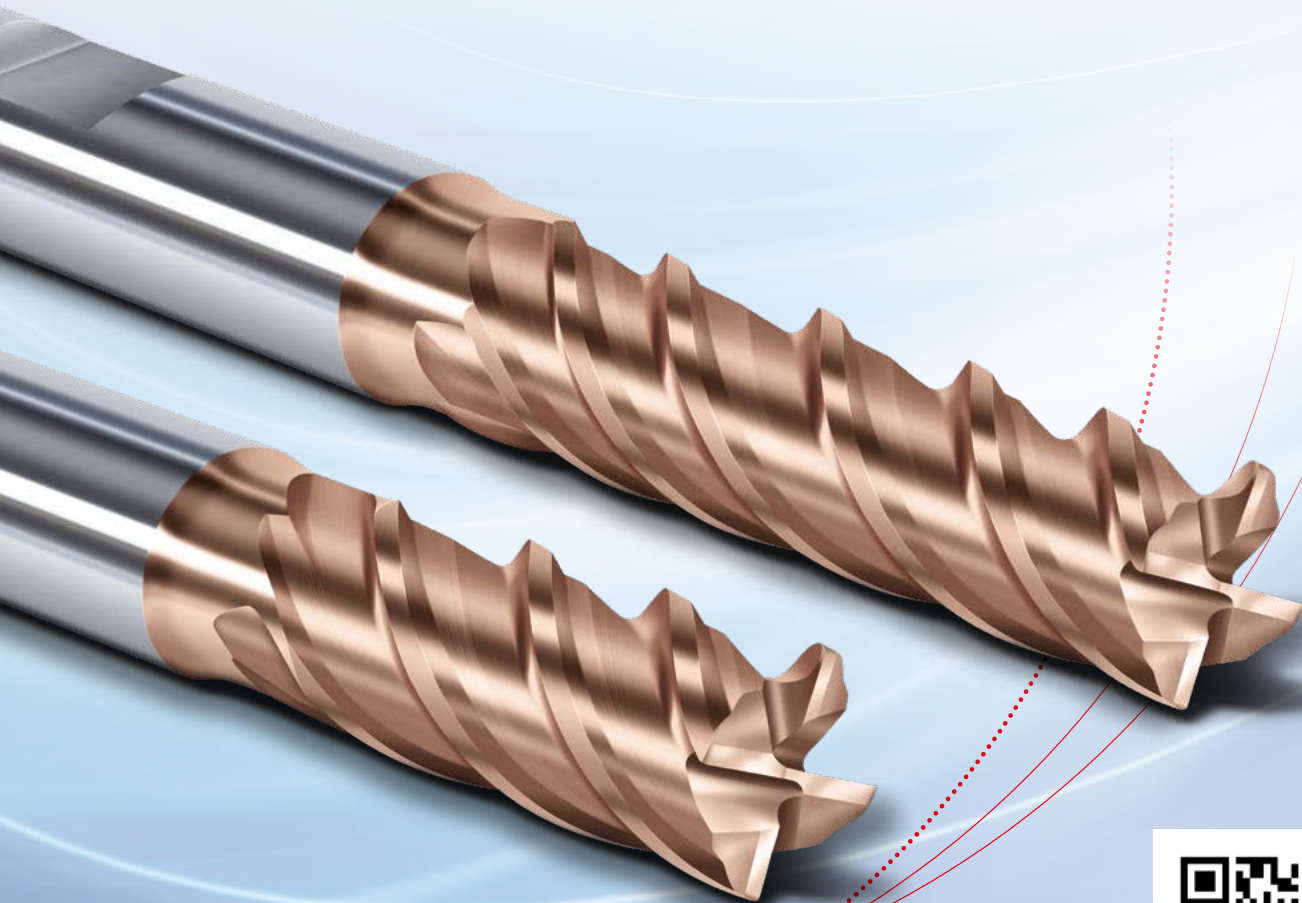


passion
for precision

fraisa

SX High-performance Milling Cutter

The specialist for machining stainless steels



Cutting data calculator

FRAISA
ToolExpert®

SX technology: Maximum performance and process reliability

The new **SX high-performance milling cutter** from FRAISA has been developed specifically for machining stainless and acid-resistant steels. A **high degree of universality**, **excellent cutting performance** and a **long tool life** are its trademarks.

During countless cutting trials, the cutting-edge geometry has been optimized in such a way that **maximum stability** and **very low-friction chip discharge** have been achieved at the same time. The result is silky smooth running of the cutter with low cutting forces.

Very tough but also abrasive rustproof and acid-resistant materials pose a challenging complex of loads for tools. Ultrafine-grain carbides have a high hardness and considerable edge strength.

Ultrafine-grain carbides form the basis of **SX high-performance milling cutters**. To protect the carbide from high temperatures and abrasive wear, an extremely smooth **DURO-Si hard coating** was chosen. As a result, the hardware of the cutters is made up of perfectly coordinated components.

In addition to FRAISA's innovative tool and production technology, another point is fundamental to the success of **SX** tools: The expertise of the cutting data matched to the **materials of the "INOX" group**. This knowledge is integrated in the **new ToolExpert** cutting data calculator and guarantees **simple, reliable, and fast implementation** in production. This makes **milling difficult stainless and heat-resistant steels** easy.

The wide **range of applications SX high-performance milling cutters** are capable of is another big benefit of this new technology. In addition to the main purpose for which they were designed, namely, **HPC processes**, these cutters are also ideal for **HDC machining**. After use, the tools can be restored to their original condition by the **FRAISA ReTool®** reconditioning service and later recycled by means of **ReToolBlue** service at the end of the service life.

The advantages

Excellent cost-performance ratio:

- High performance, long tool life, repeat accuracy and reliability
- ToolCare® tool management, FRAISA ReTool® tool reconditioning and ReToolBlue tool recycling
- Application know-how for stainless, acid- and temperature-resistant steels

Comprehensive range with catalog cutting data

- Diameters between 3 mm and 20 mm
- Two different lengths: standard and medium-long
- Specially developed catalog cutting data for HPC machining
- Tools with a corner radius available on request (custom-made)

Wide range of applications

- For replacing existing tools and as a solution for new applications
- HPC machining with 65% ae and 1.5xd ap, ToolExpert with HDC machining
- Maximum performance thanks to the perfect combination of tool type and cutting data
- Soft-cutting tools for dependable use in demanding applications

Perfection – FRAISA ToolExpert®

- Completely revised cutting performance data and revised material table
- Quick, simple, and reliable cutting-data search function by entering the material number
- Automatic data transfer to CAM

FRAISA ToolExpert® – The innovative online tool for optimum tool use

Perfectly coordinated tool- and material-specific cutting data for your production line: ToolExpert provides the perfect basis for optimum usage of your FRAISA tools – quick and easy.

FRAISA experts determine the optimum operating points in comprehensive tests carried out at our own application centers. All factors involved are taken into account, so that the new ToolExpert offers you a comprehensive collection of data all in one place.

FRAISA ToolExpert® offers many advantages

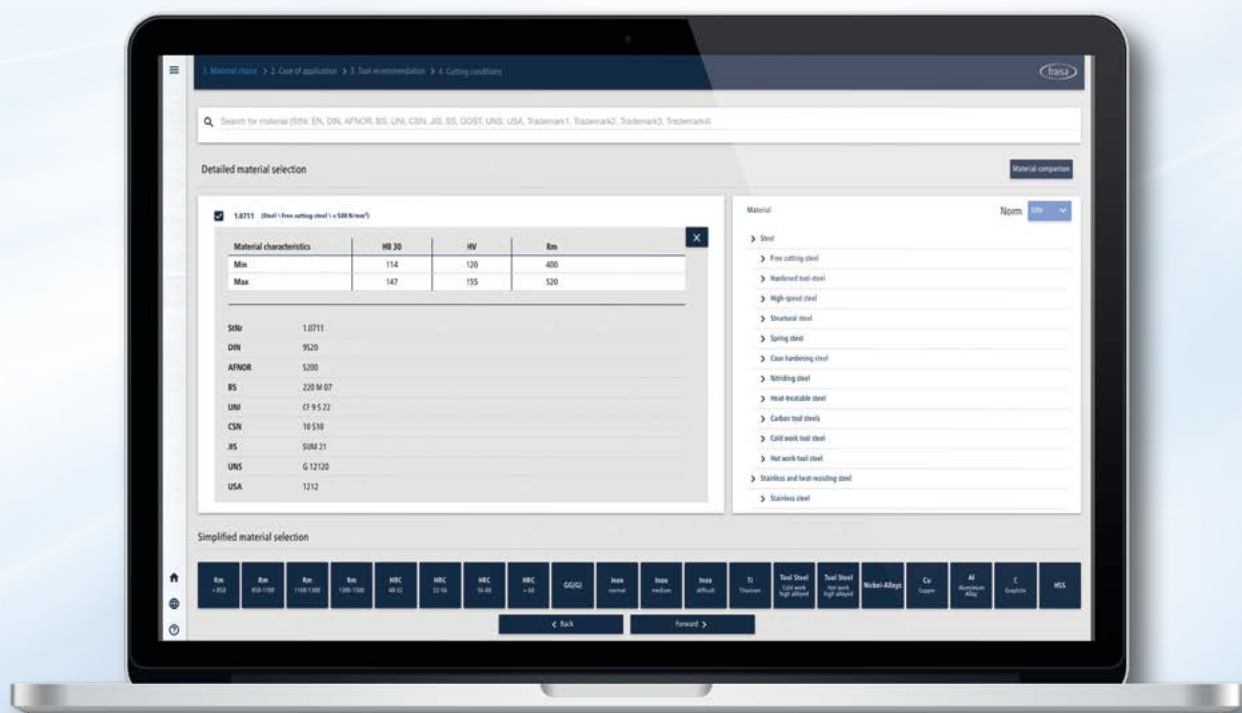
- **Precise:** Find perfectly coordinated, tool- and material-specific cutting data
- **Simple:** Access data online at any time and from anywhere without software downloads
- **Quick:** Find application parameters with just a few clicks and without registering
- **Order function:** Order the tool you want directly from our E-shop via a link
- **Flexible:** Search for tools or materials to be machined as required
- **Comprehensive:** Call up cutting data for FRAISA tools from a database of more than 11,000 materials
- **User-friendly:** Work intuitively thanks to the new, responsive design

Entering the exact material designation

The current ToolExpert contains **11,200 materials and comparisons of standards** grouped into **30 machining classes**. Even within the assigned machining classes, materials have different properties that affect machinability. Each material is therefore individually fine-tuned with respect to its machinability with the aid of specific additions, as a result of which the cutting data are reduced or increased accordingly.

If you use the simplified material selection method (softkey), the cutting data is retrieved from the machining class level. By **entering the exact material designation in Tool-Expert**, you obtain the best cutting data possible for your application.

[3]



The technologies of the SX high-performance tools

The new **SX technology** was developed in FRAISA's Production department and Test Center, while the FRAISA ToolSchool was responsible for developing and validating the cutting data. All product development measures were focused on achieving **high productivity, a long tool life and cost efficiency**.

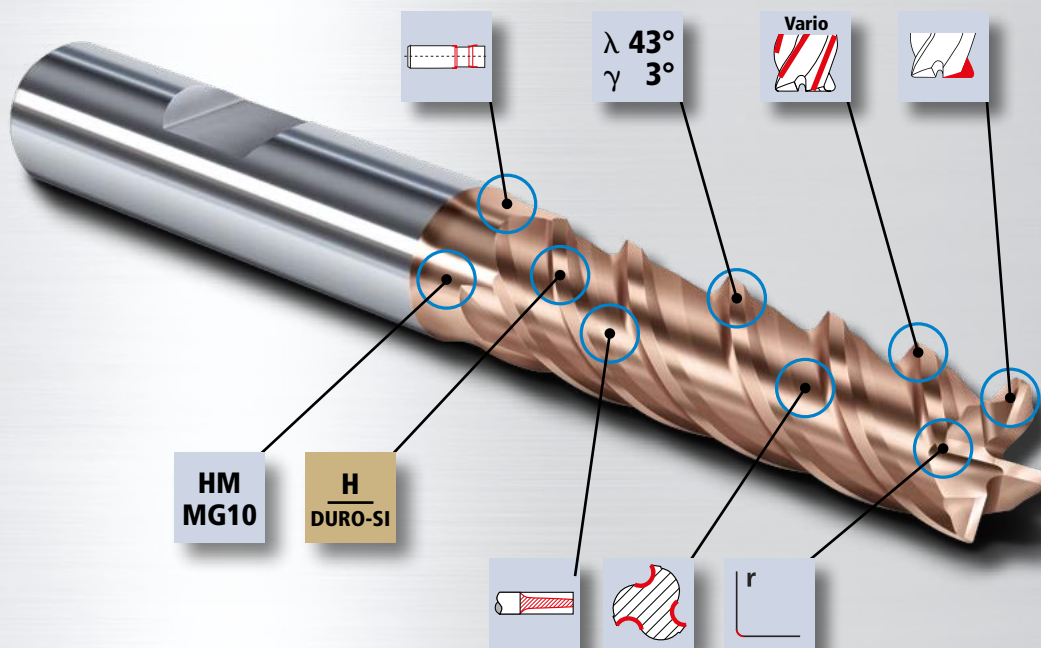
A **strong-edged, ultrafine-grain carbide** with **excellent wear properties** forms the basis of the SX high-performance tools. A positive, easy-cut geometry was combined with **optimized flutes** and an **increasing tool core diameter**. The result: **Optimum chip formation, good chip removal, and high tool stability**.

To ensure the **SX tools** can withstand high mechanical and thermal stresses, the exposed cutting-edge corner has been equipped with a **special, robust, polished tooth edge** and a **small corner radius**.

The **high-performance DURO-Si coating** protects the tools against high temperature loads and ensures **maximum performance and tool life** by means of its high wear resistance. The **SX high-performance tools** are ideally suited to HPC and HDC machining and consequently cover a **wide range of applications and materials**.

[4]

The technologies



Detailed descriptions of each technology can be found in our "High-performance Milling Tools" catalog.

FRAISA tool technology for maximum competitiveness!

FRAISA carries out extensive tests with **its own high-performance milling cutters and milling tools made by competitors**. We do this to keep a constant eye on the status quo in tool and application technology. These tests involve using the milling cutters in **different materials with different milling strategies**.

A special focus is placed on HDC milling: Due to the high mechanical and thermal loads, testing with this milling process is particularly intensive. This ensures that the tools can be used for a **wide range of materials and applications** – while also providing **maximum performance** and a **long service life**.

Application expertise for optimum results

Machining stainless, acid- and heat-resistant steels is a **particular challenge**. Using the right high-performance tool and the appropriate cutting data for the job is crucial. But it's also essential to monitor other factors and make optimizations if necessary.



Notes on application technology:

Cooling lubricant:

The external cooling lubricant jet should be **aimed precisely**. Use the internal coolant supply and feed with suitable clamping devices. The **type of cooling lubricant** and the concentration of the emulsion used also have a significant influence on performance. If conditions are not ideal or unstable, reduce the cutting data vc and/or ae .

Material:

Material batches can differ despite having the same material number. For this reason, you should monitor the milling results closely after a **batch change** and play things safe by reducing the cutting parameters.

[5]

Programming:

"Smooth traverses" without abrupt changes of direction and excessively high cutting edge utilization should be programmed. Reduce the cutting data in less than ideal or unstable conditions.

Tool:

Too large a tool diameter can overload the machine environment and the application. As a result, it is better to use smaller tool diameters with a high ap and ae .

Chucking devices:

The SX technology was mainly developed in chucking devices with a lateral chucking slot (Weldon shank). These are high-performance roughing tools for HPC and HDC machining – so any concentricity error caused by the chucking screw is irrelevant.

Our product experts recommend that you use good-quality, undamaged chucking devices and tighten the screw to the torque specified by the manufacturer.

Overview of materials, comparisons of standards, and chemical composition

Materials and comparisons of standards are grouped into 30 machining classes. Even within the assigned machining classes, materials have different mechanical, physical, and chemical properties that affect machinability. By entering the exact designation of a material in ToolExpert, you can call up the specific cutting data for this material.

[6]

Inox normal Cr-Ni 	1.4301 X5CrNi18-9 Z6CN18.09 AISI 304 CrNiMo 189	1.4303 X5CrNi18-12 Z8CN18.12 AISI 308, 305 CrNiMo 1812	1.4305 X10CrNiS18-9 Z10CNF18.09 AISI 303 CrNiMo 189	1.4306 X2CrNi19-11 Z2CN18.10 AISI 304L CrNiMo 1911
	1.4307 X2CrNi18-9 Z2CN18.10 AISI 304L CrNiMo 189	1.4310 X12CrNi17-7 Z12CN17.07 AISI 301 CrNiMo 177	1.4401 XCrNiMo18-10 Z6CND17.11 AISI 316 CrNiMo 1810	1.4404 X2CrNiMo17-13-2 Z2CND17.12 AISI 316L CrNiMo 17132
	1.4541 X6CrNiTi18-10 Z6CNT18.10 AISI 321 CrNiMo 1810	1.4567 X3CrNiCu18-9-4 Z3CNU18-10 AISI 304 Cu CrNiCu 1894	1.4571 X6CrNiMoTi17-12-2 Z6CNT17.12 AISI 316 Ti CrNiMo 17122	
Inox medium Cr-Ni-Mo+ 	1.4429 X2CrNiMoN17-13-3 Z2CND17.13Az AISI 316LN CrNiCu 17133	1.4435 X2CrNiMo18-14-3 Z3CND18.14.08 AISI 316L CrNiMo 18143	1.4436 X5CrNiMo17-13-3 Z6CND18.12.03 AISI 316 CrNiMo 17133	1.4462 X2CrNiMoN22-5-3 Z 2 CND 22 5 Az AISI 318 LN CrNiMo 2253
	1.4539 X2NiCrMoCu25-20-5 Z1CNDU25.20 AISI 904L NiCrMo 25205	1.4542 (17-4PH) X5CrNiCuNb17-14 Z5CNU17.4 AISI 630 CrNi 1714	1.4545 (15-5PH) X5CrNiCu15-5 Z5CNU15.05 AISI XM12 CrNi 145	1.4578 X3CrNiCuMo17-11-3-2 Z4CNUD17.11.03FF CrNiCuMo 171132
	1.4821 X15CrNiSi25-4 Z20CNS25.04 CrNiMo 1812	1.4828 X15CrNiSi20-12 Z9CN24.13 AISI 309 CrNi 2012	1.4835 X9CrNiSiNCe21-11-2 AISI 253MA CrNiSi 21112	1.4878 X8CrNiTi18-10 Z6CNT18.10 AISI 321H CrNi 1810

Inox difficult
Cr-Ni-Mo++



1.4529	1.4562	1.4841	1.4872
X1NiCrMoCuN25-20-7 AISI 926	X1NiCrMoCu32-28-7	X15CrNiSi25-21 Z15CNS25.20 AISI 314	X25CrMnNiN25-9-7
Ni Cr Mo 25 20 7	Ni Cr Mo 32 28 7	Cr Ni 25 21	Cr Mn Ni 25 9 7
1.4876			
X10NiCrAlTi32-21 Z10NC32.21 AISI 800H			
Ni Cr 32 21			

Inox martensitic
C < 0.3 %

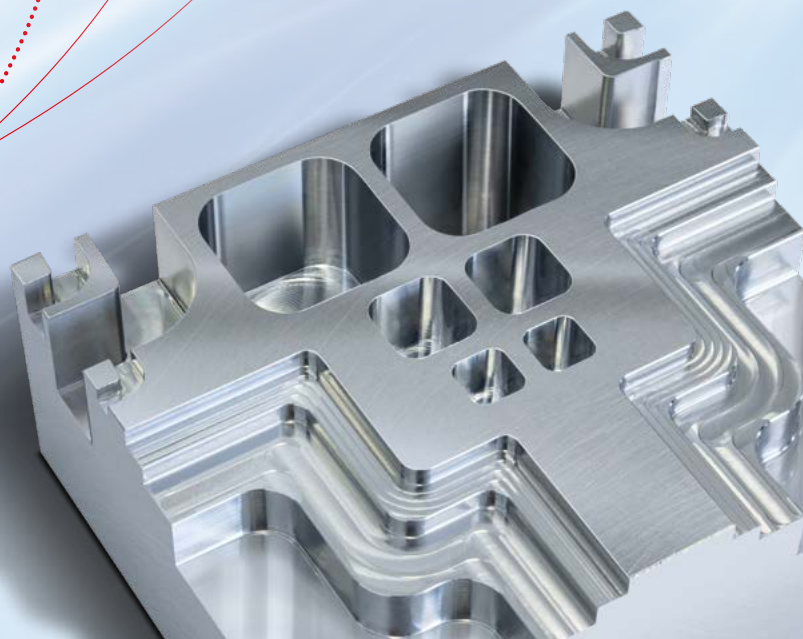


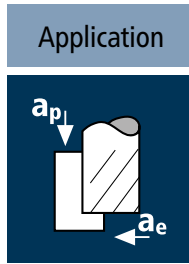
1.4005	1.4006	1.4021	1.4024
X12CrS13 Z12CF13 AISI 416	X10Cr13 Z12C13 AISI 410	X20Cr13 Z20C13 AISI 420	X15Cr13 Z13C13 AISI 420
C Cr 0.12 13	C Cr 0.1 13	C Cr 0.2 13	C Cr 0,15 13
1.4028	1.4044	1.4057	1.4104
X30Cr13 Z30C13 AISI 420	X15CrNi17-3 Z15CN16.02 AISI 431	X20CrNi16-2 Z15CN16.02 AISI 431	X12CrMoS17 Z10CF17 AISI 430F
C Cr 0.3 13	C Cr Ni 0.15 17 3	C Cr Ni 0.2 16 2	C Cr 0.14 17
1.4108			
X30CrMoN15-1			
C Cr 0.3 15			

Inox martensitic
C > 0.3 %



1.4031	1.4034	1.4037	1.4112
X39Cr13 Z40C14	X46Cr13 Z40C14	X65Cr13	X90CrMoV18 AISI 440B
C Cr 0.39 13	C Cr 0.46 13	C Cr 0.65 13	C Cr 0.9 18
1.4116	1.4117	1.4122	1.4125
X50CrMoV15 Z50CD15	X38CrMoV15	X39CrMo17-1	X105CrMo17 Z100CD17 AISI 440C
C Cr 0.5 15	C Cr 0.38 15	C Cr Mo 0.39 17 1	C Cr 1.05 17



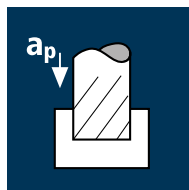


Material
Inox normal [Cr-Ni/1.4301] [Cr-Ni-Mo/1.4571]

Inox medium [Cr-Ni-Mo+/1.4539] Duplex steel [17-4 PH]

Inox difficult [Cr-Ni-Mo++/1.4529] Heat resistant steel [1.4841]

Inox martensitic C < 0.3% [Cr/1.4021]



Inox normal [Cr-Ni/1.4301] [Cr-Ni-Mo/1.4571]

Inox medium [Cr-Ni-Mo+/1.4539] Duplex steel [17-4 PH]

Inox difficult [Cr-Ni-Mo++/1.4529] Heat resistant steel [1.4841]

Inox martensitic C < 0.3% [Cr/1.4021]

d1 [mm]	z	v _c [m/min]	f _z [mm]	a _p [mm]	a _e [mm]	n [min ⁻¹]	v _r [mm/min]	Q [cm ³ /min]
3.00	4	96	0.015	3.750	1.200	10185	610	2.8
4.00	4	96	0.020	5.000	1.600	7640	610	4.9
5.00	4	80	0.023	6.250	3.250	5095	470	9.5
6.00	4	80	0.027	9.000	3.900	4245	460	16.1
8.00	4	80	0.036	12.000	5.200	3185	460	28.6
10.00	4	80	0.045	15.000	6.500	2545	460	44.7
12.00	4	80	0.054	18.000	7.800	2120	460	64.4
16.00	4	80	0.064	20.000	10.400	1590	405	84.7
20.00	4	80	0.080	25.000	13.000	1275	405	132.4

3.00	4	59	0.014	3.750	1.200	6260	340	1.5
4.00	4	59	0.020	5.000	1.600	4695	375	3.0
5.00	4	59	0.023	6.250	3.250	3755	340	6.9
6.00	4	59	0.027	9.000	3.900	3130	340	11.9
8.00	4	59	0.036	12.000	5.200	2350	340	21.1
10.00	4	59	0.045	15.000	6.500	1880	340	33.0
12.00	4	59	0.054	18.000	7.800	1565	340	47.5
16.00	4	59	0.064	20.000	10.400	1175	300	62.5
20.00	4	59	0.080	25.000	13.000	940	300	97.7

3.00	4	48	0.014	3.750	1.200	5095	275	1.2
4.00	4	48	0.018	5.000	1.600	3820	275	2.2
5.00	4	44	0.020	6.250	3.250	2800	225	4.6
6.00	4	44	0.024	9.000	3.900	2335	225	7.9
8.00	4	44	0.032	12.000	5.200	1750	225	14.0
10.00	4	44	0.040	15.000	6.500	1400	225	21.8
12.00	4	44	0.048	18.000	7.800	1165	225	31.5
16.00	4	44	0.056	20.000	10.400	875	195	40.8
20.00	4	44	0.070	25.000	13.000	700	195	63.7

3.00	4	122	0.020	3.750	1.200	12945	1010	4.5
4.00	4	122	0.026	5.000	1.600	9710	1010	8.1
5.00	4	102	0.030	6.250	3.250	6495	780	15.8
6.00	4	102	0.036	9.000	3.900	5410	780	27.4
8.00	4	102	0.048	12.000	5.200	4060	780	48.6
10.00	4	102	0.060	15.000	6.500	3245	780	76.0
12.00	4	102	0.072	18.000	7.800	2705	780	109.4
16.00	4	102	0.088	20.000	10.400	2030	715	148.6
20.00	4	102	0.110	25.000	13.000	1625	715	232.1

3.00	4	70	0.009	2.250	3.000	7425	265	1.8
4.00	4	70	0.012	3.000	4.000	5570	265	3.2
5.00	4	70	0.015	6.250	5.000	4455	265	8.3
6.00	4	70	0.022	9.000	6.000	3715	320	17.3
8.00	4	70	0.029	12.000	8.000	2785	320	30.8
10.00	4	70	0.036	15.000	10.000	2230	320	48.1
12.00	4	70	0.043	18.000	12.000	1855	320	69.3
16.00	4	70	0.051	20.000	16.000	1395	285	91.3
20.00	4	70	0.064	25.000	20.000	1115	285	142.6

3.00	4	47	0.008	2.250	3.000	4985	160	1.1
4.00	4	47	0.012	3.000	4.000	3740	180	2.2
5.00	4	52	0.015	6.250	5.000	3310	195	6.1
6.00	4	52	0.022	9.000	6.000	2760	240	12.9
8.00	4	52	0.029	12.000	8.000	2070	240	22.9
10.00	4	52	0.036	15.000	10.000	1655	240	35.8
12.00	4	52	0.043	18.000	12.000	1380	240	51.5
16.00	4	52	0.051	20.000	16.000	1035	210	67.8
20.00	4	52	0.064	25.000	20.000	830	210	105.9

3.00	4	39	0.008	2.250	3.000	4140	135	0.9
4.00	4	39	0.011	3.000	4.000	3105	135	1.6
5.00	4	39	0.013	6.250	5.000	2485	130	4.0
6.00	4	39	0.019	9.000	6.000	2070	160	8.6
8.00	4	39	0.026	12.000	8.000	1550	160	15.3
10.00	4	39	0.032	15.000	10.000	1240	160	23.8
12.00	4	39	0.038	18.000	12.000	1035	160	34.3
16.00	4	39	0.045	20.000	16.000	775	140	44.5
20.00	4	39	0.056	25.000	20.000	620	140	69.5

3.00	4	89	0.009	2.250	3.000	9445	340	2.3
4.00	4	89	0.012	3.000	4.000	7080	340	4.1
5.00	4	89	0.015	5.000	5.000	5665	340	8.5
6.00	4	89	0.022	7.500	6.000	4720	410	18.4
8.00	4	89	0.029	10.000	8.000	3540	410	32.6
10.00	4	89	0.036	12.500	10.000	2835	410	51.0
12.00	4	89	0.043	15.000	12.000	2360	410	73.4
16.00	4	89	0.053	16.000	16.000	1770	375	95.7
20.00	4	89	0.066	20.000	20.000	1415	375	149.6

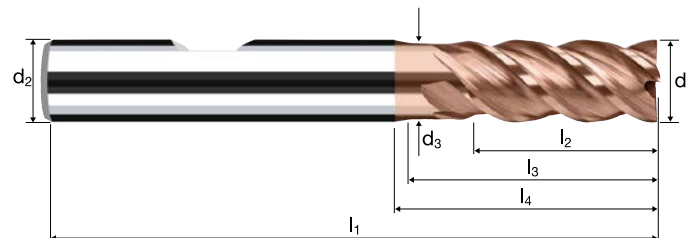
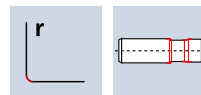
Cylindrical end mills SX

Smooth-edged, normal version with short neck



HM
MG10

λ 43°
 γ 3°



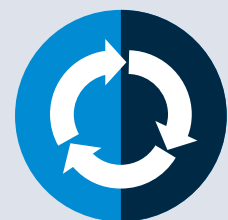
Roughing HPC Roughing HDC Finishing

Rm < 850 Inox Stainless Ti Titanium Nickel-Alloys Mangan-Steels Tool Steel

Example: Order-N°.											DURO-Si	
											H8606	
											H8506	
Ø Code	d ₁ e8	d ₂ h6	d ₃	l ₁	l ₂	l ₃	l ₄	r	α	z		
180	3.00	6.00	2.80	57	8.00	14.00	20.37	0.050	4.5°	4	•	
220	4.00	6.00	3.70	57	11.00	16.00	20.82	0.100	3.0°	4	•	
260	5.00	6.00	4.60	57	13.00	18.00	21.27	0.100	1.5°	4	•	
300	6.00	6.00	5.50	57	13.00	18.15	20.00	0.150	0.0°	4	•	
391	8.00	8.00	7.40	63	19.00	23.63	26.00	0.150	0.0°	4	•	
450	10.00	10.00	9.20	72	22.00	27.99	31.00	0.200	0.0°	4	•	
501	12.00	12.00	11.00	83	26.00	33.29	37.00	0.200	0.0°	4	•	
610	16.00	16.00	15.00	92	32.00	38.73	43.00	0.200	0.0°	4	•	
682	20.00	20.00	19.00	104	38.00	48.23	53.00	0.250	0.0°	4	•	

[9]

FRAISA ReTool® – Industrial tool reconditioning with performance guarantee



FRAISA ReTool® offers an all-round service that restores used tools to their original performance level – using the very latest technology and in a resource-friendly way. Our ability to provide this performance guarantee is a priority of our team of experts right from very early on in product development. The outcome: mint-condition tools as productive as they were the first day they were used.

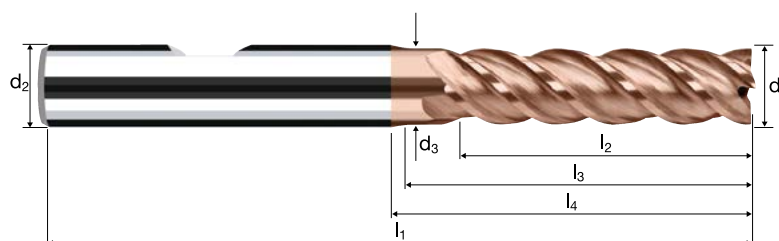
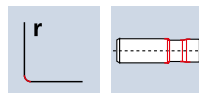
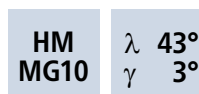
Over 30 years' experience in tool reconditioning:

Our competence center in Germany is Europe's largest service center for carbide milling tools.



Video on our service product: FRAISA ReTool®

Smooth-edged, medium length version with short neck



Finishing



Nickel-Alloys
Mangan-Steels
Tool Steel

[11]



Scan this QR code to find
more information on the
FRAISA Group.



The fastest way to our E-Shop.

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passion
for precision



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HIB01961 03/2021 EN