PILOT
Precision Products

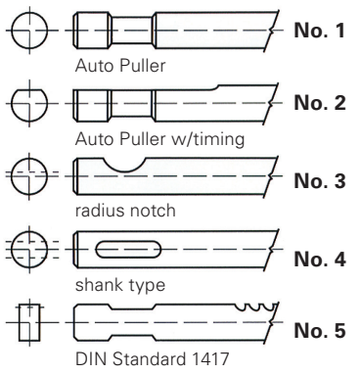
Request for Quotation

Thank you for your interest in our products. To request a quote please complete the form below and either scan and email it to **info@pilotprecision.com** or fax it to **413-773-8430**.

duMONT Minute Man® Industrial Broaches

Hassay Savage

PULL ENDS



Contact Information

First Name _____ Last Name _____

Company _____

Address _____

Address _____

City _____ State Zip Code _____

Phone Number _____ Fax Number _____ Email _____

Broaching Information

Size and Shape of Cut _____

Length of Cut _____ Tolerance _____

Material to be Broached _____

Pre-Broaching Condition of Hole Surface:

Pilot Hole Size _____

Hole Size (for cast holes) _____
(include draft/fillet radii, if any)

Pre-Broaching Condition of Hole Surface:

Bore Size _____ Keyway Width _____

Length of Cut _____ Tolerance _____

Depth of Keyway (measured across bore) _____

Type of Broaching Machine:

Push Pull Tonnage _____ Ram Travel _____

Daylight Opening _____

Provide the Following Information

Pull End No. _____

Size _____

Distance to 1st Tooth _____

Starting Hole Size _____

Finished Size _____ Length of Cut _____

Material _____

Remarks _____

Straight, Serrated, or Involute Spline Information (include Part Print):

Inv. Std. _____ *No. of Splines* _____

Diametrical Pitch _____

Pressure Angle _____

Major Dia. _____ *Minor Dia.* _____

Measurement Between Wires _____

Wire Size _____

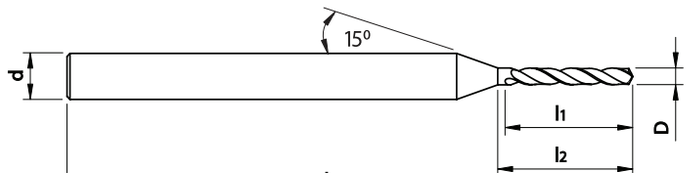
Circular Tooth Thickness _____

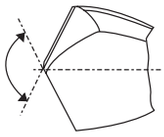
PILOT Precision Products

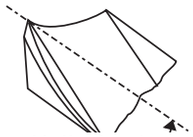
Request for Quotation

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GMauvaisUSA™




Point Angle


Helix Angle

Contact Information

Date _____

First Name _____ Last Name _____

Company/Title _____

Address _____

Address _____

City _____ State _____ Zip Code _____ Country _____

Phone Number _____ Fax Number _____ Email _____

Custom Specifications

_____ Right or Left Cutting

_____ "D" flute diameter

_____ "d" shank diameter

_____ "l1" flute length

_____ "L" overall length OAL

_____ Special Coating

_____ Helix Angle of 15°, 24°, 35° or other.

_____ Point Angles of 90°, 110°, 120°, 130° or other.

_____ Special Diameters as 0.92 mm or other.

_____ Special Tolerances as +/- 0.001 mm or other.

_____ Coolant Through Drills at 3 & 4 mm shanks & 1.25 to 3 mm flute diameters.

Please check one:

❑ Solid Carbide ❑ HSS-E Cobalt %

Supply Tool Print/Drawing if Possible • Minimum Special Order is 10 Pieces / per Specification

Lead-Time on Specials – 4 Weeks ARO • SOLD IN 10 PIECE PACKAGES ONLY

A Reputation for Excellence

The duMONT and Hassay Savage Companies have been designing and manufacturing Precision Broaches for decades, and these Broaches are recognized all over the world for their quality, durability and engineering detail.

duMONT Minute Man® and Hassay Savage are proud to be the largest suppliers of Push-type Broaches in America, offering parts to a wide variety of businesses through a vast national and international distribution network. Our record of design ingenuity, fast delivery and courteous follow-up is unsurpassed.



Materials

All duMONT Minute Man® and Hassay Savage Broaches are manufactured of the finest quality high speed steel. We are equipped to fabricate from a variety of grades to meet your specifications. Contact your industrial distributor or the duMONT Engineering Department for details.

Call Your Industrial Distributor

Your industrial distributor is your best source for duMONT Minute Man® and Hassay Savage Broaches. If your regular distributor does not carry our products, call us and we will be happy to give you the name of the nearest distributor. For special technical assistance, call our Engineering Department at 413-350-5200.

Fast Delivery

An order for stock items placed by your industrial distributor with us by 3:30 PM EST will almost always be shipped on the same working day.

Material Safety Data Sheet

Available upon request or at PilotPrecision.com.

General Ordering Information

When ordering stock Pilot Precision Products Tools from your distributor, please specify EDP No., size and description to ensure proper fulfillment.

Transportation

All shipments are made via UPS where weight limitations allow. Express shipments, both surface and air, are available at your request. Shipments are F.O.B. South Deerfield, MA unless otherwise stated.

Prices

Please contact us for current pricing or refer to the current price list for prices on all stock items. Prices are subject to change without notice.

TiN or TiAlN Coating

All standard items are available with coatings from stock or short delivery. Please contact Pilot Precision Products for details.

Warning: *Cutting tools may shatter. Eye protection should be worn wherever and whenever cutting tools are being used.*

MADE in the USA

Keyway Broach Sets

1/16 thru 3/8 inch sizes

Applications: **Short Run Production** | **General Maintenance**

All of our Broach Sets are furnished in traditional boxes, either varnished wood or plastic, depending upon the set selected, and come complete with Precision Broaches, slotted Bushings and necessary Shims.

No. 00 Precision Set / No. 1

3 Broaches and 5 Bushings = 15 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. duMONT	EDP No. Hassay Savage
1/16, 3/32, 1/8	A / I	1/4, 5/16, 3/8, 7/16, 1/2	11101 Std 11301 TiN	15315





Standard Set No. 10

4 Broaches and 9 Bushings = 18 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. duMONT
1/8, 3/16	B	1/2, 5/8, 3/4, 7/8	11104 Std 11304 TiN
1/4, 3/8	C	1, 1-1/8, 1-1/4, 1-3/8, 1-1/2	

Standard Set No. C-10

4 Broaches and 18 Bushings = 36 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. Hassay Savage
1/8, 3/16	II	1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 7/8	15336
1/4, 3/8	III	15/16, 1, 1-1/16, 1-1/8, 1-3/16, 1-1/4, 1-5/16, 1-3/8, 1-7/16, 1-1/2, 1-9/16	

Standard Set No. 10A

4 Broaches and 9 Bushings = 18 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. duMONT
1/8, 3/16	B	9/16, 11/16, 13/16	11108 Std 11308 TiN
1/4, 3/8	C	15/16, 1-1/16, 1-3/16 1-5/16, 1-7/16, 1-9/16	

Standard Set No. C-10A

3 Broaches and 18 Bushings = 36 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. Hassay Savage
1/8	II	1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 7/8	15330
3/16, 1/4	III	15/16, 1, 1-1/16, 1-1/8, 1-3/16, 1-1/4, 1-5/16, 1-3/8, 1-7/16, 1-1/2, 1-9/16	

Standard Set No. 30

3 Broaches and 9 Bushings = 15 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. duMONT
1/8	B	1/2, 5/8, 3/4	11112 Std 11312 TiN
3/16 , 1/4	C	7/8, 1, 1-1/8, 1-1/4, 1-3/8, 1-1/2	

Standard Set No. 30A / C-2

3 Broaches and 9 Bushings = 15 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. duMONT	EDP No. Hassay Savage
1/8	B / II	9/16, 11/16, 13/16	11115 Std 11315 TiN	15320
3/16, 1/4	C / III	15/16, 1-1/16, 1-3/16, 1-5/16, 1-7/16, 1-9/16		

Standard Set No. C-2A

3 Broaches and 9 Bushings = 15 Keyway combinations.
Collared bushings only.

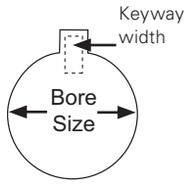
Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. Hassay Savage
1/8	II	1/2, 5/8, 3/4, 7/8	15321
3/16 , 1/4	III	1, 1-1/8, 1-1/4, 1-3/8, 1-1/2	

All standard items are available with TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

Keyway Broach Sets

1/8 thru 3/8 inch sizes

Applications: **Short Run Production** | **General Maintenance**



All of our Broach Sets are furnished in traditional boxes, either varnished wood or plastic, depending upon the set selected, and come complete with Precision Broaches, slotted Bushings and necessary Shims.



No. 10-10A Combination Set

4 Broaches and 18 Bushings = 36 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. duMONT
1/8, 3/16	B	1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 7/8	11120 Std 11320 TiN
1/4, 3/8	C	15/16, 1, 1-1/16, 1-1/8, 1-3/16, 1-1/4, 1-5/16, 1-3/8, 1-7/16, 1-1/2, 1-9/16	

Standard Set C-1

4 Broaches and 9 Bushings = 18 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. Hassay Savage
1/8, 3/16	II	1/2, 5/8, 3/4, 7/8	15318
1/4, 3/8	III	1, 1-1/8, 1-1/4, 1-3/8, 1-1/2	

No. 20 Combination Set

5 Broaches and 18 Bushings = 47 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. duMONT
1/8, 3/16	B	1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 7/8	11121 Std 11321 TiN
1/4, 5/16, 3/8	C	15/16, 1, 1-1/16, 1-1/8, 1-3/16, 1-1/4, 1-5/16, 1-3/8, 1-7/16, 1-1/2, 1-9/16	

Standard Set C-1A

4 Broaches and 9 Bushings = 18 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. Hassay Savage
1/8, 3/16	II	9/16, 11/16, 13/16	15319
1/4, 3/8	III	15/16, 1-1/16, 1-3/16 1-5/16, 1-7/16, 1-9/16	

No. 30-30A Combination Set

3 Broaches and 18 Bushings = 30 Keyway combinations.
Collared bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No. duMONT
1/8	B	1/2, 9/16, 5/8, 11/16, 3/4, 13/16	11124 Std 11324 TiN
3/16, 1/4	C	7/8, 15/16, 1, 1-1/16, 1-1/8, 1-3/16, 1-1/4, 1-5/16, 1-3/8, 1-7/16, 1-1/2, 1-9/16	

Keyway Broach Sets

5/16 thru 3/4 inch sizes

Applications: **Short Run Production** | **General Maintenance**

All of our Broach Sets are furnished in traditional boxes, either varnished wood or plastic, depending upon the set selected, and come complete with Precision Broaches, slotted Bushings and necessary Shims.





Standard Set No. 40A / 3-D

4 Broaches and 8 Bushings = 32 Keyway combinations.
Plain bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No.	
			duMONT	Hassay Savage
5/16, 3/8, 7/16, 1/2	D / IV	1-1/2, 1-5/8, 1-3/4, 1-7/8, 2, 2-1/8, 2-1/4, 2-1/2	11127 Std 11327 TiN	15024

Heavy Duty Set No. 40 1/2 A / 4-E

2 Broaches and 6 Bushings = 12 Keyway combinations.
Plain bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No.	
			duMONT	Hassay Savage
5/8, 3/4	E / V	2-3/8, 2-1/2, 2-5/8, 2-3/4, 2-7/8, 3	11131 Std 11331 TiN	15012

Standard Set No. 40 / 3-DA

4 Broaches and 8 Bushings = 32 Keyway combinations.
Plain bushings only.

Keyway Size (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No.	
			duMONT	Hassay Savage
5/16, 3/8, 7/16, 1/2	D / IV	1-7/16, 1-9/16, 1-11/16, 1-13/16, 1-15/16, 2-3/16, 2-7/16, 2-15/16	11129 Std 11329 TiN	15124

Heavy Duty Set No. 40 1/2 / 4-F

2 Broaches and 6 Bushings = 12 Keyway combinations.
Plain bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No.	
			duMONT	Hassay Savage
5/8, 3/4	E / V	2-5/16, 2-7/16, 2-9/16, 2-11/16, 2-13/16, 2-15/16	11133 Std 11333 TiN	15014

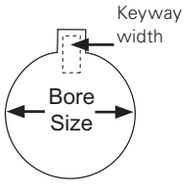
Keyway Broach Sets

1/8 thru 3/4 inch sizes

Applications: **Virtually all standard broaching operations—our most complete set**

All of our Broach Sets are furnished in traditional boxes, either varnished wood or plastic, depending upon the set selected, and come complete with Precision Broaches, slotted Bushings and necessary Shims.





Heavy Duty Set No. 50 / No. 5

3 Broaches and 17 Bushings = 29 Keyway combinations.
Plain bushings only.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No.	
			duMONT	Hassay Savage
1/2	D / IV	2, 2-1/16, 2-1/8, 2-3/16, 2-1/4, 2-5/16, 2-3/8, 2-7/16	11135 Std 11335TiN	15026
5/8, 3/4	E / V	2-5/16, 2-3/8, 2-7/16, 2-1/2, 2-9/16, 2-5/8,		
		2-11/16, 2-3/4, 2-13/16, 2-7/8, 2-15/16, 3		

No. 100 Heavy Duty Combination Set

9 Broaches and 44 Bushings = 102 Keyway combinations.
Collared B / II and C / III bushings, plain D / IV and E / V bushing.

Keyway Sizes (inch)	Broach Style	Bushing Diameters *(bore sizes, inch)*	EDP No.	
			duMONT	Hassay Savage
1/8, 3/16	B / II	1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 7/8	11136 Std 11336 TiN	15100
1/4, 5/16	C / III	15/16, 1, 1-1/16, 1-1/8, 1-3/16, 1-1/4, 1-5/16, 1-3/8, 1-7/16, 1-1/2, 1-9/16		
3/8, 7/16, 1/2	D / IV	1-7/16, 1-1/2, 1-9/16, 1-5/8, 1-11/16, 1-3/4, 1-13/16, 1-7/8, 1-15/16, 2, 2-1/16, 2-1/8, 2- 3/16, 2-1/4		
5/8, 3/4	E / V	2-5/16, 2-3/8, 2-7/16, 2-1/2, 2-9/16, 2-5/8, 2-11/16, 2-3/4, 2-13/16, 2-7/8, 2-15/16, 3		

All standard items are available with TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

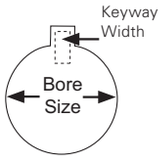
Metric Keyway Broach Sets

2mm thru 18mm

Applications: **Short Run Production** | **General Maintenance**

All of our Broach Sets are furnished in traditional boxes, either varnished wood or plastic, depending upon the set selected, and come complete with Precision Broaches, slotted Bushings and necessary Shims.





No. 60 Metric Set

2 Broaches and 3 Bushings = 6 Keyway combinations.
Collared bushings only.

Keyway Sizes (mm)	Broach Style	Bushing Diameters *(bore sizes, mm)*	EDP No. duMONT
2 3	A	6, 8, 10	44497 Std 44397 TiN

Precision Set 10

2 Broaches and 5 Bushings = 10 Keyway combinations.
Collared bushings only.

Keyway Sizes (mm)	Broach Style	Bushing Diameters *(bore sizes, mm)*	EDP No. Hassay Savage
2 3	I	6, 7, 8, 9, 10	15410

No. 70 Metric Set

4 Broaches and 13 Bushings = 26 Keyway combinations.
Collared bushings only.

Keyway Sizes (mm)	Broach Style	Bushing Diameters *(bore sizes, mm)*	EDP No. duMONT
4 5	B1	12, 14 15, 16	44498 Std 44398 TiN
6 8	C	18, 19, 20, 22 24, 25, 26, 28, 30	

Metric Set 18

4 Broaches and 9 Bushings = 18 Keyway combinations.
Collared bushings only.

Keyway Sizes (mm)	Broach Style	Bushing Diameters *(bore sizes, mm)*	EDP No. Hassay Savage
4 5	II	12, 14, 16, 18	15418
6 8	III	20, 22, 24, 26, 28	

No. 80 Metric Set

3 Broaches and 12 Bushings = 36 Keyway combinations.
Plain bushings only.

Keyway Sizes (mm)	Broach Style	Bushing Diameters *(bore sizes, mm)*	EDP No. duMONT
10	D	32, 34, 35, 36	44499 Std 44399 TiN
12		38, 40, 42, 44	
14		45, 46, 48, 50	

Metric Set 24

3 Broaches and 8 Bushings = 24 Keyway combinations.
Plain bushings only.

Keyway Sizes (mm)	Broach Style	Bushing Diameters *(bore sizes, mm)*	EDP No. Hassay Savage
10 12 14	IV	34, 36, 38, 40, 42, 44, 46, 48	15224

No. 90 Metric Set

2 Broaches and 8 Bushings = 16 Keyway combinations.
Plain bushings only.

Keyway Sizes (mm)	Broach Style	Bushing Diameters *(bore sizes, mm)*	EDP No. duMONT
16	E	52, 54, 55, 56	44500 Std 44300 TiN
18		58, 60, 62, 65	

Metric Set 12

2 Broaches and 6 Bushings = 12 Keyway combinations.
Plain bushings only.

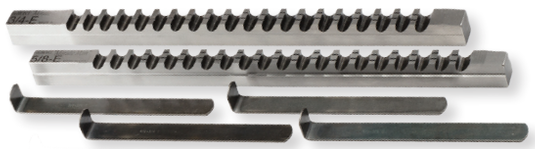
Keyway Sizes (mm)	Broach Style	Bushing Diameters *(bore sizes, mm)*	EDP No. Hassay Savage
16 18	V	54, 56, 58, 60, 62, 64	15212

All standard items are available with TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

Keyway Broaches

1/16 thru 2 inch sizes

Applications: **Short Run Production** | **General Maintenance**



Stock Keyway Broaches

Broaches are supplied with necessary Shims unless otherwise noted. For extra or replacement Shims see the table below.

Broach Size (inch)	Tolerances	Broach Dimensions	Shims Required	Length of Cut		Pressure Required. for Max. L/C (lbs.)	EDP No.			
				Min.	Max.		duMONT Std	duMONT TiN	duMONT TiAlN	Hassay Savage
1/16-A	.0625 – .0635	1/8 x 5	0	13/64	1-1/8	390	22201	22301	22801	10104
3/32-A	.0938 – .0948	1/8 x 5	0	13/64	1-1/8	780	22202	22302	22802	10106
1/8-A	.1252 – .1262	1/8 x 5	1	13/64	1-1/8	650	22203	22303	22803	10108
3/32-B	.0938 – .0948	3/16 x 6-3/4	0	19/64	1-11/16	930	22204	22304	22804	10206
1/8-B	.1252 – .1262	3/16 x 6-3/4	1	19/64	1-11/16	720	22205	22305	22805	10208
5/32-B	.1564 – .1574	3/16 x 6-3/4	1	19/64	1-11/16	1,320	22206	22306	22806	10210
3/16-B	.1877 – .1887	3/16 x 6-3/4	1	19/64	1-11/16	1,860	22207	22307	22807	10212
3/16-C	.1877 – .1887	3/8 x 11-3/4	1	25/64	2-1/2	1,540	22208	22308	22808	10312
1/4-C	.2502 – .2512	3/8 x 11-3/4	1	25/64	2-1/2	2,520	22209	22309	22809	10316
5/16-C	.3127 – .3137	3/8 x 11-3/4	2	25/64	2-1/2	3,960	22210	22310	22810	10320
3/8-C	.3755 – .3765	3/8 x 11-3/4	2	25/64	2-1/2	4,340	22211	22311	22811	10324
5/16-D	.3127 – .3137	9/16 x 13-7/8	2	1	6	8,000	22212	22312	22812	10420
3/8-D	.3755 – .3765	9/16 x 13-7/8	2	1	6	7,000	22213	22313	22813	10424
7/16-D	.4380 – .4390	9/16 x 13-7/8	3	1	6	9,400	22214	22314	22814	10428
1/2-D	.5006 – .5016	9/16 x 13-7/8	3	1	6	9,800	22215	22315	22815	10432
9/16-D	.5631 – .5641	9/16 x 13-7/8	4	1	6	8,900	10142	10342	10842	10436
5/8-E	.6260 – .6270	3/4 x 15-1/2	4	1	6	9,600	22216	22316	22816	10540
3/4-E	.7515 – .7525	3/4 x 15-1/2	5	1	6	11,900	22217	22317	22817	10548
7/8-F	.8765 – .8775	1 x 20-1/4	6	1	6	9,800	22218	22318	22818	10656
1-F	1.0015 – 1.0025	1 x 20-1/4	7	1	6	11,100	22219	22319	22819	10664
1-1/8	1.1265 – 1.1275	1-1/8 x 20-1/4	8	1	6	14,750	10171	-	-	10666
1-1/4	1.2520 – 1.2530	1-1/4 x 20-1/4	9	1-1/2	8	22,100	10172	-	-	10668
1-3/8	1.3770 – 1.3780	1-3/8 x 20-1/4	**	1-1/2	8	23,500	10173	-	-	10670
1-1/2	1.5020 – 1.5030	1-1/2 x 20-1/4	**	1-1/2	8	26,500	10174	-	-	10672
1-3/4	1.7520 – 1.7530	1-3/4 x 20-1/4	**	1-1/2	8	31,400	10175	-	-	-
2	2.003 – 2.004	1-3/4 x 20-1/16	**	1-1/2	8	35,900	10176	-	-	-

*Based on mild steel **Shims are not supplied with these broaches, sold as Progressive Shims only, see below

Extra Shims

Extra Shims are provided in necessary Shim Sets only. For Broaches larger than 1-1/4" progressive Shims are available as special items. Please specify EDP No. when ordering extra or replacement Shims. Shims correspond to Broach size, not to Bushing type.

Broach Size (inch)	# / Set	Shim Thickness	EDP No.
1/8-A	1	.031	22250
1/8-B	1	.031	22252
5/32-B	1	.042	22253
3/16-B	1	.050	22254
3/16-C	1	.050	22255
1/4-C	1	.0625	22256

Broach Size (inch)	# / Set	Shim Thickness	EDP No.
5/16-C	2	.055	22257
3/8-C	2	.0625	22258
5/16-D	2	.056	22259
3/8-D	2	.0625	22260
7/16-D	3	.056	22261
1/2-D	3	.0625	22262
9/16-D	4	.056	22269

Broach Size (inch)	# / Set	Shim Thickness	EDP No.
5/8-E	4	.0625	22263
3/4-E	5	.0625	22264
7/8-F	6	.0625	22265
1-F	7	.0625	22266
1-1/8	8	.0625	22267
1-1/4	9	.0625	22268

Progressive Shims

Broach Size (inch)	# / Set	Shim Thickness	EDP No.
1-3/8	4	.062, .125, .250, .375	22270
1-1/2	4	.062, .125, .250, .375	22271
1-3/4	4	.062, .125, .250, .375	22272
2	5	.062, .125, .250, .375, .500	22273

SPECIAL ORDERS: We are fully equipped to manufacture Special Keyway Broaches not listed above. TiN or TiAlN coatings are available. Please contact Pilot Precision Products for details.

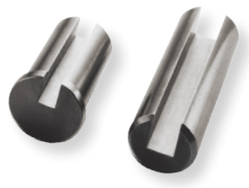
All standard items are available with TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

Bushing Styles A / I thru F / VI

Applications: **To use Keyway Broaches in various bore sizes**

Keyway Bushings

Keyway Bushings enable the operator to use individual Keyway Broaches in a variety of bore sizes. Both Bushings and Broaches are designated by a letter or roman numeral which signifies the width of the Keyway Broach and Bushing opening. For proper fit, use Bushings with the same letter designation as the Broach being used – i.e. "A / I" Bushings with "A / I" Broaches, "B / II" Bushings with "B/ II" Broaches, etc.



A / I Bushings for A / I Broaches *(collared only)*

Diameter (inch)	Length	EDP No. duMONT	EDP No. Hassay Savage
1/4	1-1/8	33301	20116
5/16		33302	20120
3/8		33303	20124
7/16		33304	20128
1/2		33305	20132

B / II Bushings for B / II Broaches *(collared only)*

Diameter (inch)	Length	EDP No. duMONT	EDP No. Hassay Savage
1/2	1-11/16	33313	20232
9/16		33314	20236
5/8		33315	20240
11/16		33316	20244
3/4		33317	20248
13/16		33318	20252
7/8		33319	20256

C / III Bushings for C / III Broaches *(collared only)*

Diameter (inch)	Length	EDP No. duMONT	EDP No. Hassay Savage
3/4	2-1/2	33334	20348
13/16		33335	20352
7/8		33336	20356
15/16		33337	20360
1		33338	20364
1-1/16		33339	20368
1-1/8		33340	20372
1-3/16		33341	20376
1-1/4		33342	20380
1-5/16		33343	20384
1-3/8		33344	20388
1-7/16		33345	20392
1-1/2		33346	20396
1-9/16		33347	20400

D / IV Bushings for D / IV Broaches *(plain only)*

Diameter (inch)	Length	EDP No. duMONT	EDP No. Hassay Savage
1-7/16	4	33348	21492
1-1/2		33349	21496
1-9/16		33350	21500
1-5/8		33351	21504
1-11/16		33352	21508
1-3/4		33353	21512
1-13/16	5	33354	21516
1-7/8		33355	21520
1-15/16		33356	21524
2		33357	21528
2-1/16		33358	21532
2-1/8		33359	21536
2-3/16		33360	21540
2-1/4		33361	21544
2-5/16		33362	21548
2-3/8	6	33363	21552
2-7/16		33364	21556
2-1/2		33365	21560
2-9/16		33366	21564
2-5/8		33367	21568
2-11/16		33368	21572
2-3/4		33369	21576
2-13/16		33370	21580
2-7/8		33371	21584
2-15/16		33372	21588
3		33373	21592

E / V Bushings for E / V Broaches *(plain only)*

Diameter (inch)	Length	EDP No. duMONT	EDP No. Hassay Savage
2-5/16	6	33374	21688
2-3/8		33375	21692
2-7/16		33376	21696
2-1/2		33377	21700
2-9/16		33378	21704
2-5/8		33379	21708
2-11/16		33380	21712
2-3/4		33381	21716
2-13/16		33382	21720
2-7/8		33383	21724
2-15/16		33384	21728
3		33385	21732
3-1/16		33386	-
3-1/8		33387	-
3-3/16		33388	-
3-1/4		33389	-
3-5/16		33390	-
3-3/8		33391	-
3-7/16		33392	-
3-1/2		33393	-
3-9/16		33394	-
3-5/8		33395	-
3-11/16		33396	-
3-3/4		33397	-
3-13/16		33398	-
3-7/8		33399	-
3-15/16		33400	-
4		33401	-

F / VI Bushings for F / VI Broaches *(plain only)*

Diameter (inch)	Length	EDP No. duMONT	EDP No. Hassay Savage
3-1/16	6	33500	23104
3-1/8		33501	23108
3-3/16		33502	23112
3-1/4		33503	23116
3-5/16		33504	23120
3-3/8		33505	23124
3-7/16		33506	23128
3-1/2		33507	23132
3-9/16		33508	23136
3-5/8		33509	23140
3-11/16		33510	23144
3-3/4		33511	23148
3-13/16		33512	23150
3-7/8		33513	23156
3-15/16		33514	23158
4		33515	23164
4-1/16		33516	24104
4-1/8		33517	24108
4-3/16		33518	24112
4-1/4		33519	24116
4-5/16		33520	24120
4-3/8		33521	24124
4-7/16		33522	24128
4-1/2		33523	24132
4-9/16		33524	24136
4-5/8		33525	24140
4-11/16		33526	24144
4-3/4		33527	24148
4-13/16		33528	24150
4-7/8		33529	24156
4-15/16		33530	21158
5		33531	25000

SPECIAL ORDERS: We are fully equipped to manufacture Special Bushings not listed above. Please contact Pilot Precision Products for details.

Metric Keyway Broaches

2mm thru 45mm

Applications: **Short Run Production** | **General Maintenance**



Stock Keyway Broaches / Optional Metric Keyway Broaches

Broaches are supplied with necessary Shims unless otherwise noted. For extra or replacement Shims see the table below.

Broach Size (mm)	Tolerances (Decimal Equiv.)	Broach Dimensions (inches)	Standard Millimeter Keys	Shims Req'd	Length of Cut (inches)		Pressure Required. for Max. L/C (lbs.)*	EDP No			
					Min.	Max.		duMONT Std.	duMONT TiN	duMONT TiAlN	Hassay Savage
2-A / I	0.0782 – 0.0791	1/8 x 5	2 x 2	0	13/64	1-1/8	720	44401	44301	44801	11102
3-A / I	0.1176 – 0.1185		3 x 3	1			650	44402	44302	44802	11103
4-B1 / II	0.1569 – 0.1579	1/4 x 6-3/4	4 x 4	1	19/64	1-11/16	1,140	44403	44303	44803	11204
5-B1 / II	0.1963 – 0.1972		5 x 5				1,860	44404	44304	44804	11205
5-C / III	0.1963 – 0.1972	3/8 x 11-3/4	5 x 5	1	25/64	2-1/2	1,470	44405	44305	44805	11305
6-C / III	0.2356 – 0.2366		6 x 6	1			2,100	44406	44306	44806	11308
7-C / III	0.2749 – 0.2763		7 x 6	1			2,900	10232	10332	10832	11307
8-C / III	0.3143 – 0.3155		8 x 7	2			3,680	44407	44307	44807	-
10-D / IV	0.3930 – 0.3942	9/16 x 13-7/8	10 x 8	2	1	6	6,500	44408	44308	44808	11410
12-D / IV	0.4716 – 0.4730		12 x 8				8,400	44409	44309	44809	11412
14-D / IV	0.5503 – 0.5517		14 x 9				11,100	44410	44310	44810	11414
16-E / V	0.6290 – 0.6304	3/4 x 15-1/2	16 x 10	3	1	6	9,400	44411	44311	44811	11516
18-E / V	0.7078 – 0.7092		18 x 11				10,600	44412	44312	44812	11518
20-F / VI	0.7864 – 0.7880	1 x 20-1/4	20 x 12	3	1	6	8,800	44413	44313	44813	11620
22-F / VI	0.8651 – 0.8667		22 x 14	4			9,400	44414	44314	44814	11622
24-F / VI	0.9439 – 0.9455		24 x 14	4			10,600	44415	44315	44815	11624
25-F / VI	0.9832 – 0.9848		25 x 14	4			12,300	44494	44394	44894	11625
28	1.1025 – 1.1035	1-1/8 x 20-1/4	28 x 16	5	1	6	12,000	10233	-	-	11628
32	1.2600 – 1.2610	1-1/4 x 20-1/4	32 x 18	5	1-1/2	8	20,600	10234	-	-	11632
36	1.4175 – 1.4185	1-7/16 x 20-1/4	36 x 20	**	1-1/2	8	24,200	10235	-	-	11636
40	1.5753 – 1.5760	1-9/16 x 20-1/4	40 x 22	**	1-1/2	8	22,500	10236	-	-	-
45	1.7718 – 1.7728	1-3/4 x 20-1/4	45 x 25	**	1-1/2	8	27,200	10237	-	-	-

*Based on mild steel **Shims are not supplied with these broaches, sold as Progressive Shims only, see below

Extra Shims

Extra Shims are provided in necessary Shim Sets only. Shims are available as special items for Broaches larger than 32mm progressive. Please specify EDP No. when ordering extra or replacement Shims. Shims correspond to Broach size, not to Bushing type.

Broach Size (mm)	# / Set	Shim Thickness	EDP No. duMONT
3-A / I	1	0.0310	44480
4-B1 / II	1	0.0380	44481
5-B1 / II		0.0500	44482
5-C / III	1	0.0470	44483
6-C / III	1	0.0625	44484
7-C / III	1	0.0625	44577
8-C / III	2	0.0500	44485

Broach Size (mm)	# / Set	Shim Thickness	EDP No. duMONT
10-D / IV	2	0.0560	44486
12-D / IV		0.0560	44487
14-D / IV		0.0625	44488
16-E / V	3	0.0560	44489
18-E / V		0.0560	44490

Broach Size (mm)	# / Set	Shim Thickness	EDP No. duMONT
20-F	3	0.0625	44491
22-F	4	0.0560	44492
24-F	5	0.0625	44493
25-F	4	0.0560	44496
28	5	0.0560	44478
32		0.0625	44479

Progressive Shims

Broach Size (mm)	# / Set	Shim Thickness	EDP No. duMONT
36	3	.062, .125, .250	44578
40	3	.062, .125, .250	44579
45	4	.062 (2pcs), .125, .250	44580

SPECIAL ORDERS: We are fully equipped to manufacture Special Keyway Broaches not listed above. TiN or TiAlN coatings are available. Please contact Pilot Precision Products for details.

Metric Keyway Bushing Styles A / I thru F / VI

Applications: **To use Keyway Broaches in various metric bore sizes**

Metric Keyway Bushings

Metric Keyway Bushings enable the operator to use individual Metric Keyway Broaches in a variety of bore sizes. Both Bushings and Broaches are designated by a letter or roman numeral which signifies the width of the Keyway Broach and Bushing opening. For proper fit, use Bushings with the same letter designation as the Broach being used i.e. Metric "A / I" Bushings with Metric "A / I" Broaches, Metric "B1 / II" Bushings with Metric "B1 / II" Broaches, etc.



A / I Bushings for A / I Broaches *(collared only)*

Diameter (mm)	(Decimal Equiv.)	EDP No. duMONT	EDP No. Hassay Savage
6	.2362	44501	22106
7	.2756	44513	22107
8	.3150	44431	22108
9	.3543	44514	22109
10	.3937	44432	22110
12	.4724	44502	
15	.5905	44503	

B1 / II Bushings for B1 / II Broaches *(collared only)*

Diameter (mm)	(Decimal Equiv.)	EDP No. duMONT	EDP No. Hassay Savage
11	.4331	44510	22211
12	.4724	44433	22212
13	.5118	44511	22213
14	.5512	44434	22214
15	.5905	44504	22215
16	.6299	44435	22216
17	.6693	44505	22217
18	.7087	44436	22218
19	.7480	44506	22219

C / III Bushings for C / III Broaches *(collared only)*

Diameter (mm)	(Decimal Equiv.)	EDP No. duMONT	EDP No. Hassay Savage
17	.6693	44512	22317
18	.7087	44437	22318
19	.7480	44438	22319
20	.7874	44439	22320
22	.8661	44440	22322
24	.9449	44441	22324
25	.9842	44442	22325
26	1.0236	44443	22326
27	1.0630	-	22327
28	1.1024	44444	22328
30	1.1811	44445	22330
32	1.2598	44446	22332
34	1.3386	44447	22334
35	1.3779	44507	22335
36	1.4173	44448	22336

D / IV Bushings for D / IV Broaches *(plain only)*

Diameter (mm)	(Decimal Equiv.)	EDP duMONT	EDP Hassay Savage
32	1.2598	44449	22432
34	1.3386	44450	22434
35	1.3779	44451	22435
36	1.4173	44452	22436
38	1.4961	44453	22438
40	1.5748	44454	22440
42	1.6535	44455	22442
44	1.7323	44456	22444
45	1.7716	44457	22445
46	1.8110	44458	22446
48	1.8898	44459	22448
50	1.9685	44460	22450
52	2.0472	44461	22452
54	2.1260	44462	22454
55	2.1653	-	22455
56	2.2047	44463	22456

E / V Bushings for E / V Broaches *(plain only)*

Diameter (mm)	(Decimal Equiv.)	EDP No. duMONT	EDP No. Hassay Savage
52	2.0472	44464	22552
54	2.1260	44465	22554
55	2.1653	44466	22555
56	2.2047	44467	22556
58	2.2835	44468	22558
60	2.3622	44469	22560
62	2.4409	44470	22562
63	2.4803	44471	-
64	2.5197	44472	22564
65	2.5590	44473	22564
66	2.5984	44474	22566
68	2.6772	44475	22568
70	2.7559	44476	22570
72	2.8346	44477	22572

F / VI Bushings for F / VI Broaches *(plain only)*

Diameter (mm)	(Decimal Equiv.)	EDP No. duMONT
70	2.7559	44539
75	2.9527	44540
80	3.1496	44541
85	3.3464	44542
90	3.5433	44543
95	3.7401	44544
100	3.9370	44545
105	4.1338	44546
110	4.3307	44547
115	4.5275	44548
120	4.7244	44549

SPECIAL ORDERS: We are fully equipped to manufacture Special Bushings not listed above. Please contact Pilot Precision Products for details.

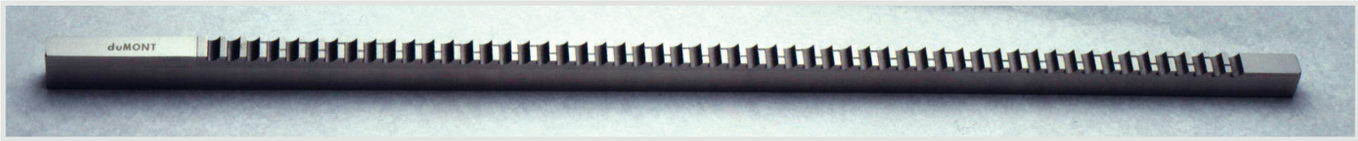
One-Pass Keyway Broaches | 1/8 thru 3/8 inch sizes | 3mm thru 14mm

Applications: **High Speed Operation** | **Accurate Small Run Production**

One-Pass Keyway Broaches

One-Pass Keyway Broaches are designed for smaller production runs of identical keyways in varying bores. Used with the appropriate Bushing size (American Standard or Metric) and Style (see pages 10 and 12) to cut to full width and depth in one-pass, no shimming required. Reminder – Broach and Bushing Style must match – "A / I" Broaches with "A / I" Bushings, "B / II" Broaches with "B / II" Bushings, etc. A special chamfering feature that will deburr the keyway while it is being broached is also available.

TiN or TiAlN coatings available.



Stock One-Pass Broaches – Inch

Broach Size (inch)	Broach Dimensions	Tooth Pitch	Length of Cut (inches) Min.	Length of Cut (inches) Max.	Pressure Required. for Max. L/C (lbs.)*	EDP No. duMONT
1/8-B / II	3/16 x 10-3/4	1/4	19/64	1-11/16	800	55507
5/32-B / II	3/16 x 10-3/4				1,450	55508
3/16-B / II	3/16 x 10-3/4				2,050	55509
1/8-C / III	3/8 x 14-1/8	9/32	19/64	2	900	55501
5/32-C / III	3/8 x 14-1/8				1,360	55502
3/16-C / III	3/8 x 17				1,570	55503
1/4-C / III	3/8 x 17				2,560	55504
5/16-C / III	3/8 x 18-1/2				3,900	55505
3/8-C / III	3/8 x 18-1/2				5,300	55506

Stock One-Pass Metric Keyway Broaches

Broach Size (mm)	Broach Dimensions	Tooth Pitch	Length of Cut (inches) Min.	Length of Cut (inches) Max.	Pressure Required. for Max. L/C (lbs.)*	EDP No. duMONT	EDP No. Hassay Savage
3-A / I	1/8 x 7-3/4	3/16	13/64	1	675	55510	11103-OP*
4-B1 / II	1/4 x 10-3/4	1/4	3/8	1-5/8	1,550	55511	11204-COP*
5-B1/ II					2,430	55512	11205-COP*
6-C / III	3/8 x 17	9/32	3/8	1-3/4	2,240	55513	11306-COP*
8-C / III	3/8 x 18-1/2	5/16		2	3,485	55514	11308-COP*
10-D / IV	9/16 x 24	3/8	25/64	2	3,410	55515	-
12-D / IV					4,220	55516	-
14-D / IV					5,670	55517	-

*Based on mild steel

Note: 4mm—12mm keyway broaches have deburring feature

All standard items are available with TiN or TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

SPECIAL ORDERS: We are fully equipped to manufacture Special Special One-Pass Broaches to your specifications. A special chamfering feature that will deburr the keyway while it is being broached is also available. TiN or TiAlN coatings are available. Please contact Pilot Precision Products for details.

Production Push-type Keyway Broaches

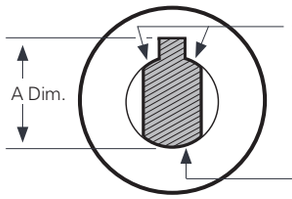
Applications: **High Speed Operation** | **Accurate Long Run Production**



Production Keyway Broaches

Production Keyway Broaches offer maximum speed and accuracy in production runs of identical bores, using either hydraulic or hand-operated presses. These Broaches are self-supporting—no Shims or Bushings are required.

Production Broach Construction



Shoulders and back are form-ground to fit bore. These 3 supporting surfaces extend the full length of the broach.

Stock Production Keyway Broaches

Production Keyway Broaches are designed for large production runs of identical keyways with identical bores. No Shims or Bushings required. A special chamfering feature that will deburr the keyway while it is being broached is also available. **TiN or TiAlN coatings available.**

Keyway Width	Body Diameter	A Dimension	Broach Length	Tooth Pitch	Length of Cut* Min.	Length of Cut* Max.	Pressure Required. for Max. L/C (lbs.)	EDP No. duMONT
1/16"	3/16"	.224"	5-5/8	3/16	13/64	1	390	55520
	1/4"	.287"	6-3/16	3/16	13/64	1	390	55521
1/8"	3/8"	.437"	8-1/2	1/4	17/64	1-1/4	850	55522
	1/2"	.565"	11-3/4	3/8	25/64	2-1/2	1,440	55523
	9/16"	.630"	11-3/4	3/8	25/64	2-1/2	1,440	55524
	5/8"	.693"	11-3/4	3/8	25/64	2-1/2	1,440	55525
3/16"	5/8"	.716"	14-3/4	3/8	25/64	2-1/2	2,170	55526
	3/4"	.844"						55528
	7/8"	.970"						55530
1/4"	1"	1.121"	18	3/8	25/64	2-1/2	2,870	55532
4mm	10mm	11.9mm .468"	12	9/32	19/64	1-7/8	1,550	55533

*Based on mild steel

All standard items are available with TiN or TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

SPECIAL ORDERS: We are fully equipped to manufacture Special Production Style Broaches to your specifications. A special chamfering feature that will deburr the keyway while it is being broached is also available. Please contact Pilot Precision Products for details.

Keyseating Broaches

1/16 thru 1-1/2 inch sizes | **2mm thru 25mm**

Applications: **Hansford Davis Keyseating Machine Models 4, 5, and 15**

Type AF – Inch

Keyseating Broaches feature superior tooth design and are ground to precision keyway tolerances. Sizes for cutting the most common keyway widths are available.
TiN or TiAlN coatings available.

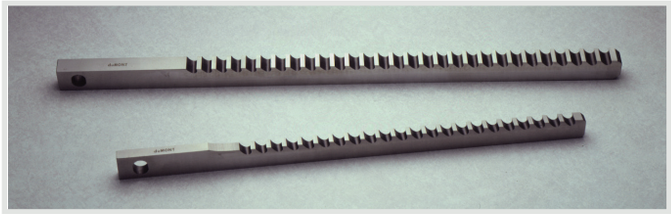
Broach Size (inch)	Overall Length	Tooth Height	Tooth Pitch	EDP No.	
				duMONT	Hassay Savage
1/16*	16	3/8	3/8	55550	10701
3/32*				55551	10702
1/8*		7/16		55552	10703
5/32*		1/2		55553	10704
3/16	16	9/16		55554	10705
	20	3/8		-	10706
1/4	16	3/4		55555	10707
	20			55556	10708
5/16	16	7/8	17/32	55557	10709
	20			55558	10710
3/8	16			55559	10711
	20			55560	10712
7/16	16	1	17/32	-	10713
	20	1	11/32	55561	10714
1/2	20	1	17/32	55562	10715
9/16				55563	10716
5/8				55564	10717
3/4				55565	10718
7/8				55566	10719
1				55567	10720

*Reinforced body width 3/16" thick

Type AFS – Inch

Staggered Tooth AFS Type Keyseating Broaches provide a stagger tooth design, promoting an efficient cut.
TiN or TiAlN coatings available.

Broach Size (inch)	Overall Length	Tooth Height	EDP No. duMONT
3/8	20	1	55601
7/16			55603
1/2			55604
9/16			55605
5/8			55606
3/4			55607
7/8			55608
1			55609
1-1/8		1-1/8	55610
1-1/4		1-1/4	55611
1-1/2		1-1/2	55612



Type AF Metric Standard

Broach Size (mm)	Overall Length	Tooth Height	Tooth Pitch	EDP No.	
				duMONT	Hassay Savage
2*	16	3/8	3/8	55570	11701
3*		7/16		55571	11702
4*		1/2		55572	11703
5		9/16		-	11704
5	20	1/2		55573	11705
6	16	3/4		55574	11706
	20			55575	11707
7	16	7/8	17/32	55576	-
	20			55577	-
8	16			55578	11708
	20			55579	11709
9	16			55580	-
	20			55581	-
10	16			55582	11710
	20			-	11711
11	20	1		55583	-
12				55584	11712
13				55585	-
14				55586	11713
15				55587	-
16				55588	11714
17				55589	-
18				55590	11715
19				55591	-
20				55592	11716
22				55593	11717
24				55594	11718
25				55595	11719

*Reinforced body width 3/16" thick

All standard items are available with TiN or TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

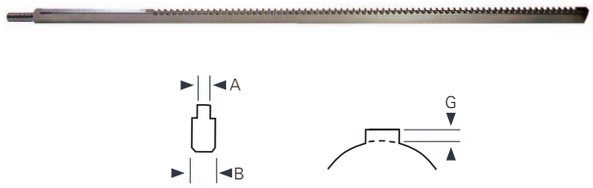
SPECIAL ORDERS: We are fully equipped to manufacture Special Keyseating Broaches not listed above. Please contact Pilot Precision Products for details.

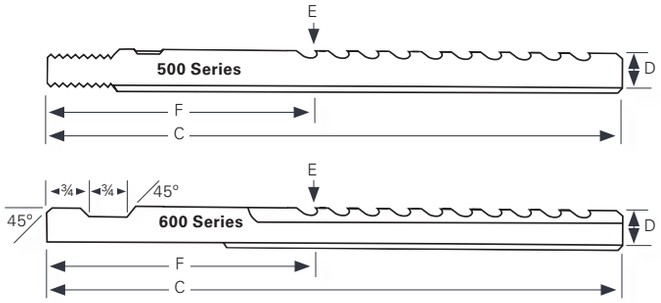
Pull-Type Keyway Broaches

1/16 thru 1 inch sizes

Applications: **For high volume production pull-type machines**

Industry Standard 500 and 600 Series





Industry Standard 500 and 600 Series

duMONT Minute Man® and Hassay Savage brands offer the most common American Standard (1/16–1") Pull-Type Keyway Broaches for use in high volume production. Available either as Industry Standard 500 Series with threaded pull end or 600 Series with notched pull end.

Nom. Dim.	A Decimal Dim.†	Min. Hole Size	Min Length Cut#	Max Length Cut*	B	C	D	E	F	G	No.of Passes	Thread Size	EDP No. duMONT 500 Series	EDP No. duMONT 600 Series	EDP No. Hassay 500 Series	EDP No. Hassay 600 Series
1/16	.0635	3/8	3/8	1-1/4	.1552	20	.313	.271	7-13/16	.042	1	1/4 – 20	10501	10601	33501	33601
3/32	.0948	7/16	1/2	1-1/2	.1865	24	.367	.309	8-1/4	.058	1	5/16 – 18	10502	10602	33502	33602
3/32	.0948	9/16	5/8	2-1/2	.2490	33	.491	.433	10	.058	1	3/8 – 16	10503	10603	33503	33603
1/8	.1260	1/2	1/2	1-1/2	.2490	30	.438	.364	9	.074	1	3/8 – 16	10504	10604	33504	33604
1/8	.1260	11/16	5/8	2-1/2	.3115	33	.594	.520	10	.074	1	1/2 – 13	10505	10605	33505	33605
5/32	.1572	19/32	1/2	1-1/2	.2490	30	.525	.436	9	.089	1	3/8 – 16	10506	10606	33506	33606
5/32	.1572	23/32	5/8	2-1/2	.3115	33	.625	.536	10	.089	1	1/2 – 13	10507	10607	33507	33607
3/16	.1885	11/16	5/8	2-1/2	.3740	36	.581	.476	10	.105	1	1/2 – 13	10508	10608	33508	33608
3/16	.1885	7/8	11/16	3-1/2	.3740	36	.796	.691	10-11/16	.105	1	1/2 – 13	10509	10609	33509	33609
7/32	.2198	11/16	5/8	2-1/2	.3740	33	.557	.437	10	.120	1	1/2 – 13	10510	10610	33510	33610
7/32	.2198	15/16	11/16	3-1/2	.3740	42	.813	.693	11-1/16	.120	1	1/2 – 13	10511	10611	33511	33611
1/4	.2510	3/4	5/8	2-1/2	.3740	36	.612	.476	10	.136	1	1/2 – 13	10512	10612	33512	33612
1/4	.2510	1	11/16	4	.4990	45	.877	.741	12	.136	1	5/8 – 11	10513	10613	33513	33613
1/4	.2510	1-3/8	7/8	6	.6240	51	1.250	1.114	13-3/4	.136	1	3/4 – 10	10514	10614	33514	33614
9/32	.2828	7/8	11/16	4	.4990	42	.716	.564	11-5/8	.152	1	5/8 – 11	10515	10615	33515	33615
9/32	.2828	1-1/4	7/8	6	.4990	51	1.093	.941	13-1/2	.152	1	5/8 – 11	10516	10616	33516	33616
5/16	.3140	1-1/16	11/16	4	.4990	45	.908	.741	12	.167	1	5/8 – 11	10517	10617	33517	33617
5/16	.3140	1-5/16	7/8	6	.4990	51	1.158	.991	13-3/4	.167	1	5/8 – 11	10518	10618	33518	33618
3/8	.3765	1-9/16	11/16	4	.4990	45	.938	.739	12	.199	1	5/8 – 11	10519	10619	33519	33619
3/8	.3765	1-5/16	7/8	6	.4990	54	1.189	.990	13-1/2	.199	1	5/8 – 11	10520	10620	33520	33620
7/16	.4390	1-9/16	11/16	4	.6240	48	1.390	1.160	12	.230	1	3/4 – 10	10521	10621	33521	33621
7/16	.4390	1-3/4	1	8	.6240	48	1.611	1.496	15-5/8	.230	2	3/4 – 10	10522	10622	33522	33622
1/2	.5015	1-1/2	11/16	4	.6240	48	1.312	1.051	12	.261	1	3/4 – 10	10523	10623	33523	33623
1/2	.5015	1-9/16	1	8	.6240	48	1.377	1.246	16-1/2	.261	2	3/4 – 10	10524	10624	33524	33624
9/16	.5645	1-11/16	11/16	4	.6865	54	1.438	1.146	11-13/16	.292	1	1 – 8	10525	10625	33525	33625
9/16	.5645	1-5/8	1	8	.6865	51	1.391	1.245	16	.292	2	1 – 8	10526	10626	33526	33626
9/16	.5645	1-15/16	1-1/8	12	.8740	60	1.641	1.495	20	.292	2	1 – 8	10527	10627	33527	33627
5/8	.6270	1-7/8	1-1/16	4	.7490	60	1.625	1.301	12	.324	1	1 – 8	10528	10628	33528	33628
5/8	.6270	1-15/16	1	8	.8740	54	1.657	1.495	16-3/8	.324	2	1 – 8	10529	10629	33529	33629
5/8	.6270	1-15/16	1-1/8	12	.8740	60	1.657	1.495	20	.324	2	1 – 8	10530	10630	33530	33630
3/4	.7520	1-15/16	11/ 16	4	.8740	60	1.625	1.239	12	.386	1	1 – 8	10531	10631	33531	33631
3/4	.7520	2-1/16	1	8	.9990	60	1.688	1.495	16-1/4	.386	2	1-1/4 – 7	10532	10632	33532	33632
3/4	.7520	2-1/16	1-1/8	12	.9990	60	1.688	1.560	20	.386	3	1-1/4 – 7	10533	10633	33533	33633
7/8	.8770	2-1/4	11/16	4	1.1240	63	1.875	1.426	12-3/8	.449	1	1-1/4 – 7	10534	10634	33534	33634
7/8	.8770	2-1/8	1	8	1.1240	63	1.719	1.494	15-3/4	.449	2	1-1/4 – 7	10535	10635	33535	33635
7/8	.8770	2-1/8	1-1/8	12	1.1240	63	1.719	1.569	20	.449	3	1-1/4 – 7	10536	10636	33536	33636
1	1.0020	2-1/4	5/8	2-1/2	1.2490	63	1.750	1.239	10-1/2	.511	1	1-1/2 – 6	10537	10637	33537	33637
1	1.0020	2-1/4	7/8	6	1.2490	63	1.750	1.494	14-1/4	.511	2	1-1/2 – 6	10538	10638	33538	33638
1	1.0020	2-1/4	1-1/8	12	1.2490	63	1.750	1.580	20	.511	3	1-1/2 – 6	10539	10639	33539	33639

† Tolerance - Based on +/-.0005 # Minimum length of part recommended to prevent part from dropping in between broach teeth *Based on mild steel

All standard items are available with TiN or TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

***Note:** All items can be made with deburring feature as specials.*

Pull-Type Keyway Broaches

2mm thru 25mm

Applications: **For high volume production pull-type machines**

Metric 2–25mm Pull-type Keyway Broaches

duMONT Minute Man® and Hassay Savage brands offer the most common Metric (2–25mm) Pull-Type Keyway Broaches for use in high volume production. Available either as Industry Standard 500 Series with threaded pull end or 600 Series with notched pull end. See image page 16.

Nom. Dim.	A Decimal Dim.†	Min. Hole Size (mm)	Min Length Cut#	Max Length Cut*	B	C	D	E	F	G	No.of Passes	Thread Size	EDP No. duMONT 500M Series	EDP No. duMONT 600M Series
2	.0792	9 .354	9.5 3/8	31.8 1-1/4	3.942 .1552	508 20	7.95 .313	6.60 .260	197 7-3/4	1.35 .053	1	1/4 – 20	10561	10661
3	.1186	11 .433	12.7 1/2	38 1-1/2	4.737 .1865	610 24	9.32 .367	7.49 .295	197 7-3/4	1.83 .072	1	5/16 – 18	10562	10662
4	.1581	13 .512	12.7 1/2	38 1-1/2	6.325 .2490	838 33	11.13 .438	8.81 .347	229 9	2.31 .091	1	3/8 – 16	10563	10663
	.1581	13 .512	15.9 5/8	63.5 2-1/2	6.325 .2490	915 36	11.07 .436	8.76 .345	254 10	2.31 .091			10564	10664
5	.1974	14 .551	14.3 9/16	44.5 1-3/4	7.91 .3115	915 36	11.07 .436	8.18 .322	248 9-3/4	2.89 .114	1	1/2 – 13	10565	10665
	.1974	23 .906	15.9 5/8	76.2 3	9.5 .3740	1067 42	2.65 .813	17.75 .699	279 11	2.89 .114			10566	10666
6	.2368	18 .709	15.9 5/8	63.5 2-1/2	9.5 .3740	915 36	15.54 .612	11.96 .471	254 10	3.58 .141	1	1/2 – 13	10567	10667
	.2368	26 1.024	17.5 11/16	102 4	12.67 .4990	1143 45	22.28 .877	18.69 .736	305 12	3.58 .141		5/8 – 11	10568	10668
8	.3157	27 1.063	17.5 11/16	102 4	12.67 .4990	1143 45	23.06 .908	18.77 .739	305 12	4.29 .169	1	5/8 – 11	10569	10669
	.3157	33 1.299	22.2 7/8	152 6	12.67 .4990	1295 51	29.41 1.158	25.12 .989	353 13-7/8	4.29 .169			10570	10670
10	.3944	27 1.063	17.5 11/16	102 4	12.67 .4990	1143 45	23.27 .916	18.77 .739	305 12	4.49 .177	1	5/8 – 11	10571	10671
	.3944	36 1.417	22.2 7/8	152 6	15.85 .6240	1295 51	31.75 1.250	27.25 1.073	353 13-7/8	4.49 .177		3/4 – 10	10572	10672
12	.4733	39 1.535	17.5 11/16	102 4	15.85 .6240	1219 48	34.06 1.341	29.46 1.160	302 11-7/8	4.60 .181	1	3/4 – 10	10573	10673
	.4733	39 1.535	25.4 1	203 8	15.85 .6240	1524 60	34.06 1.341	29.46 1.160	406 16	4.60 .181			10574	10674
14	.552	40 1.575	17.5 11/16	102 4	17.44 .6865	1372 54	34.39 1.354	29.11 1.146	295 11-5/8	5.28 .208	1	1 – 8	10575	10675
	.552	44 1.732	25.4 1	203 8	19.02 .7490	1524 60	38.33 1.509	33.04 1.301	400 15-3/4	5.28 .208			10576	10676
16	.6308	47 1.850	17.5 11/16	102 4	19.02 .7490	1524 60	41.28 1.625	35.46 1.396	305 12	5.82 .229	1	1 – 8	10577	10677
	.6308	48 1.890	28.6 1-1/8	305 12	22.2 .8740	1524 60	41.28 1.625	38.35 1.510	508 20	5.82 .229	2		10578	10678
18	.7095	48 1.890	17.5 11/16	102 4	22.2 .8740	1524 60	41.28 1.625	35.26 1.388	305 12	6.02 .237	1	1 – 8	10579	10679
	.7095	51 2.008	28.6 1-1/8	305 12	25.37 .9990	1524 60	42.88 1.688	39.85 1.569	513 20-3/16	6.02 .237	2	1-1/4 – 7	10580	10680
20	.7884	56 2.205	17.5 11/16	102 4	28.55 1.1240	1600 63	47.63 1.875	4.94 1.612	302 11-7/8	6.68 .263	1	1-1/4 – 7	10581	10681
	.7884	53 2.087	28.6 1-1/8	305 12	28.55 1.1240	1600 63	43.66 1.719	4.31 1.587	503 19-13/16	6.68 .263	2		10582	10682
22	.8672	57 2.244	17.5 11/16	102 4	28.55 1.1240	1600 63	47.63 1.875	4.39 1.590	302 11-7/8	7.24 .285	1	1-1/4 – 7	10583	10683
	.8672	53 2.087	28.6 1-1/8	305 12	28.55 1.1240	1600 63	43.66 1.719	4.03 1.576	503 19-13/16	7.24 .285	2		10584	10684
25	.9853	56 2.205	17.5 11/16	102 4	31.72 1.2490	1600 63	44.45 1.750	36.98 1.456	270 10-5/8	7.47 .294	1	1-1/2 – 6	10585	10685
	.9853	56 2.205	28.6 1-1/8	305 12	31.72 1.2490	1600 63	44.45 1.750	4.72 1.603	508 20	7.47 .294	2	2-1/2 – 6	10586	10686

† Tolerance - Based on +/-.0005 # Minimum length of part recommended to prevent part from dropping in between broach teeth *Based on mild steel

All standard items are available with TiN or TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

***Note:** All items can be made with deburring feature as specials.*

Round Push Broaches

1/4 thru 1 inch

Applications: **Drives, jigs, fixtures, sizing and finishing**

Round Broaches

duMONT Minute Man® and Hassay Savage Round Broaches are designed to generate in one-pass a precision round hole in a previously cast, drilled or reamed round hole. These Internal Hole Broaches are ideal for precise tolerances, sizing and finish for those applications demanding precision and finish. Broaches are finished with variable pitch teeth and available in American Standard sizes. A burnishing section can be furnished. Metric sizes available upon request.

TiN or TiAlN coatings available.



Stock Round Broaches

Nominal Diameter (inch)	Tolerances	Broach Length	Pilot Diameter	Drill Size	Length of Cut Min.	Length of Cut Max.	Pressure Required. for Max. L/C (lbs.)	EDP No. duMONT
1/4	.2505 – .2510	5-7/8	.2344	15/64	5/16	3/4	840	77730
5/16	.3130 – .3135		.2469	19/64			1,050	77731
3/8	.3755 – .3760	6-7/8	.3594	23/64	3/8	1	1,440	77732
7/16	.4380 – .4385		.4219	27/64			1,680	77733
1/2	.5005 – .5010	8	.4844	31/64	1/2	1-1/4	2,240	77734
5/8	.6255 – .6260	8-1/2	.6094	39/64			2,500	77736
3/4	.7505 – .7510	9-1/8	.7344	47/64	5/8	1-1/2	3,720	77738
7/8	.8755 – .8765	9-1/4	.8594	55/64			4,340	77740
1	1.0005 – 1.0015	10-1/4	.9844	63/64	5/8	1-3/4	4,970	77742

Full Square Push Broaches

3/16 thru 1/2 inch

Applications: **Drives, jigs, fixtures, sizing and finishing**

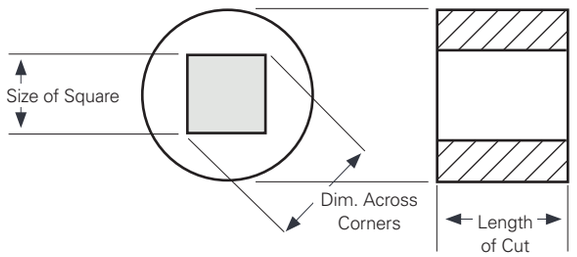
Full Square Broaches

Our Full Square Broaches are designed to generate in one-pass a Full Square hole in a previously cast or drilled round hole. The Broach leaves no radii on the flats of the broached piece and the pilot diameter equals the finished full square size.

TiN or TiAlN coatings available.



Dimensions of Standard Full Square Broach Holes



Stock Standard Square Broaches

Full Square Size (inch)	Tolerances (Dec. Equiv.)	Broach Length	Pilot Diameter	Drill Size	Dimension Across Corners	Tooth Pitch	Length of Cut Min.	Length of Cut Max.	Pressure Required. for Max. L/C (lbs.)	EDP No. duMONT	EDP No. Hassay Savage
3/16	.1880 – .1890	6	3/16	3/16	.2630 – .2650	1/8	3/16	1/2	870	66403	14012
1/4	.2505 – .2515	8-1/2	1/4	1/4	.3510 – .3530	5/32	1/4	5/8	1,310	66405	14016
5/16	.3130 – .3140	10-1/2	5/16	5/16	.4390 – .4410	3/16	5/16	7/8	1,895	66407	14020
3/8	.3755 – .3765	13-1/8	3/8	3/8	.5260 – .5280	7/32	5/16	1	2,410	66409	14024
7/16	.4385 – .4395	14-1/4	7/16	7/16	.6140 – .6160				3,090	66411	14028
1/2	.5005 – .5015	14-3/4	1/2	1/2	.7010 – .7030	1/4	3/8	1	3,860	66413	14032

All standard items are available with TiN or TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

Square Push Broaches

1/8 thru 1 inch sizes | **4mm thru 25mm sizes**

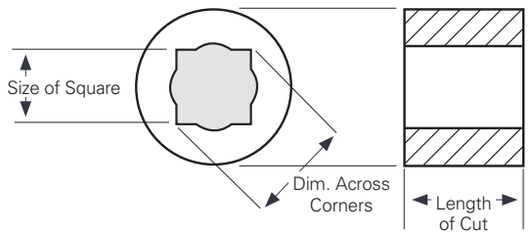
Applications: **Drives, jigs, fixtures and other square broaching operations**



Square Push Broaches

Our Standard Square Broaches are designed to generate in one-pass a Standard Square hole in a previously cast or drilled round hole. Standard Square Broaches begin in an oversized pilot hole and generate the square hole while leaving small radii on the flats. Available from stock in the most common American Standard / Metric sizes (1/8–1" & 4mm–25mm). **TiN or TiAlN coatings available.**

American Standard / Metric Square Broach



Stock Standard Square Broaches

Square Size (inch)	Tolerances	Broach Length	Pilot Diameter	Drill Size	Dimension Across Corners	Tooth Pitch	Length of Cut Min.	Length of Cut Max.	Pressure Required. for Max. L/C (lbs.)	EDP No. duMONT	EDP No. Hassay Savage
1/8	.1255 – .1265	4-1/8	.1285	No. 30	.1750 – .1770	1/8	3/16	1/2	700	66601	13008
5/32	.1565 – .1575	5-1/8	.1590	No. 21	.2180 – .2200	5/32	1/4	1/2	600	66602	13010
3/16	.1880 – .1890	5-9/16	.1935	No. 10	.2620 – .2640		1/4	5/8	1,080	66603	13012
7/32	.2190 – .2200	6-3/8	.2280	No. 1	.3060 – .3080	3/16	1/4	3/4	1,410	66604	13014
1/4	.2505 – .2515	6-1/2	.2656	17/64	.3510 – .3530				1,740	66605	13016
9/32	.2815 – .2825	7-3/4	.2969	19/64	.3930 – .3950	7/32	5/16	1	2,130	66606	13018
5/16	.3130 – .3140	7-7/8	.3281	21/64	.4370 – .4390		3/8	1	2,100	66607	13020
11/32	.3440 – .3450	9-3/8	.3594	23/64	.4830 – .4850	1/4	3/8	1-1/4	3,480	66608	13022
3/8	.3755 – .3765	9-3/8	.3906	25/64	.5240 – .5260				3,720	66609	13024
13/32	.4065 – .4075	10-5/8	.4219	27/64	.5690 – .5710	9/32	1/2	1-3/8	4,080	66610	13026
7/16	.4380 – .4390	10-7/8	.4531	29/64	.6110 – .6130	5/16	1/2	1-3/8	4,500	66611	13028
15/32	.4690 – .4700	12	.5000	1/2	.6570 – .6590				4,000	66612	13030
1/2	.5005 – .5015	12	.5312	17/32	.6990 – .7010				4,500	66613	13032
9/16	.5630 – .5640	14-3/4	.5938	19/32	.7870 – .7890	3/8	1/2	1-1/2	5,700	66614	13036
5/8	.6260 – .6270	16-5/16	.6562	21/32	.8730 – .8750	7/16	5/8	1-5/8	5,920	66615	13040
11/16	.6885 – .6895	17-3/4	.7500	3/4	.9630 – .9650				4,800	66616	13044
3/4	.7510 – .7520	17-3/4	.8125	13/16	1.0450 – 1.0470				5,940	66617	13048
7/8	.8765 – .8775	22-3/4	.9375	15/16	1.2270 – 1.2290	7/16	5/8	2	9,200	66618	13056
1	1.002 – 1.0030	24-1/8	1.0938	1-3/32	1.4030 – 1.4050				9,200	66619	13064

Stock Metric Standard Square Broaches

Square Size (mm)	Tolerances (Dec. Equiv.)	Broach Length	Pilot Diameter	Drill Size	Dimension Across Corners	Tooth Pitch	Length of Cut Min.	Length of Cut Max.	Pressure Required. for Max. L/C (lbs.)	EDP No. duMONT	EDP No. Hassay Savage
4	.1575 – .1580	5-1/8	.1614	4.1	.2205 – .2220	5/32	1/4	1/2	480	66630	17001
5	.1968 – .1973	6-1/2	.2047	5.2	.2765 – .2780				800	66631	17002
6	.2362 – .2370	6-11/16	.2519	6.4	.3300 – .3320	3/16	1/4	3/4	1,300	66632	17003
7	.2756 – .2764	7-3/4	.2913	7.4	.3850 – .3870	7/32	3/8	1	1,800	66633	-
8	.3150 – .3158	7-7/8	.3307	8.4	.4400 – .4420				2,300	66634	17004
9	3543 – .3551	9-3/8	.3701	9.4	.4970 – .4990	1/4	3/8	1-1/4	3,500	66639	-
10	.3937 – .3945	10-1/4	.4094	10.4	.5530 – .5550				3,600	66635	17005
12	.4724 – .4732	12	.5039	12.8	.6620 – .6640	5/16	1/2	1-3/8	4,200	66636	17006
14	.5512 – .5520	14-3/4	.5826	14.8	.7730 – .7750	3/8	1/2	1-1/2	5,600	66637	17007
16	.6302 – .6310	16-5/16	.6614	16.8	.8790 – .8810	7/16	5/8	1-5/8	6,000	66638	17008
18	.7090 – .7097	17-7/8	.7716	19.6	.9930 – .9950				5,200	66640	17009
20	.7874 – .7882	20-7/8	.8504	21.6	1.1030 – 1.1050				6,600	66641	17010
22	.8663 – .8671	22-3/4	.9291	23.6	1.2130 – 1.2150	7/16	5/8	2	8,900	66642	17011
24	.9453 – .9460	24	1.0079	25.6	1.3230 – 1.3250				9,200	66643	17012
25	.9845 – .9852	24-1/8	1.0630	27.0	1.3790 – 1.3810				9,200	66644	17013

All standard items are available with TiN or TiAlN coating from stock or short delivery. Please contact Pilot Precision Products for details.

SPECIAL ORDERS: We are fully equipped to manufacture Special Full Square Broaches and Special Metric Square Broaches not listed above to your specifications. Please contact Pilot Precision Products for details.

Hexagon Push Broaches | 1/8 thru 1 inch sizes | 4mm thru 25mm sizes

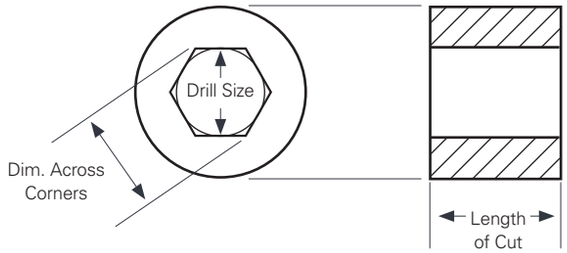
Applications: **Drives, jigs, fixtures and other hexagonal broaching operations**

Hexagon Broaches

Our Hexagon Broaches are designed to generate in one-pass a Hexagon hole in a previously cast or drilled round hole. Available from stock in the most common American Standard / Metric sizes (1/8–1" & 4mm–25mm).
TiN or TiAlN coatings available.



American Standard / Metric Square Broach



Stock Hexagon Broaches

Hex Size (inch)	Tolerances	Broach Length	Pilot Diameter	Drill Size	Dimension Across Corners	Tooth Pitch	Length of Cut Min.	Length of Cut Max.	Pressure Required. for Max. L/C (lbs.)	EDP No. duMONT	EDP No. Hassay Savage
1/8	.1255 – .1265	4-1/8	1/8	1/8	.1445 – .1455	1/8	3/16	3/8	200	77701	12008
5/32	.1565 – .1575	4-15/16	5/32	5/32	.1800 – .1815	1/8	1/4	1/2	300	77702	12010
3/16	.1880 – .1890	5-1/6	3/16	3/16	.2160 – .2180	5/32	1/4	5/8	560	77703	12012
7/32	.2190 – .2200	5-3/8	7/32	7/32	.2500 – .2520	5/32	1/4	3/4	775	77704	12014
1/4	.2505 – .2515	6	1/4	1/4	.2870 – .2890	3/16			1,025	77705	12016
9/32	.2815 – .2825	7-1/4	9/32	9/32	.3230 – .3250	3/16	5/16	1	1,290	77706	12018
5/16	.3130 – .3140	7-3/4	5/16	5/16	.3590 – .3610	7/32	3/8	1	1,510	77707	12020
11/32	.3440 – .3450	7-3/4	11/32	11/32	.3950 – .3970	7/32	3/8	1-1/4	2,280	77708	12022
3/8	.3755 – .3765	8-1/2	3/8	3/8	.4310 – .4330				2,400	77709	12024
13/32	.4065 – .4075	9-5/8	13/32	13/32	.4670 – .4690	1/4	1/2	1-3/8	2,790	77710	12026
7/16	.4380 – .4390	10-1/2	7/16	7/16	.5040 – .5060				2,700	77711	12028
15/32	.4690 – .4700	11-7/8	15/32	15/32	.5390 – .5410	9/32	1/2	1-3/8	2,700	77712	12030
1/2	.5005 – .5015	11-7/8	1/2	1/2	.5750 – .5770				3,025	77713	12032
9/16	.5630 – .5640	13-3/4	9/16	9/16	.6480 – .6500	5/16	1/2	1-5/8	4,800	77714	12036
5/8	.6260 – .6270	16-1/4	5/8	5/8	.7200 – .7220	3/8	5/8	2	5,400	77715	12040
11/16	.6885 – .6895	16-3/4	11/16	11/16	.7920 – .7940				6,000	77716	12044
3/4	.7510 – .7520	17-1/4	3/4	3/4	.8650 – .8670				6,960	77717	12048
7/8	.8765 – .8775	18-1/2	7/8	7/8	1.0080 – 1.0100				8,400	77718	12056
1	1.0020 – 1.0030	19-3/4	1	1	1.1520 – 1.1540				11,100	77719	12064

Stock Metric Hexagon Broaches

Hexagon (mm)	Tolerances (Dec. Equiv.)	Broach Length	Pilot Diameter	Drill Size	Dimension Across Corners	Tooth Pitch	Length of Cut Min.	Length of Cut Max.	Pressure Required. for Max. L/C (lbs.)	EDP No. duMONT	EDP No. Hassay Savage
4	.1575 – .1580	4-15/16	.1575	4.0	.1810 – .1825	1/8	1/4	1/2	300	77750	12104
5	.1968 – .1973	5-3/8	.1968	5.0	.2260 – .2275	5/32	1/4	3/4	775	77751	12105
6	.2362 – .2370	6	.2362	6.0	.2710 – .2730	3/16	1/4	3/4	1,025	77752	12106
7	.2756 – .2764	7-1/4	.2756	7.0	.3170 – .3190	7/32	1/4	1	1,290	77753	12107
8	.3150 – .3158	7-3/4	.3150	8.0	.3620 – .3640		3/8	1	1,510	77754	12108
9	.3545 – .3555	8-1/2	.3543	9.0	.4090 – .4110	1/4	3/8	1-1/4	2,300	77759	-
10	.3937 – .3945	9-5/8	.3937	10.0	.4530 – .4550	9/32	1/2	1-3/8	2,790	77755	12110
12	.4724 – .4732	11-7/8	.4724	12.0	.5430 – .5450	5/16	1/2	1-3/8	2,700	77756	12112
14	.5512 – .5520	13-3/4	.5512	14.0	.6350 – .6370	3/8	1/2	1-5/8	4,800	77757	12114
16	.6302 – .6310	16-1/4	.6299	16.0	.7250 – .7270	3/8	5/8	2	5,400	77758	12116
18	.7092 – .7097	16-3/4	.7087	18.0	.8170 – .8190	3/8	5/8	2	6,400	77760	12118
20	.7876 – .7886	17-5/8	.7874	20.0	.9050 – .9070				7,200	77761	12120
22	.8664 – .8674	18-1/2	.8661	22.0	.9990 – 1.0010				8,200	77762	12122
24	.9450 – .9460	19-1/2	.9449	24.0	1.0890 – 1.0910				9,700	77763	12124
25	.9845 – .9855	19-3/4	.9842	25.0	1.1350 – 1.1370				11,000	77764	12125

Custom Broaches

Push and Pull Types

Applications: **For high volume production pull-type machines**

Keyway Broaches



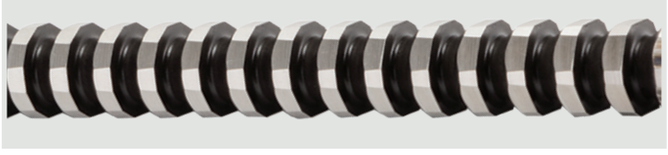
duMONT Minute Man® and Hassay Savage manufacture Special Keyway Broaches in either Push or Pull-type in both American Standard and Metric Sizes. Special Application Multi-pass Push Keyway Broaches and One-Pass Keyway Broaches which require the appropriate guide Bushing can often be manufactured from an existing blank for quick delivery. One-Pass Push Keyway Broaches are also available in a self-guiding Production Style that require no guide Bushing. Both One-Pass Push-type styles as well as their Pull-type counterparts are available with a special chamfer feature that will deburr the keyway bore interface. Double-Keyway and Keyseating Broaches are also available. Pull-type Broaches are available with a variety of pull ends—Threaded, Notched, Pin,and Automatic, to name a few.

Surface Broaches



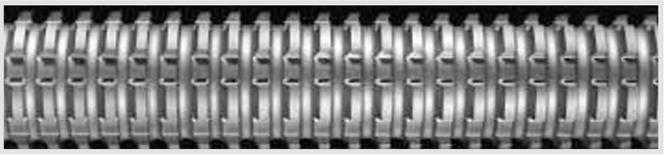
Surface Broaches are available as either individual Broaches or as inserts for broaching flat surfaces, irregular shapes, external forms, concave or convex surfaces, serrations, cam shapes, corner squaring and dovetails.

Internal Hole Broaches



Internal Hole Broaches in Push and Pull-type including Square, Hexagon, Round, Rectangular, Keyway, and irregularly shaped Broaches are all readily available. Broaches for Burnishing, Sizing and Combination or Cut and Finish applications are also manufactured as either Push or Pull-type. Pull-type Broaches are available with a variety of pull ends—Threaded, Notched, Pin and Automatic, to name a few.

Spline Broaches



Spline Broaches specifically designed and manufactured for your application, duMONT Minute Man® and Hassay Savage offer straight sided, Involute Spline, and Serration Broaches in both Push or Pull-type designs. Due to the complex nature of these tools a customer part print is required. Pull-type Broaches are available with a variety of pull ends—Threaded, Notched, Pin and Automatic, to name a few.

Let Us Meet Your Custom Broach Requirements

Our Custom Broaches can be ordered from your industrial distributor. Check to see if a standard item will serve your needs, before ordering a Custom Broach. Using standard items means off-the-shelf delivery and substantially lower cost. When standard items are not appropriate, we would be pleased to design and manufacture a Broach to meet your specific needs.

What We Need To Know

A fully dimensioned drawing of the finished part, casting, forging, or broach would be most helpful. When a part print is unavailable, the following information should be provided:

1. Description of cut (size/shape/tolerance)
2. Length of cut
3. Type of material to be broached
4. Size and shape of hole or surface to be broached (For cast holes, give minimum hole size, including draft and fillet radii, if any)
5. For Keyway Broaches give:
   a. Minimum bore size
   b. Depth of keyway across bore
   c. Width of keyway
   d. Tolerance
6. Type of broaching machine (Push or Pull/Tonnage/Ram Travel/Daylight Opening)
7. Number of pieces to broach

Custom Broaches and Re-Sharpening

Push and Pull Types

Applications: **Virtually any broaching operation** | **Short and long-run production**





Capabilities

duMONT Minute Man® and Hassay Savage are leading specialists in the design and manufacture of Broaches for industrial applications. Along with the extensive assortment of Stock Broaches listed in this catalog, we offer short delivery of Special Broaches custom-designed for your application or manufactured from your prints.

Our engineering staff has years of experience designing Special Broaches to replace time-consuming and costly machining operations. Whenever possible we will meet your Special Broach requirements by modifying an existing Stock Broach, thereby reducing both the cost and delivery time ordinarily associated with ordering Specials. With our extensive stock and expertise in designing and manufacturing specials, we are able to serve our customers as a single complete source for all of their broaching needs.

We are fully equipped to manufacture both Standard and Custom Broaches in either Push or Pull Styles, including all types of Keyway, Internal Hole, and Surface Broaches. Special features, such as chamfering or deburring for one-pass operation are readily available. All our Special Broaches are manufactured from the highest quality high-speed steel.

TiN or TiAlN coatings available.

Broach Re-Sharpening

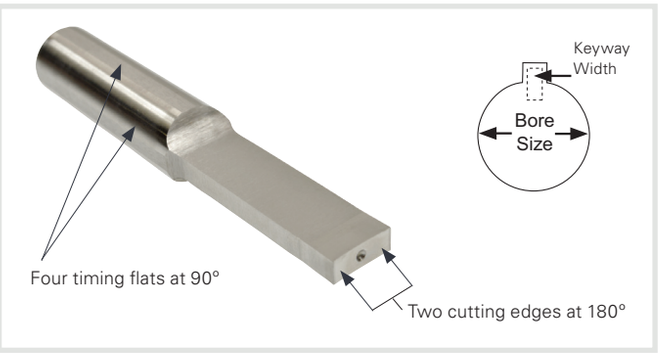
Broaches, regardless of type, should never be used when dull. The use of a dull Broach may result in poor finish or cause drifting, damage to the teeth or breakage. Correct and timely re-sharpening will increase Broach life and quality of parts. The necessity to sharpen a Broach is dependent on numerous factors; material, tolerance, and required finish, etc. A number of conditions indicate the need for sharpening:

- Poor finish, tears, galling, etc. on the workpiece.
- Cutting edges showing signs of rollover and teeth dull to the touch.
- When using a Hydraulic Press, the pressure gauge showing an increase in pressure required to complete the cut.
- Nicks, gouges, etc. in the teeth from improper handling.
- Broach sticking in the workpiece, pick-up on tops of teeth.
- Holes gauging undersize.

duMONT Minute Man® and Hassay Savage offer expert Broach re-sharpening services, with the goal to restore the cutting edges of the Broach to its original condition. Broaches returned for this service are each individually examined and specific regrind instructions are generated for the reconditioning of the tool. Broaches exhibiting excessive wear are evaluated to insure a re-sharpening is appropriate or if it is time to consider replacing the tool. The re-sharpening process is a precision operation, under or over sharpening will produce unsatisfactory results. Removing too much material in the re-sharpening process can dramatically reduce tool life. Improper re-sharpening can result in a departure from original tooth form, creating under sized parts, compromised cutting action and potentially causing irreparable damage. Correct sharpening ensures satisfactory production in terms of time efficiency, conformance to specifications and finish. duMONT Minute Man® and Hassay Savage are fully equipped to provide expert re-sharpening services. We need to evaluate the Broach, to insure it is able to be adequately reconditioned. Based on this examination a quote for re-sharpening would be provided.

CNC Single Point Keyway Broaches

Keyway Size Ranges **1/8 thru 1/2 inch sizes and 4mm thru 12mm**



Broaching keyways on CNC machines today is as common as turning a part.

- Eliminate part handling and improve your control
- Short effective nibbling broaches that take the place of longer tools
- Quick set up on CNC machines

Save time and money with blind hole and thru hole CNC keyway broaching with standard tools that are off the shelf.

- Single point nibbling cutters that are designed with two separate cutting surfaces at 180° apart.
- The one piece construction is created on a high speed tooling blank that has common size round shank with 4 ground timing flats to align the keyway for timing to the part it is broaching.
- These tools will offer long tool life, and can be easily sharpened many times for extended tool life.
- Ideally designed for either CNC lathe or CNC vertical machining centers.

For CNC lathe: mount tool directly into the turret on centerline while a setscrew-locking holder will lock into place and position.

For CNC vertical machining center: a collet will hold the tool shank and provide timing orientation. With the spindle locked, the broach can be brought in line with pre-prepared bore diameter and chamfer lead of the part to start broaching the keyway at a speed of 10" – 30" in/min and an in-feed of .003" -.005" depth per pass, using a flood coolant for lubrication during the cut. Once the initial process is achieved, speeds can be increased to 50 – 80 IPM. The in-feeding cycle is repeated until the desired depth of the keyway is achieved. Chips can be removed from the bottom of the hole in a couple of ways:

In a **blind hole bore**, remove the chips by either:

- prior trepanning the bottom of the keyway area and allow chips to fall away.
- or pre-drill a hole from the outside to the inside of the part at the bottom of the keyway location.

With a **thru hole**, you can broach right through, but do not disengage with the part, and simply de-burr the keyway upon completion.

The Advantages:

- Complete the part on one machine
- Only way to keyway a blind hole
- Cut down on set-up time
- Improve your process
- Become more flexible with machining
- Manage small lot production
- Use cost effective standard tooling
- No bushing guide required
- No hydraulic press or pull required

Things That You Should Know:

- Standard tooling will come with common shank diameters.
- Keyway size and length or depth of cut will determine the shank size.
- Strength and rigidity in the set-up will give you longer tool life.
- Keyway production will achieve excellent finishes and better accuracy.
- Specials are available with expedited delivery.

CNC Single Point Keyway — Inch Shank

Keyway Size	Tolerance Inches	Shank Diameter	Overall Length	Max. LOC	Min. Bore Size	EDP No. Hassay Savage
1/8"	0.127	5/8	3.75	1.5	7/16	69008
4mm	0.159				9/16	69004
3/16"	0.189					69012
5mm	0.198				5/8	69005
6mm	0.238	3/4	4.50	2	11/16	69106
1/4"	0.251					69116
5/16	0.314				3/4	69120
8mm	0.317					69108
3/8"	0.377	1			1	69224
10mm	0.396					69210
12mm	0.474					69212
1/2"	0.502					69232

CNC Single Point Keyway — Metric Shank

Keyway Size	Tolerance Inches	Shank Diameter	Overall Length	Max. LOC	Min. Bore Size	EDP No. Hassay Savage
1/8"	0.127	16mm	3.75	1.5	11mm	69308
4mm	0.159				14mm	69304
3/16"	0.189					69312
5mm	0.198				16mm	69305
6mm	0.238	20mm	4.50	2	17mm	69406
1/4"	0.252					69416
5/16"	0.314					69420
8mm	0.317					69408
3/8"	0.377	25mm			25mm	69524
10mm	0.396					69510
12mm	0.474					69512
1/2"	0.502					69532

Hexagonal Rotary Punch Broaches M-2

Material: **M-2 HSS for mild steel**

Rotary/Punch Broaches:

- Use in a variety of machines
- Cut polygons in blind holes
- Any type of CNC or manual turning, milling, drilling or screw machine.

Punching Versus Rotary Broaching:

Many applications can be achieved without the rotary broach holder.

For the purpose of merely punching a polygon into an existing pilot hole, these broaches have successfully been used with universal machining methods.



Hexagonal Rotary/Punch Broaches
8mm – 0.315 Shank

Hex Size (inch)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
.050	0.050	5/64	1-1/4	66002
1/16	0.063	3/32		66004
5/64	0.079	7/64		66005
3/32	0.095	9/64		66006
7/64	0.111	5/32		66007
1/8	0.127	3/16		66008
9/64	0.143	7/32		66009
5/32	0.158	1/4		66010
3/16	0.190	9/32		66012
7/32	0.221			66014
1/4	0.252	3/8		66016
9/32	0.284			66018
5/16	0.315			66020
11/32	0.346	7/16		66022
3/8	0.378	1/2		66024
13/32	0.410			66026
7/16	0.441			66028
15/32	0.472			66030
1/2	0.504			66032

Hexagonal Rotary/Punch Broaches
1/2" – 0.500 Shank

Hex Size (inch)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
3/32	0.095	9/64	1-3/4	66106
7/64	0.111	5/32		66107
1/8	0.127	3/16		66108
9/64	0.143	7/32		66109
5/32	0.158	1/4		66110
3/16	0.190	9/32		66112
7/32	0.221			66114
1/4	0.252	3/8		66116
9/32	0.284	7/16		66118
5/16	0.315	1/2		66120
11/32	0.346	9/16		66122
3/8	0.378			66124
13/32	0.410	5/8		66126
7/16	0.441			66128
15/32	0.472			66130
1/2	0.504			66132
9/16	0.567			66136
5/8	0.630			66140
11/16	0.693			66144
3/4	0.755			66148

Metric Hexagonal Rotary/Punch Broaches
8mm – 0.315 Shank

Hex Size (mm)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
1.3	0.050	3/32	1-1/4	662013
1.5	0.061	3/32		662015
2.0	0.081	7/64		66202
2.5	0.101	5/32		662025
3.0	0.120	3/16		66203
3.5	0.139	3/16		662035
4.0	0.160	1/4		66204
4.5	0.179	1/4		662045
5.0	0.199	5/16		66205
6.0	0.238	3/8		66206
7.0	0.278	3/8		66207
8.0	0.319	3/8		66208
9.0	0.358	3/8		66209
10.0	0.398	1/2		66210
11.0	0.437	1/2		66211
12.0	0.476	1/2		66212

Metric Hexagonal Rotary/Punch Broaches
1/2" – 0.500 Shank

Hex Size (mm)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
2.0	0.081	5/32	1-3/4	66302
2.5	0.101			663025
3.0	0.120	3/16		66303
4.0	0.160	1/4		66304
5.0	0.199	5/16		66305
6.0	0.238	3/8		66306
7.0	0.278	1/2		66307
8.0	0.320			66308
9.0	0.358			66309
10.0	0.398	9/16		66310
11.0	0.437			66311
12.0	0.476	5/8		66312
13.0	0.516			66313
14.0	0.556			66314
15.0	0.597			66315
16.0	0.636			66316
17.0	0.674	7/8		66317
18.0	0.714			66318
19.0	0.754			66319

*Overall Tool Length Tolerances +/-.015

Hexagonal Rotary/Punch Broaches
3/4" – 0.750 Shank

Hex Size (inch)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
3/8	0.379	1/2	2-3/4	66524
7/16	0.442			66528
1/2	0.505	5/8		66532
9/16	0.567	3/4		66536
5/8	0.631			66540
3/4	0.754	7/8		66548
7/8	0.883			66556
1.0	1.014			66564

The practical forming length of rotary punch broaching is usually up to 1-1/2 times the size of the broach (measured across flats).

Hexagonal Rotary Punch Broaches M-42

Material: **M-42 HSS With 8% COBALT CONTENT For More Difficult To Machine Alloys**

Broach Tool Material

These broaches are manufactured from **M-42 Cobalt High Speed Steel**. This material provides edge toughness for standard operations, and resists heat to effect better tool life in machining most metals.

For broaching materials such as ductile iron, tool steel, stainless steels, titanium alloys, or nickel-cobalt alloys, this superior grade of high speed steel with **8% Cobalt content** provides significantly longer tool life with these more difficult to machine alloys.



What Is The Difference Between Rotary, Swiss, Punch & Index?



Rotary:

The tool shape is cut into the part with the spindle turning when using a rotary holder system.

Broaching Holder:

Serves two functions

- Holds the broach tool in a free spinning bearing
- Places the broach tool at a 1° angle relative to the centerline of the workpiece

There are two types of commonly used holders:
Adjustable Rotary Broach Holder
Non-Adjustable Rotary Broach Holder

Swiss Style:

The tool shape is cut into the part with the spindle turning when using a rotary holder system. This is typical when used on a horizontal machining center.

Punch:

The shape is cut into the part with the spindle locked in a stationary position, and the broach is then punched into the part without a rotary holder.

Index:

A broaching process that involves a stationary spindle and a partial form of the shape that is to be generated. Once hole preparation is completed, the tool form is generated on a CNC machine by making imprints of the tool to the proper depth while the part is indexed properly to create the full form desired. See page 30 for more details on Index Broaching.

Metric Hexagonal Rotary/Punch Broaches
8mm – 0.315 Shank

Hex Size (mm)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
2.0	0.081	7/64	1-1/4	66202 - M42
2.5	0.101	5/32		662025 - M42
3.0	0.120	3/16		66203- M42
3.5	0.139			662035 - M42
4.0	0.160	1/4		66204 - M42
4.5	0.179			662045 - M42

Hexagonal Rotary/Punch Broaches
8mm – 0.315

Hex Size (inch)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
1/16	0.063	3/32	1-1/4	66004 - M42
5/64	0.079	7/64		66005 - M42
3/32	0.095	9/64		66006 - M42
7/64	0.111	5/32		66007 - M42
1/8	0.127	3/16		66008 - M42
9/64	0.143	7/32		66009 - M42
5/32	0.158	1/4		66010 - M42
3/16	0.190	9/32		66012 - M42
7/32	0.221	11/32		66014 - M42
1/4	0.252	3/8		66016 - M42
9/32	0.284			66018 - M42
5/16	0.315			66020 - M42
11/32	0.346	7/16		66022 - M42
3/8	0.378	1/2		66024 - M42

Hexagonal Rotary/Punch Broaches
1/2 – 0.500 Shank

Hex Size (inch)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
3/32	0.095	9/64	1-3/4	66106 - M42
7/64	0.111	5/32		66107 - M42
1/8	0.127	3/16		66108 - M42
9/64	0.143	7/32		66109 - M42
5/32	0.158	1/4		66110 - M42
3/16	0.190	9/32		66112 - M42
7/32	0.221			66114 - M42
1/4	0.252	3/8		66116 - M42
9/32	0.284	7/16		66118 - M42
5/16	0.315	1/2		66120 - M42
11/32	0.346	9/16		66122 - M42
3/8	0.378			66124 - M42

*Overall Tool Length Tolerances +/-.015

Square Rotary Punch Broaches | 1/16 thru 3/8 inch | 1.5mm thru 12mm

Material: **M-2 HSS for mild steel applications,** special materials available for more difficult to machine alloys

Use With:

- Screw Machines
- CNC Machines



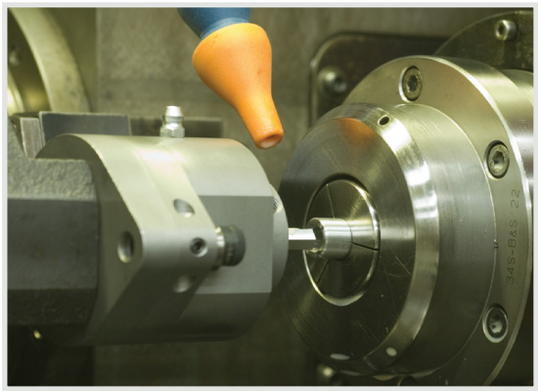
The practical forming length of rotary punch broaching is usually up to 1-1/2 times the size of the broach (measured across flats).

Square Rotary/Punch Broaches
8mm–.315 Shank

Square Size (inch)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
1/16	0.063	1/8	1-1/4	68004
3/32	0.095	9/64		68006
1/8	0.127	3/16		68008
5/32	0.158	1/4		68010
3/16	0.190	9/32		68012
7/32	0.221	11/32		68014
1/4	0.252	3/8		68016
9/32	0.284			68018
5/16	0.315			68020
11/32	0.346			68022
3/8	0.379			68024

Metric Square Rotary/Punch Broaches
8mm–.315 Shank

Square Size (mm)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
1.5	0.0605	3/32	1-1/4	682015
2.0	0.0805	7/64		68202
2.5	0.101	5/32		682025
3.0	0.120	3/16		68203
3.5	0.139			682035
4.0	0.160	1/4		68204
4.5	0.179			682045
5.0	0.199	5/16		68205
6.0	0.238	3/8		68206
7.0	0.278			68207
8.0	0.319			68208
9.0	0.358			68209
10.0	0.398	1/2		68210



Square Rotary/Punch Broaches
1/2–.500 Shank

Square Size (inch)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
3/32	0.095	9/64	1-3/4	68106
1/8	0.127	3/16		68108
5/32	0.158	1/4		68110
3/16	0.190	9/32		68112
7/32	0.221	11/32		68114
1/4	0.252	3/8		68116
9/32	0.284	7/16		68118
5/16	0.315	1/2		68120
11/32	0.346	9/16		68122
3/8	0.378	5/8		68124
7/16	0.441			68128
1/2	0.504			68132
9/16	0.567	3/4		68136
5/8	0.630	7/8		68140

Square Rotary/Punch Broaches
3/4–.750 Shank

Square Size (inch)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
1/2	0.504	5/8	2-3/4	68532
9/16	0.567	3/4		68536
5/8	0.630			68540
3/4	0.755	7/8		68548

Metric Square Rotary/Punch Broaches
1/2–.500 Shank

Square Size (mm)	Across Flats +0.001 / -0.000	Max. Depth of Cut	Overall Length*	EDP No. Hassay Savage
1.5	0.0605	3/32	1-3/4	683015
2.0	0.0805	7/64		68302
2.5	0.101	5/32		683025
3.0	0.120	3/16		68303
3.5	0.139			683035
4.0	0.160	1/4		68304
4.5	0.179			683045
5.0	0.199	5/16		68305
6.0	0.238	3/8		68306
7.0	0.278			68308
8.0	0.319			68128
9.0	0.358			68309
10.0	0.398	1/2		68310
11.0	0.437	9/16		68311
12.0	0.476	5/8		68312

*Overall Tool Length Tolerances +/-.015

SPECIAL ORDERS: We are fully equipped to manufacture Square Rotary Punch Broaches not listed above. Please contact Pilot Precision Products for details.

Adjustable Rotary Broach Holders

Accepts a variety of shapes, such as internal hex & square rotary broaches

Rotary Broach Holders

Use on any type CNC, manual turning, milling or screw machine.
Holders and broaches are sold separately and available from stock for immediate delivery.

For optimal tool life in large production settings these broaches should be used with Rotary Broach Holders.

- The holder has an internal live spindle, which holds the cutting broach tool.
- The centerline of the cutting tool is offset at 1° from the centerline of the work piece.
- This 1° offset causes the broach to wobble creating a shearing effect as the broach is advanced into the work piece.



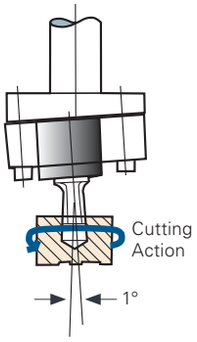


Diagram A
Broaching a Rotating Work Piece

In a turning or screw machine, the holder is mounted stationary while its internal live spindle and the broach rotates after contact with the rotating work piece. At the appropriate feed, the workpiece is sheared by the pressure of the broach through a wobbling type action producing the polygon shape desired.

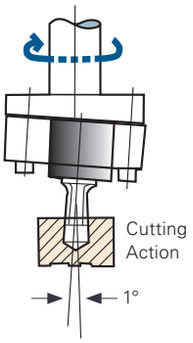


Diagram B
Broaching a Stationary Work Piece

In a vertical milling or drilling machine, the holder is mounted into and rotates with the machine spindle while its internal live spindle along with the broach remains stationary upon contact with the stationary work piece. While the machine spindle is rotating, the broach's pressure shears the polygon shape into the work piece with a wobbling type action.

Adjustable Rotary Broach Holders
Use with 8mm – 0.315 Broach Shank Diameters

Overall Length (inch)	Holder Shank Diameter	Holder Shank Length	Broach Shank Depth	EDP No. Hassay Savage
3-27/64	5/8	1-1/2	9/16	P-67040
3-59/64	3/4	2		P-67048S

Adjustable Rotary Broach Holders
Use with 1/2 – 0.500 Broach Shank Diameters

Overall Length (inch)	Holder Shank Diameter	Holder Shank Length	Broach Shank Depth	EDP No. Hassay Savage
4-17/32	3/4	2	0.742	P-67048
	1			P-67064
5-17/32	1-1/4	3		P-67068
	1-1/2			P-67072

Heavy Duty Adjustable Rotary Broach Holders
Use with 3/4 – 0.750 Broach Shank Diameter

Overall Length (inch)	Holder Shank Diameter	Holder Shank Length	Broach Shank Depth	EDP No. Hassay Savage
7-9/16	1-1/2	3	1.25	P-67072HDS
	1-3/4			P-67076HD

Hassay Savage Internal Rotary Tool Holder Set-Up Procedure

1. Place the Rotary Tool Holder in the Turret (Lathe) or Tool Holder (Milling) depending on the application which fits your needs.
2. Mount the Set Up Plug or Punch Broach in the spindle of the Rotary Tool Holder and take care that the Plug or Punch is bottomed out in the spindle before tightening the set screw on the Holder's Spindle.
3. Drill and Ream a hole to the proper diameter (0.001 larger) for the Set Up Plug in a piece of raw material with a lead chamfer 0.010-0.015 larger than the cross points dimension of the Punch being used. If using the Punch Broach for centering, drill and ream the hole to the diameter of the cross point's dimension.
4. Loosen the 2 cap screws 2-3 turns on the face to generate 3/16 space between the flange portion of the Holder so that it is easily movable in the cup of your hand.
5. Advance the Rotary Tool Holder with the inserted Plug or Punch to 0.030 away from the part while holding the holder flush against the flange.
6. By hand, insert the Plug or Punch into the reamed hole.
7. Advance the turret or tool holder until the holder and tool is fully engaged in the hole
8. With the Plug or Punch still engaged in the hole, rotate the broach by hand in the hole while tightening the 2 cap screws.
9. Retract the turret or tool holder out of the reamed hole.
10. Remove the set up plug (If using one) and replace with the Punch Broach making sure the Punch Broach is bottomed out in the holder the same as in step 2.
11. See Next Page for Set-Up Plugs.

Rotary Broaching Set-Up Plugs

Standard plugs - for hex broach set-up only

Metric Rotary Broaching Set-Up Plugs*
8mm Shank

Size	Plug Dia. -0.001 - inch	Shank Dia. -0.013 - mm	Depth of Plug (inch)	OAL Overall Length (inch)	EDP No. Hassay Savage
1/8	0.129	8 mm	5/16	1-1/4	67008
3/16	0.193				67012
1/4	0.257				67016
5/16	0.321		3/8		67020
3/8	0.387		1/2		67024
1/2	0.515				67032

We can also supply you with custom turned diameters for your exact drill and bore size when repeatable set-ups are required for your job on a continuous basis, for both hex and square applications.

These will all come with the standard lengths and shank diameters of: 8mm, .500 and .750.



Standard Rotary Broaching Set-Up Plugs*
1/2 Inch Shank

Size	Plug Dia. -0.001 - inch	Shank Dia . -0.0005 - inch	Depth of Plug (inch)	OAL Overall Length (inch)	EDP No. Hassay Savage
3/16	0.193	0.500	5/16	1-3/4	67112
1/4	0.257				67116
3/8	0.387				67124
1/2	0.515		1/2		67132
5/8	0.643				67140

Standard Rotary Broaching Set-Up Plugs*
3/4 Inch Shank

Size	Plug Dia. -0.001 - inch	Shank Dia. -0.0005 - inch	Depth of Plug (inch)	OAL Overall Length (inch)	EDP No. Hassay Savage
3/8	0.387	0.750	1/2	2-3/4	67524
1/2	0.515				67532
5/8	0.643		3/4		67540
3/4	0.771				67548

*Stock inventories are standard diameter gauge-plugs with specifications to use in standard holders.

Swiss Style Rotary Punch Broaches

28mm OAL

For use with M2 and PM-M4 materials - medical, dental & aerospace

- Consistent High-Tolerance Forms for Long Production Runs
- Superb Surface Finishes
- Outstanding Tool Life in Stainless & Titanium
- Special Sizes, Special Tolerances in Less Than 5 Days



Standard Hexagonal Rotary/Punch Broaches
0.315 Shank

Hex Size (inch)	Across Flats +/- 0.0002	Max. Depth of Cut	OAL Overall Length	EDP No. M-2* Hassay Savage	EDP No. PM-M-4** Hassay Savage
0.051	0.051	5/64	28mm	76002	77002
1/16	0.0645	3/32		76004	77004
5/64	0.0801	7/64		76005	77005
3/32	0.0958	9/64		76006	77006
7/64	0.1113	5/32		76007	77007
1/8	0.1270	3/16		76008	77008
9/64	0.1426	7/32		76009	77009
5/32	0.1585	1/4		76010	77010
3/16	0.1895	9/32		76012	77012
7/32	0.2207	11/32		76014	77014
1/4	0.2520	3/8		76016	77016

Metric Hexagonal Rotary/Punch Broaches
0.315 Shank

Hex Size (mm)	Across Flats +/- 0.0002	Max. Depth of Cut	OAL Overall Length	EDP No. M-2* Hassay Savage	EDP No. PM-M-4** Hassay Savage
1.5	0.0610	3/32	28mm	762015	772015
2.0	0.0807	5/32		76202	77202
2.5	0.1004			762025	772025
3.0	0.1201	3/16		76203	77203
3.5	0.1398			762035	772035
4.0	0.1595	1/4		76204	77204
4.5	0.1792			762045	772045
5.0	0.1989	5/16		76205	77205
6.0	0.2382	3/8		76206	77206

*M-2 for use with mild steel (HSS)
**PM-M4 for use with stainless, titanium & other high alloy steel

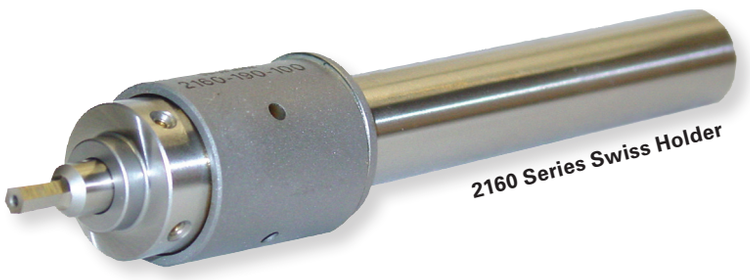
This Swiss Style Tooling Designed for Holders on Page 29

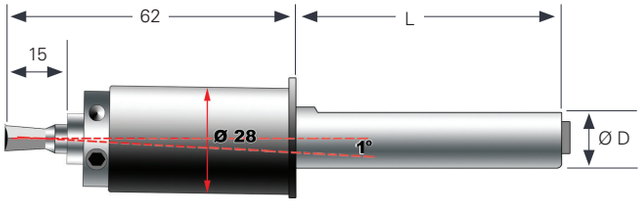
SPECIAL ORDERS: We are fully equipped to manufacture custom turned diameters for your exact drill and bore size when repeatable set-ups are required for your job on a continuous basis, for both hex and square applications.

These will all come with the standard lengths and shank diameters of: 8mm, 0.500 and 0.750. Please contact Pilot Precision Products for details.

Swiss Style Non-Adjustable Holders

High performance results, quality, and consistent tool life that keeps machines running longer







Swiss Style Holders

- No center indicating required – self-centering
- Smaller head diameter eliminates interference on tool blocks
- Longer shank can be cut to proper length
- Short head length for limited back work space
- Built in wobble cutting feature 1° angle
- Heavy duty bearing takes 2,250 lbs. Pushing force
- Swiss made quality high-precision
- Fits most swiss type tool blocks & gang machines
- Excellent for aerospace, medical part / bone screw & dental part production applications
- Recommended profile range for this holder series is 0.050" To 0.375"
- Maintenance-free operation

Swiss Style Holders
Holds 8mm Shank/Max. Push Force 2,250 lbs.

D	L	(inch/mm)	EDP No. Hassay Savage
5/8	1-1/2	inch	HSP-2160-158-038
3/4	4		HSP-2160-190-100
1	4-3/4		HSP-2160-254-120
12	38	mm	HSP-2160-120-038
14			HSP-2160-140-038
16			HSP-2160-160-038
20	100		HSP-2160-200-100
22			HSP-2160-220-100
25	120		HSP-2160-250-120

Index Broaching

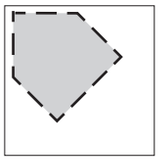
An Alternative To Full Form Rotary Broaching

Basic Principles of the Procedure

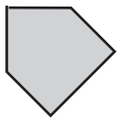
CNC Turning Machine

The CNC Turning Center performs each of these operations on the work piece before the Index Broach makes contact with the work piece.

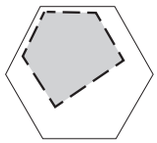
- Face off the work piece.
- Countersink a pilot hole for the drill bit, slightly larger than the across corner dimensions of the broach.
- Drill pilot hole approximately 2 percent larger for hex and 10 percent larger for square than the size across the flats.
- Hole is now prepared for Index Broach.



Single Point Square Form



Single Point Broach



Single Point Hex Broach

Index Broaching to Generate Full Polygon Forms

This broaching process involves a stationary spindle with orientation and lock capabilities. Once hole preparation is completed, then it is punched with a partial form of the shape that is to be generated. The tool form is indexed on a CNC machine by making imprints of the tool to the proper depth while the part is created to the full form desired.

Index Broaching can be performed on multiple machining applications. For instance, the **CNC machining centers** are the most common for Index Broaching:

- Lathes
- Swiss Style Machines
- Vertical Machining Centers

Typical applications include:

- Hexagonal
- Double Hexagonal
- 6 Lobe / Hexalobe
- Square
- Keyways / Slots / Splines

Required Tooling Includes:

- 90° Spot / Chamfer Tool
- Desired Pilot Drill
- Index Punch Broach

Why Hassay Savage Index Broaches?

- For Longer Production Runs
- Superb Surface Finishes
- Outstanding Tool Life in Stainless & Titanium
- Special Sizes, Special tolerances in Less Than 5 Days
- Hassay Savage Broaches Made to ± 0.0005 Tolerance
- Produce bone screws to ± 0.0002 Tolerance
- Material specification & superior heat treating assures quality of every Index Broach
- Cobalt Base High Speed Broach Blanks in most standard sizes in stock for fast delivery

Hassay Savage Index Broaches for:

- Medical & Dental Part Manufacturing
- Aerospace / Aircraft
- Automotive
- Fasteners
- Firearms & Munitions
- Electronics
- Plastics
- Communication Systems



Hex or Square Broach

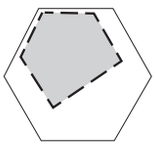




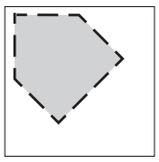
T10 - 2 Point Hexalobe

Index Broaching

Hex and Hexalobe



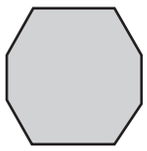
Single Point Hex Broach



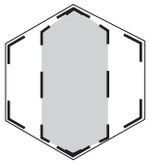
Single Point Square Form



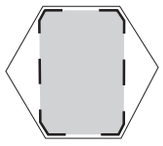
2 Point Hex Index Broach



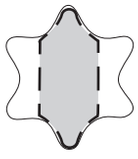
4 Point Index Hex Broach



Full 6 Point Hex Form



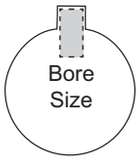
Full 6 Point Hex Form



Full 6 Lobe Form



2 Index Lobe Broach



Keyway Shaper

2 or 4 Point Hex Broach Cutting Process

- Hole preparation completed with chamfer & proper pilot hole size
- Machine spindle locked
- Punch enters the work piece, cutting the work piece, then retracts.
- The machine spindle indexes 60° then locks
- The punch enters the work piece a second time, cutting the work piece, then retracts
- Machine spindle indexes 60° then locks
- Punch enters for a third and final imprint
- Drill or boring bar used to make pilot hole can re-enter cut and remove ribbons and chips formed inside the cut

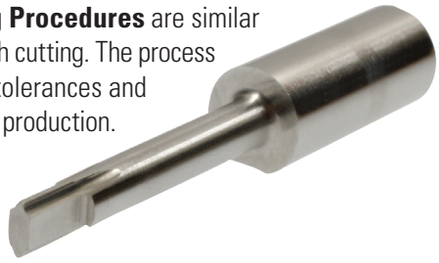
2 Point Hex Broach Cutting Procedure is effective for broaching materials with higher tensile strength and relieves overall pressure during the process.



4 Point Hex Broach Cutting Procedure is effective for index broaching titanium and stainless steel materials to help improve better tolerances and surface finishes in the finished part.

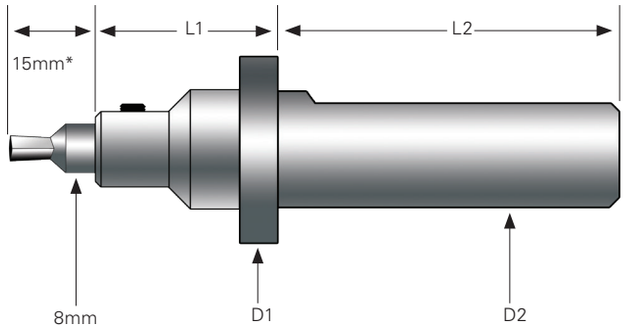


6 Lobe Hexalobe Broach Cutting Procedures are similar procedures as 2 point or 4 point broach cutting. The process reduces overall pressure, improves tolerances and surface finishes. Ideal for automated production.



Static Index Punch Broach Holders

These Static Holders can also be used for Full Form Hex Broaches up to 1/4" / 7mm



*Only applies when 8mm series broaches are used.



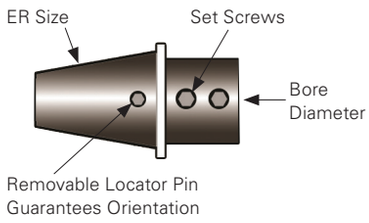
Punch Holders

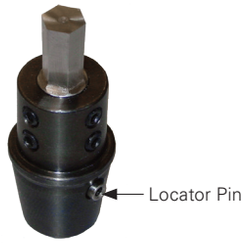
D1 (inch)	D2	L1 (inch)	L2 (inch)	EDP No. Hassay Savage
1.00	0.625"	1.25	2.5	HSBH-158250-125-8
	0.750"			HSBH-190250-125-8
	20mm			HSBH-200250-125-8
	22mm			HSBH-220250-125-8
1.10	1.00"			HSBH-254250-125-8

Quick Change ER Collet Punch & Index Broach ER Holder Systems

For Swiss and CNC Machining

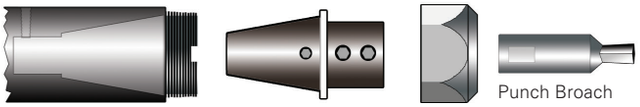
When orientation and concentricity of an internal polygon profile is crucial, an ER holder can be used to securely hold a punch or index broach tool and accurately align the tool to center, while ensuring perfect alignment of the profile orientation. **These Quick Change Holders can be preset and reloaded in seconds.**





Punch Broach / Boring Adapters & Nuts

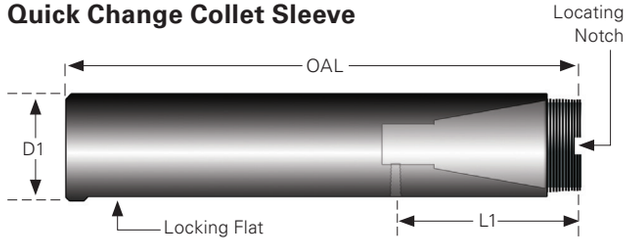
ER Size	Bore Dia.	Nut Thread	EDP No. Hassay Savage
ER16	0.250"	M19 x 1mm Nut & Locator Pin	HSP-PA16-25001
	8mm		HSP-PA16-31501
ER20	0.250"	M24 x 1mm Nut & Locator Pin	HSP-PA20-25001
	8mm		HSP-PA20-31501



Quick Change Collet Sleeves
For Shank Only Holders

ER Size	D1	L1	OAl	EDP No. Hassay Savage
ER16	0.500"	1.1"	4.5"	HSP-CS16-160500
	0.625"			HSP-CS16-160625
	0.750"			HSP-CS16-160750
	20mm	28mm	71mm	HSP-CS16-160787
	22mm		118mm	HSP-CS16-160866
	25mm		95mm	HSP-CS16-160984
	1"	1.1"	4.5"	HSP-CS16-161000
ER20	0.750"	1.2"		HSP-CS20-200750
	22mm	30mm	114mm	HSP-CS20-200866
	1.00"	1.2"	4.5"	HSP-CS20-201000
	1.250"			HSP-CS20-201250
	32mm	30mm	118mm	HSP-CS20-201260

Quick Change Collet Sleeve



Use Recommendations

Part Preparation

- The diameter of the pre-drilled hole should be larger than the measurement across the flats on the broach.
- Drill the hole 20% deeper than desired depth of cut for chip clearance.
- Countersink with a 90° lead chamfer slightly larger than the largest dimension of the broach face (distance across points) for lead of the broach.

Centering the Broach

The most critical component in running these tools is having the broach centered as close as possible to the centerline of the work piece. Improper centering will cause uneven hole configurations, oversize holes, spiraling, and excessive cutter/holder wear.

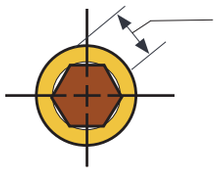
- It is necessary to align the end of the broach tool to the centerline of the work piece diameter by means of adjusting the screws located on the sides of the holder, and the use of set-up plugs.
- Alignment instructions are included with purchase of the tool holder.

Speeds and Feeds

Rotational speed (RPM) has a direct effect on cutting speed and tool life.

- Start at 800 RPM with a feed rate of .016 times the size of the broach in inches for a feed rate in IPR units.

Example: The feed rate for a ¼" rotary punch broach would be 0.016 x .250 = .004/rev.



Pre-drilled hole to be equal to or 2% larger than smallest dimension of broach form

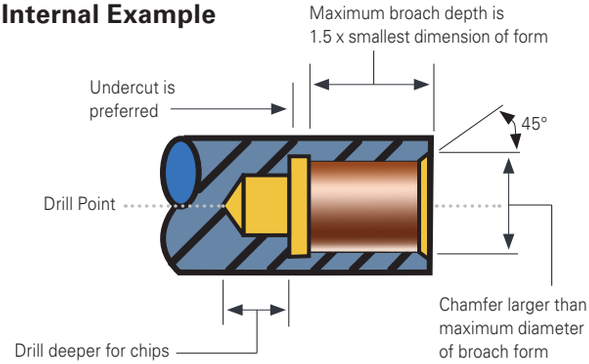
Note: For improved tool life, use a larger pre-drilled hole.

Broach Tool Material

Broaches are customarily manufactured from M-2 high speed steel. This material provides the required edge toughness for standard operations, which do not generate enough heat to effect tool life in machining most metals.

However, for broaching materials such as ductile iron, tool steel, stainless steels, titanium alloys, or nickel-cobalt alloys, a cobalt or PM-4 (powdered metal) broach would be recommended for optimal tool life. Coatings are also available.

Internal Example



Cutting Principle

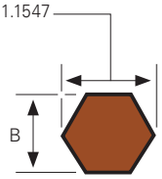
- The tool is held at a 1° angle relative to the part centerline.
- The face of the broach tool is the pivot of the 1° angle and is placed on centerline with the part.
- The cutting edge is kept on center and the rest of the tool oscillates around the part centerline with a wobble effect.
- While the faces of the tool and part are at a relative 1° angle, only the leading point of the tool is cutting and not the entire tool profile.
- The wobble effect moves the leading edge to rotate in and out of the cut like a cam.
- It shears the shape into the part with a scalloping effect as it advances forward.
- This reduces the required thrust force up to 80% when it is at the optimum feed.
- Venting can be added to broach to relieve pressure.



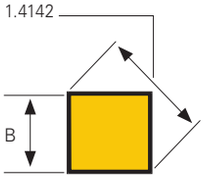
Vented Hex Broach

Hole Preparation Examples

Hex:
B x 1.02 = Pre-drilled hole, 2% larger
s.c.* = B x 1.1547



Square:
B x 1.10 = Pre-drilled hole, 10% larger
s.c.* = B x 1.4142



*s.c. = sharp corners

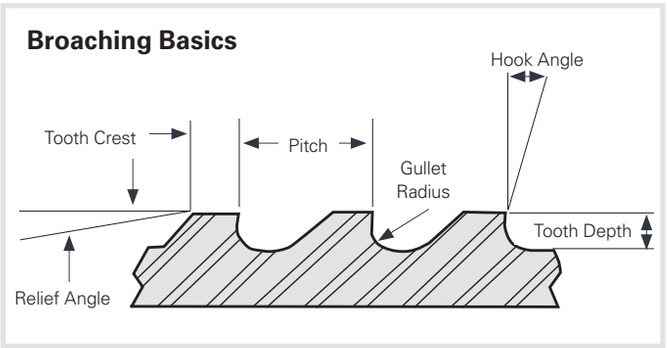
Engineering Section

Applications: **Standard Push Broaching Procedures** | **Broaching Basics**

Standard Broaching Procedures

duMONT Minute Man® and Hassay Savage Broaches are designed for fast, accurate, and convenient broaching with arbor or hydraulic presses. A study of the Broaching Procedures presented in this section will familiarize the operator with proper broaching procedures and troubleshooting practices. Following proper broaching fundamentals, paying attention to technique and Broach maintenance will help prevent drifting, deflection and even breakage while providing greater efficiencies in the cutting of your parts. If you have a specific question or problem, contact our Engineering Department at 413-350-5200 or by email at info@pilotprecision.com.

Warning Information



Cutting tools may shatter or break, therefore **eye protection should be worn wherever and whenever cutting tools are being used**. Government Regulations require use of safety glasses and other appropriate safety equipment at all times in the vicinity of cutting tool use.

Workpiece Material

duMONT Minute Man® and Hassay Savage stock Broaches can be used on a variety of workpiece materials. It is not practical to Broach material having a Rockwell hardness higher than Rc35. When broaching **Iron** or **Steel**, use the standard Broach as supplied. **Brass** and **Free Machining Bronze** may require stoning of a slight land on the top of the teeth to prevent drifting (pulling into the work). Custom Broaches are designed and engineered to provide the correct tooth form, pitch and rake angles for the material specified.

Length of Cut

Our Broaches are designed to be used in operations where a minimum of two teeth are engaged at all times. Tooth engagement is required to maintain a smooth cutting action promoting a clean finish. The chip generated during the cutting process must be contained within the gullet of the tooth to avoid binding of the tool. This could cause potential damage to the Broach, the workpiece and injury to the operator. Appropriate chip load allows for smooth cutting, and improved tool life. All individual stock Broaches have recommended Minimum and Maximum Length of Cut guidelines which should be followed. The required force necessary to achieve the Maximum Length of Cut is also provided with the individual Broach specifications. Workpieces may be stacked to establish the Minimum Length of Cut, or to improve the efficiencies of the operation as long as Maximum Length of Cut is not exceeded. Proper nesting and clamping of stacked parts is vital when this approach is taken. The Maximum Length of Cut with Push-type Keyway Broaches should not exceed the length of the Bushing being used. **Reminder:** "A/I" Style Broaches are used with "A/I" Style Bushings, "B/II" Style Broaches with "B/II" Style Bushings, etc. Pilot Precision Products Push-type and Pull-type Broaches often can be designed to accommodate your specific length of cut requirements.

Set-Up and Alignment

Successful broaching begins with proper set-up, and alignment of the Broach, workpiece and ram. Attention to these details will provide a stable workpiece, and prevent drifting, deflection or even breakage caused by misalignment. The workpiece must be solidly fixed or nested perfectly square with the baseplate and ram face. Make sure all square and parallel surfaces on the face of the ram and baseplate remain true. It is essential to maintain a rigid set-up at all times and caution should be taken when stacking parts to maintain the integrity of the set-up. Never attempt to exceed the Broach's specified Maximum Length of Cut. At the beginning of a cut, be sure the Broach is centered under the ram. Proper alignment is important. After the Broach starts to cut, back off pressure on the ram to allow the Broach to center itself, if not in perfect alignment. If Broach moves out of alignment after starting cut, back off the pressure on the ram and align the broach itself. Repeat this procedure during successive cuts. This will assure a perfectly straight broached hole.

Suggestions for a drifting or "hogging" Push-type Keyway Broach:

1. Reverse workpiece or turn Broach so teeth face toward the back of the press.
2. Let the Bushing protrude above the workpiece to give more support to the back of the Broach, thereby helping to keep it aligned. If a collared Bushing is used, place it upside down under the workpiece.

Ram Adapter Use

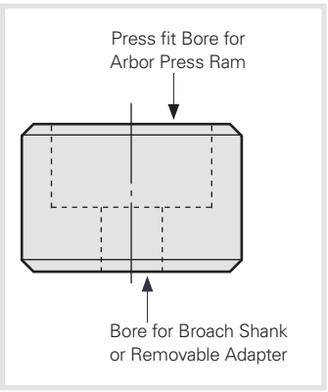
Ram Adapters are used for broaching applications that require Round, Custom Shapes such as Rectangular as well as Square, and Hexagon Broaches 1/4" and 6mm or smaller. A Ram Adapter would also be recommended in situations where an extraordinary high degree of accuracy is required.

Engineering Section

How to Use Broaches

Applications: **Standard Push Broaching Procedures** | **Broach Re-Sharpening**





These Adapters are also referred to as rear guides and provide support and guidance for the Broach at the shank end, minimizing the possibility of deflection or breakage. When an Adapter is used as a rear guide for the Broach, the hole in the Ram Adapter must be in alignment with the pilot hole in the workpiece. It is important a Ram Adapter provides a tight, true fit to both the press ram and to the Broach shank. An adapter may also be used to allow the shanks of smaller Internal Hole Broaches to be gripped to avoid deflection and breakage.

Cutting Fluids and Lubrication

Broach lubrication is crucial to tool life and the quality of the finish produced. Lubrication enables chips to slide freely and curl in the tooth gullets minimizing frictional heat. This cuts down on Broach wear and prevents build up on the cutting edge of the teeth. Push-type Keyway Broaches, regardless of the material to be broached, require lubrication on the back side of the Broach in order to reduce friction. Proper lubrication will increase Broach life and produce a cleaner finish. Various materials require different lubricants.

Mild Steel – A good quality cutting oil or water-soluble coolant brushed on the teeth and back side of the Broach.

Tough Steels such as Nickel Alloys – A good grade of a sulfur-based cutting oil.

Brass – Typically is broached dry.

Bronze – Works well with an oil or soluble oil.

Cast Iron – Is almost always broached dry but requires lubrication for the backside of the Broach.

Aluminum – Straight kerosene may be used but special lubricants are available.

You may wish to contact your cutting fluid dealer for additional recommendations and availability.

Coatings Available

duMONT Minute Man® and Hassay Savage Broaches are available with TiN, and TiAlN coatings. The coatings provide enhanced performance for specific applications, delivering greater value and tool life on your more challenging materials.

TiN – provides increased lubricity and wear resistance when broaching abrasive materials such as fiberglass and some aluminum alloys.

TiAlN – offers significant increase in surface hardness (Rc low 90s). Applications would include broaching in most stainless steels, alloy steels and harder materials.

Broaching with Keyway Sets or Individual Broaches



Use of Individual Push-type Keyway Broaches or Keyway Broaches from a Broach Set requires the use of a Bushing and Shim(s). The Bushing size and style are determined by the bore diameter of the workpiece as well as the Style of Broach to be used. "A / I" Style Broaches are used with "A / I" Style Bushings, "B / II" style Broaches with "B / II" Style Bushings, etc. The smallest Broaches cut in one pass and require no Shim. Multiple pass Keyway Broaches are furnished with all necessary Shim(s) unless otherwise noted. A Shim is required to compensate for the thickness removed following a Keyway Broach's cutting pass. The addition of a Shim to the bottom of the bushing's slot serves to move the Broach forward toward its standard finished cutting depth. Subsequent passes require the stacking of Shims.

1. Select the right Broach for the bore (sizes are plainly marked).
2. Insert Broach (which is also plainly marked for size) and check alignment.
3. Place this assembly in the press.
4. Lubricate.
5. Apply pressure to the Broach—back off pressure on Ram to allow the Broach to center itself if not in perfect alignment—reapply pressure to push Broach through the work.
6. Clean Broach using a stiff brush to remove chips from cutting section.
7. Insert shim and repeat steps 3 through 6 as required to obtain exact keyway depth.

Engineering Section

How to Use Broaches

Applications: **Broaching with Keyway Sets and Production Keyway Broaches**

Broaching with One-Pass Keyway Broaches



Broaching with One-Pass Keyway Broaches requires the use of a Bushing. The Bushing size and Style are determined by the bore diameter of the workpiece as well as the Style of Broach to be used. "A/I" Style Broaches are used with "A/I" Style Bushings, "B/II" Style Broaches with "B/II" Style Bushings, etc. No Shims are required. The Broach cuts to full width and depth in one pass.

1. Select the right Bushing for the bore (sizes are plainly marked) and insert in the bore of work.
2. Insert Broach (which is also plainly marked for size) for the desired width of keyway into the Bushing slot and check alignment.
3. Place this assembly in the press.
4. Lubricate.
5. Apply pressure to the Broach—back off pressure on Ram to allow the Broach to center itself, if not in perfect alignment—reapply pressure to push Broach through the work.
6. Clean Broach using a stiff brush to remove chips from cutting section.
7. Repeat steps 2 thru 6 for subsequent parts.

Broaching with Production Keyway Broaches

Broaching with Production Style Keyway Broaches requires no Shims or Bushings. The back and shoulders of the Broach are ground to fit the diameter of the bore, supporting and guiding itself while cutting the keyway in one pass.

1. Select desired Broach and insert pilot into bore of part.
2. Lubricate.
3. Apply pressure to the Broach—back off pressure on Ram to allow the Broach to center itself, if not in perfect alignment.
4. Clean Broach using a stiff brush to remove chips from cutting section.
5. Repeat steps 2 through 4 for subsequent passes.

Broaching with Internal Hole Broaches



Broaching with Internal Hole Broaches requires no Shims or Bushings. Round, Square, Hexagon and many Custom Shapes are designed to finish in one pass, in cast or drilled bores requiring a thru hole finish. The starting hole must be drilled square with the face of the work. Square and Hexagon Broaches, 1/4" and 6mm or smaller, should be gripped by the shank in an adapter to prevent deflection and breakage.

1. Pilot Holes: Properly drilled pilot holes are essential for a true and clean cut. Never use a dull or poorly sharpened drill to make pilot holes.
2. Select desired Broach. Confirm the bore of workpiece is equal to pilot diameter of broach. (The use of a ram adapter is advised with all Round Broaches and for Square and Hexagon Broaches 1/4" and 6mm or smaller).
3. Insert pilot into bore of part.
4. Ram Speed: Always use proper ram speed to prevent chatter marks and edge wear. (See Metals Handbook – Vol. 3 "Machining".)
5. Lubricate.
6. Apply pressure to the Broach—back off pressure on Ram to allow the Broach to center itself, if not in perfect alignment—reapply pressure to push Broach through the work.
7. Clean Broach using a stiff brush to remove chips from cutting section.
8. Repeat steps 3 through 7 for subsequent parts.

Troubleshooting

We aim to make your broaching experience efficient, effective and trouble-free. Most broaching failures (poor finish, drifting, deflection, breakage, chatter marks or edge wear) can be attributed to deficiencies in alignment, lubrication, Broach sharpness, tooth configuration or design, material hardness and incorrect broaching speed or pressure as detailed in this section. If you have specific questions or problems not covered on these pages, contact our Engineering Department.

Arbor Presses

Hand Operated

Arbor Presses

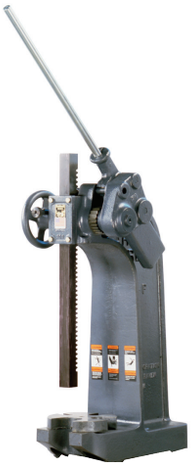
duMONT Minute Man® Arbor Presses are easy to operate Manual Broaching Machines designed for Push Broaching with Keyways and Internal Hole Broaches. These Hand Operated Presses are available in 3 and 5 ton models and provide the pressure required to Push Broaches through the work piece. Both Arbor Presses provide these essential features:

- Ratchet operation with compound leverage for minimum operator effort.
- Pawl between lever and pinion permits positioning lever for most convenient reach and pull.
- Counter weight returns lever to upright rest position.
- Ram positioned by handwheel reduces travel, tests Broach alignment, supports the Broach and workpiece assembly.
- Round ram with rack teeth cut to center concentrates force along the center line to avoid cramping.
- Rugged table machined square with ram, and slotted for Broach drop-through.

Please contact factory for details. Ordering Arbor Presses may be ordered through your nearest duMONT Minute Man® and Hassay Savage distributor for short delivery. When ordering, specify the EDP number with type and size as listed in the table below.







	Dake 1 ½ Arbor Press	Dake 1 ½ B Arbor Press	Dake 2 ½ Arbor Press
EDP No.	**55004**	**55006**	**55008**
Stroke	11-1/2	18-1/4	21-1/2
Tonnage	3	3	6
Horsepower	Manual	Manual	Manual
Shipping Weight	220 lbs.	325 lbs.	450 lbs.

To the Distributor

duMONT Minute Man® and Hassay Savage broaches offer your customers the benefits of advanced design and the latest market technology in manufacturing. Our strict quality controls and skilled group of toolmakers ensure that Pilot Precision Products broaches cut more precisely, last longer and wear better to make money for you and your customers.

duMONT Minute Man® and Hassay Savage offer:

- Unsurpassed high-quality products made by experienced toolmakers
- Consistent product mix
- Excellent profit structure
- Timely service
- Pride in what we do
- Experienced craftsmanship

ISA **Member**

(Industrial Supply Association) we are organized by the ISA standard numbering system.
Pilot Precision Products Code - 615948
(Uniform Code Council).

Warranty

Pilot Precision Products, warrants to original equipment manufacturers, distributors and industrial and commercial users of its products that each new product manufactured or supplied by Pilot Precision Products, shall be free from defects in material and workmanship. Pilot Precision Products, obligation under this warranty is limited to furnishing without additional charge a replacement or, at its option, repairing or issuing credit for any product which shall within one year from the date of sale be returned freight prepaid to the plant designated by Pilot Precision Products, representative and which upon inspection is determined by Pilot Precision Products, to be defective in materials or workmanship. Complete information as to operating conditions, machine setup, and application of cutting fluid should accompany any product returned for inspection. The provisions of this warranty shall not apply to any Pilot Precision Products Tools, product which has been subjected to misuse, improper operating conditions, machine setup or application of cutting fluid or which has been repaired or altered if such repair or alteration in the judgment of Pilot Precision Products, would adversely affect performance of the product. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Pilot Precision Products, shall have no liability or responsibility on any claim of any kind, whether in contract, tort or otherwise, for any loss or damage arising out of, connected with, or resulting from the manufacture, sale, delivery or use of any product sold hereunder, in excess of the cost of replacement or repair as provided herein. IN NO EVENT SHALL Pilot Precision Products, BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES. Pilot Precision Products, makes no other warranty, expressed or implied, except as set forth above; and Pilot Precision Products, neither assumes nor authorizes any other person or entity to assume for it any other obligation or liability in connection with any of its products.

Warning: *Cutting tools may shatter or break, therefore eye protection should be worn wherever and whenever cutting tools are being used. Government Regulations require use of safety glasses and other appropriate safety equipment at all times in the vicinity of cutting tool use.*

Accurate and Efficient

The duMONT CNC Indexable Broaching System offers a patented solution for effective and efficient broaching and shaping operations on CNC Lathes and Machining Centers as well as Slotting and shaping machines. The CNC Indexable Broaching system is designed to be flexible while delivering the rigidity and performance required. The CNC Indexable Broaching system allows the cutting of thru and blind hole keyways, keyways in a tapered bore and shaped or splined holes. A chamfer at the intersection of the bore and the wall of the keyway slot is also an available feature. The CNC Indexable Broaching system enables these additional machining operations to be performed while the part remains in the CNC equipment and its coordinate system, promoting both accuracy and time savings. A Square Adaptor which accepts the components of the Broaching System is available for use with the Slotting and Shaping machines. Programming assistance is available, please refer to PilotPrecision.com or call 413-350-5200 for details.

System Components

Inserts – Stock Keyway and Slotting Inserts in Inch and Metric Sizes

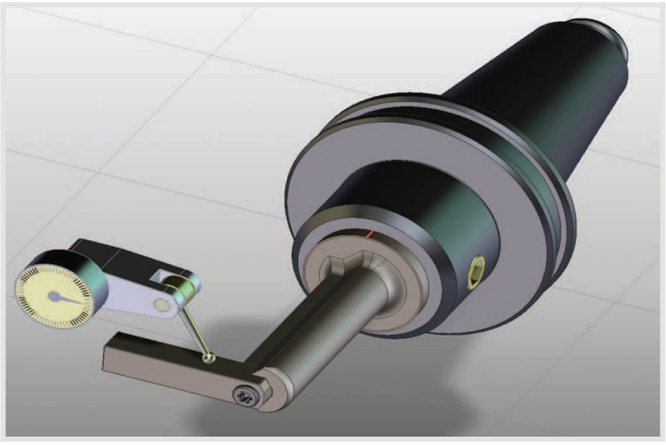
The Insert designed to work exclusively with a duMONT Tool Holder is manufactured from a sintered steel alloy with a 13% cobalt content, heat treated to a 72 HRC hardness to provide toughness and impact resistance, and TiN coated to further enhance performance. Stock Inserts may be re-sharpened two to three times depending on the keyway width tolerance and requires recoating after re-sharpening. The Engineering Section discusses additional types of Special Inserts that may be designed and manufactured for specific applications.

Tool Holders – 25mm Shank Tool Holders and 32mm Shank Tool Holders

The duMONT Tool Holder is designed to work exclusively with the Insert. The Holders are manufactured of heat treated tool steel hardened to 58/60 HRC at the Insert seat, providing resistance to deformation and longer tool life. The seat and mounting system provides ridged support and backing for the Insert. Most Tool Holders come with two 3.5mm holes for Thru Tool Coolant delivery promoting lubrication, cooling and chip flushing, improving finish and tool performance. The Tool Holders come in Standard and Long Lengths and can, in many cases, accommodate more than one insert size. The Stock Tool Holders are often used in conjunction with Special Form Inserts designed for specific applications.

Eccentric Bushings – Eccentric Bushings for 25mm and 32mm Tool Holders

The Eccentric Bushings are designed to facilitate the use of the Tooling System in Lathes that do not have a Y-axis adjustment. The Bushing, used in conjunction with the Centering Plates discussed later in this section, provides a method for correcting symmetry. The Eccentric Bushing has a range of +/- .020 (0.5mm) and provides gradient lines each representing a displacement of .001 (0.03mm). This movement should be sufficient to adjust for any error that may occur on a CNC Lathe and insure proper alignment. The Bushings are also available in the shorter VDI style.



Square Adaptors – Square Adaptors for use on Traditional Slotting, and Shaping Machines

The Square Adaptors provide a means of interfacing the Broaching System to a wide variety of conventional Slotting and Shaping Machines. The Square Adaptors are available in 1.378 (35mm) and 1.575 (40mm) size and accept the 25mm Tool Holder and 32mm Tool Holder respectively. The Adaptor offers a locating slot on each of its four sides enabling accurate 90° indexing.

Centering Plates – Centering Plates for use in Tool Holders

The appropriate size Centering Plate is mounted in the Tool Holder to facilitate correct mounting and orientation of the Tool Holder with the machine. Through the use of a sensor or dial indicator, the centering of the Plate will be readily transferred to the Insert when mounted in the Tool Holder. The Eccentric Bushing mentioned earlier may also be introduced in instances where a Y-axis adjustment is not available.

Sharpening Stems – Sharpening Stems for Stock Inserts

Hexagon shanked Sharpening Stems are available for mounting and supporting an Insert during re-sharpening. Inserts that show a decline in surface finish (a sign of wear), can have their life extended through a re-sharpening process. The Inserts are designed to allow two to three re-sharpenings, more if tolerances allow. Recoating of the Insert is required after sharpening. Sharpening must be properly performed using an appropriate grinder and grinding wheel. The original cutting angle must be maintained.

Mounting Screws – Insert Mounting Screws, Drivers and Set

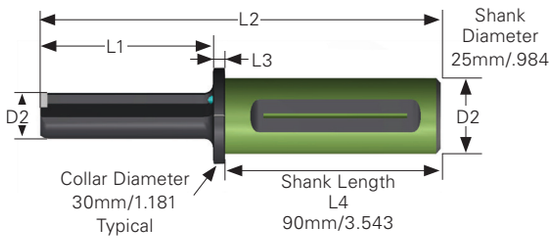
Screw Inserts are mounted in the Tool Holder using a Torx Screw or a 5mm Hex Screw. The Screw size varies with the size of the Insert and Tool Holder. Replacement and extra Screws are available to avoid downtime, as are Torx Drivers as needed. Swivel Ball-Bearing Point Set Screws are used only in Lathes without Y-axis during Eccentric Bushing rotation to correct symmetry errors. Do not over-tighten the Ball-Bearing Point Set Screw – it must allow the Tool Holder to move up and down as the Bushing is rotated. It is important to confirm the screw/bolt requirements for the existing tooling to be used in the mounting of the tooling system.



Stock Tool Holders for Inch and Metric Keyway and Slotting Inserts

The Tool Holders designed to work exclusively with duMONT Stock Keyway and Slotting Inserts are heat treated tool steel, hardened to 58/60 HRC at the Insert seat providing resistance to deformation and longer tool life. Most Tool Holders provide two 3.5mm holes for Thru Tool Coolant delivery promoting lubrication, cooling and chip flushing improving finish and tool performance. Available in 25mm (.984 inch) and 32mm (1.260 inch) diameters in both Standard and Long Lengths designated by –S and –L respectfully. **Always confirm that the first digit in the Description of the Tool Holder Size matches the Tool Holder Size referenced for the Insert to be used — i.e. Tool Holder Description 6-25-S (EDP No. 99008) could be used with Inserts (EDP No. 99209) ¼ Inch or (EDP No. 99406) 6mm.** See the Engineering Section for additional process and Special Insert information and available applications — Keyways in Tapered Bore, Square, Hexagon and Involute Internal Gears.

25mm Shank Stock Tool Holder



25mm Shank Stock Tool Holders for Inch and Metric Keyway and Slotting Inserts

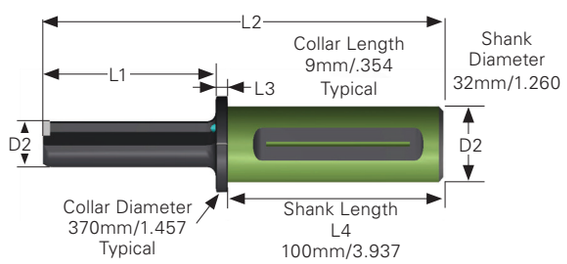
Description provides: Tool Holder Size — Shank Diameter — Length Designation Standard or Long.
See Pages 55-57 for Accessories.

Tool Holder Accessories

EDP No.	Description Tool Holder Size	Minimum Bore Dia. (mm)	Minimum Bore Dia. (inch)	Stem Dia. (D2) (mm)	Stem Dia. (D2) (inch)	Stem Length (L1) (mm)	Stem Length (L1) (inch)	Overall Length (L2) (mm)	Overall Length (L2) (inch)	Centering Plate	Mounting Screw	Driver	Thru Tool Coolant
99000	2-25-S	7	.276	6.5	.256	25	.984	124	4.882	CP-0	MS-1	T08	Yes
99001	2-25-L	7	.276	6.5	.256	35	1.378	134	5.276	CP-0	MS-1	T08	Yes
99002	3-25-S	8.5	.335	8	.315	30	1.181	129	5.079	CP-1	MS-1	T08	Yes
99003	3-25-L	8.5	.335	8	.315	40	1.575	139	5.472	CP-1	MS-1	T08	Yes
99004	4-25-S	10.5	.413	10	.394	40	1.575	139	5.472	CP-1	MS-1	T08	Yes
99005	4-25-L	10.5	.413	10	.394	56	2.205	155	6.102	CP-1	MS-1	T08	Yes
99006	5-25-S	12.5	.492	12	.472	46	1.811	145	5.709	CP-1	MS-1	T08	Yes
99007	5-25-L	12.5	.492	12	.472	66	2.598	165	6.496	CP-1	MS-1	T08	Yes
99008	6-25-S	16.5	.650	16	.630	56	2.205	155	6.102	CP-2	MS-2	T15	Yes
99009	6-25-L	16.5	.650	16	.630	81	3.189	182	7.087	CP-2	MS-2	T15	Yes
99010	8-25-S	21	.827	20	.787	68	2.677	162	6.378	CP-2	MS-2	T15	Yes
99011	8-25-L	21	.827	20	.787	100	3.937	199	7.825	CP-2	MS-2	T15	Yes
99012	10-25-S*	28	1.102	25	.984	86	3.386	185	7.284	CP-3	MS-3	T20	No
99013	10-25-L	28	1.102	25	.984	126	4.961	225	8.858	CP-3	MS-3	T20	No
99014	12-25-S*	30	1.181	30	1.181	102	4.016	203	7.992	CP-3	MS-3	T20	No
99015	12-25-L	30	1.181	30	1.181	161	6.339	260	10.236	CP-3	MS-3	T20	No

*Collar Length 11mm (.433 inch)

32mm Shank Stock Tool Holder



32mm Shank Stock Tool Holders for Inch and Metric Keyway and Slotting Inserts

Description provides: Tool Holder Size — Shank Diameter — Length Designation Standard or Long.

See pages 55-57 for accessories

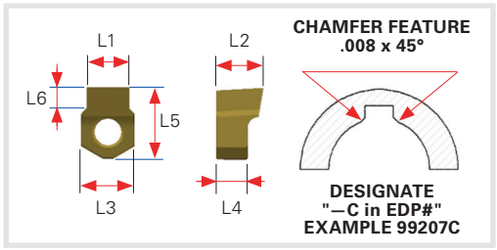
Tool Holder Accessories

EDP No.	Description Tool Holder Size	Minimum Bore Dia. (mm)	Minimum Bore Dia. (inch)	Stem Dia. (D2) (mm)	Stem Dia. (D2) (inch)	Stem Length (L1) (mm)	Stem Length (L1) (inch)	Overall Length (L2) (mm)	Overall Length (L2) (inch)	Centering Plate	Mounting Screw	Driver	Thru Tool Coolant
99030	2-32-S	7	.276	6.5	.256	25	.984	134	5.276	CP-0	MS-1	T08	Yes
99031	2-32-L	7	.276	6.5	.256	35	1.378	134	5.276	CP-0	MS-1	T08	Yes
99032	3-32-S	8.5	.335	8	.315	30	1.181	139	5.472	CP-1	MS-1	T08	Yes
99033	3-32-L	8.5	.335	8	.315	40	1.575	149	5.866	CP-1	MS-1	T08	Yes
99034	4-32-S	10.5	.413	10	.394	40	1.575	149	5.866	CP-1	MS-1	T08	Yes
99035	4-32-L	10.5	.413	10	.394	56	2.205	165	6.496	CP-1	MS-1	T08	Yes
99036	5-32-S	12.5	.492	12	.472	46	1.811	155	6.102	CP-1	MS-1	T08	Yes
99037	5-32-L	12.5	.492	12	.472	66	2.598	165	6.496	CP-1	MS-1	T08	Yes
99038	6-32-S	16.5	.650	16	.630	56	2.205	165	6.496	CP-2	MS-2	T15	Yes
99039	6-32-L	16.5	.650	16	.630	81	3.189	190	7.480	CP-2	MS-2	T15	Yes
99040	8-32-S	21	.827	20	.787	68	2.677	172	6.772	CP-2	MS-2	T15	Yes
99041	8-32-L	21	.827	20	.787	100	3.937	209	8.228	CP-2	MS-2	T15	Yes
99042	10-32-S	28	1.102	25	.984	86	3.386	195	7.677	CP-3	MS-3	T20	Yes
99043	10-32-L	28	1.102	25	.984	126	4.961	235	9.252	CP-3	MS-3	T20	Yes
99044	12-32-S	30	1.181	30	1.181	102	4.016	213	8.386	CP-3	MS-3	T20	Yes
99045	12-32-L	30	1.181	30	1.181	160	6.339	270	10.630	CP-3	MS-3	T20	Yes
99046	14/16-32-S	35	1.378	35	1.378	126	4.961	231	9.094	CP-4	MS-3	T20	No
99047	14/16-32-L	35	1.378	35	1.378	180	7.087	285	11.220	CP-4	MS-3	T20	No
99048	18/26-32-S*	42	1.654	40	1.575	140	5.512	249	9.803	CP-5	MS-4	5mm-Hex	No
99049	18/26-32-L*	42	1.654	40	1.575	200	7.874	309	12.165	CP-5	MS-4	5mm-Hex	No

*Collar Length 11mm (.433 inch)

Broaching and Slotting Inserts

The Inserts designed to work exclusively with duMONT Tool Holders are a sintered steel alloy with a 13% cobalt content, heat treated to a 72 HRC hardness providing toughness and impact resistance. A TiN coating is applied to improve wear resistance and lubricity. All Inserts are designed to allow several re-sharpenings. Stock Insert specifications and mild steel application data are provided. A Chamfer Feature is available see footnote. See the Engineering Section for process and Special Insert information and available applications — Keyways in Tapered Bore, Square, Hexagon and Involute Internal Gears. We can add custom corner radius per your requirement, allow up to 2 weeks for modification and recoating.

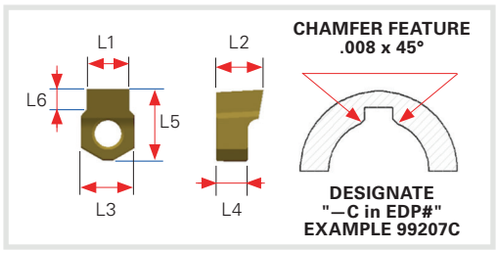


See pages 41-42 and 50 for Tool Holders.
See pages 56 for Sharpening Stem.

Inserts (mm) - Tolerances — *To order a different tolerance - EDP# + (TOLERANCE) = 99202P9*

EDP No.	L1 (mm)	H-7 (Standard) L1 (High)	H-7 (Standard) L1 (Low)	P-9 L1 (High)	P-9 L1 (Low)	D-10 L1 (High)	D-10 L1 (Low)	C-11 L1 (High)	C-11 L1 (Low)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	Tool Holder Size	Sharpen Stem
99401		0.07910	0.07810											1.30		
99401( )	2			0.07850	0.07750	0.08110	0.08540	0.08350	0.08300	5.00	6.50	5.00	6.00	1.30	2	SS-1
99401C*		0.07910	0.07810											1.09		
99402		0.11860	0.11830											2.00		
99402( )	3			0.11790	0.11690	0.12090	0.12047	0.12280	0.12244	6.08	6.50	5.00	7.50	2.00	3	SS-1
99402C*		0.11860	0.11830											1.42		
99403		0.15800	0.15767											2.60		
99403( )	4			0.15710	0.15590	0.16020	0.15984	0.16220	0.16180	6.08	7.00	5.00	8.00	2.60	4	SS-1
99403C*		0.15800	0.15767											2.07		
99404		0.19730	0.19705											3.00		
99404( )	5			0.19650	0.19530	0.19960	0.19920	0.20160	0.20118	6.08	7.00	5.00	8.00	3.00	5	SS-1
99404C*		0.19730	0.19705											2.74		
99406		0.23680	0.23650											4.00		
99406( )	6			0.23560	0.23420	0.23940	0.23897	0.24090	0.24055	10.08	9.00	6.00	13.50	4.00	6	SS-2
99406C*		0.23680	0.23650											3.00		
99407		0.31560	0.31527											4.50		
99407( )	8			0.31440	0.31300	0.31810	0.31770	0.32050	0.32010	10.08	9.00	6.00	13.50	4.50	8	SS-2
99407C*		0.31560	0.31527											3.78		
99408		0.39430	0.39410											6.00		
99408( )	10			0.39300	0.39130	0.39720	0.39680	0.40000	0.39960	13.10	14.00	10.00	18.50	6.00	10	SS-3
99408C*		0.39430	0.39410											3.88		
99409		0.47310	0.47280											6.50		
99409( )	12			0.47170	0.47000	0.47600	0.47560	0.47950	0.47910	13.10	14.00	10.00	18.50	6.50	12	SS-3
99409C*		0.47310	0.47280											3.89		
99410		0.55190	0.55157											7.00		
99410( )	14			0.55050	0.54880	0.55510	0.55472	0.55910	0.55860	18.00	14.00	10.00	22.00	7.00	14/16	SS-4
99410C*		0.55190	0.55157											4.71		
99411		0.63060	0.63030											8.00		
99411( )	16			0.62920	0.62750	0.63390	0.63346	0.63780	0.63740	18.00	14.00	10.00	22.00	8.00	14/16	SS-4
99411C*		0.63060	0.63030											5.53		
99412		0.70950	0.70905											9.00		
99412( )	18			0.70780	0.70580	0.71450	0.71413	0.71810	0.71770	26.00	18.00	10.00	30.00	9.00	18/26	SS-5
99412C*		0.70950	0.70905											5.67		
99413		0.78820	0.78780											10.00		
99413( )	20			0.78650	0.78450	0.79330	0.79287	0.79690	0.79645	26.00	18.00	10.00	30.00	10.00	18/26	SS-5
99413C*		0.78820	0.78780											6.29		
99414		0.86700	0.86650											11.00		
99414( )	22			0.86520	0.86320	0.87200	0.87160	0.87560	0.87519	26.00	18.00	10.00	30.00	11.00	18/26	SS-5
99414C*		0.86700	0.86650											6.79		
99494		0.98510	0.98464											12.00		
99494( )	25			0.98340	0.98140	0.99010	0.98970	0.99370	0.99330	26.00	18.00	10.00	30.00	12.00	18/26	SS-5
99494C*		0.98510	0.98464											7.02		

*Chamfer feature providing a 45° Chamfer at the intersection of the bore and the walls of the broached section when cut to full depth is available by specifying a "C" in the EDP No. for example --- 99402-C.



See pages 41-42 and 50 for Tool Holders.
See page 56 for Sharpening Stem.

Inserts (inch) - Tolerances

To order a different tolerance - EDP# + (TOLERANCE) = 99202P9

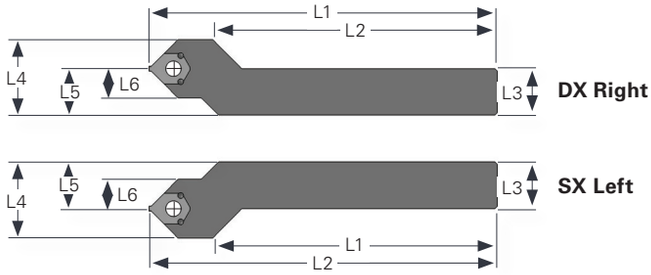
EDP No.	L1 (Inch)	H-7 (Standard) L1 (High)	H-7 (Standard) L1 (Low)	P-9 L1 (High)	P-9 L1 (Low)	D-10 L1 (High)	D-10 L1 (Low)	C-11 L1 (High)	C-11 L1 (Low)	L2 (Inch)	L3 (Inch)	L4 (Inch)	L5 (Inch)	L6 (Inch)	Tool Holder Size	Sharpen Stem
99202		0.09410	0.09370											0.0551		
99020( )	3/32			0.09360	0.09260	0.09610	0.09570	0.09850	0.09810	0.1968	0.2362	0.1968	0.2559	0.0551	2	SS-1
99202C*		0.09410	0.09370											0.0520		
99203		0.12550	0.12551											0.0905		
99203( )	1/8			0.12460	0.12340	0.12810	0.12770	0.13070	0.13030	0.2362	0.2755	0.1968	0.3149	0.0905	3	SS-1
99203C*		0.12550	0.12551											0.0740		
99206		0.15670	0.15652											0.1141		
99206( )	5/32			0.15590	0.15470	0.15930	0.15892	0.16200	0.16160	0.2362	0.2755	0.1968	0.3149	0.1141	4	SS-1
99206C*		0.15670	0.15652											0.0790		
99207		0.18800	0.18778											0.1299		
99207( )	3/16			0.18710	0.18590	0.19060	0.19020	0.19320	0.19280	0.2362	0.2755	0.1968	0.3149	0.1299	5	SS-1
99207C*		0.18800	0.18778											0.1050		
99209		0.25080	0.25040											0.1587		
99209( )	1/4			0.24940	0.24800	0.25390	0.25350	0.25670	0.25630	0.3968	0.3543	0.2362	0.5314	0.1587	6	SS-2
99209C*		0.25080	0.25040											0.1360		
99210		0.28180	0.28160											0.1692		
99210( )	9/32			0.28060	0.27920	0.28510	0.28470	0.28790	0.28750	0.3968	0.3543	0.2362	0.5314	0.1692	8	SS-2
99210C*		0.28180	0.28160											0.1520		
99212		0.31310	0.31270											0.1875		
99212( )	5/16			0.31190	0.31050	0.31640	0.31600	0.31920	0.31880	0.3968	0.3543	0.2362	0.5314	0.1875	8	SS-2
99212C*		0.31310	0.31270											0.1670		
99213		0.37560	0.37520											0.2500		
99213( )	3/8			0.37440	0.37300	0.37890	0.37850	0.38170	0.38130	0.5157	0.5511	0.3937	0.7283	0.2500	10	SS-3
99213C*		0.37560	0.37520											0.1990		
99214		0.43820	0.43780											0.2500		
99214( )	7/16			0.43680	0.43510	0.44220	0.44180	0.44560	0.44520	0.5157	0.5511	0.3937	0.7283	0.2500	12	SS-4
99214C*		0.43820	0.43780											0.2300		
99215		0.50070	0.50030											0.3000		
99215( )	1/2			0.49930	0.49760	0.50470	0.50430	0.50810	0.50760	0.5157	0.5511	0.3937	0.7283	0.3000	12	SS-4
99215C*		0.50070	0.50030											0.2610		
99242		0.56320	0.56280											0.2750		
99242( )	9/16			0.56180	0.56010	0.56720	0.56680	0.57060	0.57020	0.7086	0.5511	0.3937	0.8661	0.2750	14/16	SS-4
99242C*		0.56320	0.56280											0.2670		
99216		0.62570	0.62530											0.3120		
99216( )	5/8			0.62430	0.62240	0.62970	0.62930	0.63310	0.63270	0.7086	0.5511	0.3937	0.8661	0.3120	14/16	SS-4
99216C*		0.62570	0.62530											0.3024		
99217		0.75080	0.75040											0.3930		
99217( )	3/4			0.74910	0.74710	0.75590	0.75550	0.75940	0.75900	1.0236	0.7086	0.3937	1.1811	0.3930	18/26	SS-5
99217C*		0.75080	0.75040											0.3860		
99218		0.87579	0.87559											0.4330		
99218( )	7/8			0.8743	0.8738	0.88090	0.88050	0.88450	0.88410	1.0236	0.7086	0.3937	1.1811	0.4330	18/26	SS-5
99218C*		0.87579	0.87559											0.4030		
99219		1.00150	1.00250											0.5410		
99219( )	1			0.9993	0.9988	1.00590	1.00550	1.00960	1.00910	1.0236	0.7086	0.3937	1.1811	0.5410	18/26	SS-5
99219C*		1.00150	1.00250													

*Chamfer feature providing a 45° Chamfer at the intersection of the bore and the walls of the broached section when cut to full depth is available by specifying a "C" in the EDP No. for example --- 99408-C.

**It is necessary on larger cuts 12mm or ½ inch keyways and above to cut in two operations, a roughing pass with a smaller width insert (approximate ½ required width) and finishing pass at the desired width. This approach reduces the pressure required.

Tools for External Machining

The series of tools for external machining was developed for external surfaces (to execute splines and keyway seatings, among others). These tools are made with tool steel. In addition to the two types of tools for external machining available in the catalog, Pilot Precision Products is able to build special tools for external machining based on specific customer demands.

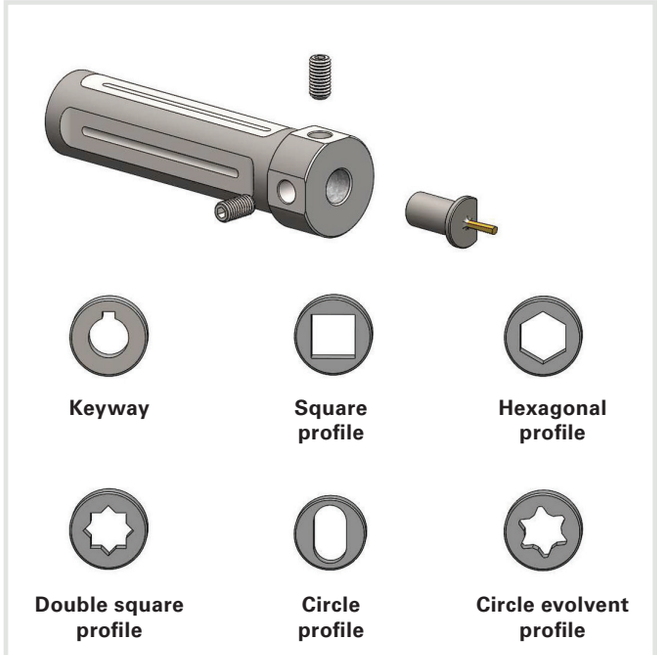


Tools for External Machining (mm)

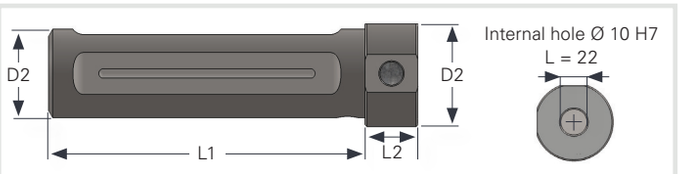
EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)
99901	20-DX	150.0	110.0	20x20	32.5	20	12.5
99902	20-SX			20x20	32.5	20	
99903	25-DX			25x25	37.5	25	
99904	25-SX			25x25	37.5	25	

MINITOOL

The MINITOOL series was developed based on the need to satisfy demands linked to machining small workpieces. Integral inserts were used to satisfy these demands, as these types of inserts make it possible to achieve extremely small cutting profiles, with very diverse geometries. In order to ensure high tool rigidity and achieve tools that are absolutely perfect for the operation that needs to be performed, the integral inserts are always designed ad hoc based on specific customer demands. To ensure the prompt supply of tools, Pilot Precision Products always has a stock of semi-finished MINITOOL inserts and has developed specific programs for its CNC sharpening machines, aimed at profiling inserts based on customer demands, in extremely short amounts of time. MINITOOL series inserts can fit UT-1/8 insert-carrier (available in different socket diameters). The aforementioned insert-carrier can, in turn, be internally fitted with eccentric bushing, the same way as the classic line duMONT tool and, therefore, can correct any alignment errors on CNC lathes that are not equipped with a Y-axis. Alternatively, MINITOOL inserts can be locked into the machine tool-carrier with a simple clamping gripper (for ex. an ER gripper). In this case, it is preferable for the machine tool to be equipped with a Y-axis.



Tool 1/8



Tools for External Machining (mm)

EDP No.	Description	L1 (mm)	L2 (mm)	D1 (mm)	D2
99906	1/8-3/4"	90	15	30	3/4"
99907	1/8-20mm	90		30	20mm
99908	1/8-25mm	90		30	25mm
99909	1/8-32mm	100		38	32mm

Tools and Inserts for Square

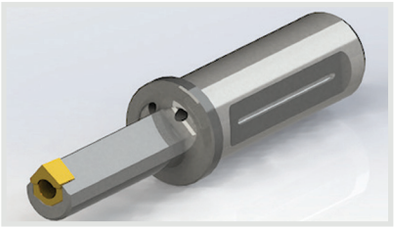
This series of duMONT tools was developed to execute internal squares. It offers the following advantages: absolute concentricity, the possibility of correcting the required measurement, machining speed and cost savings. Every insert size in this line is able to execute various square sizes, which makes using duMONT tools for squares very economical and convenient. To execute internal square holes, it is necessary to cut a pre-hole with a diameter based on the following formula:

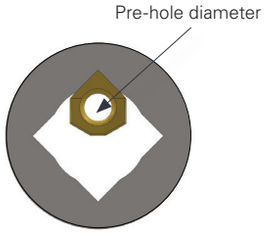
PRE-HOLE DIAMETER = SQUARE THICKNESS X 1.050

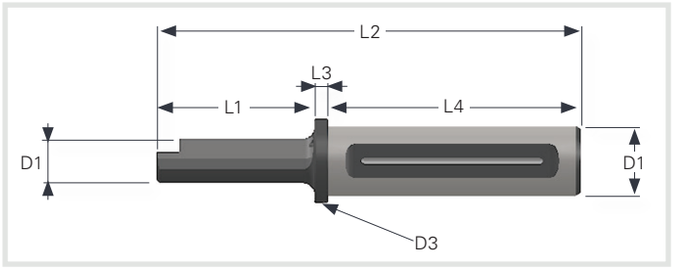
For example, for a square with a thickness of 10mm, the diameter of the pre-hole will be: 10mm x 1.050 = 10.50mm

To execute completely square holes, the customer will need to make a specific request and will be supplied with an ad hoc tool. In addition to this, in many other cases, in order to obtain a perfectly appropriate tool for the type of square hole that needs to be executed, it will be possible to produce a special tool that meets the customer's specifications.

Tools for Square



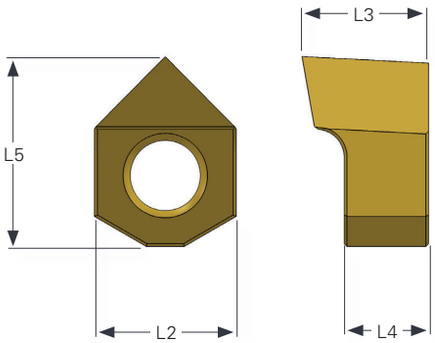




Tools for Square (mm)

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	D1 (mm)	D2 (mm)	D3 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
99621	8/10-25	30.0	129.0	9.0	90.0	25.0	7.25	30.0	CP-1	T08	MS-1	8.0	368
99622	8/10-32	30.0	139.0		100.0	32.0	7.25	38.0	CP-1	T08	MS-1	8.0	673
99623	10/13-25	40.0	139.0		90.0	25.0	8.60	30.0	CP-1	T08	MS-1	10.0	368
99624	10/13-32	40.0	149.0		100.0	32.0	8.60	38.0	CP-1	T08	MS-1	10.0	672
99625	13/16-25	50.0	149.0		90.0	25.0	12.00	30.0	CP-2	T15	MS-2	13.0	428
99626	13/16-32	50.0	159.0		100.0	32.0	12.00	38.0	CP-2	T15	MS-2	13.0	725
99627	16/19-25	52.0	151.0		90.0	25.0	15.00	30.0	CP-3	T20	MS-3	16.0	647
99628	16/19-32	52.0	161.0		100.0	32.0	15.00	38.0	CP-3	T20	MS-3	16.0	935
99629	19/27-25	86.0	185.0		90.0	25.0	18.50	30.0	CP-3	T20	MS-3	19.0	824
99630	19/27-32	86.0	195.0		100.0	32.0	18.50	38.0	CP-3	T20	MS-3	19.0	1,157
99631	27/37-25	100.0	199.0		90.0	25.0	25.00	30.0	CP-4	T20	MS-3	27.0	1,390
99632	27/37-32	100.0	209.0		100.0	32.0	25.00	38.0	CP-4	T20	MS-3	27.0	1,490
99633	37/50-32	140.0	249.0		100.0	32.0	35.00	45.0	CP-5	BRUG-5	MS-4	37.0	1,903

Inserts for Square



Inserts for Square (mm)

EDP No.	Working range (mm)	Working range (inches)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	Tool Holder Size	Sharpen Stem
99601	8mm/10mm	0.314/0.393	6.00	7.00	5.00	7.00	8/10	SS-1
99602	10mm/13mm	0.393/0.511	6.00	7.00	5.00	7.50	10/13	SS-1
99603	13mm/16mm	0.511/0.629	10.00	8.00	6.00	12.00	13/16	SS-2
99604	16mm/19mm	0.629/0.748	10.00	8.00	6.00	12.50	16/19	SS-2
99605	19mm/27mm	0.748/1.062	13.00	13.00	10.00	17.00	19/27	SS-3
99606	27mm/37mm	1.062/1.456	18.00	14.00	10.00	22.00	27/37	SS-4
99607	37mm/50mm	1.456/1.968	26.00	18.00	10.00	30.00	37/50	SS-5

See pages 55-57 for accessories.

Tools and Inserts for Hexagon

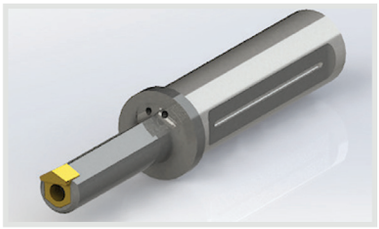
The duMONT CNC Indexable Broaching System was developed to execute internal hexagons. It offers the following advantages: absolute concentricity, the possibility of correcting the required measurement, machining speed and cost savings. Every insert size in this line is able to execute various hexagonal sizes, which makes using duMONT tools for hexagons very economical and convenient. To execute internal hexagonal holes, it is necessary to cut a pre-hole with a diameter based on the following formula:

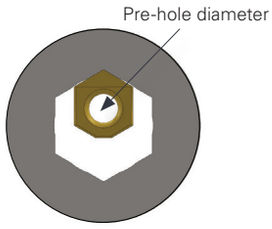
PRE-HOLE DIAMETER = HEXAGON THICKNESS X 1.020

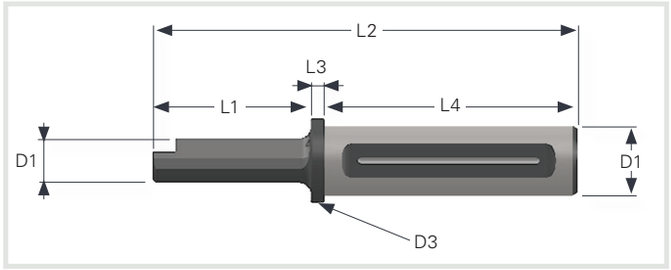
For example, for a hexagon with a thickness of 10mm, the diameter of the pre-hole will be: 10mm x 1.020 = 10.20mm

To achieve your desired hexagonal hole, contact our Engineering Department for a custom solution to meet your needs.

Tools for Hexagon



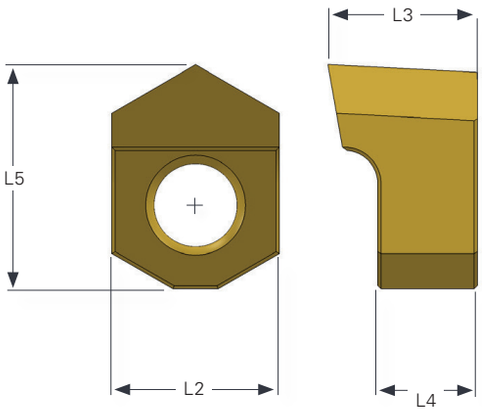




Tools for Hexagon (mm)

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	D1 (mm)	D2 (mm)	D3 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
99721	9/11-25	30.0	129.0	9.0	90.0	25.0	8.0	30.0	CP-1	T08	MS-1	9.0	388
99722	9/11-32	30.0	139.0		100.0	32.0	8.0	38.0	CP-1	T08	MS-1	9.0	673
99723	11/17-25	40.0	139.0		90.0	25.0	10.0	30.0	CP-1	T08	MS-1	11.0	368
99724	11/17-32	40.0	149.0		100.0	32.0	10.0	38.0	CP-1	T08	MS-1	11.0	672
99725	17/28-25	56.0	155.0		90.0	25.0	15.0	30.0	CP-2	T15	MS-2	17.0	647
99726	17/28-32	56.0	165.0		100.0	32.0	15.0	38.0	CP-2	T15	MS-2	17.0	935
99727	28/37-25	86.0	185.0		90.0	25.0	25.0	30.0	CP-3	T20	MS-3	28.0	1,390
99728	28/37-32	86.0	195.0		100.0	32.0	25.0	38.0	CP-3	T20	MS-3	28.0	1,157
99729	37/45-25	126.0	225.0		90.0	25.0	35.0	45.0	CP-4	T20	MS-3	37.0	1,490
99730	37/45-32	126.0	235.0		100.0	32.0	35.0	45.0	CP-4	T20	MS-3	37.0	1,850
99731	45/70-32	140.0	249.0		100.0	32.0	40.0	45.0	CP-5	BRUG 5	MS-4	45.0	1,950

Inserts for Hexagon



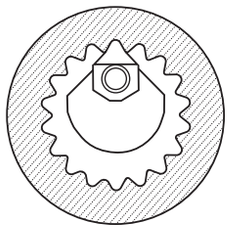
Inserts for Hexagon (mm)

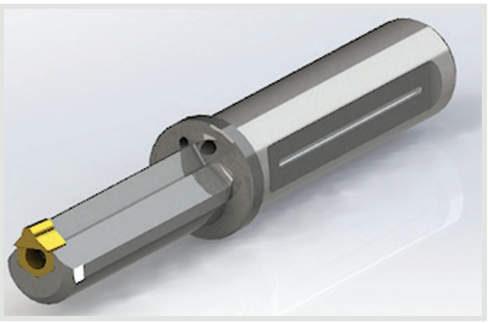
EDP No.	Working range (mm)	Working range (inches)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	Tool Holder Size	Sharpen Stem
99701	9mm/11mm	0.354/0.433	6.00	7.00	5.00	7.50	9/11	SS-1
99702	11mm/17mm	0.433/0.669	6.00	7.00	5.00	8.00	11/17	SS-1
99703	17mm/28mm	0.669/1.102	10.00	9.00	6.00	13.50	17/28	SS-2
99704	28mm/37mm	1.102/1.456	13.00	14.00	10.00	18.50	28/37	SS-3
99705	37mm/45mm	1.456/1.771	18.00	14.00	10.00	22.00	37/45	SS-4
99706	45mm/70mm	1.771/2.755	26.00	16.00	10.00	30.00	45/70	SS-5

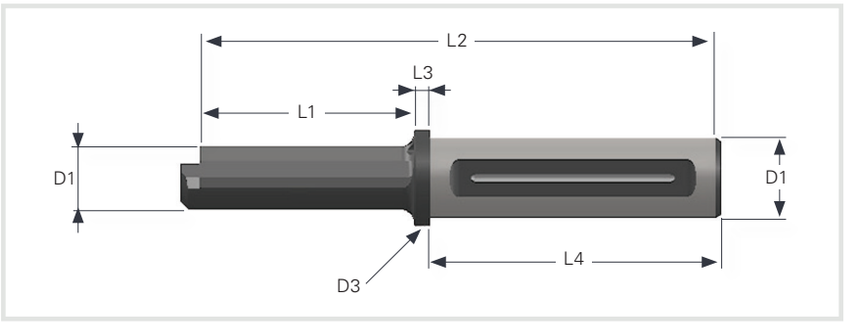
See pages 55-57 for accessories.

Tools for Splined Profiles

The SP tool line was designed to make splined internal profiles. The choice of tool is determined by the minimum entry hole of the workpiece to be machined. In fact, we recommend purchasing a tool with a diameter (D2) as close to the value of said hole as possible, as shown in the table. It is also possible to make special tools in various diameters and sizes based on specific customer needs.







Tools for Splined Profiles (mm)

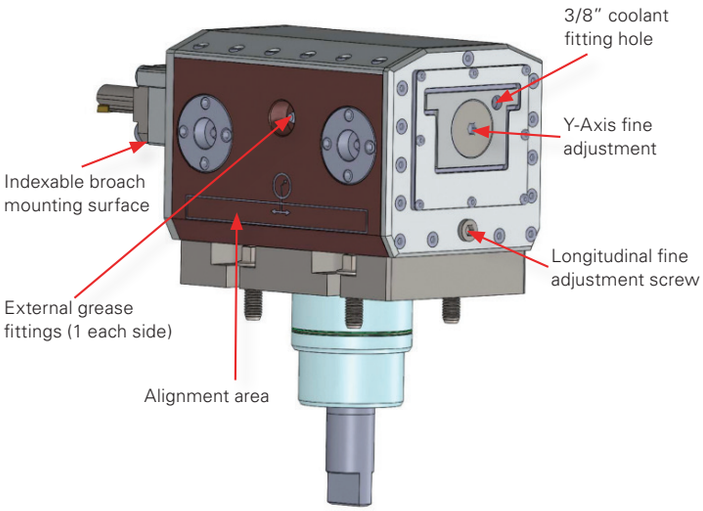
EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	D1 (mm)	D2 (mm)	D3 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
99801*	02-25	25.0	124.0	9.0	90.0	25.0	6.5	30.0	CP-0	T08	MS-1	7.0	382
99802*	02-32	25.0	134.0		100.0	32.0	6.5	37.0	CP-0	T08	MS-1	7.0	600
99803*	03-25	30.0	129.0		90.0	25.0	8.0	30.0	CP-1	T08	MS-1	8.5	368
99804*	03-32	30.0	139.0		100.0	32.0	8.0	37.0	CP-1	T08	MS-1	8.5	673
99805*	04-25	40.0	139.0		90.0	25.0	10.0	30.0	CP-1	T08	MS-1	10.5	368
99806*	04-32	40.0	149.0		100.0	32.0	10.0	37.0	CP-1	T08	MS-1	10.5	672
99807*	05-25	46.0	145.0		90.0	25.0	12.0	30.0	CP-1	T08	MS-1	12.5	382
99808*	05-32	46.0	155.0		100.0	32.0	12.0	37.0	CP-1	T08	MS-1	12.5	698
99809*	06-25	56.0	155.0		90.0	25.0	16.0	30.0	CP-2	T15	MS-2	16.5	428
99810*	06-32	56.0	165.0		100.0	32.0	16.0	37.0	CP-2	T15	MS-2	16.5	725
99811*	08-25	68.0	162.0		90.0	25.0	20.0	30.0	CP-2	T15	MS-2	21.0	488
99812*	08-32	68.0	172.0		100.0	32.0	20.0	37.0	CP-2	T15	MS-2	21.0	820
99813*	10-25	86.0	185.0		90.0	25.0	25.0	30.0	CP-3	T20	MS-3	28.0	647
99814*	10-32	86.0	195.0		100.0	32.0	25.0	37.0	CP-3	T20	MS-3	28.0	935
99815*	12-25	102.0	203.0		90.0	25.0	30.0	30.0	CP-3	T20	MS-3	33.0	824
99816*	12-32	102.0	213.0		100.0	32.0	30.0	37.0	CP-3	T20	MS-3	33.0	1,157
99817*	14/16-25	126.0	221.0		90.0	25.0	35.0	37.0	CP-4	T20	MS-3	38.0	1,211
99818*	14/16-32	126.0	231.0		100.0	32.0	35.0	37.0	CP-4	T20	MS-3	38.0	1,490
99819*	18/25-32	140.0	249.0		100.0	32.0	40.0	45.0	CP-5	BRUG.5	MS-4	42.0	1,903

Note: Inserts used on the tool line for splined profiles are all considered special: they are not in stock; rather, they are manufactured specifically for the customer based on the type of machining required. Please contact us for a quote.

Motorized Slotter

Experience a processing speed 100x faster than using a machine's axis for CNC broaching!

The duMONT Motorized Slotter can handle internal and external keyway and spline profiles with ease and at remarkably reduced cycle times while consolidating operations in one machine and eliminating secondary broaching operations.



Features:

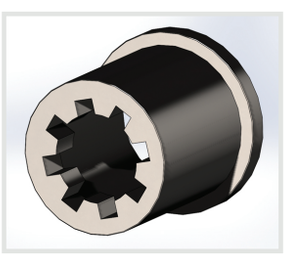
- The duMONT slotter includes two grease fittings for proper maintenance and longer unit life. Competitors offer sealed units that cannot be lubricated causing premature failure due to coolant penetrating the unit, damaging bearings and mechanical components.
- Other manufacturers provide a round broaching ram which reduces torsional rigidity. Our 6-sided design provides maximum torsional rigidity resulting in extended tool life and superior part finish.
- The duMONT slotter provides 2 fine adjustments not found on any competitor's unit. Y-axis & cutter angle fine adjustment up to 3 degrees for better tool life and productivity.

To ensure a long service life and an excellent processing finish, it is advisable to follow the parameters listed below:

	35 mm stroke	50 mm stroke	65 mm stroke		
EDP No.	99862	99863	99864		
	Insert Width	Insert Width	Insert Width	Cutting speed	Cut per Stroke Min / Max
Aluminum	16mm	16mm	16mm	38m/min.	0.06/0.15mm
Soft steel	14mm	14mm	14mm	33m/min.	0.04/0.07mm
Cast iron	14mm	14mm	12mm	28m/min.	0.04/0.07mm
Common steel	14mm	14mm	12mm	30m/min.	0.03/0.05mm
Hardened steel	12mm	12mm	10mm	25m/min.	0.02/0.04mm
Stainless steel	12mm	12mm	10mm	25m/min.	0.02/0.04mm
Plastic	18mm	18mm	18mm	40m/min.	0.07/0.15mm
Bronze-Brass	14mm	12mm	12mm	30m/min.	0.03/0.06mm

*When ordering please provide your machine turret model (BMT, VDI, etc.) for easier installation.

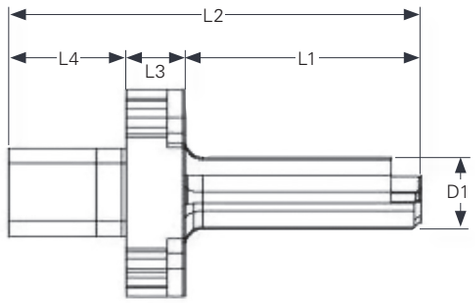
Efficiently solves the problem of having to perform secondary processing operations by equipping your CNC lathe to do more.

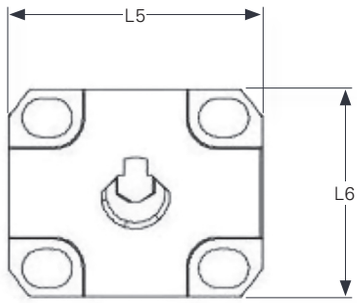


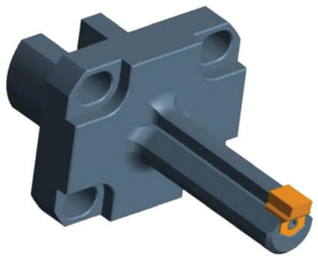
CNC Broached Barrel Extension

MH Slotting Series Insert Holder

The line of tools illustrated here was developed for use on motorized slotting machines for CNC lathes. With the line of tools for motorized slotting machines, it is possible to use the inserts of standard lines for keyway seatings, for hexagonal profiles and for square profiles. It is also possible to manufacture tools and inserts for special profiles. The technical data table does not include the measurements for the diameter and length of the side designed for clamping inside the motorized slotting machine, as these measurements are defined case by case based on customer demands. The picture below is provided by way of example and illustrates one of the many possible shapes that the tool legs can have.







MH 35 Slotting Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum Bore Dia. (mm)	Minimum Bore Dia. (inch)	Minimum hole (mm)	Weight (g)
99161	**02-35**	25	58	13	20	43	35	6	CP-0	T-08	MS-1	7	0.276	7	0.150
99162	**03-35**	30	63	13	20	43	35	8	CP-1	T-08	MS-1	8.5	0.335	8.7	0.160
99163	**04-35**	40	73	13	20	43	35	10	CP-1	T-08	MS-1	10.5	0.413	11	0.170
99164	**05-35**	46	79	13	20	43	35	12	CP-1	T-08	MS-1	12.5	0.492	13	0.180
99165	**06-35**	46	79	13	20	43	35	16	CP-2	T-15	MS-2	16.5	0.650	17	0.210
99166	**08-35**	46	79	13	20	43	35	20	CP-2	T-15	MS-2	21	0.827	21.5	0.225
99167	**10/12-35**	46	79	13	20	43	35	22	CP-3	T-20	MS-3	28/30	1.102/1.181	24	0.235
99168	**14/16-35**	46	79	13	20	43	35	25	CP-4	T-20	MS-3	35	1.378	27	0.245

MH 50 Slotting Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum Bore Dia. (mm)	Minimum Bore Dia. (inch)	Minimum hole (mm)	Weight (g)
99169	**02-50**	25	58	13	20	43	35	6	CP-0	T-08	MS-1	7	0.276	7	0.150
99170	**03-50**	30	63	13	20	43	35	8	CP-1	T-08	MS-1	8.5	0.335	8.7	0.160
99171	**04-50**	40	73	13	20	43	35	10	CP-1	T-08	MS-1	10.5	0.413	11	0.170
99172	**05-50**	46	79	13	20	43	35	12	CP-1	T-08	MS-1	12.5	0.492	13	0.180
99173	**06-50**	56	89	13	20	43	35	16	CP-2	T-15	MS-2	16.5	0.650	17	0.210
99174	**08-50**	56	89	13	20	43	35	20	CP-2	T-15	MS-2	21	0.827	21.5	0.225
99175	**10/12-50**	56	89	13	20	43	35	22	CP-3	T-20	MS-3	28/30	1.102/1.181	24	0.235
99176	**14/16-50**	56	89	13	20	43	35	25	CP-4	T-20	MS-3	35	1.378	27	0.245

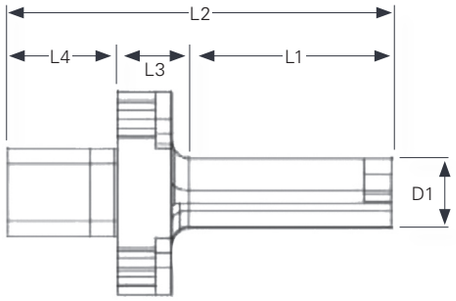
MH 65 Slotting Series Insert Holder

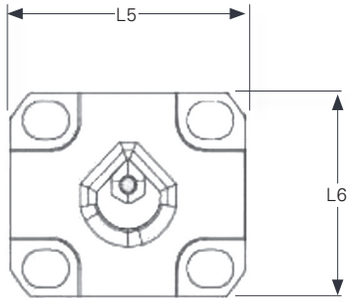
EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum Bore Dia. (mm)	Minimum Bore Dia. (inch)	Minimum hole (mm)	Weight (g)
99177	**02-65**	25	58	13	20	43	35	6	CP-0	T-08	MS-1	7	0.276	7	0.150
99178	**03-65**	30	63	13	20	43	35	8	CP-1	T-08	MS-1	8.5	0.335	8.7	0.160
99179	**04-65**	40	73	13	20	43	35	10	CP-1	T-08	MS-1	10.5	0.413	11	0.170
99180	**05-65**	46	79	13	20	43	35	12	CP-1	T-08	MS-1	12.5	0.492	13	0.210
99181	**06-65**	56	89	13	20	43	35	16	CP-2	T-15	MS-2	16.5	0.650	17	0.180
99182	**08-65**	68	102	13	20	43	35	20	CP-2	T-15	MS-2	21	0.827	21.5	0.240
99183	**10/12-65**	70	103	13	20	43	35	22	CP-3	T-20	MS-3	28/30	1.102/1.181	24	0.265
99184	**14/16-65**	70	103	13	20	43	35	25	CP-4	T-20	MS-3	35	1.378	27	0.285

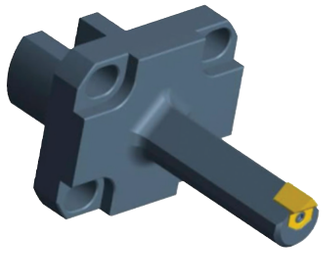
See pages 55-57 for accessories.
See pages 43-44 for inserts

MH Square Series Insert Holder

NEW for 2020







MH 35 Square Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10000*	**8/10-35**	30	58	13	20	43	35	7.25	CP-1	T-08	MS-1	8	0.150
10001*	**10/13-35**	40	63	13	20	43	35	8.6	CP-1	T-08	MS-1	10	0.160
10002*	**13/16-35**	46	73	13	20	43	35	12	CP-2	T-15	MS-2	13	0.170
10003*	**16/19-35**	46	79	13	20	43	35	15	CP-3	T-20	MS-3	16	0.180
10004*	**19/27-35**	46	79	13	20	43	35	18.5	CP-3	T-20	MS-3	19	0.210
10005*	**27/37-35**	46	79	13	20	43	35	25	CP-4	T-20	MS-3	27	0.225

MH 50 Square Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10006*	**8/10-50**	30	58	13	20	43	35	7.25	CP-1	T-08	MS-1	8	0.150
10007*	**10/13-50**	40	63	13	20	43	35	8.6	CP-1	T-08	MS-1	10	0.160
10008*	**13/16-50**	50	77	13	20	43	35	12	CP-2	T-15	MS-2	13	0.170
10009*	**16/19-50**	52	87	13	20	43	35	15	CP-3	T-20	MS-3	16	0.210
10010*	**19/27-50**	60	93	13	20	43	35	18.5	CP-3	T-20	MS-3	19	0.225
10011*	**27/37-50**	60	93	13	20	43	35	25	CP-4	T-20	MS-3	27	0.285

MH 65 Square Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10012*	**8/10-65**	30	58	13	20	43	35	7.25	CP-1	T-08	MS-1	8	0.150
10013*	**10/13-65**	40	63	13	20	43	35	8.6	CP-1	T-08	MS-1	10	0.160
10014*	**13/16-65**	50	77	13	20	43	35	12	CP-2	T-15	MS-2	13	0.170
10015*	**16/19-65**	52	87	13	20	43	35	15	CP-3	T-20	MS-3	16	0.210
10016*	**19/27-65**	75	108	13	20	43	35	18.5	CP-3	T-20	MS-3	19	0.290
10017*	**27/37-65**	75	108	13	20	43	35	25	CP-4	T-20	MS-3	27	0.315

*New for 2020, please allow 2-4 weeks for delivery.

See pages 55-57 for accessories.
See page 46 for inserts.

Pre-Hole Diameter = Square Thickness X 1.050

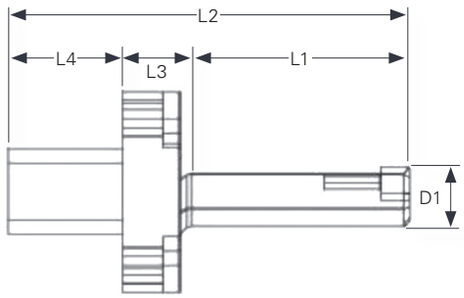
For example, for a square with a thickness of 10mm, the diameter of the pre-hole will be: 10mm x 1.050 = 10.50mm

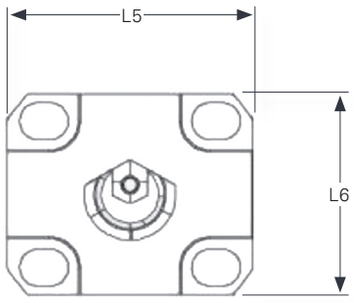
To execute completely square holes, the customer will need to make a specific request and will be supplied with an ad hoc tool.

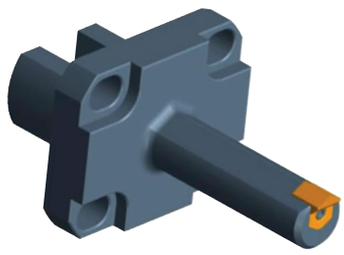
In addition to this, in many other cases, to obtain a perfectly appropriate tool for the type of square hole that needs to be executed, it will be possible to produce a special tool that meets the customer's specifications.

MH Hexagon Series Insert Holder

NEW for 2020







MH 35 Hexagon Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10018*	**9/11-35**	30	58	13	20	43	35	8	CP-1	T-08	MS-1	8.7	0.150
10019*	**11/17-35**	40	63	13	20	43	35	10	CP-1	T-08	MS-1	11	0.160
10020*	**17/28-35**	46	73	13	20	43	35	15	CP-2	T-15	MS-2	16	0.170
10021*	**28/37-35**	46	79	13	20	43	35	25	CP-3	T-20	MS-3	27	0.180
10022*	**37/45-35**	46	79	13	20	43	35	28	CP-4	T-20	MS-3	30	0.270

MH 50 Hexagon Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10023*	**9/11-50**	30	58	13	20	43	35	8	CP-1	T-08	MS-1	8.7	0.150
10024*	**11/17-50**	40	63	13	20	43	35	10	CP-1	T-08	MS-1	11	0.160
10025*	**17/28-50**	50	73	13	20	43	35	15	CP-2	T-15	MS-2	16	0.210
10026*	**28/37-50**	52	79	13	20	43	35	25	CP-3	T-20	MS-3	27	0.225
10027*	**37/45-50**	60	79	13	20	43	35	28	CP-4	T-20	MS-3	30	0.245
10011*	**27/37-50**	60	93	13	20	43	35	25	CP-4	T-20	MS-3	27	0.285

MH 65 Hexagon Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10028*	**9/11-65**	30	58	13	20	43	35	8	CP-1	T-08	MS-1	8.7	0.150
10029*	**11/17-65**	40	73	13	20	43	35	10	CP-1	T-08	MS-1	11	0.160
10030*	**17/28-65**	60	93	13	20	43	35	15	CP-2	T-15	MS-2	16	0.210
10031*	**28/37-65**	75	108	13	20	43	35	25	CP-3	T-20	MS-3	27	0.225
10032*	**37/45-65**	75	108	13	20	43	35	28	CP-4	T-20	MS-3	30	0.275

*New for 2020, please allow 2-4 weeks for delivery.

See pages 55-57 for accessories.
See page 47 for inserts.

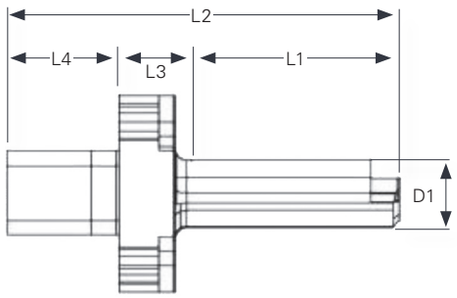
Pre-Hole Diameter = Square Thickness X 1.020

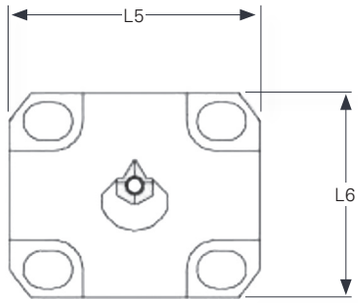
For example, for a hexagon with a thickness of 10mm, the diameter of the pre-hole will be: 10mm x 1.020 = 10.20mm

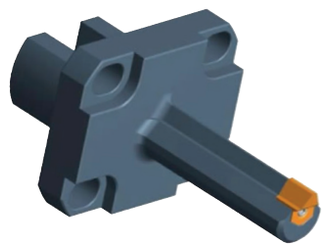
To achieve your desired hexagonal hole, contact our Engineering Department for a custom solution to meet your needs.

MH-Spline Series Insert Holder

NEW for 2020







MH-Spline 35 Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10033*	**02-35**	25	58	13	20	43	35	6.5	CP-0	T-08	MS-1	7	0.150
10034*	**03-35**	30	63	13	20	43	35	8	CP-1	T-08	MS-1	8.7	0.160
10035*	**04-35**	40	73	13	20	43	35	10	CP-1	T-08	MS-1	11	0.170
10036*	**05-35**	46	79	13	20	43	35	12	CP-1	T-08	MS-1	13	0.180
10037*	**06-35**	46	79	13	20	43	35	16	CP-2	T-15	MS-2	17	0.210
10038*	**08-35**	46	79	13	20	43	35	20	CP-2	T-15	MS-2	21.5	0.225
10039*	**10-35**	46	79	13	20	43	35	22	CP-3	T-20	MS-3	24	0.235
10040*	**12-35**	46	79	13	20	43	35	25	CP-3	T-20	MS-3	27	0.245
10041*	**14/16-35**	46	79	13	20	43	35	28	CP-4	T-20	MS-3	30	0.245

MH-Spline 50 Series Insert Holder

EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10042*	**02-50**	25	58	13	20	43	35	6.5	CP-0	T-08	MS-1	7	0.150
100343*	**03-50**	30	63	13	20	43	35	8	CP-1	T-08	MS-1	8.7	0.160
10044*	**04-50**	40	73	13	20	43	35	10	CP-1	T-08	MS-1	11	0.170
10045*	**05-50**	46	79	13	20	43	35	12	CP-1	T-08	MS-1	13	0.180
10046*	**06-50**	56	89	13	20	43	35	16	CP-2	T-15	MS-2	17	0.210
10047*	**08-50**	60	93	13	20	43	35	20	CP-2	T-15	MS-2	21.5	0.245
10048*	**10-50**	60	93	13	20	43	35	22	CP-3	T-20	MS-3	24	0.265
10049*	**12-50**	60	93	13	20	43	35	25	CP-3	T-20	MS-3	27	0.285
10050*	**14/16-50**	60	93	13	20	43	35	28	CP-4	T-20	MS-3	30	0.310

MH-Spline 65 Series Insert Holder

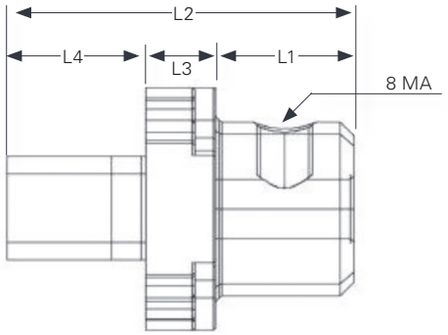
EDP No.	Description	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10051*	**02-65**	25	58	13	20	43	35	6.5	CP-0	T-08	MS-1	7	0.150
10052*	**03-65**	30	63	13	20	43	35	8	CP-1	T-08	MS-1	8.7	0.160
10053*	**04-65**	40	73	13	20	43	35	10	CP-1	T-08	MS-1	11	0.170
10054*	**05-65**	46	79	13	20	43	35	12	CP-1	T-08	MS-1	13	0.180
10055*	**06-65**	60	79	13	20	43	35	16	CP-2	T-15	MS-2	17	0.210
10056*	**08-65**	70	100	13	20	43	35	20	CP-2	T-15	MS-2	21.5	0.245
10057*	**10-65**	75	108	13	20	43	35	22	CP-3	T-20	MS-3	24	0.265
10058*	**12-65**	75	108	13	20	43	35	25	CP-3	T-20	MS-3	27	0.310
10059*	**14/16-65**	75	108	13	20	43	35	28	CP-4	T-20	MS-3	30	0.310

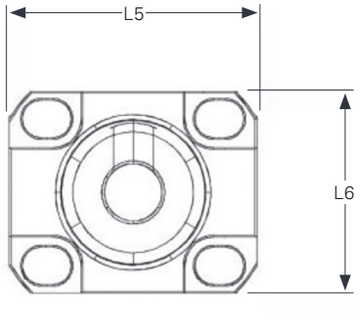
*New for 2020, please allow 2-4 weeks for delivery. When ordering please provide your machine turret model (BMT, VDI, etc.) for easier installation.
See pages 55-57 for accessories.

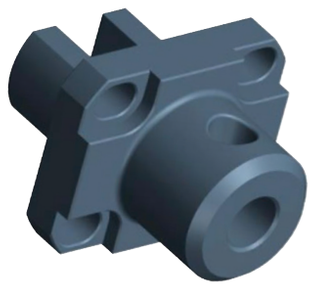
Note: Inserts used on the tool line for splined profiles are all considered special: they are not in stock; rather, they are manufactured specifically for the customer based on the type of machining required. Please contact us for a quote.

MH-M Series Tool Holder Adaptor

NEW for 2020







MH-M 35 Series Tool Holder Adaptor

EDP No.	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10060*	20	50	15	20	43	35	-	-	-	-	-	-

MH-M 50 Series Tool Holder Adaptor

EDP No.	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10061*	20	50	15	20	43	35	-	-	-	-	-	-

MH-M 65 Series Tool Holder Adaptor

EDP No.	L1 (mm)	L2 (mm)	L3 (mm)	L4 (mm)	L5 (mm)	L6 (mm)	D1 (mm)	Centering Plate	Torx driver	Mounting screw	Minimum hole (mm)	Weight (g)
10062*	20	50	15	20	43	35	-	-	-	-	-	-

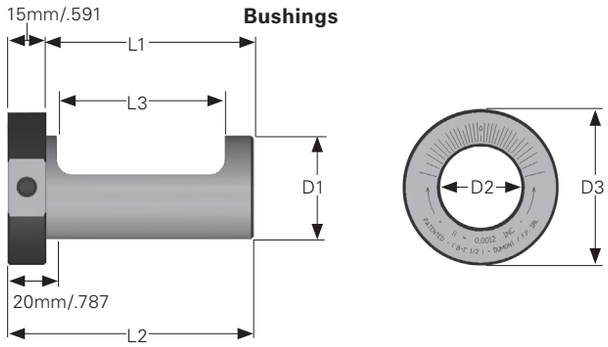
*New for 2020, please allow 2-4 weeks for delivery.

See pages 41-42 and 46-48 for Tool Holders.

Stock Eccentric Bushings

The Eccentric Bushings are designed to allow the use of the Tool Holders in lathes that do not have a Y-axis. The Bushing, manufactured from tool steel, hardened and ground, enables symmetry corrections within a range of +Y 0.5mm (.020 inch) to –Y 0.5mm (.020 inch). The Eccentric Bushings can accommodate Tool Holders with either 25mm or 32mm shanks and are available in various diameters, allowing the Tooling System to be use in a wide variety of machines. Shorter VDI style Eccentric bushings are also available.

Bushings



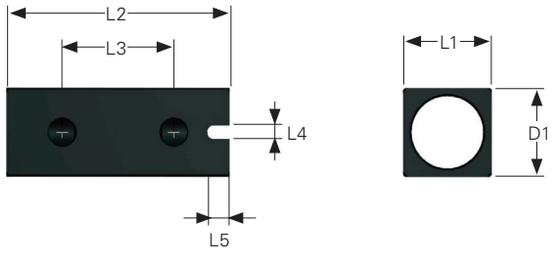
Stock Eccentric Bushings for use with 25mm (.984 inch) and 32mm (1.260 inch) Tool Holders

EDP No.	Description	Shank Diameter (D1)		Shank Internal Dia.(D2)		Shank Length (L1)		Overall Length (L2)		Collar Diameter (D3)		Undercut Length (L2)	
		(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)
99060	EB-1-1/4	31.8	1.250	25	0.984	70	2.756	85	3.346	55	2.165	58	2.283
99061	EB-1-1/2	38.1	1.500	32	1.260	80	3.150	95	3.740	55	2.165	66	2.598
99062	EB-2	50.8	2.000	32	1.260	100	3.937	115	4.528	65	2.559	75	2.953
99063	EB-32	32	1.260	25	0.984	70	2.756	85	3.346	55	2.165	58	2.283
99064	EB-40	40	1.575	32	1.260	80	3.150	95	3.740	55	2.165	66	2.598
99065	EB-50	50	1.969	32	1.260	100	3.937	115	4.528	65	2.559	75	2.953
99066	EB-60	60	2.362	32	1.260	100	3.937	115	4.528	80	3.150	75	2.953
99070	EB-1-1/4-VDI	31.8	1.250	25	0.984	50	1.969	65	2.559	55	2.165	38	1.496
99071	EB-1-1/2-VDI	38.1	1.500	32	1.260	65	2.559	80	3.150	55	2.165	51	2.008
99072	EB-2-VDI	50.8	2.000	32	1.260	80	3.150	95	3.740	65	2.559	55	2.168
99073	EB-32-VDI	32	1.260	25	0.984	50	1.969	65	2.559	55	2.165	38	1.496
99074	EB-40-VDI	40	1.575	32	1.260	65	2.559	80	3.150	55	2.165	51	2.008
99075	EB-50-VDI	50	1.969	32	1.260	80	3.150	95	3.740	65	2.559	55	2.165
99076	EB-60-VDI	60	2.362	32	1.260	80	3.150	95	3.740	80	3.150	55	2.165

Stock Square Adaptors

The Square Adaptors are available in two sizes for use with either 25mm or 32mm Tool Holders. The Adaptors provide a method for allowing the Tooling System to be used on traditional machines such as Slotting and Shaping machines. Manufactured from 39NiCrMo3 steel, heat treated and then blued, the Adaptor provides two holes 12 MA threaded for use with two flat head M12 x 8 screws to secure the Tool Holder in place. The Square Adaptor offers a locating slot on each of the four sides.

Square Adaptor

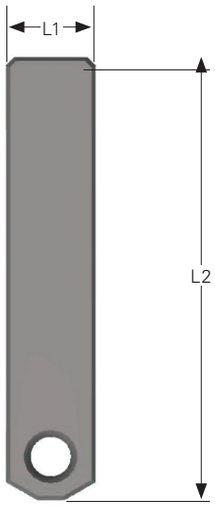


Stock Square Adaptors

EDP No.	Description	Shank Diameter (D1)		Width & Height (L1)		Overall Length (L2)		Locking Bolt Holes (L3)		Locating Slot Width (L4)		Locating Slow Depth (L5)	
		(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)
99535	SA-35	25	.984	35	1.387	90	3.543	40	1.575	6	.236	10	0.394
99540	SA-40	32	1.260	40	1.575	100	3.937	50	1.969	6	.236	10	0.394
99550	SA-50	32	1.260	50	1.969	170	6.693	50	1.969	6	.236	10	0.394

Stock Centering Plates

The Centering Plates are design to fit specific Tool Holders and facilitate correct mounting and orientation of the Tool Holder. The Centering Plate sits in the Tool Holder as does the Insert, and provides a surface to be referenced using a sensor or gauge. The results are used to reference against the axis of the part to be processed. The chart below identifies the Tool Holders that can be used with a particular Centering Plate.

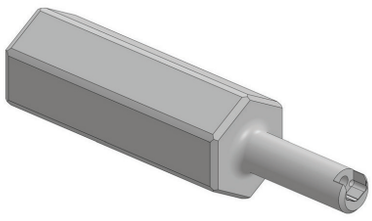


Stock Centering Plates

EDP No.	Description	Used with tool holders size	Plate Height (L1) (mm)	Plate Height (L1) (inch)	Plate Height (L2) (mm)	Plate Height (L2) inch
99500	CP-0	2	5	0.197	50	1.968
99501	CP-1	3, 4 & 5	6	0.236	50	1.969
99502	CP-2	6 & 8	10	0.394	50	1.969
99503	CP-3	10 & 12	13	0.512	60	2.362
99504	CP-4	14/16	18	0.709	70	2.756
99505	CP-5	18/26	26	1.024	70	2.756

Stock Sharpening Stems

Insert life can be extended through re-sharpening of Inserts that show a decline in surface finish (a sign of wear). The Sharpening Stems, available in 5 sizes, are designed to accept specific Insert sizes. The Insert is removed from the Tool Holder and mounted on the Sharpening Stem. The Sharpening Stem holds the Insert securely in place as the cutting edge of the Insert is sharpened at its original angle using a suitable grinder and grinding wheel.



Stock Sharpening Stems

EDP No.	Description	Used with insert (inch)	Used with insert (mm)	Overall Length (mm)	Overall Length (inch)
99521	SS-1	3/32, 1/8, 5/32 & 3/16	2, 3, 4 & 5	150	5.906
99522	SS-2	1/4, 9/32 & 5/16	6 & 8		
99523	SS-3	3/8	10 & 12		
99524	SS-4	7/16 – 5/8	14 & 16		
99525	SS-5	3/4-1	18 – 26		

Insert Mounting Screws and Torx Drivers

Inserts are mounted in the Tool Holder using a Torx Screw or 5mm Hex screw. The Screw size varies with the size of the Tool Holder. Replacement and extra Screws are available as are the appropriate size Torx Drivers. The charts on the right lists the individual Screw and Driver sizes and the Tool Holders they are used with.

Stock Insert Mounting Screws and Torx Driver

EDP No.	Description	Style	Thread	Used with tool holders size
99551	MS-1	Torx	M 2.5 x .45	2, 3, 4 & 5
99552	MS-2	Torx	M 4 x .70	6 & 8
99553	MS-3	Torx	M 6 x 1.00	10, 12 & 14/16
99554	MS-4	5mm Hex	M 8 x 1.25	18/26

Torx Drivers

EDP No.	Description	Style	Used with tool holders size
99561	T-08	Torx	2, 3, 4 & 5
99562	T-15	Torx	6 & 8
99563	T-20	Torx	10, 12 & 14/16

Stock Swivel Ball-Bearing Point Set Screws

Used in Lathe Without Y-axis

The Set Screws are used only in Lathe without Y-axis during Eccentric Bushing rotation to correct symmetry errors. Do not over-tighten Ball-Bearing Point Set Screw it must allow the Tool Holder to move up and down as the Bushing is rotated. It is important to confirm the bolt requirements for the existing tooling to be used in the mounting of the Tooling System.

Stock Swivel Ball-Bearing Point Set Screws

EDP No.	Description	Thread	Length
99571	BB-1	M 6 x 1.00	15mm
99572	BB-2	M 8 x 1.25	18mm
99573	BB-3	M 10 x 1.5	23mm
99574	BB-4	M 12 x 1.75	26mm
99575	BB-5	M 14 x 2.00	30mm
99576	BB-6	M 16 x 2.00	33mm
99577	BB-7	UNC 5/16-18	37/64
99578	BB-8	UNC 3/8-16	5/8
99579	BB-9	UNC 1/2-13	3/4
99580	BB-10	UNC 5/8-11	36/64

Engineering Section



Special Inserts and Applications

The CNC Indexable Broaching System offers a wide range of Special Design Inserts that provide the opportunity to manufacture parts more efficiently and accurately through single machine processing. When location or timing is a critical design element of the part, the tooling system offers a means to do more work within the same coordinate system. Allow us to put our experience to work for you. Get the right Insert for the material you are machining, the shape or form you require with the programming needed to get your job done. Please contact us at 413-350-5200.

Blind Hole Inserts

Blind Hole Cutting requires a Special Insert. The Insert's composition and hardness is altered to reduce the risk of chipping. Additional design considerations are required for small diameter holes with restricted chip flow, deep hole cutting, and when working with bars of material in lathe operations. The programs used for Blind Hole Cutting require that special attention be given to the end of each stroke and the retraction of the Insert. A straight X-axis move out of the work can result in chipping of the Insert. Programming assistance is available; the manufacturer, model, and controls of the machine to be used as well as a fully dimensioned drawing of the finished part are required. The proper design, insert material, and programming is essential to success.

Cornering Inserts

Machine Squares, Hexagons, and Octagons with Inserts designed with two cutting edges intersecting at the appropriate angle 90°, 120° or 135°. Cut the corner, rotate the spindle (C axis) as required for the next cut (re-run of the subroutine) and repeat to completion. The same cornering Inserts may be used to generate a range of sizes of the given shape by simply increasing or decreasing the tool offset.

Internal Toothing and Grooving Inserts

Inserts designed to meet industry standards (ANSI, DIN, ISO etc.) as well as nonstandard geometries are available. A chamfering feature may be added in order to produce a burr-free part. One machine processing in the same coordinate system promotes product uniformity and processing efficiencies.

Sharpening – Allow us to extend the life of your inserts

Re-sharpening extends the life of the Insert and saves money. The Inserts that show a decline in surface finish (a sign of wear), can have their life extended through a resharpening process. The Inserts are designed to allow two to three resharpenings, more if tolerances allow. A Sharpening Stem is available for mounting and supporting of an Insert during re-sharpening. The Stem's hexagon shank facilitates the resharpening process. Sharpening must be properly performed using an appropriate grinder and grinding wheel. The original cutting angle must be maintained. Recoating of the Insert is required after sharpening.

Contact us for a quote to re-sharpen your inserts to proper manufactured geometry.

Engineering Section

	Aluminum			Bronze			Mild Steel / Low Alloy Steel			High Alloy Steel			Stainless		
Width of Insert	Cut per Stroke (inch)	Cutting Speed (inches/min)	Pressure Required (lbs)	Cut per Stroke (inch)	Cutting Speed (inches/min)	Pressure Required (lbs)	Cut per Stroke Inch	Cutting Speed (inches/min)	Pressure Required (lbs)	Cut per Stroke (inch)	Cutting Speed (inches/min)	Pressure Required (lbs)	Cut per Stroke (inch)	Cutting Speed (inches/min)	Pressure Required (lbs)
3/32	0.0060	480	71	0.0040	340	132	0.0035	300	182	0.0030	230	170	0.0023	200	141
1/8	0.0060	480	94	0.0040	340	176	0.0035	300	242	0.0028	230	211	0.0025	200	204
5/32	0.0060	480	118	0.0040	340	220	0.0035	300	302	0.0025	230	235	0.0023	200	235
3/16	0.0060	480	141	0.0040	340	236	0.0033	300	342	0.0025	230	282	0.0023	200	281
1/4	0.0055	480	172	0.0032	340	281	0.0025	300	345	0.0022	230	331	0.0020	200	326
9/32	0.0055	400	194	0.0032	300	316	0.0022	265	341	0.0021	200	355	0.0020	175	366
5/16	0.0050	400	196	0.0032	300	351	0.0022	265	379	0.0020	200	376	0.0019	175	387
3/8	0.0050	400	235	0.0027	300	355	0.0019	265	393	0.0017	200	384	0.0016	175	391
7/16	0.0044	400	241	0.0027	300	414	0.0018	265	434	0.0016	200	421	0.0015	175	428
1/2	0.0042	380	263	0.0026	270	456	0.0016	230	441	0.0015	180	451	0.0014	150	456
9/16	0.0040	380	282	0.0024	270	473	0.0016	230	496	0.0014	180	473	0.0013	150	476
5/8	0.0040	380	313	0.0023	270	504	0.0015	230	517	0.0014	180	526	0.0013	150	529
3/4	0.0035	380	329	0.0020	270	526	0.0013	230	538	0.0012	180	541	0.0011	150	538
2mm	0.0060	480	59	0.0040	340	110	0.0035	300	151	0.0025	230	118	0.0023	200	118
3mm	0.0060	480	89	0.0040	340	165	0.0035	300	227	0.0025	230	177	0.0023	200	176
4mm	0.0060	480	118	0.0040	340	220	0.0035	300	303	0.0025	230	236	0.0023	200	235
5mm	0.0060	480	148	0.0036	340	248	0.0033	300	357	0.0025	230	295	0.0023	200	294
6mm	0.0055	480	162	0.0032	340	264	0.0033	300	429	0.0022	230	312	0.0020	200	307
8mm	0.0055	400	216	0.0032	300	353	0.0025	265	433	0.0020	200	378	0.0018	175	368
10mm	0.0050	400	246	0.0027	300	372	0.0020	265	433	0.0017	200	401	0.0016	175	409
12mm	0.0045	380	266	0.0027	270	446	0.0019	230	494	0.0015	180	425	0.0014	150	430
14mm	0.0040	380	276	0.0025	270	482	0.0017	230	515	0.0013	180	430	0.0013	150	466
16mm	0.0040	380	315	0.0022	270	485	0.0015	230	520	0.0013	180	491	0.0011	150	450
18mm	0.0037	380	328	0.0020	270	496	0.0014	230	546	0.0012	180	510	0.0010	150	461
20mm	0.0034	360	335	0.0019	250	523	0.0013	200	563	0.0012	150	567	0.0010	130	512
22mm	0.0032	360	346	0.0018	250	546	0.0012	200	571	0.0010	150	520	0.0010	130	535
25mm	0.0032	360	394	0.0017	250	585	0.0011	200	595	0.0009	150	531	0.0009	130	544

CNC Programming Support

Programming – Allow us to put our experience to work for you.

Programming assistance is available; the make, model, and controls of the machine used, along with a print drawing of the part is required.

In the CNC program it is necessary to establish an approaching value which accounts for the "cord", the distance from the center of the cutting edge of the Insert to I.D. of the bore at the point the corners of the Inserts contact the I.D. of the bore. This distance is a function of Insert width and Bore Diameter. The approaching value being sufficiently lower than the diameter of the bore avoids damage to the Insert.

On-site engineering programming service is available at an hourly rate plus travel costs.

Notes

Custom Solutions Are Standard



magafor
Since 1937

Magafor

Magafor is the recognized world leader in the production of precision tools. Pilot is proud to be the exclusive American distributor of such fine products.

Specialization
With more than 250 product groups and over 8,000 standard products, Magafor offers the solution adapted to each of your machining applications. For example, the 0.40mm diameter micro end-mill is available in 26 different lengths and styles. You'd be hard-pressed to find a manufacturer offering more options. Styles, materials and lengths vary within each specific range of tooling to offer you the widest selection.

Innovation
Magafor meets the needs of even the most demanding customers by: detecting customer needs to create new technologies; analyzing and comparing the totality of the special tools; and comparing market trends to create custom solutions.

Trial & Test Standard Tools
Magafor is so confident in the performance and reliability of its products—as are we!—that we'll extend the most liberal trial program in the industry. At your request, we'll provide standard test tools FREE of charge. Contact customer service with any questions and to facilitate this request.

Blanket Orders
Please know that we accept and encourage blanket orders on standard stock items, standard non-stock items and custom items. We will always ensure continuous delivery with large safety stock levels.

Specials
Magafor excels in manufacturing custom tooling and delivering solutions that show cost savings in most applications.

Coatings

In addition to Futura and TiN coatings, three new "X" coatings, sprung from multi-layer nano technology are available:

Red'X:
Cobalt tool coating has a higher hardness of (3700 HV) and is similar to TiAlN in a multi-layer coating. Choose this coating for dry machining. Using coolant will add lubricity.

Hard'X:
Carbide tool coating has a high hardness (3500 HV) and shows a high thermic stability. It offers excellent protection against heat and wear and is ideal for dry-machining high-speed cut-in treated steels and dies up to 67 Rc.

Graph'X:
Diamond coating (8000 HV) is particularly effective when machining graphite, composite materials, plastics with glass-fibers or carbon-fibers.

Note: Vickers Hardness Test
HV = a unit of hardness given by the test known as the Vickers Pyramid Number

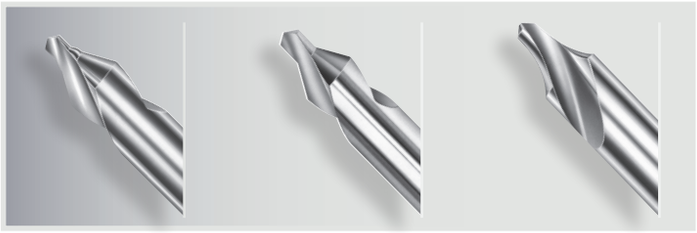
MICRO MILLING

Magafor is the only cutting tool manufacturer member of the European Commission that has been chosen to research micro-machining.

This research targets performance improvements of all **Magafor** tools, ensuring customers the greatest profit margins.

Materials Used in the Manufacture of Our Tools and Coatings Designation

Designation			
Magafor	**European**	**American**	**Japanese**
HSS	HSS	M2	SKH-51
HSS-E COBALT	HSS-E	M35	SKH-55
HSS-E 8% COBALT	HSS-E8	M42	SKH-59
TIN	TiN	TiN	TiN
Futura	TiAlN	TiAlN	TiAlN
Red'X	TiAlN with higher hardness (3700 HV)		
Hard'X	AlTiN	Latuma	
Graph'X	Diamond coating		
K15 CARBIDE — 6.5 – 7% Cobalt (0.006 – 0.008mm grain size)			



Engaged right from the start in the process aspiring to excellence, in addition to our Futura and TiN coatings, Magafor offers three "**X**" coatings, sprung from multi-layer nano technology.

Red'X cobalt tool coating has a higher hardness of (3700 HV) and is similar to TiAlN in a multi-layer coating. Choose this coating for dry machining. Using coolant will add lubricity.

Hard'X [For hard milling] carbide tool coating has a high hardness (3500 HV) and shows a high thermic stability. It offers excellent protection against heat and wear and is ideal for dry machining-high speed cut-in treated steels and dies up to 67 Rc.

Graph'X [For composite milling] diamond coating (8000 HV) is particularly effective when machining graphite, composite materials, plastics with glass-fibers or carbon-fibers.

Hardness and Use for Materials

Material	HSS	HSS-Co	HSS-Co + TiN	HSS 8% Co	HSS 8% Co + Red'X	CARBIDE	CARBIDE + Hard'X
Hardness	63 HRC	65 HRC	65 HRC + 2300 HV	67 HRC	67 HRC + 3500 HV	1800HV	1800HV + 3500
Use	Small Series	Production intensive		Hard and abrasive alloys		Treated steel	

Note: Vickers Hardness Test HV = a unit of hardness given by the test known as the Vickers Pyramid Number

EDP Numbering System

EDP # 88860001810 - 1.81 mm
Solid Carbide High Precision
Micro Reamer

88860001810
Prefix A B

A = Series # - 8600
Series # 8600 refers to Solid Carbide High Precision Micro Reamers
B = Size - 1.81 mm
Size 01810 refers to 1.81 mm

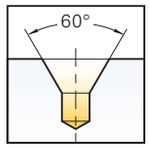
Series Index

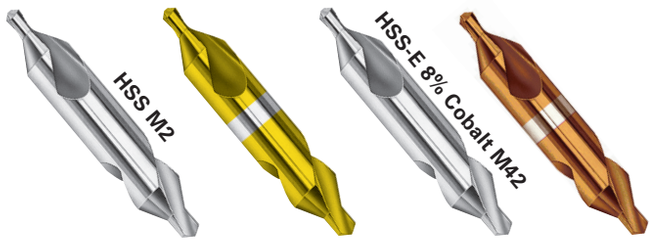
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019-L	73	203	88	4837	91	8199	71	8527-H	100
0290	68	2901	88	4839	79	8201	88	8550	78
0811	67	2903	88	4933	83	8203-H	88	8550-H	78
08115	63	43-A	82	4936	83	8431	83	8600	92-97
0890	68	411	84	8008-A	70	8431-H	83	8610	91
0895	71	421	86	8008-B	70	8431-L	83	8670	90
0896	71	422	85	8008-C	70	8432	80		
0910	67	423	86	8008-D	70	8434	80		
0915	63	425	86	8040	74	845-H	78		
0919	73	430	79	8088	74	8460	77		
0919-L	73	4303	83	8088-H	74	8460-H	77		
0995	71	431	81	8090	75	8480	77		
0996	71	432	79	8090-H	75	8480-H	77		
10	67	433	79	8092	75	8490	77		
105	67	434	79	8092-H	75	8490-H	77		
11	68	435	79	8095	75	8500	101-102		
1055	63	436	83	8095-H	75	8500-G	101-102		
115	63	437	81	8100	67	8500-H	101-102		
125	65	438	79	8100-H	67	8507	103		
135	65	439	79	8105	64	8507-H	103		
145	66	4811	84	8105-H	64	8507-D	103		
154	64	4821	86	8119-A	70	8507-DG	103		
155	64	4822	85	8119-B	70	8507-DH	103		
185	64	4823	86	8119-C	70	8509	102		
191	71	4825	86	8119-D	70	8509-G	102		
195	71	483-A	82	8190-H	72	8509-H	102		
196	71	4831	81	8195	72	8510	103		
197	71	4832	79	8195-H	72	8510-G	103		
199	71	4833	79	8196	72	8510-H	103		
201	88	4834	79	8196-H	72	8522-H	104		

Center Drills

Plain Type 60°

Applications: **Centering, spotting and combined machining**

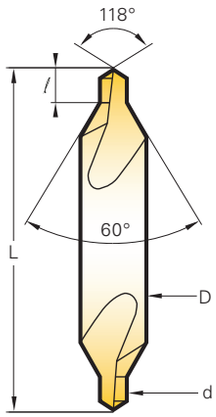




Plain Center Drills - Angle 60°

Size	D	d	L	/	115	M2/TiN 08115	Cobalt + 1055	M42/Red'X 0915
00000	1/8	0.010	1-1/4	0.008 – 0.018	81115000A000*	80081150A0	81105500A00*	80091500A00*
0000		0.015		0.014 – 0.025	8111500B000*	80081150B0	81105500B00*	80091500B00*
000		0.020		0.020 – 0.032	8111500C000	80081150C0	81105500C00*	80091500C00*
00		0.025		0.028 – 0.040	8111500D000	80081150D0	81105500D00*	80091500D00*
0		1/32		0.035 – 0.047	8111500E000	80081150E0	81105500E00*	80091500E00*
1	1/8	3/64	1-1/4	0.055 – 0.067	81115010000	80081150100	81105501000	80091501000
2	3/16	5/64	1-7/8	0.095 – 0.106	81115020000	80081150200	81105502000	80091502000
3	1/4	7/64	2	0.130 – 0.154	81115030000	80081150300	81105503000	80091503000
4	5/16	1/8	2-1/8	0.150 – 0.175	81115040000	80081150400	81105504000	80091504000
4-1/2	3/8	9/64	2-1/2	0.170 – 0.193	81115045000	80081150450	-	-
5	7/16	3/16	2-3/4	0.230 – 0.256	81115050000	80081150500	81105505000	80091505000
6	1/2	7/32	3	0.270 – 0.295	81115060000	80081150600	81105506000	80091506000
7	5/8	1/4	3-1/4	0.315 – 0.340	81115070000	80081150700	81105507000	80091507000
8	3/4	5/16	3-1/2	0.390 – 0.420	81115080000	80081150800	81105508000	80091508000
9	7/8	11/32	3-5/8	0.430 – 0.460	81115090000	80081150900	-	-
10	1	3/8	3-3/4	0.475 – 0.500	81115100000	80081151000	-	-

*Single end tool



Tolerances

Tool Diameters	D	d	Angle 60°	Angle 118°
.010 – 7/64	n/a	+ .0039	-	-
1/8 – 7/32	-0.0007	+ .0047	-	-
1/4 – 3/8	-0.0009	+ .0059	-	-
7/16 – 5/8	-0.0011	+ .0059	- 30'	± 2°
3/4 – 1	-0.0013	+ .0059	-	-

Concentricity of Drill Diameter to Body is: +/– .0005 runout





American Standard Value Sets

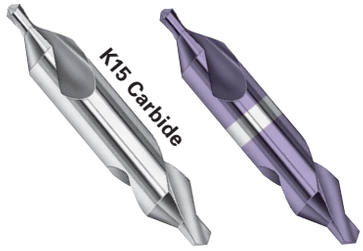
Composition Quantity	15 Pieces HSS 81115000015	Composition Quantity	HSS 81115000000	Composition Quantity	5 Pieces Cobalt 81105500000
3 pieces each	# 1	1 piece each	# 1	1 piece each	# 1
	# 2		# 2		# 2
	# 3		# 3		# 3
	# 4		# 4		# 4
2 pieces	# 4-1/2		# 5		# 5
1 piece	# 5				

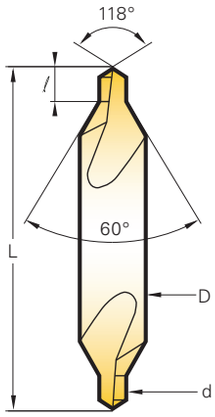
Sets also available TiN coated

Center Drills

Plain Type 60°, 82°, 90° and Longs

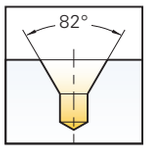
Applications: **Centering**

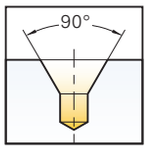


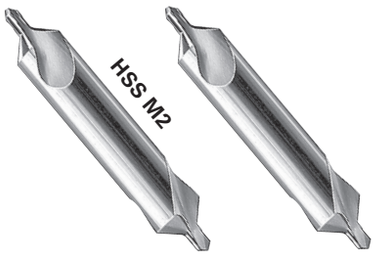


ASA Solid Carbide Plain Center Drills - Angle 60°

Size	D	d	L	l	K15 Carbide 8105	Hard'X 8105- H
00	1/8	0.025	1-1/4	0.020 – 0.040	88810500D00	888105H00D0
0	1/8	1/32	1-1/4	0.035 – 0.047	88810500E00	888105H00E0
1	1/8	3/64	1-1/4	0.055 – 0.067	88810501000	888105H0100
2	3/16	5/64	1-7/8	0.095 – 0.106	88810502000	888105H0200
3	1/4	7/64	2	0.130 – 0.154	88810503000	888105H0300
4	5/16	1/8	2-1/8	0.150 – 0.175	88810504000	888105H0400
5	7/16	3/16	2-3/4	0.230 – 0.256	88810505000	888105H0500
6	1/2	7/32	3	0.270 – 0.295	88810506000	888105H0600









Plain Center Drill - Angles 82° and 90°

Size	D	d	L	l	Angle 82° 154	Angle 90° 155
1	1/8	3/64	1-1/4	0.055 – 0.067	81154010000	81155010000
2	3/16	5/64	1-7/8	0.095 – 0.106	81154020000	81155020000
3	1/4	7/64	2	0.130 – 0.154	81154030000	81155030000
4	5/16	1/8	2-1/8	0.150 – 0.175	81154040000	81155040000
5	7/16	3/16	2-3/4	0.230 – 0.256	81154050000	81155050000
6	1/2	7/32	3	0.270 – 0.295	81154060000	81155060000
7	5/8	1/4	3-1/4	0.135 – 0.340	81154070000	81155070000
8	3/4	5/16	3-1/2	0.390 – 0.420	81154080000	81155080000



American Standard Value Sets - Angle 60°

5 Pieces / 4" OAL	
Composition	81185000000 Long
1 piece each	# 1 Long # 2 Long # 3 Long # 4 Long # 5 Long

Longs - Angle 60°

Size (inch)	D	d	L	HSS M2 185
1 x 3	1/8	3/64	3	81185010300
1 x 4			4	81185010400
1 x 5			5	81185010500
1 x 6			6	81185010600
2 x 3	3/16	5/64	3	81185020300
2 x 4			4	81185020400
2 x 5			5	81185020500
2 x 6			6	81185020600
3 x 3	1/4	7/64	3	81185030300
3 x 4			4	81185030400
3 x 5			5	81185030500
3 x 6			6	81185030600
4 x 3	5/16	1/8	3	81185040300
4 x 4			4	81185040400
4 x 5			5	81185040500
4 x 6			6	81185040600
4-1/2 x 4	3/8	9/64	4	81185045400
4-1/2 x 5			5	81185045500
4-1/2 x 6			6	81185045600
5 x 4	7/16	3/16	4	81185050400
5 x 5			5	81185050500
5 x 6			6	81185050600
6 x 4	1/2	7/32	4	81185060400
6 x 5			5	81185060500
6 x 6			6	81185060600
7 x 5	5/8	1/4	5	81185070500
7 x 6			6	81185070600
8 x 6	3/4	5/16	6	81185080600

Center Drills

Radius Type, Form R

Applications: **Centering**

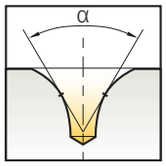


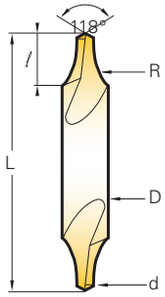
Magafor center drills with radius have a special profile and offer the following benefits over a 60° center drill:

- The radius eliminates the risk of breakage
- It provides an exact bearing
- It serves as a protective chamfer

Center Drills Radius Type Form R

ASA #	D	d	L	R	l	HSS M2 125
1 - R	1/8	3/64	1-1/4	0.150	0.125 – 0.150	81125010000
2 - R	3/16	5/64	1-7/8	0.230	0.200 – 0.225	81125020000
3 - R	1/4	7/64	2	0.315	0.270 – 0.300	81125030000
4 - R	5/16	1/8	2-1/8	0.400	0.340 – 0.370	81125040000
5 - R	7/16	3/16	2-3/4	0.500	0.480 – 0.510	81125050000
6 - R	1/2	7/32	3	0.530	0.540 – 0.575	81125060000
7 - R	5/8	1/4	3-1/4	0.700	0.660 – 0.700	81125070000
8 - R	3/4	5/16	3-1/2	0.790	0.810 – 0.850	81125080000





Tolerances

Tool Diameters	D	d	R max
.010 – 7/64	-0.0007	+ 0.0039	-
1/8 – 7/32	-0.0007	+ 0.0047	-
1/4 – 3/8	-0.0009	+ 0.0059	1.25 R
7/16 – 5/8	-0.0011	n/a	-
3/4 – 1	-0.0013	n/a	-

American Form R Standard Sets

Composition Quantity	5 Pieces 81125000000
1 piece each Radius Type	# 1 - R # 2 - R # 3 - R # 4 - R # 5 - R



Center Drills

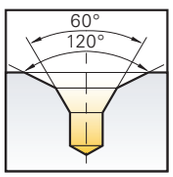
Bell Type, Form B

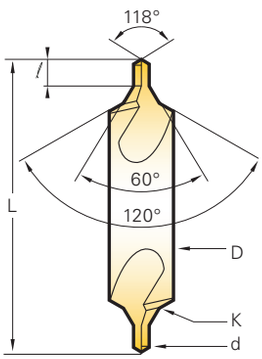
Center drills with protective chamfer guarantee the center obtained from any risk of blows and deformation. The splay resulting from the protective chamfer makes it easier to load parts between points on machines with automatic feed.

Bell Type w/Saved Angle Form B

Size	D	d	K	L	l	HSS M2 135
11	1/8	3/64	0.100	1-1/4	0.055 – 0.070	81135110000
12	3/16	1/16	0.150	1-7/8	0.707 – 0.090	81135120000
13	1/4	3/32	0.200	2	0.110 – 0.135	81135130000
14	5/16	7/64	0.250	2-1/8	0.125 – 0.155	81135140000
15	7/16	5/32	0.350	2-3/4	0.185 – 0.215	81135150000
16	1/2	3/16	0.400	3	0.230 – 0.260	81135160000
17	5/8	7/32	0.500	3-1/4	0.270 – 0.300	81135170000
18	3/4	1/4	0.600	3-1/2	0.310 – 0.340	81135180000
19	7/8	5/16	0.700	3-5/8	0.390 – 0.420	81135190000
20	1	3/8	0.800	3-3/4	0.470 – 0.500	81135200000







Tolerances

Tool Diameters	D	d	Angle 60°	Angle 118°	Angle 120°
.010 – 7/64	-0.0007	+ 0.0039	-	-	-
1/8 – 7/32	-0.0007	+ 0.0047	-	-	-
1/4 – 3/8	-0.0009	+ 0.0059	-30'	± 2°	-4°
7/16 – 5/8	-0.0011	-	-	-	-
3/4 – 1	-0.0013	-	-	-	-

American Standard Form B Sets

Composition Quantity	81135000000
1 piece each Bell Type	# 11 # 12 # 13 # 14 # 15



Unique Center Drills

With Reinforcing Bulge, Form W



Magafor center drill form W is stronger than the common center drill:

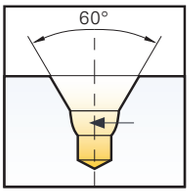
- The bulge reinforces the point
- It increases the chips removal
- It makes the lubrication of the drill easier
- It runs at faster speeds and feeds

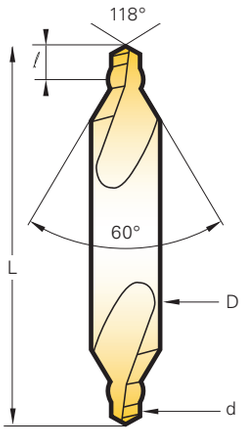
Plain Center Drills w/Bulge Form W

ASA #	D	d	L	/	HSS M2 145
1 - W	1/8	6/64	1-1/4	0.055 – 0.067	81145010000
2 - W	3/16	5/64	1-7/8	0.094 – 0.106	81145020000
3 - W	1/4	7/64	2	0.130 – 0.154	81145030000
4 - W	5/16	1/8	2-1/8	0.150 – 0.175	81145040000
5 - W	7/16	3/16	2-3/4	0.230 – 0.256	81145050000
6 - W	1/2	7/32	3	0.270 – 0.295	81145060000
7 - W	5/8	1/4	3-1/4	0.315 – 0.340	81145070000
8 - W	3/4	5/16	3-1/2	0.390 – 0.420	81145080000

Tolerances

Tool Diameters	D	d	Angle 60°	Angle 118°
.010 – 7/64	-0.0007	+ 0.0039	-	-
1/8 – 7/32	-0.0007	+ 0.0047	-	-
1/4 – 3/8	-0.0009	+ 0.0059	-30'	± 2°
7/16 – 5/8	-0.0011	n/a	-	-
3/4 – 1	-0.0013	n/a	-	-

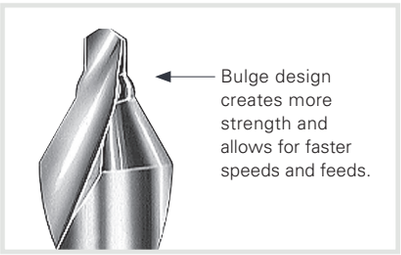




American Standard Form W Sets

Composition Quantity	81145000000
1 piece each Bulge	# 1 - W # 2 - W # 3 - W # 4 - W # 5 - W



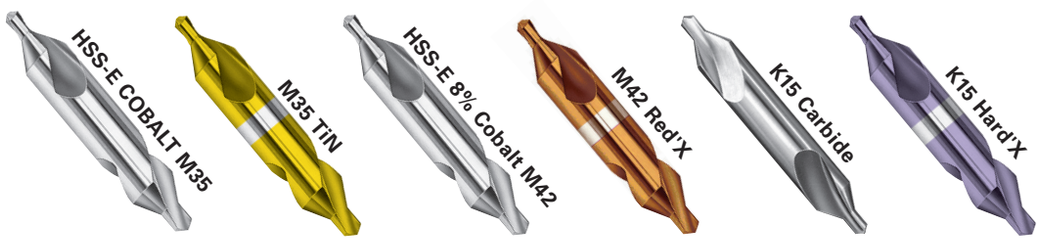


To place an order or to learn more about Pilot Precision Products, contact customer service at 413-350-5200.

Metric Center Drills

Angle 60°

Applications: **Centering**



Plain Center Drills - Angle 60° — ISO - NFE 66051-A - DIN 333-A - JIS-1

D x d	L	/	Cobalt M35 10	HSS-E M35 TiN 0811	HSS-E 8% Cobalt M42 105	M42/Red'X 0910	Carbide 8100	K15/Hard'X 8100-H
3.15 x 0.5*	25	0.6 – 0.9	-	80081103105	-	-	88810003105	888100H031505
3.15 x 0.8*		1.0 – 1.3	-	80081103108	-	-	88810003108	888100H031508
3.15 x 1.0	31	1.3 – 1.7	81100315100	80081103151	81105031510	80091003151	88810003151	888100H03151
3.15 x 1.25		1.6 – 2.0	81100315125	80081103125	81105031512	80091003125	88 810003125	888100H0315125
3.5 x 0.75	35	1.0 – 1.3	81100350750	800811035075	-	-	-	-
4.0 x 1.0		1.3 – 1.7	81100410000	80081104100	-	-	88810004100	888100H04010
4.0 x 1.6		2.0 – 2.6	81100416000	80081104160	81105041600	80091004160	88810004160	888100H0416
5.0 x 1.5	40	2.0 – 2.6	81100515000	80081105150	-	-	88810005150	888100H0515
5.0 x 2.0		2.5 – 3.1	81100520000	80081105200	81105052000	80091005200	88810005200	888100H0520
6.0 x 2.0	45	2.5 – 3.1	81100620000	80081106200	-	-	88810006200	888100H0620
6.3 x 2.5		3.1 – 3.8	81100632500	80081106325	81105063250	80091006325	88810006325	888100H06325
8.0 x 2.5	50	3.1 – 3.8	81100825000	80081108250	-	-	88810008250	888100H0825
8.0 x 3.0		3.9 – 4.6	81100830000	80081108300	-	-	88810008300	888100H0830
8.0 x 3.15		3.9 – 4.6	81100831500	80081108315	81105083150	80091008315	88810008315	888100H08315
10.0 x 3.0	55	3.9 – 4.6	81101030000	80081110300	-	-	88810010300	888100H1030
10.0 x 4.0		5.0 – 5.9	81101040000	80081110400	81105104000	80091010400	88810010400	888100H1040
12.0 x 4.0	63	5.0 – 5.9	81101240000	80081112400	-	-	-	-
12.0 x 5.0		6.3 – 7.2	81101250000	80081112500	-	-	88810012500	888100H1250
12.5 x 5.0		6.3 – 7.2	81101255000	80081112550	81105125500	80091012550	88810012550	888100H1255
14.0 x 5.0	69	6.3 – 7.2	81101450000	80081114550	-	-	-	-
16.0 x 6.3	71	8.0 – 8.9	-	80081116630	-	-	88810016630	888100H1663
20.0 x 8.0	80	10.1 – 11.1	-	80081120800	-	-	-	-

*Single end K15 Carbide — 6.5 – 7% Cobalt (0.006 – 0.008mm grain size)

magafor Since 1937

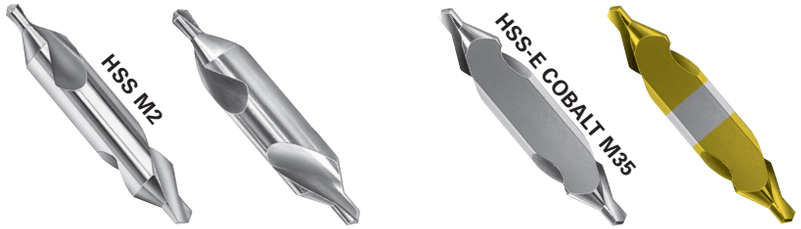
The largest manufacturer of center drills worldwide, with over 4 million units sold annually.

Metric Center Drills

Angle 60°, Form A

Applications: **Centering**

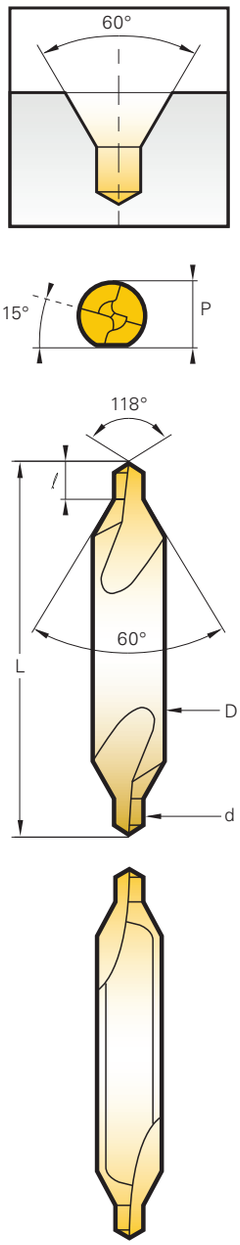
Magafor center drills are particularly effective thanks to their unique ground spiral flutes. Special attention to the concentricity of the drill diameter to body makes them superior to other offerings on the market.



Metric Center Drills Form A - Angle 60°

D x d	L	l	Right Hand HSS M2 11	Left Hand HSS M2 11	P -0.1	With flat, right hand HSS-E M35 Cobalt 0290	With flat, right hand HSS-E M35 TiN 0890
3.0 x 0.5	31	0.6 – 0.9	81110305000	-	-	-	-
3.15 x 0.5*	25	0.6 – 0.9	81110305050	81160315050	-	-	-
3.15 x 0.63*		0.7 – 0.9	81110305063	81160315063			
3.15 x 0.8*		1.0 – 1.3	81110305080	81160315080			
3.15 x 1.0	31	1.3 – 1.7	81110305100	81160315100	-	-	-
3.15 x 1.25		1.6 – 2.0	81110305125	81160315125			
3.5 x 0.75	35	1.0 – 1.3	81110350750	81160350750	-	-	-
4.0 x 1.0		1.3 – 1.7	81110410000	81160410000			
4.0 x 1.25		1.6 – 2.0	81110412500	81160412500			
4.0 x 1.6		2.0 – 2.6	81110416000	81160416000	3.25	80029004160	80089004160
5.0 x 1.5	40	2.0 – 2.6	81110515000	81160515000	-	-	-
5.0 x 1.6		2.0 – 2.6	81110516000	81160516000			
5.0 x 2.0		2.5 – 3.1	81110520000	81160520000	4.20	80029005200	80089005200
6.0 x 2.0	45	2.5 – 3.1	81110620000	81160620000	-	-	-
6.3 x 2.0		2.5 – 3.1	81110632000	81160632000			
6.3 x 2.5		3.1 – 3.8	81110632500	81160632500	5.35	80029006325	80089006325
8.0 x 2.5	50	3.1 – 3.8	81110825000	81160825000	-	-	-
8.0 x 3.0		3.9 – 4.6	81110830000	81160830000			
8.0 x 3.15		3.9 – 4.6	81110831500	81160831500	6.96	80029008315	80089008315
10.0 x 3.0	55	3.9 – 4.6	81111030000	81161030000	-	-	-
10.0 x 3.15		3.9 – 4.6	81111031500	81161031500			
10.0 x 4.0		5.0 – 5.9	81111040000	81161040000	8.40	80029010400	80089010400
12.0 x 4.0	63	5.0 – 5.9	81111240000	81161240000	-	-	-
12.0 x 5.0		6.3 – 7.2	81111250000	81161250000			
12.5 x 4.0		5.0 – 5.9	81111254000	81161254000			
12.5 x 5.0		6.3 – 7.2	81111255000	81161255000	10.95	80029012550	80089012550
14.0 x 5.0	69	6.3 – 7.2	81111450000	81161450000	-	-	-
16.0 x 5.0	71	6.3 – 7.2	81111650000	81161650000	-	-	-
16.0 x 6.3		8.0 – 8.9	81111663000	81161663000	14.00	80029016630	80089016630
18.0 x 6.0	77	8.0 – 8.9	81111860000	-	-	-	-
20.0 x 6.3	80	8.0 – 8.9	81112063000	-	-	-	-
20.0 x 8.0		10.1 – 11.1	81112080000	81162080000	17.90	80029020800	
25.0 x 8.0	100	10.1 – 11.1	81112580000	-	-	-	-
25.0 x 10.0		12.8 – 13.8	81112510000		22.50	80029025100	
31.5 x 10.0	125	12.8 – 13.8	81113151000	-	-	-	-
31.5 x 12.5		16.5 – 17.5	81113151250				

*Single end

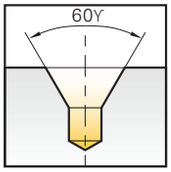


Tolerances

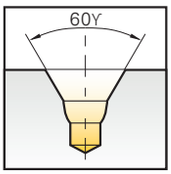
D	d	L	60°	118°
h8	K12	± 1	-30°	± 2°

Performance

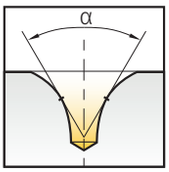
Recommendations for the use of Center Drills and NC Spot Drills



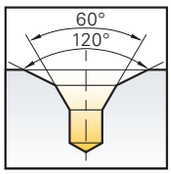
Form A
- The most universal center drill
- 60° angle
- Standard center
- 118° point



Form W
- The bulge reinforces the point
- Increases chip removal
- Makes the lubrication of the drill easier
- 118° point



Form R
- The radius eliminates the risk of breakage, and is more robust than the 60° drill
- Provides an exact bearing surface
- Serves as a protective chamfer
- 118° point



Form B
- Center drill with protective chamfer guarantees the center from any risk of blows and deformation
- 118° point

SFM: Surface Feet per Minute
RPM: Revolutions per Minute
IPT: Inches per Tooth (chip load)
IPM: Inches per Minute
IPR: Inches per Revolution

Speed Formula:
RPM = 3.82 x (SFM ÷ Diameter)

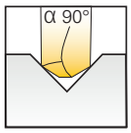
Feed:
IPM = IPT x # of Flutes x RPM
IPR = IPM ÷ RPM
SFM = RPM x Diameter ÷ 3.82

Formula for Speed (RPM)

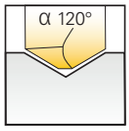
Example:

#1 center drill (.078) cutting soft material <81 HRB

SFM = 148 for 5/64Ø HSS
RPM= 3.82 x (148 ÷ 0.0787) = 14.36
IPM = 0.001 x 2 x 7180 = 14.36
IPR = 14.36 ÷ 7180 = .002



90° NC Spot Drill Centering and chamfering are obtained in a single operation.



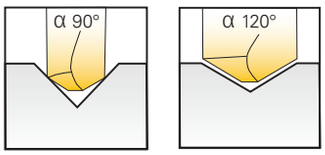
120° & 142° NC Spot Drill The preliminary hole corresponds to the angle at the end of the tool used in drilling and prevents it from deviating.

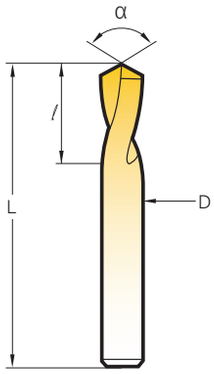
Material		HSS SFM	HSS Feed Inch/Rev 2 mm 5/64	3 mm 1/8	6 mm 1/4	10 mm 3/8	16mm 5/8	TiN SFM	TiN Feed Inch/Rev 2 mm 5/64	3 mm 1/8	6 mm 1/4	10 mm 3/8	16mm 5/8
Steel:	< 81 HRB (B)	99 – 148	0.0020	0.0024	0.0031	0.0059	0.0079	197 – 296	0.0031	0.0035	0.0047	0.0098	0.0118
	< 24 Rc (C)	82 – 99						165 – 230					
	24 – 32 Rc	49 – 82	0.0012	0.0016	0.0024	0.0039	0.0059	115 – 148	0.0020	0.0024	0.0035	0.0055	0.0087
	32 – 41 Rc	33 – 49						82 – 99					
Stainless Steel/Titanium		20 – 33						39 – 53					
Inconel/Nimonic/Waspaloy		16 – 20	0.0008	0.0012	0.0020	0.0028	0.0039	33 – 43	0.0016	0.0020	0.0028	0.0039	0.0059
Brass/Copper		132 – 197	0.0020	0.0028	0.0035	0.0059	0.0079	362 – 428	0.0028	0.0035	0.0055	0.0106	0.0142
Copper Alloys Bronze		99 – 132						263 – 362					
Aluminum		494 – 658	0.0031	0.0039	0.0079	0.0157	0.0197	1,152 – 1,481	0.0047	0.0055	0.0118	0.0217	0.0256
Hardened Aluminum < 6% Si		197 – 329	0.0024	0.0031	0.0039	0.0059	0.0098	395 – 592	0.0031	0.0039	0.0059	0.0118	0.0157
Cast Aluminum > 6% Si		132 – 197						262 – 395					
Thermoplastics		329 – 428	0.0031	0.0035	0.0079	0.0138	0.0157	658 – 855	0.0047	0.0055	0.0118	0.0217	0.0256

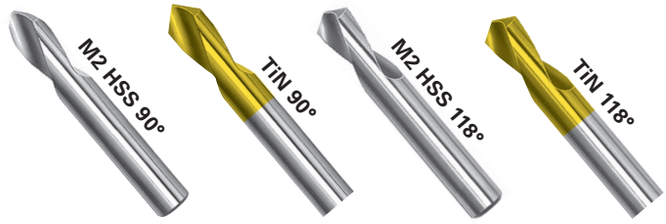
Material		Futura/Red'X SFM	Futura/Red'X Feed Inch/Rev 2 mm 5/64	3 mm 1/8	6 mm 1/4	10 mm 3/8	16mm 5/8	Carbide SFM	Carbide Feed Inch/Rev 2 mm 5/64	3 mm 1/8	6 mm 1/4	10 mm 3/8	16mm 5/8
Steel:	< 81 HRB (B)	296 – 395	0.0039	0.0047	0.0063	0.0118	0.0177	362 – 461	0.0047	0.0055	0.0079	0.0138	0.0217
	< 24 Rc (C)	247 – 329						296 – 362					
	24 – 32 Rc	165 – 214	0.0028	0.0031	0.0047	0.0071	0.0110	197 – 263	0.0035	0.0039	0.0055	0.0087	0.0094
	32 – 41 Rc	99 – 214						115 – 165					
Stainless Steel/Titanium		59 – 79						72 – 99					
Inconel/Nimonic/Waspaloy		49 – 66	0.0020	0.0024	0.0039	0.0055	0.0079	63 – 82	0.0031	0.0028	0.0047	0.0067	0.0094
Brass/Copper		4,218 – 494	0.0039	0.0047	0.0071	0.0142	0.0197	494 – 592	0.0047	0.0055	0.0087	0.0173	0.0240
Copper Alloys Bronze		362 – 428						428 – 949					
Aluminum		1,645 – 2,300	0.0063	0.0071	0.0157	0.0295	0.0354	1,974 – 2,632	0.0039	0.0087	0.0193	0.0354	0.0374
Hardened Aluminum < 6% Si		592 – 823	0.0039	0.0047	0.0071	0.0142	0.0197	658 – 987	0.0047	0.0055	0.0087	0.0173	0.0240
Cast Aluminum > 6% Si		395 – 559						461 – 658					
Thermoplastics		987 – 1316	0.0063	0.0071	0.0157	0.0295	0.0354	1,217 – 1,579	0.0079	0.0087	0.0193	0.0354	0.0374

Short & Long NC Spotting Drills

Angle 90°, 118°, 120°







90-degree angle

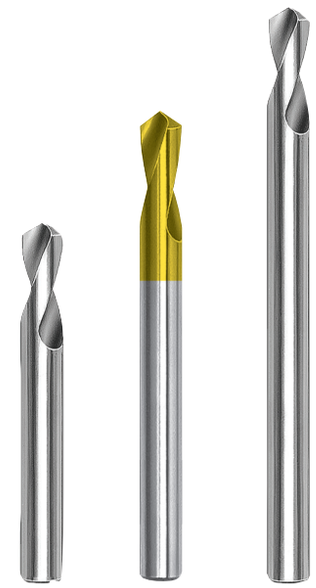
Centering and chamfering are obtained in a single operation.

118- and 120-degree angle

The preliminary hole obtained corresponds to the angle at the end of the tool used in drilling and prevents it from drifting and allowing the drill point to cut first.

M2 HSS & TiN - Short Series

D (inch)	L (inch)	l	T	Angle 90° M2 HSS 8119A	Angle 90° TiN 8008A	Angle 118° M2 HSS 8119B	Angle 118° TiN 8008B
1/8	1-1/4	0.0380	0.012	8119A031700	8008A031700	8119B031700	8008B031700
3/16	1-3/8	0.5000	0.020	8119A047600	8008A047600	8119B047600	8008B047600
1/4	1-1/2	0.6400	0.025	8119A063500	8008A063500	8119B063500	8008B063500
5/16			0.031	8119A079300	8008A079300	8119B079300	8008B079300
3/8	2	1	0.039	8119A095200	8008A095200	8119B095200	8008B095200
7/16			0.043	8119A111100	8008A111100	8119B111100	8008B111100
3/8			0.051	8119A127000	8008A127000	8119B127000	8008B127000
5/8	2-1/4	1-1/8	0.063	8119A158700	8008A158700	8119B158700	8008B158700
3/4			0.075	8119A190500	8008A190500	8119B190500	8008B190500
7/8	2-1/2	1-1/4	0.088	8119A222200	8008A222200	8119B222200	8008B222200
1			0.100	8119A254000	8008A254000	8119B254000	8008B254000



Standard Long Extra Long

M2 HSS & TiN - Long Series

3 different lengths

D (inch)	L (inch)	l	T	Angle 90° M2 HSS 8119C	Angle 90° TiN 8008C	Angle 120° M2 HSS 8119D	Angle 120° TiN 8008D
1/4	2-5/8	0.900	0.025	8119C063500	8008C063500	8119D063500	8008D063500
	4	0.900		8119C063504	8008C063504	8119D063504	8008D063504
	5-1/2	0.87		8119C0635055	8008C063505	8119D063505	8008D063505
3/8	3-1/8	1	0.039	8119C095200	8008C095200	8119D095200	8008D095200
	5			8119C095205	8008C095205	8119D095205	8008D095205
	7			8119C095207	8008C095207	8119D095207	8008D095207
1/2	3-3/4	1-3/8	0.051	8119C127000	8008C127000	8119D127000	8008D127000
	6			8119C127006	8008C127006	8119D127006	8008D127006
	8			8119C127008	8008C127008	8119D127008	8008D127008
5/8	4-1/2	1-3/8	0.063	8119C158700	8008C158700	8119D158700	8008D158700
	8			8119C158708	8008C158708	8119D158708	8008D158708
	9			8119C158709	8008C158709	8119D158709	8008D158709
3/4	5	1-5/8	0.075	8119C190505	8008C190505	8119D190505	8008D190505
	8			8119C190508	8008C190508	8119D190508	8008D190508
	10			8119C190510	8008C190510	8119D190510	8008D190510
1	5-3/8	1-3/4	0.100	8119C254000	8008C254000	8119D254000	8008D254000
	8			8119C254008	8008C254008	8119D254008	8008D254008
	10			8119C254010	8008C254010	8119D254010	8008D254010

Tolerances

Tool Diameters	D (inch)	Angle	L
1/8" – 3/16"	0 – 0.0005	±1°	±0.0395
1/4" – 3/8"	0 – 0.0006		
7/16" – 5/8"	0 – 0.0007		
3/4" – 1"	0 – 0.0008		
1-1/4" – 1-3/4"	0 – 0.0010		

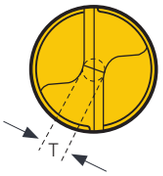


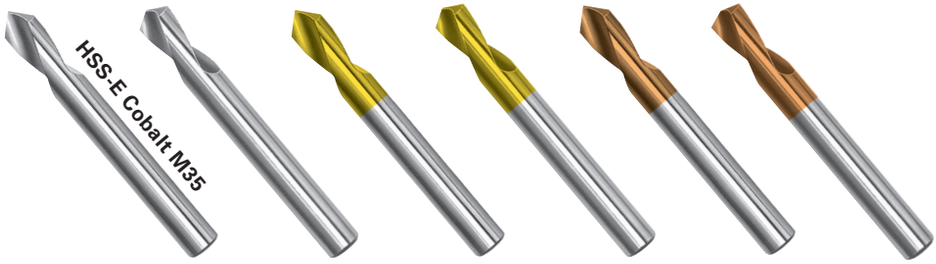
M2 HSS American Standard Spot Drill Value Sets

Composition Quantity	4 Pieces 8119C000004	4 Pieces 8119D000004
1 piece each	1/4 x 2-5/8	1/4 x 2-5/8
	3/8 x 3- 1/8	3/8 x 3-1/8
	1/2 x 3-3/4	1/2 x 3-3/4
	5/8 x 4-1/2	5/8 x 4-1/2

NC Spotting Drills

Angle 60°, 90°, 120°





NC Spotting Drills

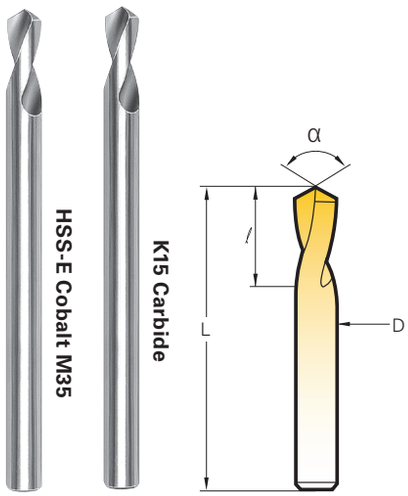
Diameter (inch)	(mm)	L	/	T	Angle 60° Cobalt 191	Angle 90° Cobalt 195	Angle 120° Cobalt 196	Angle 90° M35/TIN 0895	Angle 120° M35/TIN 0896	Angle 90° M35/Red'X 0995*	Angle 120° M35/Red'X 0996*
0.078	2	2	0.315	0.008	-	81195020000	81196020000	80089502000	80089602000	80099502000	80099602000
0.118	3		0.400	0.012	-	81195030000	81196030000	80089503000	80089603000	80099503000	80099603000
1/8			0.400	0.012	-	81195031700	81196031700	80089503170	80089603170	80099503170	80099603170
0.157	4	2-1/16	0.475	0.016	81191040000	81195040000	81196040000	80089504000	80089604000	80099504000	80099604000
3/16		2-3/8	0.600	0.020	-	81195047600	81196047600	80089504760	80089604760	80099504760	80099604760
0.197	5				81191050000	81195050000	81196050000	80089505000	80089605000	80099505000	80099605000
0.236	6	2-5/8	0.800	0.023	81191060000	81195060000	81196060000	80089506000	80089606000	80099506000	80099606000
1/4			0.900	0.025	-	81195063500	81196063000	80089506350	80089606350	80099506350	80099606300
5/16		3-1/8	1	0.031	-	81195079300	-	80089507930	-	-	-
0.315	8				81191080000	81195080000	81196080000	80089508000	80089608000	80099508000	80099608000
3/8		3-1/2	1	0.039	-	81195095200	81196095200	80089509520	80089609520	80099509520	80099609520
0.394	10				81191100000	81195100000	81196100000	80089510000	80089610000	80099510000	80099610000
0.472	12	4	1-1/4	0.047	81191120000	81195120000	81196120000	80089512000	80089612000	80099512000	80099612000
1/2			1-3/8	0.051	-	81195127000	81196127000	80089512700	80089612700	80099512700	80099612700
0.551	14	4-1/2	1-3/8	0.055	-	81195140000	81196140000	80089514000	80089614000	80099514000	80099614000
5/8				0.063	-	81195158700	81196158000	80089515870	80089615800	80099515870	80099615800
0.630	16			0.063	81191160000	81195160000	81196160000	80089516000	80089616000	80099516000	80099616000
0.709	18	5-1/8	1-5/8	0.071	-	81195180000	81196180000	80089518000	80089618000	80099518000	80099618000
3/4				0.075	-	81195127000	81196190500	80089519050	80089619050	80099519050	80099619050
0.787	20			0.079	81191200000	81195190500	81196200000	80089520000	80089620000	80099520000	80099620000
0.984	25	5-3/8	1-3/4	0.098	-	81195250000	81196250000	80089525000	80089625000	80099525000	80099625000
1				0.100	-	81195254000	81196254000	80089525400	80089625400	80099525400	80099625400

*The Spotting Drills (0995 & 0996) with Red'X coating are designed for machining abrasive hard alloys.

NC Spotting Drills - Long

Diameter (inch)	(mm)	L	/	T	Angle 90° Cobalt 197	Angle 120° Cobalt 199	Angle 90° Carbide 8197	Angle 120° Carbide 8199
0.118	3	3-1/8	0.400	0.012	81197030000	81199030000	88819703000	-
0.157	4	4	0.475	0.016	81197040000	81199040000	88819704000	88819904000
0.197	5	4-3/4	0.600	0.020	81197050000	81199050000	88819705000	88819905000
0.236	6	5-1/2	0.800	0.023	81197060000	81199060000	88819706000	88819906000
1/4			0.870	0.025	81197063500	81199063500	88819706350	88819906350
0.315	8		1	0.031	81197080000	81199080000	88819708000	88819908000
3/8		6-3/4	1	0.039	81197095200	81199095200	88819709520	88819909520
0.394	10				81197100000	81199100000	88819710000	88819910000
0.472	12	6-3/4	1-3/16	0.047	81197120000	81199120000	88819712000	88819912000
1/2			1-3/8	0.051	81197127000	81199127000	88819712700	88819912700
5/8		8	1-3/8	0.063	81197158000	81199158000	88819715800	88819915800
0.630	16		1-3/8		81197160000	81199160000	88819716000	88819916000
3/4			1-5/8	0.075	81197190500	81199190500	88819719050	88819919050
0 .787	20		1-5/8	0.079	81197200000	81199200000	88819720000	88819920000
1			1-3/4	0.100	81197254000	81199254000	-	-

Hard'X coatings available with K15 CARBIDE — 6.5 – 7% Cobalt (0,006 – 0,008mm grain size)



Cobalt Spot Drill Value Sets

Composition Quantity	Angle 90° 81195000004	Angle 120° 81196000004
1 piece each	1/4 3/8 1/2 5/8 Ø	1/4 3/8 1/2 5/8 Ø

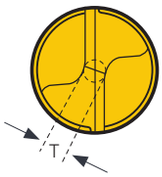
Sets also available TiN and Futura coated



NC Spotting Drills

Angle 90°, 120°, 142°

Hard'X
AlTiN Latuma

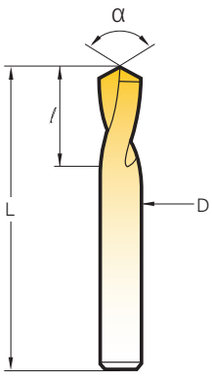


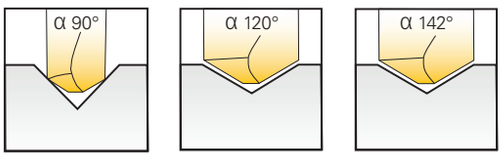


NC Spotting Drills

Diameter (inch)	(mm)	L	/	T*	Angle 90° Carbide 8195	Angle 90° K15/Hard'X 8195-H	Angle 120° Carbide 8196	Angle 120° K15/Hard'X 8196-H	Angle 142° K15/Hard'X 8190-H
0.078	2.0	1-9/16	0.315	0.008	88819502000	888195H0200	88819602000	888196H0200	-
0.118	3.0	1-3/4	0.400	0.012	88819503000	888195H0300	88819603000	888196H0300	-
0.125	3.17	1.969	0.473	0.013	88819503170	888195H0317	-	-	-
0.157	4.0	2	0.475	0.016	88819504000	888195H0400	88819604000	888196H0400	-
0.1875	4.76	1.969	0.591	0.019	88819504760	888195H0476	-	-	-
0.197	5.0	2	0.600	0.020	88819505000	888195H0500	88819605000	888196H0500	-
0.236	6.0		0.700	0.023	88819506000	888195H0600	88819606000	888196H0600	888190H0600
1/4			0.700	0.023	88819506350	888195H0635	88819606350	888196H0635	888190H0635
5/16		2-3/8	0.900	0.031	88819507930	888195H0793	-	-	-
0.315	8.0				88819508000	888195H0800	88819608000	888196H0800	888190H0800
3/8		2-3/4	0.950	0.039	88819509520	888195H0952	88819609520	888196H0952	888190H0952
0.394	10.0			0.039	88819510000	888195H1000	88819610000	888196H1000	888190H1000
0.472	12.0			0.047	88819512000	888195H1200	88819612000	888196H1200	888190H1200
1/2				0.051	88819512700	888195H1270	88819612700	888196H1270	888190H1270
0.551	14.0	3	0.950	0.055	88819514000	888195H1400	88819614000	888196H1400	-
5/8		3-1/8	1	0.063	88819515870	888195H15870	88819615870	888196H1587	888190H1587
0.630	16.0				88819516000	888195H1600	88819616000	888196H1600	888190H1600
0.787	20.0	4	1-3/8	0.079	88819520000	888195H2000	88819620000	888196H2000	-

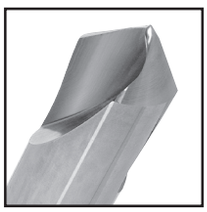
*T = web thickness of split point
†140° angle : for hard alloys and high performance drilling
K15 CARBIDE — 6.5 – 7% Cobalt (0.006 – 0.008mm grain size)





90° NC Spot Drill Centering and chamfering are obtained in a single operation.

120° & 142° NC Spot Drill
The preliminary hole corresponds to the angle at the end of the tool used in drilling and prevents it from deviating

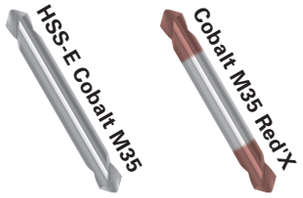


Standard Web Thinning "Split-Point" Feature for High-Speed Cutting

To place an order or to learn more about Pilot Precision Products, contact customer service at 413-350-5200.

DUO-MAG | Double Ended NC Spotting Drills

1 DUO-MAG = 2 Single End NC Spot Drills



Double End NC Spot Drills - Angle 90°

D	d	L	DUO-MAG 019	Red'X 0919
3/16	1/16	2	80019010000	80091901000
1/4	3/32	2	80019020000	80091902000
3/8	9/64	3	80019030000	80091903000
1/2	3/16	4	80019040000	80091904000

Metric Double End NC Spot Drills - Angle 90°

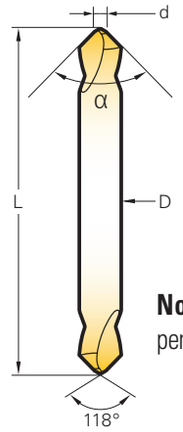
D x d	L	DUO-MAG 019	Red'X 0919
3.0 x 0.5	40	80019030500	80091903050
4.0 x 1.0	45	80019041000	80091904100
6.0 x 2.0	55	80019062000	80091906200
8.0 x 2.5	65	80019082500	80091908250
10.0 x 3.0	75	80019103000	80091910300
12.0 x 3.5	85	80019123500	80091912350
16.0 x 4.0	90	80019164000	80091916400
20.0 x 5.0	100	80019205000	80091920500

Metric Double End Long NC Spot Drills - Angle 90°

D x d	L	DUO-MAG 019L	Red'X 0919L
3.0 x 0.5	100	80019L03050	800919L3050
4.0 x 1.0	100	80019L04100	800919L0410
6.0 x 2.0	100	80019L06200	800919L0620
8.0 x 2.5	100	80019L08250	800919L0825
10.0 x 3.0	100	80019L10300	800919L1030
12.0 x 3.5	100	80019L12350	800919L1235
16.0 x 4.0	150	80019XL1640	800919XL164
20.0 x 5.0	150	80019XL2050	800919XL205

Tolerances

Tool Diameters	D (inch)	Angle	L
0.078 – 0.118	0 + 0.0002"	±1°	±0.0395
1/8 – 0.236	0 + 0.0003"		
1/4 – 0.394	0 + 0.0004"		
0.472 – 1	0 + 0.0005"		

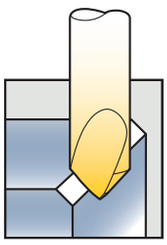


Note: The 118° sharpening angle makes tool penetration easier, while reinforcing the point. (d)

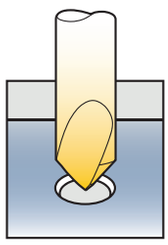


Duo Mag Sets American Standard

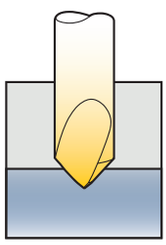
Composition Quantity	4 Pieces Cobalt 8001900004	4 Pieces Red'X 80091900004
1 piece each	3/16" 1/4" 3/8" 1/2"	3/16" 1/4" 3/8" 1/2"



Longitudinal Chamfering



Chamfering

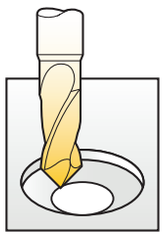


Centering Spotting

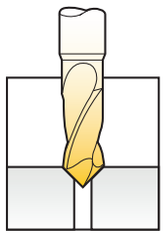
MULTI-V®

1 Multi-V = 10 Operations

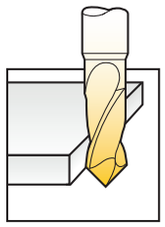




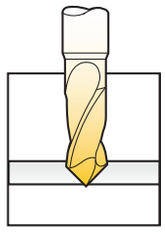
90°-120°
Interpolation Milling



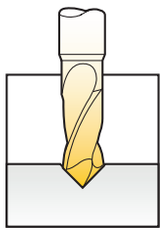
90°-120°
Chamfering



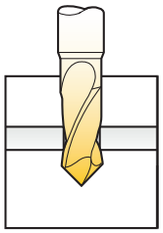
60°-90°-120°
Contouring Side Milling



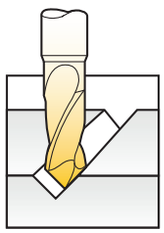
60°-90°-120°
Direct Chamfering



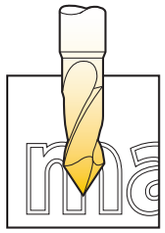
90°-120°
Centering - Spotting



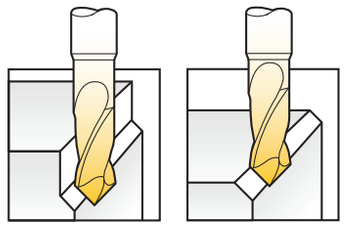
90°-120°
Drilling



90°-120°
V - Grooving



40°-60°-90°
Engraving



60°-90°-120°
Longitudinal Chamfers

This is the ideal tool for machine centers and NC processing machines.

- The Multi-V combines multiple machining process to:
  - reduce machine set-up time
  - reduce operating time
  - reduce overall tool changes.
- Easy storage:
  - fewer tools required.
  - less tool spaces required in magazine
- Improved performances:
  - fine cutting edge with improved depth and surface finish
  - micro grain solid carbide for better wear resistance and greater rigidity
  - 30° spiral helix facilitates better chip removal

Metric Multi-V - Angles 40°, 60°
K15 Carbide — 6.5 – 7% Cobalt (0.006 – 0.008mm grain size)

Diameter						Angle 40°	Angle 60°	
(inch)	(mm)	L	l	d2	T*	Multi-V 8040†	Multi-V 8088†	Hard'X 8088-H†
0.020	0.5	1-1/2	0.040	0.118	0.002	88804000500	88808800500	888088H0050
0.031	0.8	1-1/2	0.063	0.118	0.003	-	88808800800	888088H0080
0.039	1.0	1-1/2	0.080	0.118	0.004	88804001000	88808801000	888088H0100
0.047	1.2	1-1/2	0.095	0.118	0.005	-	88808801200	888088H0120
0.059	1.5	1-1/2	0.120	0.118	0.006	88804001500	88808801500	888088H0150
0.070	1.8	1-1/2	0.142	0.118	0.007	-	88808801800	888088H0180
0.078	2.0	1-1/2	0.160	0.118	0.008	88804002000	88808802000	888088H0200
0.098	2.5	1-1/2	0.195	0.118	0.010	-	88808802500	888088H0250
0.118	2	2	0.240	0.157	0.012	88804003000	88808803000	888088H0300
0.157	4	2	0.315	0.197	0.016	-	88808804000	888088H0400
0.197	5	2	0.395	0.236	0.020	88804005000	88808805000	888088H0500
0.236	6	2-3/8	0.475	0.315	0.023		88808806000	888088H0600
0.315	8	2-3/4	0.630	0.394	0.031		88808808000	888088H0800
0.394	10	2-3/4	0.710	0.472	0.039	-	88808810000	888088H1000
0.472	12	2-3/4	0.790	0.472	0.047		88808812000	888088H1200
0.630	16	3-1/8	1.025	0.630	0.063		88808816000	888088H1600
0.787	20	4	1.260	0.787	0.079		88808820000	888088H2000



K15 Carbide

*T = web thickness of split point
†Angle 40° – 60° : ideal for engraving

MULTI-V®

Multi-Function Tools

1 Multi-V = 10 Operations

Hard'X
AlTiN Latuma

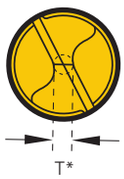
Standard Multi-V - Angle 90°
K15 Carbide — 6.5 – 7% Cobalt (0.006 – 0.008mm grain size)

Diameter (inch)	Diameter (mm)	L	/	d2	T*	Multi-V 8090	Hard'X 8090-H
0.003	0.1	1-1/2	0.008	0.118	0.001	88809000100	888090H0010
0.007	0.2	1-1/2	0.016	0.118	0.001	88809000200	888090H0020
0.011	0.3	1-1/2	0.024	0.118	0.001	88809000300	888090H0030
0.015	0.4	1-1/2	0.032	0.118	0.002	88809000400	888090H0040
0.020	0.5	1-1/2	0.040	0.118	0.002	88809000500	888090H0050
0.024	0.6	1-1/2	0.047	0.118	0.002	88809000600	888090H0060
0.028	0.7	1-1/2	0.055	0.118	0.003	88809000700	888090H0070
0.031	0.8	1-1/2	0.063	0.118	0.003	88809000800	888090H0080
0.035	0.9	1-1/2	0.071	0.118	0.003	88809000900	888090H0090
0.039	1.0	1-1/2	0.080	0.118	0.004	88809001000	888090H0100
0.043	1.1	1-1/2	0.087	0.118	0.004	88809001100	888090H0110
0.047	1.2	1-1/2	0.095	0.118	0.005	88809001200	888090H0120
0.051	1.3	1-1/2	0.102	0.118	0.005	88809001300	888090H0130
0.055	1.4	1-1/2	0.110	0.118	0.006	88809001400	888090H0140
0.059	1.5	1-1/2	0.120	0.118	0.006	88809001500	888090H0150
0.0625	1.58	1- 3/4	0.126	0.125	0.007	88809001580	888090H0158
0.063	1.6	1-1/2	0.125	0.118	0.006	88809001600	888090H0160
0.066	1.7	1-1/2	0.134	0.118	0.007	88809001700	888090H0170
0.071	1.8	1-1/2	0.140	0.118	0.007	88809001800	888090H0180
0.074	1.9	1-1/2	0.145	0.118	0.008	88809001900	888090H0190
0.078	2.0	1-1/2	0.160	0.118	0.008	88809002000	888090H0200
0.082	2.1	1-1/2	0.165	0.118	0.008	88809002100	888090H0210
0.086	2.2	1-1/2	0.173	0.118	0.009	88809002200	888090H0220
0.090	2.3	1-1/2	0.181	0.118	0.009	88809002300	888090H0230
0.094	2.4	1-1/2	0.190	0.118	0.009	88809002400	888090H0240
0.098	2.5	1-1/2	0.195	0.118	0.010	88809002500	888090H0250
0.102	2.6	1-1/2	0.205	0.118	0.010	88809002600	888090H0260
0.118	3.0	2	0.240	0.157	0.012	88809003000	888090H0300
0.125	3.17	2	0.248	0.188	0.013	88809003170	888090H0317
0.157	4.0	2	0.315	0.197	0.016	88809004000	888090H0400
3/16	-	2	0.375	1/4	0.020	88809004760	888090H0476
0.197	5.0	2	0.395	0.236	0.020	88809005000	888090H0500
0.236	6.0	2-3/4	0.475	0.315	0.023	88809006000	888090H0600
1/4	-	2-3/4	0.475	5/16	0.025	88809006350	888090H0635
5/16	-	2-3/4	0.630	3/8	0.031	88809007930	888090H0793
0.315	8.0	2-3/4	0.630	0.394	0.031	88809008000	888090H0800
3/8	-	2-3/4	0.710	1/2	0.039	88809009520	888090H0952
0.394	10.0	2-3/4	0.710	0.472	0.039	88809010000	888090H1000
0.472	12.0	2-3/4	0.790	0.47	0.047	88809012000	888090H1200
1/2	-	2-3/4	0.790	1/2	0.051	88809012700	888090H1270
5/8	-	3-1/8	1.000	5/8	0.063	88809015870	888090H1587
0.630	16.0	3-1/8	1.025	0.630	0.063	88809016000	888090H1600
0.787	20.0	4	1.260	0.787	0.079	88809020000	888090H2000

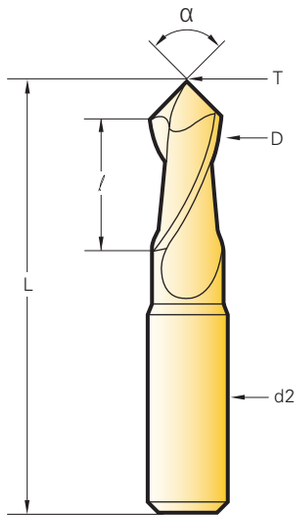
*T = web thickness of split point



K15 Carbide



T*



Tolerances

L	D	α		d2
0.003 – 0.118	-0–0.0010	± 1°	0.118	0 – 0.00020
0.157 – 0.236	-0–0.0012		0.157 – 0.197	1 – 0.00030
0.250 – 0.394	-0–0.0014		0.197 – 0.500	1 – 0.00035
0.472 – 0.630	-.0018–0.0036		0.500 – 0.630	1 – 0.00045
0.787	-.0025–0.0045		0.787	1 – 0.00050

Metric Multi-V - Angle 100°, 120°
K15 Carbide — 6.5 – 7% Cobalt (0.006 – 0.008mm grain size)

Diameter (inch)	Diameter (mm)	L	/	d2	T*	Angle 120° Multi-V 8092	Angle 120° Hard'X 8092-H	Angle 100° Multi-V 8095	Angle 100° Hard'X 8095-H
0.039	1.0	1-1/2	0.080	0.118	0.004	88809201000	888092H0100		
0.059	1.5	1-1/2	0.120	0.118	0.006	88809201500	888092H0150		
0.078	2.0	1-1/2	0.160	0.118	0.008	88809202000	888092H0200		
0.098	2.5	1-1/2	0.195	0.118	0.010	88809202500	888092H0250	-	-
0.118	3.0	2	0.240	0.157	0.012	88809203000	888092H0300		
0.157	4.0	2	0.315	0.197	0.016	88809204000	888092H0400		
0.197	5.0	2	0.395	0.236	0.020	88809205000	888092H0500		
0.236	6.0	2-3/8	0.475	0.315	0.023	88809206000	888092H0600	88809506000	888095H0600
0.315	8.0	2-3/4	0.630	0.394	0.031	88809208000	888092H0800	88809508000	888095H0800
0.394	10.0	2-3/4	0.710	0.472	0.039	88809210000	888092H1000	88809510000	888095H1000
0.472	12.0	2-3/4	0.790	0.472	0.047	88809212000	888092H1200	88809512000	888095H1200
0.630	16.0	2-1/8	1.025	0.630	0.063	88809216000	888092H1600	88809516000	888095H1600
0.787	20.0	4	1.260	0.787	0.079	88809220000	888092H2000	-	-

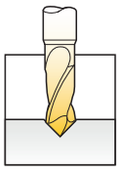
*T = web thickness of split point



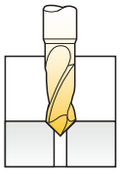
K15 Carbide

MULTI-V®

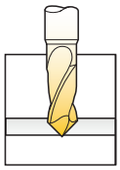
Performance Recommendations



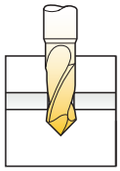
90°-120°
Centering - Spotting



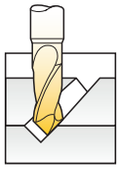
90°-120°
Chamfering



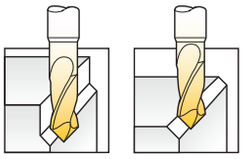
60°-90°-120°
Direct Chamfering



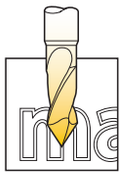
90°-120°
Drilling



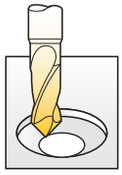
90°-120°
V - Grooving



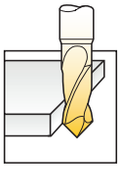
60°-90°-120°
Longitudinal Chamfers



40°-60°
Engraving



90°-120°
Interpolation Milling



60°-90°-120°
Contouring Side Milling

Performance Recommendations for Use

Material	SFM		Diameter 3mm – 3/16"	Diameter 5mm – 1/4"	Diameter 10mm – 5/16"	Feed inches/rev. 12mm – 1/2"	Feed inches/rev. 16mm – 5/8"	Feed inches/rev. 20mm
Steel < 81 HRB (B)	230 – 247	RPM	6400	4000	2500	1900	1500	1300
		IPM	12.6	12.6	13.8	14.2	14.2	14.3
		inch/tooth	0.002	0.0031	0.0055	0.0075	0.0094	0.0110
Steel < 24 Rc (C)	132 – 197	RPM	4000	2600	1600	1200	900	850
		IPM	7.9	8.2	8.8	9.4	8.9	9.4
		inch/tooth	0.002	0.0031	0.0055	0.0075	0.0094	0.0110
Steels 24 – 32 RC Cast Iron < 180 HB (Grey Cast Iron)	115 – 132	RPM	3200	2200	1400	1000	850	680
		IPM	5.7	6.1	6.6	7.1	7.4	7.5
		inch/tooth	0.0018	0.0028	0.0047	0.0071	0.0087	0.0110
Steels 32 – 41 RC Cst Iron > 180 HB Stainless Steels	99 – 115	RPM	2800	1800	1100	800	650	550
		IPM	5.0	5.0	5.2	5.4	5.6	5.6
		inch/tooth	0.0018	0.0028	0.0047	0.0067	0.0087	0.0102
Titanium Alloys	82 – 99	RPM	2200	1600	900	660	500	480
		IPM	3.5	3.8	3.9	4.1	4.3	4.7
		inch/tooth	0.0016	0.0024	0.0043	0.0063	0.0087	0.0098
Ni Co Alloys Inconel - Nimionic - Waspaloy	66	RPM	1800	1100	700	500	400	320
		IPM	2.8	2.6	3.0	3.1	3.1	3.1
		inch/tooth	0.0016	0.0024	0.0043	0.0063	0.0079	0.0098
Copper Alloys Bronze	165 – 395	RPM	5000	3500	2200	1900	1700	1400
		IPM	19.7	20.7	21.7	22.4	23.4	24.8
		inch/tooth	0.0039	0.0059	0.0098	0.0118	0.0138	.0177
Aluminum	494	RPM	10000	6300	4000	3200	2500	2000
		IPM	19.7	22.3	23.6	25.2	26.6	27.6
		inch/tooth	0.0020	0.0035	0.0059	0.0079	0.0106	0.0138
Thermoplastics	494	RPM	7300	4600	2800	2900	2300	1900
		IPM	14.4	16.3	20.9	22.8	24.4	26.2
		inch/tooth	0.002	0.0035	0.0075	0.0079	0.0106	0.0138

Material	SFM		Diameter 3mm – 3/16"	Diameter 5mm – 1/4"	Diameter 10mm – 5/16"	Feed inches/rev. 12mm – 1/2"	Feed inches/rev. 16mm – 5/8"	Feed inches/rev. 20mm
Steel < 81 HRB (B)	230 – 247	RPM	6800	4300	2650	2000	1500	1200
		IPM	2.6	2.6	2.8	3.0	3.0	3.0
		inch/tooth	0.0002	0.0003	0.0006	0.0007	0.0010	0.0012
Steel < 24 Rc (C)	132 – 197	RPM	5400	3500	2100	1600	1200	1000
		IPM	2.2	2.2	2.3	2.4	2.4	2.4
		inch/tooth	0.0002	0.0003	0.0006	0.0007	0.0010	0.0012
Steels 24 – 32 RC Cast Iron < 180 HB (Grey Cast Iron)	115 – 132	RPM	3600	2300	1400	1000	800	630
		IPM	1.1	1.1	1.3	1.4	1.4	1.4
		inch/tooth	0.0002	0.0002	0.0005	0.0007	0.0008	0.0011
Steels 32 – 41 RC Cst Iron > 180 HB Stainless Steels	99 – 115	RPM	3000	2000	1200	900	700	550
		IPM	1.0	1.0	1.2	1.2	1.2	1.2
		inch/tooth	0.0002	0.0002	0.0005	0.0006	0.0008	0.0011
Titanium Alloys	82 – 99	RPM	2200	1600	1000	760	600	400
		IPM	0.7	0.8	0.8	0.8	0.9	0.9
		inch/tooth	0.0002	0.0002	0.0004	0.0005	0.0007	0.0011
Ni Co Alloys Inconel - Nimionic - Waspaloy	66	RPM	1800	1100	700	500	400	320
		IPM	0.4	0.5	0.6	0.6	0.6	0.6
		inch/tooth	0.0001	0.0002	0.0004	0.0005	0.0007	0.0010
Copper Alloys Bronze	165 – 395	RPM	7000	6000	3500	3200	2200	1750
		IPM	4.4	4.7	4.7	5.0	5.2	5.5
		inch/tooth	0.0003	0.0004	0.0007	0.0008	0.0012	0.0016
Aluminum	494	RPM	13000	8600	5300	4000	3000	2400
		IPM	7.9	8.7	9.4	9.4	9.8	9.8
		inch/tooth	0.0003	0.0005	0.0009	0.0012	0.0017	0.0020
Thermoplastics	494	RPM	13000	8600	5300	4000	3000	2400
		IPM	10.2	10.2	10.4	10.6	10.6	10.6
		inch/tooth	0.0004	0.0006	0.0010	0.0013	0.0018	0.0022

Material	SFM		Diameter 3mm – 3/16"	Diameter 5mm – 1/4"	Diameter 10mm – 5/16"	Feed inches/rev. 12mm – 1/2"	Feed inches/rev. 16mm – 5/8"	Feed inches/rev. 20mm
Steel < 81 HRB (B)	230 – 247	RPM	6800	4300	2650	2000	1500	1200
		IPM	4.3	4.7	5.1	5.9	6.1	6.1
		inch/tooth	0.003	0.0006	0.0010	0.0016	0.0020	0.0026
Steel < 24 Rc (C)	132 – 197	RPM	5400	3500	2100	1600	1200	1000
		IPM	3.3	3.5	4.1	4.7	4.9	4.9
		inch/tooth	0.0003	0.0005	0.0010	0.0016	0.0020	0.0024
Steels 24 – 32 RC Cast Iron < 180 HB (Grey Cast Iron)	115 – 132	RPM	3600	2300	1400	1000	800	630
		IPM	2.3	2.4	2.8	3.1	3.1	3.1
		inch/tooth	0.0003	0.0005	0.0010	0.0016	0.0020	0.0024
Steels 32 – 41 RC Cst Iron > 180 HB Stainless Steels	99 – 115	RPM	3000	2000	1200	900	700	550
		IPM	1.8	2.0	2.4	2.6	2.6	2.6
		inch/tooth	0.0003	0.0005	0.0010	0.0014	0.0020	0.0024
Titanium Alloys	82 – 99	RPM	2200	1600	1000	760	600	400
		IPM	1.4	1.6	2.0	2.2	2.2	2.2
		inch/tooth	0.0003	0.0005	0.0010	0.0014	0.0018	0.0028
Ni Co Alloys Inconel - Nimionic - Waspaloy	66	RPM	1800	1100	700	500	400	320
		IPM	1.0	1.0	1.4	1.4	1.6	1.6
		inch/tooth	0.0003	0.0004	0.0010	0.0014	0.0020	0.0024
Copper Alloys Bronze	165 – 395	RPM	10000	7000	3600	2500	2300	1800
		IPM	7.9	8.3	8.5	8.9	9.1	9.2
		inch/tooth	0.0004	0.0006	0.0012	0.0018	0.0020	0.0026
Aluminum	494	RPM	13000	8600	5300	4000	3000	2400
		IPM	8.3	8.9	12.6	14.2	11.8	12.2
		inch/tooth	0.0003	0.0005	0.0012	0.0018	0.0020	0.0026
Thermoplastics	494	RPM	13000	8600	5300	4000	3000	2400
		IPM	12.2	10.2	14.6	15.7	12.6	13.0
		inch/tooth	0.0005	0.0006	0.0014	0.0020	0.0020	0.0028

Bi-face

Biconical Cutters

Applications: **Front and Back Chamfering**

Hard'X
AlTiN Latuma

Bi-Face Advantages

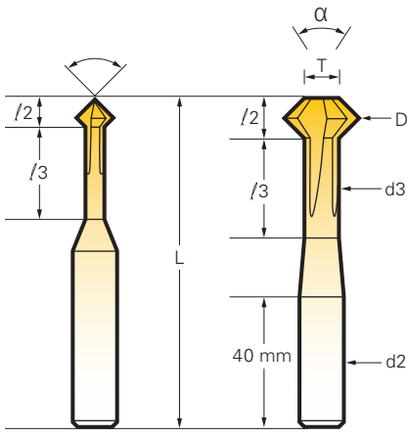
Special design = positive cut + relieving profile

- Unequalled surface finish
- Impressive performance
- Extended tool profile life

*For super finish operations, **Bi-face** has a constant relieved profile. Longitudinal or interpolated work for front and back chamfering of edges and holes.*



K15 Carbide

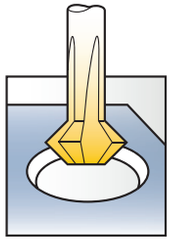


Mini Standard

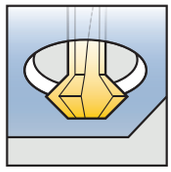
Tolerances			
D	Tolerance	L	α
Ø .040 ~ 0.197	0 – 0.002	± 0.040	± 1°
Ø .236 ~ 0.630	0 – 0.004	± 0.040	± 1°

Mini - Angle 90°
3 Flutes

Diameter (inch)	Diameter (mm)	d2	d3 max	T max	L min	/ 2	/ 3	Bi-face 8480	Hard'X 8480-H
0.040	1.0	0.118	0.028	0.012	2-3/8	0.020	0.197	88848001000	888480H0100
0.059	1.5		0.043	0.018		0.029	0.236	88848001500	888480H0150
0.079	2.0		0.059	0.024		0.037	0.315	88848002000	888480H0200
0.118	3.0		0.087	0.035		0.059	0.394	88848003000	888480H0300



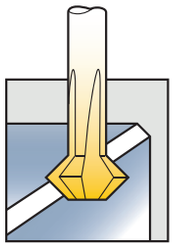
Front Chamfering



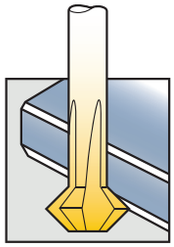
Back Chamfering

Standard - Angle 90°
4 Flutes

Diameter (inch)	Diameter (mm)	d2	d3 max	T max	L min	/ 2	/ 3	Bi-face 8490	Hard'X 8490-H
0.118	3.0	0.236	0.087	0.047	4	0.051	0.394	88849003000	888490H0300
0.157	4.0		0.114	0.063		0.069	0.472	88849004000	888490H0400
0.197	5.0		0.134	0.079		0.091	0.591	88849005000	888490H0500
0.236	6.0		0.154	0.094		0.114	0.709	88849006000	888490H0600
0.315	8.0		0.193	0.193		0.118	1.339	88849008000	888490H0800
0.394	10.0		0.232	0.232		0.157		88849010000	888490H1000
0.472	12.0		0.232	0.232		0.236		88849012000	888490H1200
0.630	16.0	0.394	0.311	0.311		0.315		88849016000	888490H1600



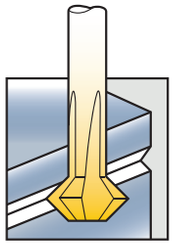
Top Chamfering



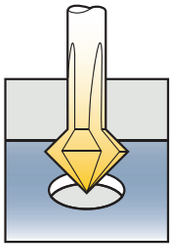
Bottom Chamfering

Standard - Angle 60°
4 Flutes

Diameter (inch)	mm	d2	d3 max	T max	L min	/ 2	/ 3	Bi-face 8460	Hard'X 8460-H
0.197	5.0	0.236	0.134	0.134	4	0.110	1.339	88846005000	888460H0500
0.315	8.0	0.236	0.193	0.232		0.213		88846008000	888460H0800
0.472	12.0	0.394	0.232	0.232		0.413		88846012000	888460H1200



V-Grooving



Deburring

See contouring section on page 85 for Bi-Face performance parameters.

Bi-face | Single Flute Interpolated Thread Milling Cutters | Angle 60°

Thread Milling Cutters - Angle 60°
3 Flutes

Screw Diameter	D (mm)	d2	d1	L	l	Hard'X 845-H
M0.8	0.57	3	0.27	39	2.4	88845MH0080
M0.9	0.64		0.31		2.7	88845MH0090
M1.0	0.71		0.35		3.0	88845MH0100
M1.2	0.91		0.55		3.6	88845MH0120
M1.4	1.06		0.62		4.2	88845MH0140
M1.6	1.2		0.69		4.8	88845MH0160
M1.8	1.35		0.84		5.5	88845MH0180
M2.0	1.5		0.92		6	88845MH0200
M2.5	1.9		1.27		7	88845MH0250
M3	2.3		1.57	66	9	88845MH0300
M4	3.1	6	2.09		12	88845MH0400
M5	4.0		2.90		15	88845MH0500
M6	4.8		3.47	75	18	88845MH0600
M8	6.5	8	4.85	80	22	88845MH0800
M10	7.9		5.95		26	88845MH1000



K15 Carbide

The same tool will achieve different pitches (right or left hand), in blind or thru holes.

NEW for 2020

Multi-Function Carbide Miniature Tools

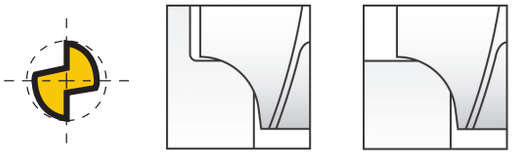
Applications: **Corner Rounding End-Mills**

Hard'X
AlTiN Latuma

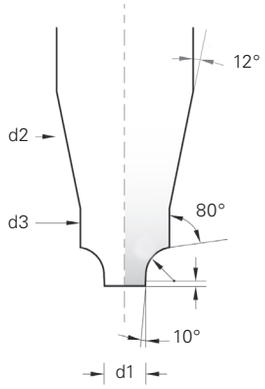


K15 Carbide

These cutters are designed for CNC machines and allow machining of even very thin materials and easy regrinds.



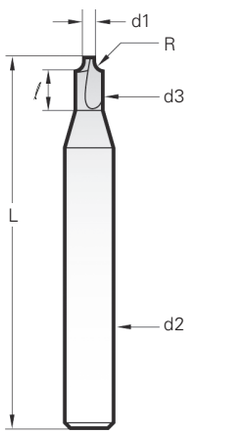
The radius is positioned in relation to the small Ø d1-, making it possible to machine compound forms, small slots and holes from 0.5mm.



Miniature

Radius (inch)	Radius (mm)	d1	d2	d3	Δx	l	L	Carbide 8550	Hard'X 8550-H
0.0039	0.10	0.020	0.118	0.031	0.35	0.098	2	88855000100	888550H0010
0.0059	0.15			0.035	0.40	0.098		88855000150	888550H0015
0.0079	0.20			0.040	0.45	0.098		88855000200	888550H0020
0.0098	0.25			0.040	0.50	0.098		88855000250	888550H0025
0.0118	0.30			0.047	0.55	0.098		88855000300	888550H0030
0.0157	0.40			0.055	0.65	0.098		88855000400	888550H0040
0.0197	0.50			0.063	0.75	0.098		88855000500	888550H0050
0.0236	0.60			0.071	0.85	0.118		88855000600	888550H0060
0.0276	0.70			0.083	0.95	0.118		88855000700	888550H0070
0.0295	0.75			0.083	1.00	0.118		88855000750	888550H0075
0.0315	0.80	0.031		0.098	1.20	0.157		88855000800	888550H0080
0.0354	0.90			0.114	1.30	0.157		88855000900	888550H0090
0.0394	1.00			0.114	1.40	0.157		88855001000	888550H0100
0.0492	1.25		0.157	0.134	1.65	0.157		88855001250	888550H0125
0.0591	1.50	0.059	0.197	0.180	2.25	0.236		88855001500	888550H0150
0.0689	1.75		0.236	0.220	2.50	0.236		88855001750	888550H0175
0.0787	2.00		0.236	0.220	2.75	0.315		88855002000	888550H0200
0.0886	2.25		0.315	0.260	3.00	0.394		88855002250	888550H0225
0.0984	2.50		0.315	0.260	3.25	0.394		88855002500	888550H0250
0.1181	3.00		0.315	0.299	3.75	0.394		88855003000	888550H0300
0.1575	4.00	0.075	0.394	0.394	4.95	-	2-3/16	88855004000	888550H0400
0.1969	5.00	0.075	0.472	0.472	5.95	-	2-1/2	88855005000	888550H0500

Coating is available



Tolerances

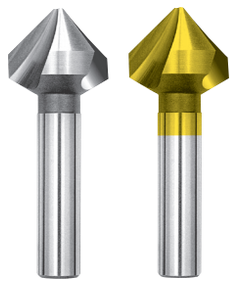
R	d1	d2	L
± .0008	± .00039	h6	± .0040

TRI-DENT

Hand Countersinks

Three Flute Countersinks

Angle	Diameter (inch)	Diameter (mm)	Capacity min/max	d	L	Cobalt	Angle	M35/TiN
	0.248	6.30	0.079 – 0.248	0.197	2	84439063000		84483906300
30°	0.488	12.40	0.012 – 0.488	0.315	2-1/2	84439124000	30°	84483912400
439	0.650	16.50	0.157 – 0.650	0.394	3	84439165000	4839	84483916500
	0.984	25.00	0.236 – 0.984	0.394	3-1/2	84439250000		84483925000
	0.248	6.30	0.051 – 0.248	0.197	1-7/8	84432063000		84483206300
	0.327	8.30	0.071 – 0.327	0.236	2	84432083000		84483208300
	0.410	10.40	0.091 – 0.410	0.236	2	84432104000		84483210400
60°	0.488	12.40	0.098 – 0.488	0.315	2-3/8	84432124000	60°	84483212400
432	0.650	16.50	0.110 – 0.650	0.394	2-1/2	84432165000	4832	84483216500
	0.807	20.50	0.118 – 0.807	0.940	2-3/4	84432205000		84483220500
	0.984	25.00	0.126 – 0.984	0.394	3	84432250000		84832250000
	1.220	31.00	0.138 – 1.22	0.472	3-1/8	84432310000		84483231000
	0.248	6.30	0.051 – 0.248	0.197	1-3/4	84434063000		84483406300
	1/4	6.35	0.051 – 0.250	1/4	1-3/4	84434063500		84483406350
	5/16	7.94	0.070 – 0.312	1/4	1-3/4	84434079300		84483407930
	0.327	8.30	0.070 – 0.327	0.236	2	84434083000		84483408300
	3/8	9.52	0.085 – 0.375	1/4	2	84434095200		84483409520
	0.410	10.40	0.087 – 0.410	0.236	2	84434104000		84483410400
	0.488	12.40	0.098 – 0.488	0.315	2-1/4	84434124000		84483412400
82°	1/2	12.70	0.100 – 0.500	1/4	2	84434127000	82°	84483412700
434	5/8	15.87	0.110 – 0.625	3/8	2-3/8	84434158700	4834	84483415870
	0.650	16.50	0.110 – 0.650	0.394	2.3/8	84434165000		84483416500
	3/4	19.05	0.120 – 0.750	3/8	2-3/8	84434190500		84483419050
	0.807	20.50	0.118 – 0.807	0.394	2-1/2	84434205000		84483420500
	0.984	25.00	0.126 – 0.984	0.394	2-11/16	84434250000		84483425000
	1.000	25.40	0.125 – 1.000	3/8	2-3/4	84434254000		84483425400
	1.220	31.00	0.138 – 1.220	0.472	2-7/8	84434310000		84483431000
	0.248	6.30	0.051 – 0.248	0.197	1-3/4	84435063000		84483506300
	0.327	8.30	0.070 – 0.327	0.236	2	84435083000		84483508300
	0.410	10.40	0.087 – 0.410	0.236	2	84435104000		84483510400
100°	0.488	12.40	0.098 – 0.488	0.315	2-3/16	84435124000	100°	84483512400
435	0.650	16.50	0.110 – 0.650	0.394	2-5/16	84435165000	4835	84483516500
	0.807	20.50	0.118 – 0.807	0.394	2-7/16	84435205000		84483520500
	0.984	25.00	0.126 – 0.984	0.394	2-1/2	84435250000		84483525000
	1.220	31.00	0.138 – 1.220	0.472	2-11/16	84435310000		84483531000
	0.248	6.30	0.051 – 0.248	0.197	1-3/4	84433063000		84483306300
	0.327	8.30	0.070 – 0.327	0.236	2	84433083000		84483308300
	0.410	10.40	0.087 – 0.410	0.236	2	84433104000		84483310400
120°	0.488	12.40	0.098 – 0.488	0.315	2-1/8	84433124000	120°	84483312400
433	0.650	16.50	0.110 – 0.650	0.394	2-1/4	84433165000	4833	84483316500
	0.807	20.50	0.118 – 0.807	0.394	2-5/16	84433205000		84483320500
	0.984	25.00	0.126 – 0.984	0.394	2-1/2	84433250000		84483325000
	1.220	31.00	0.138 – 1.220	0.472	2-1/2	84433310000		84483331000



HSS-E Cobalt M35







Hand Countersinks - HSS-E Colbalt M35

Diameter (inch)	Diameter (mm)	Capacity min/max	Angle 82° Cobalt 438	Angle 90° Cobalt 430
0.488	12.4	0.118 – 0.488	84438124000	84430124000
0.650	16.5	0.157 – 0.650	84438165000	84430165000
0.807	20.5	0.157 – 0.807	84438205000	84430205000
0.984	25.0	0.197 – 0.984	84438250000	84430250000
1.220	31.0	0.197 – 1.220	84438310000	84430310000

Universal Auto-Lock Chuck

Handle	Capacity min/max	EDP No.
Ergonomic	3/64 – 8mm	84400200000
Large	3/64 – 1/2"	84400100000

To hold any straight shank tool, for use by hand.

3 Flute Countersink Sets

Angle	Cobalt	Composition (mm)
60°	84432000000	10.4 16.5 20.5 25 31
	84432000000 TiN	
82°	84434000000	
	84434000000 TiN	
100°	84435000000	
120°	84433000000	

TRI-DENT | 60° and 82° Three Flute Countersinks

Applications: **Countersinking and Chamfering**



Three Flute Countersinks - Angle 60° DIN 334-C				
D (mm)	**d1 max**	**d2**	**L**	**Magaforce 8432**
6.3	1.5	5	47	88843206300
8.3	2.0	6	52	88843208300
10.4	2.5	6	53	88843210400
12.4	2.8	8*	60	88843212400
16.5	3.2	10*	65	88843216500
20.5	3.5	10*	69	88843220500
25.0	3.8	10*	75	88843225000
31.0	4.2	12*	81	88843231000

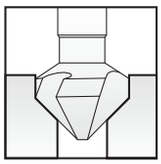
*3 flatted shanks = effective holding

Three Flute Countersinks - Angle 82° DIN 334-C				
D (mm)	**d1 max**	**d2**	**L**	**Magaforce 8434**
10.4	2.5	6	50	88843410400
12.4	2.8	8*	56	88843412400
16.5	3.2	10*	61	88843416500
20.5	3.5	10*	64	88843420500
25.0	3.8	10*	68	88843425000

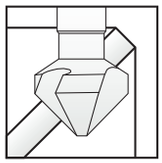
*3 flatted shanks = effective holding

Tolerances			
D	**Angle**	**d**	**L**
z 9	- 1°	h9	± 1mm

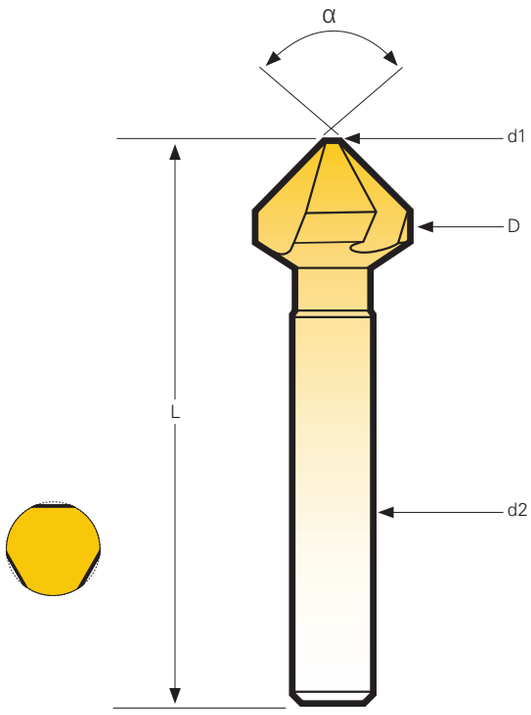
Carbide = hardness 1800 HV to machine steels over 1300 N/mm^2, treated steels up to 60 HRC, abrasive tough steels, stainless steels, titanium alloys, hard bronze, inconel, nimonic, waspaloy, hard cast irons and all other metals, thermoplastics, nylon, PVC, laminated, graphite, reinforced polymer with glass or carbon fibers and ceramic glass.



Countersink



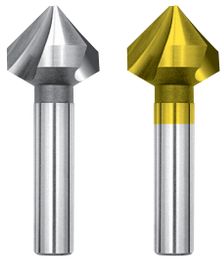
Chamfer



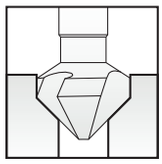
TRI-DENT

90° Three Flute Countersinks

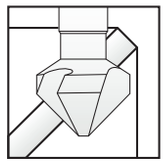
Applications: **Countersinking and Chamfering**



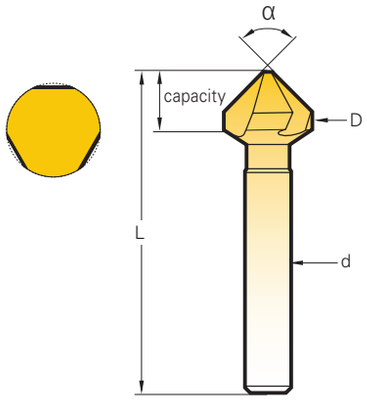
HSS-E Cobalt M35



Countersink



Chamfer



Three Flute Countersinks - Angle 90°

Diameter (inch)	Diameter (mm)	Capacity min/max	d	L	Cobalt 431	M35/TiN 4831
0.158	4.00	0.051 – 0.158	0.158	1-5/8	84431040000	84483104000
0.170	4.30	0.051 – 0.170	0.158	1-5/8	84431043000	84483104300
0.197	5.00	0.051 – 0.197	0.158	1-5/8	84431050000	84483105000
0.209	5.30	0.051 – 0.209	0.197	1-3/4	84431053000	84483105300
0.229	5.80	0.051 – 0.229	0.197	1-3/4	84431058000	84483105800
0.236	6.00	0.051 – 0.236	0.197	1-3/4	84431060000	84483106000
0.248	6.30	0.051 – 0.248	0.197	1-3/4	84431063000	84483106300
1/4	6.35	0.050 – 0.250	1/4	1-3/4	84431063500	84483106350
0.276	7.00	0.063 – 0.279	0.236	2	84431070000	84483107000
0.288	7.30	0.063 – 0.288	0.236	2	84431073000	84483107300
5/16	7.94	0.070 – 0.312	1/4	1-3/4	84431079300	84483107930
0.315	8.00	0.017 – 0.315	0.236	2	84431080000	84483108000
0.327	8.30	0.071 – 0.327	0.236	2	84431083000	84483108300
0.354	9.00	0.079 – 0.354	0.236	2	84431090000	84483109000
0.370	9.40	0.079 – 0.370	0.236	2	84431094000	84483109400
3/8	9.52	0.085 – 0.375	1/4	3	84431095200	84483109520
0.394	10.00	0.087 – 0.394	0.236	4	84431104000	84483110000
0.410	10.40	0.087 – 0.410	0.236	5	84431115000	84483110400
0.453	11.50	0.098 – 0.453	0.315	2-1/4	84431115000	84483111500
0.472	12.00	0.098 – 0.472	0.315	2-1/4	84431120000	84483112000
0.488	12.40	0.098 – 0.488	0.315	2-1/4	84431124000	84483112400
1/2	12.70	0.100 – 0.500	1/4	2	84431127000	84483112700
0.528	13.40	0.098 – 0.528	0.315	2-1/4	84431134000	84483113400
0.567	14.40	0.098 – 0.567	0.315	2-1/4	84431144000	84483114400
0.590	15.00	0.110 – 0.590	0.394	2-3/8	84431150000	84483115000
5/8	15.87	0.110 – 0.625	3/8	2-3/8	84431158700	84483115870
0.650	16.50	0.110 – 0.650	0.394	2-3/8	84431165000	84483116500
0.748	19.00	0.118 – 0.748	0.394	2-1/2	84431190000	84483119000
3/4	19.05	0.120 – 0.750	3/8	2-3/8	84431190500	84483119050
0.807	20.50	0.118 – 0.807	0.394	2-1/2	84431205000	84483120500
0.906	23.00	0.126 – 0.906	0.394	2-5/8	84431230000	84483123000
0.984	25.00	0.126 – 0.984	0.394	2-5/8	84431250000	84483125000
1.000	25.40	0.125 – 1.00	3/8	2-3/4	84431254000	84483125400
1.024	26.00	0.126 – 1.024	0.394	2-5/8	84431260000	84483126000
1.102	28.00	0.138 – 1.102	0.472	2-3/4	84431280000	84483128000
1.181	30.00	0.138 – 1.181	0.472	2-3/4	84431300000	84483130000
1.220	31.00	0.138 – 1.220	0.472	2-3/4	84431310000	84483131000

Tolerances

D	Angle	d	L
± .05	- 1°	h6	± 1mm

Countersinks with 3 Flatted Shanks* - Angle 90°

Diameter (inch)	Diameter (mm)	Capacity min/max	d	L	Cobalt 437	M35/TiN 4837
0.488	12.4	0.098 – 0.488	0.315	2 - 1/4	84437124000	84483712400
0.597	14.4	0.098 – 0.597	0.315	2 - 1/4	84437144000	84483714400
0.650	16.5	0.110 – 0.650	0.394	2 - 3/8	84437165000	84483716500
0.807	20.5	0.118 – 0.807	0.394	2 - 1/2	84437205000	84483720500
0.984	25.0	0.126 – 0.984	0.394	2 - 5/8	84437250000	84483725000
1.220	31.0	0.138 – 1.220	0.472	2 - 3/4	84437310000	84483731000
1.339	34.0	0.177 – 1.339	0.630	4	84437340000	84483734000
1.378	35.0	0.177 – 1.378	0.630	4	84437350000	84483735000
1.457	37.0	0.177 – 1.457	0.630	4 - 5/8	84437370000	84483737000
1.575	40.0	0.177 – 1.575	0.630	4 - 5/8	84437400000	84483740000
1.969	50.0	0.197 – 1.969	0.630	5	84437500000	84483750000
2.480	63.0	0.394 – 2.480	0.630	5 - 1/2	84437630000	84483763000
3.150	80.0	0.551 – 3.150	0.630	6 - 1/2	84437800000	84483780000

This highly productive countersinking cutter is a much-improved version of the traditional multiflute milling cutter. It offers the following benefits:

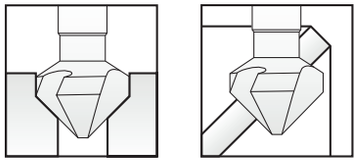
- Grooves opened wide to allow for greater chip removal
- High positive cut
- Constant profile relief (for many regrinds)
- Self-centering countersink
- Work without vibration

Tool dimensions are adapted to countersink the 82° and 90° caps crews. Lubrication is recommended.

TRI-DENT | 90° Three Flute Countersinks Anti-Vibration

Applications: **Countersinking and Chamfering**



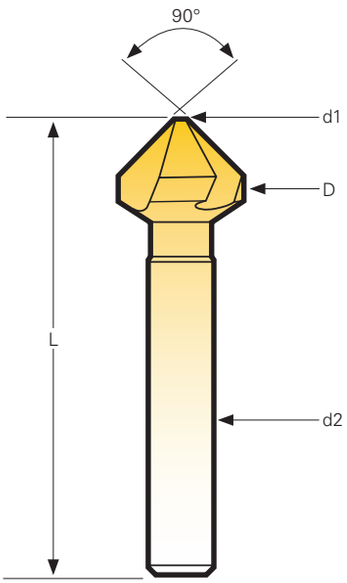


The equal division 3 x 120° of the flutes offers good results in most materials.

For iron alloys vibrations may happen and generate chatter.

These new **anti-vibration** countersinks with variable pitch flutes avoid this phenomenon.

HSS-E Cobalt = hardness 65 HRC, to machine steels up to 1000N/mm^2, cast iron up to 180 HB, copper, brass, bronze and aluminum.



Three Flute Countersinks Anti-Vibration - Angle 90° DIN 334-C

D (mm)	d1 max	d2	L	HSS-E 43-A	TiN 483-A
4.3	1.3	4	40	8443A043000	84483A04300
5.3	1.5	4	40	8443A053000	84483A05300
6.0	1.5	5	45	8443A060000	84483A06000
6.3	1.5	5	45	8443A063000	84483A06300
8.0	2.0	6	50	8443A080000	84483A08000
8.3	2.0	6	50	8443A830000	84483A08300
9.4	2.2	6	50	8443A094000	84483A09400
10.0	2.5	6	50	8443A100000	84483A10000
10.4	2.5	6	50	8443A104000	84483A10400
11.5	2.8	8	56	8443A115000	84483A11500
12.0	2.8	8	56	8443A120000	84483A12000
12.4	2.8	8	56	8443A124000	84483A12400
15.0	3.2	10	60	8443A150000	84483A15000
16.5	3.2	10	60	8443A165000	84483A16500
20.5	3.5	10	63	8443A205000	84483A20500
25.0	3.8	10	67	8443A250000	84483A25000
28.0	4	12	71	8443A280000	84483A28000
30.0	4.2	12	71	8443A300000	84483A30000
31.0	4.2	12	71	8443A310000	84483A31000

Value Sets

Composition	Quality	Code	EDP No.
5 cutters 10.4, 16.5 20.5, 25, 31	HSS-E TiN	43-A 483-A	8443A00000 84483A00000
6 cutters 6.3, 8.3, 10., 12.4, 16.5, 20.5	HSS-E TiN	43-A 483-A	8443A00002 84483A00002

***NOTE:* Inch Sizes will be available Nov/Dec 2020**

To place an order or to learn more about Pilot Precision Products, contact customer service at 413-350-5200.

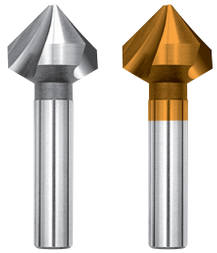
TRI-DENT

90° Three Flute Countersinks

Three Flute Countersinks - Angle 90°
Special for abrasion-resistant hard alloys

Diameter (inch)	Diameter (mm)	Capacity min/max	D	L	Cobalt + 436	M42/RedX 4936
0.248	6.3	0.051 – 0.248	0.197	1-3/4	84436063000	84493606300
0.327	8.3	0.071 – 0.327	0.236	1-3/4	84436083000	84493608300
0.410	10.4	0.087 – 0.410	0.236	1-3/4	84436104000	84493610400
0.488	12.4	0.098 – 0.488	0.315	2-1/4	84436124000	84493612400
0.650	16.5	0.110 – 0.650	0.394	2-3/8	84436165000	84493616500
0.807	20.5	0.118 – 0.807	0.394	2-1/2	84436205000	84493620500
0.984	25.0	0.126 – 0.984	0.394	2-5/8	84436250000	84493625000
1.220	31.0	0.138 – 1.220	0.472	2-3/4	84436310000	84493631000
1.969	50.0*	0.197 – 1.969	0.630	5	84436500000	84493650000

*3 flatted shanks



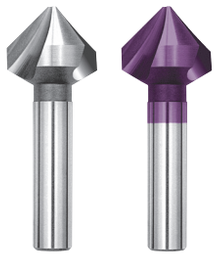
HSS-E 8% COBALT M42

NOTE:
All metric sizes are available. Call customer service for information or to place an order.

Countersinks - Angle 90°
3 Flutes

Diameter (inch)	Diameter (mm)	Capacity min/max	D	L	Carbide 8431	K15/Hard-H 8431-H
0.170	4.3	0.051 – .0170	0.157	1-9/16	88843104300	888431H0430†
0.209	5.3	0.051 – 0.209	0.157	1-9/16	88843105300	888431H0530†
0.248	6.3	0.051 – 0.248	0.197	1-3/4	88843106300	888431H0630†
0.327	8.3	0.071 – 0.327	0.236	1-3/4	88843108300	888431H0830†
0.410	10.4	0.087 – 0.410	0.236	1-3/4	88843110400	888431H1040
0.488	12.4*	0.098 – 0.488	0.315	2-1/4	88843112400	888431H1240
0.650	16.5*	0.110 – 0.650	0.394	2-3/8	88843116500	888431H1650
0.807	20.5*	0.118 – 0.807	0.394	2-1/2	88843120500	888431H2050
0.984	25.0*	0.126 – 0.984	0.394	2-5/8	88843125000	888431H2500
1.200	31.0*	0.138 – 1.220	0.472	2-3/4	88843131000	888431H3100

*Ø 12,4 – 31,0 = 3 flatted shanks



K15 SOLID CARBIDE

Long Series - Angle 90°

Diameter (inch)	Diameter (mm)	Capacity min/max	D	L	Cobalt 4303	M35/RedX 4933	Carbide 8431-L
0.248	6.3	0.051 – 0.248	0.236	3-5/16	84430306500	84493306300	888431L0630
0.327	8.3	0.071 – 0.327	0.315	3-3/8	84430308300	84493308300	888431L0830
0.410	10.4	0.087 – 0.410	0.394	3-1/2	84430310400	84493310400	888431L1040
0.488	12.4	0.098 – 0.488	0.394	4-1/4	84430312400	84493312400	888431L1240
0.650	16.5	0.110 – 0.650	0.630	4 - 7/16	84430316500	84493316500	888431L1650
0.807	20.5	0.118 – 0.807	0.360	4-1/2	84430320500	84493320500	888431L2050
0.984	25.0	0.126 – 0.984	0.788	4 -11/16	84430325000	84493325000	-



HSS-E COBALT M35



84431000000-M



84431000000 / 84436000000



84483100006

Trident Countersink Sets

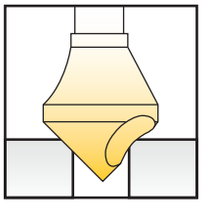
Angle	EDP No.	Composition (mm)
60°	84432000000 84483200000 TiN	Ø 10.4 - 16.5 20.5 - 25 - 31
82°	84434000000 84483400000 TiN	
100°	84435000000	
120°	84433000000	

Countersink Sets - Angle 90°

EDP No.	Composition
84431000000-M 84481000000-M TiN	Ø 10 - 15 - 20.5mm
84431000007 84481000007 TiN	1/4" - 3/8" - 1/2" - 3/4"
84431000000	10.4 - 16.5 - 20.5 - 25.0 - 31.0mm
84483100000 TiN	
84436000000	
84431000002	6.3 - 8.3 - 10.4 - 12.4 - 16.5 - 20.5mm
84483100002 TiN	
8443600002	
88843100002	
84431000003 [1]	6.3 - 8.3 - 10.4 - 12.4 - 16.5 - 20.5 - 25mm
84431000004 [1]	4.3 - 5.3 - 6.3 - 8.3 - 10.4 - 12.4 - 16.5 - 20.5 - 25 - 31mm
88843100000	10.4 - 16.5 - 20.5 - 25.0 - 31 mm carbide
84431000006 [2]	6.3 - 12.4 - 16.5 - 20.5mm
84483100006 TiN [2]	
84431000008 [2]	1/4" - 3/8" - 1/2" - 3/4"
84483100008 TiN [2]	

[1] Set supplied with 1 auto-lock chuck handle Code 4001
[2] Set supplied with 8mm auto-lock chuck handle Code 4002

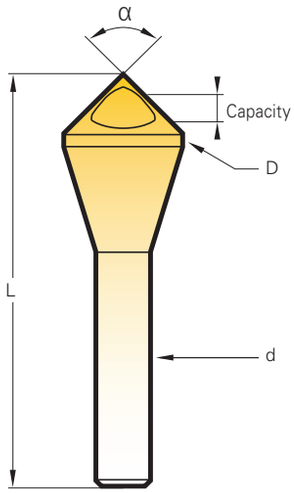
Zero Flute Deburring Tool with Hole





The deburring tool "with hole" is specially designed for countersinking and chamfering light metals and plastics.

The surface obtained is smooth and without burrs. We recommend lubricating.



Metric Zero Flute Deburring Tool with Hole - Angle 90°

#	Diameter (inch)	Diameter (mm)	Capacity min/max	D	L	Cobalt 411	M352/TiN 4811
0	1/4[1]		5/64 – 3/16	1/4	1-3/4	84411063500	84481106350
	0.394	10	5/32 – 11/32	0.236	1-3/4	84411100000	84481110000
1	7/16		7/32 – 13/32	1/4	1-3/4	84411112000	84481111200
2	9/16		1/4 – 1/2	1/4	2	84411140000	84481114000
	0.590	15	1/4 – 9/16	0.315	2-1/4	84411150000	84481115000
	0.787	20	5/16 – 11/16	0.394	2-1/2	84411200000	84481120000
3	13/16		5/16 – 11/16	1/2	2-5/8	84411204000	84481120400
	0.984	25	3/8 – 7/8	0.472	3	84411250000	84481125000
	1.102	28	7/16 – 1	0.472	3-3/8	84411280000	84481128000
	1.181	30	1/2 – 1-1/8	0.472	3-1/2	84411300000	84481130000
4	1-3/16		1/2 – 1-1/8	1/2	3-1/2	84411301000	84481130100
	1.378	35	9/16 – 1-5/16	0.630[2]	4	84411350000	84481135000
	1.575	40	5/8 – 1-1/2	0.630[2]	4-5/8	84411400000	84481140000
	1.969	50	3/4 – 1-7/8	0.630[2]	5	84411500000	84481150000

[1] Double end cutter
[2] Shanks with 3 flats for better holding

Metric Zero Flute Deburring Tool with Hole - Angles 60°, 82°, 100° and 120°

Angle	#	Diameter (inch)	Diameter (mm)	Capacity min/max	D	L	Cobalt
60° 412	0	1/4[1]	-	7/64 – 3/16	1/4	1-3/4	84412063500
	-	0.394	10	3/16 – 11/32	0.236	2	84412100000
	1	7/16	-	3/16 – 3/8	1/4	1-3/4	84412112000
	2	9/16	-	9/32 – 1/2	1/4	2	84412140000
	-	0.590	15	5/16 – 9/16	0.315	2-3/8	84412150000
	-	0.787	20	3/8 – 11/16	0.394	2-7/8	84412200000
	3	13/16	-	3/8 – 11/16	1/2	2-5/8	84412204000
	-	0.984	25	1/2 – 7/8	0.472	3-3/8	84412250000
	-	1.181	30	9/16 – 1 – 1/8	0.472	3-5/8	84412300000
	4	1-3/16	-	9/16 – 1 – 1/8	1/2	3-1/2	84412301000
	-	1.378	35	11/16 – 1 – 5/16	0.630	4-1/2	84412350000
82° 414	0	1/4[1]	-	5/64 – 3/16	1/4	1-3/4	84414063500
	-	0.394	10	5/32 – 11/32	0.236	1-3/4	84414100000
	1	7/16	-	7/32 – 13/32	1/4	1-3/4	84414112000
	2	9/16	-	1/4 – 1/2	1/4	2	84414140000
	-	0.590	15	1/4 – 9/16	0.315	2-1/4	84414150000
	-	0.787	20	5/16 – 11/16	0.394	2-1/2	84414200000
	3	13/16	-	5/16 – 11/16	1/2	2-5/8	84414204000
	-	0.984	25	3/8 – 7/8	0.472	3	84414250000
	-	1.181	30	1/2 – 1-1/8	0.472	3-1/2	84414300000
	4	1-3/16	-	1/2 – 1-1/8	1/2	3-1/2	84414301000
	-	1.378	35	9/16 – 1-5/16	0.630	4	84414350000
100° 415	-	0.394	10	5/32 – 11/32	0.236	1-3/4	84415100000
		0.590	15	1/4 – 9/16	0.315	2-1/8	84415150000
		0.787	20	9/32 – 11/16	0.394	2-1/2	84415200000
		0.984	25	11/32 – 7/8	0.472	3	84415250000
		1.181	30	7/16 – 1-1/16	0.472	3-3/8	84415300000
		1.387	35	1/2 – 1-5/16	0.630	4	84415350000
120° 413	-	0.394	10	5/32 – 11/32	0.236	1-3/4	84413100000
		0.590	15	1/4 – 9/16	0.315	2	84413150000
		0.787	20	9/32 – 11/16	0.394	2-3/8	84413200000
		0.984	25	11/32 – 7/8	0.472	2-7/8	84413250000
		1.181	30	7/16 – 1-1/16	0.472	3-1/4	84413300000
		1.378	35	1/2 – 1-5/16	0.630	3-3/4	84413350000

[1] Double end cutter
[2] Shanks with 3 flats for better holding

Tolerances

D	Angle	d	L
± .03	- 1°	h9	± 1mm



Metric Single Flute Countersink Sets - 5 pieces

Angle	EDP No.	Composition
60°	84412000000	Ø 10-15-20-25-30 mm
	84412000005	# 0-1-2-3-4
82°	84414000000	Ø 10-15-20-25-30 mm
	84414000005	# 0-1-2-3-4
90°	84411000000	Ø 10-15-20-25-30 mm
	84481100000-TIN	Ø 10-15-20-25-30 mm
	84411000002	Ø 10-15-20-28-35 mm
	84411000005	# 0-1-2-3-4
	84481100005-TIN	# 0-1-2-3-4
100°	84415000000	Ø 10-15-20-25-30 mm
120°	84413000000	Ø 10-15-20-25-30 mm

Single Flute Chamfering Cutters

The characteristics of the single flute chamfering cutters are similar to those of the deburring tools "with hole". They do vary on the following points:

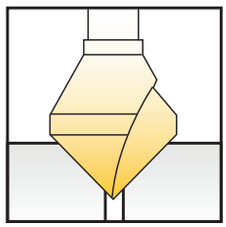
- Greater countersinking capacity from the point to the outside diameter (up to Ø 30mm)
- Simultaneous drilling and countersinking on thin elements (laminates, aluminum, wood)

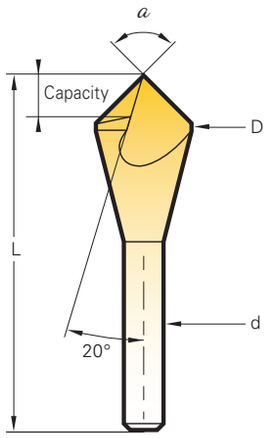
Constant finish-grind profile makes it possible to obtain many easy regrinds:
a mere touch of the grinder to the tooth is sufficient

We recommend lubricating.



HSS-E Cobalt M35





Single Flute Chamfering Cutters - Angles 60° and 82°

Angle	Diameter (inch)	Diameter (mm)	Capacity min/max	d	L	Cobalt 422	M35/TiN 4822
60°	1/8	-	1/32 – 1/8	1/8	1-1/4	84422031700	84482203170
	3/16	-	3/64 – 3/16	3/16	1-3/8	84422047600	84482204760
	0.236	6	3/64 – 0.236	0.236	1-5/8	84422060000	84482206000
	1/4	-	3/64 – 1/4	1/4	1-1/2	84422063500	84482206350
	5/16	-	3/64 – 5/16	1/4	1-5/8	84422079300	84482207930
	3/8	-	3/64 – 3/8	1/4	1-3/4	84422095200	84482209520
	0.394	10	3/64 – 0.394	0.236	1-7/8	84422100000	84482210000
	0.472	12	5/64 – 0.472	0.315	2-1/8	84422120000	84482212000
	1/2	-	5/64 – 1/2	1/4	2	84422127000	84482212700
	0.590	15	5/64 – 0.590	0.315	2-3/8	84422150000	84482215000
	5/8	-	5/64 – 5/8	3/8	2-1/4	84422158700	84482215870
	3/4	-	5/64 – 3/4	1/2	2-5/8	84422190500	84482219050
	0.787	20	5/64 – 0.787	0.394	2-7/8	84422200000	84482220000
	7/8	-	7/64 – 7/8	1/2	2-3/4	84422222200	84482222220
	0.984	25	1/8 – 0.984	0.472	3-3/8	84422250000	84482225000
	1	-	1/8 – 1	1/2	2-3/4	84422254000	84482225400
	1.181	30	1/8 – 1.181	0.472	3-5/8	84422300000	84482230000
	1-1/4	-	1/8 – 1-1/4	1/2	3	84422317500	84482231750
82°	1/8	-	1/32 – 1/8	1/8	1-1/4	84424031700	84482403170
	3/16	-	3/64 – 3/16	3/16	1-3/8	84424047600	84482404760
	0.236	6	3/64 – 0.236	0.236	1-5/8	84424060000	84482406000
	1/4	-	3/64 – 1/4	1/4	1-1/2	84424063500	84482406350
	5/16	-	3/64 – 5/16	1/4	1-5/8	84424079300	84482407930
	3/8	-	3/64 – 3/8	1/4	1-3/4	84424095200	84482409520
	0.394	10	3/64 – 0.394	0.236	1-3/4	84424100000	84482410000
	0.472	12	5/64 – 0.472	0.315	2	84424120000	84482412000
	1/2	-	5/64 – 1/2	1/4	2	84424127000	84482412700
	0.590	15	5/64 – 0.590	0.315	2-1/4	84424150000	84482415000
	5/8	-	5/64 – 5/8	3/8	2-1/4	84424158700	84482415870
	3/4	-	5/64 – 3/4	1/2	2-5/8	84424190500	84482419050
	0.787	20	5/64 – 0.787	0.394	2-5/8	84424200000	84482420000
	7/8	-	7/64 – 7/8	1/2	2-3/4	84424222200	84482422220
	0.984	25	1/8 – 0.984	0.472	3	84424250000	84482425000
	1	-	1/8 – 1	1/2	2-3/4	84424254000	84482425400
	1.181	30	1/8 – 1.181	0.472	3-1/2	84424300000	84482430000
	1-1/4	-	1/8 – 1-1/4	1/2	2-3/4	84424317500	84482431750

Note: 30° and 45° angles are metric standard. Call 413-350-5200 for information.

Tolerances

D	Angle	d	L
± .03	- 1°	h9	± 1mm

Single Flute Chamfering Cutters

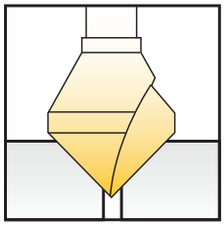
Single Flute Chamfering Cutters[1] - Angle 90°

Diameter (inch)	Diameter (mm)	Capacity min/max	d	L	Cobalt 421	M35/TiN 4821
1/8	-	1/32 – 1/8	1/8	1-1/4	84421031700	84482103170
0.157	4	3/64 – 0.157	0.157	1-1/2	84421040000	84482104000
3/16	-	3/64 – 3.160	3/16	1-3/8	84421047600	84482104760
0.197	5	3/64 – 0.197	0.197	1-1/2	84421050000	84482105000
0.236	6	3/64 – 0.236	0.236	1-1/2	84421060000	84482106000
1/4	-	3/64 – 1/4	1/4	1-1/2	84421063500	84482106350
5/16	-	3/64 – 5/16	1/4	1-5/8	84421079300	8482107930
0.315	8	3/64 – 0.315	0.236	1-1/2	84421080000	84482108000
3/8	-	3/64 – 3/8	1/4	1-3/4	84421095200	84482109520
0.394	10	3/64 – 0.394	0.236	1-3/4	84421100000	84482110000
0.472	12	5/64 – 0.472	0.315	2	84421120000	84482112000
1/2	-	5/64 – 1/2	1/4	2	84421127000	84482112700
0.590	15	5/64 – 0.590	0.315	2-1/8	84421150000	84482115000
5/8	-	5/64 – 5/8	3/8	2-1/4	84421158700	84482115870
3/4	-	5/64 – 3/4	1/2	2-5/8	84421190500	84482119050
0.787	20	5/64 – 0.787	0.394	2-5/8	84421200000	84482120000
7/8	-	7/64 – 7/8	1/2	2-3/4	84421222200	84482122220
0.984	25	1/8 – 0.984	0.472	3	84421250000	84482125000
1	-	1/8 – 1.000	1/2	2-3/4	84421254000	84482125400
1.181	30	1/8 – 1.181	0.472	3-1/2	84421300000	84482130000
1-1/4	-	1/8 – 1-1/4	1/2	2-3/4	84421317500	84482131750
1.378	35	5/32 – 1.378	0.630[1]	4	84421350000	84482135000
1.575	40	7/32 – 1.575	0.630[1]	4-5/8	84421400000	84482140000
2.000	50	15/32 – 2.000	0.630[1]	5	84421500000	84482150000

[1] Shank with 3 flats for better holding



HSS-E Cobalt M35



Single Flute Chamfering Cutters - Angle 100°

Diameter (inch)	Diameter (mm)	Capacity min/max	d	L	Cobalt 425	M35/TiN 4825
0.394	10	3/64 – 0.394	0.236	1- 3/4	84425100000	84482510000
0.472	12	5/64 – 0.472	0.315	1-7/8	84425120000	84482512000
0.590	15	5/64 – 0.590	0.315	2-1/8	84425150000	84482515000
0.787	20	5/64 – 0.787	0.394	2-1/2	84425200000	84482520000
0.984	25	1/8 – 0.984	0.472	3	84425250000	84482525000
1.181	30	1/8 – 1.181	0.472	3 - 3/8	84425300000	84482530000



Single Flute Chamfering Cutters - Angle 120°

Diameter (inch)	Diameter (mm)	Capacity min/max	d	L	Cobalt 423	M35/TiN 4823
0.394	10	3/64 – 0.394	0.236	1- 3/4	84423100000	84482310000
0.472	12	5/64 – 0.472	0.315	1-7/8	84423120000	84482312000
0.590	15	5/64 – 0.590	0.315	2	84423150000	84482315000
0.787	20	5/64 – 0.787	0.394	2-3/8	84423200000	84482320000
0.984	25	1/8 – 0.984	0.472	2-7/8	84423250000	84482325000
1.181	30	1/8 – 1.181	0.472	3-1/4	84423300000	84482330000

Metric Single Flute Countersink - Sets of 5 Pieces

Angle	Cobalt	M35/TiN	Composition
60°	84422000000	84482200000	10-15-20 25-30
82°	84424000000	84482400000	
90°	84421000000	84482100000	
100°	84425000000	84482500000	
120°	84423000000	84482300000	

Single Flute Countersink - Sets of 6 Pieces

Angle	Cobalt	M35/TiN	Composition
60°	84422000006	84482200006	1/4 - 5/16
82°	84424000006	84482400006	3/8 - 1/2
90°	84421000006	84482100006	5/8 - 3/4

Deburring Countersinking - Performance

Performance

Use Recommendations

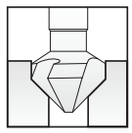
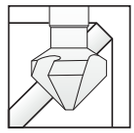
SFM = Speed : Surface Feet Per Minute
IPM = Feed : Inches Per Minute
RPM = SFM X 12 / 3.14 X Diameter

Example:

3/4" - .750 Diameter 3 Flute to Countersink 304 SS

$$RPM = \frac{45 \times 12}{3.14 \times .75} = \frac{540}{2.35} = 230 \text{ RPM}$$

Recommendation N°1
Recommendation N°2

			Deburring Countersinking										Contouring					
																		
Material			HSS. Co	=+TiN	HSS. Co	=+TiN	HSS. Co	=+TiN	HSS .8% Co	+Red'X	Carbure/Carbide	+Hard'X	HSS. Co	=+TiN	HSS. 8% Co	+Red'X	Carbure/Carbide	+Hard'X
	SFM		115-148	115-148	115-148	115-148	55-70	55-70	112-145	112-145	128-256	128-256	55-70	55-70	112-145	112-145	128-256	128-256
Steel	Ø10	IPM	6.5	6.5	6.5	6.5	3.4	3.4	6.5	6.5	10.0	10.0	3.4	3.4	6.5	6.5	10.0	10.0
< 81 HRB (B)	Ø20	IPM	3.4	3.4	3.4	3.4	1.8	1.8	3.4	3.4	5.0	5.0	1.8	1.8	3.4	3.4	5.0	5.0
	Ø30	IPM	2.0	2.0	2.0	2.0	1.2	1.2	2.0	2.0	3.4	3.4	1.2	1.2	2.0	2.0	3.4	3.4
	SFM		65-95	65-95	65-95	65-95	32-48	32-48	65-95	65-95	95-160	95-160	32-48	32-48	65-95	65-95	95-160	95-160
Steel	Ø10	IPM	4.3	4.3	4.3	4.3	2.4	2.4	4.3	4.3	6.6	6.6	2.4	2.4	4.3	4.3	6.6	6.6
< 24 Rc	Ø20	IPM	2.0	2.0	2.0	2.0	1.2	1.2	2.0	2.0	3.4	3.4	1.2	1.2	2.0	2.0	3.4	3.4
	Ø30	IPM	1.4	1.4	1.4	1.4	0.8	0.8	1.4	1.4	2.4	2.4	0.8	0.8	1.4	1.4	2.4	2.4
	SFM		48-64	48-64	48-64	48-64	25-38	25-38	48-64	48-64	64-128	64-128	25-38	25-38	48-64	48-64	64-128	64-128
Steel	Ø10	IPM	2.0	2.0	2.0	2.0	1.4	1.4	2.0	2.0	4.0	4.0	1.4	1.4	2.0	2.0	4.0	4.0
24 - 32 Rc	Ø20	IPM	1.4	1.4	1.4	1.4	1.0	1.0	1.4	1.4	2.4	2.4	1	1.0	1.4	1.4	2.4	2.4
	Ø30	IPM	1.0	1.0	1.0	1.0	0.6	0.6	1.0	1.0	1.8	1.8	0.6	0.6	1.0	1.0	1.8	1.8
	SFM		38-48	38-48	38-48	38-48	20-32	20-32	38-48	38-48	64-128	64-128	20-32	20-32	38-48	38-48	64-128	64-128
Stainless Steel	Ø10	IPM	1.8	1.8	1.8	1.8	1.2	1.2	1.8	1.8	4.0	4.0	1.2	1.2	1.8	1.8	4.0	4.0
32 - 41 Rc	Ø20	IPM	1.0	1.0	1.0	1.0	0.6	0.6	1.0	1.0	2.4	2.4	0.6	0.6	1.0	1.0	2.4	2.4
	Ø30	IPM	0.8	0.8	0.8	0.8	0.3	0.3	0.8	0.8	1.6	1.6	0.3	0.3	0.8	0.8	1.6	1.6
	SFM									38-48	48-64	48-64				38-48	48-64	48-64
Abrasion Resistant Steel	Ø10	IPM								1.6	2.0	2.0				1.6	2.0	2.0
	Ø20	IPM								1.2	1.4	1.4				1.2	1.4	1.4
	Ø30	IPM								0.8	1.0	1.0				0.8	1.0	1.0
	SFM								13-20	13-20	32-38	32-38			13-20	13-20	32-38	32-38
Inconel	Ø10	IPM							0.6	0.6	1.2	1.2			0.6	0.6	1.2	1.2
	Ø20	IPM							0.3	0.3	0.6	0.6			0.3	0.3	0.6	0.6
	Ø30	IPM							0.3	0.3	0.4	0.4			0.3	0.3	0.4	0.4
	SFM		64-128	64-128	64-128	64-128	48-80	48-80	64-128	64-128	128-256	128-256	48-80	48-80	64-128	64-128	128-256	128-256
Cast Iron	Ø10	IPM	5.0	5.0	5.0	5.0	2.8	2.8	5.0	5.0	0.3	0.3	2.8	2.8	5.0	5.0	0.3	0.3
	Ø20	IPM	3.0	3.0	3.0	3.0	1.6	1.6	3.0	3.0	6.0	6.0	1.6	1.6	3.0	3.0	6.0	6.0
	Ø30	IPM	2.0	2.0	2.0	2.0	1.2	1.2	2.0	2.0	4.0	4.0	1.2	1.2	2.0	2.0	4.0	4.0
	SFM		160-190	160-190	160-190	160-190	112-145	112-145	160-190	160-190	128-320	128-320	112-145	112-145	160-190	160-190	128-320	128-320
Aluminium	Ø10	IPM	10.0	10.0	10.0	10.0	7.8	7.8	10.0	10.0	13.8	13.8	7.8	7.8	10.0	10.0	13.8	13.8
	Ø20	IPM	7.0	7.0	7.0	7.0	5.2	5.2	7.0	7.0	9.0	9.0	5.2	5.2	7.0	7.0	9.0	9.0
	Ø30	IPM	6.0	6.0	6.0	6.0	4.3	4.3	6.0	6.0	7.8	7.8	4.3	4.3	6.0	6.0	7.8	7.8
	SFM		96-128	96-128	96-128	96-128	65-95	65-95	96-128	96-128			65-95	65-95	96-128	96-128		
Bronze Brass	Ø10	IPM	6.0	6.0	6.0	6.0	4.7	4.7	6.0	6.0			4.7	4.7	6.0	6.0		
	Ø20	IPM	4.3	4.3	4.3	4.3	3.4	3.4	4.3	4.3			3.4	3.4	4.3	4.3		
	Ø30	IPM	3.5	3.5	3.5	3.5	2.8	2.8	3.5	3.5			2.8	2.8	3.5	3.5		
	SFM		65-95	65-95	65-95	65-95	48-80	48-80	65-95	65-95	160-256	160-256	48-80	48-80	65-95	65-95	160-256	160-256
Copper	Ø10	IPM	4.7	4.7	4.7	4.7	3.75	3.75	4.7	4.7	12.0	12.0	3.75	3.75	4.7	4.7	12.0	12.0
	Ø20	IPM	3.0	3.0	3.0	3.0	2.4	2.4	3.0	3.0	7.8	7.8	2.4	2.4	3.0	3.0	7.8	7.8
	Ø30	IPM	2.6	2.6	2.6	2.6	1.8	1.8	2.6	2.6	7.0	7.0	1.8	1.8	2.6	2.6	7.0	7.0
	SFM		160-320	160-320	160-320	160-320	112-224	112-224	112-224	112-224			112-224	112-224	112-224	112-224		
Laminated	Ø10	IPM	16.0	16.0	16.0	16.0	12.0	12.0	12.0	12.0			12.0	12.0	12.0	12.0		
	Ø20	IPM	12.0	12.0	12.0	12.0	7.8	7.8	7.8	7.8			7.8	7.8	7.8	7.8		
	Ø30	IPM	10.0	10.0	10.0	10.0	6.0	6.0	6.0	6.0			6.0	6.0	6.0	6.0		
	SFM		160-320	160-320	160-320	160-320	112-224	112-224	112-224	112-224			112-224	112-224	112-224	112-224		
Nylon, PVC Plastics	Ø10	IPM	18.0	18.0	18.0	18.0	16.0	16.0	16.0	16.0			16.0	16.0	16.0	16.0		
	Ø20	IPM	13.8	13.8	13.8	13.8	12.0	12.0	12.0	12.0			12.0	12.0	12.0	12.0		
	Ø30	IPM	12.0	12.0	12.0	12.0	10.0	10.0	10.0	10.0			10.0	10.0	10.0	10.0		

Auto Body Drill Bits to Disconnect Spot Welds

Hard'X
AlTiN Latuma

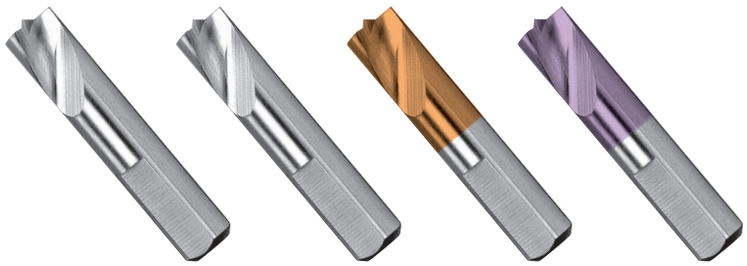
The machining of hard sheets has to be done with coated tools.
The high-performance series **8203-H** is made from **Hard'X** coated carbide.

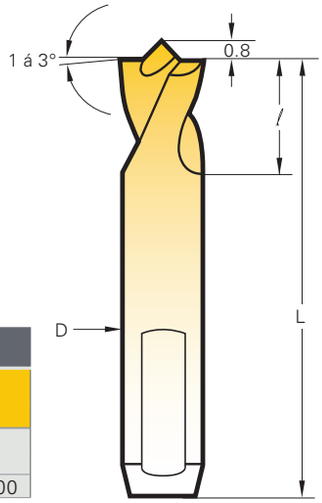
- Easy to start
- Long lasting
- Will spot and drill one panel only, without walking

These short drills are specially designed to be used with these two types of hand type pneumatic disconnector tools:

- With swan-neck = Magafor 202
- With revolver-handle = Magafor 203

Flatted shanks with 60° taper for a good location in the disconnector.

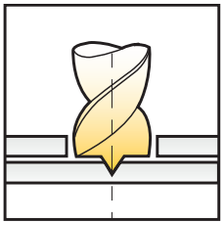




Short Series

Diameter (inch)	Diameter (mm)	L	/	Cobalt 202	Cobalt 203	M35/Red'X 2903	K15/Hard'X 8203-H
0.236	6	1-3/4	0.590	-	82203060000	-	-
5/16	8	1-1/2	0.590	8220208000	-		
5/16	8	1-3/4	0.590	-	82203080000	82290308000	888203H0800





Long Series

Diameter (inch)	Diameter (mm)	d	L	Cobalt 201	M35/Red'X 2901	Brazed Carbide 8201
0.236	6	2-5/8	1.100	82201060000	82290106000	-
0.275	7	2-7/8	1.340	82201070000	82290107000	
0.314	8	-	-	-	-	88820108000
5/16	-	3-1/8	1.450	82201080000	82290108000	-
0.394	10	3-1/2	1.690	82201100000	82290110000	

Tolerances

D	L	/
h8	± 1	+1

The centering point grants perfect drilling without any drifting or walking. Thanks to the special sharpening, the first sheet will be bored without damage to the second one. This design allows for excellent penetration, a high resistance to wear and a great many regrinds. The carbide spot-weld drills are designed to machine the new, very-high elastic limit sheet metal (VHEL).

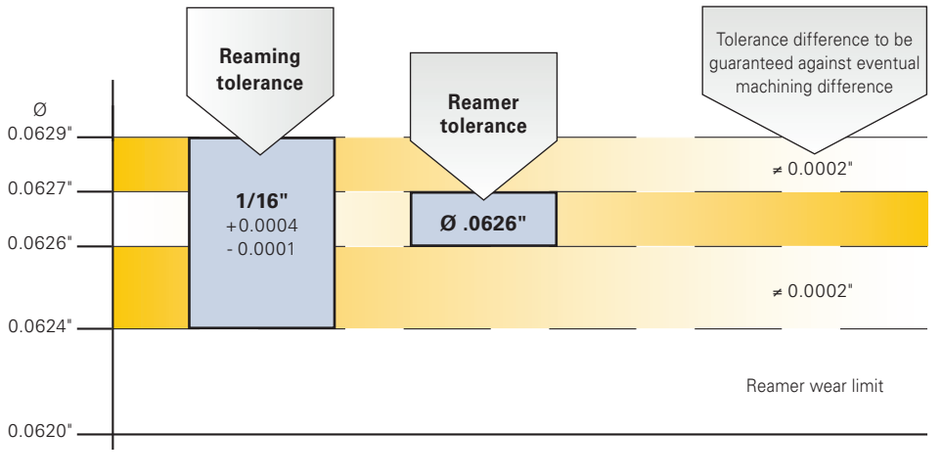
High Precision Reamers

How to Choose Standard Inch Reamers

Examples	Reaming (Hole) Ø		Tolerance (inch)	Reamer (Tool) Ø	Tolerance-inch
1	1/64"	+0.00006 - 0.00012	0.01568 0.01550	EDP No. 861000395 **0.01551"**	0.01559 0.01551
2	1/32"	+0.0001 - 0.0002	0.03135 0.03105	EDP No. 86000079 **0.03110"**	0.03122 0.03110
3	1/16"	+0.0004 - 0.0001	0.0629 0.0624	EDP No. 86000159 **0.0626"**	0.06272 0.06260

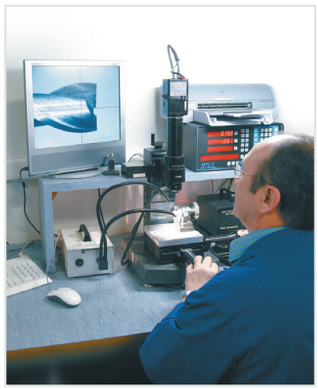


Example 3 Explanation

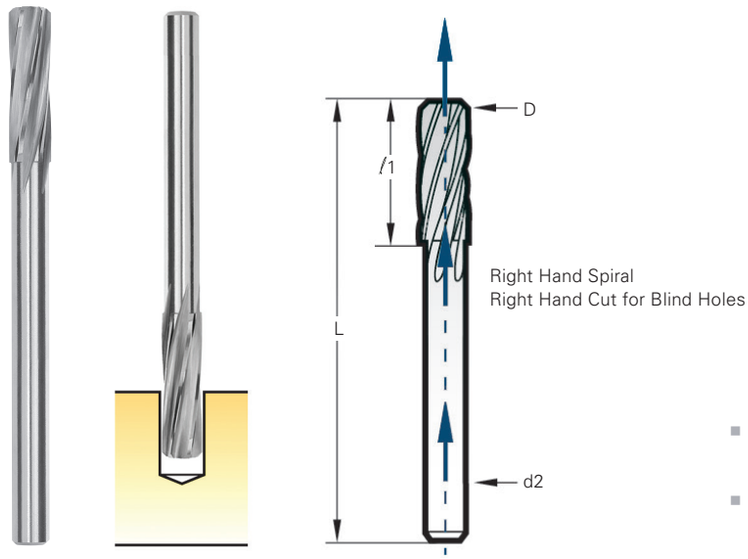


How to Choose Metric Reamers Code 8610 – 8600 : page 85–91

Tolerance	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14
D 10	2.04	3.04	4.05	5.06	6.06	8.07	10.08	12.10	14.10
E 8	2.02	**3.02**	4.03	5.03	6.03	8.03	10.03	12.04	14.04
E 9	2.03	3.03	4.04	5.04	6.04	8.05	10.05	12.06	14.06
F 7	2.01	3.01	4.01	5.01	6.01	8.02	10.02	12.02	14.02
F 8	2.01	3.01	4.02	5.02	5.02	8.02	10.02	12.03	14.03
G 7	2.00	3.00	4.01	5.02	5.02	8.01	10.01	12.01	14.01
H 6	2.00	3.01	4.00	5.00	6.00	8.00	10.00	12.00	14.00
H 8	2.01	3.01	4.01	**5.01**	6.01	8.01	10.01	12.01	14.01
H 9	2.01	2.99	4.02	5.02	6.02	8.02	10.02	12.03	14.03
M 7	1.99	2.99	3.99	4.99	5.99	7.99	9.99	11.99	13.99
N 7	1.99	2.99	3.99	4.99	5.99	7.98	9.98	11.98	13.98
P 7	1.99	2.99	3.98	4.98	5.98	7.98	**9.98**	11.97	13.97
R 7	1.98	2.98	3.98	4.98	5.98	7.98	9.98	11.97	13.97



Reamers with Coolant Thru for Blind Holes | 8670 Series



- Central oil feeding: the lubricant is fed directly into the hole to ream
- Right hand spiral - improved removal of swarf and coolant flow

8670 Series

EDP No.	Diameter (inch)	Diameter (mm)	L	/1	d2	Wire/Frac
88867003900	0.1535	3.90	2.05	0.787	0.1575	
88867004000	0.1575	4.00	2.05	0.787	0.1575	
88867004100	0.1614	4.10	2.05	0.787	0.1575	
88867004200	0.1654	4.20	2.05	0.787	0.1575	
88867004300	0.1693	4.30	2.05	0.787	0.1575	
88867004400	0.1732	4.40	2.05	0.787	0.1575	
88867004500	0.1772	4.50	2.05	0.787	0.1575	
88867004600	0.1811	4.60	2.05	0.787	0.1575	
88867004700	0.1850	4.70	2.05	0.787	0.1575	
88867004762	0.1875	4.762	2.05	0.787	0.1575	3/16"
88867004800	0.1890	4.80	2.48	0.866	0.1575	
88867004900	0.1929	4.90	2.48	0.866	0.1575	
88867005000	0.1969	5.00	2.48	0.866	0.1575	
88867005100	0.2008	5.10	2.48	0.866	0.1575	
88867005200	0.2047	5.20	2.48	0.866	0.1575	
88867005300	0.2087	5.30	2.48	0.866	0.1575	
88867005400	0.2126	5.40	2.48	0.866	0.1575	
88867005500	0.2165	5.50	2.48	0.866	0.1575	
88867005600	0.2205	5.60	2.48	0.866	0.1575	
88867005700	0.224	5.70	2.48	0.866	0.1575	
88867005800	0.2284	5.80	2.48	0.866	0.1575	
88867005900	0.2323	5.90	2.48	0.866	0.1969	
88867006000	0.2362	6.00	2.48	0.866	0.1969	
88867006100	0.2402	6.10	2.48	0.866	0.1969	
88867006200	0.2241	6.20	2.48	0.866	0.1969	
88867006300	0.2480	6.30	2.48	0.866	0.1969	
88867006350	0.2500	6.35	2.48	0.866	0.1969	E / 1/4"
88867006400	0.2520	6.40	2.48	0.866	0.1969	
88867006500	0.2259	6.50	2.48	0.866	0.1969	
88867006600	0.2598	6.60	2.48	0.866	0.1969	
88867006700	0.2638	6.70	2.80	0.984	0.248	
88867006800	0.2677	6.80	2.80	0.984	0.248	
88867006900	0.2717	6.90	2.80	0.984	0.248	
88867007000	0.2756	7.00	2.80	0.984	0.248	
88867007100	0.2795	7.10	2.80	0.984	0.248	
88867007200	0.2835	7.20	2.80	0.984	0.248	
88867007300	0.2874	7.30	2.80	0.984	0.248	
88867007400	0.2913	7.40	2.80	0.984	0.248	
88867007500	0.2756	7.50	2.80	0.984	0.248	
88867007600	0.2992	7.60	2.80	0.984	0.248	
88867007700	0.3031	7.70	2.80	0.984	0.248	
88867007800	0.3071	7.80	2.80	0.984	0.248	
88867007900	0.3110	7.90	2.80	0.984	0.248	
88867007937	0.3125	7.937	2.80	0.984	0.248	5/16"

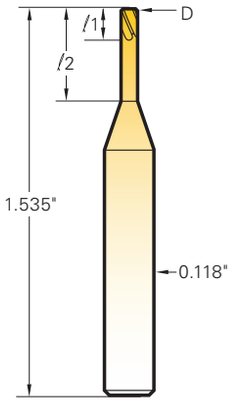
8670 Series

EDP No.	Diameter (inch)	Diameter (mm)	L	/1	d2	Wire/Frac
88867008000	0.3150	8.00	2.80	0.984	0.248	
88867008100	0.3189	8.10	2.80	0.984	0.248	
88867008200	0.3328	8.20	2.80	0.984	0.248	
88867008300	0.3268	8.30	2.80	0.984	0.248	
88867008400	0.3307	8.40	2.80	0.984	0.248	
88867008500	0.3346	8.50	2.80	0.984	0.248	
88867008600	0.3386	8.60	2.80	0.984	0.315	
88867008700	0.3425	8.70	2.80	0.984	0.315	
88867008800	0.3465	8.80	2.80	0.984	0.315	
88867008900	0.3504	8.90	2.80	0.984	0.315	
88867009000	0.3543	9.00	2.80	0.984	0.315	
88867009100	0.3583	9.10	2.80	0.984	0.315	
88867009200	0.3543	9.20	2.80	0.984	0.315	
88867009300	0.3661	9.30	2.80	0.984	0.315	
88867009400	0.3701	9.40	2.80	0.984	0.315	
88867009500	0.3740	9.50	2.80	0.984	0.315	
88867009525	0.3750	9.525	2.80	0.984	0.315	3/8"
88867009600	0.3780	9.60	2.80	0.984	0.315	
88867009700	0.3819	9.70	2.80	0.984	0.315	
88867009800	0.3858	9.80	2.80	0.984	0.315	
88867009900	0.3897	9.90	2.80	0.984	0.315	
88867010000	0.3937	10.00	2.80	0.984	0.315	
88867010100	0.3976	10.10	2.80	0.984	0.315	
88867010200	0.4016	10.20	2.80	0.984	0.315	
88867010300	0.4055	10.30	2.80	0.984	0.315	
88867010400	0.4094	10.40	2.80	0.984	0.315	
88867010500	0.4134	10.50	2.80	0.984	0.315	
88867010600	0.4173	10.60	2.80	0.984	0.315	
88867010700	0.4213	10.70	3.15	1.102	0.394	
88867010800	0.4252	10.80	3.15	1.102	0.394	
88867010900	0.4291	10.90	3.15	1.102	0.394	
88867011000	0.4331	11.00	3.15	1.102	0.394	
88867011100	0.4370	11.10	3.15	1.102	0.394	
88867011112	0.4375	11.112	3.15	1.102	0.394	7/16"
88867011200	0.4409	11.20	3.15	1.102	0.394	
88867011300	0.449	11.30	3.15	1.102	0.394	
88867011400	0.4488	11.40	3.15	1.102	0.394	
88867011500	0.4528	11.50	3.15	1.102	0.394	
88867011600	0.4567	11.60	3.15	1.102	0.394	
88867011700	0.4606	11.70	3.15	1.102	0.394	
88867011800	0.4646	11.80	3.15	1.102	0.394	
88867011900	0.4685	11.90	3.15	1.102	0.394	15/32"
88867012000	0.4724	12.00	3.15	1.102	0.394	-
88867012700	0.5000	12.70	3.15	1.102	0.394	1/2"

High Precision Carbide Micro-Reamers



K15 Carbide



Micro-reamers are manufactured and stocked in all diameters at every 0.0002" increment. Their reinforced shank offers a greater stability necessary for these high precision tools.

Magaforce 8610 Micro-Precision		
D 0.0002" increment	/1	/2
0.0079 to 0.0096	0.036	0.079
0.0098 to 0.0116	0.043	0.098
0.0118 to 0.0136	0.055	0.118
0.0138 to 0.0156	0.067	0.138
0.0157 to 0.0195	0.079	0.157
0.0197 to 0.0234	0.091	0.197

For Magaforce 8610 EDP numbers see below

Tolerances - inch	
H4	± 0.00004

K15 Carbide — 6.5 – 7% Cobalt (0.600 – 0.008mm grain size)

4 flutes, 20° left spiral, right hand cut

8610 Series			
EDP No.	(mm)	Decimal	Wire
88861000200	0.200	0.0079	92
88861000205	0.205	0.0081	
88861000210	0.210	0.0083	91
88861000215	0.215	0.0085	
88861000220	0.220	0.0087	90
88861000225	0.225	0.0089	
88861000230	0.230	0.0091	89
88861000235	0.235	0.0093	
88861000240	0.240	0.0094	88
88861000245	0.245	0.0096	
88861000250	0.250	0.0098	
88861000255	0.255	0.0100	87
88861000260	0.260	0.0102	
88861000265	0.265	0.0104	86
88861000270	0.270	0.0106	
88861000275	0.275	0.0108	
88861000280	0.280	0.0110	85
88861000285	0.285	0.0112	
88861000290	0.290	0.0114	84
88861000295	0.295	0.0116	
88861000300	0.300	0.0118	
88861000305	0.305	0.0120	83
88861000310	0.310	0.0122	
88861000315	0.315	0.0124	82
88861000320	0.320	0.0126	
88861000325	0.325	0.0128	
88861000330	0.330	0.0130	81

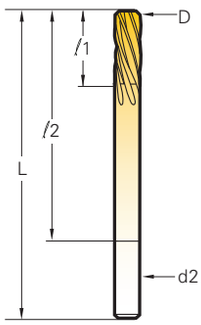
8610 Series			
EDP No.	(mm)	Decimal	Wire
88861000335	0.335	0.0132	
88861000340	0.340	0.0134	80
88861000345	0.345	0.0136	
88861000350	0.350	0.0138	
88861000355	0.355	0.0140	
88861000360	0.360	0.0142	
88861000365	0.365	0.0144	79
88861000370	0.370	0.0146	
88861000375	0.375	0.0148	
88861000380	0.380	0.0150	
88861000385	0.385	0.0152	
88861000390	0.390	0.0154	
88861000395	0.395	0.0156	
88861000400	0.400	0.0157	
88861000405	0.405	0.0159	78
88861000410	0.410	0.0161	
88861000415	0.415	0.0163	
88861000420	0.420	0.0165	
88861000425	0.425	0.0167	
88861000430	0.430	0.0169	
88861000435	0.435	0.0171	
88861000440	0.440	0.0173	
88861000445	0.445	0.0175	
88861000450	0.450	0.0177	
88861000455	0.455	0.0179	77
88861000460	0.460	0.0181	
88861000465	0.465	0.0183	-

8610 Series			
EDP No.	(mm)	Decimal	Wire
88861000470	0.470	0.0185	
88861000475	0.475	0.0187	
88861000480	0.480	0.0189	
88861000485	0.485	0.0191	
88861000490	0.490	0.0193	
88861000495	0.495	0.0195	
88861000500	0.500	0.0197	
88861000505	0.505	0.0199	76
88861000510	0.510	0.0201	
88861000515	0.515	0.0203	
88861000520	0.520	0.0205	
88861000525	0.525	0.0207	
88861000530	0.530	0.0209	75
88861000535	0.535	0.0211	
88861000540	0.540	0.0213	
88861000545	0.545	0.0215	
88861000550	0.550	0.0217	
88861000555	0.555	0.0219	
88861000560	0.560	0.0220	
88861000565	0.565	0.0222	
88861000570	0.570	0.0224	74
88861000575	0.575	0.0226	
88861000580	0.580	0.0228	
88861000585	0.585	0.0230	
88861000590	0.590	0.0232	
88861000595	0.595	0.0234	

All reamers come with 10° left hand spiral/right cut flute, designed for thru holes to optimally flush out chips for improved tool life and surface finish.

High Precision 8600 Miniature Reamers

Magaforce 8600 Micro-Precision				
D 0.0002" increment	/1	/2	L	d2
0.0236 to 0.0413	0.275	0.393	1.300	D
0.0417 to 0.0610	0.393	0.944	1.580	D
0.0614 to 0.0929	0.433	1.220	1.970	D
0.0933 to 0.1476	0.590	1.500	2.250	D
0.1480 to 0.1673	0.748	1.930	2.950	0.158
0.1677 to 0.1870	0.827	2"	3.150	0.177
0.1874 to 0.2087	0.906	2.320	3.390	0.197
0.2091 to 0.2284	1.024	2.559	3.660	0.217
0.2288 to 0.2638	1.102	2.795	3.980	0.236
0.2642 to 0.2972	1.220	3.071	4.290	0.276
0.2976 to 0.3366	1.299	3.307	4.610	0.315
0.3370 to 0.3760	1.417	3.465	4.920	0.354
0.3763 to 0.3957	1.496	3.819	5.236	0.394
0.3961 to 0.4350	1.496	3.819	5.236	0.394
0.4354 to 0.4744	1.732	4.331	5.945	0.472
0.4748 to 0.5138	1.732	4.331	5.945	0.472
0.5535 to 0.5890	1.969	4.4.09	6.378	0.551
0.5929 to 0.7500	2.047	4.606	6.693	0.630
0.7468 to 0.7500	2.283	5.354	7.441	0.630





K15 Carbide

All reamers have a 45° chamfer lead
Ø 0.0236" to 0.0929 = 4 flutes, Ø 0.0933" to .5138= 6 flutes,
10° left spiral/right hand cut for thru holes.

For Magaforce 8600 EDP numbers see below

Tolerances		
	(mm)	(inch)
H7	0.60 – 3.00	0 + .00012
H8	3.00 – 6.00	0 + .00016
H9	6.00 – 19.05	0 + .00020

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860000600	0.60	0.0236	
88860000610	0.61	0.0240	73
88860000620	0.62	0.0244	
88860000630	0.63	0.0248	72
88860000640	0.64	0.0252	
88860000650	0.65	0.0256	
88860000660	0.66	0.0260	71
88860000670	0.67	0.0264	
88860000680	0.68	0.0268	
88860000690	0.69	0.0272	
88860000700	0.70	0.0276	
88860000710	0.71	0.0280	70
88860000720	0.72	0.0283	
88860000730	0.73	0.0287	
88860000740	0.74	0.0291	69
88860000750	0.75	0.0295	
88860000760	0.76	0.0299	
88860000770	0.77	0.0303	
88860000780	0.78	0.0307	
88860000790	0.79	0.0311	68
88860000800	0.80	0.0315	
88860000810	0.81	0.0319	67
88860000820	0.82	0.0323	
88860000830	0.83	0.0327	
88860000840	0.84	0.0331	66
88860000850	0.85	0.0335	
88860000860	0.86	0.0339	
88860000870	0.87	0.0343	
88860000880	0.88	0.0346	
88860000890	0.89	0.0350	65
88860000900	0.90	0.0354	
88860000910	0.91	0.0358	64
88860000920	0.92	0.0362	
88860000930	0.93	0.0366	
88860000940	0.94	0.0370	63
88860000950	0.95	0.0374	
88860000960	0.96	0.0378	62
88860000970	0.97	0.0382	

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860000980	0.98	0.0386	
88860000990	0.99	0.0390	61
88860001000	1.00	0.0394	
88860001010	1.01	0.0398	60
88860001020	1.02	0.0402	
88860001030	1.03	0.0406	
88860001040	1.04	0.0409	59
88860001050	1.05	0.0413	
88860001060	1.06	0.0417	
88860001070	1.07	0.0421	58
88860001080	1.08	0.0425	
88860001090	1.09	0.0429	57
88860001100	1.10	0.0433	
88860001110	1.11	0.0437	
88860001120	1.12	0.0441	
88860001130	1.13	0.0445	
88860001140	1.14	0.0449	
88860001150	1.15	0.0453	
88860001160	1.16	0.0457	
88860001170	1.17	0.0461	
88860001180	1.18	0.0465	56
88860001190	1.19	0.0469	
88860001200	1.20	0.0472	
88860001210	1.21	0.0476	
88860001220	1.22	0.0480	
88860001230	1.23	0.0484	
88860001240	1.24	0.0488	
88860001250	1.25	0.0492	
88860001260	1.26	0.0496	
88860001270	1.27	0.0500	
88860001280	1.28	0.0504	
88860001290	1.29	0.0508	
88860001300	1.30	0.0512	
88860001310	1.31	0.0516	
88860001320	1.32	0.0520	55
88860001330	1.33	0.0524	
88860001340	1.34	0.0528	
88860001350	1.35	0.0531	

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860001360	1.36	0.0535	
88860001370	1.37	0.0539	
88860001380	1.38	0.0543	
88860001390	1.39	0.0547	
88860001400	1.40	0.0551	54
88860001410	1.41	0.0555	
88860001420	1.42	0.0559	
88860001430	1.43	0.0563	
88860001440	1.44	0.0567	
88860001450	1.45	0.0571	
88860001460	1.46	0.0575	
88860001470	1.47	0.0579	
88860001480	1.48	0.0583	
88860001490	1.49	0.0587	
88860001500	1.50	0.0590	
88860001510	1.51	0.0594	53
88860001520	1.52	0.0598	
88860001530	1.53	0.0602	
88860001540	1.54	0.0606	
88860001550	1.55	0.0610	
88860001560	1.56	0.0614	
88860001570	1.57	0.0618	
88860001580	1.58	0.0622	
88860001590	1.59	0.0626	
88860001600	1.60	0.630	
88860001610	1.61	0.0634	52
88860001620	1.62	0.0638	
88860001630	1.63	0.0642	
88860001640	1.64	0.0646	
88860001650	1.65	0.0650	
88860001660	1.66	0.0654	
88860001670	1.67	0.0657	
88860001680	1.68	0.0661	
88860001690	1.69	0.0665	
88860001700	1.70	0.0669	51
88860001710	1.71	0.0673	
88860001720	1.72	0.0677	
88860001730	1.73	0.0681	

Note: Highlighted items are an increment of 0.0003

10° left spiral/right hand cut for thru holes.

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860001740	1.74	0.0685	
88860001750	1.75	0.0689	
88860001760	1.76	0.0693	
88860001770	1.77	0.0697	
88860001780	1.78	0.0701	50
88860001790	1.79	0.0705	
88860001800	1.80	0.0709	
88860001810	1.81	0.0713	
88860001820	1.82	0.0717	
88860001830	1.83	0.0720	
88860001840	1.84	0.0724	
88860001850	1.85	0.0728	49
88860001860	1.86	0.0732	
88860001870	1.87	0.0736	
88860001880	1.88	0.0740	
88860001890	1.89	0.0744	
88860001900	1.90	0.0748	
88860001910	1.91	0.0752	
88860001920	1.92	0.0756	
88860001930	1.93	0.0760	48
88860001940	1.94	0.0764	
88860001950	1.95	0.0768	
88860001960	1.96	0.0772	
88860001970	1.97	0.0776	
88860001980	1.98	0.0780	
88860001990	1.99	0.0783	47
88860002000	2.00	0.0787	
88860002010	2.01	0.0791	
88860002020	2.02	0.0795	
88860002030	2.03	0.0799	
88860002040	2.04	0.0803	
88860002050	2.05	0.0807	
88860002060	2.06	0.0811	46
88860002070	2.07	0.0815	
88860002080	2.08	0.0819	45
88860002090	2.09	0.0823	
88860002100	2.10	0.0827	
88860002110	2.11	0.0831	
88860002120	2.12	0.0835	
88860002130	2.13	0.0839	
88860002140	2.14	0.0843	
88860002150	2.15	0.0846	
88860002160	2.16	0.0850	
88860002170	2.17	0.0854	
88860002180	2.18	0.0858	44
88860002190	2.19	0.0862	
88860002200	2.20	0.0866	
88860002210	2.21	0.0870	
88860002220	2.22	0.0874	
88860002230	2.23	0.0878	
88860002240	2.24	0.0882	
88860002250	2.25	0.0886	
88860002260	2.26	0.0890	43
88860002270	2.27	0.0894	
88860002280	2.28	0.0898	
88860002290	2.29	0.0902	
88860002300	2.30	0.0906	
88860002310	2.31	0.0909	
88860002320	2.32	0.0913	
88860002330	2.33	0.0917	
88860002340	2.34	0.0921	
88860002350	2.35	0.0925	
88860002360	2.36	0.0929	
88860002370	2.37	0.0933	42
88860002380	2.38	0.0937	
88860002390	2.39	0.0941	

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860002400	2.40	0.0945	
88860002410	2.41	0.0949	
88860002420	2.42	0.0953	
88860002430	2.43	0.0957	
88860002440	2.44	0.0961	41
88860002450	2.45	0.0965	
88860002460	2.46	0.0969	
88860002470	2.47	0.0972	
88860002480	2.48	0.0976	
88860002490	2.49	0.0980	40
88860002500	2.50	0.0984	
88860002510	2.51	0.0988	
88860002520	2.52	0.0992	
88860002530	2.53	0.0996	39
88860002540	2.54	0.1000	
88860002550	2.55	0.1004	
88860002560	2.56	0.1008	
88860002570	2.57	0.1012	
88860002580	2.58	0.1016	38
88860002590	2.59	0.1020	
88860002600	2.60	0.1024	
88860002610	2.61	0.1028	
88860002620	2.62	0.1031	
88860002630	2.63	0.1035	
88860002640	2.64	0.1039	37
88860002650	2.65	0.1043	
88860002660	2.66	0.1047	
88860002670	2.67	0.1051	
88860002680	2.68	0.1055	
88860002690	2.69	0.1059	
88860002700	2.70	0.1063	36
88860002710	2.71	0.1067	
88860002720	2.72	0.1071	
88860002730	2.73	0.1075	
88860002740	2.74	0.1079	
88860002750	2.75	0.1083	
88860002760	2.76	0.1087	
88860002770	2.77	0.1091	
88860002780	2.78	0.1094	
88860002790	2.79	0.1098	35
88860002800	2.80	0.1102	
88860002810	2.81	0.1106	
88860002820	2.82	0.1110	34
88860002830	2.83	0.1114	
88860002840	2.84	0.1118	
88860002850	2.85	0.1122	
88860002860	2.86	0.1126	
88860002870	2.87	0.1130	33
88860002880	2.88	0.1134	
88860002890	2.89	0.1138	
88860002900	2.90	0.1142	
88860002910	2.91	0.1146	
88860002920	2.92	0.1150	
88860002930	2.93	0.1154	
88860002940	2.94	0.1157	
88860002950	2.95	0.1161	32
88860002960	2.96	0.1164	
88860002970	2.97	0.1169	
88860002980	2.98	0.1173	
88860002990	2.99	0.1177	
88860003000	3.00	0.1181	
88860003010	3.01	0.1185	
88860003020	3.02	0.1189	
88860003030	3.03	0.1193	
88860003040	3.04	0.1197	
88860003050	3.05	0.1201	31

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860003060	3.06	0.1205	
88860003070	3.07	0.1209	
88860003080	3.08	0.1213	
88860003090	3.09	0.1217	
88860003100	3.10	0.1220	
88860003110	3.11	0.1224	
88860003120	3.12	0.1228	
88860003130	3.13	0.1232	
88860003140	3.14	0.1236	
88860003150	3.15	0.1240	
88860003160	3.16	0.1244	
88860003170	3.17	0.1248	
88860003175	3.175	0.1250	
88860003180	3.18	0.1252	
88860003190	3.19	0.1256	
88860003200	3.20	0.1260	
88860003210	3.21	0.1264	
88860003220	3.22	0.1268	
88860003230	3.23	0.1272	
88860003240	3.24	0.1276	
88860003250	3.25	0.1280	
88860003260	3.26	0.1283	30
88860003270	3.27	0.1287	
88860003280	3.28	0.1291	
88860003290	3.29	0.1295	
88860003300	3.30	0.1299	
88860003310	3.31	0.1303	
88860003320	3.32	0.1308	
88860003330	3.33	0.1311	
88860003340	3.34	0.1315	
88860003350	3.35	0.1319	
88860003360	3.36	0.1323	
88860003370	3.37	0.1327	
88860003380	3.38	0.1331	
88860003390	3.39	0.1335	
88860003400	3.40	0.1339	
88860003410	3.41	0.1343	
88860003420	3.42	0.1346	
88860003430	3.43	0.1350	
88860003440	3.44	0.1354	
88860003450	3.45	0.1358	29
88860003460	3.46	0.1362	
88860003470	3.47	0.1366	
88860003480	3.48	0.1370	
88860003490	3.49	0.1374	
88860003500	3.50	0.1378	
88860003510	3.51	0.1382	
88860003520	3.52	0.1386	
88860003530	3.53	0.1390	
88860003540	3.54	0.1394	
88860003550	3.55	0.1398	
88860003560	3.56	0.1402	
88860003570	3.57	0.1406	28
88860003580	3.58	0.1409	
88860003590	3.59	0.1413	
88860003600	3.60	0.1417	
88860003610	3.61	0.1421	
88860003620	3.62	0.1425	
88860003630	3.63	0.1429	
88860003640	3.64	0.1433	
88860003650	3.65	0.1437	
88860003660	3.66	0.1141	27
88860003670	3.67	0.1445	
88860003680	3.68	0.1449	
88860003690	3.69	0.1453	
88860003700	3.70	0.1457	

Note: Highlighted items are an increment of 0.0003

10° left spiral/right hand cut for thru holes.

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860003710	3.71	0.1461	
88860003720	3.72	0.1465	
88860003730	3.73	0.1469	26
88860003740	3.74	0.1472	
88860003750	3.75	0.1476	
88860003760	3.76	0.1480	
88860003770	3.77	0.1484	
88860003780	3.78	0.1488	
88860003790	3.79	0.1492	
88860003800	3.80	0.1496	25
88860003810	3.81	0.1500	
88860003820	3.82	0.1504	
88860003830	3.83	0.1508	
88860003840	3.84	0.1512	
88860003850	3.85	0.1516	
88860003860	3.86	0.1520	24
88860003870	3.87	0.1524	
88860003880	3.88	0.1528	
88860003890	3.89	0.1531	
88860003900	3.90	0.1535	
88860003910	3.91	0.1539	23
88860003920	3.92	0.1543	
88860003930	3.93	0.1547	
88860003940	3.94	0.1551	
88860003950	3.95	0.1555	
88860003960	3.96	0.1559	
88860003970	3.97	0.1563	
88860003980	3.98	0.1567	
88860003990	3.99	0.1571	22
88860004000	4.00	0.1575	
88860004010	4.01	0.1579	
88860004020	4.02	0.1583	
88860004030	4.03	0.1587	
88860004040	4.04	0.1591	21
88860004050	4.05	0.1594	
88860004060	4.06	0.1598	
88860004070	4.07	0.1602	
88860004080	4.08	0.1606	
88860004090	4.09	0.1610	20
88860004100	4.10	0.1614	
88860004110	4.11	0.1618	
88860004120	4.12	0.1622	
88860004130	4.13	0.1626	
88860004140	4.14	0.1630	
88860004150	4.15	0.1634	
88860004160	4.16	0.1638	
88860004170	4.17	0.1642	
88860004180	4.18	0.1646	
88860004190	4.19	0.1650	
88860004200	4.20	0.1654	
88860004210	4.21	0.1657	
88860004220	4.22	0.1661	19
88860004230	4.23	0.1665	
88860004240	4.24	0.1669	
88860004250	4.25	0.1673	
88860004260	4.26	0.1677	
88860004270	4.27	0.1681	
88860004280	4.28	0.1685	
88860004290	4.29	0.1689	
88860004300	4.30	0.1693	18
88860004310	4.31	0.1697	
88860004320	4.32	0.1701	
88860004330	4.33	0.1705	
88860004340	4.34	0.1709	
88860004350	4.35	0.1713	
88860004360	4.36	0.1717	

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860004370	4.37	0.1720	
88860004380	4.38	0.1724	
88860004390	4.39	0.1728	17
88860004400	4.40	0.1732	
88860004410	4.41	0.1736	
88860004420	4.42	0.1740	
88860004430	4.43	0.1744	
88860004440	4.44	0.1748	
88860004450	4.45	0.1752	
88860004460	4.46	0.1756	
88860004470	4.47	0.1760	
88860004480	4.48	0.1764	
88860004490	4.49	0.1768	16
88860004500	4.50	0.1772	
88860004510	4.51	0.1776	
88860004520	4.52	0.1780	
88860004530	4.53	0.1783	
88860004540	4.54	0.1787	
88860004550	4.55	0.1791	
88860004560	4.56	0.1795	
88860004570	4.57	0.1799	15
88860004580	4.58	0.1803	
88860004590	4.59	0.1807	
88860004600	4.60	0.1811	
88860004610	4.61	0.1815	
88860004620	4.62	0.1819	14
88860004630	4.63	0.1823	
88860004640	4.64	0.1827	
88860004650	4.65	0.1831	
88860004660	4.66	0.1835	
88860004670	4.67	0.1839	
88860004680	4.68	0.1843	
88860004690	4.69	0.1846	
88860004700	4.70	0.1850	13
88860004710	4.71	0.1854	
88860004720	4.72	0.1858	
88860004730	4.73	0.1862	
88860004740	4.74	0.1866	
88860004750	4.75	0.1870	
88860004760	4.76	0.1874	
88865004762	4.763	0.1875	
88860004770	4.77	0.1878	
88860004780	4.78	0.1882	
88860004790	4.79	0.1886	
88860004800	4.80	0.1890	12
88860004810	4.81	0.1894	
88860004820	4.82	0.1898	
88860004830	4.83	0.1902	
88860004840	4.84	0.1906	
88860004850	4.85	0.1909	11
88860004860	4.86	0.1913	
88860004870	4.87	0.1917	
88860004880	4.88	0.1921	
88860004890	4.89	0.1925	
88860004900	4.90	0.1929	
88860004910	4.91	0.1933	10
88860004920	4.92	0.1937	
88860004930	4.93	0.1941	
88860004940	4.94	0.1945	
88860004950	4.95	0.1949	
88860004960	4.96	0.1953	
88860004970	4.97	0.1957	
88860004980	4.98	0.1961	9
88860004990	4.99	0.1965	
88860005000	5.00	0.1969	
88860005010	5.01	0.1972	

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860005020	5.02	0.1976	
88860005030	5.03	0.1980	
88860005040	5.04	0.1984	
88860005050	5.05	0.1988	8
88860005060	5.06	0.1992	
88860005070	5.07	0.1996	
88860005080	5.08	0.2000	
88860005090	5.09	0.2004	
88860005100	5.10	0.2008	7
88860005110	5.11	0.2012	
88860005120	5.12	0.2016	
88860005130	5.13	0.2020	
88860005140	5.14	0.2024	
88860005150	5.15	0.2028	
88860005160	5.16	0.2031	
88860005170	5.17	0.2035	
88860005180	5.18	0.2039	6
88860005190	5.19	0.2043	
88860005200	5.20	0.2047	
88860005210	5.21	0.2051	
88860005220	5.22	0.2055	5
88860005230	5.23	0.2059	
88860005240	5.24	0.2063	
88860005250	5.25	0.2067	
88860005260	5.26	0.2071	
88860005270	5.27	0.2075	
88860005280	5.28	0.2079	
88860005290	5.29	0.2083	
88860005300	5.30	0.2087	
88860005310	5.31	0.2091	4
88860005320	5.32	0.2094	
88860005330	5.33	0.2098	
88860005340	5.34	0.2102	
88860005350	5.35	0.2106	
88860005360	5.36	0.2110	
88860005370	5.37	0.2114	
88860005380	5.38	0.2118	
88860005390	5.39	0.2122	
88860005400	5.40	0.2126	
88860005410	5.41	0.2130	3
88860005420	5.42	0.2134	
88860005430	5.43	0.2138	
88860005440	5.44	0.2142	
88860005450	5.45	0.2146	
88860005460	5.46	0.2150	
88860005470	5.47	0.2154	
88860005480	5.48	0.2158	
88860005490	5.49	0.2161	
88860005500	5.50	0.2165	
88860005510	5.51	0.2169	
88860005520	5.52	0.2173	
88860005530	5.53	0.2177	
88860005540	5.54	0.2181	
88860005550	5.55	0.2185	
88860005560	5.56	0.2189	
88860005570	5.57	0.2193	
88860005580	5.58	0.2197	
88860005590	5.59	0.2201	
88860005600	5.60	0.2205	
88860005610	5.61	0.2209	2
88860005620	5.62	0.2213	
88860005630	5.63	0.2217	
88860005640	5.64	0.2220	
88860005650	5.65	0.2224	
88860005660	5.66	0.2228	
88860005670	5.67	0.2232	

Note: Highlighted items are an increment of 0.0003

10° left spiral/right hand cut for thru holes.

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860005680	5.68	0.2236	
88860005690	5.69	0.2240	
88860005700	5.70	0.2244	
88860005710	5.71	0.2248	
88860005720	5.72	0.2252	
88860005730	5.73	0.2256	
88860005740	5.74	0.2260	
88860005750	5.75	0.2264	
88860005760	5.76	0.2268	
88860005770	5.77	0.2272	
88860005780	5.78	0.2276	
88860005790	5.79	0.2280	1
88860005800	5.80	0.2284	
88860005810	5.81	0.2288	
88860005820	5.82	0.2291	
88860005830	5.83	0.2295	
88860005840	5.84	0.2299	
88860005850	5.85	0.2303	
88860005860	5.86	0.2307	
88860005870	5.87	0.2311	
88860005880	5.88	0.2315	
88860005890	5.89	0.2319	
88860005900	5.90	0.2323	
88860005910	5.91	0.2327	
88860005920	5.92	0.2331	
88860005930	5.93	0.2335	
88860005940	5.94	0.2339	A
88860005950	5.95	0.2343	
88860005960	5.96	0.2347	
88860005970	5.97	0.2350	
88860005980	5.98	0.2354	
88860005990	5.99	0.2358	
88860006000	6.00	0.2362	
88860006010	6.01	0.2366	
88860006020	6.02	0.2370	
88860006030	6.03	0.2374	
88860006040	6.04	0.2378	
88860006050	6.05	0.2382	B
88860006060	6.06	0.2386	
88860006070	6.07	0.2390	
88860006080	6.08	0.2394	
88860006090	6.09	0.2398	
88860006100	6.10	0.2402	
88860006110	6.11	0.2406	
88860006120	6.12	0.2410	
88860006130	6.13	0.2413	
88860006140	6.14	0.2417	
88860006150	6.15	0.2421	C
88860006160	6.16	0.2425	
88860006170	6.17	0.2429	
88860006180	6.18	0.2433	
88860006190	6.19	0.2437	
88860006200	6.20	0.2441	
88860006210	6.21	0.2445	
88860006220	6.22	0.2449	
88860006230	6.23	0.2453	
88860006240	6.24	0.2457	
88860006250	6.25	0.2461	D
88860006260	6.26	0.2465	
88860006270	6.27	0.2468	
88860006280	6.28	0.2472	
88860006290	6.29	0.2476	
88860006300	6.30	0.2480	
88860006310	6.31	0.2484	
88860006320	6.32	0.2488	
88860006330	6.33	0.2492	

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860006340	6.34	0.2496	
88860006350	6.35	0.2500	E
88860006360	6.36	0.2504	
88860006370	6.37	0.2508	
88860006380	6.38	0.2512	
88860006390	6.39	0.2517	
88860006400	6.40	0.2520	
88860006410	6.41	0.2524	
88860006420	6.42	0.2528	
88860006430	6.43	0.2531	
88860006440	6.44	0.2535	
88860006450	6.45	0.2539	
88860006460	6.46	0.2543	
88860006470	6.47	0.2547	
88860006480	6.48	0.2551	
88860006490	6.49	0.2555	
88860006500	6.50	0.2559	
88860006510	6.51	0.2563	
88860006520	6.52	0.2567	
88860006530	6.53	0.2571	F
88860006540	6.54	0.2575	
88860006550	6.55	0.2579	
88860006560	6.56	0.2583	
88860006570	6.57	0.2587	
88860006580	6.58	0.2591	
88860006590	6.59	0.2594	
88860006600	6.60	0.2598	
88860006610	6.61	0.2602	
88860006620	6.62	0.2606	
88860006630	6.63	0.2610	G
88860006640	6.64	0.2614	
88860006650	6.65	0.2618	
88860006660	6.66	0.2622	
88860006670	6.67	0.2626	
88860006680	6.68	0.2630	
88860006690	6.69	0.2634	
88860006700	6.70	0.2638	
88860006710	6.71	0.2642	
88860006720	6.72	0.2646	
88860006730	6.73	0.2650	
88860006740	6.74	0.2654	
88860006750	6.75	0.2657	
88860006760	6.76	0.2661	H
88860006770	6.77	0.2665	
88860006780	6.78	0.2669	
88860006790	6.79	0.2673	
88860006800	6.80	0.2677	
88860006810	6.81	0.2681	
88860006820	6.82	0.2685	
88860006830	6.83	0.2689	
88860006840	6.84	0.2693	
88860006850	6.85	0.2697	
88860006860	6.86	0.2701	
88860006870	6.87	0.2705	
88860006880	6.88	0.2709	
88860006890	6.89	0.2713	
88860006900	6.90	0.2717	
88860006910	6.91	0.2720	I
88860006920	6.92	0.2724	
88860006930	6.93	0.2728	
88860006940	6.94	0.2732	
88860006950	6.95	0.2736	
88860006960	6.96	0.2740	
88860006970	6.97	0.2744	
88860006980	6.98	0.2748	
88860006990	6.99	0.2752	

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860007000	7.00	0.2756	
88860007010	7.01	0.2760	
88860007020	7.02	0.2764	
88860007030	7.03	0.2768	J
88860007040	7.04	0.2772	
88860007050	7.05	0.2776	
88860007060	7.06	0.2780	
88860007070	7.07	0.2783	
88860007080	7.08	0.2787	
88860007090	7.09	0.2791	
88860007100	7.10	0.2795	
88860007110	7.11	0.2799	
88860007120	7.12	0.2803	
88860007130	7.13	0.2807	
88860007140	7.14	0.2811	K
88860007150	7.15	0.2815	
88860007160	7.16	0.2819	
88860007170	7.17	0.8223	
88860007180	7.18	0.2827	
88860007190	7.19	0.2831	
88860007200	7.20	0.2835	
88860007210	7.21	0.2839	
88860007220	7.22	0.2843	
88860007230	7.23	0.2846	
88860007240	7.24	0.2850	
88860007250	7.25	0.2854	
88860007260	7.26	0.2858	
88860007270	7.27	0.2862	
88860007280	7.28	0.2866	
88860007290	7.29	0.2870	
88860007300	7.30	0.2874	
88860007310	7.31	0.2878	
88860007320	7.32	0.2882	
88860007330	7.33	0.2886	
88860007340	7.34	0.2890	
88860007350	7.35	0.2894	
88860007360	7.36	0.2898	L
88860007370	7.37	0.2902	
88860007380	7.38	0.2906	
88860007390	7.39	0.2909	
88860007400	7.40	0.2913	
88860007410	7.41	0.2917	
88860007420	7.42	0.2921	
88860007430	7.43	0.2925	
88860007440	7.44	0.2929	
88860007450	7.45	0.2933	
88860007460	7.46	0.2937	
88860007470	7.47	0.2941	
88860007480	7.48	0.2945	
88860007490	7.49	0.2949	M
88860007500	7.50	0.2953	
88860007510	7.51	0.2957	
88860007520	7.52	0.2961	
88860007530	7.53	0.2965	
88860007540	7.54	0.2969	
88860007550	7.55	0.2972	
88860007560	7.56	0.2976	
88860007570	7.57	0.2980	
88860007580	7.58	0.2984	
88860007590	7.59	0.2988	
88860007600	7.60	0.2992	
88860007610	7.61	0.2996	
88860007620	7.62	0.3000	
88860007630	7.63	0.3004	
88860007640	7.64	0.3008	
88860007650	7.65	0.3012	

Note: Highlighted items are an increment of 0.0003

10° left spiral/right hand cut for thru holes.

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860007660	7.66	0.3016	
88860007670	7.67	0.3020	N
88860007680	7.68	0.3024	
88860007690	7.69	0.3028	
88860007700	7.70	0.3031	
88860007710	7.71	0.3035	
88860007720	7.72	0.3039	
88860007730	7.73	0.3043	
88860007740	7.74	0.3047	
88860007750	7.75	0.3051	
88860007760	7.76	0.3055	
88860007770	7.77	0.3059	
88860007780	7.78	0.3063	
88860007790	7.79	0.3067	
88860007800	7.80	0.3071	
88860007810	7.81	0.3075	
88860007820	7.82	0.3079	
88860007830	7.83	0.3083	
88860007840	7.84	0.3087	
88860007850	7.85	0.3091	
88860007860	7.86	0.3094	
88860007870	7.87	0.3098	
88860007880	7.88	0.3102	
88860007890	7.89	0.3106	
88860007900	7.90	0.3110	
88860007910	7.91	0.3114	
88860007920	7.92	0.3118	
88860007930	7.93	0.3122	
88865007937	7.938	0.3125	
88860007940	7.94	0.3126	
88860007950	7.95	0.3130	
88860007960	7.96	0.3134	
88860007970	7.97	0.3138	
88860007980	7.98	0.3142	
88860007990	7.99	0.3146	
88860007000	8.00	0.3150	
88860007010	8.01	0.3154	
88860007020	8.02	0.3157	
88860007030	8.03	0.3161	O
88860007040	8.04	0.3165	
88860007050	8.05	0.3169	
88860007060	8.06	0.3173	
88860007070	8.07	0.3177	
88860007080	8.08	0.3181	
88860007090	8.09	0.3185	
88860007100	8.10	0.3189	
88860007110	8.11	0.3193	
88860007120	8.12	0.3197	
88860007130	8.13	0.3201	
88860007140	8.14	0.3205	
88860007150	8.15	0.3209	
88860007160	8.16	0.3213	
88860007170	8.17	0.3217	
88860007180	8.18	0.3220	
88860007190	8.19	0.3224	
88860007200	8.20	0.3228	P
88860007210	8.21	0.3232	
88860007220	8.22	0.3236	
88860007230	8.23	0.3240	
88860007240	8.24	0.3244	
88860008250	8.25	0.3248	
88860008260	8.26	0.3552	
88860008270	8.27	0.3256	
88860008280	8.28	0.3260	
88860008290	8.29	0.3264	

Note: Highlighted items are an increment of 0.0003

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860008300	8.30	0.3268	
88860008310	8.31	0.3272	
88860008320	8.32	0.3276	
88860008330	8.33	0.3280	
88860008340	8.34	0.3283	
88860008350	8.35	0.3287	
88860008360	8.36	0.3291	
88860008370	8.37	0.3295	
88860008380	8.38	0.3299	
88860008390	8.39	0.3303	
88860008400	8.40	0.3307	
88860008410	8.41	0.3311	
88860008420	8.42	0.3315	
88860008430	8.43	0.3319	Q
88860008440	8.44	0.3323	
88860008450	8.45	0.3327	
88860008460	8.46	0.3331	
88860008470	8.47	0.3335	
88860008480	8.48	0.3339	
88860008490	8.49	0.3343	
88860008500	8.50	0.3346	
88860008510	8.51	0.3350	
88860008520	8.52	0.3354	
88860008530	8.53	0.3358	
88860008540	8.54	0.3362	
88860008550	8.55	0.3366	
88860008560	8.56	0.3370	
88860008570	8.57	0.3374	
88860008580	8.58	0.3378	
88860008590	8.59	0.3382	
88860008600	8.60	0.3386	
88860008610	8.61	0.3390	R
88860008620	8.62	0.3394	
88860008630	8.63	0.3398	
88860008640	8.64	0.3402	
88860008650	8.65	0.3406	
88860008660	8.66	0.3409	
88860008670	8.67	0.3413	
88860008680	8.68	0.3417	
88860008690	8.69	0.3421	
88860008700	8.70	0.3425	
88860008710	8.71	0.3429	
88860008720	8.72	0.3433	
88860008730	8.73	0.3437	
88860008740	8.74	0.3441	
88860008750	8.75	0.3445	
88860008760	8.76	0.3449	
88860008770	8.77	0.3453	
88860008780	8.78	0.3457	
88860008790	8.79	0.3461	
88860008800	8.80	0.3465	
88860008810	8.81	0.3469	
88860008820	8.82	0.3472	
88860008830	8.83	0.3476	
88860008840	8.84	0.3480	S
88860008850	8.85	0.3484	
88860008860	8.86	0.3488	
88860008870	8.87	0.3492	
88860008880	8.88	0.3496	
88860008890	8.89	0.3500	
88860008900	8.90	0.3504	
88860008910	8.91	0.3508	
88860008920	8.92	0.3512	
88860008930	8.93	0.3516	
88860008940	8.94	0.3520	

8600 Series			
EDP No.	(mm)	Decimal	Wire
88860008950	8.95	0.3524	
88860008960	8.96	0.3528	
88860008970	8.97	0.3531	
88860008980	8.98	0.3535	
88860008990	8.99	0.3539	
88860008000	9.00	0.3543	
88860008010	9.01	0.3547	
88860008020	9.02	0.3551	
88860008030	9.03	0.3555	
88860008040	9.04	0.3559	
88860008050	9.05	0.3563	
88860008060	9.06	0.3567	
88860008070	9.07	0.3571	
88860008080	9.08	0.3575	
88860008090	9.09	0.3579	T
88860008100	9.10	0.3583	
88860008110	9.11	0.3587	
88860008120	9.12	0.3591	
88860008130	9.13	0.3594	
88860008140	9.14	0.3598	
88860008150	9.15	0.3602	
88860009170	9.17	0.3610	
88860009180	9.18	0.3614	
88860009190	9.19	0.3618	
88860009200	9.20	0.3622	
88860009210	9.21	0.3626	
88860009220	9.22	0.3630	
88860009230	9.23	0.3634	
88860009240	9.24	0.3638	
88860009250	9.25	0.3642	
88860009260	9.26	0.3646	
88860009270	9.27	0.3650	
88860009280	9.28	0.3654	
88870009290	9.29	0.3657	
88870009300	9.30	0.3661	
88870009310	9.31	0.3665	
88860009320	9.32	0.3669	
88850009330	9.33	0.3673	
88860009340	9.34	0.3677	
88860009350	9.35	0.3681	U
88860009260	9.36	0.3685	
88860009370	9.37	0.3689	
88860009280	9.38	0.3693	
88860009390	9.39	0.3697	
88860009400	9.40	0.3701	
88860009410	9.41	0.3705	
88860009420	9.42	0.3709	
88860009430	9.43	0.3713	
88860009440	9.44	0.3717	
88860009450	9.45	0.3720	
88860009460	9.46	0.3724	
88860009470	9.47	0.3728	
88860009480	9.48	0.3732	
88860009490	9.49	0.3736	
88860009500	9.50	0.3740	
88860009510	9.51	0.3744	
88860009520	9.52	0.3748	
88865009525	9.525	0.3750	
88860009530	9.53	0.3752	
88860009540	9.54	0.3756	
88860009550	9.55	0.3760	
88860009560	9.56	0.3763	
88860009570	9.57	0.3767	
88860009650	9.65	-	
88860009730	9.73	-	

10° left spiral/right hand cut for thru holes.

8600 Series

25/64" Range

EDP No.	(mm)	Decimal
88860009870	9.87	0.3886
88860009880	9.88	0.3889
88860009890	9.89	0.3893
88860009900	9.90	0.3897
88860009910	9.91	0.3901
88860009920	9.92	0.3905
88860009930	9.93	0.3909
88860009940	9.94	0.3913
88860009950	9.95	0.3917
88860009960	9.96	0.3921

10mm Range

EDP No.	(mm)	Decimal
88860009970	9.97	0.3925
88860009980	9.98	0.3929
88860009990	9.99	0.3933
88860010000	10.00	0.3937
88860010010	10.01	0.3941
88860010020	10.02	0.3945
88860010030	10.03	0.3949
88860010040	10.04	0.3953
88860010050	10.05	0.3957

27/64" Range

EDP No.	(mm)	Decimal
88860010660	10.66	0.4197
88860010670	10.67	0.4201
88860010680	10.68	0.4205
88860010690	10.69	0.4209
88860010700	10.70	0.4213
88860010710	10.71	0.4217
88860010720	10.72	0.4220
88860010730	10.73	0.4224
88860010740	10.74	0.4228
88860010750	10.75	0.4232
88860010760	10.76	0.4236

11mm Range

EDP No.	(mm)	Decimal
88860010950	10.95	0.4311
88860010960	10.96	0.4315
88860010970	10.97	0.4319
88860010980	10.98	0.4323
88860010990	10.99	0.4327
88860011000	11.00	0.4331
88860011010	11.01	0.4335
88860011020	11.02	0.4339
88860011030	11.03	0.4343
88860011040	11.04	0.4346
88860011050	11.05	0.4350

7/16" Range

EDP No.	(mm)	Decimal
88860011060	11.06	0.4354
88860011070	11.07	0.4358
88860011080	11.08	0.4362
88860011090	11.09	0.4366
88860011100	11.10	0.4370
88860011110	11.11	0.4374
88865011112	11.113	0.4375
88860011120	11.12	0.4378
88860011130	11.13	0.4382
88860011140	11.14	0.4386
88860011150	11.15	0.4390
88860011160	11.16	0.4394
88860011170	11.17	-

Note: Highlighted items are an increment of 0.0003

8600 Series

29/64" & 11.5mm Range

EDP No.	(mm)	Decimal
88860011450	11.45	0.4508
88860011460	11.46	0.4512
88860011470	11.47	0.4516
88860011480	11.48	0.4520
88860011490	11.49	0.4524
88860011500	11.50	0.4528
88860011510	11.51	0.4531
88860011520	11.52	0.4535
88860011530	11.53	0.4539
88860011540	11.54	0.4543
88860011550	11.55	0.4547

5/32" Range

EDP No.	(mm)	Decimal
88860011850	11.85	0.4665
88860011860	11.86	0.4669
88860011870	11.87	0.4673
88860011880	11.88	0.4677
88860011890	11.89	0.4681
88860011900	11.90	0.4685
88860011910	11.91	0.4689
88860011920	11.92	0.4693
88860011930	11.93	0.4697

12mm Range

EDP No.	(mm)	Decimal
88860011940	11.94	0.4701
88860011950	11.95	0.4705
88860011960	11.96	0.4709
88860011970	11.97	0.4713
88860011980	11.98	0.4717
88860011990	11.99	0.4720
88860012000	12.00	0.4724
88860012010	12.01	0.4728
88860012020	12.02	0.4732
88860012030	12.03	0.4736
88860012040	12.04	0.4740
88860012050	12.05	0.4744

31/64" Range

EDP No.	(mm)	Decimal
88860012250	12.25	0.4823
88860012260	12.26	0.4827
88860012270	12.27	0.4831
88860012280	12.28	0.4835
88860012290	12.29	0.4839
88860012300	12.30	0.4843
88860012310	12.31	0.4846
88860012320	12.32	0.4850
88860012330	12.33	0.4854
88860012340	12.34	0.4858
88860012350	12.35	0.4862

8600 Series

1/2" Range

EDP No.	(mm)	Decimal
88860012650	12.65	0.4980
88860012660	12.66	0.4984
88860012670	12.67	0.4988
88860012680	12.68	0.4992
88860012690	12.69	0.4996
88860012700	12.70	0.5000
88860012710	12.71	0.5004
88860012720	12.72	0.5008
88860012730	12.73	0.5012
88860012740	12.74	0.5016
88860012750	12.75	0.5020
88860012940	12.94	0.5094
88860012950	12.95	0.5098
88860012960	12.96	0.5102
88860012970	12.97	0.5106
88860012980	12.98	0.5110
88860012990	12.99	0.5114

13mm Range

EDP No.	(mm)	Decimal
88860013000	13.00	0.5118
88860013010	13.01	0.5122
88860013020	13.02	0.5126
88860013030	13.03	0.5130
88860013040	13.04	0.5134
88860013050	13.05	0.5138
88865014287	14.287	0.5625
88865015875	15.875	0.6250
88865019050	19.050	0.7500

High Precision Micro Reamers

Correct Hole Sizes for Best Reamer Results

All Magafor Micro and Miniature Solid Carbide Reamers are left hand spiral – right hand cut with a 45° Lead. Designed for thru holes or holes with enough room to accommodate a small amount of waste material.

The left-hand spiral acts like an Archimedean Screw. Coolant is directly led to the cutting edges for better lubrication and cooling. Chips are pushed forward with no scratches and leaves outstanding surface finishes.

Over 1,125 Standard Sizes Starting at .0078 in .0002" increments to 0.0236" In 0.0004" increments to 0.5020"

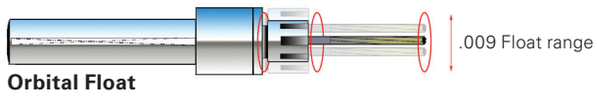
Final Hole Size to Drilled Hole Size

Final Hole Reamer Size (mm/inch)	Reduce Drill Hole Size (inch) min/max	Reduce Drill Hole Size (mm) min/max
0.20 / 0.00787	-0.00157 / -0.00236	-0.04 / -0.06
0.30 / 0.01181	-0.00197 / -0.00315	-0.05 / -0.08
0.40 / 0.01575	-0.00197 / -0.00394	-0.05 / -0.10
0.50 / 0.01969	-0.00197 / -0.0047	-0.05 / -0.12
0.60 / 0.02362	-0.0019 / -0.00472	-0.05 / -0.12
2.00 / 0.07874	-0.00197 / -0.00472	-0.05 / -0.12
6.00 / 0.23622	-0.00591 / -0.00787	-0.15 / -0.20
10.00 / 0.39370	-0.0059 / -0.00787	-0.15 / -0.20
15.00 / 0.59055	-0.01181 / -0.01575	-0.30 / -0.40
20.00 / 0.78740	-0.01181 / -0.01575	-0.30 / -0.40
25.00 / 0 .98425	-0.01181 / -0.01969	-0.30 / -0.50
15.00 / 0.59055	-0.01181 / -0.01575	-0.30 / -0.40
20.00 / 0.78740	-0.01181 / -0.01575	-0.30 / -0.40
25.00 / 0.98425	-0.01181 / -0.01969	-0.30 / -0.50

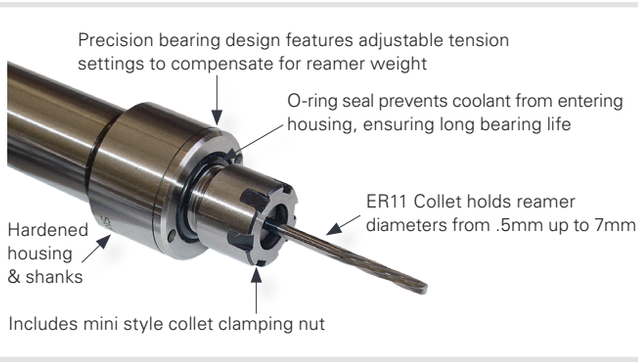
Ultra-Precision Floating Reamer Holders

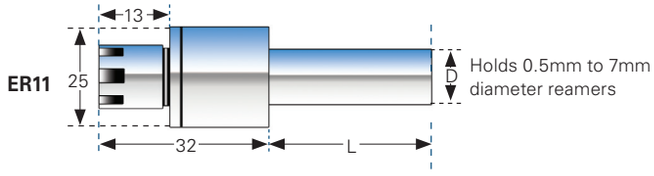
Complete Orbital Float for True Alignment

Designed with "True Orbital Float" capability, the micro reamer holder aligns the reamer perfectly to the drilled hole enabling better size control, reduces "bell-mouthing" and increases tool life.



Orbital Float





ER11 Floating Reamer Holder w/ Mini-nut Assembly

Item No.	D	L
HSP-11-010-042	10mm	42.00
HSP-11-090-042	3/4 "	2.75"
HSP-11-200-042	20mm	41.50
HSP-11-200-042	22mm	41.50



Collet Set



Mini Wrench



Mini Nut

Accessory Components

Item No.	Description
HSP-04621	ER11 Mini Wrench
HSP-ER-11-MNS	ER11 Mini Nut

Collet Sets

Item No.	Description
HSP-11R-S7-ISP	7pc ER11 Inch bore Collet Set Size Range 1/16, 3/32, 1/8, 5/32, 3/16, 7/32, 1/4"
HSP-11R-S13-MSP	13pc ER11 Metric Bore Collet Set Size Range .5-7mm in .5mm increments
HSP-11R-S13-MUP	13pc ULTRA PRECISION Metric Bore Collet Set (0.0002"TIR) Size Range 0.5-7mm in 0.5mm increments

Reamer Formulas for Speeds & Feeds

The parameters below are based on using a carbide reamer at the highest SFM

SFM: Surface Feet per Minute
RPM: Revolutions per Minute
IPT: Inches per Tooth (chip load)
IPM: Inches per Minute
IPR: Inches per Revolution

Speed Formula:
RPM = 3.82 x (SFM ÷ Diameter)

Feed:
IPM = IPT x # of Flutes x RPM
IPR = IPM ÷ RPM
SFM = RPM x Diameter ÷ 3.82

Example:
using a Carbide 2mm Reamer
in Steel < 81 HRB
RPM = 3.82 x (132 ÷ .0787) = 6407 RPM
IPM = .0015 x 4 x 6407 = 38.4 IPM
IPR = 38.4 ÷ 6407 = .0059 IPR

This chart lists general reference parameters for a starting point. Below are a couple of tips for fine-tuning the desired size.

To increase the hole diameter: Slow down the feed rate and/or decrease RPM

To decrease the hole diameter: Increase the feed rate and/or increase the RPM

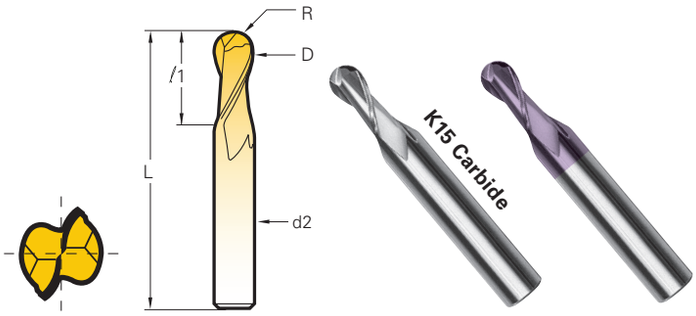
General reference parameters for a starting point

Material	Speed / SFM Carbide	Speed / SFM Cobalt		Diameter mm 2	4	6	10	15	20
Steel < 81 HRB	82 – 132	49 – 72	IPR IPM RPM	0.006 38.4 6400	0.006 19.2 3200	0.006 12.8 2130	0.0098 12.3 1300	0.0098 8.2 850	0.0118 7.7 640
Steel < 24 Rc.	66 – 82	39 – 56	IPR IPM RPM	0.0039 14.3 4000	0.0039 8.4 2000	0.0047 6.4 1300	0.0071 5.7 800	0.0071 3.8 500	0.0098 3.8 400
Steel 24-32 Rc.	39 – 59	25 – 33	IPR IPM RPM	0.0031 8.6 2800	0.0031 4.3 1430	0.0039 3.4 1000	0.0071 4.1 600	0.0059 2.3 400	0.0087 2.4 280
Steel 32-41 Rc.	33 – 49	16 – 23	IPR IPM RPM	0.0031 7.1 2400	0.0031 3.6 1200	0.0035 2.9 800	0.0059 2.9 500	0.0079 2.5 300	0.0098 2.3 240
Stainless Steel	23 – 39	10 – 16	IPR IPM RPM	0.0028 5.7 1900	0.0028 2.8 950	0.0039 2.3 630	0.0047 1.8 400	0.0059 1.5 250	0.0079 1.5 240
Inconel/Waspaloy	20 – 33	7 – 10	IPR IPM RPM	0.0028 4.8 1600	0.0028 2.4 800	0.0039 1.9 540	0.0047 1.5 320	0.0059 1.3 200	0.0079 1.2 200
Cast Iron ≤ 180 HB (Grey)	99 – 132	20 – 49	IPR IPM RPM	0.0039 231.1 6400	0.0039 11.5 3200	0.0047 10.2 2130	0.0079 10 1300	0.0098 8.2 850	0.0098 6.1 640
Cast Iron > 180 HB	26 – 49	13 – 16	IPR IPM RPM	0.0028 7.1 2400	0.0028 3.6 1200	0.0039 2.9 800	0.0059 2.9 480	0.0071 2.3 300	0.0079 1.9 240
Copper	82 – 99	39 – 66	IPR IPM RPM	0.0047 23.1 4800	0.0047 11.5 2400	0.0071 11.5 1600	0.0079 7.5 960	0.0098 6.1 640	0.0118 5.8 480
Brass	115 – 132	66 – 99	IPR IPM RPM	0.0079 50 6400	0.0079 25 3200	0.0087 17.9 2130	0.0118 15.4 1300	0.0138 11.8 850	0.0157 10 640
Bronze	66 – 82	39 – 56	IPR IPM RPM	0.0059 21.5 4000	0.0059 11.9 2000	0.0071 9.5 1320	0.0087 7.2 800	0.138 7.3 530	0.0146 5.7 400
Aluminum	132 – 197	82 – 115	IPR IPM RPM	0.0059 57.3 9500	0.0059 28.7 4800	0.0071 22.9 3200	0.0098 18.3 1900	0.0118 15.3 1300	0.0138 13.2 950
Recommended drill hole diameter:				1.90	3.90	5.85	9.80	14.70	19.70

High Performance Micro-Milling

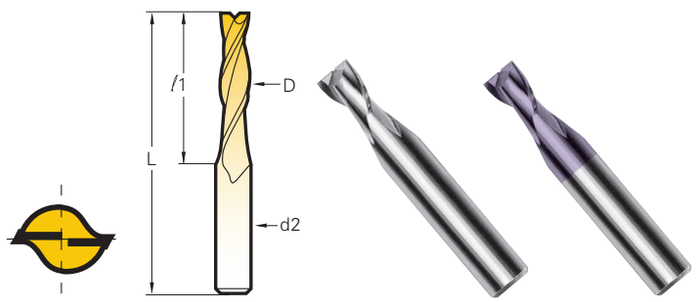
microforce

Applications: **Machining hard materials, abrasives composites, titanium and Hi-temp Alloys.**



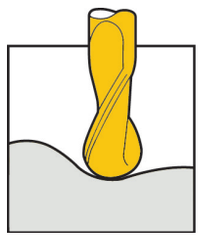
Ball End Series L = 39mm d2 = 0.188 / 3mm /= 1.5 x D

Diameter (inch)	Diameter (mm)	/1	r	magafor 8527	Hard'X 8527-H
0.0039	0.10	0.0039	0.0020	88852700100	-
0.0059	0.15	0.0079	0.0030	88852700150	-
0.0079	0.20	0.0118	0.0039	88852700200	-
0.0098	0.25	0.0138	0.0049	88852700250	-
0.0118	0.30	0.0177	0.0059	88852700300	888527H0030
0.0157	0.40	0.0236	0.0079	88852700400	888527H0040
0.0197	0.50	0.0295	0.0098	88852700500	888527H0050
0.0236	0.60	0.0354	0.0118	88852700600	888527H0060
0.0276	0.70	0.0413	0.0138	88852700700	888527H0070
0.0315	0.80	0.0472	0.0157	88852700800	888527H0080
0.0354	0.90	0.0531	0.0177	88852700900	888527H0090
0.0394	1.00	0.0591	0.0197	88852701000	888527H0100
0.0472	1.20	0.0709	0.0236	88852701200	888527H0120
0.0591	1.50	0.0886	0.0295	88852701500	888527H0150
0.0787	2.00	0.1181	0.0394	88852702000	888527H0200

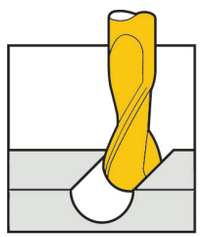


Square End Series L = 39mm d2 = 3mm /= 1.5 x D

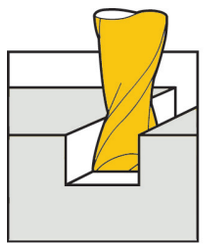
Diameter (inch)	Diameter (mm)	/1	magafor 8507	Hard'X 8507-H
0.0039	0.10	0.0039	88850700100	-
0.0059	0.15	0.0079	88850700150	-
0.0079	0.20	0.0118	88850700200	-
0.0098	0.25	0.0138	88850700250	-
0.0118	0.30	0.0177	88850700300	888507H0030
0.0157	0.40	0.0236	88850700400	888507H0040
0.0197	0.50	0.0295	88850700500	888507H0050
0.0236	0.60	0.0354	88850700600	888507H0060
0.0276	0.70	0.0413	88850700700	888507H0070
0.0315	0.80	0.0472	88850700800	888507H0080
0.0354	0.90	0.0531	88850700900	888507H0090
0.0394	1.00	0.0591	88850701000	888507H0100
0.0433	1.10	0.0650	88850701100	888507H0110
0.0472	1.20	0.0709	88850701200	888507H0120
0.0512	1.30	0.0768	88850701300	888507H0130
0.0551	1.40	0.0827	88850701400	888507H0140
0.0591	1.50	0.0886	88850701500	888507H0150
0.0630	1.60	0.0945	88850701600	888507H0160
0.0669	1.70	0.1004	88850701700	888507H0170
0.0709	1.80	0.1063	88850701800	888507H0180
0.0748	1.90	0.1122	88850701900	888507H0190
0.0787	2.00	0.1181	88850702000	888507H0200



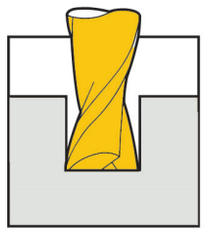
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Precise Grooving 0 – 0.01mm



Precise Grooving R +/- 0.01mm



Flat Bottom Boring

Engaged right from the start in the process aspiring to excellence, in addition to our Futura and TiN coatings, Magafor offers three "**X**" coatings, sprung from multi-layer nano technology.

Hard'X [For hard milling] carbide tool coating has a high hardness (3500 HV) and shows a high thermic stability. It offers excellent protection against heat and wear and is ideal for dry machining-high speed cut-in treated steels and dies up to 67 Rc.

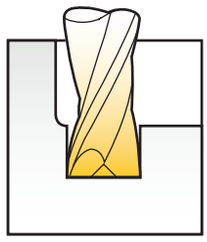
Graph'X [For composite milling] diamond coating (8000 HV) is particularly effective when machining graphite, composite materials, plastics with glass-fibers or carbon-fibers.

Standard Length Miniature End-mills

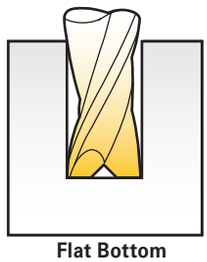
Standard Length Miniature End-Mills							/ ≃ 2-3 x D
Diameter (inch)	Diameter (mm)	/1	L	d2	magaforce 8500	Graph'X 8500-G	Hard'X 8500-H
0.0020	0.05	0.004			88850000050		
0.0024	0.06	0.005			88850000060		
0.0031	0.08	0.006			88850000080		
0.0039	0.10	0.008			88850000100		
0.0047	0.12	0.009			88850000120	-	-
0.0059	0.15	0.012			88850000150		
0.0079	0.20	0.020			88850000200		
0.0098	0.25	0.020			88850000250		
0.0118	0.30	0.039			88850000300	888500G0030	888500H0030
0.0138	0.35	0.039			88850000350	888500G0035	888500H0035
0.0157	0.40	0.039			88850000400	888500G0040	888500H0040
0.0177	0.45	0.039			88850000450	888500G0045	888500H0045
0.0197	0.50	0.059			88850000500	888500G0050	888500H0050
0.0216	0.55	0.059			88850000550	888500G0055	888500H0055
0.0236	0.60	0.059			88850000600	888500G0060	888500H0060
0.0256	0.65	0.059			88850000650	888500G0065	888500H0065
0.0276	0.70	0.079			88850000700	888500G0070	888500H0070
0.0295	0.75	0.079			88850000750	888500G0075	888500H0075
0.0315	0.80	0.079			88850000800	888500G0080	888500H0080
0.0335	0.85	0.079			88850000850	888500G0085	888500H0085
0.0354	0.90	0.098			88850000900	888500G0090	888500H0090
0.0374	0.95	0.098			88850000950	888500G0095	888500H0095
0.0394	1.00	0.12	1-1/2	0.118 3mm	88850001000	888500G0100	888500H0100
0.0413	1.05	0.12			88850001050	888500G0105	888500H0105
0.0433	1.10	0.12			88850001100	888500G0110	888500H0110
0.0452	1.15	0.12			88850001150	888500G0115	888500H0115
0.0472	1.20	0.16			88850001200	888500G0120	888500H0120
0.0492	1.25	0.16			88850001250	888500G0125	888500H0125
0.0512	1.30	0.16			88850001300	888500G0130	888500H0130
0.0551	1.40	0.16			88850001400	888500G0140	888500H0140
0.0591	1.50	0.16			88850001500	888500G0150	888500H0150
0.0630	1.60	0.20			88850001600	888500G0160	888500H0160
0.0669	1.70	0.20			88850001700	888500G0170	888500H0170
0.0709	1.80	0.20			88850001800	888500G0180	888500H0180
0.0748	1.90	0.20			88850001900	888500G0190	888500H0190
0.0787	2.00	0.20			88850002000	888500G0200	888500H0200
0.0827	2.10	0.24			88850002100	888500G0210	888500H0210
0.0866	2.20	0.24			88850002200	888500G0220	888500H0220
0.0906	2.30	0.24			88850002300	888500G0230	888500H0230
0.0945	2.40	0.24			88850002400	888500G0240	888500H0240
0.0984	2.50	0.28			88850002500	888500G0250	888500H0250
0.1024	2.60	0.28			88850002600	888500G0260	888500H0260
0.1063	2.70	0.28			88850002700	888500G0270	888500H0270
0.1102	2.80	0.28			88850002800	888500G0280	888500H0280
0.1142	2.90	0.28			88850002900	888500G0290	888500H0290
0.1181	3.00	0.39	1-3/4	0.157 4mm	88850003000	888500G0300	888500H0300
0.1220	3.10	0.39			88850003100	888500G0310	888500H0310

continued next page

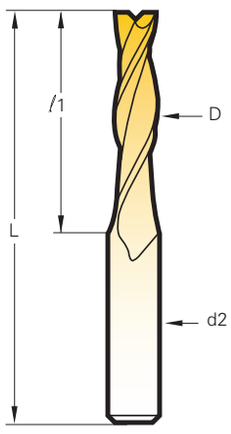




Slotting
Engraving



Flat Bottom
Boring



K15 Carbide — 6.5 – 7% Cobalt
(0.006 – 0.008mm grain size)

Tolerances - inch
0 – 0.0004

Standard Length Miniature End-Mills

microforce

continued from page 101

Standard Length Miniature End-Mills

/ ≃ 2-3 x D

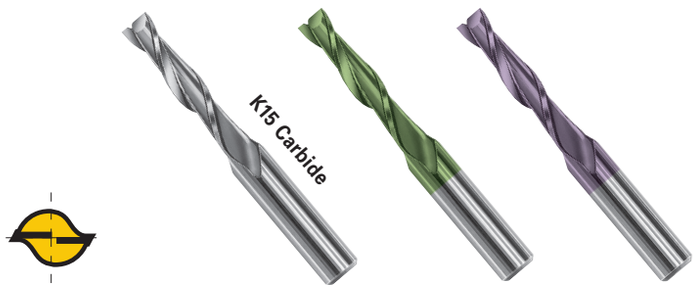
Diameter (inch)	Diameter (mm)	/1	L	d2	magaforce 8500	Graph'X 8500-G	Hard'X 8500-H
0.1260	3.20	0.39	1-3/4	0.157 4mm	88850003200	888500G0320	888500H0320
0.1299	3.30	0.39			88850003300	888500G0330	888500H0330
0.1339	3.40	0.39			88850003400	888500G0340	888500H0340
0.1378	3.50	0.39			88850003500	888500G0350	888500H0350
0.1417	3.60	0.39			88850003600	888500G0360	888500H0360
0.1457	3.70	0.39			88850003700	888500G0370	888500H0370
0.1496	3.80	0.39			88850003800	888500G0380	888500H0380
0.1535	3.90	0.39			88850003900	888500G0390	888500H0390
0.1575	4.00	0.47	1-1/2	0.118 3mm	88850004000	888500G0400	888500H0400
0.1614	4.10	0.47			88850004100	888500G0410	888500H0410
0.1654	4.20	0.47			88850004200	888500G0420	888500H0420
0.1693	4.30	0.47			88850004300	888500G0430	888500H0430
0.1732	4.40	0.47			88850004400	888500G0440	888500H0440
1.7720	4.50	0.47			88850004500	888500G0450	888500H0450
0.1811	4.60	0.47			88850004600	888500G0460	888500H0460
0.1850	4.70	0.47			88850004700	888500G0470	888500H0470
0.1890	4.80	0.47			88850004800	888500G0480	888500H0480
0.1929	4.90	0.47			88850004900	888500G0490	888500H0490
0.1969	5.00	0.55	2-3/16	0.236 6mm	88850005000	888500G0500	888500H0500
0.2008	5.10	0.55			88850005100	888500G0510	888500H0510
0.2047	5.20	0.55			88850005200	888500G0520	888500H0520
0.2087	5.30	0.55			88850005300	888500G0530	888500H0530
0.2126	5.40	0.55			88850005400	888500G0540	888500H0540
0.2165	5.50	0.55			88850005500	888500G0550	888500H0550
0.2205	5.60	0.55			88850005600	888500G0560	888500H0560
0.2244	5.70	0.55			88850005700	888500G0570	888500H0570
0.2283	5.80	0.55			88850005800	888500G0580	888500H0580
0.2323	5.90	0.55			88850005900	888500G0590	888500H0590





K15 Carbide

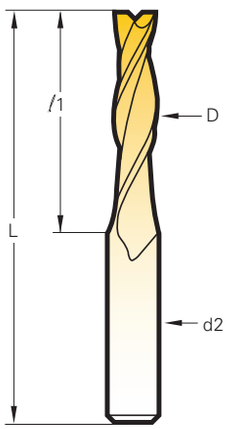
Long Miniature End-mills



Long Series

K15 Carbide — d2 = 0.118 L = 39mm / = 5 x D

Diameter (inch)	Diameter (mm)	/1	magaforce 8509	Graph'X 8509-G	Hard'X 8509-H
0.0157	0.4	0.078	88850900400	888509G0040	888509H0040
0.0197	0.5	0.098	88850900500	888509G0050	888509h0050
0.0236	0.6	0.118	88850900600	888509G0060	888509H0060
0.0276	0.7	0.137	88850900700	888509G0070	888509H0070
0.0315	0.8	0.157	88850900800	888509G0080	888509H0080
0.0354	0.9	0.177	88850900900	888509G0090	888509H0090
0.0394	1.0	0.197	88850901000	888509G0100	888509H0100
0.0472	1.2	0.236	88850901200	888509G0120	888509H0120
0.0591	1.5	0.295	88850901500	888509G0150	888509H0150
0.0787	2.0	0.394	88850902000	888509G0200	888509H0200



Tolerances - inch

0 – 0.0004

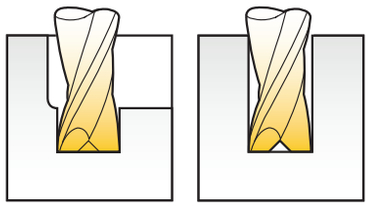
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Extra-long Miniature End-mills



Extra-Long Series
K15 Carbide
/ = 8 x D

Diameter (inch)	Diameter (mm)	/1	L	d2	magaforce 8510	Graph'X 8510-G	Hard'X 8510-H
0.0197	0.5	0.157	1-1/2	0.118 3 mm	88851000500	888510G0050	888510H0050
0.0236	0.6	0.197			88851000600	888510G0060	888510H0060
0.0315	0.8	0.236			88851000800	888510G0080	888510H0080
0.0394	1.0	0.315			88851001000	888510G0100	888510H0100
0.0472	1.2	0.354			88851001200	888510G0120	888510H0120
0.0591	1.5	0.472	1-3/4	0.157 4 mm	88851001500	888510G0150	888510H0150
0.0787	2.0	0.630			88851002000	888510G0200	888510H0200
0.0984	2.5	0.788	2-3/8	0.197 5 mm	88851002500	888510G0250	888510H0250
0.1181	3.0	0.945			88851003000	888510G0300	888510H0300

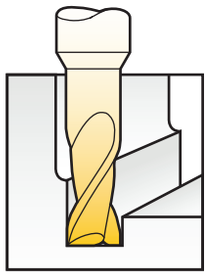


Slotting Engraving | Flat Bottom Boring

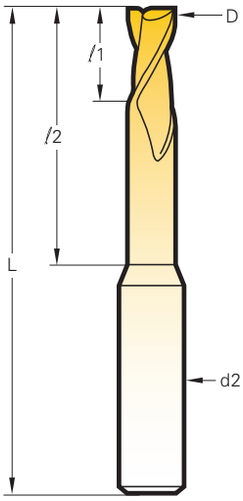
Tolerances - inch

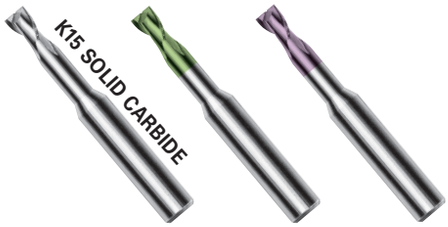
0 – 0.0004

Miniature End-mills with Back Clearance



Hard to Reach Machining





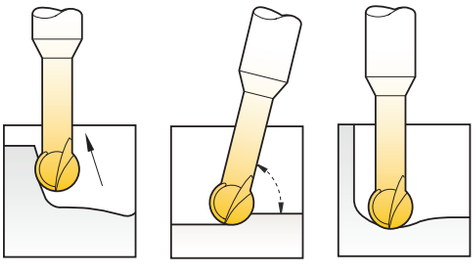
Long Neck Series d2 = 0.188 / 3mm /= 1.5 x D

Diameter x /2 (inch)	Diameter x /2 (mm)	/1	L	magaforce 8507-D	K15/Graph'X 8507-DG	K15/Hard'X 8507-DH
0.0157 x 0.078	0.4 x 2	0.024	1-1/2	888507D0042	888507DG0042	888507DH0042
0.0197 x 0.078	0.5 x 2	0.027	1-1/2	888507D0052	888507DG0052	888507DH0052
0.0197 x 0.157	0.5 x 4	0.027	1-1/2	888507D0054	888507DG00545	888507DH0054
0.0197 x 0.236	0.5 x 6	0.027	2-3/8	888507D0056	888507DG0056	888507DH0056
0.0236 x 0.157	0.6 x 4	0.029	1-1/2	888507D0064	888507DG0064	888507DH0064
0.0276 x 0.157	0.7 x 4	0.035	1-1/2	888507D0074	888507DG0074	888507DH0074
0.0315 x 0.157	0.8 x 4	0.041	1-1/2	888507D0084	888507DG0084	888507DH0084
0.0315 x 0.236	0.8 x 6	0.041	1-1/2	888507D0086	888507DG0086	888507DH0086
0.0315 x 0.354	0.8 x 9	0.041	2-3/8	888507D0089	888507DG0089	888507DH0089
0.0354 x 0.236	0.9 x 6	0.053	1-1/2	888507D0096	888507DG0096	888507DH0096
0.0394 x 0.157	1.0 x 4	0.059	1-1/2	888507D0140	888507DG014	888507DH014
0.0394 x 0.236	1.0 x 6	0.059	1-1/2	888507D0160	888507DG016	888507DH016
0.0394 x 0.354	1.0 x 9	0.059	1-1/2	888507D0190	888507DG019	888507DH019
0.0394 x 0.472	1.0 x 12	0.059	2-3/8	888507D0112	888507DG0112	888507DH0112
0.0472 x 0.236	1.2 x 6	0.071	1-1/2	888507D0126	888507DG0126	888507DH0126
0.0472 x 0.354	1.2 x 9	0.071	1-1/2	888507D0129	888507DG0129	888507DH0129
0.0551 x 0.236	1.4 x 6	0.083	1-1/2	888507D0146	888507DG0146	888507DH0146
0.0551 x 0.354	1.4 x 9	0.083	1-1/2	888507D0149	888507DG0149	888507DH0149
0.0591 x 0.236	1.5 x 6	0.089	1-1/2	888507D0156	888507DG0156	888507DH0156
0.0591 x 0.354	1.5 x 9	0.089	1-1/2	888507D0159	888507DG0159	888507DH0159
0.0591 x 0.472	1.5 x 12	0.089	2-3/8	888507D01512	888507DG01512	888507DH01512
0.0709 x 0.354	1.8 x 9	0.106	1-1/2	888507D0189	888507DG0189	888507DH0189
0.0709 x 0.472	1.8 x 12	0.106	1-1/2	888507D01812	888507DG01812	888507DH01812
0.0787 x 0.354	2.0 x 9	0.118	1-1/2	888507D0290	888507DG029	888507DH029
0.0787 x 0.472	2.0 x 12	0.118	1-1/2	888507D0212	888507DG0212	888507DH0212
0.0787 x 0.590	2.0 x 15	0.118	2-3/8	888507D0215	888507DG0215	888507DH0215
0.0984 x 0.590	2.5 x 15	0.148	2-3/8	888507D02515	888507DG02515	888507DH02515

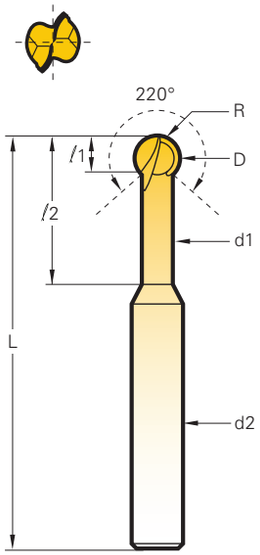
220° Ball-End Miniature End-Mills with Back Clearance



K15 Carbide



Metric Long Neck Series								/ 2 = 5 x D
Diameter (inch)	Diameter (mm)	d1	d2	L	/1	/2	R	Hard'X 8522-H
0.0315	0.8	0.70	3	60	0.55	4.0	0.4	888522H0080
0.0394	1.0	0.85	3	60	0.70	5.0	0.5	888522H0100
0.0472	1.2	1.00	3	60	0.80	6.0	0.6	888522H0120
0.0590	1.5	1.30	3	60	1.00	7.5	0.75	888522H0150
0.0787	2.0	1.70	3	60	1.35	10.0	1.0	888522H0200
0.1180	3.0	2.60	6	75	2.00	15.0	1.5	888522H0300
0.1575	4.0	3.45	6	75	2.70	20.0	2.0	888522H0400
0.1969	5.0	4.30	6	75	3.40	25.0	2.5	888522H0500



Unique!

OPTI-MAG

NEW for 2020

The ten most cited micro end mills brands in the world were tested to determine the two best. These two competitors were then compared with our **HARD'X** cutters. Eight evaluation criteria were selected to optimize our micro-cutters: they focused on the geometry of the tool – its dynamic behavior – the material / coating couple. **Under the most difficult machining conditions**, hundreds of tests were carried out to produce the new **OPTIMAG** milling and end mills. **They offer the best compromise of speed/advance of use** to obtain the desired surface states and precision, while ensuring a longer tool life.

The micro-machining strategies advocated by our competitors recommend small advances to the tooth, in the order of a few microns. The ruggedness of the geometry of the **OPTIMAG cutters allows for much larger advances**. These advances promote cutting **while ensuring tool stability**. Thus the desired surface conditions are obtained, without premature wear of the tool.

NOTE: OPTI-MAG Long reach design micro endmills not inventoried in the USA or listed in this catalog. Contact us for information and sizes available for order.

To place an order or to learn more about Pilot Precision Products, contact customer service at 413-350-5200.

microforce

Performance Recommendations

- Endmills with long neck, extra-long neck, and deep machining: Reduce the speed, while maintaining the suggested feed.
- Superficial work: Increase the speed, while maintaining the suggested feed.

This chart lists general reference parameters for a starting point.

SFM: Surface Feet per Minute
RPM: Revolutions per Minute
IPT: Inches per Tooth (chip load)
IPM: Inches per Minute
IPR: Inches per Revolution

Speed Formula:
RPM = 3.82 x (SFM ÷ Diameter)

Feed:
IPM = IPT x # of Flutes x RPM
IPR = IPM ÷ RPM
SFM = RPM x Diameter ÷ 3.82

Hard'X

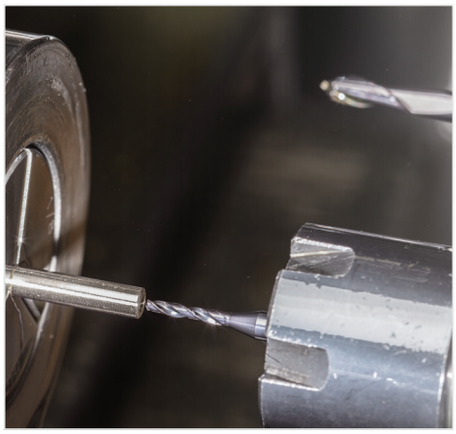
Material	Diameter (inch - mm)	Speed SFM	RPM	IPT 2 Flute	IPM
Chromium / Cobalt	0.0197 - 0.5	82	15,900 – 28,504	0.0004	13 – 23
	0.0394 - 1.0	~	7,950 – 14,252	0.0006	9.5 – 17
	0.0787 - 2.0	147	3,980 – 7,135	0.0012	9.5 – 17
	0.1575 - 4.0		1,989 – 3,565	0.0023	9 – 16
Graphite, Plastic w/ glass or carbon fibers	0.0197 - 0.5	197	38,200 – 57,203	0.0004	30 – 46
	0.0394 - 1.0	~	19,100 – 28,602	0.0006	23 – 34
	0.0787 - 2.0	295	9,562 – 14,189	0.0012	23 – 34
	0.1575 - 4.0		4,778 – 7,155	0.0023	22 – 33
Steel 24 ~ 44 HrC	0.0394 - 1.0	~	12,700 – 15,900	0.0003	7.5 - 9.5
	0.0787 - 2.0	164	6,359 – 7,960	0.0007	9-11
	0.1575 - 4.0		3,177 – 3,978	0.0014	9-11
Treated Steel 45 ~ 55 HrC	0.0197 - 0.5	98	19,003 – 22,300	0.0001	3.8 - 4.5
	0.0394 - 1.0	~	9,502 – 11,150	0.0002	3.8 - 4.5
	0.0787 - 2.0	115	4,757 – 5,582	0.0004	3.8 - 4.5
	0.1575 - 4.0		2,377 – 2,789	0.0008	3.8 - 4.5
Treated Steel > 55 HrC	0.0197 - 0.5	49	9,502 – 11,798	0.00006	1.1 - 1.4
	0.0394 - 1.0	~	4,750 – 6,399	0.00015	1.4 - 1.9
	0.0787 - 2.0	66	2,378 – 3,204	0.00024	1.1 - 1.5
	0.1575 - 4.0		1,188 – 1,600	0.00055	1.3 - 1.8
Stainless steel	0.0197 - 0.5	131	25,400 – 31,000	0.0002	10 – 12
	0.0394 - 1.0	~	12,700 – 15,900	0.0004	10 – 13
	0.0787 - 2.0	164	6,359 – 7,960	0.0008	10 – 13
	0.1575 - 4.0		3,177 – 3,978	0.0019	12 – 15
Super alloys Inconel / Waspaloy	0.0197 - 0.5	59	11,440 – 15,900	0.00004	1 – 1.3
	0.0394 - 1.0	~	5,720 – 7,950	0.00012	1.4 - 1.9
	0.0787 - 2.0	82	2,864 – 3,980	0.00016	1 – 1.3
	0.1575 - 4.0		1,431 – 1,989	0.00032	1 – 1.3
Titanium / Ti-alloy	0.0197 - 0.5	65	12,604 – 19,003	0.00008	2 – 3
	0.0394 - 1.0	~	6,302 – 9,502	0.00024	3 – 4.5
	0.0787 - 2.0	98	3,155 – 4,757	0.00032	2 – 3
	0.1575 - 4.0		1,577 – 2,377	0.00059	1.9 - 2.8
Ceramics	0.0197 - 0.5	229	44,405 – 57,203	0.0004	35 – 46
	0.0394 - 1.0	~	22,203 – 28,602	0.0008	35 – 46
	0.0787 - 2.0	295	11,115 – 14,189	0.0016	35 – 45
	0.1575 - 4.0		5,554 – 7,155	0.0031	34 - 44
Aluminum other plastics	0.0197 - 0.5	328	63,602 – 95,403	0.0004	51 – 76
	0.0394 - 1.0	~	31,801 – 47,702	0.0006	38 – 57
	0.0787 - 2.0	492	15,920 – 23,881	0.0012	38 – 57
	0.1575 - 4.0		7,955 – 11,933	0.0023	36 - 55
Copper / Brass / Bronze	0.0197 - 0.5	164	31,000 – 50,804	0.0004	25 – 41
	0.0394 - 1.0	~	15,900 – 25,402	0.0006	19 – 30
	0.0787 - 2.0	262	7,960 – 12,717	0.0012	19 – 30
	0.1575 - 4.0		3,978 – 6,355	0.0023	18 - 29

Graph'X

Speed SFM	RPM	IPT 2 flute	IPM
164	31,000 – 38,200	0.0004	25 – 30
~	15,900 – 19,100	0.0006	19 – 23
197	7,960 – 9,562	0.0012	19 – 23
	3,978 – 4,778	0.0023	18 – 22
656	127,204 – 159,005	0.0004	102 - 127
~	63,602 – 79,502	0.0006	76 – 95
820	31,841 – 39,802	0.0012	76 – 95
	15,911 – 19,888	0.0023	73 - 91

Notes

GMauvaisUSA™



Superior Micro Drills...

Since 1928, GMauvaisUSA™ been delivering high precision micro drills in µm Micron tolerances to the Swiss Watch Industry. With innovative and unique manufacturing technologies in turning, bar cutting, grinding, milling, flute grinding, sharpening and heat-treating, the company produces products of the most consistent quality and reliable specifications, meeting their strict standards for superior quality. Their ability to control our high production operations with incredibly tight tolerances, makes us the right choice. Pilot Precision Products offers a complete range of products in solid carbide and cobalt high speed steel.

In-process quality controls ensure accurate dimensions and perfect surface finishes. Even with the strictest of quality and in-process controls, our production capabilities provide us the flexibility to offer precision, custom specification micro drill solutions for the most unique and demanding micro drill applications. Quality, precision, consistency and outstanding performance are what you can count on from GMauvaisUSA™ from every product we make.

This commitment to consistent quality and performance is relied upon by the most demanding industries. We are a key supplier to the Automotive, Aerospace, Computer / Multi-Media, Medical, Eyewear / Optics, Electronics, Connectors, Watch / Jewelry and Writing Instrument Industries where precision and performance are mandatory in daily production operations.

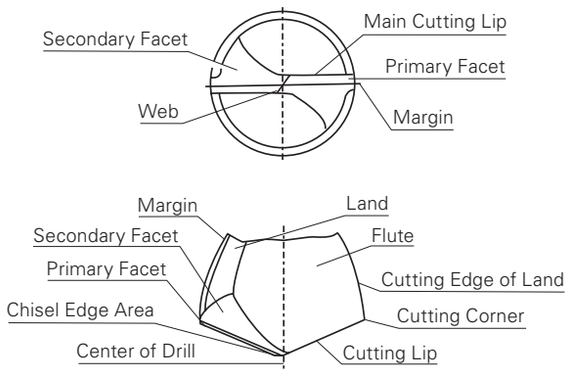
The Anatomy of a Superior Micro Drill

- Superior edge quality and flute surface finishes for high performance
- Extraordinary concentricity, circularity and straightness within 2 microns
- Consistent, accurate dimensions every time
- Amazing dimension control at h6, h4 and h3 µm tolerances
- Ultra-fine surface finish for smooth operation
- Superior HSS heat treating and 10% cobalt micro grain carbide for outstanding performance and long tool life



approximately 10x actual size

Drill Terminology





µm

What is a Micron?

1 micron = .001mm = .00003937"

One Hundreth (1/100) of a human hair



Superior Precision, Quality, Consistency and Performance

5140 Series HSS-E Cobalt 8%

2–3 x D, Center Cut – Pilot – Spot Drills 120°



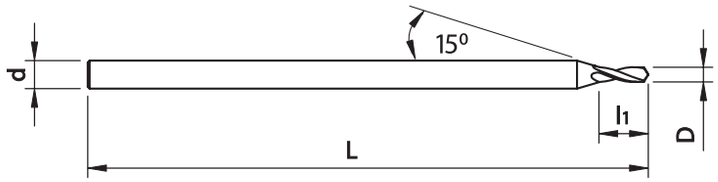


+ 0.000/- 0.006mm (h6)

For use prior to using 5100 series drills. Can also be used as a drill with 2–3 x D Depth.
All items can be ordered as left hand at same pricing. Special, custom specification items available.

Custom specifications such as:

- Helix angle of 15°, 24°, 30° or other
- Point angles of 90°, 110°, 130°, 140° or other
- Special diameters of 1,255mm or other
- Special tolerances as +/- 0.001mm or other
- Coatings available upon request
- Minimum custom order is 10 pieces
- **Lead-time on custom orders—4 weeks ARO**



OAL 25mm

5140 Series HSS-E Cobalt 8% - Drill Sizes 0.20 – 3.00mm
NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
0.20	0.0079	92	1.5	0.6	25.0	5140020R
0.25	0.0098			0.8		5140025R
0.30	0.0118			0.9		5140030R
0.35	0.0138			1.0		5140035R
0.40	0.0157					5140040R
0.45	0.0177			1.2		5140045R
0.50	0.0197					5140050R
0.55	0.0217			1.4		5140055R
0.60	0.0236					5140060R
0.65	0.0256			1.7		5140065R
0.70	0.0276					5140070R
0.75	0.0295			1.8		5140075R
0.80	0.0315					5140080R
0.85	0.0335					5140085R
0.90	0.0354					5140090R
0.95	0.0374			2.0		5140095R
1.00	0.0394					5140100R
1.05	0.0413			2.3		5140105R
1.10	0.0433					5140110R
1.15	0.0453					5140115R
1.20	0.0472					5140120R
1.25	0.0492			2.7		5140125R
1.30	0.0512					5140130R
1.35	0.0531					5140135R
1.40	0.0551	54				5140140R
1.45	0.0571					5140145R
1.50	0.0591		2.0	3.0		5140150R
1.60	0.0630	51				5140160R

5140 Series HSS-E Cobalt 8% - Drill Sizes 0.20 – 3.00mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
1.70	0.0669		2.0	3.3	25.0	5140170R
1.80	0.0709					5140180R
1.90	0.0748					5140190R
2.00	0.0787			4.0		5140200R
2.10	0.0827		2.5	4.0		5140210R
2.20	0.0866					5140220R
2.30	0.0906			4.6		5140230R
2.40	0.0945					5140240R
2.50	0.0984					5140250R
2.60	0.1024		3.0	4.6		5140260R
2.70	0.1063			5.3		5140270R
2.80	0.1102					5140280R
2.90	0.1142					5140290R
3.00	0.1181					5140300R

Pilot Drills

- **For use prior to using 5100 series drills**
- **Can be used as pilot drill with 2-3 x D Depth**

5100 Series HSS-E Cobalt 8%

5 x D – Depth of Cut 120°



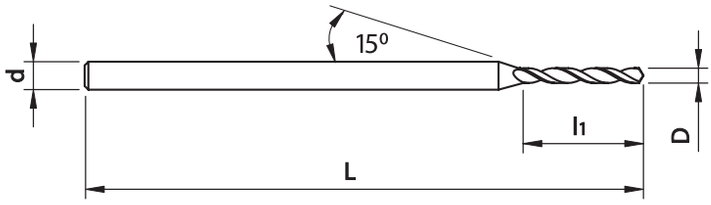


+ 0.000/- 0.006mm (h6)

For materials with long forming chips, steel up to 35 rhc, copper, stainless, titanium.
All items can be ordered as left hand at same pricing. Special, custom specification items available.

Custom specifications such as:

- Helix angle of 15°, 30°, 35° or other
- Point angles of 90°, 110°, 130°, 140° or other
- Special diameters of 1.255mm or other
- Special tolerances as +/- 0.001mm or other
- Coatings available upon request
- Minimum custom order is 10 Pieces
- **Lead-time on custom orders—4 weeks ARO**



OAL Range 25 – 40mm

5100 Series HSS-E Cobalt 8% - Drill Sizes 0.10 – 0.65mm
NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
0.10	0.0039		1.0	0.7	25	5100010R
0.11	0.0043					5100011R
0.12	0.0047					5100012R
0.13	0.0051			1.0		5100013R
0.14	0.0055					5100014R
0.15	0.0059	97				5100015R
0.16	0.0063	96		1.4		5100016R
0.17	0.0067	95				5100017R
0.18	0.0071	94				5100018R
0.19	0.0075	93				5100019R
0.20	0.0079	92		1.8		5100020R
0.21	0.0083	91				5100021R
0.22	0.0087	90				5100022R
0.23	0.0091	89				5100023R
0.24	0.0094	88				5100024R
0.25	0.0098			2.2		5100025R
0.26	0.0102					5100026R
0.27	0.0106	86				5100027R
0.28	0.0110	85				5100028R
0.29	0.0114	84				5100029R
0.30	0.0118					5100030R
0.31	0.0122			2.8		5100031R
0.32	0.0126	82				5100032R
0.33	0.0130	81				5100033R
0.34	0.0134	80				5100034R
0.35	0.0138					5100035R
0.36	0.0142					5100036R
0.37	0.0146	79				5100037R

5100 Series HSS-E Cobalt 8% - Drill Sizes 0.10 – 0.65mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
0.38	0.0150		1	2.8	25	5100038R
0.39	0.0154					5100039R
0.40	0.0157			3.2		5100040R
0.41	0.0161	78				5100041R
0.42	0.0165					5100042R
0.43	0.0169					5100043R
0.44	0.0173					5100044R
0.45	0.0177					5100045R
0.46	0.0181	77		3.6		5100046R
0.47	0.0185					5100047R
0.48	0.0189					5100048R
0.49	0.0193					5100049R
0.50	0.0197					5100050R
0.51	0.0201	76	1.5	4.0		5100051R
0.52	0.0205					5100052R
0.53	0.0209	75				5100053R
0.54	0.0213					5100054R
0.55	0.0217					5100055R
0.56	0.0220			4.5		5100056R
0.57	0.0224	74				5100057R
0.58	0.0228					5100058R
0.59	0.0232					5100059R
0.60	0.0236					5100060R
0.61	0.0240	73		4.7		5100061R
0.62	0.0244					5100062R
0.63	0.0248	72				5100063R
0.64	0.0252					5100064R
0.65	0.0256					5100065R

Series 5100 Continued

5100 Series HSS-E Cobalt 8%

5 x D – Depth of Cut 120º, continued



5100 Series HSS-E Cobalt 8% - Drill Sizes 0.66 – 1.59mm

NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
0.66	0.0260	71	1.5	4.7	25.0	5100066R
0.67	0.0264					5100067R
0.68	0.0268			5.2		5100068R
0.69	0.0272					5100069R
0.70	0.0276					5100070R
0.71	0.0280	70				5100071R
0.72	0.0283					5100072R
0.73	0.0287					5100073R
0.74	0.0291	69				5100074R
0.75	0.0295					5100075R
0.76	0.0299			5.5		5100076R
0.77	0.0303					5100077R
0.78	0.0307					5100078R
0.79	0.0311	68-1/32				5100079R
0.80	0.0315					5100080R
0.81	0.0319	67				5100081R
0.82	0.0323					5100082R
0.83	0.0327					5100083R
0.84	0.0331	66				5100084R
0.85	0.0335					5100085R
0.86	0.0339			6.0		5100086R
0.87	0.0343					5100087R
0.88	0.0346					5100088R
0.89	0.0350	65				5100089R
0.90	0.0354					5100090R
0.91	0.0358	64				5100091R
0.92	0.0362					5100092R
0.93	0.0366					5100093R
0.94	0.0370	63				5100094R
0.95	0.0374					5100095R
0.96	0.0378	62		6.5		5100096R
0.97	0.0382					5100097R
0.98	0.0386					5100098R
0.99	0.0390	61				5100099R
1.00	0.0394					5100100R
1.01	0.0398	60				5100101R
1.02	0.0402					5100102R
1.03	0.0406					5100103R
1.04	0.0409	59				5100104R
1.05	0.0413					5100105R
1.06	0.0417			7.0		5100106R
1.07	0.0421	58				5100107R
1.08	0.0425					5100108R
1.09	0.0429	57				5100109R
1.10	0.0433					5100110R
1.11	0.0437					5100111R
1.12	0.0441					5100112R

5100 Series HSS-E Cobalt 8% - Drill Sizes 1.60 – 2.53mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
1.13	0.0445		1.5	7.0	25.0	5100113R
1.14	0.0449					5100114R
1.15	0.0453					5100115R
1.16	0.0457			7.5		5100116R
1.17	0.0461					5100117R
1.18	0.0465	56				5100118R
1.19	0.0469	3/64				5100119R
1.20	0.0472					5100120R
1.21	0.0476					5100121R
1.22	0.0480					5100122R
1.23	0.0484					5100123R
1.24	0.0488					5100124R
1.25	0.0492					5100125R
1.26	0.0496					5100126R
1.27	0.0500					5100127R
1.28	0.0504					5100128R
1.29	0.0508					5100129R
1.30	0.0512					5100130R
1.31	0.0516			8.5		5100131R
1.32	0.0520	55				5100132R
1.33	0.0524					5100133R
1.34	0.0528					5100134R
1.35	0.0531					5100135R
1.36	0.0535					5100136R
1.37	0.0539					5100137R
1.38	0.0543					5100138R
1.39	0.0547					5100139R
1.40	0.0551	54				5100140R
1.41	0.0555					5100141R
1.42	0.0559					5100142R
1.43	0.0563					5100143R
1.44	0.0567					5100144R
1.45	0.0571					5100145R
1.46	0.0575					5100146R
1.47	0.0579					5100147R
1.48	0.0583					5100148R
1.49	0.0587					5100149R
1.50	0.0591		2.0	10.0	35.0	5100150R
1.51	0.0594	53				5100151R
1.52	0.0598					5100152R
1.53	0.0602					5100153R
1.54	0.0606					5100154R
1.55	0.0610					5100155R
1.56	0.0614					5100156R
1.57	0.0618					5100157R
1.58	0.0622					5100158R
1.59	0.0626	1/16				5100159R

Series 5100 Continued

5100 Series HSS-E Cobalt 8%

5 x D – Depth of Cut 120°, continued



5100 Series HSS-E Cobalt 8% - Drill Sizes 1.60 – 2.53mm

NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
1.60	0.0630		2.0	10.0	35.0	5100160R
1.61	0.0634	52				5100161R
1.62	0.0638					5100162R
1.63	0.0642					5100163R
1.64	0.0646					5100164R
1.65	0.0650					5100165R
1.66	0.0654					5100166R
1.67	0.0657					5100167R
1.68	0.0661					5100168R
1.69	0.0665					5100169R
1.70	0.0669	51				5100170R
1.71	0.0673					5100171R
1.72	0.0677					5100172R
1.73	0.0681					5100173R
1.74	0.0685					5100174R
1.75	0.0689					5100175R
1.76	0.0693					5100176R
1.77	0.0697			11.0		5100177R
1.78	0.0701	50				5100178R
1.79	0.0705					5100179R
1.80	0.0709					5100180R
1.81	0.0713					5100181R
1.82	0.0717					5100182R
1.83	0.0720					5100183R
1.84	0.0724					5100184R
1.85	0.0728	49				5100185R
1.86	0.0732					5100186R
1.87	0.0736					5100187R
1.88	0.0740					5100188R
1.89	0.0744					5100189R
1.90	0.0748					5100190R
1.91	0.0752					5100191R
1.92	0.0756					5100192R
1.93	0.0760	48				5100193R
1.94	0.0764					5100194R
1.95	0.0768					5100195R
1.96	0.0772					5100196R
1.97	0.0776					5100197R
1.98	0.0780	5/64				5100198R
1.99	0.0783	47				5100199R
2.00	0.0787					5100200R
2.01	0.0791		2.5	12.0		5100201R
2.02	0.0795					5100202R
2.03	0.0799					5100203R
2.04	0.0803					5100204R
2.05	0.0807					5100205R
2.06	0.0811	46				5100206R

5100 Series HSS-E Cobalt 8% - Drill Sizes 1.60 – 2.53mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
2.07	0.0815		2.5	12.0	35.0	5100207R
2.08	0.0819	45				5100208R
2.09	0.0823					5100209R
2.10	0.0827					5100210R
2.11	0.0831					5100211R
2.12	0.0835					5100212R
2.13	0.0839					5100213R
2.14	0.0843					5100214R
2.15	0.0846					5100215R
2.16	0.0850					5100216R
2.17	0.0854					5100217R
2.18	0.0858	44				5100218R
2.19	0.0862					5100219R
2.20	0.0866					5100220R
2.21	0.0870			14.0		5100221R
2.22	0.0874					5100222R
2.23	0.0878					5100223R
2.24	0.0882					5100224R
2.25	0.0886					5100225R
2.26	0.0890	43				5100226R
2.27	0.0894					5100227R
2.28	0.0898					5100228R
2.29	0.0902					5100229R
2.30	0.0906					5100230R
2.31	0.0909					5100231R
2.32	0.0913					5100232R
2.33	0.0917					5100233R
2.34	0.0921					5100234R
2.35	0.0925					5100235R
2.36	0.0929					5100236R
2.37	0.0933					5100237R
2.38	0.0937	3/32				5100238R
2.39	0.0941					5100239R
2.40	0.0945					5100240R
2.41	0.0949					5100241R
2.42	0.0953					5100242R
2.43	0.0957					5100243R
2.44	0.0961	41				5100244R
2.45	0.0965					5100245R
2.46	0.0969					5100246R
2.47	0.0972					5100247R
2.48	0.0976					5100248R
2.49	0.0980	40				5100249R
2.50	0.0984					5100250R
2.51	0.0988		3.0	16.0	40.0	5100251R
2.52	0.0992					5100252R
2.53	0.0996	39				5100253R

Series 5100 Continued

5100 Series HSS-E Cobalt 8%

5 x D – Depth of Cut 120º, continued

5100 Series HSS-E Cobalt 8% - Drill Sizes 2.54 – 3.00mm

NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
2.54	0.1000		3.0	16.0	40.0	5100254R
2.55	0.1004					5100255R
2.56	0.1008					5100256R
2.57	0.1012					5100257R
2.58	0.1016	38				5100258R
2.59	0.1020					5100259R
2.60	0.1024					5100260R
2.61	0.1028					5100261R
2.62	0.1031					5100262R
2.63	0.1035					5100263R
2.64	0.1039	37				5100264R
2.65	0.1043					5100265R
2.66	0.1047					5100266R
2.67	0.1051					5100267R
2.68	0.1055					5100268R
2.69	0.1059					5100269R
2.70	0.1063	36				5100270R
2.71	0.1067					5100271R
2.72	0.1071					5100272R
2.73	0.1075					5100273R
2.74	0.1079					5100274R
2.75	0.1083					5100275R
2.76	0.1087			18.0		5100276R
2.77	0.1091					5100277R

5100 Series HSS-E Cobalt 8% - Drill Sizes 2.54 – 3.00mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
2.78	0.1094	7/64	3.0	18.0	40.0	5100278R
2.79	0.1098	35				5100279R
2.80	0.1102					5100280R
2.81	0.1106					5100281R
2.82	0.1110	34				5100282R
2.83	0.1114					5100283R
2.84	0.1118					5100284R
2.85	0.1122					5100285R
2.86	0.1126					5100286R
2.87	0.1130	33				5100287R
2.88	0.1134					5100288R
2.89	0.1138					5100289R
2.90	0.1142					5100290R
2.91	0.1146					5100291R
2.92	0.1150					5100292R
2.93	0.1154					5100293R
2.94	0.1157					5100294R
2.95	0.1161	32				5100295R
2.96	0.1165					5100296R
2.97	0.1169					5100297R
2.98	0.1173					5100298R
2.99	0.1177					5100299R
3.00	0.1181					5100300R

5100 Series HSS-E Cobalt 8%



- **For materials with long forming chips, steel up to 35 RHC, Copper, Stainless, Titanium**
- **Amazing dimension control at h6, h4 & h3 µm tolerances**
- **Ultra-fine surface finish for smooth operation**
- **Superb heat treating for outstanding performance & long tool life**
- **Coatings available upon request**

6140 Series Solid Carbide

2-3 x D, Center Cut – Pilot – Spot Drills 120°



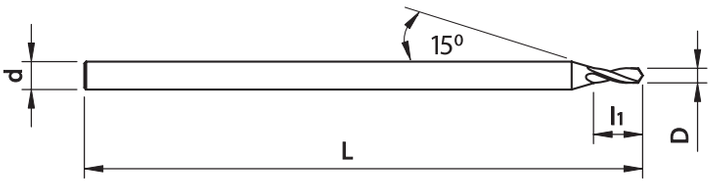
10% COBALT MICRO GRAIN CARBIDE | RH | 120° Point | 24° Helix | 2 FLUTES | RHC 65 | h6

+ 0.000/- 0.006mm (h6) Uncoated Version
+ 0.002/-0.004mm Coated Version

For use prior to using 6120 and 6100 series drills. Can also be used as a drill with 2–3 x D depth.
All items can be ordered as left hand at same pricing. Special, custom specification items available.

Custom specifications such as:

- Helix angle of 15°, 30°, 35° or other
- Point angles of 90°, 110°, 130°, 140° or other
- Special diameters as 0.92mm or other
- Special tolerances as +/- 0.001mm or other
- Coolant thru drills at 3 and 4mm shanks and 1.25 to 3mm flute diameters
- Coatings available upon request
- Minimum custom order is 10 Pieces
- **Lead-time on custom orders—4 Weeks ARO**



OAL Range 30 – 38mm

6140 Series Solid Carbide* - Drill Sizes 0.20 – 3.00mm
NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.20	0.0079	92	1.5	.9	30.0	6140020R	-
0.25	0.0098					6140025R	-
0.30	0.0118					6140030R	-
0.35	0.0138			1.2		6140035R	-
0.40	0.0157			1.5		6140040R	-
0.45	0.0177					6140045R	-
0.50	0.0197			1.9		6140050R	6140050RC
0.55	0.0217					6140055R	6140055RC
0.60	0.0236					6140060R	6140060RC
0.65	0.0256			2.1		6140065R	6140065RC
0.70	0.0276			2.4		6140070R	6140070RC
0.75	0.0295					6140075R	6140075RC
0.80	0.0315			2.6		6140080R	6140080RC
0.85	0.0335					6140085R	6140085RC
0.90	0.0354			3.0		6140090R	6140090RC
0.95	0.0374					6140095R	6140095RC
1.00	0.0394			3.4		6140100R	6140100RC
1.05	0.0413					6140105R	6140105RC
1.10	0.0433			3.8		6140110R	6140110RC
1.15	0.0453					6140115R	6140115RC
1.20	0.0472			4.2		6140120R	6140120RC

6140 Series Solid Carbide - Drill Sizes 0.20 – 3.00mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
1.25	0.0492		1.5	4.2	30.0	6140125R	6140125RC
1.30	0.0512					6140130R	6140130RC
1.35	0.0531			4.7		6140135R	6140135RC
1.40	0.0551	54				6140140R	6140140RC
1.45	0.0571					6140145R	6140145RC
1.50	0.0591		2.0	4.7	38.0	6140150R	6140150RC
1.60	0.0630	51		5.4		6140160R	6140160RC
1.70	0.0669					6140170R	6140170RC
1.80	0.0709			6.5		6140180R	6140180RC
1.90	0.0748					6140190R	6140190RC
2.00	0.0787		3.0	6.5		6140200R	6140200RC
2.10	0.0827					6140210R	6140210RC
2.20	0.0866					6140220R	6140220RC
2.30	0.0906					6140230R	6140230RC
2.40	0.0945					6140240R	6140240RC
2.50	0.0984			7.5		6140250R	6140250RC
2.60	0.1024					6140260R	6140260RC
2.70	0.1063					6140270R	6140270RC
2.80	0.1102					6140280R	6140280RC
2.90	0.1142					6140290R	6140290RC
3.00	0.1181					6140300R	6140300RC

***SPECIAL ORDERS:** Series 6140 flute diameters coated sizes smaller than 0.50mm are special order. Please contact Pilot Precision Products for details at 413-350-5200.

6130 Series Solid Carbide

4–5 x D – Depth of Cut 120°



h6 Tolerance Reinforced Shank d 3.0mm

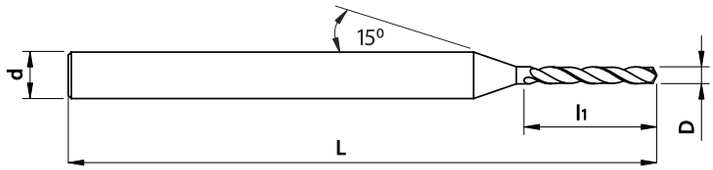


+ 0.000/- 0.006mm (h6) Uncoated Version
+ 0.002/-0.004mm Coated Version

For soft, medium to high tensile strength steel, stainless, titanium alloys and cast iron.
All items can be ordered as left hand at same pricing. Special, custom specification items available.

Custom specifications such as:

- Helix angle of 15°, 30°, 35° or other
- Point Angles of 90°, 110°, 130°, 140° or other
- Special Diameters as 1.255mm or other
- Special Tolerances as +/- 0.001mm or other
- Minimum custom order is 10 pieces
- **Lead-Time on custom orders—4 Weeks ARO**



OAL 38mm

6130 Series Solid Carbide - Drill Sizes 0.20 – 0.88mm
NOTE: ***Sold in 10 piece packages only***

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.20	0.0079	92	3.0	1.1	38.0	6130020R	-
0.21	0.0083	91				6130021R	-
0.22	0.0087	90				6130022R	-
0.23	0.0091	89				6130023R	-
0.24	0.0094	88				6130024R	-
0.25	0.0098			1.3		6130025R	-
0.26	0.0102					6130026R	-
0.27	0.0106	86				6130027R	-
0.28	0.0110	85				6130028R	-
0.29	0.0114	84				6130029R	-
0.30	0.0118			1.6		6130030R	-
0.31	0.0122					6130031R	-
0.32	0.0126	82				6130032R	-
0.33	0.0130	81				6130033R	-
0.34	0.0134	80				6130034R	-
0.35	0.0138					6130035R	-
0.36	0.0142					6130036R	-
0.37	0.0146	79				6130037R	-
0.38	0.0150					6130038R	-
0.39	0.0154			2.0		6130039R	-
0.40	0.0157					6130040R	-
0.41	0.0161	78				6130041R	-
0.42	0.0165					6130042R	-
0.43	0.0169					6130043R	-
0.44	0.0173					6130044R	-
0.45	0.0177					6130045R	-
0.46	0.0181	77				6130046R	-
0.47	0.0185					6130047R	-
0.48	0.0189					6130048R	-
0.49	0.0193					6130049R	-
0.50	0.0197			2.4		6130050R	6130050RC
0.51	0.0201	76				6130051R	6130051RC
0.52	0.0205					6130052R	6130052RC
0.53	0.0209	75				6130053R	6130053RC
0.54	0.0213			2.8		6130054R	6130054RC

6130 Series Solid Carbide - Drill Sizes 0.20 – 0.88mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.55	0.0217		3.0	2.8	38.0	6130055R	6130055RC
0.56	0.0220					6130056R	6130056RC
0.57	0.0224	74				6130057R	6130057RC
0.58	0.0228					6130058R	6130058RC
0.59	0.0232					6130059R	6130059RC
0.60	0.0236					6130060R	6130060RC
0.61	0.0240	73		3.3		6130061R	6130061RC
0.62	0.0244					6130062R	6130062RC
0.63	0.0248	72				6130063R	6130063RC
0.64	0.0252					6130064R	6130064RC
0.65	0.0256					6130065R	6130065RC
0.66	0.0260	71				6130066R	6130066RC
0.67	0.0264					6130067R	6130067RC
0.68	0.0268			3.8		6130068R	6130068RC
0.69	0.0272					6130069R	6130069RC
0.70	0.0276					6130070R	6130070RC
0.71	0.0280	70				6130071R	6130071RC
0.72	0.0283					6130072R	6130072RC
0.73	0.0287					6130073R	6130073RC
0.74	0.0291	69				6130074R	6130074RC
0.75	0.0295					6130075R	6130075RC
0.76	0.0299			4.2		6130076R	6130076RC
0.77	0.0303					6130077R	6130077RC
0.78	0.0307					6130078R	6130078RC
0.79	0.0311	68-1/32				6130079R	6130079RC
0.80	0.0315			4.4		6130080R	6130080RC
0.81	0.0319	67				6130081R	6130081RC
0.82	0.0323					6130082R	6130082RC
0.83	0.0327					6130083R	6130083RC
0.84	0.0331	66				6130084R	6130084RC
0.85	0.0335			4.8		6130085R	6130085RC
0.86	0.0339					6130086R	6130086RC
0.87	0.0343					6130087R	6130087RC
0.88	0.0346					6130088R	6130088RC

Series 6130 Continued

***SPECIAL ORDERS:** Series 6130 flute diameters coated sizes smaller than 0.50mm are special order. Please contact Pilot Precision Products for details.

6130 Series Solid Carbide

4–5 x D – Depth of Cut 120°, continued

6130 Series Solid Carbide -
Drill Sizes 0.89–1.99 mm x 3mm Shank Tools
*NOTE: **Sold in 10 piece packages only***

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Llute length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.89	0.0350	65	3.0	4.8	38.0	6130089R	6130089RC
0.90	0.0354					6130090R	6130090RC
0.91	0.0358	64				6130091R	6130091RC
0.92	0.0362					6130092R	6130092RC
0.93	0.0366					6130093R	6130093RC
0.94	0.0370	63				6130094R	6130094RC
0.95	0.0374					6130095R	6130095RC
0.96	0.0378	62				6130096R	6130096RC
0.97	0.0382					6130097R	6130097RC
0.98	0.0386					6130098R	6130098RC
0.99	0.0390	61				6130099R	6130099RC
1.00	0.0394					6130100R	6130100RC
1.01	0.0398	60				6130101R	6130101RC
1.02	0.0402					6130102R	6130102RC
1.03	0.0406					6130103R	6130103RC
1.04	0.0409	59				6130104R	6130104RC
1.05	0.0413					6130105R	6130105RC
1.06	0.0417					6130106R	6130106RC
1.07	0.0421	58				6130107R	6130107RC
1.08	0.0425					6130108R	6130108RC
1.09	0.0429	57				6130109R	6130109RC
1.100	0.0433			5.4		6130110R	6130110RC
1.11	0.0437					6130111R	6130111RC
1.12	0.0441					6130112R	6130112RC
1.13	0.0445					6130113R	6130113RC
1.14	0.0449					6130114R	6130114RC
1.15	0.0453					6130115R	6130115RC
1.16	0.0457					6130116R	6130116RC
1.17	0.0461					6130117R	6130117RC
1.18	0.0465	56				6130118R	6130118RC
1.19	0.0469	3/64				6130119R	6130119RC
1.20	0.0472			6.0		6130120R	6130120RC
1.21	0.0476					6130121R	6130121RC
1.22	0.0480					6130122R	6130122RC
1.23	0.0484					6130123R	6130123RC
1.24	0.0488					6130124R	6130124RC
1.25	0.0492					6130125R	6130125RC
1.26	0.0496					6130126R	6130126RC
1.27	0.0500					6130127R	6130127RC
1.28	0.0504					6130128R	6130128RC
1.29	0.0508					6130129R	6130129RC
1.30	0.0512			6.7		6130130R	6130130RC
1.31	0.0516					6130131R	6130131RC
1.32	0.0520	55				6130132R	6130132RC
1.33	0.0524					6130133R	6130133RC
1.34	0.0528					6130134R	6130134RC
1.35	0.0531					6130135R	6130135RC
1.36	0.0535					6130136R	6130136RC
1.37	0.0539					6130137R	6130137RC
1.38	0.0543					6130138R	6130138RC
1.39	0.0547					6130139R	6130139RC
1.40	0.0551	54				6130140R	6130140RC
1.41	0.0555					6130141R	6130141RC
1.42	0.0559					6130142R	6130142RC
1.43	0.0563					6130143R	6130143RC
1.44	0.0567					6130144R	6130144RC

*NOTE: **For 2.00 to 3.00mm x 3mm Shank go to 6120 Series***

6130 Series Solid Carbide -
Drill Sizes 0.89–1.99 mm x 3mm Shank Tools

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
1.45	0.0571		3.0	6.7	38.0	6130145R	6130145RC
1.46	0.0575					6130146R	6130146RC
1.47	0.0579					6130147R	6130147RC
1.48	0.0583					6130148R	6130148RC
1.49	0.0587					6130149R	6130149RC
1.50	0.0591			7.2		6130150R	6130150RC
1.51	0.0594	53				6130151R	6130151RC
1.52	0.0598					6130152R	6130152RC
1.53	0.0602					6130153R	6130153RC
1.54	0.0606					6130154R	6130154RC
1.55	0.0610					6130155R	6130155RC
1.56	0.0614					6130156R	6130156RC
1.57	0.0618					6130157R	6130157RC
1.58	0.0622					6130158R	6130158RC
1.59	0.0626	1/16				6130159R	6130159RC
1.60	0.0630					6130160R	6130160RC
1.61	0.0634	52				6130161R	6130161RC
1.62	0.0638					6130162R	6130162RC
1.63	0.0642					6130163R	6130163RC
1.64	0.0646					6130164R	6130164RC
1.65	0.0650					6130165R	6130165RC
1.66	0.0654					6130166R	6130166RC
1.67	0.0657					6130167R	6130167RC
1.68	0.0661					6130168R	6130168RC
1.69	0.0665					6130169R	6130169RC
1.70	0.0669	51				6130170R	6130170RC
1.71	0.0673					6130171R	6130171RC
1.72	0.0677					6130172R	6130172RC
1.73	0.0681					6130173R	6130173RC
1.74	0.0685					6130174R	6130174RC
1.75	0.0689					6130175R	6130175RC
1.76	0.0693					6130176R	6130176RC
1.77	0.0697					6130177R	6130177RC
1.78	0.0701	50				6130178R	6130178RC
1.79	0.0705					6130179R	6130179RC
1.80	0.0709			8.4		6130180R	6130180RC
1.81	0.0713					6130181R	6130181RC
1.82	0.0717					6130182R	6130182RC
1.83	0.0720					6130183R	6130183RC
1.84	0.0724					6130184R	6130184RC
1.85	0.0728	49				6130185R	6130185RC
1.86	0.0732					6130186R	6130186RC
1.87	0.0736					6130187R	6130187RC
1.88	0.0740					6130188R	6130188RC
1.89	0.0744					6130189R	6130189RC
1.90	0.0748					6130190R	6130190RC
1.91	0.0752					6130191R	6130191RC
1.92	0.0756					6130192R	6130192RC
1.93	0.0760	48				6130193R	6130193RC
1.94	0.0764					6130194R	6130194RC
1.95	0.0768					6130195R	6130195RC
1.96	0.0772					6130196R	6130196RC
1.97	0.0776					6130197R	6130197RC
1.98	0.0780	5/64				6130198R	6130198RC
1.99	0.0783	47				6130199R	6130199RC

6120 Series Solid Carbide

4–5 x D – Depth of Cut 120º



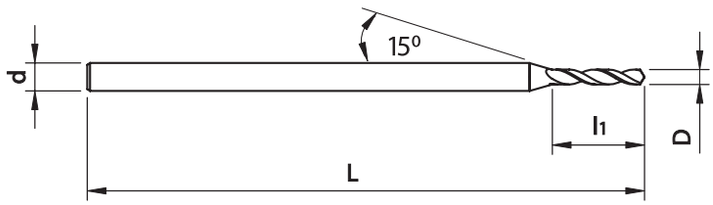


+ 0.000/- 0.006mm (h6) Uncoated Version
+ 0.002/-0.004mm Coated Version

For medium to high tensile strength steel, stainless, titanium alloys and cast iron.
All items can be ordered as left hand at same pricing. Special, custom specification items available.

Custom specifications such as:

- Helix angle of 15°, 24°, 30° or other
- Point angles of 90°, 110°, 130°, 140° or other
- Special diameters as 1.255mm or other
- Special tolerances as +/- 0.001mm or other
- Coolant thru drills at 3 and 4mm shanks and 1.25 to 3mm flute diameters
- Coatings available upon request
- Minimum custom order is 10 Pieces / Spec.
- **Lead-time on custom orders—4 Weeks ARO**



OAL Range 25 – 38mm

6120 Series Solid Carbide - Drill Sizes 0.20 – 0.71mm
NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.20	0.0079	92	1.0	1.1	25.0	6120020R	-
0.21	0.0083	91				6120021R	-
0.22	0.0087	90				6120022R	-
0.23	0.0091	89				6120023R	-
0.24	0.0094	88				6120024R	-
0.25	0.0098			1.3		6120025R	-
0.26	0.0102					6120026R	-
0.27	0.0106	86				6120027R	-
0.28	0.0110	85				6120028R	-
0.29	0.0114	84				6120029R	-
0.30	0.0118			1.6		6120030R	-
0.31	0.0122					6120031R	-
0.32	0.0126	82				6120032R	-
0.33	0.0130	81				6120033R	-
0.34	0.0134	80				6120034R	-
0.35	0.0138					6120035R	-
0.36	0.0142					6120036R	-
0.37	0.0146	79				6120037R	-
0.38	0.0150					6120038R	-
0.39	0.0154			2.0		6120039R	-
0.40	0.0157					6120040R	-
0.41	0.0161	78				6120041R	-
0.42	0.0165					6120042R	-
0.43	0.0169					6120043R	-
0.44	0.0173					6120044R	-
0.45	0.0177					6120045R	-

6120 Series Solid Carbide - Drill Sizes 0.20 – 0.71mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.46	0.0181	77	1.0	2.0	25.0	6120046R	-
0.47	0.0185					6120047R	-
0.48	0.0189					6120048R	-
0.49	0.0193					6120049R	-
0.50	0.0197			2.4		6120050R	6120050RC
0.51	0.0201	76				6120051R	6120051RC
0.52	0.0205					6120052R	6120052RC
0.53	0.0209	75				6120053R	6120053RC
0.54	0.0213			2.8		6120054R	6120054RC
0.55	0.0217					6120055R	6120055RC
0.56	0.0220					6120056R	6120056RC
0.57	0.0224	74				6120057R	6120057RC
0.58	0.0228					6120058R	6120058RC
0.59	0.0232					6120059R	6120059RC
0.60	0.0236		1.5	2.8	30.0	6120060R	6120060RC
0.61	0.0240	73		3.3		6120061R	6120061RC
0.62	0.0244					6120062R	6120062RC
0.63	0.0248	72				6120063R	6120063RC
0.64	0.0252					6120064R	6120064RC
0.65	0.0256					6120065R	6120065RC
0.66	0.0260	71				6120066R	6120066RC
0.67	0.0264					6120067R	6120067RC
0.68	0.0268			3.8		6120068R	6120068RC
0.69	0.0272					6120069R	6120069RC
0.70	0.0276					6120070R	6120070RC
0.71	0.0280	70				6120071R	6120071RC

Series 6120 Continued

***SPECIAL ORDERS:** Series 6120 flute diameters coated sizes smaller than 0.50mm are special order. Please contact Pilot Precision Products for details.

6120 Series Solid Carbide

4–5 x D – Depth of Cut 120°, continued



6120 Series Solid Carbide - Drill Sizes 0.72 – 1.65mm

NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.72	0.0283		1.5	3.8	30.0	6120072R	6120072RC
0.73	0.0287					6120073R	6120073RC
0.74	0.0291	69				6120074R	6120074RC
0.75	0.0295					6120075R	6120075RC
0.76	0.0299			4.2		6120076R	6120076RC
0.77	0.0303					6120077R	6120077RC
0.78	0.0307					6120078R	6120078RC
0.79	0.0311	68-1/32				6120079R	6120079RC
0.80	0.0315			4.4		6120080R	6120080RC
0.81	0.0319	67				6120081R	6120081RC
0.82	0.0323					6120082R	6120082RC
0.83	0.0327					6120083R	6120083RC
0.84	0.0331	66				6120084R	6120084RC
0.85	0.0335					6120085R	6120085RC
0.86	0.0339			4.8		6120086R	6120086RC
0.87	0.0343					6120087R	6120087RC
0.88	0.0346					6120088R	6120088RC
0.89	0.0350	65				6120089R	6120089RC
0.90	0.0354					6120090R	6120090RC
0.91	0.0358	64				6120091R	6120091RC
0.92	0.0362					6120092R	6120092RC
0.93	0.0366					6120093R	6120093RC
0.94	0.0370	63				6120094R	6120094RC
0.95	0.0374					6120095R	6120095RC
0.96	0.0378	62				6120096R	6120096RC
0.97	0.0382					6120097R	6120097RC
0.98	0.0386					6120098R	6120098RC
0.99	0.0390	61				6120099R	6120099RC
1.00	0.0394					6120100R	6120100RC
1.01	0.0398	60				6120101R	6120101RC
1.02	0.0402					6120102R	6120102RC
1.03	0.0406					6120103R	6120103RC
1.04	0.0409	59				6120104R	6120104RC
1.05	0.0413					6120105R	6120105RC
1.06	0.0417					6120106R	6120106RC
1.07	0.0421	58				6120107R	6120107RC
1.08	0.0425					6120108R	6120108RC
1.09	0.0429	57				6120109R	6120109RC
1.10	0.0433			5.4		6120110R	6120110RC
1.11	0.0437					6120111R	6120111RC
1.12	0.0441					6120112R	6120112RC
1.13	0.0445					6120113R	6120113RC
1.14	0.0449					6120114R	6120114RC
1.15	0.0453					6120115R	6120115RC
1.16	0.0457					6120116R	6120116RC
1.17	0.0461					6120117R	6120117RC
1.18	0.0465	56				6120118R	6120118RC

6120 Series Solid Carbide - Drill Sizes 0.72 – 1.65mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
1.19	0.0469	3/64	1.5	5.4	30.0	6120119R	6120119RC
1.20	0.0472			6.0		6120120R	6120120RC
1.21	0.0476					6120121R	6120121RC
1.22	0.0480					6120122R	6120122RC
1.23	0.0484					6120123R	6120123RC
1.24	0.0488					6120124R	6120124RC
1.25	0.0492					6120125R	6120125RC
1.26	0.0496					6120126R	6120126RC
1.27	0.0500					6120127R	6120127RC
1.28	0.0504					6120128R	6120128RC
1.29	0.0508					6120129R	6120129RC
1.30	0.0512			6.7		6120130R	6120130RC
1.31	0.0516					6120131R	6120131RC
1.32	0.0520	55				6120132R	6120132RC
1.33	0.0524					6120133R	6120133RC
1.34	0.0528					6120134R	6120134RC
1.35	0.0531					6120135R	6120135RC
1.36	0.0535					6120136R	6120136RC
1.37	0.0539					6120137R	6120137RC
1.38	0.0543					6120138R	6120138RC
1.39	0.0547					6120139R	6120139RC
1.40	0.0551	54				6120140R	6120140RC
1.41	0.0555					6120141R	6120141RC
1.42	0.0559					6120142R	6120142RC
1.43	0.0563					6120143R	6120143RC
1.44	0.0567					6120144R	6120144RC
1.45	0.0571					6120145R	6120145RC
1.46	0.0575					6120146R	6120146RC
1.47	0.0579					6120147R	6120147RC
1.48	0.0583					6120148R	6120148RC
1.49	0.0587					6120149R	6120149RC
1.50	0.0591		2.0	7.2	38.0	6120150R	6120150RC
1.51	0.0594	53				6120151R	6120151RC
1.52	0.0598					6120152R	6120152RC
1.53	0.0602					6120153R	6120153RC
1.54	0.0606					6120154R	6120154RC
1.55	0.0610					6120155R	6120155RC
1.56	0.0614					6120156R	6120156RC
1.57	0.0618					6120157R	6120157RC
1.58	0.0622					6120158R	6120158RC
1.59	0.0626	1/16				6120159R	6120159RC
1.60	0.0630					6120160R	6120160RC
1.61	0.0634	52				6120161R	6120161RC
1.62	0.0638					6120162R	6120162RC
1.63	0.0642					6120163R	6120163RC
1.64	0.0646					6120164R	6120164RC
1.65	0.0650					6120165R	6120165RC

Series 6120 Continued

6120 Series Solid Carbide

4–5 x D – Depth of Cut 120°, continued



6120 Series Solid Carbide - Drill Sizes 1.66 – 2.59mm

NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
1.66	0.0654		2.0	7.2	38.0	6120166R	6120166RC
1.67	0.0657					6120167R	6120167RC
1.68	0.0661					6120168R	6120168RC
1.69	0.0665					6120169R	6120169RC
1.70	0.0669	51				6120170R	6120170RC
1.71	0.0673					6120171R	6120171RC
1.72	0.0677					6120172R	6120172RC
1.73	0.0681					6120173R	6120173RC
1.74	0.0685					6120174R	6120174RC
1.75	0.0689					6120175R	6120175RC
1.76	0.0693					6120176R	6120176RC
1.77	0.0697					6120177R	6120177RC
1.78	0.0701	50				6120178R	6120178RC
1.79	0.0705					6120179R	6120179RC
1.80	0.0709			8.4		6120180R	6120180RC
1.81	0.0713					6120181R	6120181RC
1.82	0.0717					6120182R	6120182RC
1.83	0.0720					6120183R	6120183RC
1.84	0.0724					6120184R	6120184RC
1.85	0.0728	49				6120185R	6120185RC
1.86	0.0732					6120186R	6120186RC
1.87	0.0736					6120187R	6120187RC
1.88	0.0740					6120188R	6120188RC
1.89	0.0744					6120189R	6120189RC
1.90	0.0748					6120190R	6120190RC
1.91	0.0752					6120191R	6120191RC
1.92	0.0756					6120192R	6120192RC
1.93	0.0760	48				6120193R	6120193RC
1.94	0.0764					6120194R	6120194RC
1.95	0.0768					6120195R	6120195RC
1.96	0.0772					6120196R	6120196RC
1.97	0.0776					6120197R	6120197RC
1.98	0.0780	5/64				6120198R	6120198RC
1.99	0.0783	47				6120199R	6120199RC
2.00	0.0787		3.0	12.0		6120200R	6120200RC
2.01	0.0791					6120201R	6120201RC
2.02	0.0795					6120202R	6120202RC
2.03	0.0799					6120203R	6120203RC
2.04	0.0803					6120204R	6120204RC
2.05	0.0807					6120205R	6120205RC
2.06	0.0811	46				6120206R	6120206RC
2.07	0.0815					6120207R	6120207RC
2.08	0.0819	45				6120208R	6120208RC
2.09	0.0823					6120209R	6120209RC
2.10	0.0827					6120210R	6120210RC
2.11	0.0831					6120211R	6120211RC
2.12	0.0835					6120212R	6120212RC

6120 Series Solid Carbide - Drill Sizes 1.66 – 2.59mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
2.13	0.0839		3.0	12.0	38.0	6120213R	6120213RC
2.14	0.0843					6120214R	6120214RC
2.15	0.0846					6120215R	6120215RC
2.16	0.0850					6120216R	6120216RC
2.17	0.0854					6120217R	6120217RC
2.18	0.0858	44				6120218R	6120218RC
2.19	0.0862					6120219R	6120219RC
2.20	0.0866					6120220R	6120220RC
2.21	0.0870					6120221R	6120221RC
2.22	0.0874					6120222R	6120222RC
2.23	0.0878					6120223R	6120223RC
2.24	0.0882					6120224R	6120224RC
2.25	0.0886					6120225R	6120225RC
2.26	0.0890	43				6120226R	6120226RC
2.27	0.0894					6120227R	6120227RC
2.28	0.0898					6120228R	6120228RC
2.29	0.0902					6120229R	6120229RC
2.30	0.0906					6120230R	6120230RC
2.31	0.0909					6120231R	6120231RC
2.32	0.0913					6120232R	6120232RC
2.33	0.0917					6120233R	6120233RC
2.34	0.0921					6120234R	6120234RC
2.35	0.0925					6120235R	6120235RC
2.36	0.0929					6120236R	6120236RC
2.37	0.0933					6120237R	6120237RC
2.38	0.0937	3/32				6120238R	6120238RC
2.39	0.0941					6120239R	6120239RC
2.40	0.0945					6120240R	6120240RC
2.41	0.0949					6120241R	6120241RC
2.42	0.0953					6120242R	6120242RC
2.43	0.0957					6120243R	6120243RC
2.44	0.0961	41				6120244R	6120244RC
2.45	0.0965					6120245R	6120245RC
2.46	0.0969					6120246R	6120246RC
2.47	0.0972					6120247R	6120247RC
2.48	0.0976					6120248R	6120248RC
2.49	0.0980	40				6120249R	6120249RC
2.50	0.0984			14.0		6120250R	6120250RC
2.51	0.0988					6120251R	6120251RC
2.52	0.0992					6120252R	6120252RC
2.53	0.0996	39				6120253R	6120253RC
2.54	0.1000					6120254R	6120254RC
2.55	0.1004					6120255R	6120255RC
2.56	0.1008					6120256R	6120256RC
2.57	0.1012					6120257R	6120257RC
2.58	0.1016	38				6120258R	6120258RC
2.59	0.1020					6120259R	6120259RC

Series 6120 Continued

6120 Series Solid Carbide

4–5x D – Depth of Cut 120°, continued



6120 Series Solid Carbide - Drill Sizes 2.60 – 3.00mm

NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
2.60	0.1024					6120260R	6120260RC
2.61	0.1028					6120261R	6120261RC
2.62	0.1031					6120262R	6120262RC
2.63	0.1035					6120263R	6120263RC
2.64	0.1039	37				6120264R	6120264RC
2.65	0.1043					6120265R	6120265RC
2.66	0.1047					6120266R	6120266RC
2.67	0.1051					6120267R	6120267RC
2.68	0.1055					6120268R	6120268RC
2.69	0.1059					6120269R	6120269RC
2.70	0.1063	36	3.0	14.0	38.0	6120270R	6120270RC
2.71	0.1067					6120271R	6120271RC
2.72	0.1071					6120272R	6120272RC
2.73	0.1075					6120273R	6120273RC
2.74	0.1079					6120274R	6120274RC
2.75	0.1083					6120275R	6120275RC
2.76	0.1087					6120276R	6120276RC
2.77	0.1091					6120277R	6120277RC
2.78	0.1094	7/64				6120278R	6120278RC
2.79	0.1098	35				6120279R	6120279RC
2.80	0.1102					6120280R	6120280RC

6120 Series Solid Carbide - Drill Sizes 2.60 – 3.00mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
2.81	0.1106					6120281R	6120281RC
2.82	0.1110	34				6120282R	6120282RC
2.83	0.1114					6120283R	6120283RC
2.84	0.1118					6120284R	6120284RC
2.85	0.1122					6120285R	6120285RC
2.86	0.1126					6120286R	6120286RC
2.87	0.1130	33				6120287R	6120287RC
2.88	0.1134					6120288R	6120288RC
2.89	0.1138					6120289R	6120289RC
2.90	0.1142					6120290R	6120290RC
2.91	0.1146		3.0	14.0	38.0	6120291R	6120291RC
2.92	0.1150					6120292R	6120292RC
2.93	0.1154					6120293R	6120293RC
2.94	0.1157					6120294R	6120294RC
2.95	0.1161	32				6120295R	6120295RC
2.96	0.1165					6120296R	6120296RC
2.97	0.1169					6120297R	6120297RC
2.98	0.1173					6120298R	6120298RC
2.99	0.1177					6120299R	6120299RC
3.00	0.1181					6120300R	6120300RC

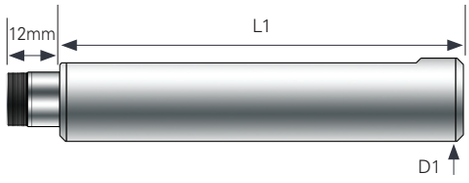


Advanced Precision Micro Tool Holders

Extreme Concentricity for Micro Drills TIR < .0002"

- High performance
- Tight tolerance
- Micro parts production





Precision CHK Collets

Item No.	Description
HSP-CHK-1.0	1.0mm CHK Collet
HSP-CHK-1.5	1.5mm CHK Collet
HSP-CHK-2.0	2.0mm CHK Collet
HSP-CHK-2.5	2.5mm CHK Collet
HSP-CHK-3.0	3.0mm CHK Collet
HSP-CHK-3.5	3.5mm CHK Collet



Collet Sleeves

Item No.	Description	D1	L1 (mm)	OAL (mm)
HSP-CHK-127-026	CHK Collet Sleeve 1/2 inch Shank	0.500"	26mm	38mm
HSP-CHK-190-076	CHK Collet Sleeve 3/4 inch Shank	0.750"	76mm	90mm
HSP-CHK-254-121	CHK Collet Sleeve 1 inch Shank	1.00"	121mm	133mm

Note: Includes Clamping Nut and Wrench

Accessory Components

Item No.	Description
HSP-CHK - NUT	Precision CHK Collet Clamping Nut
HSP-CHK 14mm	14mm Flat Wrench



6100 Series Solid Carbide

5–7 x D – Depth of Cut 120º



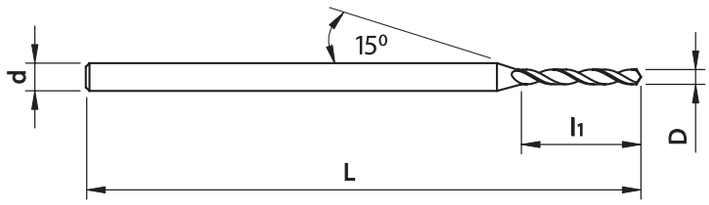


+ 0.000/- 0.006mm (h6) Uncoated Version
+ 0.002/-0.004mm Coated Version

For medium to high tensile strength steel, stainless, titanium alloys and cast iron.
All items can be ordered as left hand at same pricing. Special, custom specification items available.

Custom specifications such as:

- Helix angle of 15°, 24°, 30° or other
- Point angles of 90°, 110°, 130°, 140° or other
- Special diameters as 1.255mm or other
- Special tolerances as +/- 0.001mm or other
- Coolant thru drills at 3 and 4mm shanks and 1.25 to 3mm flute diameters
- Minimum custom order is 10 Pieces / Spec.
- **Lead-time on custom orders—4 Weeks ARO**



OAL Range 25 – 38mm

6100 Series Solid Carbide - Drill Sizes 0.10 – 0.61mm
NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.10	0.0039		1.0	0.5	25.0	6100010R	-
0.11	0.0043					6100011R	-
0.12	0.0047					6100012R	-
0.13	0.0051			0.6		6100013R	-
0.14	0.0055			0.7		6100014R	-
0.15	0.0059	97		1.0		6100015R	-
0.16	0.0063	96				6100016R	-
0.17	0.0067	95				6100017R	-
0.18	0.0071	94				6100018R	-
0.19	0.0075	93				6100019R	-
0.20	0.0079	92		1.8		6100020R	-
0.21	0.0083	91				6100021R	-
0.22	0.0087	90				6100022R	-
0.23	0.0091	89				6100023R	-
0.24	0.0094	88				6100024R	-
0.25	0.0098			2.2		6100025R	-
0.26	0.0102					6100026R	-
0.27	0.0106	86				6100027R	-
0.28	0.0110	85				6100028R	-
0.29	0.0114	84				6100029R	-
0.30	0.0118					6100030R	-
0.31	0.0122			2.8		6100031R	-
0.32	0.0126	82				6100032R	-
0.33	0.0130	81				6100033R	-
0.34	0.0134	80				6100034R	-
0.35	0.0138					6100035R	-

6100 Series Solid Carbide - Drill Sizes 0.10 – 0.61mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.36	0.0142		1.0	2.8	25.0	6100036R	-
0.37	0.0146	79				6100037R	-
0.38	0.0150					6100038R	-
0.39	0.0154			3.6		6100039R	-
0.40	0.0157					6100040R	-
0.41	0.0161	78				6100041R	-
0.42	0.0165					6100042R	-
0.43	0.0169					6100043R	-
0.44	0.0173					6100044R	-
0.45	0.0177					6100045R	-
0.46	0.0181	77				6100046R	-
0.47	0.0185					6100047R	-
0.48	0.0189					6100048R	-
0.49	0.0193			4.0		6100049R	-
0.50	0.0197					6100050R	6100050RC
0.51	0.0201	76				6100051R	6100051RC
0.52	0.0205					6100052R	6100052RC
0.53	0.0209	75				6100053R	6100053RC
0.54	0.0213					6100054R	6100054RC
0.55	0.0217			4.5		6100055R	6100055RC
0.56	0.0220					6100056R	6100056RC
0.57	0.0224	74				6100057R	6100057RC
0.58	0.0228					6100058R	6100058RC
0.59	0.0232					6100059R	6100059RC
0.60	0.0236		1.5	5.0	30.0	6100060R	6100060RC
0.61	0.0240	73				6100061R	6100061RC

Series 6100 Continued

***SPECIAL ORDERS:** Series 6100 flute diameters coated sizes smaller than 0.50mm are special order. Please contact Pilot Precision Products for details.

6100 Series Solid Carbide

5–7 x D – Depth of Cut 120°, continued



6100 Series Solid Carbide - Drill Sizes 0.62 – 1.53mm

NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.62	0.0244		1.5	5.0	30.0	6100062R	6100062RC
0.63	0.0248	72				6100063R	6100063RC
0.64	0.0252					6100064R	6100064RC
0.65	0.0256					6100065R	6100065RC
0.66	0.0260	71				6100066R	6100066RC
0.67	0.0264					6100067R	6100067RC
0.68	0.0268					6100068R	6100068RC
0.69	0.0272			5.6		6100069R	6100069RC
0.70	0.0276					6100070R	6100070RC
0.71	0.0280	70				6100071R	6100071RC
0.72	0.0283					6100072R	6100072RC
0.73	0.0287					6100073R	6100073RC
0.74	0.0291	69				6100074R	6100074RC
0.75	0.0295					6100075R	6100075RC
0.76	0.0299			6.3		6100076R	6100076RC
0.77	0.0303					6100077R	6100077RC
0.78	0.0307					6100078R	6100078RC
0.79	0.0311	68-1/32				6100079R	6100079RC
0.80	0.0315					6100080R	6100080RC
0.81	0.0319	67				6100081R	6100081RC
0.82	0.0323					6100082R	6100082RC
0.83	0.0327					6100083R	6100083RC
0.84	0.0331	66				6100084R	6100084RC
0.85	0.0335					6100085R	6100085RC
0.86	0.0339			7.1		6100086R	6100086RC
0.87	0.0343					6100087R	6100087RC
0.88	0.0346					6100088R	6100088RC
0.89	0.0350	65				6100089R	6100089RC
0.90	0.0354					6100090R	6100090RC
0.91	0.0358	64				6100091R	6100091RC
0.92	0.0362					6100092R	6100092RC
0.93	0.0366					6100093R	6100093RC
0.94	0.0370	63				6100094R	6100094RC
0.95	0.0374					6100095R	6100095RC
0.96	0.0378	62		8.0		6100096R	6100096RC
0.97	0.0382					6100097R	6100097RC
0.98	0.0386					6100098R	6100098RC
0.99	0.0390	61				6100099R	6100099RC
1.00	0.0394					6100100R	6100100RC
1.01	0.0398	60				6100101R	6100101RC
1.02	0.0402					6100102R	6100102RC
1.03	0.0406					6100103R	6100103RC
1.04	0.0409	59				6100104R	6100104RC
1.05	0.0413					6100105R	6100105RC
1.06	0.0417			9.0		6100106R	6100106RC
1.07	0.0421	58				6100107R	6100107RC

6100 Series Solid Carbide - Drill Sizes 0.62 – 1.53mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
1.08	0.0425		1.5	9.0	30.0	6100108R	6100108RC
1.09	0.0429	57				6100109R	6100109RC
1.10	0.0433					6100110R	6100110RC
1.11	0.0437					6100111R	6100111RC
1.12	0.0441					6100112R	6100112RC
1.13	0.0445					6100113R	6100113RC
1.14	0.0449					6100114R	6100114RC
1.15	0.0453					6100115R	6100115RC
1.16	0.0457			10.0		6100116R	6100116RC
1.17	0.0461					6100117R	6100117RC
1.18	0.0465	56				6100118R	6100118RC
1.19	0.0469	3/64				6100119R	6100119RC
1.20	0.0472					6100120R	6100120RC
1.21	0.0476					6100121R	6100121RC
1.22	0.0480					6100122R	6100122RC
1.23	0.0484					6100123R	6100123RC
1.24	0.0488					6100124R	6100124RC
1.25	0.0492					6100125R	6100125RC
1.26	0.0496					6100126R	6100126RC
1.27	0.0500					6100127R	6100127RC
1.28	0.0504					6100128R	6100128RC
1.29	0.0508					6100129R	6100129RC
1.30	0.0512					6100130R	6100130RC
1.31	0.0516			11.2		6100131R	6100131RC
1.32	0.0520	55				6100132R	6100132RC
1.33	0.0524					6100133R	6100133RC
1.34	0.0528					6100134R	6100134RC
1.35	0.0531					6100135R	6100135RC
1.36	0.0535					6100136R	6100136RC
1.37	0.0539					6100137R	6100137RC
1.38	0.0543					6100138R	6100138RC
1.39	0.0547					6100139R	6100139RC
1.40	0.0551	54				6100140R	6100140RC
1.41	0.0555					6100141R	6100141RC
1.42	0.0559					6100142R	6100142RC
1.43	0.0563					6100143R	6100143RC
1.44	0.0567					6100144R	6100144RC
1.45	0.0571					6100145R	6100145RC
1.46	0.0575					6100146R	6100146RC
1.47	0.0579					6100147R	6100147RC
1.48	0.0583					6100148R	6100148RC
1.49	0.0587					6100149R	6100149RC
1.50	0.0591		2.0	12.0	38.0	6100150R	6100150RC
1.51	0.0594	53				6100151R	6100151RC
1.52	0.0598					6100152R	6100152RC
1.53	0.0602					6100153R	6100153RC

Series 6100 Continued

6100 Series Solid Carbide

5–7 x D – Depth of Cut 120°, continued



6100 Series Solid Carbide - Drill Sizes 1.54 – 1.99mm

***NOTE:* Sold in 10 piece packages only**

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
1.54	0.0606					6100154R	6100154RC
1.55	0.0610					6100155R	6100155RC
1.56	0.0614					6100156R	6100156RC
1.57	0.0618					6100157R	6100157RC
1.58	0.0622					6100158R	6100158RC
1.59	0.0626	1/16				6100159R	6100159RC
1.60	0.0630					6100160R	6100160RC
1.61	0.0634	52				6100161R	6100161RC
1.62	0.0638					6100162R	6100162RC
1.63	0.0642					6100163R	6100163RC
1.64	0.0646					6100164R	6100164RC
1.65	0.0650		2.0	12.0	38.0	6100165R	6100165RC
1.66	0.0654					6100166R	6100166RC
1.67	0.0657					6100167R	6100167RC
1.68	0.0661					6100168R	6100168RC
1.69	0.0665					6100169R	6100169RC
1.70	0.0669	51				6100170R	6100170RC
1.71	0.0673					6100171R	6100171RC
1.72	0.0677					6100172R	6100172RC
1.73	0.0681					6100173R	6100173RC
1.74	0.0685					6100174R	6100174RC
1.75	0.0689					6100175R	6100175RC
1.76	0.0693					6100176R	6100176RC

6100 Series Solid Carbide - Drill Sizes 1.54 – 1.99mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
1.77	0.0697					6100177R	6100177RC
1.78	0.0701	50				6100178R	6100178RC
1.79	0.0705					6100179R	6100179RC
1.80	0.0709					6100180R	6100180RC
1.81	0.0713					6100181R	6100181RC
1.82	0.0717					6100182R	6100182RC
1.83	0.0720					6100183R	6100183RC
1.84	0.0724					6100184R	6100184RC
1.85	0.0728	49				6100185R	6100185RC
1.86	0.0732					6100186R	6100186RC
1.87	0.0736					6100187R	6100187RC
1.88	0.0740		2.0	12.0	38.0	6100188R	6100188RC
1.89	0.0744					6100189R	6100189RC
1.90	0.0748					6100190R	6100190RC
1.91	0.0752					6100191R	6100191RC
1.92	0.0756					6100192R	6100192RC
1.93	0.0760	48				6100193R	6100193RC
1.94	0.0764					6100194R	6100194RC
1.95	0.0768					6100195R	6100195RC
1.96	0.0772					6100196R	6100196RC
1.97	0.0776					6100197R	6100197RC
1.98	0.0780	5/64				6100198R	6100198RC
1.99	0.0783	47				6100199R	6100199RC

***NOTE:* For drill sizes 2.00mm and larger See our 6120 and 6200 Series**

6100 Series Solid Carbide



- **For medium to high tensile strength Steel, Stainless, Titanium Alloys and Cast Iron**
- **Amazing dimension control at h6, h4 & h3 µm tolerances**
- **Ultra-fine surface finish for smooth operation**
- **Micro Grain Carbide with 10% Cobalt Content for outstanding performance & long tool life**
- **Coatings available upon request**

6200 HP Series Solid Carbide

6–7 x D – Depth of Cut 140°



h4 Tolerance Reinforced Shank d 3.0mm

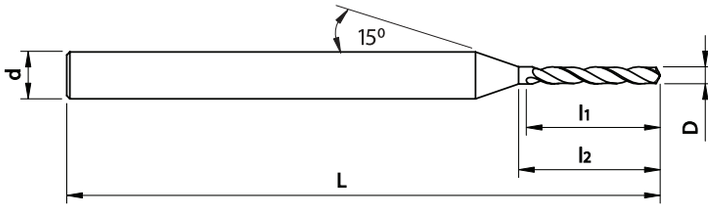


+ 0.000/- 0.004mm (h4) Uncoated Version
+ 0.002/-0.002mm Coated Version

High performance drill, wide range applications, steels, cast iron and non-ferrous metals.
All items can be ordered as left hand at same pricing. Special, custom specification items available.

Custom specifications such as:

- Helix angle of 15°, 24°, 35° or other
- Point angles of 90°, 110°, 120°, 130° or other
- Special diameters as 0.92mm or other
- Special tolerances as +/- 0.001mm or other
- Coolant thru drills at 3 and 4mm shanks and 1.25 to 3mm flute diameters
- Minimum custom order is 10 Pieces
- **Lead-time on custom orders—4 Weeks ARO**



OAL 50mm

6200 HP Series Solid Carbide - Drill Sizes 0.50 – 3.00mm
NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	l2 D Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
0.50	0.0197		3.0	3.5	4.4	50.0	6200050R	6200050RC
0.55	0.0217			4.0	5.0		6200055R	6200055RC
0.60	0.0236			4.5	5.6		6200060R	6200060RC
0.65	0.0256			5.0	6.3		6200065R	6200065RC
0.70	0.0276						6200070R	6200070RC
0.75	0.0295			5.5	6.9		6200075R	6200075RC
0.80	0.0315			5.6	7.2		6200080R	6200080RC
0.85	0.0335			6.0	7.6		6200085R	6200085RC
0.90	0.0354			6.5	8.1		6200090R	6200090RC
0.95	0.0374			6.7	8.5		6200095R	6200095RC
1.00	0.0394			7.0	8.8		6200100R	6200100RC
1.05	0.0413			7.5	9.4		6200105R	6200105RC
1.10	0.0433			8.0	1.1		6200110R	6200110RC
1.15	0.0453			8.1	1.4		6200115R	6200115RC
1.20	0.0472			8.5	11.0		6200120R	6200120RC
1.25	0.0492			8.9	11.3		6200125R	6200125RC
1.30	0.0512			9.2	11.7		6200130R	6200130RC
1.35	0.0531			9.6	12.2		6200135R	6200135RC
1.40	0.0551	54		10.0	12.5		6200140R	6200140RC
1.45	0.0571			11.5	13.0		6200145R	6200145RC
1.50	0.0591						6200150R	6200150RC
1.55	0.0610			11.0	13.5		6200155R	6200155RC
1.60	0.0630			11.5	14.0		6200160R	6200160RC
1.65	0.0650			12.0	15.0		6200165R	6200165RC
1.70	0.0669	51					6200170R	6200170RC
1.75	0.0689			12.5	15.5		6200175R	6200175RC

6200 HP Series Solid Carbide - Drill Sizes 0.50 – 3.00mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	l2 D Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
1.80	0.0709		3.0	13.0	16.0	50.0	6200180R	6200180RC
1.85	0.0728	49					6200185R	6200185RC
1.90	0.0748			13.5	17.5		6200190R	6200190RC
1.95	0.0768			14.0	18.0		6200195R	6200195RC
2.00	0.0787						6200200R	6200200RC
2.05	0.0807			14.5	18.5		6200205R	6200205RC
2.10	0.0827			15.0	19.0		6200210R	6200210RC
2.15	0.0846						6200215R	6200215RC
2.20	0.0866			16.0	20.0		6200220R	6200220RC
2.25	0.0886						6200225R	6200225RC
2.30	0.0906			16.5	21.0		6200230R	6200230RC
2.35	0.0925						6200235R	6200235RC
2.40	0.0945			17.0	22.0		6200240R	6200240RC
2.45	0.0965			17.5	22.5		6200245R	6200245RC
2.50	0.0984			18.0	23.0		6200250R	6200250RC
2.55	0.1004						6200255R	6200255RC
2.60	0.1024			18.5	23.5		6200260R	6200260RC
2.65	0.1043						6200265R	6200265RC
2.70	0.1063	36		19.0	24.0		6200270R	6200270RC
2.75	0.1083						6200275R	6200275RC
2.80	0.1102			20.0	25.0		6200280R	6200280RC
2.85	0.1122						6200285R	6200285RC
2.90	0.1142			21.0	26.0		6200290R	6200290RC
2.95	0.1161	32					6200295R	6200295RC
3.00	0.1181						6200300R	6200300RC

6220 HP Series Solid Carbide

12 x D – Depth of Cut 140°



h5 Tolerance Reinforced Shank d 3.0mm

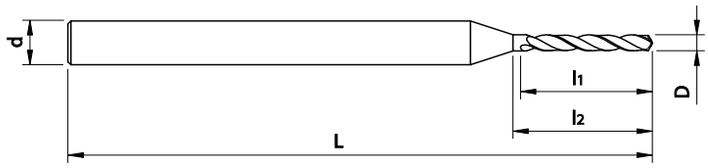


+ 0.000/- 0.005mm (h5) Uncoated Version
+ 0.002/-0.003mm Coated Version

High performance drill with reinforced shank at 3.00mm.
Spot/center drill recommended for better hole straightness - with 6140 series.
For soft, medium and tensile strength steels, stainless, titanium, alloys and cast iron.
High performance with outstanding surface finishes with strong core - no deviation.
All items can be quoted as left hand cut - contact us.

Custom specifications such as:

- Size range from 0.20mm to 3.00mm in increments of 0.05mm
- Intermediate sizes upon request
- Special sizes and tolerances available
- Minimum custom order is 10 Pieces
- **Lead-time on custom orders—4 Weeks ARO**



OAL 50 – 60mm

6220 HP Series Solid Carbide - Drill Sizes 0.50 – 2.00mm
NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	l2 D Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
0.50	0.0197		3.0	6.0	7.2	50.0	6220050R
0.55	0.0217			6.6	7.9		6220055R
0.60	0.0236			7.2	8.6		6220060R
0.65	0.0256			7.8	9.4		6220065R
0.70	0.0276			8.4	1.1		6220070R
0.75	0.0295			9.0	1.8		6220075R
0.80	0.0315			9.6	11.5		6220080R
0.85	0.0335			1.2	12.2		6220085R
0.90	0.0354			1.8	13.0		6220090R
0.95	0.0374			11.4	13.7		6220095R
1.00	0.0394			12.0	14.4		6220100R
1.05	0.0413			12.6	15.1		6220105R
1.10	0.0433			13.2	15.8		6220110R
1.15	0.0453			13.8	16.6		6220115R
1.20	0.0472			14.4	17.3		6220120R
1.25	0.0492			15.0	18.0		6220125R

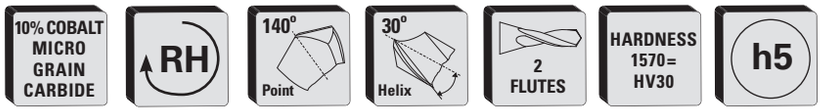
6220 HP Series Solid Carbide - Drill Sizes 0.50 – 2.00mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	l2 D Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
1.30	0.0512		3.0	15.6	18.7	50.0	6220130R
1.35	0.0531			16.2	19.4		6220135R
1.40	0.0551	54		16.8	20.2		6220140R
1.45	0.0571			17.4	20.9		6220145R
1.50	0.0591			18.0	21.6		6220150R
1.55	0.0610			18.6	22.3	60.0	6220155R
1.60	0.0630			19.2	23.0		6220160R
1.65	0.0650			19.8	23.8		6220165R
1.70	0.0669	51		24.0	24.5		6220170R
1.75	0.0689			21.0	25.2		6220175R
1.80	0.0709			21.6	25.9		6220180R
1.85	0.0728	49		22.2	26.6		6220185R
1.90	0.0748			22.8	27.4		6220190R
1.95	0.0768			23.4	28.1		6220195R
2.00	0.0787			24.0	28.8		6220200R

6230 CT Series Coolant-Thru

15 x D – Depth of Cut 140°





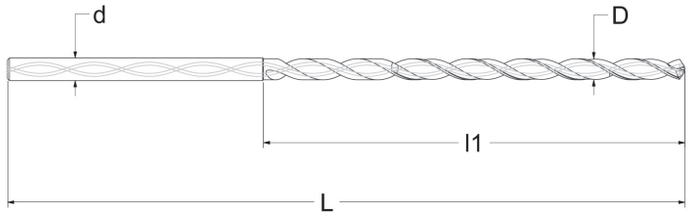
h5 Tolerance
2-Flutes Drill with
2 Helicoidal Internal Holes

+ 0.000/- 0.005mm (h5) Uncoated Version
+ 0.002/-0.0003mm Coated Version

High performance-coolant-thru micro drills with a strong web for maximum alignment and accuracy. Coolant-thru to optimize lubrication, chip removal and cooling. Ideal for a wide range of applications, medium and high tensile strength steels, stainless steel, titanium-alloys, cast iron.
Standard sizes in 0.05mm increments, but intermediate sizes upon request.

Custom specifications such as:

- Point angles of 90°, 110°, 120°, 130° or other
- Special diameters as 2.03 mm or other
- Special tolerances as +/- 0.001 mm or other
- Minimum special order is 10 Pieces
- **Lead-time on customs 4 weeks ARO**
  6 weeks with coating



OAL 70 – 90mm

6230 CT Series Coolant-Thru - Drill Sizes 2.05 – 3.00mm
***NOTE:* Sold in single unit packages**

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Fength (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.	TiAlN Coated (RC) EDP No.
2.05	0.0807		3.0	34	70.0	6230205R	6230205RC
2.10	0.0827					6230210R	6230210RC
2.15	0.0846			36		6230215R	6230215RC
2.20	0.0866					6230220R	6230220RC
2.25	0.0886			38		6230225R	6230225RC
2.30	0.0906					6230230R	6230230RC
2.35	0.0925			40		6230235R	6230235RC
2.40	0.0945					6230240R	6230240RC
2.45	0.0965			42		6230245R	6230245RC
2.50	0.0984					6230250R	6230250RC
2.55	0.1004			44	90.0	6230255R	6230255RC
2.60	0.1024					6230260R	6230260RC
2.65	0.1043			46		6230265R	6230265RC
2.70	0.1063					6230270R	6230270RC
2.75	0.1083	36		48		6230275R	6230275RC
2.80	0.1102					6230280R	6230280RC
2.85	0.1122			50		6230285R	6230285RC
2.90	0.1142					6230290R	6230290RC
2.95	0.1161	32				6230295R	6230295RC
3.00	0.1181					6230300R	6230300RC

Features:

- For holes with depth 15 x diameter
- Solid Tungsten Carbide Sub-micro grain with 2 helicoidal holes
- Right-cut, point geometry for self-centering
- Standard sizes in increments of 0.05mm
- Other diameters and lengths on request
- Available uncoated or TiAlN coated

Benefits:

- Higher drilling speed and longer tool life
- Suitable for specific materials
- High precision with h5 tolerances
- Strong, no deviation, maximum alignment accuracy
- Optimum cooling, lubrication and chip removal

All 6230 Series Drills sold in single unit packages

1100 Series Solid Carbide Half Round Gun Drills | 10 x D – Depth of Cut 120°



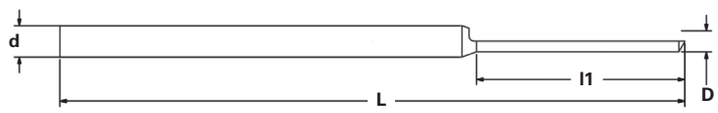


+ 0.000/- 0.005mm (h5)

Direct drilling, no centering required, good chip evacuation, high performance in brass connectors.
For soft materials, brass, copper, gold, silver and stainless, titanium alloys.
Single lip half round for outstanding coolant flow and fine surface finishes.
All items can be ordered as left hand cut at same pricing.
Special, custom specification items available.

Custom specifications such as:

- Size range from 0.5mm to 2.00mm in increments of 0.05mm
- Intermediate sizes upon request
- Special sizes, point angles and tolerances available
- Minimum custom order is 10 Pieces
- **Lead-time on customs 4 weeks ARO 6 weeks with coating**



OAL 30 – 38 – 50mm

1100 Series Solid Carbide Half Round Gun Drills-
Drill Sizes 0.20 – 3.00mm *NOTE: **Sold in 10 piece packages only***

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
0.20	0.0079		1.50	2.00	30.0	1100020R
0.25	0.0098			2.50		1100025R
0.30	0.0118			3.00		1100030R
0.35	0.0138			3.50		1100035R
0.40	0.0157			4.00		1100040R
0.45	0.0177			4.50		1100045R
0.50	0.0197			5.00		1100050R
0.55	0.0217			5.50		1100055R
0.60	0.0236			6.00		1100060R
0.65	0.0256			6.50		1100065R
0.70	0.0276			7.00		1100070R
0.75	0.0295			7.50		1100075R
0.80	0.0315			8.00		1100080R
0.85	0.0335			8.50		1100085R
0.90	0.0354			9.00		1100090R
0.95	0.0374			9.50		1100095R
1.00	0.0394			10.00		1100100R
1.05	0.0413			11.50		1100105R
1.10	0.0433			11.00		1100110R
1.15	0.0453			11.50		1100115R
1.20	0.0472			12.00		1100120R
1.25	0.0492			12.50		1100125R
1.30	0.0512			13.00		1100130R
1.35	0.0531			13.50		1100135R

1100 Series Solid Carbide Half Round Gun Drills-
Drill Sizes 0.20 – 3.00mm

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
1.40	0.0551	54	1.5	14.00	30.0	1100140R
1.45	0.0571			14.50		1100145R
1.50	0.0591		2.0	15.00	38.0	1100150R
1.55	0.0610			15.50		1100155R
1.60	0.0630			16.00		1100160R
1.65	0.0650			16.50		1100165R
1.70	0.0669	51		17.00		1100170R
1.75	0.0689			17.50		1100175R
1.80	0.0709			18.00		1100180R
1.85	0.0728	49		18.50		1100185R
1.90	0.0748			19.00		1100190R
1.95	0.0768			19.50		1100195R
2.00	0.0787		3.0	20.00	50.0	1100200R
2.10	0.0827			21.00		1100210R
2.20	0.0866			22.00		1100220R
2.30	0.0906			23.00		1100230R
2.40	0.0945			24.00		1100240R
2.50	0.0984			25.00		1100250R
2.60	0.1024			26.00		1100260R
2.70	0.1063	36		27.00		1100270R
2.80	0.1102			28.00		1100280R
2.90	0.1142			29.00		1100290R
3.00	0.1181			30.00		1100300R

3100 Series Short Solid Carbide 3 Flute Short Cross Drills | 140°



h5 Tolerance Reinforced Shank d 3.0mm

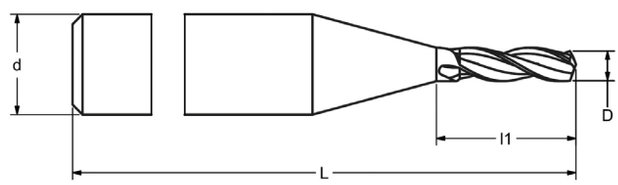


+ 0.000/- 0.005mm (h5)

High performance drill, 3-flutes for drilling and reaming in one operation.
For soft, medium and tensile strength steels, stainless, titanium, alloys and cast iron.
Good for transversal drilling with no burrs inside cut and strong web with no deviation.
Special, custom specification items available.

Custom specifications such as:

- Only available in right hand cut
- Size range from 0.5mm to 3.00mm in increments of 0.05 or 0.10mm
- Intermediate sizes upon request
- Special sizes and tolerances available
- Minimum Special Order is 10 Pieces
- **Lead-time on customs 4 weeks ARO 6 weeks with coating**



OAL 30mm

3100 Series Short Solid Carbide
3 Flute Short Cross Drills - Drill Sizes 0.50 – 1.50mm
NOTE: Sold in 10 piece packages only

D Flute Dia. (mm)	D Dec. Equiv. Flute Dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
0.50	0.0197		3.0	3.0	30.0	3100050R
0.55	0.0217					3100055R
0.60	0.0236					3100060R
0.65	0.0256					3100065R
0.70	0.0276					3100070R
0.75	0.0295			3.5		3100075R
0.80	0.0315					3100080R
0.85	0.0335					3100085R
0.90	0.0354					3100090R
0.95	0.0374					3100095R
1.00	0.0394					3100100R
1.05	0.0413			4.0		3100105R
1.10	0.0433					3100110R
1.15	0.0453					3100115R
1.20	0.0472					3100120R
1.25	0.0492					3100125R
1.30	0.0512			5.0		3100130R
1.35	0.0531					3100135R
1.40	0.0551	54				3100140R
1.45	0.0571					3100145R
1.50	0.0591					3100150R

3200 Series Long Solid Carbide 3 Flute Long Reamer Drills | 140°



h5 Tolerance Reinforced Shank d 3.0mm

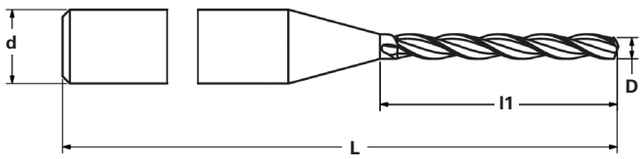


+ 0.000/- 0.005mm (h5)

High performance drill, 3-flutes for drilling and reaming in one operation.
For soft, medium and tensile strength steels, stainless, titanium, alloys and cast iron.
Good for transversal drilling with no burrs inside cut and strong web with no deviation.
Special, custom specification items available.

Custom specifications such as:

- Only available in right hand cut
- Size range from 0.5mm to 3.00mm in increments of 0.05 or 0.10mm
- Intermediate sizes upon request
- Special sizes and tolerances available
- Minimum special order is 10 Pieces
- **Lead-time on customs 4 weeks ARO 6 weeks with coating**



OAL 38mm

3200 Series Long Solid Carbide
3 Flute Long Reamer Drills - Drill Sizes 0.50 – 3.00mm
***NOTE:* Sold in 10 piece packages only**

D Flute Dia. (mm)	D dec. equiv. flute dia. (inch)	Wire # Frac	d Shank Dia. (mm)	l1 Flute Length (mm)	L Overall Length OAL (mm)	Uncoated (R) EDP No.
0.50	0.0197		3.0	6.0	38	3200050R
0.55	0.0217			7.0		3200055R
0.60	0.0236					3200060R
0.65	0.0256					3200065R
0.70	0.0276			9.5		3200070R
0.75	0.0295					3200075R
0.80	0.0315					3200080R
0.85	0.0335					3200085R
0.90	0.0354					3200090R
0.95	0.0374					3200095R
1.00	0.0394					3200100R
1.05	0.0413			1.5		3200105R
1.10	0.0433					3200110R
1.15	0.0453					3200115R
1.20	0.0472					3200120R
1.25	0.0492					3200125R
1.30	0.0512					3200130R
1.35	0.0531					3200135R
1.40	0.0551	54				3200140R
1.45	0.0571					3200145R
1.50	0.0591					3200150R
1.60	0.0630			12.0		3200160R
1.70	0.0669	51				3200170R
1.80	0.0709					3200180R
1.90	0.0748					3200190R
2.00	0.0787					3200200R
2.10	0.0827			14.0		3200210R
2.20	0.0866					3200220R
2.30	0.0906					3200230R
2.40	0.0945					3200240R
2.50	0.0984					3200250R
2.60	0.1024			16.0		3200260R
2.70	0.1063	36				3200270R
2.80	0.1102					3200280R
2.90	0.1142					3200290R
3.00	0.1181					3200300R

Speeds and Feeds Chart

Cutting Speed - RPM = SFM X 97 / Drill Dia.
Feed Rate - IPM = RPM X IPR

Guidelines - Not Guaranteed

Material	Diameter (mm)	Speed (sfm)	Feed Rate (Ipr)
Mild and Low Carbon Steels	0.10 – 0.50	40 – 80	0.0002 – 0.0003
	0.51 – 0.70	80 – 140	0.0003 – 0.0004
	0.71 – 0.99	140 – 200	0.0004 – 0.0006
	1.00 – 2.00	140 – 200	0.0006 – 0.0016
	2.01 – 3.00	140 – 200	0.0016 – 0.0020
High Carbon, Alloy Steels	0.10 – 0.50	30 – 70	0.0002 – 0.0003
	0.51 – 0.70	70 – 100	0.0002 – 0.0004
	0.71 – 0.99	70 –100	0.0004 – 0.0006
	1.00 – 2.00	100 – 170	0.0006 – 0.0016
	2.01 – 3.00	100 – 170	0.0014 – 0.0020
Stainless Steels – 300 Series, 17–4	0.10 – 0.50	20 – 40	0.0001 – 0.0002
	0.51 – 0.70	40 – 70	0.0002 – 0.0003
	0.71 – 0.99	70 – 120	0.0002 – 0.0003
	1.00 – 2.00	70 – 120	0.0003 – 0.0010
	2.01 – 3.00	70 – 120	0.0008 – 0.0014
Stainless Steels – 400 Series	0.10 – 0.50	30 – 60	0.0001 – 0.0002
	0.51 – 0.70	60 – 90	0.0002 – 0.0003
	0.71 – 0.99	90 – 140	0.0003 – 0.0004
	1.00 – 2.00	90 – 140	0.0004 – 0.0012
	2.01 – 3.00	90 – 140	0.0010 – 0.0018
Cast Iron	0.10 – 0.50	70 – 160	0.0002 – 0.0003
	0.51 – 0.70	160 – 200	0.0003 – 0.0004
	0.71 – 0.99	200 – 340	0.0004 – 0.0008
	1.00 – 2.00	200 – 340	0.0008 – 0.0020
	2.01 – 3.00	200 – 340	0.0016 – 0.0026
Ductile Iron	0.10 – 0.50	60 – 100	0.0001 – 0.0002
	0.51 – 0.70	100 – 140	0.0002 – 0.0003
	0.71 – 0.99	140 – 270	0.0003 – 0.0006
	1.00 – 2.00	140 – 270	0.0006 – 0.0016
	2.01 – 3.00	140 – 270	0.0014 – 0.0024
Aluminum	0.10 – 0.50	80 – 170	0.0002 – 0.0003
	0.51 – 0.70	170 – 270	0.0003 – 0.0005
	0.71 – 0.99	270 – 400	0.0005 – 0.0008
	1.00 – 2.00	270 – 400	0.0008 – 0.0024
	2.01 – 3.00	270 – 400	0.0020 – 0.0031
High Alloys – Inconel, Titanium	0.10 – 0.50	30 – 70	0.0001 – 0.0002
	0.51 – 0.70	70 – 100	0.0002 – 0.0003
	0.71 – 0.99	100 – 170	0.0003 – 0.0004
	1.00 – 2.00	100 – 170	0.0004 – 0.0012
	2.01 – 3.00	100 – 170	0.0010 – 0.0018

***NOTE:** Cutting parameters are good for series 5100 cobalt, 6000 & 3000 carbide drills*

Introducing Pilot Precision Products

Best in-class brands, outstanding customer service and fast, reliable service

1945

duMONT Minute Man®
Industrial Broaches established

1969

Hassay Savage founded by former duMONT employee

1999–2016

duMONT now owned by the Davis family formerly of American Saw and Manufacturing Co.

2001 – 2013

Hassay Savage entered into distribution agreements tooling supplier from France: Magafor® and GMauvaisUSA™

September 2016

duMONT acquired by present-day owners

Eric Hagopian previous owner of Hoppe Technologies, a manufacturer of Aerospace components. Bringing tight quality control systems and high-tech manufacturing expertise.

2017

$2M in capital equipment and facilities improvements deployed at duMONT

Implemented Epicor ERP to merge and improve our sales and manufacturing process management.

June 2017

Hassay Savage acquired from its co-founder's son by present-day owner

October 15, 2018

Official ground breaking of new factory in South Deerfield, becoming Pilot Precision Products

All investments in capitol equipment, Epicor ERP and our new factory are strategic plans making Pilot fully scalable for future growth.

January 2019

The decision was made to merge duMONT, Hassay Savage, Magafor and GMauvaisUSA.

Pilot Precision Products was officially launched.

May 2019

Pilot Precision Products proudly moved into its new location and began producing product and filling customer orders from the newly constructed factory and fulfillment center.

ISO 9001:2015 Certification for the first time.

Although all brands remain the same, Pilot Precision Products is building momentum as the new industrial tooling supplier in the market. New product opportunities are being evaluated and additional machinery is being added to the factory to further bolster production capabilities for existing and new brands.

We remain focused on the future and keenly aware of our humble beginnings.