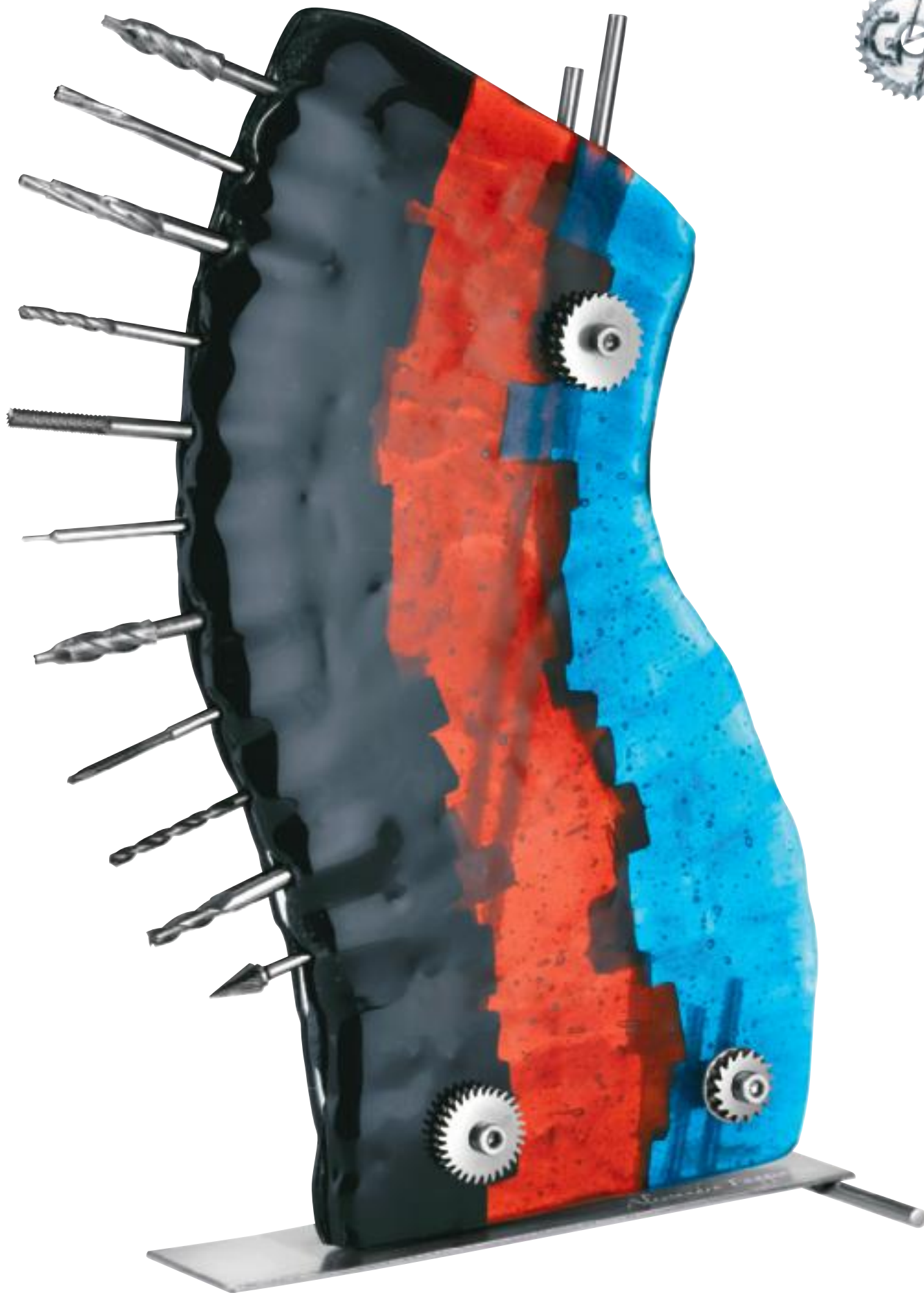


TOMMASIN

UTENSILI s.r.l.

CATALOGO FRESE MECCANICA - MILLING TOOLS CATALOG

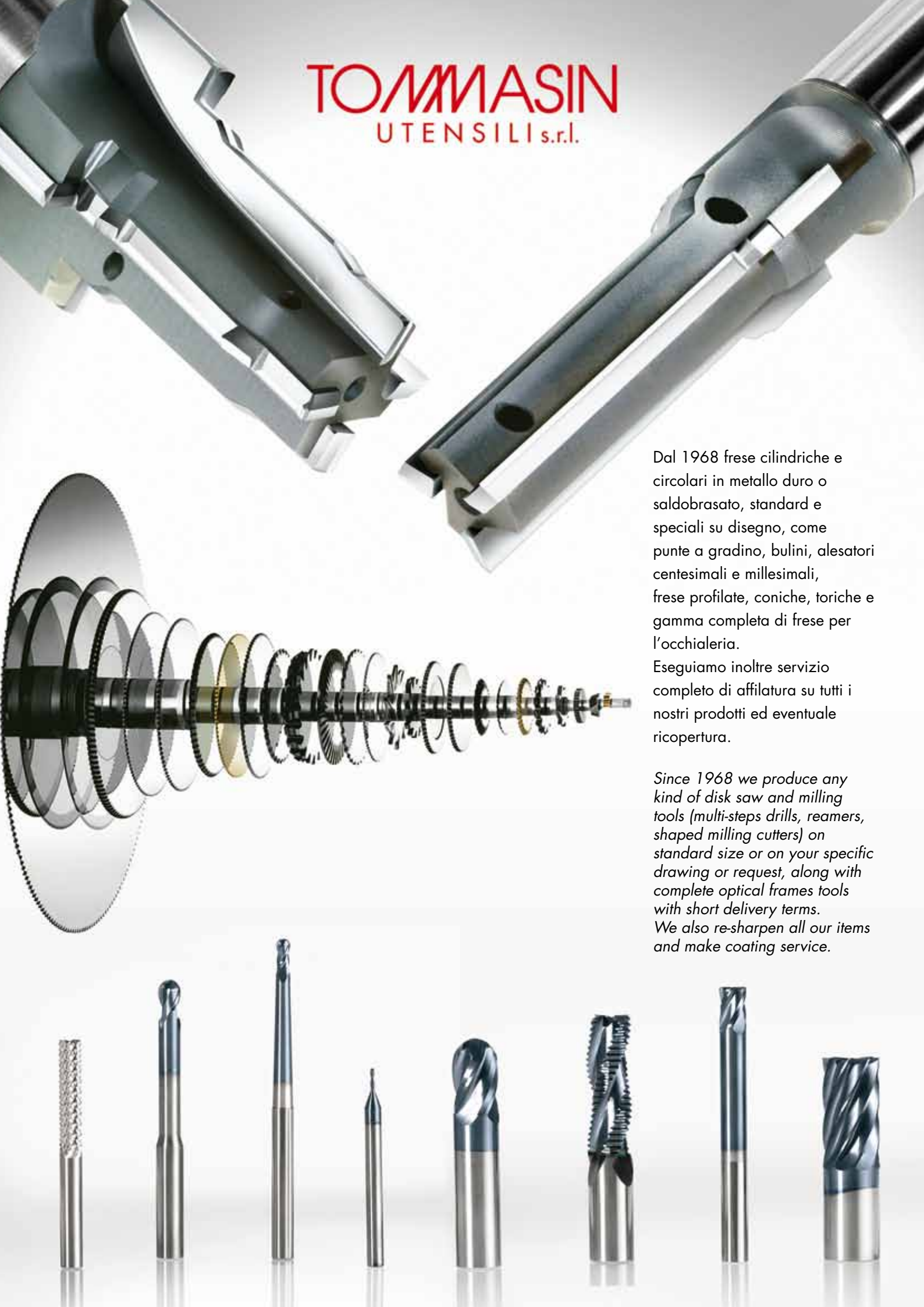


TOMMASIN UTENSILI s.r.l.

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www.tommasin.com - info@tommasin.com

TOMMASIN

UTENSILI s.r.l.



Dal 1968 frese cilindriche e circolari in metallo duro o saldobrasato, standard e speciali su disegno, come punte a gradino, bulini, alesatori centesimali e millesimali, frese profilate, coniche, toriche e gamma completa di frese per l'occhialeria.

Eseguiamo inoltre servizio completo di affilatura su tutti i nostri prodotti ed eventuale ricopertura.

Since 1968 we produce any kind of disk saw and milling tools (multi-steps drills, reamers, shaped milling cutters) on standard size or on your specific drawing or request, along with complete optical frames tools with short delivery terms. We also re-sharpen all our items and make coating service.

UTENSILI SPECIALI

Da oltre quaranta anni produciamo utensili a disegno su specifica del cliente. La nostra gamma comprende qualsiasi utensile sia in metallo duro integrale che saldobrasato, cilindrico e circolare.

Eseguiamo lo studio dell'utensile, comprensivo di disegno tecnico con le spoglie appropriate, allo scopo di ottimizzare la lavorazione su qualsiasi tipo di materiale.

A richiesta forniamo anche servizio di affilatura e ricopertura in tempi brevi.



SPECIAL TOOLS

Since over 40 years we produce special tools on specific customer request as circular and cylindrical tools in one block carbide or with body steel and carbide blades.

Thanks to our great experience we can make all the drawings for the tools with the right relief angle, for any kind of material you have to work on.

Any service of resharpener and coating will be supplied on request in short delivery time.



TOMMASIN





Linea Stampi
Mould line pag. 7



Acciaio e Titanio
Steel and Titanium pag. 13



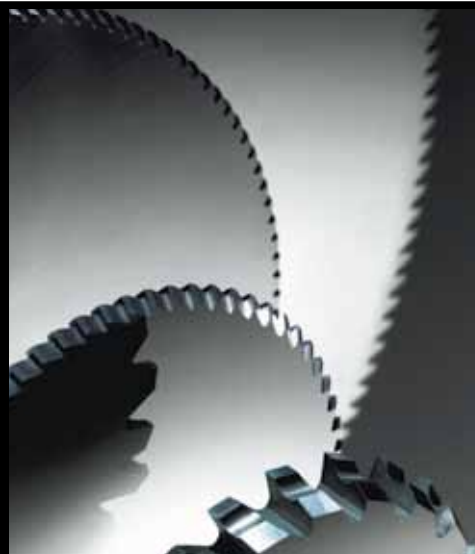
Alluminio, plastica e materiale non ferroso
Aluminium, plastic and fiberglass pag. 15



Meccanica Generale
Standard Tools pag. 19



Punte elicoidali e alesatori
Drills and reamers pag. 27



Seghe circolari in metallo duro integrale
Disk Saws (tungsten carbide) pag. 37



CONTROLLO QUALITÀ

La caratteristica comune di ogni nostro utensile è la qualità.

Da sempre la nostra azienda si è distinta per il controllo a cui ogni singolo utensile viene sottoposto.

Grazie a microscopi elettronici e moderni proiettori di profili, si esamina il profilo, le spoglie e la qualità di finitura della fresa.

Il controllo per ogni singolo pezzo ci permette di fornire un prodotto che rispecchia totalmente tolleranze di forma e misura fornite dal disegno del cliente.

A richiesta si fornisce un rapporto di qualità che attesta il controllo eseguito per ogni fornitura.



QUALITY CONTROL

Quality is the common factor we can find in each item we produce.

Since ever our company check every single tool, tank to modern electronic microscope and profile projector. In this way we can analyze shape and size tolerance according to costumer's drawings.

Any quality report can be requested for each shipment.



Linea stampi

Mould line

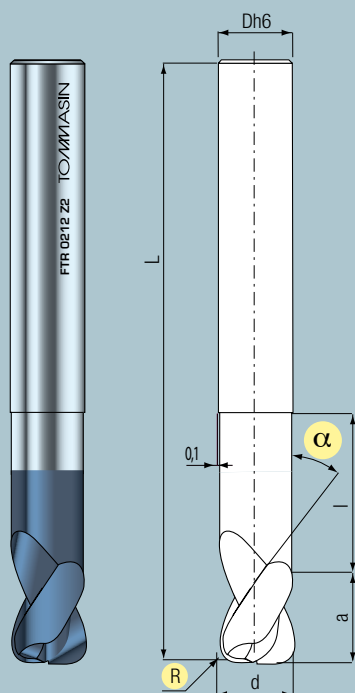
Frese per acciai e Titanio

Steels & Titanium End Mills

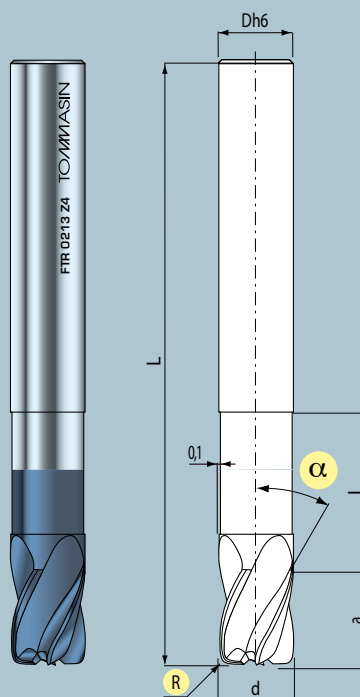
TOMMASIN



art. **0212-Z2**



art. **0213-Z4**

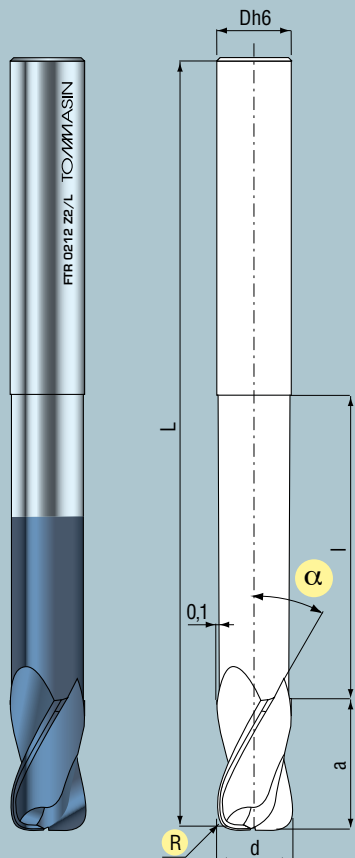


STANDARD

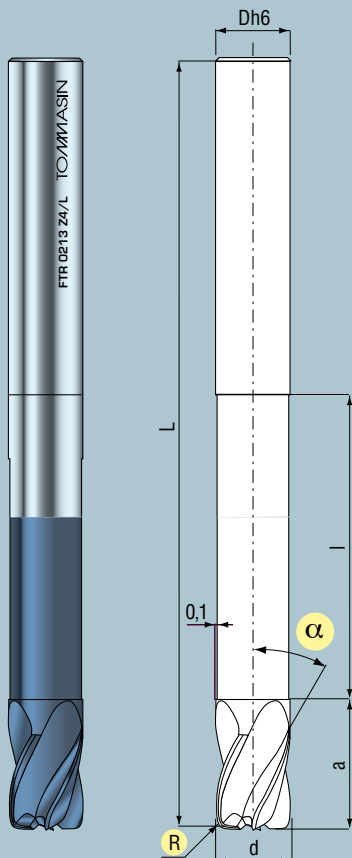
d=D	R	l	L	a	α
6,0	0,5	15	62	7	30°
6,0	1,0	15	62	7	30°
8,0	0,5	17	65	10	30°
8,0	1,0	17	65	10	30°
8,0	1,5	17	65	10	30°
8,0	2,0	17	65	10	30°
10,0	0,5	21	80	12	35°
10,0	1,0	21	80	12	35°
10,0	1,5	21	80	12	35°
10,0	2,0	21	80	12	35°
12,0	1,0	23	80	15	35°
12,0	1,5	23	80	15	35°
12,0	2,0	23	80	15	35°
14,0	1,5	28	100	18	35°
14,0	2,5	28	100	18	35°
16,0	2,5	28	100	18	35°

ricopertura TiAlN
coating TiAlN

art. **0212/L-Z2**



art. **0213/L-Z4**



STANDARD

d=D	R	l	L	a	α
6,0	0,5	32	80	8	30°
6,0	1,0	32	80	8	30°
8,0	0,5	40	100	11	30°
8,0	1,0	40	100	11	30°
8,0	1,5	40	100	11	30°
10,0	0,5	45	106	13	35°
10,0	1,0	45	106	13	35°
10,0	1,5	45	106	13	35°
10,0	2,0	45	106	13	35°
12,0	1,0	52	120	15	35°
12,0	1,5	52	120	15	35°
12,0	2,0	52	120	15	35°
14,0	1,5	60	150	19	35°
14,0	2,0	60	150	19	35°
16,0	2,0	60	150	19	35°

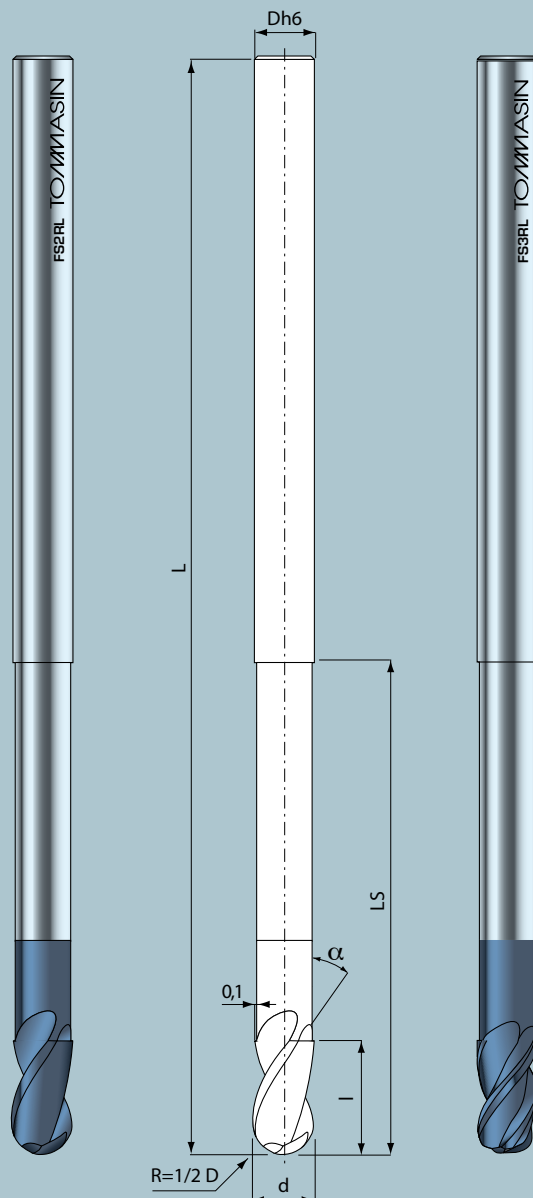
ricopertura TiAlN
coating TiAlN

FS2RL

art. **0194**

TAB. VEL. ☐ pag. 46

$\alpha = 30^\circ$



FS3RL

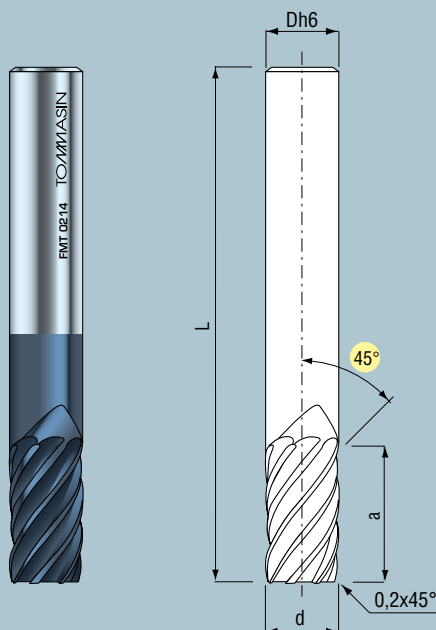
*art. **0195-Z3**

* = a richiesta - on request

con ricopertura
with coating

d	D	D1	R	l	L	LS
3	3	2,8	1,5	4	50	10
3	3	2,8	1,5	4	80	15
4	4	3,8	2	5	50	10
4	4	3,8	2	5	80	20
5	5	4,7	2,5	6	57	15
5	5	4,7	2,5	6	80	20
6	6	5,5	3	7	57	20
6	6	5,5	3	7	110	20
8	8	7,4	4	9	60	26
8	8	7,4	4	9	110	26
8	8	7,4	4	9	160	53
10	10	9,2	5	11	72	31
10	10	9,2	5	11	110	31
10	10	9,2	5	11	160	53
12	12	11	6	13	83	37
12	12	11	6	13	110	37
12	12	11	6	13	160	53
16	16	15	8	17	110	43
16	16	15	8	17	160	53
20	20	19	10	21	160	53

art. **0214**

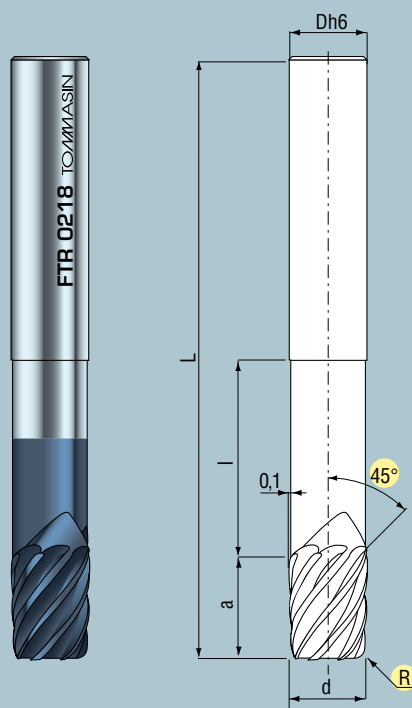


STANDARD

d=D	L	a	Z
4,0	55	14	6
6,0	60	18	6
8,0	75	25	6
10,0	80	30	8
12,0	83	34	8
14,0	92	40	10

ricopertura TiAlN
coating TiAlN

*art. **0218**

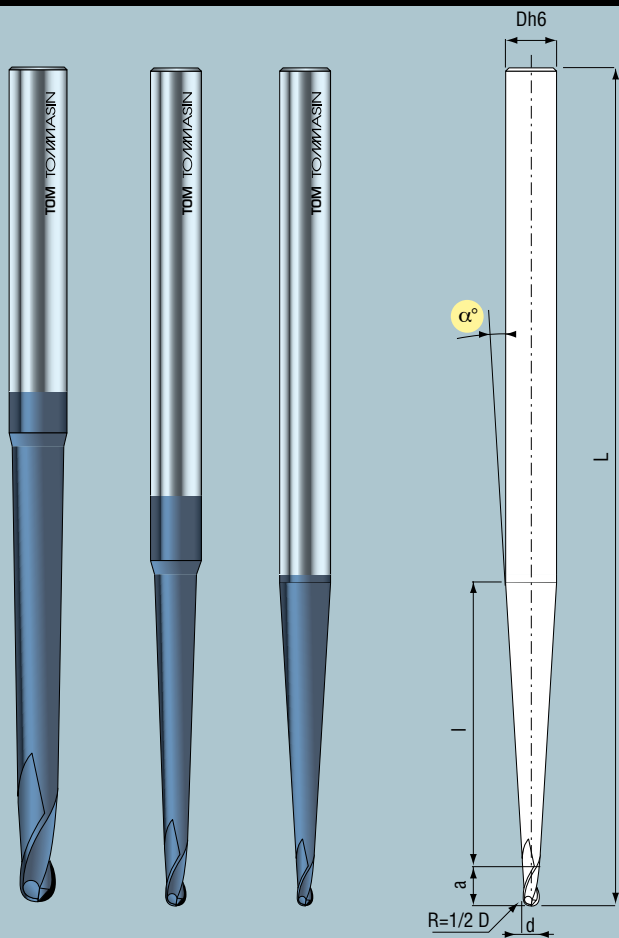


STANDARD

d=D	6	8	10	12	14	16
R	1,0	1,0	1,5	1,5	2,0	2,0
l	20	20	26	30	30	30
L	80	80	90	110	110	120
a	10,0	10,0	12,0	16,0	20,0	25,0
Z	6	6	8	10	10	10

ricopertura TiAlN
coating TiAlN

* = a richiesta - on request



art. **0211**

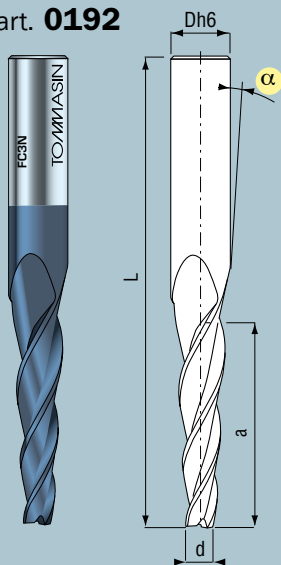
STANDARD

d	2,0	2,0	3,0	3,0	4,0	5,0	6,0	8,0	10,0
D	6,0	6,0	6,0	6,0	6,0	8,0	8,0	10,0	12,0
l	26	40	30	40	45	45	55	65	65
L	80	93	93	100	100	115	115	125	150
a	5,0	5,0	6,0	6,0	6,0	8,0	10,0	12,0	15,0
α°	2°	3,30°	2°	3°	1,30°	1,30°	1°	1°	1°

ricopertura TiAIN
coating TiAIN

art. **0192**

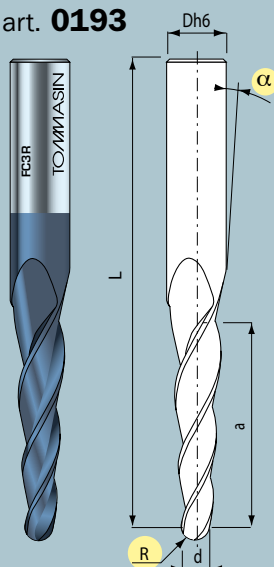
FC3R art. **0193**



STANDARD

d	4,5	6,0	8,0	10,0	12,0	4,0	6,0
D	6,0	8,0	10,0	12,0	14,0	8,0	10,0
a	20	30	30	35	35	30	30
L	57	63	72	83	83	63	72
α	1°	1°	1°	1°	1°	3°	3°

d	8,0	10,0	12,0	3,0	3,5	4,0	8,0
D	12,0	*14,0	*18,0	8,0	10,0	*12,0	*14,0
a	35	35	55	25	30	35	35
L	83	83	100	63	72	83	83
α	3°	3°	3°	5°	5°	5°	5°



- 3 taglienti, taglio al centro
- 3 cutting edges, center cutting

ricopertura TiAIN
coating TiAIN

* = a richiesta - on request

STANDARD

d	4,5	6,0	8,0	10,0	12,0	4,0	6,0
R	2,25	3,0	4,0	5,0	6,0	2,0	3,0
D	6,0	8,0	10,0	12,0	14,0	8,0	10,0
L	57	63	72	83	83	63	72
a	20	30	30	35	35	30	30
α	1°	1°	1°	1°	1°	3°	3°

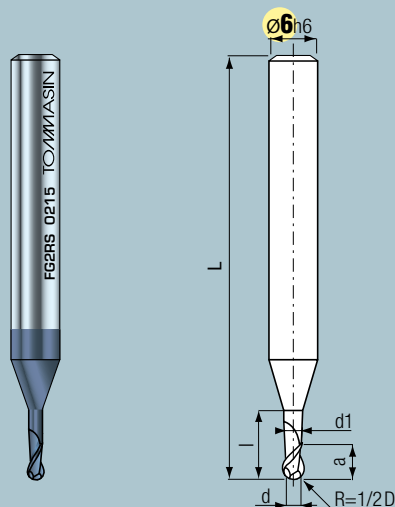
d	8,0	10,0	12,0	3,0	3,5	4,0	8,0
R	4,0	5,0	6,0	1,5	1,75	2,0	4,0
D	12,0	*14,0	*18,0	8,0	10,0	*12,0	*14,0
L	83	83	100	63	72	83	92
a	35	35	55	25	30	35	40
α	3°	3°	3°	5°	5°	5°	5°

TYPE **TFC/S** Frese gambo rinforzato - testa emisferica Ball-nosed twist end mill with shank Ø 6

metallo duro Grana Extrafine < 0,5 µ
Grain Extrafine ordered < 0,5 µ

F G 2 R S

art. **0215-Z2**



STANDARD

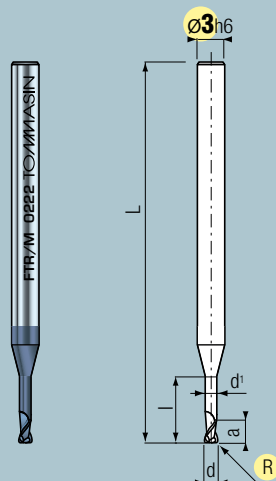
d	l	L	a	d ¹
0,6	1,2	54	0,6	0,56
0,8	1,6	54	0,8	0,76
1,0	2,5	54	1,0	0,96
1,0	5,0	54	1,6	0,96
1,2	3,0	54	1,2	1,16
1,2	5,0	54	1,8	1,16
1,5	6,0	54	2,2	1,45
1,5	12,0	66	2,2	1,45
1,5	18,0	66	2,2	1,45
2,0	6,0	54	3,0	1,95
2,0	12,0	66	3,0	1,95
2,0	18,0	66	3,0	1,95
3,0	11,0	54	4,2	2,95
3,0	20,0	66	4,2	2,95
4,0	13,0	60	5,5	3,95
4,0	22,0	66	5,5	3,95

Ricopertura strato sottile
Micro film coating

TYPE **FTR/M** Micro frese toriche gambo rinforzato Micro toroidal end milling tools

metallo duro Grana Extrafine. < 0,5 µ
Grain Extrafine ordered. < 0,5 µ

art. **0222-Z2**

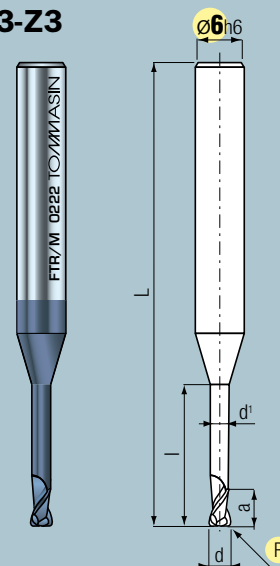


STANDARD

d	1,0	1,0	1,0	1,5	1,5	1,5
R	0,2	0,2	0,2	0,3	0,3	0,3
l	5	8	10	6	9	12
L	50	50	50	50	50	50
a	1,6	1,6	1,6	2,2	2,2	2,2
d ¹	0,95	0,95	0,95	1,45	1,45	1,45

art. **0222-Z2**

*art. **0223-Z3**



STANDARD

STANDARD

d	2,0	2,0	2,0	3,0	3,0	3,0	4,0	4,0	4,0
R	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
l	9	15	18	11	16	20	12	18	24
L	60	60	60	60	60	60	60	60	60
a	3,0	3,0	3,0	4,2	4,2	4,2	6,0	6,0	6,0
d ¹	1,95	1,95	1,95	2,95	2,95	2,95	3,90	3,90	3,90

Ricopertura strato sottile
Micro film coating

* = a richiesta - on request

TYPE **FA4N2** Frese doppia elica per acciai Temprati

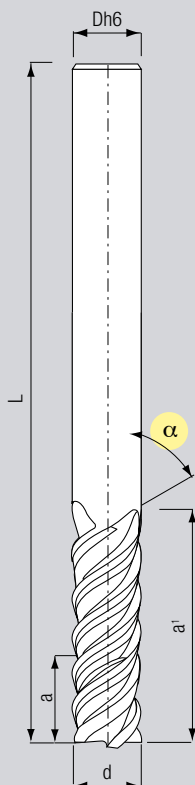
Double helix end mills for hardened steels

FA4N2

art. **0250**

con ricopertura
with coating

Z4 $\alpha = 55^\circ$



STANDARD

d	D	L	a	a'
4	4	57	7	11
6	6	57	8	13
8	8	63	12	19
10	10	72	14	22
12	12	83	16	26
14	14	83	16	26
16	16	92	20	32
18	18	104	22	35
20	20	104	25	38

TAB. VEL. ☐ pag. 46

TYPE **TFC/T** Frese cilindriche elica $*60^\circ$ alta velocità tagliente al centro

*Twist-end milling tools, $*60^\circ$ high speed*

metallo duro Grana Extrafine. $< 0,5\mu$

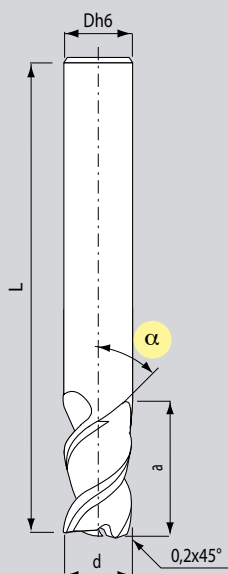
Grain Extrafine ordered. $< 0,5\mu$

FA3T

art. **0206** - Z3 $\alpha = 55^\circ - 60^\circ$

FA4T

*art. **0207** - Z4 $\alpha = 60^\circ$



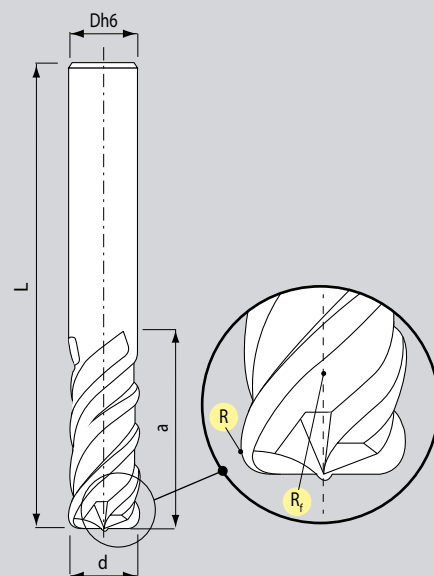
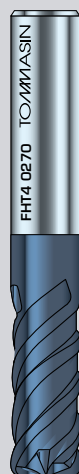
d=D	L	a
4,0	57	8
6,0	60	10
8,0	64	24
10,0	72	26
12,0	83	30
14,0	83	34
16,0	92	40

ricopertura TiAlN
coating TiAlN

* = a richiesta - on request

FHT4

art. **0270** - Z4 $\alpha = 50^\circ$



d	D	R _f	R	a	L	Z
3	6	1,5	0,5	11	57	4
4	6	2	0,5	11	57	4
6	6	3	0,5	15	57	4
8	8	4	1,0	20	63	4
10	10	5	1,5	26	72	4
12	12	6	1,5	30	83	4

TYPE F3N-INOX

Frese per acciai inossidabili inox e titanio
Inox and titanium end mill

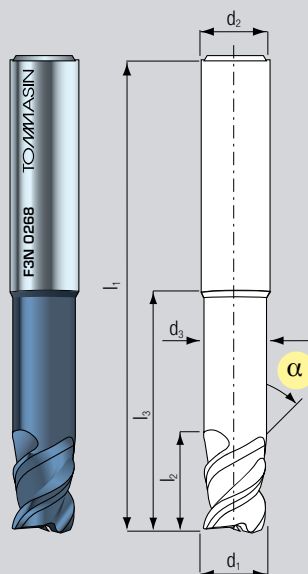
F 3 N

art. **0268**

0,05-0,15
45°

Z3 $\alpha = 55^\circ$

con ricopertura
with coating



STANDARD

d1 e8	d2 h6	d3	l1	l2	l3
3	6	2,8	57	4	14
4	6	3,8	57	5	16
5	6	4,8	57	6	18
6	6	5,8	57	7	20
8	8	7,6	63	9	26
10	10	9,8	72	11	31
12	12	11,8	80	15	30
16	16	15,8	92	17	43

TAB. VEL. Inox ☐ pag. 46

TYPE FTR-INOX

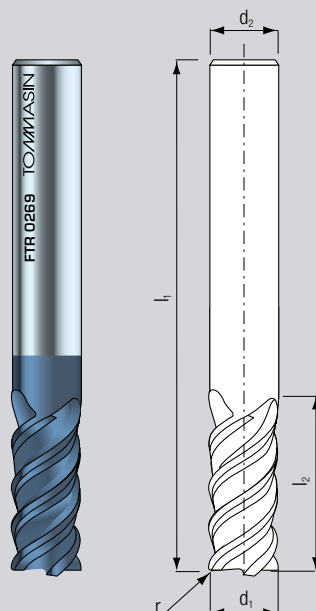
Frese toriche per acciaio e titanio
Toroidal end mill for inox and titanium

F T R

art. **0269**

Z4 $\alpha = 55^\circ$

con ricopertura
with coating



STANDARD

d1	d2	r	l2	l1
10	10	1,0	22	72
10	10	1,5	22	72
12	12	1,0	26	83
12	12	1,5	26	83
16	16	1,5	32	92
20	20	2,0	38	104

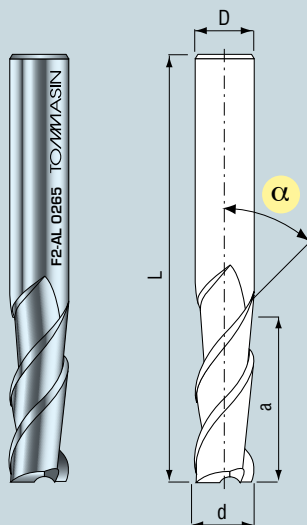
TAB. VEL. Inox/ Titanium ☐ pag. 46/47

Frese per alluminio, plastica e materiale non ferroso
Aluminium, plastic and fiberglass End Mills



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art. **0265**



STANDARD

d	D	a	L
4	6	12	58
5	6	15	58
6	6	18	58
8	8	24	64
10	10	28	72
12	12	35	83
16	16	42	93
20	20	48	104

$\alpha = 45^\circ$

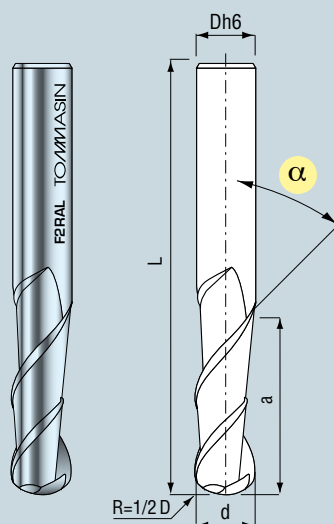
$Z = 2$

* = ricopertura a richiesta - coating on request

TAB. VEL. ☐ pag. 47

F2RAL

art. **0266**



STANDARD

d	D	R	a	L
4	4	2	10	63
6	6	3	12	63
8	8	4	16	80
10	10	5	19	89
12	12	6	22	100
16	16	8	26	100

$\alpha = 45^\circ$

$Z = 2$

* = ricopertura a richiesta - coating on request

TAB. VEL. ☐ pag. 47

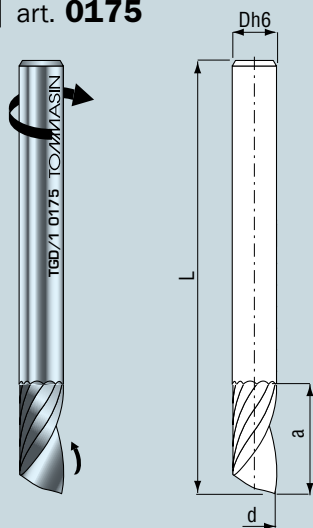
TYPE TGD/1

Frese monoelica Elica dx (rotazione Destra)
Single fluted twist milling tool Right spiral cutting

per leghe leggere e materie plastiche.
for aluminium and plastic material.

F 1 N S

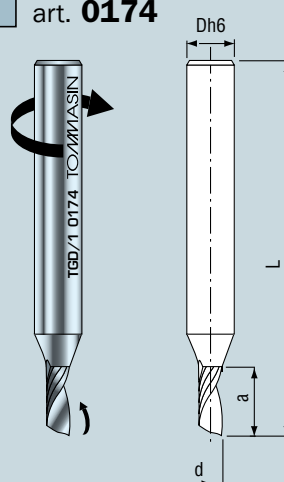
art. **0175**



D=d	L	a
3,0	40	6,0
3,0	40	12,0
4,0	50	7,0
4,0	50	15,0
5,0	50	8,0
5,0	50	18,0
6,0	60	10,0
6,0	60	20,0
8,0	63	12,0
8,0	63	22,0

F 1 N S G

art. **0174**



d	D	L	a
2,0	4,0	50	5,0
2,0	6,0	57	10,0
2,5	4,0	50	6,0
2,5	6,0	57	12,0
3,0	6,0	50	7,0
3,0	6,0	57	12,0

TYPE TGE/1

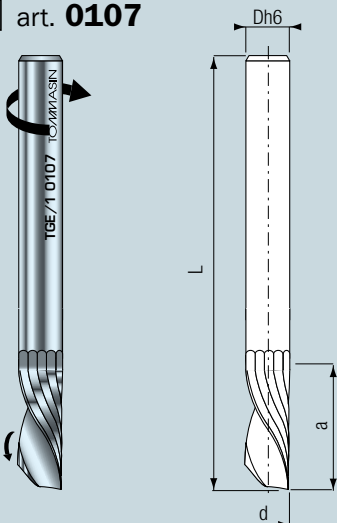
Frese monoelica Elica sx (rotazione Destra)
Single fluted twist milling tool Right side cut (left spiral cutting)

per leghe leggere e materie plastiche.
for aluminium and plastic material.

F 1 E S

art. **0172**

art. **0107**

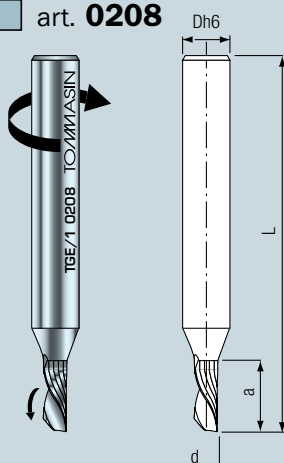


D=d	L	a
3,0	40	6,0
3,0	40	12,0
4,0	50	7,0
4,0	50	15,0
5,0	50	8,0
5,0	50	18,0
6,0	60	10,0
6,0	60	20,0
8,0	63	12,0
8,0	63	22,0

F 1 E S G

art. **0298**

art. **0208**

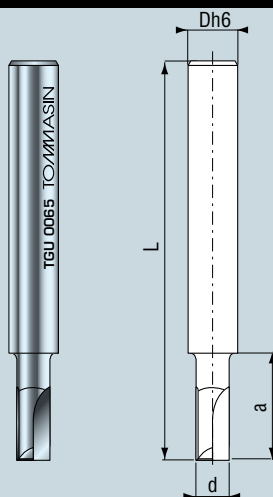


d	D	L	a
2,0	4,0	50	5,0
2,0	6,0	57	10,0
2,5	4,0	50	6,0
2,5	6,0	57	12,0
3,0	6,0	50	7,0
3,0	6,0	57	12,0

TYPE TGU

Frese frontali
Straight-fluted end mills

denti diritti, 2 taglienti.
2 cutting edges.



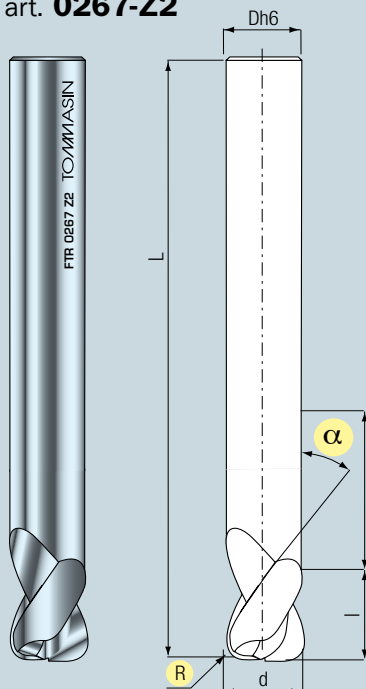
F D N S

art. **0065**

d	2,0	3,0	4,0	5,0	6,0	8,0	10,0
D	6,0	6,0	6,0	6,0	6,0	8,0	10,0
L	54	54	54	54	54	60	70
a	6,0	8,0	12,0	14,0	16,0	20,0	22,0

F T R A L

art. **0267-Z2**



STANDARD

d	D	R	I	L
4	4	0,5	10	63
6	6	0,5	14	63
6	6	1,0	14	63
8	8	0,5	16	80
8	8	1,0	16	80
10	10	1,0	19	89
10	10	1,5	19	89
12	12	1,0	22	100
12	12	2,0	22	100
16	16	2,0	26	100

$\alpha = 45^\circ$

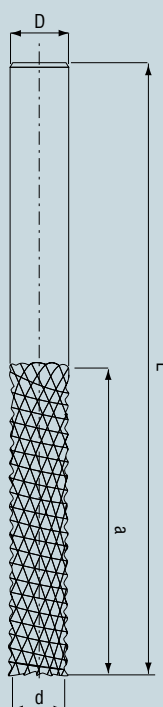
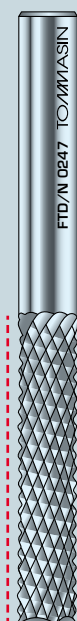
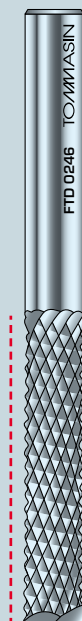
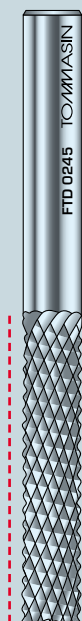
TAB. VEL. ☐ pag. 47

Per vetroresine, Fibre sintetiche e materiali non ferrosi
For reinforced plastic and fiber glass

art. **0245**
Testa normale
Standard

art. **0246**
Taglio frontale
Frontal cutting

*art. **0247**
Punta conica
drill-milling tools



STANDARD

D=d	L	a
3,0	40	10
4,0	40	15
5,0	50	16
6,0	50	18
8,0	63	25
10,0	73	30
12,0	80	33
14,0	85	35

* = a richiesta
on request

Meccanica Generale
Standard Tools

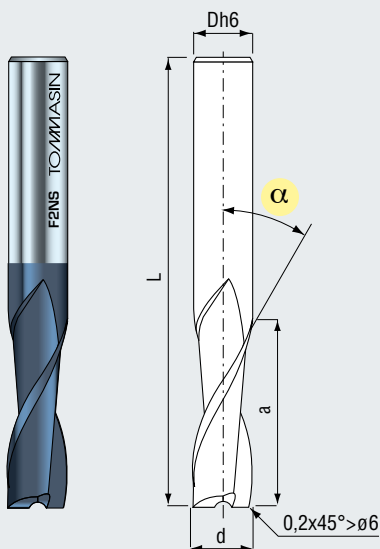


TOMMASIN

F 2 N S

art. **0064**

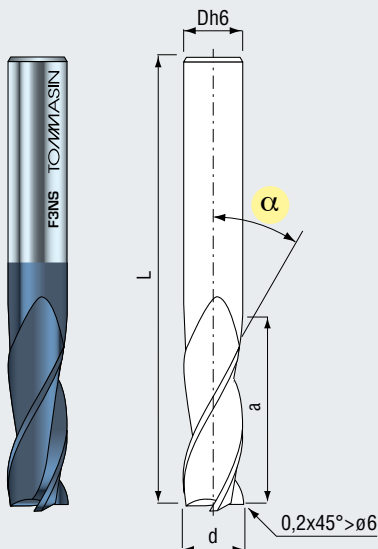
2 eliche, taglienti al centro
2 cutting edges, center cutting



F 3 N S

art. **0031**

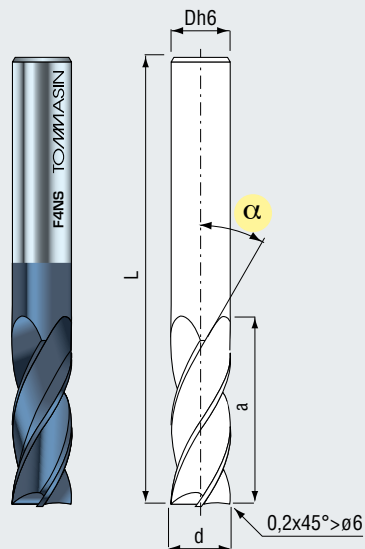
3 eliche, taglienti al centro
3 cutting edges, center cutting



F 4 N S

art. **0032**

4 eliche, taglienti al centro
4 cutting edges, center cutting



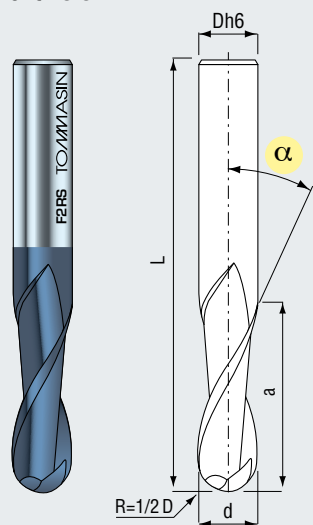
con ricopertura
with coating

d=D	*2,0	3,0	4,0	5,0	6,0	8,0	10,0	12,0	14,0	15,0	16,0	18,0	20,0
L	38	38	40	50	54	64	70	75	75	75	82	100	100
a	8	12	12	14	16	20	22	24	27	27	27	32	32
α	30°	30°	30°	30°	30°	30°	35°	35°	35°	35°	35°	35°	35°

* = a richiesta
on request

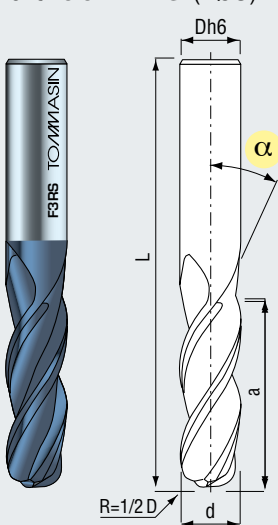
F 2 R S

art. **0021-Z2**



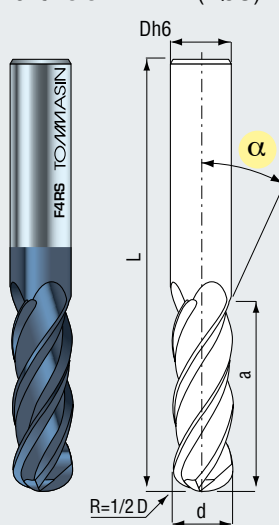
F 3 R S

art. **0021-Z3 (>Ø3)**



F 4 R S

art. **0021-Z4 (>Ø3)**



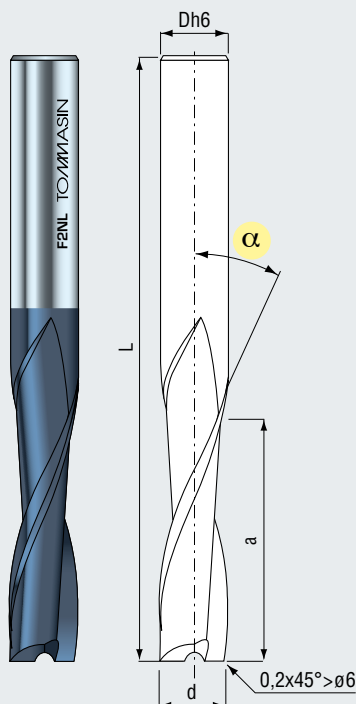
con ricopertura
with coating

d=D	*2,0	3,0	4,0	5,0	6,0	8,0	10,0	12,0	14,0	15,0	16,0	18,0	20,0
L	38	38	40	50	54	64	70	75	75	75	82	100	100
a	8	12	12	14	16	20	22	24	27	27	27	32	32
α	30°	30°	30°	30°	30°	30°	35°	35°	35°	35°	35°	35°	35°

* = a richiesta
on request

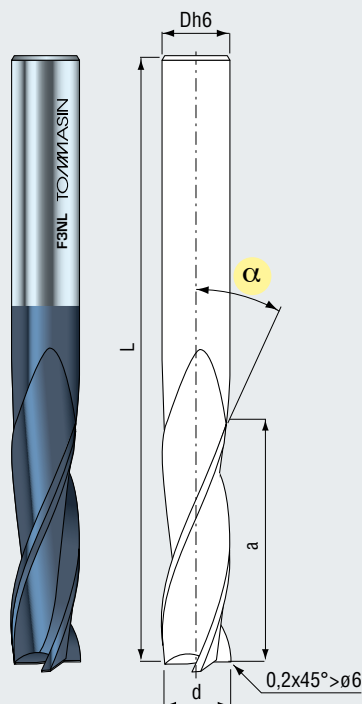
F 2 N L

art. **0064-L**



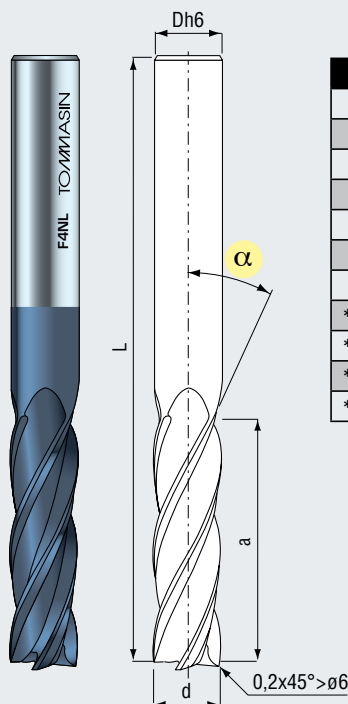
F 3 N L

art. **0031-L**



F 4 N L

art. **0032-L**



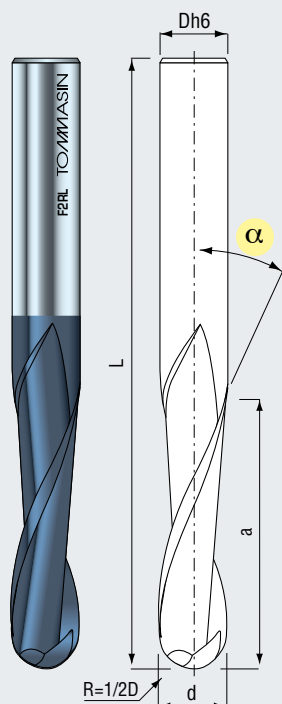
d=D	L	a	α
*3,0	60	20	35°
*4,0	60	20	35°
*5,0	60	20	35°
6,0	65	24	35°
8,0	80	32	35°
10,0	90	32	40°
12,0	100	50	40°
*14,0	100	50	40°
*16,0	110	50	40°
*18,0	110	50	40°
*20,0	110	50	40°

con ricopertura
with coating

* = a richiesta
on request

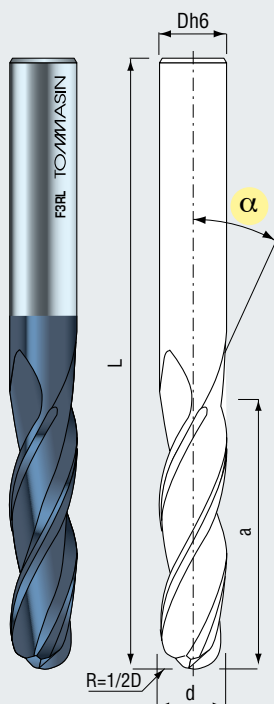
F 2 R L

art. **0021/L-Z2**



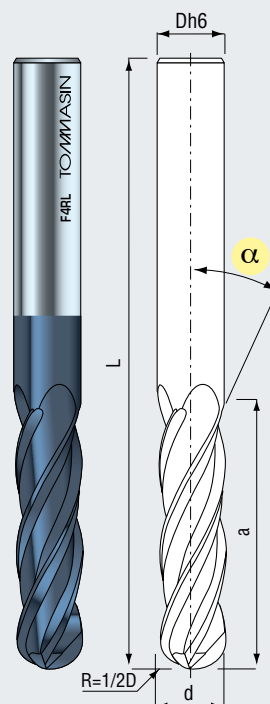
F 3 R L

art. **0021/L-Z3**



F 4 R L

art. **0021/L-Z4**

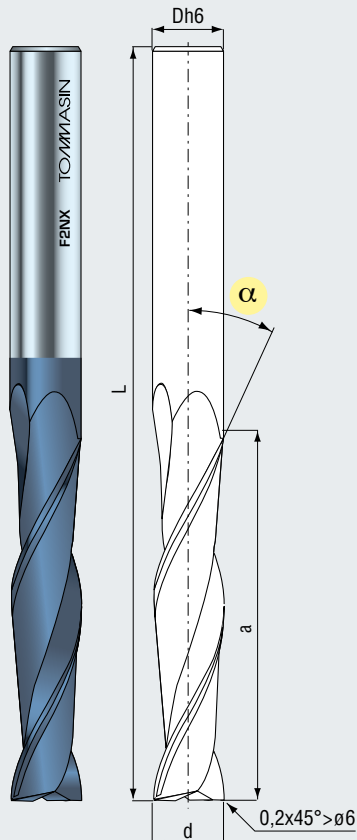


d=D	L	a	α
*3,0	60	20	35°
*4,0	60	20	35°
*5,0	60	20	35°
6,0	65	24	35°
8,0	80	32	35°
10,0	90	32	40°
12,0	100	50	40°
*14,0	100	50	40°
*16,0	110	50	40°
*18,0	110	50	40°
*20,0	110	50	40°

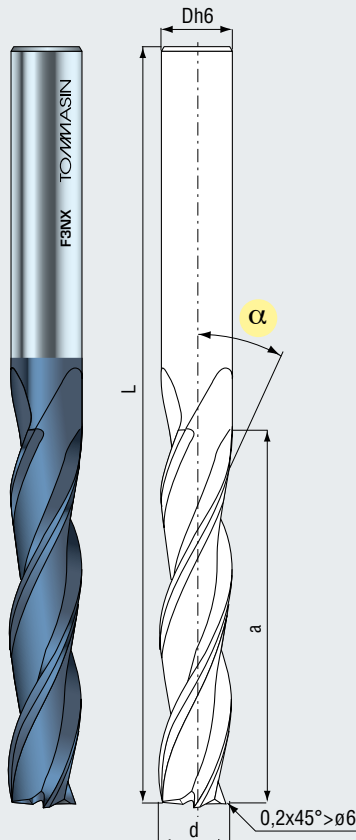
con ricopertura
with coating

* = a richiesta
on request

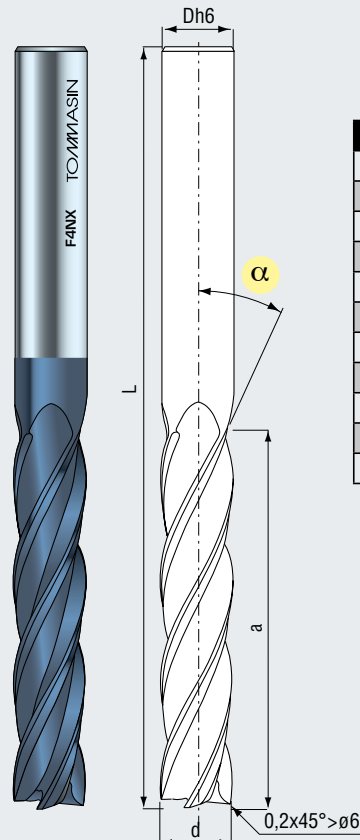
F 2 N X *art. 0064XL



F 3 N X *art. 0031XL



F 4 N X *art. 0032XL



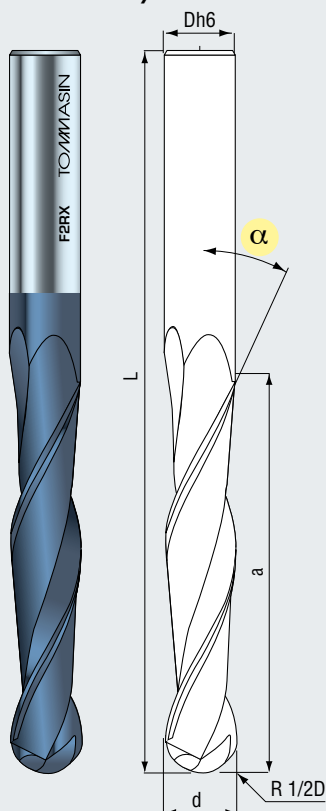
d=D	L	a	α
3,0	70	30	35°
4,0	75	40	35°
5,0	80	40	35°
6,0	80	45	35°
8,0	100	50	35°
10,0	110	50	40°
12,0	150	70	40°
14,0	150	75	40°
16,0	150	75	40°
18,0	150	80	40°
20,0	150	80	40°

con ricopertura
with coating

* = a richiesta
on request

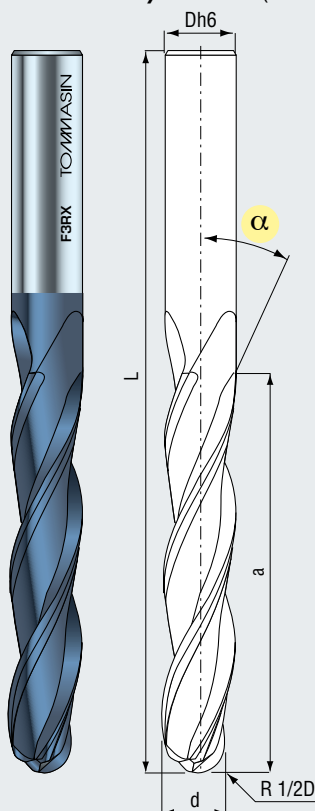
F 2 R X

*art. 0021/XL-Z2



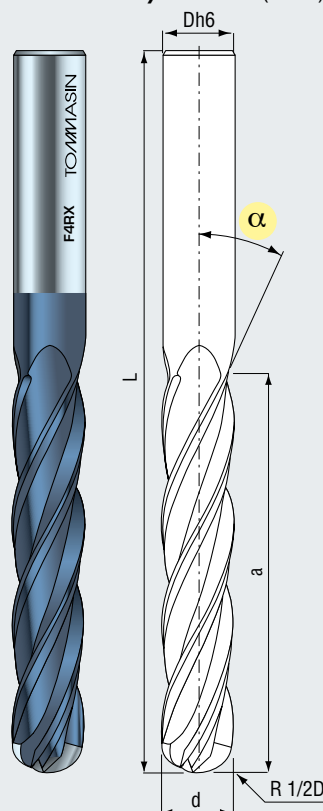
F 3 R X

*art. 0021/XL-Z3 (>Ø3)



F 4 R X

*art. 0021/XL-Z4 (>Ø5)



d=D	L	a	α
3,0	70	30	35°
4,0	75	40	35°
5,0	80	40	35°
6,0	80	45	35°
8,0	100	50	35°
10,0	110	50	40°
12,0	150	70	40°
14,0	150	75	40°
16,0	150	75	40°
18,0	150	80	40°
20,0	150	80	40°

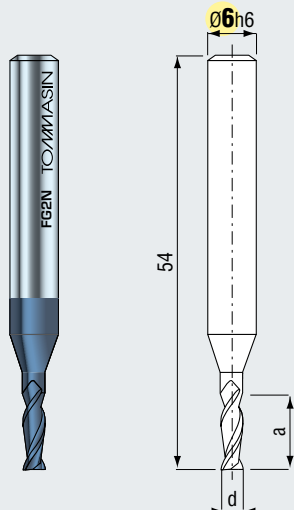
con ricopertura
with coating

* = a richiesta
on request

Testa piana - Taglio al centro / Flat head - Center cutting

FG2N

art. **0030-Z2**

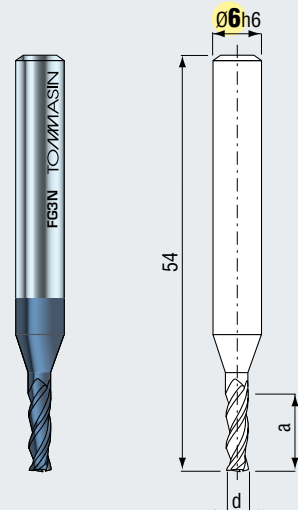


STANDARD

	d	L	a
	2,0	54	5
	2,0	54	10
	2,5	54	5
	2,5	54	11
	3,0	54	6
	3,0	54	12
	3,5	54	6
	3,5	54	12
	4,0	54	6
	4,0	54	12

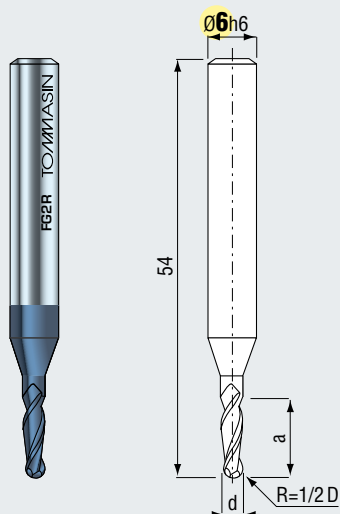
con ricopertura
with coating

FG3N



FG2R

art. **0021/A-Z2**



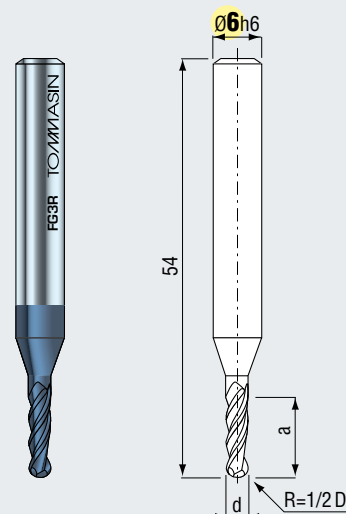
STANDARD

d	L	a
2,0	54	5
2,5	54	5
3,0	54	6
4,0	54	12

con ricopertura
with coating

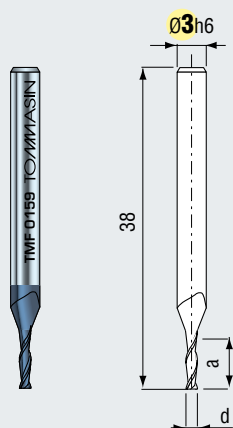
FG3R

*art. **0021/A-Z3**



* = a richiesta
on request

art. **0159-Z2**
*art. **0219-Z3** d>1 mm



STANDARD

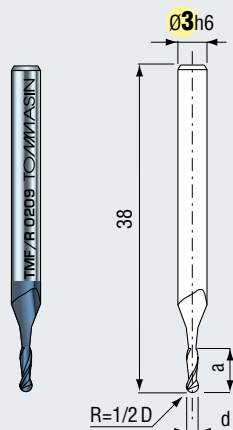
d	*0,4	0,5	0,6	0,7	0,8	0,9	1,0	1,1
a	1,5	1,5	2,0	3,0	3,2	3,2	3,5	3,5

d	1,2	1,3	1,4	1,5	1,6	1,7	1,8	2,0	2,5
a	3,5	4,0	4,0	4,5	4,5	5,0	5,0	5,0	5,0

ricopertura TiAlN
coating TiAlN

* = a richiesta - on request

art. **0209-Z2**
*art. **0210-Z3** d>1,5 mm



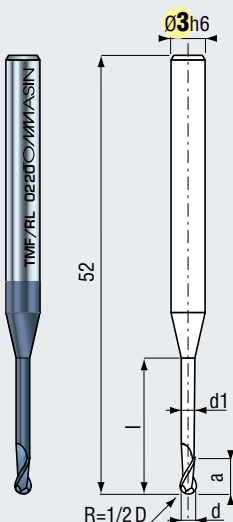
STANDARD

d	*0,4	0,5	0,6	0,8	1,0	1,5
a	1,5	1,5	2,0	3,0	3,5	4,5

ricopertura TiAlN
coating TiAlN

* = a richiesta - on request

art. **0220-Z2**
*art. **0221-Z3** d>1,5 mm



STANDARD

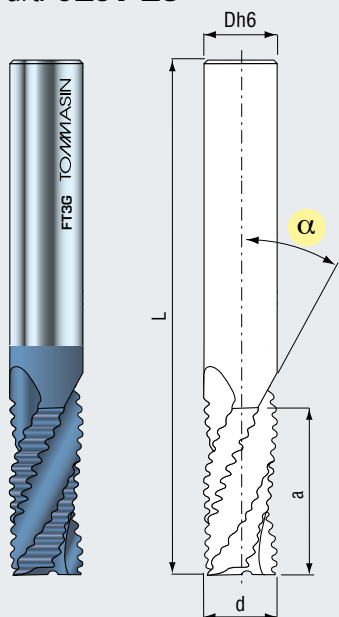
d	0,5	0,6	0,8	1,0	1,5
l	6,0	6,0	8,0	10,0	12,0
a	0,8	0,9	1,2	1,6	2,4
d ¹	0,45	0,55	0,75	0,95	1,45

ricopertura TiAlN
coating TiAlN

* = a richiesta - on request

FT3G

art. **0197-Z3**



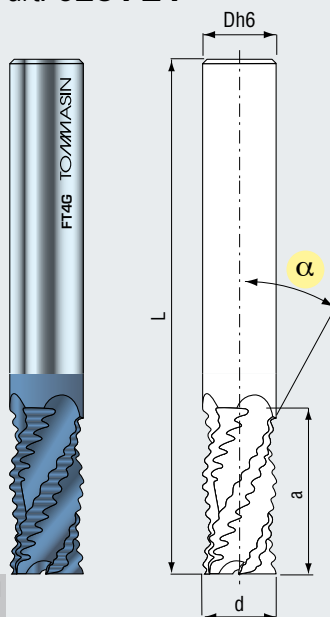
STANDARD

d=D	L	a	α
6,0	50	14	30°
8,0	60	19	30°
10,0	67	22	35°
12,0	74	26	35°
14,0	74	28	35°

ricopertura TiAlN
 coating TiAlN

FT4G

art. **0254-Z4**

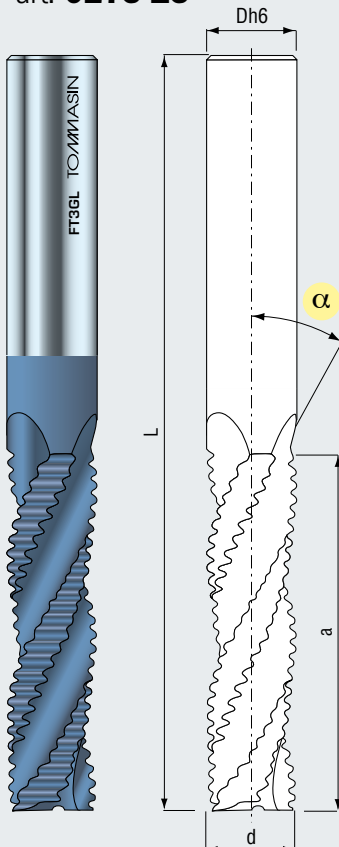


STANDARD

d=D	L	a	α
10,0	67	22	35°
12,0	74	26	35°
14,0	74	28	35°
16,0	80	34	35°
20,0	92	36	35°

FT3GL

*art. **0273-Z3**



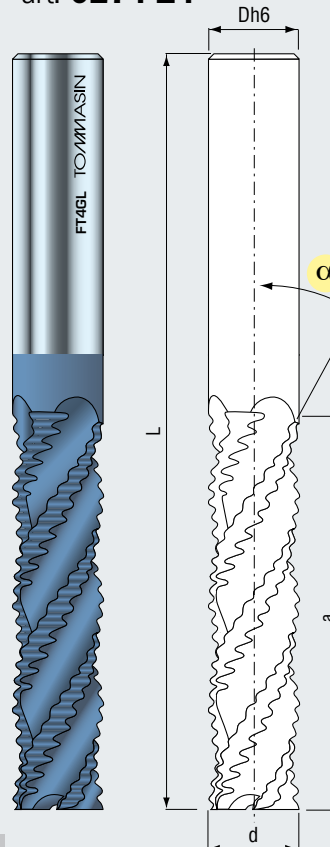
STANDARD

d=D	L	a	α
8,0	80	32	30°
10,0	80	35	35°
12,0	100	45	35°
14,0	110	45	35°

ricopertura TiAlN
 coating TiAlN

FT4GL

*art. **0274-Z4**



STANDARD

d=D	L	a	α
10,0	80	35	35°
12,0	100	50	35°
14,0	110	50	35°
16,0	110	55	35°
20,0	110	55	35°

* = a richiesta
 on request

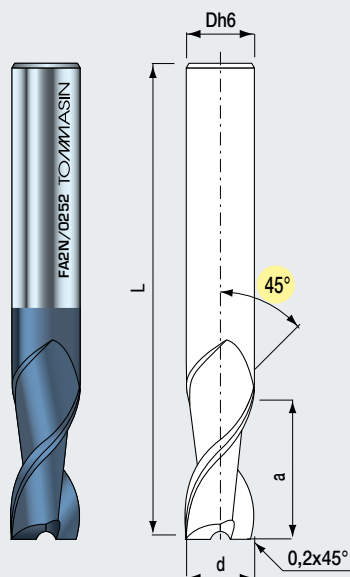
TYPE TFC/AN Frese cilindriche elica 45° tagliente al centro

Twist-end milling tools, 45° center cutting

metallo duro Grana Extrafine. < 0,5μ
Grain Extrafine ordered. < 0,5 μ

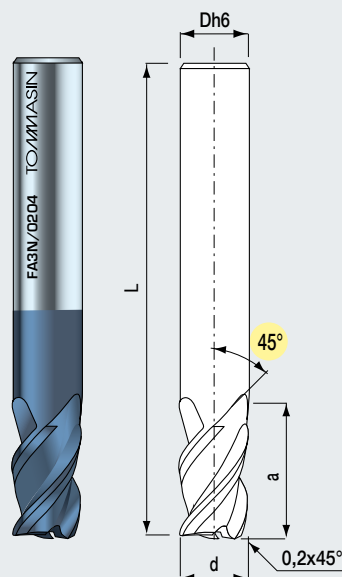
FA2N

art. **0252-Z2**



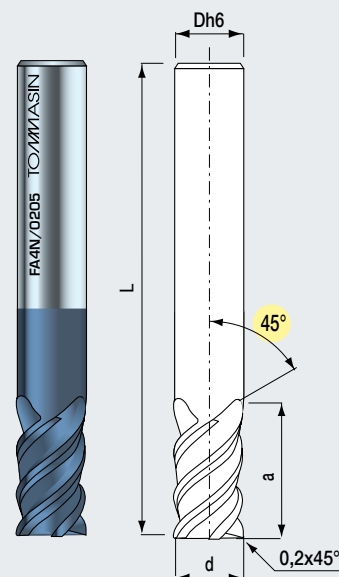
FA3N

art. **0204-Z3**



FA4N

art. **0205-Z4**



STANDARD

d=D	L	a
*4,0	50	8
6,0	57	10
8,0	63	16
10,0	70	20
12,0	73	22
14,0	75	22
16,0	82	26

ricopertura TiAlN
coating TiAlN

* = a richiesta
on request

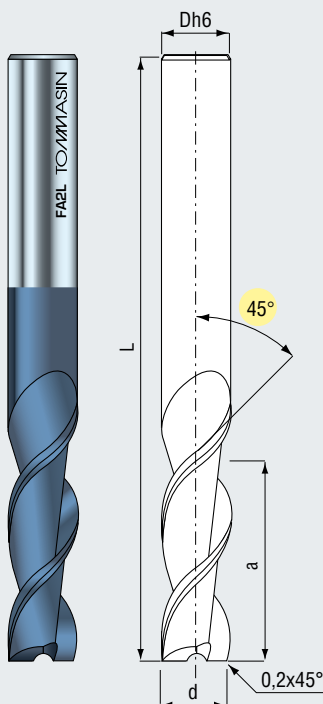
TYPE TFC/AL Frese cilindriche elica 45° serie lunga - tagliente al centro

Twist-end milling tools, 45° Long series center cutting

metallo duro Grana Extrafine. < 0,5 μ
Grain Extrafine ordered. < 0,5 μ

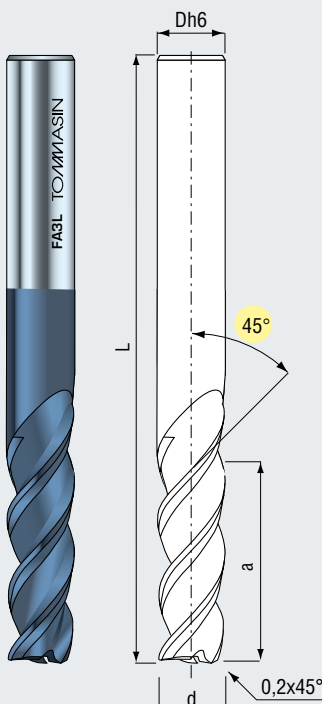
FA2L

*art. **0262-Z2**



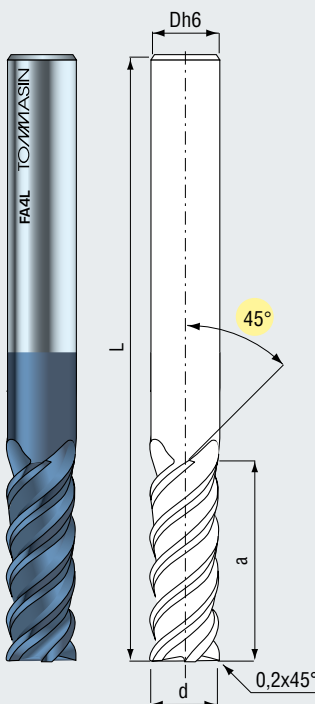
FA3L

*art. **0263-Z3**



FA4L

*art. **0264-Z4**



STANDARD

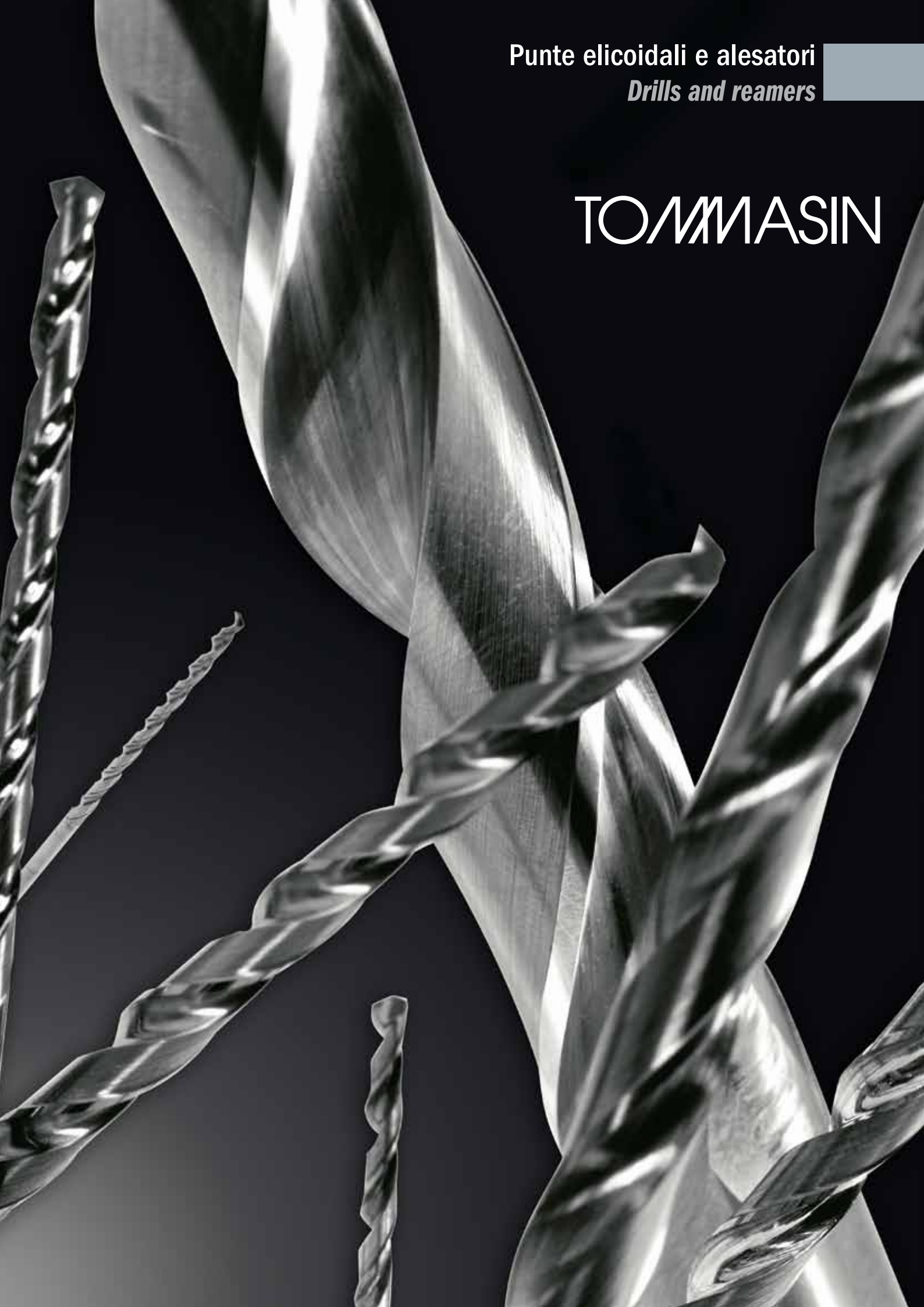
d=D	L	a
6,0	70	24
8,0	80	30
10,0	90	32
12,0	100	45
14,0	100	50
16,0	100	50

ricopertura TiAlN
coating TiAlN

* = a richiesta
on request

Punte elicoidali e alesatori
Drills and reamers

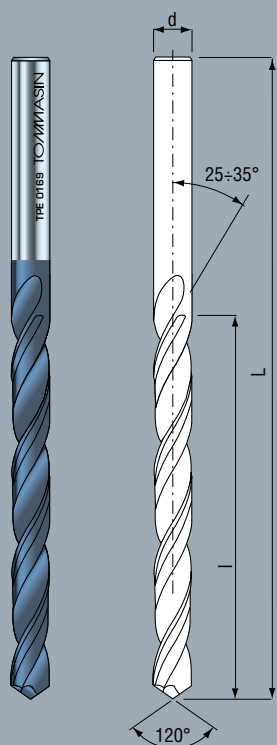
TO/MASIN



P T 2

art. **0169**

- Serie standard
- Standard size



DIN 338

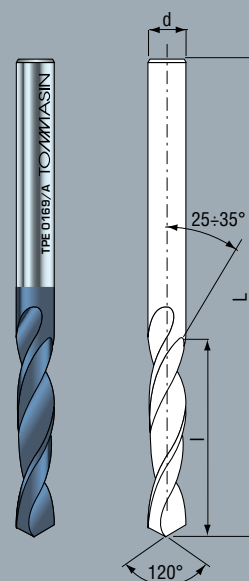
D=d	L	l
*0,5	22	6
*0,6	24	7
*0,7	28	9
*0,8	30	10
*0,9	32	11
1	34	12
1,1	36	14
1,2+1,3	38	16
1,4+1,5	40	18
1,6+1,7	43	20
1,8+1,9	46	22
2+2,1	49	24
2,2+2,3	53	27
2,4+2,6	57	30
2,7+3	61	33
3,1+3,3	65	36
3,4+3,7	70	39
3,8+4,2	75	43
4,3+4,7	80	47
4,8+5,3	86	52
5,4+6	93	57
6,1+6,7	101	63
6,8+7,5	109	69
7,6+8,5	117	75
8,6+9,5	125	81
9,6+10,5	133	87
*10,8+11,9	142	94
*12+13	150	101
*13,5+14,5	160	108
*15	169	114
*15,5+16	178	120

con ricopertura
dal Ø 1,5
with coating
from Ø 1,5

P C 2

art. **0169/A**

- Serie corta
- Short size

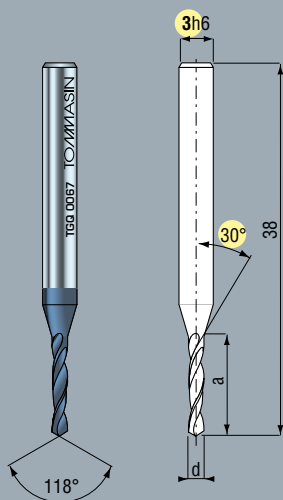


DIN 1897

D=d	L	l
0,3	22	4
0,35+0,6	22	5
0,65+0,70	28	6
0,75+0,9	28	8
1+1,1	26	8
1,2+1,3	30	8
1,4+1,5	32	9
1,6+1,7	34	10
1,8+1,9	36	11
2+2,1	38	12
2,2+2,3	40	13
2,4+2,6	43	14
2,7+3	46	16
3,1+3,3	49	18
3,4+3,7	52	20
3,8+4,2	55	22
4,3+4,7	58	24
4,8+5,3	62	26
5,4+6	66	28
6,1+6,7	70	31
6,8+7,5	74	34
7,6+8,5	79	37
8,6+9,5	84	40
9,6+10,5	89	43
11+11,5	95	47
12+13	102	51
14	107	54
*14,5+15	111	56
*16	115	58
*18	123	62
*20	131	66

con ricopertura
dal Ø 1,5
with coating
from Ø 1,5

art. **0067**



d	D	a
*0,3	3,0	4,0
*0,4	3,0	4,0
0,5	3,0	5,0
0,6	3,0	6,0
0,7	3,0	6,0
0,8	3,0	8,0
0,9	3,0	9,0
1,0	3,0	9,0
1,1	3,0	9,0
1,2	3,0	10

d	D	a
1,3	3,0	10
1,4	3,0	10
1,5	3,0	10
1,6	3,0	12
1,7	3,0	12
1,8	3,0	12
1,9	3,0	12
2,0	3,0	12
2,1	3,0	12
2,2	3,0	12

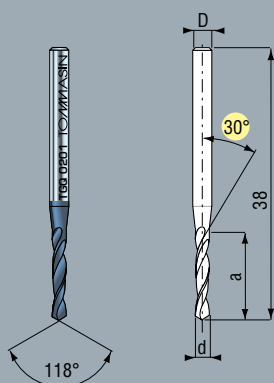
con ricopertura
dal Ø 1,5
with coating
from Ø 1,5

* = a richiesta
on request

Diametri semidecimali

Half decimal diameters

art. **0201**



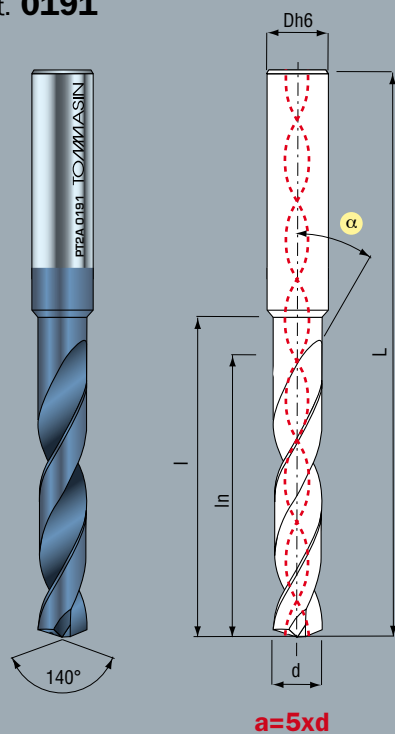
d	D	a
*0,25	2,0	3,0
*0,30	2,0	3,0
*0,35	2,0	4,0
*0,40	2,0	4,0
*0,45	2,0	4,0
0,50	2,0	6,0
0,55	2,0	6,0
0,60	2,0	6,0
0,65	2,0	7,0
0,70	2,0	7,0
0,75	2,0	8,0
0,80	2,0	8,0

d	D	a
0,85	2,0	8,0
0,90	2,0	8,0
0,95	2,0	10,0
1,00	2,0	10,0
1,05	2,0	10,0
1,10	2,0	10,0
1,15	2,0	10,0
1,20	2,0	10,0
1,25	2,0	10,0
1,30	2,0	10,0
1,35	2,0	10,0
1,40	2,0	12,0

d	D	a
1,45	2,0	12,0
1,50	2,0	12,0
1,55	2,0	12,0
1,60	2,0	12,0
1,65	2,0	12,0
1,70	2,0	12,0
1,75	2,0	12,0
1,80	2,0	12,0
1,85	2,0	12,0
1,90	2,0	12,0
1,95	2,0	12,0
2,00	2,5	12,0

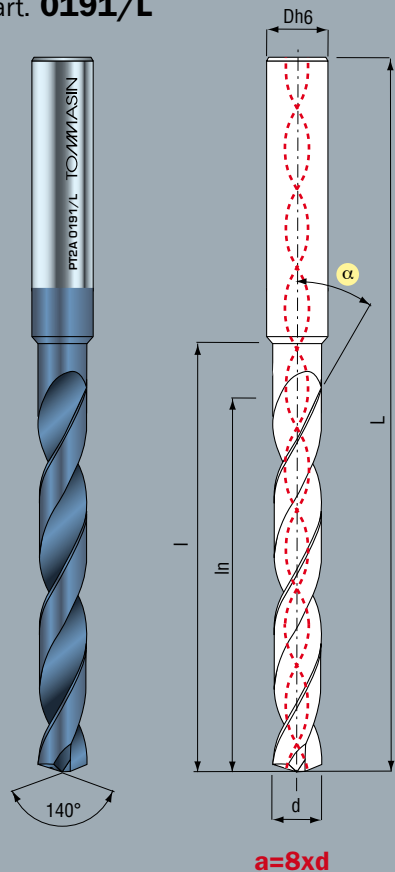
con ricopertura
dal Ø 1,5
with coating
from Ø 1,5

* = a richiesta
on request

art. **0191****ricopertura TiAlN**
coating TiAlN

d mm h6	D mm h6	L mm	l mm	ln mm
3,00	6,00	66	28	23
3,10	6,00	66	28	23
3,30	6,00	66	28	23
3,50	6,00	66	28	23
3,70	6,00	66	28	23
3,80	6,00	74	36	29
4,00	6,00	74	36	29
4,20	6,00	74	36	29
4,50	6,00	74	36	29
4,80	6,00	82	44	35
5,00	6,00	82	44	35
5,10	6,00	82	44	35
5,20	6,00	82	44	35
5,50	6,00	82	44	35
5,80	6,00	82	44	35
6,00	6,00	82	44	35
6,30	8,00	91	53	43
6,50	8,00	91	53	43
6,80	8,00	91	53	43
7,00	8,00	91	53	43
7,50	8,00	91	53	43
7,80	8,00	91	53	43
8,00	8,00	91	53	43
8,50	10,00	103	61	49
8,80	10,00	103	61	49
9,00	10,00	103	61	49

d mm h6	D mm h6	L mm	l mm	ln mm
9,20	10,00	103	61	49
9,50	10,00	103	61	49
9,80	10,00	103	61	49
10,00	10,00	103	61	49
10,20	12,00	118	71	56
10,50	12,00	118	71	56
10,80	12,00	118	71	56
11,00	12,00	118	71	56
11,50	12,00	118	71	56
11,80	12,00	118	71	56
12,00	12,00	118	71	56
12,30	14,00	124	77	60
12,50	14,00	124	77	60
12,80	14,00	124	77	60
13,00	14,00	124	77	60
13,50	14,00	124	77	60
14,00	14,00	124	77	60
14,50	16,00	133	83	63
15,00	16,00	133	83	63
15,50	16,00	133	83	63
16,00	16,00	133	83	63
16,50	18,00	143	93	71
17,00	18,00	143	93	71
17,50	18,00	143	93	71
18,00	18,00	143	93	71
20,00	20,00	153	101	77

*art. **0191/L**

d mm h6	D mm h6	L mm	l mm	ln mm
3,50	6,00	72	34	29
3,70	6,00	72	34	29
3,80	6,00	81	43	36
4,00	6,00	81	43	36
4,20	6,00	81	43	36
4,50	6,00	81	43	36
4,80	6,00	95	57	48
5,00	6,00	95	57	48
5,10	6,00	95	57	48
5,20	6,00	95	57	48
5,50	6,00	95	57	48
5,80	6,00	95	57	48
6,00	6,00	95	57	48
6,30	8,00	114	76	64
6,50	8,00	114	76	64
6,80	8,00	114	76	64
7,00	8,00	114	76	64
7,50	8,00	114	76	64
7,80	8,00	114	76	64
8,00	8,00	114	76	64
8,50	10,00	142	95	80
8,80	10,00	142	95	80
9,00	10,00	142	95	80
9,20	10,00	142	95	80

d mm h6	D mm h6	L mm	l mm	ln mm
9,50	10,00	142	95	80
9,80	10,00	142	95	80
10,00	10,00	142	95	80
10,20	12,00	162	114	96
10,50	12,00	162	114	96
10,80	12,00	162	114	96
11,00	12,00	162	114	96
11,50	12,00	162	114	96
11,80	12,00	162	114	96
12,00	12,00	162	114	96
12,30	14,00	178	133	128
12,50	14,00	178	133	128
12,80	14,00	178	133	128
13,00	14,00	178	133	128
13,50	14,00	178	133	128
14,00	14,00	178	133	128
14,50	16,00	203	152	128
15,00	16,00	203	152	128
15,50	16,00	203	152	128
16,00	16,00	203	152	128

ricopertura TiAlN
coating TiAlN

* = a richiesta - on request

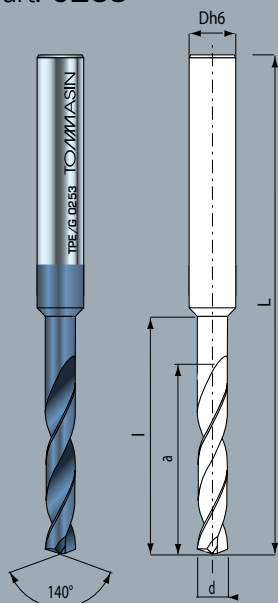
TYPE TPE/G

Punte elicoidali - gambo rinforzato

Twist drills with reinforced shank

metallo duro Micro Grana
Tungsten Carbide Micro-Grain

*art. **0253**



d	D	L	l	a
3,0	6,0	60	21	18
3,3	6,0	60	21	20
3,5	6,0	66	23	22
3,8	6,0	66	25	24
4,0	6,0	66	25	24
4,3	6,0	66	28	26
4,5	6,0	66	30	28
4,8	6,0	70	30	28
5,0	6,0	70	32	30
5,3	6,0	70	34	32
5,5	6,0	70	36	32
5,8	6,0	70	36	32
6,0	8,0	80	40	36
6,3	8,0	80	40	38
6,5	8,0	80	44	38
6,8	8,0	80	44	40

ricopertura TiAlN
coating TiAlN

* = a richiesta - on request

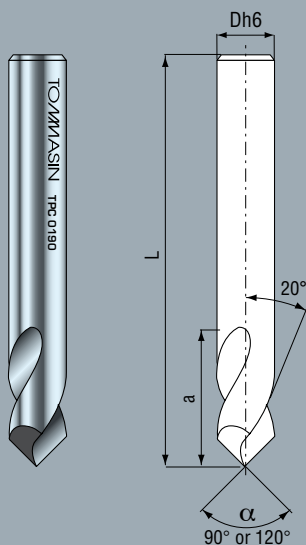
TYPE TPC

Punte a centrare

Center Drills

metallo duro integrale
Micrograne tungsten carbide

art. **0190**

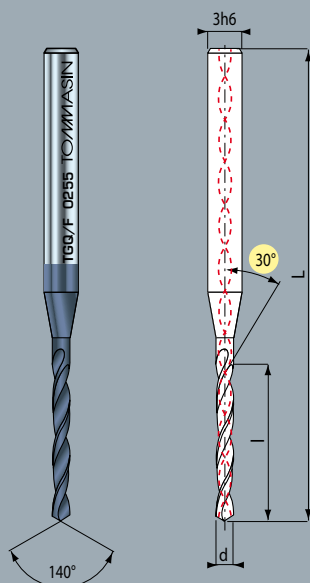


D=d	L	a
4,0	50	12
5,0	50	14
6,0	60	15
8,0	63	20
10,0	66	23
12,0	73	28

TYPE **TGQ/F** Micropunte con fori di lubrificazione Center Micro drill with coolant holes

metallo duro Grana Extrafine
grain Extrafine ordered

art. **0255**



con ricopertura
with coating

d mm h6	D mm h6	L mm	l mm
1,00*	3,00	55	8
1,10*	3,00	55	12
1,20*	3,00	55	12
1,30*	3,00	55	12
1,40*	3,00	55	12
1,50*	3,00	55	12
1,60*	3,00	65	12
1,70*	3,00	65	12
1,80*	3,00	65	12
1,90*	3,00	65	12
2,00*	3,00	65	12
2,10*	3,00	74	20
2,20*	3,00	74	20
2,30*	3,00	74	20
2,40*	3,00	74	20
2,50	3,00	74	20
2,60	3,00	81	23
2,70	3,00	81	23
2,80	3,00	81	23
2,90	3,00	81	23

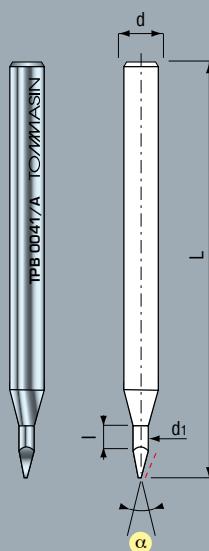
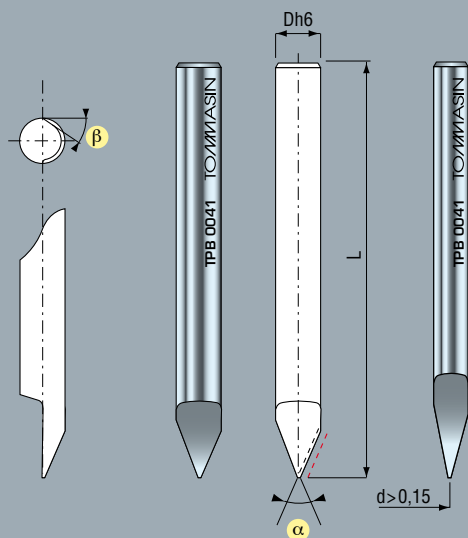
* = a richiesta
on request

TYPE **TPB** Punta per lavorazione su pantografi Gravers for pantograph

metallo duro Micro Grana
tungsten Carbide Micro-Grain

art. **0041**

art. **0041/A**



STANDARD

D	3,0	4,0	6,0
L	40	50	57
α	15° or 25°	15° or 25°	15° or 25°

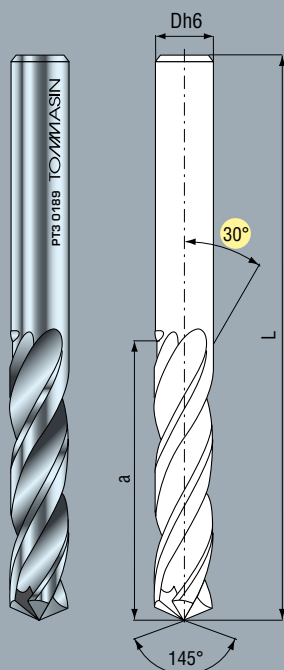
ANGOLI DI AFFILATURA

Per materiali	β°
acciai legati	12-15
acciai da costruzione	20-25
ottone duro	25-35
ottone tenero	35-40
alluminio duro	40
alluminio tenero	45
celluloide	45-60
legno, fibra prespan, ecc.	45-50

VELOCITÀ

Per materiali	sgross. m/ min.	finit. m/ min.
Acciai da utensili e dolci	60	90
Acciai da utensili duri	40	70
Ghisa e ghisa dura	50	80
Acciai da costr. e forg. R. 40/60 Kg/mm ²	60	90
Acciai da costr. e forg. R. 80 Kg/mm ²	40	70
Acciai da costr. e forg. R > 80 Kg/mm ²	25	45
Ottone duro	100	150
Ottone tenero	70	120
Alluminio, fibra ecc.	200	200
Legno, celluloide	200	250

*art. **0189**



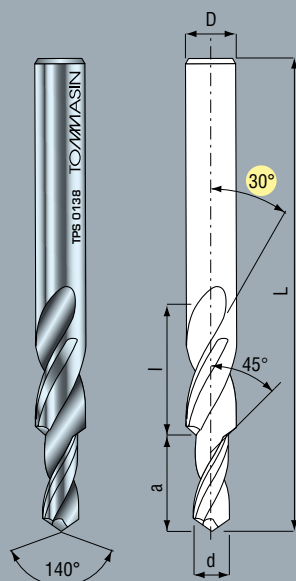
DIN 1897

D=d	L	a
3,0	46	16
3,2	50	18
3,5	52	20
3,8	55	22
4,0	55	22
4,3	58	24
4,5	58	24
4,8	62	26
5,0	62	28
5,3	66	28
5,5	66	31
6,0	70	31
6,3	70	31
6,5	70	31
6,8	74	34

D=d	L	a
7,0	74	34
7,5	74	34
8,0	80	37
8,5	80	37
9,0	84	40
9,5	84	40
10,0	90	43
10,5	90	43
11,0	95	47
12,0	100	51
13,0	100	51
14,0	110	55
15,0	110	56
16,0	115	59
18,0	120	63

* = a richiesta - on request

*art. **0138**



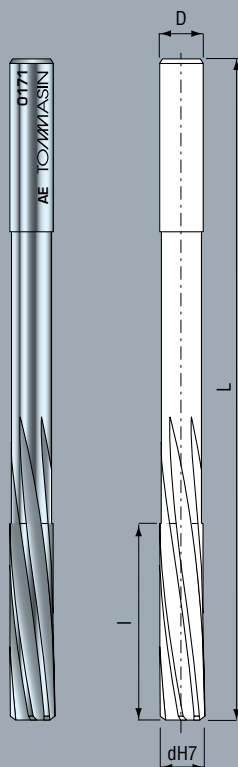
M	d	D	a	l	L
3,0	2,5	6,0	20	9	64
4,0	3,3	6,0	20	12	64
5,0	4,2	6,0	26	14	64
6,0	5,0	8,0	35	17	80
8,0	6,8	10,0	43	22	90
10,0	8,5	14,0	52	25	110
12,0	10,2	16,0	54	30	110

* = a richiesta - on request

A E

art. **0171**

- Alesatore elicoidale spirale sinistra
- Left hand twist reamer right hand cut **DIN 212**



STANDARD

d	D	l	L	Z
1,5	2	8	40	4
1,6	2	9	40	4
1,7	2	9	40	4
1,8	2	10	46	4
1,9	2	10	46	4
2	2	11	50	4
2,1	2,5	11	50	4
2,2	2,5	11	50	4
2,3	2,5	12	55	4
2,4	2,5	13	55	4
2,5	2,5	14	55	5
2,6	2,6	14	55	5
2,7	2,7	14	60	5
2,8	3	15	60	5
2,9	3	15	60	5
3	3	15	60	5
3,1	3,1	16	65	5
3,2	3,2	16	65	5
3,3	3,5	16	65	5
3,4	3,5	16	65	5

d	D	l	L	Z
3,5	3,5	18	70	5
3,6	3,6	18	70	5
3,7	3,7	18	70	5
3,8	4	18	70	5
3,9	4	19	75	5
4	4	19	75	5
4,1	4,1	19	75	5
4,2	4,2	19	75	5
4,3	4,5	19	75	5
4,4	4,5	21	80	5
4,5	4,5	21	80	5
4,6	4,6	21	80	5
4,7	5	21	80	5
4,8	5	21	80	5
4,9	5	23	86	5
5	5	23	86	5
5,1	5,1	23	86	5
5,2	5,2	23	86	5
5,3	5,5	23	86	5
5,4	5,5	23	86	5

d	D	l	L	Z
5,5	5,5	26	93	6
5,6	5,6	26	93	6
5,7	5,7	26	93	6
5,8	6	26	93	6
5,9	6	26	93	6
6	6	26	100	6
6,1	6,1	28	100	6
6,2	6,5	28	100	6
6,3	6,5	28	100	6
6,4	6,5	28	100	6
6,5	6,5	28	100	6
7	7	31	110	6
7,5	7,5	31	110	6
8	8	33	120	6
8,5	8,5	33	120	6
9	9	35	125	6
9,5	9,5	36	125	6
10	10	38	133	6
12	12	44	150	8
14	14	47	160	8

Divisione dei taglienti

Cutting division

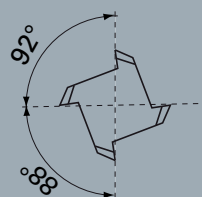
Scanalature elicoidali sinistre

Left twist cut

4 taglienti

4 cuts

92° / 88°



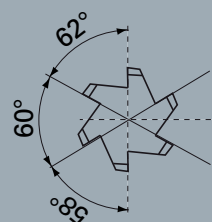
Scanalature elicoidali sinistre

Left twist cut

6 taglienti

6 cuts

62° / 60° / 58°

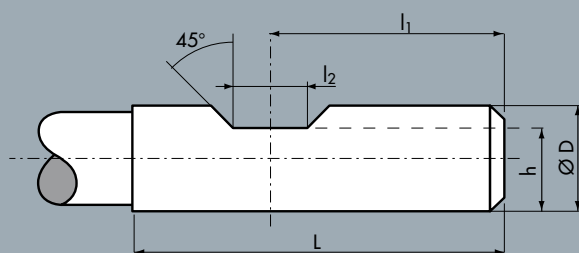


Codoli con attacco DIN 6535

Shanks with side flat DIN 6535

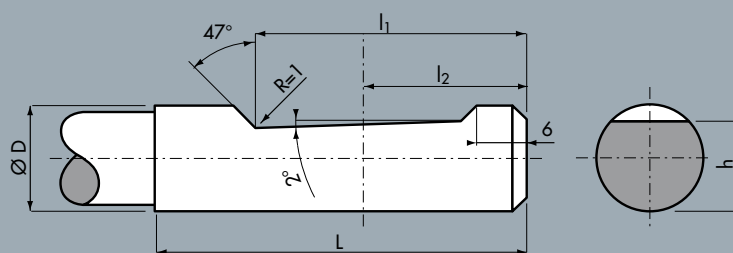
a richiesta
on request

(WELDON-HB)



D	L	l ₁	h	l ₂
4	28	-	-	-
6	36	18	4,8	4,2
8	36	18	6,6	5,5
10	40	20	8,4	7
12	45	22,5	10,4	8
14	45	22,5	12,7	8
16	48	24	14,2	10
18	48	24	14,2	10
20	50	25	18,2	11
25	56	32	23	12
32	60	36	30	14

(HE-HEK)



D	L	l ₁	h	l ₂
4	28	-	-	-
6	36	25	18	5,3
8	36	25	18	7,1
10	40	28	20	8,9
12	45	33	22,5	10,9
14	45	33	22,5	12,4
16	48	36	24	14,5
18	48	36	24	16,2
20	50	38	25	18,2
25	56	44	32	23
32	60	48	35	30

Ricoperture

Surface coating

a richiesta
on request

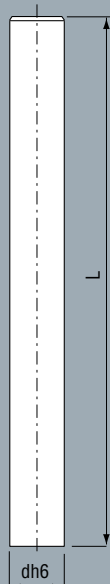
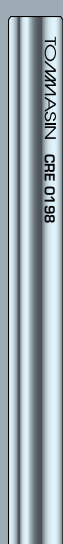
La tecnica PVD (physical vapor deposition) permette di creare delle ricoperture che applicate sugli utensili, migliorano le caratteristiche di base, avvicinandosi ai migliori compromessi. A seconda del tipo di superficie su cui viene applicata e del tipo di lavorazione a cui l'utensile sarà sottoposto, esistono diversi tipi di ricoperture, le cui caratteristiche sono evidenziate nella seguente tabella.

RICOPERTURA coating material	TiAlN	TiCN	TiN	WC/C	CrN	DLC	DIAMOND
MICRO DUREZZA micro hardness HV 0,05	3300	3000	2500	1000	750	> 2000	>8000
COEFFICIENTE DI FRIZIONE contro acciaio non lubrificato coefficient of friction against unlubricated steel	0,3	0,25	0,4	0,2	0,3	0,1/0,2	-
SPESSORE coating thicknesses	1-4 um	1-4 um	1-4 um	1-4 um	1-4 um	0,5-2,5 um	3-20 um
TEMPERATURA DI RICOPERTURA coating temperature	450°C	420°C	420°C	-	180°C 450°C	250°C	-
TEMPERATURA MAX. maximum working temperature	800°C	450°C	550°C	300°C	650°C	300°C	-
COLORE coating colour	nero antracite	blu grigio	oro giallo	nero grigio	argento grigio	nero	nero
ABRASIOINE resistance to abrasion	+++	+++	++	+	++	+++	-

TYPE **CRE**

Cilindretti rettificati
metallo duro Micro Grana
Grounder rods
Tungsten Carbide Micro-Grain

art. **0198**



C R E

Lunghezza standard

d	L
2,0	40
2,0	100
2,5	40
2,5	100
3,0	50
3,0	100
4,0	55
4,0	100
5,0	60
5,0	100

d	L
6,0	65
6,0	100
8,0	80
8,0	100
10,0	100
12,0	100
14,0	110
16,0	110
18,0	110
20,0	110

TYPE **BRE**

Bulini smezzati
metallo duro Micro Grana
Engraving tools
Tungsten Carbide Micro-Grain

art. **0202**

B R E S

- Bulini rettificati, **serie standard**
- Single lip cutter, standard lenght

d	2	3	4	5	6	8	10	12
L	40	40	40	50	60	80	80	80
I	3	3	4	5	5	7	8	8

art. **0203**

B R E L

- Bulini rettificati, **serie lunga**
- Single lip cutter, long series

d	3	4	5	6	8	10	12	14
L	100	100	100	100	100	100	100	100
I	4	5	7	8	10	13	16	18

Qualità di M.D. - Composizione e caratteristiche Mechanical characteristics of solid carbide

Codice ISO	Codice USA	Dimensione grana	TiC/ Ta(Nb)C	Legante	Densità	Durezza			Resistenza alla flessione TRS		K _{1c} * SEVNB
				(%)	g/cm ³	HV10	HV30	HRA	MPa	P.S.i.	MPa*m ^{1/2}
K10-K20	C-2	ultrafine	-	8,2	14,55	1970	1930	93,7	4400	638.000	7,5
K10-K30	C-2	ultrafine	-	12,0	14,10	1760	1730	92,7	4600	667.000	7,5
K05-K10	C-3	micrograna	-	6,0	14,80	1820	1790	93,0	3500	507.500	8,2
K10-K30	C-3	micrograna	-	7,5	14,75	1750	1720	92,6	3500	507.500	8,6
K20-K40	C-2	micrograna	-	10,0	14,50	1610	1590	91,9	3700	536.000	9,4
					14,45	1680	1660	92,3	3700	536.000	9,4
K20-K40	C-3	micrograna	-	9,0	14,55	1610	1590	91,9	3600	522.000	10,4
K15	C-2	micrograna	-	6,0	15,00	1650	1630	92,1	2600	377.000	10,2
K10	C-3	fine	-	5,6	14,95	1760	1730	92,7	2150	311.900	9,2
K15	C-2	fine	-	6,0	14,95	1670	1650	92,2	2200	333.500	9,9

Classificazione della dimensione grana WC

Dimensione grana WC (um)	Classificazione
< 0,2	nano
0,2 - 0,5	ultrafine
0,5 - 0,8	micrograna
0,8 - 1,3	fine
1,3 - 2,5	media
2,5 - 6,0	grossa
> 6,0	extragrossa

Seghe circolari in metallo duro integrale
Disk Saws (tungsten carbide)

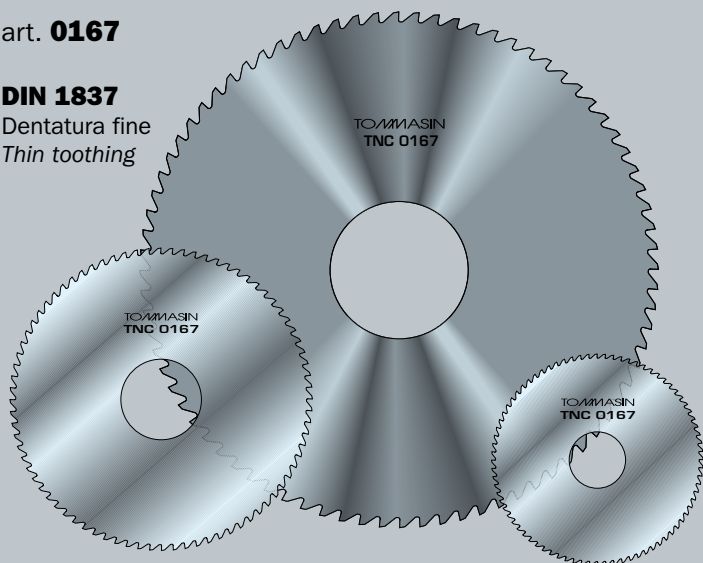


TOMMASIN

art. **0167**

DIN 1837

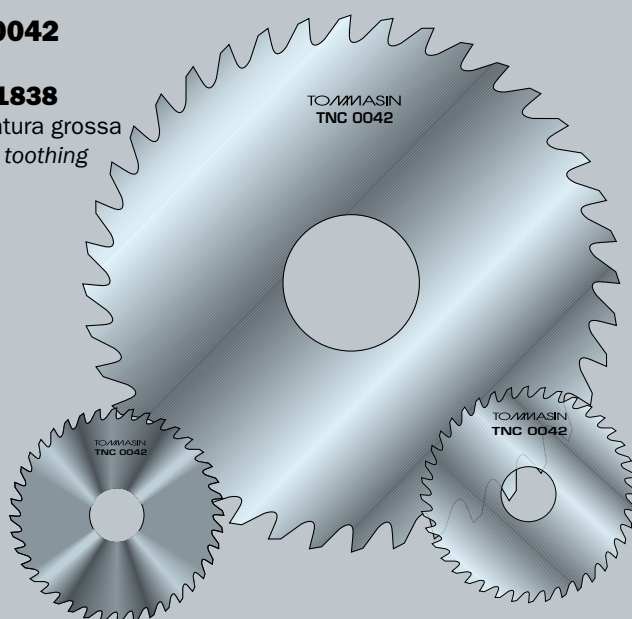
Dentatura fine
Thin toothing



art. **0042**

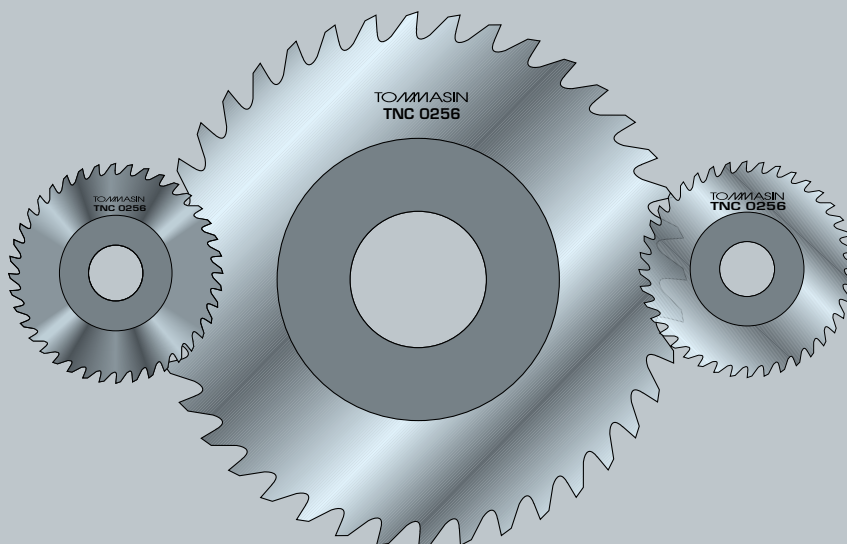
DIN 1838

Dentatura grossa
Large toothing



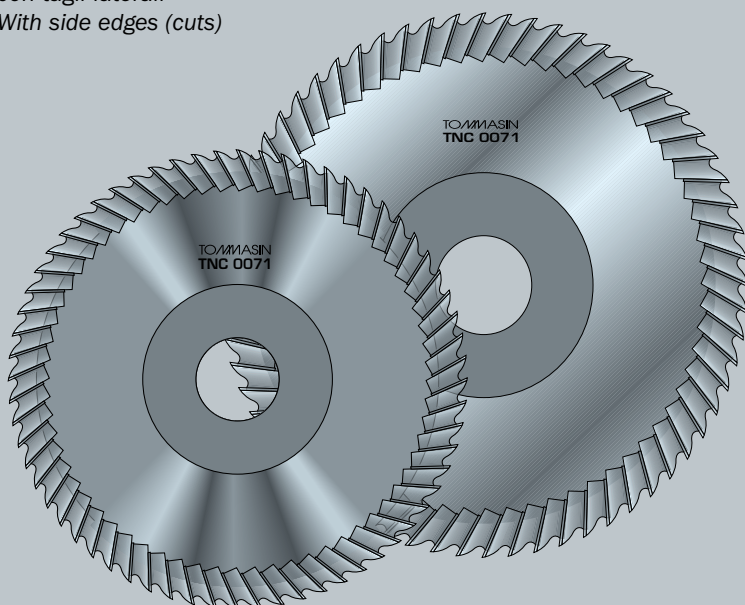
*art. **0256**

Con Mozzo
With Hub



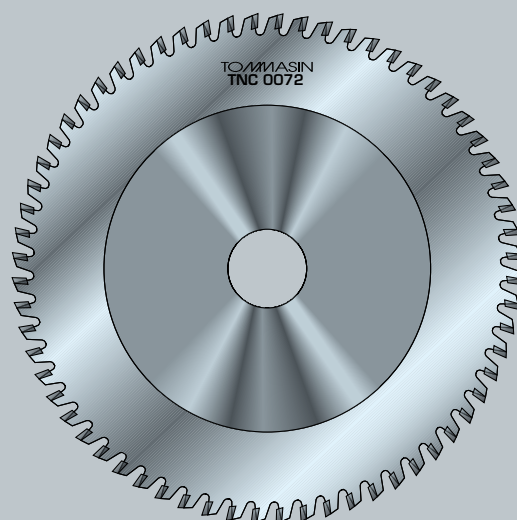
*art. **0071**

con tagli laterali
With side edges (cuts)



*art. **0072**

con placchette riportate
With reported blade



* = a richiesta - on request

Dentatura seghe circolari normali

Normal disk saws toothing

DIN 1837-1838

DIN 1837-1838

Ø mm	Ø 20		Ø 25		Ø 30		Ø 40			Ø 50			Ø 63		
FORO/Hole	5h7		8h7		8h7		10h7			13h7			16h7		
SPESSORE Thickness	DIN 1837	DIN 1838	DIN 1837	DIN 1838	DIN 1837	DIN 1838	DIN 1837	DIN 1838		DIN 1837	DIN 1838		DIN 1837	DIN 1838	
0,2	80	40	80	48	100	72	128	80	64	128	100	64	160	128	100
0,3	64	30	80	48	80	72	100	80	64	128	100	64	140	128	80
0,4	64	30	64	38	80	60	100	60	44	100	80	64	128	100	64
0,5	48	22	64	38	80	60	100	60	44	100	64	48	128	80	64
0,6	48	22	64	38	80	60	100	60	44	100	64	48	128	64	48
0,7	48	22	48	28	64	36	80	48	30	80	64	40	100	64	48
0,8-0,9	48	20	48	28	64	36	80	48	30	80	64	40	100	64	48
1-1,1	40	20	48	28	64	30	64	48	30	80	64	40	100	64	48
1,2-1,5	40	20	48	28	48	24	64	48	30	80	64	40	80	64	40
1,6-1,9	40	20	40	24	48	24	64	48	30	64	40	32	80	64	40
2÷2,4	32	18	40	24	48	24	48	40	30	64	40	32	80	64	40
2,5÷2,9	32	16	40	24	40	22	48	40	30	64	40	24	64	40	32
3÷3,5	24	14	32	18	40	22	48	40	28	48	32	24	64	40	32
3,6÷4	24	14	32	18	40	22	48	40	28	48	32	24	64	32	24
4,1÷5,2	24	14	32	18	32	16	40	36	22	48	30	24	48	32	24
5,3÷6	24	14	24	14	32	14	40	36	26	40	24	20	48	32	20

Ø mm	Ø 80			Ø 100			Ø 125			Ø 160			Ø 200		
FORO/Hole	22h7			22h7			22h7			32h7			32h7		
SPESSORE Thickness	DIN 1837	DIN 1838		DIN 1837	DIN 1838		DIN 1837	DIN 1838		DIN 1837	DIN 1838		DIN 1837	DIN 1838	
0,4÷0,5	160	128	100	160	128	100	/	/	/	/	/	/	/	/	/
0,6÷0,7	128	100	64	160	128	80	160	120	64	/	/	/	/	/	/
0,8÷0,9	128	100	64	128	80	64	160	100	64	180	120	80	200	160	120
1÷1,1	100	64	48	128	64	48	160	100	64	160	120	80	200	140	100
1,2÷1,5	100	64	48	128	64	48	128	80	64	160	120	80	200	140	100
1,6÷1,9	100	64	48	100	64	48	128	80	64	160	120	80	160	100	80
2÷2,5	80	64	40	100	64	48	100	64	48	128	80	64	160	100	80
2,6÷2,9	80	64	40	100	64	40	100	64	48	128	80	64	160	80	64
3÷3,5	80	64	40	80	64	40	100	64	48	128	80	64	128	80	64
3,6÷4	64	40	32	80	64	40	100	64	48	100	64	48	128	80	64
4,1÷5,2	64	40	24	80	64	40	80	64	40	100	64	48	128	80	64
5,3÷6	64	32	24	64	40	32	80	64	40	100	64	48	100	64	48

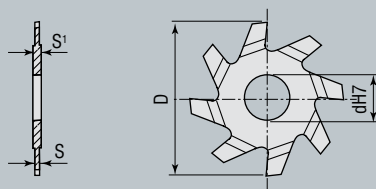
*art. **0161**

Ø		foro/hole	Z
50	0,30	10	160
50	0,40	10	160
50	0,45	10	160
50	0,50	10	160
50	0,60	10	160
50	0,70	10	160
50	0,80	10	160

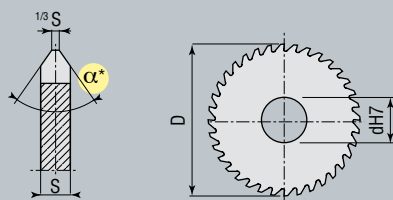
Ø		foro/hole	Z
63	0,30	10	200
63	0,40	10	200
63	0,45	10	200
63	0,50	10	200
63	0,60	10	200
63	0,70	10	200
63	0,80	10	200

FRESE PER SMICCAGGIO COLLETTORI ELETTRICI
MILLING CUTTERS FOR ELECTROMOTOR

***Art. 0089** Profilo normale - Normal profile



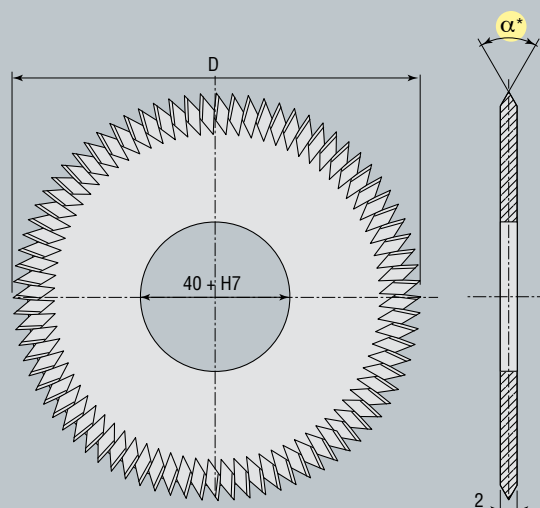
***Art. 0090** Profilo a "V" - "V" profile



FRESE CIRCOLARI PER CIRCUITI STAMPATI
CIRCULAR CUTTERS FOR PRINTED CIRCUIT

***Art. 0091**

Per macchine scoring - For scoring machines



Impiego: Scegliendo il metallo duro con le caratteristiche adatte al materiale da lavorare, le ns. seghe circolari permettono di ottenere la maggior produzione determinata dalle alte velocità di taglio, con il minimo costo di unità di prodotto.

La massima resa si ottiene curando alcuni accorgimenti essenziali, quali: l'assenza dei giochi dell'albero porta frese, bloccaggio rigido del pezzo da lavorare, evitando pressioni laterali.

Entrata in lavoro morbida ed avanzamento costante, che varia da 0,002 a 0,04 in rapporto al materiale da lavorare, spessore e diametro della sega ed eventuali vibrazioni.

Lubrificare dovunque è possibile con oli emulsionabili se si lavorano materiali ferrosi; petrolio o kerosene per leghe leggere, quali alluminio, alpacca, ecc.; getto d'aria compressa, se ghisa o fibre plastiche.

Use: Choosing carbide with the right characteristic for material to work, our circular saws let obtain the greatest production determined by high cutting speed, with the minimum product unit cost.

You can get the greatest result observing some main shrewdness, like the lack of cutters shaft play, rigid blocking of the part to mill, avoiding side pressing.

Smooth working entrance and invariable feeding, with a tolerance from 0,002 to 0,04, with respect to material to mill, thickness, saw diameter and possible vibrations.

It's possible to lubricate everywhere with emulsible oil if working on ferrous metal; petroleum or kerosene for light alloy, like aluminium, nickel silver, etc.; compressed air jet if working on cast iron or plastic fibre.

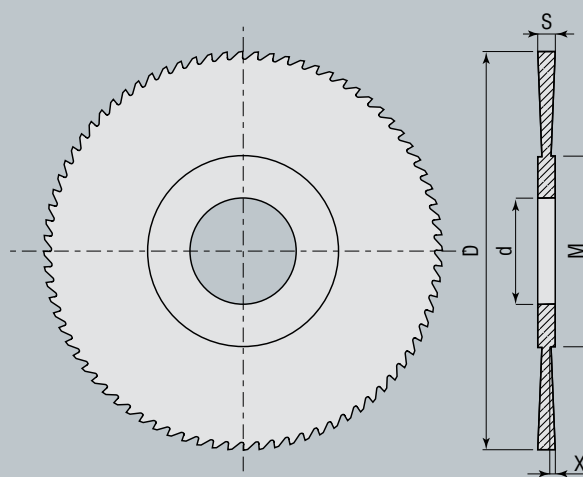
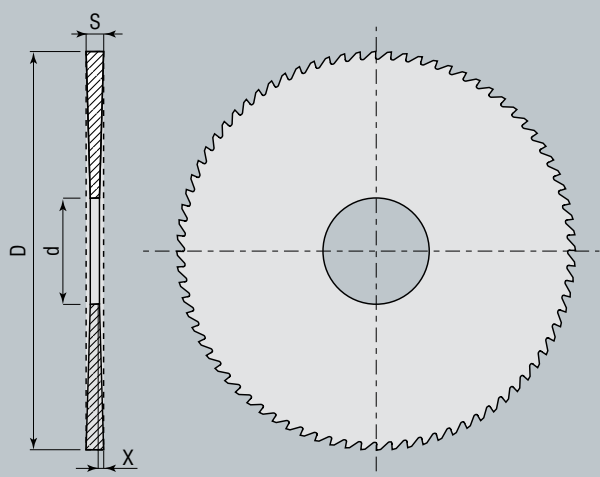
* = a richiesta - on request

Sega circolare senza mozzo

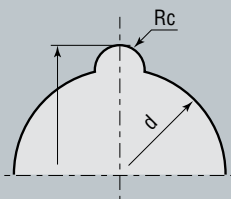
Circular saw without hub

Sega circolare con mozzo

Circular saw with hub



*OPTIONAL



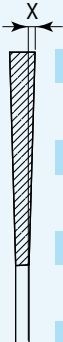
DRAGGING
SPLINE

CHIAVETTA
TRASCINAMENTO

Rastremazioni e scarichi (X) - Ns. standard

Tapering and releasing (X) - Our Standard

Scarico Tot. / Tot. Releasing = X2

D	12-30		0,01 ÷ 0,03
D	40		0,02 ÷ 0,03
D	50		0,03 ÷ 0,04
D	63		0,04 ÷ 0,06
D	70		0,05 ÷ 0,07
D	80		0,06 ÷ 0,08
D	100		0,07 ÷ 0,09
D	125		0,08 ÷ 0,1

Velocità di taglio

Cutting speed

Materiale	Materials	V = m/min
Acciaio 50 Kg./mm ²	Steel 50 Kg./mm ²	140 ÷ 160
Acciaio inox	Stainless steel	80 ÷ 150
Acciaio 120 Kg./mm ²	Steel 120 Kg./mm ²	35 ÷ 45
Acciaio fuso	Steel jets	25 ÷ 35
Ghisa in fusione	Grey cast iron	110 ÷ 130
Titanio	Titanium	25 ÷ 35
Metalli non ferrosi	Non ferrous metals	150 ÷ 220
Materie sintetiche	Synthetic materials	280 ÷ 360

Grado di finitura

PIANI LATERALI = Lappatura speculare
SPOGLIA INFERIORE = Superfinitura
SPOGLIA SUPERIORE = Lappatura

Finishing limit

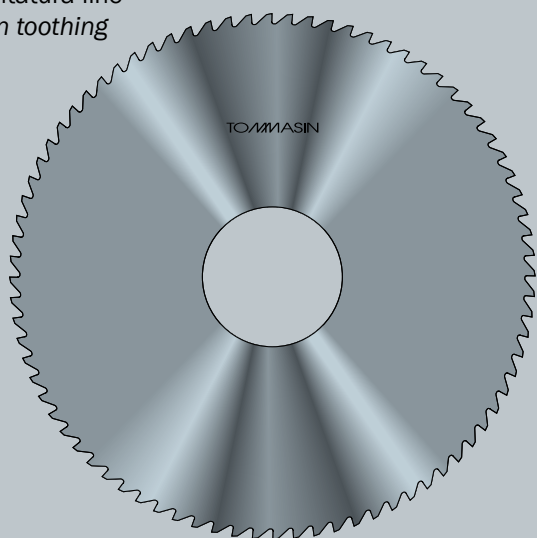
SIDE FACE = Specular lapping
LOWER RELIEF ANGLE = Super finishing
UPPER RELIEF ANGLE = Lapping

Tolleranze / Tolerance

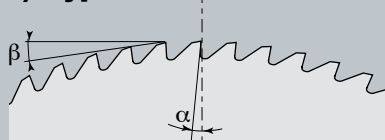
Spessore / Thickness + 0,01 Diametro / Diameter + 0,2 - 0 Foro / Hole H7

Art. 0167 DIN 1837

Dentatura fine
Thin toothing



Tipo / Type A DIN 1837



Dentatura fine - Thin teeth

Acciaio 120 Kg./mm² - Ghisa in fusione - Acciaio fuso

Steel 120 Kg./mm² - Grey cast iron - Steel jets

$\alpha = 0 \div 5^\circ$ $\beta = 6 \div 8^\circ$

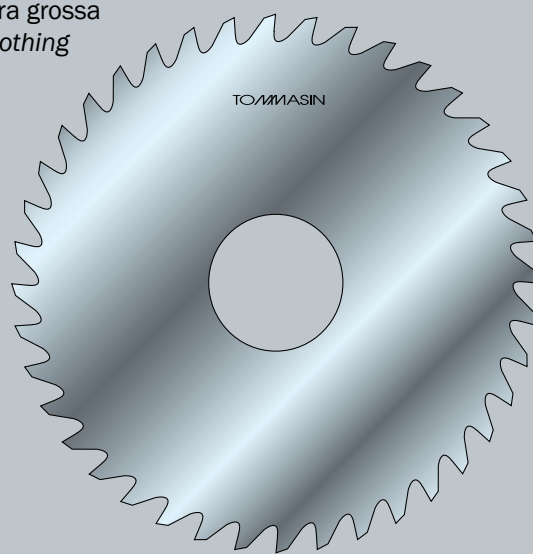
Acciaio 50 Kg./mm² - Metalli non ferrosi

Steel 50 Kg./mm² - Non ferrous metals

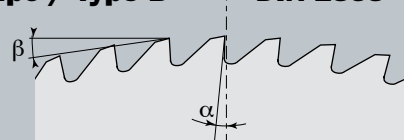
$\alpha = 3 \div 7^\circ$ $\beta = 10 \div 14^\circ$

Art. 0042 DIN 1838

Dentatura grossa
Large toothing



Tipo / Type B DIN 1838



Dentatura grossa - Large teeth

Per bronzo, ottone e simili

For bronze, brass and similar

$\alpha = 2 \div 5^\circ$ $\beta = 9 \div 12^\circ$

Per alluminio, rame, materie sintetiche

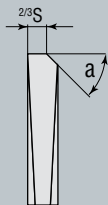
For aluminium copper and synthetic material

$\alpha = 6 \div 12^\circ$ $\beta = 10 \div 16^\circ$

Tipo / Type "C"

***Art. 0248 Dentatura stradata**
Alternating teeth

S = > 0.8



La stradatura alternata dei denti genera la continua interruzione del truciolo, favorendo così una maggior capacità di scarico. Ottima resa su acciaio inox e materiali pastosi.

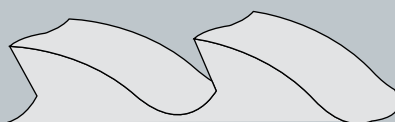
Alternating teeth make a continuous interruption of chip, favouring a greater releasing capacity.

Very good result on stainless steel and plastic material.

Tipo / Type "D"

***Art. 0249 Dentatura elicoidale**
Helicoidal teeth

S = > 2.2



Il dente elicoidale garantisce una asportazione omogenea e continua, eliminando così notevolmente le sbavature residue. Consigliato soprattutto per ottenere buone finiture, lavorando con grossi spessori.

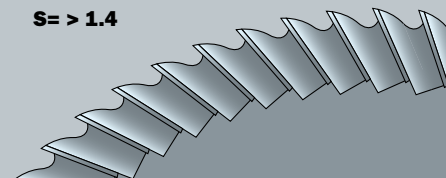
Helicoidal teeth guarantees an homogeneous and continuous removal, taking away in great quantity the remaining residue.

It's recommended specially to obtain good finishing, working with large thickness.

Tipo / Type "E"

***Art. 0071 con tagli laterali**
with side edges (cuts)

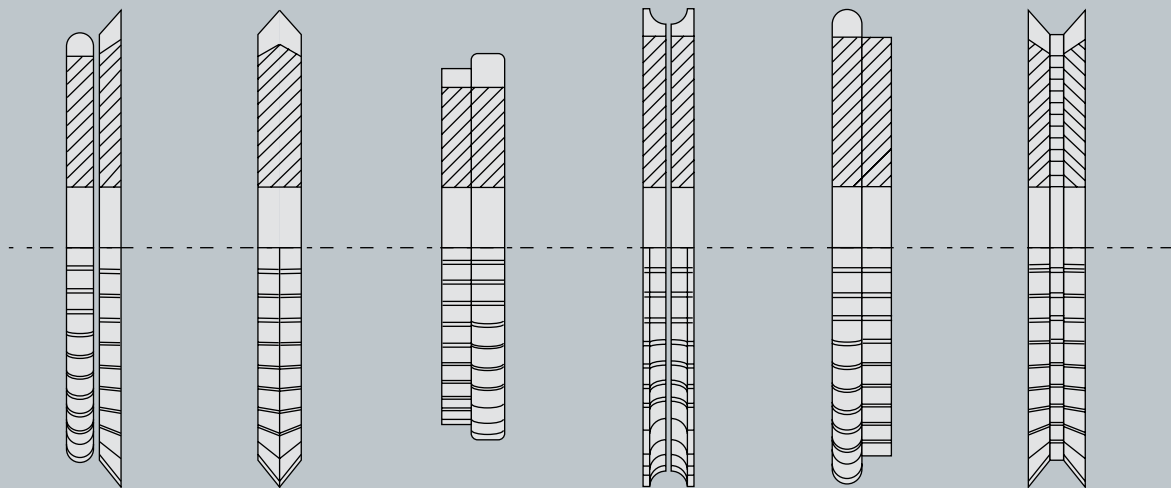
S = > 1.4



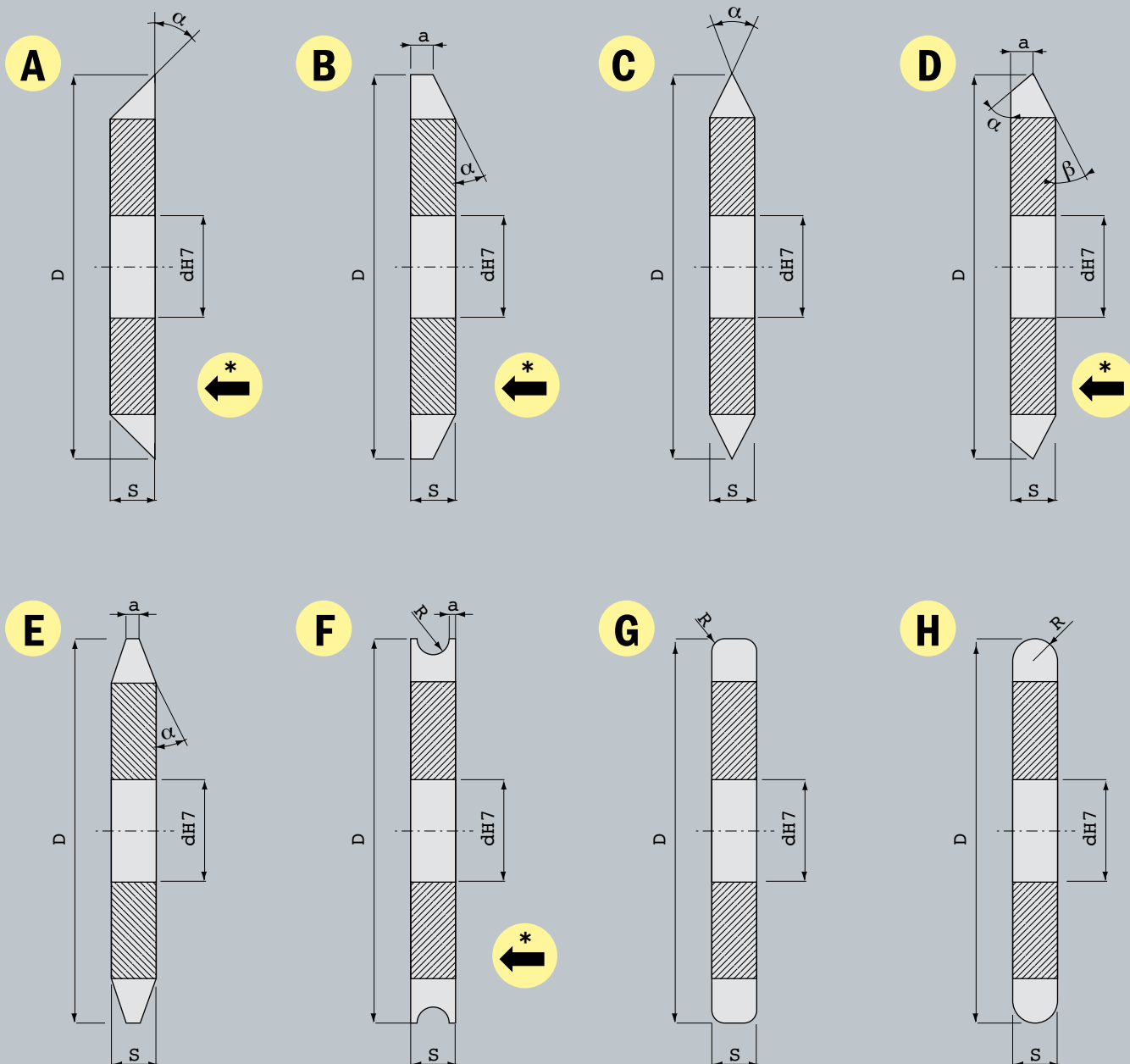
Gli scarichi laterali permettono di ottenere una buona finitura, senza rigature, anche in tagli profondi, riducendo al minimo l'attrito laterale.

The side cuts let obtain a good finishing, without lines, even in deep cut, reducing to a minimum the lateral friction.

* = a richiesta - on request



Elementi indispensabili per richieste specifiche di profili
Essential sizes for requests of special shape



*Indicare senso di rotazione.

*Indicate rotational direction.



TOMMASIN

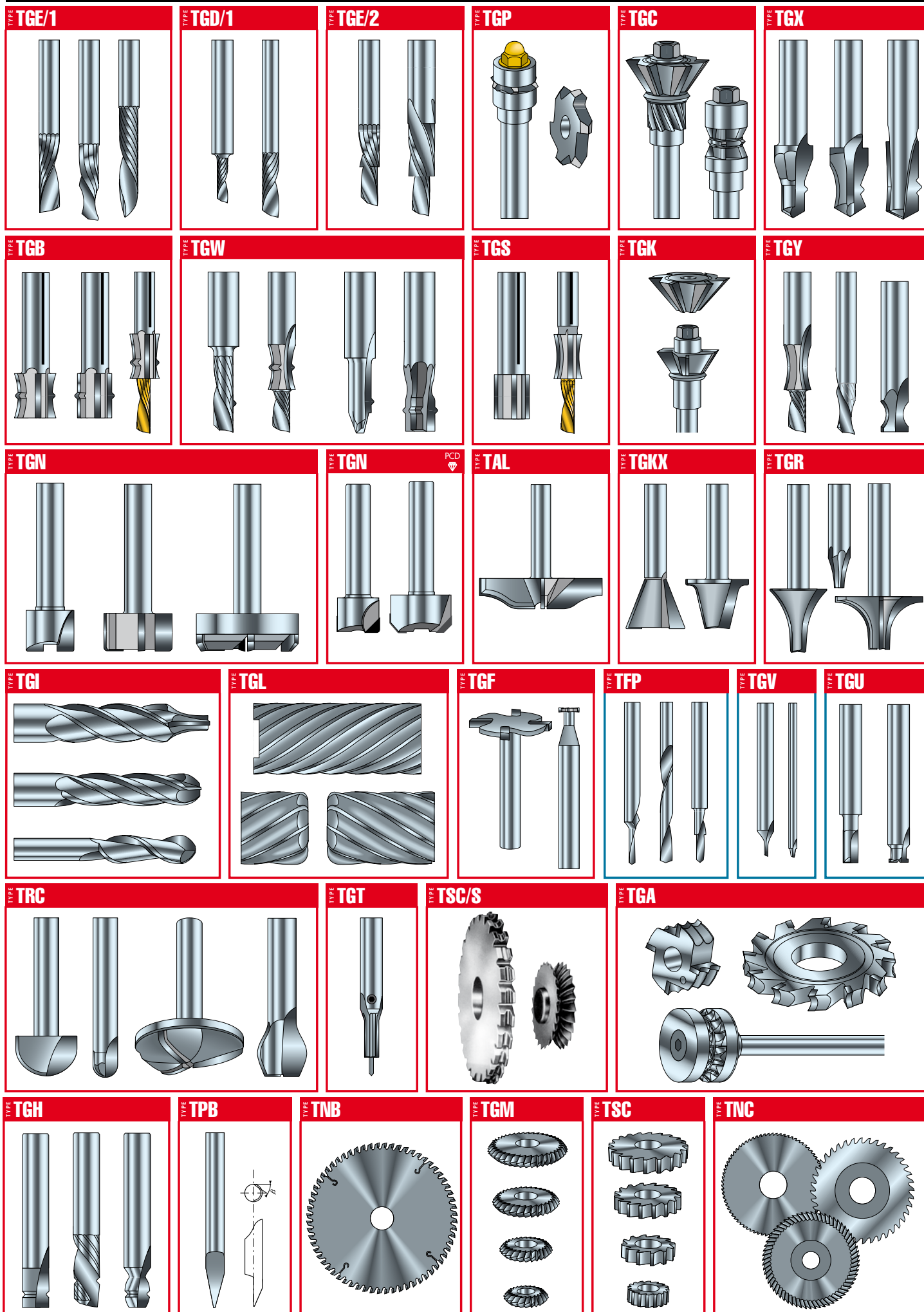
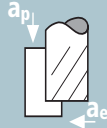


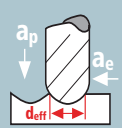
Tabella velocità

ACCIAI INOX / STEEL INOX F3N-INOX



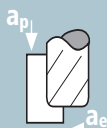
Applicazione	d1 [mm]	z	vc [m/min]	fz [mm]	ap [mm]	ae [mm]	n [min ⁻¹]	vf [mm/min]	Q [cm ³ /min]
Acciaio inossidabili [Cr-Ni/1.4301]	3	3	80	0.015	3	1.5	8490	380	1.5
	4	3	80	0.020	4	2.0	6365	380	3.0
	5	3	80	0.025	5	2.5	5095	380	5.0
	6	3	80	0.030	6	3.0	4245	380	7.0
	8	3	80	0.040	8	4.0	3185	380	12.0
	10	3	80	0.055	10	5.0	2545	420	21.0
	12	3	80	0.065	12	6.0	2120	415	30.0
	16	3	80	0.085	16	4.0	1590	405	26.0
Acciaio inossidabili [Cr-Ni-Mo-.../1.4571]	3	3	40	0.015	3	1.5	4245	190	1.0
	4	3	40	0.020	4	2.0	3185	190	1.5
	5	3	40	0.025	5	2.5	2545	190	2.5
	6	3	40	0.030	6	3.0	2120	190	3.5
	8	3	40	0.040	8	4.0	1590	190	6.0
	10	3	40	0.055	10	5.0	1275	210	10.5
	12	3	40	0.065	12	6.0	1060	205	15.0
	16	3	40	0.085	16	4.0	795	205	13.0
Acciaio resistente al calore [17-4 PH]	3	3	25	0.015	3	1.5	2655	120	0.5
	4	3	25	0.020	4	2.0	1990	120	1.0
	5	3	25	0.025	5	2.5	1590	120	1.5
	6	3	25	0.030	6	3.0	1325	120	2.0
	8	3	25	0.035	8	4.0	995	105	3.5
	10	3	25	0.045	10	5.0	795	105	5.5
	12	3	25	0.050	12	6.0	665	100	7.0
	16	3	25	0.060	16	4.0	495	90	6.0
Leg. a base di nichel indurite [Inconel 718]	3	3	15	0.015	3	1.5	1590	70	0.5
	4	3	15	0.020	4	2.0	1195	70	0.5
	5	3	15	0.025	5	2.5	955	70	1.0
	6	3	15	0.030	6	3.0	795	70	1.5
	8	3	15	0.035	8	4.0	595	60	2.0
	10	3	15	0.045	10	5.0	475	65	3.5
	12	3	15	0.050	12	6.0	400	60	4.5
	16	3	15	0.060	16	4.0	300	55	3.5

ACCIAI / STEEL FSRL



Applicazione	d1 [mm]	z	vc [m/min]	fz [mm]	ap [mm]	ae [mm]	d_eff [mm]	n [min ⁻¹]	vf [mm/min]	Q [mm ³ /min]
Acciaio da utensile temperato 42 - 48 HRC	1.0	2	220	0.020	0.03	0.06	0.34	60000	2400	4.5
	2.0	2	220	0.040	0.06	0.12	0.68	60000	4800	34.5
	3.0	2	220	0.060	0.09	0.18	1.02	60000	7200	116.5
	4.0	2	220	0.080	0.12	0.24	1.36	51315	8210	236.5
	6.0	2	220	0.090	0.18	0.36	2.05	34210	6160	399.0
	8.0	2	220	0.120	0.24	0.48	2.73	25660	6160	709.5
	10.0	2	220	0.150	0.30	0.60	3.41	20525	6160	1109.0
	12.0	2	220	0.120	0.36	0.72	4.09	17105	4105	1064.0
	16.0	2	220	0.160	0.48	0.96	5.46	12830	4105	1891.5
	1.0	2	180	0.020	0.03	0.06	0.34	60000	2400	4.5
Acciaio da utensile temperato 52 - 56 HRC	2.0	2	180	0.040	0.06	0.12	0.68	60000	4800	34.5
	3.0	2	180	0.060	0.09	0.18	1.02	55980	6720	109.0
	4.0	2	180	0.080	0.12	0.24	1.36	41985	6720	193.5
	6.0	2	180	0.090	0.18	0.36	2.05	27990	5040	326.5
	8.0	2	180	0.120	0.24	0.48	2.73	20995	5040	580.5
	10.0	2	180	0.150	0.30	0.60	3.41	16795	5040	907.0
	12.0	2	180	0.120	0.36	0.72	4.09	13995	3360	871.0
	16.0	2	180	0.160	0.48	0.96	5.46	10495	2260	1548.5
	1.0	2	80	0.020	0.03	0.06	0.34	60000	2400	4.5
	2.0	2	80	0.040	0.06	0.12	0.68	37320	2985	21.5
Acciaio da utensile temperato > 60 HRC	3.0	2	80	0.060	0.09	0.18	1.02	24880	2985	48.5
	4.0	2	80	0.080	0.12	0.24	1.36	18660	2985	86.0
	6.0	2	80	0.090	0.18	0.36	2.05	12440	2240	145.0
	8.0	2	80	0.120	0.24	0.48	2.73	9330	2240	258.0
	10.0	2	80	0.150	0.30	0.60	3.41	7465	2240	403.0
	12.0	2	80	0.120	0.36	0.72	4.09	6220	1495	387.5
	16.0	2	80	0.160	0.48	0.96	5.46	4665	1495	689.0
	1.0	2	280	0.020	0.03	0.06	0.34	60000	2400	4.5
	2.0	2	280	0.040	0.06	0.12	0.68	60000	4800	34.5
	3.0	2	280	0.060	0.09	0.18	1.02	60000	7200	116.5
Ghisa (griglia / sferoidale)	4.0	2	280	0.080	0.12	0.24	1.36	60000	9600	276.5
	6.0	2	280	0.090	0.18	0.36	2.05	43540	7835	507.5
	8.0	2	280	0.120	0.24	0.48	2.73	32655	7835	902.5
	10.0	2	280	0.150	0.30	0.60	3.41	26125	7840	1411.0
	12.0	2	280	0.120	0.36	0.72	4.09	21770	5225	1354.5
	16.0	2	280	0.160	0.48	0.96	5.46	16330	5225	2407.5

ACCIAI INOX / STEEL INOX FTR-INOX



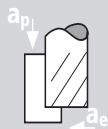
Applicazione	d1 [mm]	z	vc [m/min]	fz [mm]	ap [mm]	ae [mm]	n [min ⁻¹]	vf [mm/min]	Q [cm ³ /min]
Acciaio inossidabili [Cr-Ni/1.4301]	6	4	80	0.025	9	3	4245	425	11.5
	8	4	80	0.035	12	4	3185	445	21.5
	10	4	80	0.045	15	5	2545	460	34.5
	12	4	80	0.055	18	6	2120	465	50.0
	16	4	80	0.075	24	4	1590	475	45.5
Acciaio inossidabili [Cr-Ni-Mo-.../1.4571]	6	4	40	0.025	9	3	2120	210	5.5
	8	4	40	0.035	12	4	1590	225	11.0
	10	4	40	0.045	15	5	1275	230	17.5
	12	4	40	0.055	18	6	1060	235	25.5
	16	4	40	0.075	24	4	795	240	23.0
Acciaio resistente al calore [17-4 PH]	6	4	25	0.025	9	3	1325	135	3.5
	8	4	25	0.035	12	4	995	140	6.5
	10	4	25	0.040	15	5	795	125	9.5
	12	4	25	0.050	18	6	665	135	14.5
	16	4	25	0.065	24	4	495	130	12.5
Leg. a base di nichel indurite [Inconel 718]	6	4	15	0.025	9	3	795	80	2.0
	8	4	15	0.035	12	4	595	85	4.0
	10	4	15	0.040	15	5	475	75	5.5
	12	4	15	0.050	18	6	400	80	8.5
	16	4	15	0.065	24	4	300	80	7.5

ACCIAI / STEEL FA4N2



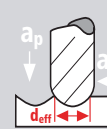
Applicazione	d1 [mm]	z	v _c [m/min]	f _z [mm]	a _p [mm]	a _e [mm]	n [min ⁻¹]	v _f [mm/min]	Q [cm ³ /min]
Acciaio da utensile temperato 24 - 32 HRC	2	4	190	0.024	2	1.0	30240	2905	6.0
	3	4	190	0.030	3	1.5	20160	2420	11.0
	4	4	190	0.042	4	2.0	15120	2540	20.5
	5	4	190	0.054	5	2.5	12095	2615	32.5
	6	4	190	0.066	6	1.5	10080	2660	24.0
	8	4	190	0.090	8	2.0	7560	2720	43.5
	10	4	190	0.108	10	2.5	6050	2615	65.5
	12	4	190	0.132	12	3.0	5040	2660	96.0
16	4	190	0.174	16	4.0	3780	2630	168.5	
Acciaio da utensile temperato 42 - 48 HRC	2	4	130	0.020	2	1.0	20690	1655	3.5
	3	4	130	0.025	3	1.5	13795	1380	6.0
	4	4	130	0.035	4	2.0	10345	1450	11.5
	5	4	130	0.045	5	2.5	8275	1490	18.5
	6	4	130	0.055	6	1.5	6895	1515	13.5
	8	4	130	0.075	8	2.0	5175	1555	25.0
	10	4	130	0.090	10	2.5	4140	1490	37.5
	12	4	130	0.110	12	3.0	3450	1520	54.5
16	4	130	0.145	16	4.0	2585	1500	96.0	
Acciaio da utensile temperato 52 - 56 HRC	2	4	60	0.010	2	1.0	9550	380	1.0
	3	4	60	0.010	3	1.5	6365	255	1.0
	4	4	60	0.020	4	2.0	4775	380	3.0
	5	4	60	0.025	5	2.5	3820	380	5.0
	6	4	60	0.030	6	1.5	3185	380	3.5
	8	4	60	0.040	8	2.0	2385	380	6.0
	10	4	60	0.050	10	2.5	1910	380	9.5
	12	4	60	0.055	12	3.0	1590	350	12.5
16	4	60	0.075	16	4.0	1195	360	23.0	
Acciaio da utensile temperato > 60 HRC	2	4	20	0.005	2	1.0	3185	65	0.1
	3	4	20	0.010	3	1.5	2120	85	0.5
	4	4	20	0.010	4	2.0	1590	65	0.5
	5	4	20	0.015	5	2.5	1275	75	1.0
	6	4	20	0.015	6	1.5	1060	65	0.5
	8	4	20	0.025	8	2.0	795	80	1.5
	10	4	20	0.030	10	2.5	635	75	2.0
	12	4	20	0.035	12	3.0	530	75	2.5
16	4	20	0.045	16	4.0	400	70	4.5	

ALLUMINIO / ALUMINIUM F2AL



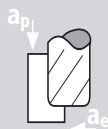
Applicazione	d1 [mm]	z	vc [m/min]	fz [mm]	ap [mm]	ae [mm]	n [min ⁻¹]	vf [mm/min]	Q [cm ³ /min]
Alluminio non legato 	6	2	350	0.060	9	2.4	18570	2230	48.0
	8	2	350	0.080	12	3.2	13925	2230	85.5
	10	2	350	0.100	15	4.0	11140	2230	134.0
	12	2	350	0.095	18	4.8	9285	1765	152.5
	16	2	350	0.145	24	6.4	6965	2020	310.5
	20	2	350	0.170	30	8.0	5570	1895	455.0
Alluminio malleabile Si < 6% 	6	2	900	0.055	9	2.4	47750	5255	113.5
	8	2	900	0.070	12	3.2	35810	5015	192.5
	10	2	900	0.090	15	4.0	28650	5155	309.5
	12	2	900	0.110	18	4.8	23875	5255	454.0
	16	2	900	0.145	24	6.4	17905	5190	797.0
	20	2	900	0.180	30	8.0	14325	5155	1237.0
Rame non legato 	6	2	600	0.050	9	2.4	31830	3185	69.0
	8	2	600	0.065	12	3.2	23875	3105	119.0
	10	2	600	0.080	15	4.0	19100	3055	183.5
	12	2	600	0.095	18	4.8	15915	3025	261.5
	16	2	600	0.130	24	6.4	11935	3105	477.0
	20	2	600	0.160	30	8.0	9550	3055	733.0
Materiali termoplastici 	6	2	1200	0.060	9	2.4	60000	7200	155.5
	8	2	1200	0.080	12	3.2	47750	7640	293.5
	10	2	1200	0.100	15	4.0	38200	7640	458.5
	12	2	1200	0.120	18	4.8	31830	7640	660.0
	16	2	1200	0.160	24	6.4	23875	7640	1173.5
	20	2	1200	0.200	30	8.0	19100	7640	1833.5

ALLUMINIO / ALUMINIUM F2RAL



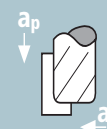
Applicazione	d1 [mm]	z	vc [m/min]	fz [mm]	ap [mm]	ae [mm]	d_eff [mm]	n [min ⁻¹]	vf [mm/min]	Q [cm ³ /min]
Alluminio malleabile Si < 6% 	3	2	900	0.060	0.3	0.6	1.80	60000	7200	1.5
	4	2	900	0.080	0.4	0.8	2.40	60000	9600	3.0
	5	2	900	0.100	0.5	1.0	3.00	60000	12000	6.0
	6	2	900	0.090	0.6	1.2	3.60	60000	10800	8.0
	8	2	900	0.120	0.8	1.6	4.80	59685	14325	18.5
	10	2	900	0.150	1.0	2.0	6.00	47750	14325	28.5
	12	2	900	0.120	1.2	2.4	7.20	39790	9550	27.5
	16	2	900	0.160	1.6	3.2	9.60	29840	9550	49.0
	20	2	900	0.200	2.0	4.0	12.00	23875	9550	76.5
Rame non legato 	3	2	600	0.060	0.3	0.6	1.80	60000	7200	1.5
	4	2	600	0.080	0.4	0.8	2.40	60000	9600	3.0
	5	2	600	0.100	0.5	1.0	3.00	60000	12000	6.0
	6	2	600	0.090	0.6	1.2	3.60	53055	9550	7.0
	8	2	600	0.120	0.8	1.6	4.80	39790	9550	12.0
	10	2	600	0.150	1.0	2.0	6.00	31830	9550	19.0
	12	2	600	0.120	1.2	2.4	7.20	26525	6365	18.5
	16	2	600	0.160	1.6	3.2	9.60	19895	6365	32.5
	20	2	600	0.200	2.0	4.0	12.00	15915	6365	51.0
Materiali termoplastici 	3	2	1200	0.060	0.3	0.6	1.80	60000	7200	1.5
	4	2	1200	0.080	0.4	0.8	2.40	60000	9600	3.0
	5	2	1200	0.100	0.5	1.0	3.00	60000	12000	6.0
	6	2	1200	0.090	0.6	1.2	3.60	60000	10800	8.0
	8	2	1200	0.120	0.8	1.6	4.80	60000	14400	18.5
	10	2	1200	0.150	1.0	2.0	6.00	60000	18000	36.0
	12	2	1200	0.120	1.2	2.4	7.20	53055	12735	36.5
	16	2	1200	0.160	1.6	3.2	9.60	39790	12735	65.0
	20	2	1200	0.200	2.0	4.0	12.00	31830	12730	102.0

ALLUMINIO / ALUMINIUM FTRAL



Applicazione	d1 [mm]	z	vc [m/min]	fz [mm]	ap [mm]	ae [mm]	n [min ⁻¹]	vf [mm/min]	Q [cm ³ /min]
Alluminio malleabile Si < 6% 	3	2	900	0.040	3	1.5	60000	4800	21.5
	4	2	900	0.050	4	2.0	60000	6000	48.0
	6	2	900	0.075	6	3.0	47750	7165	129.0
	8	2	900	0.100	8	4.0	35810	7160	229.0
	10	2	900	0.125	10	5.0	28650	7165	358.5
	12	2	900	0.150	12	6.0	23875	7165	516.0
	16	2	900	0.160	16	8.0	17905	5730	733.5
	20	2	900	0.230	20	10.0	14325	6590	1318.0
	25	2	900	0.265	25	12.5	11460	6075	1898.5
Rame non legato 	3	2	600	0.035	3	1.5	60000	4200	19.0
	4	2	600	0.045	4	2.0	47750	4300	34.5
	6	2	600	0.070	6	3.0	31830	4455	80.0
	8	2	600	0.090	8	4.0	23875	4300	137.5
	10	2	600	0.115	10	5.0	19100	4395	220.0
	12	2	600	0.135	12	6.0	15915	4295	309.0
	16	2	600	0.180	16	8.0	11935	4295	550.0
	20	2	600	0.225	20	10.0	9550	4300	860.0
	25	2	600	0.280	25	12.5	7640	4280	1337.5
Materiali termoplastici 	3	2	1200	0.030	3	1.5	60000	3600	16.0
	4	2	1200	0.040	4	2.0	60000	4800	38.5
	6	2	1200	0.060	6	3.0	60000	7200	129.5
	8	2	1200	0.080	8	4.0	47750	7640	244.5
	10	2	1200	0.100	10	5.0	38200	7640	382.0
	12	2	1200	0.120	12	6.0	31830	7640	550.0
	16	2	1200	0.160	16	8.0	23875	7640	978.0
	20	2	1200	0.200	20	10.0	19100	7640	1528.0
	25	2	1200	0.250	25	12.5	15280	7640	2387.5

TITANIO / TITANIUM FTR

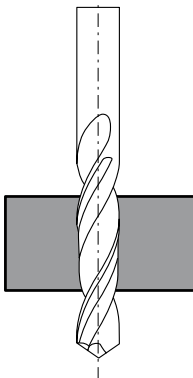
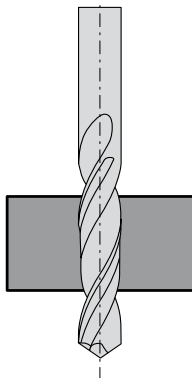
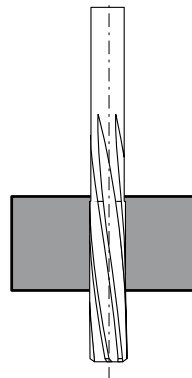


Applicazione	d1 [mm]	z	vc [m/min]	fz [mm]	ap [mm]	ae [mm]	n [min ⁻¹]	vf [mm/min]	Q [cm ³ /min]
Leghe di titanio indurite >300 HB [TiAl6V4] 	10	4	70	0.030	15	2.5	2230	270	10.0
	12	4	70	0.035	18	3.0	1855	260	14.0
	16	4	70	0.045	24	4.0	1395	250	24.0
	20	4	70	0.055	30	5.0	1115	245	37.0
Leghe di titanio fino a 300 HB [TiAl5SnZ] 	10	4	90	0.030	15	2.5	2865	345	13.0
	12	4	90	0.035	18	3.0	2385	335	18.0
	16	4	90	0.045	24	4.0	1790	320	30.5
	20	4	90	0.055	30	5.0	1430	315	47.5

INFORMAZIONI TECNICHE

TECHNICAL INFORMATION

- Dati indicativi velocità di taglio (Vt) e avanzamento (Av) per utensili in Metallo duro integrale
- Suggested data for cutting speed (Vt) and feed (Av) of solid carbide tools

• Dati indicativi velocità di taglio (Vt) e avanzamento (Av) per utensili in Metallo duro integrale • Suggested data for cutting speed (Vt) and feed (Av) of solid carbide tools					Punte Z/2 - Z3 Drills Z/2 - Z3		Punte rivestite Coated drills		Alesatori Reamers			
												
					Velocità di taglio Cutting speed HM Vt=m/1'	Avanzamento al giro Feed per revolution Sz=mm Ø=mm		Avanzamento al giro Feed per revolution Sz=mm Ø=mm		Velocità di taglio (Vt) Cutting speed Avanzamento al giro Feed per revolution		
Materiali	Sottogruppi di materiali				HM	HM+RIV.	Ø<6	Ø>6	Ø<6	Ø>6	(m/min)	Av (mm/g)
Acciaio Steel	Da costruzione Mild steel	R<500	N/mm²	80	110	0,070÷0,140	0,140÷0,450	0,140÷0,250	0,250÷0,450	10÷15	0,100÷0,300	
		R=800	N/mm²	80	110	0,070÷0,140	0,140÷0,450	0,140÷0,250	0,250÷0,450	10÷15	0,100÷0,300	
	Da cementazione Cement steel	R<500	N/mm²	100	150	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
		R=800-1000	N/mm²	90	120	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
	Da bonifica Hardening steel	R=700-900	N/mm²	80	110	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
		R=1200-1400	N/mm²	70	100	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
	Legati Alloy steel	R<700	N/mm²	80	110	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
		R<700	N/mm²	70	100	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
	Al cromo - Nickel Cr-Ni steel				55	80	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250
	Inox AISI 304				40	60	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250
Inox AISI 316				30	45	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
	Da utensili Tool steel	R<1300	N/mm²	70	100	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
		R>1300	N/mm²	55	80	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250	
Nichel e leghe Ni Ni-Ni Alloys	Nichel				20	40	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,100÷0,300
	Inconel				15	35	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,100÷0,300
	Hastelloy				10	30	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,100÷0,300
Ghisa Cast iron	Ghisa Cast iron	HB<180		100	200	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	10÷15	0,100÷0,300	
		HB>180		80	150	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	10÷15	0,100÷0,300	
Materiali non ferrosi Non ferrous mat.	Rame / Copper				180	250	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,800	8÷12	0,080÷0,250
	Bronzo / Bronze				150	220	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250
	Ottone / Brass				150	200	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250
Alluminio e Leghe All. Aluminium and light alloys	Alluminio a trucco lungo / Aluminium				280	500	0,120÷0,200	0,200÷0,550	0,180÷0,320	0,320÷0,600	20÷30	0,100÷0,600
	Leghe leggere Light alloys	Si<6%		250	400	0,120÷0,200	0,200÷0,550	0,180÷0,320	0,320÷0,600	20÷30	0,100÷0,600	
		Si>6%		180	300	0,120÷0,200	0,200÷0,550	0,180÷0,320	0,320÷0,600	20÷30	0,100÷0,600	
	Ergal				90	120	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	8÷12	0,080÷0,250
Titanio Titanium	Non ricotto / Unannealed				30	45	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	15÷18	0,080÷0,250
	Ricotto / Annealed				25	40	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	15÷18	0,080÷0,250
	Indurito / Hardened				15	25	0,030÷0,070	0,060÷0,180	0,060÷0,100	0,100÷0,180	15÷18	0,080÷0,250
Materie plastiche Plastics	Termoplastiche / thermoplastic				250	500	0,070÷0,140	0,140÷0,450	0,140÷0,250	0,250÷0,450	20÷30	0,100÷0,600
	Duroplast non laminato / Unlaminated duroplast				200	300	0,070÷0,140	0,140÷0,450	0,140÷0,250	0,250÷0,450	20÷30	0,100÷0,600
	Duroplast laminato / Laminated duroplast				160	240	0,070÷0,140	0,140÷0,450	0,140÷0,250	0,250÷0,450	20÷30	0,100÷0,600

FORMULE / FORMULAS:

$$Vt = \frac{11 \cdot D \cdot N}{1000} \quad n = \frac{Vt \cdot 1000}{11 \cdot D}$$

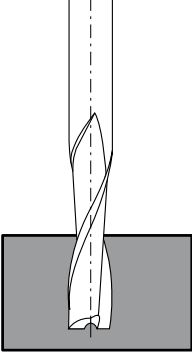
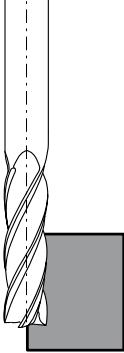
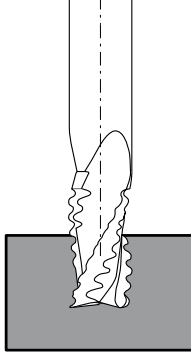
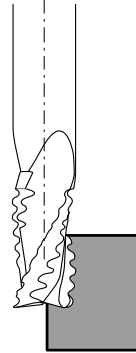
Vt= Velocità
di taglio m/1'
Cutting speed

D= Diametro
dell'utensile mm
Tool diameter (mm)

n= Numero di giri
dell'utensile rpm
Tool revolution rpm

VELOCITÀ E AVANZAMENTI

CUTTING SPEED AND FEEDING

Frese Z/2 per cave Slot cutters		Frese a finire Z4/6 Finishing end mills		Frese con gambo sgrossare Roughing end mills		Frese con gambo sgrossare Roughing end mills		Alta velocità High Speed	
								Frese a copiare rivestite Radius twist and mills with coated 	
Avanzamento al dente Feed per tooth Sz=mm Ø=mm		Avanzamento al dente Feed per tooth Sz=mm Ø=mm		Avanzamento al dente Feed per tooth Sz=mm Ø=mm		Avanzamento al dente Feed per tooth Sz=mm Ø=mm		Velocità di taglio (Vt) Cutting speed Avanzamento al dente Feed per edge	
Ø<6	Ø>6	Ø<6	Ø>6	Ø<10	Ø>10	Ø<10	Ø>10	Vt (m/min)	Sz (mm)
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	300	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	300	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	160	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	160	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	160	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	160	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	160	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	160	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	130	0,100±0,200
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	130	0,100±0,200
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	130	0,100±0,200
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	130	0,100±0,200
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	60	0,200±0,300
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	60	0,200±0,300
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	60	0,200±0,300
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	500	0,150±0,350
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	250	0,150±0,350
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	300	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	300	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	300	0,120±0,250
0,005±0,018	0,018±0,070	0,008±0,035	0,035±0,120	0,020±0,030	0,030±0,080	0,025±0,035	0,035±0,090	1200	0,200±0,400
0,005±0,018	0,018±0,070	0,008±0,035	0,035±0,120	0,020±0,030	0,030±0,080	0,025±0,035	0,035±0,090	1000	0,200±0,400
0,005±0,018	0,018±0,070	0,008±0,035	0,035±0,120	0,020±0,030	0,030±0,080	0,025±0,035	0,035±0,090	1000	0,200±0,400
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	400	0,120±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	80	0,150±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	70	0,150±0,250
0,004±0,015	0,015±0,060	0,007±0,025	0,025±0,100	0,015±0,025	0,025±0,070	0,020±0,030	0,030±0,080	60	0,150±0,250
0,005±0,018	0,018±0,070	0,008±0,035	0,035±0,120	0,020±0,030	0,030±0,080	0,025±0,035	0,035±0,090	800	0,200±0,400
0,005±0,018	0,018±0,070	0,008±0,035	0,035±0,120	0,020±0,030	0,030±0,080	0,025±0,035	0,035±0,090	500	0,200±0,400
0,005±0,018	0,018±0,070	0,008±0,035	0,035±0,120	0,020±0,030	0,030±0,080	0,025±0,035	0,035±0,090	300	0,200±0,400

$$AV = Sz \times Z \times n$$

or

$$A = S \times n$$

Av= Avanzamento
mm/l'

Feed per minute

n= Numero di giri
dell'utensile rpm

Tool revolution

Sz= Avanzamento
per dente mm

Feed per tooth

Z= Numero dei denti
dell'utensile

Number of cutting edge

S= Avanzamento
al giro

Feed per revolution

Tabella velocità / Numero giri												
	Ø											
Vt-m/1'	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 7	Ø 8	Ø 9	Ø 10	Ø 12	Ø 16	Ø 20
5	796	531	398	318	265	227	199	177	159	133	99	80
6	955	637	477	382	318	273	239	212	191	159	119	95
7	1114	743	557	446	371	318	279	248	223	186	139	111
8	1273	849	637	509	424	364	318	283	255	212	159	127
9	1432	955	716	573	477	409	358	318	286	239	179	143
10	1592	1061	796	637	531	455	398	354	318	265	199	159
11	1751	1167	875	700	584	500	438	389	350	292	219	175
12	1910	1273	955	764	637	546	477	424	382	318	239	191
13	2069	1379	1035	828	690	591	517	460	414	345	259	207
14	2228	1486	1114	891	743	637	557	495	446	371	279	223
15	2387	1592	1194	955	796	682	597	531	477	398	298	239
16	2547	1698	1273	1019	849	728	637	566	509	424	318	255
17	2706	1804	1353	1082	902	773	676	601	541	451	338	271
18	2865	1910	1432	1146	955	819	716	637	573	477	358	286
19	3024	2016	1512	1210	1008	864	756	672	605	504	378	302
20	3183	2122	1592	1273	1061	910	796	707	637	531	398	318
21	3342	2228	1671	1337	1114	955	836	743	668	557	418	334
22	3502	2334	1751	1401	1167	1000	875	778	700	584	438	350
23	3661	2441	1830	1464	1220	1046	915	814	732	610	458	366
24	3820	2547	1910	1528	1273	1091	955	849	764	637	477	382
25	3979	2653	1990	1592	1326	1137	995	884	796	663	497	398
26	4138	2759	2069	1655	1379	1182	1035	920	828	690	517	414
27	4297	2865	2149	1719	1432	1228	1074	955	859	716	537	430
28	4457	2971	2228	1783	1486	1273	1114	990	891	743	557	446
29	4616	3077	2308	1846	1539	1319	1154	1026	923	769	577	462
30	4775	3183	2387	1910	1592	1364	1194	1061	955	796	597	477
31	4934	3289	2476	1974	1645	1410	1234	1096	987	822	617	493
32	5093	3395	2547	2037	1698	1455	1273	1132	1019	849	637	509
33	5252	3502	2626	2101	1751	1501	1313	1167	1050	875	657	525
34	5412	3608	2706	2165	1804	1546	1353	1203	1082	902	676	541
35	5571	3714	2785	2228	1857	1592	1393	1238	1114	928	696	557
36	5730	3820	2865	2292	1910	1637	1432	1273	1146	955	716	573
40	6367	4244	3183	2547	2122	1819	1592	1415	1273	1061	796	637
45	7162	4775	3581	2865	2387	2046	1791	1592	1432	1194	895	716
48	7640	5093	3820	3056	2547	2183	1910	1698	1528	1273	955	764
50	7958	5305	3979	3183	2653	2274	1990	1768	1592	1326	995	796
55	8754	5836	4377	3502	2918	2501	2189	1945	1751	1459	1094	875
60	9550	6367	4775	3820	3183	2729	2387	2122	1910	1592	1194	955
62	9868	6579	4934	3947	3289	2819	2467	2193	1974	1645	1234	987
65	10346	6897	5173	4138	3449	2956	2586	2299	2069	1724	1293	1035
68	10823	7215	5412	4329	3608	3092	2706	2405	2165	1804	1353	1082
70	11141	7428	5571	4457	3714	3183	2785	2476	2228	1857	1393	1114
75	11937	7958	5969	4775	3979	3411	2984	2653	2387	1990	1492	1194
80	12733	8489	6367	5093	4244	3638	3183	2830	2547	2122	1592	1273
85	13529	9019	6764	5412	4510	3865	3382	3006	2706	2255	1691	1353
90	14325	9550	7162	5730	4775	4093	3581	3183	2865	2387	1791	1432
100	15916	10611	7958	6367	5305	4548	3979	3537	3183	2653	1990	1592
110	17508	11672	8754	7003	5836	5002	4377	3891	3502	2918	2189	1751
120	19100	12733	9550	7640	6367	5457	4775	4244	3820	3183	2387	1910
130	20691	13794	10346	8277	6897	5912	5173	4598	4138	3449	2586	2069
150	23875	15916	11937	9550	7958	6821	5969	5305	4775	3979	2984	2387
160	25466	16977	12733	10186	8489	7276	6367	5659	5093	4244	3183	2547
180	28650	19100	14325	11460	9550	8186	7162	6367	5730	4775	3581	2865
200	31833	21222	15916	12733	10611	9095	7958	7074	6367	5305	3979	3183
220		23344	17508	14006	11672	10005	8754	7781	7003	5836	4377	3502
250		26527	19895	15916	13264	11369	9948	8842	7958	6632	4974	3979
300		31833	23875	19100	15916	13643	11937	10611	9550	7958	5969	4775
350			27854	22283	18569	15916	13927	12379	11141	9285	6963	5571
370			29445	23556	19630	16826	14723	13087	11778	9815	7361	5889
400			31833	25466	21222	18190	15916	14148	12733	10611	7958	6367
500				31833	26527	22738	19895	17685	15916	13264	9948	7958
1000									31833	26527	19895	15916

Speed / RPM Table													
	Ø												
	Ø 25	Ø 32	Ø 36	Ø 40	Ø 50	Ø 56	Ø 63	Ø 80	Ø 100	Ø 125	Ø 160	Ø 200	Vt-m/1'
	64	50	44	40	32	28	25	20	16	13	10	8	5
	76	60	53	48	38	34	30	24	19	15	12	10	6
	89	70	62	56	45	40	35	28	22	18	14	11	7
	102	80	71	64	51	45	40	32	25	20	16	13	8
	115	90	80	72	57	51	45	36	29	23	18	14	9
	127	99	88	80	64	57	51	40	32	25	20	16	10
	140	109	97	88	70	63	56	44	35	28	22	18	11
	153	119	106	95	76	68	61	48	38	31	24	19	12
	166	129	115	103	83	74	66	52	41	33	26	21	13
	178	139	124	111	89	80	71	56	45	36	28	22	14
	191	149	133	119	95	85	76	60	48	38	30	24	15
	204	159	141	127	102	91	81	64	51	41	32	25	16
	216	169	150	135	108	97	86	68	54	43	34	27	17
	229	179	159	143	115	102	91	72	57	46	36	29	18
	242	189	168	151	121	108	96	76	60	48	38	30	19
	255	199	177	159	127	114	101	80	64	51	40	32	20
	267	209	186	167	134	119	106	84	67	53	42	33	21
	280	219	195	175	140	125	111	88	70	56	44	35	22
	293	229	203	183	146	131	116	92	73	59	46	37	23
	306	239	212	191	153	136	121	95	76	61	48	38	24
	318	249	221	199	159	142	126	99	80	64	50	40	25
	331	259	230	207	166	148	131	103	83	66	52	41	26
	344	269	239	215	172	153	136	107	86	69	54	43	27
	357	279	248	223	178	159	141	111	89	71	56	45	28
	369	288	256	231	185	165	147	115	92	74	58	46	29
	382	298	265	239	191	171	152	119	95	76	60	48	30
	395	308	274	247	197	176	157	123	99	79	62	49	31
	407	318	283	255	204	182	162	127	102	81	64	51	32
	420	328	292	263	210	188	167	131	105	84	66	53	33
	433	338	301	271	216	193	172	135	108	87	68	54	34
	446	348	309	279	223	199	177	139	111	89	70	56	35
	458	358	318	286	229	205	182	143	115	92	72	57	36
	509	398	354	318	255	227	202	159	127	102	80	64	40
	573	448	398	358	286	256	227	179	143	115	90	72	45
	611	477	424	382	306	273	243	191	153	122	95	76	48
	637	497	442	398	318	284	253	199	159	127	99	80	50
	700	547	486	438	350	313	278	219	175	140	109	88	55
	764	597	531	477	382	341	303	239	191	153	119	95	60
	789	617	548	493	395	352	313	247	197	158	123	99	62
	828	647	575	517	414	369	328	259	207	166	129	103	65
	866	676	601	541	433	387	344	271	216	173	135	108	68
	891	696	619	557	446	398	354	279	223	178	139	111	70
	955	746	663	597	477	426	379	298	239	191	149	119	75
	1019	796	707	637	509	455	404	318	255	204	159	127	80
	1082	846	752	676	541	483	429	338	271	216	169	135	85
	1146	895	796	716	573	512	455	358	286	229	179	143	90
	1273	995	884	796	637	568	505	398	318	255	199	159	100
	1401	1094	973	875	700	625	556	438	350	280	219	175	110
	1528	1194	1061	955	764	682	606	477	382	306	239	191	120
	1655	1293	1150	1035	828	739	657	517	414	331	259	207	130
	1910	1492	1326	1194	955	853	758	597	477	382	298	239	150
	2037	1592	1415	1273	1019	910	808	637	509	407	318	255	160
	2292	1791	1592	1432	1146	1023	910	716	573	458	358	286	180
	2547	1990	1768	1592	1273	1137	1011	796	637	509	398	318	200
	2801	2189	1945	1751	1401	1251	1112	875	700	560	438	350	220
	3183	2487	2211	1990	1592	1421	1263	995	796	637	497	398	250
	3820	2984	2653	2387	1910	1705	1516	1194	955	764	597	477	300
	4457	3482	3095	2785	2228	1990	1768	1393	1114	891	696	557	350
	4711	3681	3272	2945	2356	2103	1870	1472	1178	942	736	589	370
	5093	3979	3537	3183	2547	2274	2021	1592	1273	1019	796	637	400
	6367	4974	4421	3979	3183	2842	2526	1990	1592	1273	995	796	500
	12733	9948	8842	7958	6367	5684	5053	3979	3183	2547	1990	1592	1000



TOMMASIN



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