

SABRE



Powder metallurgy tools
for Steel and Stainless Steel






EUROPA
TOOL





Clarkson





2-FLUTE END MILLS

Code	Item	Description	Page No.
100140		Short Length ø3.0mm - 25.0mm	P.3
101140		Standard Length ø3.0mm - 25.0mm	P.4
112140		Short Length Ball Nose ø3.0mm - 25.0mm	P.5
114140		Standard Length Ball Nose ø3.0mm - 25.0mm	P.6

3-FLUTE END MILLS

103140		Short Length ø3.0mm - 25.0mm	P.7
104140		Standard Length ø3.0mm - 25.0mm	P.8

4-FLUTE END MILLS

107140		Standard Length ø3.0mm - 25.0mm	P.9
108140		Long Length ø3.0mm - 25.0mm	P.10

ROUGHING END MILLS

190140		Short Length Fine Pitch ø6.0mm - 25.0mm	P.11
191140		Long Length Fine Pitch ø6.0mm - 25.0mm	P.12
121240		Extended Neck Fine Pitch 45° Helix ø4.0mm - 25.0mm	P.13
118140		Short Length Coarse Pitch ø6.0mm - 25.0mm	P.14
192140		Extended Neck Coarse Pitch ø10.0mm - 25.0mm	P.15
		Cutting Data	P.16-24



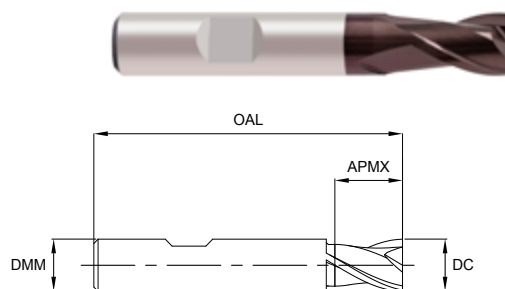
SHORT LENGTH



Series No. 100140

► cutting conditions : p.17

Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.



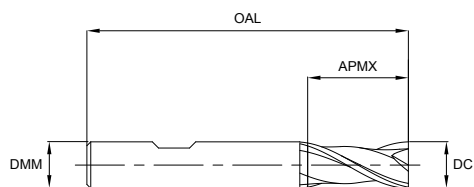
EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL
1001400300	3.0	6	5.0	49
1001400400	4.0	6	7.0	51
1001400500	5.0	6	8.0	52
1001400600	6.0	6	8.0	52
1001400800	8.0	8	11.0	61
1001401000	10.0	10	13.0	63
1001401200	12.0	12	16.0	73
1001401600	16.0	16	19.0	79
1001402000	20.0	20	22.0	88
1001402500	25.0	25	26.0	102

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
3.0 - 6.0	-0.020 / -0.038	h6
8.0, 10.0	-0.025 / -0.047	
12.0, 16.0	-0.032 / -0.059	
20.0, 25.0	-0.040 / -0.073	

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																



STANDARD LENGTH



Series No.101140

► cutting conditions : p.17

Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.

EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL
1011400300	3.0	6	8.0	52
1011400400	4.0	6	11.0	55
1011400500	5.0	6	13.0	57
1011400600	6.0	6	13.0	57
1011400800	8.0	8	19.0	69
1011401000	10.0	10	22.0	72
1011401200	12.0	12	26.0	83
1011401600	16.0	16	32.0	92
1011402000	20.0	20	38.0	104
1011402500	25.0	25	45.0	121

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
3.0 - 6.0	-0.020 / -0.038	h6
8.0, 10.0	-0.025 / -0.047	
12.0, 16.0	-0.032 / -0.059	
20.0, 25.0	-0.040 / -0.073	

ISO	P			M		K		N				S		H		
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	●	●	○	●	●	●	●									



SHORT LENGTH BALL NOSE

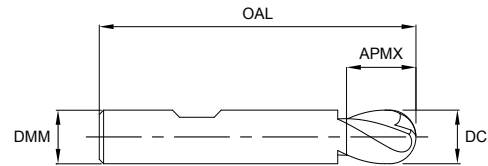
HSS-E
PM



Series No. 112140

► cutting conditions : p.18

Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.



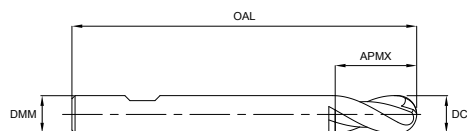
EUROPA CODE ORDCODE	DIAMETER DC	RADIUS RE	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL
1121400300	3.0	1.5	6	5.0	49
1121400400	4.0	2.0	6	7.0	51
1121400500	5.0	2.5	6	8.0	52
1121400600	6.0	3.0	6	8.0	52
1121400800	8.0	4.0	8	11.0	61
1121401000	10.0	5.0	10	13.0	63
1121401200	12.0	6.0	12	16.0	73
1121401600	16.0	8.0	16	19.0	79
1121402000	20.0	10.0	20	22.0	88
1121402500	25.0	12.5	25	26.0	102

Mill Dia. Tolerance TCDC(mm)	Radius Tolerance (mm)		Shank Dia. Tolerance TCDMM
	RETOLL	RETOLU	
0.00 / -0.03	-0.020	+0.020	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																



STANDARD LENGTH BALL NOSE

HSS-E
PM

Series No.114140

► cutting conditions : p.18

Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.

EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL
1141400300	3.0	6	8.0	56
1141400400	4.0	6	11.0	63
1141400500	5.0	6	13.0	68
1141400600	6.0	6	13.0	68
1141400800	8.0	8	19.0	88
1141401000	10.0	10	22.0	95
1141401200	12.0	12	26.0	110
1141401600	16.0	16	32.0	123
1141402000	20.0	20	38.0	141
1141402500	25.0	25	45.0	166

Mill Dia. Tolerance TCDC(mm)	Radius Tolerance (mm)		Shank Dia. Tolerance TCDMM
	RETOLL	RETOLU	
0.00 / -0.03	-0.020	+0.020	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																



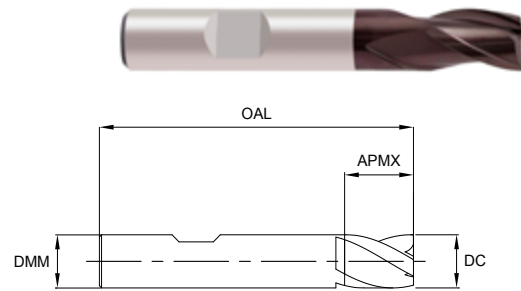
SHORT LENGTH



Series No. 103140

► cutting conditions : p.19-20

Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.



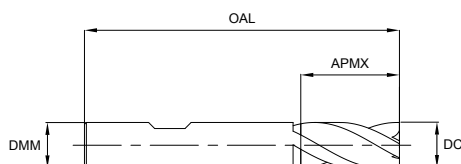
EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL
1031400300	3.0	6	5.0	49
1031400400	4.0	6	7.0	51
1031400500	5.0	6	8.0	52
1031400600	6.0	6	8.0	52
1031400800	8.0	8	11.0	61
1031401000	10.0	10	13.0	63
1031401200	12.0	12	16.0	73
1031401600	16.0	16	19.0	79
1031402000	20.0	20	22.0	88
1031402500	25.0	25	26.0	102

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
3.0 - 6.0	-0.020 / -0.038	h6
8.0, 10.0	-0.025 / -0.047	
12.0, 16.0	-0.032 / -0.059	
20.0, 25.0	-0.040 / -0.073	

ISO	P			M		K		N				S		H		
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																



STANDARD LENGTH



HSS-E
PM



Series No.104140

► cutting conditions : p.19-20

Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.

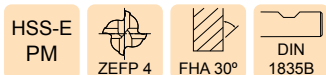
EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL
1041400300	3.0	6	8.0	52
1041400400	4.0	6	11.0	55
1041400500	5.0	6	13.0	57
1041400600	6.0	6	13.0	57
1041400800	8.0	8	19.0	69
1041401000	10.0	10	22.0	72
1041401200	12.0	12	26.0	83
1041401600	16.0	16	32.0	92
1041402000	20.0	20	38.0	104
1041402500	25.0	25	45.0	121

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
3.0 - 6.0	-0.020 / -0.038	h6
8.0, 10.0	-0.025 / -0.047	
12.0, 16.0	-0.032 / -0.059	
20.0, 25.0	-0.040 / -0.073	

ISO	P			M		K		N				S		H		
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	●	●	○	●	●	●	●									



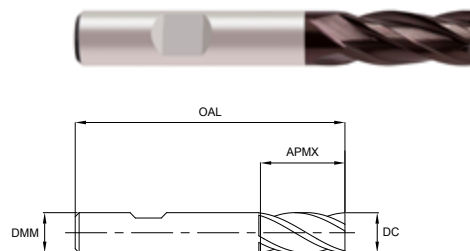
STANDARD LENGTH



Series No. 107140

► cutting conditions : p.21

Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.



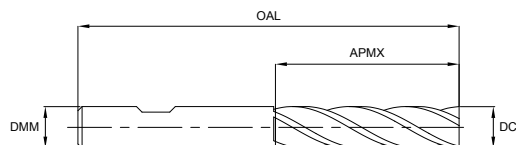
EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL
1071400300	3.0	6	8.0	52
1071400400	4.0	6	11.0	55
1071400500	5.0	6	13.0	57
1071400600	6.0	6	13.0	57
1071400800	8.0	8	19.0	69
1071401000	10.0	10	22.0	72
1071401200	12.0	12	26.0	83
1071401600	16.0	16	32.0	92
1071402000	20.0	20	38.0	104
1071402500	25.0	25	45.0	121

Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
0.00 / -0.03	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																



LONG LENGTH



HSS-E
PM



Series No.108140

► cutting conditions : p.21

Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.

EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL
1081400300	3.0	6	12.0	56
1081400400	4.0	6	19.0	63
1081400500	5.0	6	24.0	68
1081400600	6.0	6	24.0	68
1081400800	8.0	8	38.0	88
1081401000	10.0	10	45.0	95
1081401200	12.0	12	53.0	110
1081401600	16.0	16	63.0	123
1081402000	20.0	20	75.0	141
1081402500	25.0	25	90.0	166

Mill Dia. Tolerance TDCD(mm)	Shank Dia. Tolerance TCDMM
0.00 / -0.03	h6

ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																



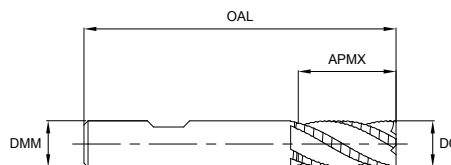
SHORT LENGTH FINE PITCH



Series No. 190140

► cutting conditions : p.23

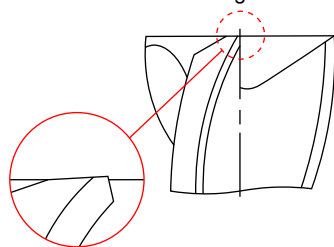
Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.



EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL	NO. OF FLUTES ZEFP	CHAMFER WIDTH CHW
1901400600	6.0	6	13.0	57	3	0.18
1901400700	7.0	10	16.0	66	3	0.18
1901400800	8.0	10	19.0	69	3	0.18
1901400900	9.0	10	19.0	69	3	0.18
1901401000	10.0	10	22.0	72	4	0.18
1901401200	12.0	12	26.0	83	4	0.18
1901401400	14.0	12	26.0	83	4	0.25
1901401600	16.0	16	32.0	92	4	0.25
1901401800	18.0	16	32.0	92	4	0.25
1901402000	20.0	20	38.0	104	4	0.25
1901402200	22.0	20	38.0	104	5	0.36
1901402500	25.0	25	45.0	121	5	0.36

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
6.0	+0.060 / -0.060	h6
7.0 - 10.0	+0.075 / -0.075	
12.0 - 16.0	+0.090 / -0.090	
18.0 - 25.0	+0.105 / -0.105	

REINFORCED Cutting EDGE



ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	●	●	○	●	●	●	●						○			

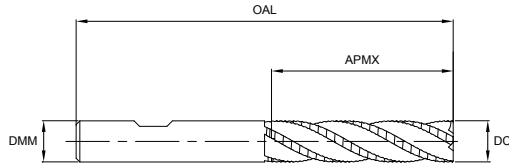


LONG LENGTH FINE PITCH



Series No.191140

► cutting conditions : p.23

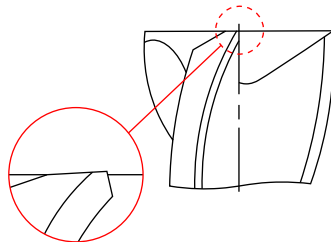


Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.

EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL	NO. OF FLUTES ZEFP	CHAMFER WIDTH CHW
1911400600	6.0	6	24.0	68	3	0.18
1911400700	7.0	10	30.0	80	3	0.18
1911400800	8.0	10	38.0	88	3	0.18
1911400900	9.0	10	38.0	88	3	0.18
1911401000	10.0	10	45.0	92	4	0.18
1911401200	12.0	12	53.0	110	4	0.18
1911401400	14.0	12	53.0	110	4	0.25
1911401600	16.0	16	63.0	123	4	0.25
1911401800	18.0	16	63.0	123	4	0.25
1911402000	20.0	20	75.0	141	4	0.25
1911402200	22.0	20	75.0	141	5	0.36
1911402500	25.0	25	90.0	168	5	0.36

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
6.0	+0.060 / -0.060	h6
7.0 - 10.0	+0.075 / -0.075	
12.0 - 16.0	+0.090 / -0.090	
18.0 - 25.0	+0.105 / -0.105	

REINFORCED Cutting EDGE



ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary ○ Secondary	●	●	○	●	●	●	●						○			



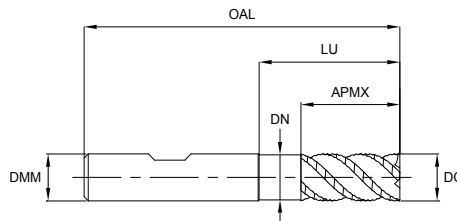
EXTENDED NECK FINE PITCH



Series No. 121240

► cutting conditions : p.23

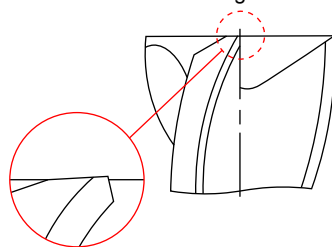
Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.



EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	EFFECTIVE LENGTH LU	OVERALL LENGTH OAL	NECK DIAMETER DN	NO. OF FLUTES ZEFP	CHAMFER WIDTH CHW
1212400400	4.0	6	11.0	-	57	-	3	0.10
1212400500	5.0	6	13.0	-	57	-	4	0.13
1212400600	6.0	6	13.0	-	57	-	4	0.15
1212400800	8.0	10	19.0	-	69	-	4	0.18
1212401000	10.0	10	22.0	31.0	72	9.5	4	0.20
1212401200	12.0	12	26.0	37.0	83	11.5	4	0.20
1212401400	14.0	12	26.0	-	83	-	5	0.20
1212401600	16.0	16	32.0	44.0	92	15.0	5	0.20
1212401800	18.0	20	38.0	-	104	-	6	0.20
1212402000	20.0	20	38.0	54.0	104	19.0	6	0.20
1212402500	25.0	25	45.0	63.0	121	24.0	6	0.20

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
6.0	+0.060 / -0.060	h6
8.0, 10.0	+0.075 / -0.075	
12.0, 16.0	+0.090 / -0.090	
20.0, 25.0	+0.105 / -0.105	

REINFORCED Cutting EDGE



ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																

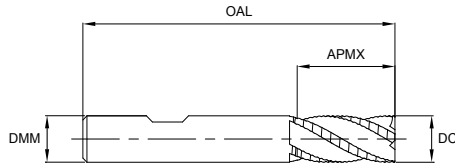


SHORT LENGTH COARSE PITCH



Series No. 118140

► cutting conditions : p.24

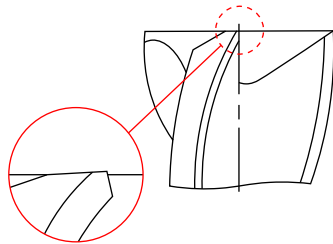


Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.

EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	OVERALL LENGTH OAL	NO. OF FLUTES ZEFP	CHAMFER WIDTH CHW
1181400600	6.0	6	13.0	57	3	0.25
1181400800	8.0	10	19.0	69	3	0.25
1181401000	10.0	10	22.0	72	4	0.36
1181401200	12.0	12	26.0	83	4	0.50
1181401600	16.0	16	32.0	92	4	0.55
1181402000	20.0	20	38.0	104	4	0.55
1181402500	25.0	25	45.0	121	5	0.55

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
6.0	+0.060 / -0.060	h6
8.0, 10.0	+0.075 / -0.075	
12.0, 16.0	+0.090 / -0.090	
20.0, 25.0	+0.105 / -0.105	

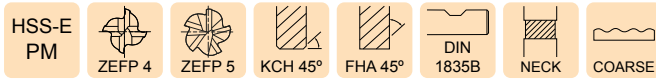
REINFORCED Cutting EDGE



ISO	P			M		K		N					S		H	
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																



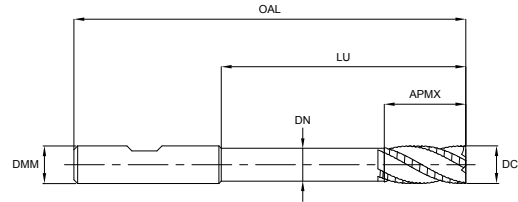
EXTENDED NECK COARSE PITCH



Series No.192140

► cutting conditions : p.22

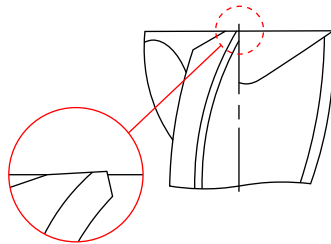
Sabre coating for increased wear resistance at high speeds.
Designed for steels, stainless steels and cast iron.
Suitable for use on difficult to cut materials.



EUROPA CODE ORDCODE	DIAMETER DC	SHANK DIAMETER DMM	LENGTH OF CUT APMX	EFFECTIVE LENGTH LU	OVERALL LENGTH OAL	NECK DIAMETER DN	NO. OF FLUTES ZEFP	CHAMFER WIDTH CHW
1921401000	10.0	10	22.0	69.0	110	8.5	4	0.34
1921401200	12.0	12	26.0	78.0	125	10.5	4	0.50
1921401600	16.0	16	32.0	87.0	138	14.0	4	0.55
1921402000	20.0	20	38.0	108.0	160	18.0	5	0.55
1921402500	25.0	25	45.0	155.0	216	23.0	5	0.55

Mill Dia. DC	Mill Dia. Tolerance TCDC(mm)	Shank Dia. Tolerance TCDMM
6.0	+0.060 / -0.060	h6
8.0, 10.0	+0.075 / -0.075	
12.0, 16.0	+0.090 / -0.090	
20.0, 25.0	+0.105 / -0.105	

REINFORCED Cutting EDGE



ISO	P			M		K		N				S		H		
VDI GROUP	1-5	6-9	10-11	12, 13	14	15-16	17-20	21-25	26-28	29.1	29.2	30	31-35	36-37	38-39	40-41
● Primary	●	●	○	●	●	●	●									
○ Secondary																

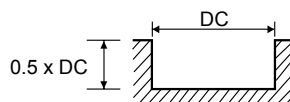


SABRE CUTTING DATA



CUTTING DATA

100140, 101140 (2 Flute)														
VDI MATERIAL GROUP	MATERIAL	HRc		Size (mm)										
				3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	20.0	25.0	
P	1-5	Non-alloy Steel	<25	v_c (m/min)	40	45	50	55	55	55	55	60	50	50
				n	4100	3600	3250	2900	2200	1800	1450	1150	780	630
				f_z	0.016	0.024	0.031	0.036	0.055	0.074	0.083	0.085	0.106	0.111
				f (mm/min)	135	175	2000	210	240	265	240	195	165	140
	6-9	Low alloy Steel	25-35	v_c (m/min)	30	40	40	45	45	45	45	45	45	40
				n	3350	3150	2600	2300	1800	1450	1150	890	700	490
				f_z	0.017	0.025	0.036	0.041	0.056	0.079	0.091	0.101	0.107	0.117
				f (mm/min)	115	160	185	190	200	230	210	180	150	115
	10-11	High alloy Steel, Tool Steel	35-45	v_c (m/min)	45	55	60	65	65	65	70	70	60	60
				n	5000	4300	3900	3500	2600	2100	1800	1350	950	750
				f_z	0.016	0.027	0.033	0.038	0.053	0.071	0.076	0.098	0.116	0.103
				f (mm/min)	160	230	255	265	275	300	275	265	220	155
M	12-14	Stainless Steel	v_c (m/min)	40	45	50	55	55	55	55	60	50	50	
			n	4100	3600	3250	2900	2200	1800	1450	1150	780	630	
			f_z	0.016	0.024	0.031	0.036	0.055	0.074	0.083	0.085	0.106	0.111	
			f (mm/min)	135	175	200	210	240	265	240	195	165	140	
K	15-20	Cast Iron	v_c (m/min)	40	45	50	55	55	55	55	60	50	50	
			n	4100	3600	3250	2900	2200	1800	1450	1150	780	630	
			f_z	0.016	0.024	0.031	0.036	0.055	0.074	0.083	0.085	0.106	0.111	
			f (mm/min)	135	175	200	210	240	265	240	195	165	140	



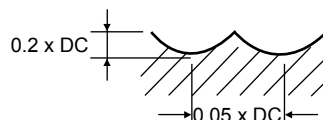
Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.
 All recommendations are based on ideal machining conditions. Adjustments may need to be made according to your set-up.
For long series and long necked tools it may be necessary to reduce feed rate by up to 50%.

v_c - cutting speed (m/min)
 n - RPM (rev/min)
 f_z - feed per tooth (mm)
 f - feed rate (mm/min)
 a_p - axial depth of cut
 a_e - radial depth of cut



CUTTING DATA

112140, 114140 (2 Flute Ball Nose)														
VDI MATERIAL GROUP	MATERIAL	HRc		Size (mm)										
				3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	20.0	25.0	
P	1-5	Non-alloy Steel	<25	v_c (m/min)	55	60	60	65	65	65	70	65	65	60
				n	5800	4620	3820	3500	2600	2100	1800	1300	1000	740
				f_z	0.02	0.031	0.038	0.046	0.067	0.095	0.097	0.123	0.14	0.142
				f (mm/min)	230	290	295	320	350	400	350	320	280	210
	6-9	Low alloy Steel	25-35	v_c (m/min)	35	40	40	45	45	45	45	45	45	35
				n	3900	3000	2550	2300	1800	1400	1200	890	680	470
				f_z	0.016	0.027	0.033	0.039	0.056	0.082	0.083	0.101	0.11	0.122
				f (mm/min)	125	160	170	180	200	230	200	180	150	115
	10-11	High alloy Steel, Tool Steel	35-45	v_c (m/min)	20	20	20	25	20	20	20	20	25	20
				n	2000	1600	1280	1200	890	680	580	440	360	250
				f_z	0.014	0.023	0.03	0.035	0.048	0.075	0.073	0.091	0.097	0.104
				f (mm/min)	55	75	76	85	85	102	85	80	70	52
M	12-14	Stainless Steel	v_c (m/min)	20	20	20	25	25	25	25	25	25	20	
			n	2200	1600	1280	1320	980	750	640	490	400	275	
			f_z	0.014	0.023	0.03	0.036	0.048	0.073	0.074	0.092	0.1	0.1	
			f (mm/min)	60	75	76	95	95	110	95	90	80	55	
K	15-20	Cast Iron	v_c (m/min)	55	60	60	65	65	65	70	65	65	60	
			n	5800	4620	3820	3500	2600	2100	1800	1300	1000	740	
			f_z	0.02	0.031	0.038	0.046	0.067	0.095	0.097	0.123	0.14	0.142	
			f (mm/min)	230	290	290	320	350	400	350	320	280	210	



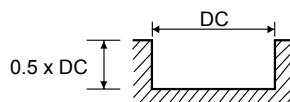
Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.
 All recommendations are based on ideal machining conditions. Adjustments may need to be made according to your set-up.
For long series and long necked tools it may be necessary to reduce feed rate by up to 50%.

v_c - cutting speed (m/min)
 n - RPM (rev/min)
 f_z - feed per tooth (mm)
 f - feed rate (mm/min)
 a_p - axial depth of cut
 a_e - radial depth of cut



CUTTING DATA

103140, 104140 (3 Flute)														
VDI MATERIAL GROUP	MATERIAL	HRc	SLOTTING	Size (mm)										
				3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	20.0	25.0	
P	1-5	Non-alloy Steel	<25	v_c (m/min)	35	45	50	55	55	55	55	60	50	50
				n	3900	3600	3200	2800	2200	180	1450	1150	790	630
				f_z	0.007	0.011	0.014	0.023	0.032	0.039	0.053	0.061	0.08	0.111
				f (mm/min)	85	115	130	190	210	210	230	210	190	210
	6-9	Low alloy Steel	25-35	v_c (m/min)	30	40	40	45	45	45	45	45	45	40
				n	3350	3000	2600	2300	1800	1400	1200	890	700	490
				f_z	0.005	0.009	0.012	0.02	0.028	0.038	0.047	0.056	0.067	0.109
				f (mm/min)	52	80	92	140	150	160	170	150	140	160
	10-11	High alloy Steel, Tool Steel	35-45	v_c (m/min)	20	25	25	25	30	30	30	30	30	30
				n	2200	1900	1700	1450	1150	890	740	560	440	360
				f_z	0.007	0.009	0.012	0.021	0.03	0.043	0.052	0.061	0.07	0.094
				f (mm/min)	45	52	62	92	102	115	115	102	92	102
M	12-14	Stainless Steel	v_c (m/min)	15	20	20	20	20	20	20	20	25	20	
			n	1800	1500	1300	1100	890	680	580	440	360	250	
			f_z	0.008	0.012	0.014	0.023	0.032	0.045	0.053	0.064	0.074	0.113	
			f (mm/min)	45	55	55	75	85	92	92	85	80	85	
K	15-20	Cast Iron	v_c (m/min)	35	45	50	55	55	55	55	60	50	50	
			n	3900	3600	3200	2800	2200	1800	1450	1150	790	630	
			f_z	0.007	0.011	0.014	0.023	0.032	0.039	0.053	0.061	0.08	0.111	
			f (mm/min)	85	115	130	190	210	210	230	210	190	210	



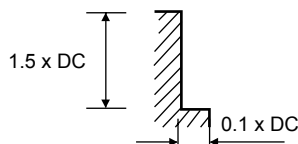
Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.
 All recommendations are based on ideal machining conditions. Adjustments may need to be made according to your set-up.
For long series and long necked tools it may be necessary to reduce feed rate by up to 50%.

v_c - cutting speed (m/min)
 n - RPM (rev/min)
 f_z - feed per tooth (mm)
 f - feed rate (mm/min)
 a_p - axial depth of cut
 a_e - radial depth of cut



CUTTING DATA

103140, 104140 (3 Flute)														
VDI MATERIAL GROUP	MATERIAL	HRc	SIDE CUTTING	Size (mm)										
				3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	20.0	25.0	
P	1-5	Non-alloy Steel	<25	v_c (m/min)	45	55	65	70	65	65	70	65	65	65
				n	4800	4400	4000	3600	2600	2100	1800	1300	1050	840
				f_z	0.008	0.012	0.015	0.023	0.035	0.046	0.056	0.071	0.081	0.109
				f (mm/min)	120	1555	175	250	270	290	300	275	255	275
	6-9	Low alloy Steel	25-35	v_c (m/min)	35	45	45	50	50	50	55	50	50	50
				n	3800	3500	2900	2600	2000	1600	1400	1000	780	630
				f_z	0.007	0.01	0.014	0.024	0.033	0.044	0.055	0.067	0.081	0.111
				f (mm/min)	75	110	125	190	200	210	230	200	190	210
	10-11	High alloy Steel, Tool Steel	35-45	v_c (m/min)	25	30	30	35	35	30	35	35	35	35
				n	2700	2300	2000	1800	1300	1000	900	660	520	420
				f_z	0.008	0.011	0.014	0.023	0.036	0.050	0.056	0.071	0.08	0.107
				f (mm/min)	65	75	85	125	140	150	150	140	125	135
M	12-14	Stainless Steel	v_c (m/min)	20	25	25	30	30	30	30	30	30	30	
			n	2200	1900	1700	1500	1100	890	740	550	440	360	
			f_z	0.01	0.013	0.015	0.022	0.035	0.047	0.056	0.07	0.083	0.111	
			f (mm/min)	65	75	75	100	115	125	125	115	110	120	
K	15-20	Cast Iron	v_c (m/min)	45	55	65	70	65	65	70	65	65	65	
			n	4800	4400	4000	3600	2600	2100	1800	1300	1050	840	
			f_z	0.008	0.012	0.015	0.023	0.035	0.045	0.056	0.071	0.081	0.109	
			f (mm/min)	120	155	175	250	270	290	300	275	255	275	



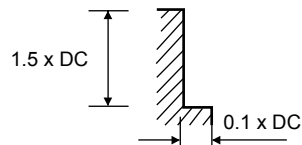
Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.
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For long series and long necked tools it may be necessary to reduce feed rate by up to 50%.

v_c - cutting speed (m/min)
 n - RPM (rev/min)
 f_z - feed per tooth (mm)
 f - feed rate (mm/min)
 a_p - axial depth of cut
 a_e - radial depth of cut



CUTTING DATA

107140, 108140 (4 Flute)														
VDI MATERIAL GROUP	MATERIAL	HRc		Size (mm)										
				3.0	4.0	5.0	6.0	8.0	10.0	12.0	16.0	20.0	25.0	
P	1-5	Non-alloy Steel	<25	v_c (m/min)	55	60	65	70	65	65	70	70	65	65
				n	6000	4700	400	3600	2600	2100	1800	1400	1050	840
				f_z	0.015	0.021	0.026	0.031	0.046	0.063	0.067	0.077	0.088	0.091
				f (mm/min)	350	400	420	450	480	530	480	430	370	305
	6-9	Low alloy Steel	25-35	v_c (m/min)	40	45	45	50	50	50	55	50	50	50
				n	4400	3600	2900	2600	2000	1600	1400	1000	780	630
				f_z	0.014	0.021	0.028	0.032	0.046	0.059	0.066	0.085	0.088	0.091
				f (mm/min)	250	300	320	330	370	380	370	340	275	230
	10-11	High alloy Steel, Tool Steel	35-45	v_c (m/min)	25	30	30	35	35	30	35	35	35	35
				n	2700	2300	2000	1800	1400	1000	890	680	530	420
				f_z	0.017	0.022	0.028	0.032	0.043	0.066	0.067	0.081	0.083	0.089
				f (mm/min)	180	200	220	230	240	265	240	220	175	150
M	12-14	Stainless Steel	v_c (m/min)	25	25	25	25	30	30	25	30	30	30	
			n	2400	2000	1700	1450	1150	890	720	550	440	360	
			f_z	0.013	0.019	0.024	0.031	0.04	0.056	0.064	0.075	0.080	0.087	
			f (mm/min)	125	150	160	180	185	200	185	165	140	125	
K	15-20	Cast Iron	v_c (m/min)	55	60	65	70	65	65	70	70	65	65	
			n	6000	4700	4000	3600	2600	2100	1800	1400	1050	840	
			f_z	0.015	0.021	0.026	0.031	0.046	0.063	0.067	0.077	0.088	0.091	
			f (mm/min)	350	400	420	450	480	530	480	430	370	305	



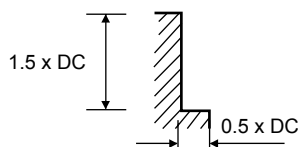
Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.
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For long series and long necked tools it may be necessary to reduce feed rate by up to 50%.

v_c - cutting speed (m/min)
 n - RPM (rev/min)
 f_z - feed per tooth (mm)
 f - feed rate (mm/min)
 a_p - axial depth of cut
 a_e - radial depth of cut



CUTTING DATA

192140 (Multiflute Rougher, Extended Neck, Coarse Pitch)									
VDI MATERIAL GROUP	MATERIAL	HRc		Size (mm)					
				10.0	12.0	16.0	20.0	25.0	
P	1-5	Non-alloy Steel	<25	v_c (m/min)	47	47	47	47	47
				n	1500	1200	950	760	600
				f_z	0.045	0.058	0.074	0.092	0.09
				f (mm/min)	270	280	280	280	270
	6-9	Low alloy Steel	25-35	v_c (m/min)	33	33	33	33	33
				n	1050	900	660	530	420
				f_z	0.039	0.054	0.074	0.092	0.088
				f (mm/min)	165	195	195	195	185
	10-11	High alloy Steel, Tool Steel	35-45	v_c (m/min)	28	28	282	28	28
				n	890	740	550	440	360
				f_z	0.038	0.052	0.07	0.088	0.086
				f (mm/min)	135	155	155	155	155
M	12-14	Stainless Steel	v_c (m/min)	30	30	30	30	30	
			n	950	800	600	480	390	
			f_z	0.038	0.055	0.073	0.091	0.087	
			f (mm/min)	145	175	175	175	170	
K	15-20	Cast Iron	v_c (m/min)	47	47	47	47	47	
			n	1500	1200	950	760	600	
			f_z	0.045	0.058	0.074	0.092	0.09	
			f (mm/min)	270	280	280	280	270	



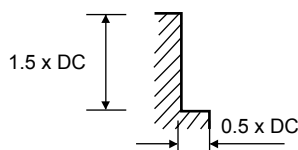
Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.
 All recommendations are based on ideal machining conditions. Adjustments may need to be made according to your set-up.
For long series and long necked tools it may be necessary to reduce feed rate by up to 50%.

v_c - cutting speed (m/min)
 n - RPM (rev/min)
 f_z - feed per tooth (mm)
 f - feed rate (mm/min)
 a_p - axial depth of cut
 a_e - radial depth of cut



CUTTING DATA

190140, 191140, 121240 (Multiflute Rougher, Fine Pitch)														
VDI MATERIAL GROUP	MATERIAL	HRc		Size (mm)										
				6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	25.0	
P	1-5	Non-alloy Steel	<25	v_c (m/min)	40	50	45	45	45	50	50	50	45	45
				n	2200	1900	1500	1200	1050	950	890	760	650	600
				f_z	0.02	0.03	0.053	0.069	0.063	0.069	0.062	0.072	0.085	0.088
				f (mm/min)	180	230	315	330	330	330	330	330	330	315
	6-9	Low alloy Steel	25-35	v_c (m/min)	30	35	35	35	35	35	35	35	30	35
				n	1600	1400	1050	900	760	660	610	530	470	420
				f_z	0.018	0.029	0.46	0.064	0.061	0.07	0.063	0.072	0.082	0.087
				f (mm/min)	115	160	195	230	230	230	230	230	230	220
	10-11	High alloy Steel, Tool Steel	35-45	v_c (m/min)	25	25	30	30	30	30	30	30	30	30
				n	1300	1050	890	740	630	550	490	440	400	360
				f_z	0.02	0.03	0.045	0.061	0.057	0.065	0.061	0.068	0.075	0.083
				f (mm/min)	105	125	160	180	180	180	180	180	180	180
M	12-14	Stainless Steel	v_c (m/min)	27	30	32	32	32	32	32	32	32	32	
			n	1450	1200	950	800	690	600	550	480	430	390	
			f_z	0.019	0.029	0.045	0.064	0.059	0.068	0.062	0.071	0.079	0.085	
			f (mm/min)	110	140	170	205	205	205	205	205	205	200	
K	15-20	Cast Iron	v_c (m/min)	40	50	45	45	45	50	50	50	45	45	
			n	2200	1900	1500	1200	1050	950	890	760	650	600	
			f_z	0.02	0.03	0.053	0.069	0.063	0.069	0.062	0.072	0.085	0.088	
			f (mm/min)	180	230	315	330	330	330	330	330	330	315	
S	31-35	HRSA Fe & Ni/Co Based	v_c (m/min)	12	12	15	15	15	15	15	15	15	15	
			n	635	475	475	395	340	300	265	240	215	190	
			f_z	0.018	0.028	0.042	0.061	0.055	0.066	0.06	0.069	0.077	0.082	
			f (mm/min)	35	40	80	95	75	80	65	65	80	80	



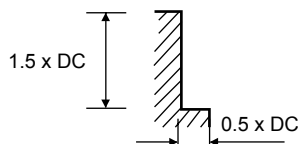
Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.
 All recommendations are based on ideal machining conditions. Adjustments may need to be made according to your set-up.
For long series and long necked tools it may be necessary to reduce feed rate by up to 50%.

v_c - cutting speed (m/min)
 n - RPM (rev/min)
 f_z - feed per tooth (mm)
 f - feed rate (mm/min)
 a_p - axial depth of cut
 a_e - radial depth of cut



CUTTING DATA

118140 (Multiflute Rougher, Coarse Pitch)														
VDI MATERIAL GROUP	MATERIAL	HRc		Size (mm)										
				6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	25.0	
P	1-5	Non-alloy Steel	<25	v_c (m/min)	40	50	45	45	45	50	50	50	45	45
				n	2200	1900	1500	1200	1050	950	890	760	650	600
				f_z	0.02	0.03	0.053	0.069	0.063	0.069	0.062	0.072	0.085	0.088
				f (mm/min)	180	230	315	330	330	330	330	330	330	315
	6-9	Low alloy Steel	25-35	v_c (m/min)	30	35	35	35	35	35	35	35	30	35
				n	1600	1400	1050	900	760	660	610	530	470	420
				f_z	0.018	0.029	0.46	0.064	0.061	0.07	0.063	0.072	0.082	0.087
				f (mm/min)	115	160	195	230	230	230	230	230	230	220
	10-11	High alloy Steel, Tool Steel	35-45	v_c (m/min)	25	25	30	30	30	30	30	30	30	30
				n	1300	1050	890	740	630	550	490	440	400	360
				f_z	0.02	0.03	0.045	0.061	0.057	0.065	0.061	0.068	0.075	0.083
				f (mm/min)	105	125	160	180	180	180	180	180	180	180
M	12-14	Stainless Steel	v_c (m/min)	27	30	32	32	32	32	32	32	32	32	
			n	1450	1200	950	800	690	600	550	480	430	390	
			f_z	0.019	0.029	0.045	0.064	0.059	0.068	0.062	0.071	0.079	0.085	
			f (mm/min)	110	140	170	205	205	205	205	205	205	200	
K	15-20	Cast Iron	v_c (m/min)	40	50	45	45	45	50	50	50	45	45	
			n	2200	1900	1500	1200	1050	950	890	760	650	600	
			f_z	0.02	0.03	0.053	0.069	0.063	0.069	0.062	0.072	0.085	0.088	
			f (mm/min)	180	230	315	330	330	330	330	330	330	315	



Recommended cutting depths are **maximum** depths, and **speeds and feeds are a starting point** based on these depths.
 All recommendations are based on ideal machining conditions. Adjustments may need to be made according to your set-up.
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