Table of Contents

Technical Info

Form Knurling

Table of Contents

Form Knurling (cont.)

Cut Knurling

Other Products

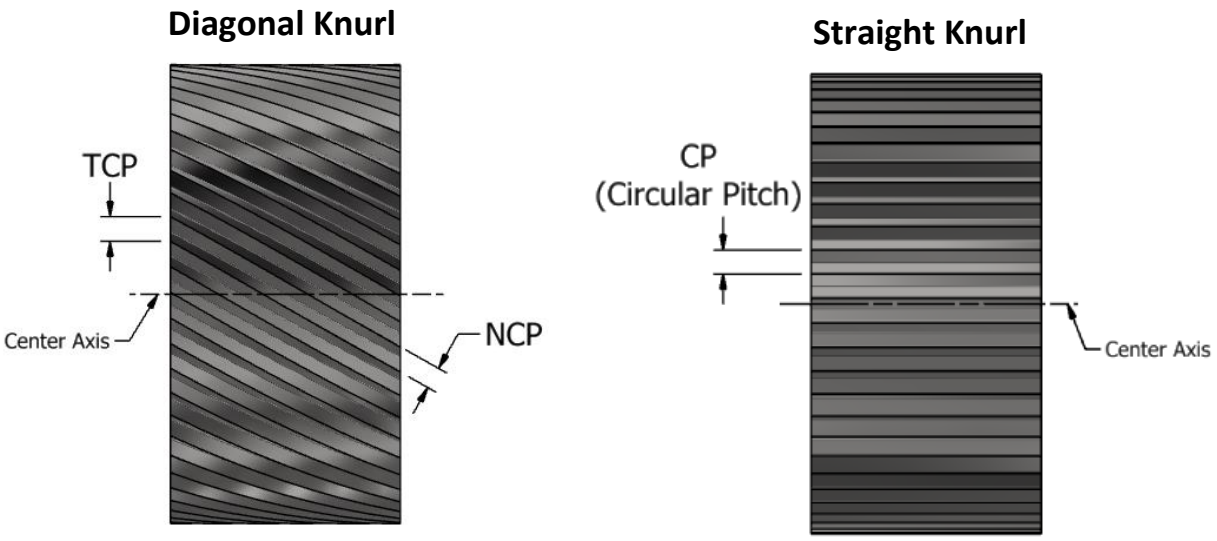
General Knurling Information

Knurling is used in the industry for a multitude of applications including things such as but not limited to: decorative applications, grip surfaces, repairing undersized shafts or oversized bores, molding, press fits to transmit torque, and splines for drive systems. The word “knurling” applies to both the method of production as well as the resultant pattern on the part. There are two common tools used to create a knurling pattern: form knurls, and cut knurls. Form knurling uses a process of material displacement to form the desired pattern on the part while cut knurling uses more of a material removal process. To see the pros and cons of each of these methods see page 4 in order to determine the best tooling for your application.

When it comes to specifying a knurl’s pitch, which is the spacing from tooth to tooth, the two most common methods are the use of **Circular Pitch** or **Diametral Pitch**. For circular pitch, there are two different types: Normal Circular Pitch and Transverse Circular Pitch. However, for consistency the industry often defines knurls using the Normal Circular Pitch. For straight knurl patterns, the Transverse Circular Pitch and Normal Circular Pitch are the same so it is often referred to as simply the circular pitch in this case. See definitions below.

Normal Circular Pitch (NCP) – The pitch that refers to the tooth to tooth spacing if you were to measure perpendicular to the helix angle. If it is a straight knurl, it is simply the tooth to tooth spacing between adjacent teeth

Transverse Circular Pitch (TCP) – The pitch that refers to the tooth to tooth spacing if you measured around the circumference looking down the axis of the part. (For straight knurls, TCP and NCP are the same)



Diagrams showing the different pitches

Diametral Pitch – The number of teeth of a knurl per inch of its pitch diameter. There are four standard diametral pitches: 64, 96, 128, and 160. Diametral Pitch dies are designed to have accurate tracking on standard fractional sized blanks up to 1” diameter in increments of 1/64”, 1/96”, 1/128”, and 1/160” consequently

Teeth Per Inch (TPI) – The number of teeth per (linear) inch measured on the circumference. As mentioned before, for straight wheels the TPI is just measured using the Circular Pitch as designated above. For diagonal or diamond patterns the Normal Circular Pitch is used to calculate the TPI. For formulas on these calculations see page 4

Metric Pitch – metric knurls are defined by the pitch measured in millimeters. For straight knurls this is the Circular Pitch, and for diagonal or diamond it is the Normal Circular Pitch.

General Knurling Information

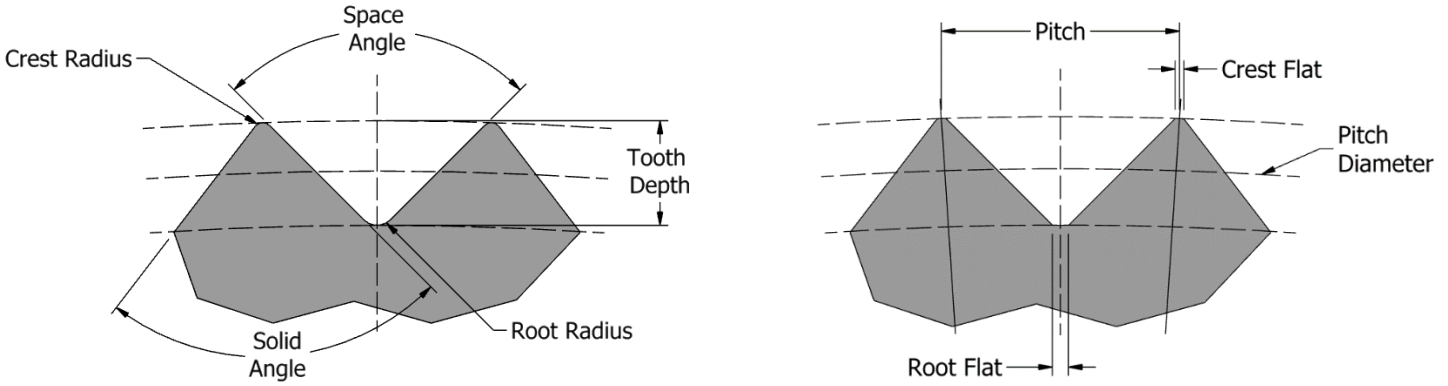


Figure above shows common terms used in knurling

For Accu Trak's stock knurls, a general calculation can be done to approximate the tooth depth of the knurl produced on the workpiece. There are three stock forms: 70° tooth form, 80° tooth form, and 90° tooth form. For this you must first know the Normal circular pitch of the knurl tool being used.

TPI = Teeth Per Inch
NCP = Normal Circular Pitch
DP = Diametral Pitch
A_H = Helix Angle

Normal Circular Pitch

All patterns of TPI knurl wheels: NCP = 1/TPI

Straight DP knurl wheels: NCP = π/DP

Diagonal DP knurl wheels: NCP = (π/DP) x cos(A_H)

Tooth Depth

70° tooth form – Tooth Depth is approximately 55% of the Normal Circular Pitch

80° tooth form – Tooth Depth is approximately 48% of the Normal Circular Pitch

90° tooth form – Tooth Depth is approximately 42% of the Normal Circular Pitch

Form Knurling vs. Cut Knurling

A general rule of thumb is if the number of teeth or the form of the teeth themselves are critical or have a tight tolerance it is a bit safer to go with form knurling. Other than that, see the pro's and con's below to determine which may be best for your application.

Form Knurling

Pros:
- Good for critical tooth form requirements
- Easier to hold a consistent specific number of teeth in most applications
- Suites a large variety of materials

Cons:
- Requires high amounts of pressure
- Leaves residual compressive stresses
- More likely to work harden material
  - In some cases, this may be a "pro"

Cut Knurling

Pros:
- Good for applications on softer materials
- Has more tolerance for blank diameters in order to produce a "good looking" knurl
- Requires less pressure
- Better for use on thin-walled parts than form knurls

Cons:
- Larger variation with tooth form
- Wears out quickly in harder material
- Can only axially feed with cut knurls
- Cannot cut close to shoulder
- Normally must begin at the end of the workpiece

Choosing the Correct Tools

When selecting the proper knurl tooling for the job, there are a few steps to go through. In this section we will walk you through each of those steps to ensure you are confident in the selection you have made. As always however, if there is still some uncertainty or need for an opinion from us our engineers are happy to assist via phone call or email.

1. Choosing the Method

First you must select the method of knurling that best suits the job. The first thing to ask is if you need to axially feed the knurl or if a bump operation will suffice. One thing to remember is knurling will take a considerable amount of pressure, so while there may be a knurl wide enough to simply bump knurl the part it may not be the best choice.

When to choose Axial Feeding:

- When the work surface you will be knurling is wider than the wheel itself
- When the work surface to be knurled is longer than the diameter of the part
- When high pressures or deflection are a concern

Which Axial Feed method to use:

- When the tooth form and number of teeth are not needed to be held in high tolerance, **cut knurls** can be used
- When the tooth form or number of teeth are critical, **convex form knurls** are often the best option
  - The convex wheels have an added relief to either side to increase tool life and decrease pressure from axial feeding
- When knurling softer material such as aluminum, cut knurling tends to be better as it has less issues with causing flaking
- When knurling harder materials such as stainless steel, the convex form knurls will generally have better tool life
  - When comparing form wheels with just bevels to cut knurls, then the life tends to become more comparable

(in the cases of cut knurls vs. form knurls when axial feeding, these are just suggestions. In most cases both will work fine so often times it is just best to go with what you may previously have experience with doing)

2. Choosing the Pattern (Form Knurling Only)

When it comes to selecting which knurl to choose you must determine which pattern is needed. For the patterns, see the chart below to see the appropriate knurl tool patterns that would produce the correct pattern on your part.

For "Form Knurling" only. *Chart showing knurl patterns and*

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°	RKE	RKV
Knurl form on part											
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30° BL30° + BR30°	GE 30°	GV 45° BL45° + BR45°	GE 45°	KV	KE

See pages 109 – 115 for Knurl Patterns made by "Cut Knurling" Tooling.

One thing to remember when "Form Knurling" is that as you can see in the chart, if you want a Right-Hand/Left-Hand/Diamond pattern you will need the opposite hand tool than what you want produced on your part. For example, a right-hand knurl tool will make a left-hand pattern on the part. Another example would be male diamonds, which can be produced by either using a right-hand and left-hand wheel together or a female diamond knurl wheel. The patterns you see above are not the only patterns that can be formed with knurl tools; however, these are the industry standards. Accu Trak also makes knurl tools with patterns for various decorative applications as well. If you are unsure if it is a pattern that can be done, please call or email us with a part print and we will reply back to you promptly.

Choosing the Correct Tools

3. Choosing the Pitch

The next step is determining the required pitch. Often times design prints will be labeled one of three ways: a callout of simply Coarse/Medium/Fine, with a desired pitch, or a desired number of teeth.

Coarse, Medium, or Fine

If what you are looking for is something that simply falls in one of these three categories then there is some leeway with which knurl you select as there is no one definitive pitch for these three. Generally speaking, we would say something around 16 TPI is coarse, around 25 TPI is medium, and around 35 TPI is fine. Again, these may vary slightly depending on part diameter and function but it is generally safe to follow that approximation.

Armstrong Standard

One thing to be aware of however is three unique pitches for diagonal wheels that are result of an old standard that modern manufacturers of knurls still tend to follow. This standard was put in place by Armstrong and Williams who measured their pitches in Transverse Circular Pitch instead of Normal Circular Pitch. The three TPI's this applies to, for only diagonal wheels, are 14, 21, and 33 TPI. The chart below shows the conversions to the respective TPI's using the NCP like all other pitches.

Armstrong Standard			
Helix	**30° and 45°**	**30°**	**45°**
	Transverse TPI	Normal TPI	Normal TPI
Coarse	14 TTPI	16.2 TPI	19.8 TPI
Medium	21 TTPI	24.2 TPI	29.7 TPI
Fine	33 TTPI	38.1 TPI	46.7 TPI

Chart showing Armstrong standard conversions to standard TPI

This means for Accu Trak knurls, stock diagonal wheels listed as 14, 21, or 33 TPI (for example, KPL 221) have the Normal TPI listed on the right side of the chart. To give another example to clarify, a KPR 233 is actually finer than a KPR 235.

Selecting by Pitch

If the pitch is specified, selection of the proper knurling tool becomes a bit easier. If it is defined by a Diametral Pitch (DP), then you can select the DP Knurl tool that has that same specified DP. If it is defined as a specific TPI simply select the knurl tool with that same TPI. If it is defined as either transverse or normal circular pitch, then follow the formulas below to convert to TPI. (The first equation is for Normal Circular Pitch, second is for Transverse)

$$TPI = \frac{1}{NCP}$$

$$TPI = \frac{1}{TCP * \cos(A_H)}$$

$$TPI = \frac{25.4}{Metric\ Pitch}$$

TPI = Teeth Per Inch
NCP = Normal Circular Pitch
TCP = Transverse Circular Pitch
A_H = Helix Angle

For metric pitches, if the proper metric pitch is not available in our stock of metric knurls, you can always convert the metric pitch to TPI using the formula above to see if perhaps there is a TPI wheel option that will work.

Choosing the Correct Tools

Selecting by Number of Teeth

If a number of teeth is called out on the design print and there is some tolerance on how many teeth are produced (so it just needs to be close), use the below formulas to calculate the TPI or Metric pitch to choose the appropriate knurl.

OD = Outside Diameter
#T = Number of Teeth
A_H = Helix Angle

For Straight Patterns:

$$TPI = \frac{\#T}{OD * \pi}$$

$$Metric\ Pitch = \frac{OD * \pi}{\#T}$$

For Diagonal Patterns:

$$TPI = \frac{\#T}{OD * \pi * \cos(A_H)}$$

$$Metric\ Pitch = \frac{OD * \pi * \cos(A_H)}{\#T}$$

If a specific number of teeth is required on the part, a bit more calculation must go into the process of determining the proper tooling. In some cases of this, it may require a special knurl wheel to be made. However, we can first determine if a stock knurl will work through a process of trial and error. The first thing that we must do is determine the approximate blank diameter you will be using. For the sake of simplicity, we are going to assume that the goal is to roll a full knurl (meaning the full tooth depth).

Step 1: Take the formulas from above and calculate an approximate TPI or metric pitch (whether you plan to use metric or inch knurls)

Step 2: Select a knurl size/series that seems appropriate for your application. Many times, this can be dictated by things such as existing knurl holders you may have, a required knurl band width if it is a bump operation, or perhaps even machine type (swiss lathes often using smaller wheels for space).

Step 3: From steps 1 and 2, you should be able to select a knurl tool that is close to what you are looking for in stock. From here you will need to calculate the blank diameter needed for your part in order for the knurl tool to roll the desired number of teeth. See page 10 for these calculations.

If there are no stock options that are near the DP, Metric Pitch, or TPI calculated than your application may require a special knurl wheel.

Choosing the Correct Tools

4. Choosing the Knurl Tool Material

For Accu Trak's stock inventory, we offer two material types: High Speed Steel (HSS) and Hi-Cobalt steel (M42). If we are to make a general guideline, usually when your part material is over roughly 28 HRC it is likely better to use Hi-Cobalt. This is an extremely generalized guideline however, that while may be safe to use often, it does not take into account things such as tooth forms, part material characteristics, machine type, etc. Below is a chart of pros and cons of each material type to give a more in-depth understanding of when to use one over the other.

High Speed Steel	Hi-Cobalt
Pros: • Good Ductility, allows for a larger margin of error in tracking/blank diameter before the teeth break • Lower Cost • Decent tool life **Cons:** • Due to lower hardness, tool life is often less than Hi-Cobalt	**Pros:** • High Hardness • Generally longer tool life **Cons:** • Due to high hardness, it has a lower ductility meaning if there is slight error in the tracking or blank diameters it is more prone to teeth breaking • Higher cost

Additionally, Accu Trak offers a variety of coatings that can be used on the tooling if necessary. These coatings often increase surface hardness and wear resistance which in some situations can be advantageous for the application. To see more on these coatings, see page 14.

5. Choosing the Holder

When it comes to choosing the holder to use there are three main variables: The operation type, the machine being used, and the knurl series type.

1. First, we determine the type of operation. This entails things such as is it a knurl on the OD, ID, Face, up to a shoulder or a conical surface of the part. Things such as axial feeding operations or whether it requires two knurls to make a diamond pattern also factor into the decision. Below are some common situations and the holders that would likely be used in them
    a. Bump Knurling on an OD: In this case often times a single wheel bump holder will suffice.
    b. Axial Feeding on an OD: In this case, two-die modular bump holders (one wheel for straight and helical patterns and two wheels for male diamond) or straddle holders (with the exception of straight patterns) are often used. If in the "**Choosing the Method"** part you decided to use cut knurls, then a cut knurl holder would be used instead. There is also the option of three die holders if you are feeding form the end of the part.
    c. ID Knurling: generally, the ID size on the part dictates which ID knurling holder is best to use
    d. Face knurling: The optimal options for this one can vary depending on the method you will use due to the amount of pitch change on your knurl band. See page 57 for more info on the methods
    e. Knurling on Conical Surfaces: Similar to face knurling, the optimal options for this one can vary depending on the method you will use due to the amount of pitch change on your knurl band. See page 57 for more info on the methods

Choosing the Correct Tools

2. After narrowing down the options to the group of holders for your application, we must look at the machine you will be using. You often will want to check to ensure that the holder size will fit in your machine without any issues. This is especially important for swiss machines. You will also want to ensure that your machine can hold the tool in the proper orientation. After this you determine the shank sizes that you can use in your machine.
3. Finally, based off the knurl series you plan to use and the shank size required, narrow down the selection to the specific holder that you require.

   (**Note: sometimes you may need to change the knurl series depending if a shank size is offered for that knurl series. We can modify holders as well for an additional fee)**

Blank Diameter Selection for Circular Pitch Knurls

When it comes to calculating a blank diameter to use for proper tracking it is important to remember that this number is just theoretical. While it could end up being exactly right for tracking in your operation, often times some slight adjustments need to be made to it while actually using the knurl due to factors that the formulas simply cannot take into account. Other factors such as feed rates, tool wear, knurling method, etc. still contribute to the tracking and may affect the actual diameter the knurl tool tracks on.

Below we will go through these calculations.

The base formula is as follows: $$\frac{OD_t+CF}{\#T_t} = \frac{BD}{\#T_p}$$

OD_t = Outside Diameter of the knurl tool
$\#T_t$ = Number of teeth on the knurl tool
$\#T_p$ = Number of teeth on the part
BD = Blank Diameter
CF= Correction Factor

From this formula, various others can be formed depending on the information that you have on hand. Here are common steps to take for figuring out your blank diameter. **If you already know the #T on your part skip to step 3.**

1. First find an approximate BD by either subtracting the amount of estimated roll up in diameter (found on page 16) from your finished diameter, or by subtracting the approximate tooth depth from the finish diameter (equation on page 4)
2. Once done, use this approximate BD to calculate a $\#T_p$ value:

$$\#T_p = \frac{BD * \#T_t}{(OD_t + CF)}$$

$\#T_t$ on stock knurls can be found on pages 17-21

Approximate Correction Factor	
TPI	**CF**
12-19	0.010"
20-29	0.007"
30-39	0.005"
40-49	0.003"
50-80	0.002"

3. Likely the equation above produced a number of teeth that was not a whole number. In this case, round to the nearest whole number and recalculate the BD using that #T for your part:

$$BD = \frac{(OD + CF) * \#T_p}{\#T_t}$$

If you have a predetermined blank diameter, you can use the formulas to also confirm whether the knurl tool you have selected will track properly or even what knurl tool you may need. If you know the blank diameter and #T on your part, then you can select a knurl series OD and calculate the number of teeth you would need on the Knurl tool to track properly and determine if any of our stock knurls have that number via the charts on pages 17-21.

(For blank diameter selection for diametrical pitch knurls see page 11)

Diametral Pitch Knurling

Diametral Pitch knurls are defined by the American Standard ANSI B94.6-1984. The purpose of these knurls is to track on fractional stock sizes up to 1" in order to simplify blank diameters. For this purpose, they are often held to tighter tolerances and meet a common standard. The one thing to remember however is even though by definition they may say they track around a specific diametral increment it may not always end up that way. The other factors such as feed rates, tool wear, knurling method, etc. still contribute to the tracking and may affect the actual diameter the knurl tool tracks on.

To determine the number of teeth rolled using a DP Knurl, use the following equation:

$$\#T_p = DP * BD$$

$\#T_p$ = Number of teeth on the part
BD = Blank Diameter
DP = Diametral Pitch

When choosing blank diameters for Diametral Pitch knurls, they are designed to track on fractional increments (in diameter) up to 1". After 1", there is not a guarantee it will track however it is still likely that it will track fine using the fractional increments. The chart below shows the fractional tracking increment for each standard DP knurl tool.

D.P.	Blank Diameter Fractional Increments
64	1/64"
96	1/96"
128	1/128"
160	1/160"

Chart of fractional tracking increment for each standard DP knurl

Diametral Pitch Conversiosn				
	TPI		Metric (mm)	
Pattern:	Straight	30° Helix	Straight	30° Helix
64 DP	20.4	23.9	1.25	1.06
96 DP	30.6	35.6	0.83	0.71
128 DP	41.1	47.4	0.62	0.54
160 DP	50.9	58.8	0.50	0.43

Diametral Pitch conversions to other units designating pitch

Special Knurls and Attachment Rolls

On top of the vast standard stock selection Accu Trak offers, we also are capable of manufacturing a large variety of special knurls. This includes knurl designs to roll specific numbers of teeth, TPI, metric pitches, knurl forms, etc. Additionally, we make dies for all the common thread rolling attachments and holders as well as knurling dies to fit just about any thread rolling machines. Another use is rolling annular grooves for being used as stops.

Not only does Accu Trak make functional knurls, we also are capable of making decorative knurl designs to roll a variety of patterns. Two of the most common of these would be a “rope” knurl pattern and a “bead” pattern. One important thing to remember with these two patterns however is normally we do not generally recommend a radius or bead of more than roughly 130° of arc. This is due to issues with the direction of the rolling forces that cause it to be difficult to roll the form completely full. Another example of a unique design is raised lettering produced on the part. The possibility of using engraved knurls to produce a raised lettering pattern varies on an individual design basis however. We also can produce knurl tools with a ratchet tooth form. If there are any questions on special knurls designs or patterns please call or email and our engineers will be happy to assist.

Attachment Style Knurling Dies				
C-1	C-2	C-3	C-4	D-1
CR-1	DR-1	DR-5	K-2	Q-2

Chart showing the common Attachment Style knurling types

Tips on Knurling and Common Issues

One thing to remember about knurling is that there are always aspects of it that cannot be accounted for solely through calculations. The tips below are ways to try and address issues that may occur.

- In general, if there are issues occurring, check to ensure your feeds and speeds are within the proper range. For more on feeds and speed see page 15
- **Mis-tracking:** The first thing to do when mis-tracking is to double check your blank diameter calculations and check to ensure that the blank you are turning is held to as tight a tolerance as possible. This is especially important after achieving proper tracking as if you have too much variation in blank diameters you may find pieces at random are not tracking properly in your production runs.
- **Mis-tracking:** If you are noticing an issue where your knurls do not track from the very start, try increasing the infeed rate slightly to allow for more penetration on the first revolution. This will give more material for the teeth to track around in the proceeding revolutions. When doing this, start with minor amounts of adjustment, say .001”-.002”/rev seeing as if you are too aggressive you risk breaking the knurl teeth (especially in harder material like stainless steel)
- **Mis-tracking:** Sometimes if the mis-tracking is only very minor, from something like blank runout, you can get rid of it by adding or increasing the existing dwell once the knurl has penetrated to full depth. One caution with this method is you risk over-rolling which will cause flaking and work hardening of the material. This method only works for very minor amounts of mis-tracking
- **Mis-tracking with Straddle Holder:** Rolling a straight pattern with a straddle holder (or any two die holder) can be difficult because the wheels are not synchronized. One trick to try is having the holder slightly off-center so one knurl wheel contacts slightly before the other. This way the second wheel should fall into the track of the first.
- **Mis-tracking for Axial feeding (band starting at the end of the part):** The most common method of engagement when axial feeding is to first feed the tool in the radial direction (x) until it reaches full penetration, and then feed along the axial direction (z). While you can simply feed directly in the (z), the previous method seems to be a bit easier to get proper initial tracking if you are having trouble. If while using the first method and you are having trouble tracking from the start of the band, try increasing the amount of width that engages the part in first contact if possible. You can also add a very slight dwell before axial feeding, however be careful as if you dwell too long it will be noticeable in the finished pattern.
- **Losing Tracking while Axial Feeding:** If you are losing tracking while feeding axially down your part there are three major things to check: Is your blank the same consistent diameter down its length, its circularity, and if deflection is occurring. If it is one of the first two, then you need to control your blank diameter more precisely. If it is the 3rd, deflection, then you either need to find a way to support both ends of your part or decrease the amount of pressure the knurl is causing. You can do this through various ways such as decreasing the workface of the knurl, or if you are making a diamond pattern with a bump holder use a straddle or three die holder instead. Cut knurling also tends to require less force than form knurling if that is an option as well.
- **Flaking:** The usual reason behind flaking is that you are over-rolling the material. This means your die is in contact with the part for too long. You either need to adjust your feed rate /spindle speed to decrease the amount of contact time, or if you have a dwell you need to reduce it (could also be a combination of the three). Generally, you want the knurl to be complete in 5-20 revolutions of the part. One thing to remember is the material being rolled also can factor into flaking. For example, this can be a common occurrence with materials such as aluminum or brass. Another reason could also be that you are pressing the knurl too far into the part.
- **Work-Hardening:** The cause of this is often the same as flaking, so the solutions are often the same as listed above as well. Be careful of work hardening your part as this will substantially decrease tool life.
- **Deflection:** If your part is deflecting the simplest solution is often to support it at both ends (if you are not already) or reduce the amount sticking out from the chuck or collet. If you aren’t already, another solution is reducing the dies workface and axial feeding to reduce the pressure. Changing holder styles can also help.
- **Knurls Binding:** Make sure you are using plenty of coolant or oil as well as carbide pins.

Coatings

There are four main coatings or treatments that are used: Ferritic Nitro-Carburizing (FNC), TiN, TiALN, and TiCN. These coatings/treatments are all used to try and improve tool life in some manner. Of the four, the most common is FNC treatment and is also the treatment used on some of our stock inventory.

Ferritic Nitro-Carburizing (FNC) treatment

FNC is a thermochemical surface hardening process that diffuses carbon and nitrogen into the surface of the material. The process improves the material's fatigue properties, wear resistance, corrosion resistance, and increases surface hardness. Due to the treatment being done at temperatures below 1100°F, core properties of the material being treated are retained. For most die steels, the process also causes minimal distortion due to it having a short process cycle within the ferrite phase. The process will often give the tool a darker hue.

Titanium Nitride coating (TiN)

TiN coating is a thin layer, approximately .0001"-.0002" thick, that improves the materials wear resistance as well as reduces friction and potential galling. Due to the process type, the material retains its core properties. The downside to TiN coating is there is a possibility of some issues with the coating's adhesion to the knurl and peeling may occur. The contributing factors to this are often either the TiN coating is too thick, or it is under high compressive load (which knurling is known for). This process gives the tool a gold appearance

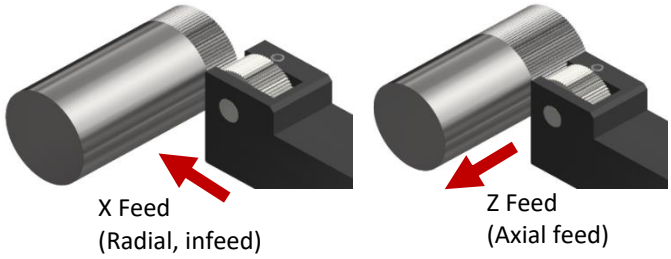
Titanium Aluminum Nitride coating (TiALN)

TiALN coating improves the tool's wear resistance and oxidation resistance. It also operates better at higher feeds and speeds due to the aluminum oxide layer that forms at higher temperatures which works to move the heat generated into the chip and away from the tool and workpiece. For this purpose, TiALN coating would be more advantageous in operations such as cut knurling or where the amount of coolant available is limited. Shares a similar downside of TiN with the coating's adhesion to the knurl tool. This process gives the tool a violet bronze color usually.

Titanium Carbonitride (TiCN)

TiCN coating improves the tool's wear resistance and surface hardness. It tends to have a slightly better abrasion resistance than TiN as well as hardness. It also holds sharp edges well which can be advantageous if you are finding the corners of the knurl tools breaking. It has a lower high temperature tolerance than TiN however which could be a factor in long knurl bands where knurls are in contact with the part for an extended duration. It also shares a similar downside of TiN with the coating's adhesion to the knurl tool. This process often gives a dark blueish grey appearance.

Speeds and Feeds



Form Knurling Feeds and Speeds

Holder Style	Speed (SFM)	Infeed (in/rev)	Axial Feed (in/rev)
Bump Holders	50 - 150	.002 - .006	.010 - .020
Straddle Holders	50 - 150	.025 - .050	.010 - .020

For mild steels start with the middle of the range
For softer materials like aluminum, start with the higher end
For harder materials like Stainless Steel, start with the lower end

Cut Knurling Feeds and Speeds

Material	Knurl Dia. (mm)	Workpiece Dia. 2-12mm, .079"-.472"		Workpiece Dia. 13-40mm, .512"-1.575"		Workpiece Dia. 41-250mm, 1.614"-9.843"	
		Speed (SFM)	Feed (in/rev)	Speed (SFM)	Feed (in/rev)	Speed (SFM)	Feed (in/rev)
Mild Steel	8.9	115	.002-.003	-	-	-	-
	14.5/15	148	.003-.004	131	.003-.004	-	-
	21.5/25	197	.003-.006	197	.003-.006	164	.003-.006
Tool Steel	8.9	82	.002-.003	-	-	-	-
	14.5/15	115	.002-.003	98	.002-.003	-	-
	21.5/25	164	.002-.005	148	.002-.005	131	.002-.005
Stainless Steel	8.9	72	0.002	-	-	-	-
	14.5/15	98	.002-.003	92	.002-.003	-	-
	21.5/25	131	.002-.005	115	.002-.005	105	.002-.005
Brass	8.9	197	.002-.004	-	-	-	-
	14.5/15	230	.003-.008	197	.003-.005	-	-
	21.5/25	295	.003-.008	295	.003-.008	262	.003-.008
Bronze	8.9	115	.002-.003	-	-	-	-
	14.5/15	148	.003-.004	131	.003-.004	-	-
	21.5/25	197	.003-.006	197	.003-.006	180	.003-.006
Aluminum	8.9	197	.002-.005	-	-	-	-
	14.5/15	230	.003-.007	230	.003-.007	-	-
	21.5/25	295	.004-.010	262	.004-.010	230	.004-.010
Cast Iron	8.9	82	.002-.003	-	-	-	-
	14.5/15	115	.002-.003	98	.002-.003	-	-
	21.5/25	164	.002-.005	148	.002-.005	131	.002-.005

Note: Feed rate listed is for both axial and infeed.

Any "-" in the chart mean that it is not advised to use that size knurl wheel for that size part

Approximate Increase in Knurl Diameter

The charts below are an approximation to be used for estimation purposes for when the teeth are rolled full. Different materials and operation types, as well as other running parameters will often affect the end result.

Approximate Increase in Knurled Diameters Using Accu Trak Circular Pitch Knurls						
TPI	Pitch mm	Tooth Angle	Straight in/mm	Diagonal in/mm	Diamond (on Part)	
					Male	Female
12	2.12	90°	.034"/.86mm	.034"/.86mm	.038"/.97mm	.023"/.58mm
16	1.59	90°	.025"/.64mm	.025"/.64mm	.029"/.74mm	.017"/.43mm
20	1.22	90°	.020"/.51mm	.020"/.51mm	.023"/.58mm	.014"/.36mm
25	1.02	90°	.016"/.41mm	.016"/.41mm	.018"/.46mm	.011"/.28mm
30	0.85	90°	.013"/.33mm	.013"/.33mm	.015"/.38mm	.009"/.23mm
35	0.73	90°	.011"/.28mm	.011"/.28mm	.013"/.33mm	.007"/.18mm
40	0.64	90°	.009"/.23mm	.009"/.23mm	.010"/.25mm	.006"/.15mm
35	0.73	70°	.014"/.36mm	.014"/.36mm	.016"/.40mm	.009"/.23mm
40	0.64	70°	.012"/.30mm	.012"/.30mm	.013"/.33mm	.008"/.20mm
50	0.51	70°	.009"/.23mm	.009"/.23mm	.010"/.25mm	.006"/.15mm
60	0.42	70°	.007"/.18mm	.007"/.18mm	.008"/.20mm	.005"/.13mm
70	0.36	70°	.006"/.15mm	.006"/.15mm	.007"/.18mm	.004"/.10mm
80	0.32	70°	.005"/.13mm	.005"/.13mm	.006"/.15mm	.004"/.10mm

Chart showing Part Diameter increase from form knurling for Circular Pitch knurls

Approximate Increase in Knurled Diameters Using Accu Trak Diametral Pitch Knurls						
DP	Pitch mm	Tooth Angle	Straight in/mm	Diagonal in/mm	Diamond (on Part)	
					Male	Female
64	1.25	80°	.024"/.61mm	.021"/.53mm	.024"/.61mm	.015"/.38mm
96	0.83	80°	.016"/.41mm	.014"/.36mm	.016"/.41mm	.010"/.25mm
128	0.62	80°	.012"/.30mm	.010"/.25mm	.012"/.30mm	.007"/.18mm
160	0.50	80°	.009"/.23mm	.008"/.20mm	.009"/.23mm	.005"/.13mm

Chart showing Part Diameter increase from form knurling for DP Knurls

Note: As a rough approximation, with standard forms usually half of the tooth depth is pressed into the part while half is raised up. This means that the approximate increase in diameter shown in the charts above can also be used as an approximation of the knurls tooth depth. So for example for a 25 TPI straight knurl the diameter will increase roughly .016”, which means that the tooth depth is roughly .016”.

Number of Teeth on Stock Knurls – Inch Sizes

The charts below show the number of teeth on Accu Trak's stock knurls. There is not an industry standard for the number of teeth, so they may vary slightly from each manufacturer.

Straight TPI Form Knurls							
Pitch	BP (Ø5/16")	EP/EQ (Ø1/2")	GK/GR (Ø5/8")	KN/KP/KR (Ø3/4")	MT (Ø7/8")	OU (Ø1")	PH (Ø1 1/4")
6 TPI	-	-	-	13	-	-	-
8 TPI	-	-	-	19	-	-	31
10 TPI	-	-	-	23	-	31	39
12 TPI	-	-	23	28	-	37	47
14 TPI	-	21	27	34	-	44	55
16 TPI	15	25	31	38	44	50	63
18 TPI	-	-	-	42	-	-	-
19 TPI	-	-	37	45	-	-	-
20 TPI	19	31	39	47	55	61	78
21 TPI	-	32	41	50	-	67	-
24 TPI	-	-	47	57	-	-	-
25 TPI	25	38	49	59	69	78	98
29 TPI	-	44	56	68	-	-	-
30 TPI	29	47	59	71	82	95	117
32 TPI	-	49	63	75	-	-	125
33 TPI	-	52	65	77	-	103	-
34 TPI	-	-	67	80	-	-	-
35 TPI	34	55	68	82	-	110	136
40 TPI	39	63	78	94	109	-	156
41 TPI	-	65	81	97	-	-	-
42 TPI	-	-	83	-	-	-	-
47 TPI	-	73	92	-	-	-	-
50 TPI	49	79	98	117	-	158	195
53 TPI	-	84	103	123	-	-	-
60 TPI	59	94	116	140	-	-	-
65 TPI	-	101	-	-	-	-	-
70 TPI	69	109	-	-	-	-	-
77 TPI	-	121	-	-	-	-	-
80 TPI	79	125	155	189	219	-	314
90 TPI	89	-	-	-	-	-	-
100 TPI	99	-	-	-	-	-	-
64 DP	20	32	40	48	56	64	81
96 DP	30	48	60	72	84	96	121
128 DP	40	64	80	96	112	128	161
160 DP	50	80	100	120	140	160	201

Number of Teeth on Stock Knurls – Inch Sizes

30° Diagonal and Diamond TPI Form Knurls							
Pitch	BP (Ø5/16")	EP/EQ (Ø1/2")	GK/GR (Ø5/8")	KN/KP/KR (Ø3/4")	MT (Ø7/8")	OU (Ø1")	PH (Ø1 1/4")
8 TPI	-	-	-	16	-	-	-
10 TPI	-	-	-	20	-	26	-
11 TPI	-	-	-	22	-	-	-
12 TPI	-	15	19	25	-	32	41
14 TPI	-	21	27	34	33	46	55
16 TPI	-	22	27	33	-	44	54
18 TPI	-	-	-	36	-	-	-
20 TPI	-	27	34	41	47	53	68
21 TPI	-	32	41	50	-	67	-
25 TPI	21	34	42	51	59	68	85
30 TPI	26	40	52	61	71	81	103
33 TPI	-	52	65	77	90	103	-
35 TPI	29	47	59	71	-	-	-
40 TPI	34	55	68	81	-	-	135
50 TPI	43	68	86	102	-	-	169
70 TPI	60	-	-	-	-	-	-
80 TPI	68	107	135	163	-	-	272
64 DP	-	32	40	48	56	-	81
96 DP	30	48	60	72	84	-	121
128 DP	40	64	80	96	-	-	161
160 DP	50	80	100	120	-	-	201

45° Diagonal and Diamond TPI Form Knurls							
Pitch	BP (Ø5/16")	EP/EQ (Ø1/2")	GK/GR (Ø5/8")	KN/KP/KR (Ø3/4")	MT (Ø7/8")	OU (Ø1")	PH (Ø1 1/4")
16 TPI	-	-	-	26	-	-	-
20 TPI	-	22	27	33	-	-	-
25 TPI	-	27	34	41	-	-	-
28 TPI	-	-	37	-	-	-	-
29 TPI	-	-	40	-	-	-	-
30 TPI	-	33	41	50	-	-	-
31 TPI	-	-	43	-	-	-	-
32 TPI	-	-	44	-	-	-	-
33 TPI	-	-	46	-	-	-	-
34 TPI	-	-	47	-	-	-	-
35 TPI	-	-	49	-	-	-	-
36 TPI	-	-	50	-	-	-	-
37 TPI	-	-	51	-	-	-	-
38 TPI	-	-	53	-	-	-	-
39 TPI	-	-	54	-	-	-	-
40 TPI	-	44	55	-	-	-	-
41 TPI	-	-	56	-	-	-	-
64 DP	-	-	40	-	-	-	-
96 DP	-	-	60	-	-	-	-
128 DP	-	-	-	-	-	-	-
160 DP	-	-	-	-	-	-	-

Number of Teeth on Stock Knurls – Metric Sizes

Straight Metric Form Knurls					
Pitch	MB/MM (Ø10mm)	MN/MQ (Ø15mm)	MK (Ø19.05mm)	ML/MR/MS/MU (Ø20mm)	MW (Ø25mm)
0.2mm	156	-	-	-	-
0.3mm	105	158	-	209	261
0.4mm	78	117	150	156	196
0.5mm	63	94	119	125	158
0.6mm	52	77	97	103	129
0.7mm	45	67	-	89	112
0.8mm	39	59	75	77	97
0.9mm	35	52	-	69	87
1.0mm	31	47	59	63	77
1.1mm	-	-	-	57	-
1.2mm	26	38	50	51	64
1.3mm	-	-	-	47	-
1.4mm	-	-	-	43	-
1.5mm	21	30	40	40	51
1.6mm	-	-	37	39	49
1.8mm	-	-	-	35	43
2.0mm	-	24	30	31	39
2.5mm	-	-	-	25	31
3.0mm	-	-	-	21	26

30° Diagonal and Diamond Form Knurls					
Pitch	MB/MM (Ø10mm)	MN/MQ (Ø15mm)	MK (Ø19.05mm)	ML/MR/MS/MU (Ø20mm)	MW (Ø25mm)
0.3mm	90	137	-	182	227
0.4mm	68	102	130	137	169
0.5mm	54	81	104	109	136
0.6mm	45	68	86	90	113
0.7mm	38	58	-	78	97
0.8mm	34	51	65	68	85
0.9mm	30	45	-	61	75
1.0mm	27	41	52	54	68
1.2mm	22	33	43	45	56
1.5mm	18	27	34	36	45
1.6mm	-	-	32	34	42
1.8mm	-	-	-	30	-
2.0mm	-	21	26	27	34
2.5mm	-	-	-	22	-
3.0mm	-	-	-	18	-

Number of Teeth on Stock Knurls – Metric Sizes

45° Diagonal and Diamond Metric Form Knurls					
Pitch	MB/MM (Ø10mm)	MN/MQ (Ø15mm)	MK (Ø19.05mm)	ML/MR/MS/MU (Ø20mm)	MW (Ø25mm)
0.3mm	73	111	-	148	187
0.4mm	55	83	-	111	139
0.5mm	44	66	-	89	111
0.6mm	36	55	-	74	93
0.7mm	31	47	-	63	78
0.8mm	27	41	-	55	70
0.9mm	24	36	-	49	61
1.0mm	22	33	-	44	55
1.2mm	18	27	-	37	47
1.5mm	14	22	-	29	37
2.0mm	-	17	-	22	28
2.5mm	-	-	-	17	-
3.0mm	-	-	-	15	-

Straight Metric Cut Knurls					
Pitch	CG (Ø8.9mm)	CB (Ø14.5mm)	CP (Ø15mm)	CC (Ø21.5mm)	CV (Ø25mm)
0.3mm	92	-	-	225	-
0.4mm	69	113	117	168	196
0.5mm	55	91	94	134	156
0.6mm	46	75	78	112	130
0.7mm	39	65	67	96	112
0.8mm	34	56	58	84	97
0.9mm	31	50	-	-	-
1.0mm	27	45	47	67	78
1.2mm	23	38	39	56	65
1.5mm	-	-	31	45	52
1.6mm	-	-	29	42	49
1.8mm	-	-	26	-	43
2.0mm	-	-	23	33	39
2.5mm	-	-	-	27	-
3.0mm	-	-	-	22	26

Number of Teeth on Stock Knurls – Metric Sizes

15° Diagonal Metric Cut Knurls					
Pitch	CG (Ø8.9mm)	CB (Ø14.5mm)	CP (Ø15mm)	CC (Ø21.5mm)	CV (Ø25mm)
0.3mm	90	-	-	218	-
0.4mm	67	109	-	162	189
0.5mm	54	87	91	130	151
0.6mm	45	72	75	108	126
0.7mm	38	62	64	-	108
0.8mm	33	54	-	81	95
0.9mm	30	-	51	73	85
1.0mm	27	43	45	64	75
1.2mm	22	36	38	53	63
1.4mm	-	-	-	-	53
1.5mm	-	-	30	43	50
1.6mm	-	-	-	-	47
1.8mm	-	-	27	-	-
2.0mm	-	-	-	32	38
3.0mm	-	-	-	21	-

30° Diagonal Metric Cut Knurls					
Pitch	CG (Ø8.9mm)	CB (Ø14.5mm)	CP (Ø15mm)	CC (Ø21.5mm)	CV (Ø25mm)
0.3mm	80	-	-	195	-
0.4mm	60	98	101	146	169
0.5mm	48	78	81	116	136
0.6mm	40	65	68	97	113
0.7mm	34	56	58	-	97
0.8mm	29	49	81	73	85
0.9mm	27	-	-	-	-
1.0mm	23	39	41	58	68
1.2mm	20	32	34	48	56
1.5mm	-	-	27	59	45
1.6mm	-	-	-	36	42
2.0mm	-	-	-	29	34
2.5mm	-	-	-	23	-

Form Knurling

In this section you will find Accu Trak's selection of Form knurls and holders. Form knurling is a material deformation process as opposed to the more common material removal processes employed in machining operations. Due to this, high pressures are often required in order to form a complete knurl. The benefit however is that form knurling can produce very clean and consistent results when done properly. It is also the preferred method if it is required to roll a specific number of teeth on the work piece.

BP Series

5/16” x 5/32” x 1/8”
(7.94 x 3.97 x 3.18mm)

- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
16 TPI / 1.59mm	90°	HSS	BPS 216	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	BPS 220	-	-	-	-	-	-
		Hi-Cobalt	BPSX220	-	-	-	-	-	-
25 TPI / 1.02mm	90°	HSS	BPS 225	BPL 225	BPR 225	-	-	BPM 225	-
		Hi-Cobalt	BPSX225	BPLX225	BPRX225	-	-	-	-
30 TPI / 0.85mm	90°	HSS	BPS 230	BPL 230	BPR 230	-	-	BPM 230	BPF 230
		Hi-Cobalt	BPSX230	BPLX230	BPRX230	-	-	-	BPFX230
35 TPI / 0.73mm	90°	HSS	BPS 235	BPL 235	BPR 235	-	-	-	-
		Hi-Cobalt	BPSX235	BPLX235	BPRX235	-	-	BPMX235	-
40 TPI / 0.64mm	90°	HSS	BPS 240	BPL 240	BPR 240	-	-	-	-
		Hi-Cobalt	BPSX240	-	-	-	-	-	-
50 TPI / 0.51mm	90°	HSS	BPS 250	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	BPS 450	BPL 450	BPR 450	-	-	BPM 450	BPF 450
		Hi-Cobalt	BPSX450	BPLX450	BPRX450	-	-	BPMX450	BPFX450
60 TPI / 0.42mm	70°	HSS	BPS 460	-	-	-	-	-	BPF 460
		Hi-Cobalt	BPSX460	-	-	-	-	-	-
70 TPI / 0.36mm	70°	HSS	BPS 470	-	-	-	-	-	BPF 470
		Hi-Cobalt	BPSX470	-	-	-	-	-	BPFX470
80 TPI / 0.32mm	70°	HSS	BPS 480	BPL 480	BPR 480	-	-	BPM 480	BPF 480
		Hi-Cobalt	BPSX480	BPLX480	BPRX480	-	-	BPMX480	BPFX480
90 TPI / 0.28mm	70°	HSS	BPS 490	-	-	-	-	-	-
		Hi-Cobalt	BPSX490	-	-	-	-	-	-
100 TPI / 0.25mm	70°	HSS	BPS 500	-	-	-	-	-	-
		Hi-Cobalt	BPSX500	BPLX500	BPRX500	-	-	-	-
64 DP	80°	HSS	BPS 064	-	-	-	-	-	-
		Hi-Cobalt	BPSX064	BPLX064	BPRX064	-	-	-	-
96 DP	80°	HSS	BPS 096	BPL 096	BPR 096	-	-	BPM 096	BPF 096
		Hi-Cobalt	BPSX 096	BPLX096	BPRX096	-	-	-	-
128 DP	80°	HSS	BPS 128	BPL 128	BPR 128	-	-	BPM 128	BPF 128
		Hi-Cobalt	BPSX128	BPLX128	BPRX128	-	-	-	-
160 DP	80°	HSS	BPS 160	BPL 160	BPR 160	-	-	BPM 160	BPF 160
		Hi-Cobalt	BPSX160	BPLX160	BPRX160	-	-	-	-

EP Series

1/2” x 3/16” x 3/16”
(12.70 x 4.76 x 4.76mm)

- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
12 TPI / 2.12mm	90°	HSS	-	-	-	-	-	-	-
		Hi-Cobalt	-	EPLX212	EPRX212	-	-	-	-
16 TPI / 1.59mm	90°	HSS	EPS 216	EPL 216	EPR 216	-	-	-	-
		Hi-Cobalt	EPSX216	EPLX216	EPRX216	-	-	-	-
20 TPI / 1.27mm	90°	HSS	EPS 220	EPL 220	EPR 220	EPC 220	EPD 220	EPM 220	EPF 220
		Hi-Cobalt	EPSX220	EPLX220	EPRX220	-	-	EPMX220	EPFX220
21 TPI / 1.21mm	90°	HSS	EPS 221	EPL 221	EPR 221	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
25 TPI / 1.02mm	90°	HSS	EPS 225	EPL 225	EPR 225	EPC 225	EPD 225	EPM 225	EPF 225
		Hi-Cobalt	EPSX225	EPLX225	EPRX225	-	-	EPMX225	EPFX225
29 TPI /0.88mm	90°	HSS	-	-	-	-	-	-	-
		Hi-Cobalt	EPSX229	-	-	-	-	-	-
30 TPI / 0.85mm	90°	HSS	EPS 230	EPL 230	EPR 230	EPC 230	EPD 230	EPM 230	EPF 230
		Hi-Cobalt	EPSX230	EPLX230	EPRX230	-	-	EPMX230	EPFX230
32 TPI /0.79mm	90°	HSS	EPS 232	-	-	-	-	-	-
		Hi-Cobalt	EPSX232	-	-	-	-	-	-
35 TPI / 0.73mm	90°	HSS	EPS 235	EPL 235	EPR 235	-	-	EPM 235	EPF 235
		Hi-Cobalt	EPSX235	EPLX235	EPRX235	-	-	-	-
40 TPI / 0.64mm	90°	HSS	EPS 240	EPL 240	EPR 240	EPC 240	EPD 240	EPM 240	EPF 240
		Hi-Cobalt	EPSX240	EPLX240	EPRX240	-	-	EPMX240	EPFX240
41 TPI /0.62mm	90°	HSS	EPS 241	-	-	-	-	-	-
		Hi-Cobalt	EPSX241	-	-	-	-	-	-
47 TPI / 0.54mm	90°	HSS	EPS 247	-	-	-	-	-	-
		Hi-Cobalt	EPSX247	-	-	-	-	-	-
50 TPI / 0.51mm	90°	HSS	EPS 250	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
60 TPI / 0.42mm	90°	HSS	EPS 260	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
28 TPI / 0.91mm	70°	HSS	EPS 428	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
30 TPI / 0.85mm	70°	HSS	EPS 430	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-

EP Series

1/2” x 3/16” x 3/16”
(12.70 x 4.76 x 4.76mm)

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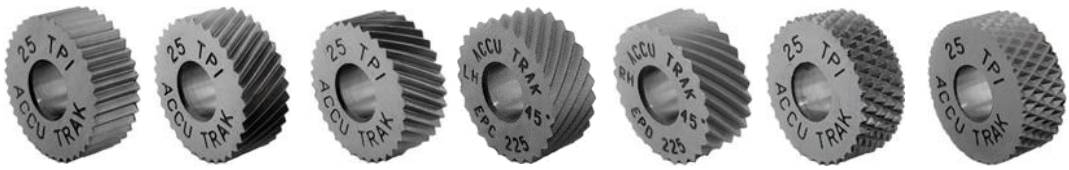
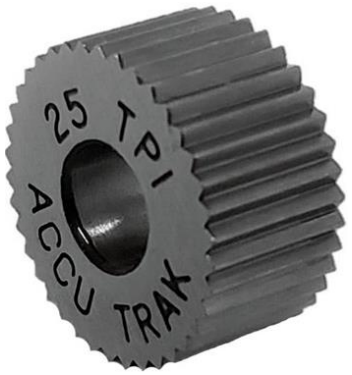


Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
35 TPI / 0.73mm	70°	HSS	EPS 435	-	-	-	-	-	-
		Hi-Cobalt	EPSX435	-	-	-	-	-	-
40 TPI / 0.64mm	70°	HSS	EPS 440	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
47 TPI / 0.54mm	70°	HSS	EPS 447	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	EPS 450	EPL 450	EPR 450	-	-	EPM 450	EPF 450
		Hi-Cobalt	EPSX450	EPLX450	EPRX450	-	-	EPMX450	EPFX450
53 TPI /0.48mm	70°	HSS	EPS 453	-	-	-	-	-	-
		Hi-Cobalt	EPSX453	-	-	-	-	-	-
60 TPI / 0.42mm	70°	HSS	EPS 460	-	-	-	-	-	-
		Hi-Cobalt	EPSX460	-	-	-	-	-	-
65 TPI / 0.39mm	70°	HSS	EPS 465	-	-	-	-	-	-
		Hi-Cobalt	EPSX465	-	-	-	-	-	-
70 TPI / 0.36mm	70°	HSS	EPS 470	-	-	-	-	-	-
		Hi-Cobalt	EPSX470	-	-	-	-	-	-
77 TPI / 0.33mm	70°	HSS	EPS 477	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
80 TPI / 0.32mm	70°	HSS	EPS 480	EPL 480	EPR 480	-	-	EPM 480	EPF 480
		Hi-Cobalt	EPSX480	EPLX480	EPRX480	-	-	-	EPFX480
64 DP	80°	HSS	EPS 064	EPL 064	EPR 064	-	-	EPM 064	EPF 064
		Hi-Cobalt	EPSX064	EPLX064	EPRX064	-	-	-	EPFX064
96 DP	80°	HSS	EPS 096	EPL 096	EPR 096	-	-	EPM 096	EPF 096
		Hi-Cobalt	EPSX 096	EPLX096	EPRX096	-	-	-	EPFX096
128 DP	80°	HSS	EPS 128	EPL 128	EPR 128	-	-	EPM 128	EPF 128
		Hi-Cobalt	EPSX128	EPLX128	EPRX128	-	-	-	EPFX128
160 DP	80°	HSS	EPS 160	EPL 160	EPR 160	-	-	EPM 160	EPF 160
		Hi-Cobalt	EPSX160	EPLX160	EPRX160	-	-	-	-

EQ Series

1/2” x 1/4” x 3/16”
(12.70 x 6.35 x 4.76mm)

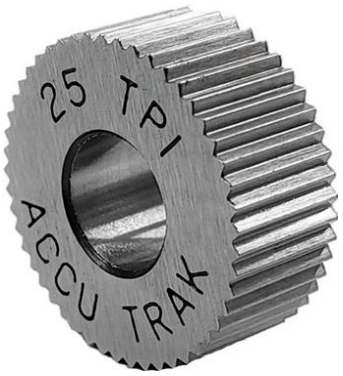


- Made from HSS material
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
14 TPI / 1.81mm	90°	HSS	EQS 214	EQL 214	EQR 214	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
16 TPI / 1.59mm	90°	HSS	EQS 216	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	EQS 220	EQL 220	EQR 220	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
21 TPI / 1.21mm	90°	HSS	EQS 221	EQL 221	EQR 221	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
25 TPI / 1.02mm	90°	HSS	EQS 225	EQL 225	EQR 225	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
30 TPI / 0.85mm	90°	HSS	EQS 230	EQL 230	EQR 230	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
33 TPI / 0.77mm	90°	HSS	EQS 233	EQL 233	EQR 233	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
35 TPI / 0.73mm	90°	HSS	EQS 235	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
47 TPI / 0.54mm	90°	HSS	EQS 247	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
47 TPI / 0.54mm	70°	HSS	EQS 447	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	EQS 450	EQL 450	EQR 450	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
60 TPI / 0.42mm	70°	HSS	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
70 TPI / 0.36mm	70°	HSS	EQS 470	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
96 DP	80°	HSS	EQS 096	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
128 DP	80°	HSS	EQS 128	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
160 DP	80°	HSS	EQS 160	-	-	-	-	-	EQF 160
		Hi-Cobalt	-	-	-	-	-	-	-

GK Series

5/8” x 1/4” x 1/4”
(15.88 x 6.35 x 6.35mm)



- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
12 TPI / 2.12mm	90°	HSS	GKS 212	GKL 212	GKR 212	-	-	-	-
		Hi-Cobalt	GKSX212	-	-	-	-	-	-
14 TPI / 1.81mm	90°	HSS	GKS 214	GKL 214	GKR 214	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
16 TPI / 1.59mm	90°	HSS	GKS 216	GKL 216	GKR 216	-	-	GKM 216	GKF 216
		Hi-Cobalt	GKSX216	GKLX216	GKRX216	-	-	GKMX216	GKFX216
19 TPI /1.37mm	90°	HSS	GKS 219	-	-	-	-	-	-
		Hi-Cobalt	GKSX219	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	GKS 220	GKL 220	GKR 220	GKC 220	GKD 220	GKM 220	GKF 220
		Hi-Cobalt	GKSX220	GKLX220	GKRX220	-	-	-	GKFX220
24 TPI /1.06mm	90°	HSS	GKS 224	-	-	-	-	-	-
		Hi-Cobalt	GKSX224	-	-	-	-	-	-
25 TPI / 1.02mm	90°	HSS	GKS 225	GKL 225	GKR 225	GKC 225	GKD 225	GKM 225	GKF 225
		Hi-Cobalt	GKSX225	GKLX225	GKRX225	-	-	GKMX225	GKFX225
29 TPI /0.88mm	90°	HSS	GKS 229	-	-	GKC 229	GKD 229	-	-
		Hi-Cobalt	GKSX229	-	-	-	-	-	-
30 TPI / 0.85mm	90°	HSS	GKS 230	GKL 230	GKR 230	GKC 230	GKD 230	GKM 230	GKF 230
		Hi-Cobalt	GKSX230	GKLX230	GKRX230	GKCX230	GKDX230	GKMX230	GKFX230
31 TPI /0.82mm	90°	HSS	-	-	-	GKC 231	GKD 231	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
32 TPI /0.79mm	90°	HSS	GKS 232	-	-	GKC 232	GKD 232	-	-
		Hi-Cobalt	GKSX232	-	-	-	-	-	-
33 TPI / 0.77mm	90°	HSS	GKS 233	-	-	GKC 233	GKD 233	-	-
		Hi-Cobalt	GKSX233	-	-	-	-	-	-
34 TPI /0.75mm	90°	HSS	GKS 234	-	-	GKC 234	GKD 234	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
35 TPI / 0.73mm	90°	HSS	GKS 235	GKL 235	GKR 235	GKC 235	GKD 235	-	GKF 235
		Hi-Cobalt	GKSX235	GKLX235	GKRX235	-	-	-	-
36 TPI /0.71mm	90°	HSS	-	-	-	GKC 236	GKD 236	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
37 TPI /0.69mm	90°	HSS	-	-	-	GKC 237	GKD 237	-	-
		Hi-Cobalt	-	-	-	-	-	-	-

GK Series

5/8” x 1/4” x 1/4”
(15.88 x 6.35 x 6.35mm)

Continued from previous page

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
38 TPI /0.67mm	90°	HSS	-	-	-	GKC 238	GKD 238	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
39 TPI /0.65mm	90°	HSS	-	-	-	GKC 239	GKD 239	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
40 TPI / 0.64mm	90°	HSS	GKS 240	GKL 240	GKR 240	GKC 240	GKD 240	GKM 240	GKF 240
		Hi-Cobalt	GKSX240	GKLX240	GKRX240	-	-	GKMX240	GKFX240
41 TPI /0.62mm	90°	HSS	GKS 241	-	-	GKC 241	GKD 241	-	-
		Hi-Cobalt	GKSX241	-	-	-	-	-	-
42 TPI /0.60mm	90°	HSS	GKS 242	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
47 TPI /0.54mm	90°	HSS	GKS 247	-	-	-	-	-	-
		Hi-Cobalt	GKSX247	-	-	-	-	-	-
16 TPI / 1.59mm	70°	HSS	GKS 416	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
25 TPI / 1.02mm	70°	HSS	GKS 425	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
30 TPI / 0.85mm	70°	HSS	GKS 430	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
35 TPI / 0.73mm	70°	HSS	GKS 435	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
40 TPI / 0.64mm	70°	HSS	GKS 440	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
47 TPI / 0.54mm	70°	HSS	GKS 447	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	GKS 450	GKL 450	GKR 450	-	-	GKM 450	GKF 450
		Hi-Cobalt	GKSX450	GKLX450	GKRX450	-	-	GKMX450	GKFX450
53 TPI /0.48mm	70°	HSS	GKS 453	-	-	-	-	-	-
		Hi-Cobalt	GKSX453	-	-	-	-	-	-
60 TPI / 0.42mm	70°	HSS	GKS 460	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
80 TPI / 0.32mm	70°	HSS	GKS 480	GKL 480	GKR 480	-	-	-	GKF 480
		Hi-Cobalt	GKSX480	GKLX480	GKRX480	-	-	-	-
64 DP	80°	HSS	GKS 064	GKL 064	GKR 064	GKC 064	GKC 064	GKM 064	GKF 064
		Hi-Cobalt	GKSX064	GKLX064	GKRX064	-	-	-	-
96 DP	80°	HSS	GKS 096	GKL 096	GKR 096	GKC 096	GKC 096	GKM 096	GKF 096
		Hi-Cobalt	GKSX 096	GKLX096	GKRX096	-	-	GKMX096	GKFX096
128 DP	80°	HSS	GKS 128	GKL 128	GKR 128	-	-	GKM 128	GKF 128
		Hi-Cobalt	GKSX128	GKLX128	GKRX128	-	-	-	GKFX128
160 DP	80°	HSS	GKS 160	GKL 160	GKR 160	-	-	GKM 160	GKF 160
		Hi-Cobalt	GKSX160	GKLX160	GKRX160	-	-	-	-

GR Series

5/8” x 5/16” x 7/32”
(15.88 x 7.94 x 5.57mm)

- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
14 TPI / 1.81mm	90°	HSS	GRS 214	GRL 214	GRR 214	-	-	-	-
		Hi-Cobalt	-	GRLX214	GRRX214	-	-	-	-
16 TPI / 1.59mm	90°	HSS	GRS 216	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	-	GRL 220	GRR 220	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
21 TPI / 1.21mm	90°	HSS	GRS 221	GRL 221	GRR 221	-	-	-	-
		Hi-Cobalt	-	GRLX221	GRRX221	-	-	-	-
25 TPI / 1.02mm	90°	HSS	GRS 225	GRL 225	GRR 225	-	-	-	-
		Hi-Cobalt	GRSX225	-	-	-	-	-	-
30 TPI / 0.85mm	90°	HSS	GRS 230	GRL 230	GRR 230	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
33 TPI / 0.77mm	90°	HSS	GRS 233	GRL 233	GRR 233	-	-	-	-
		Hi-Cobalt	GRSX233	-	-	-	-	-	-

KN Series

3/4” x 1/4” x 1/4”
(19.05 x 6.35 x 6.35mm)

- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
10 TPI / 2.54mm	90°	HSS	KNS 210	KNL 210	KNR 210	-	-	-	-
		Hi-Cobalt	KNSX210	-	-	-	-	-	-
12 TPI / 2.12mm	90°	HSS	KNS 212	KNL 212	KNR 212	-	-	-	KNF 212
		Hi-Cobalt	KNSX212	KNLX212	KNRX212	-	-	-	-
14 TPI / 1.81mm	90°	HSS	KNS 214	KNL 214	KNR 214	-	-	-	-
		Hi-Cobalt	KNSX214	KNLX214	KNRX214	-	-	-	-
16 TPI / 1.59mm	90°	HSS	KNS 216	KNL 216	KNR 216	-	-	KNM 216	KNF 216
		Hi-Cobalt	KNSX216	KNLX216	KNRX216	-	-	KNMX216	KNFX216
19 TPI /1.37mm	90°	HSS	KNS 219	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	KNS 220	KNL 220	KNR 220	-	-	KNM 220	KNF 220
		Hi-Cobalt	KNSX220	KNLX220	KNRX220	-	-	KNMX220	KNFX220
21 TPI /1.21mm	90°	HSS	KNS 221	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
24 TPI /1.06mm	90°	HSS	KNS 224	-	-	-	-	-	-
		Hi-Cobalt	KNSX224	-	-	-	-	-	-
25 TPI / 1.02mm	90°	HSS	KNS 225	KNL 225	KNR 225	-	-	KNM 225	KNF 225
		Hi-Cobalt	KNSX225	KNLX225	KNRX225	-	-	KNMX225	KNFX225
29 TPI /0.88mm	90°	HSS	KNS 229	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
30 TPI / 0.85mm	90°	HSS	KNS 230	KNL 230	KNR 230	-	-	KNM 230	KNF 230
		Hi-Cobalt	KNSX230	KNLX230	KNRX230	-	-	-	KNFX230
33 TPI / 0.77mm	90°	HSS	KNS 233	-	-	-	-	-	-
		Hi-Cobalt	KNSX233	KNLX233	KNRX233	-	-	-	-
34 TPI /0.75mm	90°	HSS	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
35 TPI / 0.73mm	90°	HSS	KNS 235	KNL 235	KNR 235	-	-	-	-
		Hi-Cobalt	KNSX235	KNLX235	KNRX235	-	-	-	-
40 TPI / 0.64mm	90°	HSS	KNS 240	KNL 240	KNR 240	-	-	KNM 240	KNF 240
		Hi-Cobalt	KNSX240	KNLX240	KNRX240	-	-	-	-
41 TPI /0.62mm	90°	HSS	KNS 241	-	-	-	-	-	-
		Hi-Cobalt	KNSX241	-	-	-	-	-	-

KN Series

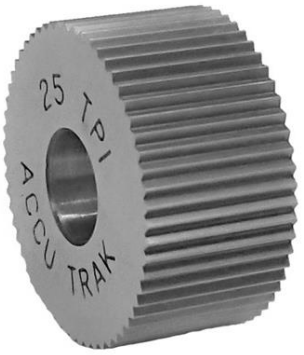
3/4” x 1/4” x 1/4”
(19.05 x 6.35 x 6.35mm)

Continued from previous page

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
50 TPI / 0.51mm	70°	HSS	KNS 450	KNL 450	KNR 450	-	-	KNM 450	KNF 450
		Hi-Cobalt	KNSX450	KNLX450	KNRX450	-	-	-	KNFX450
53 TPI /0.48mm	70°	HSS	-	-	-	-	-	-	-
		Hi-Cobalt	KNSX453	-	-	-	-	-	-
60 TPI / 0.42mm	70°	HSS	KNS 460	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
80 TPI / 0.32mm	70°	HSS	KNS 480	KNL 480	KNR 480	-	-	-	KNF 480
		Hi-Cobalt	KNSX480	KNLX480	KNRX480	-	-	-	KNFX480
64 DP	80°	HSS	KNS 064	KNL 064	KNR 064	-	-	-	-
		Hi-Cobalt	KNSX064	KNLX064	KNRX064	-	-	-	-
96 DP	80°	HSS	KNS 096	KNL 096	KNR 096	-	-	KNM 096	KNF 096
		Hi-Cobalt	KNSX 096	KNLX096	KNRX096	-	-	-	-
128 DP	80°	HSS	KNS 128	KNL 128	KNR 128	-	-	-	-
		Hi-Cobalt	KNSX128	KNLX128	KNRX128	-	-	-	KNFX128
160 DP	80°	HSS	KNS 160	KNL 160	KNR 160	-	-	-	-
		Hi-Cobalt	KNSX160	KNLX160	KNRX160	-	-	-	-

KP Series

3/4” x 3/8” x 1/4”
(19.05 x 9.53 x 6.35mm)



- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
8 TPI / 3.18mm	90°	HSS	KPS 208	KPL 208	KPR 208	-	-	-	-
		Hi-Cobalt	KPSX208	KPLX208	KPRX208	-	-	-	-
10 TPI / 2.54mm	90°	HSS	KPS 210	KPL 210	KPR 210	-	-	KPM 210	-
		Hi-Cobalt	KPSX210	KPLX210	KPRX210	-	-	-	-
11 TPI / 2.31mm	90°	HSS	-	KPL 211	KPR 211	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
12 TPI / 2.12mm	90°	HSS	KPS 212	KPL 212	KPR 212	-	-	KPM 212	KPF 212
		Hi-Cobalt	KPSX212	KPLX212	KPRX212	-	-	-	-
14 TPI / 1.81mm	90°	HSS	KPS 214	KPL 214	KPR 214	-	-	KPM 214	KPF 214
		Hi-Cobalt	KPSX214	KPLX214	KPRX214	-	-	-	KPFX214
16 TPI / 1.59mm	90°	HSS	KPS 216	KPL 216	KPR 216	KPC 216	KPD 216	KPM 216	KPF 216
		Hi-Cobalt	KPSX216	KPLX216	KPRX216	-	-	KPMX216	KPFX216
18 TPI /1.41mm	90°	HSS	KPS 218	KPL 218	KPR 218	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
19 TPI /1.37mm	90°	HSS	KPS 219	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	KPS 220	KPL 220	KPR 220	KPC 220	KPD 220	KPM 220	KPF 220
		Hi-Cobalt	KPSX220	KPLX220	KPRX220	-	-	KPMX220	KPFX220
21 TPI / 1.21mm	90°	HSS	KPS 221	KPL 221	KPR 221	-	-	KPM 221	-
		Hi-Cobalt	KPSX221	KPLX221	KPRX221	-	-	-	-
24 TPI /1.06mm	90°	HSS	KPS 224	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
25 TPI / 1.02mm	90°	HSS	KPS 225	KPL 225	KPR 225	KPC 225	KPD 225	KPM 225	KPF 225
		Hi-Cobalt	KPSX225	KPLX225	KPRX225	-	-	KPMX225	KPFX225
30 TPI / 0.85mm	90°	HSS	KPS 230	KPL 230	KPR 230	KPC 230	KPD 230	KPM 230	KPF 230
		Hi-Cobalt	KPSX230	KPLX230	KPRX230	-	-	KPMX230	KPFX230
32 TPI /0.79mm	90°	HSS	KPS 232	-	-	-	-	-	-
		Hi-Cobalt	-	KPLX232	KPRX232	-	-	-	-
33 TPI / 0.77mm	90°	HSS	KPS 233	KPL 233	KPR 233	-	-	KPM 233	-
		Hi-Cobalt	KPSX233	KPLX233	KPRX233	-	-	-	-
34 TPI /0.75mm	90°	HSS	KPS 234	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-

KP Series

3/4” x 3/8” x 1/4”
(19.05 x 9.53 x 6.35mm)

Continued from previous page

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
35 TPI / 0.73mm	90°	HSS	KPS 235	KPL 235	KPR 235	-	-	-	-
		Hi-Cobalt	KPSX235	KPLX235	KPRX235	-	-	-	-
40 TPI / 0.64mm	90°	HSS	KPS 240	KPL 240	KPR 240	-	-	KPM 240	KPF 240
		Hi-Cobalt	KPSX240	KPLX240	KPRX240	-	-	KPMX240	KPFX240
41 TPI /0.62mm	90°	HSS	KPS 241	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
35 TPI / 0.73mm	70°	HSS	KPS 435	-	-	-	-	-	-
		Hi-Cobalt	KPSX435	-	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	KPS 450	KPL 450	KPR 450	-	-	KPM 450	KPF 450
		Hi-Cobalt	KPSX450	KPLX450	KPRX450	-	-	KPMX450	KPFX450
53 TPI /0.48mm	70°	HSS	KPS 453	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
60 TPI / 0.42mm	70°	HSS	KPS 460	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
80 TPI / 0.32mm	70°	HSS	KPS 480	KPL 480	KPR 480	-	-	KPM 480	KPF 480
		Hi-Cobalt	KPSX480	KPLX480	KPRX480	-	-	-	KPFX480
64 DP	80°	HSS	KPS 064	KPL 064	KPR 064	-	-	KPM 064	KPF 064
		Hi-Cobalt	KPSX064	KPLX064	KPRX064	-	-	KPMX064	KPFX064
96 DP	80°	HSS	KPS 096	KPL 096	KPR 096	-	-	KPM 096	KPF 096
		Hi-Cobalt	KPSX 096	KPLX096	KPRX096	-	-	-	KPFX096
128 DP	80°	HSS	KPS 128	KPL 128	KPR 128	-	-	KPM 128	KPF 128
		Hi-Cobalt	KPSX128	KPLX128	KPRX128	-	-	-	-
160 DP	80°	HSS	KPS 160	KPL 160	KPR 160	-	-	KPM 160	-
		Hi-Cobalt	KPSX160	KPLX160	KPRX160	-	-	-	-

KR Series

3/4” x 1/2” x 1/4”
(19.05 x 12.70 x 6.35mm)

- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
10 TPI / 2.54mm	90°	HSS	-	KRL 210	KRR 210	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
12 TPI / 2.12mm	90°	HSS	-	KRL 212	KRR 212	-	-	-	KRF 212
		Hi-Cobalt	-	KRLX212	KRRX212	-	-	-	-
14 TPI / 1.81mm	90°	HSS	KRS 214	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
16 TPI / 1.59mm	90°	HSS	KRS 216	KRL 216	KRR 216	-	-	KRM 216	KRF 216
		Hi-Cobalt	-	-	-	-	-	-	KRFX216
20 TPI / 1.27mm	90°	HSS	KRS 220	KRL 220	KRR 220	-	-	KRM 220	KRF 220
		Hi-Cobalt	KRSX220	KRLX220	KRRX220	-	-	-	KRFX220
25 TPI / 1.02mm	90°	HSS	KRS 225	KRL 225	KRR 225	-	-	KRM 225	KRF 225
		Hi-Cobalt	-	-	-	-	-	-	-
30 TPI / 0.85mm	90°	HSS	KRS 230	KRL 230	KRR 230	-	-	KRM 230	KRF 230
		Hi-Cobalt	KRSX230	-	-	-	-	-	KRFX230
32 TPI / 0.79mm	90°	HSS	KRS 232	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
33 TPI / 0.77mm	90°	HSS	KRS 233	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
35 TPI / 0.73mm	90°	HSS	KRS 235	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
40 TPI / 0.64mm	90°	HSS	KRS 240	KRL 240	KRR 240	-	-	KRM 240	-
		Hi-Cobalt	-	-	-	-	-	-	-
30 TPI / 0.85mm	70°	HSS	KRS 430	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
35 TPI / 0.73mm	70°	HSS	KRS 435	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	KRS 450	KRL 450	KRR 450	-	-	KRM 450	KRF 450
		Hi-Cobalt	KRSX450	-	-	-	-	-	-
80 TPI / 0.32mm	70°	HSS	-	KRL 480	KRR 480	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-

KR Series

3/4” x 1/2” x 1/4”
(19.05 x 12.70 x 6.35mm)

Continued from previous page

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
64 DP	80°	HSS	KRS 064	KRL 064	KRR 064	-	-	KRM 064	KRF 064
		Hi-Cobalt	-	KRLX064	KRRX064	-	-	-	-
96 DP	80°	HSS	KRS 096	KRL 096	KRR 096	-	-	KRM 096	KRF 096
		Hi-Cobalt	-	-	-	-	-	-	-
128 DP	80°	HSS	KRS 128	KRL 128	KRR 128	-	-	KRM 128	KRF 128
		Hi-Cobalt	KRSX128	-	-	-	-	-	-
160 DP	80°	HSS	KRS 160	KRL 160	KRR 160	-	-	KRM 160	KRF 160
		Hi-Cobalt	-	-	-	-	-	-	-

MT Series

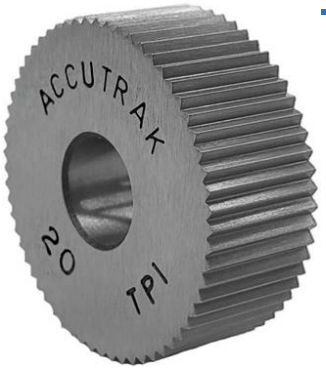
7/8” x 3/8” x 1/4”
(22.23 x 9.53 x 6.35mm)

- Made from HSS material
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

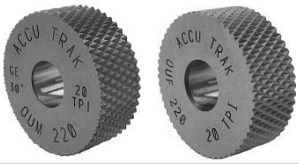
Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
14 TPI / 1.81mm	90°	HSS	-	MTL 214	MTR 214	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
16 TPI / 1.59mm	90°	HSS	MTS 216	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	MTS 220	MTL 220	MTR 220	-	-	-	MTF 220
		Hi-Cobalt	-	-	-	-	-	-	-
25 TPI / 1.02mm	90°	HSS	MTS 225	MTL 225	MTR 225	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
30 TPI / 0.85mm	90°	HSS	MTS 230	MTL 230	MTR 230	-	-	-	MTF 230
		Hi-Cobalt	-	-	-	-	-	-	-
33 TPI / 0.77mm	90°	HSS	-	MTL 233	MTR 233	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
40 TPI / 0.64mm	90°	HSS	MTS 240	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
80 TPI / 0.32mm	70°	HSS	MTS 480	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
64 DP	80°	HSS	MTS 064	MTL 064	MTR 064	-	-	-	MTF 064
		Hi-Cobalt	-	-	-	-	-	-	-
96 DP	80°	HSS	MTS 096	MTL 096	MTR 096	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
128 DP	80°	HSS	MTS 128	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
160 DP	80°	HSS	MTS 160	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-

OU Series

1” x 3/8” x 5/16”
(25.40 x 9.53 x 7.94mm)



- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request



Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
10 TPI / 2.54mm	90°	HSS	-	OUL 210	OUR 210	-	-	-	-
		Hi-Cobalt	OUSX210	-	-	-	-	-	-
12 TPI / 2.12mm	90°	HSS	OUS 212	OUL 212	OUR 212	-	-	-	-
		Hi-Cobalt	OUSX212	-	OURX212	-	-	-	-
14 TPI / 1.81mm	90°	HSS	OUS 214	OUL 214	OUR 214	-	-	-	-
		Hi-Cobalt	OUSX214	OULX214	OURX214	-	-	-	-
16 TPI / 1.59mm	90°	HSS	OUS 216	OUL 216	OUR 216	-	-	-	-
		Hi-Cobalt	OUSX216	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	OUS 220	OUL 220	OUR 220	-	-	OUM 220	OUF 220
		Hi-Cobalt	OUSX220	-	-	-	-	-	-
21 TPI / 1.21mm	90°	HSS	OUS 221	OUL 221	OUR 221	-	-	-	-
		Hi-Cobalt	OUSX221	OULX221	OURX221	-	-	-	-
25 TPI / 1.02mm	90°	HSS	OUS 225	OUL 225	OUR 225	-	-	OUM 225	OUF 225
		Hi-Cobalt	OUSX225	-	-	-	-	-	-
30 TPI / 0.85mm	90°	HSS	OUS 230	OUL 230	OUR 230	-	-	OUM 230	OUF 230
		Hi-Cobalt	OUSX230	-	-	-	-	-	-
33 TPI / 0.77mm	90°	HSS	OUS 233	OUL 233	OUR 233	-	-	-	-
		Hi-Cobalt	OUSX233	OULX233	OURX233	-	-	-	-
35 TPI / 0.73mm	90°	HSS	OUS 235	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	OUS 450	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
64 DP	80°	HSS	OUS 064	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
96 DP	80°	HSS	OUS 096	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-

PH Series

1-1/4” x 1/2” x 1/2”
(31.75 x 12.70 x 12.70mm)

- HSS and Hi-Cobalt steel stock options
- Smooth lapped finish
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female
8 TPI / 3.18mm	90°	HSS	PHS 208	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
10 TPI / 2.54mm	90°	HSS	PHS 210	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	PHMX210	-
12 TPI / 2.12mm	90°	HSS	PHS 212	PHL 212	PHR 212	-	-	PHM 212	-
		Hi-Cobalt	PHSX212	PHLX212	PHRX212	-	-	-	-
14 TPI / 1.81mm	90°	HSS	PHS 214	PHL 214	PHR 214	-	-	PHM 214	-
		Hi-Cobalt	-	-	-	-	-	-	-
16 TPI / 1.59mm	90°	HSS	PHS 216	PHL 216	PHR 216	-	-	PHM 216	PHF 216
		Hi-Cobalt	PHSX216	PHLX216	PHRX216	-	-	PHMX216	PHFX216
18 TPI /1.41mm	90°	HSS	-	-	-	-	-	PHM 218	-
		Hi-Cobalt	-	-	-	-	-	-	-
20 TPI / 1.27mm	90°	HSS	PHS 220	PHL 220	PHR 220	-	-	PHM 220	PHF 220
		Hi-Cobalt	PHSX220	PHLX220	PHRX220	-	-	PHMX220	PHFX220
25 TPI / 1.02mm	90°	HSS	PHS 225	PHL 225	PHR 225	-	-	PHM 225	PHF 225
		Hi-Cobalt	PHSX225	PHLX225	PHRX225	-	-	PHMX225	PHFX225
30 TPI / 0.85mm	90°	HSS	PHS 230	PHL 230	PHR 230	-	-	PHM 230	PHF 230
		Hi-Cobalt	PHSX230	PHLX230	PHRX230	-	-	PHMX230	-
32 TPI /0.79mm	90°	HSS	PHS 232	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
35 TPI / 0.73mm	90°	HSS	PHS 235	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
40 TPI / 0.64mm	90°	HSS	PHS 240	PHL 240	PHR 240	-	-	PHM 240	-
		Hi-Cobalt	PHSX240	-	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	PHS 450	PHL 450	PHR 450	-	-	PHM 450	-
		Hi-Cobalt	PHSX450	-	-	-	-	-	-
80 TPI / 0.32mm	70°	HSS	PHS 480	PHL 480	PHR 480	-	-	-	PHF 480
		Hi-Cobalt	-	-	-	-	-	-	PHFX480
64 DP	80°	HSS	PHS 064	PHL 064	PHR 064	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
96 DP	80°	HSS	PHS 096	PHL 096	PHR 096	-	-	PHM 096	PHF 096
		Hi-Cobalt	-	PHLX096	PHRX096	-	-	-	-
128 DP	80°	HSS	PHS 128	PHL 128	PHR 128	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-
160 DP	80°	HSS	PHS 160	PHL 160	PHR 160	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-

MB Series

10 x 3 x 4mm
(.394” x .118” x .157”)

- Made from Hi-Cobalt steel material
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.3mm / 84.7 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MBSX0.3	-	-	MBCX0.3	MBDX0.3	-	-	-	MBGX0.3
0.4mm / 63.5 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MBSX0.4	-	-	MBCX0.4	MBDX0.4	-	-	-	MBGX0.4
0.5mm / 50.8 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MBSX0.5	-	-	MBCX0.5	MBDX0.5	-	-	-	MBGX0.5
0.6mm / 42.3 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MBSX0.6	-	-	MBCX0.6	MBDX0.6	-	-	-	MBGX0.6
0.7mm / 36.3 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MBSX0.7	-	-	MBCX0.7	MBDX0.7	-	-	-	MBGX0.7
0.8mm / 31.8 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MBSX0.8	-	-	MBCX0.8	MBDX0.8	-	-	-	MBGX0.8
0.9mm / 28.2 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MBSX0.9	-	-	MBCX0.9	MBDX0.9	-	-	-	MBGX0.9
1.0mm / 25.4 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MBSX1.0	-	-	MBCX1.0	MBDX1.0	-	-	-	MBGX1.0

MM Series

10 x 4 x 4mm
(.394” x .157” x .157”)

- HSS and Hi-Cobalt steel stock options
- Bevels available per customer request
- Coatings and Treatments per customer request

Standard (Metric)

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.2mm / 127 TPI	90°	HSS	MMS-0.2	-	-	-	-	-	-	-	-
		Hi-Cobalt	MMSX0.2	-	-	-	-	-	-	-	-
0.3mm / 84.7 TPI	90°	HSS	MMS-0.3	MML-0.3	MMR-0.3	MMC-0.3	MMD-0.3	-	MMF-0.3	MMN-0.3	MMG-0.3
		Hi-Cobalt	MMSX0.3	MMLX0.3	MMRX0.3	MMCX0.3	MMDX0.3	MMMX0.3	MMFX0.3	-	MMGX0.3
0.4mm / 63.5 TPI	90°	HSS	MMS-0.4	MML-0.4	MMR-0.4	MMC-0.4	MMD-0.4	MMM-0.4	MMF-0.4	MMN-0.4	MMG-0.4
		Hi-Cobalt	MMSX0.4	MMLX0.4	MMRX0.4	MMCX0.4	MMDX0.4	MMMX0.4	MMFX0.4	-	MMGX0.4
0.5mm / 50.8 TPI	90°	HSS	MMS-0.5	MML-0.5	MMR-0.5	MMC-0.5	MMD-0.5	MMM-0.5	MMF-0.5	MMN-0.5	MMG-0.5
		Hi-Cobalt	MMSX0.5	MMLX0.5	MMRX0.5	MMCX0.5	MMDX0.5	MMMX0.5	MMFX0.5	MMNX0.5	MMGX0.5
0.6mm / 42.3 TPI	90°	HSS	MMS-0.6	MML-0.6	MMR-0.6	MMC-0.6	MMD-0.6	MMM-0.6	MMF-0.6	MMN-0.6	MMG-0.6
		Hi-Cobalt	MMSX0.6	MMLX0.6	MMRX0.6	MMCX0.6	MMDX0.6	-	MMFX0.6	-	MMGX0.6
0.7mm / 36.3 TPI	90°	HSS	MMS-0.7	MML-0.7	MMR-0.7	MMC-0.7	MMD-0.7	MMM-0.7	MMF-0.7	MMN-0.7	MMG-0.7
		Hi-Cobalt	MMSX0.7	MMLX0.7	MMRX0.7	MMCX0.7	MMDX0.7	-	MMFX0.7	-	MMGX0.7
0.8mm / 31.8 TPI	90°	HSS	MMS-0.8	MML-0.8	MMR-0.8	MMC-0.8	MMD-0.8	MMM-0.8	MMF-0.8	MMN-0.8	MMG-0.8
		Hi-Cobalt	MMSX0.8	MMLX0.8	MMRX0.8	MMCX0.8	MMDX0.8	-	MMFX0.8	-	MMGX0.8
0.9mm / 28.2 TPI	90°	HSS	MMS-0.9	MML-0.9	MMR-0.9	MMC-0.9	MMD-0.9	MMM-0.9	MMF-0.9	MMN-0.9	MMG-0.9
		Hi-Cobalt	MMSX0.9	MMLX0.9	MMRX0.9	MMCX0.9	MMDX0.9	-	MMFX0.9	-	MMGX0.9
1.0mm / 25.4 TPI	90°	HSS	MMS-1.0	MML-1.0	MMR-1.0	MMC-1.0	MMD-1.0	MMM-1.0	MMF-1.0	MMN-1.0	MMG-1.0
		Hi-Cobalt	MMSX1.0	MMLX1.0	MMRX1.0	MMCX1.0	MMDX1.0	-	MMFX1.0	-	MMGX1.0
1.2mm / 21.2 TPI	90°	HSS	MMS-1.2	MML-1.2	MMR-1.2	MMC-1.2	MMD-1.2	MMM-1.2	MMF-1.2	MMN-1.2	MMG-1.2
		Hi-Cobalt	MMSX1.2	MMLX1.2	MMRX1.2	-	-	-	MMFX1.2	-	MMGX1.2
1.5mm / 16.9 TPI	90°	HSS	MMS-1.5	MML-1.5	MMR-1.5	MMC-1.5	MMD-1.5	MMM-1.5	MMF-1.5	MMN-1.5	MMG-1.5
		Hi-Cobalt	MMSX1.5	MMLX1.5	MMRX1.5	MMCX1.5	MMDX1.5	-	MMFX1.5	MMNX1.5	MMGX1.5

MN Series

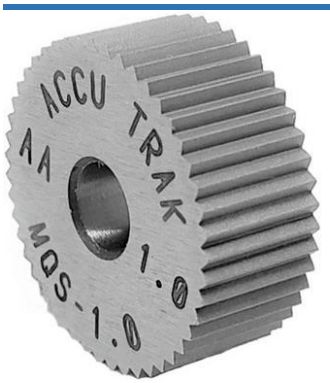
15 x 4 x 4mm
(.591” x .157” x .157”)

- HSS and Hi-Cobalt steel stock options
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.3mm / 84.7 TPI	90°	HSS	MNS-0.3	MNL-0.3	MNR-0.3	MNC-0.3	MND-0.3	-	-	-	MNG-0.3
		Hi-Cobalt	MNSX0.3	-	-	-	-	-	-	-	MNGX0.3
0.4mm / 63.5 TPI	90°	HSS	MNS-0.4	MNL-0.4	MNR-0.4	MNC-0.4	MND-0.4	-	MNF-0.4	-	MNG-0.4
		Hi-Cobalt	MNSX0.4	-	-	-	-	-	-	-	MNGX0.4
0.5mm / 50.8 TPI	90°	HSS	MNS-0.5	MNL-0.5	MNR-0.5	MNC-0.5	MND-0.5	-	MNF-0.5	-	MNG-0.5
		Hi-Cobalt	MNSX0.5	MNLX0.5	MNRX0.5	-	-	-	-	-	MNGX0.5
0.6mm / 42.3 TPI	90°	HSS	MNS-0.6	MNL-0.6	MNR-0.6	MNC-0.6	MND-0.6	-	MNF-0.6	-	MNG-0.6
		Hi-Cobalt	MNSX0.6	MNLX0.6	MNRX0.6	-	-	-	-	-	MNGX0.6
0.7mm / 36.3 TPI	90°	HSS	MNS-0.7	MNL-0.7	MNR-0.7	MNC-0.7	MND-0.7	-	MNF-0.7	-	MNG-0.7
		Hi-Cobalt	MNSX0.7	-	-	-	-	-	-	-	MNGX0.7
0.8mm / 31.8 TPI	90°	HSS	MNS-0.8	MNL-0.8	MNR-0.8	MNC-0.8	MND-0.8	-	MNF-0.8	-	MNG-0.8
		Hi-Cobalt	MNSX0.8	MNLX0.8	MNRX0.8	-	-	-	-	-	MNGX0.8
0.9mm / 28.2 TPI	90°	HSS	MNS-0.9	MNL-0.9	MNR-0.9	MNC-0.9	MND-0.9	-	MNF-0.9	-	MNG-0.9
		Hi-Cobalt	MNSX0.9	-	-	-	-	-	-	-	MNGX0.9
1.0mm / 25.4 TPI	90°	HSS	MNS-1.0	MNL-1.0	MNR-1.0	MNC-1.0	MND-1.0	-	MNF-1.0	-	MNG-1.0
		Hi-Cobalt	MNSX1.0	-	-	-	-	-	-	-	MNGX1.0
1.2mm / 21.2 TPI	90°	HSS	MNS-1.2	MNL-1.2	MNR-1.2	MNC-1.2	MND-1.2	-	-	-	MNG-1.2
		Hi-Cobalt	MNSX1.2	-	-	-	-	-	-	-	MNGX1.2
1.5mm / 16.9 TPI	90°	HSS	MNS-1.5	MNL-1.5	MNR-1.5	MNC-1.5	MND-1.5	-	-	-	MNG-1.5
		Hi-Cobalt	MNSX1.5	-	-	-	-	-	-	-	-

MQ Series

15 x 6 x 4mm
(.394” x .236” x .157”)

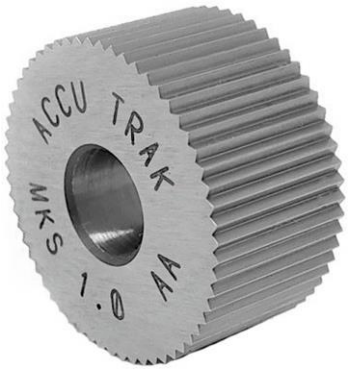


- HSS and Hi-Cobalt steel stock options
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.2mm / 127 TPI	90°	HSS	MQS-0.2	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.3mm / 84.7 TPI	90°	HSS	MQS-0.3	MQL-0.3	MQR-0.3	MQC-0.3	MQD-0.3	MQM-0.3	MQF-0.3	MQN-0.3	MQG-0.3
		Hi-Cobalt	MQSX0.3	MQLX0.3	MQRX0.3	MQCX0.3	MQDX0.3	-	MQFX0.3	-	MQGX0.3
0.4mm / 63.5 TPI	90°	HSS	MQS-0.4	MQL-0.4	MQR-0.4	MQC-0.4	MQD-0.4	MQM-0.4	MQF-0.4	MQN-0.4	MQG-0.4
		Hi-Cobalt	MQSX0.4	MQLX0.4	MQRX0.4	MQCX0.4	MQDX0.4	-	MQFX0.4	-	MQGX0.4
0.5mm / 50.8 TPI	90°	HSS	MQS-0.5	MQL-0.5	MQR-0.5	MQC-0.5	MQD-0.5	MQM-0.5	MQF-0.5	MQN-0.5	MQG-0.5
		Hi-Cobalt	MQSX0.5	MQLX0.5	MQRX0.5	MQCX0.5	MQDX0.5	MQMX0.5	MQFX0.5	MQNX0.5	MQGX0.5
0.6mm / 42.3 TPI	90°	HSS	MQS-0.6	MQL-0.6	MQR-0.6	MQC-0.6	MQD-0.6	MQM-0.6	MQF-0.6	MQN-0.6	MQG-0.6
		Hi-Cobalt	MQSX0.6	MQLX0.6	MQRX0.6	MQCX0.6	MQDX0.6	MQMX0.6	MQFX0.6	MQNX0.6	MQGX0.6
0.7mm / 36.3 TPI	90°	HSS	MQS-0.7	MQL-0.7	MQR-0.7	MQC-0.7	MQD-0.7	MQM-0.7	MQF-0.7	MQN-0.7	MQG-0.7
		Hi-Cobalt	MQSX0.7	MQLX0.7	MQRX0.7	MQCX0.7	MQDX0.7	-	MQFX0.7	-	MQGX0.7
0.8mm / 31.8 TPI	90°	HSS	MQS-0.8	MQL-0.8	MQR-0.8	MQC-0.8	MQD-0.8	MQM-0.8	MQF-0.8	MQN-0.8	MQG-0.8
		Hi-Cobalt	MQSX0.8	MQLX0.8	MQRX0.8	MQCX0.8	MQDX0.8	MQMX0.8	MQFX0.8	MQNX0.8	MQGX0.8
0.9mm / 28.2 TPI	90°	HSS	MQS-0.9	MQL-0.9	MQR-0.9	MQC-0.9	MQD-0.9	MQM-0.9	MQF-0.9	MQN-0.9	MQG-0.9
		Hi-Cobalt	MQSX0.9	-	-	MQCX0.9	MQDX0.9	-	MQFX0.9	-	MQGX0.9
1.0mm / 25.4 TPI	90°	HSS	MQS-1.0	MQL-1.0	MQR-1.0	MQC-1.0	MQD-1.0	MQM-1.0	MQF-1.0	MQN-1.0	MQG-1.0
		Hi-Cobalt	MQSX1.0	MQLX1.0	MQRX1.0	MQCX1.0	MQDX1.0	MQMX1.0	MQFX1.0	MQNX1.0	MQGX1.0
1.2mm / 21.2 TPI	90°	HSS	MQS-1.2	MQL-1.2	MQR-1.2	MQC-1.2	MQD-1.2	MQM-1.2	MQF-1.2	MQN-1.2	MQG-1.2
		Hi-Cobalt	MQSX1.2	MQLX1.2	MQRX1.2	-	-	-	MQFX1.2	-	MQGX1.2
1.5mm / 16.9 TPI	90°	HSS	MQS-1.5	MQL-1.5	MQR-1.5	MQC-1.5	MQD-1.5	MQM-1.5	MQF-1.5	MQN-1.5	MQG-1.5
		Hi-Cobalt	MQSX1.5	-	-	MQCX1.5	MQDX1.5	-	MQFX1.5	MQNX1.5	MQGX1.5
2.0mm / 12.7 TPI	90°	HSS	MQS-2.0	MQL-2.0	MQR-2.0	MQC-2.0	MQD-2.0	-	-	MQN-2.0	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-

MK Series

19.05 x 9.53 x 6.35mm
(.75” x .375” x .25”)



- Made from HSS material
- Bevels available per customer request
- Coatings and Treatments per customer request
- For additional TPI options, see “KP Series”

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.4mm / 63.5 TPI	90°	HSS	MKS-0.4	MKL-0.4	MKR-0.4	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.5mm / 50.8 TPI	90°	HSS	MKS-0.5	MKL-0.5	MKR-0.5	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.6mm / 42.3 TPI	90°	HSS	MKS-0.6	MKL-0.6	MKR-0.6	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.7mm / 36.3 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.8mm / 31.8 TPI	90°	HSS	MKS-0.8	MKL-0.8	MKR-0.8	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.9mm / 28.2 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.0mm / 25.4 TPI	90°	HSS	MKS-1.0	MKL-1.0	MKR-1.0	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.2mm / 21.2 TPI	90°	HSS	MKS-1.2	MKL-1.2	MKR-1.2	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.5mm / 16.9 TPI	90°	HSS	MKS-1.5	MKL-1.5	MKR-1.5	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.6mm / 15.9 TPI	90°	HSS	MKS-1.6	MKL-1.6	MKR-1.6	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
2.0mm / 12.7 TPI	90°	HSS	MKS-2.0	MKL-2.0	MKR-2.0	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-

MR Series

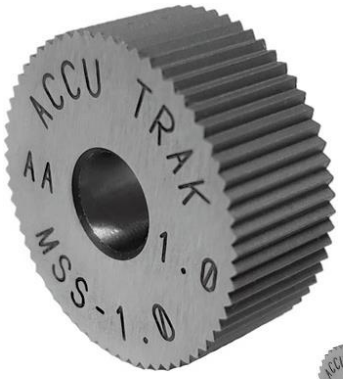
20 x 6 x 6mm
(.787” x .236” x .236”)

- HSS and Hi-Cobalt steel stock options
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.4mm / 63.5 TPI	90°	HSS	MRS-0.4	MRL-0.4	MRR-0.4	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.5mm / 50.8 TPI	90°	HSS	MRS-0.5	MRL-0.5	MRR-0.5	MRC-0.5	MRD-0.5	-	MRF-0.5	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.6mm / 42.3 TPI	90°	HSS	MRS-0.6	MRL-0.6	MRR-0.6	MRC-0.6	MRD-0.6	MRM-0.6	MRF-0.6	-	-
		Hi-Cobalt	-	MRLX0.6	MRRX0.6	-	-	-	-	-	-
0.7mm / 36.3 TPI	90°	HSS	MRS-0.7	MRL-0.7	MRR-0.7	MRC-0.7	MRD-0.7	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.8mm / 31.8 TPI	90°	HSS	MRS-0.8	MRL-0.8	MRR-0.8	MRC-0.8	MRD-0.8	-	-	-	-
		Hi-Cobalt	-	MRLX0.8	MRRX0.8	-	-	-	-	-	-
0.9mm / 28.2 TPI	90°	HSS	MRS-0.9	MRL-0.9	MRR-0.9	MRC-0.9	MRD-0.9	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.0mm / 25.4 TPI	90°	HSS	MRS-1.0	MRL-1.0	MRR-1.0	MRC-1.0	MRD-1.0	-	-	-	-
		Hi-Cobalt	MRSX1.0	-	-	-	-	-	-	-	-
1.1mm / 23.1 TPI	90°	HSS	MRS-1.1	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.2mm / 21.2 TPI	90°	HSS	MRS-1.2	MRL-1.2	MRR-1.2	MRC-1.2	MRD-1.2	-	-	-	MRG-1.2
		Hi-Cobalt	MRSX1.2	-	-	-	-	-	-	-	-
1.3mm / 19.5 TPI	90°	HSS	MRS-1.3	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.4mm / 18.1 TPI	90°	HSS	MRS-1.4	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.5mm / 16.9 TPI	90°	HSS	MRS-1.5	MRL-1.5	MRR-1.5	MRC-1.5	MRD-1.5	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.6mm / 15.9 TPI	90°	HSS	MRS-1.6	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
2.0mm / 12.7 TPI	90°	HSS	MRS-2.0	MRL-2.0	MRR-2.0	-	-	-	-	-	-
		Hi-Cobalt	-	MRLX2.0	MRRX2.0	-	-	-	-	-	-

MS Series

20 x 8 x 6mm
(.787” x .315” x .236”)



- HSS and Hi-Cobalt steel stock options
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.3mm / 84.7 TPI	90°	HSS	MSS-0.3	MSL-0.3	MSR-0.3	MSC-0.3	MSD-0.3	MSM-0.3	MSF-0.3	MSN-0.3	-
		Hi-Cobalt	MSSX0.3		-	-	-	-	MSFX0.3	-	MSGX0.3
0.4mm / 63.5 TPI	90°	HSS	MSS-0.4	MSL-0.4	MSR-0.4	MSC-0.4	MSD-0.4	MSM-0.4	MSF-0.4	MSN-0.4	-
		Hi-Cobalt	MSSX0.4	MSLX0.4	MSRX0.4	-	-	-	-	-	MSGX0.4
0.5mm / 50.8 TPI	90°	HSS	MSS-0.5	MSL-0.5	MSR-0.5	MSC-0.5	MSD-0.5	MSM-0.5	MSF-0.5	MSN-0.5	MSG-0.5
		Hi-Cobalt	MSSX0.5	MSLX0.5	MSRX0.5	MSCX0.5	MSDX0.5	-	MSFX0.5	-	MSGX0.5
0.6mm / 42.3 TPI	90°	HSS	MSS-0.6	MSL-0.6	MSR-0.6	MSC-0.6	MSD-0.6	MSM-0.6	MSF-0.6	MSN-0.6	MSG-0.6
		Hi-Cobalt	MSSX0.6	MSLX0.6	MSRX0.6	MSCX0.6	MSDX0.6	MSMX0.6	MSFX0.6	MSNX0.6	MSGX0.6
0.7mm / 36.3 TPI	90°	HSS	MSS-0.7	MSL-0.7	MSR-0.7	MSC-0.7	MSD-0.7	MSM-0.7	MSF-0.7	MSN-0.7	MSG-0.7
		Hi-Cobalt	MSSX0.7	MSLX0.7	MSRX0.7	MSCX0.7	MSDX0.7	-	-	-	MSGX0.7
0.8mm / 31.8 TPI	90°	HSS	MSS-0.8	MSL-0.8	MSR-0.8	MSC-0.8	MSD-0.8	MSM-0.8	MSF-0.8	MSN-0.8	MSG-0.8
		Hi-Cobalt	MSSX0.8	MSLX0.8	MSRX0.8	MSCX0.8	MSDX0.8	-	MSFX0.8	MSNX0.8	MSGX0.8
0.9mm / 28.2 TPI	90°	HSS	MSS-0.9	MSL-0.9	MSR-0.9	MSC-0.9	MSD-0.9	MSM-0.9	MSF-0.9	MSN-0.9	MSG-0.9
		Hi-Cobalt	MSSX0.9	-	-	MSCX0.9	MSDX0.9	-	MSFX0.9	-	MSGX0.9
1.0mm / 25.4 TPI	90°	HSS	MSS-1.0	MSL-1.0	MSR-1.0	MSC-1.0	MSD-1.0	MSM-1.0	MSF-1.0	MSN-1.0	MSG-1.0
		Hi-Cobalt	MSSX1.0	MSLX1.0	MSRX1.0	MSCX1.0	MSDX1.0	-	MSFX1.0	MSNX1.0	MSGX1.0
1.2mm / 21.2 TPI	90°	HSS	MSS-1.2	MSL-1.2	MSR-1.2	MSC-1.2	MSD-1.2	MSM-1.2	MSF-1.2	MSN-1.2	MSG-1.2
		Hi-Cobalt	MSSX1.2	MSLX1.2	MSRX1.2	MSCX1.2	MSDX1.2	-	-	-	MSGX1.2
1.5mm / 16.9 TPI	90°	HSS	MSS-1.5	MSL-1.5	MSR-1.5	MSC-1.5	MSD-1.5	MSM-1.5	MSF-1.5	MSN-1.5	MSG-1.5
		Hi-Cobalt	MSSX1.5	MSLX1.5	MSRX1.5	MSCX1.5	MSDX1.5	MSMX1.5	MSFX1.5	-	MSGX0.5
1.6mm / 15.9 TPI	90°	HSS	MSS-1.6	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
2.0mm / 12.7 TPI	90°	HSS	MSS-2.0	MSL-2.0	MSR-2.0	MSC-2.0	MSD-2.0	MSM-2.0	MSF-2.0	MSN-2.0	MSG-2.0
		Hi-Cobalt	MSSX2.0	MSLX2.0	MSRX2.0	-	-	MSMX2.0	MSFX2.0	-	MSGX2.0
2.5mm / 10.2 TPI	90°	HSS	MSS-2.5	MSL-2.5	MSR-2.5	MSC-2.5	MSD-2.5	MSM-2.5	-	MSN-2.5	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
3.0mm / 8.5 TPI	90°	HSS	MSS-3.0	MSL-3.0	MSR-3.0	MSC-3.0	MSD-3.0	MSM-3.0	-	MSN-3.0	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-

MU Series

20 x 10 x 6mm
(.787” x .394” x .236”)

- Made from Hi-Cobalt steel material
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.3mm / 84.7 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX0.3	MULX0.3	MURX0.3	MUCX0.3	MUDX0.3	MUMX0.3	MUFX0.3	MUNX0.3	MUGX0.3
0.4mm / 63.5 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX0.4	MULX0.4	MURX0.4	MUCX0.4	MUDX0.4	MUMX0.4	MUFX0.4	MUNX0.4	MUGX0.4
0.5mm / 50.8 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX0.5	MULX0.5	MURX0.5	MUCX0.5	MUDX0.5	MUMX0.5	MUFX0.5	MUNX0.5	MUGX0.5
0.6mm / 42.3 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX0.6	MULX0.6	MURX0.6	MUCX0.6	MUDX0.6	MUMX0.6	MUFX0.6	MUNX0.6	MUGX0.6
0.7mm / 36.3 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX0.7	MULX0.7	MURX0.7	MUCX0.7	MUDX0.7	MUMX0.7	MUFX0.7	MUNX0.7	MUGX0.7
0.8mm / 31.8 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX0.8	MULX0.8	MURX0.8	MUCX0.8	MUDX0.8	MUMX0.8	MUFX0.8	MUNX0.8	MUGX0.8
0.9mm / 28.2 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX0.9	MULX0.9	MURX0.9	MUCX0.9	MUDX0.9	MUMX0.9	MUFX0.9	MUNX0.9	MUGX0.9
1.0mm / 25.4 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX1.0	MULX1.0	MURX1.0	MUCX1.0	MUDX1.0	MUMX1.0	MUFX1.0	MUNX1.0	MUGX1.0
1.2mm / 21.2 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX1.2	MULX1.2	MURX1.2	MUCX1.2	MUDX1.2	MUMX1.2	MUFX1.2	MUNX1.2	MUGX1.2
1.5mm / 16.9 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX1.5	MULX1.5	MURX1.5	MUCX1.5	MUDX1.5	MUMX1.5	MUFX1.5	MUNX1.5	MUGX1.5
2.0mm / 12.7 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX2.0	MULX2.0	MURX2.0	MUCX2.0	MUDX2.0	MUMX2.0	MUFX2.0	MUNX2.0	MUGX2.0
2.5mm / 10.2 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX2.5	MULX2.5	MURX2.5	-	-	-	-	-	-
3.0mm / 8.5 TPI	90°	HSS	-	-	-	-	-	-	-	-	-
		Hi-Cobalt	MUSX3.0	-	-	-	-	-	-	-	-

MW Series

25 x 8 x 6mm
(.984” x .315” x .236”)

- Made from HSS material
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female
0.3mm / 84.7 TPI	90°	HSS	MWS-0.3	MWL-0.3	MWR-0.3	MWC-0.3	MWD-0.3	-	MWF-0.3	-	MWG-0.3
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.4mm / 63.5 TPI	90°	HSS	MWS-0.4	MWL-0.4	MWR-0.4	MWC-0.4	MWD-0.4	-	MWF-0.4	-	MWG-0.4
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.5mm / 50.8 TPI	90°	HSS	MWS-0.5	MWL-0.5	MWR-0.5	MWC-0.5	MWD-0.5	-	MWF-0.5	-	MWG-0.5
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.6mm / 42.3 TPI	90°	HSS	MWS-0.6	MWL-0.6	MWR-0.6	MWC-0.6	MWD-0.6	-	MWF-0.6	-	MWG-0.6
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.7mm / 36.3 TPI	90°	HSS	MWS-0.7	MWL-0.7	MWR-0.7	MWC-0.7	MWD-0.7	-	MWF-0.7	-	MWG-0.7
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.8mm / 31.8 TPI	90°	HSS	MWS-0.8	MWL-0.8	MWR-0.8	MWC-0.8	MWD-0.8	MWM-0.8	MWF-0.8	MWN-0.8	MWG-0.8
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
0.9mm / 28.2 TPI	90°	HSS	MWS-0.9	MWL-0.9	MWR-0.9	MWC-0.9	MWD-0.9	-	MWF-0.9	-	MWG-0.9
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.0mm / 25.4 TPI	90°	HSS	MWS-1.0	MWL-1.0	MWR-1.0	MWC-1.0	MWD-1.0	MWM-1.0	MWF-1.0	MWN-1.0	MWG-1.0
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.2mm / 21.2 TPI	90°	HSS	MWS-1.2	MWL-1.2	MWR-1.2	MWC-1.2	MWD-1.2	MWM-1.2	MWF-1.2	MWN-1.2	MWG-1.2
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.5mm / 16.9 TPI	90°	HSS	MWS-1.5	MWL-1.5	MWR-1.5	MWC-1.5	MWD-1.5	MWM-1.5	MWF-1.5	MWN-1.5	MWG-1.5
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.6mm / 15.9 TPI	90°	HSS	MWS-1.6	MWL-1.6	MWR-1.6	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
1.8mm / 14.1 TPI	90°	HSS	MWS-1.8	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
2.0mm / 12.7 TPI	90°	HSS	MWS-2.0	MWL-2.0	MWR-2.0	MWC-2.0	MWD-2.0	MWM-2.0	MWF-2.0	MWN-2.0	MWG-2.0
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
2.5mm / 10.2 TPI	90°	HSS	MWS-2.5	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-
3.0mm / 8.5 TPI	90°	HSS	MWS-3.0	-	-	-	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-	-	-	-	-

W2 Series

1/2” x 1/4” x 1/4, 3/8”
(12.70 x 6.35 x 6.35, 9.53mm)

- Made from Hi-Cobalt steel material
- 45° Beveled Edges
- Standard stock TiN Coated
- For use in “up to shoulder” applications
- 5/32” Work face

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	GE 30° Male	GV 30° Female
16 TPI / 1.59mm	90°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX216	W2LX216	W2RX216	-	-
20 TPI / 1.27mm	90°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX220	W2LX220	W2RX220	-	-
25 TPI / 1.02mm	90°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX225	W2LX225	W2RX225	-	-
30 TPI / 0.85mm	90°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX230	W2LX230	W2RX230	-	-
35 TPI / 0.73mm	90°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX235	W2LX235	W2RX235	-	-
40 TPI / 0.64mm	90°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX240	W2LX240	W2RX240	-	-
50 TPI / 0.51mm	90°	HSS	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-
50 TPI / 0.51mm	70°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX450	W2LX450	W2RX450	-	-
60 TPI / 0.42mm	70°	HSS	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-
70 TPI / 0.36mm	70°	HSS	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-
80 TPI / 0.32mm	70°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX480	W2LX480	W2RX480	-	-
90 TPI / 0.28mm	70°	HSS	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-
100 TPI / 0.25mm	70°	HSS	-	-	-	-	-
		Hi-Cobalt	-	-	-	-	-
64 DP	80°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX064	W2LX064	W2RX064	-	-
96 DP	80°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX 096	W2LX096	W2RX096	-	-
128 DP	80°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX128	W2LX128	W2RX128	-	-
160 DP	80°	HSS	-	-	-	-	-
		Hi-Cobalt	W2SX160	W2LX160	W2RX160	-	-

ML Series

20 x 8 x 10, 12mm
(.787” x .315” x .394”, .472”)

- Made from HSS material
- 45° Beveled Edges
- Coatings and Treatments per customer request
- For “up to shoulder” applications

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	GE 30° Male	GV 30° Female
0.3mm / 84.7 TPI	90°	HSS	MLS-0.3	-	-	-	MLF-0.3
		Hi-Cobalt	-	-	-	-	-
0.4mm / 63.5 TPI	90°	HSS	MLS-0.4	MLL-0.4	MLR-0.4	-	MLF-0.4
		Hi-Cobalt	-	-	-	-	-
0.5mm / 50.8 TPI	90°	HSS	MLS-0.5	MLL-0.5	MLR-0.5	-	MLF-0.5
		Hi-Cobalt	-	-	-	-	-
0.6mm / 42.3 TPI	90°	HSS	MLS-0.6	MLL-0.6	MLR-0.6	-	MLF-0.6
		Hi-Cobalt	-	-	-	-	-
0.7mm / 36.3 TPI	90°	HSS	MLS-0.7	-	-	-	-
		Hi-Cobalt	-	-	-	-	-
0.8mm / 31.8 TPI	90°	HSS	MLS-0.8	MLL-0.8	MLR-0.8	-	MLF-0.8
		Hi-Cobalt	-	-	-	-	-
0.9mm / 28.2 TPI	90°	HSS	-	MLL-0.9	MLR-0.9	-	MLF-0.9
		Hi-Cobalt	-	-	-	-	-
1.0mm / 25.4 TPI	90°	HSS	MLS-1.0	MLL-1.0	MLR-1.0	-	MLF-1.0
		Hi-Cobalt	-	-	-	-	-
1.2mm / 21.2 TPI	90°	HSS	MLS-1.2	MLL-1.2	MLR-1.2	-	MLF-1.2
		Hi-Cobalt	-	-	-	-	-
1.5mm / 16.9 TPI	90°	HSS	MLS-1.5	MLL-1.5	MLR-1.5	-	MLF-1.5
		Hi-Cobalt	-	-	-	-	-
1.6mm / 15.9 TPI	90°	HSS	MLS-1.6	MLL-1.6	MLR-1.6	-	-
		Hi-Cobalt	-	-	-	-	-
1.8mm / 14.1 TPI	90°	HSS	MLS-1.8	MLL-1.8	MLR-1.8	-	-
		Hi-Cobalt	-	-	-	-	-
2.0mm / 12.7 TPI	90°	HSS	MLS-2.0	MLL-2.0	MLR-2.0	-	MLF-2.0
		Hi-Cobalt	-	-	-	-	-

EPV Series

1/2” x 3/16” x 3/16”
(12.70 x 4.76 x 4.76mm)

- Made from Hi-Cobalt steel material
- Radius full form reliefs
- Standard stock FNC treated
- Optimal for axial feeding

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal
16 TPI / 1.59mm	90°	Hi-Cobalt	EPSV216	EPLV216	EPRV216	-	-
20 TPI / 1.27mm	90°	Hi-Cobalt	EPSV220	EPLV220	EPRV220	-	-
21 TPI / 1.21mm	90°	Hi-Cobalt	EPSV221	-	-	-	-
25 TPI / 1.02mm	90°	Hi-Cobalt	EPSV225	EPLV225	EPRV225	-	-
30 TPI / 0.85mm	90°	Hi-Cobalt	EPSV230	EPLV230	EPRV230	-	-
32 TPI / 0.79mm	90°	Hi-Cobalt	EPSV232	-	-	-	-
35 TPI / 0.73mm	90°	Hi-Cobalt	EPSV235	EPLV235	EPRV235	-	-
40 TPI / 0.64mm	90°	Hi-Cobalt	EPSV240	EPLV240	EPRV240	-	-
50 TPI / 0.51mm	90°	Hi-Cobalt	EPSV250	-	-	-	-
35 TPI / 0.73mm	70°	Hi-Cobalt	EPSV435	-	-	-	-
50 TPI / 0.51mm	70°	Hi-Cobalt	EPSV450	EPLV450	EPRV450	-	-
53 TPI / 0.48mm	70°	Hi-Cobalt	EPSV453	-	-	-	-
60 TPI / 0.42mm	70°	Hi-Cobalt	EPSV460	EPLV460	EPRV460	-	-
80 TPI / 0.32 mm	70°	Hi-Cobalt	EPSV480	EPLV480	EPRV480	-	-
64 DP	80°	Hi-Cobalt	EPSV064	EPLV064	EPRV064	-	-
96 DP	80°	Hi-Cobalt	EPSV096	EPLV096	EPRV096	-	-
128 DP	80°	Hi-Cobalt	EPSV128	EPLV128	EPRV128	-	-
160 DP	80°	Hi-Cobalt	EPSV160	EPLV160	EPRV160	-	-

Ferritic Nitrocarburizing (FNC) is a case hardening process which diffuses nitrogen and carbon into ferrous metals. This improves the fatigue properties as well as corrosion resistance giving the dies better tool life in a majority of cases.

Disclaimer:
There may be some variation in appearance of FNC treated knurls. This is normal and all the knurls will function the same.

GKV Series

5/8” x 1/4” x 1/4”
(15.88 x 6.35 x 6.35mm)

- Made from Hi-Cobalt steel material
- Radius full form reliefs
- Standard stock FNC treated
- Optimal for axial feeding

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal
12 TPI / 2.12mm	90°	Hi-Cobalt	GKSV212	GKLV212	GKRV212	-	-
14 TPI / 1.81mm	90°	Hi-Cobalt	GKSV214	-	-	-	-
16 TPI / 1.59mm	90°	Hi-Cobalt	GKSV216	GKLV216	GKRV216	-	-
20 TPI / 1.27mm	90°	Hi-Cobalt	GKSV220	GKLV220	GKRV220	-	-
25 TPI / 1.02mm	90°	Hi-Cobalt	GKSV225	GKLV225	GKRV225	-	-
30 TPI / 0.85mm	90°	Hi-Cobalt	GKSV230	GKLV230	GKRV230	-	-
32 TPI / 0.79mm	90°	Hi-Cobalt	GKSV232	-	-	-	-
35 TPI / 0.73mm	90°	Hi-Cobalt	GKSV235	GKLV235	GKRV235	-	-
40 TPI / 0.64mm	90°	Hi-Cobalt	GKSV240	GKLV240	GKRV240	-	-
50 TPI / 0.51mm	90°	Hi-Cobalt	GKSV250	-	-	-	-
50 TPI / 0.51mm	70°	Hi-Cobalt	GKSV450	GKLV450	GKRV450	-	-
80 TPI / 0.32 mm	70°	Hi-Cobalt	GKSV480	GKLV480	GKRV480	-	-
64 DP	80°	Hi-Cobalt	GKSV064	GKLV064	GKRV064	-	-
96 DP	80°	Hi-Cobalt	GKSV096	GKLV096	GKRV096	-	-
128 DP	80°	Hi-Cobalt	GKSV128	GKLV128	GKRV128	-	-
160 DP	80°	Hi-Cobalt	GKSV160	GKLV160	GKRV160	-	-

Ferritic Nitrocarburizing (FNC) is a case hardening process which diffuses nitrogen and carbon into ferrous metals. This improves the fatigue properties as well as corrosion resistance giving the dies better tool life in a majority of cases.

Disclaimer:
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KNV Series

3/4” x 1/4” x 1/4”
(19.05 x 9.53 x 6.35mm)

- Made from Hi-Cobalt steel material
- Radius full form reliefs
- Standard stock FNC treated
- Optimal for axial feeding

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal
16 TPI / 1.59mm	90°	Hi-Cobalt	KNSV216	KNLV216	KNRV216	-	-
20 TPI / 1.27mm	90°	Hi-Cobalt	KNSV220	KNLV220	KNRV220	-	-
25 TPI / 1.02mm	90°	Hi-Cobalt	KNSV225	KNLV225	KNRV225	-	-
30 TPI / 0.85mm	90°	Hi-Cobalt	KNSV230	KNLV230	KNRV230	-	-
35 TPI / 0.73mm	90°	Hi-Cobalt	KNSV235	KNLV235	KNRV235	-	-
40 TPI / 0.64mm	90°	Hi-Cobalt	KNSV240	KNLV240	KNRV240	-	-
50 TPI / 0.51mm	70°	Hi-Cobalt	KNSV450	KNLV450	KNRV450	-	-
64 DP	80°	Hi-Cobalt	KNSV064	KNLV064	KNRV064	-	-
96 DP	80°	Hi-Cobalt	KNSV096	KNLV096	KNRV096	-	-
128 DP	80°	Hi-Cobalt	KNSV128	KNLV128	KNRV128	-	-
160 DP	80°	Hi-Cobalt	KNSV160	KNLV160	KNRV160	-	-

Ferritic Nitrocarburizing (FNC) is a case hardening process which diffuses nitrogen and carbon into ferrous metals. This improves the fatigue properties as well as corrosion resistance giving the dies better tool life in a majority of cases.

Disclaimer:
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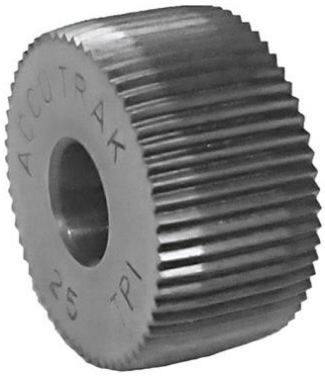
KPV Series

3/4” x 3/8” x 1/4”
(19.05 x 9.53 x 6.35mm)



- Made from Hi-Cobalt steel material
- Radius full form reliefs
- Standard stock FNC treated
- Optimal for axial feeding

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal
6 TPI / 4.23mm	90°	Hi-Cobalt	KPSV206	-	-	-	-
8 TPI / 3.18mm	90°	Hi-Cobalt	KPSV208	KPLV208	KPRV208	-	-
10 TPI / 2.54mm	90°	Hi-Cobalt	KPSV210	KPLV210	KPRV210	-	-
12 TPI / 2.12mm	90°	Hi-Cobalt	KPSV212	KPLV212	KPRV212	-	-
14 TPI / 1.81mm	90°	Hi-Cobalt	KPSV214	KPLV214	KPRV214	-	-
16 TPI / 1.59mm	90°	Hi-Cobalt	KPSV216	KPLV216	KPRV216	-	-
20 TPI / 1.27mm	90°	Hi-Cobalt	KPSV220	KPLV220	KPRV220	-	-
21 TPI / 1.21mm	90°	Hi-Cobalt	KPSV221	KPLV221	KPRV221	-	-
25 TPI / 1.02mm	90°	Hi-Cobalt	KPSV225	KPLV225	KPRV225	-	-
30 TPI / 0.85mm	90°	Hi-Cobalt	KPSV230	KPLV230	KPRV230	-	-
32 TPI / 0.79mm	90°	Hi-Cobalt	KPSV232	-	-	-	-
33 TPI / 0.77mm	90°	Hi-Cobalt	KPSV233	KPLV233	KPRV233	-	-
35 TPI / 0.73mm	90°	Hi-Cobalt	KPSV235	KPLV235	KPRV235	-	-
40 TPI / 0.64mm	90°	Hi-Cobalt	KPSV240	KPLV240	KPRV240	-	-
47 TPI / 0.54mm	90°	Hi-Cobalt	KPSV247	-	-	-	-
50 TPI / 0.51mm	70°	Hi-Cobalt	KPSV450	KPLV450	KPRV450	-	-
80 TPI / 0.32 mm	70°	Hi-Cobalt	KPSV480	KPLV480	KPRV480	-	-
64 DP	80°	Hi-Cobalt	KPSV064	KPLV064	KPRV064	-	-
96 DP	80°	Hi-Cobalt	KPSV096	KPLV096	KPRV096	-	-
128 DP	80°	Hi-Cobalt	KPSV128	KPLV128	KPRV128	-	-
160 DP	80°	Hi-Cobalt	KPSV160	KPLV160	KPRV160	-	-

Ferritic Nitrocarburizing (FNC) is a case hardening process which diffuses nitrogen and carbon into ferrous metals. This improves the fatigue properties as well as corrosion resistance giving the dies better tool life in a majority of cases.

Disclaimer:
There may be some variation in appearance of FNC treated knurls. This is normal and all the knurls will function the same.

PHV Series

1-1/4” x 1/2” x 1/2”
(31.75 x 12.70 x 12.70mm)

- Made from Hi-Cobalt steel material
- Radius full form relief
- Standard stock FNC treated
- Optimal for axial feeding

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal
8 TPI / 3.18mm	90°	Hi-Cobalt	PHSV208	PHLV208	PHRV208	-	-
10 TPI / 2.54mm	90°	Hi-Cobalt	PHSV210	PHLV210	PHRV210	-	-
12 TPI / 2.12mm	90°	Hi-Cobalt	PHSV212	PHLV212	PHRV212	-	-
14 TPI / 1.81mm	90°	Hi-Cobalt	PHSV214	PHLV214	PHRV214	-	-
16 TPI / 1.59mm	90°	Hi-Cobalt	PHSV216	PHLV216	PHRV216	-	-
20 TPI / 1.27mm	90°	Hi-Cobalt	PHSV220	PHLV220	PHRV220	-	-
21 TPI / 1.21mm	90°	Hi-Cobalt	-	PHLV221	PHRV221	-	-
25 TPI / 1.02mm	90°	Hi-Cobalt	PHSV225	PHLV225	PHRV225	-	-
30 TPI / 0.85mm	90°	Hi-Cobalt	PHSV230	PHLV230	PHRV230	-	-
33 TPI / 0.77mm	90°	Hi-Cobalt	-	PHLV233	PHRV233	-	-
40 TPI / 0.64mm	90°	Hi-Cobalt	PHSV240	-	-	-	-
50 TPI / 0.51mm	70°	Hi-Cobalt	PHSV450	PHLV450	PHRV450	-	-
80 TPI / 0.32 mm	70°	Hi-Cobalt	PHSV480	PHLV480	PHRV480	-	-
64 DP	80°	Hi-Cobalt	PHSV064	PHLV064	PHRV064	-	-
96 DP	80°	Hi-Cobalt	PHSV096	PHLV096	PHRV096	-	-
128 DP	80°	Hi-Cobalt	PHSV128	PHLV128	PHRV128	-	-
160 DP	80°	Hi-Cobalt	PHSV160	PHLV160	PHRV160	-	-

Ferritic Nitrocarburizing (FNC) is a case hardening process which diffuses nitrogen and carbon into ferrous metals. This improves the fatigue properties as well as corrosion resistance giving the dies better tool life in a majority of cases.

Disclaimer:
There may be some variation in appearance of FNC treated knurls. This is normal and all the knurls will function the same.

MRV Series

20 x 6 x 6mm
(.787” x .236” x .236”)

- Made from Hi-Cobalt steel material
- Radius full form relief
- Standard stock FNC treated
- Optimal for axial feeding

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal	BR 30° RH Diagonal	BL 45° LH Diagonal	BR 45° RH Diagonal
0.4mm / 63.5 TPI	90°	Hi-Cobalt	MRSV0.4	MRLV0.4	MRRV0.4	MRCV0.4	MRDV0.4
0.5mm / 50.8 TPI	90°	Hi-Cobalt	MRSV0.5	MRLV0.5	MRRV0.5	MRCV0.5	MRDV0.5
0.6mm / 42.3 TPI	90°	Hi-Cobalt	MRSV0.6	MRLV0.6	MRRV0.6	MRCV0.6	MRDV0.6
0.7mm / 36.3 TPI	90°	Hi-Cobalt	MRSV0.7	-	-	MRCV0.7	MRDV0.7
0.8mm / 31.8 TPI	90°	Hi-Cobalt	MRSV0.8	MRLV0.8	MRRV0.8	MRCV0.8	MRDV0.8
1.0mm / 25.4 TPI	90°	Hi-Cobalt	MRSV1.0	MRLV1.0	MRRV1.0	MRCV1.0	MRDV1.0
1.2mm / 21.2 TPI	90°	Hi-Cobalt	MRSV1.2	MRLV1.2	MRRV1.2	MRCV1.2	MRDV1.2
1.5mm / 16.9 TPI	90°	Hi-Cobalt	MRSV1.5	MRLV1.5	MRRV1.5	MRCV1.5	MRDV1.5
1.6mm / 15.9 TPI	90°	Hi-Cobalt	MRSV1.6	MRLV1.6	MRRV1.6	MRCV1.6	MRDV1.6
2.0mm / 12.7 TPI	90°	Hi-Cobalt	MRSV2.0	MRLV2.0	MRRV2.0	MRCV2.0	MRDV2.0

Ferritic Nitrocarburizing (FNC) is a case hardening process which diffuses nitrogen and carbon into ferrous metals. This improves the fatigue properties as well as corrosion resistance giving the dies better tool life in a majority of cases.

Disclaimer:
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Armstrong Series

- Made from HSS and Hi-Cobalt steel material
- 45° Beveled Edges
- Two knurls per set (as illustrated)
- Coatings and Treatments per customer request

Size: 5/8” x 5/16” x 7/32” (GR)

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal
14 TPI / 1.81mm	90°	HSS	KS GR14	KD GR14
		Hi-Cobalt	-	-
21 TPI / 1.21mm	90°	HSS	KS GR21	KD GR21
		Hi-Cobalt	-	-
33 TPI / 0.77mm	90°	HSS	KS GR33	KD GR33
		Hi-Cobalt	-	-

Size: 3/4” x 3/8” x 1/4” (KP)

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal
14 TPI / 1.81mm	90°	HSS	KS KP14	KD KP14
		Hi-Cobalt	KS KP14X	KD KP14X
21 TPI / 1.21mm	90°	HSS	KS KP21	KD KP21
		Hi-Cobalt	KS KP21X	KD KP21X
33 TPI / 0.77mm	90°	HSS	KS KP33	KD KP33
		Hi-Cobalt	KS KP33X	KD KP33X

Size: 1” x 3/8” x 5/16” (OU)

Pitch	Tooth Form	Steel Type	AA Straight	BL 30° LH Diagonal
14 TPI / 1.81mm	90°	HSS	KS OU14	KD OU14
		Hi-Cobalt	-	-
21 TPI / 1.21mm	90°	HSS	KS OU21	KD OU21
		Hi-Cobalt	-	-
33 TPI / 0.77mm	90°	HSS	KS OU33	KD OU33
		Hi-Cobalt	-	-

Conical Knurls

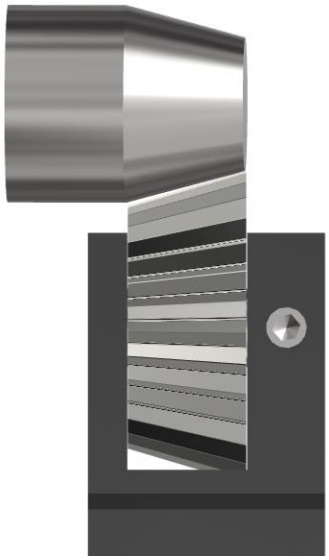


Figure 1: Poor
Only Suitable for pitch change less than 10%

Figure 2: Good
Only Suitable for pitch change less than 20%

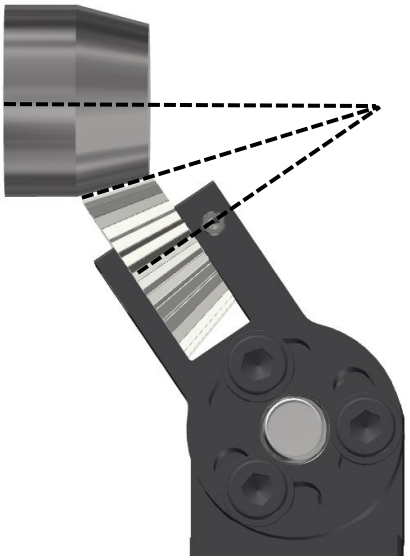


Figure 3: Ideal
Will produce the best result

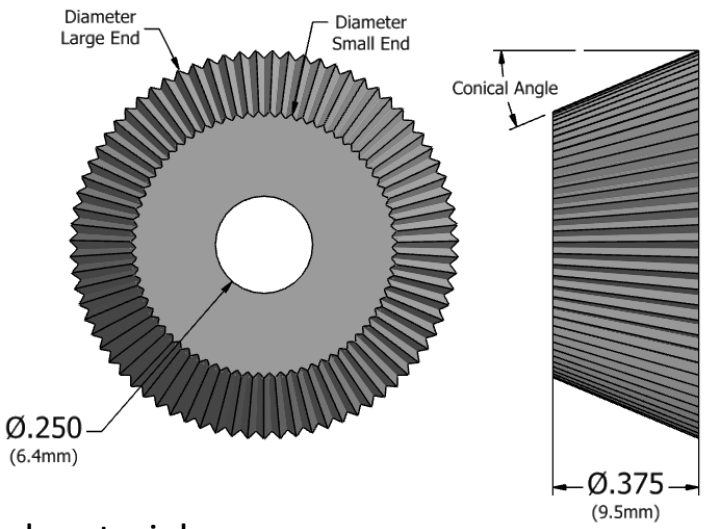
When Conical or Face knurling there is one important aspect to be aware of, and that is as the diameter changes along your workface the pitch does as well. Depending on the amount of pitch change, a few different tooling methods can be used. Though the images above show examples of a conical work piece, the same principles apply for face knurling.

Figure 1 shows the first method, and often produces the worst results. As stated, it is generally suitable up to a pitch change of 10%, however the form itself suffers quite a bit. When knurling on a conical surface or face of the part, even though the diameter changes the number of teeth remains constant which gives the pitch change. The poor quality of teeth occurs due to the fact that you are using the incorrect pitch at any given diameter along your workface. To put numbers to it, if you look at a 1” diameter with a 25 TPI knurl pattern you will have 78 Teeth. Using the method in Figure 1 would be like trying to use a 20 TPI knurl to roll the same 78 Teeth. Geometrically speaking it cannot be done and the geometry of the tooth no longer remains a consistent form down the entire workface. Now as long as the pitch change is small enough, these alterations to the tooth form can be negligible but as the pitch change becomes greater it is no longer the case. Generally speaking, method 1 is not a good selection no matter the pitch change if you are looking to mate another knurled part with it.

Figure 2 shows the second method, which involves using a cylindrical knurl that has the same pitch as the average desired on your part. This means if the large end of your part was 1” and the small end was .75” and required 50 teeth on it, the pitch of the knurl used would be that at a diameter of .875” (which would be 18 TPI). This makes the variation in the tooth form much smaller than method 1, meaning you can use it for a larger “pitch change” range.

Figure 3 shows the third method, which is considered the ideal as its intent is to match the proper pitch with the correct diameter on the entire work face. This method will keep the pitch and tooth depth change consistent along the entire part which will aesthetically and functionally give the best result. This is achieved due to the centerlines of the knurl/part and the line along the workface all converging on the same vertex. This means the rate of pitch change on your part and knurl are the same which results in the correct Diameter/pitch relationship when rolling. It is also the desired method to use when it is necessary for parts to mate with the knurled tooth form.

Conical Knurls

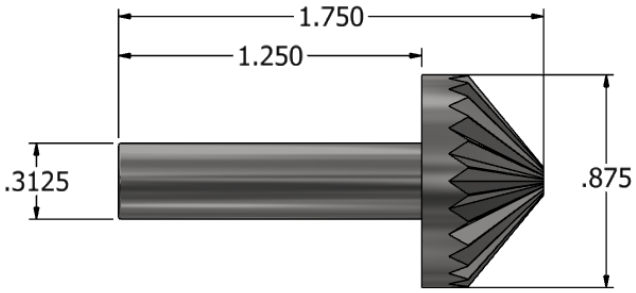


- Made from HSS steel material
- Coatings and Treatments per Customer request

Tool Number	# Teeth	Conical Angle		Diameter (in/mm)		Pitch (TPI/mm)	
		Root	Crest	Small End	Large End	Small End	Large End
KT 15F	125	15°	15.34°	.794 / 20.2	1.000 / 25.4	50.1 / 0.51	39.8 / 0.64
KT 15M	78	15°	15.56°	.791 /20.1	1.000 / 25.4	31.4 / 0.81	24.8 / 1.02
KT 15C	31	15°	16.56°	.777 /19.7	1.000 / 25.4	12.7 / 2.0	9.9 / 2.57
KT 22F	125	22°	22.47°	.690 / 17.5	1.000 / 25.4	57.7 / 0.44	39.8 / 0.64
KT 22MF	100	22°	22.57°	.688 / 17.5	1.000 / 25.4	46.2 / 0.55	31.8 / 0.80
KT 22MMF	89	22°	22.79°	.685 / 17.4	1.000 / 25.4	41.4 / 0.61	28.3 / 0.88
KT 22M	78	22°	22.78°	.685 / 17.4	1.000 / 25.4	36.2 / 0.70	24.8 / 1.02
KT 22MMC	64	22°	23.11°	.680 / 17.3	1.000 / 25.4	30.0 / 0.85	20.4 / 1.25
KT 22MC	50	22°	23.24°	.678 / 17.2	1.000 / 25.4	23.5 / 1.08	15.9 / 1.60
KT 22C	31	22°	24.15°	.664 / 16.9	1.000 / 25.4	14.9 / 1.70	9.9 / 2.57
KT 30F	125	30°	30.58°	.557 / 14.1	1.000 / 25.4	71.5 / 0.36	39.8 / 0.64
KT 30M	78	30°	30.97°	.550 / 14.0	1.000 / 25.4	45.2 / 0.56	24.8 / 1.02
KT 30C	31	30°	32.65°	.519 / 13.2	1.000 / 25.4	19.0 / 1.34	9.9 / 2.57

Note: All of the 22° angle wheels are designed for rolling windscreen wiper shafts in our 3 die holders with special die tool blocks (or "SWS" swivel holders). Email or call us at 800-433-4933 or 508-892-1787 for more

Standard Shank Conical Knurls



Above: Standard Shank Conical

- Made from HSS and Hi-Cobalt steel
- 45° Conical Angle
- Standard stock FNC Treated

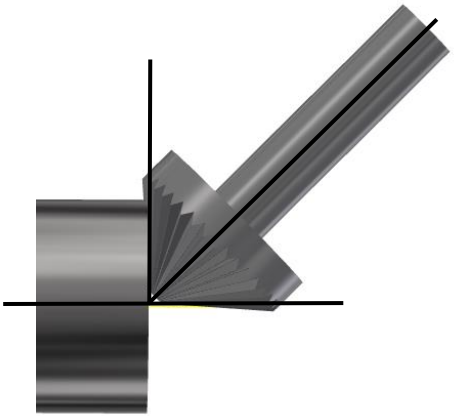
Pitch	# Teeth	Tooth Form	Steel Type	Tool #
Fine	72	90°	HSS	KT FINE
			Hi-Cobalt	KT XF
Med-Fine	60	90°	HSS	KT MF
			Hi-Cobalt	KT XMF
Medium	48	90°	HSS	KT MEDIUM
			Hi-Cobalt	KT XM
Med-Coarse	36	90°	HSS	KT MC
			Hi-Cobalt	KT XMC
Coarse	24	90°	HSS	KT COARSE
			Hi-Cobalt	KT XC

Ferritic Nitrocarburizing (FNC) is a case hardening process which diffuses nitrogen and carbon into ferrous metals. This improves the fatigue properties as well as corrosion resistance giving the dies better tool life in a majority of cases.

Disclaimer:
There may be some variation in appearance of FNC treated knurls. This is normal and all the knurls will function the same.

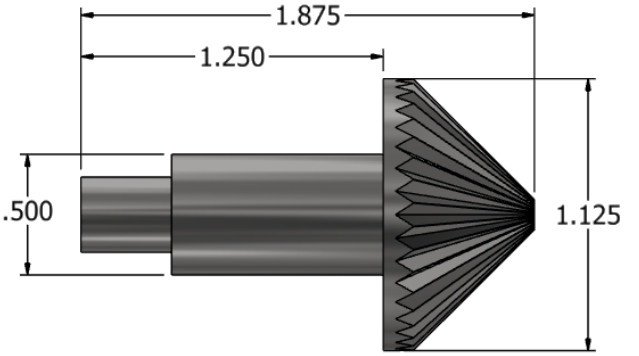
TPI rolled on Part

Part OD	Ideal Die Contact Point	TPI at Contact point				
		Fine 72 T	Med-Fine 60T	Medium 60T	Med-Coarse 36T	Coarse 24T
0.25	0.177	130 TPI	108 TPI	87 TPI	65 TPI	43 TPI
0.5	0.353	65 TPI	54 TPI	43 TPI	32 TPI	22 TPI
0.75	0.53	43 TPI	36 TPI	29 TPI	22 TPI	14 TPI
1	0.707	32 TPI	27 TPI	22 TPI	16 TPI	11 TPI
1.237	0.875	26 TPI	22 TPI	17 TPI	13 TPI	9 TPI
1.591	1.125	20 TPI	17 TPI	14 TPI	10 TPI	7 TPI
Approx. # Teeth Rolled with tip at center		102T	85T	68T	51T	34T



Above is a representation of the ideal tool contact. The centerlines, part workface, and root of the tool all converge to the same point.

Heavy Duty Shank Conical Knurls



Above: Heavy Duty Shank Conical

- Made from HSS and Hi-Cobalt steel
- 45° Conical Angle
- Standard Stock FNC treated

Pitch	# Teeth	Tooth Form	Steel Type	Tool #
Fine	72	90°	HSS	KT HDF
			Hi-Cobalt	KTHDXF
Med-Fine	60	90°	HSS	KT HDMF
			Hi-Cobalt	KT HDXMF
Medium	48	90°	HSS	KT HDM
			Hi-Cobalt	KT HDXM
Med-Coarse	36	90°	HSS	KT HDMC
			Hi-Cobalt	KT HDXMC
Coarse	24	90°	HSS	K HDC
			Hi-Cobalt	KT HDXC

Ferritic Nitrocarburizing (FNC) is a case hardening process which diffuses nitrogen and carbon into ferrous metals. This improves the fatigue properties as well as corrosion resistance giving the dies better tool life in a majority of cases.

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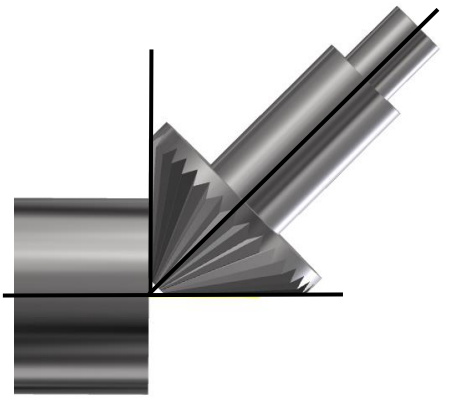
TPI rolled on Part

Part OD	Ideal Die Contact Point	TPI at Contact point				
		Fine 72 T	Med-Fine 60T	Medium 60T	Med-Coarse 36T	Coarse 24T
0.25	0.177	130 TPI	108 TPI	87 TPI	65 TPI	43 TPI
0.5	0.353	65 TPI	54 TPI	43 TPI	32 TPI	22 TPI
0.75	0.53	43 TPI	36 TPI	29 TPI	22 TPI	14 TPI
1	0.707	32 TPI	27 TPI	22 TPI	16 TPI	11 TPI
1.237	0.875	26 TPI	22 TPI	17 TPI	13 TPI	9 TPI
1.591	1.125	20 TPI	17 TPI	14 TPI	10 TPI	7 TPI
Approx. # Teeth Rolled with tip at center		102T	85T	68T	51T	34T



Above is a representation of the ideal tool contact. The centerlines, part workface, and root of the tool all converge to the same point.

Single Wheel Bump Holders

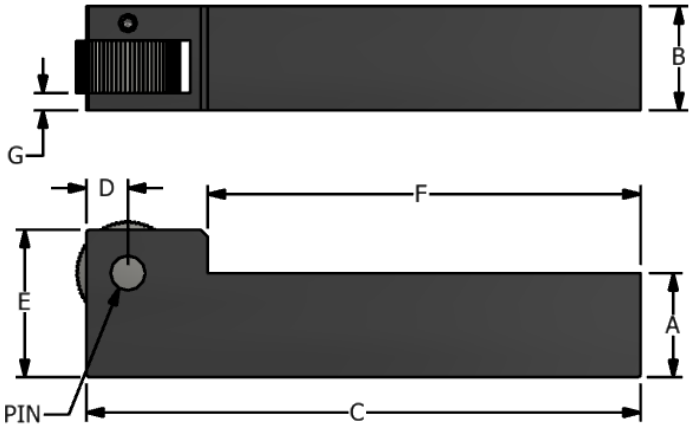
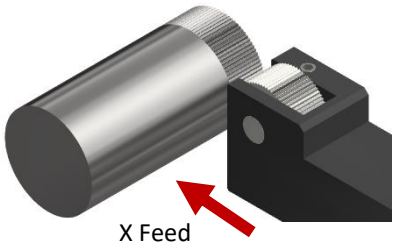
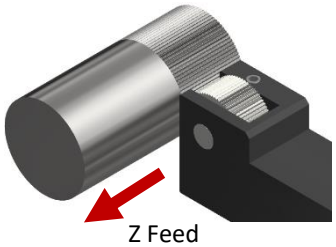


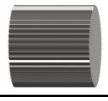
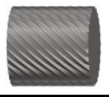
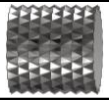
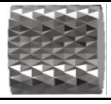
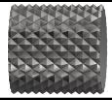
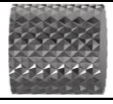
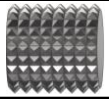
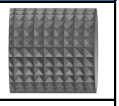
Figure above is a Right-Hand Holder



X Feed
(Radial)



Z Feed
(Axial)

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°	RKE	RKV
Knurl form on part											
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°	KV	KE
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X	X	X	X	X	X

Inch Series

Right Hand Holder	Left Hand Holder	Knurl Series	Pins	Holder Dimensions (in)						
				A	B	C	D	E	F	G
OR BHBPR	OR BHBPL	BP	C 062	0.312	0.375	4.000	0.125	0.500	3.375	0.050
OR BHBPRA	OR BHBPLA	BP	C 062	0.375	0.375	4.000	0.125	0.610	3.375	0.050
OR BHEPR	OR BHEPL	EP/EPV	C 083	0.500	0.500	3.500	0.180	0.750	2.750	0.093
OR BHEPRB	-	EP/EPV	C 083	0.375	0.375	3.500	0.180	0.625	2.750	0.093
OR BHEQR	OR BHEQL	EQ	C 083	0.500	0.500	3.500	0.180	0.750	2.750	0.093
OR BHGKR	OR BHGKL	GK/GKV/KN/KNV	C 104	0.625	0.625	4.000	0.200	0.940	3.250	0.125
OR BHGKRB	-	GK/GKV/KN/KNV	C 104	0.500	0.625	4.000	0.200	0.750	3.125	0.125
OR BHKNR	-	GK/GKV/KN/KNV	C 124	0.750	0.750	4.500	0.200	1.063	3.500	0.125
OR BHKPR	OR BHKPL	KP/KPV	C 124	0.750	0.750	4.000	0.300	1.063	3.125	0.125
OR BHKPR1	OR BHKPL1	KP/KPV	C 164	1.000	1.000	5.000	0.200	1.313	3.875	0.125
OR BHKRR	OR BHKRL	KR	C 164	0.750	1.000	4.500	0.200	1.063	3.500	0.125
OR BHKRR1	OR BHKRL1	KR	C 164	1.000	1.000	5.000	0.200	1.313	3.875	0.125
OR BHOUR	-	OU	C 165	1.000	1.000	5.000	0.250	1.350	3.875	0.170
OR BHPHR	OR BHPHL	PH/PHV	C 168	1.000	1.000	5.000	0.375	1.500	3.750	0.200
OR BHLKR1	-	2" x 3/4" x 1/2"	C 248	1.000	1.500	6.000	0.325	1.500	4.375	0.250

Single Wheel Bump Holders

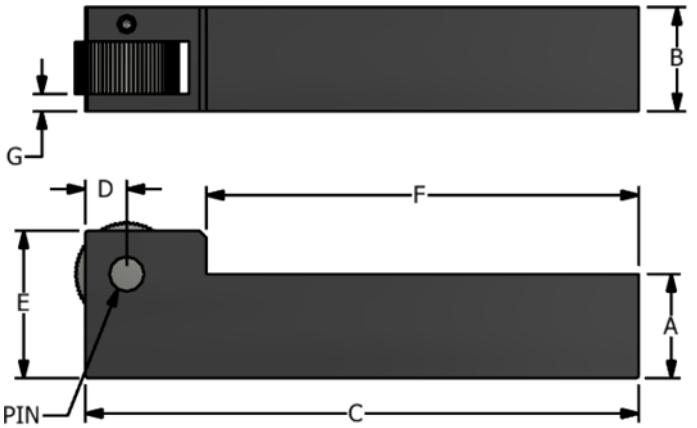


Figure above is a Right-Hand Holder

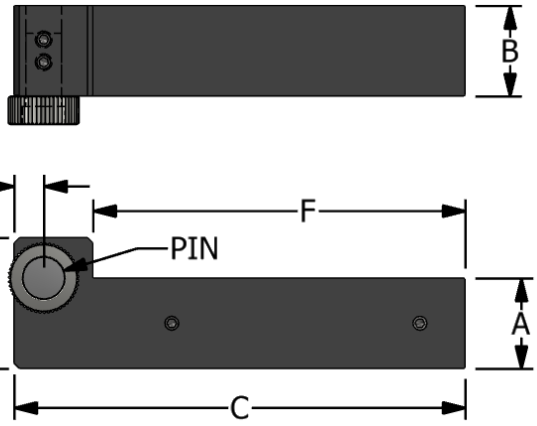
Metric

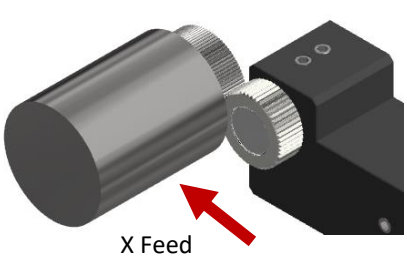
Right Hand Holder	Left Hand Holder	Knurl Series	Pins	Holder Dimensions (mm)						
				A	B	C	D	E	F	G
OR BHM12R	OR BHM12L	MM/MN	C M412	12.0	12.0	90.0	4.0	18.0	70.0	2.5
OR BHN16R	-	MM/MN	C M416	16.0	16.0	100.0	4.8	22.0	80.0	2.5
OR BHQ16R	-	MQ	C M416	16.0	16.0	100.0	4.8	22.0	80.0	3.0
OR BHR16R	OR BHR16L	MR/MRV	C M616	16.0	16.0	100.0	8.0	25.0	80.0	3.0
OR BHR20R	-	MR/MRV	C M620	20.0	20.0	100.0	8.0	28.0	80.0	3.0
OR BHR25R	-	MR/MRV	C M625	25.0	25.0	127.0	4.8	32.0	100.0	3.0
OR BHS20R	OR BHS20L	MS/MW	C M620	20.0	20.0	100.0	6.0	28.0	75.0	3.0
OR BHW25R	-	MS/MW	C M625	25.0	25.0	127.0	10.0	35.0	100.0	3.0
OR BHU25R	-	MU	C M625	25.0	25.0	127.0	4.8	35.0	100.0	3.0

Setup

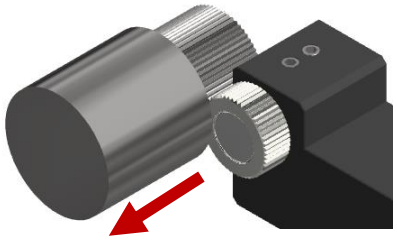
1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the Carbide Pin
3. Insert the appropriate Knurl in the slot of the holder, and then slide the carbide pin back through
4. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

Up to Shoulder Bump Holders



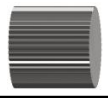
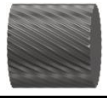
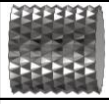
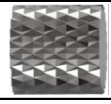
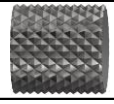
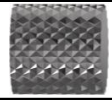
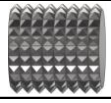
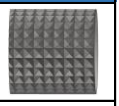


X Feed
(Radial)



Z Feed
(Axial)

Note: By flipping the pin around these holders can be used as either a left-hand holder or right-hand holder

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°	RKE	RKV
Knurl form on part											
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°	KV	KE
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X	X	X	X	X	X

Inch

Tool Number	Knurl Series	Pins	Holder Dimensions (in)					
			A	B	C	D	E	F
OR UTS12	ML	OR UTSP	0.750	0.750	4.000	0.340	1.250	3.125
OR UTS16	ML	OR UTSP	1.000	1.000	5.000	0.340	1.450	3.125

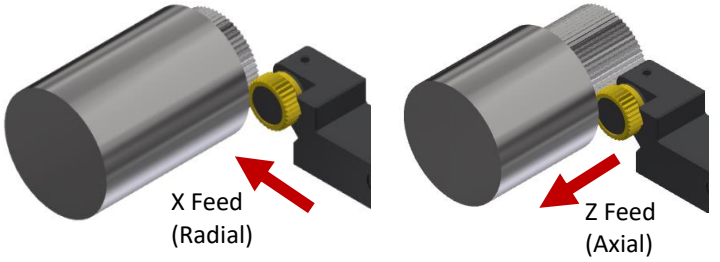
Metric

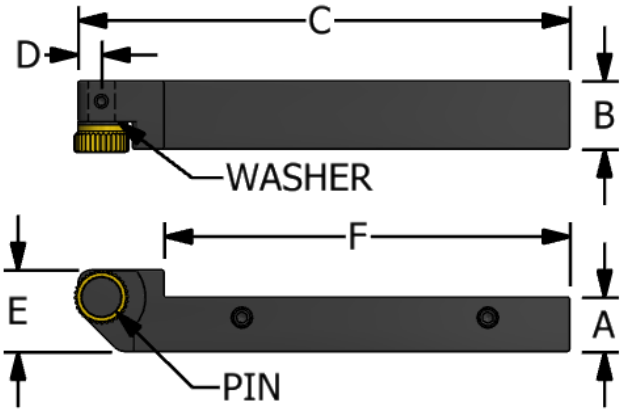
Tool Number	Knurl Series	Pins	Holder Dimensions (mm)					
			A	B	C	D	E	F
OR UTSM16	ML	OR UTSP	16.00	19.05	101.60	8.85	28.50	79.00
OR UTSM20	ML	OR UTSP	20.00	19.05	101.60	7.65	31.00	79.00
OR UTSM25	ML	OR UTSP	25.00	25.40	127.00	7.65	36.00	105.00

Setup

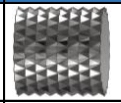
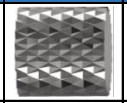
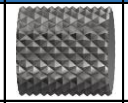
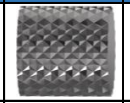
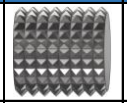
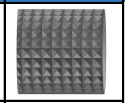
1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the pin
3. Slide the pin through the knurl so the head of the pin is flush with the side of the knurl
4. With the knurl now on the pin, insert the pin back into the holder
5. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

Up to Shoulder Bump Holders





Note: Holders are designed in order to be usable in Swiss Machines

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°	RKE	RKV
Knurl form on part											
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°	KV	KE
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X	X	X	X	X	X

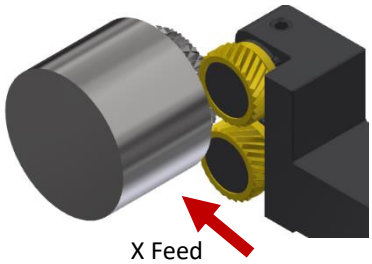
Inch

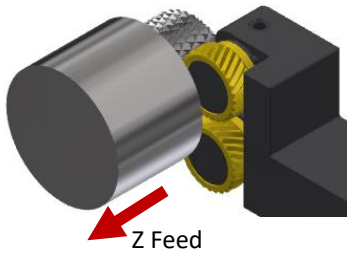
Tool Number	Knurl Series	Pins	Washer	Holder Dimensions (in)					
				A	B	C	D	E	F
OR BW2R08	W2	OR UTSPW2	BL W2	0.500	0.625	4.500	0.215	0.750	3.750
OR BW2R10	W2	OR UTSPW2	BL W2	0.625	0.625	4.500	0.215	0.875	3.750

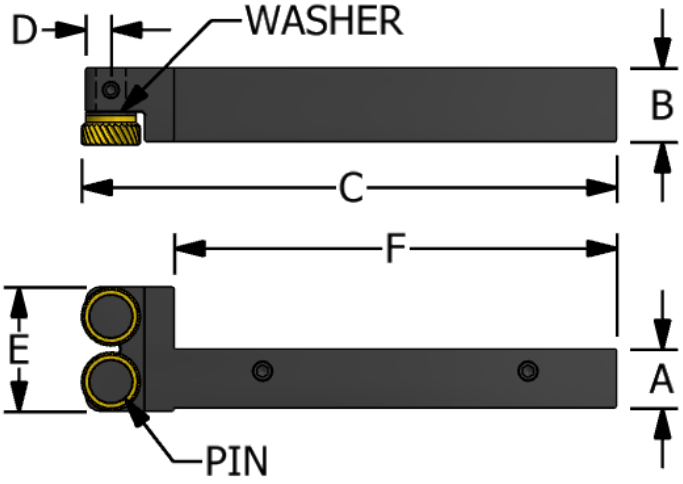
Setup

1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the pin
3. Slide the pin through the knurl so the head of the pin is flush with the side of the knurl
4. Now slide the washer onto the pin on the opposite side of the counterbore of the knurl
    a. So that the washer will be between the knurl and holder
5. With the knurl and washer now on the pin, insert the pin back into the holder
6. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

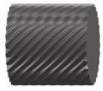
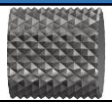
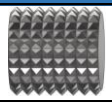
Up to Shoulder Bump Holders







Note: Holders are designed in order to be usable in Swiss Machines

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGE 45°	RKE
Knurl form on part								
Knurl Type	AA+AA	BR 30°+BR 30°	BL 30°+BL 30°	BR 45°+BR 45°	BL 45°+BL 45°	BR 30° + BL 30°	BR 45° + BL 45°	AA+AG
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X, Z	X, Z	X

Warning: While it is possible to make a straight or diagonal pattern using two wheels of the same hand, unless the knurls are synchronized in some manner it is difficult to achieve consistent reliable results.

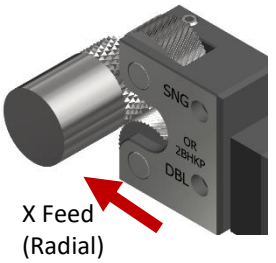
Inch

Tool Number	Knurl Series	Pins	Washer	Holder Dimensions (in)					
				A	B	C	D	E	F
OR 2W2R08	W2	OR UTSPW2	BL W2	0.500	0.625	4.500	0.215	1.050	3.750
OR 2W2R10	W2	OR UTSPW2	BL W2	0.625	0.625	4.500	0.215	1.150	3.750

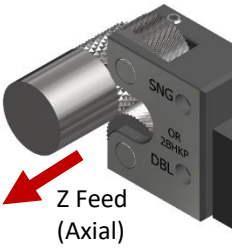
Setup

1. Using an Allen Key, loosen the set screw on top and bottom of the head of the holder
2. Remove the pins
3. Slide the pins through the knurls so the head of the pin is flush with the side of the knurl
4. Now slide the washer onto the pins on the opposite side of the counterbore of the knurl
    b. So that the washer will be between the knurl and holder
5. With the knurl and washer now on the pins, insert the pins back into the holder
6. Tighten the set screw onto the pins and make sure the knurl can spin without binding up

Modular Bump Holders

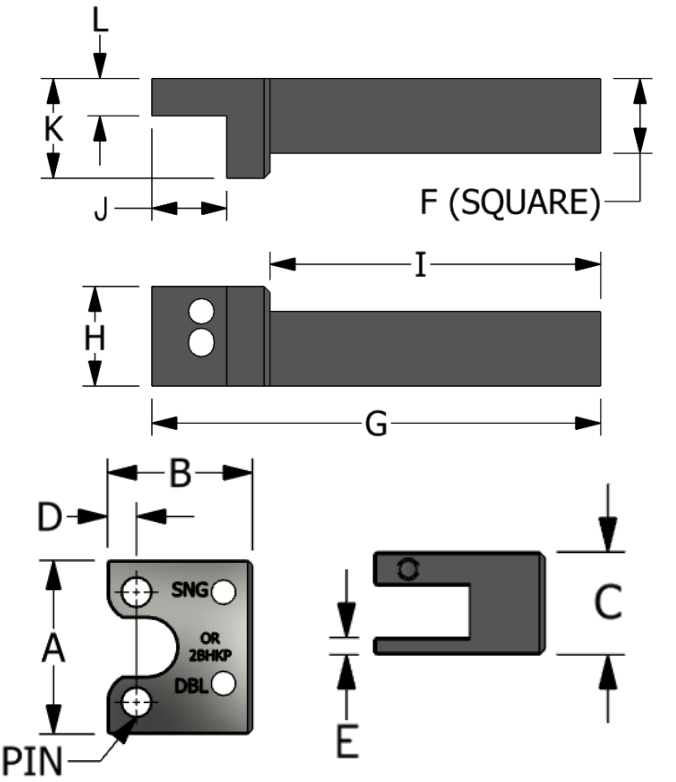


X Feed
(Radial)



Z Feed
(Axial)

Note: Heads and Shanks are sold separately. Inch heads are interchangeable with any of the inch shanks. Metric shanks are interchangeable with any of the metric shanks.



	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°	RKE	RKV
Knurl form on part											
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30° BR 30° + BL 30°	GE 30°	GV 45° BR 45° + BR 45°	GE 45°	KV	KE
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X, Z	X	X, Z	X	X	X

Inch Heads

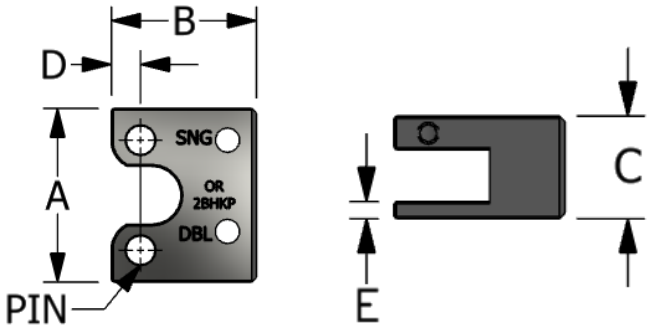
Tool Number	Knurl Series	Pins	Min. Part Diameter	Holder Dimensions (in)				
				A	B	C	D	E
OR 2BHEP	EP/EPV	C 123	0.062	1.500	1.250	0.750	0.200	0.125
OR 2BHGK	GK/GKV/KN/KNV	C 124	0.188	1.500	1.250	0.750	0.225	0.125
OR 2BHKP	KP/KPV	C 124	0.250	1.500	1.250	0.750	0.250	0.125
OR 2BHKR	KR	C 144	0.250	1.500	1.250	0.875	0.250	0.125
OR 2BHPH	PH/PHV	C 168	0.312	2.500	1.500	1.000	0.450	0.188
OR 2BHMLI	ML	OR UTSP	0.100	1.625	1.250	0.625	0.287	-

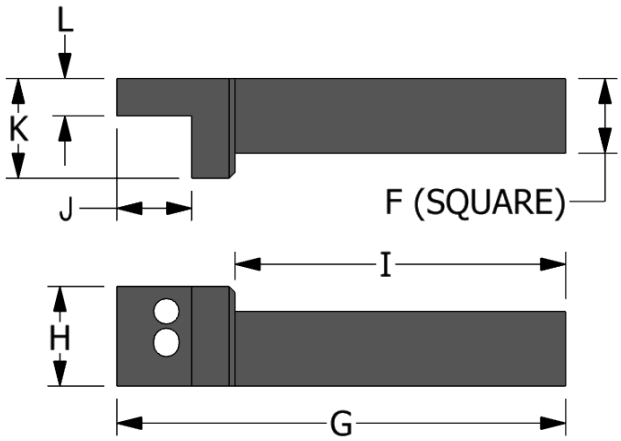
Inch Shanks

Tool Number	Holder Dimensions (in)						
	F	G	H	I	J	K	L
OR SH08R	0.500	4.500	1.000	3.500	0.750	1.000	0.375
OR SH10R	0.625	4.500	1.000	3.500	0.750	1.000	0.375
OR SH12R	0.750	4.500	1.000	3.325	0.750	1.000	0.375
Or SH16R	1.000	5.000	1.250	3.930	0.750	1.250	0.375
OR SH20R	1.250	6.000	1.500	4.813	0.750	1.375	0.500

All inch shanks have .060” of vertical adjustment in the 2 dies setup for alignment purposes

Modular Bump Holders





Note: Heads and Shanks are sold separately. Inch heads are interchangeable with any of the inch shanks. Metric shanks are interchangeable with any of the metric shanks.

Metric Heads

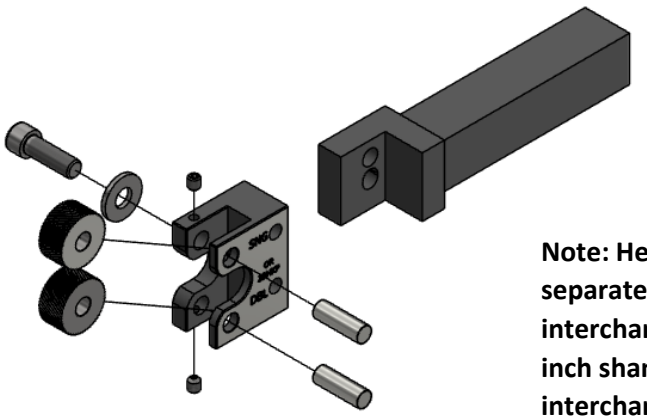
Tool Number	Knurl Series	Pins	Min. Part Diameter	Holder Dimensions (mm)				
				A	B	C	D	E
OR 2BHMN	MN	C M419	2.00	38.10	31.75	19.05	5.03	3.18
OR 2BHMQ	MQ	C M419	2.00	38.10	31.75	19.05	6.17	3.18
OR 2BHMR	MR/MRV	C M619	2.00	38.10	31.75	19.05	6.30	3.18
OR 2BHMS	MS	C M619	2.50	38.10	31.75	19.05	6.30	4.76
OR 2BHMLM	ML	OR UTSP	2.50	41.28	31.75	15.88	7.40	-

Metric Shanks

Tool Number	Holder Dimensions (mm)						
	F	G	H	I	J	K	L
OR SHM12	12.00	114.30	25.40	84.14	19.05	25.40	6.35
OR SHM16	16.00	114.30	25.40	87.12	19.05	25.40	9.53
OR SHM20	20.00	114.30	25.40	88.90	19.05	25.40	9.53
OR SHM25	25.00	127.00	31.75	100.00	19.05	31.75	12.70

All metric shanks have 1.57mm of vertical adjustment in the 2 dies setup for alignment purposes

Modular Bump Holders



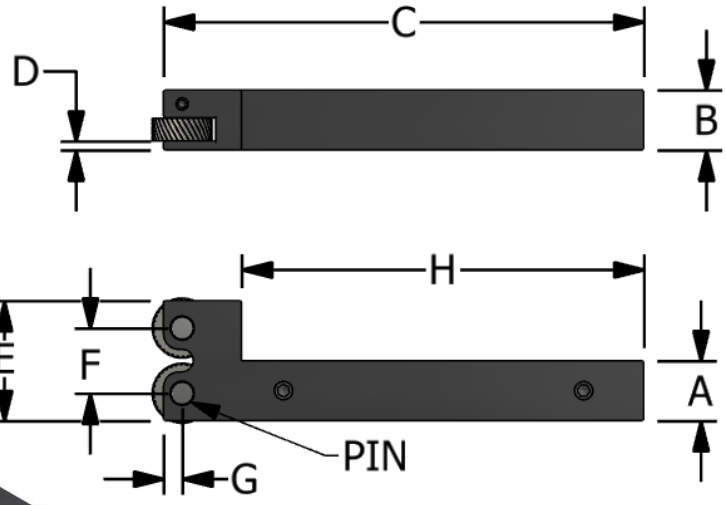
Note: Heads and Shanks are sold separately. Inch heads are interchangeable with any of the inch shanks. Metric shanks are interchangeable with any of the metric shanks.

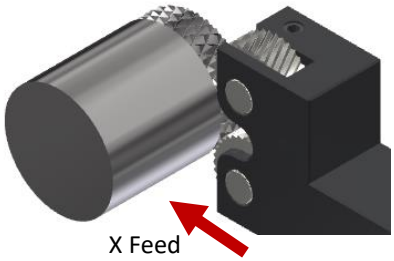
Setup

1. Match the head up (with marking facing out) with the appropriate hole on the shank depending on if you will be using a single knurl or two.
2. Insert the bolt with the washer and tighten so the head does not move.
3. Using an Allen Key, loosen the set screw on top/bottom of the head of the holder
4. Remove the Carbide Pin
5. Insert the appropriate Knurl in the slot of the holder, and then slide the carbide pin back through
6. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

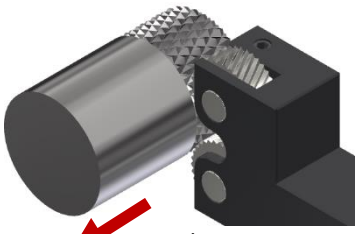
Warning: When knurling a straight pattern, it is recommended to just use one straight wheel instead of two. This holder does not synchronize the two wheels so there is a risk of mis-tracking or inconsistent results if using two straight wheels.

Compact Two Die Bump Holder



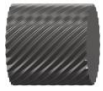
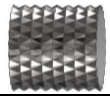
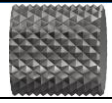
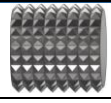


X Feed
(Radial)



Z Feed
(Axial)

Note: Holders are designed in order to be usable in Swiss Machines

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGE 45°	RKE
Knurl form on part								
Knurl Type	AA+AA	BR 30°+BR 30°	BL 30°+BL 30°	BR 45°+BR 45°	BL 45°+BL 45°	BR 30° + BL 30°	BR 45° + BL 45°	AA+AG
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X, Z	X, Z	X

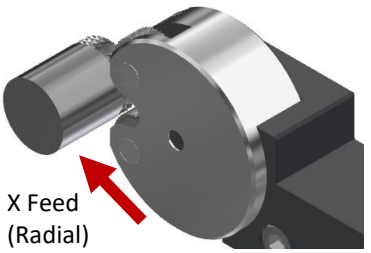
Warning: While it is possible to make a straight or diagonal pattern using two wheels of the same hand, unless the knurls are synchronized in some manner it is difficult to achieve consistent reliable results.

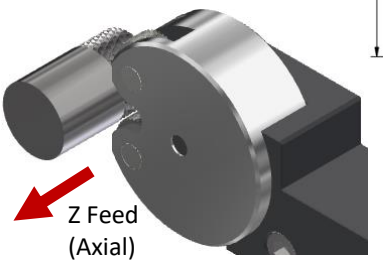
Tool Number	Knurl Series	Pins	Holder Dimensions (in)							
			A	B	C	D	E	F	G	H
OR 2EP08	EP/EPV	C 083	0.500	0.500	4.000	0.075	1.000	0.542	0.200	3.350
OR 2EP10	EP/EPV	C 103	0.625	0.625	4.000	0.075	1.125	0.542	0.200	3.350

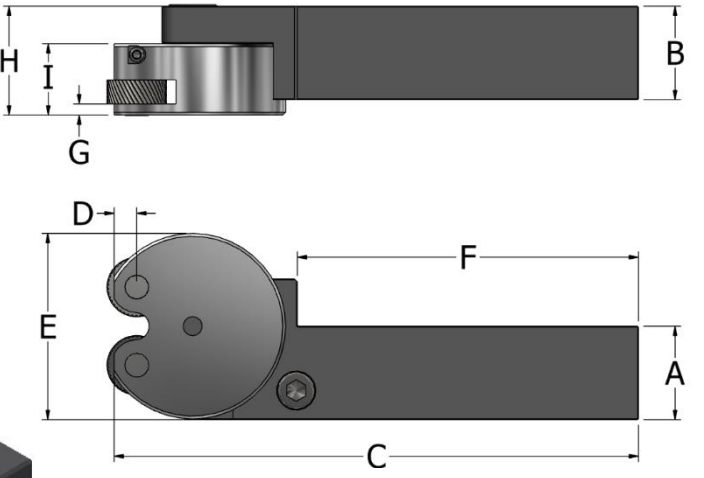
Setup

1. Using an Allen Key, loosen the set screw on top /bottom of the head of the holder
2. Remove the Carbide Pin
3. Insert the appropriate Knurls in the slot of the holder, and then slide the carbide pin back through
4. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

Two Die Self-Centering Bump Holder







Note: Can be used in both a single and double wheel setup. Self-Centering bump holders are optimal when concentricity of the part has some slight variance.

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°	RKE	RKV
Knurl form on part											
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30° BR 30° + BL 30°	GE 30°	GV 45° BR 45° + BR 45°	GE 45°	KV	KE
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X, Z	X	X, Z	X	X	X

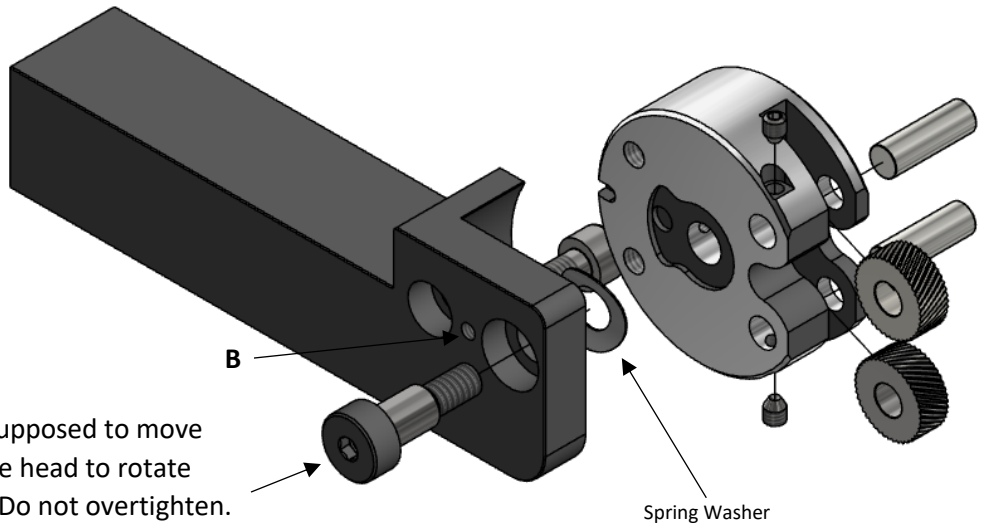
Inch

Tool Number	Knurl Series	Pins	Holder Dimensions (in)							
			A	B	C	D	E	F	G	H
OR KN12ISC	GK/GKV/KN/KNV	C 124	0.750	0.750	5.500	0.235	1.725	3.575	0.115	1.150
OR KN16ISC	GK/GKV/KN/KNV	C 124	1.000	1.000	5.500	0.235	1.960	3.590	0.115	1.150
OR KP12ISC	KP/KPV	C 124	0.750	0.750	5.500	0.235	1.725	3.575	0.115	1.150
OR KP16ISC	KP/KPV	C 124	1.000	1.000	5.500	0.235	1.960	3.590	0.115	1.150

Metric

Tool Number	Knurl Series	Pins	Holder Dimensions (mm)							
			A	B	C	D	E	F	G	H
OR MR20MSC	MR/MV	C M619	20.00	20.00	139.70	5.79	44.83	90.00	2.92	29.00
OR MR25MSC	MR/MV	C M619	25.00	25.00	139.70	5.79	49.53	90.00	2.92	29.00
OR MS20MSC	MS/MW	C M621	20.00	20.00	139.70	5.79	44.83	90.00	2.92	29.00
OR MS25MSC	MS/MW	C M619	25.00	25.00	139.70	5.79	49.53	90.00	2.92	29.00
OR MU20MSC	MU	C M623	20.00	20.00	139.70	5.79	44.83	90.00	2.92	29.00
OR MU25MSC	MU	C M619	25.00	25.00	139.70	5.79	49.53	90.00	2.92	29.00

Two Die Self-Centering Bump Holder



Note: The bolt is supposed to move slightly to allow the head to rotate and "self-center". Do not overtighten.

Setup

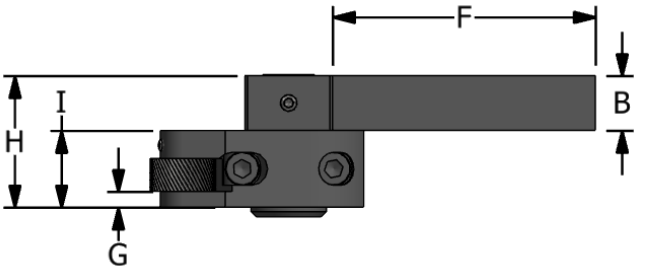
Single Wheel Use

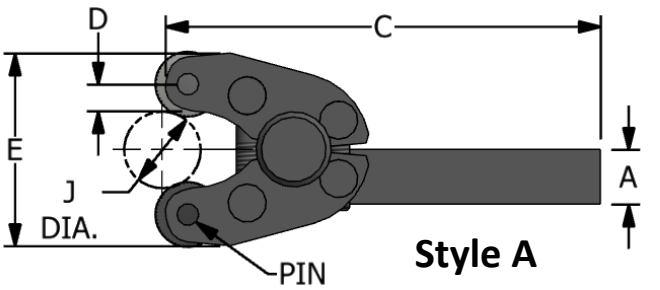
1. Remove the bolt from the front of the shank in the spot labeled A (on front of shank)
2. Loosen the set screw labeled/marked B on the back by 2 turns
    a. The head should be able to freely rotate without limit at this point
3. Rotate the head so the hole on the head lines up with hole A on the back of the shank and insert the bolt you previously removed from hole A on the front.
4. Tighten the bolt enough so that the head does not rotate
5. Using an Allen Key, loosen the set screw holding the carbide pin in
6. Remove the Carbide Pin
7. Insert the appropriate Knurl in the slot of the holder, and then slide the carbide pin back through
8. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

Double Wheel Use

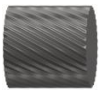
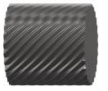
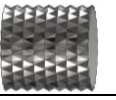
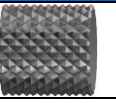
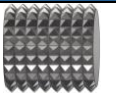
1. If the holder is set for single wheel use currently, remove the bolt in hole A on the back and reinsert this in the front of the shank on the holder.
    a. If it is not set up for single wheel usage skip to Step 3
2. Rotate the holder so the carbide pins are lined up vertically with each other and retighten B two turns
3. Ensure the head can rotate a bit each way but is limited by the bolt B
    a. This gives the "self-centering" action but also ensures the head does not spin all the way around
4. Using an Allen Key, loosen the set screw on the top/ bottom of the head
5. Remove the Carbide Pin
6. Insert the appropriate Knurl in the slot of the holder, and then slide the carbide pin back through
7. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

Straddle Holder





Style A

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGE 45°	RKE
Knurl form on part								
Knurl Type	AA+AA	BR 30°+BR 30°	BL 30°+BL 30°	BR 45°+BR 45°	BL 45°+BL 45°	BR 30° + BL 30°	BR 45° + BL 45°	AA+AG
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X, Z	X, Z	X

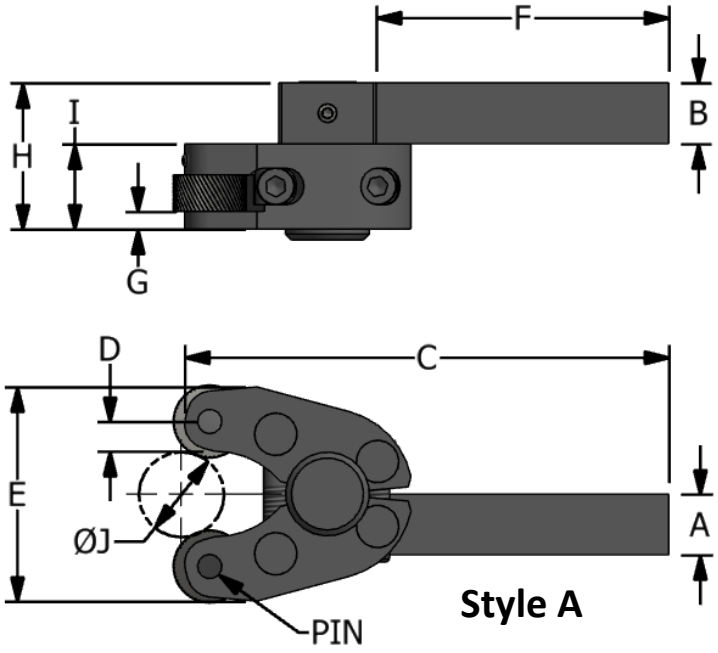
Note: The chart above applies for all straddle holders

<u>Warning</u>: While it is possible to make a straight or diagonal pattern using two wheels of the same hand, unless the knurls are synchronized in some manner it is difficult to achieve consistent reliable results.

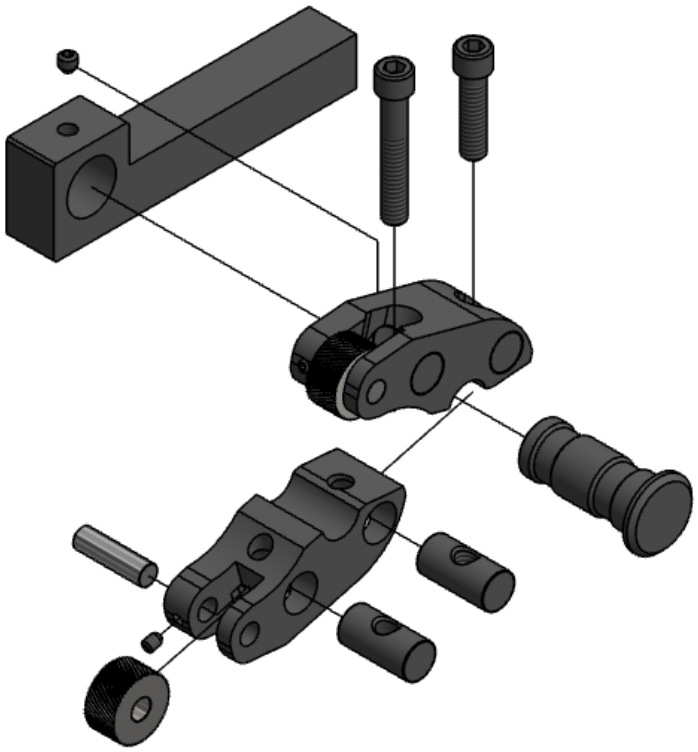
Inch

Tool Number	Style	Pins	Knurl Series	Holder Dimensions (in)									
				A	B	C	D	E	F	G	H	I	J
OR BPCS05	A	C 082	BP	0.312	0.312	5.000	0.100	1.250	3.880	0.062	0.812	0.500	0 - .44
OR BPCS06	A	C 082	BP	0.375	0.375	5.000	0.125	1.250	3.880	0.062	0.875	0.500	0 - .44
OR BPCS08	A	C 082	BP	0.500	0.500	5.000	0.133	1.250	3.880	0.062	1.000	0.500	0 - .38
OR EPTS05	A	C 083	EP/EPV	0.312	0.312	5.000	0.200	1.600	3.880	0.062	0.812	0.500	0 - .63
OR EPTS06	A	C 083	EP/EPV	0.375	0.375	5.000	0.200	1.600	3.880	0.062	0.875	0.500	0 - .63
OR EPTS08	A	C 083	EP/EPV	0.500	0.500	5.000	0.200	1.600	3.880	0.062	1.000	0.500	0 - .63
OR EPCS05	A	C 103	EP/EPV	0.312	0.312	5.000	0.200	1.750	3.000	0.125	1.000	0.625	0 -.75
OR EPCS06	A	C 103	EP/EPV	0.375	0.375	5.000	0.200	1.750	3.000	0.125	1.000	0.625	0 -.75
OR EPCS08	A	C 103	EP/EPV	0.500	0.500	5.000	0.200	1.750	3.000	0.125	1.125	0.625	0 -.75
OR EPCS10	A	C 103	EP/EPV	0.625	0.625	5.000	0.200	1.750	3.000	0.125	1.250	0.625	0 - .75
OR EPCS12	A	C 103	EP/EPV	0.750	0.750	5.000	0.200	1.750	3.000	0.125	1.375	0.625	0 - .75
OR KPCS08	A	C 144	KP/KPV/MT	0.500	0.500	5.000	0.265	2.500	3.000	0.200	1.375	0.875	0 - 1.0
OR KPCS10	A	C 144	KP/KPV/MT	0.625	0.625	5.000	0.265	2.500	3.000	0.200	1.500	0.875	0 - 1.0
OR KPCS12	A	C 144	KP/KPV/MT	0.750	0.750	5.000	0.275	2.500	3.000	0.200	1.625	0.875	0 - 1.0
OR KPCS16	A	C 144	KP/KPV/MT	1.000	1.000	5.000	0.265	2.500	3.000	0.200	1.875	0.875	0 - 1.0
OR KRCS12	A	C 164	KR	0.750	0.750	6.000	0.275	3.500	3.000	0.250	1.750	1.000	0 - 2.0
OR KRCS16	A	C 164	KR	1.000	1.000	6.000	0.265	3.500	3.000	0.250	2.000	1.000	0 - 2.0
OR LKCS16	A	C 208	PH/PHV+3/4" WIDE	1.000	1.000	6.500	0.475	4.500	3.000	0.250	2.250	1.250	0 - 2.0
OR LKCS16B	A	C 208	PH/PHV+3/4" WIDE	1.000	1.000	7.500	0.475	3.880	3.560	0.375	2.250	1.500	0 - 2.0
OR LKCS163	A	C 208	PH/PHV+3/4" WIDE	1.000	1.000	7.250	0.475	5.500	3.000	0.250	2.250	1.250	0 - 3.0
OR LKCS164	A	C 208	PH/PHV+3/4" WIDE	1.000	1.000	8.810	0.475	6.000	3.500	0.250	2.250	1.250	0 - 4.0
OR LKCS166	A	C 208	PH/PHV+3/4" WIDE	1.000	1.000	10.250	0.475	8.380	3.500	0.250	2.250	1.250	0 - 6.0

Straddle Holder



Style A



For patterns and feed directions chart, see page 72

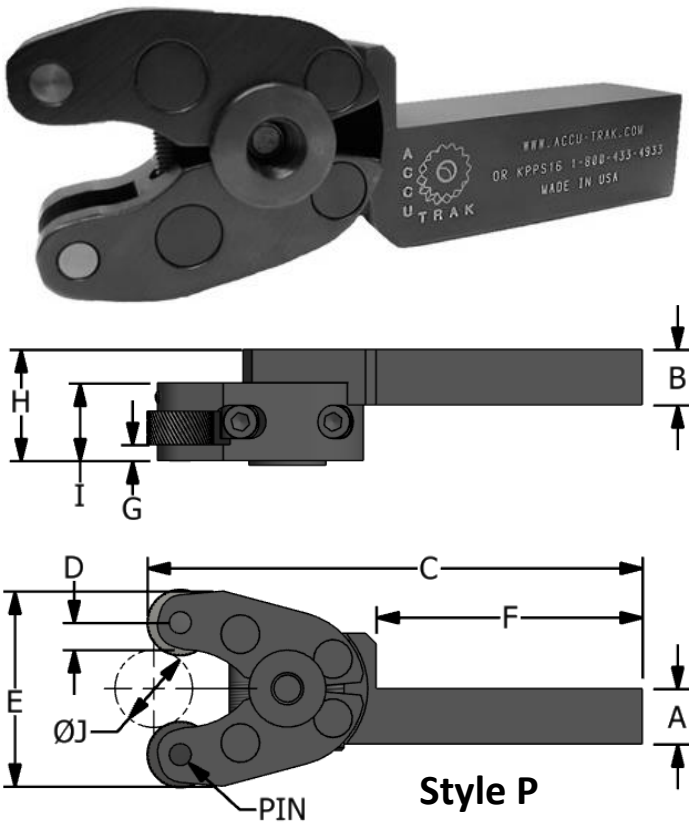
Metric

Tool Number	Style	Pins	Knurl Series	Holder Dimensions (mm)									
				A	B	C	D	E	F	G	H	I	J
OR MRCS12	A	C M619	MR/MRV	12.00	12.00	127.00	6.73	58.50	76.20	5.00	31.05	19.05	0 - 22
OR MRCS16	A	C M619	MR/MRV	16.00	16.00	127.00	6.98	58.50	76.20	5.00	35.05	19.05	0 - 22
OR MRCS20	A	C M619	MR/MRV	20.00	20.00	127.00	7.32	58.50	76.20	5.00	39.05	19.05	0 - 22
OR MRCS25	A	C M619	MR/MRV	25.00	25.00	127.00	7.20	58.50	76.20	5.00	44.05	19.05	0 - 22

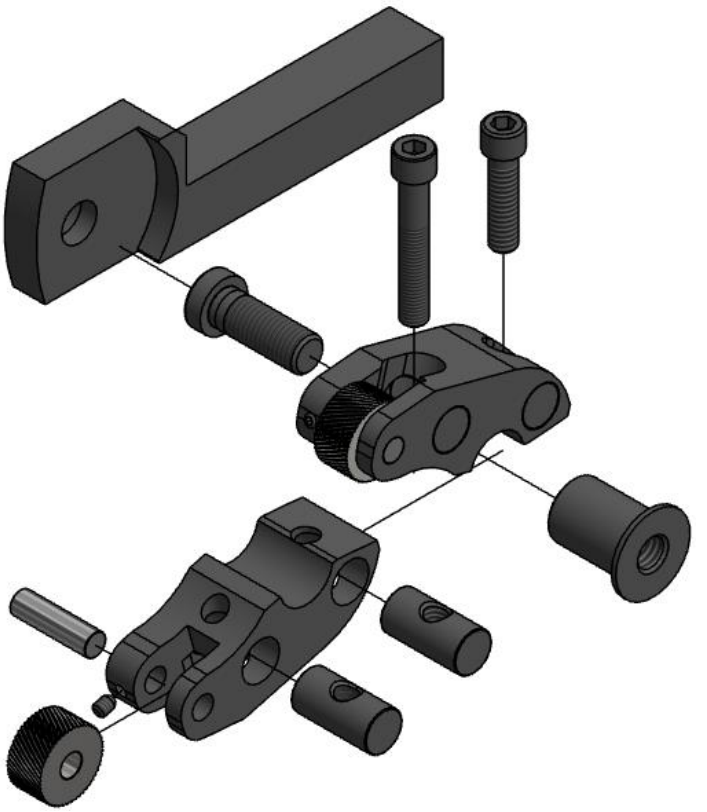
Setup

1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws holding the knurl pins in and slide the pin out. Put the wheels in the holder and slide the pins through then retighten the screws.
3. Put gauge pin in your chuck or collet and straddle holder on your tool turret or block
4. Manual jog the holder close to the workpiece so the knurls just pass the front face.
5. Loosen the top bolts on the head of the holder and bring the holder down until the knurls are directly above and below the centerline on your part and contacting the piece
6. Tighten the bolts on the head to lock the setting and manual jog the holder off the piece.
7. The holder should now be set up for your operation. Remember you may still need to make minor adjustments to the settings.

Straddle Holder



Style P



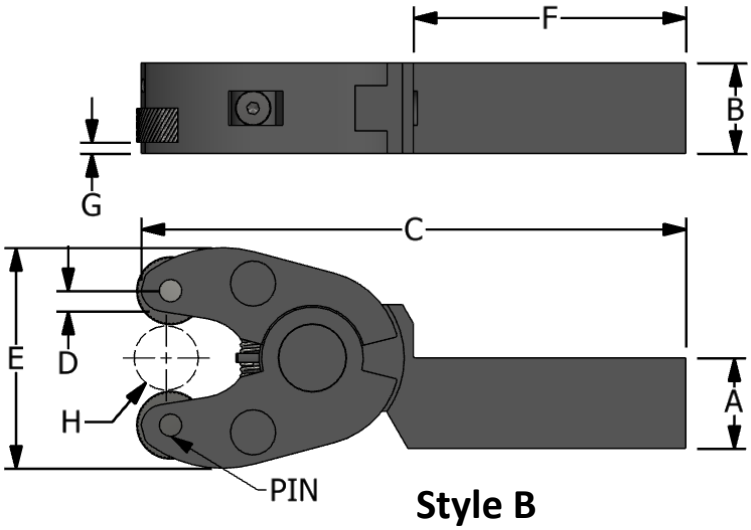
For patterns and feed directions chart, see page 72

Tool Number	Style	Pins	Knurl Series	Holder Dimensions (in)									
				A	B	C	D	E	F	G	H	I	J
OR EPPS06	P	C 103	EP/EPV	0.375	0.375	5.000	0.200	1.800	2.800	0.130	0.930	0.625	0 - .76
OR EPPS08	P	C 103	EP/EPV	0.500	0.500	5.000	0.200	1.800	2.800	0.130	0.930	0.625	0 - .76
OR KPPS10	P	C 144	KP/KPV/MT	0.625	1.000	5.500	0.265	2.500	3.000	0.200	1.130	0.875	0 - 1.0
OR KPPS12	P	C 144	KP/KPV/MT	0.750	1.000	5.500	0.265	2.500	3.000	0.200	1.130	0.875	0 - 1.0
OR KPPS16	P	C 144	KP/KPV/MT	1.000	1.000	5.500	0.265	2.500	3.000	0.200	1.130	0.875	0 - 1.0

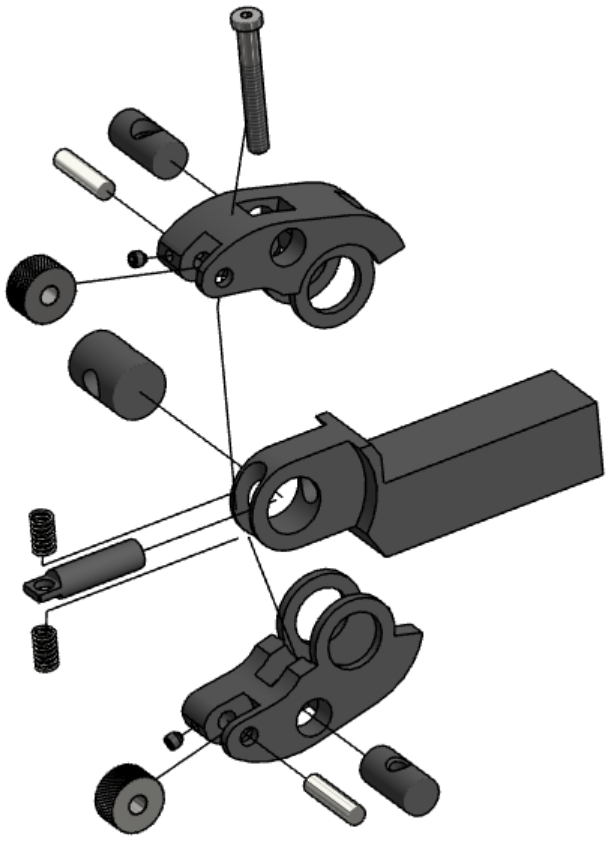
Setup

1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws holding the knurl pins in and slide the pin out. Put the wheels in the holder and slide the pins through then retighten the screws.
3. Put gauge pin in your chuck or collet and straddle holder on your tool turret or block
4. Manual jog the holder close to the workpiece so the knurls just pass the front face.
5. Loosen the top bolts on the head of the holder and bring the holder down until the knurls are directly above and below the centerline on your part and contacting the piece
6. Tighten the bolts on the head to lock the setting and manual jog the holder off the piece.
7. The holder should now be set up for your operation. Remember you may still need to make minor adjustments to the settings.

Straddle Holder



Style B



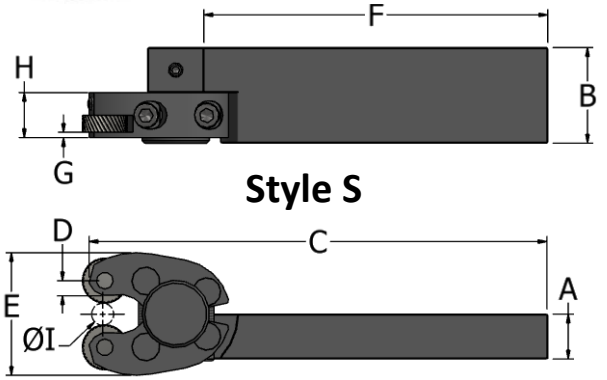
For patterns and feed directions chart, see page 72

Tool Number	Style	Pins	Knurl Series	Holder Dimensions (in)							
				A	B	C	D	E	F	G	H
OR KPOS12	B	C 103	KP/KPV	0.750	1.000	6.200	0.250	3.000	3.000	0.125	0 - 1.5
OR KPOS16	B	C 103	KP/KPV	1.000	1.000	6.200	0.250	3.000	3.000	0.125	0 - 1.5

Setup

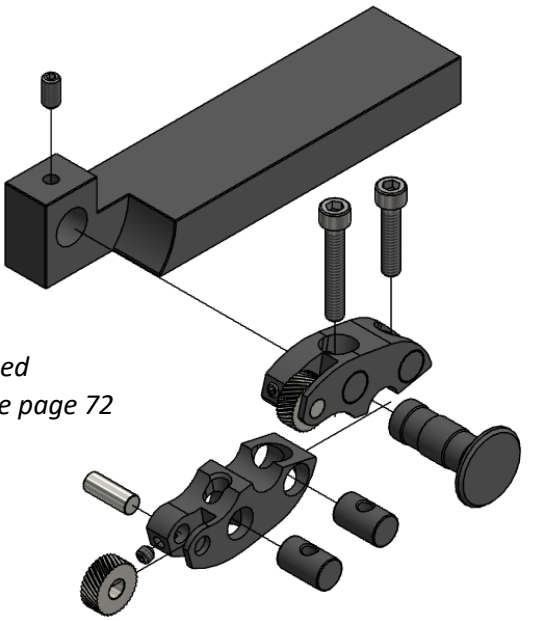
1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws holding the knurl pins in and slide the pin out. Put the wheels in the holder and slide the pins through then retighten the screws.
3. Put gauge pin in your chuck or collet and straddle holder on your tool turret or block
4. Manual jog the holder close to the workpiece so the knurls just pass the front face.
5. Loosen the top bolt on the head of the holder and bring the holder down until the knurls are directly above and below the centerline on your part and contacting the piece
6. Tighten the bolts on the head to lock the setting and manual jog the holder off the piece.
7. The holder should now be set up for your operation. Remember you may still need to make minor adjustments to the settings.

Straddle Holder – Designed for Swiss Machines



Style S

Note: These holders are designed to fit in tool gang blocks of swiss machines.



For patterns and feed directions chart, see page 72

Inch

Tool Number	Style	Pins	Knurl Series	Holder Dimensions (in)								
				A	B	C	D	E	F	G	H	I
OR EPTS08S	S	C 083	EP/EPV	0.500	1.065	5.165	0.194	1.600	3.825	0.060	0.500	0 - .625
OR EPTS10S	S	C 083	EP/EPV	0.625	1.065	5.165	0.194	1.600	3.825	0.060	0.500	0 - .625
OR KNS10S	S	C 124	KN/KNV	0.625	1.000	5.600	0.275	2.275	3.000	0.200	0.750	0 - 1.0
OR KNS12S	S	C 124	KN/KNV	0.750	1.000	5.600	0.265	2.275	3.000	0.200	0.750	0 - 1.0
OR KNS16S	S	C 124	KN/KNV	1.000	1.000	5.600	0.265	2.275	3.000	0.200	0.750	0 -1.0

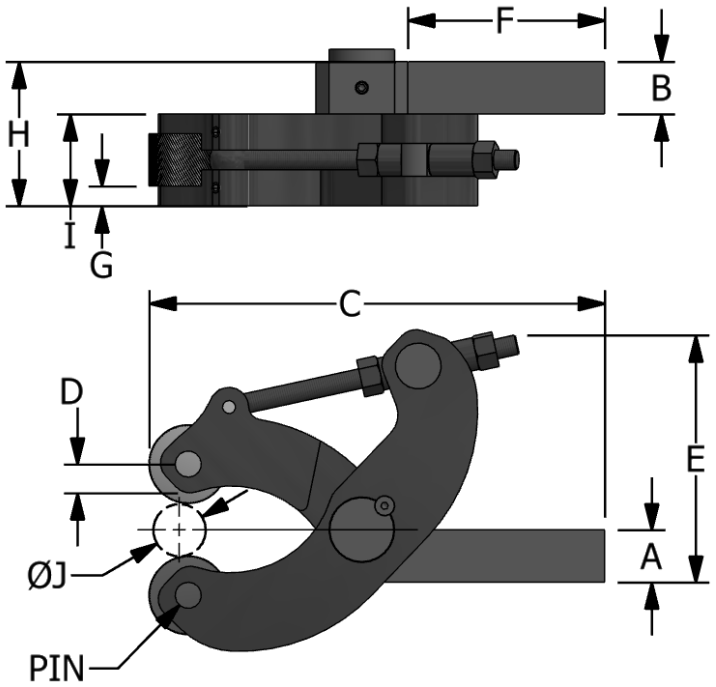
Metric

Tool Number	Style	Pins	Knurl Series	Holder Dimensions (mm)								
				A	B	C	D	E	F	G	H	I
OR KNS20MS	S	C 124	KN/KNV	20.00	25.40	142.20	6.73	57.15	76.20	5.08	19.05	0 - 22.86
OR KNS25MS	S	C 124	KN/KNV	25.00	25.40	142.20	6.73	57.15	76.20	5.08	19.05	0 - 22.86

Setup

1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws holding the knurl pins in and slide the pin out. Put the wheels in the holder and slide the pins through then retighten the screws.
3. Put gauge pin in your chuck or collet and straddle holder on your tool turret or block
4. Manual jog the holder close to the workpiece so the knurls just pass the front face.
5. Loosen the top bolts on the head of the holder and bring the holder down until the knurls are directly above and below the centerline on your part and contacting the piece
6. Tighten the bolts on the head to lock the setting and manual jog the holder off the piece.
7. The holder should now be set up for your operation. Remember you may still need to make minor adjustments to the settings.

Heavy Duty Straddle Holder



For patterns and feed directions chart, see page 72

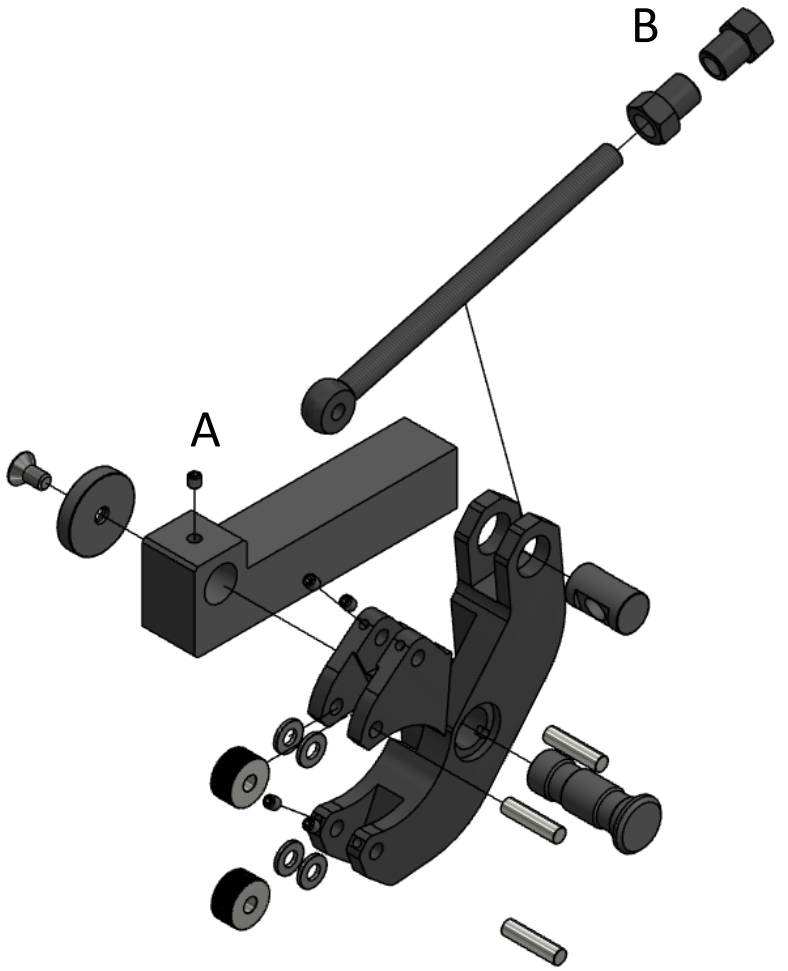
Inch

Tool Number	Pins	Knurl Series	Holder Dimensions (in)									
			A	B	C	D	E	F	G	H	I	J
OR SKP10D	C 164	KN/KNV/KP/KPV/KR	0.625	0.625	6.000	0.325	4.200	3.000	0.250	1.625	1.000	0 - 2.1
OR SKP12D	C 164	KN/KNV/KP/KPV/KR	0.750	0.750	6.000	0.325	4.400	3.000	0.250	1.750	1.000	0 - 2.1
OR SKP16E	C 164	KN/KNV/KP/KPV/KR	1.000	1.000	7.000	0.325	4.700	4.000	0.250	2.000	1.000	0 - 2.1
OR SPH16E	C 168	PH/PHV	1.000	1.000	7.500	0.450	6.000	4.000	0.250	2.000	1.000	0 - 3.1
OR SSPOR	C 288	PH/PHV + 1" WIDE	1.000	1.000	7.500	0.535	6.000	4.000	0.375	2.750	1.750	0 - 3.1

Metric

Tool Number	Pins	Knurl Series	Holder Dimensions (mm)									
			A	B	C	D	E	F	G	H	I	J
OR SMW20	C M625	MS/MW/MR/MRV	20.000	20.000	145.000	8.060	115.000	76.200	8.700	45.400	25.400	0 - 50
OR SMW25	C M625	MS/MW/MR/MRV	25.000	25.000	145.000	8.500	125.000	76.200	8.700	50.400	25.400	0 - 50

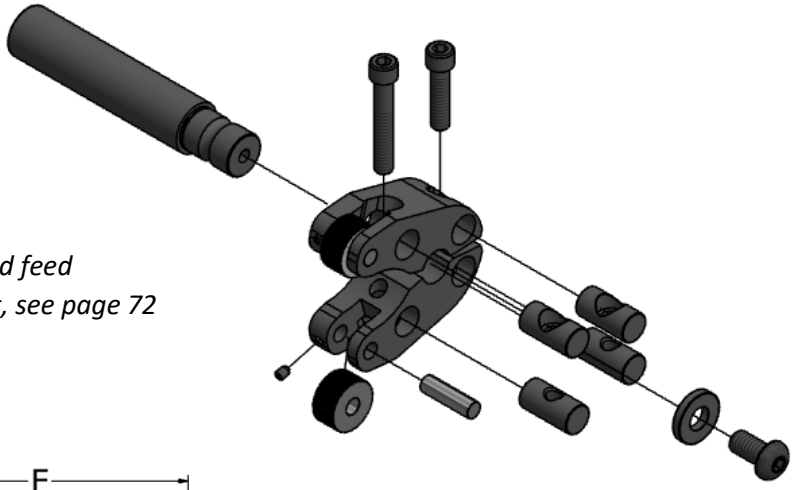
Heavy Duty Straddle Holder



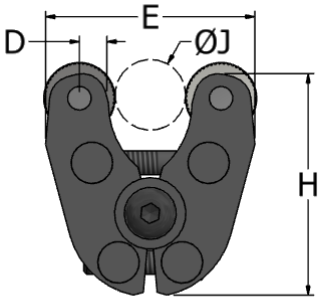
Setup

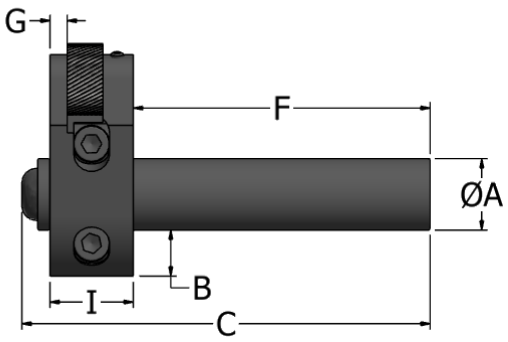
1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws holding the knurl pins in and slide the pin out. Put the wheels in the holder and slide the pins through then retighten the screws.
3. Put gauge pin in your chuck or collet and straddle holder on your tool turret or block
4. Manual jog the holder close to the workpiece so the knurls just pass the front face
5. Loosen the set screw A shown in the image above so that the head can rotate.
6. Now adjust the nuts labeled B in the image above to widen the jaws of the head until it is enough to go over your part
7. Manually jog the holder so the knurls are above and below the centerline of your gauge piece and adjust the set screw A and nuts B as needed
8. Once in the proper position, retighten the bolts and manually jog the holder of the piece
9. The holder should now be set up for your operation. Remember you may still need to make minor adjustments to the settings.

Offset Round Shank Straddle Holder



For patterns and feed directions chart, see page 72





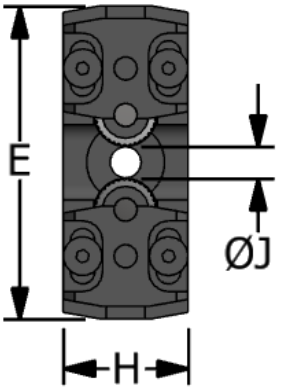
Note: These holders are to be mounted similarly to drills in lathes. The knurls however are not on the centerline of the shank so you will have to make adjustments in your tool settings.

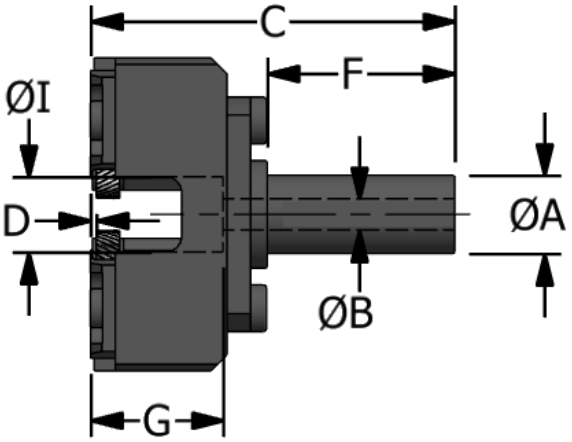
Tool Number	Pins	Knurl Series	Holder Dimensions (in)									
			A	B	C	D	E	F	G	H	I	J
OR EPCO10	C 103	EP/EPV	0.500	0.500	3.500	0.194	2.000	2.600	0.125	2.000	0.625	0 - .75
OR KPCO10	C 144	KP/KPV	0.625	0.550	4.250	0.260	2.300	3.115	0.200	2.375	0.875	0 - 1.0
OR KPCO12	C 144	KP/KPV	0.750	0.500	4.250	0.260	2.300	3.100	0.200	2.375	0.875	0 - 1.0
OR KPCO16	C 144	KP/KPV	1.000	0.375	5.250	0.260	2.300	4.125	0.200	2.375	0.875	0 - 1.0

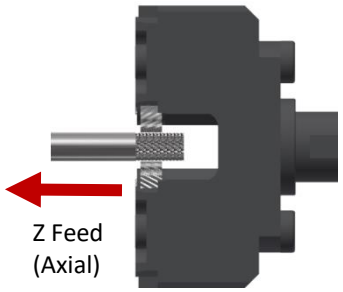
Setup

1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws holding the knurl pins in and slide the pin out. Put the wheels in the holder and slide the pins through then retighten the screws.
3. Put gauge pin in your chuck or collet and straddle holder on your machine
4. Manual jog the holder close to the workpiece so the knurls just pass the front face.
    a. You will likely need to adjust the axis or offset the holder in order to get the knurls in the right position
5. Loosen the top bolts on the head of the holder and bring the holder down until the knurls are directly above and below the centerline on your part and contacting the piece
6. Tighten the bolts on the head to lock the setting and manual jog the holder off the piece.
7. The holder should now be set up for your operation. Remember you may still need to make minor adjustments to the settings.

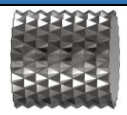
Two Die Round Shank Holder







Note: These holders can only feed onto the part in the axial direction. They can also only be used on knurl bands that extend to the end of your part

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGE 45°
Knurl form on part							
Knurl Type	AA+AA	BR 30°+BR 30°	BL 30°+BL 30°	BR 45°+BR 45°	BL 45°+BL 45°	BR 30° + BL 30°	BR 45° + BL 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z

<u>Warning</u>: While it is possible to make a straight or diagonal pattern using two wheels of the same hand, unless the knurls are synchronized in some manner it is difficult to achieve consistent reliable results.

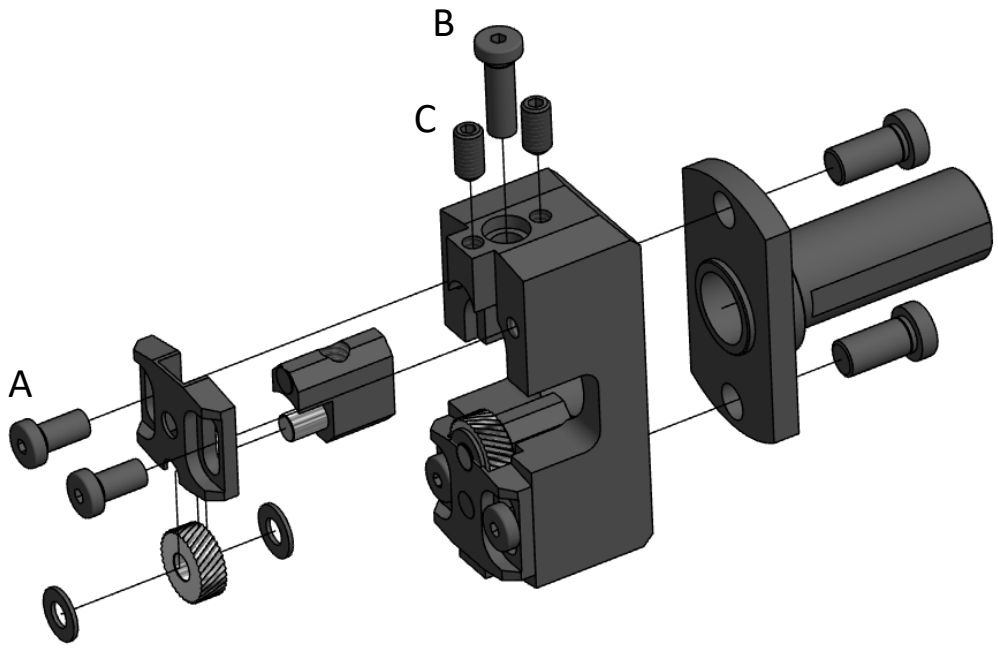
Inch

Tool Number	Pins	Knurl Series	Holder Dimensions (in)									
			A	B	C	D	E	F	G	H	I	J
OR TEP08	C 123	EP/EPV	0.500	0.250	3.000	0.100	2.500	1.500	1.063	1.000	0.605	0 - .50
OR TEP10	C 123	EP/EPV	0.625	0.250	3.000	0.100	2.500	1.500	1.063	1.000	0.605	0 - .50
OR TEP12	C 123	EP/EPV	0.750	0.385	3.000	0.100	2.500	1.500	1.063	1.000	0.605	0 - .50
OR TKN12D	C 204	KN/KNV	0.750	0.370	5.000	0.100	4.500	2.500	2.060	2.000	1.525	0 - 1.51

Metric

Tool Number	Pins	Knurl Series	Holder Dimensions (mm)									
			A	B	C	D	E	F	G	H	I	J
OR TEP10M	C 123	EP/EPV	10.00	6.35	76.20	2.54	63.50	38.10	27.00	25.40	15.37	0 - 12.7
OR TEP12M	C 123	EP/EPV	12.00	6.35	76.20	2.54	63.50	38.10	27.00	25.40	15.37	0 - 12.7

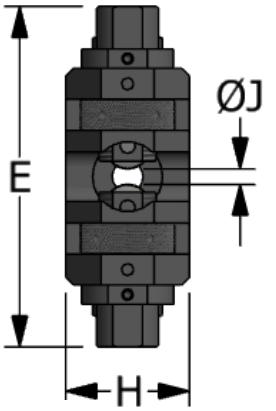
Two Die Round Shank Holder

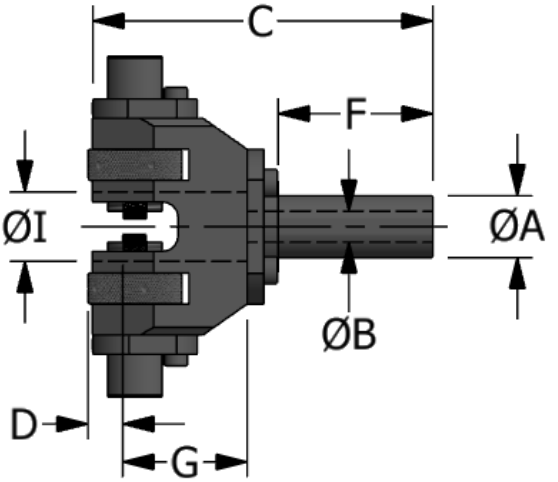


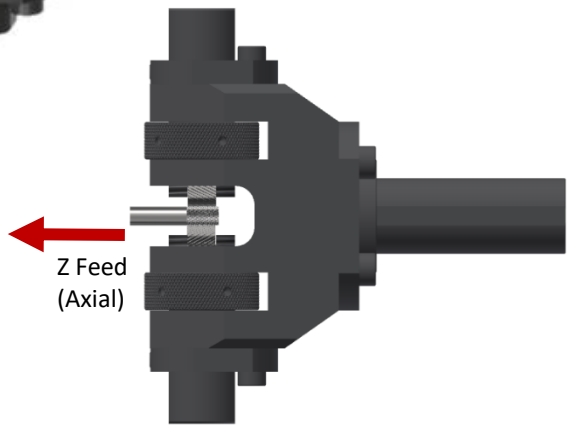
Setup

1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Next remove the two screws labeled A in the diagram and remove the small plate they were holding
3. Slide the knurl wheels on the pin. Make sure there is a washer on both sides of the knurl.
4. Put the plate back on and loosely screw bolts A back into the holder.
    a. Make sure the circular extrusion on the holder is set into the hole in the center of the plate
5. Mount the holder in the machine, similar to how you would a boring bar or drill. This holder is meant to be fed axially onto the part from the end of the part
6. Insert your gauge piece into the chuck or collet of your lathe
7. Loosen bolt B and bolts C on both top and bottom of your holder.
    a. You should now be able to slide the knurl posts closer or further apart.
8. Carefully manual jog your holder over to the work piece so the knurls are slightly above and below the piece
    a. The full width of the knurl does not need to be over the part, just a small portion
9. Holding the posts so that the knurls are just touching the diameter of your gauge piece, tighten up bolts B and C
10. Handle Jog the holder away from the part and tighten up Bolts A
11. Your holder should now be setup for your piece. Make sure to run a test piece first to make any slight adjustments that may be needed. Remember you want to adjust each post equal amounts to keep your piece centered in the holder.

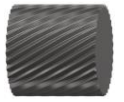
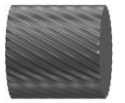
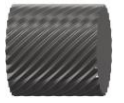
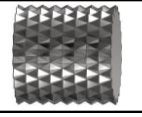
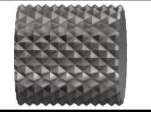
Two Die Round Shank Holder with Swivel Knurl Blocks







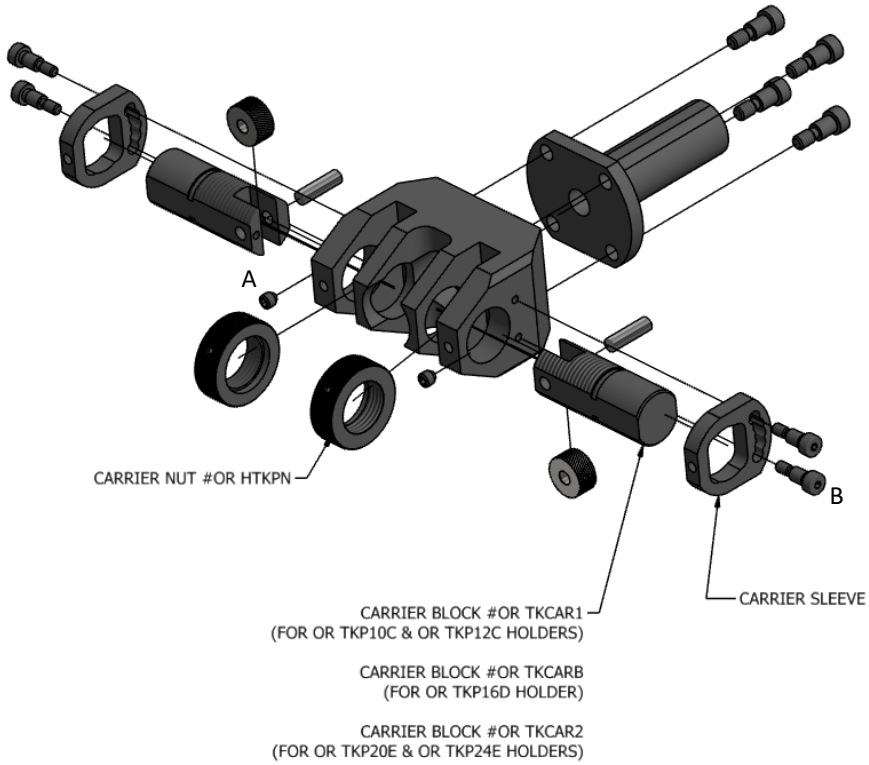
Note: These holders can only feed onto the part in the axial direction. They can also only be used on knurl bands that extend to the end of your part. The tool posts in the head are also capable of being angled allowing for various helix angles with one set of knurls.

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGE 45°
Knurl form on part							
Knurl Type	AA+AA	BR 30°+BR 30°	BL 30°+BL 30°	BR 45°+BR 45°	BL 45°+BL 45°	BR 30° + BL 30°	BR 45° + BL 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z

<u>Warning</u>: While it is possible to make a straight or diagonal pattern using two wheels of the same hand, unless the knurls are synchronized in some manner it is difficult to achieve consistent reliable results.

Tool Number	Pins	Knurl Series	Holder Dimensions (in)									
			A	B	C	D	E	F	G	H	I	J
OR TKP12C	C 144	KP/KPV	0.750	0.500	5.500	0.500	5.000	2.500	2.050	1.500	1.000	0 - 1.13
OR TKP16D	C 144	KP/KPV	1.000	0.500	6.000	0.500	6.000	2.500	2.550	2.000	1.520	0 - 1.53
OR TKP20E	C 144	KP/KPV	1.250	0.750	7.000	0.500	7.000	3.000	3.050	2.000	2.020	0 - 2.03
OR TKP24E	C 144	KP/KPV	1.500	0.750	7.000	0.500	7.000	3.000	3.050	2.000	2.020	0 - 2.03

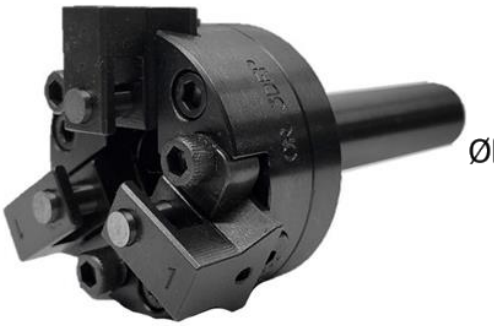
Two Die Round Shank Holder with Swivel Knurl Blocks

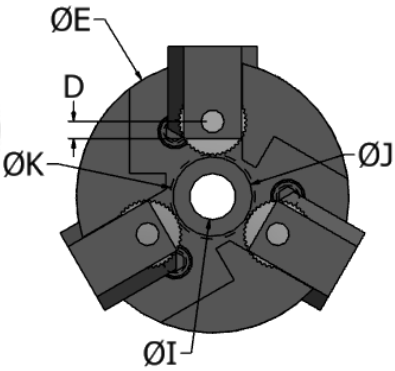


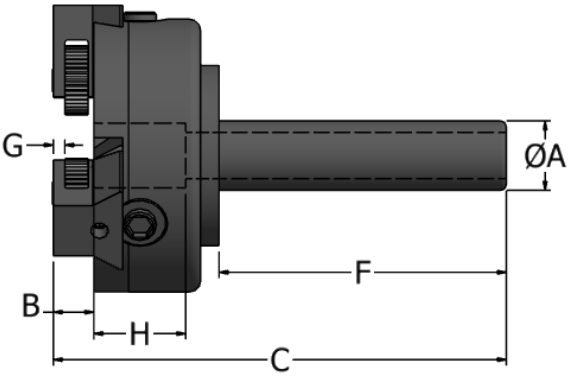
Setup

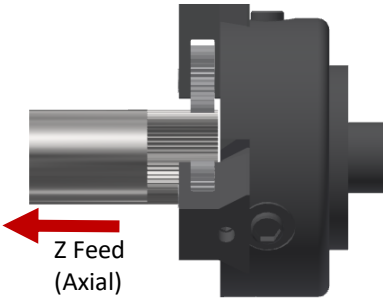
1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws A so that the carrier blocks can be adjusted by rotating the carrier nuts.
3. Determine that the carrier blocks are set to the correct angle, they should arrive set so that a straight knurl tool would produce a straight pattern
    a. If you need to adjust them, unscrew the screws B and rotate the carrier block as needed and reinsert the screws
4. Loosen the set screws holding the knurl pin to slide it out so you can insert the knurl into the carrier blocks and then reinsert the pin and retighten the set screws
    a. You may need to move the carrier blocks using the carrier nuts to fit the knurl in
5. Mount the holder in the machine, similar to how you would a boring bar or drill. This holder is meant to be fed axially onto the part from the end of the part
6. Insert your gauge piece into the chuck or collet of your lathe
7. Carefully handle jog your holder over to the work piece so the knurls are slightly above and below the piece
    a. The full width of the knurl does not need to be over the part, just a small portion
8. Handle Jog the holder away from the part and tighten up Bolts A
9. Your holder should now be setup for your piece. Make sure to run a test piece first to make any slight adjustments that may be needed. Remember you want to adjust each post equal amounts to keep your piece centered in the holder.

Heavy Duty Three Die Holder

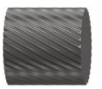
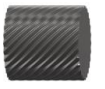
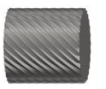
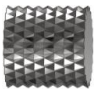
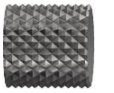








Note: Dim. K is for the part capacity of the holder using the knurls stated in the chart

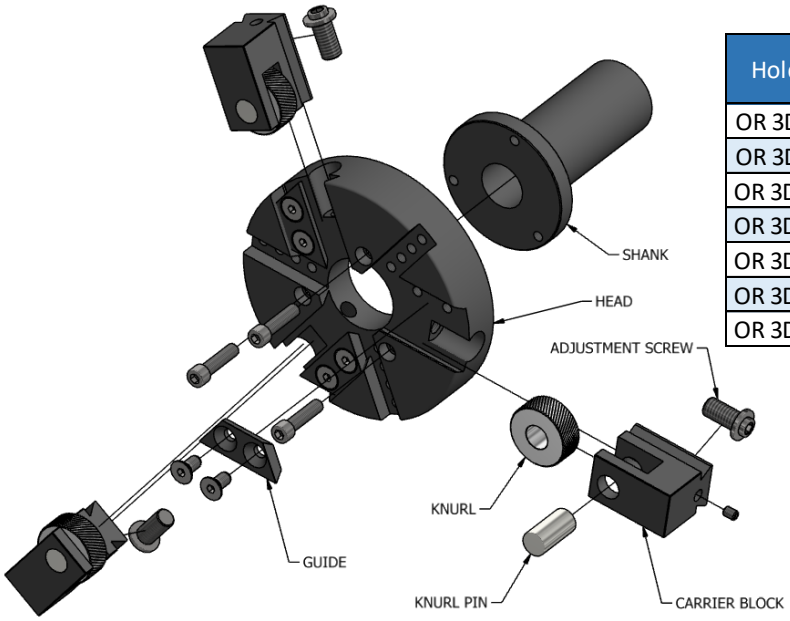
	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGE 45°
Knurl form on part							
Knurl Type	AA+AA+AA	BR 30°+BR 30°+BR 30°	BL 30°+BL 30°+BL 30°	BR 45°+BR 45°+BR 45°	BL 45°+BL 45°+BL 45°	BR 30°+BL 30°+BL 30° BL 30°+BR 30°+BR 30°	BR 45°+BL 45°+BL 45° BL 45°+BR 45°+BR 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z

Tool Number	Pins	Knurl Series	Holder Dimensions (in)										
			A	B	C	D	E	F	G	H	I	J	K
OR 3DBP08	C 082	BP	0.500	0.325	3.265	0.103	1.725	2.000	0.100	0.525	0.330	0.500	.060 - .475
OR 3DBP10	C 082	BP	0.625	0.325	3.875	0.103	1.725	2.600	0.100	0.525	0.385	0.500	.060 - .475
OR 3DBP12	C 082	BP	0.750	0.325	3.875	0.103	1.725	2.600	0.100	0.525	0.385	0.500	.060 - .475
OR 3DEP08	C 103	EP/EPV	0.500	0.325	3.265	0.154	1.725	2.000	0.085	0.525	0.330	0.500	.090 - .475
OR 3DEP10	C 103	EP/EPV	0.625	0.325	3.875	0.154	1.725	2.600	0.085	0.525	0.385	0.500	.090 - .475
OR 3DEP12	C 103	EP/EPV	0.750	0.325	3.875	0.154	1.725	2.600	0.085	0.525	0.385	0.500	.090 - .475
OR 3DGK10	C 124	GK/GKV KN/KNV	0.625	0.450	4.050	0.215	2.950	2.250	0.125	0.965	0.385	0.815	.120 - .940 .140 - .940
OR 3DGK12	C 124	GK/GKV KN/KNV	0.750	0.450	4.900	0.215	2.950	3.100	0.125	0.965	0.465	0.815	.120 - .940 .140 - .940
OR 3DGK16	C 124	GK/GKV KN/KNV	1.000	0.450	4.900	0.215	2.950	3.100	0.125	0.965	0.675	0.815	.120 - .940 .140 - .940
OR 3DPH16	C 208	PH/PHV	1.000	1.050	5.750	0.400	4.975	3.375	0.250	0.965	-	1.500	Call for Details
OR 3DPH24	C 208	PH/PHV	1.500	1.050	5.750	0.400	4.975	3.375	0.250	0.965	-	1.500	Call for Details

Up to Shoulder

Tool Number	Pins	Knurl Series	Holder Dimensions (in)										
			A	B	C	D	E	F	G	H	I	J	K
OR 3DML12	OR UTSP	ML	0.750	0.825	5.600	0.332	2.950	3.100	-	0.965	0.465	0.815	Call for Details
OR 3DML16	OR UTSP	ML	1.000	0.825	5.600	0.332	2.950	3.100	-	0.965	0.675	0.815	Call for Details

Heavy Duty Three Die Holder



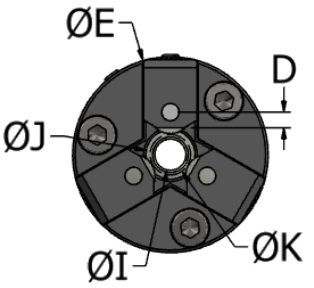
Holder	Replacement Parts		
	Carrier Block Tool #	Binder Tool #	Adjustmet Screw Tool #
OR 3DBP_	OR 3BPCAR	OR 3EPBIN	OR 3EPSCR
OR 3DEP_	OR 3BPCAR	OR 3EPBIN	OR 3EPSCR
OR 3DGK_	OR 3GKCAR	OR 3GKBIN	OR 3GKSCR
OR 3DGK_	OR CARKTI	OR 3GKBIN	OR 3GKSCR
OR 3DGK_	OR CARKTM	OR 3GKBIN	OR 3GKSCR
OR 3DML_	OR 3MLCAR	OR 3GKBIN	OR 3GKSCR
OR 3DPH_	OR 3PHCAR	OR 3PHBIN	OR 3PHSCR

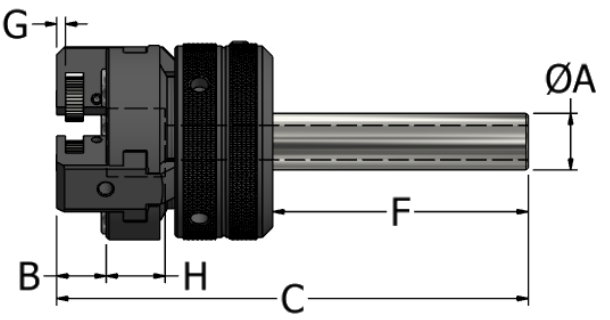
OR CARKTI is for our stock 22° conicals.
OR CARKTM is for 25.5° conicals.
Both these are most commonly used for parts pertaining to windshield wipers

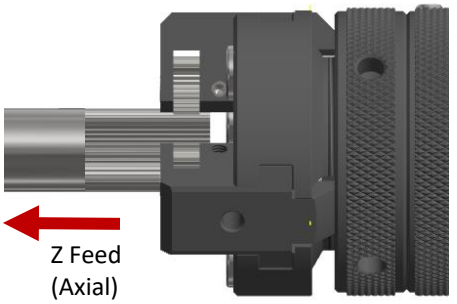
Setup

1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws in the back of the carrier blocks in order to slide the carbide pins out and insert the wheels into the slots. Once in, reinsert the pins and tighten the set screws
    a. You may need to take the carrier block off to get the pin out. To do this you can either unscrew the adjustment screw until the block can be slid out or remove the binder holding the carrier block down
3. Mount the holder in the machine, similar to how you would a boring bar or drill. This holder is meant to be fed axially onto the part from the end of the part
4. Insert your gauge piece into the chuck or collet of your lathe
5. Manually jog the holder in front of the part and widen the carrier blocks using the adjustment screws so the knurls will go around the OD of your gauge piece
6. Bring the holder in further in the axial direction so the knurls are just past the front face of your piece
7. Using the adjustment screws, bring the knurls in until each contacts the part
8. Once this is done, manually jog the holder back off the piece
9. Your holder should now be setup for your piece. Make sure to run a test piece first to make any slight adjustments that may be needed. Remember you want to adjust each post equal amounts to keep your piece centered in the holder.

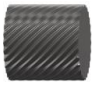
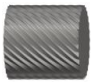
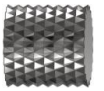
Compact Synchronized Adjustment Three Die Holder







Note: Dim. K is for the part capacity of the holder using the knurls stated in the chart

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGE 45°
Knurl form on part							
Knurl Type	AA+AA+AA	BR 30°+BR 30°+BR 30°	BL 30°+BL 30°+BL 30°	BR 45°+BR 45°+BR 45°	BL 45°+BL 45°+BL 45°	BR 30°+BL 30°+BL 30° BL 30°+BR 30°+BR 30°	BR 45°+BL 45°+BL 45° BL 45°+BR 45°+BR 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z

Inch

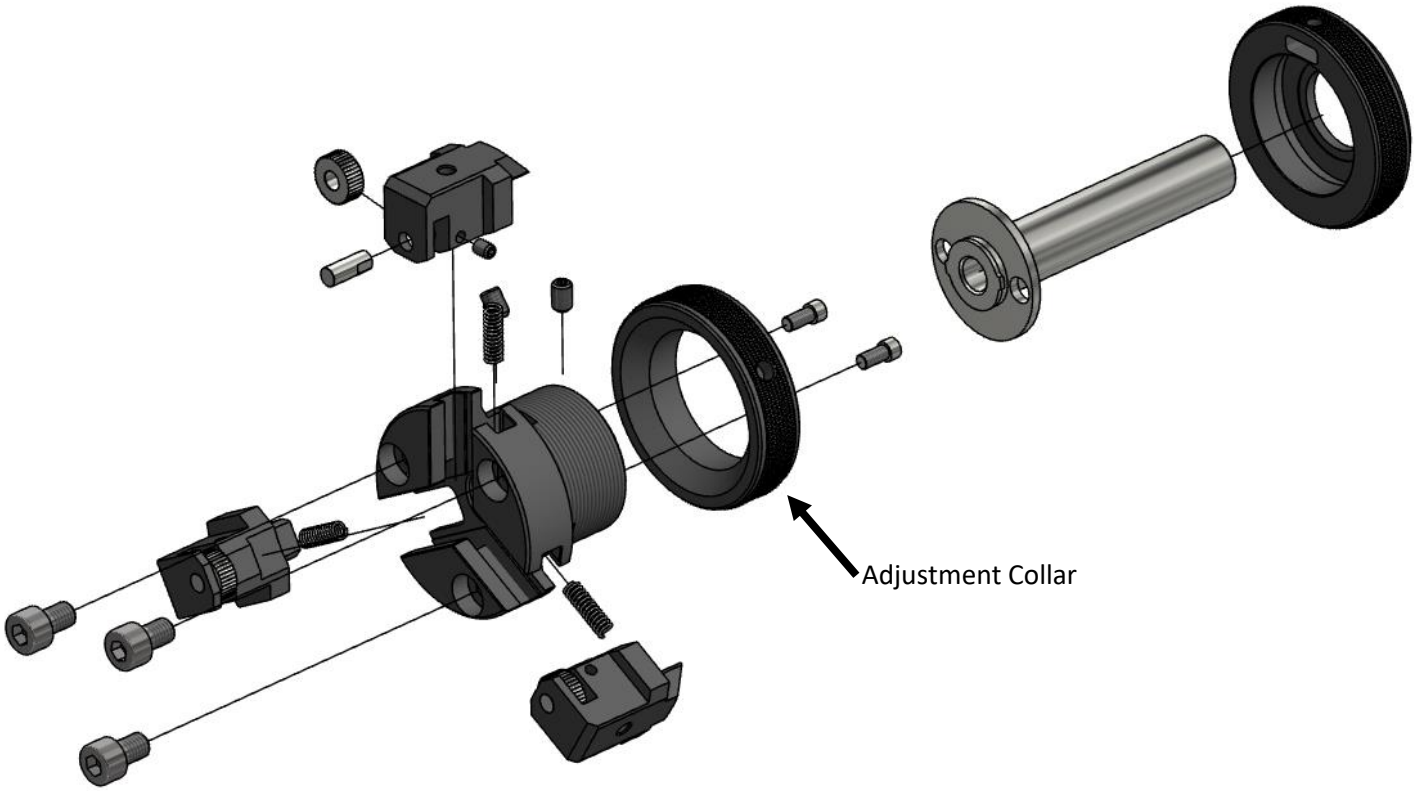
Tool Number	Pins	Knurl Series	Holder Dimensions (in)										
			A	B	C	D	E	F	G	H	I	J	K
OR I3MM08	BL I412	MM	0.500	0.430	2.960	0.139	1.735	1.000	0.080	1.240	-	0.435	0.080 - .400
OR I3MR12	BL I619	MR/MRV	0.750	0.787	5.475	0.313	2.755	2.255	0.080	2.030	0.300	0.590	.160 - 1.200
OR I3MR16	BL I619	MR/MRV	1.000	0.787	5.475	0.313	2.755	2.255	0.080	2.030	0.300	0.590	.160 - 1.200

Metric

Tool Number	Pins	Knurl Series	Holder Dimensions (mm)										
			A	B	C	D	E	F	G	H	I	J	K
OR I3MM16	BL I412	MM	16.00	10.92	107.30	3.53	44.07	57.50	2.03	31.50	6.90	11.05	2.00 - 10.00
OR I3MR20	BL I619	MR/MRV	20.00	20.00	139.07	8.00	70.00	57.28	2.03	51.56	7.62	15.00	4.00 - 30.00

Note: The adjustment of the wheels is synchronized in that each tool post moves together when turning the adjustment collar. The knurl dies themselves however are not synchronized to rotate together.

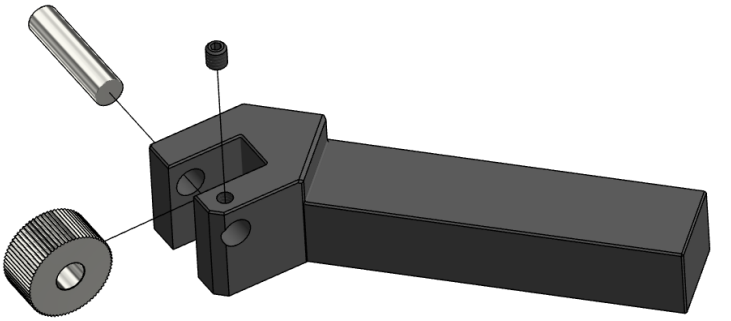
Compact Synchronized Adjustment Three Die Holder

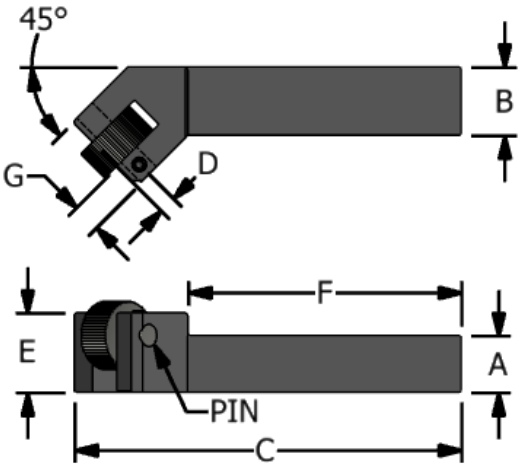


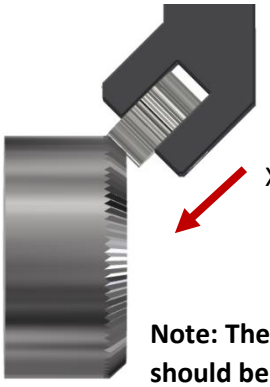
Setup

1. First either locate or make a gauge piece to the diameter that will be used to set the width of the knurls in the holder to the right position (this is your finished part's Minor Diameter). To determine this diameter, follow the equation below. Remember this diameter may still need further tweaking after depending on the knurl/operation.
    a. Setup Diameter = Blank Diameter – Tooth Depth
2. Loosen the set screws in the back of the carrier blocks in order to slide the carbide pins out and insert the wheels into the slots. Once in, reinsert the pins and tighten the set screws
3. Mount the holder in the machine, similar to how you would a boring bar or drill. This holder is meant to be fed axially onto the part from the end of the part
4. Insert your gauge piece into the chuck or collet of your lathe
5. Manually jog the holder in front of the part and widen the carrier blocks using the adjustment collars so the knurls will go around the OD of your gauge piece
    a. You may need to loosen the set screw in the adjustment collar
6. Bring the holder in further in the axial direction so the knurls are just past the front face of your piece
7. Using the adjustment collar, bring the knurls in until each contacts the part and tighten the set screw on the collar
8. Once this is done, manually jog the holder back off the piece
9. Your holder should now be setup for your piece. Make sure to run a test piece first to make any slight adjustments that may be needed. Remember you want to adjust each post equal amounts to keep your piece centered in the holder.

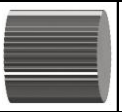
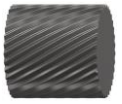
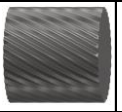
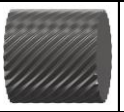
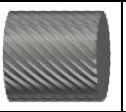
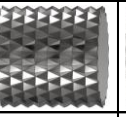
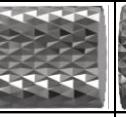
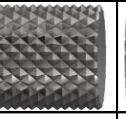
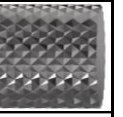
Fixed 45° Bump Holder







Note: The approaching infeed angle should be perpendicular to the face of the part

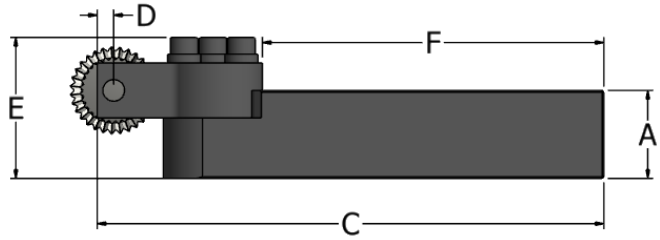
	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z

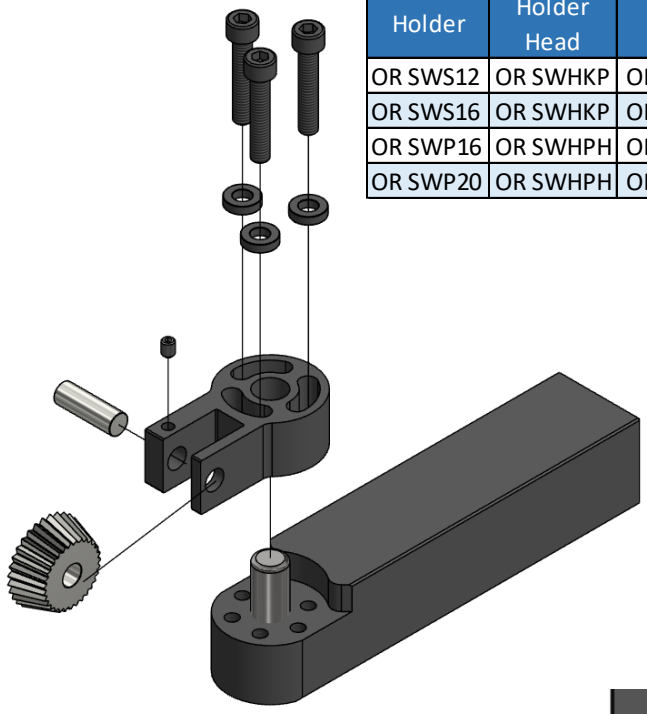
Tool Number	Knurl Series	Pins	Holder Dimensions (in)						
			A	B	C	D	E	F	G
OR KP4512	KP/MK	C 164	0.750	0.750	4.500	0.190	1.063	3.250	0.313
OR KP4516	KP/MK	C 164	1.000	1.000	5.000	0.190	1.313	3.750	0.313

Setup

1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the Carbide Pin
3. Insert the appropriate Knurl in the slot of the holder, and then slide the carbide pin back through
4. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

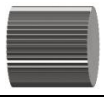
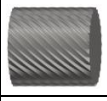
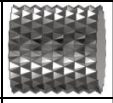
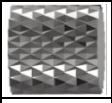
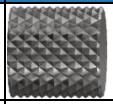
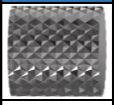
Swivel Head Square Shank Holder

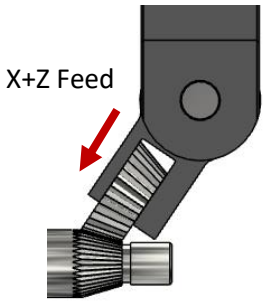




Holder	Replacement Parts	
	Holder Head	Holder Shank
OR SWS12	OR SWHKP	OR SWS12S
OR SWS16	OR SWHKP	OR SWS16S
OR SWP16	OR SWHPH	OR SWP16S
OR SWP20	OR SWHPH	OR SWP20S

Note: The holder heads can be flipped so the narrower sidewall is on the bottom or top

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z



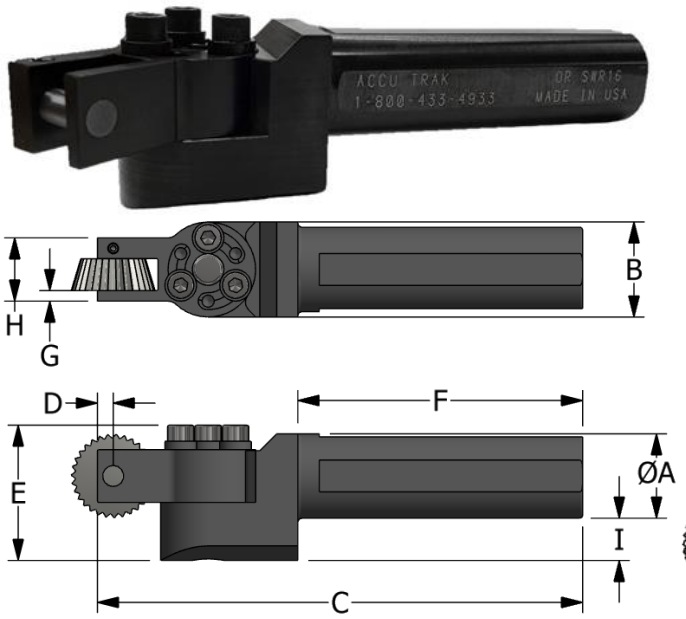
Note: The approaching infeed angle should be perpendicular to the face of the part

Tool Number	Knurl Size	Pins	Holder Dimensions (in)							
			A	B	C	D	E	F	G	H
OR SWS12	1.00x.375x.25	C 124	0.750	1.100	5.750	0.185	1.600	3.875	0.125	0.750
OR SWS16	1.00x.375x.25	C 124	1.000	1.100	5.750	0.185	1.600	3.875	0.125	0.750
OR SWP16	1.25x.500x.500	C 248	1.000	1.500	7.000	0.310	1.870	4.500	0.500	1.500
OR SWP20	1.25x.500x.500	C 248	1.250	1.500	7.000	0.310	2.120	4.500	0.500	1.500

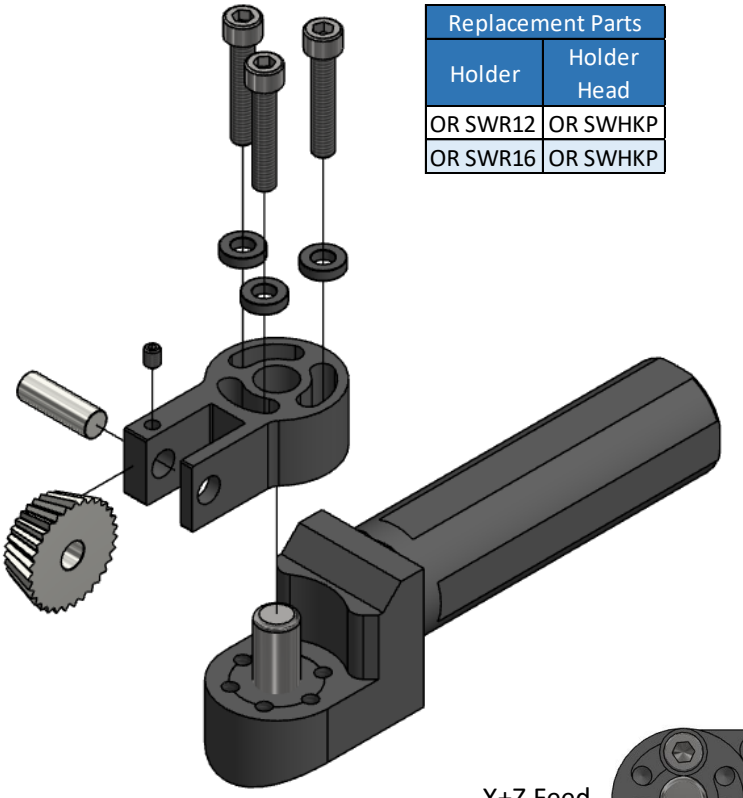
Setup

1. Loosen the set screw holding in the carbide pin, slide the pin out and insert the wheel into the slot
2. Put the carbide pin back in the holder head and tighten the set screw
3. Loosen the 3 screws on top of the head of the tool holder and adjust to the proper angle using measurement tools
    a. You can also set the angle by turning a part blank to the appropriate taper and bringing the knurl in the head into contact, making it flush with the piece, and then retightening the screws.

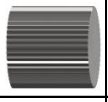
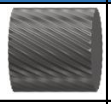
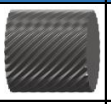
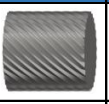
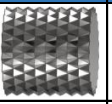
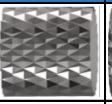
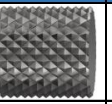
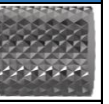
Swivel Head Round Shank Holder

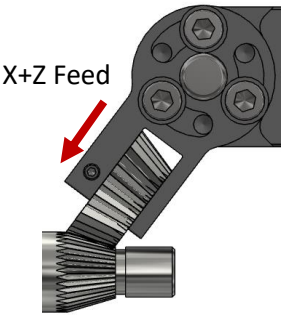


Replacement Parts	
Holder	Holder Head
OR SWR12	OR SWHKP
OR SWR16	OR SWHKP



Note: The holder heads can be flipped so the narrower sidewall is on the bottom or top

	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z



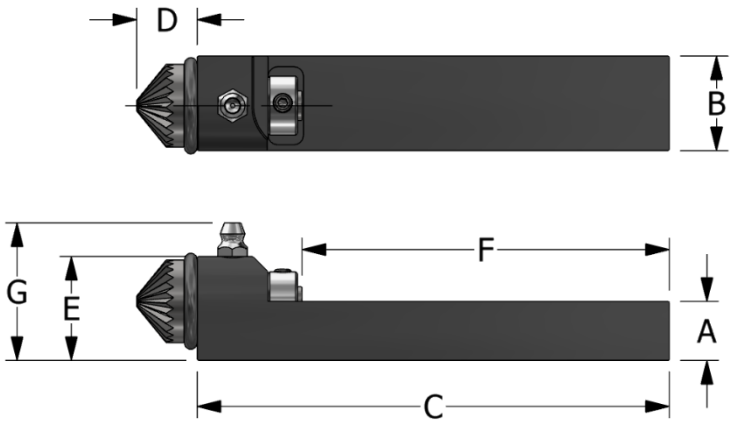
Note: The approaching infeed angle should be perpendicular to the face of the part

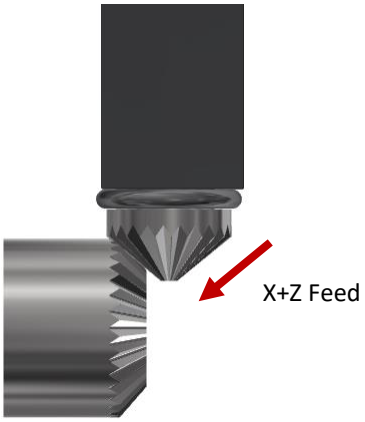
Tool Number	Knurl Size	Pins	Holder Dimensions (in)								
			A	B	C	D	E	F	G	H	I
OR SWR12	1.00x.375x.25	C 124	0.750	1.125	5.750	0.185	1.600	3.875	0.125	0.750	0.625
OR SWR16	1.00x.375x.25	C 124	1.000	1.125	5.750	0.185	1.600	3.375	0.125	0.750	0.500

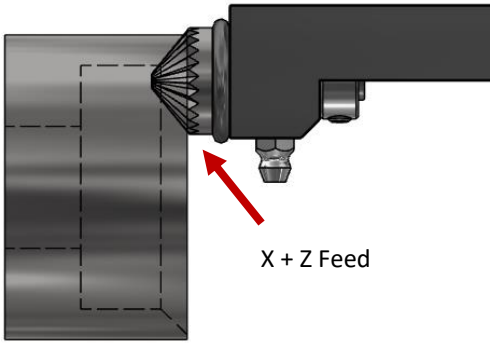
Setup

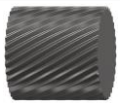
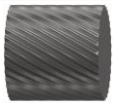
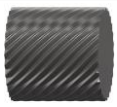
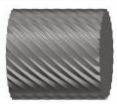
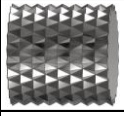
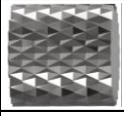
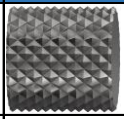
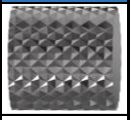
1. Loosen the set screw holding in the carbide pin, slide the pin out and insert the wheel into the slot
2. Put the carbide pin back in the holder head and tighten the set screw
3. Loosen the 3 screws on top of the head of the tool holder and adjust to the proper angle using measurement tools
    a. You can also set the angle by turning a part blank to the appropriate taper and bringing the knurl in the head into contact, making it flush with the piece, and then retightening the screws.

Shank Conical Bump Holder





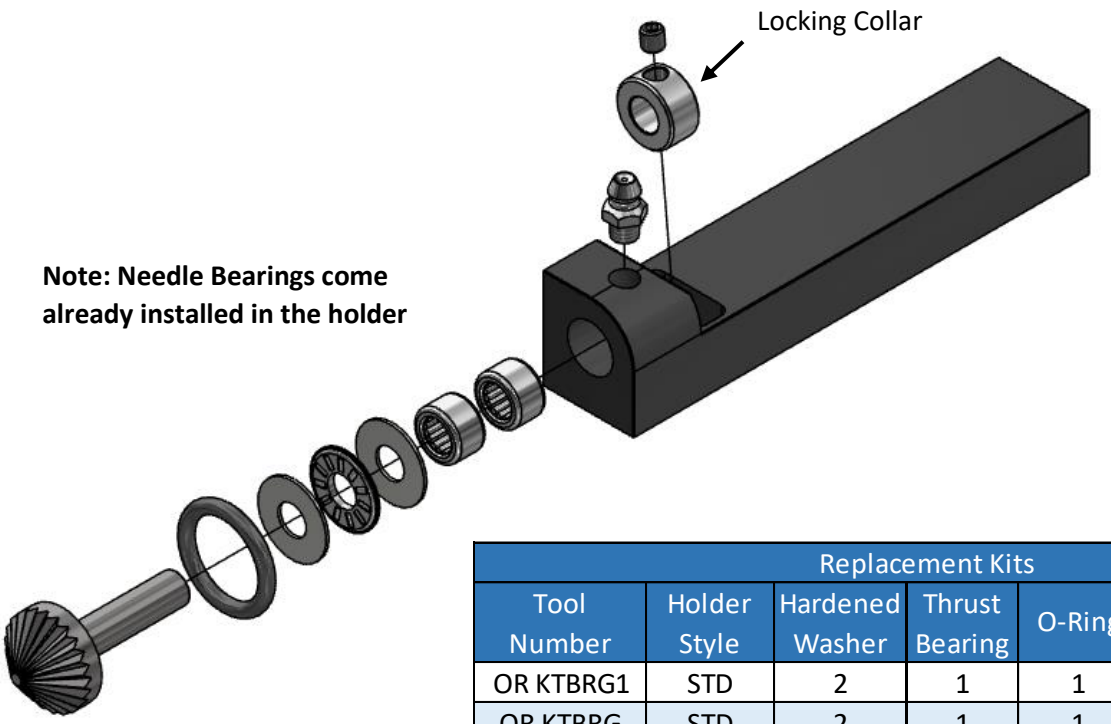


	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z	X+Z

Tool Number	Knurl Series	Holder Dimensions (in)						
		A	B	C	D	E	F	G
OR KTE08	STD Shank	0.500	1.000	5.000	0.660	0.975	3.890	1.350
OR KTE10	STD Shank	0.625	1.000	5.000	0.660	1.100	3.890	1.500

Note: The conical angle this holder can be used for is dictated by the conical angle of the knurl dies. In the case of our stock standard shank conicals, that angle is 45 Degrees.

Shank Conical Bump Holder



Note: Needle Bearings come already installed in the holder

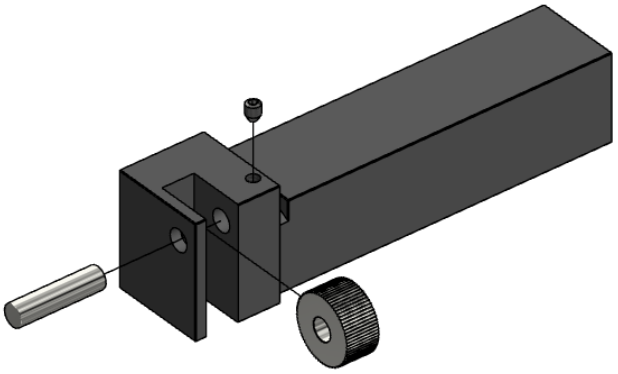
Replacement Kits						
Tool Number	Holder Style	Hardened Washer	Thrust Bearing	O-Ring	Needle Bearing	Carbide Bushing
OR KTBRG1	STD	2	1	1	-	-
OR KTBRG	STD	2	1	1	2	-
OR KT45CB	STD	-	-	-	-	1

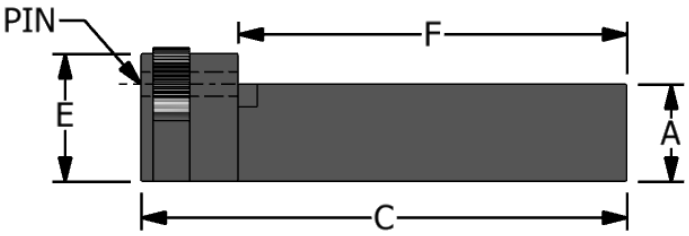
Note: Carbide bushings can replace the 2 needle bearings

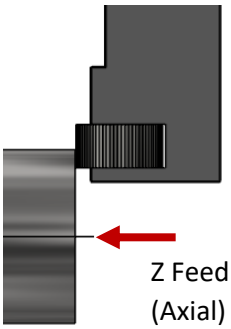
Setup

1. Take the appropriate shank conical knurl and on it, stack the associated hardware that came with the holder in this order: washer, thrust bearing, washer, then O-ring over top of them
2. Now slide the knurl through the Needle Bearings (or carbide bushing, whichever is installed in your holder)
3. Take the Locking Collar and slide it on the end of the shank of the knurl and tighten the set screw

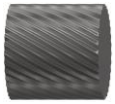
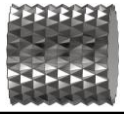
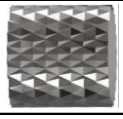
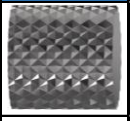
Fixed 90° Face Knurling Holder







Note: This method is only suitable when pitch the pitch change of the knurl band is under 15%

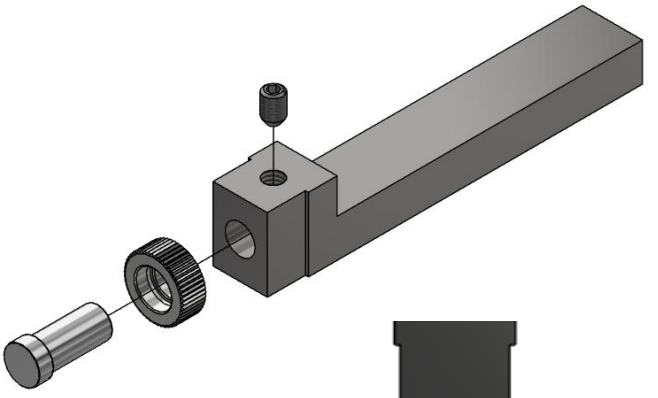
	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z	Z	Z

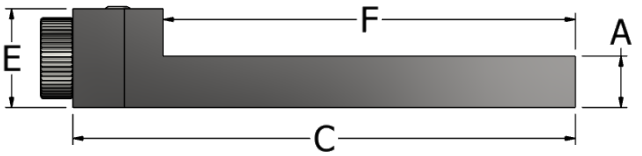
Tool Number	Knurl Series	Pins	Holder Dimensions (in)						
			A	B	C	D	E	F	G
OR 90KP12	KP/MK/MT	C 164	0.750	0.750	4.500	0.185	1.063	3.500	0.125
OR 90KP16	KP/MK/MT	C 164	1.000	1.000	5.000	0.250	1.313	4.000	0.125

Setup

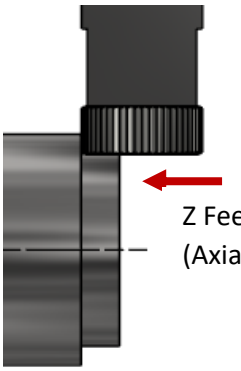
1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the Carbide Pin
3. Insert the appropriate Knurl in the slot of the holder, and then slide the carbide pin back through
4. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

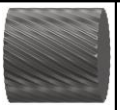
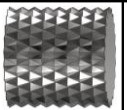
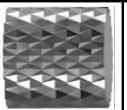
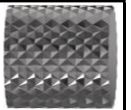
Fixed 90° Face Knurling Up to Shoulder Holder





Note: This method is only suitable when pitch the pitch change of the knurl band is under 15%



	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z	Z	Z

Inch

Tool Number	Knurl Series	Pins	Holder Dimensions (in)						
			A	B	C	D	E	F	G
OR UTS08A	ML	OR UTSP	0.500	0.787	4.875	0.394	0.960	4.000	0.710
OR UTS10A	ML	OR UTSP	0.625	0.787	4.875	0.394	1.085	4.000	0.710
OR UTS12A	ML	OR UTSP	0.750	0.787	4.875	0.394	1.215	4.000	0.710
OR UTS16A	ML	OR UTSP	1.000	1.000	4.875	0.322	1.460	4.000	-

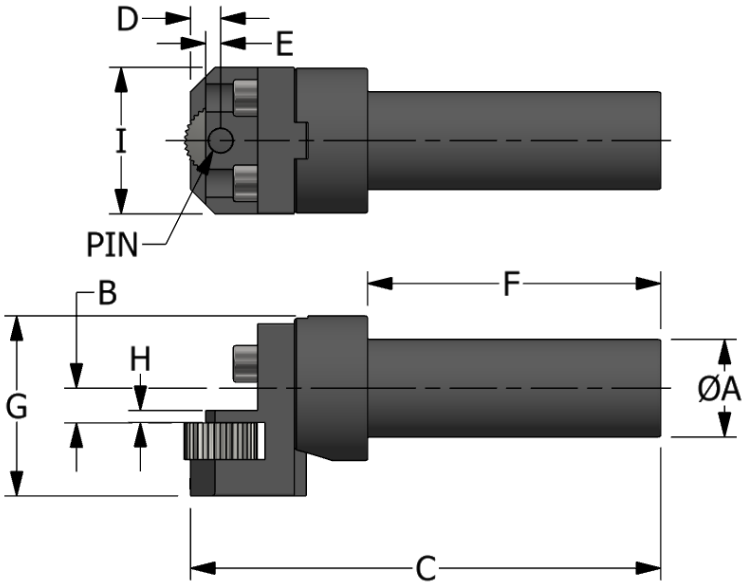
Metric

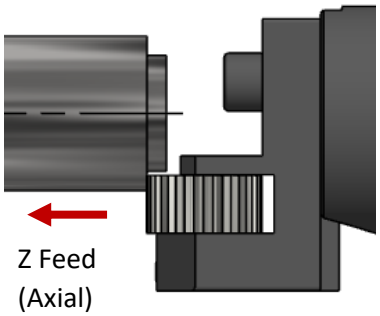
Tool Number	Knurl Series	Pins	Holder Dimensions (mm)						
			A	B	C	D	E	F	G
OR UTSM16A	ML	OR UTSP	16.00	16.00	101.60	8.00	27.94	79.38	-

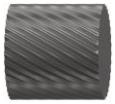
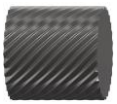
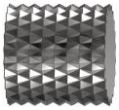
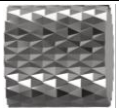
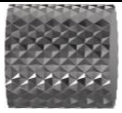
Setup

1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the pin
3. Slide the pin through the knurl so the head of the pin is flush with the side of the knurl
4. With the knurl now on the pin, insert the pin back into the holder
5. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

Adjustable Face Knurling Holder





	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z	Z	Z

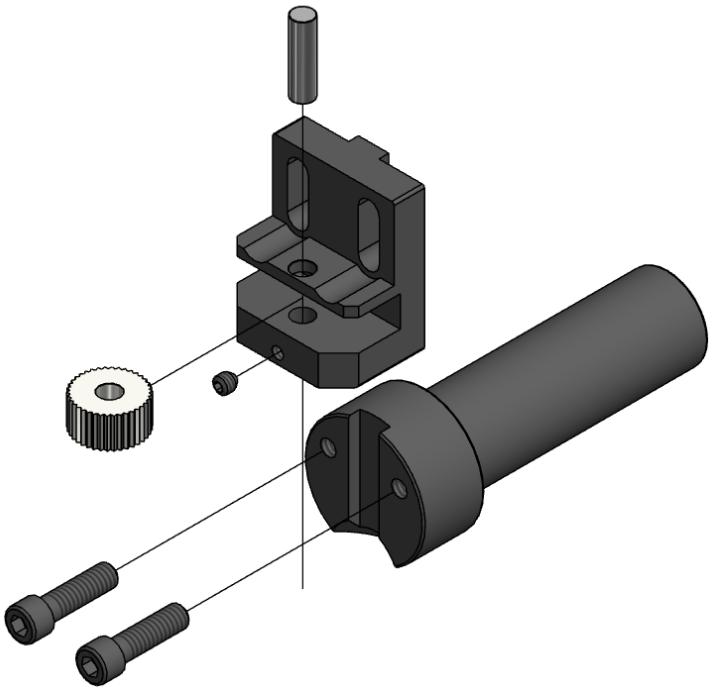
Inch

Tool Number	Knurl Series	Pins	Holder Dimensions (in)								
			A	B	C	D	E	F	G	H	I
OR STUB10	KP,MK,MT	C 144	0.625	0 - 1.0	4.810	0.310	0.155	3.000	2.500	0.125	4.810
OR STUB12	KP,MK,MT	C 144	0.750	0 - 1.0	4.810	0.310	0.155	3.000	2.500	0.125	4.810
OR STUB16	KP,MK,MT	C 144	1.000	0 - 1.0	4.810	0.310	0.155	3.000	2.500	0.125	4.810

Metric

Tool Number	Knurl Series	Pins	Holder Dimensions (mm)								
			A	B	C	D	E	F	G	H	I
OR STUB00	KP,MK,MT	C 144	16.00	0 - 25.4	122.00	7.87	3.94	76.20	63.50	3.18	38.10
OR STUB20	KP,MK,MT	C 144	20.00	0 - 25.4	122.00	7.87	3.94	76.20	63.50	3.18	38.10
OR STUB25	KP,MK,MT	C 144	25.00	0 - 25.4	122.00	7.87	3.94	76.20	63.50	3.18	38.10

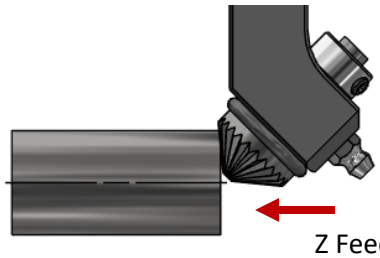
Adjustable Face Knurling Holder



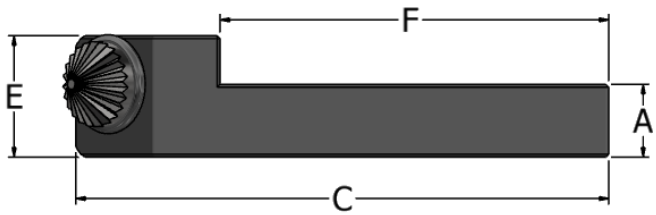
Setup

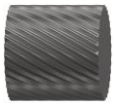
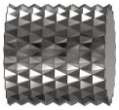
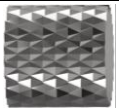
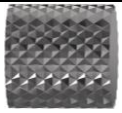
1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the pin and insert the knurl into the slot
3. Tighten the set screw onto the pin and make sure the knurl can spin without binding up
4. Loosen the bolts on the front of the holder mounting the head to the shank and slide the head to the diameter setting necessary for your operation.
    a. These heads are reversible, so you may need to flip it around
5. Retighten the bolts once the head is set to the proper position for your parts diameter

Fixed 45° Shank Conical Face Knurling Holder



Z Feed (Axial)



	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z	Z	Z

Standard Inch

Tool Number	Knurl Series	Holder Dimensions (in)						
		A	B	C	D	E	F	G
OR KTSD10	STD Shank	0.625	0.625	5.480	1.250	1.125	4.000	1.375
OR KTSD12	STD Shank	0.750	0.750	5.480	1.250	1.250	4.000	1.375
OR KTSD16	STD Shank	1.000	1.000	5.480	1.250	1.500	4.000	1.375

Standard Metric

Tool Number	Knurl Series	Holder Dimensions (mm)						
		A	B	C	D	E	F	G
OR KTSM16	STD Shank	16.00	16.00	139.20	31.50	28.70	101.60	34.93
OR KTSM20	STD Shank	20.00	20.00	139.20	31.50	32.64	101.60	34.93
OR KTSM25	STD Shank	25.00	25.00	139.20	31.50	37.72	101.60	34.93

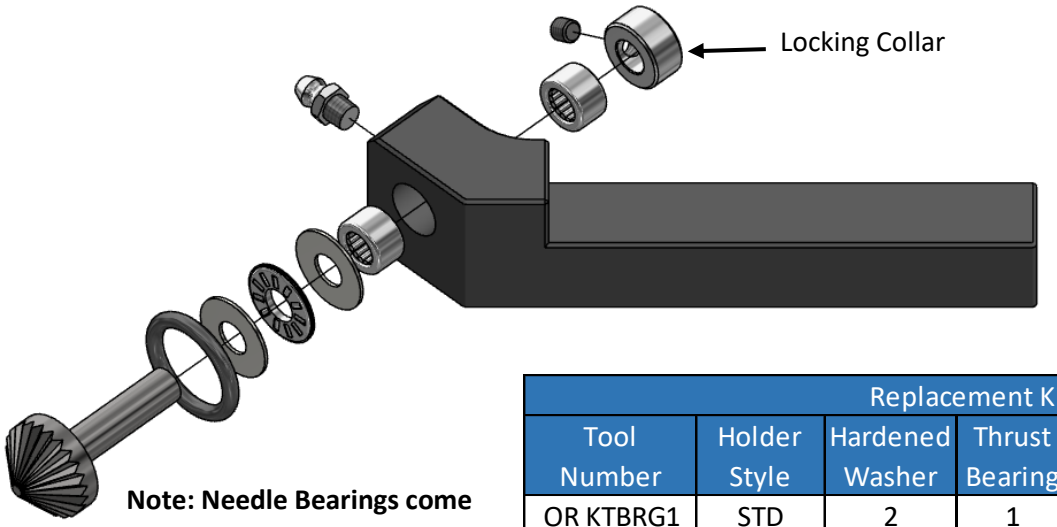
Heavy Duty Inch

Tool Number	Knurl Series	Holder Dimensions (in)						
		A	B	C	D	E	F	G
OR KTHD10	HD Shank	0.625	0.625	5.480	1.240	1.125	4.000	1.375
OR KTHD12	HD Shank	0.750	0.750	5.480	1.240	1.250	4.000	1.375
OR KTHD16	HD Shank	1.000	1.000	5.480	1.240	1.500	4.000	1.375

Heavy Duty Metric

Tool Number	Knurl Series	Holder Dimensions (mm)						
		A	B	C	D	E	F	G
OR KTHM16	HD Shank	16.00	16.00	139.20	31.50	28.70	101.60	34.93
OR KTHM20	HD Shank	20.00	20.00	139.20	31.50	32.64	101.60	34.93
OR KTHM25	HD Shank	25.00	25.00	139.20	31.50	37.72	101.60	34.93

Fixed 45° Shank Conical Face Knurling Holder



Note: Needle Bearings come already installed in the holder

Replacement Kits						
Tool Number	Holder Style	Hardened Washer	Thrust Bearing	O-Ring	Needle Bearing	Carbide Bushing
OR KTBRG1	STD	2	1	1	-	-
OR KTBRG	STD	2	1	1	2	-
OR KT45CB	STD	-	-	-	-	1
OR KTHDBRA	HD	2	1	1	-	-
OR KTHDBR	HD	2	1	1	2	-

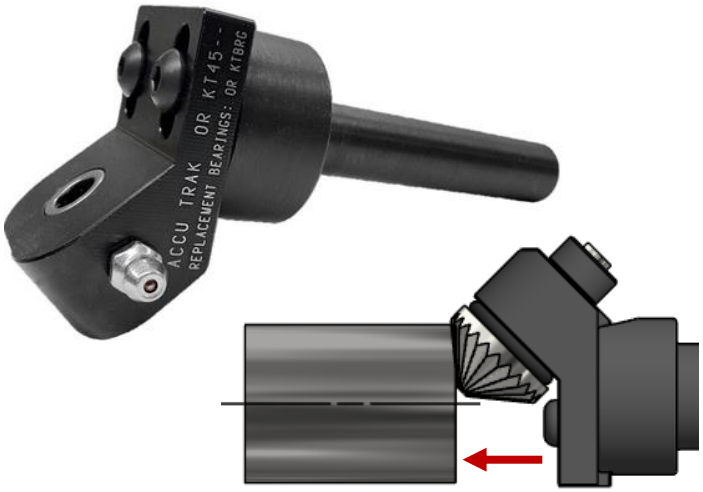
Note: Carbide bushings can replace the 2 needle bearings

Setup

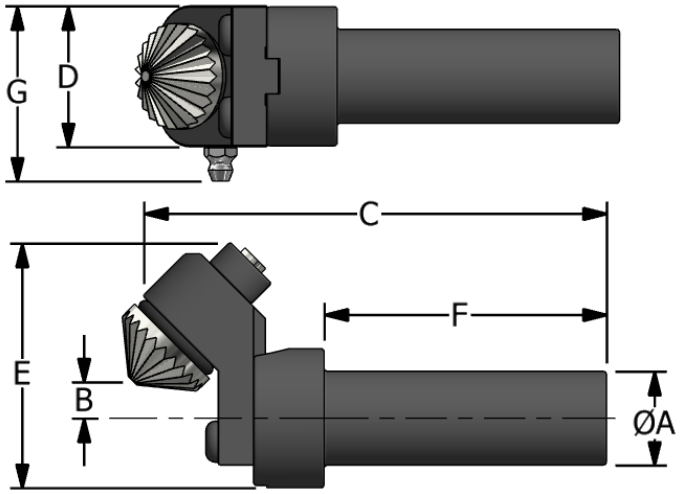
1. Take the appropriate shank conical knurl and on it, stack the associated hardware that came with the holder in this holder: washer, thrust bearing, washer, then O-ring over top of them
2. Now slide the knurl through the Needle Bearings (or carbide bushing, whichever is installed in your holder)
3. Take the Locking Collar and slide it on the end of the shank of the knurl and tighten the set screw

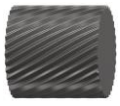
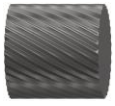
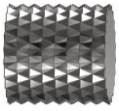
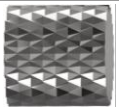
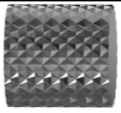
For best results with a conical, remember you want to ideally have it so the conical tip is on the centerline of the part. For a diagram of this see page 57, 59, and 60 where the conical knurls are located.

Adjustable Shank Conical Face Knurling Holder



Z Feed (Axial)



	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°
Knurl form on part									
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°
Feed Axis	Z	Z	Z	Z	Z	Z	Z	Z	Z

Standard Inch

Tool Number	Knurl Series	Holder Dimensions (in)						
		A	B	C	D	E	F	G
OR KT4510	STD Shank	0.650	0 - .500	4.925	1.500	1.625	3.000	1.875
OR KT4512	STD Shank	0.750	0 - .500	4.925	1.500	1.625	3.000	1.875
OR KT4516	STD Shank	1.000	0 - .500	4.925	1.500	1.625	3.000	1.875

Heavy Duty Inch

Tool Number	Knurl Series	Holder Dimensions (in)						
		A	B	C	D	E	F	G
OR HD4510	HD Shank	0.625	0 - .500	4.925	1.500	1.625	3.000	1.875
OR HD4512	HD Shank	0.750	0 - .500	4.925	1.500	1.625	3.000	1.875
OR HD4516	HD Shank	1.000	0 - .500	4.925	1.500	1.625	3.000	1.875

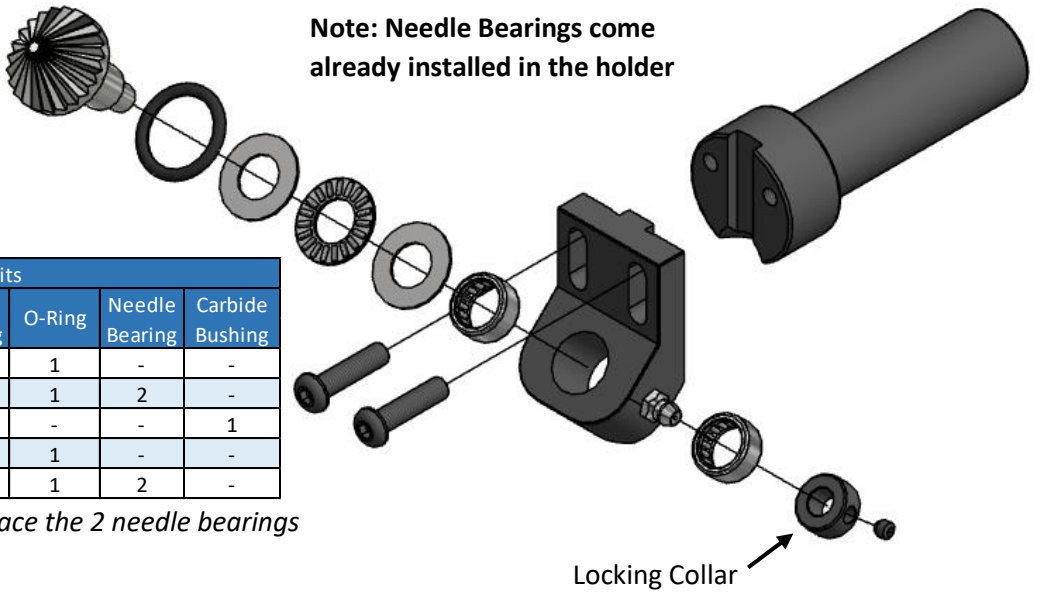
Standard Metric

Tool Number	Knurl Series	Holder Dimensions (mm)						
		A	B	C	D	E	F	G
OR KT45M16	STD Shank	16.00	12.70	125.10	38.10	41.28	76.20	47.63
OR KT45M20	STD Shank	20.00	12.70	125.10	38.10	41.28	76.20	47.63
OR KT45M25	STD Shank	25.00	12.70	125.10	38.10	41.28	76.20	47.63

Heavy Duty Metric

Tool Number	Knurl Series	Holder Dimensions (mm)						
		A	B	C	D	E	F	G
OR HD45M16	HD Shank	16.00	12.70	125.10	38.10	41.28	76.20	47.63
OR HD45M20	HD Shank	20.00	12.70	125.10	38.10	41.28	76.20	47.63
OR HD45M25	HD Shank	25.00	12.70	125.10	38.10	41.28	76.20	47.63

Adjustable Shank Conical Face Knurling Holder



Replacement Kits						
Tool Number	Holder Style	Hardened Washer	Thrust Bearing	O-Ring	Needle Bearing	Carbide Bushing
OR KTBRG1	STD	2	1	1	-	-
OR KTBRG	STD	2	1	1	2	-
OR KT45CB	STD	-	-	-	-	1
OR KTHDBRA	HD	2	1	1	-	-
OR KTHDBR	HD	2	1	1	2	-

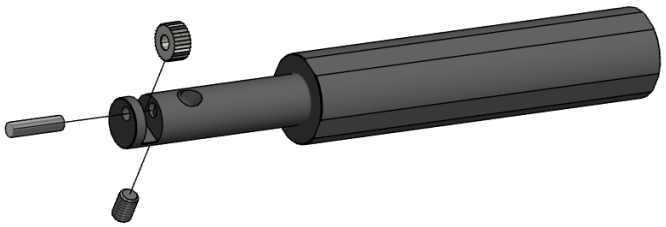
Note: Carbide bushings can replace the 2 needle bearings

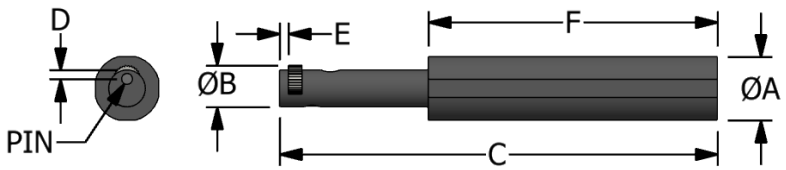
Setup

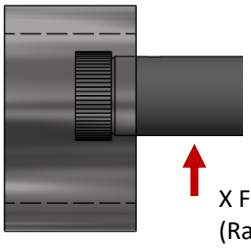
1. Take the appropriate shank conical knurl and on it, stack the associated hardware that came with the holder in this order: washer, thrust bearing, washer, then O-ring over top of them
2. Now slide the knurl through the Needle Bearings (or carbide bushing, whichever is installed in your holder)
3. Take the Locking Collar and slide it on the end of the shank of the knurl and tighten the set screw
4. Lastly, adjust the head to the proper position for your part's diameter by loosening the bolts on the front in order to be able to slide the head up and down.
5. Once in the proper position, retighten the bolts

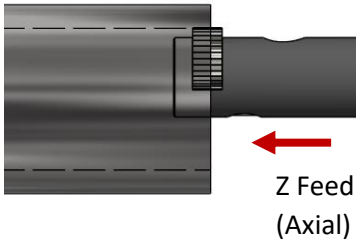
For best results with a conical, remember you want to ideally have it so the conical tip is on the centerline of the part. For a diagram of this see page 57, 59, and 60 where the conical knurls are located.

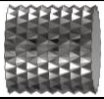
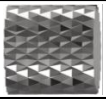
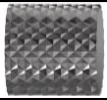
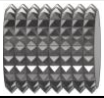
Internal Knurling Holder with Supported Pin









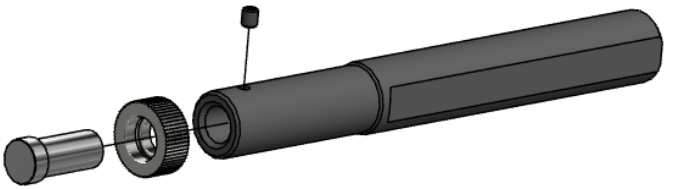
	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°	RKE	RKV
Knurl form on part											
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°	KV	KE
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X	X	X	X	X	X

Tool Number	Knurl Size	Pins	Holder Dimensions (in)					
			A	B	C	D	E	F
OR IBP12C	BP	C 082	0.750	0.420	5.000	0.103	0.100	3.313
OR IBP12CS	BP	C 082	0.750	0.420	5.000	0.103	0.100	4.250
OR IEP16D	EP	C 113	1.000	0.625	6.000	0.190	0.100	3.800
OR IGK20E	GK	C 144	1.250	0.860	7.000	0.250	0.125	3.750
OR IKP20F	KP	C 144	1.250	1.125	8.000	0.285	0.125	3.750

Setup

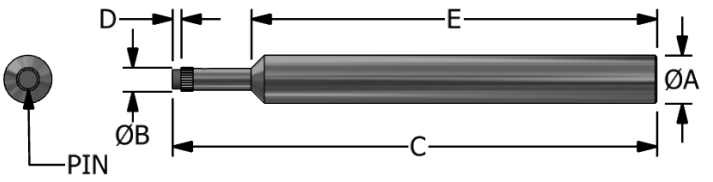
1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the Carbide Pin
3. Insert the appropriate Knurl in the slot of the holder, and then slide the carbide pin back through
4. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

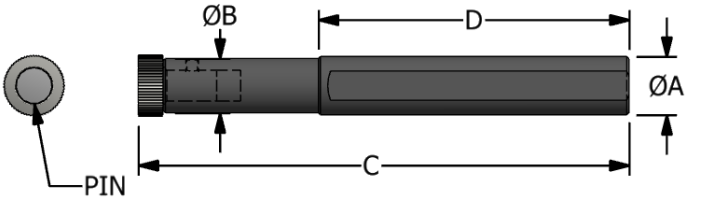
Internal Knurling Holder with Unsupported Pin

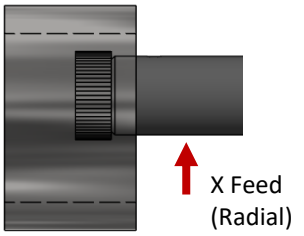


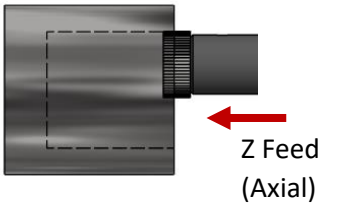
Style A

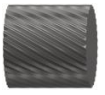
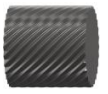
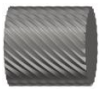
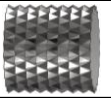
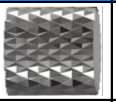
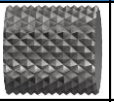
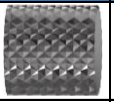
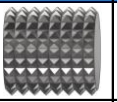
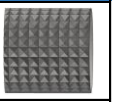
Style B









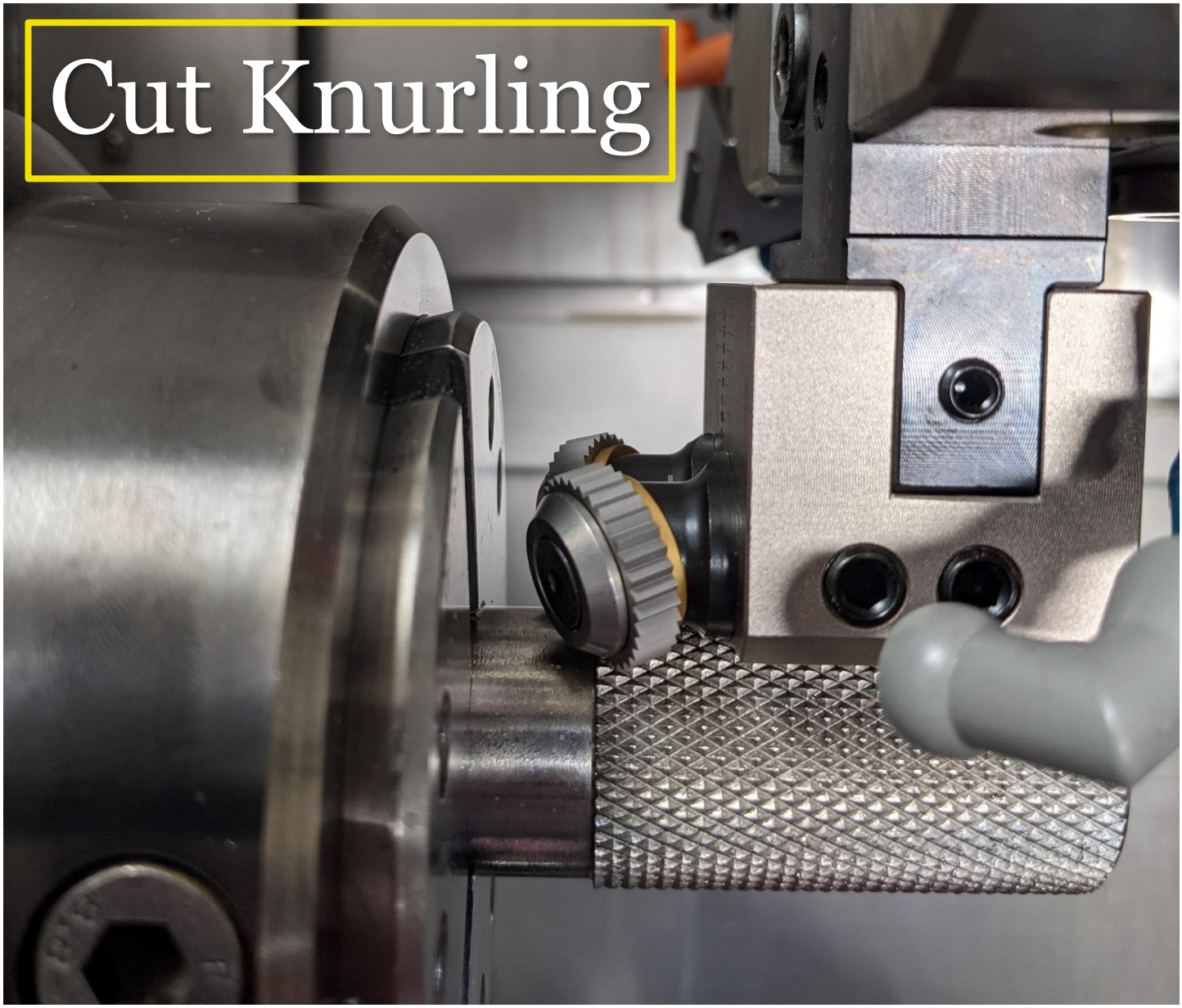
	RAA	RBL 30°	RBR 30°	RBL 45°	RBR 45°	RGE 30°	RGV 30°	RGE 45°	RGV 45°	RKE	RKV
Knurl form on part											
Knurl Type	AA	BR 30°	BL 30°	BR 45°	BL 45°	GV 30°	GE 30°	GV 45°	GE 45°	KV	KE
Feed Axis	X, Z	X, Z	X, Z	X, Z	X, Z	X	X	X	X	X	X

Tool Number	Style	Knurl Size	Pins	Holder Dimensions (in)				
				A	B	C	D	E
OR IBP08A	A	BP	OR INTPBP	0.500	0.280	5.285	0.120	4.250
OR IBP10B	A	BP	OR INTPNP	0.625	0.280	6.285	0.120	5.250
OR IBP10BS	A	BP	OR INTPBP	0.625	0.280	6.285	0.120	5.750
OR IML10	B	ML	OR UTSP	0.625	0.700	6.315	-	4.000
OR IML12	B	ML	OR UTSP	0.750	0.700	6.315	-	4.000
OR IML16	B	ML	OR UTSP	1.000	0.700	6.315	-	4.000

Setup

1. Using an Allen Key, loosen the set screw on top of the head of the holder
2. Remove the pin
3. Slide the pin through the knurl so the head of the pin is flush with the side of the knurl
4. With the knurl now on the pin, insert the pin back into the holder
5. Tighten the set screw onto the pin and make sure the knurl can spin without binding up

Cut Knurling



In this section you will find Accu Trak's selection of Cut knurls and holders. Cut knurling is a material removal process, similar to other common lathe applications. Because it is a material removal process, it generally requires less pressure than the conventional form knurling methods. Cut knurling does however sometimes limit the accuracy with which you can control the knurl form dimensions. This method is often used for things such as aesthetic knurls or for hand grips as opposed to knurl teeth that will be mating with others. It is also a common method to use in soft materials such as aluminum. One thing to remember when cut knurling is the wheels are held at an angle, so for example in order to produce a straight knurl pattern, you would need a 30° Diagonal wheel.

CG Series

8.9 x 2.5 x 4mm
(.350” x .098” x .157”)

- Made from Hi-Cobalt steel
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 15° LH Diagonal	BR 15° RH Diagonal	BL 30° LH Diagonal	BR 30° RH Diagonal
0.3mm / 84.7 TPI	90°	Hi-Cobalt	CGSX0.3	CGAX0.3	CGBX0.3	CGLX0.3	CGRX0.3
0.4mm / 63.5 TPI	90°	Hi-Cobalt	CGSX0.4	CGAX0.4	CGBX0.4	CGLX0.4	CGRX0.4
0.5mm / 50.8 TPI	90°	Hi-Cobalt	CGSX0.5	CGAX0.5	CGBX0.5	CGLX0.5	CGRX0.5
0.6mm / 42.3 TPI	90°	Hi-Cobalt	CGSX0.6	CGAX0.6	CGBX0.6	CGLX0.6	CGRX0.6
0.7mm / 36.3 TPI	90°	Hi-Cobalt	CGSX0.7	CGAX0.7	CGBX0.7	CGLX0.7	CGRX0.7
0.8mm / 31.8 TPI	90°	Hi-Cobalt	CGSX0.8	CGAX0.8	CGBX0.8	CGLX0.8	CGRX0.8
0.9mm / 28.2 TPI	90°	Hi-Cobalt	CGSX0.9	CGAX0.9	CGBX0.9	CGLX0.9	CGRX0.9
1.0mm / 25.4 TPI	90°	Hi-Cobalt	CGSX1.0	CGAX1.0	CGBX1.0	CGLX1.0	CGRX1.0
1.2mm / 21.2 TPI	90°	Hi-Cobalt	CGSX1.2	CGAX1.2	CGBX1.2	CGLX1.2	CGRX1.2

CB Series

14.5 x 3 x 5mm
(.571” x .118” x .197”)

- Made from Hi-Cobalt steel
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 15° LH Diagonal	BR 15° RH Diagonal	BL 30° LH Diagonal	BR 30° RH Diagonal
0.4mm / 63.5 TPI	90°	Hi-Cobalt	CBSX0.4	CBAX0.4	CBBX0.4	CBLX0.4	CBRX0.4
0.5mm / 50.8 TPI	90°	Hi-Cobalt	CBSX0.5	CBAX0.5	CBBX0.5	CBLX0.5	CBRX0.5
0.6mm / 42.3 TPI	90°	Hi-Cobalt	CBSX0.6	CBAX0.6	CBBX0.6	CBLX0.6	CBRX0.6
0.7mm / 36.3 TPI	90°	Hi-Cobalt	CBSX0.7	CBAX0.7	CBBX0.7	CBLX0.7	CBRX0.7
0.8mm / 31.8 TPI	90°	Hi-Cobalt	CBSX0.8	CBAX0.8	CBBX0.8	CBLX0.8	CBRX0.8
0.9mm / 28.2 TPI	90°	Hi-Cobalt	CBSX0.9	-	-	-	-
1.0mm / 25.4 TPI	90°	Hi-Cobalt	CBSX1.0	CBAX1.0	CBBX1.0	CBLX1.0	CBRX1.0
1.2mm / 21.2 TPI	90°	Hi-Cobalt	CBSX1.2	CBAX1.2	CBBX1.2	CBLX1.2	CBRX1.2

CP Series

15 x 4 x 8mm
(.591” x .157” x .315”)

- Made from Hi-Cobalt steel
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 15° LH Diagonal	BR 15° RH Diagonal	BL 30° LH Diagonal	BR 30° RH Diagonal
0.4mm / 63.5 TPI	90°	Hi-Cobalt	CPSX0.4	-	-	CPLX0.4	CPRX0.4
0.5mm / 50.8 TPI	90°	Hi-Cobalt	CPSX0.5	CPAX0.5	CPBX0.5	CPLX0.5	CPRX0.5
0.6mm / 42.3 TPI	90°	Hi-Cobalt	CPSX0.6	CPAX0.6	CPBX0.6	CPLX0.6	CPRX0.6
0.7mm / 36.3 TPI	90°	Hi-Cobalt	CPSX0.7	CPAX0.7	CPBX0.7	CPLX0.7	CPRX0.7
0.8mm / 31.8 TPI	90°	Hi-Cobalt	CPSX0.8	-	-	CPLX0.8	CPRX0.8
0.9mm / 28.2 TPI	90°	Hi-Cobalt	CPSX0.9	-	-	-	-
1.0mm / 25.4 TPI	90°	Hi-Cobalt	CPSX1.0	CPAX1.0	CPBX1.0	CPLX1.0	CPRX1.0
1.2mm / 21.2 TPI	90°	Hi-Cobalt	CPSX1.2	CPAX1.2	CPBX1.2	CPLX1.2	CPRX1.2
1.5mm / 16.9 TPI	90°	Hi-Cobalt	CPSX1.5	CPAX1.5	CPBX1.5	CPLX1.5	CPRX1.5
1.6mm / 15.9 TPI	90°	Hi-Cobalt	CPSX1.6	-	-	-	-
1.8mm / 14.1 TPI	90°	Hi-Cobalt	CPSX1.8	CPAX1.8	CPBX1.8	-	-
2.0mm / 12.7 TPI	90°	Hi-Cobalt	CPSX2.0	-	-	-	-

CC Series

21.5 x 5 x 8mm
(.846” x .197” x .315”)

- Made from Hi-Cobalt steel
- Bevels available per customer request
- Coatings and Treatments per customer request

Pitch	Tooth Form	Steel Type	AA Straight	BL 15° LH Diagonal	BR 15° RH Diagonal	BL 30° LH Diagonal	BR 30° RH Diagonal
0.3mm / 84.7 TPI	90°	Hi-Cobalt	CCSX0.3	CCAX0.3	CCBX0.3	CCLX0.3	CCRX0.3
0.4mm / 63.5 TPI	90°	Hi-Cobalt	CCSX0.4	CCAX0.4	CCBX0.4	CCLX0.4	CCRX0.4
0.5mm / 50.8 TPI	90°	Hi-Cobalt	CCSX0.5	CCAX0.5	CCBX0.5	CCLX0.5	CCRX0.5
0.6mm / 42.3 TPI	90°	Hi-Cobalt	CCSX0.6	CCAX0.6	CCBX0.6	CCLX0.6	CCRX0.6
0.7mm / 36.3 TPI	90°	Hi-Cobalt	CCSX0.7	-	-	CCLX0.7	CCRX0.7
0.8mm / 31.8 TPI	90°	Hi-Cobalt	CCSX0.8	CCAX0.8	CCBX0.8	CCLX0.8	CCRX0.8
1.0mm / 25.4 TPI	90°	Hi-Cobalt	CCSX1.0	CCAX1.0	CCBX1.0	CCLX1.0	CCRX1.0
1.2mm / 21.2 TPI	90°	Hi-Cobalt	CCSX1.2	CCAX1.2	CCBX1.2	CCLX1.2	CCRX1.2
1.5mm / 16.9 TPI	90°	Hi-Cobalt	CCSX1.5	CCAX1.5	CCBX1.5	CCLX1.5	CCRX1.5
1.6mm / 15.9 TPI	90°	Hi-Cobalt	CCSX1.6	-	-	CCLX1.6	CCRX1.6
2.0mm / 12.7 TPI	90°	Hi-Cobalt	CCSX2.0	CCAX2.0	CCBX2.0	CCLX2.0	CCRX2.0
2.5mm / 10.2 TPI	90°	Hi-Cobalt	CCSX2.5	-	-	CCLX2.5	CCRX2.5
3.0mm / 8.5 TPI	90°	Hi-Cobalt	CCSX3.0	CCAX3.0	CCBX3.0	-	-

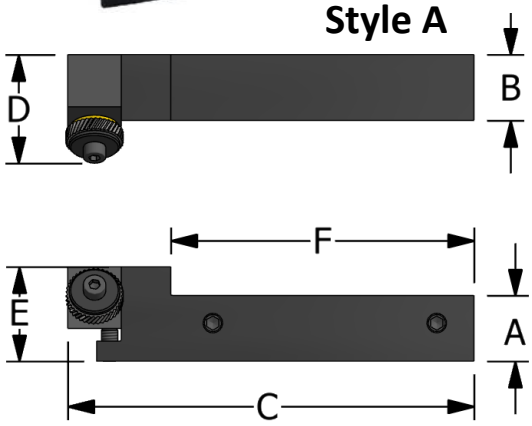
CV Series

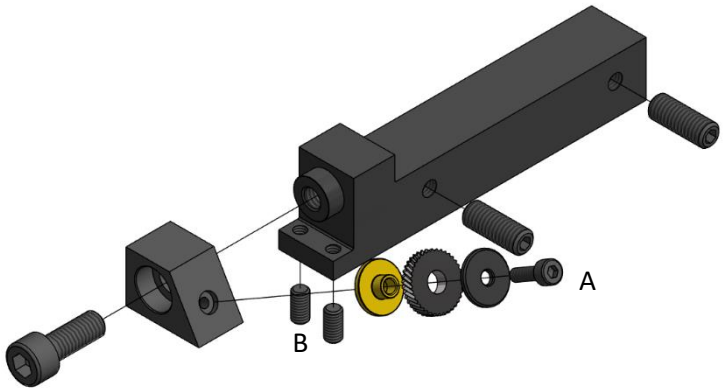
25 x 6 x 8mm
(.984” x .236” x .315”)

- Made from Hi-Cobalt steel
- Bevels available per customer request
- Coatings and Treatments per customer request

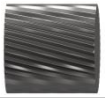
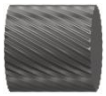
Pitch	Tooth Form	Steel Type	AA Straight	BL 15° LH Diagonal	BR 15° RH Diagonal	BL 30° LH Diagonal	BR 30° RH Diagonal
0.4mm / 63.5 TPI	90°	Hi-Cobalt	CVSX0.4	CVAX0.4	CVBX0.4	CVLX0.4	CVRX0.4
0.5mm / 50.8 TPI	90°	Hi-Cobalt	CVSX0.5	CVAX0.5	CVBX0.5	CVLX0.5	CVRX0.5
0.6mm / 42.3 TPI	90°	Hi-Cobalt	CVSX0.6	CVAX0.6	CVBX0.6	CVLX0.6	CVRX0.6
0.7mm / 36.3 TPI	90°	Hi-Cobalt	CVSX0.7	CVAX0.7	CVBX0.8	CVLX0.7	CVRX0.7
0.8mm / 31.8 TPI	90°	Hi-Cobalt	CVSX0.8	CVAX0.8	CVBX0.8	CVLX0.8	CVRX0.8
1.0mm / 25.4 TPI	90°	Hi-Cobalt	CVSX1.0	CVAX1.0	CVBX1.0	CVLX1.0	CVRX1.0
1.2mm / 21.2 TPI	90°	Hi-Cobalt	CVSX1.2	CVAX1.2	CVBX1.2	CVLX1.2	CVRX1.2
1.5mm / 16.9 TPI	90°	Hi-Cobalt	CVSX1.5	CVAX1.5	CVBX1.5	CVLX1.5	CVRX1.5
1.6mm / 15.9 TPI	90°	Hi-Cobalt	CVSX1.6	-	-	CVLX1.6	CVRX1.6
1.8mm / 14.1 TPI	90°	Hi-Cobalt	CVSX1.8	-	-	-	-
2.0mm / 12.7 TPI	90°	Hi-Cobalt	CVSX2.0	CVAX2.0	CVBX2.0	CVLX2.0	CVRX2.0
3.0mm / 8.5 TPI	90°	Hi-Cobalt	CVSX3.0	-	-	-	-

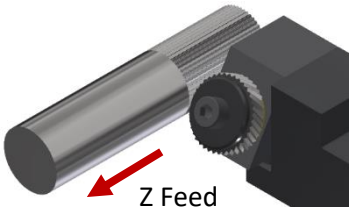
Single Die Cut Type Holder





	Replacement Parts			
Holder	Bushing	Washer	Screw (A)	Head
CB	OR E1453	OR A1453	OR T1453	OR ISCBHD
CC	OR E2155	OR A2155	OR T2155	OR ISCCHD

	RAA	RBL 15°	RBR 15°	RBL 30°	RBR 30°
Knurl form on part					
Knurl Type	BR 30° or BL 30°	BR 45°	BL 45°	AA	AA
Feed Axis	Z	Z	Z	Z	Z



Inch

Tool Number	Knurl Series	Holder Hand	Holder Dimensions (in)					
			A	B	C	D	E	F
OR IS.75	CC	RH/LH	0.750	0.984	5.250	1.500	1.350	3.875
OR IS1.0	CC	RH/LH	1.000	0.984	5.250	1.540	1.350	3.875

Metric

Tool Number	Knurl Series	Holder Hand	Holder Dimensions (mm)					
			A	B	C	D	E	F
OR IS14	CB	RH/LH	14.00	16.00	100.00	28.00	23.00	75.00
OR IS16	CB	RH/LH	16.00	16.00	100.00	28.00	23.00	75.00
OR IS20	CC	RH/LH	20.00	25.00	133.00	39.00	36.00	98.00
OR IS25	CC	RH/LH	25.00	25.00	133.00	39.00	36.00	98.00

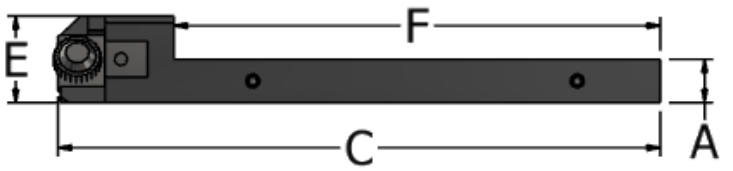
Setup

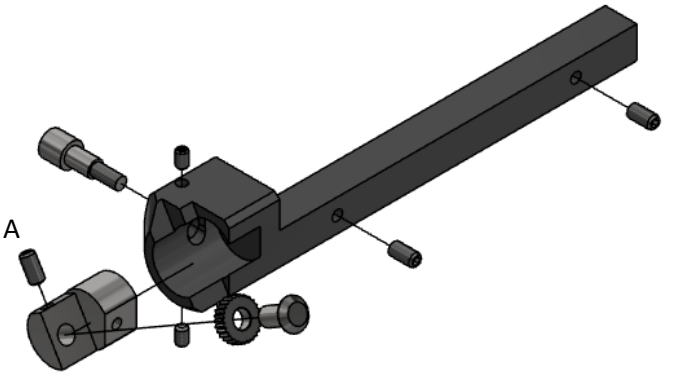
1. Using an allen key, take out the bolt (A) in the knurl head
2. Now place the knurl on the bushing, then put the washer on the other side of the knurl
3. Re-insert the bolt through the washer, wheel, and bushing and tighten to holder. Ensure the wheels spin.
    a. Further adjustment can be made to the knurl's angle using the set screws (B) below the head

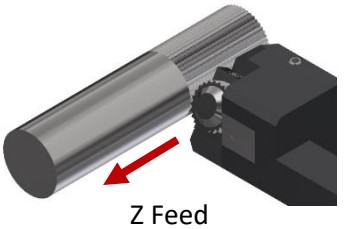
Remember, cut holders have the knurls mounted at an angle so the knurl hands required to produce specific patterns are different than normal form knurls. See the chart above for more info

Swiss Machine Single Die Cut Type Holder

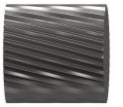
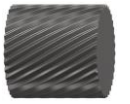
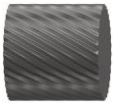
Style S







Z Feed
(Axial)

	RAA	RBL 15°	RBR 15°	RBL 30°	RBR 30°
Knurl form on part					
Knurl Type	BR 30° or BL 30°	BR 45°	BL 45°	AA	AA
Feed Axis	Z	Z	Z	Z	Z

Tool Number	Knurl Series	Pins	Holder Hand	Holder Dimensions (mm)					
				A	B	C	D	E	F
OR IS06R	CG	OR ISCGP	RH	6.00	6.00	110.00	18.00	16.00	90.00
OR IS08R	CG	OR ISCGP	RH	8.00	8.00	110.00	18.00	16.00	90.00
OR IS10R	CG	OR ISCGP	RH	10.00	10.00	110.00	18.00	18.00	90.00
OR IS10L	CG	OR ISCGP	LH	10.00	10.00	110.00	18.00	18.00	90.00
OR IS12R	CG	OR ISCGP	RH	12.00	12.00	110.00	18.00	20.00	90.00

These holders can also be used in normal CNC machines also

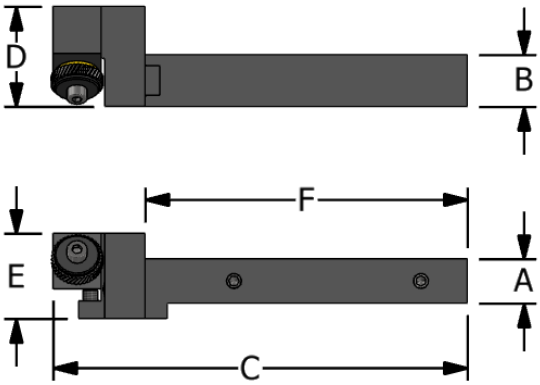
Setup

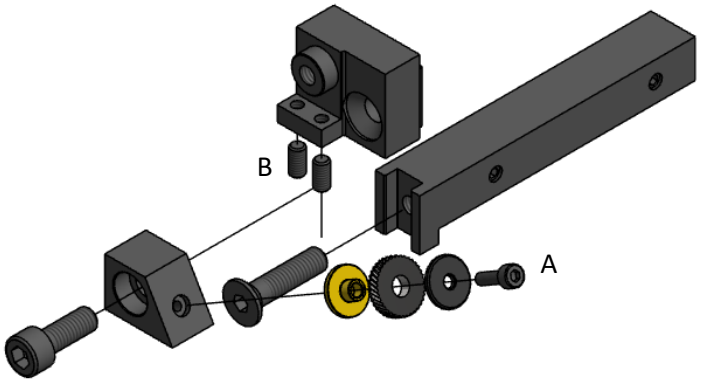
1. Using an allen key, loosen the set screw (A) in the knurl head insert
2. Slide the pin out and mount your knurl onto the holder, sliding the pin through the knurl
3. Retighten the set screw and ensure your knurl wheel freely rotates

Remember, cut holders have the knurls mounted at an angle so the knurl hands required to produce specific patterns are different than normal form knurls. See the chart above for more info

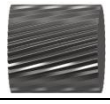
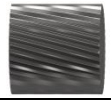
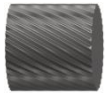
Swiss Machine Single Die Cut Type Holder

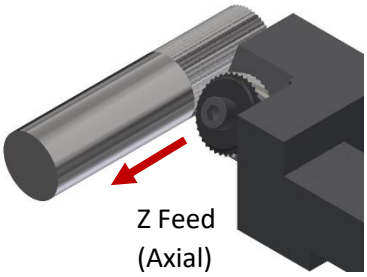
Style S2





	Replacement Parts			
Holder	Bushing	Washer	Screw (A)	Head
CB	OR E1453	OR A1453	OR T1453	OR ISCBHD

	RAA	RBL 15°	RBR 15°	RBL 30°	RBR 30°
Knurl form on part					
Knurl Type	BR 30° or BL 30°	BR 45°	BL 45°	AA	AA
Feed Axis	Z	Z	Z	Z	Z



Tool Number	Knurl Series	Holder Hand	Holder Dimensions (mm)					
			A	B	C	D	E	F
OR IS12RS	CB	RH/LH	12.00	14.00	113.00	27.00	23.00	87.00
OR IS14RS	CB	RH/LH	14.00	14.00	113.00	27.00	23.00	87.00
OR IS16RS	CB	RH/LH	16.00	16.00	113.00	27.00	23.00	87.00

These holders can also be used in normal CNC machines also

Setup

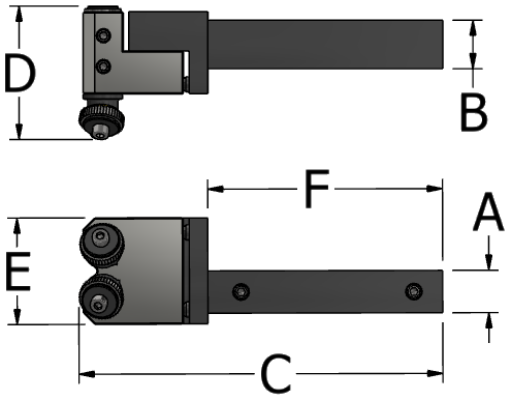
1. Using an allen key, take out the bolt (A) in the knurl head
2. Now place the knurl on the bushing, then put the washer on the other side of the knurl
3. Re-insert the bolt through the washer, wheel, and bushing and tighten to holder. Ensure the wheels spin.
    a. Further adjustment can be made to the knurl's angle using the set screws (B) below the head

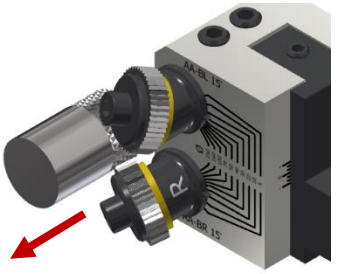
Remember, cut holders have the knurls mounted at an angle so the knurl hands required to produce specific patterns are different than normal form knurls. See the chart above for more info

Two Die Cut Type Holder

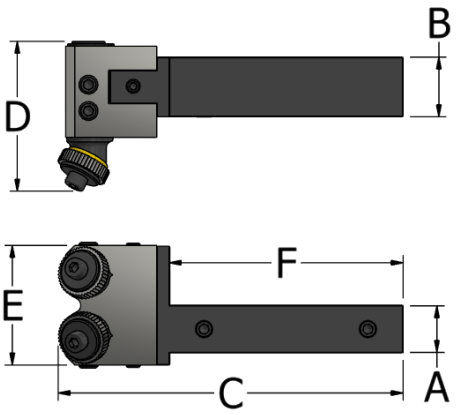
Style A

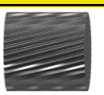
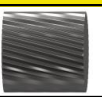
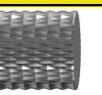
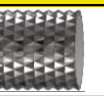
Style B





Z Feed
(Axial)



	RAA	RBL 15°	RBR 15°	RBL 30°	RBR 30°	RGE 15°	RGE 30°	RGE 45°
Knurl form on part								
Knurl Type	BR 30° or BL 30°	BR 45°	BL 45°	AA	AA	BR 45° + BL 45°	AA + AA	BR 15° + BL 15°
Feed Axis	Z	Z	Z	Z	Z	Z	Z	Z

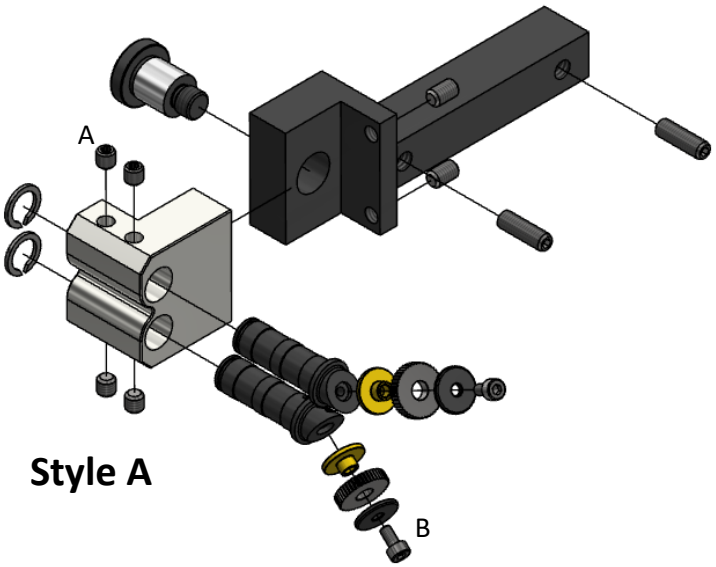
Inch

Tool Number	Knurl Series	Holder Hand	Style	Holder Dimensions (in)						
				A	B	C	D	E	F	Capacity
OR ID.75R	CC	RH/LH	B	0.750	0.984	5.650	2.450	1.975	3.855	.20 - 9.84
OR ID1.0R	CC	RH/LH	B	1.000	0.984	5.650	2.450	1.975	3.855	.20 - 9.84

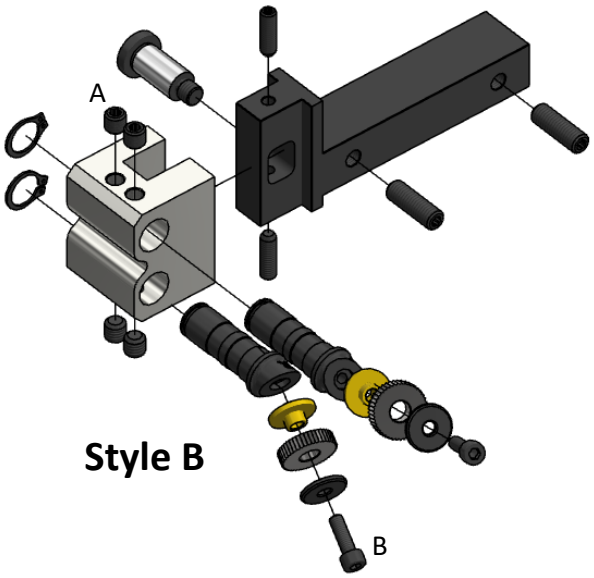
Metric

Tool Number	Knurl Series	Holder Hand	Style	Holder Dimensions (mm)						
				A	B	C	D	E	F	Capacity
OR ID14R	CB	RH	A	14.00	16.00	118.00	45.00	35.00	77.00	.16 - .197
OR ID16R	CB	RH	A	16.00	16.00	118.00	45.00	35.00	77.00	.16 - .197
OR ID20R	CC	RH/LH	B	20.00	25.00	145.00	63.00	50.00	98.00	.20 - 9.84
OR ID25R	CC	RH/LH	B	25.00	25.00	145.00	63.00	50.00	98.00	.20 - 9.84

Swiss Machine Two Die Cut Type Holder



Style A



Style B

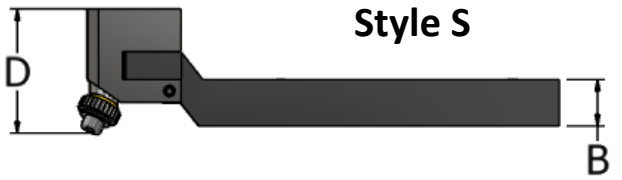
	Replacement Parts			
Holder	Bushing	Washer	Screw (A)	Head
CB	OR E1453	OR A1453	OR T1453	OR IDCBHD
CC	OR E2155	OR A2155	OR T2155	OR IDCCHD

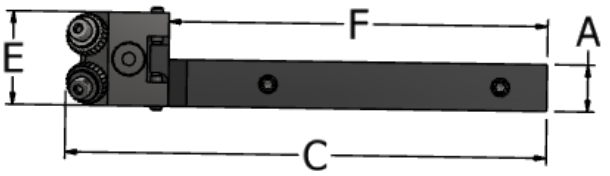
Setup

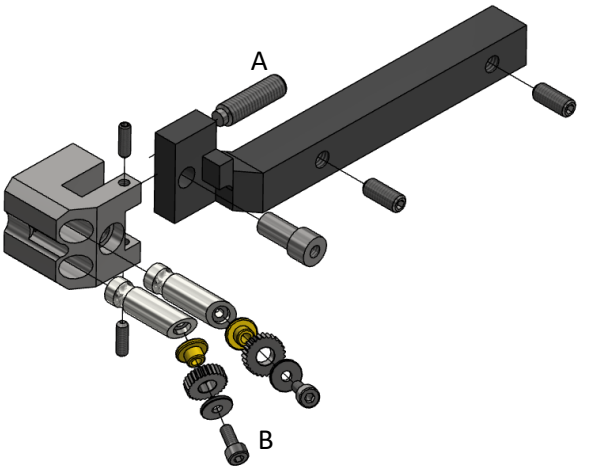
1. Using an allen key, loosen the set screws (A) on the top and bottom of the holder head, the knurl posts should be able to rotate now
2. Using the diameter markings on the front of the head, rotate the knurl posts until the arrow is pointed to approximately the diameter of your part.
3. Retighten the set screws on the top and bottom of the head so the posts no longer rotate.
4. Remove the bolt holding the washer and bushing (B)
5. Slide the knurl onto the bushing and then put the washer on the other side.
6. Slide the bolt back through and tighten back into the knurl posts. The knurl should be able to rotate freely.

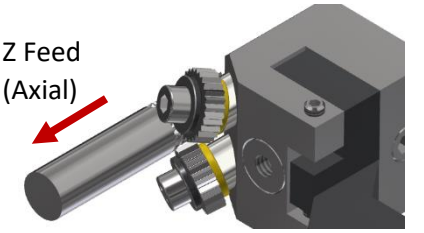
Remember, cut holders have the knurls mounted at an angle so the knurl hands required to produce specific patterns are different than normal form knurls. See the chart above for more info

Swiss Machine Two Die Cut Type Holder

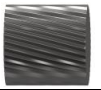
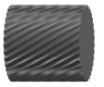
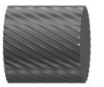
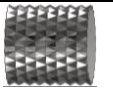
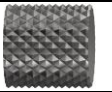








	Replacement Parts			
Holder	Bushing	Washer	Screw (A)	Head
CG	OR E8925	OR A8925	OR T8925	OR IDCGHD

	RAA	RBL 15°	RBR 15°	RBL 30°	RBR 30°	RGE 15°	RGE 30°	RGE 45°
Knurl form on part								
Knurl Type	BR 30° or BL 30°	BR 45°	BL 45°	AA	AA	BR 45° + BL 45°	AA + AA	BR 15° + BL 15°
Feed Axis	Z	Z	Z	Z	Z	Z	Z	Z

Tool Number	Knurl Series	Holder Hand	Style	Holder Dimensions (mm)						
				A	B	C	D	E	F	Capacity
OR ID06R	CG	RH	S	6.00	6.00	103.00	27.00	22.00	80.00	.06 - .472
OR ID08R	CG	RH	S	8.00	8.00	103.00	27.00	22.00	80.00	.06 - .472
OR ID10R	CG	RH	S	10.00	10.00	103.00	27.00	22.00	80.00	.06 - .472
OR ID12R	CG	RH	S	12.00	12.00	103.00	27.00	22.00	80.00	.06 - .472

These holders can also be used in normal CNC machines also

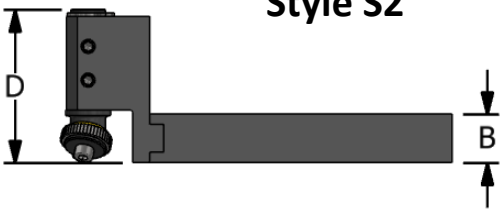
Setup

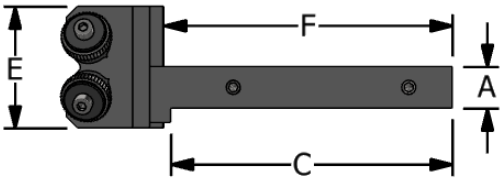
1. Using an allen key, loosen the set screw (A) on the side of the head, the knurl posts should be able to rotate now
2. Using the diameter markings on the back of the head, rotate the knurl posts until the arrow is pointed to approximately the diameter of your part.
3. Retighten the set screw on the side of the head so the posts no longer rotate.
4. Remove the bolt holding the washer and bushing (B)
5. Slide the knurl onto the bushing and then put the washer on the other side.
6. Slide the bolt back through and tighten back into the knurl posts. The knurl should be able to rotate freely.

Remember, cut holders have the knurls mounted at an angle so the knurl hands required to produce specific patterns are different than normal form knurls. See the chart above for more info

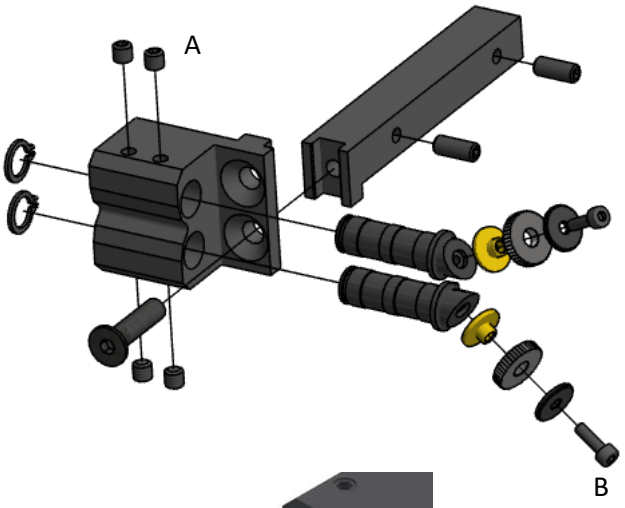
Swiss Machine Two Die Cut Type Holder

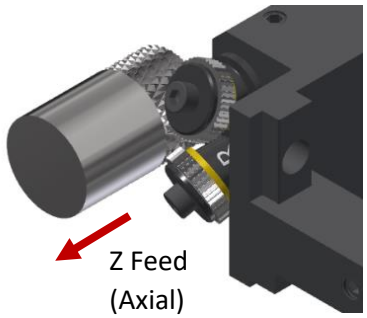
Style S2

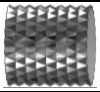




	Replacement Parts			
Holder	Bushing	Washer	Screw (A)	Head
CB	OR E1453	OR A1453	OR T1453	OR IDCBHD





	RAA	RBL 15°	RBR 15°	RBL 30°	RBR 30°	RGE 15°	RGE 30°	RGE 45°
Knurl form on part								
Knurl Type	BR 30° or BL 30°	BR 45°	BL 45°	AA	AA	BR 45° + BL 45°	AA + AA	BR 15° + BL 15°
Feed Axis	Z	Z	Z	Z	Z	Z	Z	Z

Tool Number	Knurl Series	Holder Hand	Style	Holder Dimensions (mm)						
				A	B	C	D	E	F	Capacity
OR ID12RS	CB	RH/LH	S2	12.00	14.00	114.00	44.50	35.00	87.00	.12 - 1.97
OR ID14RS	CB	RH/LH	S2	14.00	14.00	114.00	44.50	35.00	87.00	.12 - 1.97
OR ID16RS	CB	RH/LH	S2	16.00	16.00	114.00	44.50	35.00	87.00	.12 - 1.97

These holders can also be used in normal CNC machines also

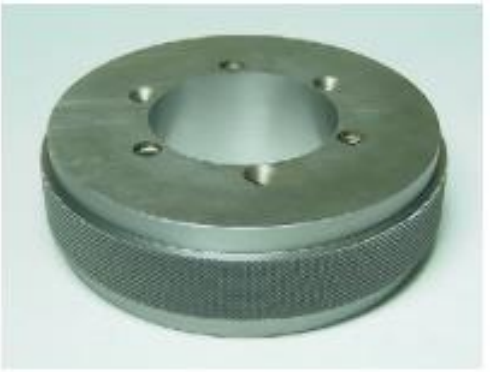
Setup

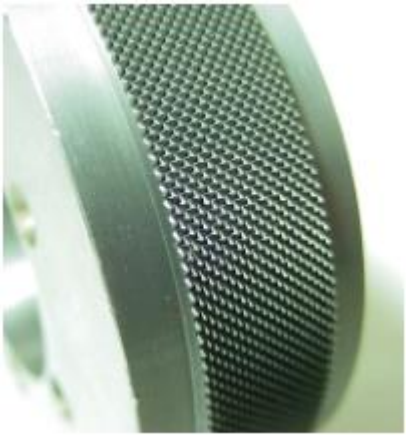
1. Using an allen key, loosen the set screws (A) on the top and bottom of the holder head, the knurl posts should be able to rotate now
2. Using the diameter markings on the front of the head, rotate the knurl posts until the arrow is pointed to approximately the diameter of your part.
3. Retighten the set screws on the top and bottom of the head so the posts no longer rotate.
4. Remove the bolt holding the washer and bushing (B)
5. Slide the knurl onto the bushing and then put the washer on the other side.
6. Slide the bolt back through and tighten back into the knurl posts. The knurl should be able to rotate freely.

Remember, cut holders have the knurls mounted at an angle so the knurl hands required to produce specific patterns are different than normal form knurls. See the chart above for more info

Anilox Rolls – Designed to customer Specifications

Used primarily in the printing industry, Accu Trak can design and manufacture knurling tools for producing anilox style rolls. Available in a variety of tool steels depending on application, these precision tools are custom made to meet your needs. Accu Trak also has the ability to make anilox rolls in a variety of sizes. Please call (800)-433-4933 for a quote.





Images above of Anilox Rolls

Burnishing and Support Rolls

Accu Trak stocks 2 types of hardened rolls in various common knurl series sizes. The first type is used as a Burnishing Roll for when a smooth surface is required on the part. This tool has a hand-polished finish on the diameter. The second type is a Support Roll that does not have a polished finish and is used as the name implies. Below you will find the tool numbers and sizes for the two types of hardened rolls.

Image above of Burnishing Roll

Image above of Support roll

Burnishing Rolls				
Tool #	Series	OD	Width	Hole
BL BPB	BP	.313"	.156"	.125"
BL EPB	EP	.500"	.187"	.188"
BL GKB	GK	.625"	.250"	.250"
BL KNB	KN	.750"	.250"	.250"
BL KPB	KP	.750"	.375"	.250"
BL KRB	KR	.750"	.500"	.205"
BL PHB	PH	1.250"	.500"	.500"
BL MLB	ML	20mm	8mm	10/12mm

Support Rolls				
Tool #	Series	OD	Width	Hole
BL BPS	BP	.313"	.156"	.125"
BL EPS	EP	.500"	.187"	.188"
BL GKS	GK	.625"	.250"	.250"
BL KNS	KN	.750"	.250"	.250"
BL KPS	KP	.750"	.375"	.250"
BL KRS	KR	.750"	.500"	.205"
BL PHS	PH	1.250"	.500"	.500"
BL MLS	ML	20mm	8mm	10/12mm

Knurl Pins and Spacers

Below is a list of Accu Trak's stock selection of knurl pins and spacers. When using a knurl ensure that the knurl spins freely on the pin without binding up in order to verify proper sizing. Carbide pins are also recommended for a vast majority of applications, and we also recommend you avoid the use of steel dowel pins as these have an issue to cause problems when knurling.

Hardened Spacer

Carbide Pins - Inch		
Tool #	Diameter -.0002"/-.0008"	Length ±.010"
C 062	0.1250	0.375
C 082	0.1250	0.500
C 083	0.1875	0.500
C 102	0.1250	0.625
C 103	0.1875	0.625
C 113	0.1875	0.688
C 123	0.1875	0.750
C 104	0.2500	0.625
C 114	0.2500	0.688
C 124	0.2500	0.750
C 144	0.2500	0.875
C 164	0.2500	1.000
C 204	0.2500	1.250
C 165	0.3125	1.000
C 108	0.5000	0.625
C 168	0.5000	1.000
C 208	0.5000	1.250
C 248	0.5000	1.500
C 288	0.5000	1.750
C 328	0.5000	2.000

Carbide Pins - Metric		
Tool #	Diameter -.005/-.020mm	Length ±.25mm
C M412	4.00	12.00
C M413	5.00	13.00
C M416	4.00	16.00
C M419	4.00	19.00
C M420	4.00	20.00
C M616	6.00	16.00
C M619	6.00	19.00
C M620	6.00	20.00
C M625	6.00	25.00
C M828	8.00	28.00
BL I412	4.00	12.00
BL I619	6.00	19.00

Up to Shoulder Pins - Metric		
Tool #	Diameter -.005/-.020mm	Length ±.25mm
OR UTSP	10/12	25.400
OR UTSPW2	10/12	25.400

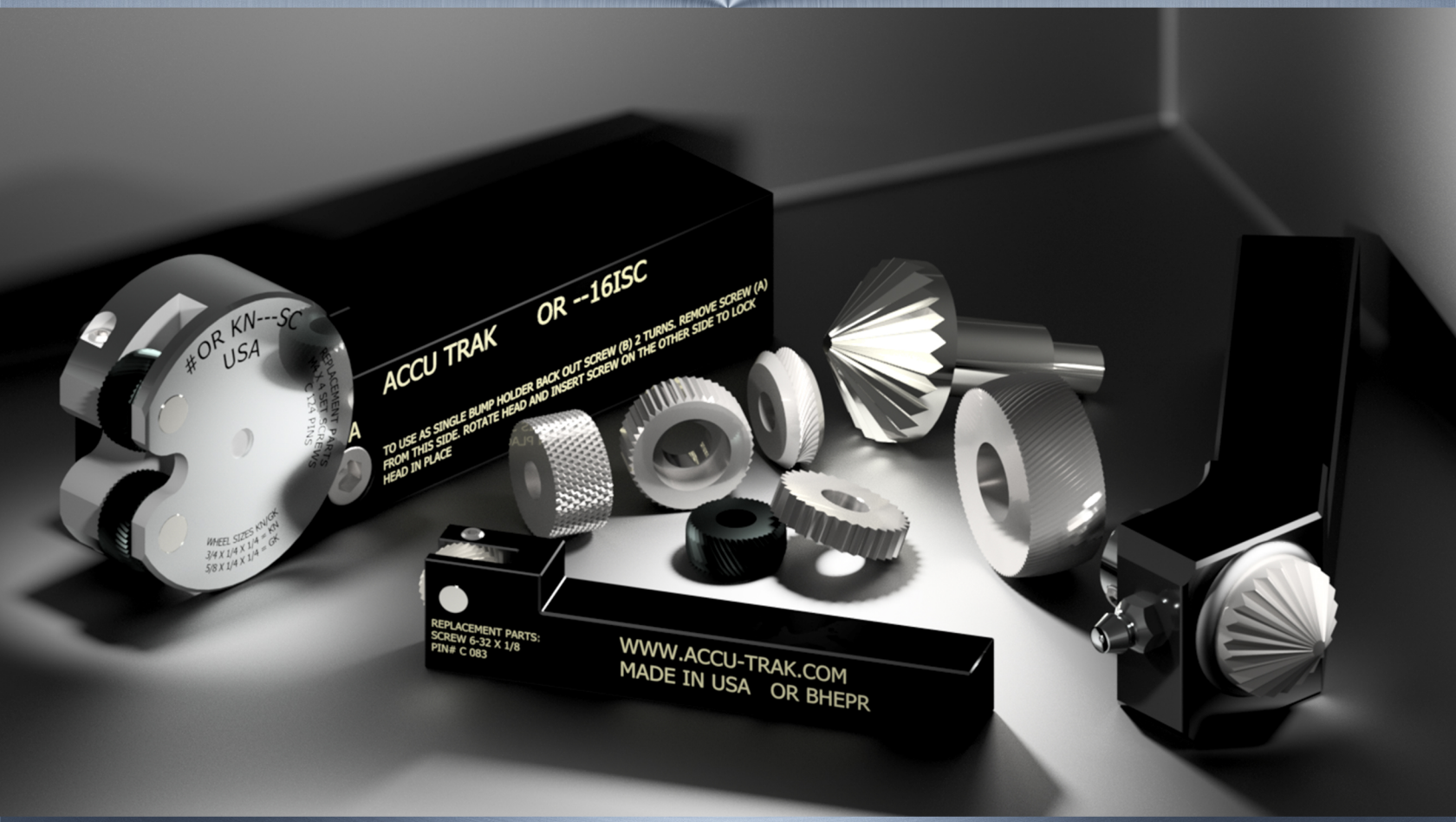
^ Format is:
Small OD/Large OD of pin

Steel Pins - Inch		
Tool #	Diameter -.0002"/-.0008"	Length ±.010"
S 083	0.1875	0.500
S 113	0.1875	0.688
S 114	0.2500	0.688
S 164	0.2500	1.000

Hardened Spacers (in)			
Tool #	Diameter	Width	Hole
BL BPF	0.270	0.063	0.128
BL 24EP	0.400	0.062	0.188
BL 24	0.515	0.062	0.257
BL 24A	0.515	0.125	0.257
BL 18-2-6	0.708	0.079	0.240

ACCU TRAK TOOL CORPORATION

Precision Knurling Tools and Holders



2021 Catalog

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