SEPTEMBER 2013

ACCU TRAK TOOL CORP.
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Cherry Valley, MA 01611-3307

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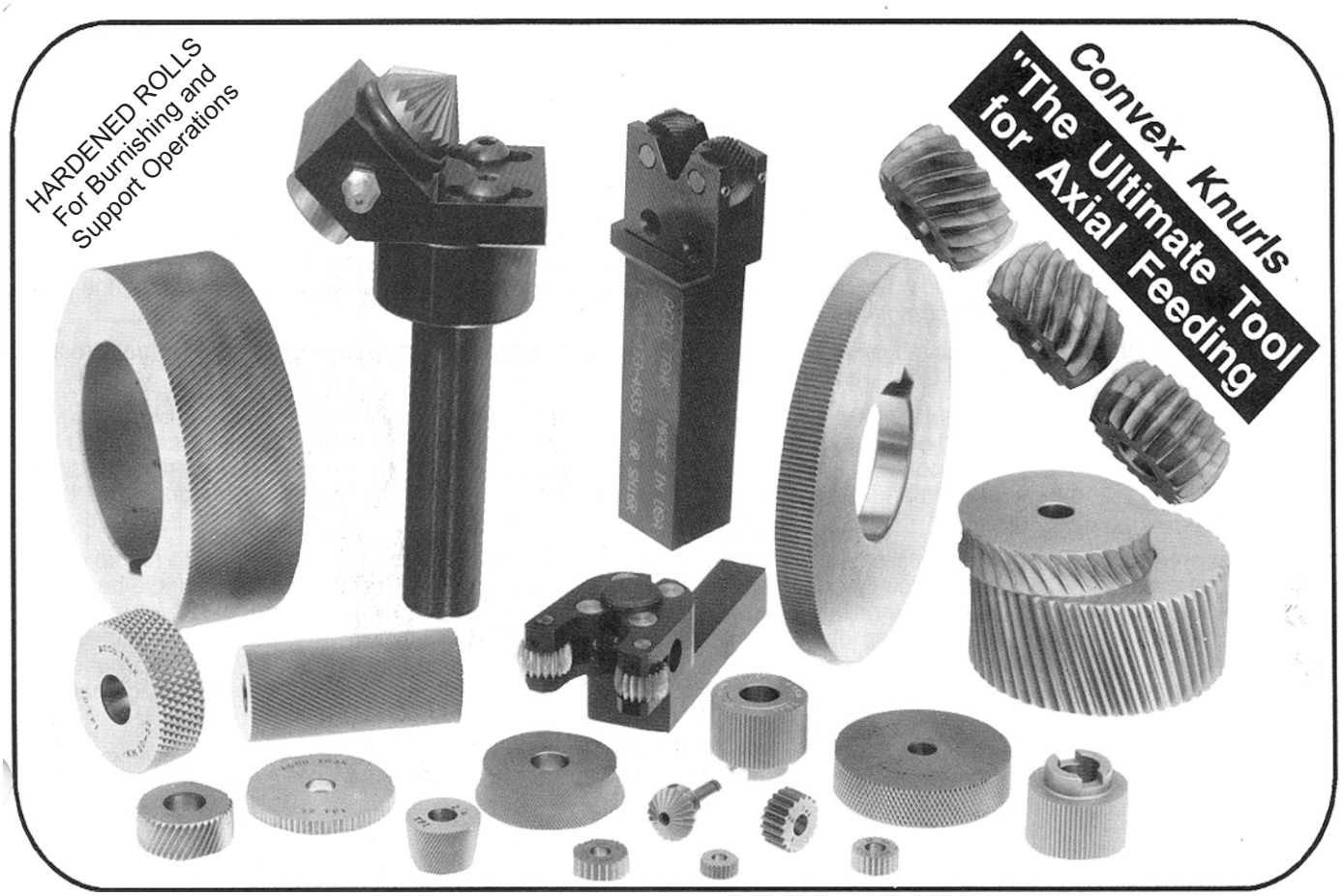
PRECISION KNURLING TOOLS AND HOLDERS

FOR CIRCULAR AND DIAMETRAL PITCH KNURLING

ACCU TRAK Knurling tools are manufactured to extremely high standards from premium alloys. Both sides and the bore are finish ground to maintain close tolerance on diameter and side runout. Our standard material is a high quality grade of High Speed steel which is **VACUUM** hardened, and tempered at least 2 times to a hardness of about 63 Rockwell C.

For severe knurling operations, such as rolling on 303 stainless or semi-hardened steels, **ACCU TRAK** also offers most listed items in a premium grade of **HI-COBALT** steel. These tools are slightly harder and in most applications deliver a substantial increase in tool life. Our sales representative will be happy to discuss any applications and recommendations on maximizing tool life versus cost for any type of knurling operation.

In addition to the stock items in this catalog, we can manufacture virtually any size and pitch of **SPECIAL KNURLING TOOLS.** Including conical, convex, concave, and attachment style dies to fit various **Thread Rolling Attachments and Machines.** We are committed to a **1-2 week delivery** for all **specials** having a standard tooth form.



Terms & Conditions

Minimum Orders: There is a $25.00 minimum order requirement.

Sales Terms: Net 30 Days (to general accounts). New accounts - please submit 3 references and the name of your bank. Payment by Check, Master Card, Visa, American Express and Wire Transfer are accepted. When paying by credit card, the credit card account information MUST be submitted when the order is placed. Your card will be charged on the day of shipment. Customer's are not allowed to pay by credit card after their order has shipped. Any balance over 30 days is subject to a 1.0% finance charge per month (12% APR)

Freight Terms: All orders are shipped F.O.B. Cherry Valley, Massachusetts 01611-3307. Most stock orders up to 50 pieces, received by 4:00 p.m. (EST) will be shipped the same day via UPS, unless otherwise specified. Any order to be shipped freight collect must be clearly marked with account number. Extra charges may be applied for carriers other than UPS to cover pickup expenses.

Return Policy: All unused stock items may be returned for full credit within 60 days of invoice date. A Minimum 10% restocking fee will be applied for returns made beyond 60 days of invoice date. Special order tools, or items altered per customer request may not be returned unless defective. All returns MUST be authorized in advance. A cancellation fee may be charged for special orders canceled after work is started. Contact Accu Trak for more information.

Claims for Shortages Any claims for shortages in shipment MUST be made within 14 days of receipt of merchandise.

Prices and Specifications: All sections of the catalog and website are subject to correction and/or change without notice. Any typographical errors in the catalog or online are subject to correction. Knurl dies are normally priced without bevels. If bevel/chamfers are required add $1.00 to the list price. One exception to this is our "ML" series counter bored knurl wheels They are beveled as stock and there is no charge for this.

Special Orders: We are committed to a 1-2 week delivery time for all special knurls having a standard tooth form up to 2" in diameter. Please call for quote or email part specifications to eng@accu-trak.com. All quotations are valid for 30 days unless otherwise specified.

Technical Support: Accu Trak takes pride in having the most knowledgeable engineers and sales staff available to offer technical support for customers, however with the many variables involved in knurling, in some rare cases, information supplied by Accu Trak representatives may not produce the desired results. In such cases Accu Trak assumes no responsibility or liability.

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QUANTITY DISCOUNTS

Total # Knurls or Pins	Discount off List Price
6 - 9	10%
10 - 19	15%
20 - 49	20%
50 - 99	25%
100 - 299	30%

Note: Knurl pins are not combinable with knurl wheels.
This discount structure does not apply to **"Special order"** tools.
Special orders are quoted and discounted on an individual basis.
Pricing is not shown in our catalog.
Please see our website or call for current pricing.

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Email contacts: Sales = sales@accu-trak.com • Engineering = eng@accu-trak.com • General Information = info@accu-trak.com

GENERAL KNURLING INFORMATION

Knurling is widely used in industry for many applications. Some of these include: decorative and "grip" surfaces, repair of undersized shafts and oversize bores, and driving serrations and splines. The word "knurling" applies to both the method of production, and the rolled section on the part. It is usually produced by forcing a knurling die into the surface of a rotating part, displacing material from the original diameter. Two methods of specifying the comparative tooth spacing are currently in use - **CIRCULAR PITCH** and **DIAMETRAL PITCH.** The **CIRCULAR PITCH** system has been used for many years and is based on the distance between teeth (pitch) and expressed as **TEETH** per **INCH** of circumference or **(TPI).** The **DIAMETRAL PITCH** system is fully explained in American Standard ANSI/ASME B94.6-1984. Unlike gearing, only four standard pitches are used (64, 96, 128, & 160) for blank diameters from 3/32" to 1". Diametral Pitch dies are designed to permit accurate tracking on standard fractional sized blanks, making blank diameter selection easier. Due to the many variables involved in any knurling operation, (speeds, feeds, coolant, hardness of piece, condition of pins, etc.), determining proper blank diameters for circular pitch dies is a bit more difficult, and usually involves some amount of experimentation. The "TIPS" below, and the formulas on page 3 should help, but if problems persist, just give us a call and we'll be glad to offer our advice.

SPEEDS & FEEDS

For convenience, Knurling is often performed at the same speeds used for cutting operations, But to prevent seizing of the rolls on the pin, we recommend a maximum speed of 150 SFPM (45.72 meters) You may find you get longer knurl life and improved appearance by slowing down the spindle. For "BUMP" knurling with a single tool from the cross-slide, the feed would normally be .001/.004 per rev. to roll the part complete in 5/20 revolutions. If you are straddle knurling with 2 knurls, feed in rapidly at .008/.025" per rev. to center and then dwell for a few revolutions. "END KNURLING" from the turret (axial feeding) is usually done at .005/.030" per rev. (Slower range for coarser Knurling on high-alloy steels, faster for finer pitches and on brass, aluminum or mild alloy steels.) Normally the dies are fed off the work about twice as fast.

KNURLING "TIPS"

A very important part of any knurling application is the set-up. The dies must be correct and the holder be rigid enough to withstand the rolling forces encountered.

1.) Since proper tracking is usually established after only **one complete revolution** of the part, the "secret" to success is to **RAM THE DIE INTO THE BLANK!!** By forming a deeper, wider impression on the first revolution, the die teeth are more likely to "step" back into the initial grooves the second time around. Many tracking problems we solve are merely a matter of increasing the feed rate. For "bump" knurling from the cross-slide, the feed rate should be fast enough so that the part is completed in 5-20 revolutions. Other solutions to tracking problems include: altering the blank diameter slightly, stoning or grinding the die O.D. approximately .002 smaller, and honing the bores .002/.003 over nominal size.

2.) If you are knurling on a CNC, and are having "double tracking" problems, you may want to stop (or slow down) the spindle for the initial contact. Resume normal speed as soon as the tool has penetrated approximately 20-40% into the blank.

3.) Use LOTS of lubricant. Knurling generates some extreme pressures, and improperly lubricated dies are likely to bind up on or gall the pins. Slower spindle speeds and **CARBIDE PINS** reduce the possibility of the dies seizing as well.

4.) Do not over-roll with knurls. In general, try to roll the pattern only about 90% full. When rolling stainless steels (especially 303) roll up the pattern in the fewest revolutions possible to minimize work-hardening the piece. The same can be said when rolling brass and other soft materials, but here it's to prevent **"FLAKING"** caused by rolling the part too many times after it has been completely formed.

5.) Control the blank diameter within a reasonable limit. A variation of .0005 in the blank diameter will usually result in an O.D. difference of .001. One large blank can destroy a set of knurls.

6.) If you are knurling from the end with a straddle-type holder that has blocks that can be swiveled, we generally recommend rolling male diamond patterns by using straight knurls set at 30° to part axis. This eliminates the need for bevels, and provides a gradual build-up and lead-out for better part finishes. Diagonal dies can produce straight knurls with the same benefits. Unfortunately, this method cannot be used if the knurling has to be done close to a larger shoulder on the part.

7.) If you are knurling a **"WIDE"** pattern, you should be concerned about the amount of force required to roll up a full form. There are many ways to reduce these forces and avoid unnecessary loads on your machine's spindle bearings and lead screw.

1) Try our **"CONVEX"** KNURLS if you can axial feed the knurl. (see pages 14 & 15).
2)**"CUT TYPE "** Knurl make small chips with much lower pressures. (See pages 26 & 28)
3) Special knurls with helical grooves can be furnished. Call for details).

8.) If none of the above tips solves your problems, please give us a call.

DIAMOND KNURLING

When someone requests a "DIAMOND" knurl or wants to roll a "DIAMOND PATTERN" on a part, there are several questions that need to be answered. It is very easy to confuse what is required on the part and on the knurling die itself. First we need to know whether a **MALE** (raised pyramid) or **FEMALE** (Depressed Pyramid) pattern is required on the part to be rolled. If the print just says "Diamond Knurl", we assume it to mean "MALE DIAMOND" Knurl on the part. Then we need to know what type holder will be used.

ROLLING A "MALE" PATTERN FROM THE CROSS-SLIDE

1. Use a set of RH and LH Diagonal knurls if a double roll holder is available. The rolls can be fed axially at .005/.030 per revolution if necessary. Most of the knurling pressure will be absorbed in the holder if it can completely straddle the part, thereby reducing part deflection and wear on the main spindle and cross-slide.
2. If only a single roll ("BUMP") holder is available, a "**FEMALE DIAMOND**" knurling tool must be used. This method is fine as long as the knurled section is relatively narrow, close to the collet and large enough in diameter so as not to deflect/bend too much.

ROLLING A "MALE" PATTERN FROM THE TURRET

3. If a Brown & Sharp, (or other brand) two die holder with swivel knurl blocks is available, you may use a set of (2) straight knurls turned at a 30° angle to the axis of the part. Feed axially onto the work blank at approximately .010/.030 per revolution. Bevels are not required on the knurls, or, with the pins parallel to the axis, use a set of RH and LH Convex axial feed knurls.
4. If the knurl blocks do not swivel, use a set of RH and LH Convex style Diagonal knurls. If you must knurl up close to shoulder, a standard knurl with no (or a small) bevel may be required.

ROLLING A "FEMALE" PATTERN

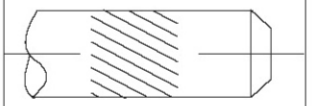
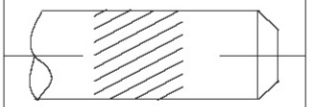
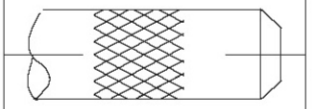
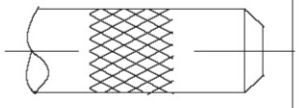
5. A female pattern on the work piece can only be produced by using a "MALE" diamond knurl. This is normally accomplished by using a single "BUMP" knurl holder from the cross-slide. Although it is possible to use two knurls in a straddle type holder, it is not normally done because of tracking problems and the necessity of custom matching the tooth form of a set of knurls axially.

Under normal circumstances a single "MALE" or "FEMALE" knurling die cannot be fed along the axis of a part. If this is a necessity, the holder must be tipped slightly and the knurl fed axially so that it advances very close to one axial pitch of the tooth spacing for each revolution.

"LOW FORCE" KNURLING

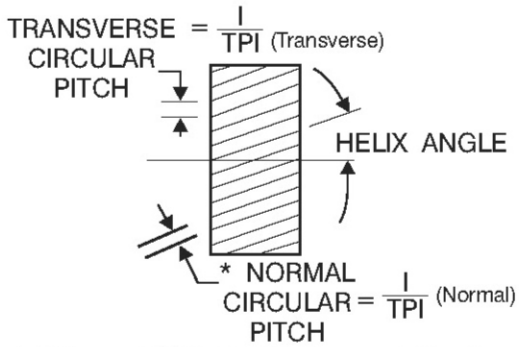
When a wide knurling pattern needs to be applied from the cross slide, especially if its a straight knurl, the use of a special LOW FORCE style of knurling die can be the difference between success and failure. Over the last several years Accu-Trak has been applying this relatively new technology routinely to solve difficult knurling jobs. The biggest reason for its success is based on the theory that: For good tracking one needs good penetration on the first revolution. With wide dies the forces needed to sink the die into the workpiece often exceeds the capabilities of the machine. But with the LOW FORCE design the amount of knurl surface area in contact with the part has been reduced allowing for higher pressures and therefore better penetration. Please call us for more information if you think you may have an application requiring this option.

TO PRODUCE STANDARD PATTERNS

STRAIGHT KNURLING	USE
	1, 2, OR 3 STRAIGHT KNURLS **OR** 1 Diagonal knurl (axis skewed) **OR** 2 Diagonal knurls (axis skewed)
RIGHT HAND DIAGONAL 	1 **LH** diagonal knurl **OR** 2 **LH** diagonal knurls **OR** 2 Straight knurls (axis skewed)
LEFT HAND DIAGONAL 	1 **RH** diagonal knurl **OR** 2 **RH** diagonal knurls **OR** 2 Straight knurls (axis skewed)
MALE DIAMOND  **(RAISED POINTS)**	1 **Female** Diamond knurl **OR** *1 **RH** & 1 **LH** diagonal **OR** *2 Straight knurls (axis skewed) ***Preferred Methods***
FEMALE DIAMOND  **(INDENTATIONS)**	1 **Male** diamond knurl

NOTE: For knurling from turret with swivel type holders, straight knurls can be used to produce all above except Female Pattern.

GENERAL TERMS



* TPI on ACCU TRAK Diagonal Knurls are measured this way (except 14, 21, & 33 TPI Diagonals to be comparable to Armstrong Standard)

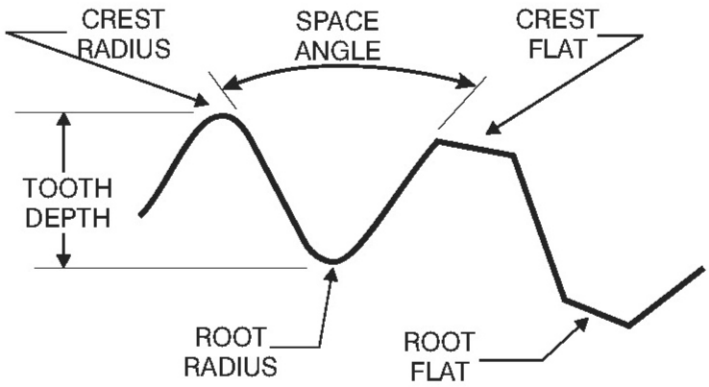


Table I

APPROXIMATE INCREASE IN KNURLED DIAMETERS

Using ACCUTRAK Circular or Diametral Pitch Knurls

TPI	Pitch mm	Tooth Angle	Straight IN./mm	Diamond (ON PART) Diagonal	Male	Female
12	2.12	90°	.034/.86	.034	.038	.023
16	1.59		.025/.64	.025	.029	.017
20	1.22		.020/.51	.020	.023	.014
25	1.02		.016/.41	.016	.018	.011
30	.85		.013/.33	.013	.015	.009
35	.73		.014/.36	.014	.016	.019
40	.64		.012/.34	.012	.013	.018
50	.51	70°	.009/.23	.009	.010	.006
60	.42		.007/.18	.007	.008	.005
70	.36		.006/.15	.006	.007	.004
80	.32		.005/.13	.005	.006	.004

Diametral Pitch	Pitch mm	Tooth Angle	Straight	Diagonal		
64	1.25	80°	.024/.61	.021	.024	.015
96	.83		.016/.41	.014	.016	.010
128	.62		.012/.30	.010	.012	.007
160	.50		.009/.23	.008	.009	.005

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ESTIMATING BUMP KNURLING VARIABLES USING CIRCULAR PITCH KNURLING DIES FROM THE "CROSS SLIDE"

The following formula can be used to determine an approximate blank diameter for proper tracking. This blank diameter can be adjusted for optimal results once good tracking has been established. It is advisable to do all test rolling at the same speed and feed as is planned for the production run.

$$\text{Knurl Diameter (ideal)} = \frac{\text{Blank Diameter}}{\text{\#Teeth (Part)}} \times \text{\#Teeth (die)} - \text{C.F.*}$$

*** C.F. (Tracking Correction Factor)**

This correction factor takes into account the fact that the tips of the knurl teeth have penatrated below the blank diameter by the end of the first revolution.

Several other formulas can be derived to calculate almost any aspect that may be required.

Table II

TPI	*Approx. Value of C.F.
12-19	.010
20-29	.007
30-39	.005
40-49	.003
50-80	.002

$$\text{\#Teeth (part)} = \frac{\text{Blank Diameter} \times \text{\#Teeth (die)}}{\text{Knurl Diameter} + \text{C.F.}}$$

$$\text{Blank Diameter} = \frac{\text{\# Teeth (part)}}{\text{\# Teeth (die)}} \times (\text{Knurl O.D.} + \text{C.F.})$$

The approximate tolerance for the knurl diameter should be: $\pm.5 \times \text{C.F.} \times \frac{\text{Knurl Diameter}}{\text{Blank Diameter}}$

If the finished diameter of the part is known, an approximate blank diameter can be determined by subtracting the proper value from Table I. (pg. 4)

DIAMETRAL PITCH KNURLING DIES

Blank diameters for diametral Pitch knurling dies are more easily computed, since they are always common fractional sizes. The formula is as follows:

$$\text{Blank Diameter} = \frac{\text{\# Teeth (part)}}{\text{Diametral Pitch}}$$

or: $\text{\# Teeth (rolled)} = \text{Blank Diameter} \times \text{Diametral Pitch}$

DIAMETRAL PITCH KNURLS

American Standard ASA B94.6-1984 describes the diametral pitch knurl system. Diametral pitch knurls are designed to track uniformly on fractional size stock up to 1" in multiples of 1/32" or 1/64". They are held to closer tolerances for this purpose.

The American Standard recommends that the use of 64 Diametral Pitch Knurls be avoided as much as possible, and that preference be given to the use of 96 D.P. Knurls for simplification of tooling.

The number of teeth that will be rolled can be easily determined by multiplying the blank diameter by the Diametral Pitch of the Knurl. Example: A 96 D.P. Knurl will roll 96 x 1/2 = 48 teeth on 1/2" Diameter stock.

D.P.	Blank Diameters for uniform tracking
64	every 64th inch
96	every 32nd inch (also every 1/96th in. - .0104)
128	every 64th inch (also every1/128th in. - .0078)
160	every 32nd inch (also every 1/160th in. - .00625)

Table III

DP	Equivalent Normal Circular TPI	
	Straight Teeth	30° Diagonal
64	20.7	23.9
96	30.8	35.6
128	41.1	47.4
160	51.2	59.1

NOTE: Unfortunately the above formulas do not hold precisely for all conditions. Sometimes apparently identical knurls from different manufacturers will not track on the same blank diameters due to a difference in the sharpness of the teeth. Also, it is possible for the number of teeth rolled on a part to change as the knurling tool wears. How deeply the knurl penetrates into the work blank on the first revolution is the main factor in determining if an adjustment should be made to the basic formula.

1. In-feed rate (or axial feed rate for knurling from the turret)
2. Sharpness of the knurl teeth
3. Hardness of the material
4. Included tooth angle of the knurl (a sharper angle penetrates easier)
5. Width of knurl face (a narrow face penetrates easier)
6. Method of Knurling (Bump from cross-slide or end knurling from turret)
7. Bevels on edges of part or knurl tool (affects knurl penetration from end)

A change in any of the above variables may correct (or cause) a mis-tracking problem.

SPECIAL KNURLING DIES

Accu Trak Tool can manufacture almost any size and pitch of special knurling dies to suit any application and holder. ***We make knurling dies for all of the common thread rolling attachments and holders. We can also make larger knurling dies to fit any of the thread rolling machines in use today.*** If you have a part that requires special dies, please call for best pricing and delivery.

In general, it's best to submit a drawing or sketch of the required die, but if that's not practical, we'll need the following information in order to quote accurately.

1. Outside Diameter (knurl)
2. Overall Width of die
3. Bore size and tolerance
4. Shoulder dimensions
5. Knurl pattern and form
6. Knurl pitch (or #Teeth)
7. Tooth angle on die
8. Root or Crest Radii (or flats)
9. Holder to be used
10. Style of die and face width
11. Blank diameter
12. #Teeth to be rolled

(unless otherwise specified, all tolerances will be Mfg. Std.)

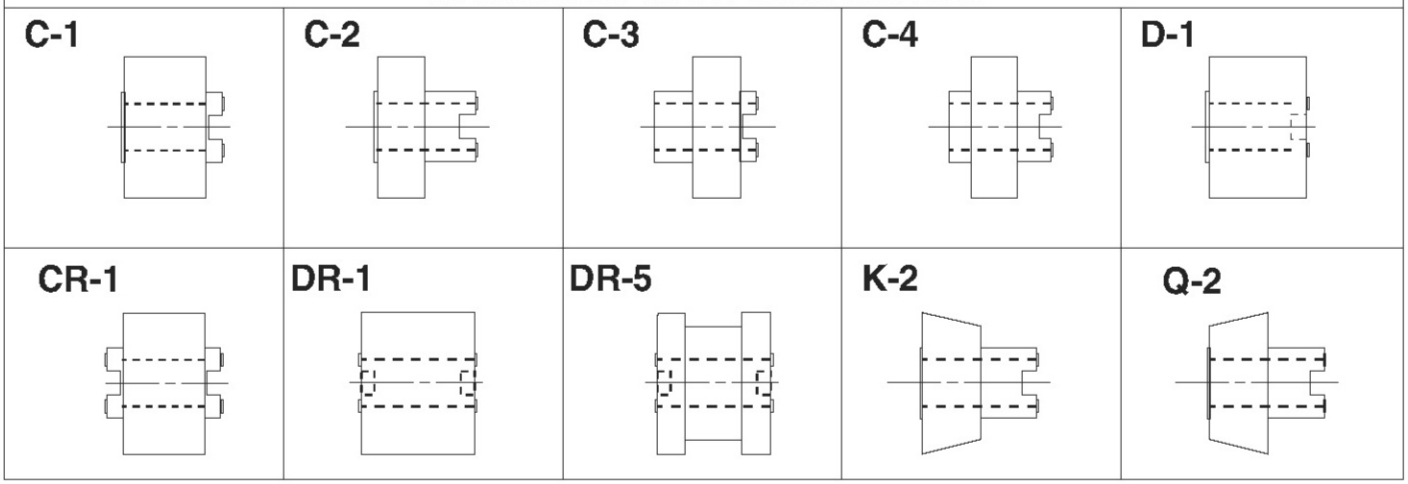
$$TPI = \frac{25.4}{\text{Metric Pitch}} \qquad \text{Metric Pitch} = \frac{25.4}{TPI}$$

Metric/Inch Conversions of Pitch

STANDARD PITCHES	TPI EQUIVALENTS
0.3 mm	84.7
0.4 mm	63.5
0.5 mm	50.8
0.6 mm	42.3
0.8 mm	31.8
1.0 mm	25.4
1.2 mm	21.2
1.5 mm	16.9
1.6 mm	15.9
2.0 mm	12.7

Illustrated below are some of the more common special items we can make.

ATTACHMENT STYLE KNURLING DIES



Knurling Conical, Convex, Concave, and End Surfaces

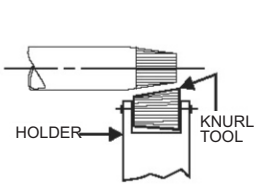


FIGURE 1 - POOR

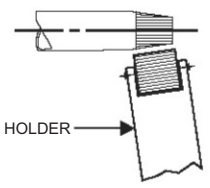
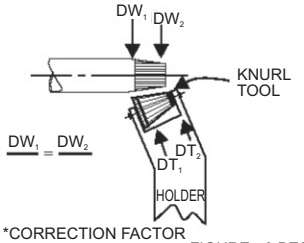


FIGURE 2 - BETTER



*CORRECTION FACTOR LESS TRACKING

FIGURE - 3 BEST

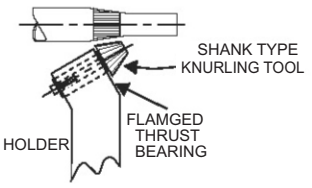


FIGURE - 4 - Shank Type Knurl

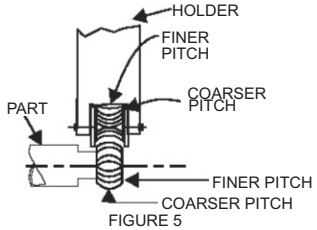


FIGURE 5

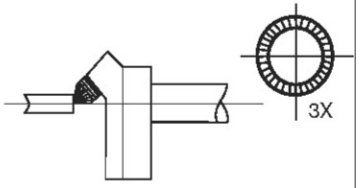


FIGURE "A" - END KNURLING

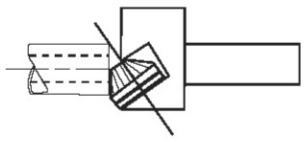


FIGURE "B" END KNURLING

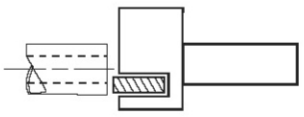


FIGURE "C" END KNURLING

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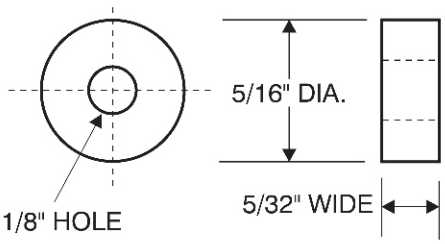
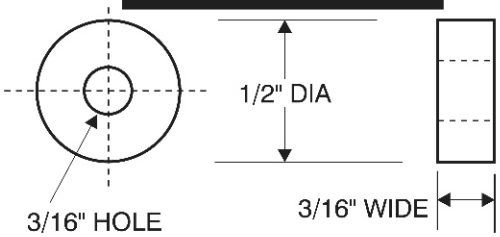
BP SERIES



EP SERIES



Will fit the folowing holders

Accu Trak

See Pages16, 17, 19, 20, 21

Brown & Sharp No.
185-200 (00D)
190-100 (00AA)
195-100 (00BA)
200-100 (00CA)
210-100 (00RA)
Boyar-Schultz 00K
Deterbeck KT-00
R & L 00

For Swiss Automatic and Special Holders
Accu Trak Holders - See Pages 16, 19, and 21

BP SERIES CIRCULAR PITCH KNURLS

INCLUDED TOOTH ANGLE	Straight Tooth Knurls	30° SPIRAL KNURLS RH Spiral	30° SPIRAL KNURLS LH Spiral	30° DIAMOND KNURL Male	30° DIAMOND KNURL Female
					
90°	**BPS 216** 16 TPI 15Teeth				
90°	**BPS 220** 20 TPI 19Teeth				
90°	**BPS 225** 25 TPI 25Teeth	**BPR 225** 25 TPI 21Teeth	**BPL 225** 25 TPI 21Teeth	**BPM 225** 25 TPI 21Teeth	
90°	**BPS 230** 30 TPI 29Teeth	**BPR 230** 30 TPI 26Teeth	**BPL 230** 30 TPI 26Teeth	**BPM 230** 30 TPI 26Teeth	**BPF 230** 30 TPI 26Teeth
90°	**BPS 235** 35 TPI 34Teeth	**BPR 235** 35 TPI 29Teeth	**BPL 235** 35 TPI 29Teeth	**BPM 235** 35 TPI 29Teeth	
90°	**BPS 240** 40 TPI 39Teeth	**BPR 240** 40 TPI 34Teeth	**BPL 240** 40 TPI 34Teeth		
70°	**BPS 450** 50 TPI 49Teeth	**BPR 450** 50 TPI 43Teeth	**BPL 450** 50 TPI 43Teeth	**BPM 450** 50 TPI 43Teeth	**BPF 450** 50 TPI 43Teeth
70°	**BPS 460** 60 TPI 59Teeth				
70°	**BPS 470** 70 TPI 69Teeth				**BPF 470** 70 TPI 60Teeth
70°	**BPS 480** 80 TPI 79Teeth	**BPR 480** 80 TPI 68Teeth	**BPL 480** 80 TPI 68Teeth	**BPM 480** 80 TPI 68Teeth	**BPF 480** 80 TPI 68Teeth
70°	**BPS 490** 90 TPI 89Teeth				
70°	**BPS 500** 100 TPI 99Teeth				

BP SERIES DIAMETRAL PITCH

80°	**BPS 064** 64 DP 20Teeth				
80°	**BPS 096** 96 DP 30Teeth	**BPR 096** 96 DP 30Teeth	**BPL 096** 96 DP 30Teeth	**BPM 096** 96 DP 30Teeth	**BPF 096** 96 DP 30Teeth
80°	**BPS 128** 128 DP 40Teeth	**BPR 128** 128 DP 40Teeth	**BPL 128** 128 DP 40Teeth	**BPM 128** 128 DP 40Teeth	**BPF 128** 128 DP 40Teeth
80°	**BPS 160** 160 DP 50Teeth	**BPR 160** 160 DP 50Teeth	**BPL 160** 160 DP 50Teeth	**BPM 160** 160 DP 50Teeth	**BPF 160** 160 DP 50Teeth

EP SERIES CIRCULAR PITCH KNURLS

INCLUDED TOOTH ANGLE	Straight Tooth knurls	30° SPIRAL KNURLS RH Spiral	30° SPIRAL KNURLS LH Spiral	30° DIAMOND KNURLS Male	30° DIAMOND KNURLS Female
					
90°	**EPS 216** 16 TPI 25 Teeth	**EPR 216** 16 TPI 22 Teeth	**EPL 216** 16 TPI 22 Teeth		
90°	**EPS 220** 20 TPI 31 Teeth	***EPR 220** 20 TPI 31 Teeth	***EPL 220** 20 TPI 27 Teeth	**EPM 220** 20 TPI 27 Teeth	**EPF 220** 20 TPI 27 Teeth
90°	**EPS 225** 25 TPI 38 Teeth	***EPR 225** 25 TPI 34 Teeth	***EPL 225** 25 TPI 34 Teeth	**EPM 225** 25 TPI 34 Teeth	**EPF 225** 25 TPI 34 Teeth
90°	**EPS 230** 30 TPI 47 Teeth	***EPR 230** 30 TPI 40 Teeth	***EPL 230** 30 TPI 40 Teeth	**EPM 230** 30 TPI 40 Teeth	**EPF 230** 30 TPI 40 Teeth
90°	**EPS 232** 32 TPI 49 Teeth				
90°	**EPS 235** 35 TPI 55 Teeth	**EPR 235** 35 TPI 47 Teeth	**EPL 235** 35 TPI 47 Teeth	**EPM 235** 35 TPI 47 Teeth	
90°	**EPS 240** 40 TPI 63 Teeth	***EPR 240** 40 TPI 55 Teeth	***EPL 240** 40 TPI 55 Teeth	**EPM 240** 40 TPI 55 Teeth	**EPF 240** 40 TPI 55 Teeth
90°	**EPS 241** 41 TPI 65 Teeth				
90°	**EPS 247** 47 TPI 73 Teeth				
90°	**EPS 250** 50 TPI 73 Teeth				
70°	**EPS 430** 30 TPI 40 Teeth				
70°	**EPS 447** 47 TPI 73 Teeth				
70°	**EPS 450** 50 TPI 79 Teeth	**EPR 450** 50 TPI 68 Teeth	**EPL 450** 50 TPI 68 Teeth	**EPM 450** 50 TPI 68 Teeth	**EPF 450** 50 TPI 68 Teeth
70°	**EPS 453** 53 TPI 83 Teeth				
70°	**EPS 460** 60 TPI 94 Teeth				
70°	**EPS 465** 65 TPI ?? Teeth				
70°	**EPS 470** 70 TPI 100 Teeth				
70°	**EPS 480** 80 TPI 125 Teeth	**EPR 480** 80 TPI 107 Teeth	**EPL 480** 80 TPI 107 Teeth	**EPM 480** 80 TPI 107 Teeth	**EPF 480** 80 TPI 107 Teeth

EP SERIES DIAMETRAL PITCH

80°	**EPS 064** 64 DP 32Teeth	**EPR 064** 64 DP 32Teeth	**EPL 064** 64 DP 32Teeth	**EPM 064** 64 DP 32Teeth	**EPF 064** 64 DP 32Teeth
80°	**EPS 096** 96 DP 48Teeth	**EPR 096** 96 DP 48Teeth	**EPL 096** 96 DP 48Teeth	**EPM 096** 96 DP 48Teeth	**EPF 096** 96 DP 48Teeth
80°	**EPS 128** 128 DP 64Teeth	**EPR 128** 128 DP 64Teeth	**EPL 128** 128 DP 64Teeth	**EPM 128** 128 DP 64Teeth	**EPF 128** 128 DP 64Teeth
80°	**EPS 160** 160 DP 80Teeth	**EPR 160** 160 DP 80Teeth	**EPL 160** 160 DP 80Teeth	**EPM 160** 160 DP 80Teeth	**EPF 160** 160 DP 80Teeth

NOTE: Chamfers should be added when axial feeding. Add $1.00 per item

QUANTITY DISCOUNTS - See inside front cover or website for quantity Discounts and Pricing.
*Most sizes are available in **Hi-Cobalt** also. Please see our website or call.*

* THESE KNURLS ARE STOCKED IN 45° LEFT (C) AND 45° RIGHT (D) SPIRAL

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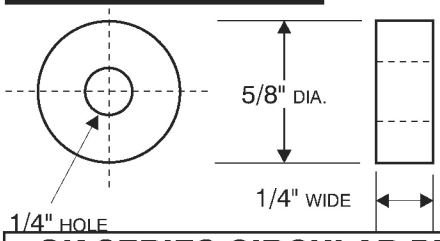
GK SERIES

Will fit the following holders:

See Pages
16, 17, 18, 20, 21
Brown & Sharp No.
185-220 (20D)
185-322 (22DA)
190-120 (20AA)
195-120 (20BA)
200-120 (20C)
210-120 (20KA)
Boyar-Schultz OK
Detterbeck 0
Bamaby KT-0
R & L 1, 2, 3



GK SERIES CIRCULAR PITCH KNURLS

INCLUDED TOOTH ANGLE	Straight Tooth Knurls	30° SPIRAL KNURLS		30° DIAMOND KNURL	
		RH Spiral	LH Spiral	Male	Female
					
90°	**GKS 212** 12 TPI 23Teeth	**GKR 212** 12 TPI 19Teeth	**GKL 212** 12 TPI 19Teeth		
90°	**GKS 216** 16 TPI 31Teeth	**GKR 216** 16 TPI 27Teeth	**GKL 216** 16 TPI 27Teeth	**GKM 216** 16 TPI 27Teeth	**GKF 216** 16 TPI 27Teeth
90°	**GKS 219** 19 TPI 37Teeth				
90°	**GKS 220** 20 TPI 39Teeth	***GKR 220** 20 TPI 34Teeth	***GKL 220** 20 TPI 34Teeth	**GKM 220** 20 TPI 34Teeth	**GKF 220** 20 TPI 34Teeth
90°	**GKS 224** 24 TPI 47Teeth				
90°	**GKS 225** 25 TPI 49Teeth	***GKR 225** 25 TPI 42Teeth	***GKL 225** 25 TPI 42Teeth	**GKM 225** 25 TPI 42Teeth	**GKF 225** 25 TPI 42Teeth
90°	**GKS 229** 29 TPI 54Teeth				
90°	**GKS 230** 30 TPI 59Teeth	***GKR 230** 30 TPI 52Teeth	***GKL 230** 30 TPI 52Teeth	**GKM 230** 30 TPI 52Teeth	**GKF 230** 30 TPI 52Teeth
90°	**GKS 232** 32 TPI 63Teeth				
90°	**GKS 235** 35 TPI 68Teeth	***GKR 235** 35 TPI 59Teeth	***GKL 235** 35 TPI 59Teeth		**GKF 235** 35 TPI 59Teeth
90°	**GKS 240** 40 TPI 78Teeth	***GKR 240** 40 TPI 68Teeth	***GKL 240** 40 TPI 68Teeth	**GKM 240** 40 TPI 68Teeth	**GKF 240** 40 TPI 68Teeth
90°	**GKS 241** 41 TPI 81Teeth				
90°	**GKS 247** 47 TPI 92Teeth				
70°	**GKS 430** 30 TPI 52Teeth				
70°	**GKS 435** 35 TPI 68Teeth				
70°	**GKS 440** 40 TPI 78Teeth				
70°	**GKS 447** 47 TPI 92Teeth				
70°	**GKS 450** 50 TPI 98Teeth	**GKR 450** 50 TPI 86Teeth	**GKL 450** 50 TPI 86Teeth	**GKM 450** 50 TPI 86Teeth	**GKF 450** 50 TPI 86Teeth
70°	**GKS 453** 53 TPI 104Teeth				
70°	**GKS 480** 80 TPI 155Teeth	**GKR 480** 80 TPI 135Teeth	**GKL 480** 80 TPI 135Teeth		**GKF 480** 80 TPI 135Teeth

GK SERIES DIAMETRAL PITCH

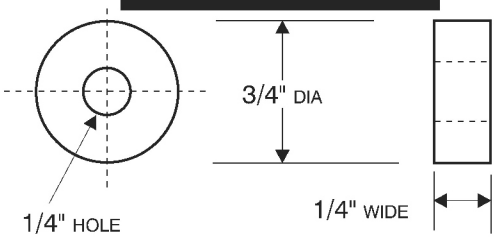
80°	**GKS 064** 64 DP 40Teeth	**GKR 064** 64 DP 40Teeth	**GKL 064** 64 DP 40Teeth	**GKM 064** 64 DP 40Teeth	**GKF 064** 64 DP 40Teeth
80°	**GKS 096** 96 DP 60Teeth	**GKR 096** 96 DP 60Teeth	**GKL 096** 96 DP 60Teeth	**GKM 096** 96 DP 60Teeth	**GKF 096** 96 DP 60Teeth
80°	**GKS 128** 128 DP 80Teeth	**GKR 128** 128 DP 80Teeth	**GKL 128** 128 DP 80Teeth	**GKM 128** 128 DP 80Teeth	**GKF 128** 128 DP 80Teeth
80°	**GKS 160** 160 DP 100Teeth	**GKR 160** 160 DP 100Teeth	**GKL 160** 160 DP 100Teeth	**GKM 160** 160 DP 100Teeth	**GKF 160** 160 DP 100Teeth

KN SERIES

Will fit the folowing holders:

See Pages
16, 17, 18, 20, 21

Brown & Sharp No.
185-224 (24A)
190-188 (22AA)
195-122 (22BA)
200-122 (22C)
210-122 (22KB)
Boyar-Schultz 2K
Deterbeck 2



KN SERIES CIRCULAR PITCH KNURLS

INCLUDED TOOTH ANGLE	Straight Tooth Knurls	30° SPIRAL KNURLS		30° DIAMOND KNURL	
		RH Spiral	LH Spiral	Male	Female
					
90°	**KNS 210** 10 TPI 23Teeth	**KNR 210** 10 TPI 20Teeth	**KNL 210** 10 TPI 20Teeth		
90°	**KNS 212** 12 TPI 28Teeth	**KNR 212** 12 TPI 25Teeth	**KNL 212** 12 TPI 25Teeth		
90°	**KNS 214** 14 TPI 34Teeth	**KNR 214** 14 TPI 34Teeth	**KNL 214** 14 TPI 34Teeth		
90°	**KNS 216** 16 TPI 38Teeth	**KNR- 216** 16 TPI 33Teeth	**KNL 216** 16 TPI 33Teeth	**KNM 216** 16 TPI 33Teeth	**KNF 216** 16 TPI 33Teeth
90°	**KNS 219** 19 TPI 45Teeth				
90°	**KNS 220** 20 TPI 47Teeth	**KNR 220** 20 TPI 41Teeth	**KNL 220** 20 TPI 41Teeth	**KNM 220** 20 TPI 41Teeth	**KNF 220** 20 TPI 41Teeth
90°	**KNS 224** 24 TPI 57Teeth				
90°	**KNS 225** 25 TPI 59Teeth	**KNR 225** 25 TPI 51Teeth	**KNL 225** 25 TPI 51Teeth	**KNM225** 25 TPI 51Teeth	**KNF 225** 25 TPI 51Teeth
90°	**KNS 229** 29 TPI 68Teeth				
90°	**KNS 230** 30 TPI 71Teeth	**KNR 230** 30 TPI 61Teeth	**KNL 230** 30 TPI 61Teeth	**KNM 230** 30 TPI 61Teeth	**KNF 230** 30 TPI 61Teeth
90°	**KNS 235** 35 TPI 82Teeth	**KNR 235** 35 TPI 71Teeth	**KNL 235** 35 TPI 71Teeth		
90°	**KNS 240** 40 TPI 94Teeth	**KNR 240** 40 TPI 81Teeth	**KNL 240** 40 TPI 81Teeth		
90°	**KNS 241** 41 TPI 97Teeth				
70°	**KNS 450** 50 TPI 117Teeth	**KNR 450** 50 TPI 102Teeth	**KNL 450** 50 TPI 102Teeth	**KNM 450** 50 TPI 102Teeth	**KNF 450** 50 TPI 102Teeth
70°	**KNS 480** 80 TPI 189Teeth	**KNR 480** 80 TPI 163Teeth	**KNL 480** 80 TPI 163Teeth		**KNF 480** 80 TPI 163Teeth

KN SERIES DIAMETRAL PITCH

80°	**KNS 064** 64 DP 48Teeth	**KNR 064** 64 DP 48Teeth	**KNL 064** 64 DP 48Teeth		
80°	**KNS 096** 96 DP 72Teeth	**KNR 096** 96 DP 72Teeth	**KNL 096** 96 DP 72Teeth	**KNM 096** 96 DP 72Teeth	**KNF 096** 96 DP 72Teeth
80°	**KNS 128** 128 DP 96Teeth	**KNR 128** 128 DP 96Teeth	**KNL 128** 128 DP 96Teeth		
80°	**KNS 160** 160 DP 120Teeth	**KNR 160** 160 DP 120Teeth	**KNL 160** 160 DP 120Teeth		

NOTE: Chamfers should be added when axial feeding. Add $1.00 per item

QUANTITY DISCOUNTS - See inside front cover or website for quantity Discounts and Pricing.

*Most sizes are available in **Hi-Cobalt** also. Please see our website or call.*

* THESE KNURLS ARE STOCKED IN 45° LEFT (C) AND 45° RIGHT (D) SPIRAL

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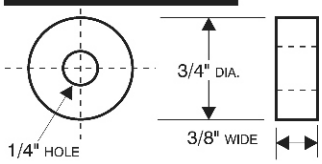
KP SERIES



Will fit the following holders:
Accu Trak
See Pages 16 - 21
Brown & Sharp No.
185-224 (24A) • 190-122 (22AA)
195-122 (22BA) • 200-122 (22C)
210-122 (22KB)
Armstrong No. 1k, 2k
3k-1, 3k-2, 675, 677
All Prat & Whitney
J. H. Williams No.
1K, 2K, 3K1, 3K2
Graham No.2, 3
Barnaby KT-2G
Slitters 50-1, 50-2, 50-3
Raimike 139-1, 139-2
All Wettstein (Eagle Rock)

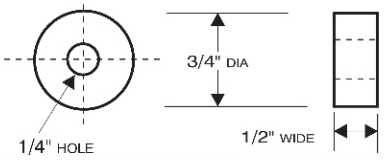
KP SERIES CIRCULAR PITCH KNURLS

INCLUDED TOOTH ANGLE	Straight Tooth Knurls	30° SPIRAL KNURLS		30° DIAMOND KNURL	
		RH Spiral	LH Spiral	Male	Female
					
90°	**KPS 208** 8 TPI 19Teeth	**KPR 208** 8 TPI 16Teeth	**KPL 208** 8 TPI 16Teeth		
90°	**KPS 210** 10 TPI 23Teeth	**KPR 210** 10 TPI 20Teeth	**KPL 210** 10 TPI 20Teeth		
90°	**KPS 212** 12 TPI 28Teeth	**KPR 212** 12 TPI 25Teeth	**KPL 212** 12 TPI 25Teeth	**KPM 212** 12 TPI 25Teeth	**KPF 212** 12 TPI 25Teeth
90°	**KPS 214** 14 TPI 34Teeth	****KPR 214** 14 TPI 34Teeth	****KPL 214** 14 TPI 34Teeth	**KPM 214** 14 TPI 34Teeth	**KPF 214** 14 TPI 34Teeth
90°	**KPS 216** 16 TPI 38Teeth	***KPR 216** 16 TPI 33Teeth	***KPL 216** 16 TPI 33Teeth	**KPM 216** 16 TPI 33Teeth	**KPF 216** 16 TPI 33Teeth
90°	**KPS 218** 18 TPI 42Teeth	**KPR 218** 18 TPI 37Teeth	**KPL 218** 18 TPI 37Teeth		
90°	**KPS 220** 20 TPI 47Teeth	***KPR 220** 20 TPI 41Teeth	***KPL 220** 20 TPI 41Teeth	**KPM 220** 20 TPI 41Teeth	**KPF 220** 20 TPI 41Teeth
90°	**KPS 221** 21 TPI 50Teeth	****KPR 221** 21 TPI 50Teeth	****KPL 221** 21 TPI 50Teeth		
90°	**KPS 225** 25 TPI 59Teeth	***KPR 225** 25 TPI 51Teeth	***KPL 225** 25 TPI 51Teeth	**KPM 225** 25 TPI 51Teeth	**KPF 225** 25 TPI
90°	**KPS 230** 30 TPI 71Teeth	***KPR 230** 30 TPI 61Teeth	***KPL 230** 30 TPI 61Teeth	**KPM 230** 30 TPI 61Teeth	**KPF 230** 30 TPI 61Teeth
90°	**KPS 233** 33 TPI 77Teeth	****KPR 233** 33 TPI 77Teeth	****KPL 233** 33 TPI 77Teeth		
90°	**KPS 235** 35 TPI 82Teeth	**KPR 235** 35 TPI 71Teeth	**KPL 235** 35 TPI 71Teeth		
90°	**KPS 240** 40 TPI 94Teeth	**KPR 240** 40 TPI 81Teeth	**KPL 240** 40 TPI 81Teeth	**KPM 240** 40 TPI 81Teeth	**KPF 240** 40 TPI 81Teeth
70°	**KPS 435** 35 TPI 82Teeth				
70°	**KPS 450** 50 TPI 117Teeth	**KPR 450** 50 TPI 102Teeth	**KPL 450** 50 TPI 102Teeth	**KPM 450** 50 TPI 102Teeth	**KPF 450** 50 TPI 102Teeth
70°	**KPS 460** 60 TPI 141Teeth				
70°	**KPS 480** 80 TPI 189Teeth	**KPR 480** 80 TPI 163Teeth	**KPL 480** 80 TPI 163Teeth	**KPM 480** 80 TPI 163Teeth	**KPF 480** 80 TPI 163Teeth

KP SERIES DIAMETRAL PITCH

80°	**KPS 064** 64 DP 48Teeth	**KPR 064** 64 DP 48Teeth	**KPL 064** 64 DP 48Teeth	**KPM 064** 64 DP 48Teeth	**KPF 064** 64 DP 48Teeth
80°	**KPS 096** 96 DP 72Teeth	**KPR 096** 96 DP 72Teeth	**KPL 096** 96 DP 72Teeth	**KPM 096** 96 DP 72Teeth	**KPF 096** 96 DP 72Teeth
80°	**KPS 128** 128 DP 96Teeth	**KPR 128** 128 DP 96Teeth	**KPL 128** 128 DP 96Teeth	**KPM 128** 128 DP 96Teeth	**KPF 128** 128 DP 96Teeth
80°	**KPS 160** 160 DP 120Teeth	**KPR 160** 160 DP 120Teeth	**KPL 160** 160 DP 120Teeth	**KPM 160** 160 DP 120Teeth	**KPF 160** 160 DP 120Teeth

KR SERIES



KR SERIES CIRCULAR PITCH KNURLS

Straight Tooth Knurls	30° SPIRAL KNURLS		30° DIAMOND KNURL	
	RH Spiral	LH Spiral	Male	Female
				
	KRR 212 12 TPI 25Teeth	**KRL 212** 12 TPI 25Teeth		
KRS 214 14 TPI 34Teeth				
KRS 216 16 TPI 38Teeth	**KRR 216** 16 TPI 33Teeth	**KRL 216** 16 TPI 33Teeth	**KRM 216** 16 TPI 33Teeth	**KRF 216** 16 TPI 33Teeth
KRS 220 20 TPI 47Teeth	**KRR 220** 20 TPI 41Teeth	**KRL 220** 20 TPI 41Teeth	**KRM 220** 20 TPI 41Teeth	**KRF 220** 20 TPI 41Teeth
KRS 225 25 TPI 59Teeth	**KRR 225** 25 TPI 51Teeth	**KRL 225** 25 TPI 51Teeth	**KRM 225** 25 TPI 51Teeth	**KRF 225** 25 TPI 51Teeth
KRS 230 30 TPI 71Teeth	**KRR 230** 30 TPI 61Teeth	**KRL 230** 30 TPI 61Teeth	**KRM 230** 30 TPI 61Teeth	**KRF 230** 30 TPI 61Teeth
KRS 232 32 TPI 75Teeth				
KRS 235 35 TPI 82Teeth				
KRS 240 40 TPI 94Teeth				
KRS 450 50 TPI 117 Teeth	**KRR 450** 50 TPI 102 Teeth	**KRL 450** 50 TPI 102 Teeth	**KRM 450** 50 TPI 102 Teeth	**KRF 450** 50 TPI 102 Teeth
	KRR 480 80 TPI 163 Teeth	**KRL 480** 80 TPI 163 Teeth		

KR SERIES DIAMETRAL PITCH KNURLS

KRS 064 64 DP 48Teeth	**KRR-064** 64 DP 48Teeth	**KRL 064** 64 DP 48Teeth	**KRM 064** 64 DP 48Teeth	**KRF 064** 64 DP 48Teeth
KRS 096 96 DP 72Teeth	**KRR 096** 96 DP 72Teeth	**KRL 096** 96 DP 72Teeth	**KRM 096** 96 DP 72Teeth	**KRF 096** 96 DP 72Teeth
KRS 128 128 DP 96Teeth	**KRR 128** 128 DP 96Teeth	**KRL 128** 128 DP 96Teeth	**KRM 128** 128 DP 96Teeth	**KRF 128** 128 DP 96Teeth
KRS 160 160 DP 120Teeth	**KRR 160** 160 DP 120Teeth	**KRL 160** 160 DP 120Teeth		

NOTE: Chamfers should be added when axial feeding. Add $1.00 per item

QUANTITY DISCOUNTS - See inside front cover or website for quantity Discounts and Pricing.

*Most sizes are available in **Hi-Cobalt** also. Please see our website or call.*

* THESE KNURLS ARE STOCKED IN 45° LEFT (C) AND 45 ° RIGHT (D) SPIRAL

**** The TPI on these knurls are measured TRANSVERSE (see page 4) To be comparable to Armstrong Williams Knurls**

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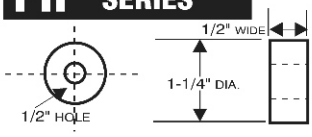
PH SERIES



HEAVY DUTY
Special Holders
OR BHPHR
OR SPH16E

PH SERIES CIRCULAR PITCH KNURLS

Straight Tooth Knurls	30° SPIRAL KNURLS		30° DIAMOND KNURL	
	RH Spiral	LH Spiral	Male	Female
				
PHS 212 12 TPI 47Teeth	**PHR 212** 12 TPI 41Teeth	**PHL 212** 12 TPI 41Teeth	**PHM 212** 12 TPI 41Teeth	
PHS 214 14 TPI 55Teeth	**PHR 214** 14 TPI 55Teeth	**PHL 214** 14 TPI 55Teeth		
PHS 216 16 TPI 63Teeth	**PHR 216** 16 TPI 54Teeth	**PHL 216** 16 TPI 54Teeth	**PHM 216** 16 TPI 54Teeth	**PHF 216** 16 TPI 54Teeth
PHS 220 20 TPI 78Teeth	**PHR 220** 20 TPI 68Teeth	**PHL 220** 20 TPI 68Teeth	**PHM 220** 20 TPI 68Teeth	**PHF 220** 20 TPI 68Teeth
PHS 225 25 TPI 98Teeth	**PHR 225** 25 TPI 85Teeth	**PHL 225** 25 TPI 85Teeth	**PHM 225** 25 TPI 85Teeth	**PHF 225** 25 TPI 85Teeth
PHS 230 30 TPI 117Teeth	**PHR 230** 30 TPI 103Teeth	**PHL 230** 30 TPI 103Teeth	**PHM 230** 30 TPI 103Teeth	**PHF 230** 30 TPI 103Teeth
PHS 232 40 TPI Teeth				
PHS 235 40 TPI Teeth				
PHS 240 40 TPI 156Teeth	**PHR 240** 40 TPI 135Teeth	**PHL 240** 40 TPI 135Teeth		
PHS 450 50 TPI 195Teeth	**PHR 450** 50 TPI 169Teeth	**PHL 450** 50 TPI 169Teeth		
PHS 480 80 TPI 314Teeth	**PHR 450** 80 TPI 272Teeth	**PHL 450** 80 TPI 272Teeth		

PH SERIES DIAMETRAL PITCH

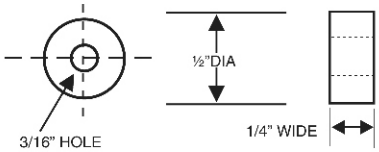
PHS 064 64 DP 81Teeth	**PHR 064** 64 DP 81Teeth	**PHL064** 64 DP 81Teeth		
PHS 096 96 DP 121Teeth	**PHR 096** 96 DP 121Teeth	**PHL 096** 96 DP 121Teeth		
PHS 128 128 DP 161Teeth	**PHR 128** 128 DP 161Teeth	**PHL 128** 128 DP 161Teeth		
PHS 160 160 DP 201Teeth	**PHR 160** 160 DP 201Teeth	**PHL 160** 160 DP 201Teeth		

NOTE: Chamfers should be added when axial feeding.
Add $1.00 per item

QUANTITY DISCOUNTS - See inside front cover or website for quantity Discounts and Pricing.
*Most sizes are available in **Hi-Cobalt** also.*
Please see our website or call.

* THESE KNURLS ARE STOCKED IN 45° LEFT (C) AND 45 ° RIGHT (D) SPIRAL

EQ SERIES



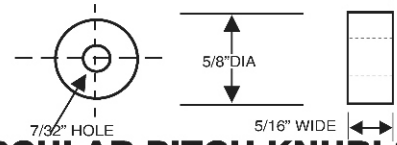
EQ SERIES CIRCULAR PITCH KNURLS

INCLUDED TOOTH ANGLE	PITCH Inch/Metric	Straight Tooth Knurls	30° SPIRAL KNURLS RH Spiral	30° SPIRAL KNURLS LH Spiral
				
90°	14 TPI / 1.81mm	**EQS 214** 14 TPI 22Teeth	**EQR 214** 14 TPI 19Teeth	**EQL 214** 14 TPI 19Teeth
90°	16 TPI / 1.59mm	**EQS 216** 16 TPI 25Teeth		
90°	20 TPI / 1.27 mm	**EQS 220** 120 TPI 31Teeth	**EQR 220** 20 TPI 27Teeth	**EQL 220** 20 TPI 27Teeth
90°	21 TPI / 1.21 mm	**EQS 221** 21 TPI 33Teeth	**EQR 221** 21 TPI 29Teeth	**EQL 221** 21 TPI 29Teeth
90°	25 TPI / 1.02mm	**EQS 225** 25 TPI 38Teeth	**EQR 225** 25 TPI 34Teeth	**EQL 225** 25 TPI 34Teeth
90°	30 TPI / 0.85	**EQS 230** 30 TPI 47Teeth	**EQR 230** 30 TPI 41Teeth	**EQL 230** 30 TPI 41Teeth
90°	33 TPI / 0.77	**EQS 233** 33 TPI 52Teeth	**EQR 233** 33 TPI 45Teeth	**EQL 233** 33 TPI 45Teeth
90°	35 TPI / 0.73	**EQS 235** 35 TPI 55Teeth		
70°	50 TPI / 0.51mm	**EQS 450** 50 TPI 79Teeth	**EQR 450** 50 TPI 68Teeth	**EQL 450** 50 TPI 68Teeth

EQ SERIES DIAMETRAL PITCH

80°	-	-	-	-
80°	96 DP / 0.82 mm	**EQS 096** 96 TPI 48Teeth		
80°	128 DP / 0.62 mm	**EQS 128** 128 TPI 64Teeth		
80°	160 DP / 0.50 mm	**EQS 160** 96 TPI 48Teeth		

GR SERIES

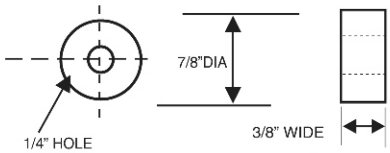


GR SERIES CIRCULAR PITCH KNURLS

INCLUDED TOOTH ANGLE	PITCH Inch/Metric	Straight Tooth Knurls	30° SPIRAL KNURLS RH Spiral	30° SPIRAL KNURLS LH Spiral
				
90°	14 TPI / 1.81mm	**GRS 214** 14 TPI 27Teeth	**GRR 214** 14 TPI 24Teeth	**GRL 214** 14 TPI 24Teeth
90°	20 TPI / 1.27 mm		**GRR 220** 20 TPI 34Teeth	**GRL 220** 20 TPI 34Teeth
90°	21 TPI / 1.21 mm	**GRS 221** 21 TPI 41Teeth	**GRR 221** 21 TPI 36Teeth	**GRL 221** 21 TPI 36Teeth
90°	25 TPI / 1.02mm	**GRS 225** 25 TPI 49Teeth	**GRR 225** 25 TPI 42Teeth	**GRL 225** 25 TPI 42Teeth
90°	33 TPI / 0.77	**GRS 233** 33 TPI 65Teeth	**GRR 233** 33 TPI 56Teeth	**GRL 233** 33 TPI 56Teeth

Toll Free in US and Canada: 1-800-433-4933 • All others: 508-892-1787 • Fax: 508-892-1789 • Website: http://accu-trak.com
Email contacts: Sales = sales@accu-trak.com • Engineering = eng@accu-trak.com • General Information = info@accu-trak.com

MT SERIES



MT SERIES CIRCULAR PITCH KNURLS

INCLUDED TOOTH ANGLE	PITCH Inch/Metric	Straight Tooth Knurls	30° SPIRAL KNURLS RH Spiral	30° SPIRAL KNURLS LH Spiral	30° DIAMOND KNURLS Male	30° DIAMOND KNURLS Female
90°	14 TPI 1.81mm		MTR 214 14 TPI 33Teeth	MTL 214 14 TPI 33Teeth		
90°	16 TPI 1.59 mm	MTS 216 21 TPI 44Teeth				
90°	20 TPI 1.27 mm	MTS 220 20 TPI 55Teeth	MTR 220 20 TPI 48Teeth	MTL 220 20 TPI 48Teeth	MTM 220 20 TPI 48Teeth	MTM 220 20 TPI 48Teeth
90°	25 TPI 1.02mm	MTS 225 25 TPI 49Teeth	MTR 225 25 TPI 42Teeth	MTL 225 25 TPI 42Teeth		
90°	30 TPI 0.85mm	MTS 230 30 TPI 82Teeth	MTR 230 30 TPI 71Teeth	MTL 230 30 TPI 71Teeth		MTM 230 30 TPI 71Teeth
90°	33 TPI 0.77mm		MTR 233 33 TPI 79Teeth	MTL 233 33 TPI 79Teeth		
90°	40 TPI 0.64mm	MTS 240 40 TPI 110Teeth				

KNURL PINS CARBIDE PINS

DIA	LENGTH	ITEM #
1/8	3/8	C 062
1/8	1/2	C 082
1/8	5/8	C 102
3/16	1/2	C 083
3/16	5/8	C 103
3/16	11/16	C 113
3/16	3/4	C 123
3/16	1	C 163
1/4	5/8	C 104
1/4	11/16	C 114
1/4	7/8	C 144
1/4	1	C 164
1/4	1-1/4	C 204
5/16	3/4	C125
5/16	1	C 165
1/2	5/8	C 108
1/2	1	C 168
1/2	1-1/4	C 208
1/2	1-1/2	C 248
1/2	1-3/4	C 288
1/2	2	C 328

METRIC SERIES - CARBIDE

DIA	LENGTH	ITEM #
4mm	12mm	C M412
4mm	13mm	C M413
4mm	16mm	C M416
4mm	19mm	C M419
4mm	20mm	C M420
6mm	16mm	C M616
6mm	19mm	C M619
6mm	20mm	C M620
6mm	25mm	C M625
8mm	28mm	C M828

INCH SERIES - STEEL

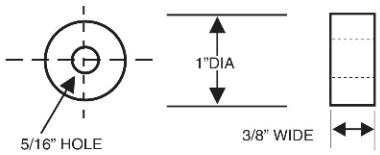
DIA	LENGTH	ITEM #
3/16	1/2	S 083
3/16	11/16	S 113
1/4	11/16	S 114
1/4	1	S 164
1/4	1-1/2	S 184

UP TO THE SHOULDER PINS (With FNC Coating)

DIA	LENGTH	ITEM #
10/12 mm	35mm	OR NTSP

Please refer to www.accu-trak.com for complete pricing and availability

OU SERIES

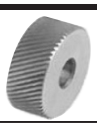
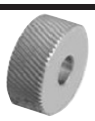
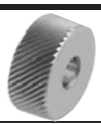
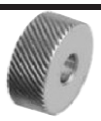
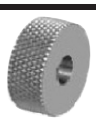
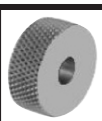
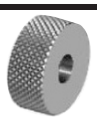


INCLUDED TOOTH ANGLE	PITCH Inch/Metric	Straight Tooth Knurls	30° SPIRAL KNURLS RH Spiral	30° SPIRAL KNURLS LH Spiral	30° DIAMOND KNURLS Male	30° DIAMOND KNURLS Female
90°	10 TPI 2.45mm		OUR 210 10 TPI 27Teeth	OUL 210 10 TPI 27Teeth		
90°	12 TPI 2.12mm	OUS 212 12 TPI 38Teeth	OUR 212 12 TPI 33Teeth	OUL 212 12 TPI 33Teeth		
90°	14 TPI 1.81mm	OUS 214 14 TPI 44Teeth	OUR 214 14 TPI 38Teeth	OUL 214 14 TPI 38Teeth		
90°	16 TPI 1.59mm	OUS 216 16 TPI 50Teeth	OUR 216 16 TPI 43Teeth	OUL 216 16 TPI 43Teeth		
90°	20 TPI 127mm	OUS 220 20 TPI 63Teeth	OUR 220 20 TPI 54Teeth	OUL 220 20 TPI 54Teeth	OUM 220 20 TPI 54Teeth	OUF 220 20 TPI 54Teeth
90°	21 TPI 1.21mm	OUS 221 21 TPI 66Teeth	OUR 221 21 TPI 57Teeth	OUL 221 21 TPI 57Teeth		
90°	25 TPI 1.02mm	OUS 225 25 TPI 78Teeth	OUR 225 25 TPI 68Teeth	OUL 225 25 TPI 68Teeth	OUM 225 25 TPI 68Teeth	OUF 225 25 TPI 68Teeth
90°	30 TPI 0.85mm	OUS 230 30 TPI 94Teeth	OUR 230 30 TPI 82Teeth	OUL 230 30 TPI 82Teeth	OUM 230 30 TPI 82Teeth	OUF 230 30 TPI 82Teeth
90°	33 TPI 0.77mm	OUS 233 33 TPI 104Teeth	OUR 233 33 TPI 90Teeth	OUL 233 33 TPI 90Teeth		
90°	35 TPI 0.73mm	OUS 235 35 TPI 110Teeth				

OU SERIES DIAMETRAL PITCH KNURLS

INCLUDED TOOTH ANGLE	PITCH Inch/Metric	Straight Tooth Knurls	30° SPIRAL KNURLS RH Spiral	30° SPIRAL KNURLS LH Spiral	30° DIAMOND KNURLS Male	30° DIAMOND KNURLS Female
80°	64 DP	OUS 064 64 DP 64Teeth	-	-	-	-
80°	96 DP	OUS 096 96 DP 96Teeth	-	-	-	-
80°	128 DP	-	-	-	-	-
80°	160 DP	-	-	-	-	-

METRIC "FORMING" KNURLS

Smooth **Milled** Tooth Profile											**HSS & Hi-Colbalt 90°** Tooth Form Beveled Edges Optional, but Recommended for Axial feeding
Series Size	Metric Pitch	"AA" straight	BL 30° LH Diag	BR 30° RH Diag	BL 45° LH Diag	BR 45° RH Diag	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female	
"MB" Series only available in **Hi-Cobalt** with **Lapped** Tooth Profile 10mm Diam. 3mm Width 4mm Hole	0.3mm	MBSX0.3	-	-	MBCX0.3	MBDX0.3	-	-	-	MBGX0.3	
	0.4mm	MBSX0.4	-	-	MBCX0.4	MBDX0.4	-	-	-	MBGX0.4	
	0.5mm	MBSX0.5	-	-	MBCX0.5	MBDX0.5	-	-	-	MBGX0.5	
	0.6mm	MBSX0.6	-	-	MBCX0.6	MBDX0.6	-	-	-	MBGX0.6	
	0.7mm	MBSX0.7	-	-	MBCX0.7	MBDX0.7	-	-	-	MBGX0.7	
	0.8mm	MBSX0.8	-	-	MBCX0.8	MBDX0.8	-	-	-	MBGX0.8	
	0.9mm	MBSX0.9	-	-	MBCX0.9	MBDX0.9	-	-	-	MBGX0.9	
	1.0mm	MBSX1.0	-	-	MBCX1.0	MBDX1.0	-	-	-	MBGX1.0	
"MM" Series 10mm Diam. 4mm Width 4mm Hole	0.2mm	MMS-0.2	-	-	-	-	-	-	-	-	**Accu trak** OR BHM12R, OR BHN16R OR 2BHMN, OR 13MNxx **German Made** 94, 99,101A, 101D, 102A, 102D, 104A
	0.3mm	MMS-03	MML-0.3	MMR-0.3	MMC-0.3	MMD-0.3	-	MMF-0.3	MMN-0.3	MMG-0.3	
	0.4mm	MMS-0.4	MML-0.4	MMR-0.4	MMC-0.4	MMD-0.4	-	MMF-0.4	MMN-0.4	MMG-0.4	
	0.5mm	MMS-0.5	MML-0.5	MMR-0.5	MMC-0.5	MMD-0.5	-	MMF-0.5	MMN-0.5	MMG-0.5	
	0.6mm	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	
	0.7mm	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	
	0.8mm	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	
	0.9mm	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	
	1.0mm	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	
	1.2mm	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	
	1.5mm	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	
"MN" Series 15mm Diam. 4mm Width 4mm Hole	0.3mm	MNS-0.3	MNL-0.3	MNR-0.3	MNC-0.3	MND-0.3	-	-	-	MNG-0.3	**Accu Trak** OR BHM12R, OR BHN16R, OR 2BHMN, OR 13MNxx **German Made** 94, 101A, 101/2A, OR 2BHMN, OR 13MNxx
	0.4mm	MNS-0.4	MNL-0.4	MNR-0.4	MNC-0.4	MND-0.4	-	-	-	MNG-0.4	
	0.5mm	MNS-0.5	MNL-0.5	MNR-0.5	MNC-0.5	MND-0.5	-	-	-	MNG-0.5	
	0.6mm	MNS-0.6	MNL-0.6	MNR-0.6	MNC-0.6	MND-0.6	-	-	-	MNG-0.6	
	0.7mm	MNS-0.7	MNL-0.7	MNR-0.7	MNC-0.7	MND-0.7	-	-	-	MNG-0.7	
	0.8mm	MNS-0.8	MNL-0.8	MNR-0.8	MNC-0.8	MND-0.8	-	-	-	MNG-0.8	
	0.9mm	MNS-0.9	MNL-0.9	MNR-0.9	MNC-0.9	MND-0.9	-	-	-	MNG-0.9	
	1.0mm	MNS-1.0	MNL-1.0	MNR-1.0	MNC-1.0	MND-1.0	-	-	-	MNG-1.0	
	1.2mm	MNS-1.2	MNL-1.2	MNR-1.2	MNC-1.2	MND-1.2	-	-	-	MNG-1.2	
	1.5mm	MNS-1.5	MNL-1.5	MNR-1.5	MNC-1.5	MND-1.5	-	-	-	MNG-1.5	
"MQ" Series 15mm Diam. 6mm Width 4mm Hole	0.3mm	MQS-0.3	MQL-0.3	MQR-0.3	MQC-0.3	MQD-0.3	MQM-0.3	MQF-0.3	MQN-0.3	HQG-0.3	**Accu Trak** OR BHQ16R **German Made** 97,99/1, 100/1 101B, 101/2C, 101/2D, 102B, 104E, 105B
	0.4mm	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	
	0.5mm	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	
	0.6mm	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	
	0.7mm	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	
	0.8mm	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	
	0.9mm	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	
	1.0mm	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	
	1.2mm	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	
	1.5mm	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	
	2.0mm	MQS-2.0	MQL-2.0	MQR-2.0	MQC-2.0	MQD-2.0	-	-	MQN-2.0	-	
"MR" Series 20mm Diam. 6mm Width 6mm Hole	0.3mm	-	-	-	-	-	-	-	-	-	**Accu Trak** OR BHR16R, OR BHR25R, OR 2BHMR, OR SMW20, OR SMW25, OR MRCS12, OR MRCS16, OR MRCS20, OR MRCS25, OR 13MRxx **German Made** 101F, 102F, 104I, 105C
	0.4mm	MRS-0.4	MRL-0.4	MMR-0.4		-	-	-	-	-	
	0.5mm	MRS-0.5	MRL-0.5	MRR-0.5	-	-	-	-	-	-	
	0.6mm	MRS-0.6	MRL-0.6	MRR-0.6		-	-	-	-	-	
	0.7mm	MRS-0.7	-	-	-	-	-	-	-	-	
	0.8mm	MRS-0.8	MRL-0.8	MRR-0.8	-	-	-	-	-	-	
	0.9mm	MRS-0.9	-	-	-	-	-	-	-	-	
	1.0mm	MRS-1.0	MRL-1.0	MRR-1.0	-	-	-	-	-	-	
	1.2mm	MRS-1.2	MRL-1.2	MRR-1.2	-	-	-	-	-	-	
	1.3mm	MRS-1.3	-	-	-	-	-	-	-	-	
	1.4mm	MRS-1.4	-	-	-	-	-	-	-	-	
	1.5mm	MRS-1.5	MRL-1.5	MRR-1.5	MRC-1.5	MRD-1.5	-	-	-	-	
	1.6mm	MRS-1.6	-	-	-	-	-	-	-	-	
	2.0mm	MRS-2.0	MRL-2.0	MRR-2.0	-	-	-	-	-	-	

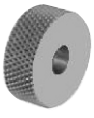
The above listed knurl wheels are made of HHS and have a Smooth Tooth Profile (except where noted).

Many are available in **Hi-Cobalt.** Please check website or call.

Please, see website for current pricing and all the latest sizes and types available as stock items.

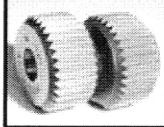
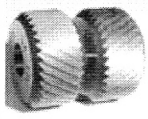
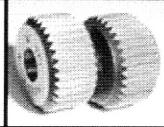
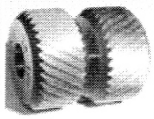
See inside front cover or website for **Quantity Discounts.**

METRIC "FORMING" KNURLS (Cont.)

Smooth **Milled** Tooth Profile											**HSS & Hi-Cobalt 90°** Tooth Form Beveled Edges Optional, but Recommended for Axial Feeding
Series Size	Metric Pitch	"AA" Straight	BL 30° LH Diag.	BR 30 ° RH Diag.	BL 45° LH Diag.	BR 45° RH Diag.	GE 30° Male	GV 30° Female	GE 45° Male	GV 45° Female	
"MS" Series 20mm Diam 8mm Width 6mm Hole	0.3mm	MSS-0.3	MSL-0.3	MSR-0.3	MSC-0.3	MSD-0.3	MSM-0.3	MSF-0.3	MSN-0.3	-	**Accu trak** OR BHS20R, OR BHW25R OR 2BHMS, OR SMW20, OR SMW25 **German Made** 95, 95/1 ,95/2 ,95/3, 96/IIF, 96/2F,96/2L, 98, 98/1, 100/2, 100/10, 101G, 104K, 105D
	0.4mm	MSS-0.4	MSL-0.4	MSR-0.4	MSC-0.4	MSD-0.4	MSM-0.4	MSF-0.4	MSN-0.4	-	
	0.5mm	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	
	0.6mm	MSS-0.6	MSL-0.6	MSR-0.6	MSC-0.6	MSD-0.6	MSM-0.6	MSF0.66	MSN-0.6	MSG-0.6	
	0.7mm	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	
	0.8mm	MSS-0.8	MSL-0.8	MSR-0.8	MSC-0.8	MSD-0.8	MSM-0.8	MSF-0.8	MSN0.8	MSG-0.8	
	1.0mm	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	
	1.2mm	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	
	1.5mm	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	
	1.6mm	MSS-1.6	-	-	-	-	-	-	-	-	
	2.0mm	MSS-2.0	MSL-2.0	MSR-2.0	MSC-2.0	MSD-0.2	MSM-2.0	MSF-2.0	MSN-2.0	MSG-2.0	
	2.5mm	MSS-2.5	MSL-2.5	MSR-2.5	MSC-2.5	MSD-2.5	-	-	-	-	
	3.0mm	MSS-3.0	MSL-3.0	MSR-3.0	MSC-3.0	MSD-3.0	-	-	-	-	
"MU" Series only available in **Hi-Copbalt** with **Lapped** Tooth Profile 20mm Diam. 10mm Width 6mm Hole	0.3mm	MUSX-0.3	MULX-0.3	MURX-0.3	MUCX-0.3	MUDX-0.3	MUMX-0.3	MUFX-0.3	MUNX-0.3	MUGX-0.3	
	0.4mm	MUSX-0.4	MULX-0.4	MURX-0.4	MUCX-0.4	MUDX-0.4	MUMX-0.4	MUFX-0.4	MUNX-0.4	MUGX-0.4	
	0.5mm	MUSX-0.5	MULX-0.5	MURX-0.5	MUCX-0.5	MUDX-0.5	MUMX-0.5	MUFX-0.5	MUNX-0.5	MUGX-0.5	
	0.6mm	MUSX0.6	MULX-0.6	MURX-0.6	MUCX-0.6	MUDX-0.6	MUMX-0.6	MUFX-0.6	MUNX-0.6	MUGX-0.6	
	0.7mm	MUSX-0.7	MULX-0.7	MURX0.7	MUCX-0.7	MUDX0.7	MUMX-0.7	MUFX-0.7	MUNX-0.7	MUGX-0.7	
	0.8mm	MUSX-0.8	MULX-0.8	MURX-0.8	MUCX-0.8	MUDX-0.8	MUMX-0.8	MUFX-0.8	MUNX-0.8	MUGX-0.8	
	0.9mm	MUSX-09.	MULX-0.9	MURX-0.9	MUCX-0.9	MUDX-0.9	MUMX-0.9	MUFX-0.9	MUNX-0.9	MUGX-0.9	
	1.0mm	MUSX-1.0	MULX-1.0	MURX-1.0	MUCX-1.0	MUDX-1.0	MUMX-1.0	MUFX-1.0	MUNX-1.0	MUGX-1.0	
	1.2mm	MUSX-1.2	MULX-1.2	MURX-1.2	MUCX-1.2	MUDX-1.2	MUMX-1.2	MUFX-1.2	MUNX-1.2	MUGX-1.2	
	1.5mm	MUSX-1.5	MULX-1.5	MURX-1.5	MUCX-1.5	MUDX-1.5	MUMX-1.5	MUFX-1.5	MUNX-1.5	MUGX-1.5	
	2.0mm	MUSX-2.0	MULX-2.0	MURX-2.0	MUCX-2.0	MUDX-2.0	MUMX-2.0	MUFX-2.0	MUNX-2.0	MUGX-2.0	
"MW" Series 25mm Diam. 8mm Width 6mm Hole	0.4mm	MWS-0.4	MWL-0.1	MWR-0.4	-	-	-	-	-	-	**Accu Trak** OR BHS2OR,, OR BHW25R, OR SWMW20, OR SMW25 **German Made** 100/3, 101/G, 102/G, 104/K, 105D
	0.5mm	MWS-0.5	MWL-0.5	MWR-0.5	MWC-0.5	MWD-0.5	-	MWF-0.5	-	MWG-0.5	
	0.6mm	MWS-0.6	MWL-0.6	MWR-0.6	MWC-0.6	MWD-0.6	-	MWF-0.6	-	MWG-0.6	
	0.7mm	-	-	-	-	-	-	MWF-0.7	-	MWG-0.7	
	0.8mm	MWS-0.8	MWL-0.8	MWR-0.8	MWC-0.8	MWD-0.8	MWM-0.8	MWF-0.8	-	MWG-0.8	
	0.9mm	-	-	-	-	-	-	MWF-0.9	-	MWG-0.9	
	1.0mm	MWS-1.0	MWL-1.0	MWR-1.0	-	-	MWM-1.0	MWF-1.0	-	MWG-1.0	
	1.2mm	MWS-1.2	MWL-1.2	MWR-1.2	MWC-1.2	MWD-1.2	MWM-1.2	MWF-1.2	-	MWG-1.2	
	1.5mm	MWS-1.5	MWL-1.5	MWR-1.5	MWC-1.5	MWD-1.5	MWM-1.5	MWF-1.5	-	MWG-1.5	
	1.6mm	MWS-1.6	MWL-1.6	MWR-1.6	-	-	-	-	-	-	
	2.0mm	MWS-2.0	-	-	MWC-2.0	MWD-2.0	MWM-2.0	MWF-2.0	-	MWG-2.0	

The above listed knurl wheels are made of HHS and have a Smooth Milled Tooth Profile (except where noted). Many are available in **Hi-Cobalt.** Please check website or call. Please see website for current pricing and all the latest sizes and types available as stock items. See inside front cover or website for **Quantity Discounts.**

Bevel Face (Armstrong Type) Knurl Wheel

CIRCULAR PITCH BEVEL FACE KNURLS								
				HSS		HI-COBALT		
Included Tooth Angle	Pitch		Size					
				AA Straight 2/SET	BL/BR 30° LH/RH Diag. 2/SET	AA Straight 2/SET	BL/BR 30° LH/RH Diag. 2/SET	
90°	14 TPI	Coarse	5/8 x 5/16 x 7/32	KS GR14	KD GR14	-	-	
90°	21 TPI	Medium		KS GR21	KD GR21	-	-	
90°	33 TPI	Fine		KS GR33	KD GR33	-	-	
-	-		-	-	-	-	-	
90°	14 TPI	Coarse	3/4 x 3/8 x 1/4	KS KP14	KD KP14	KS KP14X	KD KP14X	
90°	21 TPI	Medium		KS KP21	KD KP21	KS KP21X	KD KP21X	
90°	33 TPI	Fine		KS KP33	KD KP33	KS KP33X	KD KP33X	
-	-		-	-	-	-	-	
90°	14 TPI	Coarse	1 x 3/8 x 5/16	KS OU14	KD OU14	-	-	
90°	21 TPI	Medium		KS OU21	KS OU21	-	-	
90°	33 TPI	Fine		KS OU33	KS OU33	-	-	

UNIQUE METRIC FORMING KNURLS

FOR "AXIAL" KNURLING

"MRV" SERIES METRIC PITCH CONVEX KNURLS
20mm Dia. X 6mm X 6mm 90° Form (FNC Coated)

PITCH mm/TPI	STRAIGHT	30° R.H. Spiral	30° L.H. Spiral
0.4/63.5	MRSV0.4	MRRV0.4	MRLV0.4
0.5/50.8	MRSV0.5	MRRV0.5	MRLV0.5
0.6/42.3	MRSV0.6	MRRV0.6	MRLV0.6
0.8/31.8	MRSV0.8	MRRV0.8	MRLV0.8
1.0/25.4	MRSV1.0	MRRV1.0	MRLV1.0
1.2/21.2	MRSV1.2	MRRV1.2	MRLV1.2
1.5/16.9	MRSV1.5	MRRV1.5	MRLV1.5
1.6/15.9	MRSV1.6	MRRV1.6	MRLV1.6
2.0/12.7	MRSV2.0	MRRV2.0	MRLV2.0

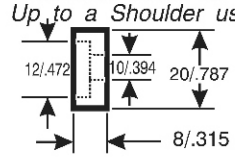
FOR "BUMP" KNURLING

"MK" SERIES METRIC PITCH KNURLS
(Popular KP size with metric pitches)
3/4" Diam. X 3/8" Wide X 1/4" Hole (19.05 X 9.5 X 6.35mm)

Pitch mm/TPI	Tooth Angle	Straight Knurl	30° R.H. Spiral	30° L.H. Spiral
0.3 mm/85 TPI	90°	MKS 0.3	-	-
0.4 mm/63 TPI	90°	MKS 0.4	MKR 0.4	MKL 0.4
0.5 mm/51 TPI	90°	MKS 0.5	MKR 0.5	MKL 0.5
0.6 mm/42 TPI	90°	MKS 0.6	MKR 0.6	MKL 0.6
0.8 mm/32 TPI	90°	MKS 0.8	MKR 0.8	MKL 0.8
1.0 mm/25 TPI	90°	MKS 1.0	MKR 1.0	MKL 1.0
1.2 mm/21 TPI	90°	MKS 1.2	MKR 1.2	MKL 1.2
1.5 mm/17 TPI	90°	MKS 1.5	MKR 1.5	MKL 1.5
1.6 mm/16 TPI	90°	MKS 1.6	MKR 1.6	MKL 1.6
2.0 mm/13 TPI	90°	MKS 2.0	MKR 2.0	MKL 2.0

"ML" SERIES Counter Bored for Up to a Shoulder use with bevels

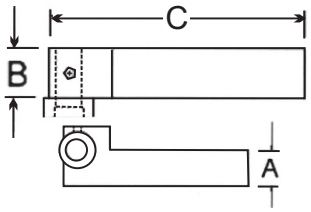
20 x 8 x 10/12mm (.787 x .315 x .394/.472")



ML series are Beveled 60° to Axis

Pitch mm/ TPI	Tooth Angle	Straight Knurl	30° RH Spiral	30° LH Spiral
0.3 mm/85 TPI	90°	MLS-0.3	-	-
0.4 mm/64 TPI	90°	MLS-0.4	MLR-0.4	MLL-0.4
0.5 mm/51 TPI	90°	MLS-0.5	MLR-0.5	MLL-0.5
0.6 mm/42 TPI	90°	MLS-0.6	MLR-0.6	MLL-0.6
0.8 mm/32 TPI	90°	MLS-0.8	MLR-0.8	MLL-0.8
1.0 mm/25 TPI	90°	MLS-1.0	MLR-1.0	MLL-1.0
1.2 mm/21 TPI	90°	MLS-1.2	MLR-1.2	MLL-1.2
1.6 mm/16 TPI	90°	MLS-1.6	MLR-1.6	MLL-1.6
2.0 mm/13 TPI	90°	MLS-2.0	MLR-2.0	MLL-2.0

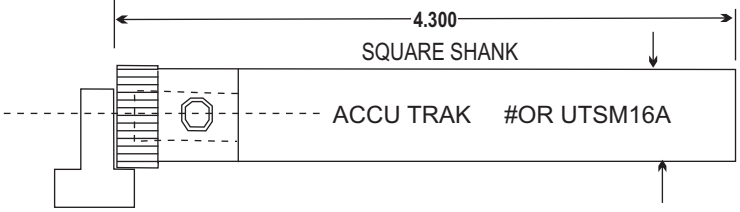
Accu Trak
OR 2BHMLI, OR 2BHMLM, OR ER-457, OR ER451, OR UTSM16, OR UTSM20, OR UTSM25, OR UTS12, OR UTS16,
GERMAN MADE HOLDERS
100/3, 101/G, 102/G, 104K, 105D



Up to a Shoulder holders

TOOLS	KNURL SERIES	PINS	HOLDER DIM inch		
			A	B	C
OR UTS12	ML	OR UTSP	.750	.750	4.000
OR UTS16	ML	OR UTSP	1.000	1.000	4.000

TOOLS	KNURL SERIES	PINS	HOLDER DIM mm		
			A	B	C
OR UTSM16	ML	OR UTSP	16	19.05	101.6
OR UTSM20	ML	OR UTSP	20	19.05	101.6
OR UTSM25	ML	OR UTSP	25	25.40	101.6



Holders using "ML" Wheels
for "Face Knurling"

TOOLS	KNURL SERIES	PINS	HOLDER DIM inch		
			A	B	C
OR UTS16A	ML	OR UTSP	1.000	1.000	4.000

TOOLS	KNURL SERIES	PINS	HOLDER DIM mm		
			A	B	C
OR UTSM16A	ML	OR UTSP	16	19.05	101.6

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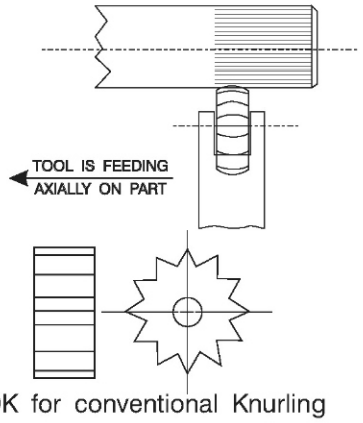
Email contacts: Sales = sales@accu-trak.com • Engineering = eng@accu-trak.com • General Information = info@accu-trak.com

AXIAL FEED CONVEX KNURLS

THESE ARE THE ULTIMATE TOOLS FOR *AXIAL FEED KNURLING

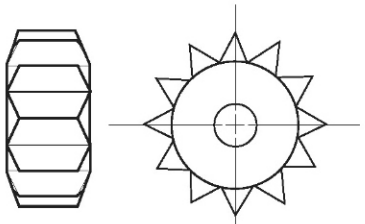
* for Knurling long pattern feeding tools along the axis of part.



OK for conventional Knurling

POOR For axial Feed Knurling Sharp Corners on leading edge of tool sees heavy loading, wear rapidly and can break off in extreme conditions.

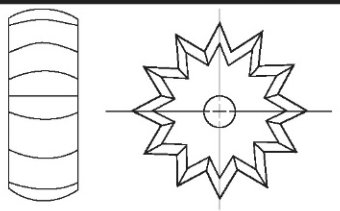
CONVEX shaped knurls for the BEST in finishes and tool life when AXIAL FEEDING. As shown in the comparison below:



BETTER Beveled edge spreads out load, but now the leading edge is a blunt surface requiring higher forces on tool and holder to deform material.

AVAILABLE IN METRIC SIZES ALSO.
SEE PAGE 14

Convex Series
For Axial Feeding



BEST CONVEX full form relief gives a "SPREAD OUT" loading on a sharp leading edge resulting in a **smoother precision finish, longer tool life and lower forces on the holder and spindle bearings.**

Hi-Cobalt Steel with EXTENDED WEAR Surface Treatment

TOOTH ANGLE	Pitch TPI/mm	EPV SERIES CIRCULAR PITCH KNURLS (1/2" Diam. X 3/16" Wide X 3/16" Hole) Tool Numbers			GKV SERIES CIRCULAR PITCH KNURLS (5/8" Diam. X 1/4" Wide X 1/4" Hole) Tool Numbers			KNV SERIES CIRCULAR PITCH KNURLS (3/4" Diam. X 1/4" Wide X 1/4" Hole) Tool Numbers			KPV SERIES CIRCULAR PITCH KNURLS (3/4" Diam. X 3/8" Wide X 1/4" Hole) Tool Numbers			PHV SERIES CIRCULAR PITCH KNURLS (1-1/4" Diam. X 1/2" Wide X 1/2" Hole) Tool Numbers		
		Straight	30° RH Spiral	30° LH Spiral	Straight	30° RH Spiral	30° LH Spiral	Straight	30° RH Spiral	30° LH Spiral	Straight	30° RH Spiral	30° LH Spiral	Straight	30° RH Spiral	30° LH Spiral
90°	8/3.18	—	—	—	—	—	—	—	—	—	KPSV208	KPRV208	KPLV208	PHSV208	PHRV208	PHLV208
90°	10/2.54	—	—	—	—	—	—	—	—	—	KPSV210	KPRV210	KPLV210	PHSV210	PHRV210	PHLV210
90°	12/2.12	—	—	—	GKSV212	GKRV212	GKLV212	—	—	—	KPSV212	KPRV212	KPLV212	PHSV212	PHRV212	PHLV212
90°	14/1.81	—	—	—	—	—	—	—	—	—	KPSV214	KPRV214	KPLV214	PHSV214	PHRV214	PHLV214
90°	16/1.59	EPSV216	EPRV216	EPLV216	GKSV216	GKRV216	GKLV216	KNSV216	KNRV216	KNLV216	KPSV216	KPRV216	KPLV216	PHSV216	PHRV216	PHLV216
90°	20/1.27	EPSV220	EPRV220	EPLV220	GKSV220	GKRV220	GKLV220	KNSV220	KNRV220	KNLV220	KPSV220	KPRV220	KPLV220	PHSV220	PHRV220	PHLV220
90°	21/1.21	EPSV221	—	—	—	—	—	—	—	—	KPSV221	KPRV221	KPLV221		PHRV221	PHLV221
90°	25/1.02	EPSV225	EPRV225	EPLV225	GKSV225	GKRV225	GKLV225	KNSV225	KNRV225	KNLV225	KPSV225	KPRV225	KPLV225	PHSV225	PHRV225	PHLV225
90°	30/.85	EPSV230	EPRV230	EPLV230	GKSV230	GKRV230	GKLV230	KNSV230	KNRV230	KNLV230	KPSV230	KPRV230	KPLV230	PHSV230	PHRV230	PHLV230
90°	32/.79	EPSV232	—	—	GKSV232	—	—	—	—	—	KPSV232	—	—	—	—	—
90°	33/.77	—	—	—	—	—	—	—	—	—	KPSV233	KPRV233	KPLV233	—	PHRV233	PHLV233
90°	35/.73	EPSV235	EPRV235	EPLV235	GKSV235	GKRV235	GKLV235	KNSV235	KNRV235	KNLV235	KPSV235	KPRV235	KPLV235	—	—	—
90°	40/.64	EPSV240	EPRV240	EPLV240	GKSV240	GKRV240	GKLV240	KNSV240	KNRV240	KNLV240	KPSV240	KPRV240	KPLV240	PHSV240	—	—
70°	50/.51	EPSV450	EPRV450	EPLV450	GKSV450	GKRV450	GKLV450	KNSV450	KNRV450	KNLV450	KPSV450	KPRV450	KPLV450	PHSV450	PHRV450	PHLV450
70°	80/.32	EPSV480	EPRV480	EPLV480	GKSV480	GKRV480	GKLV480	—	—	—	KPSV480	KPRV480	KPLV480	PHSV480	PHRV480	PHLV480
	DP/mm	EPV SERIES DIAMETRAL PITCH KNURLS			GKV SERIES DIAMETRAL PITCH KNURLS			KNV SERIES DIAMETRAL PITCH KNURLS			KPV SERIES DIAMETRAL PITCH KNURLS			PHV SERIES DIAMETRAL PITCH KNURLS		
80°	64/1.25	EPSV064	EPRV064	EPLV064	GKSV064	GKRV064	GKLV064	KNSV064	KNRV064	KNLV064	KPSV064	KPRV064	KPLV064	PHSV064	PHRV064	PHLV064
80°	96/.83	EPSV096	EPRV096	EPLV096	GKSV096	GKRV096	GKLV096	KNSV096	KNRV096	KNLV096	KPSV096	KPRV096	KPLV096	PHSV096	PHRV096	PHLV096
80°	128/.62	EPSV128	EPRV128	EPLV128	GKSV128	GKRV128	GKLV128	KNSV128	KNRV128	KNLV128	KPSV128	KPRV128	KPLV128	PHSV128	PHRV128	PHLV128
80°	160/.50	EPSV160	EPRV160	EPLV160	GKSV160	GKRV160	GKLV160	KNSV160	KNRV160	KNLV160	KPSV160	KPRV160	KPLV160	PHSV160	PHRV160	PHLV160

QUANTITY DISCOUNTS - See inside front cover or website for quantity Discounts and Pricing.
*Most sizes are available in **Hi-Cobalt** also. Please see our website or call.*

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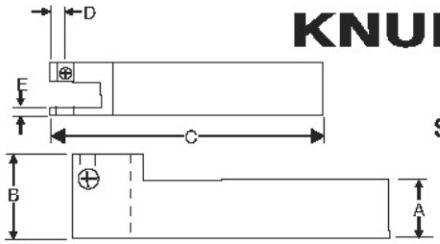
KNURLING HOLDERS



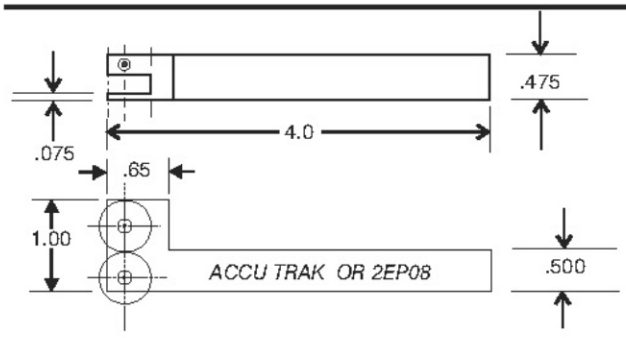
(Right Hand Shown)
Supplied with Carbide
Pin & Set Screw

SINGLE DIE "BUMP" HOLDERS FOR CNC AND OTHER LATHES
INCH SERIES

RH HOLDER	LH HOLDER	DIES	PIN	HOLDER DIMENTIONS (IN)				
				A	B	C	D	E
OR BHBPR	OR BHBPL	BP .312X.156X.125"	C 062	0.312	0.610	4.0	0.125	0.050
OR BHBPRA	OR BHBPLA	BP .312X.156X.125"	C 083	0.500	0.750	3.5	0.180	0.093
OR BHEQR	OR BHEQL	EQ .500X.250X.250"	C 083	0.500	0.750	3.5	0.180	0.093
OR BHGKRB	-	GK .625 X .250 X .250" KN .75 X .250 X .250"	C 104	0.555	0.845	4.0	0.200	0.125
OR BHGKR	OR BHGKL	GK .625 X .250 X .250" KN .75 X .250 X .250"	C 104	0.625	0.969	4.0	0.200	0.125
OR BHKPR	OR BHKPL	KP .75X.375X.250"	C 124	0.750	1.062	4.0	0.200	0.125
OR BVHKPR1	OR BHKPL1	KP .75X.375X.250"	C 164	1.000	1.312	5.0	0.200	0.125
OR BHKRR	OR BHKRL	KR .75X.500X.250"	C 164	0.75	1.062	4.0	0.200	0.125
OR BHKRR1	OR BHKRL1	KR .75X.500X.250"	C 164	1.00	1.350	5.0	0.200	0.125
OR BHOUR	-	OU 1.0X.375X.313"	C 165	1.00	1.350	5.0	0.250	0.170
OR BHPHR	-	PH 1.25X.50X.50"	C 168	1.00	1.50	5.0	0.375	0.187
OR BHLKR1	-	2X.75X.50"	C 248	1.00	1.50	6.0	0.328	.0250

NOTE:- * May also use "KN" Series Dies with "BL 24A" (1/8) Spacer
NOTE: - Hardened spacer 1/4" I.D. available in 2 different widths "BL 24" = .062" and" BL 24A"

RH HOLDER	LH HOLDER	DIES	PIN	HOLDER DIMENSIONS (mm)				
				A	B	C	D	E
OR BHM12R	OR BHM12L	MM 10 X 4 X 4mm MN 15 X 4 X 4mm	C M412	12	18	90	4.0	2.5
OR BHN16R	-	MM 10 X 4 X 4mm MN 15 X 4 X 4mm	C M412	16	21.5	90	4.8	2.5
OR BHQ16R	OR BHQ16L	MQ 15 X 6 X 4mm	C M416	16	21.5	100	4.8	3
OR BHR16R	OR BHR16L	MR 20 X 6 X 6mm	C M616	16	25	100	4.8	3
OR BHR25R	-	MR 20 X 6 X 6mm	C M625	25	32	120	4.8	3
OR BHS20R	OR BHS20L	MS 20 X 8 X 6mm MW 25 X 8 X 6mm	C M620	20	27	100	4.8	3
OR BHW25R	-	MS 20 X 8 X 6mm MW 25 X 8 X 6mm	C M625	25	32	130	4.8	3
OR BHU25R	-	MU 20 x 10 x 6mm	C M625	25	33	127	4.8	3



COMPACT TWO DIE "BUMP" STYLE

(USED ON CITIZEN AND OTHER "Swiss Style" MACHINES

HOLDER USES EP Series of knurls - Designed for use on small automatic turning machines. *Holders are stocked with a 1/2" and 5/8" high shank but may be altered to fit most machines

(OR 2EP10 = .625)

HOLDERS	
OR 2EP08	OR 2EP10

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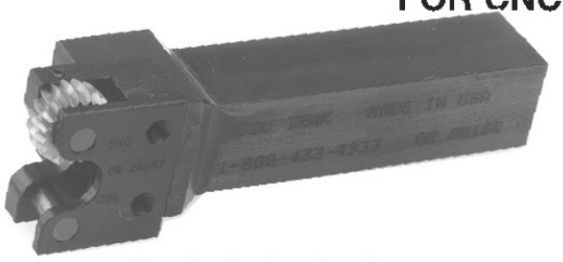
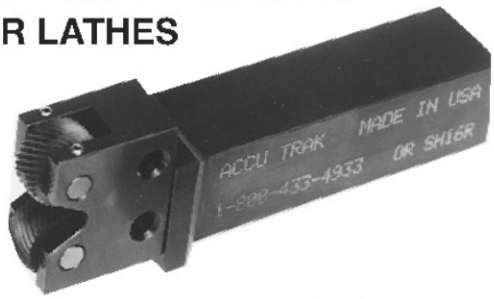
SINGLE OR TWO DIE MODULAR "BUMP" HOLDERS FOR CNC AND OTHER LATHES



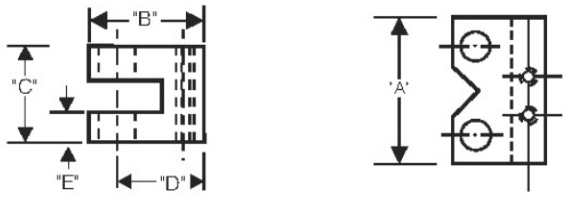
Single Die Set Up Shown
(preferred method for "Straight" Knurling)



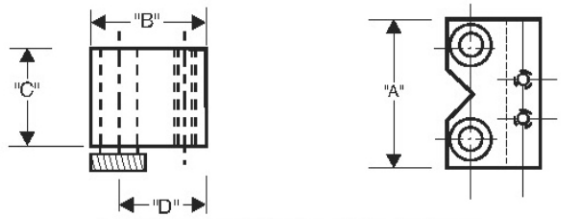
Two Die Set Up Shown
(Preferred method for "Diamond" Knurling)

Modular design permits using this holder for single or two die operation. All inch Heads and Inch Shanks are interchangeable. All Metric Heads and Metric Shanks are interchangeable also. The heads are shipped with 2 pre-installed carbide pins and an adjusting/clamping screw. A small adjustment on the adjusting/clamping screw allows the Head to center itself upon setup. Be sure to tighten the screw before running the first piece.

HEADS



STANDARD



UP TO THE SHOULDER STYLE
(OR 2BHMLI & OR 2BHMLM)

INCH HEADS

TOOL#	KNURL SERIES	PIN	HEAD DIMENSIONS (in)				
			A	B	C	D	E
OR 2BHEP	EP/EPV	C 123	1.50	1.25	.750	1.050	.1250
OR 2BHGK	GK/GKV	C 124	1.50	1.25	.750	1.025	.1250
OR 2BHKP	KP/KPV	C124	1.50	1.25	.750	1.000	.1250
OR 2BHKR	KR	C 144	1.50	1.25	.875	1.000	.1250
OR 2BHPH	PH/PHV	C 166	2.50	1.50	1.000	1.150	.1875
OR 2BHMLI	ML	OR UTSP	1.625	1.25	.625	.960	-

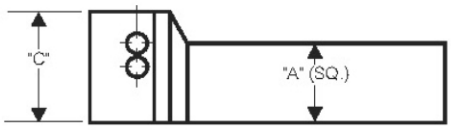
METRIC HEADS

TOOL#	KNURL SERIES	PIN	HEAD DIMENSIONS (mm)				
			A	B	C	D	E
OR 2BHMN	MM/MN	C M419	38.1	31.8	19.1	26.7	3.2
OR 2BHMQ	MQ	C M419	38.1	31.8	19.1	26.7	3.2
OR 2BHMR	MR/MRV	C M619	38.1	31.8	19.1	25.4	3.2
OR 2BHMS	MS	C M619	38.1	31.8	19.1	25.4	4.8
OR 2BHMLM	ML	OR UTSP	41.3	31.8	15.9	24.2	-

INCH SHANKS

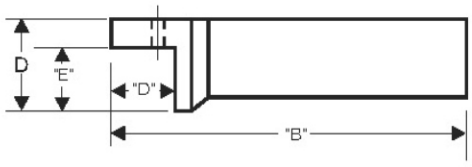
TOOL #	SHANK DIMENSIONS (in)					
	A	B	C	D	E	F
OR SH08R	.50	4.50	1.00	1.00	.625	.750
OR SH10R	.625	4.50	1.00	1.00	.625	.750
OR SH12R	.75	4.50	1.00	1.00	.625	.750
OR SH16R	1.00	4.50	1.00	1.00	.750	.750
OR SH20R	1.25	6.00	1.50	1.50	1.00	.750

SHANKS



METRIC SHANKS

TOOL #	SHANK DIMENSIONS (mm)					
	A	B	C	D	E	F
OR SHM12	12	114	25.4	25.4	15.9	19.1
OR SHM16	16	114	25.4	25.4	15.9	19.1
OR SHM20	20	114	25.4	25.4	15.9	19.1
OR SHM25	25	127	31.8	31.8	19.1	19.1



NOTE: INCH & METRIC HEADS ARE NOT INTERCHANGEABLE

For a complete unit, order 1 head and 1 shank.

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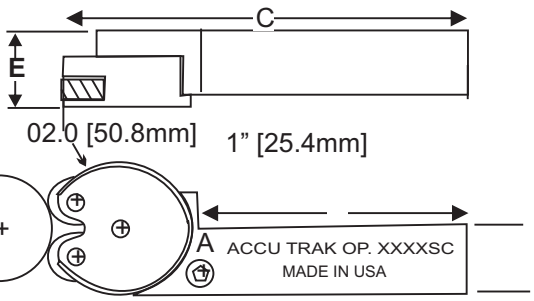
NEW SELF CENTERING BUMP KNURL HOLDERS

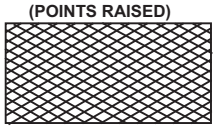
"INCH and METRIC SIZES"

For CNC's or other Lathes (Right Hand use only)



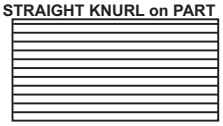
SELF CENTERING MODE ABOVE SHOWN FOR MAKING MALE DIAMOND PATTERN USING RH & LH TOOLS CONCURRENTLY

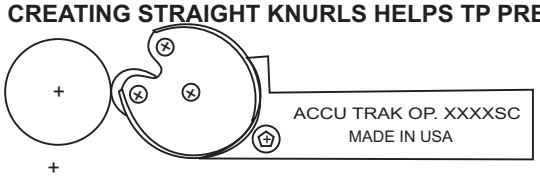
MALE DIAMOND KNURL on PART (POINTS RAISED)



LOCKED MODE SHOWN BELOW FOR MAKING STRAIGHT KNURL PATTERN USING A SINGLE STRAIGHT KNURL (USING ONE KNURL DIE INSTEAD OF TWO WHEN CREATING STRAIGHT KNURLS HELPS TP PREVENT MISS-TRACKING)

STRAIGHT KNURL on PART





TO USE AS SINGLE, BACK OUT SCREW ON OTHER SIDE 2 TURNS, REMOVE SCREW (A) FROM THE SIDE. ROTATE HEAD AND INSERT SCREW ON OTHER SIDE TO LOCK HEAD IN PLACE.

INCH SERIES HOLDERS

TOOL#	KNURL SERIES	PINS	DIMENSIONS (IN)				
			A	B	C	D	E
OR KN121SC	GK / GKV / KN / KNV	C124	0.75	-	5.50	3.60	1.125
OR KN161SC	GK / GKV / KN / KNV	C 124	1.00	-	5.50	3.60	1.125
OR KP121SC	KP / KPV	C 124	0.75	-	5.50	3.60	1.125
OR KP161SC	KP / KPV	C 124	1.00	-	5.50	3.60	1.125

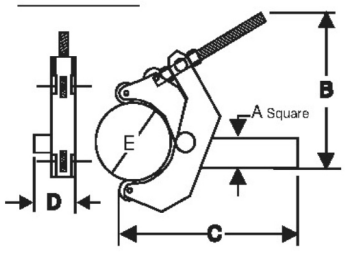
METRIC SERIES HOLDERS

TOOL#	KNURL SERIES	PINS	DIMENSIONS (mm)				
			A	B	C	D	E
OR MR20MRC	MR	C M619	20	-	139.7	91.44	28.58
OR MR25MSC	MR	C M619	25	-	139.7	91.44	28.58
OR MS20MSC	MS / MW	C M619	20	-	139.7	90.44	28.58
OR MS25MSC	MS / MW	C M619	25	-	139.7	90.44	28.58
OR MU20MRC	MU	C M619	20	-	139.7	90.44	28.58
OR MU25MSC	MU	C M619	25	-	139.7	90.44	28.58

*** NOTE: All KP Holders can use the MT Knurls Capacity "F" is .070 - .870. - REPLACEMENT PARTS AVAILABLE AT www.accu-trak.com**

LARGE CAPACITY HEAVY DUTY STRADDLE HOLDERS

HEAVY DUTY



HOLDER	DIES	PIN	HOLDER DIMENSIONS (in)				
			A	B	C	D	E
OR SKP10D	KN/KNV/KP/KPV/KR	C 164	0.625	4.2	5.75	1.63	2.1
OR SKP12D	KN/KNV/KP/KPV/KR	C 164	0.75	4.4	5.75	1.75	2.1
OR SKP16E	KN/KNV/KP/KPV/KR	C 164	1	4.7	6.75	2	2.1
OR SPH16E	PH/PHV	C 168	1	6	6.75	2	3.1
OR SSPOR	PH/PHV+1"WIDE	C 168	1	6	7.5	2.5	3.1

HOLDER	DIES	PIN	HOLDER DIMENSIONS (mm)				
			A	B	C	D	E
OR SMW20	MR/MS/MW	C M625	20	112	145	45	50
OR SMW25	MR/MS/MW	C M625	20	120	170	51	50

Designed for medium and large lathes, self centering and very robust. Ideal for heavy Axial Feeding with Convex Style Knurls Supplied with Carbide Pins & Set Screws

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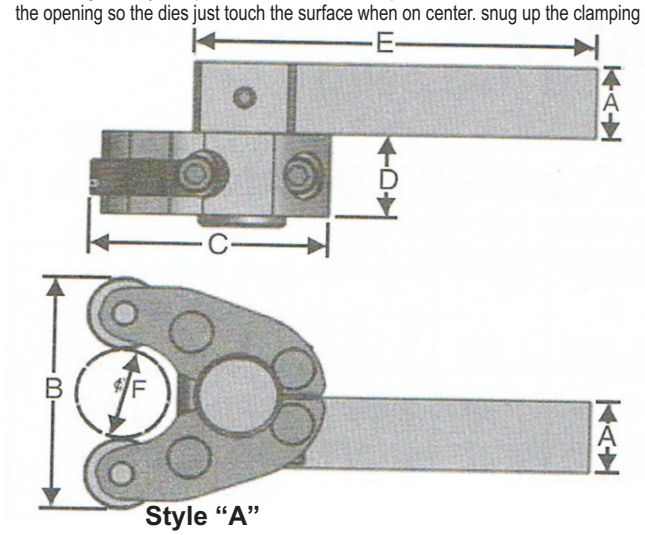
Email contacts: Sales = sales@accu-trak.com • Engineering = eng@accu-trak.com • General Information = info@accu-trak.com

COMPACT STRADDLE HOLDER FOR CNC LATHES AND SWISS MACHINES

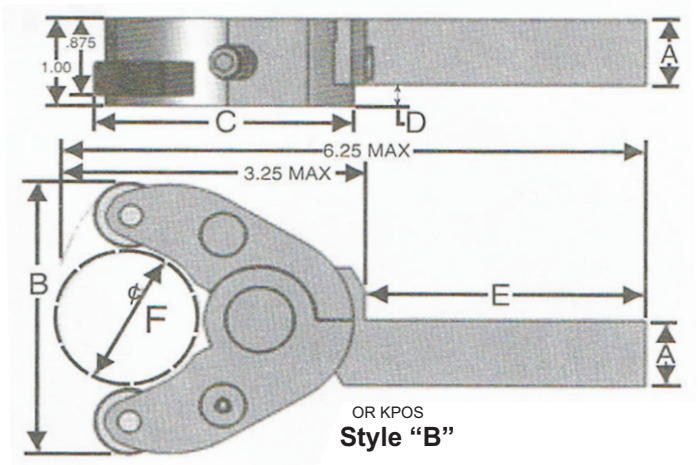
These holders are compact in design and idealy suited for CNC and Swiss style machines. Great for axial feeding with Convex Knurls. The opening can be adjusted for different diameters by alternately loosening and tightening the two clamping screws.

SET UP PROCEDURE

When starting a new job, if possible, machine a "set up" blank that is a few thousands bigger in Diameter than the identical Root Diameter of the knurled part. Bring the holder in and adjust the opening so the dies just touch the surface when on center. snug up the clamping screws then run a piece and check the form, etc. if everything is ok snug up the clamping screws.

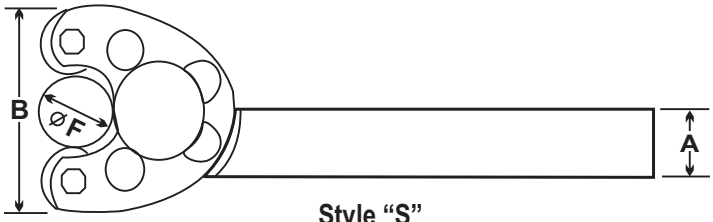


Style "A"

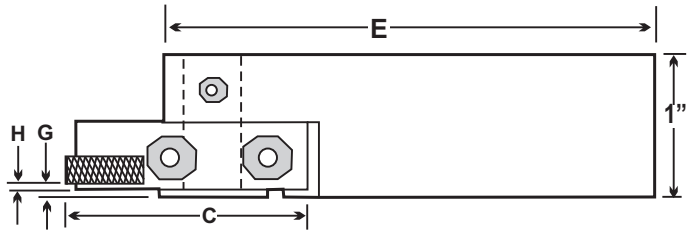


OR KPOS

Style "B"



Style "S"
for Swiss Machines



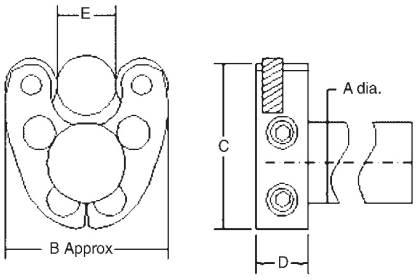
HOLDER	HOLDER STYLE	KNURL SERIES	PINS	HOLDER DIMENTION (IN)								
				A	B	C	D	E	F	G	H	KNURL WIDTH
OR BPCS05	A	BP	C 082	0.312	1.25	1.5	0.5	4.5	0-.37	-	-	5/32
OR BPCS06	A	BP	C 082	0.375	1.25	1.5	0.5	4.5	0-.37	-	-	5/32
OR BPCS08	A	BP	C 082	0.5	1.25	1.5	0.5	4.5	0-.37	-	-	5/32
OR EPTS05	A	EP/EPV	C 103	0.312	1.25	1.65	0.5	1.5	0-.50	-	-	3/16
OR EPTS06	A	EP/EPV	C 103	0.375	1.25	1.65	0.5	4.5	0-.50	-	-	3/16
OR EPTS08S	S	EP/EPV	C 103	0.5	1.5	2.12	1	4.5	0-.50	.125	.062	3/16
OR EPTS10S	S	EP/EPV	C 103	0.625	1.5	2.12	1	4.5	0-.75	.125	.062	3/16
OR EPCS05	A	EP/EPV	C 103	0.312	1.5	2.12	0.625	4	.06-.75	-	-	3/16
OR EPCS06	A	EP/EPV	C 103	0.375	1.5	2.12	0.625	4	.06-.75	-	-	3/16
OR EPCS08	A	EP/EPV	C 103	0.5	1.5	2.12	0.625	4	.06-.75	-	-	3/16
OR EPCS10	A	EP/EPV	C 103	0.625	1.5	2.12	0.625	4	.06-.75	-	-	3/16
OR EPCS12	A	EP/EPV	C 103	0.75	1.5	2.12	0.625	4	.06-.75	-	-	3/16
OR KPCS08	A	KP/KPV/MK/MT*	C 144	.50	1.75	2.4	0.875	4	.19-1.0	-	-	3/8
OR KPCS10	A	KP/KPV/MK/MT*	C 144	0.625	1.75	2.4	0.875	4	.19-1.0	-	-	3/8
OR KPCS12	A	KP/KPV/MK/MT*	C 144	0.75	1.75	2.4	1.875	4	.19-1.0	-	-	3/8
OR KPCS16	A	KP/KPV/MK/MT*	C 144	1	1.75	2.4	0.875	4	.19-1.0	-	-	3/8
OR KPPS10	A	KP/KVP/MK/MT*	C 144	0.625	1.75	2.4	0.5	4	.19-1.0	-	-	3/8
OR KPPS12	A	KP/KPV/MT/MT*	C 144	0.75	1.75	2.4	0.5	4	.19-1.0	-	-	3/8
OR KPPS16	A	KP/LPV/MK/MT*	C 144	1	1.75	2.4	0.5	4	.19-1.0	-	-	3/8
OR KPOS12	B	KP/KPV/MK/MT*	C 144	1.75	2	2.4	0.25	4	0-1.5	-	-	3/8
OR KPOS16	B	KP/KPV/MK/MT*	C 144	1	2	2.4	0	4	0.1.5	-	-	3/8
OR KRCS12	A	KR/KP/KPV/MN/KNV	C 164	0.75	3.5	3.7	1	4	0-2.0	-	-	1/2
OR KRCS16	A	KR/KP/KPV/KN/KNV	C 164	1	3.5	3.7	1	4	0-2.0	-	-	1/2
OR LKCS16	A	PH/PHV+3/4" WIDE	C 328	1	3	4.4	1.25	5.5	0-2.0	-	-	3/4
OR PH+CS	A	PH/PHV+1" WIDE	C 328	1	3	4.4	1.75	5.5	0-1.0	-	-	1.0

HOLDER	HOLDER STYLE	KNURL SERIES	PINS	HOLDER DIMENSION (mm)						KURL WIDTH
				A	B	C	D	E	CAPACITY F	
OR MRCS12	A	MR/MRV	C M619	12	65	60	19	100	0-02	6
OR MRCS16	A	MR/MRV	C M619	16	65	60	19	100	0-22	6
OR MRCS20	A	MR/MRV	C M619	20	65	60	19	100	0-22	6
OR MRCS25	A	MR/MRV	C M619	25	65	60	19	100	0-22	6

KNURLING HOLDERS

TWO DIE END ROLLING COMPACT STRADDLE HOLDERS
AVAILABLE IN "OFFSET" AND "INLINE" STYLES

REGULAR COMPACT WITH "OFFSET" SHANK



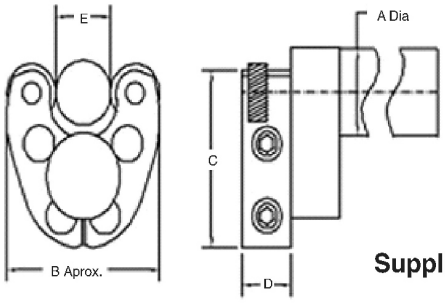
HOLDER	DIES	PIN	SHANK A*	B	C	D	Capacity E**
OR EPCO10	EP	C 103	0.625	1.5	2.12	.63	.06-.75
OR KPCO10	KN / KP / MT	C 144	0.625	1.75	2.4	.87	.19-1.0
OR KPCO12	KN / KP / MT	C 144	**0.750**	1.75	2.4	.87	.19-1.0
OR KPCO16	KN / KP / MT	C 144	1	1.75	2.4	.87	.19-1.0

Supplied with Carbide Pins & Set Screws

Designed for small CNC and Hardinge Retro fit machines such as **Omniturn** and **Accuturn.**

*** Other Shank Sizes Available** **** .070 - .870 with MT Series Knurls**

REGULAR COMPACT WITH IN LINE SHANK



HOLDER	DIES	PIN	SHANK A	B	C	D	Capacity E
OR EPCT10	EP .50 X .187 X .187	C 103	*.625	1.50	2.12	.63	.06-.75
OR KPCT10	KP .75 X .375 X .25	C 144	*.625	1.75	2.40	.87	**.19-1.0
OR KPCT12	KP .75 X .375 X .25	C 144	*.750	1.75	2.40	.87	**.19-1.0

Supplied with Carbide Pins & Set Screws Designed for small Swiss Style machines.

*** Other Shank Sizes Available** **** .070 - .870 with MT Series Knurls**

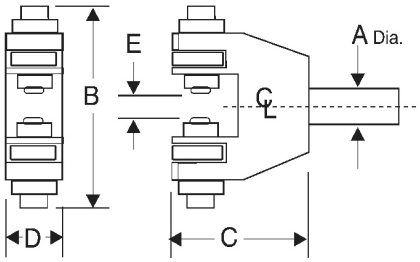
TWO DIE ROUND SHANK HOLDERS

For Knurling From Turret

COMPACT SERIES

HOLDER	DIES	PIN	"D" SHANK DIAMETER	CAPACITY (in)
OR TEP10M	EP/EPV	C 124	10mm	0-.500
OR TEP12M	EP/EPV	C 124	12mm	0-.500
OR TEP08	EP/EPV	C 124	.500"	0-.500
OR TEP10	EP/EPV	C124	.625"	0-.500
OR TEP12	EP/EPV	C 124	.750	0-.500

HEAVY DUTY



HEAVY DUTY SERIES

HOLDER	DIES	PIN	A	B	CB	D	E
OR TKP10C	KP .75X.375X.25	C 144	.625	5.00	2.50	2.00	1.03
OR TKP12C	KP .75X.375X.25	C 144	.750	5.00	2.50	2.00	1.03
OR TKP16D	KP .75X.375X.25	C 144	1.00	6.50	3.50	2.00	1.53
OR TKP20E	KP .75X.375X.25	C 144	1.25	7.00	4.00	2.00	2.03
OR TKP24E	KP .75X.375X.25	C 144	1.50	7.00	4.00	2.00	2.03

Supplied with Carbide Pins & Set Screws

REPLACEMENT PARTS AVAILABLE AT www.accu-trak.com

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Email contacts: Sales = sales@accu-trak.com • Engineering = eng@accu-trak.com • General Information = info@accu-trak.com

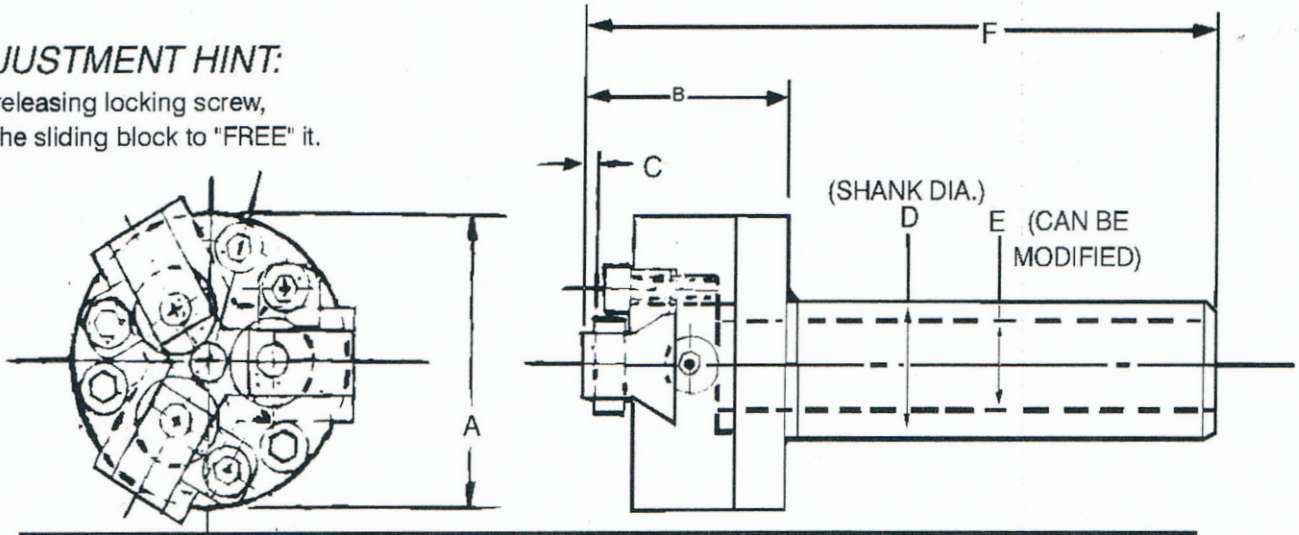
HEAVY DUTY COMPACT THREE DIE EXTERNAL KNURLING HOLDER
(Also can be adapted for Burnishing and Internal Knurling*)

Compact design makes it ideal for use on screw machines and CNC lathes when axial feeding from the turret. Parts are self supported and they can extend thru the shank for long jobs. We recommend using "CONVEX" Knurls for the best performance.

To Set Up: Determine Blank Diameter using Table 1 from page **4** of our catalog. Then subtract the approximate knurl depth to obtain the minor diameter of the part. Set the three carrier blocks to this size or a few thousandths Larger. Test roll some parts. For further small adjustments move only ONE OF THE BLOCKS. NOTE, adjustments are made from the front of holder and Knurl Pins are solid carbide held with set screws. Recommended Feed Rate is .010 - .030" per Rev. (OFF TWICE AS FAST) with a spindle speed of approximately 50 - 150 SFPM.

ADJUSTMENT HINT:

After releasing locking screw, "tap" the sliding block to "FREE" it.



HOLDER	KNURL SERIES	CAPACITY DIA.**	A	B	C	D	E	F
OR 3DBP10	BP	.060 - .475	1.75	1.255	.090	.625	.390	3.855
OR 3DBP12			1.75	1.255	.090	.750	.475	3.855
OR 3DEP10	EP / EPV	.090 - .475	1.75	1.255	.090	.625	.390	3.855
OR 3DEP12			1.75	1.255	.090	.750	.475	3.855
OR 3DEP16			1.75	1.255	.090	1.000	.530	3.855
*OR 3DGK10	GK / GKV KN / KNV	.120 - .940 .140 - .940	3.00	1.600	.125	.625	.390	3.900
*OR 3DGK12			3.00	1.600	.125	.750	.475	4.900
*OR 3DGK16			3.00	1.600	.125	1.000	.718	4.900
OR 3DML12	ML	Call for Details	3.00	1.975	-	.750	.475	5.275
OR 3DML16			3.00	1.975	-	1.000	.718	5.275
OR 3DPH16	PH / PHV	Call for Details	5.00	3.200	.250	1.000	.718	6.500
OR 3DPH24			5.00	3.200	.250	1.500	.938	6.500

* Special Skewed Die Blocks available for use with the stock Conical Dies (Pages 22-23)
Call for pricing and delivery.

** Capacity ranges listed are approximate - More Range available with modifications.

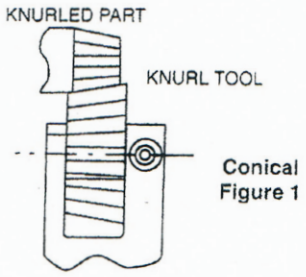
REPLACEMENT PARTS AVAILABLE AT www.accu-trak.com

*... If you cannot find what you are looking for - **PLEASE CALL***

Conical Knurling

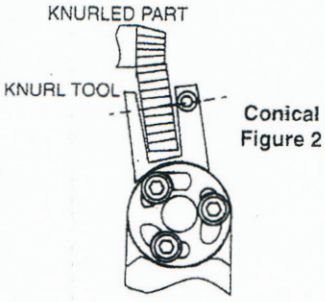
Often, parts may require knurling on conical or radial surfaces, either for function or decorative purposes. With proper tools and application, a clean, well-formed knurl or serration can be produced.

One of the most frequent mistakes when knurling a conical surface is having the knurling tool and the part set with parallel axes. This is shown in figure 1 and is similar to running a pair of bevel gears the wrong way. It can work for larger parts with small conical angles, but as the conical angle increases, the results become worse. This method should only be used when the pitch change from the small to the large end of the part is less than 10%.



Conical
Figure 1

While technically not correct, using a conventional forming knurl as shown in figure 2 can be effective when rolling on relatively larger diameters with small conical angles. The advantage here is that tooling is substantially cheaper, but once again as the conical angle increases the knurl will be of lesser quality. This method can be used to produce acceptable parts when the pitch change is as high as 15-20%.

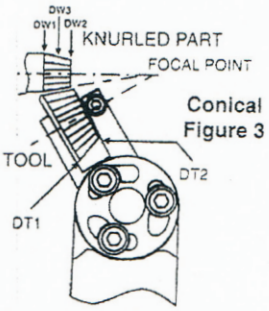


Conical
Figure 2

A better method of producing a clean knurl on a conical surface with maximum tool life is shown in figure 3. By using an adjustable angle holder with the proper conical knurl die, this method makes it possible to roll tapered serrations with a controlled number of teeth and consistent repeatability.

For proper tracking at both ends of the piece, it is necessary to establish the geometrical relationship between the part and the tool with consideration given to the space available for tooling. It is sometimes advantageous to use a shank-type knurling tool where clearance is not available for the conventional style knurl holder.

In certain cases, parts may be knurled with radial teeth on the end of parts, but by using a conical knurl of the proper design. Here again, the results depend primarily on establishing the geometric relationship between the part and the tool. For more information on either of the above cases see face knurling on pages 24 and 25.



Conical
Figure 3

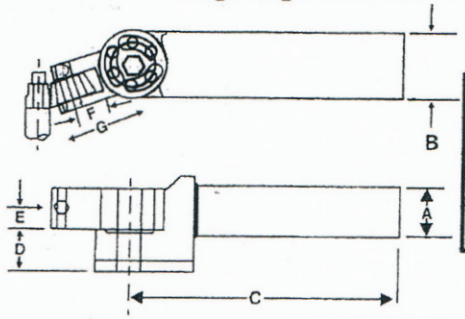
Whenever knurling on conical and end surfaces, a tracking correction factor is usually applied to the calculated diameter. This is due to the many variables involved, such as hardness of material, elasticity of machine tools and tool holders, etc. This factor is necessarily empirical.

For help in selecting the proper tool for your job call Accu Trak at (800) 433-4933 or send us an e-mail at eng@accu-trak.com with your part requirements.

TAPER KNURLING HOLDER

FOR KNURLING ON CONICAL DIAMETER. HOLDERS ARE ADJUSTABLE TO ACCOMMODATE ANY ANGLE

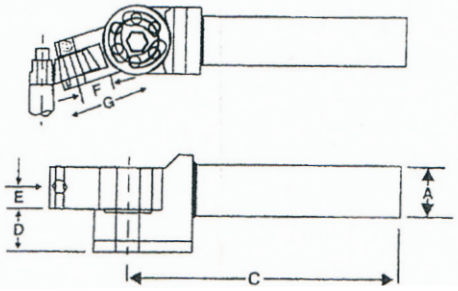
For Narrow Knurl Bands or small taper angles, Stock KP & PH Series can be used. When the Pitch change is greater than 20% special Conical Dies found on page 23, are recommended.



HOLDER	DIE SIZE	PIN	DIMENSIONS (in)						
			A	B	C	D	E	F	G
OR SWS12	1.00 X .375 X .250	C 124	.75	1.125	4.45	.688	.312	.531	1.31
OR SWS16	1.00 X .375 X .250	C 124	1.00	1.125	4.45	.688	.312	.531	1.31
OR SWS20	1.25 X .500 X .500	C 248	1.25	1.500	4.45	.750	.500	.688	1.75

ROUND SHANKS

HOLDER	DIE SIZE	PIN	DIMENSIONS (in)						
			A	B	C	D	E	F	G
OR SWR12	1.00 X .375 X .250	C 124	.75	-	4.437	.688	.312	.531	1.31
OR SWR16	1.00 X .375 X .250	C 124	1.00	-	4.437	.688	.312	.531	1.31



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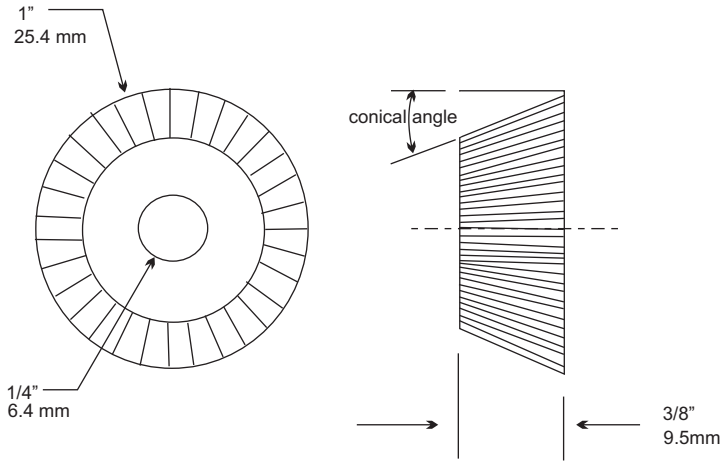
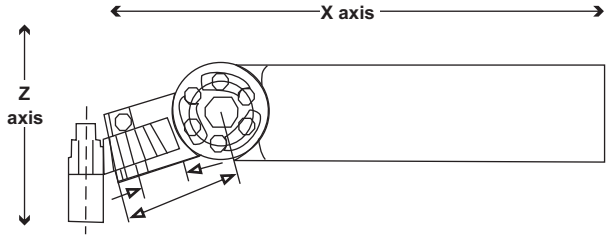
CONICAL KNURL DIES



tOOL#	# TEETH	CONICAL ANGLE ROOT	CREST	DIAMETER SMALL END (mm)	LARGE END (mm)	PITCH SMALL END (mm)	LARGE END (mm)
KT 15F	125	15°	15.38°	.794 / 20.2	1.000 / 25.4	50.1 / 0.5	39.8 / 0.6
KT 15M	78	15°	15.62°	.790 / 20.1	1.000 / 25.4	31.4 / 0.8	24.8 / 1.0
KT 15C	31	15°	16.67 °	.775 / 19.7	1.000 / 25.4	12.7 / 2.0	9.9 / 26
KT 22F	125	22°	22.55°	.689 / 17.5	1.000 / 25.4	58.7 / 0.2	39.8 / 0.6
KT 22MF	100	22°	22.70°	.686 / 17.4	1.000 / 25.4	46.4 / 0.5	31.8 / 0.8
KT 22MMF	89	22°	22.80°	.685 / 17.4	1.000 / 25.4	46.4 / 0.6	28.3 / 0.9
KT 22M	78	22°	22.90°	.653 / 17.4	1.000 / 25.4	36.3 . 0.7	24.8 / 1.0
KT 22MMC	84	22°	23.11°	.650 / 17.3	1.000 / 25.4	30.0 / 0.85	20.4 / 1.25
KT 22MC	50	22°	23.45°	.675 / 17.1	1.000 / 25.4	23.6 / 1.1	15.9 / 1.6
KT 22C	31	22°	24.44°	.659 / 16.7	1.000 / 25.4	15.0 / 1.7	9.9 / 2.3
KT 30F	125	30°	30.74°	.554 / 14.1	1.000 / 25.4	.718 / 0.4	39.8 / 0.5
KT 30M	78	30°	31.21°	.546 / 13.9	1.000 / 25.4	45.5 / 0.6	24.8 / 1.0
KT 30C	31	30°	33.29°	.568 / 12.9	1.000 / 25.4	19.4 / 1.3	9.9 / 2.6



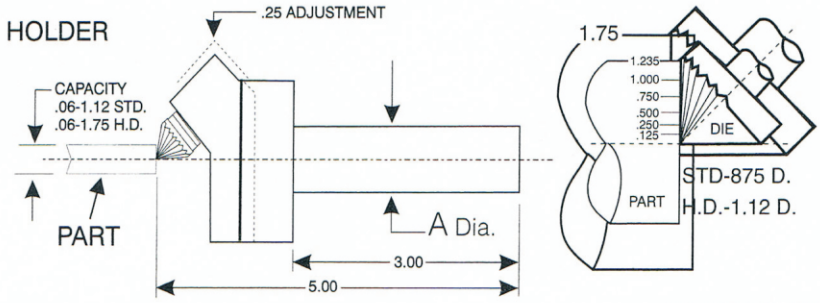
These conical knurling wheels, designed to fit our TAPER KNURLING HOLDERS are suitable for knurling many Straight tooth pattern conical parts including windshield wiper shafts per German knurl spec DIN 72 783.

When using a single knurling wheel from the cross-slide (coming in on the X' axis) the axial (Z) position is very important. The pitch of a conical knurl varies from the large to the small end. Therefor, if the knurl is moved axially, the pitch at the point of contact to the workpiece changes. This may result in a different number of teeth rolled on the part. If mis-tracking should occur, when first setting up, it can be solved by moving the holder a small amount in either direction along the"Z" axis. The usual in-feed rate would be .002-.004"/rev. (0.05-0.10mm/rev.). Remember that (except for very narrow or low angle conical knurl patterns) the large end of the wheel must contact the large end of the workpiece to achieve a clean knurl pattern.. This requires a special holder that can present the wheel at the proper angle. An adjustable holder is preferred so that variation in the knurl and/or blank can easily be allowed for.
Please call for help in selecting the proper wheel/holder for your job. **Engineering & Design changes may apply for some special applications.**

FACE KNURLING HOLDERS

"ADJUSTABLE" END ROLLING FOR SCREW MACHINES AND AUTOMATICS

The End Rolling System tool holder in its normal configuration has enough adjustment for the Die to Knurl up to a 1.25" diameter. The slide can be "reversed" and now the maximum diameter is 2.50". When knurling on these larger diameters the tip of the Die isn't on the center of the part, but if the knurl "Band" on the part is narrow an acceptable impression can be made. In general if the rate of pitch change on the part is within 10% of the rate of pitch change on the Die a good straight knurl will be made. The greater the deviation, the more "S" shaped will be the impression.



PART O.D.	IDEAL DIE CONTACT POINT	TPI AT CONTACT POINT				
		FINE 72T	Med-Fine 60T	MEDIUM 48T	Med-Course 36T	COARSE 24T
.250	.177	130 TPI	108 TPI	87 TPI	65 TPI	43 TPI
.500	.353	65TPI	54 TPI	43 TPI	32 TPI	22 TPI
.750	.530	43 TPI	36 TPI	29 TPI	22 TPI	14 TPI
1.000	.707	32 TPI	27 TPI	22 TPI	16 TPI	11 TPI
1.237	.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
Approximate # of Teeth Rolled with Tip at Center		102T.	85T	68T	51T	34T

ADJUSTABLE END ROLLING HOLDERS

A	STANDARD	HEAVY DUTY
	TOOL #	TOOL #
0.625	OR KT4510	OR HD4510
0.750	OR KT4512	OR HD4512
1.000	OR KT4516	OR HD4516
16mm	OR KT45M16	OR HD45M16
20mm	OR KT45M20	OR HD45M20
25mm	OR KT45M25	OR HD45M25

(Heads may be purchased separately -Standard OR KT45 • Heavy Duty OR HD45)

SHANK CONICAL KNURL DIES WITH "TIN" COATING

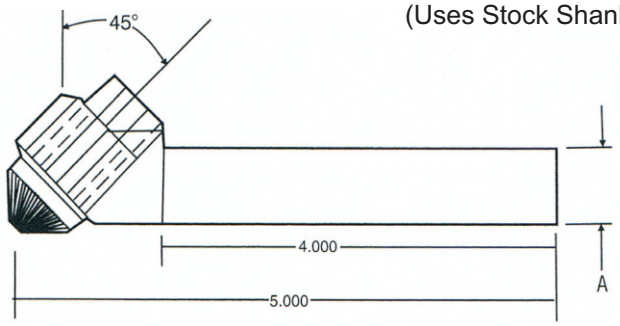
		STANDARD (5/16" Shank)		HEAVY DUTY (½"Shank)	
		Tool # HSS	Tool # Hi-Cobalt	Tool # HSS	Tool # Hi-Cobalt
FINE	72	KT FINE	KT XF	KT HDF	KT HDXF
MED-FINE	60	KT MF	KT XMF	KT HDMF	KT HDXMF
MEDIUM	48	KT MEDIUM	KT XM	KT HDM	KT HDXM
MED-COARSE	36	KT MC	KT XMC	KT HDMC	KT HDXMC
COARSE	24	KT COARSE	KT XC	KT HDC	KT HDXC

FOR BEST RESULTS THE FOLLOWING CONDITIONS SHOULD BE FOLLOWED DURING SET-UP

1). Center the tip of the knurling die close to the center of the part.
2). Select the knurl die with a pitch that closely matches the pitch of the part.
3). If knurl is "Double Tracking" loosen button head screws and adjust slide a small amount.

"FIXED" END ROLLING FOR MANUAL & CNC LATHES

(Uses Stock Shank Conical Dies)



FIXED END ROLLING HOLDERS

A	STANDARD	HEAVY DUTY
	TOOL #	TOOL #
0.625	OR KTSD10	OR KTHD10
0.750	OR KTSD12	OR KTHD12
1.000	OR KTSD16	OR KTHD16
16mm	OR KTSM16	OR KTHM16
20mm	OR KTSM20	OR KTHM20
25mm	OR KTSM25	OR KTHM25

NOTE: LARGER HOLDERS AND DIES AVAILABLE - CALL FOR PRICING AND DELIVERY.

REPLACEMENT BEARING KITS

STANDARD HOLDER
OR KTBRG

HEAVY DUTY
OR KTHDBR

Each kit includes: 2 hardened washers, 1 thrust bearing, 1 O-ring and 2 needle bearings.

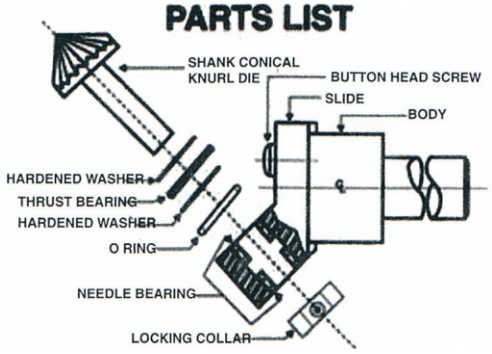
OR KTBRG1

Kit includes: 2 hardened washers, 1 thrust bearing and 1 O-ring.

OR KT45CB

Kit includes: 1 carbide bushing (which replaces the needle bearings).

PARTS LIST



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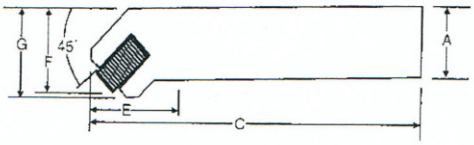
ANGULAR BUMP HOLDER



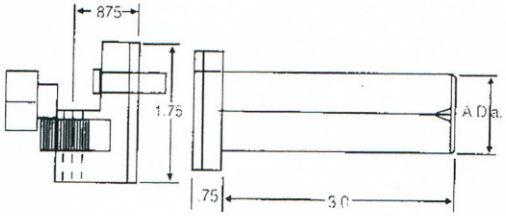
HOLDER	KNURL	PIN	A	C	E	F	G
*OR KP4512	KP	C 164	.750	4.5	1.25	1.2	1.25
*OR KP4516	KP	C 164	1.00	5.0	1.25	1.2	1.25

**** Can also use "KN" Series Knurl with "BL 24" Spacers.***

These holders are for knurling on a chamfer. They will work fine if the chamfer is small. If the knurl band is wide, it may be hard to get a clean pattern because as the knurl pitch must change as the diameter changes. If required, a special conical knurl and holder can be supplied. Carbide pin, hex wrench and medium pitch knurl are included

END ROLLING OVER A STUB

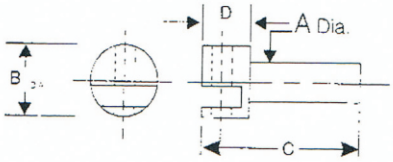
For knurling a narrow band or when the impression needs not to be exact, this 2 piece adjustable head unit can be used on a wide range of diameters. Uses both KP and MT Series stock knurl dies



Tool #	Knurl Series	Pin	A (inch)
OR STUB10	KP/MK/MT	C 144	.625
OR STUB12	KP/MK/MT	C 144	.750
OR STUB16	KP/MK/MT	C 144	1.000

Tool #	Knurl Series	Pin	A (mm)
OR STUB00	KP/MK/MT	C 144	16
OR STUB20	KP/MK/MT	C 144	20
OR STUB25	KP/MK/MT	C 144	25

RADIAL END ROLLING HOLDERS
FOR FACE KNURLING NARROW BANDS WHERE THE PITCH CHANGE IS LESS THAN 25%

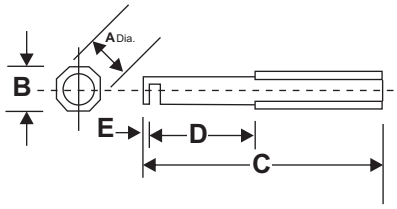


HOLDER	DIES	PIN	A*	B	C	D	E
OR FKP12A	KP .75X.375X.25	C 164	.75	1.38	3.87	.87	.25-1.0
OR FKP16A	KP .75X.375X.25	C 164	1.00	1.38	3.87	.87	.25-1.0
OR FPH16B	PH 1.25X .50X.50	C 208	1.00	2.00	4.38	1.36	.50-1.5

* SHANKS CAN BE MACHINED SMALLER

(FOR KNURLING WIDER BANDS USE ADJUSTABLE END ROLLING HOLDER SHOWN ON PAGE 22)

INTERNAL HOLDERS
FOR I.D. KNURLING ON CNC AND MANUAL LATHES



HOLDER	Knurl Series	PIN	DIMENSIONS (IN.)					
			A	B	C	D	E	MINIMUM I.D.
OR IBPO8A	BP .312X.156X.125	OR IN	.500	.290	6.00`	1.25	.08	.37
OR IBP10B	BP .312X..156X.125	OR INTPBP	.625	.290	6.00	1.25	.08	.37
OR IBP10BS	BP .312X.156X.125	OR INPBP	.625	.290	6.00	.25	.08	.37
OR IBP12C	BP .312X.156X.125	C 082	.48	5.48	5.00	1.60	.10	.54
OR IBP12CS	BP .312X.156X.125	C 082	.750	.42	5.00	.65	.10	.54
OR IEP16D	EP .500X.187X.187	C 113	1.00	.73	6.00	2.10	.10	.80
OR IGK20E	GK .625X.25X.25	C 144	1.25	.98	7.00	3.10	.11	1.04
OR IKP20F	KP .75X.375X.25	C 144	1.25	1.23	8.00	4.10	.11	1.30

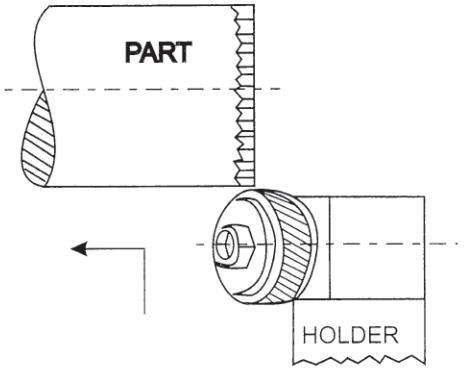
CUT TYPE KNURLING

CUT TYPE Knurling is relatively new and not widely used in the U.S. market but very common in the rest of the world. The knurling dies are skewed (Layed over 30º) to the work piece Axis creating a cutting action rather than a forming process, There are both Single and two die holders available. Interesting is the fact that to get the Diamond Pattern two straight tooth dies are used (on a two die holder) and for a straight Pattern a single Helical Die is used. Many people believe you can control the diameter of a finished knurled part easier with this method, (just remember you aren't increasing the diameter of the work piece.) Holder shanks should be mounted at a Right Angle to the work piece and always use plenty of coolant to wash away chips.

KNURLING "TIPS"

FOR "CUT" TYPE KNURLING

To prevent ant "Double Tracking" the diameter should be selected such that the circumference is an Approximate multiple of the pitch. You will want to hold this diameter consistent within ±.025mm. Dept of the cut should be .5 - .6mm X pitch. **The Method of approach is very improtant to getting a good locking knurl.** On the end of the work piece, approximately 1-2 pitches wide, plunge the tool straight into the part. Traverse across the part **after** reaching the correct depth.



NOTE: - Do not Just Feed Axially

APPROXIMATE SPEEDS & FEEDS FOR CUT KNURLING

		Work Piece ○ < 12mm (<.472")				Work Piece ○ < 12-40mm (.472-1.575")				Work Piece○ < 40-250mm (1.575-9.84")			
		Cuttiing Speed		Feed Rate		Cutting Speed		Feed Rate		Cutting Speed		Feed Rate	
		m/min	ft/min	mm/rev	in/rev	m/min	ft/min	mm/rev	in/rev	m/min	ft/min	mm/rev	in/rev
	CG	35	115	0.05 - 0.08	.002 - .003								
60 Kg Steel	CB	45	148	0.07 - 0.09	.003 - .006	40	131	0.07 - 0.09	.003 - .004				
	CC	60	197	0.07 - 0.14	.003 - .006	60	197	0.07 - 0.15	.003 - .006	50	164	0.07 - 0.15	.003 - .006
	CG	25	82	0.04 - 0.07	.002 - .003								
90 Kg Steel	CB	35	115	0.06 - 0.08	.002 - .003	30	98	0.06 - 0.08	.002 - .003				
`	CC	50	164	0.06 - 0.12	.002 - .005	45	148	0.06 - 0.12	.002 - .005	40	131	0.06 - 0.12	.002 - .005
	CG	22	72	0.04 - 0.06	.002 - .002								
Stainless Steel	CB	30	98	0.06 -.008	.002 - .003	28	92	0.06 - 0.08	.002 - .003				
	CC	40	131	0.06 - 0.12	.002 - .005	35	115	0.06 - 0.12	.002 - .005	32	105	0.06 - 0.12	.002 - .005
	CG	60	197	0.06 - 0.12	.002 - .004								
Brass	CB	70	230	0.08 - 0.12	.003 0 .005	60	197	0.08 - 0.12	.003 - .005				
	CC	90	295	0.08 - 0.20	.003 - .008	90	295	0.08 - 0.20	.003 - .008	80	262	0.08 - .020	.003 - .008
	CG	50	164	0.05 - 0.09	.002 - .004								
Brass 60	CB	60	197	0.06 - 0.10	.002 - .004	60	197	0.06 0 0.10	.002 - .004				
	CC	90	295	0.07 - 0.15	.003 - .006	90	295	0.07 - 0.15	.003 - .006	80	252	0.07 - 0.15	.003 - .006
	CG	35	115	0.05 - 0.08	.002 - .003								
Bronze	CB	45	148	0.07 - 0.09	.003 - .004	40	131	0.07 - 0.09	.003 - .004				
	CC	60	197	0.07 - 0.14	.003 - .006	60	197	0.07 - 0.14	.003 - .006	55	180	0.07 - 0.14	.003 - .006
	CG	60	197	0.06 - 0.13	.002 - .005								
Aluminum	CB	70	230	0.08 - 0.18	.003 - .007	70	230	0.08 - 0.18	.006 - .007				
	CC	90	295	0.10 - 0.25	.004 - .010	80	262	0.10 - 0.25	.004 - .010	70	230	0.10 - 0.25	.004 - .010
	CG	22	72	0.04 - 0.06	.002 - .002								
Grey Iron	CB	30	98	0.06 - 0.08	.002 - .003	28	92	0.06 - 0.08	.002 - .003				
	CC	40	131	0.06 - 0.12	.002 - .005	35	115	0.06 - 0.12	.002 - .005	32	105	0.06 - 0.12	.002 - .005
	CG	25	32	0.04 - 0.07	.002 - .003								
Cast Iron	CB	35	115	0.06 - 0.08	.002 - .008	30	98	0.06 - 0.08	.002 - .003				
	CC	50	164	0.06 - 0.12	.002 - .005	45	148	0.06 - 0.12	.002 - .005	40	131	0.06 - 0.12	.002 - .005

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METRIC "CUT TYPE" KNURLS (PER DIN 403)

(Greatly Reduced Knurling Pressure)

Uses a cutting action instead of forming the metal. Often times when knurling non-ferrous material (Aluminum, Brass etc.) the forming action work harden the material causing the crest to become brittle and break off. Not so with the "cut type" knurl - the milling action leaves a sharp solid crest for a perfect knurl. See Page 28 for holders.

HIGH COBALT STEEL

LAPPED Tooth Profile • All 90° Tooth Form

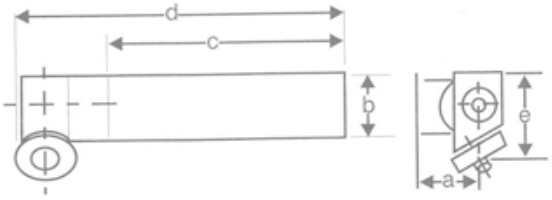
Smooth **Lapped** Tooth profile							**HI-Cobalt** 90° Tooth Form Multiple Coatings Available
Series Size	Pitch Metric / TPI	"AA" Straight	BL 15° LH Diag	BR 15° RH Diag	BL 30° LH Diag	BR 30° RH Diag	
"CG" Series 8.9mm Diam. 2.5mm Width 4mm Hole	0.3mm / 84.7 TPI	CGSX0.3	CGAX0.3	CGBX0.3	CGLX0.3	CGRX0.3	**Accu Trak Holders** OR ISO6R, OR ISO8R, OR IS10R, OR IS12R OR IDO6R, OR IDO08R, OR ID10R, OR ID12R
	0.4mm / 63.5 TPI	CGSX0.4	CGAX0.4	CGBX0.4	CGLX0.4	CGRX0.4	
	0.5mm / 50.8 TPI	CGSX0.5	CGAX0.5	CGBX0.5	CGLX0.5	CGRX0.5	
	0.6mm / 42.3 TPI	CGSX0.6	CGAX0.6	CGBX0.6	CGLX0.6	CGRX0.6	
	0.7mm / 36.3 TPI	CGSX0.7	CGAX0.7	CGBX0.7	CGLX0.7	CGRX0.7	
	0.8mm / 31.8 TPI	CGSX0.8	CGAX0.8	CGBX0.8	CGLX0.8	CGRX0.8	
	0.9mm / 28.2 TPI	CGSX0.9	CGAX0.9	CGBX0.9	CGLX0.9	CGRX0.9	
	1.0mm / 25.4 TPI	CGSX1.0	CGAX1.0	CGBX1.0	CGLX1.0`	CGRX1.0	
	1.2mm / 21.2 TPI	CGSX1.2	CGAX1.2	CGBX1.2	CGLX1.2	CGRX1.2	
"CB" Series 14.5mm Diam. 3.0mm Width 5.0mm Hole	0.4mm / 63.5 TPI	CBSX0.4	CBAX0.4	CBBX0.4	CBLX0.4	CBRX0.4	**Accu Trak Holders** OR IS14, OR IS16, OR ID14R, ORID16R **Quick** STRO, STRI,O/KF
	0.5mm / 50.8 TPI	CBSX0.5	CBAX0.5	CBBX0.5	CBLX0.5	CBRX0.5	
	0.6mm / 42.3 TPI	CBSX0.6	CBAX0.6	CBBX0.6	CBLX0.6	CBRX0.6	
	0.7mm / 36.3 TPI	CBSX0.7	-	-	CBLX0.7	CBRX0.7	
	0.8mm / 31.8 TPI	CBSX0.8	CBAX0.8	CBBX0.8	CBLX0.8	CBRX0.8	
	0.9mm / 28.2 TPI	CBSX0.9	-	-	-	-	
	1.0mm / 25.4 TPI	CBSX1.0	CBAX1.0	CBBX1.0	CBLX1.0	CBRX1.0	
	1.2mm / 21.2 TPI	CBSX1.2	CBAX1.2	CBBX1.2	CBLX1.2	CBRX1.2	
"CP" Series 15mm Diam. 4mm Width 8mm Hole	0.4mm / 63.5 TPI	CPSX0.4	-	-	CPLX0.4	CPRX0.4	**German Made** 211, 211/1,212/3R,212/3L 213/1, 213/2, 213/3, 213/4, 213/5, 213/6, 221/OL, 221/OR, 221/1L, 222/2, 223/OR, 223/OL, 226/1, 226/2, 226/3
	0.5mm / 50.8 TPI	CPSX0.5	CPAX0.5	CPBX0.5	CPLX0.5	CPRX0.5	
	0.6mm / 42.3 TPI	CPSX0.6	-	-	CPLX0.6	CPRX0.6	
	0.7mm / 36.3 TPI	CPSX0.7	CPAX0.7	CPBX0.7	CPLX0.7	CPRX0.7	
	0.8mm / 31.8 TPI	CPSX0.8	-	-	CPLX0.8	CPRX0.8	
	1.0mm / 25.4 TPI	CPSX1.0	CPAX1.0	CPBX1.0	CPLX1.0	CPRX1.0	
	1.2mm / 21.2 TPI	CPSX1.2	CPAX1.2	CPBX1.2	CPLX1.2	CPRX1.2	
	1.5mm / 16.9 TPI	CPSX1.5	CPAX1.5	CPBX1.5	CPLX1.5	CPRX1.5	
	1.6mm / 15.9 TPI	CPSX1.6	-	-	-	-	
	1.8mm / 14.1 TPI	CPSX1.8	CPAX1.8	CPBX1.8	-	-	
	2.0mm / 12.7 TPI	CPSX2.0	-	-	-	-	
"CC" Series 21.5mm Diam. 5mm Width 8mm Hole	0.3mm / 84.7 TPI	CCSX0.3	CCAX0.3	CCBX0.3	CCLX0.3	CCRX0.3	**Accu Trak** OR Is20, ORIS25, OR IS.75, OR IS1.0, OR ID20R, OR ID25R, OR ID.75R, OR ID1.0R **Quick** STRII, I/KF, O-I/FL
	0.4mm / 63.5 TPI	CCSX0.4	CCAX0.4	CCBX0.4	CCLX0.4	CCRX0.4	
	0.5mm / 50.8 TPI	CCSX0.5	CCAX0.5	CCBX0.5	CCLX0.5	CCRX0.5	
	0.6mm / 42.3 TPI	CCSX0.6	CCAX0.6	CCBX0.6	CCLX0.6	CCRX0.6	
	0.8mm / 31.8 TPI	CCSX0.8	CCAX0.8	CCBX0.8	CCLX0.8	CCRX0.8	
	1.0mm / 25.4 TPI	CCSX1.0	CCAX1.0	CCBX1.0	CCLX1.0	CCRX1.0	
	1.2mm / 21.2 TPI	CCSX1.2	CCAX1.2	CCBX1.2	CCLX1.2	CCRX1.2	
	1.5mm / 16.9 TPI	CCSX1.5	CCAX1.5	CCBX1.5	CCLX1.5	CCRX1.5	
	1.6mm / 15.9 TPI	CCSX1.6	-	-	CCLX1.6	CCRX1.6	
	2.0mm / 12.7 TPI	CCSX2.0	CCAX2.0	CCBX2.0	CCLX2.0	CCRX2.0	
	3.0mm / 8.5 TPI	CCSX3.0	CCAX3.0	CCBX3.0	-	-	
"CV" Series 25mm Diam. 6mm Width 8mm Hole	0.4mm / 63.5 TPI	CVSX0.4	CVAX0.4	CVBX0.4	CVLX0.4	CVRX0.4	**German Made** 210, 210/1, 212/4R, 212/4L, 212/5R, 212/5L 217, 220/1L, 220/1R, 220/2L, 220/2R, 223/1L, 223/2L,223/2R, 223/3L, 223/3R,227/1, 227/2, 227/3
	0.5mm / 50.8 TPI	CVSX0.5	CVAX0.5	CVBX0.5	CVLX0.5	CVRX0.5	
	0.6mm / 42.3 TPI	CVSX0.6	CVAX0.6	CVBX0.6	CVLX0.6	CVRX0.6	
	0.7mm / 36.3 TPI	CVSX0.7	CVAX0.7	CVBX0.7	CVLX0.7	CVRX0.7	
	0.8mm / 31.8 TPI	CVSX0.8	CVAX0.8	CVBX0.8	CVLX0.8	CVRX0.8	
	1.0mm / 25.4 TPI	CVSX1.0	CVAX1.0	CVBX1.0	CVLX1.0	CVRX1.0	
	1.2mm / 21.2 TPI	CVSX1.2	CVAX1.2	CVBX1.2	CVLX1.2	CVRX1.2	
	1.5mm / 16.9 TPI	CVSX1.5	CVAX1.5	CVBX1.5	CVLX1.5	CVRX1.5	
	1.6mm / 15.9 TPI	CVSX1.6	-	-	CVLX1.6	CVRX1.6	
	1.8mm / 14.1 TPI	CVSX1.8	-	-	-	-	
	2.0mm / 12.7 TPI	CVSX2.0	CVAX2.0	CVBX2.0	CVLX2.0	CVRX2.0	
	3.0mm / 8.5 TPI	CVSX3.0	-	-	-	-	

CUT KNURL HOLDERS

SINGLE

These tools produce a straight knurl using a 30° right handed knurling die. If the pasttern is not paralle, adjust the head. Be sure to use plenty of coolant to flush away the chips.

See our website under "Cut Type Knurling" for setup instructions



	Holder	Knurl Series	A	B	C	D	E	Capacity	
Metric	OR IS06R	CG	6mm	6mm	90mm	110mm	16mm	1.5 - 12mm	.06 - .47"
	OR IS08R	CG	8mm	8mm	90mm	110mm	16mm	1.5 - 12mm	.06 - .47"
	OR IS10R	CG	10mm	10mm	90mm	110mm	16mm	1.5 - 12mm	.06 - .47"
	OR IS12R	CG	12mm	10mm	90mm	110mm	16mm	1.5 - 112mm	.06 - .47"
	OR IS14	CB	14mm	14mm	74mm	100mm	22mm	4 - 50mm	.16 - .197"
	OR IS16	CB	16mm	16mm	74mm	100mm	22mm	4 - 50mm	.16 - .197"
	OR IS20*	CC	20mm	20mm	114mm	150mm	32mm	5 - 250mm	.20 - 9.84"
	OR IS25*	CC	25mm	25mm	114mm	150mm	32mm	5 - 250mm	.20 - 9.84"
Inch	OR IS.75*	CC	0.75"	1.00"	4.50"	5.90"	1.26"	6 - 250mm	.20 - 9.84"
	OR IS1.0*	CC	1.00"	1.00"	4.50"	5.90"	1.26"	7 - 250mm	.20 - 9.84"

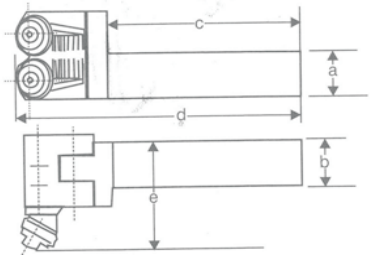
*Holders with an asterisk have reversible heads and can be used in the left or right hand position.

DOUBLE

These tools produce a 30° male diamond knurl pattern **using two straight dies.** Use fine adjusting screws to insure that both dies are hitting equally. Always use plenty of coolant to flush away chips

For a 45° diamond pattern, use (1) 15° RH and (1) 15° LH wheel.

See our website under "Cut Type Knurling" for setup instructions



	Holder	Knurl Series	A	B	C	D	E	Capacity	
Metric	OR ID06R	CG	6mm	6mm	80mm	107mm	25mm	1.5 - 12mm	.06 - .47"
	OR ID08R	CG	8mm	6mm	80mm	107mm	25mm	1.5 - 25mm	.06 - .47"
	OR ID10R	CG	10mm	10mm	80mm	107mm	25mm	1.5 - 12mm	.06 - .47"
	OR ID12R	CG	12mm	12mm	80mm	107mm	25mm	1.5 - 12mm	.06 - .47"
	OR ID14R	CB	14mm	16mm	78mm	120mm	44mm	4 - 50mm	.06 - 1.97"
	OR ID16R	CB	16mm	16mm	78mm	120mm	44mm	4 - 50mm	.06 - 1.97"
	OR ID20R*	CC	20mm	25mm	111mm	165mm	63mm	5 - 250mm	.20 - 9.84"
	OR ID25R*	CC	25mm	25mm	111mm	165mm	63mm	5 - 250mm	.20 - 9.84"
Inch	OR ID1.75*	CC	0.75*	1.00"	4.50"	6.50"	2.48"	6 - 250mm	.20 - 9.84"
	OR ID1.0R*	CC	1.00"	1.00"	4.50"	6.50"	2.48"	7 - 250mm	.20 - 9.84"

*Holders with an asterisk have reversible heads and can be used in the left or right hand position.

Please see our website for repair parts for holders

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HARDENED ROLLS

Accu Trak stocks 2 types of hardened rolls in various common sizes. The first type is used as a "Burnishing Roll" and has a hand polished finish on the O.D. The other is most often used as a "Support Roll" and is unpolished. These are great tools for your burnishing and support roll applications. "Support Rolls" are about 1/2 the price of "Burnishing Rolls".

BURNISHING ROLL TOOL#	SUPPORT ROLL TOOL#	O.D.	WIDTH	HOLE
BL EPB	BL EPS	.500"	.187"	.1880"
BL GKB	BL GKS	.625"	.250"	.2505"
BL KNB	BL KNS	.750"	.250"	.2505"
BL KPB	BL KPS	.750"	.375"	.2505"
BL KRB	BL KRS	.750"	.500"	.2505"
BL PHB	BL PHS	1.125"	.500"	.5005"

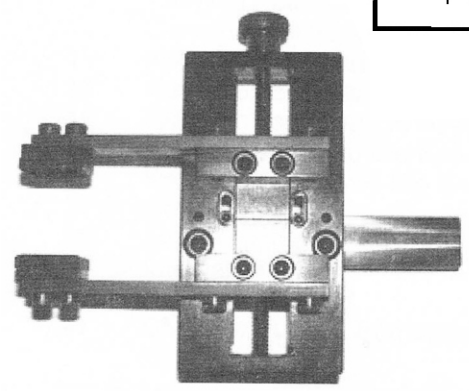
ACCU-TRAK can make additional sizes and configurations for special needs. Please provide a drawing of the Roll or Part for pricing and delivery.

Unique CNC Bar Puller/Bar Puller-Cut Off Tool

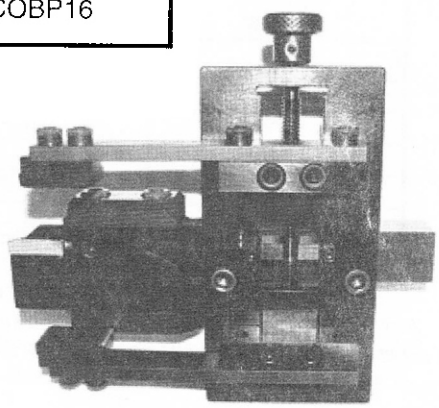
This newly designed adjustable bar puller is a substantially improved version of previously available tools. It is the perfect addition for a CNC turning machine lacking an automatic bar feed system. The unit, manufactured using heat treated tool steels, is supplied with either a 3/4" or 1" square shank. The hardened tool steel jaws **adjust simultaneously** by turning a single screw and have the capacity for handling parts ranging from 0 to 3-3/8" in diameter. Installation time on a CNC machine is less than 10 minutes and changing to different diameters is very quick and simple.

It is **now also available with a cut-off blade holder** so that two operations can be accomplished in one turret position, thus saving a station and reducing cycle time. It will accept standard 1-1/4" blades that use inserts made by Sandvik, Iscar, Carboloy, Kennemetal and others. Full length blades need to be cut in half (or less) by the customer.

Shank Size/Type	Tool #
3/4" Bar Puller Only	OR BP12
1" Bar Puller Only	OR BP16
3/4" Bar Puller with Cut-off	OR COBP12
1" Bar Puller with Cut-off	OR COBP16



Without Cut-off



With Cut-off

KNURLING - ROLL FORMING VERSUS CUTTING
When and When Not To Use One Or The Other

Knurling by the roll forming method is a plastic deformation process characterized by the absence of metal chips. Many so-called "conventional"" knurling jobs are performed, essentially to enhance the gripping properties of parts' surfaces. Pre-forming dimension are purposely made smaller than the required finished size to accommodate the outward displacement or material generated by the penetration of knurl teeth into the part.

In many instances knurling by roll forming need not be pretty but rather functional as in a car wheel bolt or electric motor shaft. Once such parts are assembled, the knurled area is often hidden from view. In the case of a part such as a tuning knob for an electric apparatus or a micrometer barrel or the handle of a medical instrument, the knurled pattern must look esthetically pleasing.

The gripping type knurled part is the most common. Most progressive machine shops are familiar with this operation. In such industrial work environments, the rule of thumb is that as long as the quantity of parts is high, the cost of roll forming will be low.

All too often, the "mind set" is to roll form whenever a print calls out a knurl pattern. The fact is that there are times when it is unwise to roll form but instead to mill a hob. These cutting alternatives most frequently arise when the work piece being knurled has a tooling application or where the knurl produced is to make other knurls or has some other demanding function.

The manufacturing volume of such tools or parts is generally low and the performance of the knurl is critical. What types of tools do we have in mind, feed rolls, rolling mill dies, deburring tools, sealing wheels and marking dies among others. Mistakenly, first consideration is given to the roll forming process to produce the patterns but the results can be less than desirable for a number of reasons:

1. Tools are generally made using alloy steels which are not the most malleable of metals and can be difficult to roll form.
2. For reason of unit cost - no extra work pieces may be available with which to establish effective knurling parameters - i.e. speeds and feeds, etc.
3. Difficulty in estimating the exact dimension "build-ups".
4. Although rolled steel may be stronger than cut steel, roll formed knurl tooth crest are not as sturdy as cut or milled tooth crests because of seams resulting from the very nature of the rolling process. - thus producing shorter tool life.

With these conditions in mind, shop management would be well advised to turn to milling or hobbing as alternative means. Additionally, with the proliferation of CNC machining centers, some knurling jobs can be set up and run just as quickly and efficiently as form rolling. Gear hobbing machines also achieve good results when work piece quantities are low, and the correct cutters (hobs) are available.

Although Accu Trak Tool manufactures a wide assortment of knurling dies, the firm also offers knurl and spline application services where machine (cutting) processes may be chosen to replace roll forming. Depending on tooling availability (hobs or milling cutters), it might be less expensive and quicker to sub-contract knurling applications than to procure the necesary knurling tools to do the job in-house.

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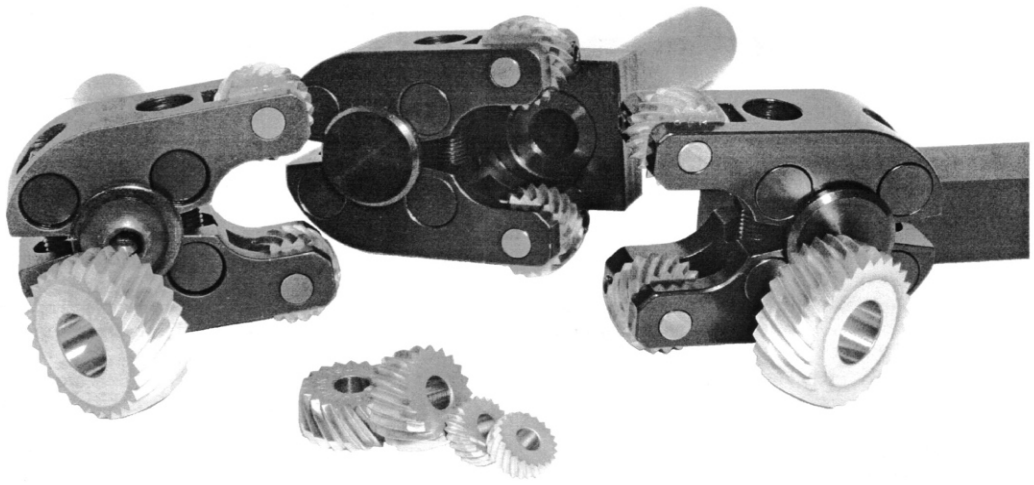

THE ULTIMATE TOOL FOR AXIAL FEED KNURLING

See Page 14 or visit www.accu-trak.com

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