel	stainless steel	stainless steel
Material description	X5CrNi1810 1.4301	X6CrNiTi181C 1.4541	X620CrNiMoTi17-12-2 1.4571
Drilling depth [mm]	175	380	110
Hole type	through hole	blind hole	blind hole
Cooling	internal	external	internal
Lubricant	soluble oil	soluble oil	soluble oil
Machine type	machining centre	machining centre	machining centre
v_c [mm/min]	55	40	45
f_z [mm]	0.014	0.016	0.008
Tool life [m]	3.5	2.7	2.1

Standard	Type	Tool description and application	Flute length (mm)/ Drilling depth	Tool material	Surface finish	Diameter range	Guhring no.
Gun drills EB80 with coolant ducts							
Guhring standard	EB 80		45,00	**Solid carbide**	TiCN	4.000 - 12.000	**5639**
Guhring standard	EB 80		80,00	**Solid carbide**	TiCN	4.000 - 12.000	**5640**
Guhring standard	EB 80		120,00	**Solid carbide**	TiCN	4.000 - 12.000	**5641**
Guhring standard	EB 80		160,00	**Solid carbide**	TiCN	4.950 - 11.950	**5642**
Gun drills EB100 with coolant ducts							
Guhring standard	EB 100		20 x D	**Solid carbide**	TiAlN SuperA	2.000 - 3.200	**5632**
Guhring standard	EB 100		30 x D	**Solid carbide**	TiAlN SuperA	2.000 - 5.000	**5633**
Guhring standard	EB 100		40 x D	**Solid carbide**	TiAlN SuperA	2.000 - 5.000	**5637**
Guhring standard	EB 100		80 x D	**Solid carbide**	TiAlN SuperA	2.000 - 8.000	**5638**

HR 500 high-performance reamers and solid carbide NC-reamers

High-performance and extreme accuracy are the features of Guhring's HR 500 reamers and solid carbide NC-reamers. HR 500 high-performance reamers excel as solid carbide tools in the diameter range up to 20.00 mm with highest performance levels. They are also available as carbide-tipped tools in the diameter range from 22.0 to 40.0 mm, so the tool material is optimally adapted to the machining task.
Guhring's NC-reamers are designed to satisfy the high quality demands in the production arena and are designed for accurate clamping in hydraulic chucks and shrink fit chucks.

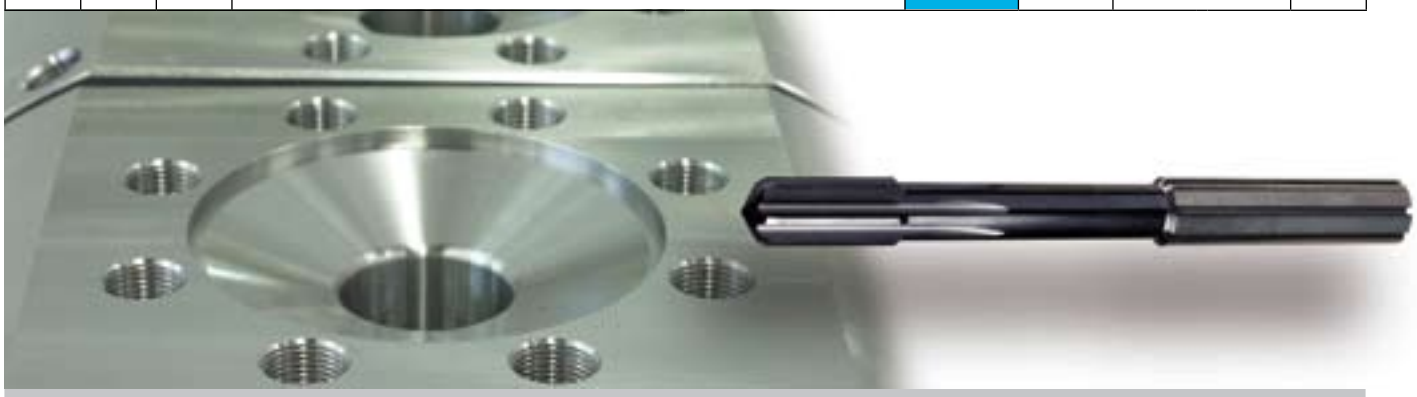
HR 500 selected machining results

Guhring no.	1686	1685	1685	1685
Diameter	10.0	16.0	5.0	7.0
Coating	TiAlN	TiAlN	TiAlN	TiAlN
Material group	stainless steel	stainless steel	stainless steel	stainless steel
Material description	X6CrNiMoTi17 12 2 1.4571	X20CrNi17 2 1.4057	X10CrNiS18 9 1.4305	X1CrNiMoN25 25 2 1.4465
Drilling depth [mm]	25.0	19.0	7.5	65
Hole type	through hole	blind hole	blind hole	blind hole
Cooling	internal	internal	external	internal
Lubricant	soluble oil	soluble oil	soluble oil	neat oil
Machine type	machining centre	machining centre	machining centre	turning centre
v_c [mm/min]	80	100	60	60
f_z [mm]	0.13	0.25	0.2	0.13
Tool life [m]	25	28.5	12	195

Solid carbide NC-reamers selected machining results

Guhring no.	1449
Diameter	7.0
Coating	TiN
Material group	stainless steel
Material description	X6CrNiMoTi17 12 2 1.4571
Drilling depth [mm]	20,0
Hole type	through hole
Cooling	external
Lubricant	soluble oil
Machine type	machining centre
v_c [mm/min]	6
f_z [mm]	0.025
Tool life [m]	7.0

Standard	Type	Shank form	Tool description and application	Tool material	Surface finish	Diameter range	Guhring no.
HR 500 S for blind holes							
Guhring standard	HR 500 S	straight h6		**solid carbide**	TiAlN	4.000 - 20.000	**1685**
Guhring standard	HR 500 S	straight h6		**solid carbide**	TiAlN	3.970 - 12.030	**1675**
HR 500 D for through holes							
Guhring standard	HR 500 D	straight h6		**solid carbide**	TiAlN	4.000 - 20.000	**1686**
Guhring standard	HR 500 D	straight h6		**solid carbide**	TiAlN	3.970 - 12.030	**1676**
HR 500 GS for blind holes							
Guhring standard	HR 500 GS	straight h6		**carbide**	TiAlN	22.000 - 40.000	**1680**
HR 500 GD for through holes							
Guhring standard	HR 500 GD	straight h6		**carbide**	TiAlN	22.000 - 40.000	**1681**
Solid carbide NC-reamers with extremely unequal spacing							
Guhring standard		straight h6		**solid carbide**	bright	0.980 - 12.050	**1427**
Guhring standard		straight h6		**solid carbide**	bright	3.000 - 12.000	**1449**



Ratio end mills RF 100 VA

RF 100 high-performance end mills excel with different spiral angles, resulting in a vibration-free cut. With the unequal helix, a considerably better surface quality is achieved on finishing operations and clearly higher feed rates can be achieved with slot drilling and rough milling.
With many applications the complete milling process can be covered with a RF 100, generating a considerable cost advantage in addition to an increase in tool life and dimensional accuracy of the workpiece.
In combination with the newly developed roughing geometry RF 100 VA/NF milling cutters enable a drastic increase in tool life compared to conventional roughing end mills with round or flat knuckle-type teeth. At the same time the surface quality improves to a peak-to-valley depth of approximately Ra = 2-3µm, making finishing operations in many cases unnecessary. In addition, the new design reduces power consumption in comparison to conventional RF 100 end mills, allowing application in unstable conditions and on less powerful machines.

RF 100 VA and RF 100 VA/NF selected machining results

Guhring no.	3805	3803	3080	3718	3803
Type	RF 100 VA	RF 100 VA	RF 100 VA	RF 100 VA/NF	RF 100 VA
Diameter	12.0	12.0	12.7	12.0	12.0
Coating	TiAlN nanoA	TiAlN nanoA	TiAlN nanoA	TiAlN nanoA	TiAlN nanoA
Material group	stainless steel	stainless steel	stainless steel	stainless steel	special alloy
Material description	X5CrNi13 4 1.4301	X12CrMoS17 1.4104	X6CrNiMoTi17 12 2 1.4571	X10CrNiS18 9 1.4305	Inconel 625
Cutting depth a_p	6.0	12.0	14.5	18.0	12.0
Cutting width a_e [mm]	3.0	6.0	2.5	12.0	12.0
Milling type	rough milling	rough milling	finish milling	slot drilling	slot drilling
Cooling	external	external	without	external	external
Lubricant	soluble oil	soluble oil		soluble oil	soluble oil
Machine type	machining centre (BT 40)	machining centre (BT 40)	machining centre (BT 50)	machining centre (HSK 100)	machining centre (HSK 63)
v_c [m/min]	113	190	118	72	33
f_z [mm/min.]	0.084	0.04	0.08	0.065	0.04
Tool life [m]	81	132	45	(126 min.)	(70 min.)

Standard	Type	Shank form	Tool description and application	Tool material	Surface finish	Diameter range	Guhring no.
Ratio end mills RF 100 VA							
centre cutting							
DIN 6527 K	NH 36°/38°	HA		**Solid carbide**	TiAlN nanoA	4.000 - 20.000	**3804**
DIN 6527 K	NH 36°/38°	HB		**Solid carbide**	TiAlN nanoA	4.000 - 20.000	**3805**
DIN 6527 L	NH 36°/38°	HA		**Solid carbide**	TiAlN nanoA	6.000 - 25.000	**3800**
DIN 6527 L	NH 36°/38°	HB		**Solid carbide**	TiAlN nanoA	6.000 - 25.000	**3803**
Guhring standard	NH 36°/38°	HA		**Solid carbide**	TiAlN nanoA	6.000 - 20.000	**3806**
Guhring standard	NH 36°/38°	HB		**Solid carbide**	TiAlN nanoA	6.000 - 20.000	**3807**
Ratio end mills RF 100 VA/NF							
centre cutting							
DIN 6527 L	NF 36°/38°	HA		**Solid carbide**	TiAlN nanoA	6.000 - 25.000	**3696**
DIN 6527 L	NF 36°/38°	HB		**Solid carbide**	TiAlN nanoA	6.000 - 25.000	**3718**
Guhring standard	NF 36°/38°	HA		**Solid carbide**	TiAlN nanoA	6.000 - 20.000	**3733**
Guhring standard	NF 36°/38°	HB		**Solid carbide**	TiAlN nanoA	6.000 - 20.000	**3885**

Taps, fluteless taps and thread milling cutters

Diversity is the motto of Guhring's threading tools for the machining of stainless steels. The user can find a suitable tool for every machining task in Guhring's wide-ranging threading tool program.
On these pages we are only introducing reference tools for ISO metric threads. Taps, fluteless taps and thread milling cutters are also available for all thread types and tolerance zones. Furthermore, there are alternative tools available with other surface finishes for further thread depths etc. The complete threading tool program can be found in the current threading tool catalogue.

Selected machining results for tapping fluteless tapping

Guhring no.	2086	2896	59	761	1139	322	1972
Diameter	M10	M16	M6	M6	M10	M8	M16x1.5
Coating	TiN	TiN	TiN	TiN	TiCN	TiN	TiCN
Material group	stainless steel	stainless steel	stainless steel	stainless steel	stainless steel	stainless steel	stainless steel
Material description	X5CrNi13 4 1.4301	X6CrNiMoTi17 12 2 1.4571	X2CrNiMo17-12-2 1.4404	X2CrNiMo18-14-3 1.4435 Guss	X10CrNiS18 9 1.4305	X5CrNi13 4 1.4301	X6CrNiMoTi17 12 2 1.4571
Thread depth [mm]	21.0	30.0	12.0	15.0	20.0	18.0	16.0
Hole type	through hole	blind hole	blind hole	blind hole	blind hole	blind hole	blind hole
Cooling	external	external	external	external	external	external	internal
Lubricant	soluble oil	neat oil	soluble oil	soluble oil	neat oil	neat oil	soluble oil
Machine type	machining centre	turning centre	machining centre	turning centre	machining centre	turning centre	machining centre
v_c [m/min]	10	8	8	5	6	6	12
Tool life	1250 threads	640 threads	730 threads	480 threads	970 threads	1680 threads	6350 threads

Selected machining results for thread milling

Guhring no.	3526	3541
Diameter	M8	M24
Coating	TiCN	TiCN
Material group	stainless steel	stainless steel
Material description	X5CrNi13 4 1.4301	X6CrNiMoTi17 12 2 1.4571
Thread depth [mm]	16.0	30.0
Hole type	blind hole	blind hole
Cooling	internal	internal
Lubricant	soluble oil	soluble oil
Machine type	machining centre	turning centre
v_c [m/min]	60	60
f_z [mm/rev.]	0.05	0.08
Tool life [m]	1140 threads (climb milling)	1350 threads (climb milling)

Standard	Type	Tolerance zone	Tool description and application	Tool material	Surface finish	Diameter range	Guhring no.
Taps for through holes							
DIN 371	VA/B	ISO 2 / 6H		**HSS-E**	TiN	M3 - M10	**2086**
Taps for blind holes							
DIN 371	VA R15/C	ISO 2 / 6H		**HSS-E**	TiN	M3 - M10	**2896**
DIN 371	VA R40/C	ISO 2 / 6H		**HSS-E PM**	TiN	M3 - M10	**59**
DIN 371	VA R50	6HX		**HSS-E PM**	TiN	M3 - M10	**761**
DIN 371	VA R50	6HX		**HSS-E PM**	TiCN	M5 - M10	**1139**
Fluteles taps for through holes and blind holes							
~DIN 371	N/C	6 HX		**HSS-E PM**	TiN	M3 - M10	**322**
~DIN 371	N/C	6 HX		**solid carbide**	TiCN	M3 - M10	**1972**
Thread milling cutters for through holes and blind holes							
Guhring standard	TMC SP			**solid carbide**	TiCN	M3 - M20	**3526**
Guhring standard	TMU SP			**solid carbide**	TiCN	≥14 - ≥30	**3541**

Made to measure - modular tools from Guhring

Guhring manufactures modular tools individually tailored to your specific machining task. Our aim is to solve complex machining tasks with intelligent tooling solutions as simply and quickly as possible, in order to save your production time and costs.

GUHRING

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