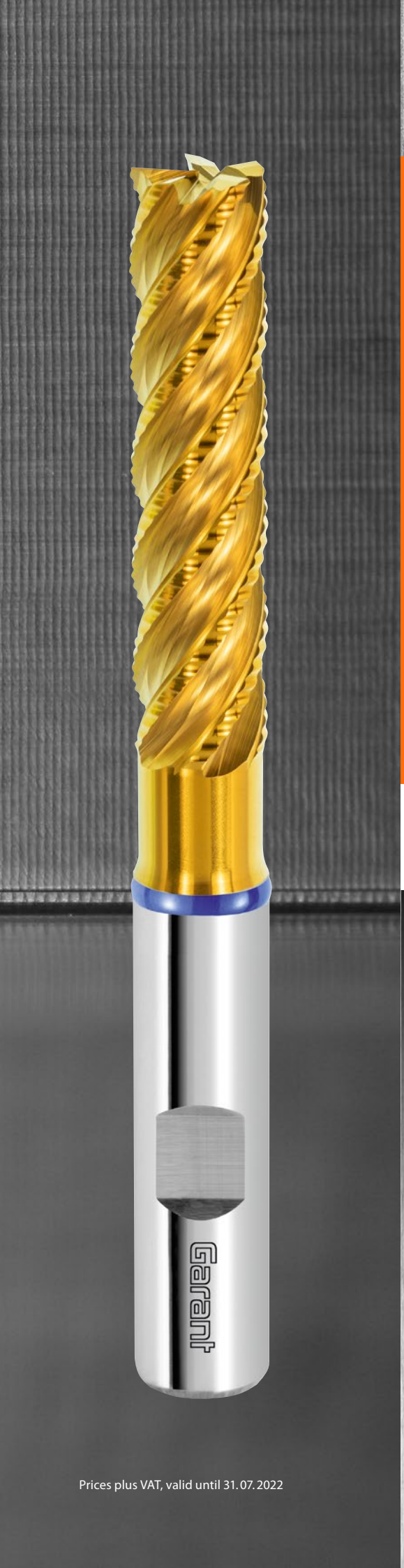
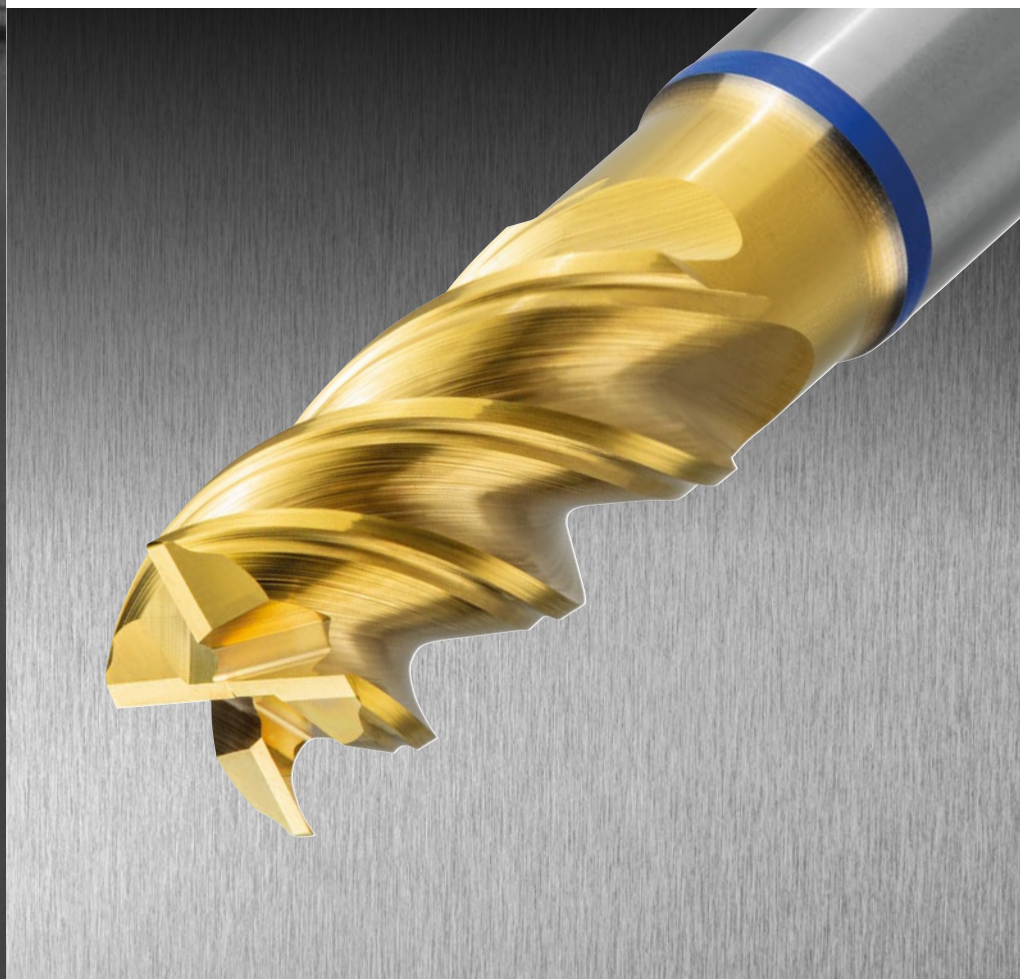


Hoffmann Group

SIMPLY THE BEST PERFORMANCE FOR HIGH-ALLOY STEELS.

GARANT Master INOX M – newly developed for outstanding tool life and optimum metal removal rate.

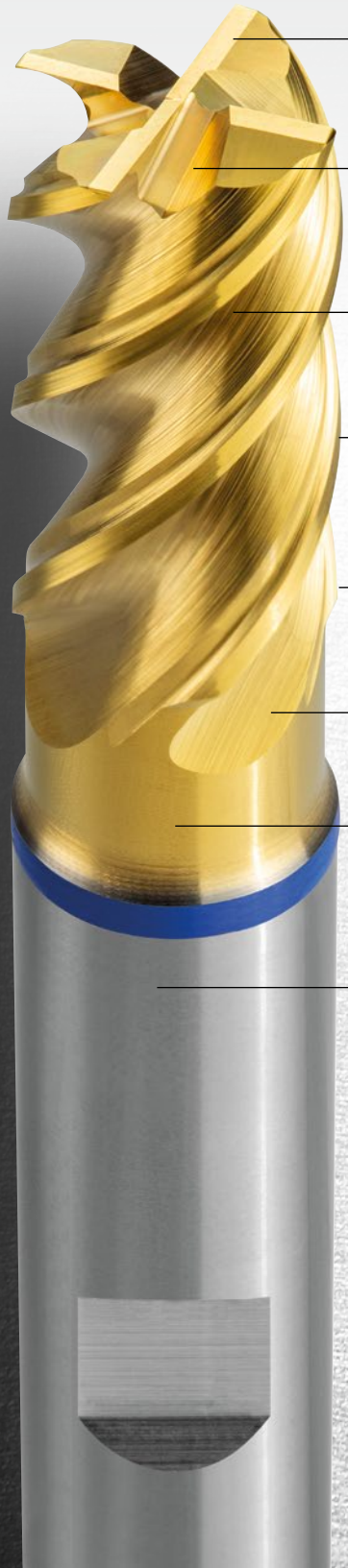
Garant



Prices plus VAT, valid until 31.07.2022

THE GARANT MASTER INOX M – WHAT MAKES IT SPECIAL.

THE NEW STAR FOR MACHINING HIGH-ALLOY STEELS (DIN EN 10088).



GARANT Master INOX M roughing end mill 202989

REINFORCED END FACE GEOMETRY

- Specially for helical machining.

SPECIALLY DEVELOPED FLUTES

- For targeted and reliable chip evacuation, to avoid chips jamming.

LATEST COATING STRUCTURE

- Prevention of heat input into the tool.

STRENGTHENED CORE DIAMETER

- For increasing stability and ensuring improved force distribution.

Garant

OPTIMISED CUTTING EDGE PREPARATION

- For very high surface qualities and to avoid edge build-up.

NEWLY DESIGNED VARIABLE HELICAL PITCH

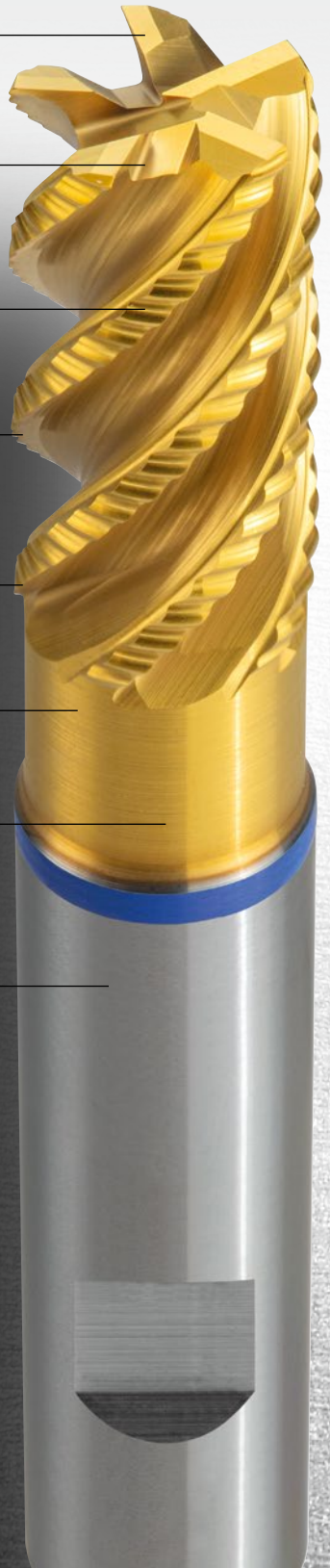
- For smooth homogeneous cutting, to avoid vibration.

DEFINED EDGE PROTECTION RADII

- Prevent premature fracture at the transition of the end cutter to the peripheral cutting edge.

THE LATEST SUBSTRATE

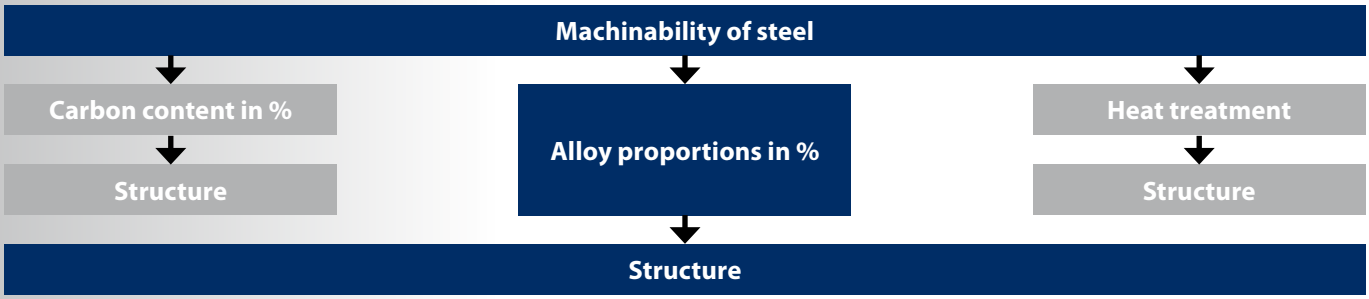
- Optimised for extreme tool life in stainless steel machining.



GARANT Master INOX M SlotMachine 205450

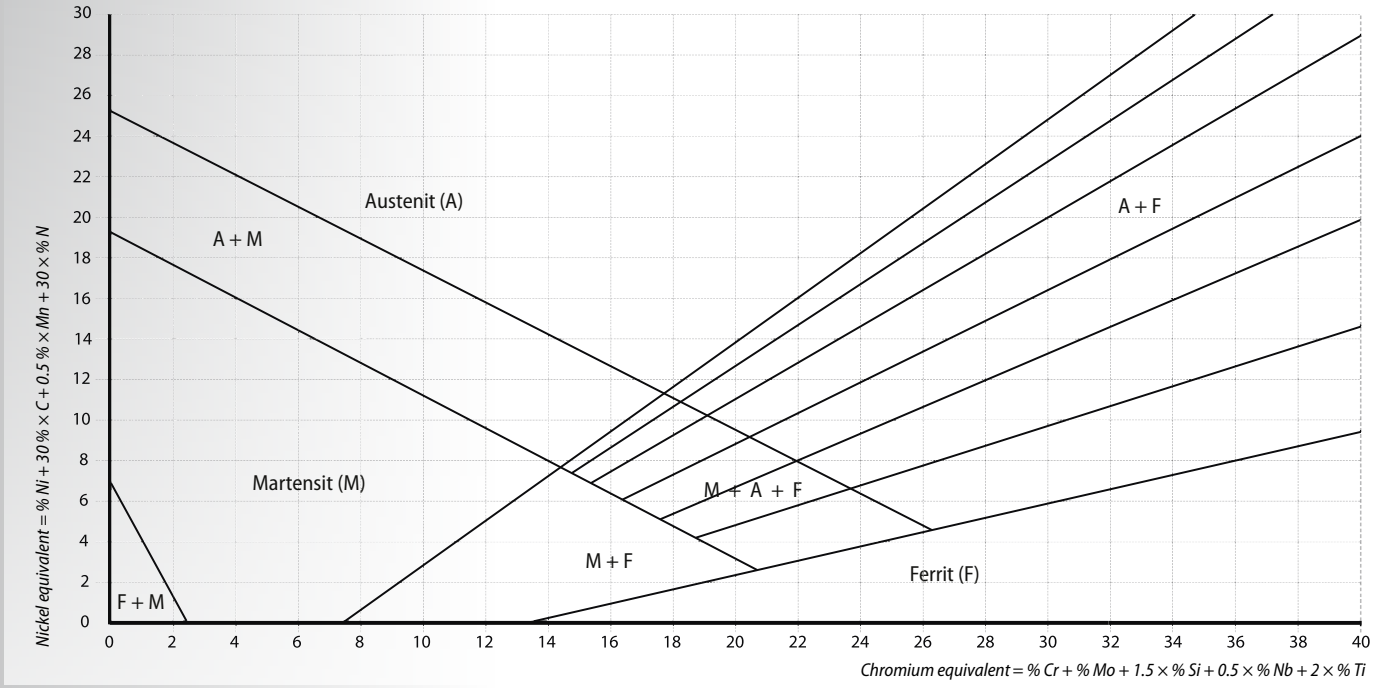
SIMPLY THE RIGHT DECISION: ALLOY PROPORTIONS AND THE GARANT MASTER INOX.

Depending on the micro-structure of the metal, metallurgists distinguish four groups of stainless steels: Martensitic, austenitic, ferritic and ferritic-austenitic (duplex) steels.
The general machinability of stainless materials depends largely on the existing alloy elements and the heat treatment that is carried out.



Schaeffler diagram

Difficulty of machining stainless steels according to the structure (Ni content and/or Cr content).



NICKEL (NI)

- Monitoring the structure: Austenitic structure as of ≥ 8 % Ni.
- Increases the toughness.
- Corrosion resistance.
- Largely non-magnetic at a higher Ni content.
- More difficult to machine as Ni content increases.

CHROMIUM (CR)

- Stainless steels contain ≥ 12 % chromium.
- Forms a protective chromium oxide layer (passive layer) on the surface with oxygen.
- Improves hardenability (carbide formation).
- Composite carbide formation (with higher C-content at the same time).
- Difficult to machine.

Austenitic structure

**1.4301, 1.4306; 1.4541;
1.4401; 1.4404; 1.4435; 1.4571;
1.4539; 1.4529;**

**Austenitic stainless steels
(12-25 % chromium and 5-30 % nickel)**

Austenitic CrNi-steels with more than 8 % nickel are characterised by excellent corrosion resistance and because of their mechanical properties are still generally easy to machine. They therefore belong to the most important group of stainless steels and are recommended for many applications. Austenite, on the other hand, has an increased molybdenum content (greater than or equal to 5 %) and a higher proportion of nickel (approx. 25 %) and is very difficult to machine.

Austenite / ferrite (duplex structure)

**1.4062; 1.4162; 1.4362;
1.4462; 1.4410; 1.4501;
1.4507;**

**Austenitic-ferritic stainless steels
(18-27 % chromium, 4-7 % nickel and 2-5 % molybdenum)**

Due to the low proportion of nickel, the material is not able to develop a completely austenitic structure. This material yields a structure with ferritic and austenitic elements, which is why it is also referred to as duplex steel. The addition of a proportion of molybdenum not only increases the corrosion resistance but also improves the tensile strength and heat resistance of the material; it does however make machining very difficult.

Martensitic structure

**1.4005; 1.4006; 1.4021; 1.4028;
1.4031; 1.4034;**

**Martensitic stainless steels
(12-18 % chromium and 0.15 % ≤ carbon)**

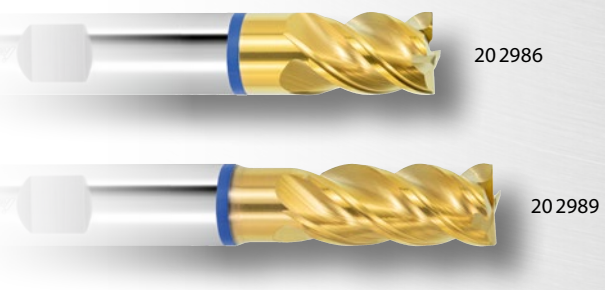
Here the distinction is made between carbon martensitic steels with 0.2–0.4 % carbon and nickel martensitic stainless steels with 0.05 % C and 4 % nickel. Depending on their product form, these steels are supplied either annealed or hardened and tempered, which has major implications for mechanical machining. In principle, carbon martensitic stainless steels are machined like carbon steels.

Ferritic structure

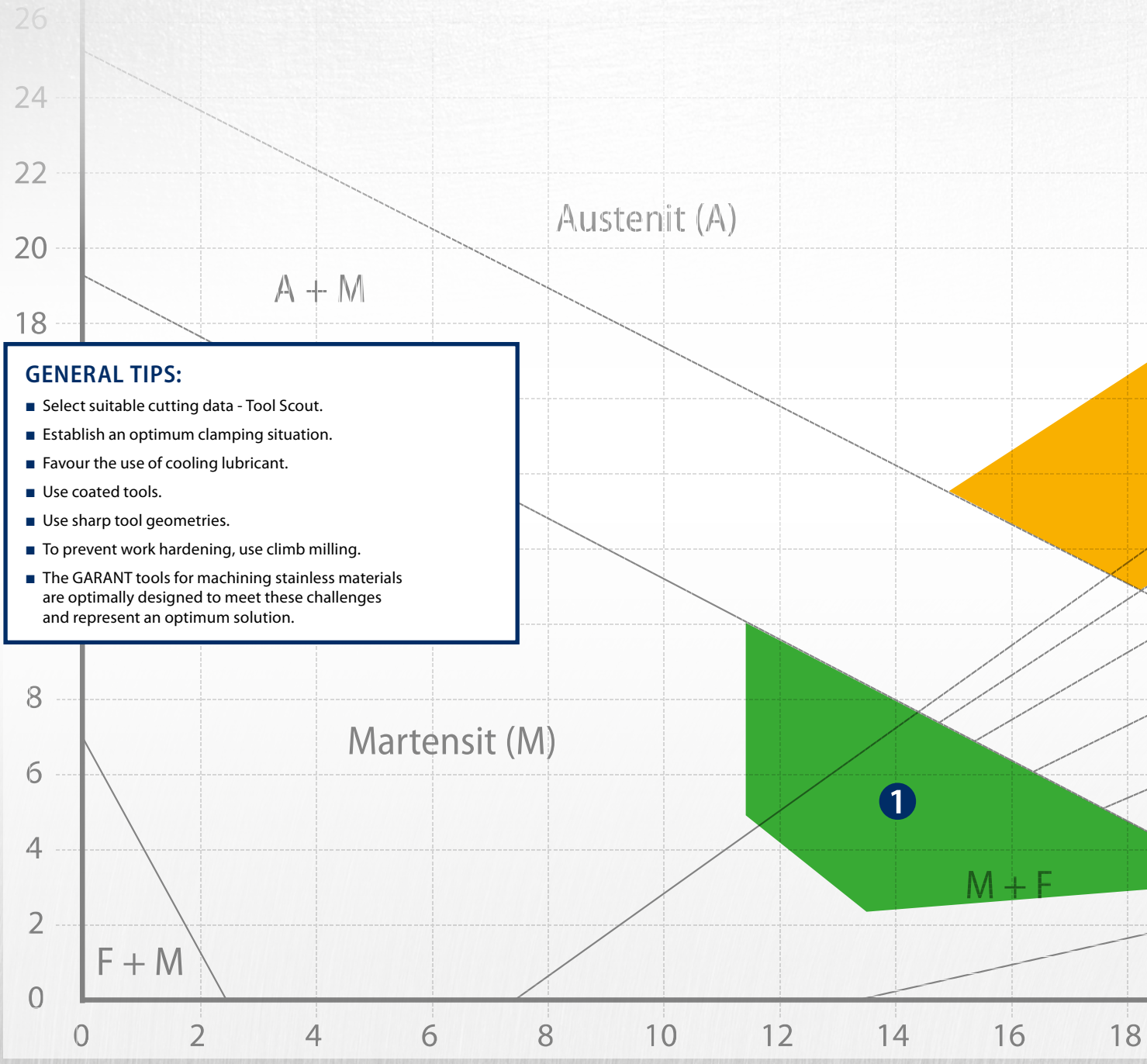
**1.4003; 1.4515;
1.4016; 1.4510; 1.4511; 1.4501; 1.4509;
1.4311; 1.4521;**

Ferritic stainless steels (11–17 % chromium)

The corrosion resistance of ferritic stainless steels with a chromium content of 11–12 % is less marked than for austenitic stainless steels; they are therefore referred to as corrosion-resistant rather than stainless steels. For 17% chromium steels on the other hand, the corrosion resistance is significantly better. The low carbon content of ≤ 0.06 % means that these steels cannot be hardened. They have a tendency towards galling, but can easily be mechanically machined.



THE SIMPLE WAY TO MACHINE PARTS CORRECTLY: OUR TIPS FOR TOP RESULTS.



GENERAL TIPS:

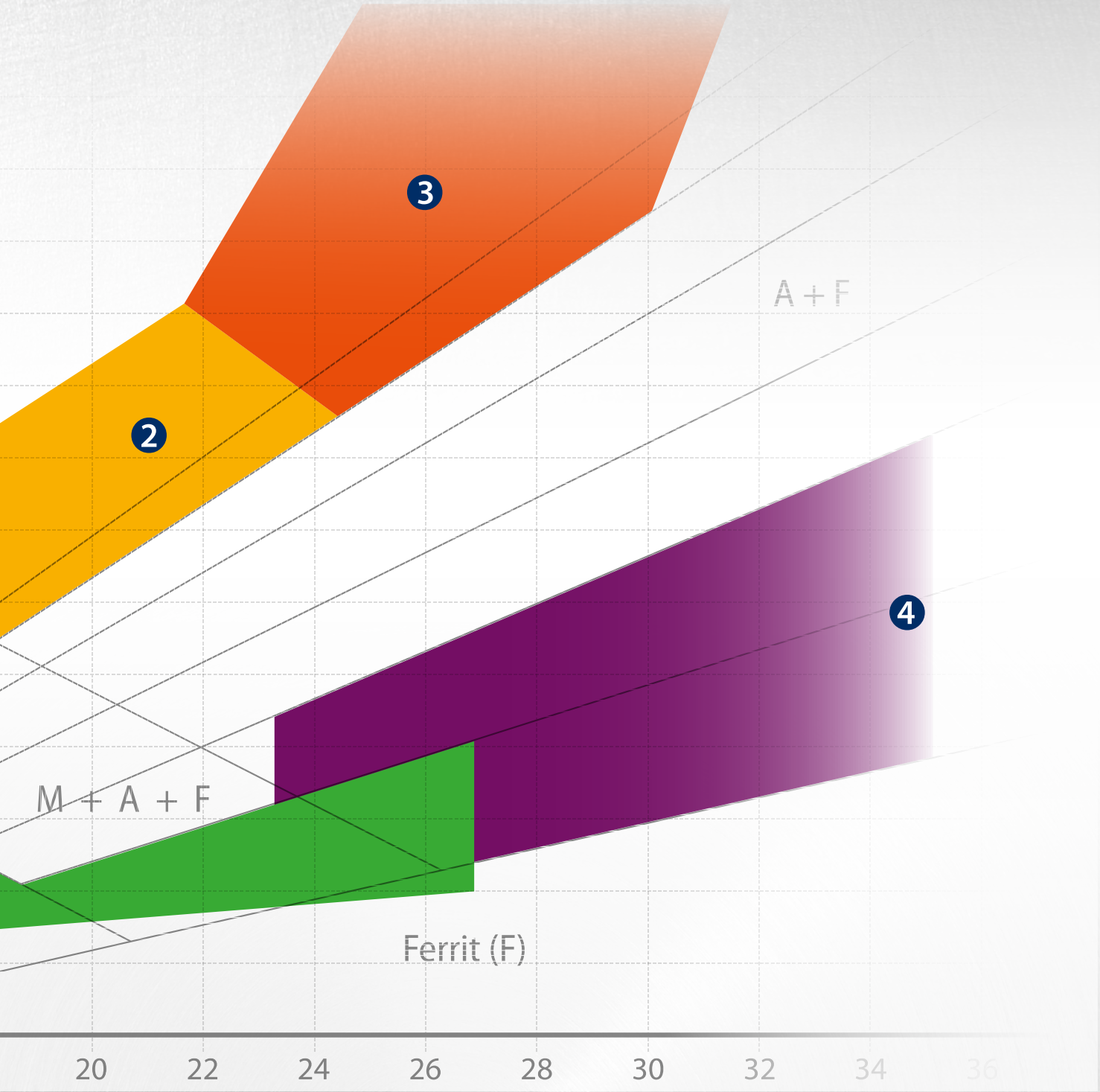
- Select suitable cutting data - Tool Scout.
- Establish an optimum clamping situation.
- Favour the use of cooling lubricant.
- Use coated tools.
- Use sharp tool geometries.
- To prevent work hardening, use climb milling.
- The GARANT tools for machining stainless materials are optimally designed to meet these challenges and represent an optimum solution.

1 FERRITIC / MARTENSITIC

- General good machinability.
- No abrasive wear.
- Comparison to ISO P (machining steel).

2 AUSTENITIC

- Use lower feed rates than for machining steel.
- Select low start cutting speeds.
- Caution against formation of built-up edges.



3 SUPER AUSTENITE

- Generally very difficult to machine.
- Reduce a_e and maximise a_p (TPC strategy).
- Caution against formation of built-up edges.
- Tool tip: Continuous wear monitoring. GARANT Master INOX M is the first choice because of its sharp geometry (lower edge honing and larger rake angle).

4 DUPLEX

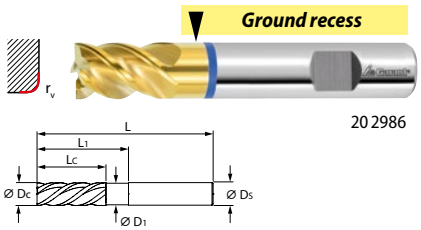
- Very demanding machining.
- Use cooling lubricant with increased fat content (up to 13 % solution).
- Reduce a_e and maximise a_p (TPC strategy).
- Continuous wear monitoring. GARANT Master INOX M is the first choice because of its sharp geometry (lower edge honing and larger rake angle).

Solid carbide | Standard | Type N | e8 | 4 | 42° | ≠ | ≠ | a_e 0.5×D | h6 DIN 6535 HB | HPC

GARANT Master INOX M HPC solid carbide milling cutter

Milling cutter with newly **developed high-performance coating** for **outstanding tool working life** and **optimum metal removal rates** in a wide range of stainless steels. Can be used at high **cutting speeds**, e.g. in duplex steels.

Note: **Successor product to No. 202993.**



20 2986

Suitable for/ v_c [m/min]	Alu plastics	Alu	Alu cast > 10 % Si	< 500 N	< 750 N	< 900 N	< 1100 N	< 1400 N	< 55 HRC	< 60 HRC	< 65 HRC	< 67 HRC	< 70 HRC	TOOLOX® 33 HRC	TOOLOX® 44 HRC	INOX < 900 N	INOX > 900 N	Uni
ISO code	N	N	N	P	P	P	P	P	H	H	H	H	H	H	H	M	M	
20 2986				250	230	200	180	170						115	80	100	90	○

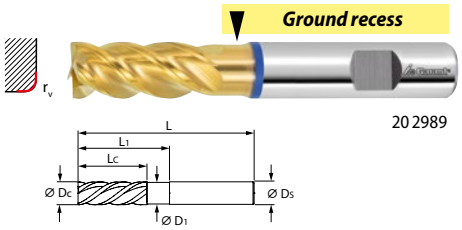
Ø e8 D_c	11X	20 2986	L_c	L_1	Ø D_1	L	Ø D_s	Corner rounding r_v	INOX > 900 N f_z	INOX > 900 N f_z
mm		TiAlN	mm	mm	mm	mm	mm	mm	mm	mm
3		35.15	5	–	–	50	6	0.1	0.02	0.03
4		35.15	8	–	–	54	6	0.1	0.03	0.04
5		35.15	9	–	–	54	6	0.1	0.04	0.05
6		35.15	10	16	5.8	54	6	0.1	0.04	0.05
8		49.30	12	20	7.7	58	8	0.15	0.06	0.07
10		62.67	14	24	9.7	66	10	0.2	0.07	0.08
12		79.00	16	26	11.6	73	12	0.2	0.07	0.09
16		128.50	22	32	15.5	82	16	0.2	0.08	0.1
20		187.90	26	40	19.5	92	20	0.2	0.1	0.12

Solid carbide | Standard | Type N | e8 | 4 | 42° | ≠ | ≠ | a_e 0.3×D | TPC $a_{e\,max}$ 0.1×D | h6 DIN 6535 HB | HPC | TPC

GARANT Master INOX M solid carbide milling cutter HPC/TPC

Milling cutter with newly **developed high-performance coating** for **outstanding tool working life** and **optimum metal removal rates** in a wide range of stainless steels. Can be used at high **cutting speeds**, e.g. in duplex steels.

Note: **Successor product to No. 203009.**



20 2989

Suitable for/ v_c [m/min]	Alu plastics	Alu	Alu cast > 10 % Si	< 500 N	< 750 N	< 900 N	< 1100 N	< 1400 N	< 55 HRC	< 60 HRC	< 65 HRC	< 67 HRC	< 70 HRC	TOOLOX® 33 HRC	TOOLOX® 44 HRC	INOX < 900 N	INOX > 900 N	Uni
ISO code	N	N	N	P	P	P	P	P	H	H	H	H	H	H	H	M	M	
20 2989				250	230	200	180	170						115	80	100	90	○

Ø e8 D_c	11X	20 2989	L_c	L_1	Ø D_1	L	Ø D_s	Corner rounding r_v	INOX > 900 N f_z	INOX > 900 N f_z
mm		TiAlN	mm	mm	mm	mm	mm	mm	mm	mm
3		41.58	8	13	2.8	57	6	0.1	0.02	0.03
4		41.58	11	17	3.8	57	6	0.1	0.03	0.04
5		41.58	13	19	4.8	57	6	0.1	0.04	0.05
6		41.58	13	19	5.8	57	6	0.1	0.04	0.05
6M		49.30	18	24	5.8	62	6	0.1	0.04	0.05
8		59.20	21	25	7.7	63	8	0.15	0.06	0.07
8M		65.93	24	30	7.7	68	8	0.15	0.06	0.07
10		79.00	22	30	9.7	72	10	0.2	0.07	0.08
10M		88.90	30	38	9.7	80	10	0.2	0.07	0.08
12		98.80	26	36	11.6	83	12	0.2	0.07	0.08
12M		123.75	36	46	11.6	93	12	0.2	0.07	0.08
14		123.75	26	36	13.6	83	14	0.2	0.08	0.09
16		158.40	36	42	15.5	92	16	0.2	0.08	0.09
16M		193.05	48	58	15.5	108	16	0.2	0.08	0.09
18		188.10	36	42	17.5	92	16	0.2	0.1	0.12
20		237.60	41	52	19.5	104	20	0.2	0.1	0.12
20M		287.10	60	74	19.5	126	20	0.2	0.1	0.12
25		366.30	45	60	24.5	125	25	0.2	0.12	0.14

Solid carbide | NR | d11 | 40° | h6 DIN 6535 HB | 4 | 5

Garant GARANT Master INOX M SlotMachine solid carbide roughing end mill HPC, TPC

With a **new-type knuckle form profile**, optimised for higher feed rates in INOX.
Improved cutting edge protection thanks to slight edge honing.
Tremendous bending strength due to the use of **ultra-fine grain substrate**.
Number of teeth tailored to performance and process reliability.

20 5453/5454 – **Problem-solver** for **TPC machining.**
Ideal for automated production as the risk of chip accumulations in the machine is largely prevented.

Advantage: The tool geometry produces particularly tightly rolled swarf that is discharged via flat chip breaker recesses.
As a result, the tool maintains an **extremely stable core.**

Application:

20 5448/5450 – For roughing machining, particularly suitable for full-slot machining.

Note:

20 5453 – $ae_{max} = 0.07 \times D$ for TPC machining.
20 5454 – $ae_{max} = 0.05 \times D$ for TPC machining.
20 5453/5454 – h_{max}: The values stated in the table are maximum values.

DIN 6527 | HPC | a_e 0.5×D

20 5448

DIN 6527 | HPC | a_e 0.5×D

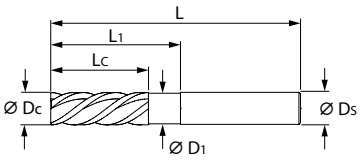
20 5450

Standard | TPC $a_{e\,max}$ 0.07×D | TPC

20 5453

Standard | TPC $a_{e\,max}$ 0.05×D | TPC

20 5454



Suitable for/ v_c [m/min]	Alu plastics	Alu	Alu cast > 10 % Si	< 500 N	< 750 N	< 900 N	< 1100 N	< 1400 N	< 55 HRC	< 60 HRC	< 65 HRC	< 67 HRC	< 70 HRC	INOX < 900 N	INOX > 900 N	Ti > 850 N	Graphite GRP CRP	Uni					
ISO code	N	N	N	P	P	P	P	P	H	H	H	H	H	M	M	S	N						
20 5448/5450				150	**140**	**120**	110	100						**90**	**80**			○		●	○		○
20 5453				140	**130**	**110**	100	90						**80**	**75**			○		●	○		○
20 5454				130	**120**	**100**	95	85						**75**	**70**			○		●	○		○

Ø d11 D_c	11X 20 5448	11X 20 5450	No. of teeth Z	L_c		L_1	Ø D_1	L		Ø D_s	Corner chamfer width at 45°	INOX > 900 N f_z	INOX > 900 N f_z
	GARANT Master INOX M SlotMachine solid carbide roughing end mill HPC			20 5448	20 5450	20 5450	20 5450	20 5448	20 5450				
mm	TiAlN	TiAlN		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
4	62.27	73.26	4	8	11	19	3.7	54	57	6	0.15	0.01	0.015
5	62.27	73.26	4	9	13	19	4.6	54	57	6	0.15	0.015	0.02
6	62.27	73.26	4	10	13	19	5.6	54	57	6	0.15	0.02	0.025
8	79.50	93.06	4	12	19	25	7.4	58	63	8	0.2	0.03	0.035
10	107.51	114.35	5	14	22	30	9.3	66	72	10	0.2	0.035	0.04
12	110.48	129.10	5	16	26	36	11.1	73	83	12	0.25	0.04	0.05
16	199.98	236.31	5	22	32	42	14.8	82	92	16	0.35	0.05	0.06
20	287.10	339.77	5	26	38	52	18.5	92	104	20	0.4	0.06	0.07

Ø d11 D_c	11X 20 5453	11X 20 5454	No. of teeth Z	L_c		L_1		Ø D_1	L		Ø D_s	Corner chamfer width at 45°	TPC INOX < 900 N h_{max}	
	GARANT Master INOX M SlotMachine solid carbide roughing end mill TPC			20 5453	20 5454	20 5453	20 5454		20 5453	20 5454			20 5453	20 5454
mm	TiAlN	TiAlN		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
6	81.58	93.85	4	18	25	24	32	5.6	62	66	6	0.15	0.032	0.029
8	108.90	125.24	4	24	33	30	40	7.4	68	79	8	0.2	0.042	0.038
10	129.69	149.00	5	30	41	38	48	9.3	80	89	10	0.2	0.051	0.046
12	153.95	177.21	5	36	49	46	56	11.1	93	100	12	0.25	0.06	0.054
16	280.17	321.75	5	48	65	58	72	14.8	108	123	16	0.35	0.078	0.071
20	437.58	–	5	60	–	74	–	18.5	150	–	20	0.4	0.097	–

Daniel,
field sales consultant

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