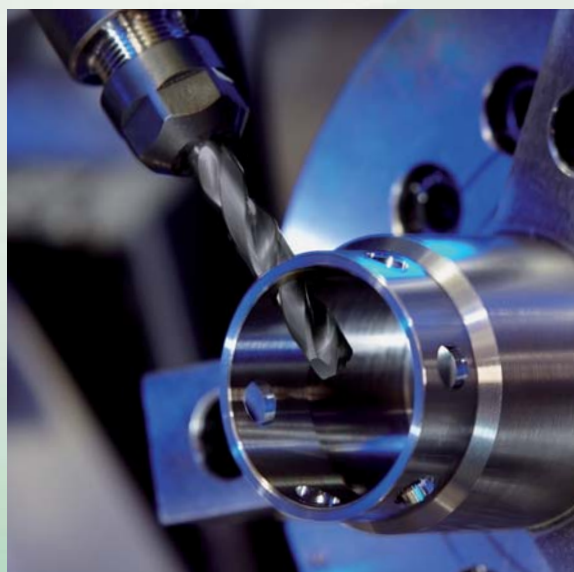


HARTNER

Precision Cutting Tools

FORETS INOX

LES SPÉCIALISTES DE L'USINAGE DES ACIERS INOXYDABLES

















+ Durée de vie extrêmement élevée grâce au nouveau revêtement AlTiZrN

Code ISO

P	Aciers communs, aciers hautement alliés
M	Aciers inoxydables
K	Fontes grises, fontes à graphite sphéroïdal et fontes malléables
N	Aluminium et ses alliages ainsi que d'autres métaux non ferreux
S	Alliages de titane, spéciaux et superalliages
H	Aciers trempés et fontes dures

Pictogrammes

Matériaux de coupe	HSS-E	VHM					
	Acier rapide	Carbure monobloc					
Version	  						
	poli	AlTiN nano	AlTiZrN				
Type	IS	S	TS 100 INOX				
Profondeur	3xD	5xD	~3xD	~5xD	~10xD		
Norme	DIN 338	DIN 340	DIN 345	DIN 1897	DIN 6537K	DIN 6537L	 selon standard Hartner
Angle au sommet	 130°	 140°					
Ø-Tolérance	h8	m7					
Sens de coupe							
	à droite						
Forme de la queue	 HA	 HE	 Cyl	 MK			
	selon DIN 6535	cylindrique	Cône morse				
Amin. de l'âme							
	avec amincissement de l'âme						
Lubrification intérieure							
	avec LI	sans LI					

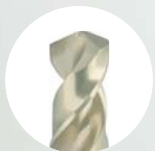


TS 100 INOX carbure monobloc haute performance

page 12

M K

- ▶ Ø 3,0 – 20,0 mm
- ▶ 3xD et 5xD
- ▶ Attachement HA et HE
- ▶ Revêtement AiTiNano
- ▶ Avec trou d'huile



Foret à queue cylindrique HSCO

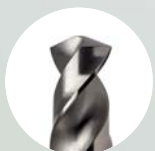
page 16

P M K N



Revêtement AlTiZrN

- ▶ Ø 0,2 – 17,5 mm
- ▶ DIN 1897 | DIN 338 | DIN 340
- ▶ Poli et avec revêtement AlTiZrN

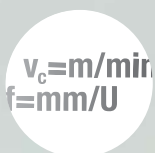


Foret à queue cône morse HSCO

page 23

P M N

- ▶ Ø 10,0 – 32,0 mm
- ▶ Norme usine courte | DIN 345
- ▶ Poli



Caractéristiques techniques

page 28

- ▶ Conseils d'utilisation

Foret INOX HSCO avec revêtement AlTiZrN



- Réelle protection contre l'usure et durée de vie élevée grâce au revêtement AlTiZrN
- Perçage économique et sécurisé des inox
- Faible effort d'avance et meilleur centrage grâce à l'angle de pointe avec affûtage en croix optimisé
- Programme standard Ø 1,00 – 13,00 mm
- DIN 1897 (~3xD) + DIN 338 (~5xD)

Angle de pointe avec affûtage en croix optimisé

Effort d'avance minimale et centrage précis sans marquage ni préperçage

Matière de coupe

Un acier rapide allié au cobalt à 5% offre à l'outil une meilleure longévité et une bonne dureté à chaud, et permet ainsi l'usinage des inox à haute température.

Goujures

La géométrie particulière des goujures garantit la fiabilité du processus de formation et d'évacuation de copeaux particulièrement lors d'usinage des inox.



revêtement



AlTiZrN

Température max. de l'application : < 900°C

Couleur : or pâle









Composition : multi-couches, nanostructuré

Dureté : 3400 HV 0,05






Le revêtement Sirius fait essentiellement à base de AlTiN convient particulièrement pour l'usinage des aciers inoxydables. Grâce à sa composition nanostructurée il fait preuve de dureté et de tenacité. La couche de finition contenant du zircon empêche en grande partie la réaction chimique avec la matière, et favorise ainsi le dégagement de copeaux.

P	M	K	N	S	H	Norme	Type	Matière de coupe	Surface	Sens de coupe	Forme de queue	Profondeur	d1/mm	N° d'article	Progr. page
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Forets TS avec trous d'huile

	•			•		DIN 6537K	TS 100 INOX	CW monobloc		à droite	HA	3xD	3,000 - 20,000	89450	10
	•			•		DIN 6537K	TS 100 INOX	CW monobloc		à droite	HE	3xD	3,000 - 20,000	89550	10
	•			•		DIN 6537L	TS 100 INOX	CW monobloc		à droite	HA	5xD	3,000 - 20,000	89451	12
	•			•		DIN 6537L	TS 100 INOX	CW monobloc		à droite	HE	5xD	3,000 - 20,000	89551	12

Forets hélicoïdaux extra-courts

	○	•	○	○		DIN 1897	IS	HSS-E	○	à droite	cyl.	~3xD	1,000 - 12,000	81173	14
															
	•	•	○	•	•	DIN 1897	IS	HSS-E		à droite	cyl.	~3xD	1,000 - 13,000	81178	15

Forets hélicoïdaux courts

	○	•	○	○		DIN 338	IS	HSS-E	○	à droite	cyl.	~5xD	1,000 - 13,000	81013	17
															
	•	•	○	•	•	DIN 338	IS	HSS-E		à droite	cyl.	~5xD	1,000 - 13,000	81078	19
	○	•	○	○		DIN 338	S	HSS-E	○	à droite	cyl.	~5xD	0,200 - 17,500	81061	21

Forets hélicoïdaux longs

	○	•	○	○		DIN 340	S	HSS-E	○	à droite	cyl.	~10xD	1,300 - 13,000	81361	23
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P	M	K	N	S	H	Norme	Type	Matière de coupe	Surface	Sens de coupe	Forme de queue	Profondeur	d1/mm	N° d'article	Progr. page
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Forets hélicoïdaux à queue CM



○	●	○	○	○	○	Norme usine	IS	HSS-E	○	à droite	CM	~3xD	10,000 - 29,000	82972	24
---	---	---	---	---	---	-------------	----	-------	---	----------	----	------	-----------------	-------	----



○	●	○	○	○	○	DIN 345	IS	HSS-E	○	à droite	CM	~5xD	11,500 - 32,000	82012	25
---	---	---	---	---	---	---------	----	-------	---	----------	----	------	-----------------	-------	----



Exemple d'application foret INOX avec le nouveau revêtement AlTiZrN

Application 1

Cas pratique :

Machine multi-broches - grande série
Usinage de grilles dans de l'inox 1.4301 (V2A)
d=2,5 mm
Profondeur de perçage 7 mm (4 étapes sans débourage)
Trou débouchant
Emulsion, lubrification externe
vc = 15 m/min
f = 0,035 mm/U

Durée de vie obtenue : 20,5 m

Application 2

Essai labo :

Machine : BAZ
Usinage d'inox 1.471 (V4A)
d = 6,0 mm
Profondeur de perçage : 18 mm
Trou borgne
Emulsion, lubrification externe
vc = 12 m/min
f = 0,080 mm/U

Durée de vie obtenue : 30 m

Application 3

Essai labo :

Machine : BAZ
Usinage d'inox 1.4301 (V2A)
d = 6,0 mm
Profondeur de perçage : 24 mm
Trou borgne
Emulsion, lubrification externe
vc = 12 m/min
f = 0,080 mm/U

Durée de vie obtenue : 17 m



Les matériaux INOX

Derrière le terme générique INOX se cache pléthore de matières aux propriétés spécifiques tels que l'acier inoxydable, l'acier non corrosif, l'acier résistant aux acides, ou bien l'acier résistant à la chaleur ou même encore une combinaison de toutes ces caractéristiques. Par ailleurs les aciers peuvent être ferritiques, sulfurés, martensitiques, austénitiques ou encore un alliage de ces types.

Ce sont ces alliages – principalement à base de nickel et/ou chrome, mais aussi parfois de titane, de vanadium, de molybdène, ou de tungstène - qui ont une influence sur la matière. La présence de plusieurs éléments peut accentuer cet effet. Ou au contraire il existe des alliages où certains éléments individuels n'exercent pas ce type d'influence mais empêchent une propriété particulière de se produire. En outre ces caractéristiques changent après un traitement thermique.

De façon générale lors de l'usinage, les inox ont tendance à s'écrouir, ils sont de mauvais conducteurs thermiques et possèdent une forte ténacité. Par ailleurs la formation de copeaux est ardue, en effet les copeaux d'inox ont tendance à s'enrouler et à se bloquer.

En conséquence ils nécessitent des outils spécifiques et des processus d'usinage spécialement conçus qui prennent en compte leurs propriétés physiques.



Usiner l'acier austénitique

Les alliages avec au moins 12 % de chrome, tels l'aluminium ou le silicium, et au moins 9 % de Nickel désignent les aciers austénitiques, ils forment le groupe le plus commun des aciers inoxydables. Ils se caractérisent par leur forte résistance à la corrosion, l'oxydation et la chaleur.

Propriétés d'usinage :

Difficile, forte émission de chaleur de l'outil, usure importante de la surface, copeaux mal formés

Domaines d'application :

Technologie de l'énergie, industrie chimique, industrie agro-alimentaire, aéronautique, bâtiment

Exemples types de matières

Groupe d'aciers	N° matière	Désignation DIN EN	ASTM
Acier	1.4301	X5CrNi18-10	304
Austénitique	1.4541	X6CrNiTi18-10	321
	1.4401	X5NiMo17-12-2	316
	1.4571	XCrNiMoTi17-12-2	316Ti



Les matériaux INOX

Usiner l'acier martensitique

Les aciers martensitiques possèdent une fraction plus élevée de carbone jusqu'à 1.2 %, et très peu d'autres composants d'alliage. Ils sont magnétiques, résistants à la corrosion et trempable.

Propriétés d'usinage :

En état malléable : facile, selon le type de traitement thermique (trempé, traité) progressivement plus difficile. Usure de l'outil élevée, fortes émissions thermiques et contraintes mécaniques

Domaines d'application :

Technologie de l'énergie, industrie chimique

Exemples types de matières

Groupe d'aciers	N° matière	Désignation DIN EN	ASTM
Acier	1.4006	X12Cr13	410
Martensitique	1.4031	X39Cr13	0
	1.4021	X20Cr13	420
	1.4057	X20CrNi17-2	431

Usiner l'acier ferritique

Les aciers ferritiques ont une teneur en chrome de 12 à 18 % et très peu d'autres composants d'alliage. Ils sont magnétiques, résistants à la chaleur moyennement résistant à la corrosion, mais pas trempable. Grâce à son faible taux de Nickel, les aciers ferritiques sont relativement économiques.

Propriétés d'usinage :

Facile, usure de l'outil par adhésion et abrasion réduite, mais formation de copeaux difficiles

Domaines d'application :

Technologie de l'énergie, industrie chimique

Exemples types de matières

Groupe d'aciers	N° matière	Désignation DIN EN	ASTM
Acier	1.4724	X10CrAlSi13	403
ferritique	1.4762	X10CrAlSi25	446
	1.4000	X6Cr13	410 S
	1.4016	X12Cr17	430



Forets TS avec trous d'huile

N° d'article 89450



P	M	K	N	S	H
	•			•	



Amin. de l'âme $\geq \varnothing 3,000$ • affûtage en pente • arête de coupe principale rectiligne • géométrie de coupe optimisée
 aciers inox., inaltérables aux acides et réfractaires • Titane et ses alliages • Inconel, Hastelloy, Monel

N° d'article 89550

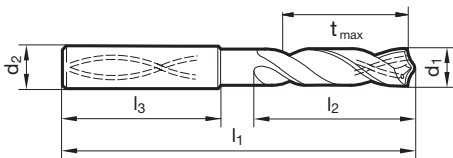


P	M	K	N	S	H
	•			•	



Amin. de l'âme $\geq \varnothing 3,000$ • affûtage en pente • arête de coupe principale rectiligne • géométrie de coupe optimisée
 aciers inox., inaltérables aux acides et réfractaires • Titane et ses alliages • Inconel, Hastelloy, Monel

$$t_{\max} = l_2 - 1,5 \times d_1$$



d1	d2	l1	l2	l3	d1	d2	l1	l2	l3
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
3,000	6,000	62,000	20,000	36,000	5,200	6,000	66,000	28,000	36,000
3,100	6,000	62,000	20,000	36,000	5,300	6,000	66,000	28,000	36,000
3,170	6,000	62,000	20,000	36,000	5,400	6,000	66,000	28,000	36,000
3,200	6,000	62,000	20,000	36,000	5,500	6,000	66,000	28,000	36,000
3,250	6,000	62,000	20,000	36,000	5,550	6,000	66,000	28,000	36,000
3,300	6,000	62,000	20,000	36,000	5,560	6,000	66,000	28,000	36,000
3,400	6,000	62,000	20,000	36,000	5,600	6,000	66,000	28,000	36,000
3,500	6,000	62,000	20,000	36,000	5,700	6,000	66,000	28,000	36,000
3,570	6,000	62,000	20,000	36,000	5,800	6,000	66,000	28,000	36,000
3,600	6,000	62,000	20,000	36,000	5,900	6,000	66,000	28,000	36,000
3,700	6,000	62,000	20,000	36,000	5,950	6,000	66,000	28,000	36,000
3,800	6,000	66,000	24,000	36,000	6,000	6,000	66,000	28,000	36,000
3,900	6,000	66,000	24,000	36,000	6,100	8,000	79,000	34,000	36,000
3,970	6,000	66,000	24,000	36,000	6,200	8,000	79,000	34,000	36,000
4,000	6,000	66,000	24,000	36,000	6,300	8,000	79,000	34,000	36,000
4,100	6,000	66,000	24,000	36,000	6,350	8,000	79,000	34,000	36,000
4,200	6,000	66,000	24,000	36,000	6,400	8,000	79,000	34,000	36,000
4,300	6,000	66,000	24,000	36,000	6,500	8,000	79,000	34,000	36,000
4,370	6,000	66,000	24,000	36,000	6,600	8,000	79,000	34,000	36,000
4,400	6,000	66,000	24,000	36,000	6,700	8,000	79,000	34,000	36,000
4,500	6,000	66,000	24,000	36,000	6,750	8,000	79,000	34,000	36,000
4,600	6,000	66,000	24,000	36,000	6,800	8,000	79,000	34,000	36,000
4,650	6,000	66,000	24,000	36,000	6,900	8,000	79,000	34,000	36,000
4,700	6,000	66,000	24,000	36,000	7,000	8,000	79,000	34,000	36,000
4,760	6,000	66,000	28,000	36,000	7,100	8,000	79,000	41,000	36,000
4,800	6,000	66,000	28,000	36,000	7,140	8,000	79,000	41,000	36,000
4,900	6,000	66,000	28,000	36,000	7,200	8,000	79,000	41,000	36,000
5,000	6,000	66,000	28,000	36,000	7,300	8,000	79,000	41,000	36,000
5,100	6,000	66,000	28,000	36,000	7,400	8,000	79,000	41,000	36,000
5,160	6,000	66,000	28,000	36,000	7,500	8,000	79,000	41,000	36,000



Forets TS avec trous d'huile

d1 mm	d2 mm	l1 mm	l2 mm	l3 mm	d1 mm	d2 mm	l1 mm	l2 mm	l3 mm
7,540	8,000	79,000	41,000	36,000	11,400	12,000	102,000	55,000	45,000
7,600	8,000	79,000	41,000	36,000	11,500	12,000	102,000	55,000	45,000
7,700	8,000	79,000	41,000	36,000	11,600	12,000	102,000	55,000	45,000
7,800	8,000	79,000	41,000	36,000	11,700	12,000	102,000	55,000	45,000
7,900	8,000	79,000	41,000	36,000	11,800	12,000	102,000	55,000	45,000
7,940	8,000	79,000	41,000	36,000	11,900	12,000	102,000	55,000	45,000
8,000	8,000	79,000	41,000	36,000	11,910	12,000	102,000	55,000	45,000
8,100	10,000	89,000	47,000	40,000	12,000	12,000	102,000	55,000	45,000
8,200	10,000	89,000	47,000	40,000	12,200	14,000	107,000	60,000	45,000
8,300	10,000	89,000	47,000	40,000	12,500	14,000	107,000	60,000	45,000
8,330	10,000	89,000	47,000	40,000	12,700	14,000	107,000	60,000	45,000
8,400	10,000	89,000	47,000	40,000	12,800	14,000	107,000	60,000	45,000
8,500	10,000	89,000	47,000	40,000	13,000	14,000	107,000	60,000	45,000
8,600	10,000	89,000	47,000	40,000	13,300	14,000	107,000	60,000	45,000
8,700	10,000	89,000	47,000	40,000	13,500	14,000	107,000	60,000	45,000
8,730	10,000	89,000	47,000	40,000	13,700	14,000	107,000	60,000	45,000
8,800	10,000	89,000	47,000	40,000	14,000	14,000	107,000	60,000	45,000
8,900	10,000	89,000	47,000	40,000	14,200	16,000	115,000	65,000	48,000
9,000	10,000	89,000	47,000	40,000	14,290	16,000	115,000	65,000	48,000
9,100	10,000	89,000	47,000	40,000	14,300	16,000	115,000	65,000	48,000
9,130	10,000	89,000	47,000	40,000	14,500	16,000	115,000	65,000	48,000
9,200	10,000	89,000	47,000	40,000	14,700	16,000	115,000	65,000	48,000
9,250	10,000	89,000	47,000	40,000	15,000	16,000	115,000	65,000	48,000
9,300	10,000	89,000	47,000	40,000	15,200	16,000	115,000	65,000	48,000
9,400	10,000	89,000	47,000	40,000	15,300	16,000	115,000	65,000	48,000
9,500	10,000	89,000	47,000	40,000	15,500	16,000	115,000	65,000	48,000
9,520	10,000	89,000	47,000	40,000	15,700	16,000	115,000	65,000	48,000
9,600	10,000	89,000	47,000	40,000	16,000	16,000	115,000	65,000	48,000
9,700	10,000	89,000	47,000	40,000	16,300	18,000	123,000	73,000	48,000
9,800	10,000	89,000	47,000	40,000	16,500	18,000	123,000	73,000	48,000
9,900	10,000	89,000	47,000	40,000	16,900	18,000	123,000	73,000	48,000
9,920	10,000	89,000	47,000	40,000	17,000	18,000	123,000	73,000	48,000
10,000	10,000	89,000	47,000	40,000	17,300	18,000	123,000	73,000	48,000
10,100	12,000	102,000	55,000	45,000	17,500	18,000	123,000	73,000	48,000
10,200	12,000	102,000	55,000	45,000	18,000	18,000	123,000	73,000	48,000
10,300	12,000	102,000	55,000	45,000	18,500	20,000	131,000	79,000	50,000
10,320	12,000	102,000	55,000	45,000	18,900	20,000	131,000	79,000	50,000
10,400	12,000	102,000	55,000	45,000	19,000	20,000	131,000	79,000	50,000
10,500	12,000	102,000	55,000	45,000	19,300	20,000	131,000	79,000	50,000
10,600	12,000	102,000	55,000	45,000	19,500	20,000	131,000	79,000	50,000
10,700	12,000	102,000	55,000	45,000	20,000	20,000	131,000	79,000	50,000
10,800	12,000	102,000	55,000	45,000					
10,900	12,000	102,000	55,000	45,000					
11,000	12,000	102,000	55,000	45,000					
11,100	12,000	102,000	55,000	45,000					
11,110	12,000	102,000	55,000	45,000					
11,200	12,000	102,000	55,000	45,000					
11,300	12,000	102,000	55,000	45,000					



Forets TS avec trous d'huile

N° d'article 89451



P	M	K	N	S	H
	•			•	



Amin. de l'âme $\geq \varnothing 3,000$ • affûtage en pente • arête de coupe principale rectiligne • géométrie de coupe optimisée
 aciers inox., inaltérables aux acides et réfractaires • Titane et ses alliages • Inconel, Hastelloy, Monel

N° d'article 89551

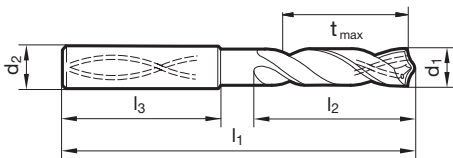


P	M	K	N	S	H
	•			•	



Amin. de l'âme $\geq \varnothing 3,000$ • affûtage en pente • arête de coupe principale rectiligne • géométrie de coupe optimisée
 aciers inox., inaltérables aux acides et réfractaires • Titane et ses alliages • Inconel, Hastelloy, Monel

$$t_{\max} = l_2 - 1,5 \times d_1$$



d1	d2	l1	l2	l3	d1	d2	l1	l2	l3
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
3,000	6,000	66,000	28,000	36,000	5,200	6,000	82,000	44,000	36,000
3,100	6,000	66,000	28,000	36,000	5,300	6,000	82,000	44,000	36,000
3,170	6,000	66,000	28,000	36,000	5,400	6,000	82,000	44,000	36,000
3,200	6,000	66,000	28,000	36,000	5,500	6,000	82,000	44,000	36,000
3,250	6,000	66,000	28,000	36,000	5,550	6,000	82,000	44,000	36,000
3,300	6,000	66,000	28,000	36,000	5,560	6,000	82,000	44,000	36,000
3,400	6,000	66,000	28,000	36,000	5,600	6,000	82,000	44,000	36,000
3,500	6,000	66,000	28,000	36,000	5,700	6,000	82,000	44,000	36,000
3,570	6,000	66,000	28,000	36,000	5,800	6,000	82,000	44,000	36,000
3,600	6,000	66,000	28,000	36,000	5,900	6,000	82,000	44,000	36,000
3,700	6,000	66,000	28,000	36,000	5,950	6,000	82,000	44,000	36,000
3,800	6,000	74,000	36,000	36,000	6,000	6,000	82,000	44,000	36,000
3,900	6,000	74,000	36,000	36,000	6,100	8,000	91,000	53,000	36,000
3,970	6,000	74,000	36,000	36,000	6,200	8,000	91,000	53,000	36,000
4,000	6,000	74,000	36,000	36,000	6,300	8,000	91,000	53,000	36,000
4,100	6,000	74,000	36,000	36,000	6,350	8,000	91,000	53,000	36,000
4,200	6,000	74,000	36,000	36,000	6,400	8,000	91,000	53,000	36,000
4,300	6,000	74,000	36,000	36,000	6,500	8,000	91,000	53,000	36,000
4,370	6,000	74,000	36,000	36,000	6,600	8,000	91,000	53,000	36,000
4,400	6,000	74,000	36,000	36,000	6,700	8,000	91,000	53,000	36,000
4,500	6,000	74,000	36,000	36,000	6,750	8,000	91,000	53,000	36,000
4,600	6,000	74,000	36,000	36,000	6,800	8,000	91,000	53,000	36,000
4,650	6,000	74,000	36,000	36,000	6,900	8,000	91,000	53,000	36,000
4,700	6,000	74,000	36,000	36,000	7,000	8,000	91,000	53,000	36,000
4,760	6,000	82,000	44,000	36,000	7,100	8,000	91,000	53,000	36,000
4,800	6,000	82,000	44,000	36,000	7,140	8,000	91,000	53,000	36,000
4,900	6,000	82,000	44,000	36,000	7,200	8,000	91,000	53,000	36,000
5,000	6,000	82,000	44,000	36,000	7,300	8,000	91,000	53,000	36,000
5,100	6,000	82,000	44,000	36,000	7,400	8,000	91,000	53,000	36,000
5,160	6,000	82,000	44,000	36,000	7,500	8,000	91,000	53,000	36,000



Forets TS avec trous d'huile

d1 mm	d2 mm	l1 mm	l2 mm	l3 mm	d1 mm	d2 mm	l1 mm	l2 mm	l3 mm
7,540	8,000	91,000	53,000	36,000	11,400	12,000	118,000	71,000	45,000
7,600	8,000	91,000	53,000	36,000	11,500	12,000	118,000	71,000	45,000
7,700	8,000	91,000	53,000	36,000	11,600	12,000	118,000	71,000	45,000
7,800	8,000	91,000	53,000	36,000	11,700	12,000	118,000	71,000	45,000
7,900	8,000	91,000	53,000	36,000	11,800	12,000	118,000	71,000	45,000
7,940	8,000	91,000	53,000	36,000	11,900	12,000	118,000	71,000	45,000
8,000	8,000	91,000	53,000	36,000	11,910	12,000	118,000	71,000	45,000
8,100	10,000	103,000	61,000	40,000	12,000	12,000	118,000	71,000	45,000
8,200	10,000	103,000	61,000	40,000	12,200	14,000	124,000	77,000	45,000
8,300	10,000	103,000	61,000	40,000	12,500	14,000	124,000	77,000	45,000
8,330	10,000	103,000	61,000	40,000	12,700	14,000	124,000	77,000	45,000
8,400	10,000	103,000	61,000	40,000	12,800	14,000	124,000	77,000	45,000
8,500	10,000	103,000	61,000	40,000	13,000	14,000	124,000	77,000	45,000
8,600	10,000	103,000	61,000	40,000	13,300	14,000	124,000	77,000	45,000
8,700	10,000	103,000	61,000	40,000	13,500	14,000	124,000	77,000	45,000
8,730	10,000	103,000	61,000	40,000	13,700	14,000	124,000	77,000	45,000
8,800	10,000	103,000	61,000	40,000	14,000	14,000	124,000	77,000	45,000
8,900	10,000	103,000	61,000	40,000	14,200	16,000	133,000	83,000	48,000
9,000	10,000	103,000	61,000	40,000	14,290	16,000	133,000	83,000	48,000
9,100	10,000	103,000	61,000	40,000	14,300	16,000	133,000	83,000	48,000
9,130	10,000	103,000	61,000	40,000	14,500	16,000	133,000	83,000	48,000
9,200	10,000	103,000	61,000	40,000	14,700	16,000	133,000	83,000	48,000
9,250	10,000	103,000	61,000	40,000	15,000	16,000	133,000	83,000	48,000
9,300	10,000	103,000	61,000	40,000	15,200	16,000	133,000	83,000	48,000
9,400	10,000	103,000	61,000	40,000	15,300	16,000	133,000	83,000	48,000
9,500	10,000	103,000	61,000	40,000	15,500	16,000	133,000	83,000	48,000
9,520	10,000	103,000	61,000	40,000	15,700	16,000	133,000	83,000	48,000
9,600	10,000	103,000	61,000	40,000	16,000	16,000	133,000	83,000	48,000
9,700	10,000	103,000	61,000	40,000	16,300	18,000	143,000	93,000	48,000
9,800	10,000	103,000	61,000	40,000	16,500	18,000	143,000	93,000	48,000
9,900	10,000	103,000	61,000	40,000	16,900	18,000	143,000	93,000	48,000
9,920	10,000	103,000	61,000	40,000	17,000	18,000	143,000	93,000	48,000
10,000	10,000	103,000	61,000	40,000	17,300	18,000	143,000	93,000	48,000
10,100	12,000	118,000	71,000	45,000	17,500	18,000	143,000	93,000	48,000
10,200	12,000	118,000	71,000	45,000	18,000	18,000	143,000	93,000	48,000
10,300	12,000	118,000	71,000	45,000	18,500	20,000	153,000	101,000	50,000
10,320	12,000	118,000	71,000	45,000	18,900	20,000	153,000	101,000	50,000
10,400	12,000	118,000	71,000	45,000	19,000	20,000	153,000	101,000	50,000
10,500	12,000	118,000	71,000	45,000	19,050	20,000	153,000	101,000	50,000
10,600	12,000	118,000	71,000	45,000	19,300	20,000	153,000	101,000	50,000
10,700	12,000	118,000	71,000	45,000	19,500	20,000	153,000	101,000	50,000
10,800	12,000	118,000	71,000	45,000	20,000	20,000	153,000	101,000	50,000
10,900	12,000	118,000	71,000	45,000					
11,000	12,000	118,000	71,000	45,000					
11,100	12,000	118,000	71,000	45,000					
11,110	12,000	118,000	71,000	45,000					
11,200	12,000	118,000	71,000	45,000					
11,300	12,000	118,000	71,000	45,000					



Forets hélicoïdaux extra-courts

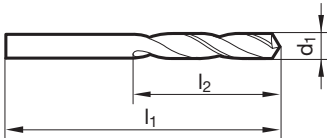
N° d'article 81173



P	M	K	N	S	H
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Forets INOX • affûtage à dépouille conique • acier rapide au Co • meilleure résistance à l'usure
 aciers austénit., inox., inaltérablesaux acides, réfractaires (V2A et V4A)



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	26,000	6,000	5,600	66,000	28,000
1,100	28,000	7,000	5,800	66,000	28,000
1,200	30,000	8,000	5,900	66,000	28,000
1,300	30,000	8,000	6,000	66,000	28,000
1,400	32,000	9,000	6,100	70,000	31,000
1,500	32,000	9,000	6,300	70,000	31,000
1,600	34,000	10,000	6,500	70,000	31,000
1,700	34,000	10,000	6,600	70,000	31,000
1,800	36,000	11,000	6,700	70,000	31,000
2,000	38,000	12,000	6,800	74,000	34,000
2,100	38,000	12,000	6,900	74,000	34,000
2,200	40,000	13,000	7,000	74,000	34,000
2,300	40,000	13,000	7,100	74,000	34,000
2,400	43,000	14,000	7,400	74,000	34,000
2,500	43,000	14,000	7,500	74,000	34,000
2,600	43,000	14,000	7,600	79,000	37,000
2,700	46,000	16,000	7,800	79,000	37,000
2,800	46,000	16,000	7,900	79,000	37,000
2,900	46,000	16,000	8,000	79,000	37,000
3,000	46,000	16,000	8,100	79,000	37,000
3,100	49,000	18,000	8,200	79,000	37,000
3,200	49,000	18,000	8,500	79,000	37,000
3,300	49,000	18,000	8,700	84,000	40,000
3,400	52,000	20,000	9,000	84,000	40,000
3,500	52,000	20,000	9,200	84,000	40,000
3,600	52,000	20,000	9,400	84,000	40,000
3,800	55,000	22,000	9,500	84,000	40,000
3,900	55,000	22,000	10,000	89,000	43,000
4,000	55,000	22,000	10,200	89,000	43,000
4,100	55,000	22,000	10,500	89,000	43,000
4,200	55,000	22,000	11,000	95,000	47,000
4,300	58,000	24,000	11,500	95,000	47,000
4,500	58,000	24,000	11,700	95,000	47,000
4,600	58,000	24,000	12,000	102,000	51,000
4,700	58,000	24,000			
4,800	62,000	26,000			
4,900	62,000	26,000			
5,000	62,000	26,000			
5,100	62,000	26,000			
5,200	62,000	26,000			
5,300	62,000	26,000			
5,500	66,000	28,000			



Forets hélicoïdaux extra-courts

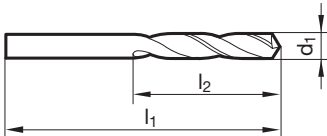
N° d'article 81178



P	M	K	N	S	H
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• acier rapide au Co • meilleure résistance à l'usure
 aciers austénit., inox., inaltérablesaux acides, réfractaires (V2A et V4A) • alliages spéciaux



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	26,000	6,000	5,100	62,000	26,000
1,100	28,000	7,000	5,200	62,000	26,000
1,200	30,000	8,000	5,300	62,000	26,000
1,300	30,000	8,000	5,400	66,000	28,000
1,400	32,000	9,000	5,500	66,000	28,000
1,500	32,000	9,000	5,550	66,000	28,000
1,600	34,000	10,000	5,600	66,000	28,000
1,700	34,000	10,000	5,700	66,000	28,000
1,800	36,000	11,000	5,800	66,000	28,000
1,900	36,000	11,000	5,900	66,000	28,000
2,000	38,000	12,000	6,000	66,000	28,000
2,100	38,000	12,000	6,100	70,000	31,000
2,200	40,000	13,000	6,200	70,000	31,000
2,300	40,000	13,000	6,300	70,000	31,000
2,400	43,000	14,000	6,400	70,000	31,000
2,500	43,000	14,000	6,500	70,000	31,000
2,600	43,000	14,000	6,600	70,000	31,000
2,700	46,000	16,000	6,700	70,000	31,000
2,800	46,000	16,000	6,800	74,000	34,000
2,900	46,000	16,000	6,900	74,000	34,000
3,000	46,000	16,000	7,000	74,000	34,000
3,100	49,000	18,000	7,100	74,000	34,000
3,200	49,000	18,000	7,200	74,000	34,000
3,300	49,000	18,000	7,300	74,000	34,000
3,400	52,000	20,000	7,400	74,000	34,000
3,500	52,000	20,000	7,450	74,000	34,000
3,600	52,000	20,000	7,500	74,000	34,000
3,700	52,000	20,000	7,600	79,000	37,000
3,800	55,000	22,000	7,700	79,000	37,000
3,900	55,000	22,000	7,800	79,000	37,000
4,000	55,000	22,000	7,900	79,000	37,000
4,100	55,000	22,000	8,000	79,000	37,000
4,200	55,000	22,000	8,100	79,000	37,000
4,300	58,000	24,000	8,200	79,000	37,000
4,400	58,000	24,000	8,300	79,000	37,000
4,500	58,000	24,000	8,400	79,000	37,000
4,600	58,000	24,000	8,500	79,000	37,000
4,650	58,000	24,000	8,600	84,000	40,000
4,700	58,000	24,000	8,700	84,000	40,000
4,800	62,000	26,000	8,800	84,000	40,000
4,900	62,000	26,000	8,900	84,000	40,000
5,000	62,000	26,000	9,000	84,000	40,000



Forets hélicoïdaux extra-courts

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
9,100	84,000	40,000	10,500	89,000	43,000
9,200	84,000	40,000	11,000	95,000	47,000
9,250	84,000	40,000	11,200	95,000	47,000
9,300	84,000	40,000	11,500	95,000	47,000
9,400	84,000	40,000	11,800	95,000	47,000
9,500	84,000	40,000	12,000	102,000	51,000
9,600	89,000	43,000	12,500	102,000	51,000
9,700	89,000	43,000	13,000	102,000	51,000
9,800	89,000	43,000			
9,900	89,000	43,000			
10,000	89,000	43,000			
10,200	89,000	43,000			



Forets hélicoïdaux courts

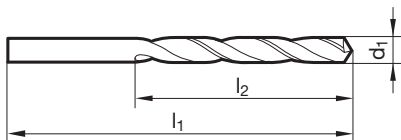
N° d'article 81013



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Forets INOX • affûtage à dépouille conique • acier rapide au Co • meilleure résistance à l'usure
 aciers austénit., inox., inaltérablesaux acides, réfractaires (V2A et V4A)



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	34,000	12,000	5,100	86,000	52,000
1,100	36,000	14,000	5,200	86,000	52,000
1,200	38,000	16,000	5,300	86,000	52,000
1,300	38,000	16,000	5,400	93,000	57,000
1,400	40,000	18,000	5,500	93,000	57,000
1,500	40,000	18,000	5,600	93,000	57,000
1,600	43,000	20,000	5,700	93,000	57,000
1,700	43,000	20,000	5,800	93,000	57,000
1,800	46,000	22,000	5,900	93,000	57,000
1,900	46,000	22,000	6,000	93,000	57,000
2,000	49,000	24,000	6,100	101,000	63,000
2,100	49,000	24,000	6,200	101,000	63,000
2,200	53,000	27,000	6,300	101,000	63,000
2,300	53,000	27,000	6,400	101,000	63,000
2,400	57,000	30,000	6,500	101,000	63,000
2,500	57,000	30,000	6,600	101,000	63,000
2,600	57,000	30,000	6,700	101,000	63,000
2,700	61,000	33,000	6,800	109,000	69,000
2,800	61,000	33,000	6,900	109,000	69,000
2,900	61,000	33,000	7,000	109,000	69,000
3,000	61,000	33,000	7,100	109,000	69,000
3,100	65,000	36,000	7,200	109,000	69,000
3,200	65,000	36,000	7,300	109,000	69,000
3,300	65,000	36,000	7,400	109,000	69,000
3,400	70,000	39,000	7,500	109,000	69,000
3,500	70,000	39,000	7,600	117,000	75,000
3,570	70,000	39,000	7,700	117,000	75,000
3,600	70,000	39,000	7,800	117,000	75,000
3,700	70,000	39,000	7,900	117,000	75,000
3,800	75,000	43,000	8,000	117,000	75,000
3,900	75,000	43,000	8,100	117,000	75,000
4,000	75,000	43,000	8,200	117,000	75,000
4,100	75,000	43,000	8,300	117,000	75,000
4,200	75,000	43,000	8,400	117,000	75,000
4,300	80,000	47,000	8,500	117,000	75,000
4,400	80,000	47,000	8,600	125,000	81,000
4,500	80,000	47,000	8,700	125,000	81,000
4,600	80,000	47,000	8,800	125,000	81,000
4,700	80,000	47,000	8,900	125,000	81,000
4,800	86,000	52,000	9,000	125,000	81,000
4,900	86,000	52,000	9,100	125,000	81,000
5,000	86,000	52,000	9,200	125,000	81,000



Forets hélicoïdaux courts

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
9,300	125,000	81,000	11,300	142,000	94,000
9,400	125,000	81,000	11,500	142,000	94,000
9,500	125,000	81,000	11,600	142,000	94,000
9,600	133,000	87,000	11,800	142,000	94,000
9,700	133,000	87,000	12,000	151,000	101,000
9,800	133,000	87,000	12,500	151,000	101,000
9,900	133,000	87,000	13,000	151,000	101,000
10,000	133,000	87,000			
10,100	133,000	87,000			
10,200	133,000	87,000			
10,300	133,000	87,000			
10,400	133,000	87,000			
10,500	133,000	87,000			
10,600	133,000	87,000			
10,900	142,000	94,000			
11,000	142,000	94,000			
11,100	142,000	94,000			
11,200	142,000	94,000			



Forets hélicoïdaux courts

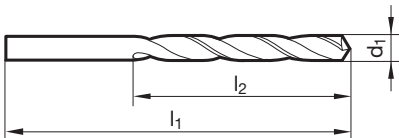
N° d'article 81078



P	M	K	N	S	H
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• acier rapide au Co • meilleure résistance à l'usure
 aciers austénit., inox., inaltérablesaux acides, réfractaires (V2A et V4A) • alliages spéciaux



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,000	34,000	12,000	5,200	86,000	52,000
1,100	36,000	14,000	5,300	86,000	52,000
1,200	38,000	16,000	5,400	93,000	57,000
1,300	38,000	16,000	5,500	93,000	57,000
1,400	40,000	18,000	5,600	93,000	57,000
1,500	40,000	18,000	5,700	93,000	57,000
1,600	43,000	20,000	5,800	93,000	57,000
1,700	43,000	20,000	5,900	93,000	57,000
1,800	46,000	22,000	6,000	93,000	57,000
1,900	46,000	22,000	6,100	101,000	63,000
2,000	49,000	24,000	6,200	101,000	63,000
2,100	49,000	24,000	6,300	101,000	63,000
2,200	53,000	27,000	6,400	101,000	63,000
2,300	53,000	27,000	6,500	101,000	63,000
2,400	57,000	30,000	6,600	101,000	63,000
2,500	57,000	30,000	6,700	101,000	63,000
2,600	57,000	30,000	6,800	109,000	69,000
2,700	61,000	33,000	6,900	109,000	69,000
2,800	61,000	33,000	7,000	109,000	69,000
2,900	61,000	33,000	7,100	109,000	69,000
3,000	61,000	33,000	7,200	109,000	69,000
3,100	65,000	36,000	7,300	109,000	69,000
3,200	65,000	36,000	7,400	109,000	69,000
3,300	65,000	36,000	7,500	109,000	69,000
3,400	70,000	39,000	7,600	117,000	75,000
3,500	70,000	39,000	7,700	117,000	75,000
3,600	70,000	39,000	7,800	117,000	75,000
3,700	70,000	39,000	7,900	117,000	75,000
3,800	75,000	43,000	8,000	117,000	75,000
3,900	75,000	43,000	8,100	117,000	75,000
4,000	75,000	43,000	8,200	117,000	75,000
4,100	75,000	43,000	8,300	117,000	75,000
4,200	75,000	43,000	8,400	117,000	75,000
4,300	80,000	47,000	8,500	117,000	75,000
4,400	80,000	47,000	8,600	125,000	81,000
4,500	80,000	47,000	8,700	125,000	81,000
4,600	80,000	47,000	8,800	125,000	81,000
4,700	80,000	47,000	8,900	125,000	81,000
4,800	86,000	52,000	9,000	125,000	81,000
4,900	86,000	52,000	9,100	125,000	81,000
5,000	86,000	52,000	9,200	125,000	81,000
5,100	86,000	52,000	9,300	125,000	81,000



Forets hélicoïdaux courts

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
9,400	125,000	81,000	11,800	142,000	94,000
9,500	125,000	81,000	12,000	151,000	101,000
9,600	133,000	87,000	12,500	151,000	101,000
9,700	133,000	87,000	13,000	151,000	101,000
9,800	133,000	87,000			
9,900	133,000	87,000			
10,000	133,000	87,000			
10,200	133,000	87,000			
10,500	133,000	87,000			
11,000	142,000	94,000			
11,200	142,000	94,000			
11,500	142,000	94,000			

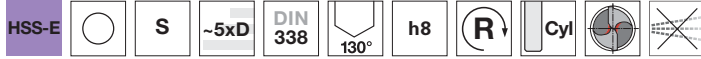


Forets hélicoïdaux courts

N° d'article 81061

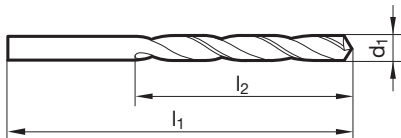


P	M	K	N	S	H
○	●			●	



Amin. de l'âme $\geq \varnothing 1,000$ • affûtage à dépouille conique • acier rapide au Co • meilleure résistance à l'usure

Titane et ses alliages • aciers austénit., inox., inaltérables aux acides, réfractaires • aciers $> 900 \text{ N/mm}^2$, à copeaux courts • Hastelloy, Inconel, Nimonic



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
0,200	19,000	2,500	1,850	46,000	22,000
0,300	19,000	3,000	1,900	46,000	22,000
0,400	20,000	5,000	1,950	49,000	24,000
0,500	22,000	6,000	1,990	49,000	24,000
0,550	24,000	7,000	2,000	49,000	24,000
0,580	24,000	7,000	2,030	49,000	24,000
0,600	24,000	7,000	2,050	49,000	24,000
0,650	26,000	8,000	2,080	49,000	24,000
0,700	28,000	9,000	2,100	49,000	24,000
0,750	28,000	9,000	2,200	53,000	27,000
0,800	30,000	10,000	2,250	53,000	27,000
0,820	30,000	10,000	2,300	53,000	27,000
0,840	30,000	10,000	2,350	53,000	27,000
0,850	30,000	10,000	2,380	57,000	30,000
0,900	32,000	11,000	2,400	57,000	30,000
0,950	32,000	11,000	2,450	57,000	30,000
1,000	34,000	12,000	2,500	57,000	30,000
1,050	34,000	12,000	2,550	57,000	30,000
1,100	36,000	14,000	2,600	57,000	30,000
1,150	36,000	14,000	2,700	61,000	33,000
1,180	36,000	14,000	2,750	61,000	33,000
1,190	38,000	16,000	2,800	61,000	33,000
1,200	38,000	16,000	2,850	61,000	33,000
1,210	38,000	16,000	2,900	61,000	33,000
1,250	38,000	16,000	2,950	61,000	33,000
1,300	38,000	16,000	3,000	61,000	33,000
1,350	40,000	18,000	3,050	65,000	36,000
1,400	40,000	18,000	3,100	65,000	36,000
1,450	40,000	18,000	3,200	65,000	36,000
1,500	40,000	18,000	3,250	65,000	36,000
1,510	43,000	20,000	3,300	65,000	36,000
1,520	43,000	20,000	3,350	65,000	36,000
1,530	43,000	20,000	3,400	70,000	39,000
1,550	43,000	20,000	3,450	70,000	39,000
1,600	43,000	20,000	3,500	70,000	39,000
1,630	43,000	20,000	3,600	70,000	39,000
1,650	43,000	20,000	3,700	70,000	39,000
1,700	43,000	20,000	3,800	75,000	43,000
1,730	46,000	22,000	3,900	75,000	43,000
1,750	46,000	22,000	4,000	75,000	43,000
1,800	46,000	22,000	4,050	75,000	43,000
1,820	46,000	22,000	4,100	75,000	43,000



Forets hélicoïdaux courts

d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
4,200	75,000	43,000	8,600	125,000	81,000
4,250	75,000	43,000	8,700	125,000	81,000
4,300	80,000	47,000	8,800	125,000	81,000
4,400	80,000	47,000	8,900	125,000	81,000
4,500	80,000	47,000	9,000	125,000	81,000
4,600	80,000	47,000	9,100	125,000	81,000
4,700	80,000	47,000	9,200	125,000	81,000
4,750	80,000	47,000	9,300	125,000	81,000
4,800	86,000	52,000	9,400	125,000	81,000
4,850	86,000	52,000	9,500	125,000	81,000
4,900	86,000	52,000	9,600	133,000	87,000
5,000	86,000	52,000	9,700	133,000	87,000
5,100	86,000	52,000	9,800	133,000	87,000
5,200	86,000	52,000	9,900	133,000	87,000
5,300	86,000	52,000	10,000	133,000	87,000
5,400	93,000	57,000	10,100	133,000	87,000
5,500	93,000	57,000	10,200	133,000	87,000
5,600	93,000	57,000	10,300	133,000	87,000
5,700	93,000	57,000	10,400	133,000	87,000
5,800	93,000	57,000	10,500	133,000	87,000
5,900	93,000	57,000	10,600	133,000	87,000
6,000	93,000	57,000	10,700	142,000	94,000
6,100	101,000	63,000	10,800	142,000	94,000
6,200	101,000	63,000	11,000	142,000	94,000
6,300	101,000	63,000	11,100	142,000	94,000
6,400	101,000	63,000	11,200	142,000	94,000
6,500	101,000	63,000	11,300	142,000	94,000
6,600	101,000	63,000	11,500	142,000	94,000
6,700	101,000	63,000	11,700	142,000	94,000
6,750	109,000	69,000	11,800	142,000	94,000
6,800	109,000	69,000	12,000	151,000	101,000
6,900	109,000	69,000	12,100	151,000	101,000
7,000	109,000	69,000	12,200	151,000	101,000
7,100	109,000	69,000	12,300	151,000	101,000
7,200	109,000	69,000	12,500	151,000	101,000
7,300	109,000	69,000	12,700	151,000	101,000
7,400	109,000	69,000	13,000	151,000	101,000
7,500	109,000	69,000	13,500	160,000	108,000
7,600	117,000	75,000	14,000	160,000	108,000
7,700	117,000	75,000	14,500	169,000	114,000
7,800	117,000	75,000	15,000	169,000	114,000
7,900	117,000	75,000	15,500	178,000	120,000
8,000	117,000	75,000	16,000	178,000	120,000
8,100	117,000	75,000	16,500	184,000	125,000
8,200	117,000	75,000	17,000	184,000	125,000
8,300	117,000	75,000	17,500	191,000	130,000
8,400	117,000	75,000			
8,500	117,000	75,000			

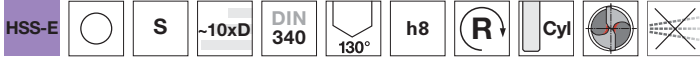


Forets hélicoïdaux longs

N° d'article 81361

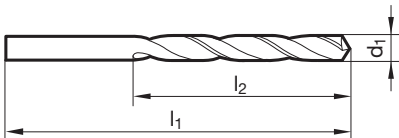


P	M	K	N	S	H
○	●			●	



Amin. de l'âme $\geq \varnothing 1,400$ • affûtage à dépouille conique • acier rapide au Co • meilleure résistance à l'usure

Titane et ses alliages • aciers austénit., inox., inaltérables aux acides, réfractaires • aciers $> 900 \text{ N/mm}^2$, à copeaux courts • aciers à roulement • Hastelloy, Inconel, Nimonic



d1 mm	l1 mm	l2 mm	d1 mm	l1 mm	l2 mm
1,300	65,000	41,000	6,200	148,000	97,000
1,400	70,000	45,000	6,300	148,000	97,000
1,500	70,000	45,000	6,400	148,000	97,000
1,900	80,000	53,000	6,500	148,000	97,000
2,000	85,000	56,000	6,600	148,000	97,000
2,100	85,000	56,000	6,700	148,000	97,000
2,200	90,000	59,000	6,800	156,000	102,000
2,500	95,000	62,000	6,900	156,000	102,000
3,000	100,000	66,000	7,000	156,000	102,000
3,100	106,000	69,000	7,100	156,000	102,000
3,200	106,000	69,000	7,300	156,000	102,000
3,300	106,000	69,000	7,400	156,000	102,000
3,400	112,000	73,000	7,600	165,000	109,000
3,500	112,000	73,000	7,700	165,000	109,000
3,600	112,000	73,000	7,800	165,000	109,000
3,700	112,000	73,000	7,900	165,000	109,000
3,800	119,000	78,000	8,000	165,000	109,000
3,900	119,000	78,000	8,100	165,000	109,000
4,000	119,000	78,000	8,200	165,000	109,000
4,100	119,000	78,000	8,300	165,000	109,000
4,200	119,000	78,000	8,400	165,000	109,000
4,300	126,000	82,000	8,500	165,000	109,000
4,400	126,000	82,000	8,700	175,000	115,000
4,500	126,000	82,000	8,800	175,000	115,000
4,600	126,000	82,000	9,000	175,000	115,000
4,800	132,000	87,000	9,500	175,000	115,000
4,900	132,000	87,000	10,000	184,000	121,000
5,000	132,000	87,000	10,500	184,000	121,000
5,300	132,000	87,000	12,000	205,000	134,000
5,400	139,000	91,000	12,500	205,000	134,000
5,500	139,000	91,000	13,000	205,000	134,000
5,600	139,000	91,000			
5,700	139,000	91,000			
5,800	139,000	91,000			
5,900	139,000	91,000			
6,000	139,000	91,000			



Forets hélicoïdaux à queue CM

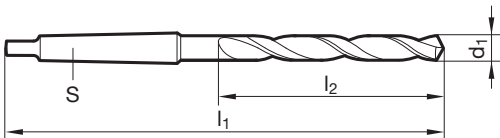
N° d'article 82972



P	M	K	N	S	H
○	●		○	○	



Forets INOX • affûtage à dépouille conique • acier rapide au Co • meilleure résistance à l'usure
 aciers austénit., inox., inaltérablesaux acides, réfractaires (V2A et V4A)



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
10,000	MK-1	138,000	57,000	21,500	MK-3	219,000	98,000
10,500	MK-1	138,000	57,000	29,000	MK-4	263,000	114,000
10,800	MK-1	142,000	61,000				
11,200	MK-1	142,000	61,000				
12,500	MK-1	147,000	66,000				
13,200	MK-1	147,000	66,000				



Forets hélicoïdaux à queue CM

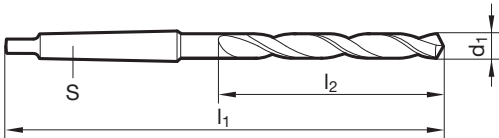
N° d'article 82012



P	M	K	N	S	H
○	●	○	○	○	○



Forets INOX • affûtage à dépouille conique • acier rapide au Co • meilleure résistance à l'usure
 aciers austénit., inox., inaltérablesaux acides, réfractaires (V2A et V4A)



d1 mm	S	l1 mm	l2 mm	d1 mm	S	l1 mm	l2 mm
11,500	MK-1	175,000	94,000	23,000	MK-2	253,000	155,000
12,000	MK-1	182,000	101,000	26,000	MK-3	286,000	165,000
14,000	MK-1	189,000	108,000	27,500	MK-3	291,000	170,000
15,000	MK-2	212,000	114,000	28,000	MK-3	291,000	170,000
15,500	MK-2	218,000	120,000	29,000	MK-3	296,000	175,000
16,000	MK-2	218,000	120,000	29,500	MK-3	296,000	175,000
16,500	MK-2	223,000	125,000	31,500	MK-3	301,000	180,000
17,000	MK-2	223,000	125,000	32,000	MK-4	334,000	185,000
17,250	MK-2	228,000	130,000				
17,500	MK-2	228,000	130,000				
18,000	MK-2	228,000	130,000				
18,500	MK-2	233,000	135,000				
19,500	MK-2	238,000	140,000				
20,000	MK-2	238,000	140,000				
20,500	MK-2	243,000	145,000				
21,000	MK-2	243,000	145,000				
22,000	MK-2	248,000	150,000				
22,500	MK-2	253,000	155,000				

The background features a technical drawing of a mechanical part with various dimensions and labels such as 'Bolzen', 'H/16', 'd2', 'd3', 'D', 'p', and 'N/6'. Overlaid on this are a microscope and a pair of calipers. The microscope is positioned diagonally, showing its objective and eyepiece lenses. The calipers are also positioned diagonally, with their jaws and scales visible. The scales of the calipers are marked with numbers 0, 5, 10, 15, 20, and 25. The entire image has a light green tint.

CONSEILS D'UTILISATION



Conseils d'utilisation forets INOX

N° d'article

Norme/DIN

Matière de coupe

Version

Type

Forme d'attachement

Lubrification

Prix/dim. page

Recommandations:

Machines très puissantes. Broches sans jeu.
Alignement précis des outils. Concentricité de l'outil serré max.: 0,02 mm. Avance assistée, franche.
Nous conseillons l'utilisation de mandrins hydrauliques et des pressions de lubrification optimales.

Conseils de lubrification:

Comme liquides de refroidissement et de lubrification, nous vous recommandons les huiles entières et les huiles solubles. Lorsque les conditions d'usinage sont favorables, il est possible de refroidir à l'air mais nous conseillons plutôt d'adopter la solution MQL d'usinage à lubrification minimale, particulièrement bien appropriée à ces outils.
Lors de l'usinage MQL, nous vous recommandons d'utiliser les outils pourvus d'un attachement conique ainsi que tous les éléments spéciaux

Il est conseillé de choisir des outils dont les avances sont en caractères gras.

Ø outil mm	Gamme d'avance n°								
	1	2	3	4	5	6	7	8	9
	f (mm/U)								
2,50	0,025	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160
3,15	0,032	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200
4,00	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
5,00	0,040	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250
6,30	0,050	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315
8,00	0,063	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400
10,00	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
12,50	0,080	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500
16,00	0,100	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630
20,00	0,125	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800
25,00	0,160	0,200	0,250	0,315	0,400	0,500	0,630	0,800	1,000

Produits de refroidissement:

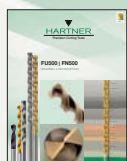
● Huile soluble

● Huile

○ Air

Matières	Exemples, nouvelle désignation (Ancienne désignation entre parenthèses) Caractères gras = N° de matières suivant DIN EN	Résistance MPa (N/mm²)	Dureté	Prod. de réf.
Aciers de construction	1.0035 S185(St33), 1.0486 P275N(StE285), 1.0345 P235GH(H1), 1.0425 P265GH(H2) 1.0050 E295 (St50-2), 1.0070 E360 (St70-2), 1.8937 P500NH (WStE500)	≤500 ≤1000		● ●
Aciers de décolletage	1.0718 11SMnPb30 (9SMnPb28), 1.0736 11SMn37 (9SMn36) 1.0727 46S20 (45S20), 1.0728 (60S20), 1.0757 46SPb20 (45SPb20)	≤850 ≤1000		● ●
Aciers d'amélioration non-alliés	1.0402 C22, 1.1178 C30E (Ck30) 1.0503 C45, 1.1191 C45E (Ck45) 1.0601 C60, 1.1221 C60E (Ck60)	≤700 ≤850 ≤1000		● ● ●
Aciers d'amélioration alliés	1.5131 50MnSi4, 1.7003 38Cr2, 1.7030 28Cr4 1.5710 36NiCr6, 1.7035 41Cr4, 1.7225 42CrMo4	≤1000 ≤1400		● ●
Aciers de cémentation non-alliés	1.0301 (C10), 1.1121 C10E (Ck10)	≤850		●
Aciers de cémentation alliés	1.7276 10CrMo11, 1.5125 11MnSi6 1.5752 15NiCr13, 1.7131 16MnCr5, 1.7264 20CrMo5	≤1000 ≤1400		● ●
Aciers de nitruration	1.8504 34CrAl6 1.8519 31CrMoV9, 1.8550 34CrAlNi7	≤1000 ≤1400		● ●
Aciers à outils	1.1750 C75W, 1.2067 102Cr6, 1.2307 29CrMoV9 1.2080 X210Cr12, 1.2083 X42Cr13, 1.2419 105WCr6, 1.2767 X45NiCrMo4	≤850 ≤1400		● ●
Aciers rapides	1.3243 S 6-5-2-5, 1.3343 S 6-5-2, 1.3344 S 6-5-3	≤1400		●
Aciers à ressort	1.5026 55Si7, 1.7176 55Cr3, 1.8159 51CrV4 (51CrV4)		≤350 HB	●
Aciers trempés	-		≤48 HRC ≤66 HRC	● ●
Aciers inoxydables, sulfurés	1.4005 X12CrS13, 1.4104 X14CrMoS17, 1.4105 X6CrMoS17, 1.4305 X8CrNiS18-9	≤900		●
austénitiques	1.4301 X5CrNi18-10 (V2A), 1.4541 X6CrNiTi18-10, 1.4571 X6CrNiMoTi 17-12-2 (V4A)	≤1100		●
martensitiques	1.4057 X20CrNi172 (X17CrNi16-2), 1.4122 X39CrMo17-1, 1.4521 X2CrMoTi18-2	≤1500		●
Fontes	0.6010 EN-GJL-100 (GG10), 0.6020 EN-GJL-200 (GG20) 0.6025 EN-GJL-250 (GG25), 0.6035 EN-GJL-350 (GG35)		≤240 HB ≤350 HB	● ●
Fontes à graphite sphéroïdal et fontes malléables	0.7050 EN-GJS-500-7 (GGG50), 0.8035 EN-GJMW-350-4 (GTW35) 0.7070 EN-GJS-700-2 (GGG70), 0.8170 EN-GJMB-700-2 (GTS70)		≤240 HB ≤350 HB	● ●
Fontes dures	-		≤350 HB	●
Nouvelles fontes GGV	EN-GJV250 (GGV25), EN-GJV350 (GGV35) EN-GJV400 (GGV40), EN-GJV500 (GGV50), SiMo 6		≤220 HB ≤300 HB	● ●
Nouvelles fontes ADI	EN-GJS-800-8 (ADI800), EN-GJS-1000-5 (ADI1000) EN-GJS-1200-2 (ADI1200), EN-GJS-1400-1 (ADI1400)	≤1000 ≤1400		● ●
Alliages spéciaux	Nimonic, Inconel, Monel, Hastelloy	≤2000		●
Titane et alliages de Titane	3.7024 Ti99,5, 3.7114 TiAl5Sn2,5, 3.7124 TiCu2 3.7154 TiAl6Zr5, 3.7165 TiAl6V4, 3.7184 TiAl4Mo4Sn2,5, - TiAl8Mo1V1	≤850 ≤1400		● ●
Aluminium et ses alliages	3.0255 Al99,5, 3.2315 AlMgSi1, 3.3515 AlMg1	≤400		●
Alliages malléables d'Al	3.0615 AlMgSiPb, 3.1325 AlCuMg1, 3.3245 AlMg3Si, 3.4365 AlZnMgCu1,5	≤650		●
Alliages d'Al d'inject. ≤ 10 % Si	3.2131 G-AlSi5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9	≤600		●
≤ 24 % Si	3.2581 G-AlSi12, 3.2583 G-AlSi12Cu, - G-AlSi12CuNiMg	≤600		●
Alliages de Magnésium	3.5200 MgMn2, 3.5812.05 G-MgAl8Zn1, 3.5612.05 G-MgAl6Zn1	≤400		●
Cuivres, faiblement alliés	2.0070 SE-Cu, 2.1020 CuSn6, 2.1096 G-CuSn5ZnPb	≤600		●
Laiton à copeaux courts, à copeaux longs	2.0380 CuZn39Pb2, 2.0401 CuZn39Pb3, 2.0410 CuZn43Pb2 2.0250 CuZn20, 2.0280 CuZn33, 2.0332 CuZn37Pb0,5	≤600 ≤600		● ●
Bronze, à copeaux courts	2.1090 CuSn7ZnPb, 2.1170 CuPb5Sn5, 2.1176 CuPb10Sn 2.0790 CuNi18Zn19Pb	≤600 ≤850		● ●
Bronze, à copeaux longs	2.0916 CuAl5, 2.0960 CuAl9Mn, 2.1050 CuSn10 2.0980 CuAl11Ni, 2.1247 CuBe2	≤850 ≤1000		● ●
Thermodurcissables	Résine époxy, Resopal, Pertinax, Moltopren	≤150		●
Thermoplastiques	Plexiglas, Hostalen, Novodur, Makralon	≤100		●
renf. de fibres d'aramides	Kevlar	≤1000		●
renf. de fibres de verre ou carbone	GFK/CFK	≤1000		●

Notre programme:



FU 500/FN 500



Outils de forage



Forets INOX



Multiplex



Microforets



Multiplex HPC



Forets TS



Automate de gestion d'outils TM



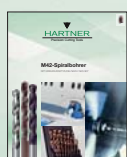
Outils de taraudage



Fraises Haute Performance en CW



TF 100 Multi-Mill



M42 Forets hélicoïdaux

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