MAXIVAL

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The machinability of the steel is a measure of the ease with which it can be shaped by the removal of material, and is always a combination of two factors: the cutting toll and the steel selected.
The contact between cutting tool and chip when machining steel, occurs under high temperature and pressure.
Machinability depends on many variables such as:

- Type of machining operations.
- Type of cutting fluid
- Rigidity of tooling
- Sturdiness of fixture
- Steel grade.

Some specific criteria for defining machinability include:

- Chip removal
- Tool wear or tool life
- Cutting rate
- Productivity

Machinability of austenitic stainless steel

The difficulties in the machinability of austenitic stainless steels are well known.
Compared to ferritic and martensitic steels, typical austenitic alloys have :

- a high work hardening rate ;
- toughness ;
- ductility ;
- high friction coefficient ;
- low thermal conductivity .

All these factors produce:

- long and tangled chips ;
- Chips wrap up around the tools making their removal difficult ;
- Higher temperature developed in tools, have an effect on both wear and risk of plastic deformation of cutting edge ;
- Large built – up edges due to the welding of steel on the cutting edge ;
- Work hardened cut surface , due to deformation and mechanical stress .

Technicians and machinists are aware of the difficulties involved with machining, and minimize them by observing some general guidelines.
There is no single set of rules that are good for all machining parts, but the most important ones are:

- Cutting fluid must be selected to provide propre lubrication and heat removal ;
- Tooling and fixtures must be sturdy to avoid vibrations ,
- Cutting fluid must be directed to the cutting zone in higher flow rate to reduce the overheating ;
- use insert with positive geometry and increase cutting speed to avoid the built-up edge ;
- because the machined surface is work hardened, tool must work below this zone .

All these " troubles" can be greatly reduced by using free machining austenitic stainless steel , but this benefit, obtained by the addition of sulphur (S= 0.15 - 0.35%) degrades the following properties:

- corrosion resistance ;
- weldability ;
- cold formability .

Therefore, if these characteristic were very important and " mandatory", a right choice must be a compromise whose name is:

MAXIVAL

What is Maxival?
Machinists prefer to call it " *an enhanced machined steel* ", metallurgist prefer to call it " *a steel with a specified inclusion picture*".
MAXIVAL is a new steel which combines a high machinability with high resistance corrosion without prejudicing the ability to cold form the material .
These characteristic tones are achieved in the steelmaking process by:

- Modifying both sulphide and oxide inclusions favorable for machining inside the upper limit of sulphur in analysis specification (S=0.02÷0.03%) ;
- Controlling the inclusions type, shape and composition ;
- Avoiding some kind of oxides which are extremely hard and cause abrasive wear of tool .

The effect is obtained by:

- using Calcium as the de-oxidizing agent ;
- converting to softer Calcium inclusion which are enveloped by a soft sulphide case .

These oxy-sulphides cause less abrasive wear and form at high and medium cutting speed a protective layer on the tool rake.
This layer protects the tool against crater wear prolonging tool life, because these inclusion have lubricating properties and deform easily.

Who is Maxival?

There are several modified austenitic stainless steels and only one duplex in Maxival Series.
The standard grades are:

AISI 304	MVAIS	AUSTENITIC
AISI 304L	MVAISL	AUSTENITIC
AISI 316	MVAPM	AUSTENITIC
AISI316L	MVAPML	AUSTENITIC
W n°1.4435	MVAPMLD2	AUSTENITIC
W n° 1.4460	MV274MDE	DUPLEX

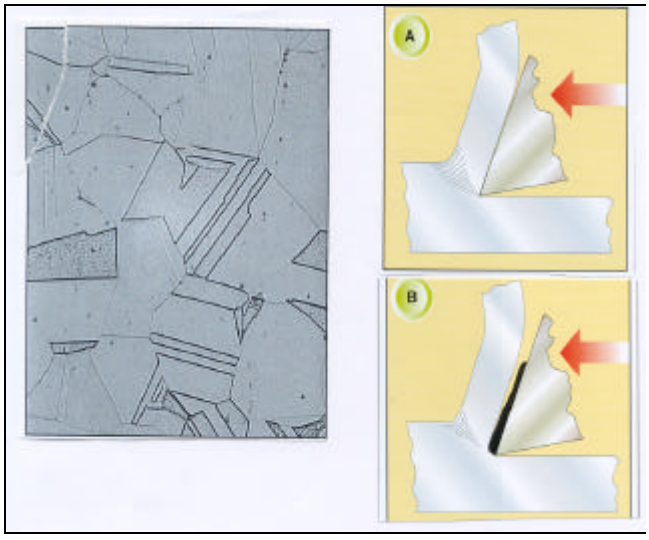
whose performances allow to obtain

- longer tool life ;
- higher feed and speed ;
- less machine downtime ;
- fewer rejections .

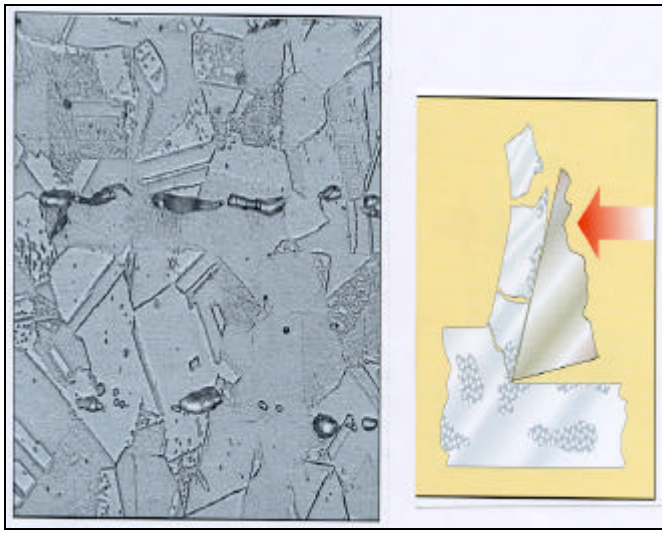
Comparison is helpful

In order to understand the level of advantages that Maxival allows, it is better to solely refer the properties of these grades compared with a free machining grade such as AISI 303 (AU18/8Z) and standard grades such as AISI 304 , AISI 316 and W n°1.4460 .
In this specific case, it appears that:

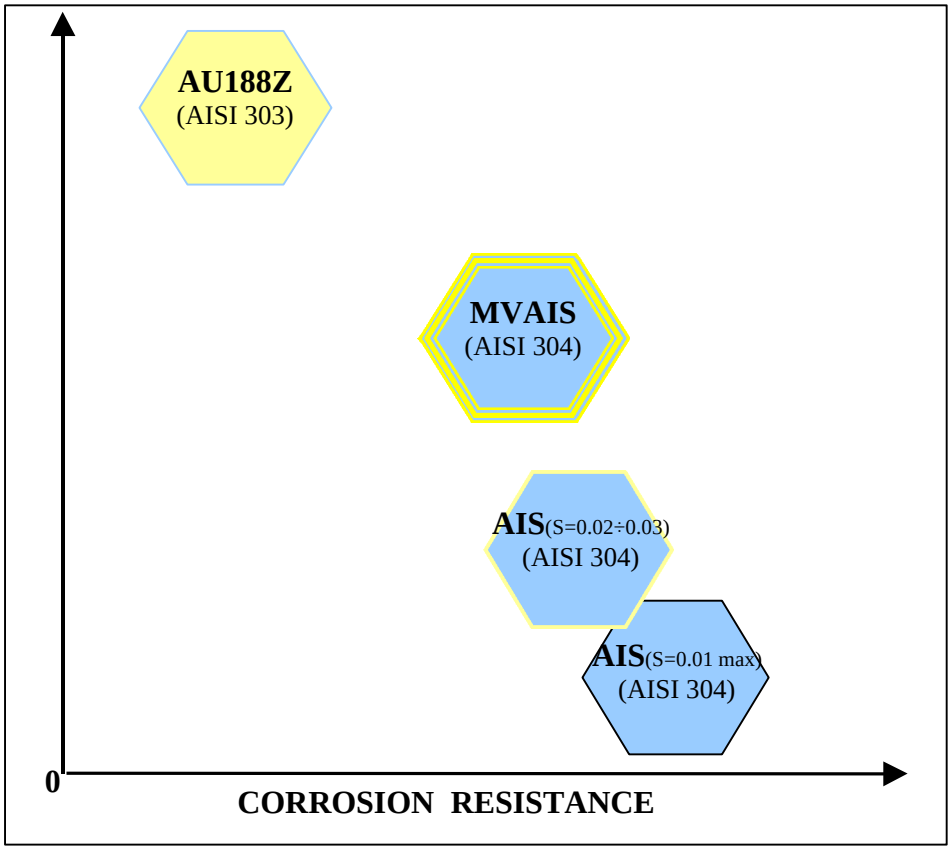
- Maxival show intermediate values between AISI 303 and standard grades relative to corrosion resistance ;
- Whilst the Maxival process greatly improves machinability, traditional AISI 303 with its high added sulphur content, is still better.
- Maxival grades have a better weldability then AISI 303 ;
- Depending on the welding process, Maxival has a different behavior compared to standard grades. This situation must be considered during the project .

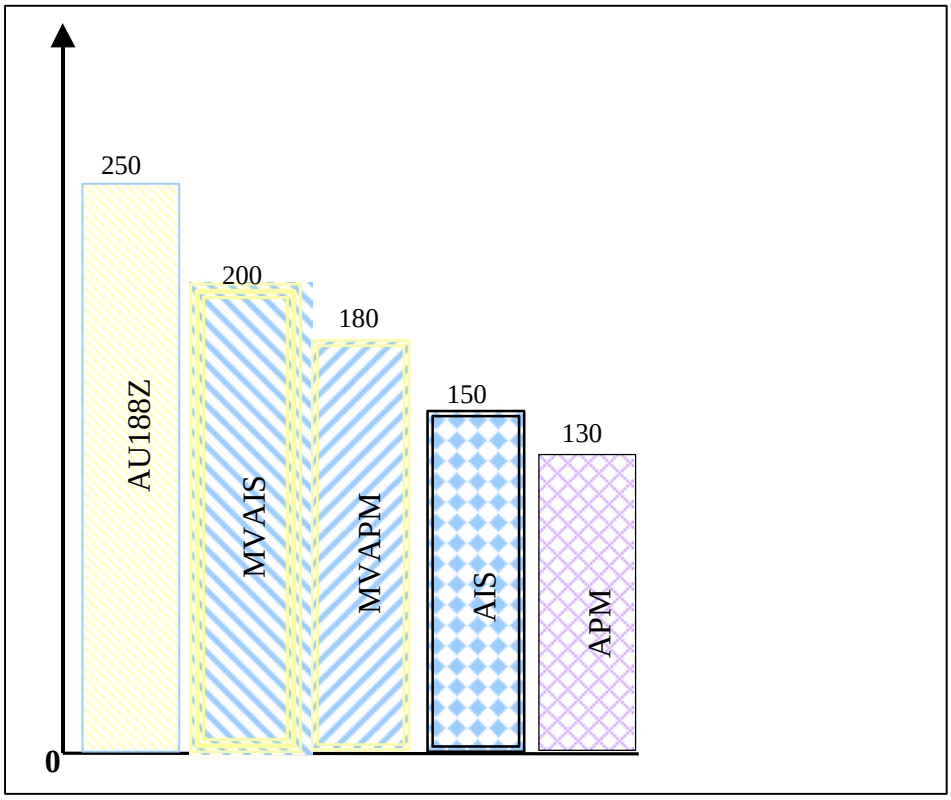


Standard Grades

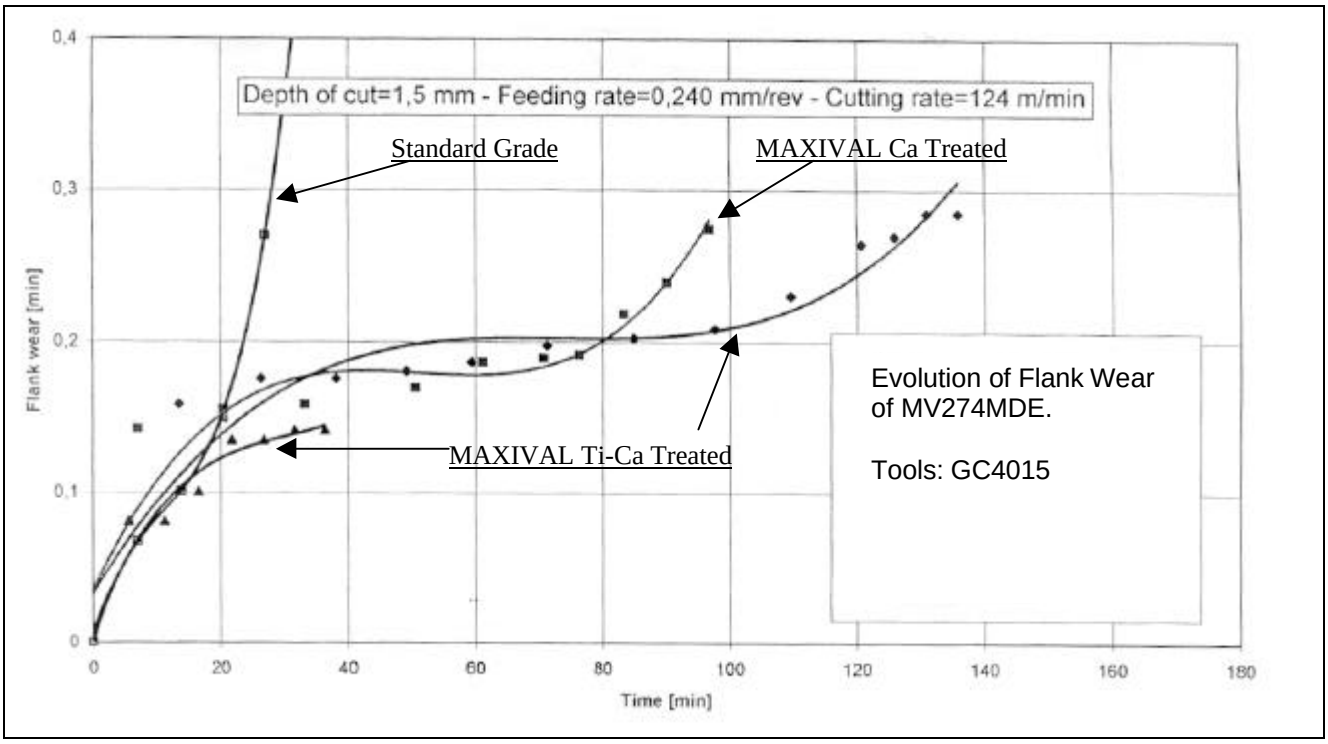

Maxival Grades

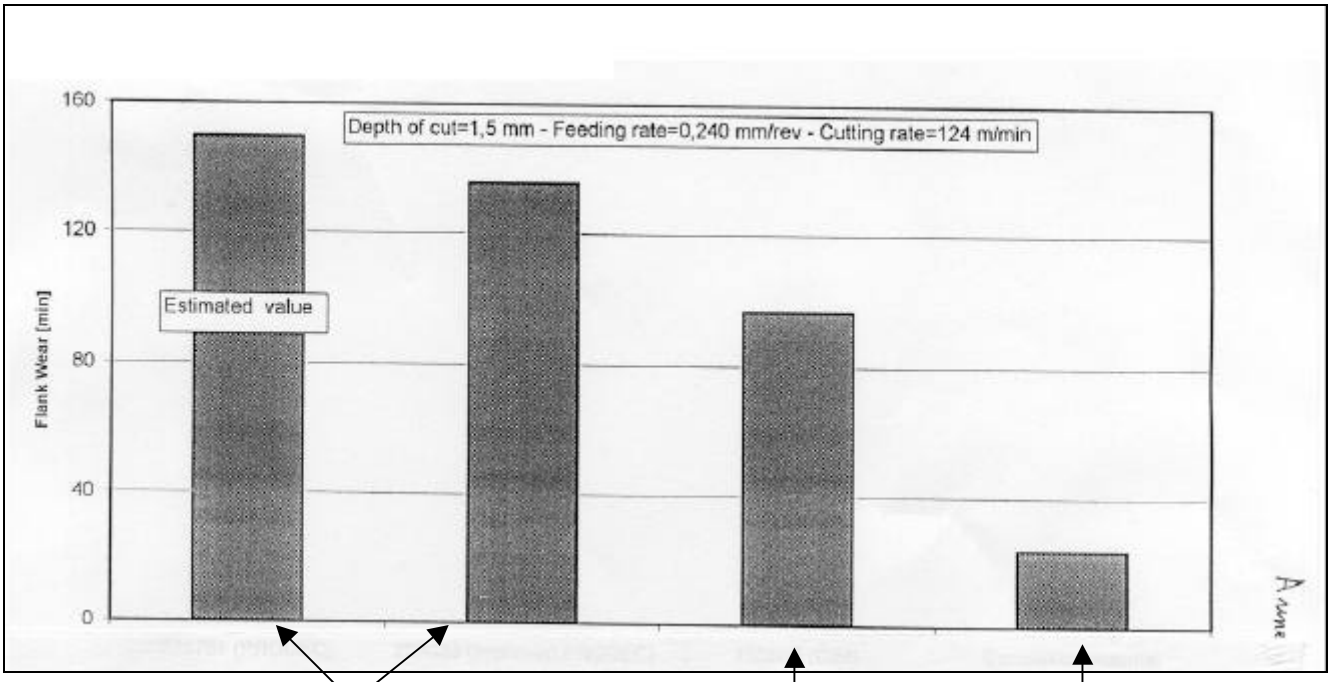
Remarks : In order to improve machinability of AISI 303 (**AU188Z**), VALBRUNA produces **MVAU188Z** according to MAXIVAL elaboration


AU188Z
(AISI 303)
MVAIS
(AISI 304)
AIS(S=0.02÷0.03)
(AISI 304)
AIS(S=0.01 max)
(AISI 304)
0
CORROSION RESISTANCE


250
200
180
150
130
AU188Z
MVAIS
MVAPM
AIS
APM
0

Comparation between VALBRUNA'S different heats of MAXIVAL and STANDARD grades





CUTTING DATA RECOMMENDATIONS

Valbruna Grade:	Standard Steel:	Condition :
AU188Z	- AISI 303 - W. No. 1.4305 - EN10088= X10CrNiS 18 9	- Annealing - Hardness HB = 150÷170 - Tensile Strenght = 550÷700 MPa

Standard Composition (%)	C	Cr	Ni	S
	0.06	17.2	8.2	0.25

TURNING

Feed (min/rev)	Cutting depth (mm)	Cutting speed (m/min)			
		Cemented carbide P10	Cemented carbide P20	Cemented carbide P35	Hight – speed steel
- 0.3	- 2	270	220	-	50
0.3 - 0.5	2 - 5	-	200	160	40
0.5 - 1.0	5 - 10	-	120	90	(20)

DRILLING

- **Twist drills, hight-speed steel**
- **Point angle: 135° ; Helix angle: 40°**

Drill dia. (mm)	Speed (rev/min)	Cutting Speed (m/min)	Feed (mm/rev)
1	5400 - 6300	17 - 20	0.05
3	2100 - 2600	20 - 25	0.10
5	1600 - 1900	25 - 30	0.20
10	800 - 950	25 - 30	0.30
15	530 - 640	25 - 30	0.35
20	400 - 470	25 - 30	0.40
30	260 - 320	25 - 30	0.45

Cooling and cutting liquid feed: ample about 10% emulsion .
When drilling with short NC drills, the feed can be increased by about 40%.
When drilling to depths more than 4 x diameter, remove chips.
When using TiN-coated hight-speed steel drills, the cutting speed can be increased by about 10%.

- **Indexable insert drills, cemented carbide**

Drill dia. (mm)	Cutting Speed (m/min)	Feed (mm/rev)	Type of cemented carbide	
20	210 - 270	0.12	P25	P15
30	210 - 270	0.14	P25	P15
40	210 - 270	0.16	P25	P15
50	210 - 270	0.22	P25	P15

Cooling and cutting liquid feed:
Liquid pressure: >0.3 Mpa (3 Kp/cm^2).
Liquid amount: > 25 l/min. .
Cutting data for indexable-insert drills-hole drilling are highty dependent on the make of the drills used; the manufacturer's recommentations must also be considered.

CUTTING DATA RECOMMENDATIONS

AU188Z

MILLING

- **Cemented carbide**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)	Type of cemented carbide
Face milling	150 - 250	0.15 - 0.30	P10 - P30
Side milling	180 - 240	0.25 - 0.30	P10 - P30
End milling	150 - 220	0.10 - 0.20	P10 - P30
End milling (solid cemented carbide)	50 - 100	0.05 - 0.20	P40

- **Hight-speed steel**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)
Face milling	35 - 40	0.15 - 0.25
Plain milling	35 - 40	0.15 - 0.25
End milling	35 - 40	0.05 - 0.20
Side milling	35 - 40	0.15 - 0.20

THREADING

Tool	Cutting speed (m/min)
Cemented Carbide (P10 – P30)	100 - 160
Hight-speed steel	30 - 35

CUTTING OFF

Tool	Cutting speed (m/min)	Feed (mm/rev)
Cemented Carbide (P30)	110 - 160	0.10 - 0.20
Hight-speed steel	40	0.05 – 0.10

REAMING

Ream dia. (mm)	Cutting speed (m/min)		Feed (mm/rev)
	Cemented Carbide (P30)	Hight-speed steel	
- 10	60	15 - 20	0.10 - 0.20
10 - 20	60	15 - 20	0.30
20 -	60	15 - 20	0.30 - 0.40

N.B. : The cutting data are to be considered as base values that must be adapted to local conditions.
The state cutting data are based on tool lives of 15 minutes for cemented carbides and 60 minutes for hight-speed steel.
Coil and lubrificant : Emulsion or cutting oil .

CUTTING DATA RECOMMENDATIONS

Valbruna Steel:	Standard Steel:	Condition :
MVAISDE	- AISI 304 - W. No. 1.4301 - EN 10088= X5CrNi 18 10	- Annealing - Hardness HB = 150÷170 - Tensile Strenght = 500÷600 MPa

Standard Composition (%)	C	Cr	Ni
	0.04	18	8.5

TURNING

Feed (min/rev)	**Cutting depth (mm)**	**Cutting speed (m/min)**			
		Cemented carbide P10	Cemented carbide P20	Cemented carbide P35	Hight – speed steel
- 0.3	-2	250	200	-	40
0.3 - 0.5	2 - 5	-	180	150	35
0.5 - 1.0	5 - 10	-	100	90	(20)

DRILLING

- **Twist drills, hight-speed steel**
- **Point angle: 135° ; Helix angle: 40°**

Drill dia. (mm)	**Speed (rev/min)**	**Cutting Speed (m/min)**	**Feed (mm/rev)**
1	3200 - 3800	10 - 12	0.05
3	1600 - 1800	15 - 17	0.10
5	1080 - 1270	17 - 20	0.20
10	540 - 640	17 - 20	0.30
15	360 - 430	17 - 20	0.35
20	270 – 320	17 - 20	0.40
30	180 - 220	17 - 20	0.45

N.B.
- Cooling and cutting liquid feed: ample about 10% emulsion .
- When drilling with short NC drills, the feed can be increased by about 40%.
- When drilling to depths more than 4 x diameter, remove chips.
- When using TiN-coated hight-speed steel drills, the cutting speed can be increased by about 10%.

- **Indexable insert drills, cemented carbide**

Drill dia. (mm)	**Cutting Speed (m/min)**	**Feed (mm/rev)**	**Type of cemented carbide**	
20	200 - 250	0.10	P25	P15
30	200 - 250	0.12	P25	P15
40	200 - 250	0.15	P25	P15
50	200 - 250	0.20	P25	P15

N.B.
Cooling and cutting liquid feed:
Liquid pressure: >0.3Mpa (3 Kp/cm^2).
Liquid amount: > 25 l/min. .
Cutting data for indexable-insert drills-hole drilling are highty dependent on the make of the drills used; the manufacturer's recommentations must also be considered.

CUTTING DATA RECOMMENDATIONS

MVAISDE

MILLING

- **Cemented carbide**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)	Type of cemented carbide
Face milling	150 - 250	0.15 - 0.30	P10 - P30
Side milling	180 - 240	0.25 - 0.30	P10 - P30
End milling	150 - 220	0.10 - 0.20	P10 - P30
End milling (solid cemented carbide)	50 - 100	0.05 - 0.20	P40

- **Hight-speed steel**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)
Face milling	25 - 30	0.12 - 0.20
Plain milling	25 - 30	0.12 - 0.20
End milling	25 - 30	0.02 - 0.20
Side milling	25 - 30	0.12 - 0.20

THREADING

Tool	Cutting speed (m/min)
Cemented Carbide (P10 – P30)	90 - 130
Hight-speed steel	15 - 20

CUTTING OFF

Tool	Cutting speed (m/min)	Feed (mm/rev)
Cemented Carbide (P30)	100 -150	0.10 - 0.20
Hight-speed steel	30	0.05

REAMING

Ream dia. (mm)	Cutting speed (m/min)		Feed (mm/rev)
	Cemented Carbide (P30)	Hight-speed steel	
- 10	50	10 - 15	0.10 - 0.20
10 - 20	50	10 - 15	0.30
20 -	50	10 - 15	0.30 - 0.40

N.B. : The cutting data are to be considered as base values that must be adapted to local conditions.
The state cutting data are based on tool lives of 15 minutes for cemented carbides and 60 minutes for hight-speed steel.
Coil and lubrificant : Emulsion or cutting oil .

CUTTING DATA RECOMMENDATIONS

Valbruna Steel:	Standard Steel:	Condition :
MVAISL	- AISI 304L - W. No. 1.4306 - EN 10088= X2CrNi 19 11	- Annealing - Hardness HB = 150÷170 - Tensile Strenght = 500÷650 MPa

Standard Composition (%)	C	Cr	Ni
	0.02	18.3	9.2

TURNING	**Feed (min/rev)**	**Cutting depth (mm)**	**Cutting speed (m/min)**			
			Cemented carbide P10	Cemented carbide P20	Cemented carbide P35	Hight – speed steel
	- 0.3	- 2	250	200	-	35
	0.3 - 0.5	2 - 5	-	180	150	30
	0.5 - 1.0	5 - 10	-	100	90	20

DRILLING

- **Twist drills, hight-speed steel**
- **Point angle: 135° ; Helix angle: 40°**

Drill dia. (mm)	**Speed (rev/min)**	**Cutting Speed (m/min)**	**Feed (mm/rev)**
1	3200 - 3800	10 - 12	0.04
3	1600 - 1800	15 - 17	0.10
5	1080 - 1270	17 - 20	0.20
10	540 - 640	17 - 20	0.30
15	360 - 430	17 - 20	0.30
20	270 - 320	17 - 20	0.35
30	180 - 220	17 - 20	0.35

- Cooling and cutting liquid feed: ample about 10% emulsion .
- When drilling with short NC drills, the feed can be increased by about 40%.
- When drilling to depths more than 4 x diameter, remove chips.
- When using TiN-coated hight-speed steel drills, the cutting speed can be increased by about 10%.

- **Indexable insert drills, cemented carbide**

Drill dia. (mm)	**Cutting Speed (m/min)**	**Feed (mm/rev)**	**Type of cemented carbide**	
20	200 - 250	0.10	P25	P15
30	200 - 250	0.12	P25	P15
40	200 - 250	0.15	P25	P15
50	200 - 250	0.20	P25	P15

Cooling and cutting liquid feed:
Liquid pressure: >0.3Mpa (3 Kp/cm^2).
Liquid amount: > 25 l/min. .

Cutting data for indexable-insert drills-hole drilling are highty dependent on the make of the drills used; the manufacturer's recommentations must also be considered.

CUTTING DATA RECOMMENDATIONS

MVAISL

MILLING

- **Cemented carbide**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)	Type of cemented carbide
Face milling	150 - 240	0.15 - 0.30	P10 - P30
Side milling	150 - 240	0.25 - 0.30	P10 - P30
End milling	150 - 220	0.10 - 0.20	P10 - P30
End milling (solid cemented carbide)	50 - 100	0.05 - 0.20	P40

- **Hight-speed steel**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)
Face milling	25 - 30	0.12 - 0.20
Plain milling	25 - 30	0.12 - 0.20
End milling	25 - 30	0.02 - 0.15
Side milling	25 - 30	0.12 - 0.20

THREADING

Tool	Cutting speed (m/min)
Cemented Carbide (P10 – P30)	90 - 130
Hight-speed steel	15 - 20

CUTTING OFF

Tool	Cutting speed (m/min)	Feed (mm/rev)
Cemented Carbide (P30)	100 - 150	0.08 - 0.20
Hight-speed steel	30	0.05

REAMING

Ream dia. (mm)	Cutting speed (m/min)		Feed (mm/rev)
	Cemented Carbide (P30)	Hight-speed steel	
- 10	50	10 - 15	0.10 - 0.20
10 - 20	50	10 - 15	0.30
20 -	50	10 - 15	0.30 - 0.40

N.B. : The cutting data are to be considered as base values that must be adapted to local conditions.
The state cutting data are based on tool lives of 15 minutes for cemented carbides and 60 minutes for hight-speed steel.
Coil and lubrificant : Emulsion or cutting oil .

CUTTING DATA RECOMMENDATIONS

Valbruna Steel:	Standard Steel:	Condition :
MVAPM	- AISI 316 - W. No. 1.4401 - EN 10088= X5CrNiMo 17 12 2	- Annealing - Hardness HB = 150÷170 - Tensile Strenght = 500÷650 MPa

Standard Composition (%)	C	Cr	Ni	Mo
	0.04	17.5	10.5	2

TURNING

Feed (min/rev)	Cutting depth (mm)	Cutting speed (m/min)			
		Cemented carbide P10	Cemented carbide P20	Cemented carbide P35	Hight – speed steel
- 0.3	-2	240	190	-	30
0.3 - 0.5	2 - 5	-	170	140	25
0.5 - 1.0	5 - 10	-	90	80	15

DRILLING

- **Twist drills, hight-speed steel**
- **Point angle: 135° ; Helix angle: 40°**

Drill dia. (mm)	Speed (rev/min)	Cutting Speed (m/min)	Feed (mm/rev)
1	3200 - 3800	10 - 12	0.05
3	1270 - 1590	12 - 15	0.10
5	760 - 950	12 - 15	0.20
10	380 - 470	12 - 15	0.30
15	250 - 320	12 - 15	0.30
20	190 - 240	12 - 15	0.35
30	130 - 160	12 - 15	0.35

N.B.
-Cooling and cutting liquid feed: ample about 10% emulsion .
-When drilling with short NC drills, the feed can be increased by about 40%.
-When drilling to depths more than 4 x diameter, remove chips.
-When using TiN-coated hight-speed steel drills, the cutting speed can be increased by about 10%.

- **Indexable insert drills, cemented carbide**

Drill dia. (mm)	Cutting Speed (m/min)	Feed (mm/rev)	Type of cemented carbide	
20	180 - 210	0.10	P25	P15
30	180 - 210	0.12	P25	P15
40	180 - 210	0.15	P25	P15
50	180 - 210	0.20	P25	P15

N.B.
Cooling and cutting liquid feed:
Liquid pressure: >0.3Mpa (3 Kp/cm^2).
Liquid amount: > 25 l/min. .

Cutting data for indexable-insert drills-hole drilling are highty dependent on the make of the drills used; the manufacturer's recommentations must also be considered.

CUTTING DATA RECOMMENDATIONS

MVAPM

MILLING

- **Cemented carbide**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)	Type of cemented carbide
Face milling	150 - 240	0.15 - 0.30	P10 - P30
Side milling	150 - 240	0.25 - 0.30	P10 - P30
End milling	150 - 220	0.10 - 0.20	P10 - P30
End milling (solid cemented carbide)	50 - 100	0.05 - 0.20	P40

- **Hight-speed steel**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)
Face milling	20 -25	0.12 - 0.20
Plain milling	20 -25	0.12 - 0.20
End milling	20 -25	0.02 - 0.15
Side milling	20 -25	0.12 - 0.20

THREADING

Tool	Cutting speed (m/min)
Cemented Carbide (P10 – P30)	90 - 130
Hight-speed steel	12 - 15

CUTTING OFF

Tool	Cutting speed (m/min)	Feed (mm/rev)
Cemented Carbide (P30)	90 - 140	0.08 - 0.20
Hight-speed steel	25	0.05

REAMING

Ream dia. (mm)	Cutting speed (m/min)		Feed (mm/rev)
	Cemented Carbide (P30)	Hight-speed steel	
- 10	50	10 - 15	0.10 - 0.20
10 - 20	50	10 - 15	0.30
20 -	50	10 - 15	0.30 - 0.40

N.B. : The cutting data are to be considered as base values that must be adapted to local conditions.
The state cutting data are based on tool lives of 15 minutes for cemented carbides and 60 minutes for hight-speed steel.
Coil and lubrificant : Emulsion or cutting oil .

CUTTING DATA RECOMMENDATIONS

Valbruna Steel:	Standard Steel:	Condition :
MVAPML	- AISI 316L - W. No. 1.4404 - EN 10088= X2CrNiMo 17 13 2	- Annealing - Hardness HB = 150÷170 - Tensile Strenght = 500÷650 MPa

Standard Composition (%)	C	Cr	Ni	Mo
	0.02	17.0	11.2	2.1

TURNING

Feed (min/rev)	**Cutting depth (mm)**	**Cutting speed (m/min)**			
		Cemented carbide P10	Cemented carbide P20	Cemented carbide P35	Hight – speed steel
- 0.3	-2	240	190	-	30
0.3 - 0.5	2 - 5	-	170	140	25
0.5 - 1.0	5 - 10	-	90	80	15

DRILLING

- **Twist drills, hight-speed steel**
- **Point angle: 135° ; Helix angle: 40°**

Drill dia. (mm)	**Speed (rev/min)**	**Cutting Speed (m/min)**	**Feed (mm/rev)**
1	3200 - 3800	10 - 12	0.05
3	1270 - 1590	12 - 15	0.10
5	760 - 950	12 - 15	0.20
10	380 - 470	12 - 15	0.30
15	250 - 320	12 - 15	0.35
20	190 - 240	12 - 15	0.35
30	130 - 160	12 - 15	0.35

N.B.
-Cooling and cutting liquid feed: ample about 10% emulsion .
-When drilling with short NC drills, the feed can be increased by about 40%.
-When drilling to depths more than 4 x diameter, remove chips.
-When using TiN-coated hight-speed steel drills, the cutting speed can be increased by about 10%.

- **Indexable insert drills, cemented carbide**

Drill dia. (mm)	**Cutting Speed (m/min)**	**Feed (mm/rev)**	**Type of cemented carbide**	
20	180 - 210	0.10	P25	P15
30	180 - 210	0.12	P25	P15
40	180 - 210	0.15	P25	P15
50	180 - 210	0.20	P25	P15

N.B.
Cooling and cutting liquid feed:
Liquid pressure: >0.3Mpa (3 Kp/cm^2).
Liquid amount: > 25 l/min. .

Cutting data for indexable-insert drills-hole drilling are highty dependent on the make of the drills used; the manufacturer's recommentations must also be considered.

CUTTING DATA RECOMMENDATIONS

MVAPML

MILLING

- **Cemented carbide**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)	Type of cemented carbide
Face milling	150 - 240	0.15 - 0.30	P10 - P30
Side milling	150 - 240	0.25 - 0.30	P10 - P30
End milling	150 - 220	0.10 - 0.20	P10 - P30
End milling (solid cemented carbide)	50 - 100	0.05 - 0.20	P40

- **Hight-speed steel**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)
Face milling	20 -25	0.12 - 0.20
Plain milling	20 -25	0.12 - 0.20
End milling	20 -25	0.02 - 0.15
Side milling	20 -25	0.12 - 0.20

THREADING

Tool	Cutting speed (m/min)
Cemented Carbide (P10 – P30)	90 - 120
Hight-speed steel	12 - 15

CUTTING OFF

Tool	Cutting speed (m/min)	Feed (mm/rev)
Cemented Carbide (P30)	90 - 140	0.08 - 0.20
Hight-speed steel	25	0.05

REAMING

Ream dia. (mm)	Cutting speed (m/min)		Feed (mm/rev)
	Cemented Carbide (P30)	Hight-speed steel	
- 10	50	10 - 15	0.10 - 0.20
10 - 20	50	10 - 15	0.30
20 -	50	10 - 15	0.30 - 0.40

N.B. : The cutting data are to be considered as base values that must be adapted to local conditions.
The state cutting data are based on tool lives of 15 minutes for cemented carbides and 60 minutes for hight-speed steel.
Coil and lubrificant : Emulsion or cutting oil .

CUTTING DATA RECOMMENDATIONS

Valbruna Steel:	Standard Steel:	Condition :
MVAPMD2	- AISI 316 - W. No. 1.4436 - EN 10088= X5CrNiMo 17 13 3	- Annealing - Hardness HB = 150÷170 - Tensile Strenght = 500÷650 MPa

Standard Composition (%)	C	Cr	Ni	Mo
	0.04	17	11	2.6

TURNING

Feed (min/rev)	Cutting depth (mm)	Cutting speed (m/min)			
		Cemented carbide P10	Cemented carbide P20	Cemented carbide P35	Hight – speed steel
- 0.3	- 2	240	190	-	30
0.3 - 0.5	2 - 5	-	170	140	25
0.5 - 1.0	5 - 10	-	90	80	15

DRILLING

- **Twist drills, hight-speed steel**
- **Point angle: 135° ; Helix angle: 40°**

Drill dia. (mm)	Speed (rev/min)	Cutting Speed (m/min)	Feed (mm/rev)
1	3200 - 3800	10 - 12	0.05
3	1270 - 1590	12 - 15	0.10
5	760 - 950	12 - 15	0.20
10	380 - 470	12 - 15	0.30
15	250 - 320	12 - 15	0.35
20	190 - 240	12 - 15	0.40
30	130 - 160	12 - 15	0.40

-Cooling and cutting liquid feed: ample about 10% emulsion .
-When drilling with short NC drills, the feed can be increased by about 40%.
-When drilling to depths more than 4 x diameter, remove chips.
-When using TiN-coated hight-speed steel drills, the cutting speed can be increased by about 10%.

- **Indexable insert drills, cemented carbide**

Drill dia. (mm)	Cutting Speed (m/min)	Feed (mm/rev)	Type of cemented carbide	
20	180 - 210	0.10	P25	P15
30	180 - 210	0.12	P25	P15
40	180 - 210	0.15	P25	P15
50	180 - 210	0.20	P25	P15

Cooling and cutting liquid feed:
Liquid pressure: >0.3Mpa (3 Kp/cm^2).
Liquid amount: > 25 l/min. .

Cutting data for indexable-insert drills-hole drilling are highty dependent on the make of the drills used; the manufacturer's recommentations must also be considered.

CUTTING DATA RECOMMENDATIONS

MVAPMD2

MILLING

- **Cemented carbide**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)	Type of cemented carbide
Face milling	150 - 250	0.15 - 0.30	P10 - P30
Side milling	180 - 240	0.25 - 0.30	P10 - P30
End milling	150 - 220	0.10 - 0.20	P10 - P30
End milling (solid cemented carbide)	50 - 100	0.05 - 0.20	P40

- **Hight-speed steel**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)
Face milling	20 -25	0.12 - 0.20
Plain milling	20 -25	0.12 - 0.20
End milling	20 -25	0.02 - 0.15
Side milling	20 -25	0.12 - 0.20

THREADING

Tool	Cutting speed (m/min)
Cemented Carbide (P10 – P30)	90 - 130
Hight-speed steel	12 - 15

CUTTING OFF

Tool	Cutting speed (m/min)	Feed (mm/rev)
Cemented Carbide (P30)	90 - 140	0.10 - 0.20
Hight-speed steel	25	0.05

REAMING

Ream dia. (mm)	Cutting speed (m/min)		Feed (mm/rev)
	Cemented Carbide (P30)	Hight-speed steel	
- 10	50	10 - 15	0.10 - 0.20
10 - 20	50	10 - 15	0.30
20 -	50	10 - 15	0.30 - 0.40

N.B. : The cutting data are to be considered as base values that must be adapted to local conditions.
The state cutting data are based on tool lives of 15 minutes for cemented carbides and 60 minutes for hight-speed steel.
Coil and lubrificant : Emulsion or cutting oil .

CUTTING DATA RECOMMENDATIONS

Valbruna Steel:	Standard Steel:	Condition :
MVAPMLD2	- AISI 316L - W. No. 1.4435 - EN 10088= X2CrNiMo 18 14 3	- Annealing - Hardness HB = 150÷170 - Tensile Strenght = 500÷650 MPa

Standard Composition (%)	C	Cr	Ni	Mo
	0.02	17.3	12.7	2.6

TURNING

Feed (min/rev)	Cutting depth (mm)	Cutting speed (m/min)			
		Cemented carbide P10	Cemented carbide P20	Cemented carbide P35	Hight – speed steel
- 0.3	-2	230	190	-	30
0.3 - 0.5	2 - 5	-	170	140	25
0.5 - 1.0	5 - 10	-	90	80	15

DRILLING

- **Twist drills, hight-speed steel**
- **Point angle: 135° ; Helix angle: 40°**

Drill dia. (mm)	Speed (rev/min)	Cutting Speed (m/min)	Feed (mm/rev)
1	3200 - 3800	10 - 12	0.05
3	1270 - 1590	12 - 15	0.10
5	760 - 950	12 - 15	0.20
10	380 - 470	12 - 15	0.30
15	250 - 320	12 - 15	0.35
20	190 - 240	12 - 15	0.35
30	130 - 160	12 - 15	0.35

-Cooling and cutting liquid feed: ample about 10% emulsion .
-When drilling with short NC drills, the feed can be increased by about 40%.
-When drilling to depths more than 4 x diameter, remove chips.
-When using TiN-coated hight-speed steel drills, the cutting speed can be increased by about 10%.

- **Indexable insert drills, cemented carbide**

Drill dia. (mm)	Cutting Speed (m/min)	Feed (mm/rev)	Type of cemented carbide	
20	180 - 210	0.10	P25	P15
30	180 - 210	0.12	P25	P15
40	180 - 210	0.15	P25	P15
50	180 - 210	0.20	P25	P15

Cooling and cutting liquid feed:
Liquid pressure: >0.3Mpa (3 Kp/cm^2).
Liquid amount: > 25 l/min. .

Cutting data for indexable-insert drills-hole drilling are highty dependent on the make of the drills used; the manufacturer's recommentations must also be considered.

CUTTING DATA RECOMMENDATIONS

MVAPMLD2

MILLING

- **Cemented carbide**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)	Type of cemented carbide
Face milling	150 - 240	0.15 - 0.30	P10 - P30
Side milling	150 - 240	0.25 - 0.30	P10 - P30
End milling	150 - 220	0.10 - 0.20	P10 - P30
End milling (solid cemented carbide)	50 - 100	0.05 - 0.20	P40

- **Hight-speed steel**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)
Face milling	20 -25	0.12 - 0.20
Plain milling	20 -25	0.12 - 0.20
End milling	20 -25	0.02 - 0.15
Side milling	20 -25	0.12 - 0.20

THREADING

Tool	Cutting speed (m/min)
Cemented Carbide (P10 – P30)	90 - 130
Hight-speed steel	12 - 15

CUTTING OFF

Tool	Cutting speed (m/min)	Feed (mm/rev)
Cemented Carbide (P30)	90 - 140	0.08 - 0.20
Hight-speed steel	25	0.05

REAMING

Ream dia. (mm)	Cutting speed (m/min)		Feed (mm/rev)
	Cemented Carbide (P30)	Hight-speed steel	
- 10	50	10 - 15	0.10 - 0.20
10 - 20	50	10 - 15	0.30
20 -	50	10 - 15	0.30 - 0.40

N.B. : The cutting data are to be considered as base values that must be adapted to local conditions.
The state cutting data are based on tool lives of 15 minutes for cemented carbides and 60 minutes for hight-speed steel.
Coil and lubrificant : Emulsion or cutting oil .

CUTTING DATA RECOMMENDATIONS

Valbruna Steel:	Standard Steel:	Condition :
MV274MDE	- W. No. 1.4460 - EN 10088= X3CrNiMoN 27 5 2	- Annealed - Hardness HB = ca.200 - Tensile Strenght = ca.700 MPa

Standard Composition (%)	C	Cr	Ni	Mo
	0.025	26.5	4.8	1.3

TURNING

Feed (min/rev)	Cutting depth (mm)	Cutting speed (m/min)			
		Cemented carbide P10	Cemented carbide P20	Cemented carbide P35	Hight – speed steel
- 0.3	- 2	230	180	-	30
0.3 - 0.5	2 - 5	-	160	130	25
0.5 - 1.0	5 - 10	-	100	80	(15)

DRILLING

- **Twist drills, hight-speed steel**
- **Point angle: 135° ; Helix angle: 40°**

Drill dia. (mm)	Speed (rev/min)	Cutting Speed (m/min)	Feed (mm/rev)
1	3200 - 3800	10 - 12	0.05
3	1270 - 1590	12 - 15	0.10
5	760 - 950	12 - 15	0.20
10	380 - 470	12 - 15	0.30
15	250 - 320	12 - 15	0.30
20	180 - 240	12 - 15	0.35
30	130 - 160	12 - 15	0.35

-Cooling and cutting liquid feed: ample about 10% emulsion .
-When drilling with short NC drills, the feed can be increased by about 40%.
-When drilling to depths more than 4 x diameter, remove chips.
-When using TiN-coated hight-speed steel drills, the cutting speed can be increased by about 10%.

- **Indexable insert drills, cemented carbide**

Drill dia. (mm)	Cutting Speed (m/min)	Feed (mm/rev)	Type of cemented carbide	
20	175 - 200	0.10	P25	P15
30	175 - 200	0.12	P25	P15
40	175 - 200	0.15	P25	P15
50	175 - 200	0.20	P25	P15

Cooling and cutting liquid feed:
Liquid pressure: >0.3Mpa (3 Kp/cm^2).
Liquid amount: > 25 l/min. .

Cutting data for indexable-insert drills-hole drilling are highty dependent on the make of the drills used; the manufacturer's recommentations must also be considered.

CUTTING DATA RECOMMENDATIONS

MV274MDE

MILLING

- **Cemented carbide**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)	Type of cemented carbide
Face milling	130 - 240	0.15 - 0.30	P10 - P40
Side milling	180 - 220	0.25 - 0.30	P10 – P30
End milling	130 - 200	0.10 - 0.20	P10 – P30
End milling (solid cemented carbide)	50 - 100	0.05 - 0.20	P40

- **Hight-speed steel**

Machining	Cutting Speed (m/min)	Feed (mm/tooth)
Face milling	20 - 25	0.12 - 0.20
Plain milling	20 - 25	0.12 - 0.20
End milling	20 - 25	0.02 - 0.15
Side milling	10 - 15	0.12 - 0.20

THREADING

Tool	Cutting speed (m/min)
Cemented Carbide (P10 – P30)	90 - 130
Hight-speed steel	12 - 15

CUTTING OFF

Tool	Cutting speed (m/min)	Feed (mm/rev)
Cemented Carbide (P30)	90 - 140	0.10 - 0.20
Hight-speed steel	25	0.05

REAMING

Ream dia. (mm)	Cutting speed (m/min)		Feed (mm/rev)
	Cemented Carbide (P30)	Hight-speed steel	
- 10	50	10 - 15	0.10 - 0.20
10 - 20	50	10 - 15	0.30
20 -	50	10 - 15	0.30 - 0.40

N.B. : The cutting data are to be considered as base values that must be adapted to local conditions.
The state cutting data are based on tool lives of 15 minutes for cemented carbides and 60 minutes for hight-speed steel.
Coil and lubrificant : Emulsion or cutting oil .