

# Proto-Cutter

*Providing Precision Cutting Tools for Over 30 Years*



[www.protocutter.com](http://www.protocutter.com)



## Proto-Cutter, Inc.

Precision Cutting Tools

*Since 1991, Proto-Cutter, Inc. has been diligently working on producing the market's finest reamers, consistently holding tight tolerances and providing superior finish. Throughout the years, our reamers have successfully been integrated in the automotive, aerospace, agriculture, arms, and medical fields.*

*While our reputation may be for reamers, we also supply a vast array of custom tooling. As you will find throughout this catalog, we specialize in custom round tooling in either HSS, CT, or S/C. Proto-Cutter has also added indexable tooling to our capabilities, including a standard line 3XD drill.*

*We will stand behind our tools and take pride in supplying tools that are MADE IN THE USA. Our commitment to quality has remained the same since we started doing business – Proto-Cutter, Inc. will continuously strive to improve its quality management system and produce the best tools in the industry by meeting or exceeding customer requirements, delivering defect-free products and services on time, every time.*

*Thank you to all of our current, former, and possibly new customers. We look forward to continuing to provide top notch tooling and customer service!*

Pete Alber

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## USING STATE-OF-THE-ART TECHNOLOGY AND HIGHLY SKILLED OPERATORS, PROTO-CUTTER PROVIDES SOLUTIONS FOR TOUGH TOOLING PROBLEMS.

**In 1991, Proto-Cutter, Inc. was established to offer cutting tool resharpening. Since that time, we have increased in size and now manufacture several types of precision cutting tools.**

At Proto-Cutter, our business philosophy is simple and straightforward: Provide the highest quality coolant-fed reamers and the best customer service anywhere in the industry to maximize your productivity and achieve your lowest cost per hole.

We specialize in manufacturing carbide tipped, solid carbide, and high-speed steel coolant-fed reamers in standard and special designs for precision hole finishing.

Standard cutting diameter tolerances are maintained within  $\pm .00015"/-.00015"$  unless otherwise specified.

In addition to our standard design right-hand spiral/right-hand cut reamers, we offer the following special flute configurations:

- Straight flute
- Left-hand spiral/right-hand cut
- Left-hand spiral/left-hand cut
- Right-hand spiral/left-hand cut

Our experienced sales engineers will work with you to determine the flute configuration that best meets your production requirements.

All of our reamers are manufactured to provide ease of set-up and operation. We can provide you with reamers capable of extended life, reamers that will produce an exceptionally high finish (minimizing the need for secondary operations), or a reamer that will give you a quality finish and provide you with long tool life. In addition, Proto-Cutter reamers eliminate chatter and other problems associated with conventional reamers.

**Proto-Cutter has become a trusted name in hole finishing tools because of our high quality standards, unmatched customer service, and fast lead times, which are qualities we also apply to our special made-to-print items. We are committed to providing high quality tools at affordable prices and look forward to serving all your cutting tool needs.**



# SEVEN IMPORTANT REASONS WHY PROTO-CUTTER SHOULD BE YOUR SOURCE FOR COOLANT-FED REAMERS

## 1. OUR "TOTAL COMMITMENT" ASSURES YOUR COMPLETE AND CONSISTENT SATISFACTION

At Proto-Cutter, "Total Commitment" serves as the foundation for everything we do. There are four areas of our business relationship with you where a commitment to quality is continually stressed.

**A commitment to product excellence:** At Proto-Cutter, we consistently utilize only the latest mechanical and computerized inspection equipment, which is applied at every facet of the manufacturing process. This investment in quality control results in tooling that is second to none.

**A commitment to superior performance combined with cost efficiency:** We understand that you want the best cutting tool your money can buy, but at a reasonable cost. Proto-Cutter provides the highest quality tools at competitive prices.

**A commitment to our responsibility to meet all your needs:** At Proto-Cutter, we do much more than just take orders. We take responsibility by meeting all of your needs in the areas of product design, quality, price and delivery.

**A commitment to professionalism:** Professionalism at Proto-Cutter means servicing our customers' needs quickly and conscientiously, and staying on the cutting edge of technology to consistently produce the finest reamers in the industry. By maintaining our "Total Commitment," we provide a competitive advantage that will aid you in your marketplace.

## 2. CUSTOM SHARPENING RESULTS IN PRECISE ACCURACY AND EXCEPTIONAL FINISH

Because we custom sharpen each and every reamer to its exact specified profile and tolerance, you are able to achieve hole size to within .0005". Hole straightness can be maintained to within .0002", depending on the hole's depth and prior operation. With Proto-Cutter reamers, you can achieve a surface finish of 32 RMs, or even better in some circumstances. By achieving this high level of finish, our reamers eliminate the need for time-consuming grinding, honing or burnishing operations. That means more holes reamed per year, increasing your productivity and dramatically reducing your cost per hole.

## 3. EXTENDED TOOL LIFE MEANS LESS MACHINE DOWNTIME

The unique design of Proto-Cutter reamers extends reamer life significantly over that of conventional reamers, giving you increased tool repeatability and less downtime for more holes reamed per year and increased productivity. *Proto-Cutter reamers give you "The Most Value For Your Hole Dollar."*

## 4. QUICK AND CONSISTENT ON-TIME DELIVERY MEANS LESS DOWNTIME FOR YOU

Our excellent on-time delivery record is consistently better than any of our competitors and means less downtime for you. When you're in a bind, don't get behind, pick up the phone and call us.

## 5. ENGINEERING ASSISTANCE AT NO COST MAKES TOOL SELECTION EASY

Our sales engineers have a broad working knowledge of materials, hardness, feeds, speeds and many other factors that contribute to the performance of the reamer. They will help you choose a reamer and a sharpening profile that will accomplish your hole finishing requirements and productivity goals. Their experience is available without cost or obligation. Just call us.

## 6. RECONDITIONING SERVICES MEAN SINGLE-SOURCING AND COST-EFFICIENCY

Reconditioning your reamers provides maximum tool life and results in decreased tool costs overall. As your single-source for both new reamers and reconditioning, Proto-Cutter will maximize your tool cost efficiency. In reamer conditioning, we precisely restore the controlled cutting edges through lead sharpening, resizing or replacing carbide tips and sharpening them to the original specifications.

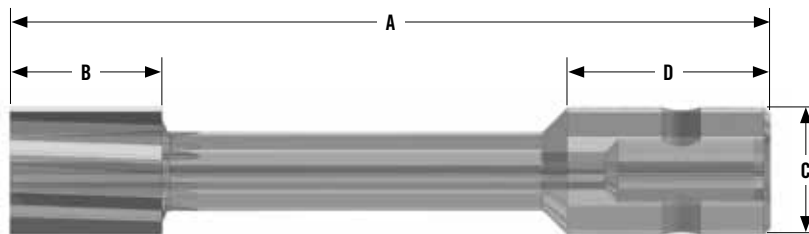
## 7. COMPUTER DATA BASE MEANS QUICK AND ACCURATE RE-ORDERING

We maintain an extensive computer data base file for each customer, recording information such as your tool numbers, reamer sizes, profile selections, and more. With this information readily accessible, each new order you place can be quickly and accurately duplicated.



# Coolant-Fed Reamers

Coolant-fed reamers lubricate and cool the cutting edges and provide exceptional chip disposal, resulting in increased productivity, longer tool life and lower tool costs.



## CARBIDE-TIPPED & SOLID CARBIDE

Carbide-tipped and solid carbide coolant-fed reamers offer many significant advantages for hole finishing:

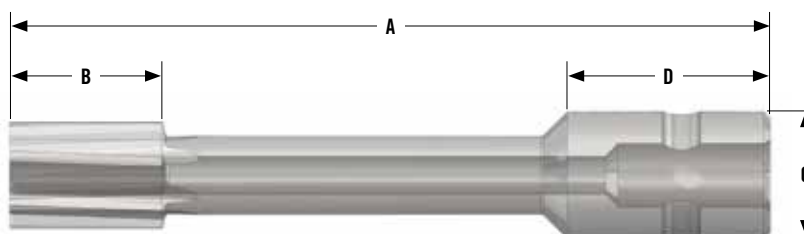
- These reamers work well for almost all materials.
- Operation at higher speeds and feed rates increases tool life and decreases cycle time.
- Depending on the application, they can outlast high-speed steel reamers by as much as 10-to-1.

Part Number	Diameter Range	A	B	C	D	Number of Flutes
PSC-0125*	.0935-.1300	2.500	.375	.375	.750	4
PSC-0157*	.1301-.1600	2.500	.375	.375	.750	4
PSC-0175*	.1601-.1800	2.500	.375	.375	.750	4
PC-0210	.1801-.2200	2.500	.500	.375	.750	4
PSC-0210*	.1801-.2200	2.500	.500	.375	.750	6
PC-0255	.2201-.2600	2.500	.500	.375	.750	4
PSC-0255*	.2201-.2600	2.500	.500	.375	.750	6
PC-0286	.2601-.2920	2.500	.500	.375	.750	4
PSC-0286*	.2601-.2920	2.500	.500	.375	.750	6
PC-0318	.2921-.3250	2.500	.500	.375	.750	6
PSC-0318*	.2921-.3250	2.500	.500	.375	.750	6
PC-0380	.3251-.3900	2.500	.500	.375	.750	6
PSC-0380*	.3251-.3900	2.500	.500	.375	.750	6
PC-0436	.3901-.4450	2.625	.500	.375	.750	6
PSC-0436*	.3901-.4450	2.625	.500	.375	.750	6
PC-0505	.4451-.5150	3.500	.625	.625	1.000	6
PC-0630	.5151-.6400	3.750	.750	.625	1.000	6
PC-0755	.6401-.7650	4.250	.750	.625	1.000	6
PC-0880	.7651-.8900	4.750	.875	.625	1.000	6
PC-1005	.8901-1.0150	5.500	1.000	1.000	1.500	8
PC-1130	1.0151-1.1400	6.000	1.250	1.000	1.500	8
PC-1255	1.1401-1.2650	6.000	1.250	1.000	1.500	8
PC-1380	1.2651-1.3900	6.000	1.250	1.000	1.500	8
PC-1505	1.3901-1.5150	6.000	1.250	1.000	1.500	8
PC-1630	1.5151-1.6400	6.000	1.250	1.000	1.500	10
PC-1755	1.6401-1.7650	6.000	1.250	1.000	1.500	10
PC-1880	1.7651-1.8900	6.000	1.250	1.000	1.500	10
PC-2015	1.8901-2.0250	6.000	1.250	1.000	1.500	10

\*PSC indicates solid carbide

The coolant-fed feature of Proto-Cutter reamers produces maximum chip-flushing action and is designed for use in blind hole and through hole reaming. In blind hole reaming, chip flushing and cooling are achieved simultaneously. The coolant is fed through the reamer body, hits the end of the blind hole and is forced back through the flutes.

## REAMERS



### HIGH-SPEED STEEL

High-speed steel (HSS) reamers are an excellent choice for low cost production jobs:

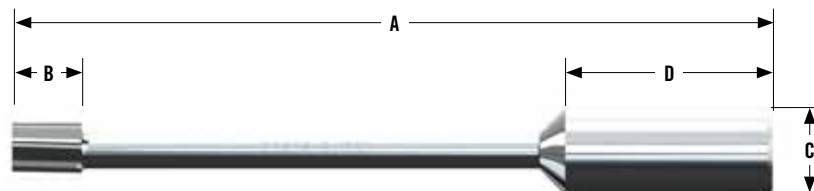
- They work well with a variety of materials.
- HSS reamers are cost efficient.
- They are great for smaller quantity production runs.

Part Number	Diameter Range	A	B	C	D	Number of Flutes
PH-0125*	.0935-.1300	2.500	.375	.375	.750	4
PH-0157*	.1301-.1600	2.500	.375	.375	.750	4
PH-0175*	.1601-.1800	2.500	.375	.375	.750	4
PH-0210	.1801-.2150	2.500	.500	.375	.750	6
PH-0254	.2151-.2600	2.500	.500	.375	.750	6
PH-0284	.2601-.2900	2.500	.500	.375	.750	6
PH-0318	.2901-.3250	2.500	.500	.375	.750	6
PH-0344	.3251-.3500	2.500	.500	.375	.750	6
PH-0407	.3501-.4100	2.625	.500	.375	.750	6
PH-0439	.4101-.4450	2.625	.500	.375	.750	6
PH-0505	.4451-.5100	3.500	.625	.625	1.000	6
PH-0567	.5101-.5700	3.500	.625	.625	1.000	6
PH-0630	.5701-.6350	3.750	.625	.625	1.000	8
PH-0692	.6351-.6950	4.250	.750	.625	1.000	8
PH-0755	.6951-.7600	4.250	.750	.625	1.000	8
PH-0817	.7601-.8200	4.500	.875	.625	1.000	8
PH-0884	.8201-.8900	4.750	.875	.625	1.000	8
PH-1015	.8901-1.0200	5.500	1.000	1.000	1.500	8
PH-1137	1.0201-1.1400	6.000	1.000	1.000	1.500	8
PH-1323	1.1401-1.3300	6.000	1.250	1.000	1.500	8
PH-1505	1.3301-1.5100	6.000	1.250	1.000	1.500	8
PH-1656	1.5101-1.6600	6.000	1.250	1.000	1.500	10
PH-1813	1.6601-1.8200	6.000	1.250	1.000	1.500	10
PH-2015	1.8201-2.0200	6.000	1.250	1.000	1.500	10

\*Does not contain coolant through hole

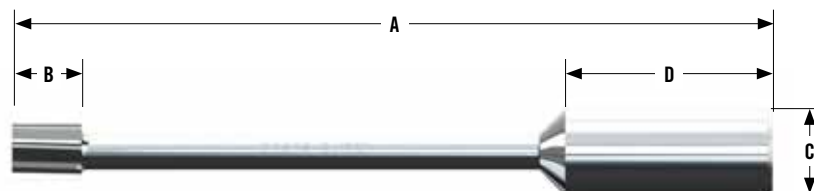
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## CARBIDE-TIPPED, COOLANT FED



Part Number	Diameter Range	A Overall Length	B Flute Length	C Shank Diameter	D Shank Length	Number of Flutes
PCF-0210	.1801-.2200	5.500	1.000	0.375	1.500	4
PCF-0255	.2201-.2600	5.500	1.000	0.375	1.500	4
PCF-0286	.2601-.2920	5.500	1.500	0.375	1.500	4
PCF-0318	.2921-.3250	5.500	1.500	0.375	1.500	6
PCF-0380	.3251-.3900	5.500	1.750	0.625	1.500	6
PCF-0436	.3901-.4450	8.000	1.750	0.625	1.500	6
PCF-0505	.4451-.5150	8.000	2.000	0.625	1.500	6
PCF-0630	.5151-.6400	8.000	2.000	0.625	1.500	6
PCF-0755	.6401-.7650	8.000	2.500	0.625	1.500	6
PCF-0880	.7651-.8900	10.000	2.500	1.000	2.500	6
PCF-1005	.8901-1.0150	10.000	2.750	1.000	2.500	8
PCF-1130	1.0151-1.1400	10.000	2.750	1.000	2.500	8
PCF-1255	1.1401-1.2650	10.000	2.750	1.000	2.500	8
PCF-1380	1.2651-1.3900	10.000	2.750	1.000	2.500	8
PCF-1505	1.3901-1.5150	10.000	2.750	1.000	2.500	8
PCF-1630	1.5151-1.6400	10.000	2.750	1.000	2.500	10
PCF-1755	1.6401-1.7650	10.000	2.750	1.000	2.500	10
PCF-1880	1.7651-1.8900	10.000	2.750	1.000	2.500	10
PCF-2015	1.8901-2.0250	10.000	2.750	1.000	2.500	10

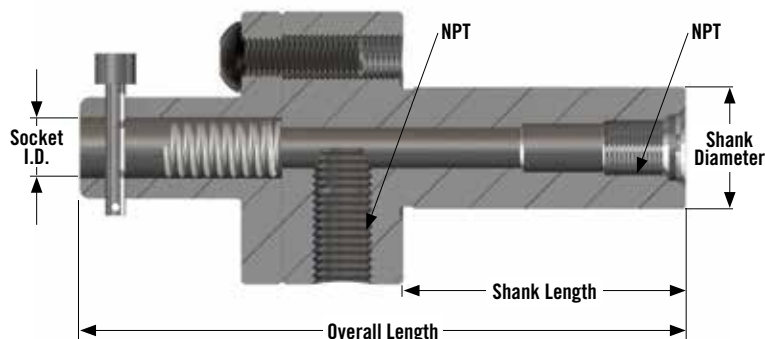
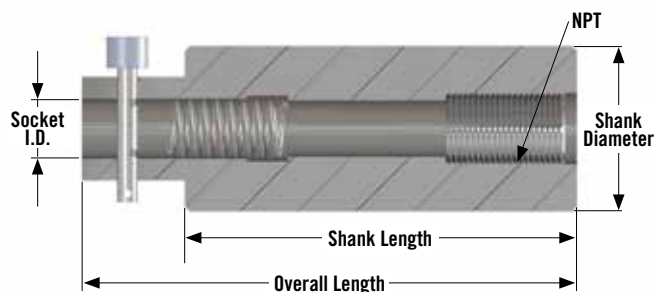
## HIGH-SPEED STEEL, COOLANT FED



Part Number	Diameter Range	A Overall Length	B Flute Length	C Shank Diameter	D Shank Length	Number of Flutes
PHF-0210	.1801-.2150	5.500	1.000	0.375	1.500	6
PHF-0254	.2151-.2600	5.500	1.000	0.375	1.500	6
PHF-0284	.2601-.2900	5.500	1.500	0.375	1.500	6
PHF-0318	.2901-.3250	5.500	1.500	0.375	1.500	6
PHF-0344	.3251-.3500	5.500	1.750	0.625	1.500	6
PHF-0407	.3501-.4100	8.000	1.750	0.625	1.500	6
PHF-0439	.4101-.4450	8.000	1.750	0.625	1.500	6
PHF-0505	.4451-.5100	8.000	2.000	0.625	1.500	6
PHF-0567	.5101-.5700	8.000	2.000	0.625	1.500	6
PHF-0630	.5701-.6350	8.000	2.000	0.625	1.500	8
PHF-0692	.6351-.6950	8.000	2.000	0.625	1.500	8
PHF-0755	.6951-.7600	8.000	2.500	0.625	1.500	8
PHF-0817	.7601-.8200	10.000	2.500	1.000	2.500	8
PHF-0884	.8201-.8900	10.000	2.500	1.000	2.500	8
PHF-1015	.8901-1.0200	10.000	2.750	1.000	2.500	8
PHF-1137	1.0201-1.1400	10.000	2.750	1.000	2.500	8
PHF-1323	1.1401-1.3300	10.000	2.750	1.000	2.500	8
PHF-1505	1.3301-1.5100	10.000	2.750	1.000	2.500	8
PHF-1656	1.5101-1.6600	10.000	2.750	1.000	2.500	10
PHF-1813	1.6601-1.8200	10.000	2.750	1.000	2.500	10
PHF-2015	1.8201-2.0200	10.000	2.750	1.000	2.500	10



## FOR COOLANT-FED REAMERS – TOOL STATIONARY



### FIXED CENTER

Fixed Center PF holders have parallel misalignment compensation of .001-.003. These are for Swiss and mills.

Part Number	Reamer Shank Diameter	Shank Diameter	Shank Length	Overall Length
PF-05	.375	.625	2.375	3.000
PF-10	.375	.750	2.375	3.000
PF-15	.375	1.000	2.375	3.000
PF-20	.625	.750	1.750	3.000
PF-25	.625	1.000	2.125	3.000
PF-30	.625	1.250	2.125	3.000
PF-35	.625	1.500	2.125	3.000
PF-40	.625	1.500	4.000	5.000
PF-45	.625	1.750	4.000	5.000
PF-50	.625	2.000	4.000	5.000
PF-55	1.000	1.000	1.437	5.000
PF-57	1.000	1.250	4.000	5.500
PF-60	1.000	1.500	4.000	5.500
PF-65	1.000	1.750	4.000	5.500
PF-70	1.000	2.000	4.000	5.500

### ADJUSTABLE

Adjustable PAF holders have parallel misalignment compensation of .015-.020. and angular misalignment of .001-.003. These are for lathes and screw machines

Part Number	Reamer Shank Diameter	Shank Diameter	Shank Length	Overall Length
PAF-05	.375	.625	1.500	3.500
PAF-10*	.375	.625	1.250	2.250
PAF-15	.375	.750	1.750	3.750
PAF-20	.375	1.000	1.750	3.750
PAF-25*	.375	1.000	2.125	3.125
PAF-30	.625	.750	2.125	4.000
PAF-35	.625	1.000	2.125	4.000
PAF-40	.625	1.250	2.125	4.000
PAF-45	.625	1.500	2.125	4.000
PAF-50	.625	1.500	3.625	5.500
PAF-55	.625	1.750	3.625	5.500
PAF-60	.625	2.000	3.625	5.500
PAF-65	1.000	1.000	2.000	5.000
PAF-67	1.000	1.250	3.625	6.000
PAF-70	1.000	1.500	3.625	6.000
PAF-75	1.000	1.750	3.625	6.000
PAF-80	1.000	2.000	3.625	6.000

\*Does not contain coolant flange on side of holder

### REPLACEMENT HEAD

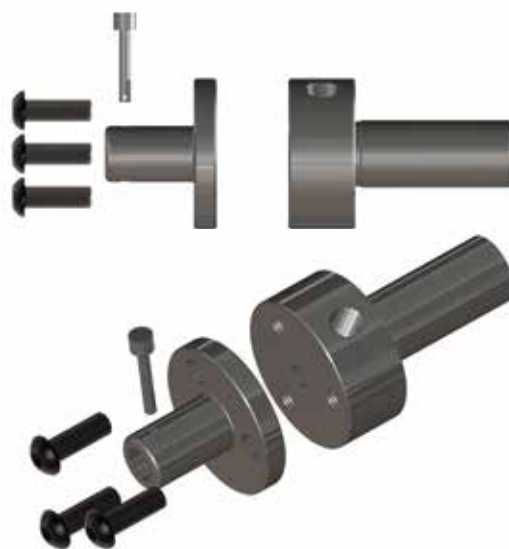
Part Number	Overall Length	Diameter
HD-0	.750	Fits PAF-10 & PAF-25
HD-1	1.25	Fits PAF-05, PAF-15, PAF-20
HD-2	1.125	Fits PAF-30 thru PAF-60
HD-3	1.625	Fits PAF-65 thru PAF-80

### REPLACEMENT PINS

Part Number	Description
PIN-1	Fits PF-05 thru PF-15 & PAF-05 thru PAF-25
PIN-2	Fits PF-20 thru PF-50 & PAF-30 thru PAF-60
PIN-3	Fits PF-55 thru PF-70 & PAF-65 thru PAF-80

### REPLACEMENT SPRINGS

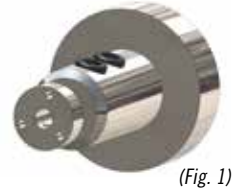
Part Number	Description
SP-1	Fits PF-05 thru PF-15 & PAF-05 thru PAF-25
SP-2	Fits PF-20 thru PF-50 & PAF-30 thru PAF-60
SP-3	Fits PF-55 thru PF-70 & PAF-65 thru PAF-80



*Illustration of PAF floating reamer holder.  
Please contact Proto-Cutter for holder instructions.*

# Holder Alignment Instructions with Ball

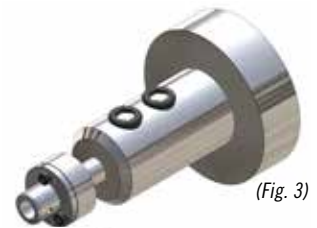
1. Place the holder body into the tool holder of the machine and tighten. (Fig. 1)
2. Drill a hole in the workpiece, preferably using the same drill that is to be used for the reamed hole. (Fig. 2)
3. It is important that the hole is concentric with the spindle. Any runout will affect the accuracy of the alignment.
4. If possible, cut a small chamfer at the beginning of the hole. (This is where the alignment ball will seat.)
5. Place the head on the holder body and snug the three cap screws until the head can only swivel axially. (Fig. 3)
6. Jog the holder up to the workpiece so you can still place the alignment ball between the hole in the workpiece and the holder. (Fig. 4)
7. Slowly inch the holder to the workpiece, while gently moving the head to help it find center until it is against the ball.
8. The head should now be aligned.
9. Tighten the three cap screws.
10. Back holder off and insert reamer. Holder is now ready for use.



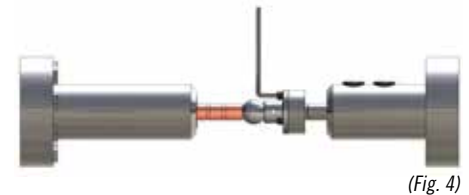
(Fig. 1)



(Fig. 2)



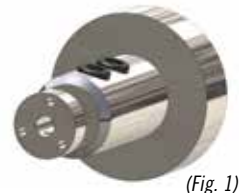
(Fig. 3)



(Fig. 4)

# Holder Alignment Instructions with Reamer

1. Place the holder body into the tool holder of the machine and tighten. (Fig. 1)
2. Drill the hole to be reamed in the workpiece. (Fig. 2)
3. Place the head on the holder body and snug the three cap screws until the head can only swivel axially. (Fig. 3)
4. Insert reamer in holder and secure with pin. (Fig. 4)
5. Tighten setscrew to remove float. (This step is optional; the reamer may be left to float during adjustment if desired.)
6. Ream hole at recommended feed and speed.
7. Stop machine while reamer is in the hole.
8. The head should now be aligned.
9. Tighten the three cap screws on the head.
10. Back reamer out and remove setscrew (if it was used in step 5). Holder is now ready for use.



(Fig. 1)



(Fig. 2)



(Fig. 3)



(Fig. 4)



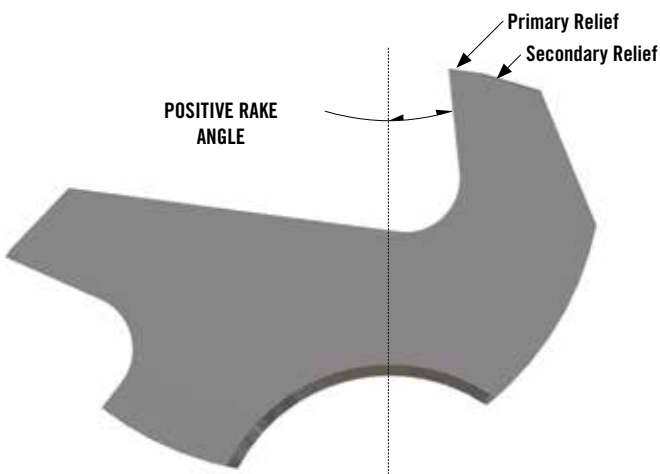
# Product Design and Performance

## SUPERIOR PRODUCT DESIGN FEATURES PRODUCE UNSURPASSED PERFORMANCE

Our reamers include established design features that minimize friction, harmonic chatter and galling to increase the performance and extend the life of your reamers.

These design features include:

- **Irregularly spaced flutes:** This type of spacing provides superior cutting action and reduces harmonic chatter. The design of the spacing, in conjunction with the coolant-fed feature, allows the reamers to produce finishes that were formerly unattainable without secondary finishing operations.
- **Special designed profile:** The profile design on the reamer is important for obtaining optimum finish and maximum tool life. Our applications engineers will select the profile best suited for your material, finish requirements and work piece configuration.
- **Positive rake angle:** This design feature enhances reamer performance and extends tool life, thereby reducing friction and permitting the reamer to cut more freely.



## RECONDITIONING TO ORIGINAL SPECIFICATIONS RESULTS IN SUPERIOR PERFORMANCE

Proto-Cutter restores original sharpening design features to extend the life of your reamers.

### Don't throw away your dull cutting tools

Proto-Cutter specializes in reconditioning "Barber-Colman" style coolant-fed reamers. We will restore the precisely controlled cutting edges on a variety of this type of reamer through lead sharpening, resizing or replacing carbide tips and sharpening them to your original specifications. We will accurately and properly recondition your reamers, delivering them to you quickly so they can be put back on the production line, and servicing them effectively again when they need it.

### We provide three basic reconditioning services:

- **Retipping** for carbide-tipped reamers. We can replace the carbide and precisely sharpen the reamer to its original diameter and tolerances. Many reamers, if properly used, can be retipped up to 50 times or more to achieve the absolute lowest cost per hole.
- **Resizing** for carbide-tipped and high-speed steel reamers. If you use a reamer blank for more than one hole size, we can resize the reamer to a smaller diameter with controlled and precise accuracy (minimum stock required of .003).
- **Lead sharpening** for carbide-tipped and high-speed steel reamers. Chamfer and/or lead angles can be ground to remove wear and extend tool life. However, this is not guaranteed to restore the reamer to the performance level of a retipped or resized tool.

## SAME DAY SERVICE, 24 OR 48 HOUR

In addition to conventional coolant flooding for through hole reaming, we offer coolant dispersion by placing coolant holes between the flutes.

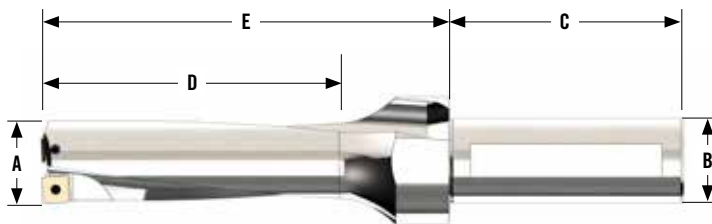
For both blind hole and through hole reaming, the coolant action flushes the chips from the cutting area, while lubricating and cooling the cutting edges. This action increases productivity by reducing frictional heat, improving the finish and extending tool life.



# Indexable Drills

Proto-Cutter's standard line of 3XD positive rake indexable drills offers a competitive advantage in price per hole for high production runs. These versatile drills make a great addition to your general tooling needs. Contact your Proto-Cutter sales representative for pricing and suggested inserts for your specific application.

## POSITIVE RAKE WITH SQUARE INSERTS



A Diameter	Part Number	B Shank Diameter	C Shank Length	D Drill Depth	E Body Length	Insert	Screw
0.75	INDR-3-07500	1.000	2.375	2.250	3.688	PCI060	PCIS20
0.875	INDR-3-08750	1.000	2.375	2.625	3.875	PCI080	PCIS25
1	INDR-3-10000	1.000	2.375	3.000	4.250	PCI080	PCIS25
1.063	INDR-3-10625	1.250	2.375	3.188	4.437	PCI080	PCIS25
1.125	INDR-3-11250	1.250	2.375	3.375	4.625	PCI100	PCIS30
1.188	INDR-3-11875	1.250	2.375	3.563	4.812	PCI100	PCIS30
1.25	INDR-3-12500	1.250	2.500	3.750	5.000	PCI100	PCIS30
1.313	INDR-3-13125	1.500	2.500	3.938	5.187	PCI110	PCIS30
1.375	INDR-3-13750	1.500	2.500	4.125	5.375	PCI110	PCIS30
1.438	INDR-3-14375	1.500	2.500	4.313	5.562	PCI110	PCIS30
1.5	INDR-3-15000	1.500	2.500	4.500	5.750	PCI130	PCIS40
1.563	INDR-3-15625	1.750	2.500	4.688	5.937	PCI130	PCIS40
1.625	INDR-3-16250	1.750	2.500	4.875	6.125	PCI130	PCIS40
1.688	INDR-3-16875	1.750	2.500	5.063	6.312	PCI130	PCIS40
1.75	INDR-3-17500	1.750	2.500	5.250	6.500	PCI130	PCIS40
1.813	INDR-3-18125	2.000	3.250	5.438	6.687	PCI140	PCIS50
1.875	INDR-3-18750	2.000	3.250	5.625	6.875	PCI140	PCIS50
1.938	INDR-3-19375	2.000	3.250	5.813	7.061	PCI140	PCIS50
2	INDR-3-20000	2.000	3.250	6.000	7.250	PCI150	PCIS50
2.125	INDR-3-21250	2.500	3.500	6.375	7.625	PCI150	PCIS50
2.25	INDR-3-22500	2.500	3.500	6.750	8.000	PCI160	PCIS60
2.375	INDR-3-23750	2.500	3.500	7.125	8.375	PCI190	PCIS70
2.5	INDR-3-25000	2.500	3.500	7.500	8.750	PCI190	PCIS70

## TOUGH CUT END MILLS

Part Number	Flute Diameter	Length of Cut	Shank Diameter	Overall Length
ACEM-4250	1/4	3/4	1/4	2 1/2
ACEM-4313	5/16	7/8	5/16	2 1/2
ACEM-4375	3/8	7/8	3/8	2 1/2
ACEM-4500	1/2	1	1/2	3
ACEM-4625	5/8	1 1/4	5/8	3 1/2
ACEM-4750	3/4	1 1/2	3/4	4
ACEM-4100	1	1 1/2	1	4

**Proto-Cutter Tough Cut End Mills have an eccentric grind excellent for tough-to-machine materials and hardened steel.** They are TiCN coated for maximum wear resistance with staggered, serrated edges to break chips and allow for finish applications, outperforming conventional rougher/finisher end mills.



## SOLID CARBIDE END MILLS – SQUARE NOSE

2 Flute	4 Flute	Flute Diameter	Length of Cut	Shank Diameter	Overall Length
CEMS2125	CEMS4125	1/8	1/2	1/8	1 1/2
CEMS2156	CEMS4156	5/32	9/16	3/16	2
CEMS2188	CEMS4188	3/16	5/8	3/16	2
CEMS2218	CEMS4218	7/32	5/8	1/4	2 1/2
CEMS2250	CEMS4250	1/4	3/4	1/4	2 1/2
CEMS2281	CEMS4281	9/32	7/8	5/16	2 1/2
CEMS2312	CEMS4312	5/16	7/8	5/16	2 1/2
CEMS2343	CEMS4343	11/32	7/8	3/8	2 1/2
CEMS2375	CEMS4375	3/8	7/8	3/8	2 1/2
CEMS2406	CEMS4406	13/32	7/8	7/16	2 1/2
CEMS2437	CEMS4437	7/16	1	7/16	2 1/2
CEMS2468	CEMS4468	15/32	1	1/2	3
CEMS2500	CEMS4500	1/2	1	1/2	3
CEMS2562	CEMS4562	9/16	1 1/4	9/16	3 1/2
CEMS2625	CEMS4625	5/8	1 1/4	5/8	3 1/2
CEMS2750	CEMS4750	3/4	1 1/2	3/4	4
CEMS2875	CEMS4875	7/8	1 1/2	7/8	4
CEMS2100	CEMS4100	1	1 1/2	1	4



## SOLID CARBIDE END MILLS – BALL NOSE

2 Flute	4 Flute	Flute Diameter	Length of Cut	Shank Diameter	Overall Length
CEMB2125	CEMB4125	1/8	1/2	1/8	1 1/2
CEMB2156	CEMB4156	5/32	9/16	3/16	2
CEMB2188	CEMB4188	3/16	5/8	3/16	2
CEMB2218	CEMB4218	7/32	5/8	1/4	2 1/2
CEMB2250	CEMB4250	1/4	3/4	1/4	2 1/2
CEMB2281	CEMB4281	9/32	7/8	5/16	2 1/2
CEMB2312	CEMB4312	5/16	7/8	5/16	2 1/2
CEMB2343	CEMB4343	11/32	7/8	3/8	2 1/2
CEMB2375	CEMB4375	3/8	7/8	3/8	2 1/2
CEMB2406	CEMB4406	13/32	7/8	7/16	2 1/2
CEMB2437	CEMB4437	7/16	1	7/16	2 1/2
CEMB2468	CEMB4468	15/32	1	1/2	3
CEMB2500	CEMB4500	1/2	1	1/2	3
CEMB2562	CEMB4562	9/16	1 1/4	9/16	3 1/2
CEMB2625	CEMB4625	5/8	1 1/4	5/8	3 1/2
CEMB2750	CEMB4750	3/4	1 1/2	3/4	4
CEMB2875	CEMB4875	7/8	1 1/2	7/8	4
CEMB2100	CEMB4100	1	1 1/2	1	4

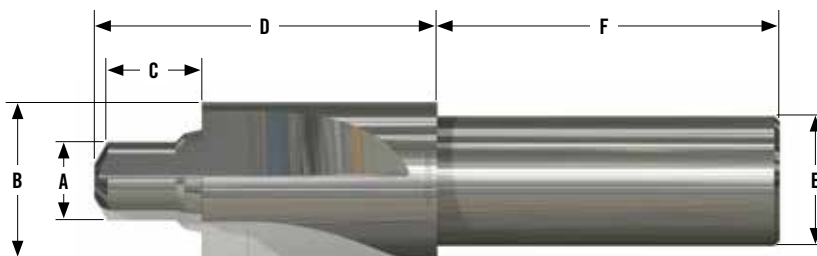




# Port Contour Cutters

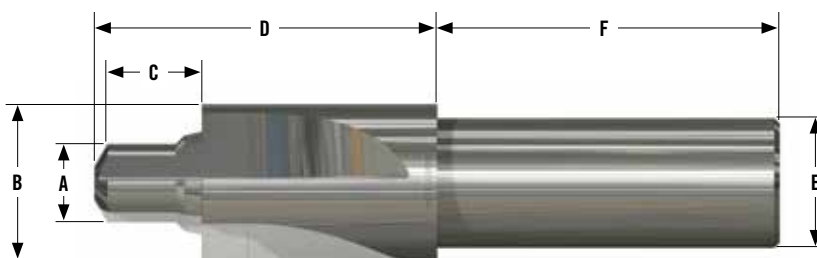
At Proto-Cutter we understand customer requirements for precision holes, which is why our port tools are all ground between centers to ensure tool concentricity. They are form relieved so a simple face grind for resharpener can be done.

## TUNGSTEN CARBIDE TIPPED, STRAIGHT SHANK – STANDARD SAE J1926, MS 16142



Thread Size	Tube		Part Number	A Small Diameter	B Spotface Diameter	C Bore Length	D Head Length	E Shank Diameter	F Shank Length	Pre-Drill Diameter/Length
	Number	O.D.								
5/16-24	2	.125	PTCS-0312	.272	.682	.473	1.500	.500	3.125	F x .688
3/8-24	3	.187	PTCS-0375	.335	.760	.473	1.500	.500	3.125	O x .688
7/16-20	4	.250	PTCS-0437	.389	.838	.552	1.500	.500	3.125	U x .812
1/2-20	5	.312	PTCS-0500	.452	.916	.552	1.500	.500	3.125	.44 x .812
9/16-18	6	.375	PTCS-0562	.509	.994	.614	1.500	.500	3.125	.48 x .875
3/4-16	8	.500	PTCS-0750	.689	1.198	.693	1.750	.750	3.875	.67 x .937
7/8-14	10	.625	PTCS-0875	.806	1.354	.786	1.750	.750	3.875	.78 x 1.062
1-1/16-12	12	.750	PTCS-1062	.981	1.635	.911	2.000	.750	3.875	.95 x 1.250
1-3/16-12	14	.875	PTCS-1187	1.106	1.775	.911	2.000	.750	3.875	1.09 x 1.250
1-5/16-12	16	1.000	PTCS-1312	1.231	1.920	.911	2.000	.750	3.875	1.21 x 1.250
1-5/8-12	20	1.250	PTCS-1625	1.544	2.280	.911	2.000	1.000	4.875	1.53 x 1.250
1-7/8-12	24	1.500	PTCS-1875	1.794	2.570	.911	2.000	1.000	4.875	1.78 x 1.250
2-1/2-12	32	2.000	PTCS-2500	2.419	3.490	.911	2.000	1.000	4.875	2.41 x 1.250

## TUNGSTEN CARBIDE TIPPED, STRAIGHT SHANK – METRIC ISO 6149, SAE J2244/1

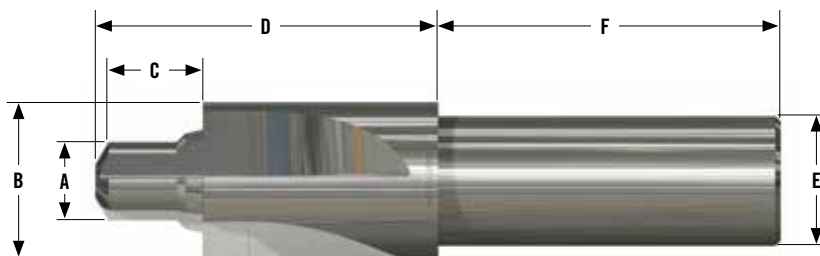


Thread Size	Part Number	A Small Diameter	B Spotface Diameter	C Bore Length	D Head Length	E Shank Diameter	F Shank Length	Pre-Drill Diameter/Length
M 8 x 1	PTCM-8	7.035 (.277)	17.09 (0.673)	11.5 (.4528)	41.28 (1.625)	12.7 (.500)	3.125	D x .589
M 10 x 1	PTCM-10	9.042 (.356)	19.99 (0.787)	11.5 (.4528)	41.28 (1.625)	19.05 (.750)	3.875	P x .589
M 12 x 1.5	PTCM-12	10.541 (.415)	23.01 (0.906)	14 (.5512)	41.28 (1.625)	19.05 (.750)	3.875	W x .681
M 14 x 1.5	PTCM-14	12.522 (.493)	24.99 (0.984)	14 (.5512)	41.28 (1.625)	19.05 (.750)	3.875	.45 x .681
M 16 x 1.5	PTCM-16	14.528 (.572)	27.99 (1.102)	15.5 (.6102)	47.63 (1.875)	19.05 (.750)	3.875	.54 x .740
M 18 x 1.5	PTCM-18	16.535 (.651)	30 (1.181)	17 (.6693)	47.63 (1.875)	19.05 (.750)	3.875	.62 x .809
M 22 x 1.5	PTCM-22	20.523 (.808)	34.01 (1.339)	18 (.7087)	47.63 (1.875)	19.05 (.750)	3.875	.78 x .849
M 27 x 2	PTCM-27	25.019 (.985)	40.01 (1.575)	22 (.8661)	53.98 (2.125)	25.4 (1.00)	4.875	.95 x 1.01
M 33 x 2	PTCM-33	31.013 (1.221)	49 (1.929)	22 (.8661)	53.98 (2.125)	25.4 (1.00)	4.875	1.17 x 1.01
M 42 x 2	PTCM-42	40.030 (1.576)	59.99 (2.362)	22.5 (.8858)	53.98 (2.125)	31.75 (1.25)	4.875	1.54 x 1.03
M 48 x 2	PTCM-48	46.025 (1.812)	65.99 (2.598)	25 (.9843)	53.98 (2.125)	31.75 (1.25)	4.875	1.78 x 1.13
M 60 x 2	PTCM-60	58.013 (2.284)	76 (2.992)	27.5 (1.0827)	53.98 (2.125)	38.1 (1.50)	4.875	2.25 x 1.22

Port tools are carbide tipped or high-speed steel. Our port tools can be altered to meet special ports. If a standard cannot be altered, a special port tool can be made. Coolant holes can be added in the flutes as an option.

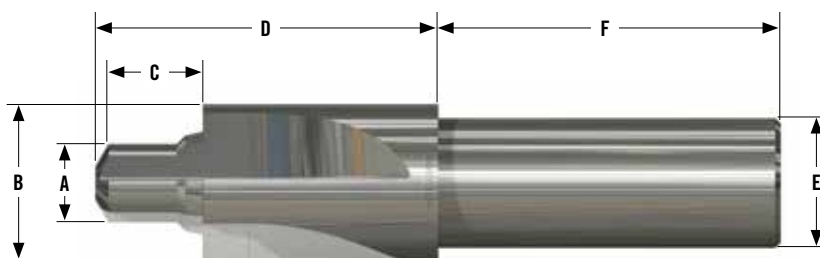
## PORT TOOLS

### HIGH-SPEED STEEL, STRAIGHT SHANK – STANDARD SAE J1926, MS 16142



Thread Size	Tube		Part Number	A Small Diameter	B Spotface Diameter	C Bore Length	D Head Length	E Shank Diameter	F Shank Length	Pre-Drill Diameter/Length
	Number	O.D.								
5/16-24	2	.125	PTHS-0312	.272	.682	.473	1.500	.500	3.125	F x .688
3/8-24	3	.187	PTHS-0375	.335	.760	.473	1.500	.500	3.125	O x .688
7/16-20	4	.250	PTHS-0437	.389	.838	.552	1.500	.500	3.125	U x .812
1/2-20	5	.312	PTHS-0500	.452	.916	.552	1.500	.500	3.125	.44 x .812
9/16-18	6	.375	PTHS-0562	.509	.994	.614	1.500	.500	3.125	.48 x .875
3/4-16	8	.500	PTHS-0750	.689	1.198	.693	1.750	.750	3.875	.67 x .937
7/8-14	10	.625	PTHS-0875	.806	1.354	.786	1.750	.750	3.875	.78 x 1.062
1-1/16-12	12	.750	PTHS-1062	.981	1.635	.911	2.000	.750	3.875	.95 x 1.250
1-3/16-12	14	.875	PTHS-1187	1.106	1.775	.911	2.000	.750	3.875	1.09 x 1.250
1-5/16-12	16	1.000	PTHS-1312	1.231	1.939	.911	2.000	.750	3.875	1.21 x 1.250
1-5/8-12	20	1.250	PTHS-1625	1.544	2.280	.911	2.250	1.000	4.875	1.53 x 1.250
1-7/8-12	24	1.500	PTHS-1875	1.794	2.570	.911	2.250	1.000	4.875	1.78 x 1.250
2-1/2-12	32	2.000	PTHS-2500	2.419	3.490	.911	2.250	1.000	4.875	2.41 x 1.250

### HIGH-SPEED STEEL, STRAIGHT SHANK – METRIC ISO 6149-1, SAE J2244/1

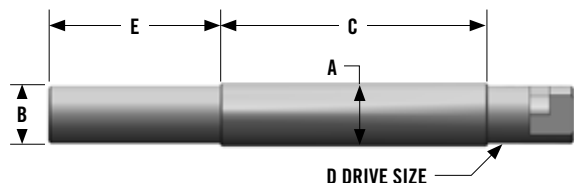


Thread Size	Part Number	A Small Diameter	B Spotface Diameter	C Bore Length	D Head Length	E Shank Diameter	F Shank Length	Pre-Drill Diameter/Length
M 8 x 1	PTHM-8	7.035 (.277)	17.09 (0.673)	11.5 (.4528)	41.28 (1.625)	12.7 (.500)	3.125	D x .589
M 10 x 1	PTHM-10	9.042 (.356)	19.99 (0.787)	11.5 (.4528)	41.28 (1.625)	19.05 (.750)	3.875	P x .589
M 12 x 1.5	PTHM-12	10.541 (.415)	23.01 (0.906)	14 (.5512)	41.28 (1.625)	19.05 (.750)	3.875	W x .681
M 14 x 1.5	PTHM-14	12.522 (.493)	24.99 (0.984)	14 (.5512)	41.28 (1.625)	19.05 (.750)	3.875	.45 x .681
M 16 x 1.5	PTHM-16	14.528 (.572)	27.99 (1.102)	15.5 (.6102)	47.63 (1.875)	19.05 (.750)	3.875	.54 x .740
M 18 x 1.5	PTHM-18	16.535 (.651)	30 (1.181)	17 (.6693)	47.63 (1.875)	19.05 (.750)	3.875	.62 x .809
M 22 x 1.5	PTHM-22	20.523 (.808)	34.01 (1.339)	18 (.7087)	47.63 (1.875)	19.05 (.750)	3.875	.78 x .849
M 27 x 2	PTHM-27	25.019 (.985)	40.01 (1.575)	22 (.8661)	53.98 (2.125)	25.4 (1.00)	4.875	.95 x 1.01
M 33 x 2	PTHM-33	31.013 (1.221)	49 (1.929)	22 (.8661)	53.98 (2.125)	25.4 (1.00)	4.875	1.17 x 1.01
M 42 x 2	PTHM-42	40.030 (1.576)	59.99 (2.362)	22.5 (.8858)	53.98 (2.125)	31.75 (1.25)	4.875	1.54 x 1.03
M 48 x 2	PTHM-48	46.025 (1.812)	65.99 (2.598)	25 (.9843)	53.98 (2.125)	31.75 (1.25)	4.875	1.78 x 1.13
M 60 x 2	PTHM-60	58.013 (2.284)	76 (2.992)	27.5 (1.0827)	53.98 (2.125)	38.1 (1.50)	4.875	2.25 x 1.22

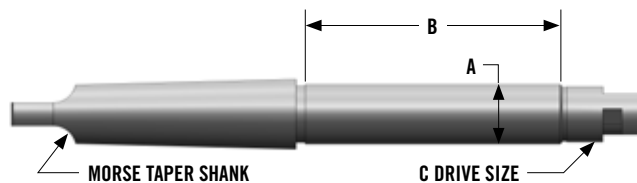
# Back Spotface Arbors

Use with 150 & 250 Series Back Spotfacers  
and 151 Series Back Counterbores

## STRAIGHT SHANK



## TAPER SHANK



A Diameter*	Part Number	B Shank Dia.	C Body Length	D Inverted Drive	E Shank Length
.3125	PARB-453-1031	.500	2.500	.3125	2.000
.3438	PARB-453-1034	.500	2.500	.3125	2.000
.3750	PARB-453-1037	.500	2.500	.3125	2.000
.4063	PARB-453-1040	.500	2.500	.3125	2.000
.4375	PARB-453-1043	.500	2.500	.3125	2.000
.4688	PARB-453-1046	.500	2.500	.3125	2.000
.5000	PARB-453-1050	.500	2.500	.3125	2.000
.5313	PARB-453-1053	.500	2.500	.3125	2.000
.3750	PARB-453-2037	.500	2.500	.3750	2.000
.4063	PARB-453-2040	.500	2.500	.3750	2.000
.4375	PARB-453-2043	.500	2.500	.3750	2.000
.4688	PARB-453-2046	.500	2.500	.3750	2.000
.5000	PARB-453-2050	.500	2.500	.3750	2.000
.5313	PARB-453-2053	.500	2.500	.3750	2.000
.5625	PARB-453-2056	.500	2.500	.3750	2.000
.5938	PARB-453-2059	.500	2.500	.3750	2.000
.6250	PARB-453-2062	.500	2.500	.3750	2.000
.6563	PARB-453-2065	.500	2.500	.3750	2.000
.5000	PARB-453-3050	.500	2.500	.5000	2.000
.5313	PARB-453-3053	.500	2.500	.5000	2.000
.5625	PARB-453-3056	.500	2.500	.5000	2.000
.5938	PARB-453-3059	.500	2.500	.5000	2.000
.6250	PARB-453-3062	.500	2.500	.5000	2.000
.6563	PARB-453-3065	.500	2.500	.5000	2.000
.6875	PARB-453-3068	.500	2.500	.5000	2.000
.7500	PARB-453-3075	.500	2.500	.5000	2.000
.7813	PARB-453-3078	.500	2.500	.5000	2.000
.8125	PARB-453-3081	.500	3.500	.5000	2.000
.8750	PARB-453-3087	.500	3.500	.5000	2.000
.9063	PARB-453-3090	.500	3.500	.5000	2.000
1.0313	PARB-453-3103	.500	3.500	.5000	2.000
.7500	PARB-453-4075	.750	3.500	.7500	2.250
.8125	PARB-453-4081	.750	3.500	.7500	2.250
.8750	PARB-453-4087	.750	3.500	.7500	2.250
.9375	PARB-453-4093	.750	3.500	.7500	2.250
1.0000	PARB-453-4100	.750	3.500	.7500	2.250
1.1250	PARB-453-4112	.750	3.500	.7500	2.250
1.2500	PARB-453-4125	.750	3.500	.7500	2.250
1.3750	PARB-453-4137	.750	3.500	.7500	2.250
1.0000	PARB-453-5100	1.000	3.500	1.0000	2.500
1.1250	PARB-453-5112	1.000	3.500	1.0000	2.500
1.2500	PARB-453-5125	1.000	3.500	1.0000	2.500
1.3750	PARB-453-5137	1.000	3.500	1.0000	2.500
1.5000	PARB-453-5150	1.000	5.000	1.0000	2.500
1.6250	PARB-453-5162	1.000	5.000	1.0000	2.500

A Diameter*	Part Number	Morse Taper Shank	B Body Length	C Inverted Drive
.3125	PARB-450-1031	2	2.500	.3125
.3438	PARB-450-1034	2	2.500	.3125
.3750	PARB-450-1037	2	2.500	.3125
.4063	PARB-450-1040	2	2.500	.3125
.4375	PARB-450-1043	2	2.500	.3125
.4688	PARB-450-1046	2	2.500	.3125
.5000	PARB-450-1050	2	2.500	.3125
.5313	PARB-450-1053	2	2.500	.3125
.3750	PARB-450-2037	2	2.500	.3750
.4063	PARB-450-2040	2	2.500	.3750
.4375	PARB-450-2043	2	2.500	.3750
.4688	PARB-450-2046	2	2.500	.3750
.5000	PARB-450-2050	2	2.500	.3750
.5313	PARB-450-2053	2	2.500	.3750
.5625	PARB-450-2056	2	2.500	.3750
.5938	PARB-450-2059	2	2.500	.3750
.6250	PARB-450-2062	2	2.500	.3750
.6563	PARB-450-2065	2	2.500	.3750
.5000	PARB-450-3050	2	2.500	.5000
.5313	PARB-450-3053	2	2.500	.5000
.5625	PARB-450-3056	2	2.500	.5000
.5938	PARB-450-3059	2	2.500	.5000
.6250	PARB-450-3062	2	2.500	.5000
.6563	PARB-450-3065	2	2.500	.5000
.6875	PARB-450-3068	2	2.500	.5000
.7500	PARB-450-3075	2	2.500	.5000
.7813	PARB-450-3078	2	2.500	.5000
.8125	PARB-450-3081	2	3.500	.5000
.8750	PARB-450-3087	2	3.500	.5000
.9063	PARB-450-3090	2	3.500	.5000
1.0313	PARB-450-3103	2	3.500	.5000
.7500	PARB-450-4075	3	3.500	.7500
.8125	PARB-450-4081	3	3.500	.7500
.8750	PARB-450-4087	3	3.500	.7500
.9375	PARB-450-4093	3	3.500	.7500
1.0000	PARB-450-4100	3	3.500	.7500
1.1250	PARB-450-4112	3	3.500	.7500
1.2500	PARB-450-4125	3	3.500	.7500
1.3750	PARB-450-4137	3	3.500	.7500
1.0000	PARB-450-5100	4	3.500	1.0000
1.1250	PARB-450-5112	4	3.500	1.0000
1.2500	PARB-450-5125	4	3.500	1.0000
1.3750	PARB-450-5137	4	3.500	1.0000
1.5000	PARB-450-5150	4	5.000	1.0000
1.6250	PARB-450-5162	4	5.000	1.0000

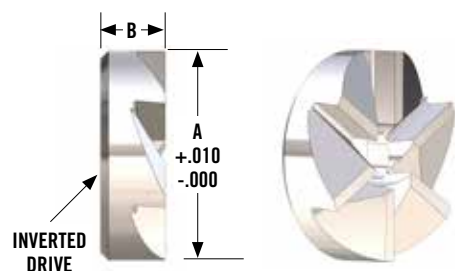
\*Finish ground for running fit in nominal size hole.



Back spotfacing and back counterboring tooling are excellent for machining difficult or remote areas on a work piece. Facing or recessing areas in a part that will not machine conventionally. Machined on the inside or on the backside of a workpiece. Like back boring, back spotfacers and back counterbores are a multi flute tool that is pulled by an arbor.

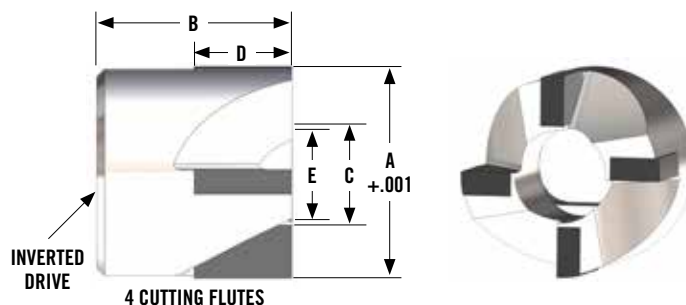
# Back Spotfacers

## HIGH-SPEED STEEL (150 SERIES)



A Diameter	Part Number	Drive Size	B Overall Length	Number of Flutes
0.500	PCBS-150-1050	0.3125	0.750	4
0.563	PCBS-150-1056	0.3125	0.750	4
0.625	PCBS-150-1062	0.3125	0.750	4
0.688	PCBS-150-1068	0.3125	0.750	4
0.750	PCBS-150-1075	0.3125	0.750	4
0.813	PCBS-150-2075	0.3750	0.750	4
0.875	PCBS-150-2081	0.3750	0.750	4
0.938	PCBS-150-2093	0.3750	0.750	4
1.000	PCBS-150-2100	0.3750	0.750	4
1.000	PCBS-150-3100	0.5000	0.750	4
1.063	PCBS-150-3106	0.5000	0.750	4
1.125	PCBS-150-3112	0.5000	0.750	4
1.188	PCBS-150-3118	0.5000	0.750	4
1.250	PCBS-150-3125	0.5000	0.750	4
1.313	PCBS-150-3131	0.5000	0.750	4
1.375	PCBS-150-3137	0.5000	0.750	4
1.438	PCBS-150-3143	0.5000	0.750	4
1.500	PCBS-150-3150	0.5000	0.750	4
1.375	PCBS-150-4137	0.7500	0.750	6
1.438	PCBS-150-4143	0.7500	0.750	6
1.500	PCBS-150-4150	0.7500	0.750	6
1.563	PCBS-150-4156	0.7500	0.750	6
1.625	PCBS-150-4162	0.7500	0.750	6
1.688	PCBS-150-4168	0.7500	0.750	6
1.750	PCBS-150-4175	0.7500	0.750	6
1.813	PCBS-150-4181	0.7500	0.750	6
1.875	PCBS-150-4187	0.7500	0.750	6
1.938	PCBS-150-4193	0.7500	0.750	6
2.000	PCBS-150-4200	0.7500	0.750	6
2.000	PCBS-150-5200	1.0000	1.000	6
2.063	PCBS-150-5206	1.0000	1.000	6
2.125	PCBS-150-5212	1.0000	1.000	6
2.188	PCBS-150-5218	1.0000	1.000	6
2.250	PCBS-150-5225	1.0000	1.000	6
2.375	PCBS-150-5237	1.0000	1.000	6
2.500	PCBS-150-5250	1.0000	1.000	6
2.625	PCBS-150-5262	1.0000	1.000	6
2.750	PCBS-150-5275	1.0000	1.000	6
2.875	PCBS-150-5287	1.0000	1.000	6
3.000	PCBS-150-5300	1.0000	1.000	6
3.250	PCBS-150-5325	1.0000	1.000	6

## TUNGSTEN CARBIDE TIPPED (250 SERIES)



A Diameter	Part Number	B Overall Length	C Carbide Root Dia.	D Carbide Length	E Drive Size
0.625	PCBS-250-1062	0.750	0.343	0.312	0.3125
0.688	PCBS-250-1068	0.750	0.343	0.312	0.3125
0.750	PCBS-250-1075	0.750	0.343	0.312	0.3125
0.750	PCBS-250-2075	0.750	0.405	0.312	0.3750
0.813	PCBS-250-2081	0.750	0.405	0.375	0.3750
0.875	PCBS-250-2087	0.750	0.405	0.375	0.3750
0.938	PCBS-250-2093	0.750	0.405	0.375	0.3750
1.000	PCBS-250-2100	0.750	0.405	0.375	0.3750
1.000	PCBS-250-3100	0.750	0.530	0.375	0.5000
1.063	PCBS-250-3106	0.750	0.530	0.375	0.5000
1.125	PCBS-250-3112	0.750	0.530	0.375	0.5000
1.188	PCBS-250-3118	0.750	0.530	0.375	0.5000
1.250	PCBS-250-3125	0.750	0.530	0.375	0.5000
1.375	PCBS-250-3137	0.750	0.530	0.375	0.5000
1.500	PCBS-250-3150	0.750	0.530	0.375	0.5000
1.375	PCBS-250-4137	0.750	0.782	0.375	0.7500
1.500	PCBS-250-4150	0.750	0.782	0.375	0.7500
1.625	PCBS-250-4162	0.750	0.782	0.375	0.7500
1.750	PCBS-250-4175	0.750	0.782	0.375	0.7500
1.875	PCBS-250-4187	0.750	0.782	0.375	0.7500
2.000	PCBS-250-4200	0.750	0.782	0.375	0.7500

# Custom Tooling

All Proto-Cutter custom tools can be made from carbide or high-speed steel and can be coolant fed. We can make custom tooling from your tool print or part print. Material is kept in inventory for occasions when rush service is required.



## CUSTOM CHUCKING & PIN-FLOAT REAMERS

Chucking and pin-float coolant-fed reamers can be used on all materials. Our custom pin-float reamers are like our standard reamers, but can be made longer or shorter. Chucking reamers are a cost-effective way to finish a hole. Lead angles on our reamers can be made with specific angles, which are important for micro finishes and sizing. Reamers can be made left-hand helix for through holes (coolant holes in the flutes) or right-hand helix for blind holes (coolant hole through the center of the tool).



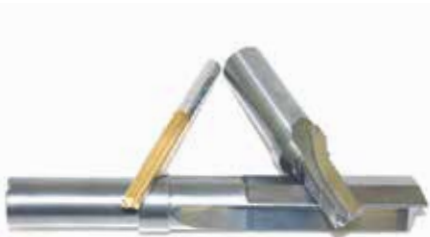
## CUSTOM STEP REAMERS

Step reamers are good for multiple hole sizing and chamfering all in one step. Reamers can be made left-hand helix for through holes (coolant holes in the flutes) or right-hand helix for blind holes (coolant hole through the center of the tool).



## CUSTOM FORM TOOLS

Form tools are used for producing radii and other geometric forms on the O.D. or I.D. of a part.



## CUSTOM DOUBLE MARGIN DRILLS

Double margin drills are used for tight hole tolerances and stability when cutting non-ferrous materials and irons.



## CUSTOM PORT TOOLS

Port tools can be made for SAE, metric, MS ports and cartridge valves with straight or Morse tapered shanks. Port tools can be made profile sharpened or cam relieved.



## CUSTOM KEY CUTTERS

Key cutters are good for plunging, slotting or making an internal groove in a part. Key cutters can be made with corner chamfer/radii.



## INDEXABLE TOOLING

Proto-Cutter's indexable tooling is constructed from a steel body that has replaceable carbide inserts to machine features by accurately positioning the inserts on the body. These inserts are made from cemented carbide, which are held in place by clamping or screwing the insert to the body. When the insert gets dull, it can be simply replaced.

Tooling includes: drills, end mills, key cutters, grooving, chamfering



## CUSTOM END MILLS

End mills can be used for all materials. End mills can be made to circle interpolate (multitask) where one or many diameters must be produced and with serrations for roughing and chamfer/radii.



## CUSTOM STEP DRILLS

Step drills work well for roughing out multiple holes.



## CUSTOM SAWS & MILLING CUTTERS

Custom saws and milling cutters are good for use on all materials and are used for slotting, circle interpolating and grooving. They can be made with corner chamfer/radii and with equally or unequally spaced flutes (reduced harmonic chatter).



## CUSTOM TAPERED & RADIUS TOOLING

Tapered and radius tools produce radii and other geometric forms in and on the outside of a part. Tooling includes reamers, end mills and spherical cutters.



## BACK SPOTFACERS & BACK COUNTERBORES

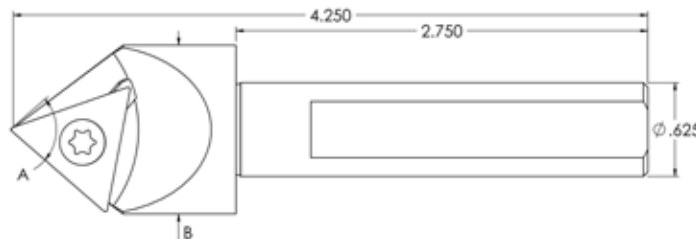
Excellent for machining difficult or remote areas on a workpiece and facing or recessing areas in a part that will not machine conventionally. Machined on the inside or on the backside of a workpiece. Like back boring, back spotfacers and back counterbores are a multiflute tool that is pulled by an arbor.



# Indexable Spot Drill/Countersink Tooling

## INDEXABLE SPOT DRILL/COUNTERSINK TOOLING

Countersink tooling produces a cone-shaped hole where a fastener like a screw or bolt will sit even with or below the workpiece. The shape of the fastener is conical to allow it to fit in the cone-shaped countersink. Our countersinks have one carbide insert that is TIN coated for maximum performance. The insert can be flipped to add additional cutting edges when dulled. Countersinks are also used for deburring, engraving and chamfering holes. Our countersinks and carbide inserts are made in the U.S.A.



Part Number	A	B	Insert	Screw
INDSD-30	60°	Ø.550	PC-21432	PCSS25
INDSD-41	82°	Ø1.125	PC-21222	PCMT55
INDSD-45	90°	Ø1.125	PC-21222	PCMT55
INDSD-60	120°	Ø.750	PC-21432	PCSS25
INDSD-82	164°		PC-21222	PCMT55
INDSD-90	180°		PC-21222	PCMT55
INDSD-120	240°		PC-21425	PCMT55

## REVERSE ENGINEERING TOOLING, DISCONTINUED TOOLING AND METCUT TOOLING

Proto-Cutter does reverse engineering tooling. For tools that are discontinued, needing improvement, or a better manufacturer, we are here to provide these services. We service tooling that is discontinued or similar to MetCut style tooling.

- Counterbores and countersinks
- Holders for counterbores and countersinks
- Pilots for counterbores and countersinks
- Back spotfacers and back counterbores
- Port contour cutters
- Reamers



# Feed Rates

## CONVERSIONS

Metric-to-Standard Conversion  
Formula (millimeters to inches)

$\text{mm} \div 25.4 = \text{inches}$

Example:

$12.70 \text{ mm} \div 25.4 = .500 \text{ inches}$

Calculating Revolutions Per  
Minute (RPM) from Surface  
Footage (SFPM) Diameter

$$\frac{12 \times \text{SFPM}}{\pi \times \text{diameter}} = \text{RPM}$$

## Speeds and Feeds

.002 - .003 per flute per  
revolution

.0025 x number of flutes  
= inches per revolution (IPR)

.0025 x number of flutes x RPM  
= inches per minute (IPM)

## SPEEDS

Material	Drilling Speed (HSS), FPM	Reaming Speed (HSS), FPM	Reaming Speed (Carbide), FPM
Gray Cast Iron	75	50	200
Ductile Iron	60	50	175
Low Carbon Steel	75	50	200
Medium Carbon Steel	75	50	200
Plain Carbon Steel	100	50	225
Plain Carbon Steel (Leaded)	100	65	250
Tool Steels	50	40	100
Alloy Steels	65	45	150
Stainless Steel	75	45	100
Nickel Alloys	50	30	175
Titanium Alloys	50	40	100
Brass	150	125	275
Copper	65	50	180
Bronze	100	75	225
Plastic	125	100	500

## FEEDS

DRILLING		
Diameter	Feed, IPR	
.1250 or Less	.001-.003	
.1250-.250	.002-.006	
.250-.500	.004-.010	
.500-1.00	.007-.015	
1.00 and up	.010-.025	
REAMING		
.002-.003 Per Flute Per Rev	OR	.0025 x Number of Flutes (IPR)

## HOW MUCH MATERIAL SHOULD I LEAVE?

Finish Hole Diameter	Amount of Material to Be Removed (Total)
.080-.170	.005-.010
.171-.280	.008-.012
.281-.880	.010-.016
.881-2.50	.015-.030

## WHY SHOULD YOU CHOOSE PROTO-CUTTER?



**Quality control:** Proto-Cutter has a return rate of less than one percent. Your reamers are checked upon arrival and inspected at least five times during the reconditioning process. A final quality inspection is performed before packaging.

**Fast turnaround:** We usually recommend one to two weeks for completion depending on the type of reconditioning necessary. Faster completion times are often possible. Our on-time delivery record is consistently better than any of our competitors. That means less downtime for you and more holes reamed per year.

**Personal service:** Our application engineers continually look for ways to improve the performance and extend the life of your tools. It's not unusual for us to call and offer advice to our customers about how they can make their reamers more productive and cost efficient.

All Proto-Cutter reconditioning and service activities are designed to meet the highest standard of quality: **yours**.

**Investing in a Proto-Cutter reamer gives you more than just a quality product. You also get the personal and professional service you deserve.**



**Proto-Cutter, Inc.**  
Precision Cutting Tools

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