Hassay Savage Company

Precision Broaches

magafor

Precision Round Tools

GMauvaisUSA™

Precision Micro Drills

2015

IN THIS BOOK...

Hassay Savage

PRECISION BROACHES

STANDARD & CUSTOM BROACHING SOLUTIONS FOR EVERY APPLICATION

Hassay Savage has the most comprehensive program of standard broaching solutions for all applications. We offer Custom Broaching Solutions for all your broaching needs. Let us be your partner in your unique, cutting applications!

GMauvaisUSA

QUALITY MICRO DRILLS

SUPERIOR PRECISION • QUALITY • CONSISTENCY

The most consistent quality micro drill program in the world, GMauvais has a complete line of HSS-E COBALT and Solid Micro Grain Carbide MICRO Drills. Standard sizes range from .1mm to 3mm, with 1,000 line items in stock. Custom made micro drills for your special application and fast delivery is our specialty.

magafor®

UNIQUE ROUND CUTTING TOOLS

PERFORMANCE • INNOVATION • SPECIALIZATION

The world's finest Center Drill, NC Spot Drill, Countersink, Multi-V, Micro Reaming and End Mill Cutting Tools for your most challenging cutting tool applications.

We hope you enjoy using our outstanding collection of the finest cutting tools for virtually every cutting application.

Hassay Savage Company • 3 Great Programs, One Great Company!

Hassay Savage





Let us be your partner in unique cutting applications!

www.hassay-savage.com

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Unique, Precision Cutting Tools!

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What is Broaching?

Broaching is a progressive metal-cutting process which incorporates a series of roughing, semi-finishing, and finishing teeth designed to remove successive portions of stock as the tool moves through or across a workpiece in a one-pass linear operation. Each tooth is calibrated to remove only a small amount of stock appropriate to the type of material broached, which permits continuous clean chip cutting.

BROACHING ORIGINATED with the venerable blacksmith 3,000 years ago. He needed to create internal spaces within the pieces he hand-forged. The blacksmith invented **DRIFTS** in varieties of configurations to punch these shapes. Drifts were driven by hammer through the cherry-red hot metal held on the primitive anvil over the pritchel or hardy hole to form a variety of internal shapes.

Pictured: A broaching operation using Hassay Savage push broaches.

MODERN BROACHING dates back to mid-nineteenth century Germany, where the drifting tool incorporated a series of uniform cutting teeth to remove material (much like a wood rasp). These **FIRST BROACHES** were short heavy hand-driven push tools. Initially, internal broaching, such as cutting keyways in pulleys and gears, accounted for the bulk of the work done, and as the power press was developed, applications for internal broaching widened.

SURFACE BROACHING evolved more slowly, but by the 1920's became critical in meeting the demands of mass production in the **AUTOMOTIVE INDUSTRY**. By the 1930s broaching processes could supply the industry with close-tolerance square holes and multiple splines for transmission gears. The technology continued to develop into spiral spline broaching, tooth cutter bars, and broaches manufactured from **HIGH-SPEED STEEL**. By the mid-50's hydraulic, fully automatic internal and external broaching machines were in wide use, making it possible to reduce the cost of mass producing accurately finished identical parts of all shapes and sizes.

BROACHING FIXTURES typically incorporate mechanical, hydraulic or pneumatic principles and utilize programmable controls and automatic clamping for continuous cycle indexing.

COMPUTERS increasingly play a vital role in the design and manufacturing set-up of broach toolmaking. The industry also asserts its competitive edge by taking advantage of significant technical advances in the fields of grinding, coolants, lubricants, stock materials, and heat treatment; which make it possible to produce a tougher, sharper tool at less cost and with faster turnaround.

SINCE 1969, HASSAY SAVAGE COMPANY has emerged as the leader in the development of broaching applications into many areas of manufacturing where there is need to produce precise complex shapes and forms. Forty-five years later, we are convinced that by joining **STATE-OF-THE-ART** technologies with the **CRAFT** of broaching as it has evolved, modern broaching heads into the twenty-first century as a competitive alternative to milling, reaming and shaping in operations where critical tolerances and high production speeds of manufactured parts are required.

Broaching Processes and Tools

Classified first as **SURFACE** *or* **INTERNAL**, *then as* **STANDARD** *or* **SPECIAL**, *each broaching tool is designed and manufactured to fit the specified print. Its length of cut, LOC, and number of teeth are set by the type of stock (i.e.- machined, cast, or forged) and amount of metal to be removed. Hassay Savage presents a comprehensive line of high-speed steel broaching tools capable of critically accurate performance in many configurations while producing extraordinarily smooth surface finishes.*

Surface Broaches

Surface broaching is most commonly used in place of milling or shaping operations on surfaces of parts or components.

The tool is a simple flat bar with multiple rows of cutting teeth, usually attached by bolting or clamping onto a broach holder.

- Surfaces may be flat, concave, convex, serrated, or cam-shaped
- Can be manufactured as insert sections and configured in a broach holder, lowering costs of initial manufacturing and replacement
- Produce highly finished surfaces of complex shapes with exacting dimensions and tolerances
- Production rates can be many times faster than milling or machining processes

Applications Include:

- Flats
- Intricate Contours
- Slots
- External Gearing
- Notches
- Serrations
- Key Lock Slots
- Turbine Forms
- Connecting Rods

Internal Broaches

Starting with a round drilled hole, internal broaching can mass produce practically any internal hole configuration from the simplest to the most complicated.

Pull broaches significantly remove more stock than push broaches, even where the workpiece has a thin or irregular wall, and can handle longer lengths of cut.

Faster and more economical than other machining processes.
All these derivative shapes generate internal gear splines, helical splines, and other irregular shapes.

Internal broaching solves scores of manufacturing applications that simply cannot be done any other way. For instance, there is no other way to make a precise square hole.

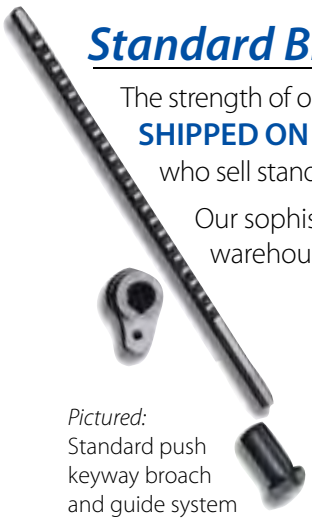
Tools Include:

- Square
- Hex
- Round Helical Cut
- Straight Spline and Serration
- Involute Spline and Serration
- Combination Keyway & Bore Sizing

Applications Include:

- Tooling Fixtures
- Keyways
- Gear & Pulley Keyways
- Hole Configurations in all Geometric Shapes

Standard Broaches



The strength of our business at Hassay Savage has been built upon standard broaches available from stock and **SHIPPED ON THE SAME DAY THE ORDER IS PLACED**. We are one of a very few broach manufacturers who sell standard tools from stock, which means we can satisfy our customers' needs immediately.

Our sophisticated system of market distribution (400 industrial distributors and 2 factory warehouse locations) permits product to be in the customer's plant when most needed.

Pictured:
Standard push keyway broach and guide system bushing: for 1/4 keyway for an idler mechanism

Special Broaches

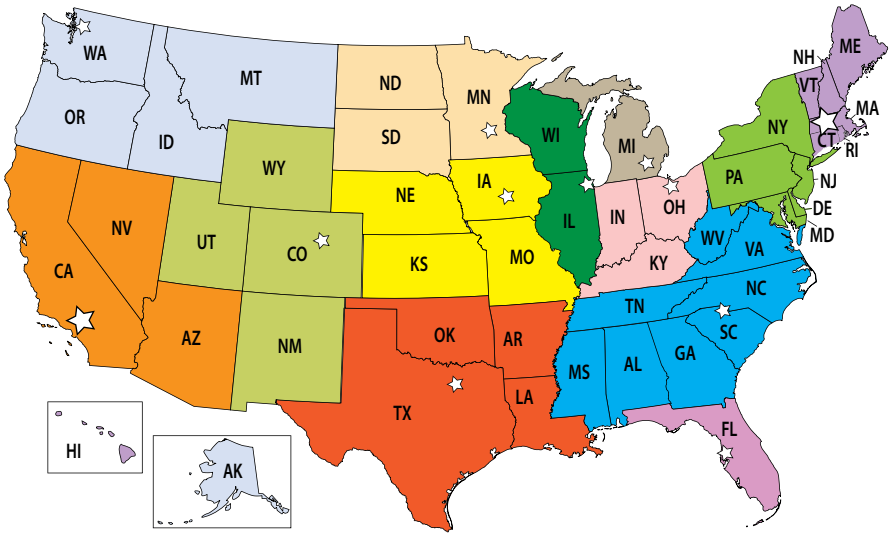
The Hassay Savage design and engineering departments offer a complete line of services for production of special broaches. Our engineers can integrate the design and manufacturing process of your custom broach, while working with you to meet your product goals and increase your profit margin.
See page 34-36 for Custom Broaching Solutions.

Hassay Savage • GMauvais • Magafor
Sales Representatives & US Warehouse Locations

Hassay Savage takes great pride in providing outstanding customer service. We ship from warehouses in

Turners Falls, MA • Anaheim, CA

We provide sales and technical support services nationwide.



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www.ramsalesandmarketing.com
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FL

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817 Eliza Court
Brunswick, OH 44212
Email: larry@tekrepgroup.com
Phone: 330-220-1116
Fax: 330-273-0121
OH, IN, KY

International Agencies:

Hassay Savage has partnered with select distributors in over 28 countries committed to our outstanding ingenuity and quality in all broaching applications. Please contact our home office for information on a Hassay Savage distributor in our growing network:

Australia, Belgium, Canada, Denmark, England, Finland, France, Germany, Greece, Holland, Ireland, Israel, Italy, Korea, Mexico, New Zealand, Russia and South Africa.

Hassay Savage HS

Precision Broaches for Every Application

MADE IN THE USA

Innovative CNC Broaching Solutions!

ISA
INDUSTRIAL SUPPLY ASSOCIATION

AMT
MANUFACTURING TECHNOLOGY

Hassay Savage

Your Total Broach Company!
Broaches For Every Application...

Medical
Orthopedic
Dental
Automotive
Firearms
Munitions
Military
Aircraft
Aerospace
Electronics
Communications
Plastics

HISTORY

Founded in 1969, Hassay Savage is a U.S. based, family owned company with designers and manufacturers of precision broaches dedicated to:

- Fine craftsmanship
- State-of-the-art design and equipment
- Computerized and process manufacturing (CNC and CAD/CAM)
- Thorough process control and process analysis (SPC)
- Dedicated tradeshow attendance

SPECIALIZATION

- Comprehensive high-speed steel broaching tools: Keyways, Squares, Hex, CNC and a variety of Unique Shapes
- Critically accurate cuts for many configurations Producing extraordinary smooth surface finishes
- World's finest push, pull and rotary broaches
- Complete breadth of line in standard broaches from stock
- Best turnaround times in the industry

PERSONALIZED SERVICE

Meet your product goals while increasing your profit margin!

We provide:

- Profit Improvement Programs (PIP)
- Cost analysis of broaching versus other machining processes
- Solutions from standard stock or custom broaches for your unique applications
- Complete turnkey design

Let us be your partner in your unique cutting applications!

HS

Hassay Savage • GMauvais • Magafor

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TOLL FREE: 1-800-247-2024 • www.hassay-savage.com

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KEYWAY BROACHES & SETS

CNC SINGLE POINT KEYWAY

ROTARY BROACHING

INDEX BROACHING

PUSH BROACHES

DAVIS STYLE KEYSEATING

500 & 600 SERIES PULL TYPE

CUSTOM BROACHES

Hassay Savage

24 Hour Fax: **413-863-2714** • Telephone: **1-800-247-2024**
Email: **info@hassay-savage.com** • **www.hassay-savage.com**

See form on page 31 for Rotary and Index broaching applications

Request For Quote Form

Customer Information

Name _____

Title _____

Company Name _____

Street Address _____

Address line 2 _____

City _____ State _____ Zip _____

Telephone _____ FAX _____

Email _____ Country _____

Broaching Information

Size & 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)

For Keyway Broaches:

Bore Size _____ Keyway Width _____

Tolerance _____ Length of Cut _____

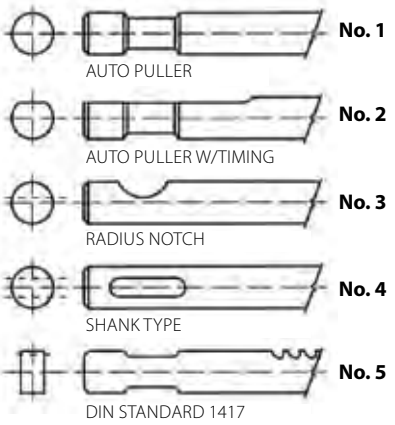
Depth of Keyway, measured across Bore _____

Type of Broaching Machine:

Push Pull Tonnage _____ Ram Travel _____

Daylight Opening _____

PULL ENDS



Please Provide This Information

Pull End No. _____

Size _____

Distance to 1st Tooth _____

Starting Hole Size _____

Finish Size _____

Length of Cut _____

Material _____

Remarks _____

Straight, Serration, 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 _____

The Hassay Savage WARRANTY

Hassay Savage Tools are warranted free from defects in material and workmanship in all cases of normal use. If under conditions of normal use a tool fails, it shall be repaired or replaced, at our option, when shipped prepaid to our factory in Turners Falls, Massachusetts 01376.

This warranty is made in lieu of all other warranties expressed or implied. This warranty does not cover tools which have been stamped for identification, experimented upon, or otherwise modified, or tools which after examination prove to have been abused, or are without flaws in material or workmanship. Government regulations require use of safety glasses and other appropriate safety equipment in the vicinity of use.

Hassay Savage Company, Inc., authorizes no other warranty by any other person or agent, nor recognizes as binding any warranty made by such person or agent on our company's behalf. We assume no further liability, except as stated herein.

Keyway Broaches Overview

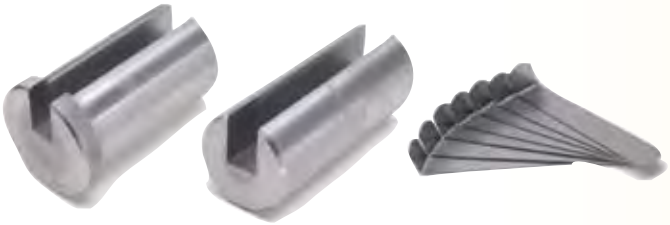
HSS Keyway Broaches Are Available as Standard Items in Sizes 1/16" to 1-1/2" and 2mm to 36mm.

Keyway Broach

- Selecting a **STANDARD BROACH** from Hassay Savage is a simple process. Choose a tool, or set of tools that will produce the cut your finished part requires. Specify the EDP, size, and brief description when ordering to ensure proper delivery.
- All **STANDARD PRODUCTS** are maintained in finished goods inventory. We can ship your order the same day it is placed. Additional special widths and lengths are also available from semi-finished and finished stock, ground to your specifications with 1 week delivery.

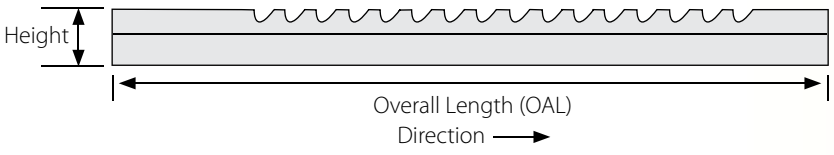
  Pressures listed in the charts are for maximum length of cut. If these lengths must be exceeded, a special Hassay Savage keyway broach can be ordered for specific length of cut and material.

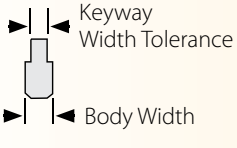
  Hassay Savage **VI Bushings** are available on **SPECIAL ORDER** in bore diameters of 3" - 6" for use with 7/8" - 1" keyway broaches.
- The specification charts on pages 16-20 describe the configurations, tolerances, cut lengths, and machine tonnage for each of the standard broaches we manufacture.
- Rake and relief angle geometries are CNC precision ground for efficient broaching in most mild steel materials for specified min/max LOC.
- In the event of thin pieces, pieces may be broached by stacking and nesting.
- **MODIFIED STANDARD KEYWAY BROACHES are available within a 1 week period,** for special widths and depths. This is an excellent delivery for the buyer looking for special applications for production or prototype.

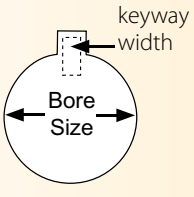


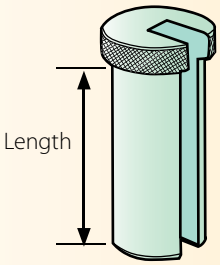
Collared Keyway Bushing | Plain Keyway Bushing | Keyway Broach Shims

1" Keyway Broach

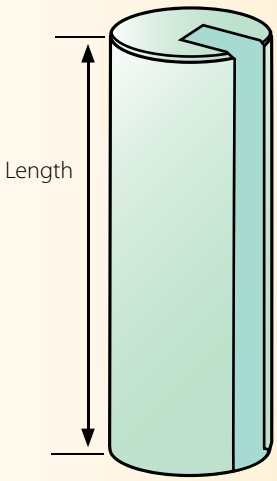




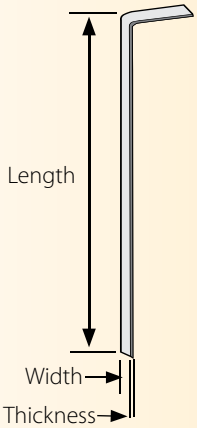




Collared Keyway Bushing



Plain Keyway Bushing



Keyway Broach Shim

Keyway Broach Sets

American Inch Standard

Keyway Range 1/16" – 3/8" with Collared Bushings in Dura Case Sets

Precision Set 1
EDP No. 15315 **DURA CASE**

3 Broaches and 5 Collared Bushings
15 Keyway Combinations *Wt. 1 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
1/16	I	1/4, 5/16, 3/8, 7/16, 1/2
3/32	I	
1/18	I	

Standard Set C-1
EDP No. 15318 **DURA CASE**

4 Broaches and 9 Collared Bushings
18 Keyway Combinations *Wt. 8 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
1/8	II	1/2, 5/8, 3/4, 7/8
3/16	II	
1/4	III	1, 1-1/8, 1-1/4, 1-3/8, 1-1/2
3/8	III	

Standard Set C-1A
EDP No. 15319 **DURA CASE**

4 Broaches and 9 Collared Bushings
18 Keyway Combinations *Wt. 8 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
1/8	II	9/16, 11/16, 13/16
3/16	II	
1/4	III	15/16, 1-1/16, 1-3/16, 1-5/16, 1-7/16, 1-9/16
3/8	III	

Standard Set C-2
EDP No. 15320 **DURA CASE**

3 Broaches and 9 Collared Bushings
15 Keyway Combinations *Wt. 8 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
1/8	II	9/16, 11/16, 13/16
3/16	III	15/16, 1-1/16, 1-3/16, 1-5/16, 1-7/16, 1-9/16
1/4	III	

Standard Set C-2A
EDP No. 15321 **DURA CASE**

3 Broaches and 9 Collared Bushings
14 Keyway Combinations *Wt. 8 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
1/8	II	1/2, 5/8, 3/4, 7/8
3/16	III	1, 1-1/8, 1-1/4, 1-3/8, 1-1/2
1/4	III	

To select a standard broach from Hassay Savage, simply choose a tool, or set of tools that will produce the cut your finished part requires.

Specify the EDP, size, and brief description when ordering to ensure proper delivery.

The specification charts, on pages 14 & 15, describe the

- Dimensional Cuts,
- Configurations,
- Tolerances,
- Length of Cut, and
- Machine Tonnage

for each standard broach we manufacture.

Standard Set C-10
EDP No. 15336 **DURA CASE**

4 Broaches and 18 Collared Bushings
36 Keyway Combinations *Wt. 13 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
1/8	II	1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 7/8
3/16	II	
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
3/8	III	

Standard Set C-10A
EDP No. 15330 **DURA CASE**

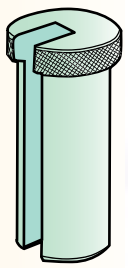
3 Broaches and 18 Collared Bushings
30 Keyway Combinations *Wt. 13 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
1/8	II	1/2, 9/16, 5/8, 11/16, 3/4, 13/16, 7/8
3/16	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
1/4	III	

All broaches are CNC qualified!

Hassay Savage HSS Broach Sets come in Durable Plastic Cases (Dura Cases) and include:

- ***Broaches***
- ***Bushings***
- ***Shims***
- ***Instructions***



Collared Keyway Bushing

Standard Set C-10 Dura Case

Heavy Duty Keyway Sets

American Inch Standard

Keyway Range 5/16" – 3/4" with Plain Bushings in Hardwood Cases

Standard Set 3-D

EDP No. 15024 **HARDWOOD**

4 Broaches and 8 Plain Bushings
32 Keyway Combinations *Wt. 50 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes inches)
5/16	IV	1-1/2, 1-5/8, 1-3/4, 1-7/8 2, 2-1/8, 2-1/4, 2-1/2
3/8	IV	
7/16	IV	
1/2	IV	

Standard Set 3-DA

EDP No. 15124 **HARDWOOD**

4 Broaches and 8 Plain Bushings
32 Keyway Combinations *Wt. 50 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes inches)
5/16	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
3/8	IV	
7/16	IV	
1/2	IV	

We are meeting the needs of today's industry. Hassay Savage broaches find use wherever precision broaching operations add to the quality and economical manufacture of identical parts.

The strength of our business has been built upon standard broaches available from stock and **SHIPPED ON THE SAME DAY THE ORDER IS PLACED.**

We are one of a very few broach manufacturers who sell standard tools from stock, which means we can satisfy our customers' needs immediately.

Heavy Duty Set 4-E

EDP No. 15012 **HARDWOOD**

2 Broaches and 6 Plain Bushings
12 Keyway Combinations *Wt. 74 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
5/8	V	2-3/8, 2-1/2, 2-5/8
3/4	V	2-3/4, 2-7/8, 3

Heavy Duty Set 4-F

EDP No. 15014 **HARDWOOD**

2 Broaches and 6 Plain Bushings
12 Keyway Combinations *Wt. 74 lbs.*

Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
5/8	V	2-5/16, 2-7/16, 2-9/16
3/4	V	2-11/16, 2-13/16, 2-15/16

Heavy Duty Set 5

EDP No. 15026 **HARDWOOD**

3 Broaches and 17 Plain Bushings
26 Keyway Combinations *Wt. 175 lbs.*

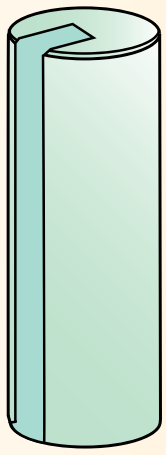
Keyway Sizes	Broach Style	Bushing Diameters (Hole Sizes)
1/2	IV	2, 2-1/16, 2-1/8, 2-3/16, 2-1/4, 2-5/16, 2-3/8, 2-7/16
5/8	V	2-1/2, 2-9/16, 2-5/8, 2-11/16, 2-3/4, 2-13/16, 2-7/8, 2-15/16, 3
3/4	V	

All broaches are CNC qualified!

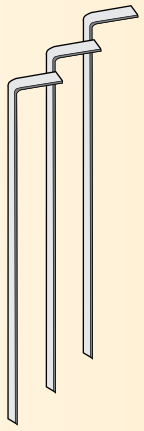
Standard Set 3-D Hardwood

Hassay Savage HSS Broach Sets in Tongue and Grooved Hardwood Cases Include:

- ***Broaches***
- ***Bushings***
- ***Shims***
- ***Instructions***



Plain Keyway Bushing



Keyway Broach Shims

Metric Keyway Broach Sets

Standard Metric

Keyway Range 2mm - 18mm

Precision Set #10

EDP No. 15410 **DURA CASE**

2 Broaches and 5 Collared Bushings
10 Keyway Combinations *Wt. 1 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
2mm	I	6, 7, 8, 9, 10
3mm	I	

Metric Set #40

EDP No. 15440 **DURA CASE**

6 Broaches and 18 Collared Bushings
36 Keyway Combinations *Wt. 12 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
2mm	I	8, 10
3mm	I	
4mm	II	12, 14, 16, 18
5mm	II	
6mm	III	18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 34, 36
8mm	III	

Metric Set #18

EDP No. 15418 **DURA CASE**

4 Broaches and 9 Collared Bushings
18 Keyway Combinations *Wt. 7 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
4mm	II	12, 14, 16, 18
5mm	II	
6mm	III	20, 22, 24, 26, 28
8mm	III	

All standard products are maintained in finish good inventory. We can **SHIP YOUR ORDER THE SAME DAY IT IS PLACED!**

Additional special widths and lengths are also available from semi-finished stock ground to your specifications with quick delivery.

The specification charts, on pages 16 & 17, describe the

- Dimensional Cuts,
- Configurations,
- Tolerances,
- Length of Cut, and
- Machine Tonnage

for each standard broach we manufacture.

Metric Set #24

EDP No. 15224 **HARDWOOD**

3 Broaches and 8 Plain Bushings
24 Keyway Combinations *Wt. 36 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
10mm	IV	34, 36, 38, 40, 42, 44, 46, 48
12mm	IV	
14mm	IV	

Metric Set #12

EDP No. 15212 **HARDWOOD**

2 Broaches and 6 Plain Bushings
12 Keyway Combinations *Wt. 70 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
16mm	V	54, 56, 58, 60, 62, 64
18mm	V	

Metric Set #30

EDP No. 15230 **HARDWOOD**

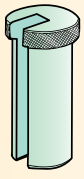
3 Broaches and 16 Plain Bushings
28 Keyway Combinations *Wt. 100 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
14mm	IV	44, 46, 48, 50
16mm	V	52, 54, 55, 56, 58, 60, 62, 64, 65, 66, 68, 70
18mm	V	

Hassay Savage HSS Broach Sets in Tongue and Grooved Hardwood Cases and Plastic Dura Cases include:

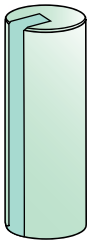
- ***Instructions***
- ***Broaches***
- ***Bushings***
- ***Shims***

Metric Set #18



Collared Keyway Bushing

Metric Set #24



Plain Keyway Bushing

Metric Keyway Broach Sets

DIN Standard Metric

Keyway Range 2mm - 18mm

DIN is an abbreviation for the **German Institute for Standardization** (Deutsches Institut für Normung). There are currently around thirty thousand DIN Standards, covering nearly every field of technology.

DIN Standard Set #50

- ***Hassay Savage Precision Quality Broaches***
- ***M2 HSS Steel Keyway Broaches for long life***
- ***Our most popular metric sizes all in one package***
- ***Strong, light weight Dura Case goes anywhere***
- ***Hardwood cases are Tongue and Grooved***

DIN Standard for Keyway

Keyway Sizes	Bushing Diameters (mm)
2mm	6-8mm
3mm	8-10mm
4mm	10-12mm
5mm	12-17mm
6mm	17-22mm
8mm	22-30mm
10mm	30-38mm
12mm	38-44mm
14mm	44-50mm
16mm	50-58mm
18mm	58-65mm
20mm	65-75mm
22mm	75-85mm
24mm	85-95mm
25mm	85-95mm

25mm Keyway Broach

DIN Standard Metric
EDP No. 15410 **DURA CASE**

2 Broaches and 5 Collared Bushings
10 Keyway Combinations *Wt. 1 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
2mm	I	6, 7, 8, 9, 10
3mm	I	

DIN Standard Metric
EDP No. 15418 **DURA CASE**

4 Broaches and 9 Collared Bushings
18 Keyway Combinations *Wt. 7 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
4mm	II	12, 14, 15, 16,
5mm	II	
6mm	III	18, 20, 22, 24, 25
8mm	III	

Collared
Keyway Bushing

DIN Standard Metric
EDP No. 15440 **DURA CASE**

6 Broaches and 13 Collared Bushings
26 Keyway Combinations *Wt. 12 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
2mm	I	8, 10
3mm	I	
4mm	II	12, 14, 15, 16
5mm	II	
6mm	III	18, 20, 22, 24, 25, 28, 30
8mm	III	

DIN Standard Metric
EDP No. 15450 **DURA CASE**

2 Broaches and 5 Plain Bushings
10 Keyway Combinations *Wt. 13 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
10mm	IV	32, 35, 38, 40, 42
12mm	IV	

All broaches are CNC qualified!

DIN Standard Metric
EDP No. 15224 **HARDWOOD**

3 Broaches and 7 Plain Bushings
21 Keyway Combinations *Wt. 36 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
10mm	IV	32, 35, 38, 40, 42, 45, 50
12mm	IV	
14mm	IV	

DIN Standard Metric
EDP No. 15212 **HARDWOOD**

2 Broaches and 5 Plain Bushings
10 Keyway Combinations *Wt. 70 lbs.*

Keyway Sizes	Broach Style	Metric Bushing Diameters (Hole Sizes mm)
16mm	V	52, 55, 58, 60, 65
18mm	V	

Plain
Keyway Bushing

Keyway Broaches American Inch Standard Sizes 1/16" to 3/8"

Bushings I, II, and III - Numbers 20116 - 20400 are ***COLLARED Bushings***

Keyway broaches and bushings are clearly marked for bore size:

Any **I American Standard Broach** can be used with any **I American Standard Bushing**

Any **II American Standard Broach** can be used with any **II American Standard Bushing**

Any **III American Standard Broach** can be used with any **III American Standard Bushing**

In some cases American Standard CANNOT be used with Metric size Bushings and Broaches.

Please call with questions: 413-863-9371

I Broaches

*Any **I Broach** can be used with any **I Bushing***

Broach	EDP No.	Width Tolerance	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
1/16-I	10104	.0625 - .0635	1/8 x 5-1/4	0	13/64	1-1/8	270
3/32-I	10106	.0937 - .0947	1/8 x 5-1/4	0	13/64	1-1/8	810
1/8-I	10108	.1252 - .1262	1/8 x 5-1/4	1	13/64	1-1/8	720

I Bushings *(Collared)*

Diameter	Length	EDP
1/4	1-1/8	20116
5/16	1-1/8	20120
3/8	1-1/8	20124
7/16	1-1/8	20128
1/2	1-1/8	20132

I Shims

Size	Thickness	Length & Width	EDP
1/8-I	.031	1-3/8 x 1/8	30108

Keyway Broach

II Broaches

*Any **II Broach** can be used with any **II Bushing***

Broach	EDP No.	Width Tolerance	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
3/32-II	10206	.0937 - .0947	3/16 x 7	0	19/64	1-11/16	990
1/8-II	10208	.1252 - .1262	3/16 x 7	1	19/64	1-11/16	780
5/32-II	10210	.1564 - .1574	3/16 x 7	1	19/64	1-11/16	1,560
3/16-II	10212	.1877 - .1887	3/16 x 7	1	19/64	1-11/16	2,100

II Bushings *(Collared)*

Diameter	Length	EDP
1/2	1-11/16	20232
9/16	1-11/16	20236
5/8	1-11/16	20240
11/16	1-11/16	20244
3/4	1-11/16	20248
13/16	1-11/16	20252
7/8	1-11/16	20256

II Shims

Size	Thickness	Length & Width	EDP
1/8-II	.031	1-7/8 x 3/16	30208
5/32-II	.042	1-7/8 x 3/16	30210
3/16-II	.050	1-7/8 x 3/16	30212

Required shims are always supplied with each keyway broach. When ordering additional or replacement shims, specify EDP Number.

III Broaches

*Any **III Broach** can be used with any **III Bushing***

Broach	EDP No.	Width Tolerance	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
3/16-III	10312	.1877 - .1887	3/8 x 11-7/8	1	13/32	2-1/2	1,440
1/4-III	10316	.2502 - .2512	3/8 x 11-7/8	1	13/32	2-1/2	2,580
5/16-III	10320	.3127 - .3137	3/8 x 11-7/8	1	13/32	2-1/2	4,200
3/8-III	10324	.3755 -.3765	3/8 x 11-7/8	2	13/32	2-1/2	3,600

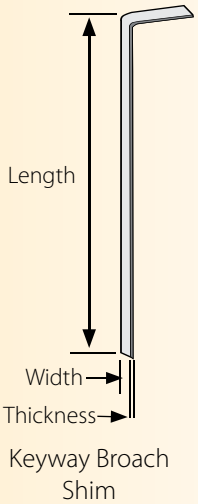
III Bushings *(Collared)*

Diameter	Length	EDP
3/4	2-1/2	20348
13/16	2-1/2	20352
7/8	2-1/2	20356
15/16	2-1/2	20360
1	2-1/2	20364
1-1/16	2-1/2	20368
1-1/8	2-1/2	20372
1-3/16	2-1/2	20376
1-1/4	2-1/2	20380
1-5/16	2-1/2	20384
1-3/8	2-1/2	20388
1-7/16	2-1/2	20392
1-1/2	2-1/2	20396
1-9/16	2-1/2	20400

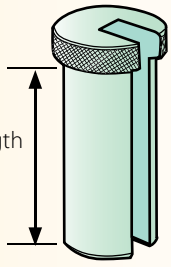
III Shims

Size	Thickness	Length & Width	EDP
3/16-III	.050	2-7/8 x 3/8	30312
1/4-III	.062	2-7/8 x 3/8	30316
5/16-III	.078	2-7/8 x 3/8	30320
3/8-III	.062	2-7/8 x 3/8	30324

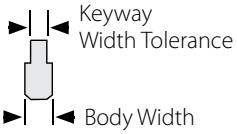
When ordering additional or replacement shims, specify EDP Number.

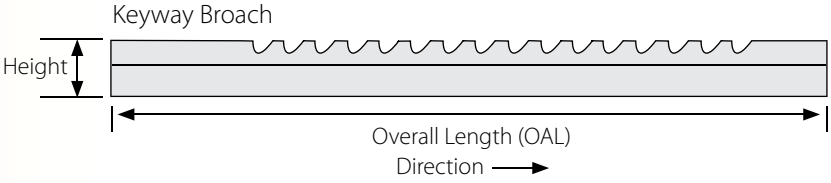


Keyway Broach Shim



Collared Keyway Bushing





Keyway Broaches American Inch Standard Sizes 5/16" to 1-1/2"

Bushings IV and V - Numbers 21492 - 21732 are ***PLAIN Bushings***

IV Broaches

*Any **IV Broach** can be used with any **IV Bushing***

Broach	EDP No.	Width Tolerance	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
5/16-IV	10420	.3127 - .3137	9/16 x13-7/8	1	3/4	6	9,250
3/8-IV	10424	.3755 - .3765	9/16 x13-7/8	2	3/4	6	8,000
7/16-IV	10428	.4380 - .4390	9/16 x13-7/8	2	3/4	6	11,750
1/2-IV	10432	.5006 - .5016	9/16 x13-7/8	3	3/4	6	11,000
9/16-IV	10436	.5630 - .5640	9/16 x13-7/8	3	3/4	6	11,100

IV Shims

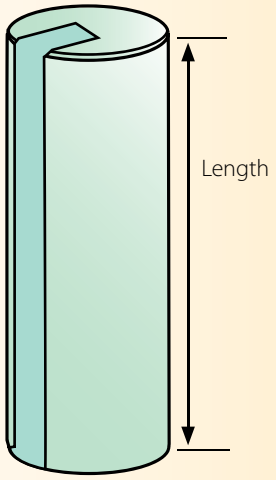
Size	Thickness	Length & Width	EDP
5/16-IV	.078	6-1/4 x 9/16	30420
3/8-IV	.062	6-1/4 x 9/16	30424
7/16-IV	.075	6-1/4 x 9/16	30428
1/2-IV	.062	6-1/4 x 9/16	30432
9/16-IV	.062	6-1/4 x 9/16	30436

Required shims are always supplied with each keyway broach.

When ordering additional or replacement shims, specify EDP Number.

IV Bushings *(Plain)*

Diameter	Length	EDP
1-7/16	4	21492
1-1/2	4	21496
1-9/16	4	21500
1-5/8	4	21504
1-11/16	4	21508
1-3/4	4	21512
1-13/16	5	21516
1-7/8	5	21520
1-15/16	5	21524
2	5	21528
2-1/16	5	21532
2-1/8	5	21536
2-3/16	5	21540
2-1/4	5	21544
2-5/16	5	21548
2-3/8	6	21552
2-7/16	6	21556
2-1/2	6	21560
2-9/16	6	21564
2-5/8	6	21568
2-11/16	6	21572
2-3/4	6	21576
2-13/16	6	21580
2-7/8	6	21584
2-15/16	6	21588
3	6	21592



Plain
Keyway Bushing

V Broaches

*Any **V Broach** can be used with any **V Bushing***

Broach	EDP No.	Width Tolerance	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
5/8-V	10540	.6260 - .6270	3/4 x 15-1/4	4	3/4	6	11,500
3/4-V	10548	.7515 - .7525	3/4 x 15-1/4	5	3/4	6	13,500

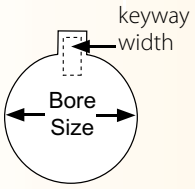
V Shims

Size	Thickness	Length & Width	EDP
5/8-V	.062	6-3/4 x 3/4	30540
3/4-V	.062	6-3/4 x 3/4	30548

V Bushings *(Plain)*

Diameter	Length	EDP
2-5/16	6	21688
2-3/8	6	21692
2-7/16	6	21696
2-1/2	6	21700
2-9/16	6	21704
2-5/8	6	21708
2-11/16	6	21712
2-3/4	6	21716
2-13/16	6	21720
2-7/8	6	21724
2-15/16	6	21728
3	6	21732

Plain Keyway Bushing



Keyway Shims correspond to broach size, not to bushing size.

Keyway broaches and bushings are clearly marked for bore size:

Any **IV Broach** can be used with any **IV Bushing**

Any **V Broach** can be used with any **V Bushing**

VI **Bushings** can be Special Ordered in diameter sizes 3"-6"

VI Shims

Broach	EDP No.	Width Tolerance	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
7/8-VI	10656	.8765 - .8775	1 x 19-1/4	6	3/4	6	11,000
1-VI	10664	1.0015 - 1.0025	1 x 19-1/4	7	3/4	6	14,000
Standard Oversize Keyways							
1-1/8	10666	1.1260 - 1.1270	1-1/8 x 23	8	3/4	6	15,750
1-1/4	10668	1.2510 - 1.2520	1-1/4 x 23	9	3/4	6	14,500
1-3/8	10670	1.3760 - 1.3770	1-3/8 x 23	10	3/4	6	19,250
1-1/2	10672	1.5020 - 1.5030	1-1/2 x 23	11	3/4	6	21,000

VI Shims

Size	Thickness	Length & Width	EDP
7/8-V	.062	6-3/4 x 1	30656
1-VI	.062	6-3/4 x 1	30664
Standard Oversize Keyways			
1-1/8	.062	7 x 1-1/8	30740
1-1/4	.062	7 x 1-1/4	30750
1-3/8	.062	7 x 1-1/4	30760
1-1/2	.062	7 x 1-1/4	30770

Hassay Savage plain **VI Bushings** are available on ***SPECIAL ORDER*** in diameter sizes 3"-6"

Metric Keyway Broaches

Standard Sizes 2mm-8mm

Bushings mm I, mm II, and mm III - Numbers 22106–22336 are ***COLLARED Bushings*** ***ISO JS 9 Tolerance***

mm I Broaches

*Any **mm I Broach** can be used with any **mm I Bushing***

Broach	EDP No.	JS 9 Width Tolerance	Standard Millimeter Keys	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
2mm-I	11102	.0782 - .0792	2mm x 2mm	1/8 x 5-1/4	0	13/64	1-1/8	510
3mm-I	11103	.1176 - .1186	3mm x 3mm	1/8 x 5-1/4	1	13/64	1-1/8	720

mm I Shims

Size	Thickness	Length & Width	EDP
3mm-I	.031	1-3/8 x 1/8	31103

Shims correspond to metric broach size, not to bushing size.

mm I Bushings

Size	Dim. In.	Length	EDP No.
6mm-I	.2362	1-1/8	22106
7mm-I	.2756	1-1/8	22107
8mm-I	.3150	1-1/8	22108
9mm-I	.3543	1-1/8	22109
10mm-I	.3937	1-1/8	22110

mm II Broaches

*Any **mm II Broach** can be used with any **mm II Bushing***

Broach	EDP No.	JS 9 Width Tolerance	Standard Millimeter Keys	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
4mm-II	11204	.1569 - .1581	4mm x 4mm	1/4 x 7	1	19/64	1-11/16	1,140
5mm-II	11205	.1963 - .1975	5mm x 5mm	1/4 x 7	1	19/64	1-11/16	2,040

mm II Shims

Size	Thickness	Length & Width	EDP
4mm-II	.038	1-7/8 x 1/4	31204
5mm-II	.050	1-7/8 x 1/4	31205

Required shims are always supplied with each keyway broach.

When ordering additional or replacement shims, specify EDP Number.

mm II Bushings

Size	Dim. In.	Length	EDP No.
11mm-II	.4331	1-1/16	22211
12mm-II	.4724	1-1/16	22212
13mm-II	.5118	1-1/16	22213
14mm-II	.5512	1-1/16	22214
15mm-II	.5905	1-1/16	22215
16mm-II	.6299	1-1/16	22216
17mm-II	.6693	1-1/16	22217
18mm-II	.7087	1-1/16	22218
19mm-II	.7480	1-1/16	22219

mm III Broaches

*Any **mm III Broach** can be used with any **mm III Bushing***

Broach	EDP No.	JS 9 Width Tolerance	Standard Millimeter Keys	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
5mm-III	11305	.1963 - .1975	5mm x 5mm	3/8 x 11-7/8	1	13/32	2-1/2	1,680
6mm-III	11306	.2356 - .2368	6mm x 6mm	3/8 x 11-7/8	1	13/32	2-1/2	1,890
7mm-III	11307	.2749 - .2763	7mm x 7mm	3/8 x 11-7/8	1	13/32	2-1/2	2,985
8mm-III	11308	.3143 - .3157	8mm x 8mm	3/8 x 11-7/8	1	13/32	2-1/2	3,995

mm III Shims

Size	Thickness	Length & Width	EDP
5mm-III	.047	2-7/8 x 3/8	31305
6mm-III	.062	2-7/8 x 3/8	31306
7mm-III	.062	2-7/8 x 3/8	31307
8mm-III	.078	2-7/8 x 3/8	31308

Keyway Metric Broaches and Metric Bushings are clearly marked for bore size:

Any **mm I Broach** can be used with any **mm I Bushing,**

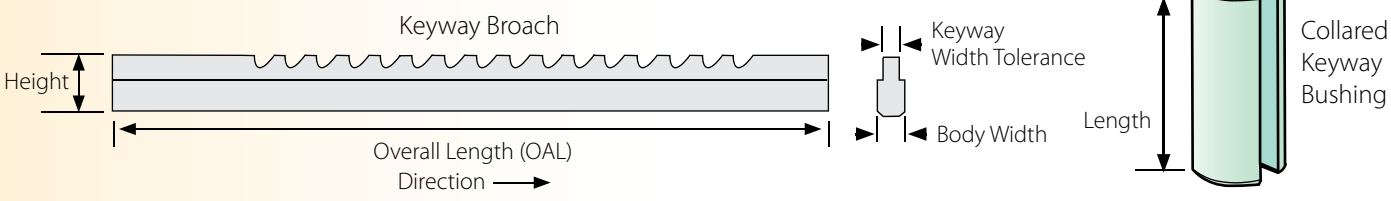
Any **mm II Broach** can be used with any **mm II Bushing,**

Any **mm III Broach** can be used with any **mm III Bushing,**

mm III Bushings

Size	Dim. In.	Length	EDP No.
17mm-III	.6693	2-1/2	22317
18mm-III	.7087	2-1/2	22318
19mm-III	.7480	2-1/2	22319
20mm-III	.7874	2-1/2	22320
22mm-III	.8661	2-1/2	22322
24mm-III	.9449	2-1/2	22324
25mm-III	.9842	2-1/2	22325
26mm-III	1.0236	2-1/2	22326
27mm-III	1.0630	2-1/2	22327
28mm-III	1.1024	2-1/2	22328
30mm-III	1.1811	2-1/2	22330
32mm-III	1.2598	2-1/2	22332
34mm-III	1.3386	2-1/2	22334
35mm-III	1.3779	2-1/2	22335
36mm-III	1.4173	2-1/2	22336

In some cases American Standard CANNOT be used with Metric size Bushings and Broaches. Please call with questions: 413-863-9371



Metric Keyway Broaches

Standard Sizes 10mm-36mm

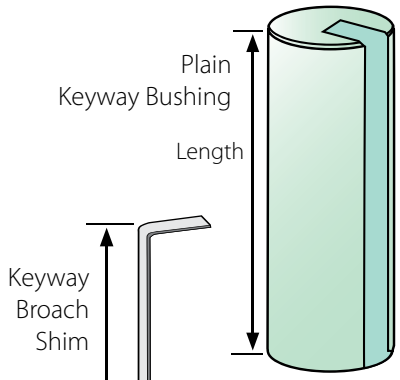
Bushings mm IV and mm V - Numbers 22432–22572 are ***PLAIN Bushings***

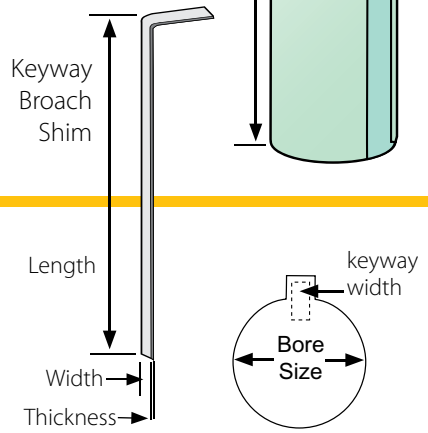
ISO JS 9 Tolerance

mm IV Broaches

*Any **mm IV Broach** can be used with any **mm IV Bushing***

Broach	EDP No.	JS 9 Width Tolerance	Standard Millimeter Keys	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
10mm-IV	11410	.3930 - .3944	10mm x 8mm	9/16 x 13-7/8	2	3/4	6	8,100
12mm-IV	11412	.4716 - .4732	12mm x 8mm	9/16 x 13-7/8	2	3/4	6	10,550
14mm-IV	11414	.5504 - .5520	14mm x 9mm	9/16 x 13-7/8	2	3/4	6	11,090





mm IV Shims

Size	Thickness	Length & Width	EDP
10mm-IV	.056	6-1/4 x 9/16	31410
12mm-IV	.056	6-1/4 x 9/16	31412
14mm-IV	.062	6-1/4 x 9/16	31414

Shims correspond to metric broach size, not to bushing size.

mm IV Bushings

Size	Dim. In.	Length	EDP No.
32mm-IV	1.2598	4	22432
34mm-IV	1.3386	4	22434
35mm-IV	1.3779	4	22435
36mm-IV	1.4173	4	22436
38mm-IV	1.4961	4	22438
40mm-IV	1.5748	4	22440
42mm-IV	1.6535	4	22442
44mm-IV	1.7323	4	22444
45mm-IV	1.7716	5	22445
46mm-IV	1.8110	5	22446
48mm-IV	1.8898	5	22448
50mm-IV	1.9685	5	22450
52mm-IV	2.0472	5	22452
54mm-IV	2.1260	5	22454
55mm-IV	2.1653	5	22455
56mm-IV	2.2047	5	22456

mm V Shims

Size	Thickness	Length & Width	EDP
16mm-V	.062	6-3/4 x 3/4	31516
18mm-V	.062	6-3/4 x 3/4	31518

mm V Bushings

Size	Dim. In.	Length	EDP No.
52mm-V	2.0472	5	22552
54mm-V	2.126	5	22554
55mm-V	2.1653	5	22555
56mm-V	2.2047	5	22556
58mm-V	2.2835	5	22558
60mm-V	2.3622	6	22560
62mm-V	2.4409	6	22562
64mm-V	2.5197	6	22564
65mm-V	2.5590	6	22565
66mm-V	2.5984	6	22566
68mm-V	2.6772	6	22568
70mm-V	2.7559	6	22570
72mm-V	2.8346	6	22572

mm V Broaches

*Any **mm V Broach** can be used with any **mm V Bushing***

Broach	EDP No.	JS 9 Width Tolerance	Standard Millimeter Keys	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
16mm-V	11516	.6291 - .6307	16mm x 10mm	3/4 x 15-1/4	3	3/4	6	11,375
18mm-V	11518	.7079 - .7095	18mm x 11mm	3/4 x 15-1/4	3	3/4	6	12,000

Required shims are always supplied with each keyway broach.
When ordering additional or replacement shims, specify EDP Number.

mm VI Broaches

*Any **mm VI Broach** can be used with any **mm VI Bushing***

Broach	EDP No.	JS 9 Width Tolerance	Standard Millimeter Keys	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
20mm-VI	11620	.7864 - .7884	20mm x 12mm	1 x 19-1/4	3	3/4	6	11,000
22mm-VI	11622	.8651 - .8671	22mm x 14mm	1 x 19-1/4	4	3/4	6	11,200
24mm-VI	11624	.9439 - .9459	24mm x 14mm	1 x 19-1/4	4	3/4	6	13,075
25mm-VI	11625	.9833 - .9853	25mm x 14mm	1 x 19-1/4	4	3/4	6	13,275
Standard Oversize Keyways								
28mm	11628	1.1034 - 1.1014	28mm x 14mm	1-1/8 x 23	4	3/4	6	14,700
30mm	11630	1.1821 - 1.1801	30mm x 14mm	1-1/4 x 23	5	3/4	6	15,700
32mm	11632	1.2610 - 1.2586	32mm x 14mm	1-1/4 x 23	5	3/4	6'	16,790
36mm	11636	1.4185 - 1.4161	36mm x 14mm	1-7/16 x 23	5	3/4	6	18,590

mm VI Shims

Size	Thickness	Length & Width	EDP
20mm-VI	.062	6-3/4 x 1	31620
22mm-VI	.062	6-3/4 x 1	31622
24mm-VI	.062	6-3/4 x 1	31624
25mm-VI	.062	6-3/4 x 1	31625
Standard Oversize Keyways			
28mm	.062	7 x 1	31628
30mm	.062	7 x 1	31630
32mm	.062	7 x 1-1/4	31632
36mm	.062	7 x 1-1/4	31636

Hassay Savage Metric **VI Bushings** are available on ***SPECIAL ORDER***. in diameter sizes 75mm - 150mm

Metric Keyway Broaches

Standard Sizes

ISO P9 Tolerance

Optional Metric Keyway Broaches — ISO P9

	Broach	EDP No.	P9 Width Tolerance	Standard Millimeter Keys	Body Width x OAL (in.)	No. of shims	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
I	2mm-I	11102P9	.0775 - .0785	2mm x 2mm	1/8 x 5-1/4	0	13/64	1-1/8	510
	3mm-I	11103P9	.1169 - .1179	3mm x 3mm	1/8 x 5-1/4	1	13/64	1-1/8	720
II	4mm-II	11204P9	.1559 - .1570	4mm x 4mm	1/4 x 7	1	19/64	1-11/16	1,140
	5mm-II	11205P9	.1953 - .1964	5mm x 5mm	1/4 x 7	1	19/64	1-11/16	2,040
III	5mm-III	11305P9	.1963 - .1973	5mm x 5mm	3/8 x 11-7/8	1	13/32	2-1/2	1,680
	6mm-III	11306P9	.2342 - .2357	6mm x 6mm	3/8 x 11-7/8	1	13/32	2-1/2	1,890
	7mm-III	11307P9	.2736 - .2750	7mm x 7mm	3/8 x 11-7/8	1	13/32	2-1/2	2,985
	8mm-III	11308P9	.3130 - .3144	8mm x 8mm	3/8 x 11-7/8	1	13/32	2-1/2	3,995
IV	10mm-IV	11410P9	.3917 - .3931	10mm x 8mm	9/16 x 13-7/8	2	3/4	6	8,100
	12mm-IV	11412P9	.4700 - .4717	12mm x 8mm	9/16 x 13-7/8	2	3/4	6	10,550
	14mm-IV	11414P9	.5488 - .5505	14mm x 9mm	9/16 x 13-7/8	2	3/4	6	11,090
V	16mm-V	11516P9	.6275 - .6292	16mm x 10mm	3/4 x 15-1/4	3	3/4	6	11,375
	18mm-V	11518P9	.7063 - .7080	18mm x 11mm	3/4 x 15-1/4	3	3/4	6	12,000
VI	20mm-VI	11620P9	.7845 - .7865	20mm x 12mm	1 x 19-1/4	3	3/4	6	11,000
	22mm-VI	11622P9	.8632 - .8652	22mm x 14mm	1 x 19-1/4	4	3/4	6	11,200
	24mm-VI	11624P9	.9420 - .9440	24mm x 14mm	1 x 19-1/4	4	3/4	6	13,075
	25mm-VI	11625P9	.9814 - .9834	25mm x 14mm	1 x 19-1/4	4	3/4	6	13,275

- **Standard metric tolerances** are to **ISO JS 9** and **P9.**
- **Preferred metric limits fits -ANSI B4.2-1978 (**American National Standards Institute)
- **Optional metric tolerances** are available to **ISO P9.** The **ISO P9** option listed on this page utilizes **the same bushings and shims** as the **Standard JS 9** metric broaches listed on the previous page.
- Bushings **mm I, mm II**, and **mm III** are **COLLARED Bushings.** Bushings **mm IV** and **mm V** are **PLAIN.**
- Hassay Savage **mm VI Bushings** are available on ***SPECIAL ORDER*** in diameter sizes 75mm-150mm

One Pass Keyway Broaches

All One Pass Keyways Are Used With **STANDARD BUSHINGS**

One Pass Keyway Broaches — American Standard

	Broach	EDP No.	Width Tolerance	Body Width x OAL (in.)	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
II	1/8-II	10208-COP**	.1252 - .1262	3/16 x 10-3/4	1/4	1-1/2	780
	5/32-II	10210-COP**	.1564 - .1574	3/16 x 10-3/4	1/4	1-1/2	1,370
	3/16-II	10212-OP*	.1877 - .1887	3/16 x 10-3/4	1/4	1-1/2	1,930
III	3/16-III	10312-COP**	.1877 - .1887	3/8 x 18-1/2	5/16	1-11/16	1,090
	1/4-III	10316-COP**	.2502 - .2512	3/8 x 18-1/2	5/16	1-11/16	1,840
	5/16-III	10320-COP**	.3127 - .3137	3/8 x 18-1/2	5/16	1-11/16	2,860
	3/8-III	10324-OP*	.3755 -.3765	3/8 x 18-1/2	5/16	1-11/16	4,030

OP* designates one-pass, no chamfer **COP**** designates chamfer one-pass

Collared Keyway Bushing

One Pass Metric Keyway Broaches — to ISO H9 Tolerance

	Broach	EDP No.	Width Tolerance	Standard Millimeter Keys	Body Width x OAL (in.)	Length of Cut Min.	Length of Cut Max.	Pressure Max.L/C (lbs.)
I	3mm-I	11103-OP*	.1185 - .1190	3mm x 3mm	1/8 x 8-1/2	1/4	1-1/8	780
II	4mm-II	11204-COP**	.1581 - .1585	4mm x 4mm	1/4 x 10-3/4	1/4	1-1/2	1,370
	5mm-II	11205-COP**	.1975 - .1979	5mm x 5mm	1/4 x 10-3/4	1/4	1-1/2	1,930
III	6mm-III	11306-COP**	.2372 - .2376	6mm x 6mm	3/8 x 18-1/2	5/16	1-11/16	1,090
	8mm-III	11308-COP**	.3159 - .3163	8mm x 7mm	3/8 x 18-1/2	5/16	1-11/16	1,840

OP* designates one-pass, no chamfer **COP**** designates chamfer one-pass

CNC Single Point Keyway Broaching

Keyway Size Ranges **1/8"-1/2"** and **4mm-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 through 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.

The ADVANTAGES:

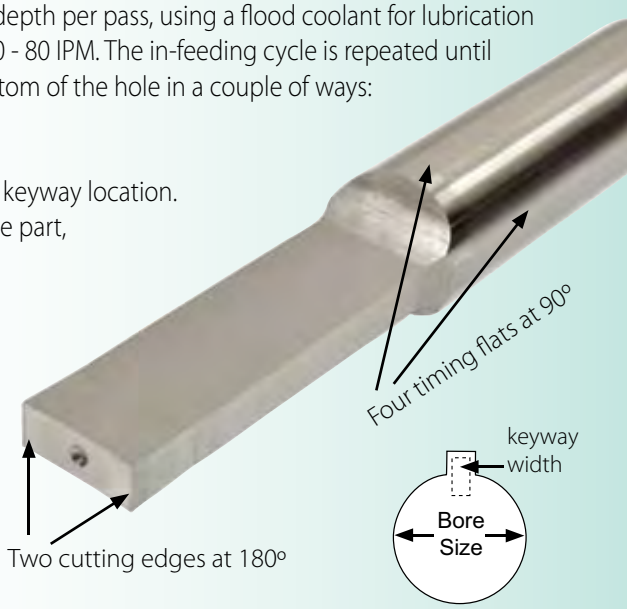
- Complete the part on one machine
- Only way to keyway a blind hole
- Cut down on set-up time
- Improve your process
- Become more flexible with machining
- Manage small lot production
- Use cost effective standard tooling
- No bushing guide required
- No hydraulic press or pull required

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



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	EDP No.	Tolerance (inches)	Shank Diameter	Overall Length	Max. LOC	Min. Bore Size
1/8	69008	0.127	5/8	3.75	1.5	7/16
4mm	69004	0.159	5/8	3.75	1.5	9/16
3/16	69012	0.189	5/8	3.75	1.5	9/16
5mm	69005	0.198	5/8	3.75	1.5	5/8
6mm	69106	0.238	7/8	4.50	2	11/16
1/4	69116	0.252	7/8	4.50	2	11/16
5/16	69120	0.314	7/8	4.50	2	3/4
8mm	69108	0.317	7/8	4.50	2	3/4
3/8	69224	0.377	1	4.50	2	1
10mm	69210	0.396	1	4.50	2	1
12mm	69212	0.475	1	4.50	2	1
1/2	69232	0.502	1	4.50	2	1

CNC Single Point Keyway Metric Shank

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

Hexagonal Rotary Punch Broaches M-2

Material: M-2 HSS For Cutting Mild Steel Applications

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 - .315 Shank — Inch

EDP #	Hex Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
66002	.051	0.051	5/64	1-1/4
66004	1/16	0.063	3/32	1-1/4
66005	5/64	0.079	7/64	1-1/4
66006	3/32	0.095	9/64	1-1/4
66007	7/64	0.111	5/32	1-1/4
66008	1/8	0.127	3/16	1-1/4
66009	9/64	0.143	7/32	1-1/4
66010	5/32	0.158	1/4	1-1/4
66012	3/16	0.190	9/32	1-1/4
66014	7/32	0.221	11/32	1-1/4
66016	1/4	0.252	3/8	1-1/4
66018	9/32	0.284	3/8	1-1/4
66020	5/16	0.315	3/8	1-1/4
66022	11/32	0.346	7/16	1-1/4
66024	3/8	0.378	1/2	1-1/4
66026	13/32	0.410	1/2	1-1/4
66028	7/16	0.441	1/2	1-1/4
66030	15/32	0.472	1/2	1-1/4
66032	1/2	0.504	1/2	1-1/4

Hexagonal Rotary/Punch Broaches

8mm - .315 Shank — Metric

EDP #	Hex Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
662013	1.3 mm	0.051	3/32	1-1/4
662015	1.5 mm	0.061	3/32	1-1/4
66202	2 mm	0.081	7/64	1-1/4
662025	2.5 mm	0.101	5/32	1-1/4
66203	3 mm	0.120	3/16	1-1/4
662035	3.5 mm	0.139	3/16	1-1/4
66204	4 mm	0.160	1/4	1-1/4
662045	4.5 mm	0.179	1/4	1-1/4
66205	5 mm	0.199	5/16	1-1/4
66206	6 mm	0.238	3/8	1-1/4
66207	7 mm	0.278	3/8	1-1/4
66208	8 mm	0.319	3/8	1-1/4
66209	9 mm	0.358	3/8	1-1/4
66210	10 mm	0.398	1/2	1-1/4
66211	11 mm	0.437	1/2	1-1/4
66212	12 mm	0.476	1/2	1-1/4

Hexagonal Rotary/Punch Broaches

3/4" - .750 Shank — Inch

EDP #	Hex Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
66524	3/8	0.379	1/2	2-1/2
66528	7/16	0.442	1/2	2-1/2
66532	1/2	0.505	5/8	2-1/2
66536	9/16	0.567	3/4	2-1/2
66540	5/8	0.631	3/4	2-1/2
66548	3/4	0.754	7/8	2-3/4
66556	7/8	0.883	7/8	2-3/4
66564	1	1.014	7/8	2-3/4

Hexagonal Rotary/Punch Broaches

1/2" - .500 Shank — Inch

EDP #	Hex Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
66106	3/32	0.095	9/64	1-3/4
66107	7/64	0.111	5/32	1-3/4
66108	1/8	0.127	3/16	1-3/4
66109	9/64	0.143	7/32	1-3/4
66110	5/32	0.158	1/4	1-3/4
66112	3/16	0.190	9/32	1-3/4
66114	7/32	0.221	9/32	1-3/4
66116	1/4	0.252	3/8	1-3/4
66118	9/32	0.284	7/16	1-3/4
66120	5/16	0.315	1/2	1-3/4
66122	11/32	0.346	9/16	1-3/4
66124	3/8	0.378	9/16	1-3/4
66126	13/32	0.410	5/8	1-3/4
66128	7/16	0.441	5/8	1-3/4
66130	15/32	0.472	5/8	1-3/4
66132	1/2	0.504	5/8	1-3/4
66136	9/16	0.567	5/8	1-3/4
66140	5/8	0.630	7/8	1-3/4
66144	11/16	0.693	7/8	1-3/4
66148	3/4	0.755	7/8	1-3/4

Hexagonal Rotary/Punch Broaches

1/2" - .500 Shank — Metric

EDP #	Hex Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
66302	2mm	0.081	5/32	1-3/4
663025	2.5mm	0.101	5/32	1-3/4
66303	3mm	0.120	3/16	1-3/4
66304	4mm	0.160	1/4	1-3/4
66305	5mm	0.199	5/16	1-3/4
66306	6mm	0.238	3/8	1-3/4
66307	7mm	0.278	1/2	1-3/4
66308	8mm	0.319	1/2	1-3/4
66309	9mm	0.358	1/2	1-3/4
66310	10mm	0.398	9/16	1-3/4
66311	11mm	0.437	9/16	1-3/4
66312	12mm	0.476	5/8	1-3/4
66313	13mm	0.516	5/8	1-3/4
66314	14mm	0.556	5/8	1-3/4
66315	15mm	0.597	5/8	1-3/4
66316	16mm	0.636	5/8	1-3/4
66317	17mm	0.674	7/8	1-3/4
66318	18mm	0.714	7/8	1-3/4
66319	19mm	0.754	7/8	1-3/4

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

***Overall Tool Length Tolerances +/-.015**

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 customer's part with 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 customer's 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 customer's part with spindle locked in a stationary position, and the broach is then punched into the customer's 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 27 for more details on Index Broaching.***

For more information see our
***Basic Broaching Learning Modules** at*
www.hassay-savage.com/resource-center

Hexagonal Rotary/Punch Broaches

8mm - .315 Shank — Metric

EDP #	Hex Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
66202-M42	2mm	0.081	7/64	1-1/4
662025-M42	2.5mm	0.101	5/32	1-1/4
66203-M42	3mm	0.120	3/16	1-1/4
662035-M42	3.5mm	0.139	3/16	1-1/4
66204-M42	4mm	0.160	1/4	1-1/4
662045-M42	4.5mm	0.179	1/4	1-1/4

Hexagonal Rotary/Punch Broaches

8mm - .315 Shank — Inch

EDP #	Hex Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
66004-M42	1/16	0.063	3/32	1-1/4
66005-M42	5/64	0.079	7/64	1-1/4
66006-M42	3/32	0.095	9/64	1-1/4
66007-M42	7/64	0.111	5/32	1-1/4
66008-M42	1/8	0.127	3/16	1-1/4
66009-M42	9/64	0.143	7/32	1-1/4
66010-M42	5/32	0.158	1/4	1-1/4
66012-M42	3/16	0.190	9/32	1-1/4
66014-M42	7/32	0.221	11/32	1-1/4
66016-M42	1/4	0.252	3/8	1-1/4
66018-M42	9/32	0.284	3/8	1-1/4
66020-M42	5/16	0.315	3/8	1-1/4
66022-M42	11/32	0.346	7/16	1-1/4
66024-M42	3/8	0.378	1/2	1-1/4

Hexagonal Rotary/Punch Broaches

1/2 - .500 Shank — Inch

EDP #	Hex Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
66106-M42	3/32	0.095	9/64	1-3/4
66107-M42	7/64	0.111	5/32	1-3/4
66108-M42	1/8	0.127	3/16	1-3/4
66109-M42	9/64	0.143	7/32	1-3/4
66110-M42	5/32	0.158	1/4	1-3/4
66112-M42	3/16	0.190	9/32	1-3/4
66114-M42	7/32	0.221	9/32	1-3/4
66116-M42	1/4	0.252	3/8	1-3/4
66118-M42	9/32	0.284	7/16	1-3/4
66120-M42	5/16	0.315	1/2	1-3/4
66122-M42	11/32	0.346	9/16	1-3/4
66124-M42	3/8	0.378	9/16	1-3/4

***Overall Tool Length Tolerances +/-.015**

Square Rotary Punch Broaches

Material: M-2 HSS For Mild Steel Applications. Special Materials Available For More Difficult To Machine Alloys

***Overall Tool Length Tolerances +/-.015**

Square Rotary/Punch Broaches

8mm - .315 Shank — Inch Square Size

EDP #	Square Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
68004	1/16	0.063	1/8	1-1/4
68006	3/32	0.095	9/64	1-1/4
68008	1/8	0.127	3/16	1-1/4
68010	5/32	0.158	1/4	1-1/4
68012	3/16	0.190	9/32	1-1/4
68014	7/32	0.221	11/32	1-1/4
68016	1/4	0.252	3/8	1-1/4
68018	9/32	0.284	3/8	1-1/4
68020	5/16	0.315	3/8	1-1/4
68022	11/32	0.346	3/8	1-1/4
68024	3/8	0.378	3/8	1-1/4

Square Rotary/Punch Broaches

1/2" - .500 Shank — Inch Square Size

EDP #	Square Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
68106	3/32	0.095	9/64	1-3/4
68108	1/8	0.127	3/16	1-3/4
68110	5/32	0.158	1/4	1-3/4
68112	3/16	0.190	9/32	1-3/4
68114	7/32	0.221	11/32	1-3/4
68116	1/4	0.252	3/8	1-3/4
68118	9/32	0.284	7/16	1-3/4
68120	5/16	0.315	1/2	1-3/4
68122	11/32	0.346	9/16	1-3/4
68124	3/8	0.378	5/8	1-3/4
68128	7/16	0.441	5/8	1-3/4
68132	1/2	0.504	5/8	1-3/4
68136	9/16	0.567	3/4	1-3/4
68140	5/8	0.630	7/8	1-3/4

Use With:

- **Screw Machines**
- **CNC Machines**
- **Swiss Machines**

Other Shanks, Metric, Square, Octagon & Spline forms Available. Please Call

1-800-247-2024

For More Information

Square Rotary/Punch Broaches

3/4" - .750 Shank — Inch Square Size

EDP #	Square Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
68532	1/2	0.504	5/8	2-1/2
68536	9/16	0.567	3/4	2-3/4
68540	5/8	0.630	3/4	2-3/4
68548	3/4	0.755	7/8	2-3/4

The practical forming length of a 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 — Metric Square Size

EDP #	Square Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
682015	1.5mm	0.0605	3/32	1-1/4
68202	2mm	0.0805	7/64	1-1/4
682025	2.5mm	0.101	5/32	1-1/4
68203	3mm	0.120	3/16	1-1/4
682035	3.5mm	0.139	3/16	1-1/4
68204	4mm	0.160	1/4	1-1/4
662045	4.5mm	0.179	1/4	1-1/4
68205	5mm	0.199	5/16	1-1/4
68206	6mm	0.238	3/8	1-1/4
68207	7mm	0.278	3/8	1-1/4
68208	8mm	0.319	3/8	1-1/4
68209	9mm	0.358	3/8	1-1/4
68210	10mm	0.398	1/2	1-1/4

Square Rotary/Punch Broaches

1/2" - .500 Shank — Metric Square Size

EDP #	Square Size	Across Flats +.001 / -.000	Max. Depth of Cut	Overall Length*
683015	1.5mm	0.0605	3/32	1-3/4
68302	2mm	0.0805	7/64	1-3/4
683025	2.5mm	0.101	5/32	1-3/4
68303	3mm	0.120	3/16	1-3/4
683035	3.5mm	0.139	3/16	1-3/4
68304	4mm	0.160	1/4	1-3/4
683045	4.5mm	0.179	1/4	1-3/4
68305	5mm	0.199	5/16	1-3/4
68306	6mm	0.238	3/8	1-3/4
68307	7mm	0.278	3/8	1-3/4
68308	8mm	0.319	3/8	1-3/4
68309	9mm	0.358	3/8	1-3/4
68310	10mm	0.398	1/2	1-3/4
68311	11mm	0.437	9/16	1-3/4
68312	12mm	0.476	5/8	1-3/4

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.

HEAVY DUTY Adjustable Rotary Broach Holders

Use with 3/4 - .750 Broach Shank Diameter

EDP #	Overall Length	Holder Shank Dia.	Holder Shank Length	Broach Shank Depth
P-67072HDS	7-9/16	1-1/2	3	1.25
P-67076HD	7-9/16	1-3/4	3	1.25

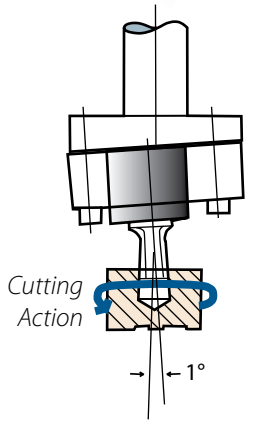


Diagram A

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.

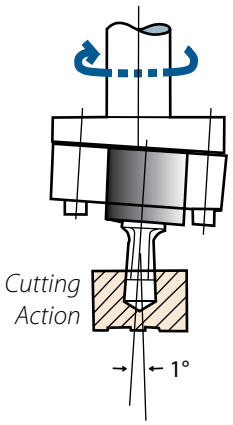


Diagram B

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 - .315 Broach Shank Diameter

EDP #	Overall Length	Holder Shank Dia.	Holder Shank Length	Broach Shank Depth
P-67040	3-27/64	5/8	1-1/2	9/16
P-67048S	3-59/64	3/4	2	9/16

Adjustable Rotary Broach Holders

Use with 1/2 - .500 Broach Shank Diameter

EDP #	Overall Length	Holder Shank Dia.	Holder Shank Length	Broach Shank Depth
P-67048	4-17/32	3/4	2	.742
P-67064	4-17/32	1	2	.742
P-67068	5-17/32	1-1/4	3	.742
P-67072	5-17/32	1-1/2	3	.742

HASSAY SAVAGE ROTARY TOOL HOLDER SET-UP PROCEDURE

For Internal Rotary Holders

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 (.001 larger) for the Set Up Plug in a piece of raw material with a lead chamfer .010-.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 .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!*

See Live Set-Up online at **www.hassay-savage.com/resource-center** under Hex Rotary Broach Holder Set-Up.

Rotary Broaching Set-Up Plugs

Standard Plugs - For Hex Broach Set-Up Only

Rotary Broaching Set-Up Plugs*

8mm Shank — Metric

EDP #	Size	Plug Dia. (-.001 in.)	Shank Dia. (-.0050 in.)	Depth of Plug (in.)	OAL Overall Length (in.)
67008	1/8	0.129	8mm	5/16	1-1/4
67012	3/16	0.193	8mm	5/16	1-1/4
67016	1/4	0.257	8mm	5/16	1-1/4
67020	5/16	0.321	8mm	3/8	1-1/4
67024	3/8	0.387	8mm	1/2	1-1/4
67032	1/2	0.515	8mm	1/2	1-1/4

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.

Contact our **CUSTOMER SERVICE DEPARTMENT** at **800-247-2024** for pricing and **24 hour delivery service**.

Rotary Broaching Set-Up Plugs*

1/2 Shank — American Standard Inch

EDP #	Size	Plug Dia. (-.001 in.)	Shank Dia. (-.0050 in.)	Depth of Plug (in.)	OAL Overall Length (in.)
67112	3/16	0.193	.500	5/16	1-3/4
67116	1/4	0.257	.500	5/16	1-3/4
67124	3/8	0.387	.500	5/16	1-3/4
67132	1/2	0.515	.500	1/2	1-3/4
67140	5/8	0.643	.500	1/2	1-3/4

Rotary Broaching Set-Up Plugs*

3/4 Shank — American Standard Inch

EDP #	Size	Plug Dia. (-.001 in.)	Shank Dia. (-.0050 in.)	Depth of Plug (in.)	OAL Overall Length (in.)
67524	3/8	0.387	.750	1/2	2-1/2
67532	1/2	0.515	.750	1/2	2-1/2
67540	5/8	0.643	.750	3/4	2-1/2
67548	3/4	0.771	.750	3/4	2-3/4

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

Swiss Style Rotary Punch Broaches - 28mm OAL

Applications 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***

Hexagonal Rotary/Punch Broaches

.315 Shank — American Standard Inch

EDP # M-2*	EDP # PM-M-4*	Hex Size	Across Flats (+/-.0002)	Max Depth of Cut	OAL Overall Length
76002	77002	0.051	0.0510	5/64	28mm
76004	77004	1/16	0.0645	3/32	28mm
76005	77005	5/64	0.0801	7/64	28mm
76006	77006	3/32	0.0958	9/64	28mm
76007	77007	7/64	0.1113	5/32	28mm
76008	77008	1/8	0.1270	3/16	28mm
76009	77009	9/64	0.1426	7/32	28mm
76010	77010	5/32	0.1585	1/4	28mm
76012	77012	3/16	0.1895	9/32	28mm
76014	77014	7/32	0.2207	11/32	28mm
76016	77016	1/4	0.2520	3/8	28mm

*** M-2** *for use with mild steel (HSS)*

*** PM-M-4** *for use with stainless, titanium & other high alloy steel*

Hexagonal Rotary/Punch Broaches

.315 Shank — Metric

EDP # M-2*	EDP # PM-M-4*	Hex Size	Across Flats (+/-.0002)	Max Depth of Cut	OAL Overall Length
762015	772015	1.5mm	0.0610	3/32	28mm
76202	77202	2mm	0.0807	5/32	28mm
762025	772025	2.5mm	0.1004	5/32	28mm
76203	77203	3mm	0.1201	3/16	28mm
762035	772035	3.5mm	0.1398	3/16	28mm
76204	77204	4mm	0.1595	1/4	28mm
762045	772045	4.5mm	0.1792	1/4	28mm
76205	77205	5mm	0.1989	5/16	28mm
76206	77206	6mm	0.2382	3/8	28mm

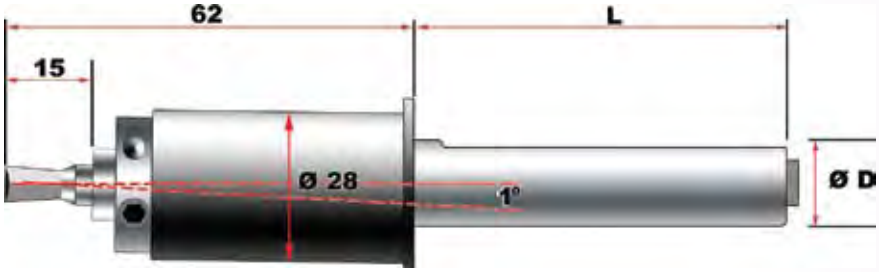
*** M-2** *for use with mild steel (HSS)*

*** PM-M-4** *for use with stainless, titanium & other high alloy steel*

This Swiss Style Tooling Designed for Holders on Page 27

Swiss Style Non-Adjustable Holders

High Performance Results, Quality, And Consistent Tool Life That Keeps Machines Running Longer



Swiss Style Holders

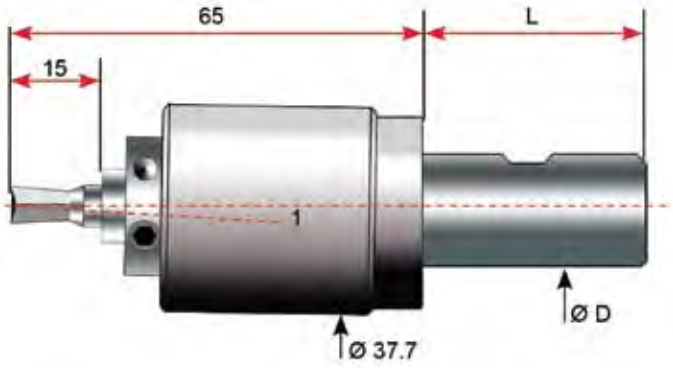
- No Center Indicating Required – Self-Centering
- Smaller Head Diameter Eliminates Interference on Tool Blocks
- Longer Shank Can Be Cut To Proper Length
- Short Head Length For Limited Back Work Space
- Built In Wobble Cutting Feature 1° Angle
- Heavy Duty Bearing Takes 2,250 lbs. Pushing Force
- Swiss Made Quality High-Precision
- Fits Most Swiss Type Tool Blocks & Gang Machines

Swiss Style Holders

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

EDP #	D	L	AS/Metric
HSP-2160-158-038	5/8	1-1/2	inch
HSP-2160-190-100	3/4	4	inch
HSP-2160-254-120	1	4-3/4	inch
HSP-2160-120-038	12mm	38mm	metric
HSP-2160-140-038	14mm	38mm	metric
HSP-2160-160-038	16mm	38mm	metric
HSP-2160-200-100	20mm	100mm	metric
HSP-2160-220-100	22mm	100mm	metric
HSP-2160-250-120	25mm	120mm	metric

2160 Series Swiss Holder



Self Centering

Designed for CNC machines, the new 2100 Series Broach Holder meets the challenge. Faster and easier setup.

- Places rotary broach on center, eliminates the need to indicate the holder
- Cylindrical shank design with Weldon Notch perfect for lathe or machining center applications
- Micro-manufacturing includes medical, dental, automotive and aircraft micro components, with micro precision systems that require high precision tolerance and quality

2100 Series Swiss Holder

Note: All of our product line groups for Hassay Savage and Magafor companies play an active and integral role in employing high performance results for those customers who demand not only quality, but also consistent tool life that keeps their machines running longer.

www.hassay-savage.com
www.magaforusa.com

Self Centering Holders

Holds 8mm Shank Metric
Max. Push Force 900 lbs.

EDP #	D	L
HSP-2100-58	15.87mm	38mm
HSP-2102	19.05mm	38mm
HSP-2104	25.4mm	38mm
HSP-2100-16	16mm	38mm
HSP-2101	20mm	38mm
HSP-2103	25mm	50mm

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.

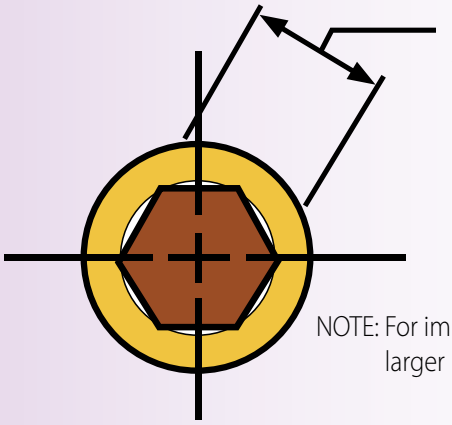
- It is necessary to align the end of the broach tool to the centerline of the work piece diameter by means of adjusting the screws located on the sides of the holder, and the use of set-up plugs.
- Alignment instructions are included with purchase of the tool holder.

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.

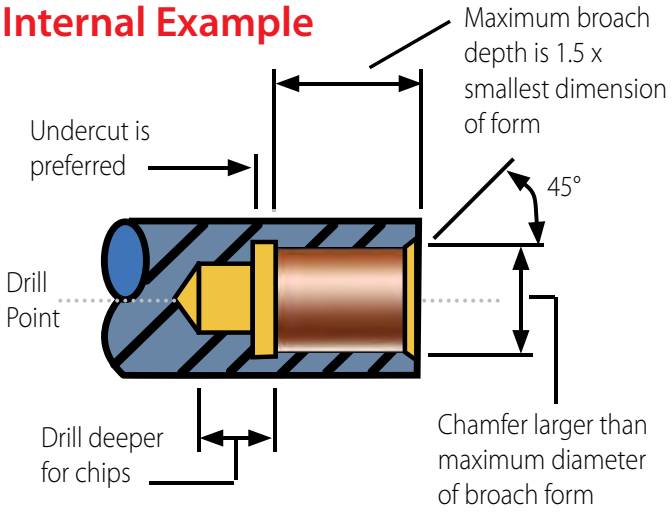
Example: The feed rate for a ¼" rotary punch broach would be 0.016 x .250 = .004/rev.



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.

Internal Example



Cutting Principle

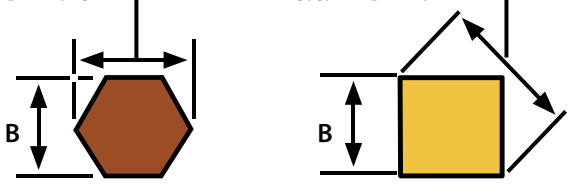
- The tool is held at a 1° angle relative to the part centerline.
- The face of the broach tool is the pivot of the 1° angle and is placed on centerline with the part.
- The cutting edge is kept on center and the rest of the tool oscillates around the part centerline with a wobble effect.
- With the 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

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.*

Index Broaching

An Alternative To Full Form Rotary Broaching

T10 - 2 Point Hexalobe

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

BASIC PRINCIPLES OF THE PROCEDURE

CNC Turning Machine

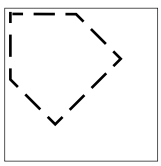
The CNC Turning Center performs each of these operations on the work piece before the Index Broach makes contact with the work piece.

- 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 than the size across the flats.
- Hole is now prepared for Index Broach.

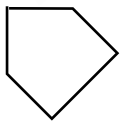
Hex or Square Index Broach

Why Hassay Savage Index Broaches?

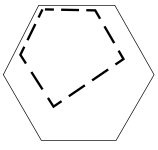
- Consistent High-Tolerance Forms for Longer Production Runs!
- Superb Surface Finishes!
- Outstanding Tool Life in Stainless & Titanium!
- Special Sizes, Special tolerances in Less Than 5 Days!
- Hassay Savage Broaches Made to + / - .0002 Tolerance!
- Produce bone screws to + / -.0005 Tolerance!
- Material 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!**



Single Point Square Form



Single Point Index Broach



Single Point Hex Broach

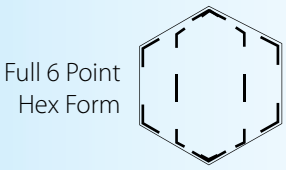
Hassay Savage Index Broaches for:

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

Index Broaching

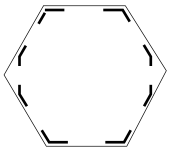
2 or 4 Point Hex Broach Cutting Process

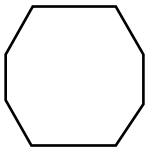
- Hole preparation completed with chamfer & proper pilot hole size.
- Machine spindle locked
- Punch enters the work piece, cutting the work piece, then retracts.
- The machine spindle indexes 60° then locks.
- The punch enters the work piece a second time, cutting the work piece, then retracts.
- Machine 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.



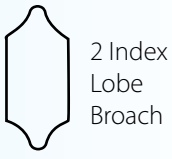
2 Point Hex Broach Cutting Procedure *is effective for broaching materials with higher tensile strength and relieves overall pressure during the process.*

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.*



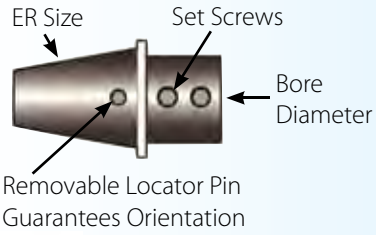
Quick Change ER Collet Punch & Index Broach ER Holder Systems

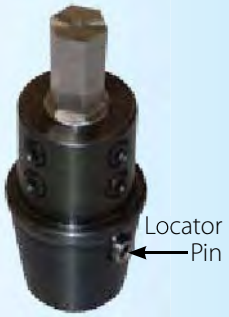
For Swiss and CNC Machining

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 Adaptors & Nuts

EDP #	ER Size	Bore Dia.	Nut Tread
HSP-PA16-25001	ER16	.250	M19 x 1mm Nut & Locator Pin
HSP-PA16-31501	ER16	8mm	M19 x 1mm Nut & Locator Pin
HSP-PA20-25001	ER20	.250	M24 x 1mm Nut & Locator Pin
HSP-PA20-31501	ER20	8mm	M24 x 1mm Nut & Locator Pin



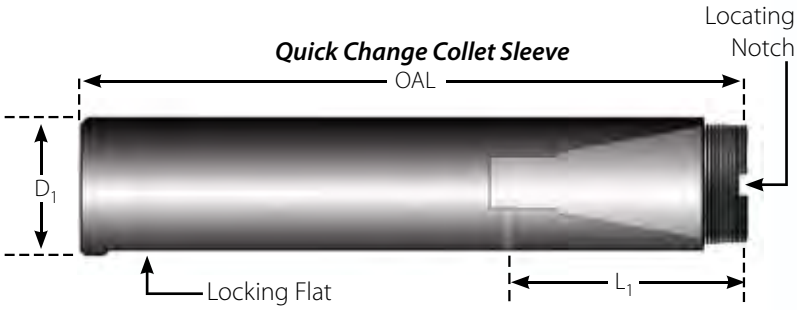



Quick Change Collet Sleeve


Punch Broach Adaptor


Holding Nut


Punch Broach



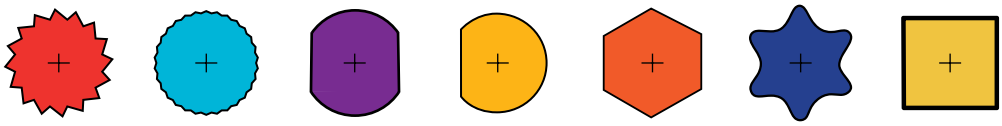
Quick Change Collet Sleeves

For SHANK ONLY Holders

EDP #	Collet	D1	L1	OAL
HSP-CS16-160500	ER16	.500	1.1	4.5
HSP-CS16-160625	ER16	.625	1.1	4.5
HSP-CS16-160750	ER16	.750	1.1	4.5
HSP-CS16-160787	ER16	20mm	28mm	71mm
HSP-CS16-160866	ER16	22mm	28mm	118mm
HSP-CS16-160984	ER16	25mm	28mm	95mm
HSP-CS16-161000	ER16	1″	1.1	4.5
HSP-CS20-200750	ER20	.750	1.2	4.5
HSP-CS20-200866	ER20	22mm	30mm	114mm
HSP-CS20-201000	ER20	1.00	1.2	4.5
HSP-CS20-201250	ER20	1.250	1.2″	4.5
HSP-CS20-201260	ER20	32mm	30mm	118mm

TO REQUEST A QUOTE PLEASE COPY AND FAX THIS PAGE TO 413-863-2714

Just Some of the Shapes You Can Broach



BROACH REQUIREMENTS

Size/Shape _____ Depth of Cut _____

Tolerance +/- _____

Desired Broach Shank Size _____

Material to be Machined _____

Type of Machine _____

Type of Holder _____

CONTACT INFORMATION

Contact Name _____

Company Name _____

Address _____

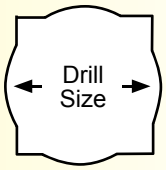
Phone Number _____

Fax Number _____

Email _____

Inch Square & Full Square Push Broaches

Designed for one pass finishing when used with • **Arbor** • **Hydraulic Press** • **Vertical Broaching**



Standard Square

Inch Square Push Broaches 1/8" - 1" — Standard Inch

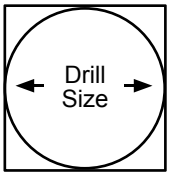
Size Square	EDP No.	Tolerance	Dimension Across Corners	Pilot Diameter	Drill Size	Broach Length	Length of Cut Min.	Length of Cut Max.	Pressure for Max.L/C (lbs.)
1/8	13008	.1250 - .1260	.1750 - .1770	.1280 –	#30	4-5/8	3/16	1/2	700
5/32	13010	.1565 - .1575	.2180 - .2200	.1585 –	#21	5-5/8	1/4	1/2	800
3/16	13012	.1880 - .1890	.2620 - .2640	.1930 –	#10	5-1/16	1/4	5/8	1,120
7/32	13014	.2190 - .2200	.3050 - .3070	.2275 –	#1	6-7/8	1/4	3/4	1,580
1/4	13016	.2505 - .2515	.3500 - .3520	.2651 –	17/64	7	1/4	3/4	1,740
9/32	13018	.2815 - .2825	.3930 - .3950	.2964 –	19/64	7-1/4	3/8	1	2,300
5/16	13020	.3130 - .3140	.4370 - .4390	.3276 –	21/64	8-1/8	3/8	1	2,630
11/32	13022	.3440 - .3450	.4810 - .4830	.3589 –	23/64	9-5/8	3/8	1-1/4	3,050
3/8	13024	3755 - .3765	.5230 - .5250	.3901 –	25/64	9-7/8	3/8	1-1/4	3,625
13/32	13026	.4065 - .4075	.5680 - .5700	.4212 –	27/64	10-7/8	1/2	1-3/8	5,200
7/16	13028	.4385 - .4395	.6110 - .6130	.4526 –	29/64	11-3/8	1/2	1-3/8	5,700
15/32	13030	.4690 - .4700	.6560 - .6580	.4995 –	1/2	12-1/2	1/2	1-3/8	5,900
1/2	13032	.5005 - .5015	.6970 - .6990	.5307 –	17/32	12-5/8	1/2	1-3/8	6,000
9/16	13036	.5630 - .5640	.7860 - .7880	.5932 –	19/32	14-7/8	1/2	1-1/2	6,200
5/8	13040	.6260 - .6270	.8710 - .8730	.6557 –	21/32	16-13/16	5/8	1-5/8	7,100
11/16	13044	.6885 - .6895	.9610 - .9630	.7495 –	3/4	18-1/2	5/8	1-5/8	7,300
3/4	13048	.7510 - .7520	1.0450 - 1.0470	.8120 –	13/16	18-7/8	5/8	1-5/8	8,600
7/8	13056	.8765 - .8775	1.2280 - 1.0300	.9370 –	15/16	22-3/4	1/2	2	12,000
1	13064	1.0020 - 1.0030	1.4030 - 1.4050	1.0932 –	1-3/32	24-1/2	1/2	2	12,500

Metric Square Push Broaches 4mm- 25mm — Metric

Size Square	EDP No.	Tolerance	Dimension Across Corners	Pilot Diameter	Drill Size	Broach Length	Length of Cut Min.	Length of Cut Max.	Pressure for Max.L/C (lbs.)
4mm	17001	.1580 - .1585	.2080 - .2090	.1655 –	4.2 mm	5-9/16	5/16	5/8	1,000
5mm	17002	.1973 - .1983	.2645 - .2655	.2047 –	5.2 mm	6-7/8	3/8	3/4	1,580
6mm	17003	.2367 - .2377	.3295 - .3300	.250 –	6.35 mm	7	3/8	3/4	1,740
8mm	17004	.3155 - .3165	.4405 - .4410	.3267 –	8.3 mm	8-3/16	7/16	7/8	2,500
10mm	17005	.3942 - .3952	.5435 - .5445	.4057 –	10.3 mm	10-7/8	1/2	1	2,800
12mm	17006	.4729 - .4739	.6540 - .6550	.4921 –	12.5 mm	12-1/2	5/8	1-1/4	3,625
14mm	17007	.5517 - .5527	.7700 - .7710	.5905 –	15.0 mm	14-7/8	3/4	1-1/2	6,200
16mm	17008	.6310 - .6320	.8780 - .8790	.6693 –	17.0 mm	16-13/16	7/8	1-5/8	7,100
18mm	17009	.7092 - .7102	.9880 - .9890	.7874 –	20.0 mm	18-1/2	7/8	1-3/4	8,200
20mm	17010	.7879 - .7889	1.0990 - 1.1000	.8661 –	22.0 mm	18-7/8	7/8	1-3/4	9,500
22mm	17011	.8666 - .8676	1.2110 - 1.2120	.9448 –	24.0 mm	23-1/4	7/8	1-3/4	9,700
24mm	17012	.9454 - .9464	1.3170 - 1.3180	1.0236 –	26.0 mm	24-9/16	7/8	1-3/4	10,000
25mm	17013	.9848 - .9858	1.3730 - 1.3740	1.0630 –	27.0 mm	24-9/16	7/8	1-3/4	10,500

Full Square Push Broaches 3/16" - 1/2" — Standard Inch

Size Square	EDP No.	Tolerance	Dimension Across Corners	Pilot Diameter	Drill Size	Broach Length	Length of Cut Min.	Length of Cut Max.	Pressure for Max.L/C (lbs.)
3/16	14012	.1880 - .1890	.2628 - .2632	.1870 –	3/16	6-1/4	3/16	1/2	1,200
1/4	14016	.2505 - .2515	.3513 - .3517	.2495 –	1/4	8-5/8	1/4	5/8	1,600
5/16	14020	.3120 - .3140	.4375 - .4380	.3120 –	5/16	10-1/4	1/4	3/4	2,300
3/8	14024	.3755 - .3765	.5243 - .5247	.3745 –	3/8	12-1/4	3/8	1	3,750
7/16	14028	.4385 - .4395	.6170 - .6180	.4370 –	7/16	14-7/16	3/8	1	3,950
1/2	14032	.5005 - .5015	.6980 - .6990	.4995 –	1/2	14-7/16	3/8	1	5,000



Full Square

Modified Standard Inch and Metric Tolerances are Available with Expedited Delivery!

Hexagonal Push Broaches

Hexagonal Push Broaches 1/8" - 1" — Standard Inch

Size Square	EDP No.	Dimension Tolerance	Dimension Across Corners	Pilot Diameter	Drill Size	Broach Length	Length of Cut Min.	Length of Cut Max.	Pressure for Max.L/C (lbs.)
1/8	12008	.1255 - .1260	.1450 - .1470	.1245 –	1/8	4-5/8	3/16	3/8	120 lbs
5/32	12010	.1565 - .1570	.1800 - .1820	.1557 –	5/32	5-1/2	1/4	1-1/2	340 lbs
3/16	12012	.1880 - .1890	.2145 - .2155	.1870 –	3/16	5-9/16	1/4	5/8	520 lbs
7/32	12014	.2190 - .2200	.2500 - .2520	.2182 –	7/32	6	1/4	3/4	890 lbs
1/4	12016	.2505 - .2515	.2865 - .2875	.2495 –	1/4	6-1/2	1/4	3/4	1,250 lbs
9/32	12018	.2815 - .2825	.3220 - .3240	.2807 –	9/32	7-3/4	3/8	1	1,650 lbs
5/16	12020	.3130 - .3140	.3580 - .3590	.3120 –	5/16	8-1/4	3/8	1	2,175 lbs
11/32	12022	.3440 - .3450	.3950 - .3970	.3432 –	11/32	8-1/4	3/8	1-1/4	3,500 lbs
3/8	12024	.3755 - .3765	.4300 - .4310	.3745 –	3/8	9	3/8	1-1/4	3,700 lbs
13/32	12026	.4065 - .4075	.4670 - .4690	.4057 –	13/32	10	1/2	1-3/8	4,100 lbs
7/16	12028	.4385 - .4395	.5020 - .5030	.4370 –	7/16	10-3/4	1/2	1-3/8	4,575 lbs
15/32	12030	.4690 - .4700	.5390 - .5410	.4682 –	15/32	12-3/8	1/2	1-3/8	4,700 lbs
1/2	12032	.5005 - .5015	.5740 - .5750	.4995 –	1/2	12-1/2	1/2	1-3/8	5,300 lbs
9/16	12036	.5630 - .5640	.6480 - .6500	.5620 –	9/16	14-1/4	1/2	1-1/2	6,700 lbs
5/8	12040	.6260 - .6270	.7170 - .7185	.6245 –	5/8	16-7/8	5/8	1-5/8	7,250 lbs
11/16	12044	.6880 - .6890	.7930 - .7950	.6870 –	11/16	17	5/8	1-5/8	9,300 lbs
3/4	12048	.7510 - .7520	.8610 - .8625	.7495 –	3/4	17-7/8	5/8	1-5/8	13,500 lbs
7/8	12056	.8755 - .8765	1.0060 - 1.0075	.8745 –	7/8	18-7/8	5/8	1-5/8	18,500 lbs
1	12064	1.0020 - 1.0030	1.1520 - 1.1530	.9995 –	1	19-7/8	5/8	1-5/8	20,050 lbs

Hexagonal Push Broaches 4mm - 25mm — Metric

Size Square	EDP No.	Dimension Tolerance	Dimension Across Corners	Pilot Diameter	Drill Size	Broach Length	Length of Cut Min.	Length of Cut Max.	Pressure for Max.L/C (lbs.)
4 mm	12104	.1580 - .1585	.1820 - .1830	.1575 –	4.0	5-1/2	1/4	1/2	340 lbs
5 mm	12105	.1973 - .1983	.2270 - .2280	.1968 –	5.0	6	1/4	3/4	890 lbs
6mm	12106	.2367 - .2377	.2730 - .2740	.2362 –	6.0	6-1/2	1/4	3/4	1,250 lbs
7 mm	12107	.2760 - .2770	.3180 - .3190	.2756 –	7.0	7-3/4	3/8	1	1,650 lbs
8mm	12108	.3155 - .3165	.3634 - .3644	.3150 –	8.0	8-1/4	3/8	1	2,175 lbs
10 mm	12110	.3942 - .3952	.4543 - .4553	.3937 –	10.0	10	1/2	1	4,100 lbs
12 mm	12112	.4729 - .4739	.5452 - .5462	.4724 –	12.0	12-3/8	1/2	1-3/8	4,700 lbs
14 mm	12114	.5517 - .5527	.6332 - .6342	.5512 –	14.0	14-1/4	1/2	1-3/8	6,700 lbs
16 mm	12116	.6310 - .6320	.7248 - .7258	.6290 –	16.0	16-7/8	5/8	1-1/2	7,250 lbs
18 mm	12118	.7092 - .7102	.8150 - .8160	.7087 –	18.0	17	5/8	1-5/8	9,400 lbs
20 mm	12120	.7879 - .7889	.9049 - .9059	.7874 –	20.0	17-7/8	5/8	1-5/8	14,150 lbs
22 mm	12122	.8666 - .8676	.9958 - .9968	.8661 –	22.0	18-7/8	5/8	1-5/8	18,500 lbs
24 mm	12124	.9454 - .9464	1.0868 - 1.0878	.9449 –	24.0	19-7/8	5/8	1-5/8	20,500 lbs
25 mm	12125	.9848 - .9858	1.1323 - 1.1333	.9842 –	25.0	19-7/8	5/8	1-5/8	22,000 lbs

SPECIAL SQUARE and HEXAGON BROACHES

If your application cannot be handled with the standard broaches listed, send us a sample or print of the part to be broached, and we will provide a quote.

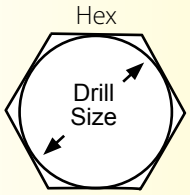
Include the following data:

HOLE:

- Dimensions Before and After Broaching
- Tolerances
- Specify Cast, Drilled or Reamed
- Length of Cut Through Part Required

MATERIAL:

- Specifications
- Specify Bar, Cast or Forged Stock
- Rc Hardness Before Broaching



To select a **STANDARD BROACH** from Hassay Savage: **Choose** a tool, or set of tools that will produce the cut your finished part requires.

Specify

- EDP
- Size
- Brief Description

STANDARD PRODUCTS are fully maintained in finished goods inventory.

We can ship your order the same day it is placed.

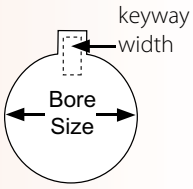
Special widths and lengths are also available from semi-finished stock ground to your specifications with quick delivery.

Davis Style Keyseating Broaches

KEYSEATING BROACHES

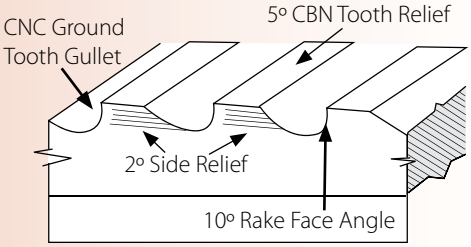
Hassay Savage HSS keyseating pull broaches are manufactured similar to the Davis AF Series cutters and are interchangeable.

- Cutter bars have 10° rake face, 5° backoff and 2° side-relief on all teeth.
- Broaches may be used on Davis model 4, 5, and 15 machines.
- Sizes range from 1/16" to 1" and 2mm to 25mm.
- For special applications contact our customer service **1-800-247-2024**



Why Hassay Savage Broaches Stand For Precision And Top Quality:

- The side relief eliminates drag in multiple-pass broaching.
- Tooth-relief, using Borazon™ wheels, improves surface finish and extends tool life.
- Precision grinding of the rake face insures consistent performance and free cutting action after several sharpenings.



Davis Keyseat Puller Design

Keyseater Inch

1/16" - 1"

EDP No.	Broach Size	Keyway Width Tolerance (inches)	Dimensions Body Width x Height x Length	Length of Cut Min.	Max.
10701	1/16	.0630 - .0640	3/16 x 3/8 x 16	5/8	1-7/8
10702	3/32	.0942 - .0952	3/16 x 7/16 x 16	5/8	1-7/8
10703	1/8	.1255 - .1265	3/16 x 7/16 x 16	5/8	1-7/8
10704	5/32	.1568 - .1578	3/16 x 1/2 x 16	5/8	1-7/8
10705	3/16	.1880 - .1890	3/16 x 9/16 x 16	5/8	1-7/8
10706	3/16	.1880 - .1890	3/16 x 3/4 x 20	5/8	3-1/8
10707	1/4	.2505 - .2515	1/4 x 3/4 x 16	5/8	1-5/8
10708	1/4	.2505 - .2515	1/4 x 3/4 x 20	5/8	3-1/8
10709	5/16	.3130 - .3140	5/16 x 7/8 x 16	1-1/16	3-3/16
10710	5/16	.3130 - .3140	5/16 x 7/8 x 20	1-1/16	5-3/16
10711	3/8	.3755 - .3765	3/8 x 7/8 x 16	1-1/16	3-3/16
10712	3/8	.3755 - .3765	3/8 x 7/8 x 20	1-1/16	5-3/16
10713	7/16	.4380 - .4390	7/16 x 1 x 16	1-1/16	3-3/16
10714	7/16	.4380 - .4390	7/16 x 1 x 20	1-1/16	5-3/16
10715	1/2	.5005 - .5015	1/2 x 1 x 20	1-1/16	5-3/16
10716	9/16	.5630 - .5640	9/16 x 1 x 20	1-1/16	5-3/16
10717	5/8	.6255 - .6265	5/8 x 1 x 20	1-1/16	5-3/16
10718	3/4	.7505 - .7515	3/4 x 1 x 20	1-1/16	5-3/16
10719	7/8	.8755 - .8765	7/8 x 1 x 20	1-1/16	5-3/16
10720	1	1.0005 - 1.0015	1 x 1x 20	1-1/16	5-3/16

Keyseater Metric

2mm - 25mm

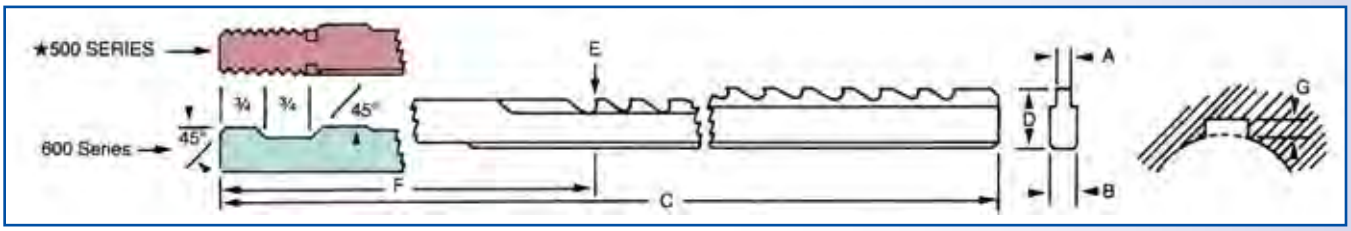
EDP No.	Broach Size	Keyway Width Tolerance (inches)	Dimensions Body Width x Height x Length	Length of Cut Min.	Max.
11701	2 mm	.0792 - .0802	3/16 x 3/8 x 16	5/8	1-7/8
11702	3 mm	.1186 - .1196	3/16 x 7/16 x 16	5/8	1-7/8
11703	4 mm	.1580 - .1590	3/16 x 1/2 x 16	5/8	1-7/8
11704	5 mm	.1974 - .1984	5 mm x 1/2 x 16	5/8	1-7/8
11705	5 mm	.1974 - .1984	5 mm x 1/2 x 20	5/8	3-1/8
11706	6 mm	.2367 - .2377	6 mm x 5/8 x 16	5/8	1-7/8
11707	6 mm	.2367 - .2377	6 mm x 5/8 x 20	5/8	3-1/8
11708	8 mm	.3155 - .3165	8 mm x 7/8 x 16	1-1/16	3-3/16
11709	8 mm	.3155 - .3165	8 mm x 7/8 x 20	1-1/16	5-5/16
11710	10 mm	.3942 - .3952	10 mm x 7/8 x 16	1-1/16	3-3/16
11711	10 mm	.3942 - .3952	10 mm x 7/8 x 20	1-1/16	5-5/16
11712	12 mm	.4724 - .4730	12 mm x 1 x 20	1-1/16	5-5/16
11713	14 mm	.5517 - .5527	14 mm x 1 x 20	1-1/16	5-5/16
11714	16 mm	.6304 - .6314	16 mm x 1 x 20	1-1/16	5-5/16
11715	18 mm	.7092 - .7102	18 mm x 1 x 20	1-1/16	5-5/16
11716	20 mm	.7879 - .7889	20 mm x 1 x 20	1-1/16	5-5/16
11717	22 mm	.8666 - .8676	22 mm x 1 x 20	1-1/16	5-5/16
11718	24 mm	.9454 - .9464	24 mm x 1 x 20	1-1/16	5-5/16
11719	25 mm	.9848 - .9858	25 mm x 1 x 20	1-1/16	5-5/16

Tolerance considerations are based on preferred metric limits and fits
ANSI B4.2-1978

Custom corner radius, size specific and full radius cutters are available with form relief upon request.

500 & 600 Series Pull Type Broaches

Hassay Savage Supplies Pull Heads For 500 And 600 Series Broaches Upon Request. Call Us For Size And Delivery.



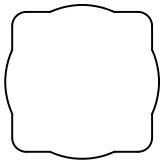
EDP No. 500 Series	EDP No. 600 Series	500 Series	600 Series	Nom. Dim.	A Decimal Dim.	Tolerance	Min. Hole Size	Min. Length Cut**	Max. Length Cut	B +.0000 -.0005	C	D ±.0005	E	F	G	No. of Cuts	Thread Size
33501	33601	501	601	1/16	.0635	+ / - .0005	3/8	3/8	1-1/4	.1552	20	.313	.271	7-3/16	.042	1	1/4 - 20
33502	33602	502	602	3/32	.0948	+ / - .0005	7/16	1/2	1-1/2	.1865	24	.367	.309	8-1/4	.058	1	5/16 - 18
33503	33603	503	603	3/32	.0948	+ / - .0005	5/8	5/8	2-1/2	.2490	33	.491	.433	10	.058	1	3/8 - 16
33504	33604	504	604	1/8	.1260	+ / - .0005	1/2	1/2	1-1/2	.2490	30	.438	.364	9	.074	1	3/8 - 16
33505	33605	505	605	1/8	.1260	+ / - .0005	7/8	5/8	2-1/2	.3115	36	.594	.520	10	.074	1	1/2 - 13
33506	33606	506	606	5/32	.1572	+ / - .0005	19/32	1/2	1-1/2	.2490	30	.525	.436	9	.089	1	3/8 - 16
33507	33607	507	607	5/32	.1572	+ / - .0005	23/32	5/8	2-1/2	.3115	33	.625	.536	10	.089	1	1/2 - 13
33508	33608	508	608	3/16	.1885	+ / - .0005	11/16	5/8	2-1/2	.3740	36	.581	.476	10	.105	1	1/2 - 13
33509	33609	509	609	3/16	.1885	+ / - .0005	15/16	11/16	3-1/2	.3740	36	.796	.691	10-11/16	.105	1	1/2 - 13
33510	33610	510	610	7/32	.2198	+ / - .0005	11/16	5/8	2-1/2	.3740	33	.557	.437	10	.120	1	1/2 - 13
33511	33611	511	611	11/32	.2198	+ / - .0005	15/16	11/16	3-1/2	.3740	42	.813	.693	11-1/16	.120	1	1/2 - 13
33512	33612	512	612	1/4	.2510	+ / - .0005	11/16	5/8	2-1/2	.3740	36	.612	.476	10	.136	1	1/2 - 13
33513	33613	513	613	1/4	.2510	+ / - .0005	1	11/16	4	.4990	45	.877	.741	11-13/16	.136	1	5/8 - 11
33514	33614	514	614	1/4	.2510	+ / - .0005	1-7/16	7/8	6	.6240	51	1.250	1.114	13-1/2	.136	1	3/4 - 10
33515	33615	515	615	9/32	.2828	+ / - .0005	7/8	11/16	4	.4990	45	.716	.564	11-5/8	.152	1	5/8 - 11
33516	33616	516	616	9/32	.2828	+ / - .0005	1-1/4	7/8	6	.4990	51	1.093	.941	13-1/2	.152	1	5/8 - 11
33517	33617	517	617	5/16	.3140	+ / - .0005	1	11/16	4	.4990	45	.908	.741	11-13/16	.167	1	5/8 - 11
33518	33618	518	618	5/16	.3140	+ / - .0005	1-5/16	7/8	6	.4990	51	1.158	.991	13-1/2	.167	1	5/8 - 11
33519	33619	519	619	3/8	.3765	+ / - .0005	1-1/16	11/16	4	.4990	45	.938	.739	11-13/16	.199	1	5/8 - 11
33520	33620	520	620	3/8	.3765	+ / - .0005	1-5/16	7/8	6	.4990	54	1.189	.990	13-1/2	.199	1	5/8 - 11
33521	33621	521	621	7/16	.4390	+ / - .0005	1-9/16	11/16	4	.6240	48	1.360	1.160	12	.230	1	3/4 - 10
33522	33622	522	622	7/16	.4390	+ / - .0005	2	1	8	.6240	48	1.611	1.496	15-5/8	.230	2	3/4 - 10
33523	33623	523	623	1/2	.5015	+ / - .0005	1-1/2	11/16	4	.6240	48	1.312	1.051	12	.261	1	3/4 - 10
33524	33624	524	624	1/2	.5015	+ / - .0005	1-1/2	1	8	.6240	48	1.377	1.246	16-1/2	.261	2	3/4 - 10
33525	33625	525	625	9/16	.5645	+ / - .0005	1-3/4	11/16	4	.6865	54	1.438	1.146	11-13/16	.292	1	1 - 8
33526	33626	526	626	9/16	.5645	+ / - .0005	1-5/8	1	8	.6865	51	1.391	1.245	16	.292	2	1 - 8
33527	33627	527	627	9/16	.5645	+ / - .0005	2-1/4	1-1/8	12	.8740	60	1.641	1.495	20	.292	2	1 - 8
33528	33628	528	628	5/8	.6270	+ / - .0005	1-7/8	11/16	4	.7490	60	1.625	1.301	12-3/16	.324	1	1 - 8
33529	33629	529	629	5/8	.6270	+ / - .0005	2-1/2	1	8	.8740	54	1.657	1.495	16-3/8	.324	2	1 - 8
33530	33630	530	630	5/8	.6270	+ / - .0005	2-1/4	1-1/8	12	.8740	57	1.657	1.495	20	.324	2	1 - 8
33531	33631	531	631	3/4	.7520	+ / - .0005	1-7/8	11/16	4	.8740	60	1.625	1.239	12-3/16	.386	1	1 - 8
33532	33632	532	632	3/4	.7520	+ / - .0005	2	1	8	.9990	60	1.688	1.495	16-3/8	.386	2	1-1/4 - 7
33533	33633	533	633	3/4	.7520	+ / - .0005	2-1/4	1-1/8	12	.9990	57	1.688	1.560	20	.386	3	1-1/4 - 7
33534	33634	534	634	7/8	.8770	+ / - .0005	2-1/4	11/16	4	1.1240	63	1.875	1.426	12-3/8	.449	1	1-1/4 - 7
33535	33635	535	635	7/8	.8770	+ / - .0005	2-1/4	1	8	1.1240	63	1.719	1.494	15-3/4	.449	2	1-1/4 - 7
33536	33636	536	636	7/8	.8770	+ / - .0005	2-1/4	1-1/8	12	1.1240	63	1.719	1.569	20	.449	3	1-1/4 - 7
33537	33637	537	637	1	1.0020	+ / - .0005	2-1/4	5/8	2-1/2	1.2490	63	1.750	1.239	10-1/2	.511	1	1-1/2 - 6
33538	33638	538	638	1	1.0020	+ / - .0005	2-1/4	7/8	6	1.2490	63	1.750	1.494	14-1/4	.511	2	1-1/2 - 6
33539	33639	539	639	1	1.0020	+ / - .0005	2-1/4	1-1/8	12	1.2490	60	1.750	1.580	20	.511	3	1-1/2 - 6

**600 Series designates notched-type shank **Minimum length of part recommended to prevent part from dropping in between teeth of broach*

Custom Broaching Solutions

Save time, increase your productivity and profits with Hassay Savage Custom Broaching Solutions! Here are just a few samples of our innovative broaching solutions:

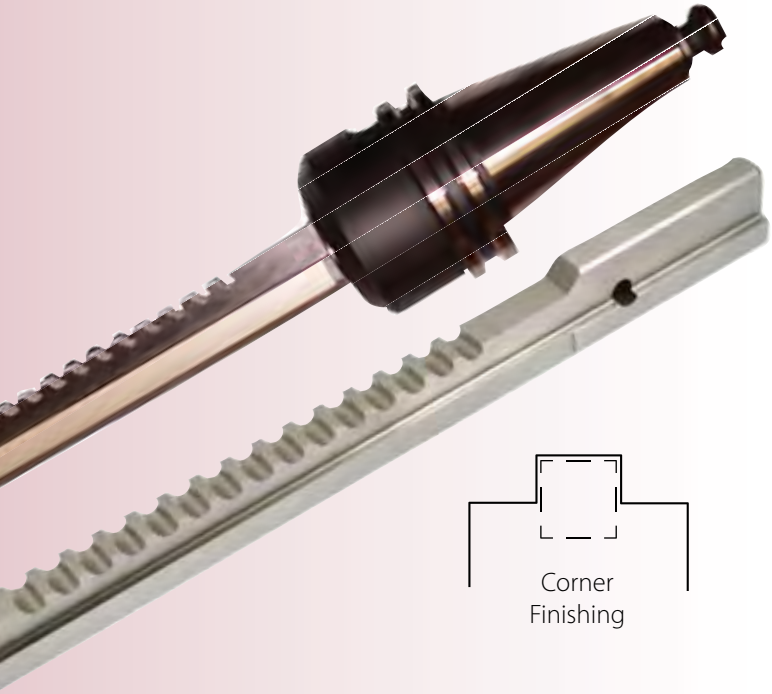
- ***Broach your part right to finish tolerances***
- ***Finish a shape right to specification in a CNC operation***
- ***Nibble, shave, shear a geometry within a part***



Rectangle Punch
Radius Corners
with Witness Marks

These and countless other possibilities can be obtained with the use of custom designed Hassay Savage Broaches. Whether it is to create an entire geometry or just complete an operation within a programmed, production machining operation, Hassay Savage can help you develop cost saving solutions for your production needs.

Broaching is no longer a stand alone operation. Take advantage of the full capabilities of your CNC Processing Equipment and finish your part by broaching within this process. It can be integrated into your current CNC production using custom designed broaches that can finish your parts right to specification without breaking set up or moving your part to a secondary operation. Our engineers can integrate the design and manufacturing process for your custom application and maintain total datum tolerance control of your parts.



Corner
Finishing

Typical Broach Applications May Include:

- Tooling Fixtures
- Gears
- Pulleys
- Keyways
- Rifling
- Special Geometric Shapes
- External Gears
- Flats
- Notches
- Serrations
- Slots
- Intricate contours
- Key Lock Slots
- Connecting Rods

We Routinely Assist The Following Industries:

- *Medical*
- *Orthopedic*
- *Dental*
- *Automotive*
- *Firearms*
- *Munitions*
- *Military*
- *Aircraft*
- *Aerospace*
- *Electronics*
- *Communications*
- *Plastics*

Selected Broaching Applications

The following list will give you an idea of the kind of first-rate special broaching that distinguishes our company world-wide.

Selected applications are:

- ***Metering Valve***:
  0.524" x 1.706" rectangle with 20" push broach: broached at Hassay Savage with 100% inspection for just-in-time shipments to OEM; job lot of 25,000 pieces/yr.
- ***Control Vent Airframe:***
  40 slots in rectangle chamber; 1.625" x 6.000"; broach was pull-type on horizontal machine; accuracy of 0.001 required throughout reference of all points; job lot of 100 units.
- ***Printing guide Lever:***
  19mm x 1,6mm rectangle with 610mm pull broach, bronze workpiece; limited production.
- ***Wave Guide:***
  1.345" x 2.848" x 36" pull broach; job lot of 500 pieces, on continuous basis.
- ***Control Pin:***
  Flats and radius slot; insert type slab broaches and radius slot broaching on vertical machine; high volume tumbler feed magazine.
- ***Pliers:***
  Set of three surface broaches to broach teeth of pliers; open clearance cut-off section; high volume run.
- ***Collets:***
  6 slots; 0.093 width; slotting broaches for cutting collet slots on vertical broach; high volume with a great variety of sizes using same broaches.
- ***Ratchet Wrench:***
  Elliptical set of holes for mechanism of ratchet; with a 2-piece construction broach for U.S. wrench manufacture.
- ***Internal Spline Gear:***
  22-tooth 36 spline pull broach; 24/48 diametrical pitch; 20° pressure angle; 2 million pieces per year.
- ***Surgical Scissors:***
  4 wide, 16 long surface broach, stainless steel workpiece; continuous medium volume.

Pictured: Custom broached parts.

Custom Broaching Solutions

Research and Development

Integration of design and manufacturing process at the prototype stage is critical!

Hassay Savage *can save you time and money when our engineers are involved from the onset.*

- State-of-the-art technology
- Understanding materials:
  ferrous metals and alloys
  non-ferrous metals
  non-metallic materials
  plastics and ceramics
  wood products
- Successful broaching is knowing the capabilities of machining centers and flexible manufacturing systems
- We support partnership development

In affiliation with University Broaching Research Laboratories, we are working on:

- Expert systems for the automation of the broach design process.
- Integrated system for the automation for the near-net shape (pre-forming) manufacture of broaching tools.
- A knowledge-based system for yielding maximum allowable cutting force during broaching by creating exacting tooth geometry.
- Computer-aided process of down-loading machining programs to workstations by the actual routing process
- Procedures that reduce the cost of designing, manufacturing, and rebuilding broaches.

The broach is an unsurpassed, unique tool that generates unique finish shapes in one pass. Broaching has a distinct advantage over other metal cutting operations because of its exacting precision, superb finish, faster production rates (as much as 5 to 10 times higher). **Wherever broaches are utilized, the result is improved quality and productivity.**

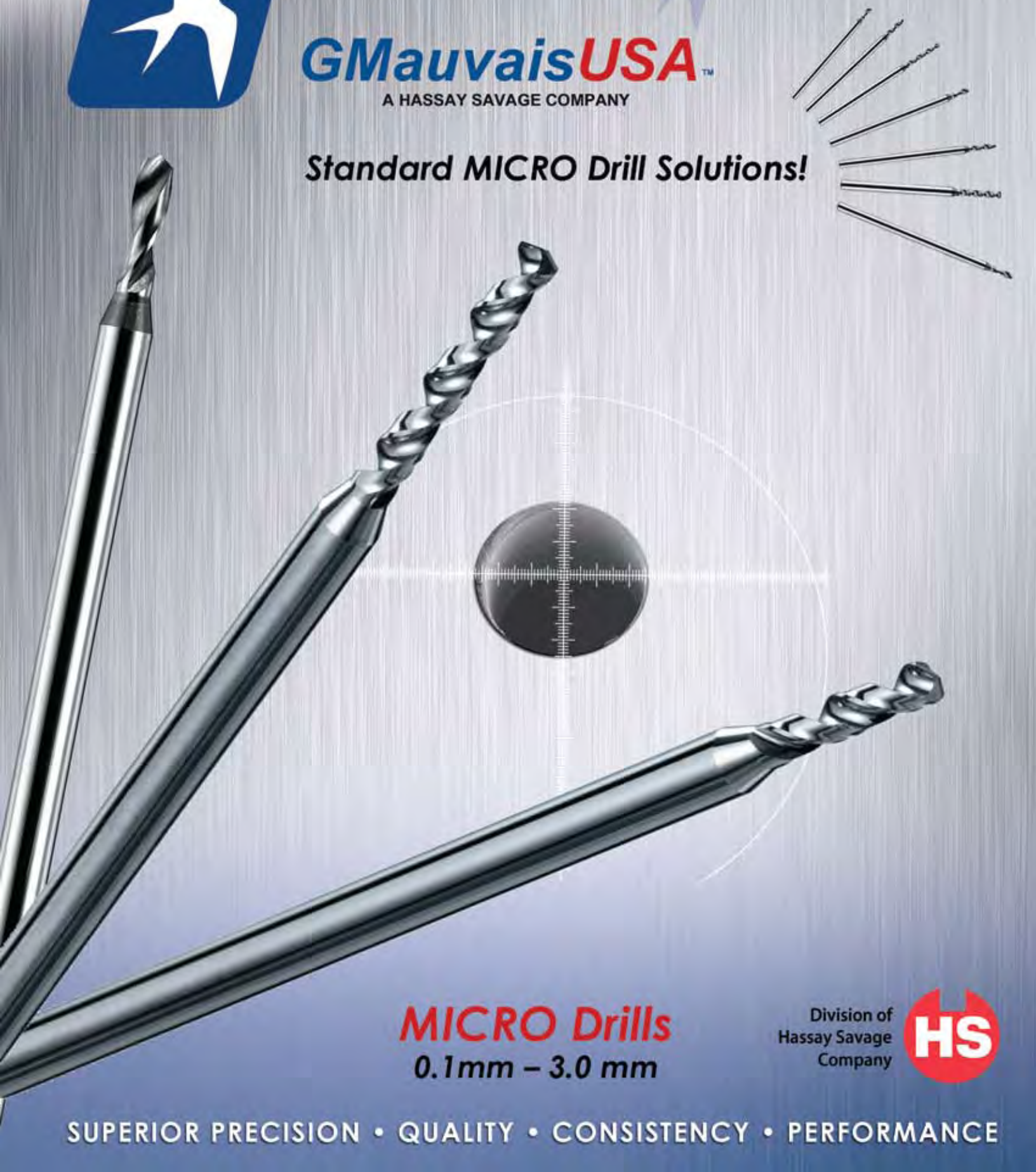
Using the Hassay Savage system gives you the best assurance in the industry!

NEW PRODUCT LINE

GMauvaisUSA™

A HASSAY SAVAGE COMPANY

Standard MICRO Drill Solutions!



MICRO Drills

0.1mm – 3.0 mm

Division of Hassay Savage Company

SUPERIOR PRECISION • QUALITY • CONSISTENCY • PERFORMANCE

GMauvaisUSA™
A HASSAY SAVAGE COMPANY

Superior Micro Drills...

Since 1928 serving the Swiss Watch Industry, our factory in Annecy, France has a global reputation for superior quality and consistency in the production of high precision micro drills in µm Micron tolerances. With innovative and unique manufacturing technologies in turning, bar cutting, grinding, milling, flute grinding, sharpening and heat-treating, we produce products of the most consistent quality and reliable specifications! Our ability to control our high production operations with incredibly tight tolerances, makes us the right choice for all your micro drill needs. We offer a complete range of products in Solid Carbide and Cobalt High Speed Steel

In-process quality controls insure 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!

Superior Precision, Quality,
Consistency & Performance

Every Day from GMauvaisUSA™!

CONTENTS

GMauvaisUSA™
A HASSAY SAVAGE COMPANY

THE ANATOMY OF A SUPERIOR MICRO DRILL

The **BIG** *Picture of a Very* **SMALL**, *Precision Made Cutting Tool!*

Superior Edge Quality & Flute Surface Finishes For **HIGH PERFORMANCE**!

Extraordinary Concentricity, Circularity & Straightness **WITHIN 2 MICRONS!**

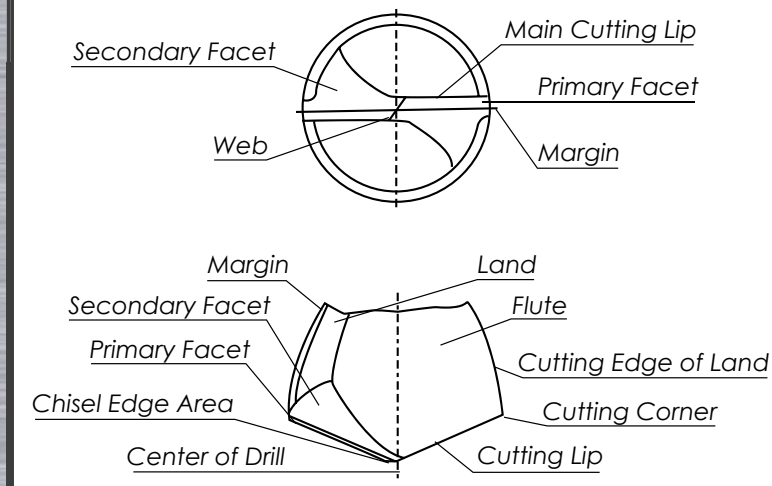
Consistent, Accurate Dimensions **EVERY TIME!**

Amazing Dimension Control **AT h6, h4 & h3 μm TOLERANCES!**

Ultra-Fine Surface Finish For **SMOOTH OPERATION!**

Superior HSS Heat Treating & 10% Cobalt Micro Grain Carbide for **OUTSTANDING PERFORMANCE & LONG TOOL LIFE!!**

DRILL TERMINOLOGY



μm What is a Micron?

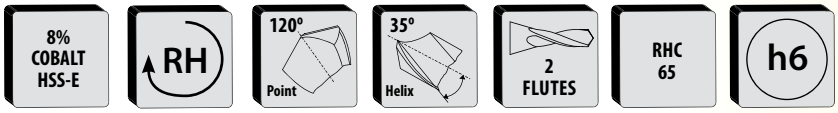
1 micron = .001 mm = .00003937"

One Hundreth (1/100) of a Human Hair!

See page 4 for Sales Representative Listings

5140 Series
HSS-E Cobalt 8%

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

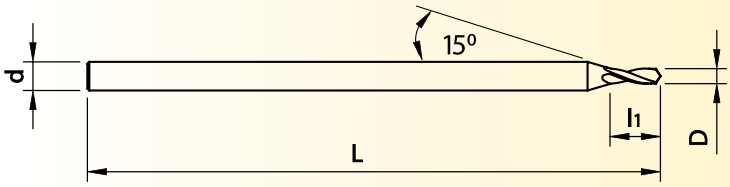


h6 + 0.000
- 0.006 mm

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 as 1.255 mm or other.
- Special Tolerances as +/- 0.001 mm or other.
- Coatings Available upon request.
- Minimum Special Order is 10 Pieces / Spec.
- Lead-Time on Specials – 3 Weeks ARO.



OAL Range 25 mm

SOLD IN 10 PIECE PACKAGES ONLY

Order Number	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)
5140020R	0.20	0.0079	92	1.5	0.6	25
5140025R	0.25	0.0098		1.5	0.8	25
5140030R	0.30	0.0118		1.5	0.9	25
5140035R	0.35	0.0138		1.5	1	25
5140040R	0.40	0.0157		1.5	1	25
5140045R	0.45	0.0177		1.5	1.2	25
5140050R	0.50	0.0197		1.5	1.2	25
5140055R	0.55	0.0217		1.5	1.4	25
5140060R	0.60	0.0236		1.5	1.4	25
5140065R	0.65	0.0256		1.5	1.7	25
5140070R	0.70	0.0276		1.5	1.7	25
5140075R	0.75	0.0295		1.5	1.8	25
5140080R	0.80	0.0315		1.5	1.8	25
5140085R	0.85	0.0335		1.5	1.8	25
5140090R	0.90	0.0354		1.5	1.8	25
5140095R	0.95	0.0374		1.5	2	25
5140100R	1.00	0.0394		1.5	2	25
5140105R	1.05	0.0413		1.5	2.3	25
5140110R	1.10	0.0433		1.5	2.3	25
5140115R	1.15	0.0453		1.5	2.3	25
5140120R	1.20	0.0472		1.5	2.3	25
5140125R	1.25	0.0492		1.5	2.7	25
5140130R	1.30	0.0512		1.5	2.7	25
5140135R	1.35	0.0531		1.5	2.7	25
5140140R	1.40	0.0551	54	1.5	2.7	25
5140145R	1.45	0.0571		1.5	2.7	25
5140150R	1.50	0.0591		2	3	25
5140160R	1.60	0.0630	51	2	3	25

Drill Sizes 0.20 - 3.00 mm

Order Number	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)
5140170R	1.70	0.0669		2	3.3	25
5140180R	1.80	0.0709		2	3.3	25
5140190R	1.90	0.0748		2	3.3	25
5140200R	2.00	0.0787		2	4	25
5140210R	2.10	0.0827		2.5	4	25
5140220R	2.20	0.0866		2.5	4	25
5140230R	2.30	0.0906		2.5	4.6	25
5140240R	2.40	0.0945		2.5	4.6	25
5140250R	2.50	0.0984		2.5	4.6	25
5140260R	2.60	0.1024		3	4.6	25
5140270R	2.70	0.1063		3	5.3	25
5140280R	2.80	0.1102		3	5.3	25
5140290R	2.90	0.1142		3	5.3	25
5140300R	3.00	0.1181		3	5.3	25

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%

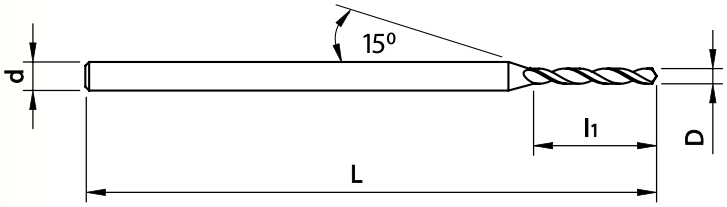
5 x *D* – Depth of Cut 120°

h6 + 0.000
- 0.006 mm

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 as 1.255 mm or other.
- Special Tolerances as +/- 0.001 mm or other.
- Coatings Available upon request.
- Minimum Special Order is 10 Pieces / Spec.
- Lead-Time on Specials – 3 Weeks ARO.



OAL Range 25 - 40 mm

SOLD IN 10 PIECE PACKAGES ONLY

Order Number	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)
5100010R	0.10	0.0039		1	0.7	25
5100011R	0.11	0.0043		1	0.7	25
5100012R	0.12	0.0047		1	0.7	25
5100013R	0.13	0.0051		1	1	25
5100014R	0.14	0.0055		1	1	25
5100015R	0.15	0.0059	97	1	1	25
5100016R	0.16	0.0063	96	1	1.4	25
5100017R	0.17	0.0067	95	1	1.4	25
5100018R	0.18	0.0071	94	1	1.4	25
5100019R	0.19	0.0075	93	1	1.4	25
5100020R	0.20	0.0079	92	1	1.8	25
5100021R	0.21	0.0083	91	1	1.8	25
5100022R	0.22	0.0087	90	1	1.8	25
5100023R	0.23	0.0091	89	1	1.8	25
5100024R	0.24	0.0094	88	1	1.8	25
5100025R	0.25	0.0098		1	2.2	25
5100026R	0.26	0.0102		1	2.2	25
5100027R	0.27	0.0106	86	1	2.2	25
5100028R	0.28	0.0110	85	1	2.2	25
5100029R	0.29	0.0114	84	1	2.2	25
5100030R	0.30	0.0118		1	2.2	25
5100031R	0.31	0.0122		1	2.8	25
5100032R	0.32	0.0126	82	1	2.8	25
5100033R	0.33	0.0130	81	1	2.8	25
5100034R	0.34	0.0134	80	1	2.8	25
5100035R	0.35	0.0138		1	2.8	25
5100036R	0.36	0.0142		1	2.8	25
5100037R	0.37	0.0146	79	1	2.8	25

Drill Sizes 0.10 - 0.65 mm

Order Number	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)
5100038R	0.38	0.0150		1	2.8	25
5100039R	0.39	0.0154		1	2.8	25
5100040R	0.40	0.0157		1	3.2	25
5100041R	0.41	0.0161	78	1	3.2	25
5100042R	0.42	0.0165		1	3.2	25
5100043R	0.43	0.0169		1	3.2	25
5100044R	0.44	0.0173		1	3.2	25
5100045R	0.45	0.0177		1	3.2	25
5100046R	0.46	0.0181	77	1	3.6	25
5100047R	0.47	0.0185		1	3.6	25
5100048R	0.48	0.0189		1	3.6	25
5100049R	0.49	0.0193		1	3.6	25
5100050R	0.50	0.0197		1	3.6	25
5100051R	0.51	0.0201	76	1.5	4	25
5100052R	0.52	0.0205		1.5	4	25
5100053R	0.53	0.0209	75	1.5	4	25
5100054R	0.54	0.0213		1.5	4	25
5100055R	0.55	0.0217		1.5	4	25
5100056R	0.56	0.0220		1.5	4.5	25
5100057R	0.57	0.0224	74	1.5	4.5	25
5100058R	0.58	0.0228		1.5	4.5	25
5100059R	0.59	0.0232		1.5	4.5	25
5100060R	0.60	0.0236		1.5	4.5	25
5100061R	0.61	0.0240	73	1.5	4.7	25
5100062R	0.62	0.0244		1.5	4.7	25
5100063R	0.63	0.0248	72	1.5	4.7	25
5100064R	0.64	0.0252		1.5	4.7	25
5100065R	0.65	0.0256		1.5	4.7	25

5100 Series Continued

5100 HSS-E Cobalt 8%

Order Number	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)
5100066R	0.66	0.0260	71	1.5	4.7	25
5100067R	0.67	0.0264		1.5	4.7	25
5100068R	0.68	0.0268		1.5	5.2	25
5100069R	0.69	0.0272		1.5	5.2	25
5100070R	0.70	0.0276		1.5	5.2	25
5100071R	0.71	0.0280	70	1.5	5.2	25
5100072R	0.72	0.0283		1.5	5.2	25
5100073R	0.73	0.0287		1.5	5.2	25
5100074R	0.74	0.0291	69	1.5	5.2	25
5100075R	0.75	0.0295		1.5	5.2	25
5100076R	0.76	0.0299		1.5	5.5	25
5100077R	0.77	0.0303		1.5	5.5	25
5100078R	0.78	0.0307		1.5	5.5	25
5100079R	0.79	0.0311	68 - 1/32	1.5	5.5	25
5100080R	0.80	0.0315		1.5	5.5	25
5100081R	0.81	0.0319	67	1.5	5.5	25
5100082R	0.82	0.0323		1.5	5.5	25
5100083R	0.83	0.0327		1.5	5.5	25
5100084R	0.84	0.0331	66	1.5	5.5	25
5100085R	0.85	0.0335		1.5	5.5	25
5100086R	0.86	0.0339		1.5	6	25
5100087R	0.87	0.0343		1.5	6	25
5100088R	0.88	0.0346		1.5	6	25
5100089R	0.89	0.0350	65	1.5	6	25
5100090R	0.90	0.0354		1.5	6	25
5100091R	0.91	0.0358	64	1.5	6	25
5100092R	0.92	0.0362		1.5	6	25
5100093R	0.93	0.0366		1.5	6	25
5100094R	0.94	0.0370	63	1.5	6	25
5100095R	0.95	0.0374		1.5	6	25
5100096R	0.96	0.0378	62	1.5	6.5	25
5100097R	0.97	0.0382		1.5	6.5	25
5100098R	0.98	0.0386		1.5	6.5	25
5100099R	0.99	0.0390	61	1.5	6.5	25
5100100R	1.00	0.0394		1.5	6.5	25
5100101R	1.01	0.0398	60	1.5	6.5	25
5100102R	1.02	0.0402		1.5	6.5	25
5100103R	1.03	0.0406		1.5	6.5	25
5100104R	1.04	0.0409	59	1.5	6.5	25
5100105R	1.05	0.0413		1.5	6.5	25
5100106R	1.06	0.0417		1.5	7	25
5100107R	1.07	0.0421	58	1.5	7	25
5100108R	1.08	0.0425		1.5	7	25
5100109R	1.09	0.0429	57	1.5	7	25
5100110R	1.10	0.0433		1.5	7	25
5100111R	1.11	0.0437		1.5	7	25
5100112R	1.12	0.0441		1.5	7	25

SOLD IN 10 PIECE PACKAGES ONLY

Drill Sizes 0.66 - 1.59 mm

Order Number	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)
5100113R	1.13	0.0445		1.5	7	25
5100114R	1.14	0.0449		1.5	7	25
5100115R	1.15	0.0453		1.5	7	25
5100116R	1.16	0.0457		1.5	7.5	25
5100117R	1.17	0.0461		1.5	7.5	25
5100118R	1.18	0.0465	56	1.5	7.5	25
5100119R	1.19	0.0469	3/64	1.5	7.5	25
5100120R	1.20	0.0472		1.5	7.5	25
5100121R	1.21	0.0476		1.5	7.5	25
5100122R	1.22	0.0480		1.5	7.5	25
5100123R	1.23	0.0484		1.5	7.5	25
5100124R	1.24	0.0488		1.5	7.5	25
5100125R	1.25	0.0492		1.5	7.5	25
5100126R	1.26	0.0496		1.5	7.5	25
5100127R	1.27	0.0500		1.5	7.5	25
5100128R	1.28	0.0504		1.5	7.5	25
5100129R	1.29	0.0508		1.5	7.5	25
5100130R	1.30	0.0512		1.5	7.5	25
5100131R	1.31	0.0516		1.5	8.5	25
5100132R	1.32	0.0520	55	1.5	8.5	25
5100133R	1.33	0.0524		1.5	8.5	25
5100134R	1.34	0.0528		1.5	8.5	25
5100135R	1.35	0.0531		1.5	8.5	25
5100136R	1.36	0.0535		1.5	8.5	25
5100137R	1.37	0.0539		1.5	8.5	25
5100138R	1.38	0.0543		1.5	8.5	25
5100139R	1.39	0.0547		1.5	8.5	25
5100140R	1.40	0.0551	54	1.5	8.5	25
5100141R	1.41	0.0555		1.5	8.5	25
5100142R	1.42	0.0559		1.5	8.5	25
5100143R	1.43	0.0563		1.5	8.5	25
5100144R	1.44	0.0567		1.5	8.5	25
5100145R	1.45	0.0571		1.5	8.5	25
5100146R	1.46	0.0575		1.5	8.5	25
5100147R	1.47	0.0579		1.5	8.5	25
5100148R	1.48	0.0583		1.5	8.5	25
5100149R	1.49	0.0587		1.5	8.5	25
5100150R	1.50	0.0591		2	10	35
5100151R	1.51	0.0594	53	2	10	35
5100152R	1.52	0.0598		2	10	35
5100153R	1.53	0.0602		2	10	35
5100154R	1.54	0.0606		2	10	35
5100155R	1.55	0.0610		2	10	35
5100156R	1.56	0.0614		2	10	35
5100157R	1.57	0.0618		2	10	35
5100158R	1.58	0.0622		2	10	35
5100159R	1.59	0.0626	1/16	2	10	35

5100 Series Continued

5100 HSS-E Cobalt 8%

Drill Sizes 1.60 - 2.53 mm

Order Number	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)
5100160R	1.60	0.0630		2	10	35
5100161R	1.61	0.0634	52	2	10	35
5100162R	1.62	0.0638		2	10	35
5100163R	1.63	0.0642		2	10	35
5100164R	1.64	0.0646		2	10	35
5100165R	1.65	0.0650		2	10	35
5100166R	1.66	0.0654		2	10	35
5100167R	1.67	0.0657		2	10	35
5100168R	1.68	0.0661		2	10	35
5100169R	1.69	0.0665		2	10	35
5100170R	1.70	0.0669	51	2	10	35
5100171R	1.71	0.0673		2	10	35
5100172R	1.72	0.0677		2	10	35
5100173R	1.73	0.0681		2	10	35
5100174R	1.74	0.0685		2	10	35
5100175R	1.75	0.0689		2	10	35
5100176R	1.76	0.0693		2	10	35
5100177R	1.77	0.0697		2	11	35
5100178R	1.78	0.0701	50	2	11	35
5100179R	1.79	0.0705		2	11	35
5100180R	1.80	0.0709		2	11	35
5100181R	1.81	0.0713		2	11	35
5100182R	1.82	0.0717		2	11	35
5100183R	1.83	0.0720		2	11	35
5100184R	1.84	0.0724		2	11	35
5100185R	1.85	0.0728	49	2	11	35
5100186R	1.86	0.0732		2	11	35
5100187R	1.87	0.0736		2	11	35
5100188R	1.88	0.0740		2	11	35
5100189R	1.89	0.0744		2	11	35
5100190R	1.90	0.0748		2	11	35
5100191R	1.91	0.0752		2	11	35
5100192R	1.92	0.0756		2	11	35
5100193R	1.93	0.0760	48	2	11	35
5100194R	1.94	0.0764		2	11	35
5100195R	1.95	0.0768		2	11	35
5100196R	1.96	0.0772		2	11	35
5100197R	1.97	0.0776		2	11	35
5100198R	1.98	0.0780	5/64	2	11	35
5100199R	1.99	0.0783	47	2	11	35
5100200R	2.00	0.0787		2	11	35
5100201R	2.01	0.0791		2.5	12	35
5100202R	2.02	0.0795		2.5	12	35
5100203R	2.03	0.0799		2.5	12	35
5100204R	2.04	0.0803		2.5	12	35
5100205R	2.05	0.0807		2.5	12	35
5100206R	2.06	0.0811	46	2.5	12	35
5100207R	2.07	0.0815		2.5	12	35
5100208R	2.08	0.0819	45	2.5	12	35
5100209R	2.09	0.0823		2.5	12	35
5100210R	2.10	0.0827		2.5	12	35
5100211R	2.11	0.0831		2.5	12	35
5100212R	2.12	0.0835		2.5	12	35
5100213R	2.13	0.0839		2.5	12	35
5100214R	2.14	0.0843		2.5	12	35
5100215R	2.15	0.0846		2.5	12	35
5100216R	2.16	0.0850		2.5	12	35
5100217R	2.17	0.0854		2.5	12	35
5100218R	2.18	0.0858	44	2.5	12	35
5100219R	2.19	0.0862		2.5	12	35
5100220R	2.20	0.0866		2.5	12	35
5100221R	2.21	0.0870		2.5	14	35
5100222R	2.22	0.0874		2.5	14	35
5100223R	2.23	0.0878		2.5	14	35
5100224R	2.24	0.0882		2.5	14	35
5100225R	2.25	0.0886		2.5	14	35
5100226R	2.26	0.0890	43	2.5	14	35
5100227R	2.27	0.0894		2.5	14	35
5100228R	2.28	0.0898		2.5	14	35
5100229R	2.29	0.0902		2.5	14	35
5100230R	2.30	0.0906		2.5	14	35
5100231R	2.31	0.0909		2.5	14	35
5100232R	2.32	0.0913		2.5	14	35
5100233R	2.33	0.0917		2.5	14	35
5100234R	2.34	0.0921		2.5	14	35
5100235R	2.35	0.0925		2.5	14	35
5100236R	2.36	0.0929		2.5	14	35
5100237R	2.37	0.0933		2.5	14	35
5100238R	2.38	0.0937	3/32	2.5	14	35
5100239R	2.39	0.0941		2.5	14	35
5100240R	2.40	0.0945		2.5	14	35
5100241R	2.41	0.0949		2.5	14	35
5100242R	2.42	0.0953		2.5	14	35
5100243R	2.43	0.0957		2.5	14	35
5100244R	2.44	0.0961	41	2.5	14	35
5100245R	2.45	0.0965		2.5	14	35
5100246R	2.46	0.0969		2.5	14	35
5100247R	2.47	0.0972		2.5	14	35
5100248R	2.48	0.0976		2.5	14	35
5100249R	2.49	0.0980	40	2.5	14	35
5100250R	2.50	0.0984		2.5	14	35
5100251R	2.51	0.0988		3	16	40
5100252R	2.52	0.0992		3	16	40
5100253R	2.53	0.0996	39	3	16	40

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5100 Series Continued

5100 HSS-E Cobalt 8%

Drill Sizes 2.54 - 3.00 mm

Order Number	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)
5100254R	2.54	0.1000		3	16	40
5100255R	2.55	0.1004		3	16	40
5100256R	2.56	0.1008		3	16	40
5100257R	2.57	0.1012		3	16	40
5100258R	2.58	0.1016	38	3	16	40
5100259R	2.59	0.1020		3	16	40
5100260R	2.60	0.1024		3	16	40
5100261R	2.61	0.1028		3	16	40
5100262R	2.62	0.1031		3	16	40
5100263R	2.63	0.1035		3	16	40
5100264R	2.64	0.1039	37	3	16	40
5100265R	2.65	0.1043		3	16	40
5100266R	2.66	0.1047		3	16	40
5100267R	2.67	0.1051		3	16	40
5100268R	2.68	0.1055		3	16	40
5100269R	2.69	0.1059		3	16	40
5100270R	2.70	0.1063	36	3	16	40
5100271R	2.71	0.1067		3	16	40
5100272R	2.72	0.1071		3	16	40
5100273R	2.73	0.1075		3	16	40
5100274R	2.74	0.1079		3	16	40
5100275R	2.75	0.1083		3	16	40
5100276R	2.76	0.1087		3	18	40
5100277R	2.77	0.1091		3	18	40
5100278R	2.78	0.1094	7/64	3	18	40
5100279R	2.79	0.1098	35	3	18	40
5100280R	2.80	0.1102		3	18	40
5100281R	2.81	0.1106		3	18	40
5100282R	2.82	0.1110	34	3	18	40
5100283R	2.83	0.1114		3	18	40
5100284R	2.84	0.1118		3	18	40
5100285R	2.85	0.1122		3	18	40
5100286R	2.86	0.1126		3	18	40
5100287R	2.87	0.1130	33	3	18	40
5100288R	2.88	0.1134		3	18	40
5100289R	2.89	0.1138		3	18	40
5100290R	2.90	0.1142		3	18	40
5100291R	2.91	0.1146		3	18	40
5100292R	2.92	0.1150		3	18	40
5100293R	2.93	0.1154		3	18	40
5100294R	2.94	0.1157		3	18	40
5100295R	2.95	0.1161	32	3	18	40
5100296R	2.96	0.1165		3	18	40
5100297R	2.97	0.1169		3	18	40
5100298R	2.98	0.1173		3	18	40
5100299R	2.99	0.1177		3	18	40
5100300R	3.00	0.1181		3	18	40

SOLD IN 10 PIECE PACKAGES ONLY

5100 HSS-E Cobalt 8%

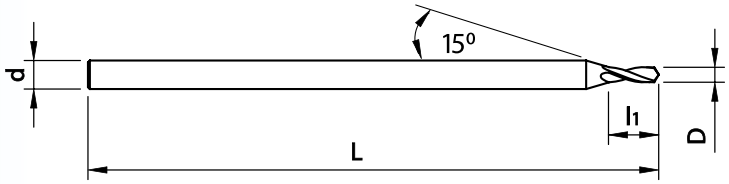
- *For materials with long forming chips, steel up to 35 RHC, Copper, Stainless, Titanium*
- *Amazing dimension control at h6, h4 & h3 μm tolerances*
- *Ultra-fine surface finish for smooth operation*
- *Superb heat treating for outstanding performance & long tool life*
- *Coatings available upon request*

6140 Series
Solid Carbide
2-3 x D, Center Cut – Pilot – Spot Drills 120°

h6 + 0.000
- 0.006 mm

FOR USE PRIOR TO USING 6120 & 6100 SERIES DRILLS. CAN ALSO BE USED AS A DRILL WITH 2-3 X D DEEP
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 0.92 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.
- Coatings Available upon request.
- Minimum Special Order is 10 Pieces / Spec.
- Lead-Time on Specials – 3 Weeks ARO.



OAL Range 30 - 38 mm

SOLD IN 10 PIECE PACKAGES ONLY

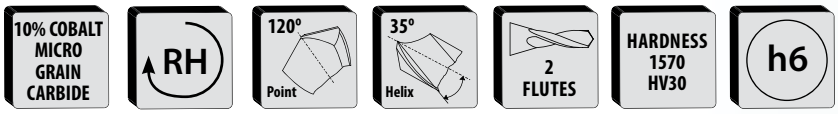
Drill Sizes 0.20 - 3.00 mm

Order Number	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)
6140020R	0.20	0.0079	92	1.5	0.9	30
6140025R	0.25	0.0098		1.5	0.9	30
6140030R	0.30	0.0118		1.5	0.9	30
6140035R	0.35	0.0138		1.5	1.2	30
6140040R	0.40	0.0157		1.5	1.5	30
6140045R	0.45	0.0177		1.5	1.5	30
6140050R	0.50	0.0197		1.5	1.9	30
6140055R	0.55	0.0217		1.5	1.9	30
6140060R	0.60	0.0236		1.5	1.9	30
6140065R	0.65	0.0256		1.5	2.1	30
6140070R	0.70	0.0276		1.5	2.4	30
6140075R	0.75	0.0295		1.5	2.4	30
6140080R	0.80	0.0315		1.5	2.6	30
6140085R	0.85	0.0335		1.5	2.6	30
6140090R	0.90	0.0354		1.5	3	30
6140095R	0.95	0.0374		1.5	3	30
6140100R	1.00	0.0394		1.5	3.4	30
6140105R	1.05	0.0413		1.5	3.4	30
6140110R	1.10	0.0433		1.5	3.8	30
6140115R	1.15	0.0453		1.5	3.8	30
6140120R	1.20	0.0472		1.5	4.2	30

Order Number	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)
6140125R	1.25	0.0492		1.5	4.2	30
6140130R	1.30	0.0512		1.5	4.2	30
6140135R	1.35	0.0531		1.5	4.7	30
6140140R	1.40	0.0551	54	1.5	4.7	30
6140145R	1.45	0.0571		1.5	4.7	30
6140150R	1.50	0.0591		2	4.7	38
6140160R	1.60	0.0630	51	2	5.4	38
6140170R	1.70	0.0669		2	5.4	38
6140180R	1.80	0.0709		2	6.5	38
6140190R	1.90	0.0748		2	6.5	38
6140200R	2.00	0.0787		3	6.5	38
6140210R	2.10	0.0827		3	6.5	38
6140220R	2.20	0.0866		3	6.5	38
6140230R	2.30	0.0906		3	6.5	38
6140240R	2.40	0.0945		3	6.5	38
6140250R	2.50	0.0984		3	7.5	38
6140260R	2.60	0.1024		3	7.5	38
6140270R	2.70	0.1063		3	7.5	38
6140280R	2.80	0.1102		3	7.5	38
6140290R	2.90	0.1142		3	7.5	38
6140300R	3.00	0.1181		3	7.5	38

6120 Series
Solid Carbide

4-5 x *D* – Depth of Cut 120°

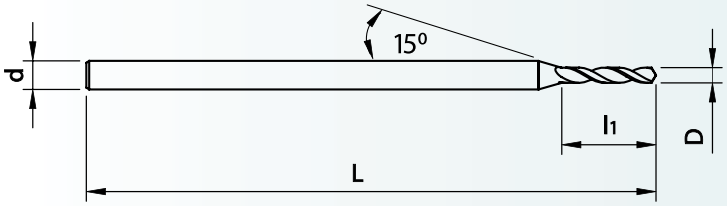


h6 + 0.000 - 0.006 mm

FOR MEDIUM TO HIGH TENSILE STRENGTH STEEL, STAINLESS, TITANIUM ALLOYS & 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 1.255 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.
- Coatings Available upon request.
- Minimum Special Order is 10 Pieces / Spec.
- Lead-Time on Specials – 3 Weeks ARO.



OAL Range 25 - 38 mm

SOLD IN 10 PIECE PACKAGES ONLY

Order Number	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)
6120020R	0.20	0.0079	92	1	1.1	25
6120021R	0.21	0.0083	91	1	1.1	25
6120022R	0.22	0.0087	90	1	1.1	25
6120023R	0.23	0.0091	89	1	1.1	25
6120024R	0.24	0.0094	88	1	1.1	25
6120025R	0.25	0.0098		1	1.3	25
6120026R	0.26	0.0102		1	1.3	25
6120027R	0.27	0.0106	86	1	1.3	25
6120028R	0.28	0.0110	85	1	1.3	25
6120029R	0.29	0.0114	84	1	1.3	25
6120030R	0.30	0.0118		1	1.6	25
6120031R	0.31	0.0122		1	1.6	25
6120032R	0.32	0.0126	82	1	1.6	25
6120033R	0.33	0.0130	81	1	1.6	25
6120034R	0.34	0.0134	80	1	1.6	25
6120035R	0.35	0.0138		1	1.6	25
6120036R	0.36	0.0142		1	1.6	25
6120037R	0.37	0.0146	79	1	1.6	25
6120038R	0.38	0.0150		1	1.6	25
6120039R	0.39	0.0154		1	2	25
6120040R	0.40	0.0157		1	2	25
6120041R	0.41	0.0161	78	1	2	25
6120042R	0.42	0.0165		1	2	25
6120043R	0.43	0.0169		1	2	25
6120044R	0.44	0.0173		1	2	25
6120045R	0.45	0.0177		1	2	25

Drill Sizes 0.20 - 0.71 mm

Order Number	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)
6120046R	0.46	0.0181	77	1	2	25
6120047R	0.47	0.0185		1	2	25
6120048R	0.48	0.0189		1	2	25
6120049R	0.49	0.0193		1	2	25
6120050R	0.50	0.0197		1	2.4	25
6120051R	0.51	0.0201	76	1	2.4	25
6120052R	0.52	0.0205		1	2.4	25
6120053R	0.53	0.0209	75	1	2.4	25
6120054R	0.54	0.0213		1	2.8	25
6120055R	0.55	0.0217		1	2.8	25
6120056R	0.56	0.0220		1	2.8	25
6120057R	0.57	0.0224	74	1	2.8	25
6120058R	0.58	0.0228		1	2.8	25
6120059R	0.59	0.0232		1	2.8	25
6120060R	0.60	0.0236		1.5	2.8	30
6120061R	0.61	0.0240	73	1.5	3.3	30
6120062R	0.62	0.0244		1.5	3.3	30
6120063R	0.63	0.0248	72	1.5	3.3	30
6120064R	0.64	0.0252		1.5	3.3	30
6120065R	0.65	0.0256		1.5	3.3	30
6120066R	0.66	0.0260	71	1.5	3.3	30
6120067R	0.67	0.0264		1.5	3.3	30
6120068R	0.68	0.0268		1.5	3.8	30
6120069R	0.69	0.0272		1.5	3.8	30
6120070R	0.70	0.0276		1.5	3.8	30
6120071R	0.71	0.0280	70	1.5	3.8	30

6120 Series Continued

6120 Series Solid Carbide

Drill Sizes 0.72 - 1.65 mm

Order Number	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)
6120072R	0.72	0.0283		1.5	3.8	30
6120073R	0.73	0.0287		1.5	3.8	30
6120074R	0.74	0.0291	69	1.5	3.8	30
6120075R	0.75	0.0295		1.5	3.8	30
6120076R	0.76	0.0299		1.5	4.2	30
6120077R	0.77	0.0303		1.5	4.2	30
6120078R	0.78	0.0307		1.5	4.2	30
6120079R	0.79	0.0311	68 - 1/32	1.5	4.2	30
6120080R	0.80	0.0315		1.5	4.4	30
6120081R	0.81	0.0319	67	1.5	4.4	30
6120082R	0.82	0.0323		1.5	4.4	30
6120083R	0.83	0.0327		1.5	4.4	30
6120084R	0.84	0.0331	66	1.5	4.4	30
6120085R	0.85	0.0335		1.5	4.4	30
6120086R	0.86	0.0339		1.5	4.8	30
6120087R	0.87	0.0343		1.5	4.8	30
6120088R	0.88	0.0346		1.5	4.8	30
6120089R	0.89	0.0350	65	1.5	4.8	30
6120090R	0.90	0.0354		1.5	4.8	30
6120091R	0.91	0.0358	64	1.5	4.8	30
6120092R	0.92	0.0362		1.5	4.8	30
6120093R	0.93	0.0366		1.5	4.8	30
6120094R	0.94	0.0370	63	1.5	4.8	30
6120095R	0.95	0.0374		1.5	4.8	30
6120096R	0.96	0.0378	62	1.5	4.8	30
6120097R	0.97	0.0382		1.5	4.8	30
6120098R	0.98	0.0386		1.5	4.8	30
6120099R	0.99	0.0390	61	1.5	4.8	30
6120100R	1.00	0.0394		1.5	4.8	30
6120101R	1.01	0.0398	60	1.5	4.8	30
6120102R	1.02	0.0402		1.5	4.8	30
6120103R	1.03	0.0406		1.5	4.8	30
6120104R	1.04	0.0409	59	1.5	4.8	30
6120105R	1.05	0.0413		1.5	4.8	30
6120106R	1.06	0.0417		1.5	4.8	30
6120107R	1.07	0.0421	58	1.5	4.8	30
6120108R	1.08	0.0425		1.5	4.8	30
6120109R	1.09	0.0429	57	1.5	4.8	30
6120110R	1.10	0.0433		1.5	5.4	30
6120111R	1.11	0.0437		1.5	5.4	30
6120112R	1.12	0.0441		1.5	5.4	30
6120113R	1.13	0.0445		1.5	5.4	30
6120114R	1.14	0.0449		1.5	5.4	30
6120115R	1.15	0.0453		1.5	5.4	30
6120116R	1.16	0.0457		1.5	5.4	30
6120117R	1.17	0.0461		1.5	5.4	30
6120118R	1.18	0.0465	56	1.5	5.4	30
6120119R	1.19	0.0469	3/64	1.5	5.4	30
6120120R	1.20	0.0472		1.5	6	30
6120121R	1.21	0.0476		1.5	6	30
6120122R	1.22	0.0480		1.5	6	30
6120123R	1.23	0.0484		1.5	6	30
6120124R	1.24	0.0488		1.5	6	30
6120125R	1.25	0.0492		1.5	6	30
6120126R	1.26	0.0496		1.5	6	30
6120127R	1.27	0.0500		1.5	6	30
6120128R	1.28	0.0504		1.5	6	30
6120129R	1.29	0.0508		1.5	6	30
6120130R	1.30	0.0512		1.5	6.7	30
6120131R	1.31	0.0516		1.5	6.7	30
6120132R	1.32	0.0520	55	1.5	6.7	30
6120133R	1.33	0.0524		1.5	6.7	30
6120134R	1.34	0.0528		1.5	6.7	30
6120135R	1.35	0.0531		1.5	6.7	30
6120136R	1.36	0.0535		1.5	6.7	30
6120137R	1.37	0.0539		1.5	6.7	30
6120138R	1.38	0.0543		1.5	6.7	30
6120139R	1.39	0.0547		1.5	6.7	30
6120140R	1.40	0.0551	54	1.5	6.7	30
6120141R	1.41	0.0555		1.5	6.7	30
6120142R	1.42	0.0559		1.5	6.7	30
6120143R	1.43	0.0563		1.5	6.7	30
6120144R	1.44	0.0567		1.5	6.7	30
6120145R	1.45	0.0571		1.5	6.7	30
6120146R	1.46	0.0575		1.5	6.7	30
6120147R	1.47	0.0579		1.5	6.7	30
6120148R	1.48	0.0583		1.5	6.7	30
6120149R	1.49	0.0587		1.5	6.7	30
6120150R	1.50	0.0591		2	7.2	38
6120151R	1.51	0.0594	53	2	7.2	38
6120152R	1.52	0.0598		2	7.2	38
6120153R	1.53	0.0602		2	7.2	38
6120154R	1.54	0.0606		2	7.2	38
6120155R	1.55	0.0610		2	7.2	38
6120156R	1.56	0.0614		2	7.2	38
6120157R	1.57	0.0618		2	7.2	38
6120158R	1.58	0.0622		2	7.2	38
6120159R	1.59	0.0626	1/16	2	7.2	38
6120160R	1.60	0.0630		2	7.2	38
6120161R	1.61	0.0634	52	2	7.2	38
6120162R	1.62	0.0638		2	7.2	38
6120163R	1.63	0.0642		2	7.2	38
6120164R	1.64	0.0646		2	7.2	38
6120165R	1.65	0.0650		2	7.2	38

SOLD IN 10 PIECE PACKAGES ONLY

6120 Series Continued

6120 Series Solid Carbide

Drill Sizes 1.66 - 2.59 mm

Order Number	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)
6120166R	1.66	0.0654		2	7.2	38
6120167R	1.67	0.0657		2	7.2	38
6120168R	1.68	0.0661		2	7.2	38
6120169R	1.69	0.0665		2	7.2	38
6120170R	1.70	0.0669	51	2	7.2	38
6120171R	1.71	0.0673		2	7.2	38
6120172R	1.72	0.0677		2	7.2	38
6120173R	1.73	0.0681		2	7.2	38
6120174R	1.74	0.0685		2	7.2	38
6120175R	1.75	0.0689		2	7.2	38
6120176R	1.76	0.0693		2	7.2	38
6120177R	1.77	0.0697		2	7.2	38
6120178R	1.78	0.0701	50	2	7.2	38
6120179R	1.79	0.0705		2	7.2	38
6120180R	1.80	0.0709		2	8.4	38
6120181R	1.81	0.0713		2	8.4	38
6120182R	1.82	0.0717		2	8.4	38
6120183R	1.83	0.0720		2	8.4	38
6120184R	1.84	0.0724		2	8.4	38
6120185R	1.85	0.0728	49	2	8.4	38
6120186R	1.86	0.0732		2	8.4	38
6120187R	1.87	0.0736		2	8.4	38
6120188R	1.88	0.0740		2	8.4	38
6120189R	1.89	0.0744		2	8.4	38
6120190R	1.90	0.0748		2	8.4	38
6120191R	1.91	0.0752		2	8.4	38
6120192R	1.92	0.0756		2	8.4	38
6120193R	1.93	0.0760	48	2	8.4	38
6120194R	1.94	0.0764		2	8.4	38
6120195R	1.95	0.0768		2	8.4	38
6120196R	1.96	0.0772		2	8.4	38
6120197R	1.97	0.0776		2	8.4	38
6120198R	1.98	0.0780	5/64	2	8.4	38
6120199R	1.99	0.0783	47	2	8.4	38
6120200R	2.00	0.0787		3	12	38
6120201R	2.01	0.0791		3	12	38
6120202R	2.02	0.0795		3	12	38
6120203R	2.03	0.0799		3	12	38
6120204R	2.04	0.0803		3	12	38
6120205R	2.05	0.0807		3	12	38
6120206R	2.06	0.0811	46	3	12	38
6120207R	2.07	0.0815		3	12	38
6120208R	2.08	0.0819	45	3	12	38
6120209R	2.09	0.0823		3	12	38
6120210R	2.10	0.0827		3	12	38
6120211R	2.11	0.0831		3	12	38
6120212R	2.12	0.0835		3	12	38
6120213R	2.13	0.0839		3	12	38
6120214R	2.14	0.0843		3	12	38
6120215R	2.15	0.0846		3	12	38
6120216R	2.16	0.0850		3	12	38
6120217R	2.17	0.0854		3	12	38
6120218R	2.18	0.0858	44	3	12	38
6120219R	2.19	0.0862		3	12	38
6120220R	2.20	0.0866		3	12	38
6120221R	2.21	0.0870		3	12	38
6120222R	2.22	0.0874		3	12	38
6120223R	2.23	0.0878		3	12	38
6120224R	2.24	0.0882		3	12	38
6120225R	2.25	0.0886		3	12	38
6120226R	2.26	0.0890	43	3	12	38
6120227R	2.27	0.0894		3	12	38
6120228R	2.28	0.0898		3	12	38
6120229R	2.29	0.0902		3	12	38
6120230R	2.30	0.0906		3	12	38
6120231R	2.31	0.0909		3	12	38
6120232R	2.32	0.0913		3	12	38
6120233R	2.33	0.0917		3	12	38
6120234R	2.34	0.0921		3	12	38
6120235R	2.35	0.0925		3	12	38
6120236R	2.36	0.0929		3	12	38
6120237R	2.37	0.0933		3	12	38
6120238R	2.38	0.0937	3/32	3	12	38
6120239R	2.39	0.0941		3	12	38
6120240R	2.40	0.0945		3	12	38
6120241R	2.41	0.0949		3	12	38
6120242R	2.42	0.0953		3	12	38
6120243R	2.43	0.0957		3	12	38
6120244R	2.44	0.0961	41	3	12	38
6120245R	2.45	0.0965		3	12	38
6120246R	2.46	0.0969		3	12	38
6120247R	2.47	0.0972		3	12	38
6120248R	2.48	0.0976		3	12	38
6120249R	2.49	0.0980	40	3	12	38
6120250R	2.50	0.0984		3	14	38
6120251R	2.51	0.0988		3	14	38
6120252R	2.52	0.0992		3	14	38
6120253R	2.53	0.0996	39	3	14	38
6120254R	2.54	0.1000		3	14	38
6120255R	2.55	0.1004		3	14	38
6120256R	2.56	0.1008		3	14	38
6120257R	2.57	0.1012		3	14	38
6120258R	2.58	0.1016	38	3	14	38
6120259R	2.59	0.1020		3	14	38

SOLD IN 10 PIECE PACKAGES ONLY

6120 Series Continued

6120 Series Solid Carbide

Drill Sizes 2.60 - 3.00 mm

Order Number	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)
6120260R	2.60	0.1024		3	14	38
6120261R	2.61	0.1028		3	14	38
6120262R	2.62	0.1031		3	14	38
6120263R	2.63	0.1035		3	14	38
6120264R	2.64	0.1039	37	3	14	38
6120265R	2.65	0.1043		3	14	38
6120266R	2.66	0.1047		3	14	38
6120267R	2.67	0.1051		3	14	38
6120268R	2.68	0.1055		3	14	38
6120269R	2.69	0.1059		3	14	38
6120270R	2.70	0.1063	36	3	14	38
6120271R	2.71	0.1067		3	14	38
6120272R	2.72	0.1071		3	14	38
6120273R	2.73	0.1075		3	14	38
6120274R	2.74	0.1079		3	14	38
6120275R	2.75	0.1083		3	14	38
6120276R	2.76	0.1087		3	14	38
6120277R	2.77	0.1091		3	14	38
6120278R	2.78	0.1094	7/64	3	14	38
6120279R	2.79	0.1098	35	3	14	38
6120280R	2.80	0.1102		3	14	38

Order Number	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)
6120281R	2.81	0.1106		3	14	38
6120282R	2.82	0.1110	34	3	14	38
6120283R	2.83	0.1114		3	14	38
6120284R	2.84	0.1118		3	14	38
6120285R	2.85	0.1122		3	14	38
6120286R	2.86	0.1126		3	14	38
6120287R	2.87	0.1130	33	3	14	38
6120288R	2.88	0.1134		3	14	38
6120289R	2.89	0.1138		3	14	38
6120290R	2.90	0.1142		3	14	38
6120291R	2.91	0.1146		3	14	38
6120292R	2.92	0.1150		3	14	38
6120293R	2.93	0.1154		3	14	38
6120294R	2.94	0.1157		3	14	38
6120295R	2.95	0.1161	32	3	14	38
6120296R	2.96	0.1165		3	14	38
6120297R	2.97	0.1169		3	14	38
6120298R	2.98	0.1173		3	14	38
6120299R	2.99	0.1177		3	14	38
6120300R	3.00	0.1181		3	14	38

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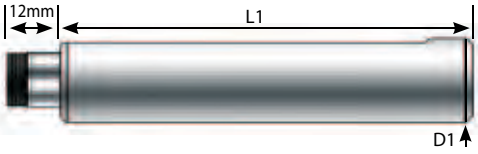
Advanced Precision Micro Tool Holders

Extreme Concentricity for Micro Drills TIR < .0002"

- *High performance*
- *Tight tolerance*
- *Micro parts production*



Collet Sleeves

Item No.	Description	D1	L1	OAL
HSP-CHK-127-026	CHK Collet Sleeve 1/2" Shank	.500"	26mm	38mm
HSP-CHK-190-076	CHK Collet Sleeve 3/4" Shank	.750"	76mm	90mm
HSP-CHK-254-121	CHK Collet Sleeve 1/2" Shank	1.00"	121mm	133mm

Note: Includes Clamping Nut & Wrench

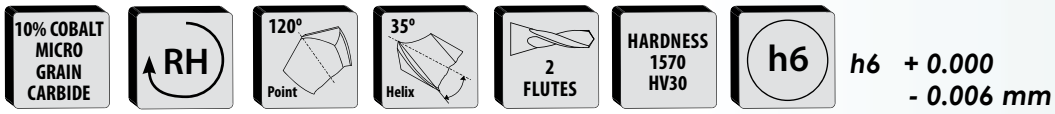
Precision CHK Collets

Item No.	Description
HSP-CHK-1.0	1.0 mm CHK Collet
HSP-CHK-1.5	1.5 mm CHK Collet
HSP-CHK-2.0	2.0 mm CHK Collet
HSP-CHK-2.5	2.5 mm CHK Collet
HSP-CHK-3.0	3.0 mm CHK Collet
HSP-CHK-3.5	3.5 mm CHK Collet

Accessory Componets

Item No.	Description
HSP-CHK - NUT	Precision CHK Collet Clamping Nut
HSP-CHK 14 mm	14 mm Flat Wrench

6100 Series
Solid Carbide 5-7 x *D* – Depth of Cut 120°

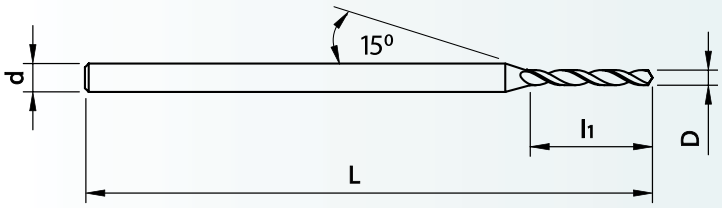


h6 + 0.000 - 0.006 mm

FOR MEDIUM TO HIGH TENSILE STRENGTH STEEL, STAINLESS, TITANIUM ALLOYS & 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 1.255 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.
- Coatings available upon request
- Minimum Special Order is 10 Pieces / Spec.
- Lead-Time on Specials – 3 Weeks ARO.



OAL Range 25 - 38 mm

SOLD IN 10 PIECE PACKAGES ONLY

Order Number	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)
6100010R	0.10	0.0039		1	0.5	25
6100011R	0.11	0.0043		1	0.5	25
6100012R	0.12	0.0047		1	0.5	25
6100013R	0.13	0.0051		1	0.6	25
6100014R	0.14	0.0055		1	0.7	25
6100015R	0.15	0.0059	97	1	1	25
6100016R	0.16	0.0063	96	1	1	25
6100017R	0.17	0.0067	95	1	1	25
6100018R	0.18	0.0071	94	1	1	25
6100019R	0.19	0.0075	93	1	1	25
6100020R	0.20	0.0079	92	1	1.8	25
6100021R	0.21	0.0083	91	1	1.8	25
6100022R	0.22	0.0087	90	1	1.8	25
6100023R	0.23	0.0091	89	1	1.8	25
6100024R	0.24	0.0094	88	1	1.8	25
6100025R	0.25	0.0098		1	2.2	25
6100026R	0.26	0.0102		1	2.2	25
6100027R	0.27	0.0106	86	1	2.2	25
6100028R	0.28	0.0110	85	1	2.2	25
6100029R	0.29	0.0114	84	1	2.2	25
6100030R	0.30	0.0118		1	2.2	25
6100031R	0.31	0.0122		1	2.8	25
6100032R	0.32	0.0126	82	1	2.8	25
6100033R	0.33	0.0130	81	1	2.8	25
6100034R	0.34	0.0134	80	1	2.8	25
6100035R	0.35	0.0138		1	2.8	25

Drill Sizes 0.10 - 0.61 mm

Order Number	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)
6100036R	0.36	0.0142		1	2.8	25
6100037R	0.37	0.0146	79	1	2.8	25
6100038R	0.38	0.0150		1	2.8	25
6100039R	0.39	0.0154		1	3.6	25
6100040R	0.40	0.0157		1	3.6	25
6100041R	0.41	0.0161	78	1	3.6	25
6100042R	0.42	0.0165		1	3.6	25
6100043R	0.43	0.0169		1	3.6	25
6100044R	0.44	0.0173		1	3.6	25
6100045R	0.45	0.0177		1	3.6	25
6100046R	0.46	0.0181	77	1	3.6	25
6100047R	0.47	0.0185		1	3.6	25
6100048R	0.48	0.0189		1	3.6	25
6100049R	0.49	0.0193		1	4	25
6100050R	0.50	0.0197		1	4	25
6100051R	0.51	0.0201	76	1	4	25
6100052R	0.52	0.0205		1	4	25
6100053R	0.53	0.0209	75	1	4	25
6100054R	0.54	0.0213		1	4	25
6100055R	0.55	0.0217		1	4.5	25
6100056R	0.56	0.0220		1	4.5	25
6100057R	0.57	0.0224	74	1	4.5	25
6100058R	0.58	0.0228		1	4.5	25
6100059R	0.59	0.0232		1	4.5	25
6100060R	0.60	0.0236		1.5	4.5	30
6100061R	0.61	0.0240	73	1.5	5	30

6100 Series Continued

6100 Series Solid Carbide

Drill Sizes 0.62 - 1.53 mm

Order Number	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)
6100062R	0.62	0.0244		1.5	5	30
6100063R	0.63	0.0248	72	1.5	5	30
6100064R	0.64	0.0252		1.5	5	30
6100065R	0.65	0.0256		1.5	5	30
6100066R	0.66	0.0260	71	1.5	5	30
6100067R	0.67	0.0264		1.5	5	30
6100068R	0.68	0.0268		1.5	5	30
6100069R	0.69	0.0272		1.5	5.6	30
6100070R	0.70	0.0276		1.5	5.6	30
6100071R	0.71	0.0280	70	1.5	5.6	30
6100072R	0.72	0.0283		1.5	5.6	30
6100073R	0.73	0.0287		1.5	5.6	30
6100074R	0.74	0.0291	69	1.5	5.6	30
6100075R	0.75	0.0295		1.5	5.6	30
6100076R	0.76	0.0299		1.5	6.3	30
6100077R	0.77	0.0303		1.5	6.3	30
6100078R	0.78	0.0307		1.5	6.3	30
6100079R	0.79	0.0311	68 - 1/32	1.5	6.3	30
6100080R	0.80	0.0315		1.5	6.3	30
6100081R	0.81	0.0319	67	1.5	6.3	30
6100082R	0.82	0.0323		1.5	6.3	30
6100083R	0.83	0.0327		1.5	6.3	30
6100084R	0.84	0.0331	66	1.5	6.3	30
6100085R	0.85	0.0335		1.5	6.3	30
6100086R	0.86	0.0339		1.5	7.1	30
6100087R	0.87	0.0343		1.5	7.1	30
6100088R	0.88	0.0346		1.5	7.1	30
6100089R	0.89	0.0350	65	1.5	7.1	30
6100090R	0.90	0.0354		1.5	7.1	30
6100091R	0.91	0.0358	64	1.5	7.1	30
6100092R	0.92	0.0362		1.5	7.1	30
6100093R	0.93	0.0366		1.5	7.1	30
6100094R	0.94	0.0370	63	1.5	7.1	30
6100095R	0.95	0.0374		1.5	7.1	30
6100096R	0.96	0.0378	62	1.5	8	30
6100097R	0.97	0.0382		1.5	8	30
6100098R	0.98	0.0386		1.5	8	30
6100099R	0.99	0.0390	61	1.5	8	30
6100100R	1.00	0.0394		1.5	8	30
6100101R	1.01	0.0398	60	1.5	8	30
6100102R	1.02	0.0402		1.5	8	30
6100103R	1.03	0.0406		1.5	8	30
6100104R	1.04	0.0409	59	1.5	8	30
6100105R	1.05	0.0413		1.5	8	30
6100106R	1.06	0.0417		1.5	9	30
6100107R	1.07	0.0421	58	1.5	9	30
6100108R	1.08	0.0425		1.5	9	30
6100109R	1.09	0.0429	57	1.5	9	30
6100110R	1.10	0.0433		1.5	9	30
6100111R	1.11	0.0437		1.5	9	30
6100112R	1.12	0.0441		1.5	9	30
6100113R	1.13	0.0445		1.5	9	30
6100114R	1.14	0.0449		1.5	9	30
6100115R	1.15	0.0453		1.5	9	30
6100116R	1.16	0.0457		1.5	10	30
6100117R	1.17	0.0461		1.5	10	30
6100118R	1.18	0.0465	56	1.5	10	30
6100119R	1.19	0.0469	3/64	1.5	10	30
6100120R	1.20	0.0472		1.5	10	30
6100121R	1.21	0.0476		1.5	10	30
6100122R	1.22	0.0480		1.5	10	30
6100123R	1.23	0.0484		1.5	10	30
6100124R	1.24	0.0488		1.5	10	30
6100125R	1.25	0.0492		1.5	10	30
6100126R	1.26	0.0496		1.5	10	30
6100127R	1.27	0.0500		1.5	10	30
6100128R	1.28	0.0504		1.5	10	30
6100129R	1.29	0.0508		1.5	10	30
6100130R	1.30	0.0512		1.5	10	30
6100131R	1.31	0.0516		1.5	11.2	30
6100132R	1.32	0.0520	55	1.5	11.2	30
6100133R	1.33	0.0524		1.5	11.2	30
6100134R	1.34	0.0528		1.5	11.2	30
6100135R	1.35	0.0531		1.5	11.2	30
6100136R	1.36	0.0535		1.5	11.2	30
6100137R	1.37	0.0539		1.5	11.2	30
6100138R	1.38	0.0543		1.5	11.2	30
6100139R	1.39	0.0547		1.5	11.2	30
6100140R	1.40	0.0551	54	1.5	11.2	30
6100141R	1.41	0.0555		1.5	11.2	30
6100142R	1.42	0.0559		1.5	11.2	30
6100143R	1.43	0.0563		1.5	11.2	30
6100144R	1.44	0.0567		1.5	11.2	30
6100145R	1.45	0.0571		1.5	11.2	30
6100146R	1.46	0.0575		1.5	11.2	30
6100147R	1.47	0.0579		1.5	11.2	30
6100148R	1.48	0.0583		1.5	11.2	30
6100149R	1.49	0.0587		1.5	11.2	30
6100150R	1.50	0.0591		2	12	38
6100151R	1.51	0.0594	53	2	12	38
6100152R	1.52	0.0598		2	12	38
6100153R	1.53	0.0602		2	12	38

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6100 Series Continued

6100 Series Solid Carbide

Drill Sizes 1.54 - 1.99 mm

Order Number	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)
6100154R	1.54	0.0606		2	12	38
6100155R	1.55	0.0610		2	12	38
6100156R	1.56	0.0614		2	12	38
6100157R	1.57	0.0618		2	12	38
6100158R	1.58	0.0622		2	12	38
6100159R	1.59	0.0626	1/16	2	12	38
6100160R	1.60	0.0630		2	12	38
6100161R	1.61	0.0634	52	2	12	38
6100162R	1.62	0.0638		2	12	38
6100163R	1.63	0.0642		2	12	38
6100164R	1.64	0.0646		2	12	38
6100165R	1.65	0.0650		2	12	38
6100166R	1.66	0.0654		2	12	38
6100167R	1.67	0.0657		2	12	38
6100168R	1.68	0.0661		2	12	38
6100169R	1.69	0.0665		2	12	38
6100170R	1.70	0.0669	51	2	12	38
6100171R	1.71	0.0673		2	12	38
6100172R	1.72	0.0677		2	12	38
6100173R	1.73	0.0681		2	12	38
6100174R	1.74	0.0685		2	12	38
6100175R	1.75	0.0689		2	12	38
6100176R	1.76	0.0693		2	12	38

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Order Number	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)
6100177R	1.77	0.0697		2	12	38
6100178R	1.78	0.0701	50	2	12	38
6100179R	1.79	0.0705		2	12	38
6100180R	1.80	0.0709		2	12	38
6100181R	1.81	0.0713		2	12	38
6100182R	1.82	0.0717		2	12	38
6100183R	1.83	0.0720		2	12	38
6100184R	1.84	0.0724		2	12	38
6100185R	1.85	0.0728	49	2	12	38
6100186R	1.86	0.0732		2	12	38
6100187R	1.87	0.0736		2	12	38
6100188R	1.88	0.0740		2	12	38
6100189R	1.89	0.0744		2	12	38
6100190R	1.90	0.0748		2	12	38
6100191R	1.91	0.0752		2	12	38
6100192R	1.92	0.0756		2	12	38
6100193R	1.93	0.0760	48	2	12	38
6100194R	1.94	0.0764		2	12	38
6100195R	1.95	0.0768		2	12	38
6100196R	1.96	0.0772		2	12	38
6100197R	1.97	0.0776		2	12	38
6100198R	1.98	0.0780	5/64	2	12	38
6100199R	1.99	0.0783	47	2	12	38

For drill sizes 2.00 mm and larger
See our 6120 and 6200 Series

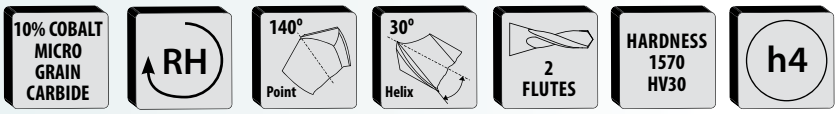
6100 Series Solid Carbide

- *For medium to high tensile strength Steel, Stainless, Titanium Alloys and Cast Iron*
- *Amazing dimension control at h6, h4 & h3 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

h4 Tolerance
Reinforced Shank d 3.0 mm
HIGH PERFORMANCE!



h4 + 0.000
- 0.004 mm

HIGH PERFORMANCE DRILL, WIDE RANGE APPLICATIONS, STEELS, CAST IRON & 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 0.92 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.
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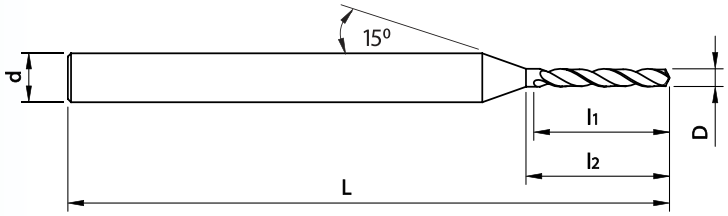
- Minimum Special Order is 10 Pieces / Spec.
- Lead-Time on Specials – 3 Weeks ARO.



OAL 50 mm

Drill Sizes 0.50 - 3.00 mm

Order Number	D flute dia. (mm)	D dec. equiv. flute dia. (inch)	Wire # Frac	d shank dia. (mm)	l1 flute length (mm)	l2 Dlength (mm)	L overall length OAL (mm)
6200050R	0.50	0.0197		3	3.5	4.4	50
6200055R	0.55	0.0217		3	4	5	50
6200060R	0.60	0.0236		3	4.5	5.6	50
6200065R	0.65	0.0256		3	5	6.3	50
6200070R	0.70	0.0276		3	5	6.3	50
6200075R	0.75	0.0295		3	5.5	6.9	50
6200080R	0.80	0.0315		3	5.6	7.2	50
6200085R	0.85	0.0335		3	6	7.6	50
6200090R	0.90	0.0354		3	6.5	8.1	50
6200095R	0.95	0.0374		3	6.7	8.5	50
6200100R	1.00	0.0394		3	7	8.8	50
6200105R	1.05	0.0413		3	7.5	9.4	50
6200110R	1.10	0.0433		3	8	10.1	50
6200115R	1.15	0.0453		3	8.1	10.4	50
6200120R	1.20	0.0472		3	8.5	11	50
6200125R	1.25	0.0492		3	8.9	11.3	50
6200130R	1.30	0.0512		3	9.2	11.7	50
6200135R	1.35	0.0531		3	9.6	12.2	50
6200140R	1.40	0.0551	54	3	10	12.5	50
6200145R	1.45	0.0571		3	10.5	13	50
6200150R	1.50	0.0591		3	10.5	13	50
6200155R	1.55	0.0610		3	11	13.5	50
6200160R	1.60	0.0630		3	11.5	14	50
6200165R	1.65	0.0650		3	12	15	50
6200170R	1.70	0.0669	51	3	12	15	50
6200175R	1.75	0.0689		3	12.5	15.5	50

Order Number	D flute dia. (mm)	D dec. equiv. flute dia. (inch)	Wire # Frac	d shank dia. (mm)	l1 flute length (mm)	l2 Dlength (mm)	L overall length OAL (mm)
6200180R	1.80	0.0709		3	13	16	50
6200185R	1.85	0.0728	49	3	13	16	50
6200190R	1.90	0.0748		3	13.5	17.5	50
6200195R	1.95	0.0768		3	14	18	50
6200200R	2.00	0.0787		3	14	18	50
6200205R	2.05	0.0807		3	14.5	18.5	50
6200210R	2.10	0.0827		3	15	19	50
6200215R	2.15	0.0846		3	15	19	50
6200220R	2.20	0.0866		3	16	20	50
6200225R	2.25	0.0886		3	16	20	50
6200230R	2.30	0.0906		3	16.5	21	50
6200235R	2.35	0.0925		3	16.5	21	50
6200240R	2.40	0.0945		3	17	22	50
6200245R	2.45	0.0965		3	17.5	22.5	50
6200250R	2.50	0.0984		3	18	23	50
6200255R	2.55	0.1004		3	18	23	50
6200260R	2.60	0.1024		3	18.5	23.5	50
6200265R	2.65	0.1043		3	18.5	23.5	50
6200270R	2.70	0.1063	36	3	19	24	50
6200275R	2.75	0.1083		3	19	24	50
6200280R	2.80	0.1102		3	20	25	50
6200285R	2.85	0.1122		3	20	25	50
6200290R	2.90	0.1142		3	21	26	50
6200295R	2.95	0.1161	32	3	21	26	50
6200300R	3.00	0.1181		3	21	26	50

SOLD IN 10 PIECE PACKAGES ONLY

SPEEDS & FEEDS CHART

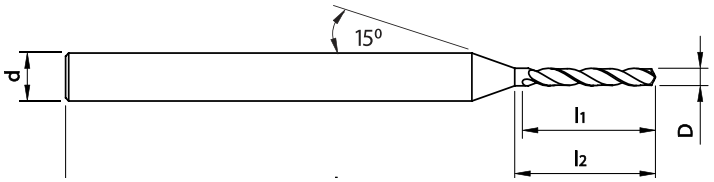
Cutting Speed - RPM = SFM X 97 / Drill Dia.
Feed Rate - IPM = RPM X IPR

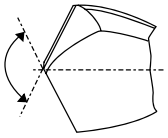
Guidelines - Not Guaranteed

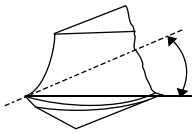
MATERIAL	DIAMETER (mm)	SPEED (SFM)	FEED RATE (IPR)
MILD & LOW CARBON STEELS	.10 - .50	40 - 80	.0002 - .0003
	.51 - .70	80 - 140	.0003 - .0004
	.71 - .99	140 - 200	.0004 - .0006
	1.00 - 2.00	140 - 200	.0006 - .0016
	2.01 - 3.00	140 - 200	.0016 - .0020
HIGH CARBON, ALLOY STEELS	.10 - .50	30 - 70	.0002 - .0003
	.51 - .70	70 - 100	.0002 - .0004
	.71 - .99	70 -100	.0004 - .0006
	1.00 - 2.00	100 - 170	.0006 - .0016
	2.01 - 3.00	100 - 170	.0014 - .0020
STAINLESS STEELS - 300 SERIES, 17-4	.10 - .50	20 - 40	.0001 - .0002
	.51 - .70	40 - 70	.0002 - .0003
	.71 - .99	70 - 120	.0002 - .0003
	1.00 - 2.00	70 - 120	.0003 - .0010
	2.01 - 3.00	70 - 120	.0008 - .0014
STAINLESS STEELS - 400 SERIES	.10 - .50	30 - 60	.0001 - .0002
	.51 - .70	60 - 90	.0002 - .0003
	.71 - .99	90 - 140	.0003 - .0004
	1.00 - 2.00	90 - 140	.0004 - .0012
	2.01 - 3.00	90 - 140	.0010 - .0018
CAST IRON	.10 - .50	70 - 160	.0002 - .0003
	.51 - .70	160 - 200	.0003 - .0004
	.71 - .99	200 - 340	.0004 - .0008
	1.00 - 2.00	200 - 340	.0008 - .0020
	2.01 - 3.00	200 - 340	.0016 - .0026
DUCTILE IRON	.10 - .50	60 - 100	.0001 - .0002
	.51 - .70	100 - 140	.0002 - .0003
	.71 - .99	140 - 270	.0003 - .0006
	1.00 - 2.00	140 - 270	.0006 - .0016
	2.01 - 3.00	140 - 270	.0014 - .0024
ALUMINUM	.10 - .50	80 - 170	.0002 - .0003
	.51 - .70	170 - 270	.0003 - .0005
	.71 - .99	270 - 400	.0005 - .0008
	1.00 - 2.00	270 - 400	.0008 - .0024
	2.01 - 3.00	270 - 400	.0020 - .0031
HIGH ALLOYS - INCONEL, TITANIUM	.10 - .50	30 - 70	.0001 - .0002
	.51 - .70	70 - 100	.0002 - .0003
	.71 - .99	100 - 170	.0003 - .0004
	1.00 - 2.00	100 - 170	.0004 - .0012
	2.01 - 3.00	100 - 170	.0010 - .0018

GMauvaisUSA™
A HASSAY SAVAGE COMPANY

REQUEST FOR QUOTATION FORM




Point Angle


Helix Angle

CUSTOM SPECIFICATIONS:

_____ Right or Left Cutting

_____ "D" flute diameter

_____ "d" shank diameter

_____ "l1" flute length

_____ "L" overall length OAL

_____ Special Coating

Please check one:

❑ Solid Carbide ❑ HSS-E Cobalt %

_____ 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.

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

Lead-Time on Specials – 3 Weeks ARO • SOLD IN 10 PIECE PACKAGES ONLY

Date: _____

Name: _____

Title: _____

Company Name: _____

Street Address: _____

Address-line 2: _____

City: _____ **State:** _____ **Zip:** _____

Telephone: _____ **Fax:** _____

E-mail: _____ **Country:** _____

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magafor

PERFORMANCE
PRECISION
SPECIALIZATION

magafor

Since 1937

Magafor is the recognized world leader in the production of precision tools.

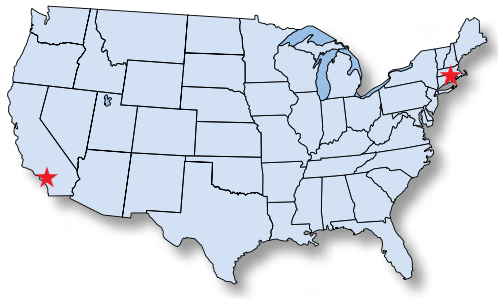
2001, Magafor teams with Hassay Savage Company, renowned broach manufacturer located in Massachusetts since 1969. Both companies now provide the finest tooling through established industry channels. Industrial distributors, with the support of our nationwide technical agents and stocking locations, provide consummate service to manufacturers throughout the United States.

Hassay Savage Company

Manufacturers of Precision Tools

US INVENTORY & TECHNICAL SUPPORT

*At **magafor** we take pride in supplying the highest quality products, making them accessible, and providing exceptional customer service. We achieve our high goals in these areas with the following :*
- US Warehouses on East Coast and West Coast
★ ***Turners Falls, MA***
★ ***Los Angeles, CA***
- 100-% US availability through local distribution in your area.
*- Technical Factory Agents - **See page 4**.*



TRIAL/TEST STANDARD TOOLS FREE!!!

We offer the most liberal trial program in the industry…
*We will provide you with **FREE** test tools upon your request. We are so confident that we will show you performance improvements and cost reduction that this allows us to do this free of charge.*

BLANKET ORDERS

Please know that we accept and encourage blanket orders on standard stock items, standard non-stock items, and special items. We will ensure continuous delivery with large safety stock levels at all times.
We will also stock standard non-stock items in the US with an estimated usage report.

SPECIALS

***magafor** excels in manufacturing special tooling, and we are confident in our ability to show cost savings in most applications.*

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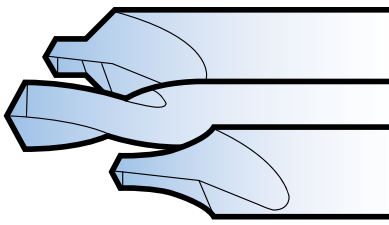

CENTERING-SPOTTING
COMBINED MACHINING
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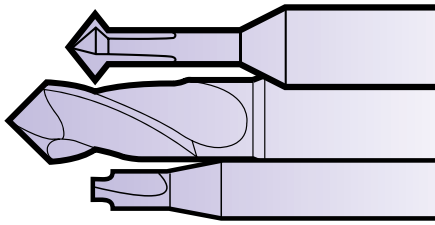

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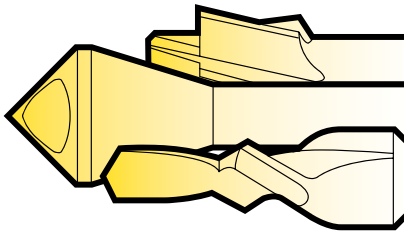

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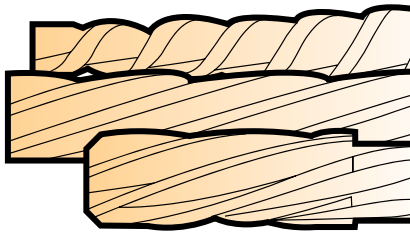

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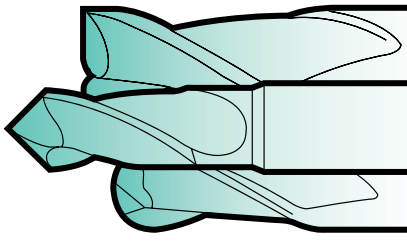


MICRO-MILLING
Pages 99-103

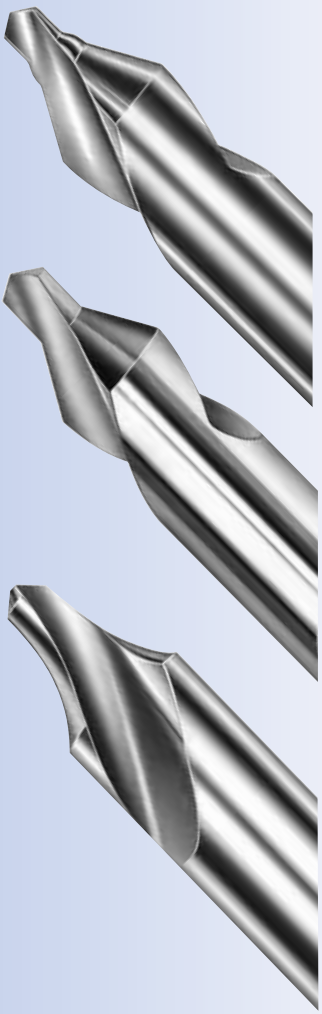
EDP NUMBERING SYSTEM

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



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

SERIES INDEX

COATINGS

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

Red'X : *cobalt tool coating with higher hardness of (3700 HV) like TiAlN in a multi-layer coating. This coating can be used for dry machining. Using coolant will add lubricity.*

Hard'X : *carbide tool coating with a high hardness (3500 HV) this coating shows a high thermic stability and an excellent protection against heat and wear. Ideal for dry machining-high speed cut-in treated steels and dies up to 67 Rc.*

Graph'X : *diamond coating (8000 HV) particularly effective to machine graphite, composite materials, plastics with glass-fibers or carbon-fibers.*

MATERIALS USED IN THE MANUFACTURE OF OUR TOOLS AND COATINGS

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)*

SPECIAL?
STANDARD MAGAFOR!

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! Who offers more? Styles, materials and lengths vary within each specific range of tooling to offer you the widest selection.

INNOVATION

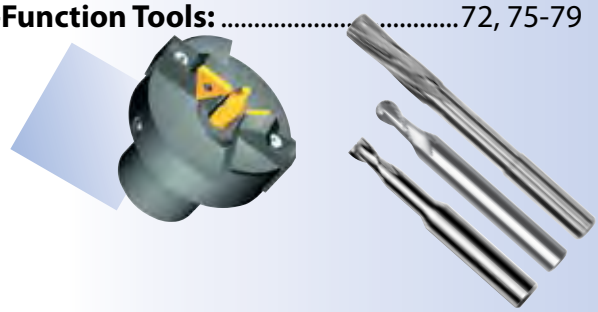
To detect the needs created by new technologies – To analyze and compare the totality of the special tools which are required of us – To compare the heavy tendencies of the market – Such are the studies undertaken by Magafor to offer a standard answer, available with specific expectations of the most demanding customers.

MINIATURE TOOLING

Forever Magafor has chosen to manufacture small tools at the feasibility limit. Naturally its production program has shown a trend towards the micro-tools.

PRODUCTIVITY

The multi-purpose concept is one of the recent major evolutions for machining operations. With it's multi-function tools and tools for combined machining, Magafor emphasizes this evolution. These new concepts reduce the machining times, the number of tools needed and set-up time.



PRECISION

The miniaturization and the market requirements directed towards perfection have incited us to stock extensive series of standard items and an unrivalled range of types, forms, materials
and coatings.
For Instance:

High Precision Micro Reamers available at every .0002" increment from .0078" to .0236" and every .0004 increment from .0240" to .7882"..... 89-97

Micro End-Mills available at every .0080" increment from .0020" to .2323"..... 99-103

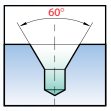
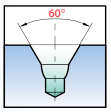
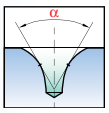
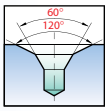
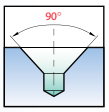
magafor *is the only cutting tool manufacturer member of the European Commission that has been chosen to research micro-machining.*

This research targets performance improvements of all ***magafor*** *tools for the greatest profit margins for our customers.*

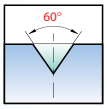
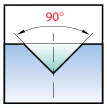
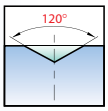
MICRO MILLING

CENTERING - SPOTTING - COMBINED MACHINING

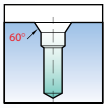
CENTERING

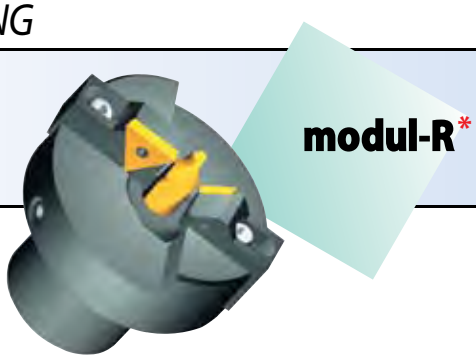
FORMS		RIGHT HAND CUT SHORT	RIGHT HAND CUT WITH FLAT	RIGHT HAND CUT LONG	LEFT HAND CUT
	A	Pages 63, 65-66	Page 70	Page 64-65	Page 65
	W	Page 67			
	R	Page 69	Page 70		
	B	Page 68	Page 70		
	82° 90°	Page 64			

SPOTTING

	60°	73ge 77			
	90°	Pages 72-73		Page 73	
	120° 140°	Pages 72-73		Page 73	

COMBINED MACHINING

	A	Pages 70	

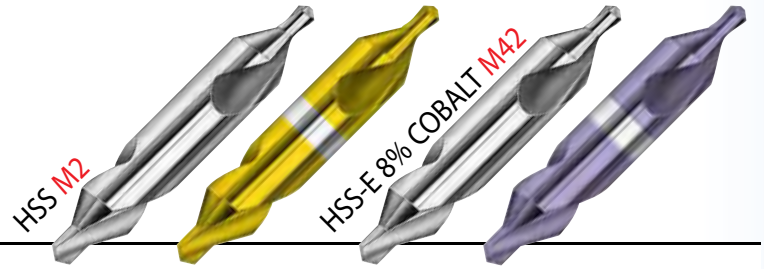


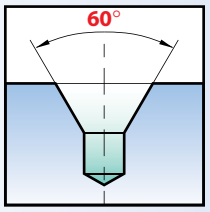
*Call for more information on modul-R centering head

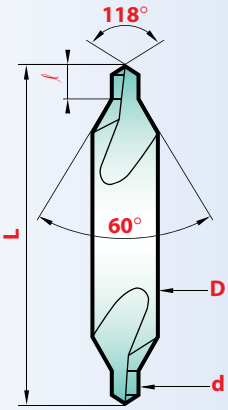
magafor, *The choice!*

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	1800 HV	1800 HV + 3500
Use	Small Series	Production intensive		Hard and abrasive alloys		Treated steels	

PLAIN TYPE 60° CENTER DRILLS Sizes in inches







SIZE	D	d	L	l	115	M2/TIN 08115	Cobalt + 1055	M42/futura 091055
00000	1/8	.010	1-1/4	.008 - .018	8111500A000*	800811500A0*	81105500A00*	8009105500A00*
0000	1/8	.015	1-1/4	.014 - .025	8111500B000*	800811500B0*	81105500B00*	8009105500B00*
000	1/8	.020	1-1/4	.020 - .032	8111500C000	800811500C0	81105500C00*	8009105500C00*
00	1/8	.025	1-1/4	.028 - .040	8111500D000	800811500D0	81105500D00*	8009105500D00*
0	1/8	1/32	1-1/4	.035 - .047	8111500E000	800811500E0	81105500E00*	8009105500E00*
1	1/8	3/64	1-1/4	.055 - .067	81115010000	80081150100	81105501000	8009105501000
2	3/16	5/64	1-7/8	.095 - .106	81115020000	80081150200	81105502000	8009105502000
3	1/4	7/64	2	.130 - . 154	81115030000	80081150300	81105503000	8009105503000
4	5/16	1/8	2-1/8	.150 - .175	81115040000	80081150400	81105504000	8009105504000
4-1/2	3/8	9/64	2-1/2	.170 - .193	81115045000	80081150450		
5	7/16	3/16	2-3/4	.230 - .256	81115050000	80081150500	81105505000	8009105505000
6	1/2	7/32	3	.270 - .295	81115060000	80081150600	81105506000	8009105506000
7	5/8	1/4	3-1/4	.315 - .340	81115070000	80081150700	81105507000	800910550700
8	3/4	5/16	3-1/2	.390 - .420	81115080000	80081150800	81105508000	8009105508000
9	7/8	11/32	3-5/8	.430 - .460	81115090000	80081150900		
10	1	3/8	3-3/4	.475 - .500	81115100000	80081151000		

Please Note: ***Single end tool***

Tolerances

Tool Diameters	D	d	Angle 60°	Angle 118°
.010 - 7/64	n/a	+ .0039		
1/8 - 7/32	- .0007	+ .0047		
1/4 - 3/8	- .0009	+ .0059	- 30'	± 2°
7/16 - 5/8	- .0011	+ .0059		
3/4 - 1	- .0013	+ .0059		

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

Value SETS American Standard

15 PIECES

COMPOSITION Quantity	HSS 81115000015
3 pieces each	# 1
	# 2
	# 3
	# 4
2 pieces	# 4-1/2
1 piece	# 5

COMPOSITION Quantity	HSS 81115000000
1 piece each	# 1
	# 2
	# 3
	# 4
	# 5

5 PIECES

COMPOSITION Quantity	Cobalt 81105500000
1 piece each	# 1
	# 2
	# 3
	# 4
	# 5

Sets also available TiN coated

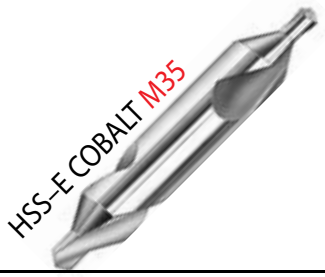
Longs

SIZE	D	d	L	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

Value SETS
American Standard

5 PIECES / Longs = 4"

COMPOSITION	magafor 81185000000 Long
# 1 - 2 - 3 - 4 - 5 Long	*1 piece of each #*

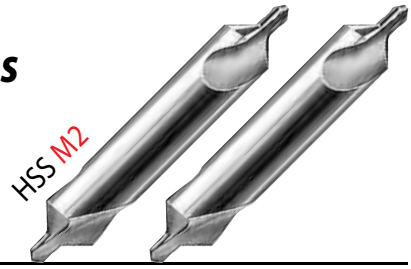


In Metric — *Japanese Standard*

D x d	L	ℓ	magafor 118
4,0 x 1,0	35	1,2 – 1,5	81118041000
5,0 x 1,2	40	1,3 – 1,8	81118051200
5,0 x 1,5	40	1,5 – 2,0	81118051500
6,0 x 2,0	45	2,0 – 2,5	81118062000
7,7 x 2,5*	50	2,5 – 3,0	81118077250
7,7 x 2,5*	57	2,5 – 3,0	81118077251
7,7 x 3,0	56	3,0 – 3.6	81118077300
7,7 x 3,2	57	3,2 – 3,8	81118077320
10,0 x 4,0*	65	4,5 – 5,1	81118104000
10,0 x 4,0*	69	4,5 – 5,1	81118104001
11,0 x 4,0	69	4,5 – 5,1	81118114000
11,0 x 5,0*	69	5,5 – 6,1	81118115000
11,0 x 5,0*	78	5,5 – 6,1	81118115001
18,0 x 6,0	95	7,0 – 8,0	81118186000

**Overall length "L" has to be mentioned*

82° - 90° Angles



					Angle 82°	90°
SIZE	D	d	L	ℓ	154	155
1	1/8	3/64	1-1/4	.055 - .067	81154010000	81155010000
2	3/16	5/64	1-7/8	.095 - .106	81154020000	81155020000
3	1/4	7/64	2	.130 - .154	81154030000	81155030000
4	5/16	1/8	2-1/8	.150 - .175	81154040000	81155040000
5	7/16	3/16	2-3/4	.230 - .256	81154050000	81155050000
6	1/2	7/32	3	.270 - .295	81154060000	81155060000
7	5/8	1/4	3-1/4	.315 - .340	81154070000	81155070000
8	3/4	5/16	3-1/2	.390 - .420	81154080000	81155080000

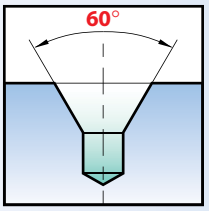
METRIC CENTER DRILLS 60° Angle Form A

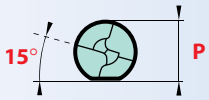
ISO • NFE 66051-A • DIN 333-A • JIS-1 — In Metric

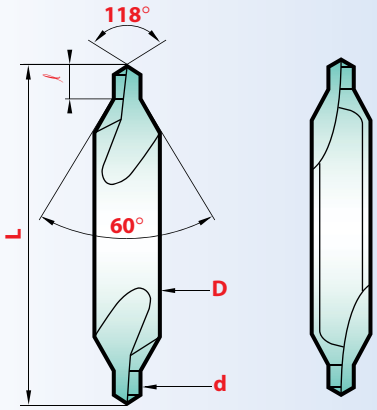
TYPE			Right hand	Left hand	With flat, right hand		
D x d	L	ℓ	11	16	P - 0,1	Cobalt 0290	M35/TIN 0890
3,0 x 0,5	31	0,6 - 0,9	81110305000				
3,15 x 0,5*	25	0,6 - 0,9	81110315050	81160315050			
3,15 x 0,63*	25	0,7 - 1,0	81110315063	81160315063			
3,15 x 0,8*	25	1,0 - 1,3	81110315080	81160315080			
3,15 x 1,0	31	1,3 - 1,7	81110315100	81160315100			
3,15 x 1,25	31	1,6 - 2,0	81110315125	81160315125			
3,5 x 0,75	35	1,0 - 1,3	81110350750	81160350750			
4,0 x 1,0	35	1,3 - 1,7	81110410000	81160410000			
4,0 x 1,25	35	1,6 - 2,0	81110412500	81160412500			
4,0 x 1,6	35	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	40	2,0 - 2,6	81110516000	81160516000			
5,0 x 2,0	40	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	45	2,5 - 3,1	81110632000	81160632000			
6,3 x 2,5	45	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	50	3,9 - 4,6	81110830000	81160830000			
8,0 x 3,15	50	3,9 - 4,6	81110831500	81160831500	6,95	80029008315	80089008315
10,0 x 3,0	55	3,9 - 4,6	81111030000	81161030000			
10,0 x 3,15	55	3,9 - 4,6	81111031500	81161031500			
10,0 x 4,0	55	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	63	6,3 - 7,2	81111250000	81161250000			
12,5 x 4,0	63	5,0 - 5,9	81111254000	81161254000			
12,5 x 5,0	63	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	71	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	80	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	100	12,8 - 13,8	81112510000		22,50	80029025100	
31,5 x 10,0	125	12,8 - 13,8	81113151000				
31,5 x 12,5	125	16,5 - 17,5	81113151250				

* *Single end*

NOTE: all metric center drills are available within 2 weeks. Call for information.





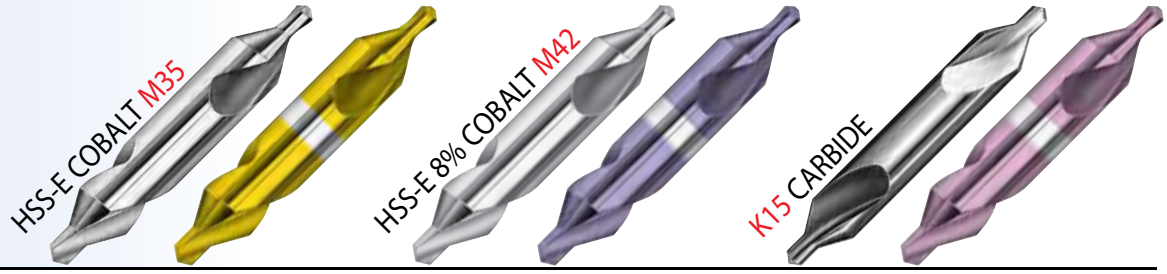


Tolerances				
D	d	L	Angles 60°	Angles 118°
h8	k12	±1	-30′	±2°

*The **magafor** center drills are particularly effective thanks to their unique ground spiral flutes.*

Special attention to concentricity of drill diameter to body makes us superior to others.

Metric



ISO • NFE 66051-A • DIN 333-A • JIS-1 — In Metric

D x d	L	ℓ	magafor 10	M35/TIN 0811	cobalt 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*	25	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	31	1,6 - 2,0	81100315125	80081103125	81105031512	80091003125	88810003125	888100H0315125
3,5 x 0,75	35	1,0 - 1,3	81100350750	800811035075				
4,0 x 1,0	35	1,3 - 1,7	81100410000	80081104100			88810004100	888100H04010
4,0 x 1,6	35	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	40	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	45	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	50	3,9 - 4,6	81100830000	80081108300			88810008300	888100H0830
8,0 x 3,15	50	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	55	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	63	6,3 - 7,2	81101250000	80081112500			88810012500	888100H1250
12,5 x 5,0	63	6,3 - 7,2	81101255000	80081112550	81105125500	80091012550	88810012550	888100H1255
14,0 x 5,0	69	6,3 - 7,2	81101450000	80081114500				
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)*

NOTE: all metric center drills are available within 2 weeks. Call for information.

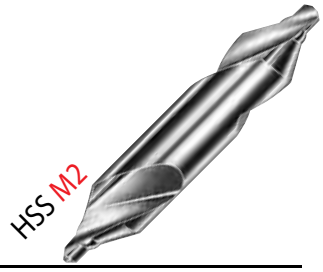
The Largest Manufacturer of Center Drills World Wide, With Over 4 Million Units Sold Annually.

Our European Catalogue Promotes 19 Pages of Combined Drills and Countersinks for World Wide Consumption.

magafor, *The choice!*

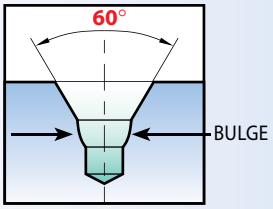
Material	HSS	HSS-Co	Hss-Co + TIN	HSS 8% Co	HSS 8% Co + Red'X	CARBIDE	CARBIDE + Hard'X
Hardness	63 HRC	65 HRC	65 HRC +2300 HV	67 HRC	67 HRC + 3500 HV	1800 HV	1800 HV + 3500
Use	Small Series	Production intensive		Hard and abrasive alloys		Treated steels	

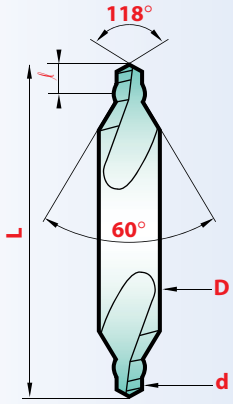
magafor "UNIQUE" CENTER DRILLS
With reinforcing bulge Form W



PLAIN TYPE WITH BULGE

SIZE	D	d	L	ℓ	145
1 - W	1/8	3/64	1-1/4	.055 - .067	81145010000
2 - W	3/16	5/64	1-7/8	.095 - .106	81145020000
3 - W	1/4	7/64	2	.130 - .154	81145030000
4 - W	5/16	1/8	2-1/8	.150 - .175	81145040000
5 - W	7/16	3/16	2-3/4	.230 - .256	81145050000
6 - W	1/2	7/32	3	.270 - .295	81145060000
7 - W	5/8	1/4	3-1/4	.315 - .340	81145070000
8 - W	3/4	5/16	3-1/2	.390 - .420	81145080000





*The **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,*
- *runs at faster speeds and feeds.*

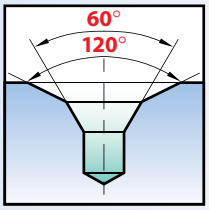
Tolerances

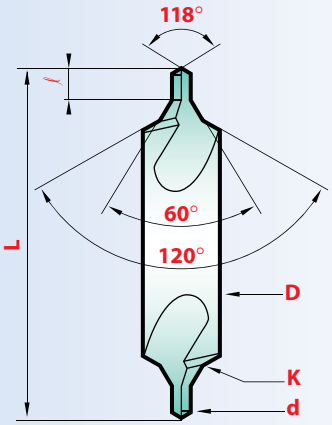
Tool Diameters	D	d	Angle 60°	Angle 118°
.010 - 7/64	- .0007	+ .0039		
1/8 - 7/32	- .0007	+ .0047		
1/4 - 3/8	- .0009	+ .0059	- 30'	± 2°
7/16 - 5/8	- .0011	n/a		
3/4 - 1	- .0013	n/a		

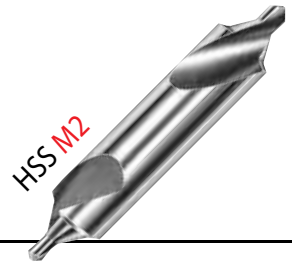
Form W SETS
American Standard
5 PIECES

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

BELL TYPE CENTER DRILLS
With saved angle
Form B







SIZE	D	d	K	L	ℓ	135
11	1/8	3/64	.100	1-1/4	.055 - .070	81135110000
12	3/16	1/16	.150	1-7/8	.070 - .090	81135120000
13	1/4	3/32	.200	2	.110 - .135	81135130000
14	5/16	7/64	.250	2-1/8	.125 - .155	81135140000
15	7/16	5/32	.350	2-3/4	.185 - .215	81135150000
16	1/2	3/16	.400	3	.230 - .260	81135160000
17	5/8	7/32	.500	3-1/4	.270 - .300	81135170000
18	3/4	1/4	.600	3-1/2	.310 - .340	81135180000
19	7/8	5/16	.700	3-5/8	.390 - .420	81135190000
20	1	3/8	.800	3-3/4	.470 - .500	81135200000

Tolerances

Tool Diameters	D	d	Angle 60°	Angle 118°	Angle 120°
.010 - 7/64	- .0007	+ .0039			
1/8 - 7/32	- .0007	+ .0047			
1/4 - 3/8	- .0009	+ .0059	- 30'	± 2°	-4°
7/16 - 5/8	- .0011	n/a			
3/4 - 1	- .0013	n/a			

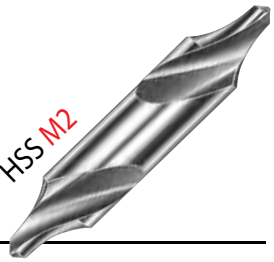
Center drills with protective chamfer guarantee the center obtained from any risk of blows and deformation. The splay resulting from the protective chamfer makes it easier to load parts between points on machines with automatic feed.

Form B SETS
American Standard

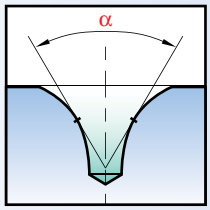
5 PIECES

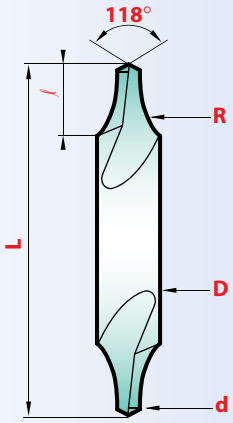
COMPOSITION Quantity	81135000000
1 piece each Bell Type	# 11
	# 12
	# 13
	# 14
	# 15

RADIUS TYPE CENTER DRILLS **Form R**



ASA #	D	d	L	R	ℓ	magafor 125
1 - R	1/8	3/64	1-1/4	.150	.125 - .150	81125010000
2 - R	3/16	5/64	1-7/8	.230	.200 - .225	81125020000
3 - R	1/4	7/64	2	.315	.270 - .300	81125030000
4 - R	5/16	1/8	2-1/8	.400	.340 - .370	81125040000
5 - R	7/16	3/16	2-3/4	.500	.480 - .510	81125050000
6 - R	1/2	7/32	3	.530	.540 - .575	81125060000
7 - R	5/8	1/4	3-1/4	.700	.660 - .700	81125070000
8 - R	3/4	5/16	3-1/2	.790	.810 - .850	81125080000





magafor *center drill with radius, thanks to its special profile, is more robust than the 60° center drill:*

- *the radius eliminates the risk of breakage,*
- *it provides an exact bearing,*
- *it serves as a protective chamfer.*

Tolerances

Tool Diameters	D	d	R max
.010 - 7/64	- 0.0007	+ .0039	
1/8 - 7/32	- 0.0007	+ .0047	
1/4 - 3/8	- 0.0009	+ .0059	1.25 R
7/16 - 5/8	- 0.0011	n/a	
3/4 - 1	- 0.0013"	n/a	

Form R SETS
American Standard

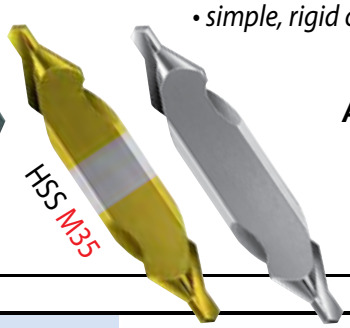
5 PIECES

COMPOSITION *Quantity*	81125000000
1 piece each Radius Type	# 1-R
	# 2-R
	# 3-R
	# 4-R
	# 5-R

modul-R
CENTERING HEADS

*The new **modul-R** center head allows to center, to face and to chamfer the surface at the same time :*
• constant depth of the centers,
• reduced machining times,
• less tools and change of tools,
• simple, rigid concept designed for middle and large series,
• inexpensive even for small series.

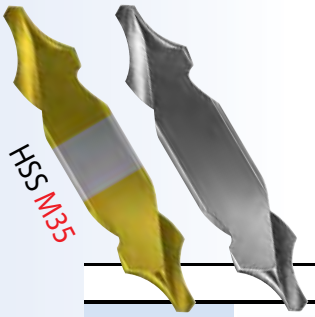
***Application** : for machining the ends of bars, axles, shafts and tubes.*
***Capacity** : flexible modular system for centers into bars from 1/4" to 2".*



*NOTE: call for further information and pricing on the **modul-R.***

METRIC PLAIN TYPE CENTER DRILLS

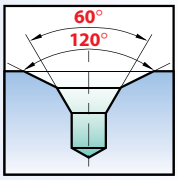
D x d	L	ℓ	FLAT	Cobalt 0290	TIN 0890
4,0 x 1,6	35	1,0 - 2,4	3,25	80029004160	80089004160
5,0 x 2,0	40	2,5 - 2,9	4,20	80029005200	80089005200
6,3 x 2,5	45	3,1 - 3,6	5,35	80029006325	80089006325
8,0 x 3,15	50	3,9 - 4,4	6,95	80029008315	80089008315
10,0 x 4,0	55	5,0 - 5,6	8,40	80029010400	80089010400
12,5 x 5,0	63	6,3 - 6,9	10,95	80029012550	80089012550
16,0 x 6,3	71	8,0 - 8,6	14,00	80029016630	80089016630
20,0 x 8,0	80	10,1 - 10,8	17,90	80029020800	
25,0 x 10,0	100	12,8 - 13,5	22,50	80029025100	



NOTE: all metric center drills are available within 2 weeks. Call for information and pricing.

METRIC RADIUS TYPE CENTER DRILLS

D x d	L	R	ℓ	FLAT	Cobalt 0291	TIN 0891
4,0 x 1,6	35	4,0	4,2 - 4,7	3,25	80029104160	80089104160
5,0 x 2,0	40	5,0	5,0 - 5,4	4,20	80029105200	80089105200
6,3 x 2,5	45	6,3	6,3 - 6,8	5,35	80029106325	80089106325
8,0 x 3,15	50	8,0	8,0 - 8,5	6,95	80029108315	80089108315
10,0 x 4,0	55	10,0	10,0 - 10,6	8,40	80029110400	80089110400
12,5 x 5,0	63	12,5	12,5 - 13,1	10,95	80029112550	80089112550
16,0 x 6,3	71	16,0	16,0 - 16,6	14,00	80029116630	80089116630
20,0 x 8,0	80	20,0	20,0 - 20,7	17,90	80029120800	

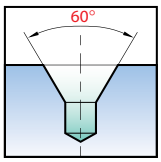


Form B
Protected center

METRIC BELL TYPE CENTER DRILLS Form B

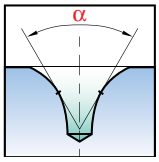
D x d	L	K	ℓ	FLAT	Cobalt 0292
6,3 X 1,6	45	3,3	2,0 - 2,4	5,35	80029206316
8,0 x 2,0	50	4,2	2,5 - 2,9	6,95	80029208200
10,0 x 2,5	55	5,3	3,1 - 3,6	8,40	80029210250
11,2 x 3,15	63	6,7	39, - 4,4	10,00	80029211231
14,0 x 4,0	69	8,5	5,0 - 5,6	12,65	80029214400
18,0 x 5,0	77	10,6	6,3 - 6,9	16,40	80029218500
20,0 x 6,3	80	13,2	8,0 - 8,6	17,90	80029220630
25,0 x 8,0	100	17,0	10,1 - 10,8	22,50	80029225800
31,5 x 10,0	125	21,2	12,8 - 13,5	28,40	80029231510

Form A



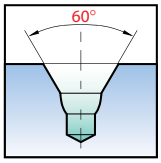
Most universal center drill.
60° angle
Standard center.
118° point

Form R

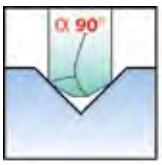


The radius eliminates the risk of breakage, and is more robust than the 60° drill.
Provides an exact bearing surface.
Serves as a protective chamfer.
118° point

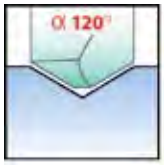
Form W

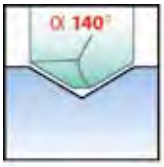


The bulge reinforces the point.
Increases chip removal.
Makes the lubrication of the drill easier.
118° point



90° NC Spot Drill
*By using the **magafor NC** drill of diameter over the drilling tool, centering and chamfering are obtained in a single operation.*





120° & 140° NC Spot Drill
*The preliminary hole obtained with the **magafor NC** drill corresponds to the angle at the end of the tool used in drilling and prevents it from deviating.*

Performance

RECOMMENDATIONS FOR THE USE OF CENTER DRILLS AND NC SPOT DRILLS

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

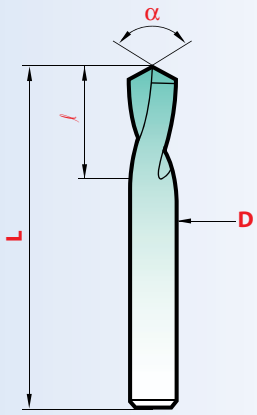
FORMULA FOR SPEED (RPM)

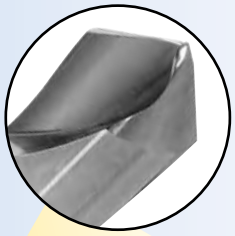
Example	#1 Center Drill (.078) Cutting Soft Material: < 81 HRB
	SFM = 148 for 5/64 Ø HSS
	RPM = 3.82 x (148 ÷ .0787) = 7180
	IPM = .001 x 2 x 7180 = 14.36
	IPR = 14.36 ÷ 7180 = .002

MATERIAL		HSS SFM	HSS FEED inch/rev 2mm 5/64	3mm 1/8	6mm 1/4	10mm 3/8	16mm 5/8	TIN SFM	TIN FEED inch/rev 2mm 5/64	3mm 1/8	6mm 1/4	10mm 3/8	16mm 5/8
STEEL-:	< 81 HRB (B)	99 - 148	.0020	.0024	.0031	.0059	.0079	197 - 296	.0031	.0035	.0047	.0098	.0118
	< 24 Rc (C)	82 - 99						165 - 230					
	24 - 32 Rc	49 - 82						115 - 148					
	32 - 41 Rc	33 - 49	.0012	.0016	.0024	.0039	.0059	82 - 99	.0020	.0024	.0035	.0055	.0087
Stainless Steel/Titanium		20 - 33						39 - 53					
Inconel/Nimonic/Waspaloy		16 - 20	.0008	.0012	.0020	.0028	.0039	33 - 43	.0016	.0020	.0028	.0039	.0059
Brass/Copper		132 - 197	.0020	.0028	.0035	.0059	.0079	362 - 428	.0028	.0035	.0055	.0106	.0142
Copper Alloys/Bronze		99 - 132						263 - 362					
Aluminum		494 - 658	.0031	.0039	.0079	.0157	.0197	1152 - 1481	.0047	.0055	.0118	.0217	.0256
Hardened Aluminum < 6% Si		197 - 329	.0024	.0031	.0039	.0059	.0098	395 - 592	.0031	.0039	.0059	.0118	.0157
Cast Aluminum > 6% Si		132 - 197						263 - 395					
Thermoplastics		329 - 428	.0031	.0035	.0079	.0138	.0157	658 - 855	.0047	.0055	.0118	.0217	.0256

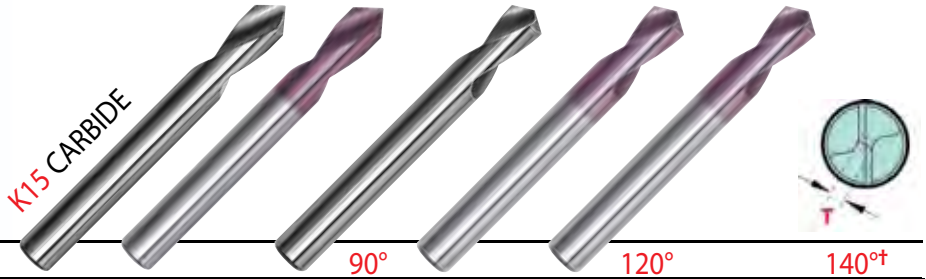
MATERIAL		Futura/Red'X SFM	Futura/Red'X FEED inch/rev 2mm 5/64	3mm 1/8	6mm 1/4	10mm 3/8	16mm 5/8	CARBIDE SFM	CARBIDE FEED inch/rev 2mm 5/64	3mm 1/8	6mm 1/4	10mm 3/8	16mm 5/8
STEEL-:	< 81 HRB (B)	296 - 395	.0039	.0047	.0063	.0118	.0177	362 - 461	.0047	.0055	.0079	.0138	.0217
	< 24 Rc (C)	247 - 329						296 - 362					
	24 - 32 Rc	165 - 214						197 - 263					
	32 - 41 Rc	99 - 214	.0028	.0031	.0047	.0071	.0110	115 - 165	.0035	.0039	.0055	.0087	.0094
Stainless Steel/Titanium		59 - 79						72 - 99					
Inconel/Nimonic/Waspaloy		49 - 66	.0020	.0024	.0039	.0055	.0079	63 - 82	.0031	.0028	.0047	.0067	.0094
Brass/Copper		428 - 494	.0039	.0047	.0071	.0142	.0197	494 - 592	.0047	.0055	.0087	.0173	.0240
Copper Alloys/Bronze		362 - 428						428 - 494					
Aluminum		1645 - 2300	.0063	.0071	.0157	.0295	.0354	1974 - 2632	.0039	.0087	.0193	.0354	.0374
Hardened Aluminum < 6% Si		592 - 823	.0039	.0047	.0071	.0142	.0197	658 - 987	.0047	.0055	.0087	.0173	.0240
Cast Aluminum > 6% Si		395 - 559						461 - 658					
Thermoplastics		987 - 1316	.0063	.0071	.0157	.0295	.0354	1217 - 1579	.0079	.0087	.0193	.0354	.0374

NC SPOTTING DRILLS





STANDARD WEB THINNING "SPLIT-POINT" FEATURE FOR HIGH SPEED CUTTING

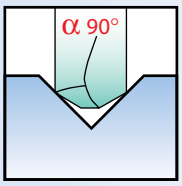


Angle						90°		120°		140°†
Diameter inch	mm	L	ℓ	T*	Carbide 8195	K15/Hard'X 8195-H	Carbide 8196	K15/Hard'X 8196-H	K15/Hard'X 8190-H
.078	2	1-9/16	.315	.008	88819502000	888195H0200	88819602000	888196H0200	
.118	3	1-3/4	.400	.012	88819503000	888195H0300	88819603000	888196H0300	
.157	4	2	.475	.016	88819504000	888195H0400	88819604000	888196H0400	
.197	5	2	.600	.020	88819505000	888195H0500	88819605000	888196H0500	
.236	6	2	.700	.023	88819506000	888195H0600	88819606000	888196H0600	888190H0600
1/4		2	.700	.023	88819506350	888195H0635	88819606350	888196H0635	888190H0635
5/16		2-3/8	.900	.031	88819507930	888195H0793			
.315	8	2-3/8	.900	.031	88819508000	888195H0800	88819608000	888196H0800	888190H0800
3/8		2-3/4	.950	.039	88819509520	888195H0952	88819609520	888196H0952	888190H0952
.394	10	2-3/4	.950	.039	88819510000	888195H1000	88819610000	888196H1000	888190H1000
.472	12	2-3/4	.950	.047	88819512000	888195H1200	88819612000	888196H1200	888190H1200
1/2		2-3/4	.950	.051	88819512700	888195H1270	88819612700	888196H1270	888190H1270
.551	14	3	.950	.055	88819514000	888195H1400	88819614000	888196H1400	
5/8		3-1/8	1	.063	88819515870	888195H15870	88819615870	888196H1587	888190H1587
.630	16	3-1/8	1	.063	88819516000	888195H1600	88819616000	888196H1600	888190H1600
.787	20	4	1-3/8	.079	88819520000	888195H2000	88819620000	888196H2000	

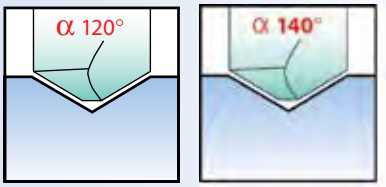
T* = *web thickness of split point*

†*140 degree angle : for hard alloys and high performance drilling*

K15 *CARBIDE* — 6.5 - 7% Cobalt *(0.006 - 0.008mm grain size)*



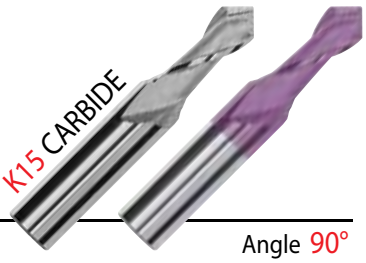
90 degree angle :
By using the ***magafor NC*** *drill of diameter over the drilling tool, centering and chamfering are obtained in a single operation.*



120 and 140 degree angles :
The preliminary hole obtained with the ***magafor NC*** *drill 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.*

Micro Range of Carbide MINIATURE NC SPOTTING DRILLS

MULTI-V®



T* = *web thickness of split point*

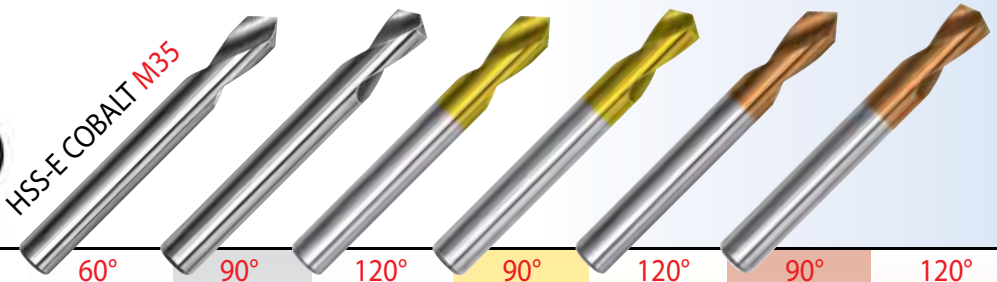
See the full line and more detail on pages 82

Hard-X AlTiN Exceed

STANDARD magafor						Angle 90°	
Diameter inch	mm	L	ℓ	d2	T*	MULTI-V 8090	K15/Hard'X 8090-H
.003	0,1	1-1/2	.008	.118	.001	88809000100	888090H0010
.007	0,2	1-1/2	.016	.118	.001	88809000200	888090H0020
.011	0,3	1-1/2	.024	.118	.001	88809000300	888090H0030
.015	0,4	1-1/2	.032	.118	.002	88809000400	888090H0040
.020	0,5	1-1/2	.040	.118	.002	88809000500	888090H0050
.024	0,6	1-1/2	.047	.118	.002	88809000600	888090H0060
.028	0,7	1-1/2	.055	.118	.003	88809000700	888090H0070
.031	0,8	1-1/2	.063	.118	.003	88809000800	888090H0080
.035	0,9	1-1/2	.071	.118	.003	88809000900	888090H0090
.039	1,0	1-1/2	.080	.118	.004	88809001000	888090H0100
.043	1,1	1-1/2	.087	.118	.004	88809001100	888090H0110
.047	1,2	1-1/2	.095	.118	.005	88809001200	888090H0120
.051	1,3	1-1/2	.102	.118	.005	88809001300	888090H0130
.055	1,4	1-1/2	.110	.118	.006	88809001400	888090H0140
.059	1,5	1-1/2	.120	.118	.006	88809001500	888090H0150
.063	1,6	1-1/2	.125	.118	.006	88809001600	888090H0160
.066	1,7	1-1/2	.134	.118	.007	88809001700	888090H0170
.071	1,8	1-1/2	.140	.118	.007	88809001800	888090H0180
.074	1,9	1-1/2	.145	.118	.008	88809001900	888090H0190
.078	2,0	1-1/2	.160	.118	.008	88809002000	888090H0200

Performance

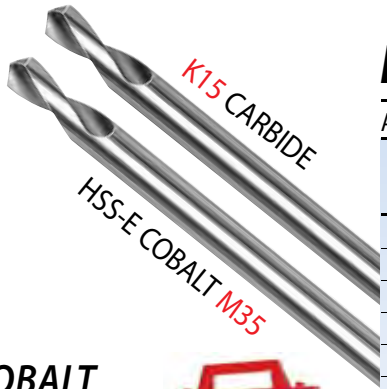
RECOMMENDATIONS FOR USE
pg. 71



Angle					60°	90°	120°	90°	120°	90°	120°
Diameter inch	mm	L	ℓ	T	Cobalt 191	Cobalt 195	Cobalt 196	M35/TIN 0895	M35/TIN 0896	M35/Red'X 0995*	M35/Red'X 0996*
.078	2	2	.315	.008		81195020000	81196020000	80089502000	80089602000	80099502000	80099602000
.118	3	2	.400	.012		81195030000	81196030000	80089503000	80089603000	80099503000	80099603000
1/8		2	.400	.012		81195031700	81196031700	80089503170	80089603170	80099503170	80099603170
.157	4	2-1/16	.475	.016	81191040000	81195040000	81196040000	80089504000	80089604000	80099504000	80099604000
3/16		2-3/8	.600	.020		81195047600	81196047600	80089504760	80089604760	80099504760	80099604760
.197	5	2-3/8	.600	.020	81191050000	81195050000	81196050000	80089505000	80089605000	80099505000	80099605000
.236	6	2-5/8	.800	.023	81191060000	81195060000	81196060000	80089506000	80089606000	80099506000	80099606000
1/4		2-5/8	.900	.025		81195063500	81196063500	80089506350	80089606350	80099506350	80099606350
5/16		3-1/8	1	.031		81195079300		80089507930			
.315	8	3-1/8	1	.031	81191080000	81195080000	81196080000	80089508000	80089608000	80099508000	80099608000
3/8		3-1/2	1	.039		81195095200	81196095200	80089509520	80089609520	80099509520	80099609520
.394	10	3-1/2	1	.039	81191100000	81195100000	81196100000	80089510000	80089610000	80099510000	80099610000
.472	12	4	1-1/4	.047	81191120000	8119512000	81196120000	80089512000	80089612000	80099512000	80099612000
1/2		4	1-3/8	.051		81195127000	81196127000	80089512700	80089612700	80099512700	80099612700
.551	14	4-1/2	1-3/8	.055		81195140000	81196140000	80089514000	80089614000	80099514000	80099614000
5/8		4-1/2	1-3/8	.063		81195158700	81196158700	80089515870	80089615870	80099515870	80099615870
.630	16	4-1/2	1-3/8	.063	81191160000	81195160000	81196160000	80089516000	80089616000	80099516000	80099616000
.709	18	5-1/8	1-5/8	.071		81195180000	81196180000	80089518000	80089618000	80099518000	80099618000
3/4		5-1/8	1-5/8	.075		81195190500	81196190500	80089519050	80089619050	80099519050	80099619050
.787	20	5-1/8	1-5/8	.079	81191200000	81195200000	81196200000	80089520000	80089620000	80099520000	80099620000
.984	25	5-3/8	1-3/4	.098		81195250000	81196250000	80089525000	80089625000	80099525000	80099625000
1		5-3/8	1-3/4	.100		81195254000	81196254000	80089525400	80089625400	80099525400	80099625400

**FUTURA coating (TiAlN) is also available at same pricing as Red'X in 90° and 120° by designating 0995xxxxF*

Example: 09950635 = Red'X Coating 09950635F = Futura Coating



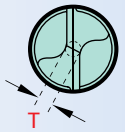
COBALT SPOT DRILL Value SETS

4 PIECES ***American Standard***

COMPOSITION 1/4 - 3/8 - 1/2 - 5/8 - Ø

TYPE		Cobalt
90°	Code	81195000004
120°	Code	81196000004

Sets also available TiN and Futura coated



Long series

Angle					90°	120°	90°	120°
Diameter inch	mm	L	ℓ	T	Cobalt 197	Cobalt 199	Carbide 8197	Carbide 8199
.118	3	3-1/8	.400	.012	81197030000	81199030000	88819703000	
.157	4	4	.475	.016	81197040000	81199040000	88819704000	88819904000
.197	5	4-3/4	.600	.020	81197050000	81199050000	88819705000	88819905000
.236	6	5-1/2	.800	.023	81197060000	81199060000	88819706000	88819906000
1/4		5-1/2	.870	.025	81197063500	81199063500	88819706350	88819906350
.315	8	5-1/2	1	.031	81197080000	81199080000	88819708000	88819908000
3/8		6-3/4	1	.039	81197095200	81199095200	88819709520	88819909520
.394	10	6-3/4	1	.039	81197100000	81199100000	88819710000	88819910000
.472	12	6-3/4	1-3/16	.047	81197120000	81199120000	88819712000	88819912000
1/2		6-3/4	1-3/8	.051	81197127000	81199127000	88819712700	88819912700
5/8		8	1-3/8	.063	81197158700	81199158700	88819715870	88819915870
.630	16	8	1-3/8	.063	81197160000	81199160000	88819716000	88819916000
3/4		8	1-5/8	.075	81197190500	81199190500	88819719050	88819919500
.787	20	8	1-5/8	.079	81197200000	81199200000	88819720000	88819920000
1		8	1-3/4	.100	81197254000	81199254000		

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

NC
SPOTTING DRILLS

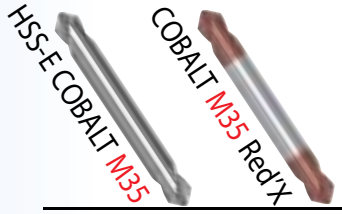
"The Double Ended Spot Drill"

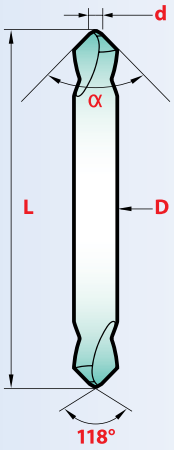
DUO⇨MAG

= 2 Single End NC Spot Drills

1 Tool - 2 Points

Twice the Cutting - Same Price!





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

90° METRIC

DUO⇨MAG *Double End NC Spot Drills*

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

90° METRIC

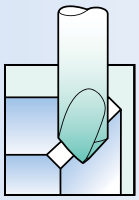
DUO⇨MAG *Long Double End NC Spot Drills*

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

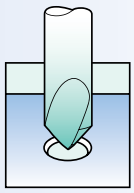
90° AMERICAN STANDARD

DUO⇨MAG *Double End NC Spot Drills*

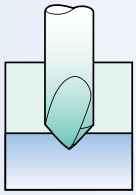
D	d	L	Duo-Mag 019	Red'X 0919
3/16	1/16	2	80019010000	80091901000
1/4	3/32	2	80019020000	80091902000
3/8	9/64	3	80019030000	80091903000
1/2	3/16	4	80019040000	80091904000



Longitudinal Chamfering



Chamfering



Centering Spotting

Duo Mag SETS
American Standard

4 PIECE

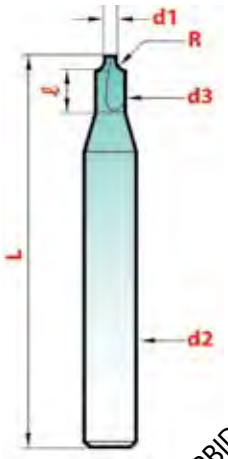
COMPOSITION Quantity	Cobalt 80019000004	*COMPOSITION Quantity*	Red'X 80091900004
4 piece each Duo Mag	3/16"	*4 piece each Duo Mag*	3/16"
	1/4"		1/4"
	3/8"		3/8"
	1/2"		1/2"

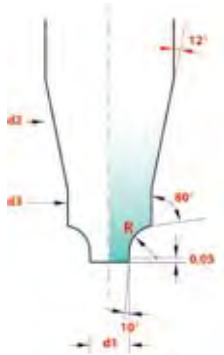
Tolerance in inches

Diameters	Tolerance D	Angle	L
.078 - .118	0 + .0002"	± 1°	± .0395
1/8 - .236	0 + .0003"		
1/4 - .394	0 + .0004"		
.472 - 1	0 + .0005"		

CARBIDE MINIATURE CORNER ROUNDING END-MILLS

The radius is positioned in relation to the small Ø d1-: so it is possible to machine compound forms, small slots and holes from 0,5 mm.





Radius								Carbide	Hard'X
Inch	mm	d1	d2	d3	Δx	l	L	8550	8550-H
.0039	0,10	.020	.118	.031	0,35	.098	2	88855000100	888550H0100
.0059	0,15	.020	.118	.035	0,40	.098	2	88855000150	888550H0015
.0079	0,20	.020	.118	.040	0,45	.098	2	88855000200	888550H0020
.0098	0,25	.020	.118	.040	0,50	.098	2	88855000250	888550H0025
.0118	0,30	.020	.118	.047	0,55	.098	2	88855000300	888550H0030
.0157	0,40	.020	.118	.055	0,65	.098	2	88855000400	888550H0040
.0197	0,50	.020	.118	.063	0,75	.098	2	88855000500	888550H0050
.0236	0,60	.020	.118	.071	0,85	.118	2	88855000600	888550H0060
.0276	0,70	.020	.118	.083	0,95	.118	2	88855000700	888550H0070
.0295	0,75	.020	.118	.083	1,00	.118	2	88855000750	888550H0075
.0315	0,80	.031	.118	.098	1,20	.157	2	88855000800	888550H0080
.0354	0,90	.031	.118	.114	1,30	.157	2	88855000900	888550H0090
.0394	1,00	.031	.118	.114	1,40	.157	2	88855001000	888550H0100
.0492	1,25	.031	.157	.134	1,65	.157	2	88855001250	888550H0125
.0591	1,50	.059	.197	.181	2,25	.236	2	88855001500	888550H0150
.0689	1,75	.059	.236	.220	2,50	.236	2	88855001750	888550H0175
.0787	2,00	.059	.236	.220	2,75	.315	2	88855002000	888550H0200
.0886	2,25	.059	.315	.260	3,00	.394	2	88855002250	888550H0225
.0984	2,50	.059	.315	.260	3,25	.394	2	88855002500	888550H0250
.1181	3,00	.059	.315	.299	3,75	.394	2	88855003000	888550H0300
.1575	4,00	.075	.394	.394	4,95	-	2-3/16	88855004000	888550H0400
.1969	5,00	.075	.472	.472	5,95	-	2-1/2	88855005000	888550H0500

Coating is available

Tolerances

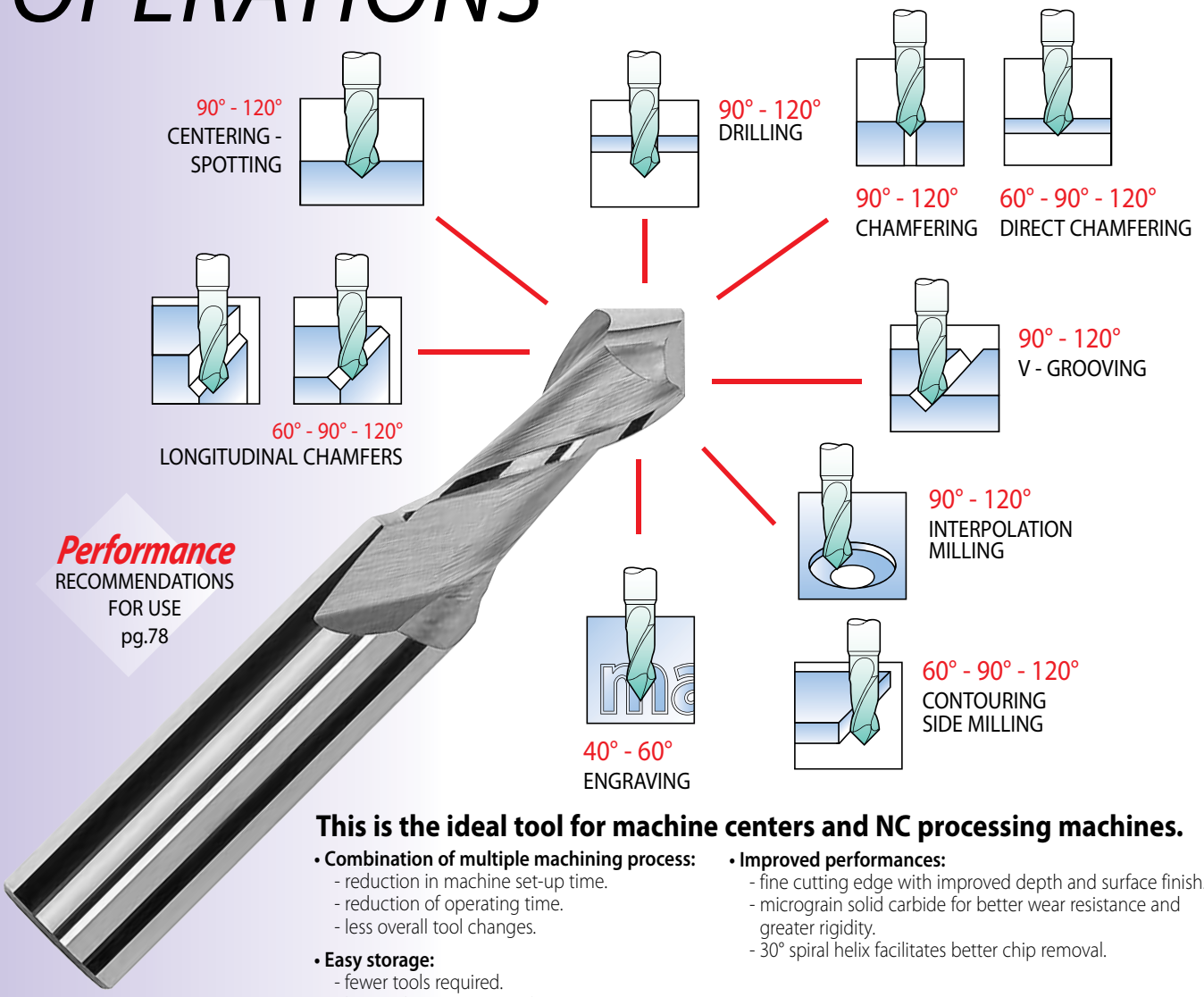
R	d1	d2	L
± .0008	± .00039	h6	± .0040

These cutters are designed for CNC machine. They allow machining even very thin materials. Many easy regrinds.

Hard-X
AlTiN Latuma

MULTI-FUNCTION TOOLS

1 MULTI-V® = 10 *OPERATIONS*



Performance
RECOMMENDATIONS FOR USE
pg.78

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

- **Combination of multiple machining process:**
  - reduction in machine set-up time.
  - reduction of operating time.
  - less 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.
  - micrograin solid carbide for better wear resistance and greater rigidity.
  - 30° spiral helix facilitates better chip removal.

METRIC

STANDARD magafor

Angle						100°		120°	
Diameter inch	Diameter mm	L	ℓ	d2	T*	MULTI-V 8095†	Hard'X 8095-H†	MULTI-V 8092	Hard'X 8092-H
.039	1,0	1-1/2	.080	.118	.004			88809201000	888092H0100
.059	1,5	1-1/2	.120	.118	.006			88809201500	888092H0150
.078	2,0	1-1/2	.160	.118	.008			88809202000	888092H0200
.098	2,5	1-1/2	.195	.118	.010			88809202500	888092H0250
.118	3	2	.240	.157	.012			88809203000	888092H0300
.157	4	2	.315	.197	.016			88809204000	888092H0400
.197	5	2	.395	.236	.020			88809205000	888092H0500
.236	6	2-3/8	.475	.315	.023	88809506000	888095H0600	88809206000	888092H0600
.315	8	2-3/4	.630	.394	.031	88809508000	888095H0800	88809208000	888092H0800
.394	10	2-3/4	.710	.472	.039	88809510000	888095H1000	88809210000	888092H1000
.472	12	2-3/4	.790	.472	.047	88809512000	888095H1200	88809212000	888092H1200
.630	16	3-1/8	1.025	.630	.063	88809516000	888095H1600	88809216000	888092H1600
.787	20	4	1.260	.787	.079			88809220000	888092H2000

T = web thickness of split point*

MULTI-V = 10 OPERATIONS

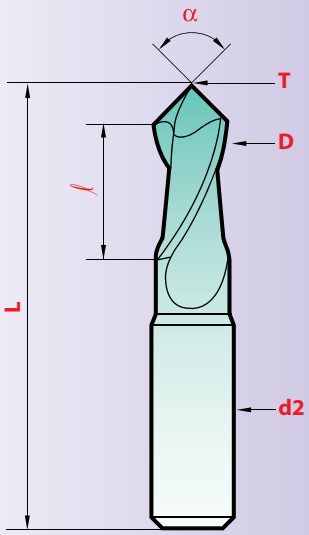
STANDARD magafor — Angle 90°

Diameter inch	Diameter mm	L	ℓ	d2	T*	MULTI-V 8090	Hard'X 8090-H
.003	0,1	1-1/2	.008	.118	.001	88809000100	888090H0010
.007	0,2	1-1/2	.016	.118	.001	88809000200	888090H0020
.011	0,3	1-1/2	.024	.118	.001	88809000300	888090H0030
.015	0,4	1-1/2	.032	.118	.002	88809000400	888090H0040
.020	0,5	1-1/2	.040	.118	.002	88809000500	888090H0050
.024	0,6	1-1/2	.047	.118	.002	88809000600	888090H0060
.028	0,7	1-1/2	.055	.118	.003	88809000700	888090H0070
.031	0,8	1-1/2	.063	.118	.003	88809000800	888090H0080
.035	0,9	1-1/2	.071	.118	.003	88809000900	888090H0090
.039	1,0	1-1/2	.080	.118	.004	88809001000	888090H0100
.043	1,1	1-1/2	.087	.118	.004	88809001100	888090H0110
.047	1,2	1-1/2	.095	.118	.005	88809001200	888090H0120
.051	1,3	1-1/2	.102	.118	.005	88809001300	888090H0130
.055	1,4	1-1/2	.110	.118	.006	88809001400	888090H0140
.059	1,5	1-1/2	.120	.118	.006	88809001500	888090H0150
.063	1,6	1-1/2	.125	.118	.006	88809001600	888090H0160
.066	1,7	1-1/2	.134	.118	.007	88809001700	888090H0170
.071	1,8	1-1/2	.140	.118	.007	88809001800	888090H0180
.074	1,9	1-1/2	.145	.118	.008	88809001900	888090H0190
.078	2,0	1-1/2	.160	.118	.008	88809002000	888090H0200
.082	2,1	1-1/2	.165	.118	.008	88809002100	888090H0210
.086	2,2	1-1/2	.173	.118	.009	88809002200	888090H0220
.090	2,3	1-1/2	.181	.118	.009	88809002300	888090H0230
.094	2,4	1-1/2	.190	.118	.009	88809002400	888090H0240
.098	2,5	1-1/2	.195	.118	.010	88809002500	888090H0250
.102	2,6	1-1/2	.205	.118	.010	88809002600	888090H0260
.118	3	2	.240	.157	.012	88809003000	888090H0300
.157	4	2	.315	.197	.016	88809004000	888090H0400
3/16		2	.375	1/4	.020	88809004760	888090H0476
.197	5	2	.395	.236	.020	88809005000	888090H0500
.236	6	2-3/8	.475	.315	.023	88809006000	888090H0600
1/4		2-3/8	.475	5/16	.025	88809006350	888090H0635
5/16		2-3/4	.630	3/8	.031	88809007930	888090H0793
.315	8	2-3/4	.630	.394	.031	88809008000	888090H0800
3/8		2-3/4	.710	1/2	.039	88809009520	888090H0952
.394	10	2-3/4	.710	.472	.039	88809010000	888090H1000
.472	12	2-3/4	.790	.472	.047	88809012000	888090H1200
1/2		2-3/4	.790	1/2	.051	88809012700	888090H1270
5/8		3-1/8	1.000	5/8	.063	88809015870	888090H1587
.630	16	3-1/8	1.025	.630	.063	88809016000	888090H1600
.787	20	4	1.260	.787	.079	88809020000	888090H2000

K15 *CARBIDE* — 6.5 - 7% Cobalt *(0,006 - 0,008mm grain size)*

T* = *web thickness of split point*

Hard-X
AlTiN Latuma



Diameters			α	d2	
.003 - .118	- 0	- .0010		.118	0 - .00020
.157 - .236	- 0	- .0012		.157 - .197	0 - .00030
.250 - .394	- 0	- .0014	± 1°	.197 - .500	0 - .00035
.472 - .630	-.0018	- .0036		.500 - .630	0 - .00045
.787	-.0025	- .0045		.787	0 - .00050

Tolerances

METRIC

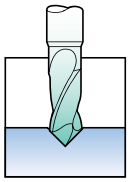
STANDARD magafor
Angle

†Angle 40° – 60° : *ideal for engraving*

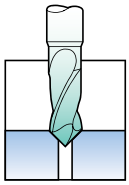
Diameter inch	Diameter mm	L	ℓ	d2	T*	MULTI-V 8040† (40°)	MULTI-V 8088† (60°)	Hard'X 8088-H† (60°)
.020	0,5	1-1/2	.040	.118	.002	88804000500	8880880050	888088H0050
.031	0,8	1-1/2	.063	.118	.003		8880880080	888088H0080
.039	1,0	1-1/2	.080	.118	.004	88804001000	8880880100	888088H0100
.047	1,2	1-1/2	.095	.118	.005		8880880120	888088H0120
.059	1,5	1-1/2	.120	.118	.006	88804001500	8880880150	888088H0150
.070	1,8	1-1/2	.142	.118	.007		8880880180	888088H0180
.078	2,0	1-1/2	.160	.118	.008	88804002000	8880880200	888088H0200
.098	2,5	1-1/2	.195	.118	.010		8880880250	888088H0250
.118	3	2	.240	.157	.012	88804003000	8880880300	888088H0300
.157	4	2	.315	.197	.016		8880880400	888088H0400
.197	5	2	.395	.236	.020	88804005000	8880880500	888088H0500
.236	6	2-3/8	.475	.315	.023		8880880600	888088H0600
.315	8	2-3/4	.630	.394	.031		8880880800	888088H0800
.394	10	2-3/4	.710	.472	.039		8880881000	888088H1000
.472	12	2-3/4	.790	.472	.047		8880881200	888088H1200
.630	16	3-1/8	1.025	.630	.063		8880881600	888088H1600
.787	20	4	1.260	.787	.079		8880882000	888088H2000

MULTI-V®
Performance
RECOMMENDATIONS OF USING

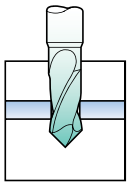
MATERIAL	SPEED SFM		diameter 3mm-3/16"	5mm-1/4"	10mm-5/16"	FEED inches/rev. 12mm-1/2"	16mm-5/8"	20mm
Steel < 81 HRB (B)	230-247	RPM	6400	4000	2500	1900	1500	1300
		IPM	12.6	12.6	13.8	14.2	14.2	14.3
		inch/tooth	.002	.0031	.0055	.0075	.0094	.0110
Steel < 24 Rc (C)	132-197	RPM	4000	2600	1600	1200	900	850
		IPM	7.9	8.2	8.8	9.4	8.9	9.4
		inch/tooth	.002	.0031	.0055	.0075	.0094	.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	.0018	.0028	.0047	.0071	.0087	.0110
Steels 32-41 Rc *Cast 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	.0018	.0028	.0047	.0067	.0087	.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	.0016	.0024	.0043	.0063	.0087	.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	.0016	.0024	.0043	.0063	.0079	.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	.0039	.0059	.0098	.0118	.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	.0020	.0035	.0059	.0079	.0106	.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	.002	.0035	.0075	.0079	.0106	.0138



90°-120°
CENTERING - SPOTTING

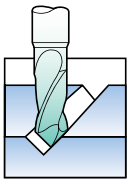


60°-90°-120°
CHAMFERING
DIRECT CHAMFERING



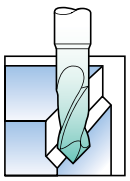
90°-120°
DRILLING

MATERIAL	SPEED SFM		diameter 3mm-3/16"	5mm-1/4"	10mm-5/16"	FEED inches/rev. 12mm-1/2"	16mm-5/8"	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	.0002	.0003	.0006	.0007	.0010	.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	.0002	.0003	.0006	.0007	.0010	.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	.0002	.0002	.0005	.0007	.0008	.0011
Steels 32-41 Rc *Cast 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	.0002	.0002	.0005	.0006	.0008	.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	.0002	.0002	.0004	.0005	.0007	.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	.0001	.0002	.0004	.0005	.0007	.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	.0003	.0004	.0007	.0008	.0012	.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	.0003	.0005	.0009	.0012	.0017	.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	.0004	.0006	.0010	.0013	.0018	.0022

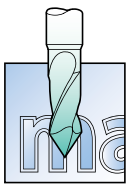


90°-120°
V - GROOVING

MATERIAL	SPEED SFM		diameter 3mm-3/16"	5mm-1/4"	10mm-5/16"	FEED inches/rev. 12mm-1/2"	16mm-5/8"	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	.0003	.0006	.0010	.0016	.0020	.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	.0003	.0005	.0010	.0016	.0020	.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	.0003	.0005	.0010	.0016	.0020	.0024
Steels 32-41 Rc *Cast 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	.0003	.0005	.0010	.0014	.0020	.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	.0003	.0005	.0010	.0014	.0018	.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	.0003	.0004	.0010	.0014	.0020	.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	.0004	.0006	.0012	.0018	.0020	.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	.0003	.0005	.0012	.0018	.0020	.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	.0005	.0006	.0014	.0020	.0020	.0028

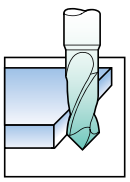


60°-90°-120°
LONGITUDINAL CHAMFERS



90°-120°
INTERPOLATION MILLING

40°-60°
ENGRAVING



60°-90°-120°
CONTOURING
SIDE MILLING

Bi-face

FRONT AND BACK CHAMFERING BICONICAL CUTTERS

BI-FACE ADVANTAGES

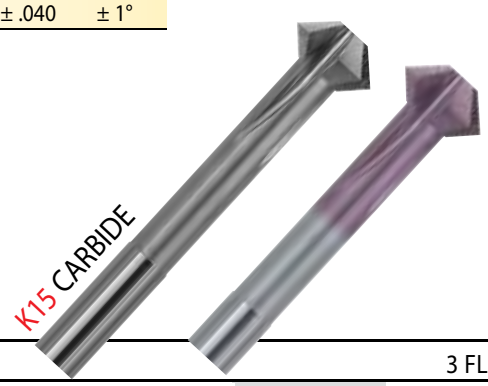
Special design = positive cut + relieving profile

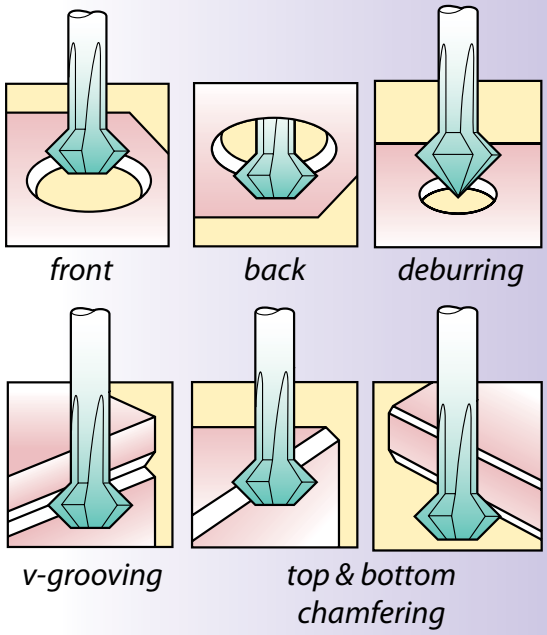
- Unequalled surface finish
- Impressive performance
- Extended tools profile life

Hard-X
AlTiN Latuma

Tolerances

D	tolerance	L	∝
Ø .040~.197	0 - .002	± .040	± 1°
Ø .236~.630	0 - .004	± .040	± 1°



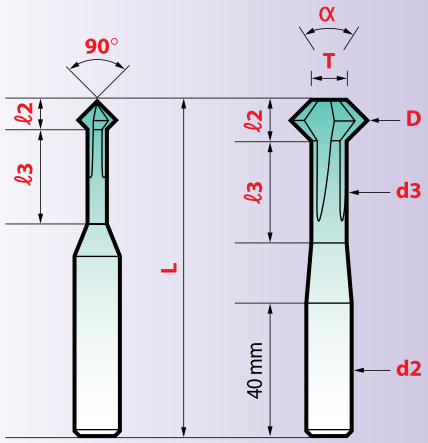


Angle 90° MINI — 3 FLUTES

Diameter inch	mm	d2	d3 max	T max	L min	ℓ2	ℓ3	Bi-face 8480	Hard'X 8480-H
.040	1,0	.118	.028	.012	2-3/8	.020	.197	88848001000	888480H0100
.059	1,5	.118	.043	.018	2-3/8	.029	.236	88848001500	888480H0150
.079	2,0	.118	.059	.024	2-3/8	.037	.315	88848002000	888480H0200
.118	3,0	.118	.087	.035	2-3/8	.059	.394	88848003000	888480H0300

Angle 90° STANDARD — 4 FLUTES

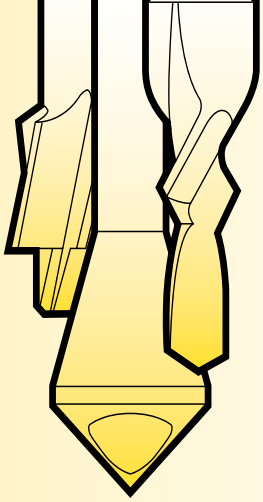
Diameter inch	mm	d2	d3 max	T max	L min	ℓ2	ℓ3	Bi-face 8490	Hard'X 8490-H
.118	3,0	.236	.087	.047	4	.051	.394	88849003000	888490H0300
.157	4,0	.236	.114	.063	4	.069	.472	88849004000	888490H0400
.197	5,0	.236	.134	.079	4	.091	.591	88849005000	888490H0500
.236	6,0	.236	.154	.094	4	.114	.709	88849006000	888490H0600
.315	8,0	.236	.193	.193	4	.118	1.339	88849008000	888490H0800
.394	10,0	.236	.232	.232	4	.157	1.339	88849010000	888490H1000
.472	12,0	.236	.232	.232	4	.236	1.339	88849012000	888490H1200
.630	16,0	.394	.311	.311	4	.315	1.339	88849016000	888490H1600



Angle 60° STANDARD — 4 FLUTES

Diameter inch	mm	d2	d3 max	T max	L min	ℓ2	ℓ3	Bi-face 8460	Hard'X 8460-H
.197	5,0	.236	.134	.134	4	.110	1.339	88846005000	888460H0500
.315	8,0	.236	.193	.232	4	.213	1.339	88846008000	888460H0800
.472	12,0	.394	.232	.232	4	.417	1.339	88846012000	888460H1200

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



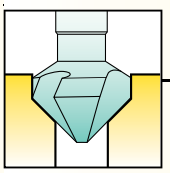
COUNTERSINKING

COUNTERSINKS

Hand Countersinks
Page 85

- *Chamfering*
- *Deburring*

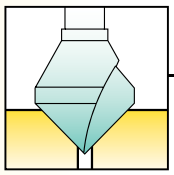
TRIDENT THREE FLUTES



Angle					
30°	60°	82°	90°	100°	120°
Page 81	Page 81	Page 81	Pages 82	Page 81	Page 81

ADVANTAGES:
- *Self-centering (3 flutes)*
- *Designed for 82° capscrew countersinking*
- *Hand using*
- *Longitudinal chamfers and contouring*
- *Works without vibrations*

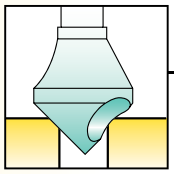
SINGLE FLUTE



Angle				
60°	82°	90°	100°	120°
Page 84	Page 84	Page 85	Page 85	Page 85

ADVANTAGES:
- *For wood and hard plastics*
- *Can drill in sheet materials*
- *Easy to resharpen*
- *Works without vibrations*

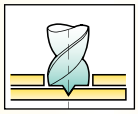
ZERO FLUTE WITH HOLE



Angle				
60°	82°	90°	100°	120°
Page 86	Page 86	Page 86	Page 86	Page 86

ADVANTAGES:
- *For light metals and plastics*
- *For deburring and small chamfers*
- *Best surface finish*
- *Works without vibrations*

AUTO BODY SPOT WELD DRILL BITS



- *Disconnect sheet metal spot weld*

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magafor, *The choice!*

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	1800 HV	1800 HV + 3500
Use	Small Series	Production intensive		Hard and abrasive alloys		Treated steels	

TRI-DENT
HAND COUNTERSINKS

METRIC		Angle	82°	90°
Diameter inch	mm	Capacity min/max	Cobalt 438	Cobalt 430
.488	12,4	.118 - .488	84438124000	84430124000
.650	16,5	.157 - .650	84438165000	84430165000
.807	20,5	.157 - .807	84438205000	84430205000
.984	25,0	.197 - .984	84438250000	84430250000
1.220	31,0	.197 - 1.220	84438310000	84430310000

UNIVERSAL AUTO-LOCK CHUCK

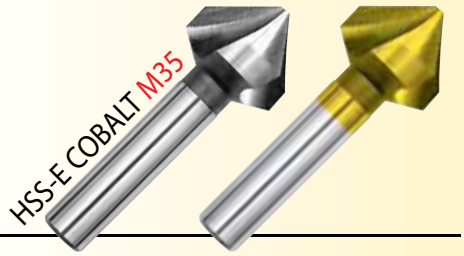
Ergonomic Handle Capacity 3/64 - 8 mm	magafor 84400200000
Large Handle Capacity 3/64 - 1/2	magafor 84400100000

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

3 FLUTE COUNTERSINK SETS

Angle	Cobalt	COMPOSITION / mm
60°	84432000000	10,4
	84483200000 TIN	16,5
82°	84434000000	20,5
	84483400000 TIN	25
100°	84435000000	31
120°	84433000000	

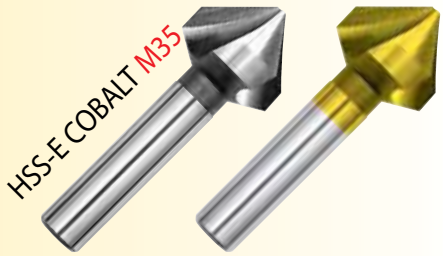
TRI-DENT
Three flute COUNTERSINKS

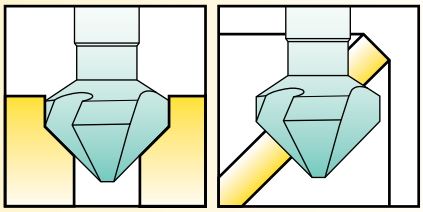


METRIC

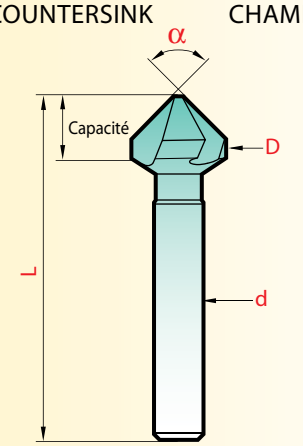
Angle	Diameter inch	mm	Capacity min/max	d	L	Cobalt	Angle	M35/TIN
30° 439	.248	6,3	.079 - .248	.197	2	84439063000	30° 4839	84483906300
	.488	12,4	.012 - .488	.315	2-1/2	84439124000		84483912400
	.650	16,5	.157 - .650	.394	3	84439165000		84483916500
	.984	25,0	.236 - .984	.394	3-1/2	84439250000		84483925000
60° 432	.248	6,3	.051 - .248	.197	1-7/8	84432063000	60° 4832	84483206300
	.327	8,3	.071 - .327	.236	2	84432083000		84483208300
	.410	10,4	.091 - .410	.236	2	84432104000		84483210400
	.488	12,4	.098 - .488	.315	2-3/8	84432124000		84483212400
	.650	16,5	.110 - .650	.394	2-1/2	84432165000		84483216500
	.807	20,5	.118 - .807	.394	2-3/4	84432205000		84483220500
	.984	25,0	.126 - .984	.394	3	84432250000		84483225000
	1.22	31,0	.138 – 1.22	.472	3-1/8	84432310000		84483231000
82° 434	.248	6,3	.051 - .248	.197	1-3/4	84434063000	82° 4834	84483406300
	1/4	6,35	.050 - .250	1/4	1-3/4	84434063500		84483406350
	5/16	7,94	.070 - .312	1/4	1-3/4	84434079300		84483407930
	.327	8,3	.070 - .327	.236	2	84434083000		84483408300
	3/8	9,52	.085 - .375	1/4	2	84434095200		84483409520
	.410	10,4	.087 - .410	.236	2	84434104000		84483410400
	.488	12,4	.098 - .488	.315	2-1/4	84434124000		84483412400
	1/2	12,7	.100 - .500	1/4	2	84434127000		84483412700
	5/8	15,87	.110 - .625	3/8	2-3/8	84434158700		84483415870
	.650	16,5	.110 - .650	.394	2.3/8	84434165000		84483416500
	3/4	19,05	.120 - .750	3/8	2-3/8	84434190500		84483419050
	.807	20,5	.118 - .807	.394	2-1/2	84434205000		84483420500
	.984	25,0	.126 - .984	.394	2-11/16	84434250000		84483425000
	1.00	25,4	.125 – 1.00	3/8	2-3/4	84434254000		84483425400
	1.22	31,0	.138 – 1.22	.472	2-7/8	84434310000		84483431000
100° 435	.248	6,3	.051 - .248	.197	1-3/4	84435063000	100° 4835	84483506300
	.327	8,3	.070 - .327	.236	2	84435083000		84483508300
	.410	10,4	.087 - .410	.236	2	84435104000		84483510400
	.488	12,4	.098 - .488	.315	2-3/16	84435124000		84483512400
	.650	16,5	.110 - .650	.394	2-5/16	84435165000		84483516500
	.807	20,5	.118 - .807	.394	2-7/16	84435205000		84483520500
	.984	25,0	.126 - .984	.394	2-1/2	84435250000		84483525000
	1.22	31,0	.138 – 1.22	.472	2-11/16	84435310000		84483531000
120° 433	.248	6,3	.051 - .248	.197	1-3/4	84433063000	120° 4833	84483306300
	.327	8,3	.070 - .327	.236	2	84433083000		84483308300
	.410	10,4	.087 - .410	.236	2	84433104000		84483310400
	.488	12,4	.098 - .488	.315	2-1/8	84433124000		84483312400
	.650	16,5	.110 - .650	.394	2-1/4	84433165000		84483316500
	.807	20,5	.118 - .807	.394	2-5/16	84433205000		84483320500
	.984	25,0	.126 - .984	.394	2-1/2	84433250000		84483325000
	1.22	31,0	.138 – 1.22	.472	2-1/2	84433310000		84483331000

TRI-DENT
90° Three flute COUNTERSINKS





COUNTERSINK CHAMFER

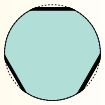


D	Angle	d	L
± 0.05	- 1°	h9	± 1mm

Tolerances

This highly productive countersinking cutter is a much improved version of the traditional multiflute milling cutter
- *grooves opened wide to allow for greater chip removal,*
- *high positive cut,*
- *constant profile relief (a great many regrinds),*
- *self centering countersink,*
- *work without vibration.*

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



90° THREE FLUTE COUNTERSINKS

Angle 90°

Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 431	M35/TIN 4831
.158	4,0	.051 - .158	.158	1-5/8	84431040000	84483104000
.170	4,3	.051 - .170	.158	1-5/8	84431043000	84483104300
.197	5,0	.051 - .197	.158	1-5/8	84431050000	84483105000
.209	5,3	.051 - .209	.197	1-3/4	84431053000	84483105300
.229	5,8	.051 - .229	.197	1-3/4	84431058000	84483105800
.236	6,0	.051 - .236	.197	1-3/4	84431060000	84483106000
.248	6,3	.051 - .248	.197	1-3/4	84431063000	84483106300
1/4	6,35	.050-.250	1/4	1-3/4	84431063500	84483106350
.276	7,0	.063 - .276	.236	2	84431070000	84483107000
.288	7,3	.063 - .288	.236	2	84431073000	84483107300
5/16	7,94	.070-.312	1/4	1-3/4	84431079300	84483107930
.315	8,0	.071 - .315	.236	2	84431080000	84483108000
.327	8,3	.071 - .327	.236	2	84431083000	84483108300
.354	9,0	.079 - .354	.236	2	84431090000	84483109000
.370	9,4	.079 - .370	.236	2	84431094000	84483109400
3/8	9,52	.085-.375	1/4	2	84431095200	84483109520
.394	10,0	.087 - .394	.236	2	84431100000	84483110000
. 410	10,4	.087 - .410	.236	2	84431104000	84483110400
.453	11,5	.098 - .453	.315	2-1/4	84431115000	84483111500
. 472	12,0	.098 - .472	.315	2-1/4	84431120000	84483112000
.488	12,4	.098 - .488	.315	2-1/4	84431124000	84483112400
1/2	12,70	.100-.500	1/4	2	84431127000	84483112700
.528	13,4	.098 - .528	.315	2-1/4	84431134000	84483113400
.567	14,4	.098 - .567	.315	2-1/4	84431144000	84483114400
.590	15,0	.110 - .590	.394	2-3/8	84431150000	84483115000
5/8	15,87	.110-.625	3/8	2-3/8	84431158700	84483115870
.650	16,5	.110 - .650	.394	2-3/8	84431165000	84483116500
.748	19,0	.118 - .748	.394	2-1/2	84431190000	84483119000
3/4	19,05	.120-.750	3/8	2-3/8	84431190500	84483119050
.807	20,5	.118 - .807	.394	2-1/2	84431205000	84483120500
.906	23,0	.126 - .906	.394	2-5/8	84431230000	84483123000
.984	25,0	.126 - .984	.394	2-5/8	84431250000	84483125000
1	25,40	.125-1.00	3/8	2-3/4	84431254000	84483125400
1.024	26,0	.126 - 1.024	.394	2-5/8	84431260000	84483126000
1.102	28,0	.138 - 1.102	.472	2-3/4	84431280000	84483128000
1.181	30,0	.138 - 1.181	.472	2-3/4	84431300000	84483130000
1.220	31,0	.138 - 1.220	.472	2-3/4	84431310000	84483131000

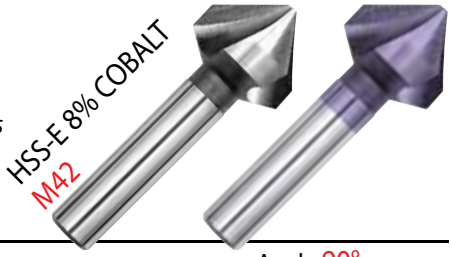
WITH 3 FLATTED SHANKS*

Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 437	TIN 4837
.488	12,4	.098 - .488	.315	2-1/4	84437124000	84483712400
.567	14,4	.098 - .567	.315	2-1/4	84437144000	84483714400
.650	16,5	.110 - .650	.394	2-3/8	84437165000	84483716500
.807	20,5	.118 - .807	.394	2-1/2	84437205000	84483720500
.984	25,0	.126 - .984	.394	2-5/8	84437250000	84483725000
1.220	31,0	.138 - 1.220	.472	2-3/4	84437310000	84483731000
1.339	34,0	.177 - 1.339	.630	4	84437340000	84483734000
1.378	35,0	.177 - 1.378	.630	4	84437350000	84483735000
1.457	37,0	.177 - 1.457	.630	4-5/8	84437370000	84483737000
1.575	40,0	.177 - 1.575	.630	4-5/8	84437400000	84483740000
1.969	50,0	.197 - 1.969	.630	5	84437500000	84483750000
2.480	63,0	.394 - 2.480	.630	5-1/2	84437630000	84483763000
3.150	80,0	.551 - 3.150	.630	6-1/2	84437800000	84483780000

* Effective holding thanks to the three flats on shank

Code 4936

• *Special for abrasion resistant hard alloys*



METRIC — Angle 90°

Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt + 436	M42/Futura 4936
.248	6,3	.051 - .248	.197	1-3/4	84436063000	84493606300
.327	8,3	.071 - .327	.236	1-3/4	84436083000	84493608300
.410	10,4	.087 - .410	.236	1-3/4	84436104000	84493610400
.488	12,4	.098 - .488	.315	2-1/4	84436124000	84493612400
.650	16,5	.110 - .650	.394	2-3/8	84436165000	84493616500
.807	20,5	.118 - .807	.394	2-1/2	84436205000	84493620500
.984	25,0	.126 - .984	.394	2-5/8	84436250000	84493625000
1.220	31,0	.138 - 1.220	.472	2-3/4	84436310000	84493631000
1.969	50,0*	.197 - 1.969	.630	5	84436500000	84493650000

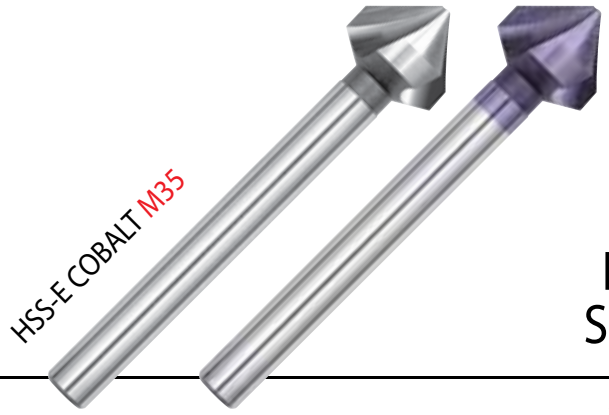
**3 flatted shanks*

K15 *SOLID* CARBIDE

METRIC — Angle 90°

Diameter inch	Diameter mm	Capacity min/max	d	L	Carbide 8431	K15/Hard'X 8431-H
.170	4,3	.051 - .170	.157	1-9/16	88843104300	888431H0430†
.209	5,3	.051 - .209	.157	1-9/16	88843105300	888431H0530†
.248	6,3	.051 - .248	.197	1-3/4	88843106300	888431H0630†
.327	8,3	.071 - .327	.236	1-3/4	88843108300	888431H0830†
.410	10,4	.087 - .410	.236	1-3/4	88843110400	888431H1040
.488	12,4*	.098 - .488	.315	2-1/4	88843112400	888431H1240
.650	16,5*	.110 - .650	.394	2-3/8	88843116500	888431H1650
.807	20,5*	.118 - .807	.394	2-1/2	88843120500	888431H2050
.984	25,0*	.126 - .984	.394	2-5/8	88843125000	888431H2500
1.220	31,0*	.138 - 1.220	.472	2-3/4	88843131000	888431H3100

* Ø 12,4 - 31,0 = *3 flatted shanks*



LONG SERIES

METRIC — Angle 90°

Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 4303	M35/Futura 4933	Carbide 8431-L
.248	6,3	.051 - .248	.236	3-5/16	84430306300	84493306300	888431L0630
.327	8,3	.071 - .327	.315	3-3/8	84430308300	84493308300	888431L0830
.410	10,4	.087 - .410	.394	3-1/2	84430310400	84493310400	888431L1040
.488	12,4	.098 - .488	.394	4-1/4	84430312400	84493312400	888431L1240
.650	16,5	.110 - .650	.630	4-7/16	84430316500	84493316500	888431L1650
.807	20,5	.118 - .807	.630	4-1/2	84430320500	84493320500	888431L2050
.984	25,0	.126 - .984	.788	4-11/16	84430325000	84493325000	

NOTE :

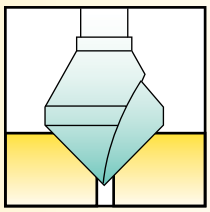
All these metric sizes are available within 2 weeks.
Call for information.

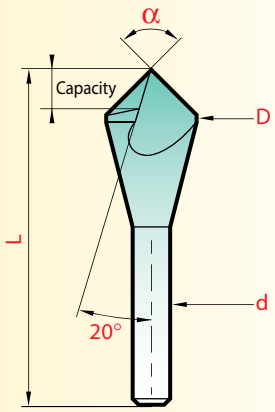
3 FLUTE COUNTERSINK SETS ANGLE 90°

magafor	Diameter/COMPOSITION
84431000000	10,4 - 16,5 - 20,5 - 25,0 - 31,0 mm
84483100000 TIN	
84436000000	
84431000002	6,3 - 8,3 - 10,4 - 12,4 - 16,5 - 20,5 mm
84483100002 TIN	
84436000002	
88843100002	
84431000003 [1]	6,3 - 8,3 - 10,4 - 12,4 - 16,5 - 20,5 - 25 mm
84431000004 [1]	4,3 - 5,3 - 6,3 - 8,3 - 10,4 - 12,4 - 16,5 - 20,5 - 25 - 31 mm
88843100000	10,4 - 16,5 - 20,5 - 25 - 31 mm carbide
84431000006 [2]	6,3 - 12,4 - 16,5 - 20,5 mm
84483100006 TIN [2]	

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

Single flute
CHAMFERING CUTTERS



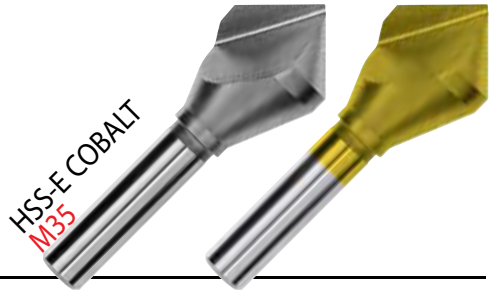


D	Angle	d	L
+0.3	-1°	h9	±1mm

Tolerances

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 30 mm),*
- *simultaneous drilling and countersinking on thin elements (laminates, aluminium, wood).*

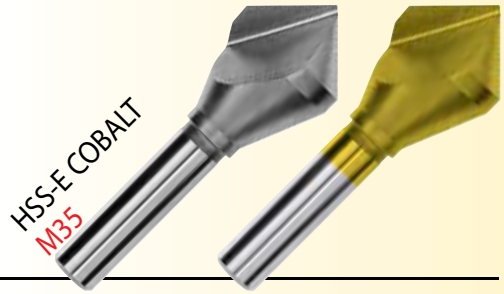
Constant finish-grind profile makes it possible to obtain many easy regrinds : a mere touch of the grinder to the tooth is sufficient. We recommend lubricating.

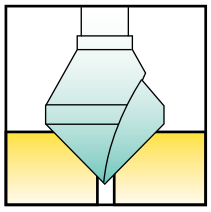


Angle	Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 422	M35/TIN 4822
60°	1/8		1/32 - 1/8	1/8	1-1/4	84422031700	84482203170
	3/16		3/64 - 3/16	3/16	1-3/8	84422047600	84482204760
	.236	6	3/64 - .236	.236	1-5/8	84422060000	84482206000
	1/4		3/64 - 1/4	1/4	1-1/2	84422063500	84482206350
	5/16		3/64 - 5/16	1/4	1-5/8	84422079300	84482207930
	3/8		3/64 - 3/8	1/4	1-3/4	84422095200	84482209520
	.394	10	3/64 - .394	.236	1-7/8	84422100000	84482210000
	.472	12	5/64 - .472	.315	2-1/8	84422120000	84482212000
	1/2		5/64 - 1/2	1/4	2	84422127000	84482212700
	.590	15	5/64 - .590	.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
	.787	20	5/64 - .787	.394	2-7/8	84422200000	84482220000
	7/8		7/64 - 7/8	1/2	2-3/4	84422222200	84482222220
	.984	25	1/8 - .984	.472	3-3/8	84422250000	84482225000
	1		1/8 - 1	1/2	2-3/4	84422254000	84482225400
	1.181	30	1/8 - 1.181	.472	3-5/8	84422300000	84482230000
	1-1/4		1/8 - 1-1/4	1/2	3	84422317500	84482231750

Angle	Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 424	M35/TIN 4824
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
	.236	6	3/64 - .236	.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
	.394	10	3/64 - .394	.236	1-3/4	84424100000	84482410000
	.472	12	5/64 - .472	.315	2	84424120000	84482412000
	1/2		5/64 - 1/2	1/4	2	84424127000	84482412700
	.590	15	5/64 - .590	.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
	.787	20	5/64 - .787	.394	2-5/8	84424200000	84482420000
	7/8		7/64 - 7/8	1/2	2-3/4	84424222200	84482422220
	.984	25	1/8 - .984	.472	3	84424250000	84482425000
	1		1/8 - 1	1/2	2-3/4	84424254000	84482425400
	1.181	30	1/8 - 1.181	.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 degree angles are metric standard. Call for information.





SETS OF 6 PIECE SINGLE FLUTE COUNTERSINKS

1/4 - 5/16 - 3/8 - 1/2 - 5/8 - 3/4

Angle	Cobalt	M35/TIN
60°	84422000006	84482200006
82°	84424000006	84482400006
90°	84421000006	84482100006

SETS OF 5 PIECES SINGLE FLUTE COUNTERSINKS METRIC

10 - 15 - 20 - 25 - 30

Angle	Cobalt	M35/TIN
60°	84422000000	84482200000
82°	84424000000	84482400000
90°	84421000000	84482100000
100°	84425000000	84482500000
120°	84423000000	84482300000

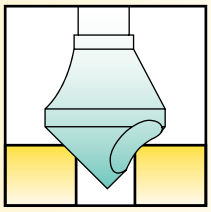
Angle	Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 421	M35/TIN 4821
90°	1/8		1/32 - 1/8	1/8	1-1/4	84421031700	84482103170
	.157	4	3/64 - .157	.157	1-1/2	84421040000	84482104000
	3/16		3/64 - 3/16	3/16	1-3/8	84421047600	84482104760
	.197	5	3/64 - .197	.197	1-1/2	84421050000	84482105000
	.236	6	3/64 - .236	.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
	.315	8	3/64 - .315	.236	1-1/2	84421080000	84482108000
	3/8		3/64 - 3/8	1/4	1-3/4	84421095200	84482109520
	.394	10	3/64 - .394	.236	1-3/4	84421100000	84482110000
	.472	12	5/64 - .472	.315	2	84421120000	84482112000
	1/2		5/64 - 1/2	1/4	2	84421127000	84482112700
	.590	15	5/64 - .590	.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
	.787	20	5/64 - .787	.394	2-5/8	84421200000	84482120000
	7/8		7/64 - 7/8	1/2	2-3/4	84421222200	84482122220
	.984	25	1/8 - .984	.472	3	84421250000	84482125000
	1		1/8 - 1	1/2	2-3/4	84421254000	84482125400
	1.181	30	1/8 - 1.181	.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	.630 [1]	4	84421350000	84482135000
	1.575	40	7/32 - 1.575	.630 [1]	4-5/8	84421400000	84482140000
	2	50	15/32 - 2	.630 [1]	5	84421500000	84482150000

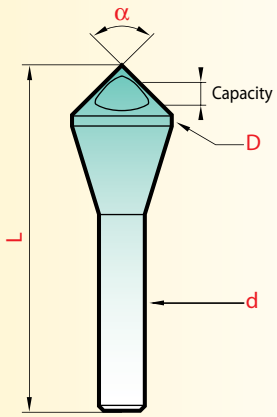
[1] *Shank with 3 flats for better holding*

Angle	Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 425	M35/TIN 4825
100°	.394	10	3/64 - .394	.236	1-3/4	84425100000	84482510000
	.472	12	5/64 - .472	.315	1-7/8	84425120000	84482512000
	.590	15	5/64 - .590	.315	2-1/8	84425150000	84482515000
	.787	20	5/64 - .787	.394	2-1/2	84425200000	84482520000
	.984	25	1/8 - .984	.472	3	84425250000	84482525000
	1.181	30	1/8 - 1.181	.472	3-3/8	84425300000	84482530000

Angle	Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 423	M35/TIN 4823
120°	.394	10	3/64 - .394	.236	1-3/4	84423100000	84482310000
	.472	12	5/64 - .472	.315	1-7/8	84423120000	84482312000
	.590	15	5/64 - .590	.315	2	84423150000	84482315000
	.787	20	5/64 - .787	.394	2-3/8	84423200000	84482320000
	.984	25	1/8 - .984	.472	2-7/8	84423250000	84482325000
	1.181	30	1/8 - 1.181	.472	3-1/4	84423300000	84482330000

ZERO FLUTE DEBURRING TOOL With Hole





D	Angle	d	L
+0.3	-1°	h9	±1mm

Tolerances

The deburring tool "with hole" is more particularly designed for countersinking and chamfering light metals and plastics.
The surface obtained is smooth and without burrs.
We recommend lubricating.

SETS OF 5 ZERO FLUTE CUTTERS

Angle	magafor EDP#	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

Angle 90°

TYPE — Right hand

#	Diameter inch	Diameter mm	Capacity min/max	d	L	Cobalt 411	M35/TIN 4811
0	1/4 [1]		5/64 - 3/16	1/4	1-3/4	84411063500	84481106350
	.394	10	5/32 - 11/32	.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
	.590	15	1/4 - 9/16	.315	2-1/4	84411150000	84481115000
	.787	20	5/16 - 11/16	.394	2-1/2	84411200000	84481120000
3	13/16		5/16 - 11/16	1/2	2-5/8	84411204000	84481120400
	.984	25	3/8 - 7/8	.472	3	84411250000	84481125000
	1.102	28	7/16 - 1	.472	3-3/8	84411280000	84481128000
	1.181	30	1/2 - 1-1/8	.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	.630 [2]	4	84411350000	84481135000
	1.575	40	5/8 - 1-1/2	.630 [2]	4-5/8	84411400000	84481140000
	1.969	50	3/4 - 1-7/8	.630 [2]	5	84411500000	84481150000

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

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
		.394	10	3/16 - 11/32	.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
		.590	15	5/16 - 9/16	.315	2-3/8	84412150000
		.787	20	3/8 - 11/16	.394	2-7/8	84412200000
	3	13/16		3/8 - 11/16	1/2	2-5/8	84412204000
		.984	25	1/2 - 7/8	.472	3-3/8	84412250000
		1.181	30	9/16 - 1-1/8	.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	.630[2]	4-1/2	84412350000
82° 414	0	1/4[1]		5/64 - 3/16	1/4	1-3/4	84414063500
		.394	10	5/32 - 11/32	.236	1-/34	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
		.590	15	1/4 - 9/16	.315	2-1/4	84414150000
		.787	20	5/16 - 11/16	.394	2-1/2	84414200000
	3	13/16		5/16 - 11/16	1/2	2-5/8	84414204000
		.984	25	3/8 - 7/8	.472	3	84414250000
		1.181	30	1/2 - 1-1/8	.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	.630 [2]	4	84414350000
100° 415		.394	10	5/32 - 11/32	.236	1-3/4	84415100000
		.590	15	1/4 - 9/16	.315	2-1/8	84415150000
		.787	20	9/32 - 11/16	.394	2-1/2	84415200000
		.984	25	11/32 - 7/8	.472	3	84415250000
		1.181	30	7/16 - 1-1/16	.472	3-3/8	84415300000
		1.378	35	1/2 - 1-5/16	.630[2]	4	84415350000
120° 413		.394	10	5/32 - 11/32	.236	1-3/4	84413100000
		.590	15	1/4 - 9/16	.315	2	84413150000
		.787	20	9/32 - 11/16	.394	2-3/8	84413200000
		.984	25	11/32 - 7/8	.472	2-7/8	84413250000
		1.181	30	7/16 - 1-1/16	.472	3-1/4	84413300000
		1.378	35	1/2 - 1-5/16	.630[2]	3-3/4	84413350000

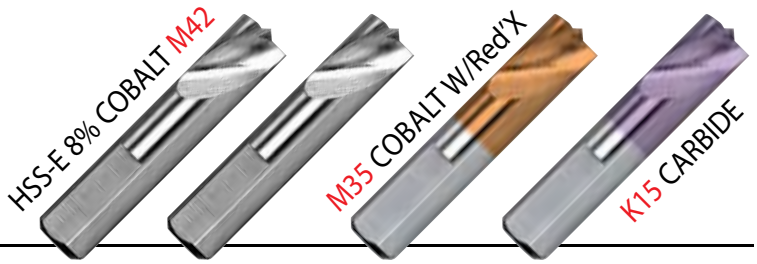
[1] *Double end cutter* [2] *3 flatted shanks*

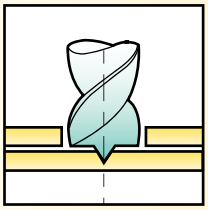
AUTO BODY DRILL BITS TO DISCONNECT SPOT WELDS

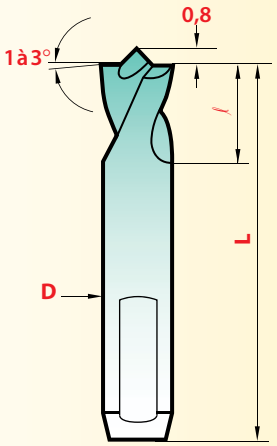
The machining of hard sheets has to be done with coated tools.

The high performance series **8203-H** is made from **Hard'X** coated carbide.

Hard-X
AlTiN Latuma







Short series

Diameter inch	Diameter mm	L	ℓ	Cobalt 202	Cobalt 203	M35/Red'X 2903	K15/Hard'X 8203-H
.236	6	1-3/4	.590		82203060000		
5/16		1-1/2	.590	82202080000			
5/16		1-3/4	.590		82203080000	82290308000	888203H0800

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

These short drills are specially designed to be used with the 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.

Tolerances

D	L	ℓ
h8	± 1	+1

Long series

Diameter inch	Diameter mm	L	ℓ	Cobalt 201	M35/Red'X 2901	Brazed Carbide 8201
.236	6	2-5/8	1.100	82201060000	82290106000	
.275	7	2-7/8	1.340	82201070000	82290107000	
.314	8					88820108000
5/16		3-1/8	1.450	82201080000	82290108000	
.394	10	3-1/2	1.690	82201100000	82290110000	

To be used with standard drilling machines.

K15 *CARBIDE* — 6.5 - 7% Cobalt *(0,006 - 0,008mm grain size)*

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 spotweld drills are designed to machine the new very-high elastic limit sheet metal (VHEL).

DEBURRING COUNTERSINKING

Recommendation N° 1

Recommendation N° 2

Performance

CONDITIONS

USING RECOMMENDATIONS

SFM = Speed : Surface Feet Per Minute

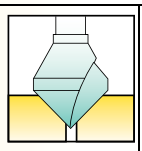
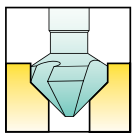
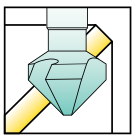
IPM = Feed : Inches Per Minute

$$RPM = \frac{SFM \times 12}{3.14 \times Diameter}$$

Example:

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

$$RPM = \frac{45 \times 12}{3.14 \times .750} = \frac{540}{2.35} = 230 \text{ RPM}$$

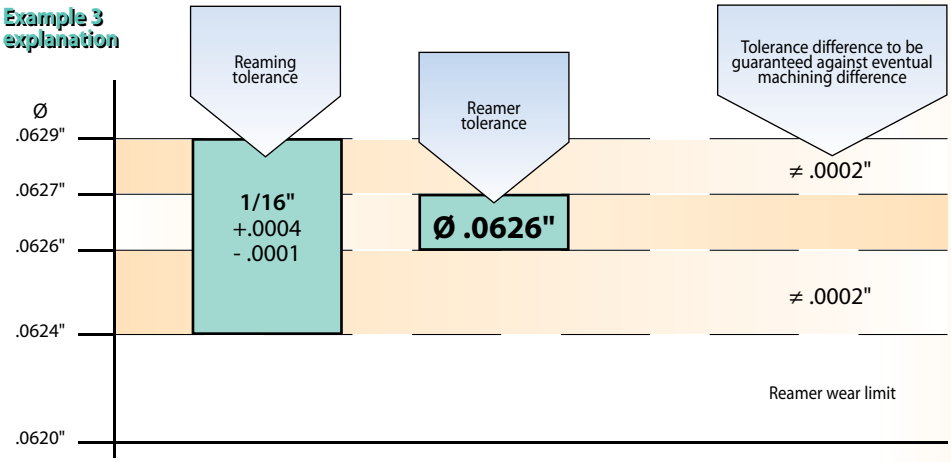
			DEBURRING - COUNTERSINKING										CONTOURING					
																		
MATERIAL			HSS.Co		HSS.Co		HSS.Co		HSS.8%Co		Carbure/Carbide		HSS.Co		HSS.8%Co		Carbure/Carbide	
				+TiN		+TiN		+TiN		+Red'X		+Hard'X		+TiN		+Red'X		+Hard'X
	SFM		115-148	115-148	115-148	115-148	55-70	55-70	112-145	112-145	128-256	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	10	3.4	3.4	6.5	6.5	10	10
< 81 HRB (B)	Ø20	IPM	3.4	3.4	3.4	3.4	1.8	1.8	3.4	3.4	5	5	1.8	1.8	3.4	3.4	5	5
	Ø30	IPM	2	2	2	2	1.2	1.2	2	2	3.4	3.4	1.2	1.2	2	2	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	2	2	2	1.2	1.2	2	2	3.4	3.4	1.2	1.2	2	2	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	2	2	2	1.4	1.4	2	2	4	4	1.4	1.4	2	2	4	4
24 - 32 Rc	Ø20	IPM	1.4	1.4	1.4	1.4	1	1	1.4	1.4	2.4	2.4	1	1	1.4	1.4	2.4	2.4
	Ø30	IPM	1	1	1	1	0.6	0.6	1	1	1.8	1.8	0.6	0.6	1	1	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	4	1.2	1.2	1.8	1.8	4	4
32 - 41 Rc	Ø20	IPM	1	1	1	1	0.6	0.6	1	1	2.4	2.4	0.6	0.6	1	1	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	Ø10	IPM								1.6	2	2				1.6	2	2
steel	Ø20	IPM								1.2	1.4	1.4				1.2	1.4	1.4
	Ø30	IPM								0.8	1	1				0.8	1	1
	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	5	5	5	2.8	2.8	5	5	0.3	0.3	2.8	2.8	5	5	0.3	0.3
	Ø20	IPM	3	3	3	3	1.6	1.6	3	3	6	6	1.6	1.6	3	3	6	6
	Ø30	IPM	2	2	2	2	1.2	1.2	2	2	4	4	1.2	1.2	2	2	4	4
	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	10	10	10	7.8	7.8	10	10	13.8	13.8	7.8	7.8	10	10	13.8	13.8
	Ø20	IPM	7	7	7	7	5.2	5.2	7	7	9	9	5.2	5.2	7	7	9	9
	Ø30	IPM	6	6	6	6	4.3	4.3	6	6	7.8	7.8	4.3	4.3	6	6	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	Ø10	IPM	6	6	6	6	4.7	4.7	6	6			4.7	4.7	6	6		
Brass	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	12	3.75	3.75	4.7	4.7	12	12
	Ø20	IPM	3	3	3	3	2.4	2.4	3	3	7.8	7.8	2.4	2.4	3	3	7.8	7.8
	Ø30	IPM	2.6	2.6	2.6	2.6	1.8	1.8	2.6	2.6	7	7	1.8	1.8	2.6	2.6	7	7
	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	16	16	16	12	12	12	12			12	12	12	12		
	Ø20	IPM	12	12	12	12	7.8	7.8	7.8	7.8			7.8	7.8	7.8	7.8		
	Ø30	IPM	10	10	10	10	6	6	6	6			6	6	6	6		
	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,	Ø10	IPM	18	18	18	18	16	16	16	16			16	16	16	16		
PVC	Ø20	IPM	13.8	13.8	13.8	13.8	12	12	12	12			12	12	12	12		
Plastics	Ø30	IPM	12	12	12	12	10	10	10	10			10	10	10	10		

HIGH PRECISION REAMERS

1 - HOW TO CHOOSE STANDARD INCH REAMERS

Examples	REAMING (Hole) Ø		Tolerance	REAMER (Tool) Ø	Tolerance
1	1/64"	+ .00006 – .00012	.01568" .01550"	EDP # 861000395 **.01551"**	.01559" .01551"
2	1/32"	+ .0001 – .0002	.03135" .03105"	EDP # 86000079 **.03110"**	.03122" .03110"
3	1/16"	+ .0004 – .0001	.0629" .0624"	EDP # 86000159 **.0626"**	.06272" .06260"

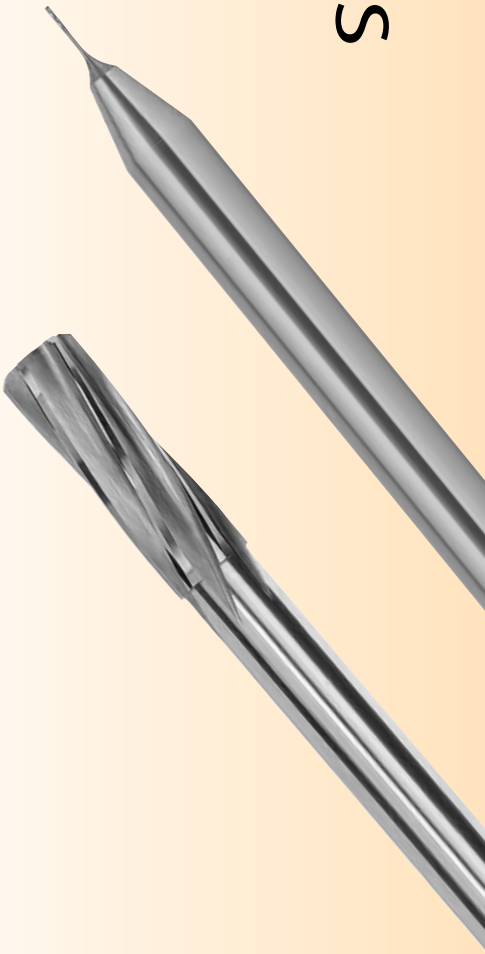
Example 3 explanation



2 - HOW TO CHOOSE METRIC REAMERS

Code 8610 - 8600 : pages 91-97

Tolerance	Ø 2	Ø 3	Ø 4	Ø 5	Ø 6	Ø 8	Ø 10	Ø 12	Ø 14
D10	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	3,00	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	3,01	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



HIGH PRECISION MICRO REAMERS

Over 1,108 Standard Sizes.

Starting at .0078 in .0002" increments to .0236"
In .0004" increments to .5020"

All Magafor Micro & Miniature Solid Carbide Reamers are left hand spiral – right hand cut with a 45° Lead.

Designed for through 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 & cooling! Chips are pushed forward with no scratches & outstanding surface finishes!

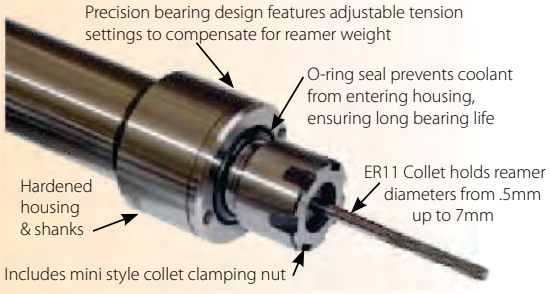
Final Hole Size to Drilled Hole Size Chart

FINAL HOLE REAMER SIZE mm / inch	Reduce Drill Hole Size By….INCH MIN / MAX	Reduce Drill Hole Size By….MM MIN / MAX
0.20 / .00787	**-0.00157" / -0.00236"**	**-0.04mm / -0.06mm**
0.30 / .01181	**-0.00197" / -0.00315"**	**-0.05mm / -0.08mm**
0.40 / .01575	**-0.00197" / -0.00394"**	**-0.05mm / -0.10mm**
0.50 / .01969	-0.00197" / -0.00472"	-0.05mm / -0.12mm
0.60 / .02362	-0.00197" / -0.00472"	-0.05mm / -0.12mm
2.00 / .07874	-0.00197" / -0.00472"	-0.05mm / -0.12mm
6.00 / .23622	-0.00591" / -0.00787"	-0.15mm / -0.20mm
10.00 / .39370	-0.00591" / -0.00787"	-0.15mm / -0.20mm
15.00 / .59055	-0.01181" / -0.01575"	-0.30mm / -0.40mm
20.00 / .78740	-0.01181" / -0.01575"	-0.30mm / -0.40mm
25.00 / .98425	-0.01181" / -0.01969"	-0.30mm / -0.50mm
15.00 / .59055	-0.01181" / -0.01575"	-0.30mm / -0.40mm
20.00 / .78740	-0.01181" / -0.01575"	-0.30mm / -0.40mm
25.00 / .98425	-0.01181" / -0.01969"	-0.30mm / -0.50mm

Ultra Precision FLOATING REAMER HOLDERS

Complete Orbital Float for True Alignment

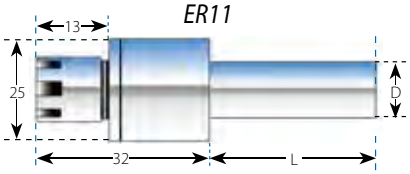
Designed with "True Orbital Float" capability, the micro reamer holder aligns the reamer perfectly to the drilled hole enabling better size control, reduces "bell-mouthing", and increases tool life.



ER11 Floating Reamer Holder with Mini-Nut Assembly

Item No.	D	L
HSP-11-010-042	10mm	42
HSP-11-190-042	3/4"	2.75
HSP-11-200-042	20mm	41.5
HSP-11-220-042	22mm	41.5

ER11



Holds .5mm to 7mm diameter reamers

Accessory Components

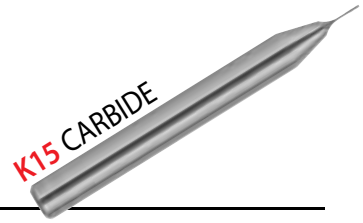
Item No.	Description
HSP-04621	ER11 Mini Wrench
HSP-ER11-MNS	ER11 Mini Nut

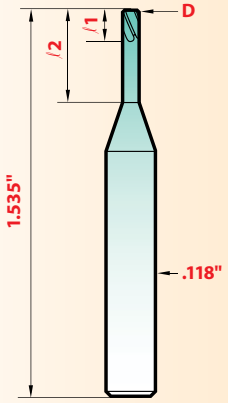
Collet Sets

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 (.0002"TIR) Size Range .5 - 7mm in .5mm increments
HSP-11R-S13-IUP	3pc ULTRA PRECISION Inch Bore Collet Set (.0002"TIR) Size Range 1/8, 5/32, 1/2"


Collet Set

HIGH PRECISION CARBIDE *MICRO-REAMERS*





MICRO-PRECISION

D .0002" increment	ℓ1	ℓ2	magaforce 8610
.0079 to .0096	.036	.079	EDP # SEE BELOW
.0098 to .0116	.043	.098	
.0118 to .0136	.055	.118	
.0138 to .0156	.067	.138	
.0157 to .0195	.079	.157	
.0197 to .0234	.091	.197	

Micro-reamers manufactured and stocked in all diameters at every .0002" increment. Their reinforced shank offers a greater stability necessary for these high precison tools.

TOLERANCE ± .00004"

K15 *CARBIDE* — 6.5 - 7% Cobalt *(0,006 - 0,008mm grain size)*

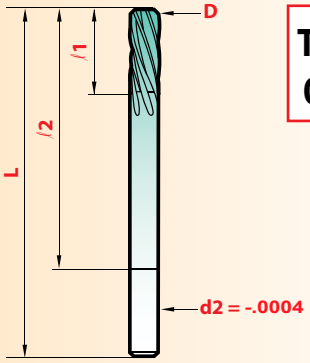
4 flutes, 20 degree left spiral, right hand cut.

EDP 8610 #	mm	Decimal	SIZE Wire
88861000200	0.200	.0079	92
88861000205	0.205	.0081	
88861000210	0.210	.0083	91
88861000215	0.215	.0085	
88861000220	0.220	.0087	90
88861000225	0.225	.0089	
88861000230	0.230	.0091	89
88861000235	0.235	.0093	
88861000240	0.240	.0094	88
88861000245	0.245	.0096	
88861000250	0.250	.0098	
88861000255	0.255	.0100	87
88861000260	0.260	.0102	
88861000265	0.265	.0104	86
88861000270	0.270	.0106	
88861000275	0.275	.0108	
88861000280	0.280	.0110	85
88861000285	0.285	.0112	
88861000290	0.290	.0114	84
88861000295	0.295	.0116	
88861000300	0.300	.0118	
88861000305	0.305	.0120	83
88861000310	0.310	.0122	
88861000315	0.315	.0124	82
88861000320	0.320	.0126	
88861000325	0.325	.0128	
88861000330	0.330	.0130	81

EDP 8610 #	mm	Decimal	SIZE Wire
88861000335	0.335	.0132	
88861000340	0.340	.0134	80
88861000345	0.345	.0136	
88861000350	0.350	.0138	
88861000355	0.355	.0140	
88861000360	0.360	.0142	
88861000365	0.365	.0144	79
88861000370	0.370	.0146	
88861000375	0.375	.0148	
88861000380	0.380	.0150	
88861000385	0.385	.0152	
88861000390	0.390	.0154	
88861000395	0.395	.0156	
88861000400	0.400	.0157	
88861000405	0.405	.0159	78
88861000410	0.410	.0161	
88861000415	0.415	.0163	
88861000420	0.420	.0165	
88861000425	0.425	.0167	
88861000430	0.430	.0169	
88861000435	0.435	.0171	
88861000440	0.440	.0173	
88861000445	0.445	.0175	
88861000450	0.450	.0177	
88861000455	0.455	.0179	77
88861000460	0.460	.0181	
88861000465	0.465	.0183	

EDP 8610 #	mm	Decimal	SIZE Wire
88861000470	0.470	.0185	
88861000475	0.475	.0187	
88861000480	0.480	.0189	
88861000485	0.485	.0191	
88861000490	0.490	.0193	
88861000495	0.495	.0195	
88861000500	0.500	.0197	
88861000505	0.505	.0199	76
88861000510	0.510	.0201	
88861000515	0.515	.0203	
88861000520	0.520	.0205	
88861000525	0.525	.0207	
88861000530	0.530	.0209	75
88861000535	0.535	.0211	
88861000540	0.540	.0213	
88861000545	0.545	.0215	
88861000550	0.550	.0217	
88861000555	0.555	.0219	
88861000560	0.560	.0220	
88861000565	0.565	.0222	
88861000570	0.570	.0224	74
88861000575	0.575	.0226	
88861000580	0.580	.0228	
88861000585	0.585	.0230	
88861000590	0.590	.0232	
88861000595	0.595	.0234	

HIGH PRECISION MINIATURE REAMERS



TOLERANCE 0 + .00012"

All reamers have a 45° chamfer lead
Ø .0236" to .0929 = 4 flutes, Ø .0933" to .5138= 6 flutes,
10 degree left spiral/right hand cut for through holes.

MICRO-PRECISION

D .0004" increment	ℓ1	ℓ2	L	d2	magaforce 8600
.0236 to .0413	.275	.393	1.30	D	EDP # SEE BELOW
.0417 to .0610	.393	.944	1.58	D	
.0614 to .0929	.433	1.220	1.97	D	
.0933 to .1476	.590	1.500	2.25	D	
.1480 to .1673	.748	1.930	2.95	.158	
.1677 to .1870	.827	2"	3.15	.177	
.1874 to .2087	.906	2.32	3.39	.197	
.209 to .228	1.024	2.560	3.66	.216	
.229 to .263	1.100	2.795	3.975	.236	
.2642 to .2972	1.220	3.071	4.29	.276	
.2976 to .3366	1.299	3.307	4.61	.315	
.3370 to .3760	1.417	3.465	4.92	.354	

Note: larger sizes up to .790" Code 8600 and/or HSS-CO M35 Code 600 are available within 2 weeks. Call for information

EDP 8600			SIZE
#	mm	Decimal	Wire
88860000600	0.60	.0236	
88860000610	0.61	.0240	73
88860000620	0.62	.0244	
88860000630	0.63	.0248	72
88860000640	0.64	.0252	
88860000650	0.65	.0256	
88860000660	0.66	.0260	71
88860000670	0.67	.0264	
88860000680	0.68	.0268	
88860000690	0.69	.0272	
88860000700	0.70	.0276	
88860000710	0.71	.0280	70
88860000720	0.72	.0283	
88860000730	0.73	.0287	
88860000740	0.74	.0291	69
88860000750	0.75	.0295	
88860000760	0.76	.0299	
88860000770	0.77	.0303	
88860000780	0.78	.0307	
88860000790	0.79	.0311	68
88860000800	0.80	.0315	
88860000810	0.81	.0319	67
88860000820	0.82	.0323	
88860000830	0.83	.0327	
88860000840	0.84	.0331	66
88860000850	0.85	.0335	
88860000860	0.86	.0339	
88860000870	0.87	.0343	
88860000880	0.88	.0346	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860000890	0.89	.0350	65
88860000900	0.90	.0354	
88860000910	0.91	.0358	64
88860000920	0.92	.0362	
88860000930	0.93	.0366	
88860000940	0.94	.0370	63
88860000950	0.95	.0374	
88860000960	0.96	.0378	62
88860000970	0.97	.0382	
88860000980	0.98	.0386	
88860000990	0.99	.0390	61
88860001000	1.00	.0394	
88860001010	1.01	.0398	60
88860001020	1.02	.0402	
88860001030	1.03	.0406	
88860001040	1.04	.0409	59
88860001050	1.05	.0413	
88860001060	1.06	.0417	
88860001070	1.07	.0421	58
88860001080	1.08	.0425	
88860001090	1.09	.0429	57
88860001100	1.10	.0433	
88860001110	1.11	.0437	
88860001120	1.12	.0441	
88860001130	1.13	.0445	
88860001140	1.14	.0449	
88860001150	1.15	.0453	
88860001160	1.16	.0457	
88860001170	1.17	.0461	
88860001180	1.18	.0465	56
88860001190	1.19	.0469	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860001200	1.20	.0472	
88860001210	1.21	.0476	
88860001220	1.22	.0480	
88860001230	1.23	.0484	
88860001240	1.24	.0488	
88860001250	1.25	.0492	
88860001260	1.26	.0496	
88860001270	1.27	.0500	
88860001280	1.28	.0504	
88860001290	1.29	.0508	
88860001300	1.30	.0512	
88860001310	1.31	.0516	
88860001320	1.32	.0520	55
88860001330	1.33	.0524	
88860001340	1.34	.0528	
88860001350	1.35	.0531	
88860001360	1.36	.0535	
88860001370	1.37	.0539	
88860001380	1.38	.0543	
88860001390	1.39	.0547	
88860001400	1.40	.0551	54
88860001410	1.41	.0555	
88860001420	1.42	.0559	
88860001430	1.43	.0563	
88860001440	1.44	.0567	
88860001450	1.45	.0571	
88860001460	1.46	.0575	
88860001470	1.47	.0579	
88860001480	1.48	.0583	
88860001490	1.49	.0587	
88860001500	1.50	.0590	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860001510	1.51	.0594	53
88860001520	1.52	.0598	
88860001530	1.53	.0602	
88860001540	1.54	.0606	
88860001550	1.55	.0610	
88860001560	1.56	.0614	
88860001570	1.57	.0618	
88860001580	1.58	.0622	
88860001590	1.59	.0626	
88860001600	1.60	.0630	
88860001610	1.61	.0634	52
88860001620	1.62	.0638	
88860001630	1.63	.0642	
88860001640	1.64	.0646	
88860001650	1.65	.0650	
88860001660	1.66	.0654	
88860001670	1.67	.0657	
88860001680	1.68	.0661	
88860001690	1.69	.0665	
88860001700	1.70	.0669	51
88860001710	1.71	.0673	
88860001720	1.72	.0677	
88860001730	1.73	.0681	
88860001740	1.74	.0685	
88860001750	1.75	.0689	
88860001760	1.76	.0693	
88860001770	1.77	.0697	
88860001780	1.78	.0701	50
88860001790	1.79	.0705	
88860001800	1.80	.0709	
88860001810	1.81	.0713	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860001820	1.82	.0717	
88860001830	1.83	.0720	
88860001840	1.84	.0724	
88860001850	1.85	.0728	49
88860001860	1.86	.0732	
88860001870	1.87	.0736	
88860001880	1.88	.0740	
88860001890	1.89	.0744	
88860001900	1.90	.0748	
88860001910	1.91	.0752	
88860001920	1.92	.0756	
88860001930	1.93	.0760	48
88860001940	1.94	.0764	
88860001950	1.95	.0768	
88860001960	1.96	.0772	
88860001970	1.97	.0776	
88860001980	1.98	.0780	
88860001990	1.99	.0783	47
88860002000	2.00	.0787	
88860002010	2.01	.0791	
88860002020	2.02	.0795	
88860002030	2.03	.0799	
88860002040	2.04	.0803	
88860002050	2.05	.0807	
88860002060	2.06	.0811	46
88860002070	2.07	.0815	
88860002080	2.08	.0819	45
88860002090	2.09	.0823	
88860002100	2.10	.0827	
88860002110	2.11	.0831	
88860002120	2.12	.0835	
88860002130	2.13	.0839	
88860002140	2.14	.0843	
88860002150	2.15	.0846	
88860002160	2.16	.0850	
88860002170	2.17	.0854	
88860002180	2.18	.0858	44
88860002190	2.19	.0862	
88860002200	2.20	.0866	
88860002210	2.21	.0870	
88860002220	2.22	.0874	
88860002230	2.23	.0878	
88860002240	2.24	.0882	
88860002250	2.25	.0886	
88860002260	2.26	.0890	43

EDP 8600			SIZE
#	mm	Decimal	Wire
88860002270	2.27	.0894	
88860002280	2.28	.0898	
88860002290	2.29	.0902	
88860002300	2.30	.0906	
88860002310	2.31	.0909	
88860002320	2.32	.0913	
88860002330	2.33	.0917	
88860002340	2.34	.0921	
88860002350	2.35	.0925	
88860002360	2.36	.0929	
88860002370	2.37	.0933	42
88860002380	2.38	.0937	
88860002390	2.39	.0941	
88860002400	2.40	.0945	
88860002410	2.41	.0949	
88860002420	2.42	.0953	
88860002430	2.43	.0957	
88860002440	2.44	.0961	41
88860002450	2.45	.0965	
88860002460	2.46	.0969	
88860002470	2.47	.0972	
88860002480	2.48	.0976	
88860002490	2.49	.0980	40
88860002500	2.50	.0984	
88860002510	2.51	.0988	
88860002520	2.52	.0992	
88860002530	2.53	.0996	39
88860002540	2.54	.1000	
88860002550	2.55	.1004	
88860002560	2.56	.1008	
88860002570	2.57	.1012	
88860002580	2.58	.1016	38
88860002590	2.59	.1020	
88860002600	2.60	.1024	
88860002610	2.61	.1028	
88860002620	2.62	.1031	
88860002630	2.63	.1035	
88860002640	2.64	.1039	37
88860002650	2.65	.1043	
88860002660	2.66	.1047	
88860002670	2.67	.1051	
88860002680	2.68	.1055	
88860002690	2.69	.1059	
88860002700	2.70	.1063	36
88860002710	2.71	.1067	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860002720	2.72	.1071	
88860002730	2.73	.1075	
88860002740	2.74	.1079	
88860002750	2.75	.1083	
88860002760	2.76	.1087	
88860002770	2.77	.1091	
88860002780	2.78	.1094	
88860002790	2.79	.1098	35
88860002800	2.80	.1102	
88860002810	2.81	.1106	
88860002820	2.82	.1110	34
88860002830	2.83	.1114	
88860002840	2.84	.1118	
88860002850	2.85	.1122	
88860002860	2.86	.1126	
88860002870	2.87	.1130	33
88860002880	2.88	.1134	
88860002890	2.89	.1138	
88860002900	2.90	.1142	
88860002910	2.91	.1146	
88860002920	2.92	.1150	
88860002930	2.93	.1154	
88860002940	2.94	.1157	
88860002950	2.95	.1161	32
88860002960	2.96	.1165	
88860002970	2.97	.1169	
88860002980	2.98	.1173	
88860002990	2.99	.1177	
88860003000	3.00	.1181	
88860003010	3.01	.1185	
88860003020	3.02	.1189	
88860003030	3.03	.1193	
88860003040	3.04	.1197	
88860003050	3.05	.1201	31
88860003060	3.06	.1205	
88860003070	3.07	.1209	
88860003080	3.08	.1213	
88860003090	3.09	.1217	
88860003100	3.10	.1220	
88860003110	3.11	.1224	
88860003120	3.12	.1228	
88860003130	3.13	.1232	
88860003140	3.14	.1236	
88860003150	3.15	.1240	
88860003160	3.16	.1244	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860003170	3.17	.1248	
88860003180	3.18	.1252	
88860003190	3.19	.1256	
88860003200	3.20	.1260	
88860003210	3.21	.1264	
88860003220	3.22	.1268	
88860003230	3.23	.1272	
88860003240	3.24	.1276	
88860003250	3.25	.1280	
88860003260	3.26	.1283	30
88860003270	3.27	.1287	
88860003280	3.28	.1291	
88860003290	3.29	.1295	
88860003300	3.30	.1299	
88860003310	3.31	.1303	
88860003320	3.32	.1308	
88860003330	3.33	.1311	
88860003340	3.34	.1315	
88860003350	3.35	.1319	
88860003360	3.36	.1323	
88860003370	3.37	.1327	
88860003380	3.38	.1331	
88860003390	3.39	.1335	
88860003400	3.40	.1339	
88860003410	3.41	.1343	
88860003420	3.42	.1346	
88860003430	3.43	.1350	
88860003440	3.44	.1354	
88860003450	3.45	.1358	29
88860003460	3.46	.1362	
88860003470	3.47	.1366	
88860003480	3.48	.1370	
88860003490	3.49	.1374	
88860003500	3.50	.1378	
88860003510	3.51	.1382	
88860003520	3.52	.1386	
88860003530	3.53	.1390	
88860003540	3.54	.1394	
88860003550	3.55	.1398	
88860003560	3.56	.1402	
88860003570	3.57	.1406	28
88860003580	3.58	.1409	
88860003590	3.59	.1413	
88860003600	3.60	.1417	
88860003610	3.61	.1421	

K15 *CARBIDE* — 6.5 - 7% Cobalt *(0,006 - 0,008mm grain size)*

EDP 8600			SIZE
#	mm	Decimal	Wire
88860003620	3.62	.1425	
88860003630	3.63	.1429	
88860003640	3.64	.1433	
88860003650	3.65	.1437	
88860003660	3.66	.1441	27
88860003670	3.67	.1445	
88860003680	3.68	.1449	
88860003690	3.69	.1453	
88860003700	3.70	.1457	
88860003710	3.71	.1461	
88860003720	3.72	.1465	
88860003730	3.73	.1469	26
88860003740	3.74	.1472	
88860003750	3.75	.1476	
88860003760	3.76	.1480	
88860003770	3.77	.1484	
88860003780	3.78	.1488	
88860003790	3.79	.1492	
88860003800	3.80	.1496	25
88860003810	3.81	.1500	
88860003820	3.82	.1504	
88860003830	3.83	.1508	
88860003840	3.84	.1512	
88860003850	3.85	.1516	
88860003860	3.86	.1520	24
88860003870	3.87	.1524	
88860003880	3.88	.1528	
88860003890	3.89	.1531	
88860003900	3.90	.1535	
88860003910	3.91	.1539	23
88860003920	3.92	.1543	
88860003930	3.93	.1547	
88860003940	3.94	.1551	
88860003950	3.95	.1555	
88860003960	3.96	.1559	
88860003970	3.97	.1563	
88860003980	3.98	.1567	
88860003990	3.99	.1571	22
88860004000	4.00	.1575	
88860004010	4.01	.1579	
88860004020	4.02	.1583	
88860004030	4.03	.1587	
88860004040	4.04	.1591	21
88860004050	4.05	.1594	
88860004060	4.06	.1598	
88860004070	4.07	.1602	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860004080	4.08	.1606	
88860004090	4.09	.1610	20
88860004100	4.10	.1614	
88860004110	4.11	.1618	
88860004120	4.12	.1622	
88860004130	4.13	.1626	
88860004140	4.14	.1630	
88860004150	4.15	.1634	
88860004160	4.16	.1638	
88860004170	4.17	.1642	
88860004180	4.18	.1646	
88860004190	4.19	.1650	
88860004200	4.20	.1654	
88860004210	4.21	.1657	
88860004220	4.22	.1661	19
88860004230	4.23	.1665	
88860004240	4.24	.1669	
88860004250	4.25	.1673	
88860004260	4.26	.1677	
88860004270	4.27	.1681	
88860004280	4.28	.1685	
88860004290	4.29	.1689	
88860004300	4.30	.1693	18
88860004310	4.31	.1697	
88860004320	4.32	.1701	
88860004330	4.33	.1705	
88860004340	4.34	.1709	
88860004350	4.35	.1713	
88860004360	4.36	.1717	
88860004370	4.37	.1720	
88860004380	4.38	.1724	
88860004390	4.39	.1728	17
88860004400	4.40	.1732	
88860004410	4.41	.1736	
88860004420	4.42	.1740	
88860004430	4.43	.1744	
88860004440	4.44	.1748	
88860004450	4.45	.1752	
88860004460	4.46	.1756	
88860004470	4.47	.1760	
88860004480	4.48	.1764	
88860004490	4.49	.1768	16
88860004500	4.50	.1772	
88860004510	4.51	.1776	
88860004520	4.52	.1780	
88860004530	4.53	.1783	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860004540	4.54	.1787	
88860004550	4.55	.1791	
88860004560	4.56	.1795	
88860004570	4.57	.1799	15
88860004580	4.58	.1803	
88860004590	4.59	.1807	
88860004600	4.60	.1811	
88860004610	4.61	.1815	
88860004620	4.62	.1819	14
88860004630	4.63	.1823	
88860004640	4.64	.1827	
88860004650	4.65	.1831	
88860004660	4.66	.1835	
88860004670	4.67	.1839	
88860004680	4.68	.1843	
88860004690	4.69	.1846	
88860004700	4.70	.1850	13
88860004710	4.71	.1854	
88860004720	4.72	.1858	
88860004730	4.73	.1862	
88860004740	4.74	.1866	
88860004750	4.75	.1870	
88860004760	4.76	.1874	
88860004770	4.77	.1878	
88860004780	4.78	.1882	
88860004790	4.79	.1886	
88860004800	4.80	.1890	12
88860004810	4.81	.1984	
88860004820	4.82	.1898	
88860004830	4.83	.1902	
88860004840	4.84	.1906	
88860004850	4.85	.1909	11
88860004860	4.86	.1913	
88860004870	4.87	.1917	
88860004880	4.88	.1921	
88860004890	4.89	.1925	
88860004900	4.90	.1929	
88860004910	4.91	.1933	10
88860004920	4.92	.1937	
88860004930	4.93	.1941	
88860004940	4.94	.1945	
88860004950	4.95	.1949	
88860004960	4.96	.1953	
88860004970	4.97	.1957	
88860004980	4.98	.1961	9
88860004990	4.99	.1965	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860005000	5.00	.1969	
88860005010	5.01	.1972	
88860005020	5.02	.1976	
88860005030	5.03	.1980	
88860005040	5.04	.1984	
88860005050	5.05	.1988	8
88860005060	5.06	.1992	
88860005070	5.07	.1996	
88860005080	5.08	.2000	
88860005090	5.09	.2004	
88860005100	5.10	.2008	7
88860005110	5.11	.2012	
88860005120	5.12	.2016	
88860005130	5.13	.2020	
88860005140	5.14	.2024	
88860005150	5.15	.2028	
88860005160	5.16	.2031	
88860005170	5.17	.2035	
88860005180	5.18	.2039	6
88860005190	5.19	.2043	
88860005200	5.20	.2047	
88860005210	5.21	.2051	
88860005220	5.22	.2055	5
88860005230	5.23	.2059	
88860005240	5.24	.2063	
88860005250	5.25	.2067	
88860005260	5.26	.2071	
88860005270	5.27	.2075	
88860005280	5.28	.2079	
88860005290	5.29	.2083	
88860005300	5.30	.2087	
88860005310	5.31	.2091	4
88860005320	5.32	.2094	
88860005330	5.33	.2098	
88860005340	5.34	.2102	
88860005350	5.35	.2106	
88860005360	5.36	.2110	
88860005370	5.37	.2114	
88860005380	5.38	.2118	
88860005390	5.39	.2122	
88860005400	5.40	.2126	
88860005410	5.41	.2130	3
88860005420	5.42	.2134	
88860005430	5.43	.2138	
88860005440	5.44	.2142	
88860005450	5.45	.2146	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860005460	5.46	.2150	
88860005470	5.47	.2154	
88860005480	5.48	.2158	
88860005490	5.49	.2161	
88860005500	5.50	.2165	
88860005510	5.51	.2169	
88860005520	5.52	.2173	
88860005530	5.53	.2177	
88860005540	5.54	.2181	
88860005550	5.55	.2185	
88860005560	5.56	.2189	
88860005570	5.57	.2193	
88860005580	5.58	.2197	
88860005590	5.59	.2201	
88860005600	5.60	.2205	
88860005610	5.61	.2209	2
88860005620	5.62	.2213	
88860005630	5.63	.2217	
88860005640	5.64	.2220	
88860005650	5.65	.2224	
88860005660	5.66	.2228	
88860005670	5.67	.2232	
88860005680	5.68	.2236	
88860005690	5.69	.2240	
88860005700	5.70	.2244	
88860005710	5.71	.2248	
88860005720	5.72	.2252	
88860005730	5.73	.2256	
88860005740	5.74	.2260	
88860005750	5.75	.2264	
88860005760	5.76	.2268	
88860005770	5.77	.2272	
88860005780	5.78	.2276	
88860005790	5.79	.2280	1
88860005800	5.80	.2284	
88860005810	5.81	.2288	
88860005820	5.82	.2291	
88860005830	5.83	.2295	
88860005840	5.84	.2299	
88860005850	5.85	.2303	
88860005860	5.86	.2307	
88860005870	5.87	.2311	
88860005880	5.88	.2315	
88860005890	5.89	.2319	
88860005900	5.90	.2323	
88860005910	5.91	.2327	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860005920	5.92	.2331	
88860005930	5.93	.2335	
88860005940	5.94	.2339	A
88860005950	5.95	.2343	
88860005960	5.96	.2347	
88860005970	5.97	.2350	
88860005980	5.98	.2354	
88860005990	5.99	.2358	
88860006000	6.00	.2362	
88860006010	6.01	.2366	
88860006020	6.02	.2370	
88860006030	6.03	.2374	
88860006040	6.04	.2378	
88860006050	6.05	.2382	B
88860006060	6.06	.2386	
88860006070	6.07	.2390	
88860006080	6.08	.2394	
88860006090	6.09	.2398	
88860006100	6.10	.2402	
88860006110	6.11	.2406	
88860006120	6.12	.2410	
88860006130	6.13	.2413	
88860006140	6.14	.2417	
88860006150	6.15	.2421	C
88860006160	6.16	.2425	
88860006170	6.17	.2429	
88860006180	6.18	.2433	
88860006190	6.19	.2437	
88860006200	6.20	.2441	
88860006210	6.21	.2445	
88860006220	6.22	.2449	
88860006230	6.23	.2453	
88860006240	6.24	.2457	
88860006250	6.25	.2461	D
88860006260	6.26	.2465	
88860006270	6.27	.2468	
88860006280	6.28	.2472	
88860006290	6.29	.2476	
88860006300	6.30	.2480	
88860006310	6.31	.2484	
88860006320	6.32	.2488	
88860006330	6.33	.2492	
88860006340	6.34	.2496	
88860006350	6.35	.2500	E
88860006360	6.36	.2504	
88860006370	6.37	.2508	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860006380	6.38	.2512	
88860006390	6.39	.2517	
88860006400	6.40	.2520	
88860006410	6.41	.2524	
88860006420	6.42	.2528	
88860006430	6.43	.2531	
88860006440	6.44	.2535	
88860006450	6.45	.2539	
88860006460	6.46	.2543	
88860006470	6.47	.2547	
88860006480	6.48	.2551	
88860006490	6.49	.2555	
88860006500	6.50	.2559	
88860006510	6.51	.2563	
88860006520	6.52	.2567	
88860006530	6.53	.2571	F
88860006540	6.54	.2575	
88860006550	6.55	.2579	
88860006560	6.56	.2583	
88860006570	6.57	.2587	
88860006580	6.58	.2591	
88860006590	6.59	.2594	
88860006600	6.60	.2598	
88860006610	6.61	.2602	
88860006620	6.62	.2606	
88860006630	6.63	.2610	G
88860006640	6.64	.2614	
88860006650	6.65	.2618	
88860006660	6.66	.2622	
88860006670	6.67	.2626	
88860006680	6.68	.2630	
88860006690	6.69	.2634	
88860006700	6.70	.2638	
88860006710	6.71	.2642	
88860006720	6.72	.2646	
88860006730	6.73	.2650	
88860006740	6.74	.2654	
88860006750	6.75	.2657	
88860006760	6.76	.2661	H
88860006770	6.77	.2665	
88860006780	6.78	.2669	
88860006790	6.79	.2673	
88860006800	6.80	.2677	
88860006810	6.81	.2681	
88860006820	6.82	.2685	
88860006830	6.83	.2689	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860006840	6.84	.2693	
88860006850	6.85	.2697	
88860006860	6.86	.2701	
88860006870	6.87	.2705	
88860006880	6.88	.2709	
88860006890	6.89	.2713	
88860006900	6.90	.2717	
88860006910	6.91	.2720	I
88860006920	6.92	.2724	
88860006930	6.93	.2728	
88860006940	6.94	.2732	
88860006950	6.95	.2736	
88860006960	6.96	.2740	
88860006970	6.97	.2744	
88860006980	6.98	.2748	
88860006990	6.99	.2752	
88860007000	7.00	.2756	
88860007010	7.01	.2760	
88860007020	7.02	.2764	
88860007030	7.03	.2768	J
88860007040	7.04	.2772	
88860007050	7.05	.2776	
88860007060	7.06	.2780	
88860007070	7.07	.2783	
88860007080	7.08	.2787	
88860007090	7.09	.2791	
88860007100	7.10	.2795	
88860007110	7.11	.2799	
88860007120	7.12	.2803	
88860007130	7.13	.2807	
88860007140	7.14	.2811	K
88860007150	7.15	.2815	
88860007160	7.16	.2819	
88860007170	7.17	.2823	
88860007180	7.18	.2827	
88860007190	7.19	.2831	
88860007200	7.20	.2835	
88860007210	7.21	.2839	
88860007220	7.22	.2843	
88860007230	7.23	.2846	
88860007240	7.24	.2850	
88860007250	7.25	.2854	
88860007260	7.26	.2858	
88860007270	7.27	.2862	
88860007280	7.28	.2866	
88860007290	7.29	.2870	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860007300	7.30	.2874	
88860007310	7.31	.2878	
88860007320	7.32	.2882	
88860007330	7.33	.2886	
88860007340	7.34	.2890	
88860007350	7.35	.2894	
88860007360	7.36	.2898	L
88860007370	7.37	.2902	
88860007380	7.38	.2906	
88860007390	7.39	.2909	
88860007400	7.40	.2913	
88860007410	7.41	.2917	
88860007420	7.42	.2921	
88860007430	7.43	.2925	
88860007440	7.44	.2929	
88860007450	7.45	.2933	
88860007460	7.46	.2937	
88860007470	7.47	.2941	
88860007480	7.48	.2945	
88860007490	7.49	.2949	M
88860007500	7.50	.2953	
88860007510	7.51	.2957	
88860007520	7.52	.2961	
88860007530	7.53	.2965	
88860007540	7.54	.2969	
88860007550	7.55	.2972	
88860007560	7.56	.2976	
88860007570	7.57	.2980	
88860007580	7.58	.2984	
88860007590	7.59	.2988	
88860007600	7.60	.2992	
88860007610	7.61	.2996	
88860007620	7.62	.3000	
88860007630	7.63	.3004	
88860007640	7.64	.3008	
88860007650	7.65	.3012	
88860007660	7.66	.3016	
88860007670	7.67	.3020	N
88860007680	7.68	.3024	
88860007690	7.69	.3028	
88860007700	7.70	.3031	
88860007710	7.71	.3035	
88860007720	7.72	.3039	
88860007730	7.73	.3043	
88860007740	7.74	.3047	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860007750	7.75	.3051	
88860007760	7.76	.3055	
88860007770	7.77	.3059	
88860007780	7.78	.3063	
88860007790	7.79	.3067	
88860007800	7.80	.3071	
88860007810	7.81	.3075	
88860007820	7.82	.3079	
88860007830	7.83	.3083	
88860007840	7.84	.3087	
88860007850	7.85	.3091	
88860007860	7.86	.3094	
88860007870	7.87	.3098	
88860007880	7.88	.3102	
88860007890	7.89	.3106	
88860007900	7.90	.3110	
88860007910	7.91	.3114	
88860007920	7.92	.3118	
88860007930	7.93	.3122	
88860007940	7.94	.3126	
88860007950	7.95	.3130	
88860007960	7.96	.3134	
88860007970	7.97	.3138	
88860007980	7.98	.3142	
88860007990	7.99	.3146	
88860008000	8.00	.3150	
88860008010	8.01	.3154	
88860008020	8.02	.3157	
88860008030	8.03	.3161	O
88860008040	8.04	.3165	
88860008050	8.05	.3169	
88860008060	8.06	.3173	
88860008070	8.07	.3177	
88860008080	8.08	.3181	
88860008090	8.09	.3185	
88860008100	8.10	.3189	
88860008110	8.11	.3193	
88860008120	8.12	.3197	
88860008130	8.13	.3201	
88860008140	8.14	.3205	
88860008150	8.15	.3209	
88860008160	8.16	.3213	
88860008170	8.17	.3217	
88860008180	8.18	.3220	
88860008190	8.19	.3224	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860008200	8.20	.3228	P
88860008210	8.21	.3232	
88860008220	8.22	.3236	
88860008230	8.23	.3240	
88860008240	8.24	.3244	
88860008250	8.25	.3248	
88860008260	8.26	.3252	
88860008270	8.27	.3256	
88860008280	8.28	.3260	
88860008290	8.29	.3264	
88860008300	8.30	.3268	
88860008310	8.31	.3272	
88860008320	8.32	.3276	
88860008330	8.33	.3280	
88860008340	8.34	.3283	
88860008350	8.35	.3287	
88860008360	8.36	.3291	
88860008370	8.37	.3295	
88860008380	8.38	.3299	
88860008390	8.39	.3303	
88860008400	8.40	.3307	
88860008410	8.41	.3311	
88860008420	8.42	.3315	
88860008430	8.43	.3319	Q
88860008440	8.44	.3323	
88860008450	8.45	.3327	
88860008460	8.46	.3331	
88860008470	8.47	.3335	
88860008480	8.48	.3339	
88860008490	8.49	.3343	
88860008500	8.50	.3346	
88860008510	8.51	.3350	
88860008520	8.52	.3354	
88860008530	8.53	.3358	
88860008540	8.54	.3362	
88860008550	8.55	.3366	
88860008560	8.56	.3370	
88860008570	8.57	.3374	
88860008580	8.58	.3378	
88860008590	8.59	.3382	
88860008600	8.60	.3386	
88860008610	8.61	.3390	R
88860008620	8.62	.3394	
88860008630	8.63	.3398	
88860008640	8.64	.3402	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860008650	8.65	.3406	
88860008660	8.66	.3409	
88860008670	8.67	.3413	
88860008680	8.68	.3417	
88860008690	8.69	.3421	
88860008700	8.70	.3425	
88860008710	8.71	.3429	
88860008720	8.72	.3433	
88860008730	8.73	.3437	
88860008740	8.74	.3441	
88860008750	8.75	.3445	
88860008760	8.76	.3449	
88860008770	8.77	.3453	
88860008780	8.78	.3457	
88860008790	8.79	.3461	
88860008800	8.80	.3465	
88860008810	8.81	.3469	
88860008820	8.82	.3472	
88860008830	8.83	.3476	
88860008840	8.84	.3480	S
88860008850	8.85	.3484	
88860008860	8.86	.3488	
88860008870	8.87	.3492	
88860008880	8.88	.3496	
88860008890	8.89	.3500	
88860008900	8.90	.3504	
88860008910	8.91	.3508	
88860008920	8.92	.3512	
88860008930	8.93	.3516	
88860008940	8.94	.3520	
88860008950	8.95	.3524	
88860008960	8.96	.3528	
88860008970	8.97	.3531	
88860008980	8.98	.3535	
88860008990	8.99	.3539	
88860009000	9.00	.3543	
88860009010	9.01	.3547	
88860009020	9.02	.3551	
88860009030	9.03	.3555	
88860009040	9.04	.3559	
88860009050	9.05	.3563	
88860009060	9.06	.3567	
88860009070	9.07	.3571	
88860009080	9.08	.3575	
88860009090	9.09	.3579	T

EDP 8600			SIZE
#	mm	Decimal	Wire
88860009100	9.10	.3583	
88860009110	9.11	.3587	
88860009120	9.12	.3591	
88860009130	9.13	.3594	
88860009140	9.14	.3598	
88860009150	9.15	.3602	
88860009160	9.16	.3606	
88860009170	9.17	.3610	
88860009180	9.18	.3614	
88860009190	9.19	.3618	
88860009200	9.20	.3622	
88860009210	9.21	.3626	
88860009220	9.22	.3630	
88860009230	9.23	.3634	
88860009240	9.24	.3638	
88860009250	9.25	.3642	
88860009260	9.26	.3646	
88860009270	9.27	.3650	
88860009280	9.28	.3654	
88860009290	9.29	.3657	
88860009300	9.30	.3661	
88860009310	9.31	.3665	
88860009320	9.32	.3669	
88860009330	9.33	.3673	
88860009340	9.34	.3677	
88860009350	9.35	.3681	U
88860009360	9.36	.3685	
88860009370	9.37	.3689	
88860009380	9.38	.3693	
88860009390	9.39	.3697	
88860009400	9.40	.3701	
88860009410	9.41	.3705	
88860009420	9.42	.3709	
88860009430	9.43	.3713	
88860009440	9.44	.3717	
88860009450	9.45	.3720	
88860009460	9.46	.3724	
88860009470	9.47	.3728	
88860009480	9.48	.3732	
88860009490	9.49	.3736	
88860009500	9.50	.3740	
88860009510	9.51	.3744	
88860009520	9.52	.3748	
88860009530	9.53	.3752	
88860009540	9.54	.3756	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860009550	9.55	.3760	
88860009560	9.56	.3763	
88860009570	9.57	.3767	
88860009650	9.65	.	
88860009730	9.73	.	
25/64" Range			
88860009870	9.87	.3886	
88860009880	9.88	.3889	
88860009890	9.89	.3893	
88860009900	9.90	.3897	
88860009910	9.91	.3901	
88860009920	9.92	.3905	
88860009930	9.93	.3909	
88860009940	9.94	.3913	
88860009950	9.95	.3917	
88860009960	9.96	.3921	
10mm Range			
88860009970	9.97	.3925	
88860009980	9.98	.3929	
88860009990	9.99	.3933	
88860010000	10.00	.3937	
88860010010	10.01	.3941	
88860010020	10.02	.3945	
88860010030	10.03	.3949	
88860010040	10.04	.3953	
88860010050	10.05	.3957	
27/64" Range			
88860010660	10.66	.4197	
88860010670	10.67	.4201	
88860010680	10.68	.4205	
88860010690	10.69	.4209	
88860010700	10.70	.4213	
88860010710	10.71	.4217	
88860010720	10.72	.4220	
88860010730	10.73	.4224	
88860010740	10.74	.4228	
88860010750	10.75	.4232	
88860010760	10.76	.4236	
11 mm Range			
88860010950	10.95	.4311	
88860010960	10.96	.4315	
88860010970	10.97	.4319	
88860010980	10.98	.4323	
88860010990	10.99	.4327	
88860011000	11.00	.4331	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860011010	11.01	.4335	
88860011020	11.02	.4339	
88860011030	11.03	.4343	
88860011040	11.04	.4346	
88860011050	11.05	.4350	
7/16" Range			
88860011060	11.06	.4354	
88860011070	11.07	.4358	
88860011080	11.08	.4362	
88860011090	11.09	.4366	
88860011100	11.10	.4370	
88860011110	11.11	.4374	
88860011120	11.12	.4378	
88860011130	11.13	.4382	
88860011140	11.14	.4386	
88860011150	11.15	.4390	
88860011160	11.16	.4394	
88860011170	11.17		
29/64" & 11.5 mm Range			
88860011450	11.45	.4508	
88860011460	11.46	.4512	
88860011470	11.47	.4516	
88860011480	11.48	.4520	
88860011490	11.49	.4524	
88860011500	11.50	.4528	
88860011510	11.51	.4531	
88860011520	11.52	.4535	
88860011530	11.53	.4539	
88860011540	11.54	.4543	
88860011550	11.55	.4547	
5/32" Range			
88860011850	11.85	.4665	
88860011860	11.86	.4669	
88860011870	11.87	.4673	
88860011880	11.88	.4677	
88860011890	11.89	.4681	
88860011900	11.90	.4685	
88860011910	11.91	.4689	
88860011920	11.92	.4693	
88860011930	11.93	.4697	
12 mm Range			
88860011940	11.94	.4701	
88860011950	11.95	.4705	
88860011960	11.96	.4709	
88860011970	11.97	.4713	

EDP 8600			SIZE
#	mm	Decimal	Wire
88860011980	11.98	.4717	
88860011990	11.99	.4720	
88860012000	12.00	.4724	
88860012010	12.01	.4728	
88860012020	12.02	.4732	
88860012030	12.03	.4736	
88860012040	12.04	.4740	
88860012050	12.05	.4744	
31/64" Range			
88860012250	12.25	.4823	
88860012260	12.26	.4827	
88860012270	12.27	.4831	
88860012280	12.28	.4835	
88860012290	12.29	.4839	
88860012300	12.30	.4843	
88860012310	12.31	.4846	
88860012320	12.32	.4850	
88860012330	12.33	.4854	
88860012340	12.34	.4858	
88860012350	12.35	.4862	
1/2" Range			
88860012650	12.65	.4980	
88860012660	12.66	.4984	
88860012670	12.67	.4988	
88860012680	12.68	.4992	
88860012690	12.69	.4996	
88860012700	12.70	.5000	
88860012710	12.71	.5004	
88860012720	12.72	.5008	
88860012730	12.73	.5012	
88860012740	12.74	.5016	
88860012750	12.75	.5020	
88860012940	12.94	.5094	
88860012950	12.95	.5098	
88860012960	12.96	.5102	
88860012970	12.97	.5106	
88860012980	12.98	.5110	
88860012990	12.99	.5114	
13 mm Range			
88860013000	13.00	.5118	
88860013010	13.01	.5122	
88860013020	13.02	.5126	
88860013030	13.03	.5130	
88860013040	13.04	.5134	
88860013050	13.05	.5138	

K15 *CARBIDE* — 6.5 - 7% Cobalt *(0,006 - 0,008mm grain size)*

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 has listed 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*

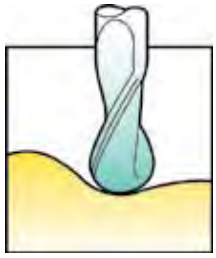
MATERIAL	SPEED / SFM CARBIDE	SPEED / SFM COBALT		Diameter mm 2	4	6	10	15	20
			IPR	.006	.006	.006	.0098	.0098	.0118
Steel < 81 HRB	82-132	49-72	IPM	38.4	19.2	12.8	12.3	8.2	7.7
			RPM	6400	3200	2130	1300	850	640
			IPR	.0039	.0039	.0047	.0071	.0071	.0098
Steel < 24 Rc.	66-82	39-56	IPM	14.3	8.4	6.4	5.7	3.8	3.8
			RPM	4000	2000	1300	800	500	400
			IPR	.0031	.0031	.0039	.0071	.0059	.0087
Steel 24-32 Rc.	39-59	25-33	IPM	8.6	4.3	3.4	4.1	2.3	2.4
			RPM	2800	1430	1000	600	400	280
			IPR	.0031	.0031	.0035	.0059	.0079	.0098
Steel 32-41 Rc,	33-49	16-23	IPM	7.1	3.6	2.9	2.9	2.5	2.3
			RPM	2400	1200	800	500	300	240
			IPR	.0028	.0028	.0039	.0047	.0059	.0079
Stainless Steel	23-39	10-16	IPM	5.7	2.8	2.3	1.8	1.5	1.5
			RPM	1900	950	630	400	250	240
			IPR	.0028	.0028	.0039	.0047	.0059	.0079
Inconel/Waspaloy	20-33	7-10	IPM	4.8	2.4	1.9	1.5	1.3	1.2
			RPM	1600	800	540	320	200	200
			IPR	.0039	.0039	.0047	.0079	.0098	.0098
Cast Iron ≤180 HB (Grey)	99-132	20-49	IPM	23.1	11.5	10.2	10	8.2	6.1
			RPM	6400	3200	2130	1300	850	640
			IPR	.0028	.0028	.0039	.0059	.0071	.0079
Cast Iron > 180 HB	26-49	13-16	IPM	7.1	3.6	2.9	2.9	2.3	1.9
			RPM	2400	1200	800	480	300	240
			IPR	.0047	.0047	.0071	.0079	.0098	.0118
Copper	82-99	39-66	IPM	23.1	11.5	11.5	7.5	6.1	5.8
			RPM	4800	2400	1600	960	640	480
			IPR	.0079	.0079	.0087	.0118	.0138	.0157
Brass	115-132	66-99	IPM	50	25	17.9	15.4	11.8	10
			RPM	6400	3200	2130	1300	850	640
			IPR	.0059	.0059	.0071	.0087	.0138	.0146
Bronze	66-82	39-56	IPM	21.5	11.9	9.5	7.2	7.3	5.7
			RPM	4000	2000	1320	800	530	400
			IPR	.0059	.0059	.0071	.0098	.0118	.0138
Aluminum	132-197	82-115	IPM	57.3	28.7	22.9	18.3	15.3	13.2
			RPM	9500	4800	3200	1900	1300	950
Recommended drill hole diameter:				1,90	3,90	5,85	9,80	14,70	19,70

MICRO-MILLING

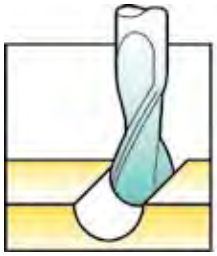
ℓ = 1,5 x D

BALL END SERIES

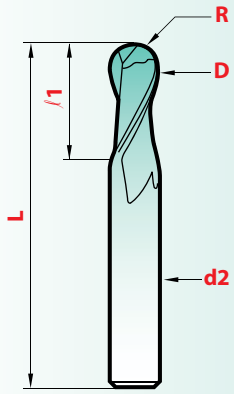
D inch	D mm	ℓ	r	Magafor 8527	Hard'X 8527-H
.0039	0.10	.0039	.0020	88852700100	
.0059	0.15	.0079	.0030	88852700150	
.0079	0.20	.0118	.0039	88852700200	
.0098	0.25	.0138	.0049	88852700250	
.0118	0.30	.0177	.0059	88852700300	888527H0030
.0157	0.40	.0236	.0079	88852700400	888527H0040
.0197	0.50	.0295	.0098	88852700500	888527H0050
.0236	0.60	.0354	.0118	88852700600	888527H0060
.0276	0.70	.0413	.0138	88852700700	888527H0070
.0315	0.80	.0472	.0157	88852700800	888527H0080
.0354	0.90	.0531	.0177	88852700900	888527H0090
.0394	1.00	.0591	.0197	88852701000	888527H0100
.0472	1.20	.0709	.0236	88852701200	888527H0120
.0591	1.50	.0886	.0295	88852701500	888527H0150
.0787	2.00	.1181	.0394	88852702000	888527H0200



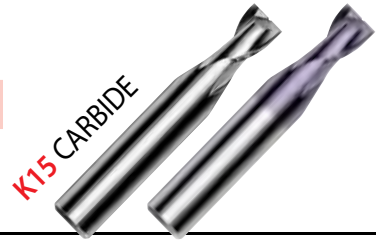
COPYING



PRECISE GROOVING
R +/- 0,01mm



ℓ = 1,5 x D

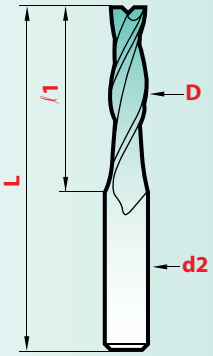


SQUARE END SERIES

D inch	D mm	ℓ	Magafor 8507	Hard'X 8507-H
.0039	0.10	.0039	88850700100	
.0059	0.15	.0079	88850700150	
.0079	0.20	.0118	88850700200	
.0098	0.25	.0138	88850700250	
.0118	0.30	.0177	88850700300	888507H0030
.0157	0.40	.0236	88850700400	888507H0040
.0197	0.50	.0295	88850700500	888507H0050
.0236	0.60	.0354	88850700600	888507H0060
.0276	0.70	.0413	88850700700	888507H0070
.0315	0.80	.0472	88850700800	888507H0080
.0354	0.90	.0531	88850700900	888507H0090
.0394	1.00	.0591	88850701000	888507H0100
.0433	1.10	.0650	88850701100	888507H0110
.0472	1.20	.0709	88850701200	888507H0120
.0512	1.30	.0768	88850701300	888507H0130
.0551	1.40	.0827	88850701400	888507H0140
.0591	1.50	.0886	88850701500	888507H0150
.0630	1.60	.0945	88850701600	888507H0160
.0669	1.70	.1004	88850701700	888507H0170
.0709	1.80	.1063	88850701800	888507H0180
.0748	1.90	.1122	88850701900	888507H0190
.0787	2.00	.1181	88850702000	888507H0200

PRECISE GROOVING
0 - 0,01mm

FLAT BOTTOM BORING

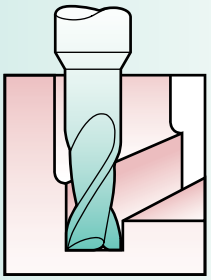


*Engaged right from the start in the process aspiring to excellence, in addition to our Futura and TIN coatings, MAGAFOR offers three new "**X**" coatings, sprung from multi-layer nano technology.*

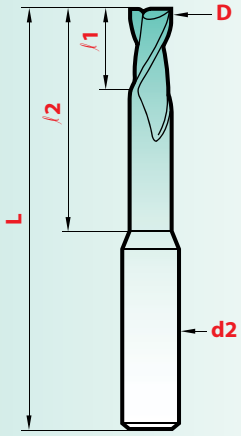
***Red'X :** cobalt tool coating with higher hardness of (3700 HV) like TiAlN in a multi-layer coating. This coating can be used for dry machining. Using coolant will add lubricity.*

***Hard'X** : carbide tool coating with a high hardness (3500 HV) this coating shows a high thermic stability and an excellent protection against heat and wear. Ideal for dry machining-high speed cut-in treated steels and dies up to 67 Rc.*

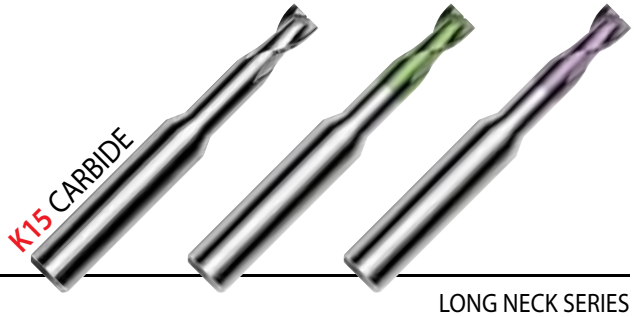
MINIATURE END-MILLS WITH BACK CLEARANCE



HARD TO REACH MACHINING



ℓ = 1,5 x D



d2 = .118 / 3 mm

LONG NECK SERIES

Diameter x ℓ2 inch	Diameter x ℓ2 mm	ℓ1	L	magaforce 8507-D	K15/Graph'X 8507-DG	k15/Hard'X 8507-DH
.0157 x .078	0,4 x 2	.024	1-1/2	888507D0042	888507DG0042	888507DH0042
.0197 x .078	0,5 x 2	.027	1-1/2	888507D0052	888507DG0052	888507DH0052
.0197 x .157	0,5 x 4	.027	1-1/2	888507D0054	888507DG0054	888507DH0054
.0197 x .236	0,5 x 6	.027	2-3/8	888507D0056	888507DG0056	888507DH0056
.0236 x .157	0,6 x 4	.029	1-1/2	888507D0064	888507DG0064	888507DH0064
.0276 x .157	0,7 x 4	.035	1-1/2	888507D0074	888507DG0074	888507DH0074
.0315 x .157	0,8 x 4	.041	1-1/2	888507D0084	888507DG0084	888507DH0084
.0315 x .236	0,8 x 6	.041	1-1/2	888507D0086	888507DG0086	888507DH0086
.0315 x .354	0,8 x 9	.041	2-3/8	888507D0089	888507DG0089	888507DH0089
.0354 x .236	0,9 x 6	.053	1-1/2	888507D0096	888507DG0096	888507DH0096
.0394 x .157	1,0 x 4	.059	1-1/2	888507D0140	888507DG014	888507DH014
.0394 x .236	1,0 x 6	.059	1-1/2	888507D0160	888507DG016	888507DH016
.0394 x .354	1,0 x 9	.059	1-1/2	888507D0190	888507DG019	888507DH019
.0394 x .472	1,0 x 12	.059	2-3/8	888507D0112	888507DG0112	888507DH0112
.0472 x .236	1,2 x 6	.071	1-1/2	888507D0126	888507DG0126	888507DH0126
.0472 x .354	1,2 x 9	.071	1-1/2	888507D0129	888507DG0129	888507DH0129
.0551 x .236	1,4 x 6	.083	1-1/2	888507D0146	888507DG0146	888507DH0146
.0551 x .354	1,4 x 9	.083	1-1/2	888507D0149	888507DG0149	888507DH0149
.0591 x .236	1,5 x 6	.089	1-1/2	888507D0156	888507DG0156	888507DH0156
.0591 x .354	1,5 x 9	.089	1-1/2	888507D0159	888507DG0159	888507DH0159
.0591 x .472	1,5 x 12	.089	2-3/8	888507D01512	888507DG01512	888507DH01512
.0709 x .354	1,8 x 9	.106	1-1/2	888507D0189	888507DG0189	888507DH0189
.0709 x .472	1,8 x 12	.106	1-1/2	888507D01812	888507DG01812	888507DH01812
.0787 x .354	2,0 x 9	.118	1-1/2	888507D0290	888507DG029	888507DH029
.0787 x .472	2,0 x 12	.118	1-1/2	888507D0212	888507DG0212	888507DH0212
.0787 x .590	2,0 x 15	.118	2-3/8	888507D0215	888507DG0215	888507DH0215
.0984 x .590	2,5 x 15	.148	2-3/8	888507D02515	888507DG02515	888507DH02515

ℓ2-: tolerance - .0008 - .0020
**Call for pricing*

MINIATURE END MILLS *Speeds & Feeds*

Performance RECOMMENDATIONS OF USING

- *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 has listed 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)

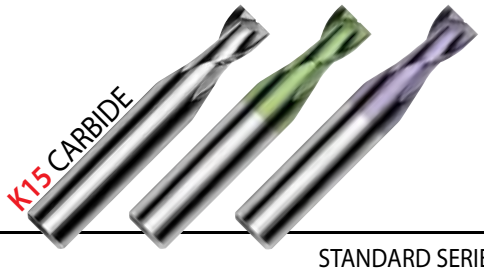
Feed: IPM = IPT x # of Flutes x RPM
IPR = IPM ÷ RPM
SFM = RPM x Diameter ÷ 3.82

Material	Diameter(mm)	SFM	RPM	Inch/tooth	IPM
Steels 24-40Rc	0,5	132	25615	.00004	2.0
	1	132	12808	.0001	2.5
	1,5	132	8538	.0001	1.7
	2	132	6404	.0002	2.5
	3	132	4270	.0002	1.7
Steel 41Rc-45Rc	0,5	82	15920	.00004	1.3
	1	82	7960	.0001	1.6
	1,5	82	5310	.0001	1.1
	2	82	3980	.0002	1.6
	3	82	2650	.0002	1.1
Steels >45Rc TiAiN coated tools only	0,5	132	25615	.00004	2.0
	1	132	12808	.0001	2.5
	1,5	132	8538	.0001	1.7
	2	132	6404	.0002	2.5
	3	132	4270	.0002	1.7

Material	Diameter(mm)	SFM	RPM	Inch/tooth	IPM
Plastics with glass or carbon filters	0,5	263	51040	.00004	4.1
	1	263	25520	.0002	10.2
	1,5	263	17010	.0006	20.4
	2	263	12760	.0008	20.4
	3	263	8500	.0012	20.4
Aluminum and other plastics	0,5	494	95860	.0002	38.3
	1	658	63840	.0005	63.8
	1,5	658	42560	.0007	60.0
	2	658	31920	.0009	57.5
	3	658	21280	.0014	60.0
Copper Brass Bronze and Steels <24 Rc	0,5	263	51000	.0002	20.4
	1	263	25520	.0005	25.5
	1,5	263	17000	.0007	24.0
	2	263	12750	.0009	23.0
	3	263	8500	.0014	24.0

STANDARD LENGTH MINIATURE END-MILLS

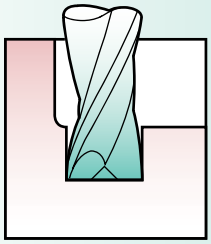
ℓ ≃ 2-3 x D



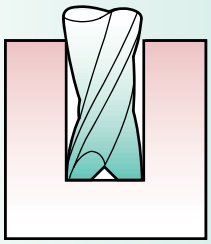
TOLERANCE 0 - .0004"

STANDARD SERIES

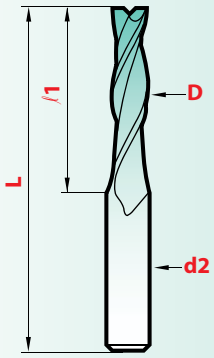
Diameter inch	Diameter mm	ℓ1	L	d2	magaforce 8500	Graph'X 8500-G	Hard'X 8500-H
.0020	0,05	.004	1-1/2	.118 3 mm	88850000050		
.0024	0,06	.005			88850000060		
.0031	0,08	.006			88850000080		
.0039	0,10	.008			88850000100		
.0047	0,12	.009			88850000120		
.0059	0,15	.012			88850000150		
.0079	0,20	.020			88850000200		
. 0098	0,25	.020			88850000250		
.0118	0,30	.039			88850000300	888500G0030	888500H0030
.0138	0,35	.039			88850000350	888500G0035	888500H0035
.0157	0,40	.039			88850000400	888500G0040	888500H0040
.0177	0,45	.039			88850000450	888500G0045	888500H0045
.0197	0,50	.059			88850000500	888500G0050	888500H0050
.0216	0,55	.059			88850000550	888500G0055	888500H0055
.0236	0,60	.059			88850000600	888500G0060	888500H0060
.0256	0,65	.059			88850000650	888500G0065	888500H0065
.0276	0,70	.079			88850000700	888500G0070	888500H0070
.0295	0,75	.079			88850000750	888500G0075	888500H0075
.0315	0,80	.079			88850000800	888500G0080	888500H0080
.0335	0,85	.079			88850000850	888500G0085	888500H0085
.0354	0,90	.098			88850000900	888500G0090	888500H0090
.0374	0,95	.098			88850000950	888500G0095	888500H0095
.0394	1,00	0.12			88850001000	888500G0100	888500H0100
.0413	1,05	0.12			88850001050	888500G0105	888500H0105
.0433	1,10	0.12			88850001100	888500G0110	888500H0110
.0452	1,15	0.12			88850001150	888500G0115	888500H0115
.0472	1,20	0.16			88850001200	888500G0120	888500H0120
.0492	1,25	0.16			88850001250	888500G0125	888500H0125
.0512	1,30	0.16			88850001300	888500G0130	888500H0130
.0551	1,40	0.16			88850001400	888500G0140	888500H0140
.0591	1,50	0.16			88850001500	888500G0150	888500H0150
.0630	1,60	0.20			88850001600	888500G0160	888500H0160
.0669	1,70	0.20			88850001700	888500G0170	888500H0170
.0709	1,80	0.20			88850001800	888500G0180	888500H0180
.0748	1,90	0.20			88850001900	888500G0190	888500H0190
.0787	2,00	0.20			88850002000	888500G0200	888500H0200
.0827	2,10	0.24			88850002100	888500G0210	888500H0210
.0866	2,20	0.24			88850002200	888500G0220	888500H0220



SLOTTING
ENGRAVING



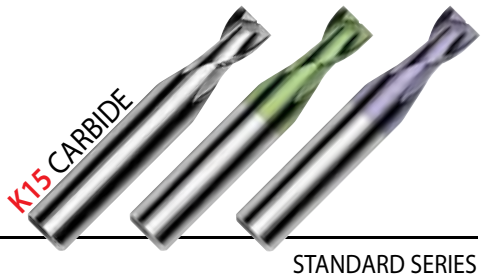
FLAT BOTTOM
BORING



K15 *CARBIDE* — 6.5 - 7% Cobalt
(0,006 - 0,008mm grain size)

STANDARD LENGTH MINIATURE END-MILLS

$\ell \simeq$ **2-3 x D**



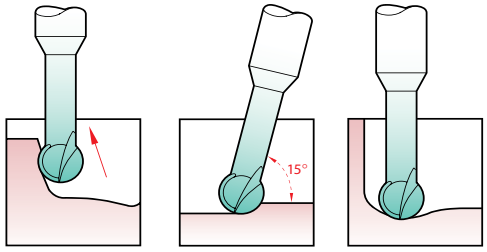
STANDARD SERIES

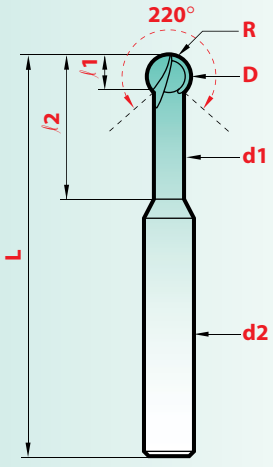
Diameter inch	Diameter mm	ℓ1	L	d2	magaforce 8500	Graph'X 8500-G	Hard'X 8500-H
.1575	4,00	0.47	2-3/16	.197 5 mm	88850004000	888500G0400	888500H0400
.1614	4,10	0.47			88850004100	888500G0410	888500H0410
.1654	4,20	0.47			88850004200	888500G0420	888500H0420
.1693	4,30	0.47			88850004300	888500G0430	888500H0430
.1732	4,40	0.47			88850004400	888500G0440	888500H0440
.1772	4,50	0.47			88850004500	888500G0450	888500H0450
.1811	4,60	0.47			88850004600	888500G0460	888500H0460
.1850	4,70	0.47			88850004700	888500G0470	888500H0470
.1890	4,80	0.47			88850004800	888500G0480	888500H0480
.1929	4,90	0.47			88850004900	888500G0490	888500H0490
.1969	5,00	0.55	2-3/16	.236 6 mm	88850005000	888500G0500	888500H0500
.2008	5,10	0.55			88850005100	888500G0510	888500H0510
.2047	5,20	0.55			88850005200	888500G0520	888500H0520
.2087	5,30	0.55			88850005300	888500G0530	888500H0530
.2126	5,40	0.55			88850005400	888500G0540	888500H0540
.2165	5,50	0.55			88850005500	888500G0550	888500H0550
.2205	5,60	0.55			88850005600	888500G0560	888500H0560
.2244	5,70	0.55			88850005700	888500G0570	888500H0570
.2283	5,80	0.55			88850005800	888500G0580	888500H0580
.2323	5,90	0.55			88850005900	888500G0590	888500H0590

STANDARD SERIES

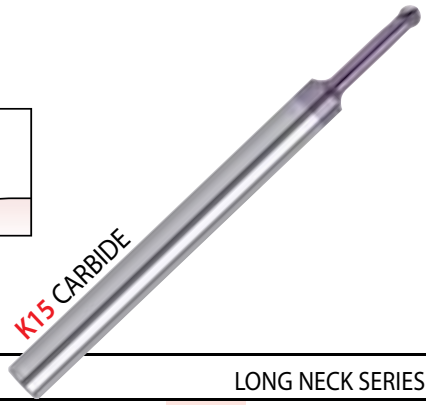
Diameter inch	Diameter mm	ℓ1	L	d2	magaforce 8500	Graph'X 8500-G	Hard'X 8500-H
.0906	2,30	0.24	1-1/2	.118 3 mm	88850002300	888500G0230	888500H0230
.0945	2,40	0.24			88850002400	888500G0240	888500H0240
.0984	2,50	0.28			88850002500	888500G0250	888500H0250
.1024	2,60	0.28			88850002600	888500G0260	888500H0260
.1063	2,70	0.28			88850002700	888500G0270	888500H0270
.1102	2,80	0.28			88850002800	888500G0280	888500H0280
.1142	2,90	0.28			88850002900	888500G0290	888500H0290
.1181	3,00	0.39	1-3/4	.157 4 mm	88850003000	888500G0300	888500H0300
.1220	3,10	0.39			88850003100	888500G0310	888500H0310
.1260	3,20	0.39			88850003200	888500G0320	888500H0320
.1299	3,30	0.39			88850003300	888500G0330	888500H0330
.1339	3,40	0.39			88850003400	888500G0340	888500H0340
.1378	3,50	0.39			88850003500	888500G0350	888500H0350
.1417	3,60	0.39			88850003600	888500G0360	888500H0360
.1457	3,70	0.39			88850003700	888500G0370	888500H0370
.1496	3,80	0.39			88850003800	888500G0380	888500H0380
.1535	3,90	0.39			88850003900	888500G0390	888500H0390

220° ball-end MINIATURE END-MILLS with back clearance





$\ell 2 = 5 \times D$



METRIC — LONG NECK SERIES

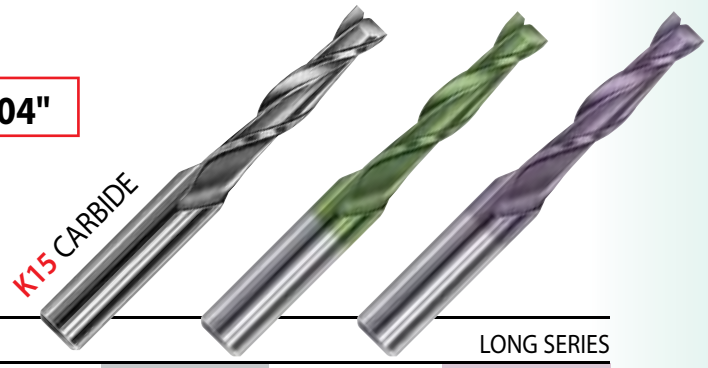
Diameter inch	Diameter mm	d1	d2	L	ℓ1	ℓ2	R	Hard'X 8522-H
.0315	0,8	0,70	3	60	0,55	4,0	0,4	888522H0080
.0394	1,0	0,85	3	60	0,70	5,0	0,5	888522H0100
.0472	1,2	1,00	3	60	0,80	6,0	0,6	888522H0120
.0590	1,5	1,30	3	60	1,00	7,5	0,75	888522H0150
.0787	2,0	1,70	3	60	1,35	10,0	1,0	888522H0200
.1180	3,0	2,60	6	75	2,00	15,0	1,5	888522H0300
.1575	4,0	3,45	6	75	2,70	20,0	2,0	888522H0400
.1969	5,0	4,30	6	75	3,40	25,0	2,5	888522H0500

**Call for pricing*

LONG MINIATURE END-MILLS

TOLERANCE 0 - .0004"

ℓ = 5 x D

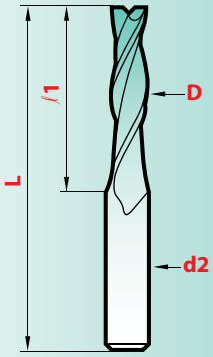


L = 1-1/2 d2 = .118 / 3 mm

LONG SERIES

Diameter inch	Diameter mm	ℓ1	magaforce 8509	Graph'X 8509-G	Hard'X 8509-H
.0157	0,4	.078	88850900400	888509G0040	888509H0040
.0197	0,5	.098	88850900500	888509G0050	888509H0050
.0236	0,6	.118	88850900600	888509G0060	888509H0060
.0276	0,7	.137	88850900700	888509G0070	888509H0070
.0315	0,8	.157	88850900800	888509G0080	888509H0080
.0354	0,9	.177	88850900900	888509G0090	888509H0090
.0394	1,0	.197	88850901000	888509G0100	888509H0100
.0472	1,2	.236	88850901200	888509G0120	888509H0120
.0591	1,5	.295	88850901500	888509G0150	888509H0150
.0787	2,0	.394	88850902000	888509G0200	888509H0200

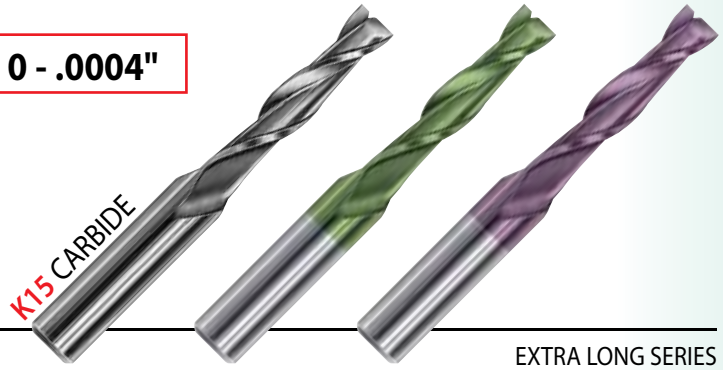
**Call for pricing*



EXTRA-LONG MINIATURE END-MILLS

TOLERANCE 0 - .0004"

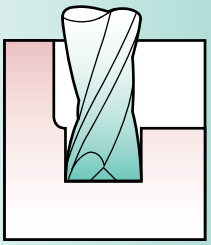
ℓ = 8 x D



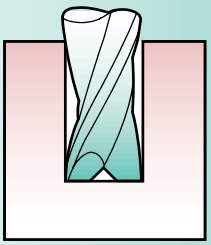
EXTRA LONG SERIES

Diameter inch	Diameter mm	ℓ1	L	d2	magaforce 8510	Graph'X 8510-G	Hard'X 8510-H
.0197	0,5	.157	1-1/2	.118 3 mm	88851000500	888510G0050	888510H0050
.0236	0,6	.197			88851000600	888510G0060	888510H0060
.0315	0,8	.236			88851000800	888510G0080	888510H0080
.0394	1,0	.315			88851001000	888510G0100	888510H0100
.0472	1,2	.354			88851001200	888510G0120	888510H0120
.0591	1,5	.472	1-3/4	.157 4 mm	88851001500	888510G0150	888510H0150
.0787	2,0	.630			88851002000	888510G0200	888510H0200
.0984	2,5	.788	2-3/8	.197 5 mm	88851002500	888510G0250	888510H0250
.1181	3,0	.945			88851003000	888510G0300	888510H0300

**Call for pricing*



SLOTTING ENGRAVING

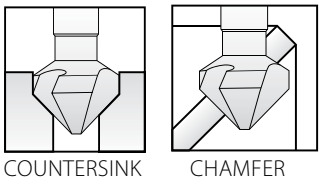


FLAT BOTTOM BORING

VALUE PACKED KITS & PROMOTION ITEMS

Versatile, Broad Application Range, Business Building!

TRIDENT 90° Three flute COUNTERSINKS



3 FLUTE COUNTERSINK SETS — ANGLE 90°

magafor		COMPOSITION M35 Cobalt
84431000000-M		Ø 10 - 15 - 20,5 mm
84431000000-M-TIN		
84431000000		Ø 10,4 - 16,5 - 20,5 - 25,0 - 31,0 mm
84483100000		
84436000000		
84431000002		Ø 6,3 - 8,3 - 10,4 - 12,4 - 16,5 - 20,5 mm
84483100002		
84436000002		
88843100002		
84431000003	(1)	Ø 6,3 - 8,3 - 10,4 - 12,4 - 16,5 - 20,5 - 25 mm
84431000004	(1)	Ø 4,3 - 5,3 - 6,3 - 8,3 - 10,4 - 12,4 -16,5 -20,5 -25 -31
88843100000		Ø 10,4 - 16,5 - 20,5 - 25 - 31 mm
84431000006	(2)	Ø 6,3 - 12,4 - 16,5 - 20,5 mm
84483100006	(2)	

(1) *Set supplied with 1 auto-lock chuck handle* **Code 4001**.
(2) *Set supplied with an 8 mm auto-lock chuck handle* **Code 4002**.

TRIDENT COUNTERSINK SETS

Angle	M35/Cobalt	COMPOSITION / mm
60°	84432000000	Ø 10.4-16.5-20.5-25-31
	84483200000	
82°	84434000000	
	84483400000	
100°	84435000000	
120°	84433000000	

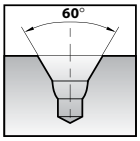
COBALT SPOT DRILL

SET OF 4 NC-DRILLS

American Standard 1 piece of each Ø

COMPOSITION 1/4 - 3/8 - 1/2 - 5/8 - Ø		
TYPE		Cobalt
90°	Code	S195/4
120°	Code	S196/4

Sets also available TiN and Futura coated



"UNIQUE" CENTER DRILLS

With reinforcing bulge

Form W SETS

American Standard

81145000000

5 PIECES COMPOSITION Quantity	
1 piece each Bulge	# 1-W
	# 2-W
	# 3-W
	# 4-W
	# 5-W

PLAIN TYPE 60° CENTER DRILLS

Sizes in inches

Value SETS *American Standard 5 PIECES*

81154000000	1 piece each #1, #2, #3, #4, #5
81115000000	1 piece each #1, #2, #3, #4, #5
S1055 (Cobalt)	1 piece each #1, #2, #3, #4, #5

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