

EVO[®] EM.XN01



| Solid Carbide End Mills - XN Series
| Frese in Metallo Duro Integrale - XN Series

... THE WAY TO THE FUTURE!



EVO®



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| **Frese in Metallo Duro Integrale - XN Series**



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EVO International Group Srl

Via Bernocchi, 7

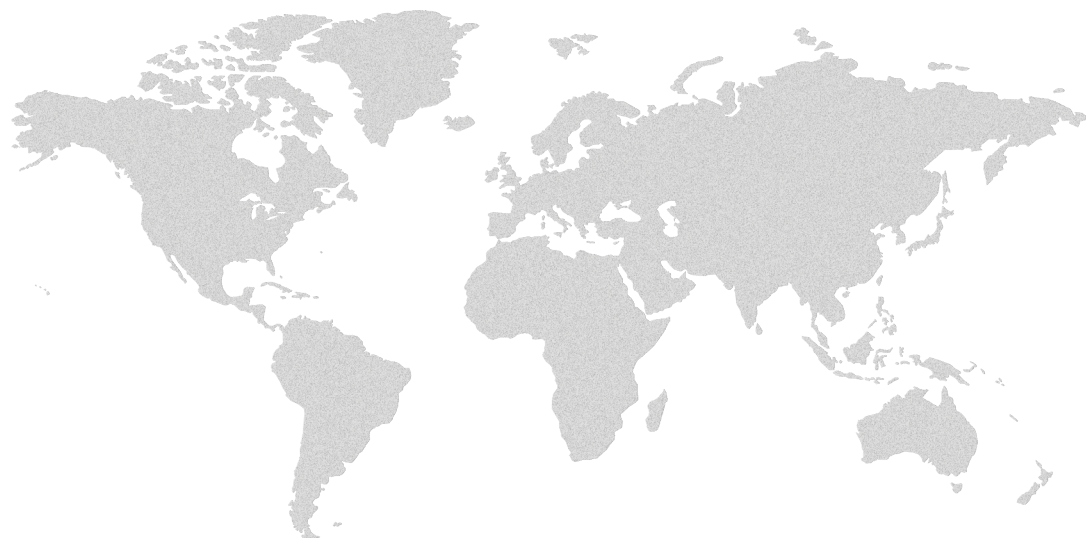
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 EVO® is a company with a wide range of products for the metalworking production with the guarantee of a high technological content and a customized service.

The experience gained through years of work in big and well-structured Companies, sales and service in the metalworking sector has led us to understand the needs of our customers and to use this knowledge to search for the most suitable and advanced solutions to optimize the production. The tests, the study of the results and the contact with producers able to offer quality and performance are the steps that characterize our work and the brand EVO® wants to be the seal that makes us recognizable on the market. Oils, high precision tools, clamping systems, circular saw blades: the products of our range are manufactured by a network of suppliers, chosen on the basis of the excellence in materials and technologies used, the certification of product and process, the stock availability. The close collaboration with external suppliers and the direct production of some product lines allow us to customize our offer.

EVO® comes from the desire to support the Companies and to keep offering tools and efficient solutions in line with their development.

EM - EVO® End Mills

The focus of EM.XN01 catalog is milling on aluminum: HPC and HSC end mill are our technical proposals to meet the needs of this type of machining.

Our cutters are studied, perfected and tested to obtain impeccable milling in competitive times, with maximum ease of use.

Our proposal is wide: we have cutters from 1 to 6 teeth, with diameters starting from 0.1 up to 20 with lengths up to 5XD.

In addition to our technology, we offer our experience and the technical support you already know.

 EVO® è un'azienda che offre prodotti per tutti i settori della lavorazione dei metalli, con la garanzia di un alto contenuto tecnologico e un servizio personalizzato.

L'esperienza maturata in anni di lavoro presso contesti strutturati e realtà di rilievo, vendita e assistenza nelle aziende metalmeccaniche, ci ha portato a interpretare le esigenze dei nostri clienti e a partire da esse per ricercare le soluzioni più idonee e all'avanguardia per ottimizzare la produzione. Prove, studio dei risultati, contatto con i produttori in grado di offrire qualità e prestazioni sono i passi che caratterizzano il nostro lavoro e il marchio EVO® vuole essere il sigillo di garanzia che ci rende riconoscibili sul mercato. Olio, utensili di precisione, sistemi di serraggio, lame circolari: i prodotti della nostra gamma provengono da un network di fornitori selezionati per eccellenza nei materiali e nelle tecnologie utilizzati, certificazioni di prodotto e di processo, disponibilità di magazzino. La stretta collaborazione con i fornitori esterni e la produzione diretta di alcune linee di prodotto ci consentono di personalizzare la nostra offerta.

EVO® nasce dalla volontà di affiancare le aziende per continuare a offrire strumenti e soluzioni efficienti, in linea con la loro evoluzione.

EM - EVO® Frese

Il catalogo EM.XN01 ha come focus la fresatura su alluminio: le frese HPC e HSC sono le nostre proposte tecniche per soddisfare le esigenze di questo tipo di lavorazioni.

Le nostre frese sono studiate, perfezionate e testate per ottenere fresature impeccabili in tempi competitivi, con la massima facilità di utilizzo.

La nostra proposta è ampia: abbiamo frese da 1 a 6 denti, con diametri a partire dallo 0,1 fino ad arrivare al 20 con lunghezze fino alla 5XD.

Oltre alla nostra tecnologia, offriamo la nostra esperienza e il supporto tecnico che conoscete.

FORM | FORMA:

- 1 - Roughing profile with internal coolant | Profilo a sgrossare con refrigerante interno
- 2 - Roughing profile | Profilo a sgrossare
- 3 - Cylindrical | Cilindrica
- 4 - Cylindrical with internal coolant | Cilindrica con refrigerante interno
- 5 - Toric | Torica
- 7 - Ball nose | Sferica
- 9 - High feed geometry | Geometria alto avanzamento

NUMBER OF TEETH | NUMERO DI DENTI:

- 1 - Z1
- 2 - Z2
- 3 - Z3
- 4 - Z4
- 5 - Z5
- 6 - Z6
- 8 - Z8
- 9 - multi

MATERIAL APPLICATION | APPLICAZIONE MATERIALE:

- 00 - Universal | Universale
- 10 - Aluminium | Alluminio
- 20 - Low-alloyed Steel (base geometry) | Acciaio debolmente legato (geometria base)
- 30 - Low-alloyed Steel | Acciaio debolmente legato
- 40 - Stainless steel | Acciaio inossidabile
- 60 - High-alloyed steel | Acciaio altolegato
- 70 - Composite material | Materiale composito
- 80 - Super alloy | Super lega
- 90 - Hardened steel | Acciaio temprato

LENGTH | LUNGHEZZA:

- 1 - Extra short | Extra corta
- 2 - Short | Corta
- 3 - Standard
- 4 - Long | Lunga
- 5 - Extra long | Extra lunga
- 6 - XXL | XXL

EM.5315.3753.080.050

TOOL TYPE | TIPOLOGIA UTENSILE:

- EC - Center drill/ Deburrer | Punta da centro/ Svasatore
- ED - Drill | Punta
- EF - Micro end mill | Micro fresa
- EL - Circular saw blade | Lama circolare
- EM - End mill | Fresa integrale
- EP - Micro drill | Micro punta
- ER - Reamer | Alesatore

BASE MATERIAL | MATERIALE BASE:

- 3 - Micrograin Hard Material | Metallo duro micrograno
- 4 - High-performance Micrograin Hard Material | Metallo duro micrograno High-performance
- 5 - Ultra-performance Hard Material | Metallo duro Ultra-performance

COATING | RIVESTIMENTO:

- 0 - Uncoated | Non rivestita
- 3 - Ti base coating | Rivestimento base Ti
- 4 - High-performance Ti base coating | Rivestimento base Ti High-performance
- 5 - Ultra-performance Ti base coating | Rivestimento base Ti Ultra-performance
- 6 - High-performance Zr base coating | Rivestimento base Zr High-performance
- 7 - High-performance C base coating | Rivestimento base C High-performance

SHANK | GAMBO:

- 3 - Cylindrical tapered | Cilindrico rastremato
- 4 - Weldon tapered | Weldon rastremato
- 5 - Cylindrical | Cilindrico
- 6 - Weldon

DIAMETER | DIAMETRO:

- 001 = 0,1 mm
- 010 = 1 mm
- 100 = 10 mm

RADIUS (only toric tool) | RAGGIO (solo utensile torico):

- 001 = 0,01 mm
- 010 = 0,1 mm
- 100 = 1 mm

EF.5908.5554.015.020

SHAPE AND NUMBER OF TEETH | FORMA E NUMERO DI DENTI:

- 3 - Cylindrical Z2 | Cilindrica Z2
- 4 - Cylindrical Z4 | Cilindrica Z4
- 5 - Toric Z2 | Torica Z2
- 7 - Ball nose Z2 | Sferica Z2

MATERIAL APPLICATION | APPLICAZIONE MATERIALE:

- 1 - Aluminium | Alluminio
- 6 - High-alloyed steel | Acciaio altolegato
- 9 - Hardened steel | Acciaio temprato

LENGTH | LUNGHEZZA:

- 02 = 2xD
- 03 = 3xD
- 04 = 4xD
- 05 = 5xD
-

SHANK DIAMETER | DIAMETRO GAMBO:

- 3 - ø 3
- 4 - ø 4
- 6 - ø 6

Cylindrical | Cilindriche



EM 3115		$\emptyset$ 1 - 12		HPC	90°	1xD		30°							N	9
EM 3115XL		$\emptyset$ 1 - 12		HPC	90°	1xD		30°							N	11
EM 3215		$\emptyset$ 4 - 20		HPC	90°	1xD		38°							N	13
EM 3270		$\emptyset$ 1 - 20		CM	90°	1xD		20°							N	15
EM 3315		$\emptyset$ 3 - 20		HPC	45°	1xD		43° 45°							N	17
EM 3315L		$\emptyset$ 5 - 20		HPC	45°	1xD		43° 45°							N	19
EM 3315XL		$\emptyset$ 3 - 20		HPC	45°	1xD		43° 45°							N	21
EM 4315		$\emptyset$ 5 - 20			45°	1xD		43° 45°							N	23
EM 4315XL		$\emptyset$ 5 - 20			45°	1xD		43° 45°							N	25
EM 3415		$\emptyset$ 4 - 20		HPC	90°	1xD		38° 42°							N	27
EM 3415L		$\emptyset$ 5 - 20		HPC	R			38° 42°							N	29
EM 3415XL		$\emptyset$ 5 - 20		HPC	R			38° 42°							N	31
EM 3415XXL		$\emptyset$ 5 - 20		HPC	R			38° 42°							N	33

Roughing Profile | Rompitrucciolo

EM 2315		$\emptyset$ 4 - 20		NR	R	2xD		43° 45°							N	35
EM 2315L		$\emptyset$ 4 - 20		NR	R	2xD		43° 45°							N	37



EM 1315		$\emptyset$ 4 - 20		NR		2xD		43° 45°							N	39
EM 1315L		$\emptyset$ 4 - 20		NR		2xD		43° 45°							N	41

Finishing | Finitura

EM 3915L		$\emptyset$ 6 - 20			90°			38° 42°							N	43
EM 3915XL		$\emptyset$ 6 - 20			90°			38° 42°							N	45
EM 3915XXL		$\emptyset$ 6 - 20			90°			38° 42°							N	47

Toric | Toriche

EM 5315		$\emptyset$ 5 - 20		HPC	R		1xD		38° 42°						N	49
EM 5315XL		$\emptyset$ 5 - 20		HPC	R		1xD		38° 42°						N	51

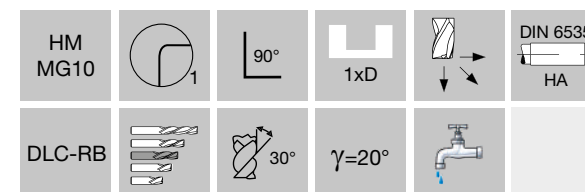
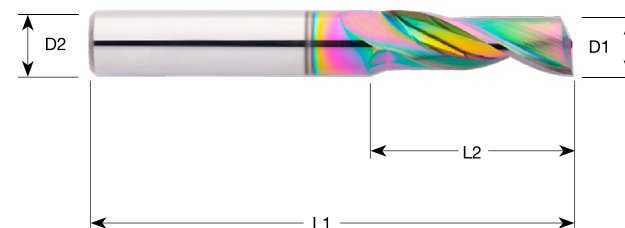
Ball Nose | Sferiche

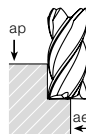
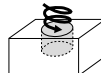
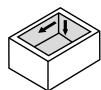
EM 7215		$\emptyset$ 0,5 - 12		HSC	U			45°							N	53
EM 7215XL		$\emptyset$ 0,5 - 12		HSC	U			45°							N	55

mat.	ø mm	Z	Vt m/min	fz mm	ap mm	ae mm	n rpm	Vf mm/min	Q cm³/min
N 1.1	1	1	500	0,008	1	1	60000*	480	0,5
Aluminium wrought alloys Leghe malleabili di Alluminio	2	1	500	0,010	2	2	60000*	600	2,4
	3	1	500	0,015	3	3	53079	796	7,2
	4	1	500	0,020	4	4	39809	796	12,7
	5	1	500	0,025	5	5	31847	796	19,9
	6	1	500	0,030	6	6	26539	796	28,7
	8	1	500	0,035	8	8	19904	697	44,6
	10	1	500	0,040	10	10	15924	637	63,7
	12	1	500	0,050	12	12	13270	663	95,5
N 1.4	1	1	350	0,010	1	1	60000*	600	0,6
Aluminium cast alloys Leghe fuse di Alluminio	2	1	350	0,015	2	2	55732	836	3,3
	3	1	350	0,020	3	3	37155	743	6,7
	4	1	350	0,025	4	4	27866	697	11,1
	5	1	350	0,030	5	5	22293	669	16,7
	6	1	350	0,035	6	6	18577	650	23,4
	8	1	350	0,040	8	8	13933	557	35,7
	10	1	350	0,050	10	10	11146	557	55,7
6% -12% Si	12	1	350	0,060	12	12	9289	557	80,3
N 1.5	1	1	250	0,010	1	1	60000*	600	0,6
Aluminium cast alloys Leghe fuse di Alluminio	2	1	250	0,015	2	2	39809	597	2,4
	3	1	250	0,020	3	3	26539	531	4,8
	4	1	250	0,025	4	4	19904	498	8,0
	5	1	250	0,030	5	5	15924	478	11,9
	6	1	250	0,035	6	6	13270	464	16,7
	8	1	250	0,040	8	8	9952	398	25,5
	10	1	250	0,050	10	10	7962	398	39,8
> 12% Si	12	1	250	0,060	12	12	6635	398	57,3
N 2.1	1	1	180	0,005	1	1	57325	287	0,3
Copper Rame	2	1	180	0,008	2	2	28662	229	0,9
	3	1	180	0,010	3	3	19108	191	1,7
	4	1	180	0,015	4	4	14331	215	3,4
	5	1	180	0,020	5	5	11465	229	5,7
	6	1	180	0,025	6	6	9554	239	8,6
	8	1	180	0,030	8	8	7166	215	13,8
	10	1	180	0,035	10	10	5732	201	20,1
	12	1	180	0,040	12	12	4777	191	27,5
N 2.2	1	1	240	0,010	1	1	60000*	600	0,6
Brass Ottone	2	1	240	0,015	2	2	38217	573	2,3
	3	1	240	0,020	3	3	25478	510	4,6
	4	1	240	0,025	4	4	19108	478	7,6
	5	1	240	0,030	5	5	15287	459	11,5
	6	1	240	0,035	6	6	12739	446	16,1
	8	1	240	0,040	8	8	9554	382	24,5
	10	1	240	0,050	10	10	7643	382	38,2
	12	1	240	0,060	12	12	6369	382	55,0
N 2.3	1	1	150	0,005	1	1	47771	239	0,2
Bronze Bronzo	2	1	150	0,008	2	2	23885	191	0,8
	3	1	150	0,010	3	3	15924	159	1,4
	4	1	150	0,015	4	4	11943	179	2,9
	5	1	150	0,020	5	5	9554	191	4,8
	6	1	150	0,025	6	6	7962	199	7,2
	8	1	150	0,030	8	8	5971	179	11,5
	10	1	150	0,035	10	10	4777	167	16,7
	12	1	150	0,040	12	12	3981	159	22,9
N 4.2	1	1	350	0,008	1	1	60000*	480	0,5
Synthetics Materie Plastiche	2	1	350	0,010	2	2	55732	557	2,2
	3	1	350	0,015	3	3	37155	557	5,0
	4	1	350	0,020	4	4	27866	557	8,9
	5	1	350	0,025	5	5	22293	557	13,9
	6	1	350	0,030	6	6	18577	557	20,1
	8	1	350	0,035	8	8	13933	488	31,2
	10	1	350	0,040	10	10	11146	446	44,6
POM / PVC	12	1	350	0,050	12	12	9289	464	66,9

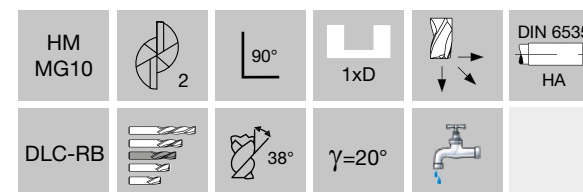
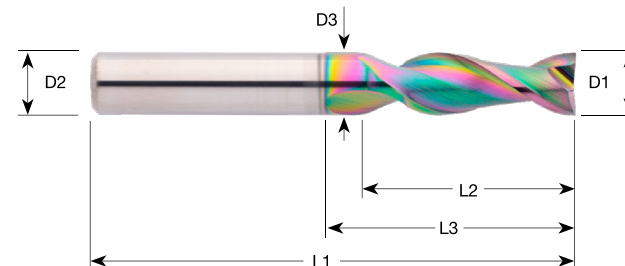
$ae \leq 0,3xd$		$Vt(c) = Vt + 10\%$	$fz(c) = fz + 20\%$
$ae \leq 0,3xd$	$ap = 1,5xd$	$Vt(c) = Vt$	$fz(c) = fz$

* rpm limit recommended
limitazione di giri consigliata

[illegible]



$ae \leq 0,4xd$		$Vt(c) = Vt + 20\%$	$fz(c) = fz + 10\%$
$ae \leq 0,4xd$	$ap = 1,5xd$	$Vt(c) = Vt$	$fz(c) = fz$

[illegible]

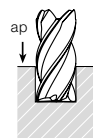
N 1.1

N 1.4
5-12% Si

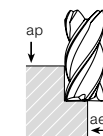
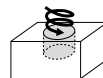
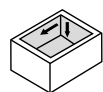
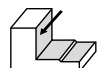
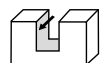
N 1.5
> 12% Si

N 2.1
Cu

N 4.2
POM / PVC

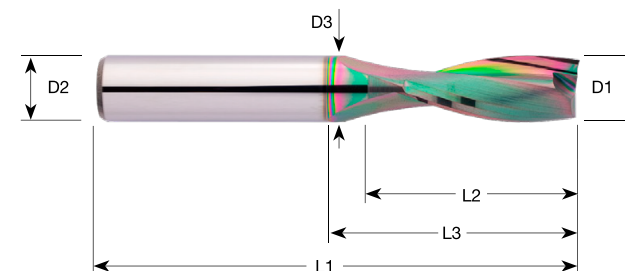


mat.	ø mm	Z	Vt m/min	fz mm	ap mm	ae mm	n rpm	Vf mm/min	Q cm³/min
N 4.2 Synthetics Materie Plastiche	1	2	450	0,004	1	1	60000*	480	0,5
	2	2	450	0,006	2	2	60000*	720	2,9
	4	2	450	0,010	4	4	35828	717	11,5
	6	2	450	0,020	6	6	23885	955	34,4
	8	2	450	0,025	8	8	17914	896	57,3
	10	2	450	0,030	10	10	14331	860	86,0
POM / PVC	12	2	450	0,040	12	12	11943	955	137,6
	16	2	450	0,050	12	12	8957	896	129,0
	20	2	450	0,060	12	12	7166	860	123,8
Duroplastic	1	1	400	0,003	1	1	60000*	360	0,4
	2	1	400	0,006	2	2	60000*	720	2,9
	4	1	400	0,010	4	4	31847	637	10,2
	6	1	400	0,020	6	6	21231	849	30,6
	8	1	400	0,025	8	8	15924	796	51,0
	10	1	400	0,030	10	10	12739	764	76,4
	12	1	400	0,035	12	12	10616	743	107,0
	16	1	400	0,045	12	12	7962	717	103,2
	20	1	400	0,050	12	12	6369	637	91,7



$ae \leq 0,3xd$	$Vt(c) = Vt + 10\%$	$fz(c) = fz + 20\%$
$ae \leq 0,3xd$ $ap = 2xd$	$Vt(c) = Vt$	$fz(c) = fz$

* rpm limit recommended
limitazione di giri consigliata



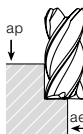
HM MG10		90°	1xD		DIN 6535 HA
DLC-RB		20°	$\gamma=22^\circ$		

N 4.1

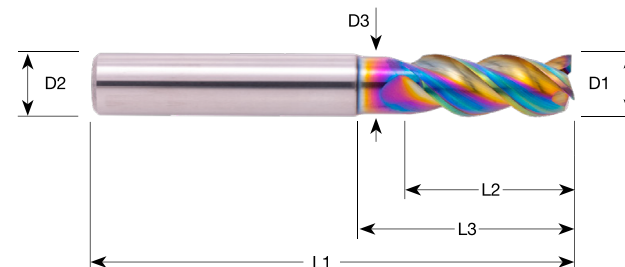
N 4.2
POM / PVC

Duroplastic

art.	D1 e8 mm	D2 h6 mm	D3 mm	L1 mm	L2 mm	L3 mm	Z
EM . 3270 . VK3753 . 010	1	3	0,9	50	5	8	2
EM . 3270 . VK3753 . 020	2	3	1,85	50	8	11	2
EM . 3270 . VK3753 . 030	3	3	2,8	50	11	14	2
EM . 3270 . VK3753 . 040	4	4	3,8	54	13	16	2
EM . 3270 . VK3753 . 050	5	5	4,8	54	15	18	2
EM . 3270 . VK3753 . 060	6	6	5,8	65	16	21	2
EM . 3270 . VK3753 . 080	8	8	7,8	70	22	27	2
EM . 3270 . VK3753 . 100	10	10	9,8	73	25	32	2
EM . 3370 . VK3753 . 120	12	12	11,8	84	28	38	3
EM . 3370 . VK3753 . 140	14	14	13,8	84	30	42	3
EM . 3370 . VK3753 . 160	16	16	15,8	93	36	44	3
EM . 3370 . VK3753 . 200	20	20	19,8	104	41	54	3

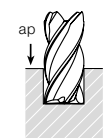


$ae \leq 0,3xd$		$Vt(c) = Vt + 10\%$	$fz(c) = fz + 20\%$
$ae \leq 0,3xd$	$ap = 2xd$	$Vt(c) = Vt$	$fz(c) = fz$

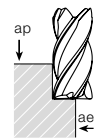


HM MG10					DIN 6533 HA
DLC-RB			$\gamma=20^\circ$		

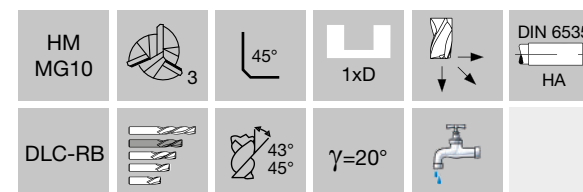
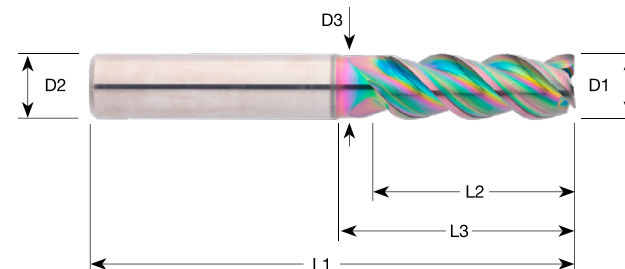
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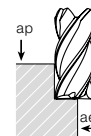
mat.	ø mm	Z	Vt m/min	fz mm	ap mm	ae mm	n rpm	Vf mm/min	Q cm³/min
N 1.1	5	3	400	0,030	5	5	25478	2293	57,3
Aluminium wrought alloys Leghe malleabili di Alluminio	6	3	400	0,040	6	6	21231	2548	91,7
	8	3	400	0,055	8	8	15924	2627	168,2
	10	3	400	0,060	10	10	12739	2293	229,3
	12	3	400	0,070	12	12	10616	2229	321,0
	16	3	400	0,080	12	16	7962	1911	366,9
	20	3	400	0,090	10	20	6369	1720	343,9
N 1.4	5	3	280	0,030	5	5	17834	1605	40,1
Aluminium cast alloys Leghe fuse di Alluminio	6	3	280	0,040	6	6	14862	1783	64,2
	8	3	280	0,055	8	8	11146	1839	117,7
	10	3	280	0,060	10	10	8917	1605	160,5
	12	3	280	0,070	12	12	7431	1561	224,7
	16	3	280	0,080	12	16	5573	1338	256,8
	20	3	280	0,090	10	20	4459	1204	240,8
6% -12% Si									
N 1.5	5	3	200	0,030	5	5	12739	1146	28,7
Aluminium cast alloys Leghe fuse di Alluminio	6	3	200	0,040	6	6	10616	1274	45,9
	8	3	200	0,055	8	8	7962	1314	84,1
	10	3	200	0,060	10	10	6369	1146	114,6
	12	3	200	0,070	12	12	5308	1115	160,5
	16	3	200	0,080	12	16	3981	955	183,4
	20	3	200	0,090	10	20	3185	860	172,0
> 12% Si									
N 2.1	5	3	150	0,020	5	5	9554	573	14,3
Copper Rame	6	3	150	0,025	6	6	7962	597	21,5
	8	3	150	0,030	8	8	5971	537	34,4
	10	3	150	0,040	10	10	4777	573	57,3
	12	3	150	0,050	12	12	3981	597	86,0
	16	3	150	0,060	12	16	2986	537	103,2
	20	3	150	0,070	10	20	2389	502	100,3
N 2.2	5	3	200	0,030	5	5	12739	1146	28,7
Brass Ottone	6	3	200	0,040	6	6	10616	1274	45,9
	8	3	200	0,055	8	8	7962	1314	84,1
	10	3	200	0,060	10	10	6369	1146	114,6
	12	3	200	0,070	12	12	5308	1115	160,5
	16	3	200	0,080	12	16	3981	955	183,4
	20	3	200	0,090	10	20	3185	860	172,0
N 2.3	5	3	120	0,020	5	5	7643	459	11,5
Bronze Bronzo	6	3	120	0,025	6	6	6369	478	17,2
	8	3	120	0,030	8	8	4777	430	27,5
	10	3	120	0,040	10	10	3822	459	45,9
	12	3	120	0,050	12	12	3185	478	68,8
	16	3	120	0,060	12	16	2389	430	82,5
	20	3	120	0,070	10	20	1911	401	80,3
N 4.2	5	3	280	0,030	5	5	17834	1605	40,1
Synthetics Materie Plastiche	6	3	280	0,040	6	6	14862	1783	64,2
	8	3	280	0,055	8	8	11146	1839	117,7
	10	3	280	0,060	10	10	8917	1605	160,5
	12	3	280	0,070	12	12	7431	1561	224,7
	16	3	280	0,080	12	16	5573	1338	256,8
	20	3	280	0,090	10	20	4459	1204	240,8
POM / PVC									



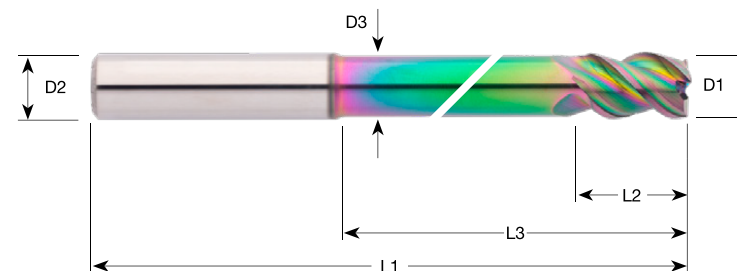
Cylindrical | Cilindrice

[illegible]

A diagram showing a U-shaped channel. Inside the channel, there is a shaded L-shaped block. An arrow points downwards from the top horizontal surface of the L-shaped block, indicating a downward force.



$ae \leq 0,3xd$	$V_t(c) = V_t + 10\%$	$f_z(c) = f_z + 20\%$
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HM MG10					DIN 6533 HA
DLC-RB			$\gamma=20^\circ$		

N 1.1

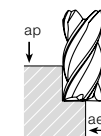
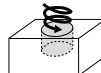
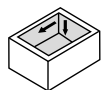
N 1.4
5-12% Si

N 1.5
> 12% Si

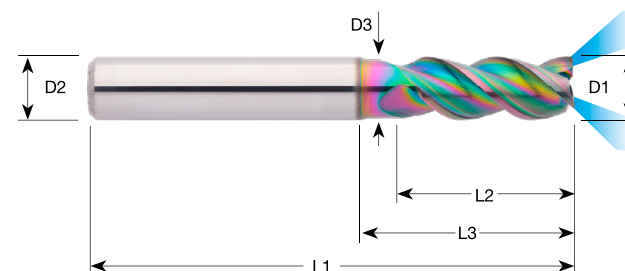
N 2.1
Cu

N 4.2
POM / PVC

[illegible]



$ae \leq 0,3xd$		$Vt(c) = Vt + 10\%$	$fz(c) = fz + 20\%$
$ae \leq 0,3xd$	$ap = 2xd$	$Vt(c) = Vt$	$fz(c) = fz$



HM MG10					DIN 6533 HA
DLC-RB			$\gamma = 20^\circ$		

[illegible]

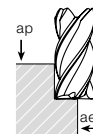
N 1.1

N 1.4
5-12% Si

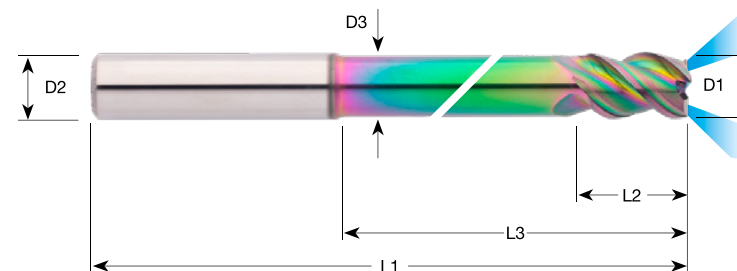
N 1.5
> 12% Si

N 2.1
Cu

N 4.2
POM / PVC



$ae \leq 0,3xd$	$V_t(c) = V_t + 10\%$	$f_z(c) = f_z + 20\%$
-----------------	-----------------------	-----------------------



HM MG10					DIN 6533 HA
DLC-RB			$\gamma = 20^\circ$		

[illegible]

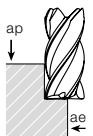
N 1.1

N 1.4
5-12% Si

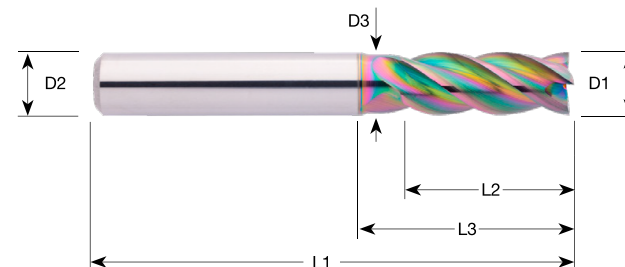
N 1.5
> 12% Si

N 2.1
Cu

N 4.2
POM / PVC



$ae \leq 0,3xd$		$Vt(c) = Vt + 10\%$	$fz(c) = fz + 20\%$
$ae \leq 0,3xd$	$ap = 2xd$	$Vt(c) = Vt$	$fz(c) = fz$



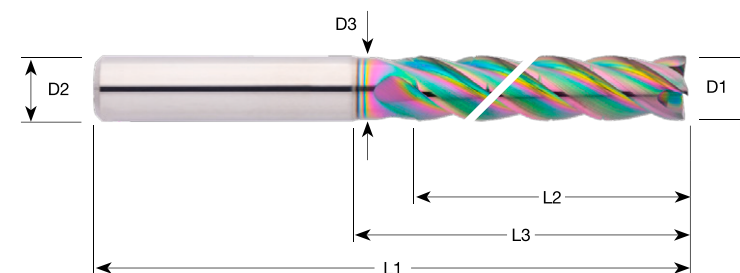
HM MG10					DIN 6533 HA
DLC-RB			$\gamma = 20^\circ$		

[illegible]

HM MG10					DIN 6533 HA $\phi \leq 8$
DLC-RB			$\gamma = 20^\circ$		DIN 6533 HB $\phi > 10$

N 1.1
N 1.4 5-12% Si
N 1.5 > 12% Si
N 2.1 Cu

HPC **EM 3415XL**



HM MG10					DIN 653 HA $\phi \leq 8$
DLC-RB			$\gamma = 20^\circ$		DIN 653 HB $\phi > 10$

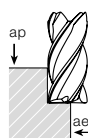
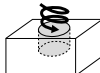
[illegible]

A 3D model of a drill bit is shown with the following labeled parameters:

- $D2$: Diameter of the cylindrical shank.
- $D3$: Diameter of the drill bit.
- $D1$: Diameter of the drill bit at the cutting edge.
- $L1$: Total length of the drill bit.
- $L2$: Length of the cutting edge.
- $L3$: Length of the cutting edge.

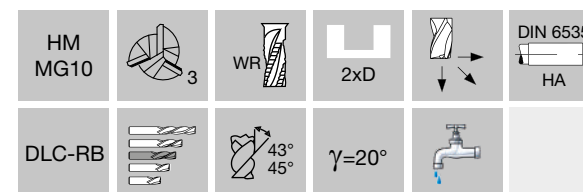
HM MG10					DIN 653 HA $\phi \leq 8$
DLC-RB			$\gamma = 20^\circ$		DIN 653 HB $\phi > 10$

EM . 3415 . VK3756 . 050	5	6	4,5	75	26	36	0,15	4
EM . 3415 . VK3756 . 060	6	6	5,5	75	31	36	0,15	4
EM . 3415 . VK3756 . 080	8	8	7,5	90	41	48	0,20	4
EM . 3415 . VK3756 . 100	10	10	9,4	104	51	60	0,20	4
EM . 3415 . VK3756 . 120	12	12	11,4	120	61	72	0,20	4
EM . 3415 . VK3756 . 160	16	16	15,4	150	81	96	0,30	4
EM . 3415 . VK3756 . 200	20	20	19,4	175	102	120	0,30	4



$ae \leq 0,6xd$	$V_t(c) = V_t + 10\%$	$f_z(c) = f_z + 20\%$
-----------------	-----------------------	-----------------------

A schematic diagram of a drill bit. The diagram shows a cylindrical shaft of diameter $D2$ and length $L1$. The shaft transitions into a drill bit of diameter $D1$. The drill bit has a cutting edge with a radius R . The length of the drill bit is $L2$, and the length of the cutting edge is $L3$.

HPC EM 2315

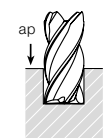
N 1.1

N 1.4
5-12% Si

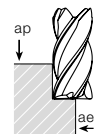
N 1.5
> 12% Si

N 2.1
Cu

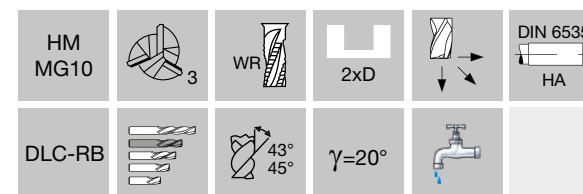
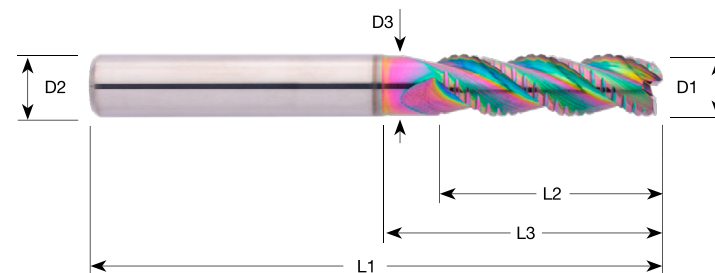
N 4.2
POM / PVC

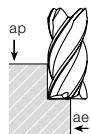
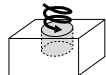
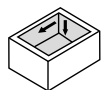


mat.	ø mm	Z	Vt m/min	fz mm	ap mm	ae mm	n rpm	Vf mm/min	Q cm³/min
N 1.1	4	3	360	0,020	6	4	28662	1720	41,3
Aluminium wrought alloys Leghe malleabili di Alluminio	5	3	360	0,025	7,5	5	22930	1720	64,5
	6	3	360	0,030	9	6	19108	1720	92,9
	8	3	360	0,035	12	8	14331	1505	144,5
	10	3	360	0,040	15	10	11465	1376	206,4
	12	3	360	0,050	18	12	9554	1433	309,6
	16	3	360	0,060	10	16	7166	1290	206,4
	20	3	360	0,080	12	20	5732	1376	330,2
N 1.4	4	3	250	0,020	6	4	19904	1194	28,7
Aluminium cast alloys Leghe fuse di Alluminio	5	3	250	0,025	7,5	5	15924	1194	44,8
	6	3	250	0,030	9	6	13270	1194	64,5
	8	3	250	0,035	12	8	9952	1045	100,3
	10	3	250	0,040	15	10	7962	955	143,3
	12	3	250	0,050	18	12	6635	995	215,0
	16	3	250	0,060	10	16	4976	896	143,3
	20	3	250	0,080	12	20	3981	955	229,3
6% -12% Si									
N 1.5	4	3	180	0,020	6	4	14331	860	20,6
Aluminium cast alloys Leghe fuse di Alluminio	5	3	180	0,025	7,5	5	11465	860	32,2
	6	3	180	0,030	9	6	9554	860	46,4
	8	3	180	0,035	12	8	7166	752	72,2
	10	3	180	0,040	15	10	5732	688	103,2
	12	3	180	0,050	18	12	4777	717	154,8
	16	3	180	0,060	10	16	3583	645	103,2
	20	3	180	0,080	12	20	2866	688	165,1
> 12% Si									
N 2.1	4	3	120	0,010	6	4	9554	287	6,9
Copper Rame	5	3	120	0,015	7,5	5	7643	344	12,9
	6	3	120	0,020	9	6	6369	382	20,6
	8	3	120	0,025	12	8	4777	358	34,4
	10	3	120	0,030	15	10	3822	344	51,6
	12	3	120	0,040	18	12	3185	382	82,5
	16	3	120	0,050	10	16	2389	358	57,3
	20	3	120	0,060	12	20	1911	344	82,5
N 2.2	4	3	180	0,020	6	4	14331	860	20,6
Brass Ottone	5	3	180	0,025	7,5	5	11465	860	32,2
	6	3	180	0,030	9	6	9554	860	46,4
	8	3	180	0,035	12	8	7166	752	72,2
	10	3	180	0,040	15	10	5732	688	103,2
	12	3	180	0,050	18	12	4777	717	154,8
	16	3	180	0,060	10	16	3583	645	103,2
	20	3	180	0,080	12	20	2866	688	165,1
N 2.3	4	3	110	0,010	6	4	8758	263	6,3
Bronze Bronzo	5	3	110	0,015	7,5	5	7006	315	11,8
	6	3	110	0,020	9	6	5839	350	18,9
	8	3	110	0,025	12	8	4379	328	31,5
	10	3	110	0,030	15	10	3503	315	47,3
	12	3	110	0,040	18	12	2919	350	75,7
	16	3	110	0,050	10	16	2189	328	52,5
	20	3	110	0,060	12	20	1752	315	75,7
N 2.5	4	3	250	0,020	6	4	19904	1194	28,7
Ampco	5	3	250	0,025	7,5	5	15924	1194	44,8
	6	3	250	0,030	9	6	13270	1194	64,5
	8	3	250	0,035	12	8	9952	1045	100,3
	10	3	250	0,040	15	10	7962	955	143,3
	12	3	250	0,050	18	12	6635	955	215,0
	16	3	250	0,060	10	16	4976	896	143,3
	20	3	250	0,080	12	20	3981	955	229,3

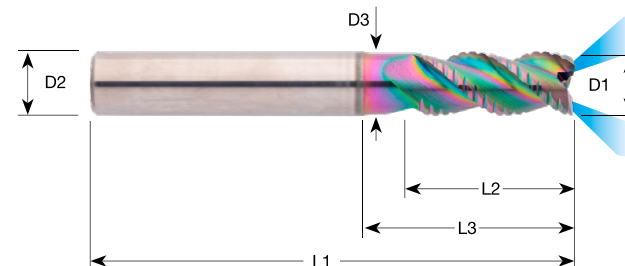


Cylindrical | Cilindrice

[illegible]



$ae \leq 0,6xd$	$V_t(c) = V_t + 10\%$	$f_z(c) = f_z + 20\%$
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HM MG10		WR 	 2xD		DIN 653 HA
DLC-RB		 43° 45°	$\gamma=20^\circ$		

[illegible]

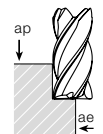
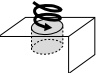
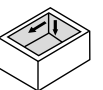
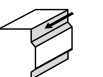
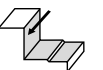
N 1.1

N 1.4
5-12% Si

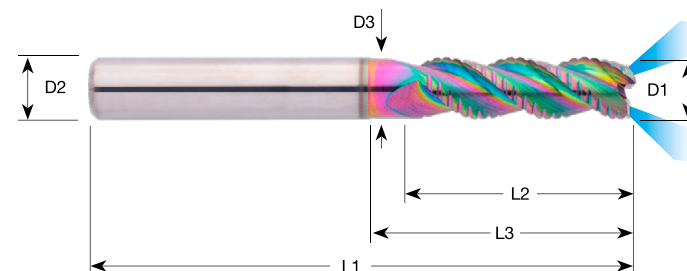
N 1.5
> 12% Si

N 2.1
Cu

N 4.2
POM / PVC



$ae \leq 0,6xd$		$Vt(c) = Vt + 10\%$	$fz(c) = fz + 20\%$
$ae \leq 0,3xd$	$ap = 3xd$	$Vt(c) = Vt$	$fz(c) = fz + 10\%$



HM MG10		WR 	 2xD		DIN 653  HA
DLC-RB		 43° 45°	$\gamma=20^\circ$		

[illegible]

HM MG10					DIN 6533 HA
DLC-RB			$\gamma=20^\circ$		

N 4.2
POM / PVC

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The diagrams show the progression of a box being formed from a flat sheet. The first diagram shows a sheet with one end folded back. The second diagram shows the sheet folded further, with arrows indicating the direction of movement. The third diagram shows the sheet fully folded into a box shape, with arrows indicating the final assembly steps.

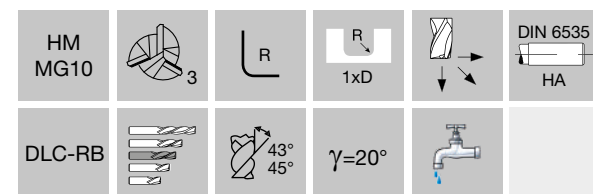
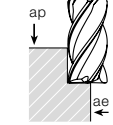
A schematic diagram of a drill bit with the following labeled parameters:

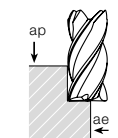
- $D3$: Diameter of the drill bit.
- $D2$: Diameter of the drill bit.
- $D1$: Diameter of the drill bit.
- $L2$: Length of the drill bit.
- $L3$: Length of the drill bit.
- $L1$: Length of the drill bit.

N 4.2
POM / PVC

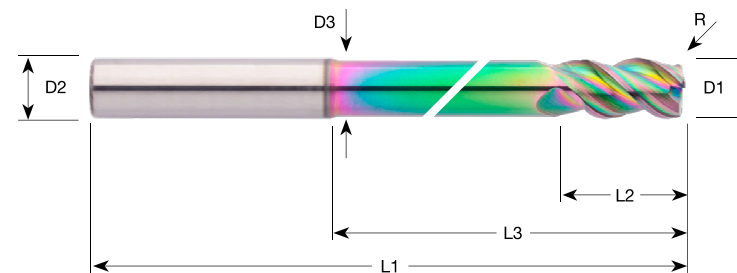
HM MG10					DIN 6533 HA
DLC-RB			$\gamma=20^\circ$		

[illegible]

HPC EM 5315



$ae \leq 0,4xd$		$Vt(c) = Vt + 10\%$	$fz(c) = fz + 20\%$
$ae \leq 0,3xd$	$ap = 0,3xd$	$Vt(c) = Vt$	$fz(c) = fz + 20\%$



N 1.1

N 1.4
5-12% Si

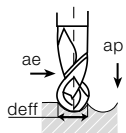
N 1.5
> 12% Si

N 2.1
Cu

N 4.2
POM / PV

HM MG10					DIN 6533 HA
DLC-RB			$\gamma = 20^\circ$		

[illegible]



mat.	ø mm	Z	Vt m/min	fz mm	ap mm	ae mm	deff mm	n rpm	Vf mm/min	β
N 1.4	0,5	2	600	0,010	0,02	0,02	0,49	60000*	1200	45
Aluminium cast alloys Leghe fuse di Alluminio	1	2	600	0,015	0,05	0,05	0,99	60000*	1800	45
	2	2	600	0,020	0,10	0,10	1,99	60000*	2400	45
	3	2	600	0,030	0,15	0,15	2,98	60000*	3600	45
	4	2	600	0,040	0,20	0,20	3,98	48021	3842	45
	6	2	600	0,050	0,30	0,30	5,97	32014	3201	45
	8	2	600	0,060	0,40	0,40	7,96	24010	2881	45
	10	2	600	0,080	0,50	0,50	9,95	19208	3073	45
6% -12% Si	12	2	600	0,100	0,60	0,60	11,94	16007	3201	45
N 1.5	0,5	2	350	0,010	0,02	0,02	0,49	60000*	1200	45
Aluminium cast alloys Leghe fuse di Alluminio	1	2	350	0,015	0,05	0,05	0,99	60000*	1800	45
	2	2	350	0,020	0,10	0,10	1,99	56024	2241	45
	3	2	350	0,030	0,15	0,15	2,98	37349	2241	45
	4	2	350	0,040	0,20	0,20	3,98	28012	2241	45
	6	2	350	0,050	0,30	0,30	5,97	18675	1867	45
	8	2	350	0,060	0,40	0,40	7,96	14006	1681	45
	10	2	350	0,080	0,50	0,50	9,95	11205	1793	45
> 12% Si	12	2	350	0,100	0,60	0,60	11,94	9337	1867	45
N 2.1	0,5	2	280	0,008	0,02	0,02	0,49	60000*	960	45
Copper Rame	1	2	280	0,012	0,05	0,05	0,99	60000*	1440	45
	2	2	280	0,020	0,10	0,10	1,99	44819	1793	45
	3	2	280	0,025	0,15	0,15	2,98	29879	1494	45
	4	2	280	0,030	0,20	0,20	3,98	22410	1345	45
	6	2	280	0,040	0,30	0,30	5,97	14940	1195	45
	8	2	280	0,050	0,40	0,40	7,96	11205	1120	45
	10	2	280	0,060	0,50	0,50	9,95	8964	1076	45
12	2	280	0,080	0,60	0,60	11,94	7470	1195	45	
N 2.3	0,5	2	180	0,008	0,02	0,02	0,49	60000*	960	45
Bronze Bronzo	1	2	180	0,012	0,05	0,05	0,99	57625	1383	45
	2	2	180	0,020	0,10	0,10	1,99	28812	1152	45
	3	2	180	0,025	0,15	0,15	2,98	19208	960	45
	4	2	180	0,030	0,20	0,20	3,98	14406	864	45
	6	2	180	0,040	0,30	0,30	5,97	9604	768	45
	8	2	180	0,050	0,40	0,40	7,96	7203	720	45
	10	2	180	0,060	0,50	0,50	9,95	5762	691	45
12	2	180	0,080	0,60	0,60	11,94	4802	768	45	
N 2.5	0,5	2	70	0,006	0,02	0,02	0,49	45095	541	45
Ampco	1	2	70	0,008	0,05	0,05	0,99	22410	359	45
	2	2	70	0,010	0,10	0,10	1,99	11205	224	45
	3	2	70	0,015	0,15	0,15	2,98	7470	224	45
	4	2	70	0,020	0,20	0,20	3,98	5602	224	45
	6	2	70	0,030	0,30	0,30	5,97	3735	224	45
	8	2	70	0,040	0,40	0,40	7,96	2801	224	45
	10	2	70	0,050	0,50	0,50	9,95	2241	224	45
12	2	70	0,060	0,60	0,60	11,94	1867	224	45	
N 3.1	0,5	2	350	0,010	0,02	0,02	0,49	60000*	1200	45
Magnesium wrought alloys Leghe malleabili di Magnesio	1	2	350	0,015	0,05	0,05	0,99	60000*	1800	45
	2	2	350	0,020	0,10	0,10	1,99	56024	2241	45
	3	2	350	0,030	0,15	0,15	2,98	37349	2241	45
	4	2	350	0,040	0,20	0,20	3,98	28012	2241	45
	6	2	350	0,050	0,30	0,30	5,97	18675	1867	45
	8	2	350	0,060	0,40	0,40	7,96	14006	1681	45
	10	2	350	0,080	0,50	0,50	9,95	11205	1793	45
12	2	350	0,100	0,60	0,60	11,94	9337	1867	45	
N 4.2	0,5	2	450	0,006	0,02	0,02	0,49	60000*	720	45
Synthetics Materie plastiche	1	2	450	0,008	0,05	0,05	0,99	60000*	960	45
	2	2	450	0,010	0,10	0,10	1,99	60000*	1200	45
	3	2	450	0,015	0,15	0,15	2,98	48021	1441	45
	4	2	450	0,020	0,20	0,20	3,98	36015	1441	45
	6	2	450	0,030	0,30	0,30	5,97	24010	1441	45
	8	2	450	0,040	0,40	0,40	7,96	18008	1441	45
	10	2	450	0,050	0,50	0,50	9,95	14406	1441	45
POM / PVC	12	2	450	0,060	0,60	0,60	11,94	12005	1441	45

For flat machining Per lavorazioni in piano	$deff = 2 \times \sqrt{D1 \times ap - ap^2}$
--	--

* rpm limit recommended
limitazione di giri consigliata

Ball Nose | Sferiche

HSC EM 7215



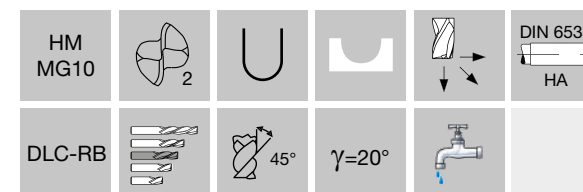
N 1.1

N 1.4
5-12% Si

N 1.5
> 12% Si

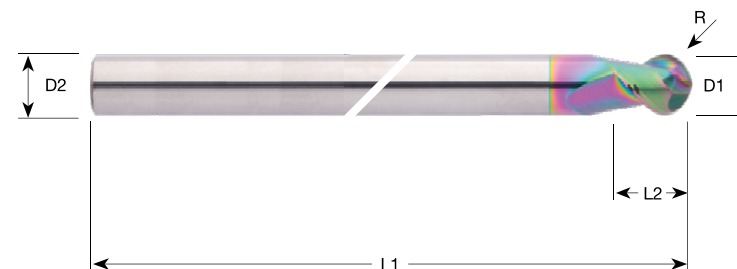
N 2.1
Cu

N 4.2
POM / PVC

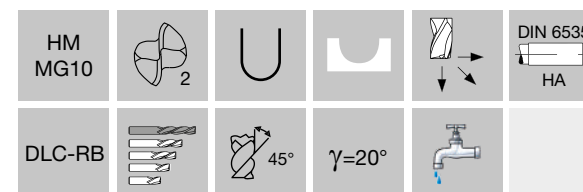
[illegible]

* rpm limit recommended
limitazione di giri consigliata

HSC EM 7215XL



N 4.2
POM / PVC

[illegible]

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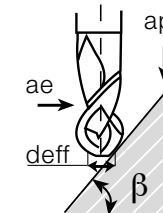
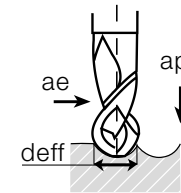
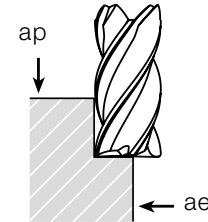
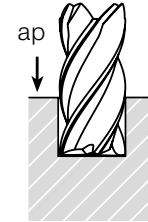
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| Materials list
| Lista dei materiali 58





D1	Tool diameter (mm)	Diametro dell'utensile (mm)
D2	Shank diameter (mm)	Diametro del gambo (mm)
D3	Tapering diameter (mm)	Diametro di rastrematura (mm)
L1	Total length (mm)	Lunghezza totale (mm)
L2	Cutter length (mm)	Lunghezza tagliente (mm)
L3	Tapering length (mm)	Lunghezza di rastrematura (mm)
Z	Teeth number	Numero di taglienti
R	Corner radius (mm)	Raggio dello spigolo (mm)
a	Collision angle (°)	Angolo di collisione (°)
fz	Feed per tooth (mm)	Avanzamento dente (mm)
Vt	Cutting speed (m/min)	Velocità di taglio (m/min)
n	Revolution per minute (rpm)	Numero di giri (g/min)
Vf	Feed rate (mm/min)	Velocità di avanzamento (mm/min)
ap	Axial depth (mm)	Profondità assiale (mm)
ae	Radial depth (mm)	Profondità radiale (mm)
b	Machining angle for spherical end mills	Angolo di lavorazione per frese sferiche
deff	Effective diameter for spherical end mills (mm)	Diametro effettivo delle frese sferiche (mm)
Q	Chip volume (cm³/min)	Volume truciolo (cm³/min)
Rm	Tensile strenght totensile stress (N/mm²)	Carico di rottura alla trazione (N/mm²)
HRC	Rockwell C hardness	Durezza Rockwell C
HB	Brinell hardness	Durezza Brinell



$$Q = ap \times ae \times Vf$$

$$n = Vt \times 1000 / D1 / \pi$$

$$Vt = (D1 \times \pi \times n) / 1000$$

$$Vf = fz \times z \times n$$

$$deff = 2 \times \sqrt{D1 \times ap - ap^2}$$

$$deff = D1 \times \sin \{ \beta + \arccos [(D1 - 2 \times ap) / D1] \}$$

EVO code	Rm N/mm ²	A5 %	HRC	HB	Mat. - Nr.	 DIN	 AFNOR	 BS	EN	 UNI	 UNE	 JIS	 SIS	 AISI/SAE/ASTM
N	Aluminum unalloyed Alluminio non legato													
1.1	65-150	<40			3.0225	Al99.5	A5	1B	-	4507	L-3051	A1x1	-	-
	40-100	<33			3.0305	Al99.9	A9	-	-	-	-	-	-	-
N	Aluminum wrought alloys - not hardened Leghe malleabili - non indurite													
1.1	100-125	>1			3.0505	AlMn0.5Mg0.5	-	N31	-	-	-	-	-	3105
	80-230	>2			3.0515	AlMn1	-	N3	-	3568	L-3810	144054	-	-
	115-290	4			3.0525	AlMn1Mg0.5	A-M1G0.5	-	-	-	-	-	-	-
	100-205	>4			3.3315	AlMg1	A-G0.6	N41	-	5764	L-3350	A2x8	144106	-
	180-310	>3			3.3535	AlMg3	A-G3M	N5	-	3575	L-3390	-	-	-
N	Aluminum wrought alloys - hardened Leghe malleabili di alluminio - indurite													
1.2	150-400	>2			3.1325	AlCuMg1	A-U4G	H14	-	3579	L-3120	-	-	-
	180-460	>3			3.1355	AlCuMg2	A-U4G1	2L97	-	3579	L-3140	A3x4	-	-
	130-360	>2			3.2315	AlMgSi1	A-SGM0.7	H30	-	3571	L-3451	-	144212	-
	130-270	>8			3.3206	AlMgSi0.5	-	H9	-	3569	L-3441	A2x5	144103	-
	120-300	>2			3.3211	AlMg1SiCu	-	H20	-	-	-	-	-	-
	410-490	>3			3.4345	AlZnMgCu0.5	AZ 4 GU/9051	L86	-	811-04	-	-	-	7050
	180-560	>1			3.4365	AlZnMgCu1.5	AZ 4 GU/9050 C	L87	-	811-05	-	-	-	7075
N	Aluminum cast alloys Si <5% Leghe fuse di alluminio con Si <5%													
1.3	280-300	<1			3.2134	G-AISi5Cu1Mg	-	-	-	-	-	-	-	-
	140-300	>2			3.3241	G-AlMg3Si	-	-	-	-	-	-	-	-
	200	1			3.3292	GD-AlMg9	A-G10S	-	-	5080	-	-	-	-
	140-210	>4			3.3541	GD-AlMg3	A-G3T	-	-	3059	-	ADC6	-	-
N	Aluminum cast alloys Si <5-12% Leghe fuse di alluminio con Si <5-12%													
1.4	160-200	1			3.2161	G-AISi8Cu3	-	-	-	-	-	-	-	-
	230-360	>2			3.2373	G-AISi9Mg	A-S9G	-	-	3051	-	AC4A	-	-
	240-350	<3			3.2163	G-AISi9Cu3	A-S9U3	LM24	-	5075	-	-	-	-
	150-340	>1			3.2381	G-AISi10Mg	A-S10G	LM9	-	3051	L-2560	-	4253	-
	160	1			3.2383	G-AISi10Mg(Cu)	A-S10GU	LM 9	-	-	-	-	4253	A 360.2
	150-170	5			3.2581	G-AISi12	A-S13	LM 6	-	3051	-	AC3	4261	A 413.2
	150-290	>1			3.2583	G-AISi12(Cu)	A-S12U	LM 20	-	3048	-	-	4260	A 413.1
N	Aluminum cast alloys Si >12% Leghe fuse di alluminio con Si >12%													
1.5	165-370	<1				G-AISi 17 Cu 4 Mg	-	-	-	-	-	-	-	-
	180-220	<1				G-AISi 18 CuNiMg	-	-	-	-	-	-	-	-
	200-240	<1				G-AISi 21 CuNiMg	-	-	-	-	-	-	-	-
	230-300	<1,5				G-AISi 25 CuNiMg	-	-	-	-	-	-	-	-
N	Pure copper, low alloyed copper Rame puro, Rame poco legato													
2.1	<600	>10			2.0240	CuZn15	CuZn15	CZ 102	-	-	-	C2300	-	C23000
	<800	>10			2.0265	CuZn30	CuZn30	CZ 106	-	-	-	C2600	-	C26000
N	Copper-zinc alloys (brass) (long-chipping) Leghe rame-zinco (ottone) (truciolo lungo)													
2.2	<800	>10			2.0321	CuZn37	CuZn37	CZ 108	-	-	-	C 2700	-	C27200
	<800	>12			2.0335	CuZn36	Ms63	CZ 108	-	P-CuZn35	-	C 2700	-	C27000
	340-480	25			2.0360	CuZn40	Ms60	DCB1	-	-	-	-	-	C28000
N	Copper-zinc alloys (brass) (short-chipping) Leghe rame-zinco (ottone) (truciolo corto)													
2.2	340-570	>11			2.0401	CuZn39Pb3	Ms58	-	-	-	-	-	-	C38500
N	Copper-tin alloys (bronze) (long-chipping) Leghe rame-stagno (bronzo) (truciolo lungo)													
2.4	<900	50			2.1016	CuSn4	-	-	-	-	-	C 5111	-	C51100
	390-620	>15			2.1030	CuSn8P	-	-	-	-	-	C5210	-	C52100

EVO code	Rm N/mm ²	A5 %	HRC	HB	Mat. - Nr.	 DIN	 AFNOR		 BS	EN	 UNI	 UNE	 JIS	 SIS	 AISI/SAE/ASTM
N	Copper-zinc alloys (bronze) (short-chip.) Leghe rame-zinco (bronzo) (truciolo corto)														
2.3	200-250	6			2.1097	G-CuSn5ZnPb	Rg5		-	-	-	-	H 5111	-	C83600
	230-320	12			2.1090.01	G-CuSn7ZnPb	Rg7		-	-	-	-	-	-	C93200
	280	18			2.1086.01	G-CuSn10Zn	Rg10		-	-	-	-	-	-	-
	600-650	7			2.0975	G-CuAl10Ni	CuNiAl11		-	-	-	-	-	-	-
N	Copper-Aluminum alloys Leghe rame-alluminio														
2.5	>550	40			Ampco 8	-	-		-	-	-	-	-	-	-
	>750	1			Ampco 21	-	-		-	-	-	-	-	-	-
	>500	0			Ampco 25	-	-		-	-	-	-	-	-	-
	>810	15			Ampco 45	-	-		-	-	-	-	-	-	-
	>1000	8			Ampco M-4	-	-		-	-	-	-	-	-	-
N	Magnesium, wrought alloys Leghe malleabili di magnesio														
3.1	>270	6			3.5612	MgAl 6 Zn	-		-	-	-	-	-	-	-
	>240	2			3.5912	G-MgAl9Zn1	-		-	-	-	-	-	-	-
N	Synthetics Materie plastiche														
4.1					Bakelit	-	-		-	-	-	-	-	-	-
					Pertinax	-	-		-	-	-	-	-	-	-
4.2					PMMA	-	-		-	-	-	-	-	-	-
					POM	-	-		-	-	-	-	-	-	-
					PVC	-	-		-	-	-	-	-	-	-
N	Fibre-reinforced synthetics Resine epossidiche rinforzate														
4.3	155-365				GFK	Fiberglass Vetroresina Fibra di Vetro			-	-	-	-	-	-	-
	190-210				CFK uni.	Carbon fiber Fibra di Carbonio			-	-	-	-	-	-	-
	190-210				CFK multi.	Carbon fiber Fibra di Carbonio			-	-	-	-	-	-	-
					AFK	Aramide fiber Fibra di Aramide			-	-	-	-	-	-	-
					BFK	Boro fiber Fibra di Boro			-	-	-	-	-	-	-
					MFK	Metal fiber Fibre Metalliche			-	-	-	-	-	-	-
					SFK	Synthetic fiber Fibre Sintetiche			-	-	-	-	-	-	-
N	Sandwich														
4.5					P-M-H	Plastic-Metal-Wood Plastica-Metallo-Legno			-	-	-	-	-	-	-
					Honeycomb	-			-	-	-	-	-	-	-
					Metall	-			-	-	-	-	-	-	-
N	Graphite														
5.0						Graphite standard Grafite standard			-	-	-	-	-	-	-
5.1						Wear-resistant Graphite Grafite resistente all'usura			-	-	-	-	-	-	-

