

*Salvage out-of-tolerance bores or shafts with the two-step KB<sup>®</sup> Knurling-Burnishing “scrap saver” process.*

*Worthless scrap or precision part? The KB “Scrap-Saver” process can make the difference.*

*Cogsdill’s KB process is an innovative approach to making the diameter of holes smaller and the diameter of shafts larger. The KB process was originally developed for automotive parts rebuilding industries, where out-of-tolerance bores and shafts on parts that were formerly scrapped are salvaged with the KB process. The process is also applied in original equipment manufacturing.*

Roll-a-Finish tool

KB knurling tool

*Note: KB knurling tool shown above without adjusting screw.*



# The KB process

## KB is Superior to Conventional Salvage Methods

Conventional salvage methods, including spray welding and chrome plating, are expensive, time-consuming, and often produce unsatisfactory results. These metal-adding processes do not deposit a uniform thickness around the circumference of the hole or shaft; they also deposit metal where it is not wanted, and remachining is required. Often remachining is difficult because no qualified surfaces are available for alignment.

Another approach is to cut away additional metal and install a bushing or sleeve. Additional time and effort is required for machining and finishing the part to bring it within tolerance.

The KB Process eliminates these problems in two quick steps through the use of two tools. The KB Knurling Tool raises the surface of the oversize bore (or undersize

shaft). The Roll-a-Finish Tool roller burnishes the knurled surface to the exact diameter required. (See below, "How It Works.") The entire two-step process can be accomplished in seconds

## Improved surface characteristics and lower cost

In addition to the benefits of Knurling/Burnishing as a sizing and salvage method, the process results in a series of plateaus on the same plane in the surface of the metal, thus providing increased contact area. Tests by a major auto manufacturer have shown increases in surface holding power of up to 35% over surfaces which are precision bored to receive press-fit bearings. In many cases the finished boring process may be eliminated altogether. The grooves in the Knurled/Burnished surface are ideally

suited for use with an adhesive agent. The grooves are also desirable for the effect of trapping and funneling away foreign matter and grit that might otherwise remain on the bearing surface of the part.

For running fits, the increased contact area diminishes the load carried at any given point on the part surface; this increases the ability of the surface to resist wear. Knurling, like Roller Burnishing, is a metal displacement process, and the work-hardening effect of the tools also contributes to the ability of the Knurled/Burnished surface to resist wear.

The KB Process can result in cost savings in several areas. Machine time can be reduced as much as 10:1. Substantial reductions are achieved in tool cost and tool inventory. Fewer machines and less floor space are required.

Knurling and Burnishing makes holding size easier; this results in savings in inspection time and scrap.

## How it works

Oversize Bore

**1** Knurl to raise surface

**2** Burnish to correct size

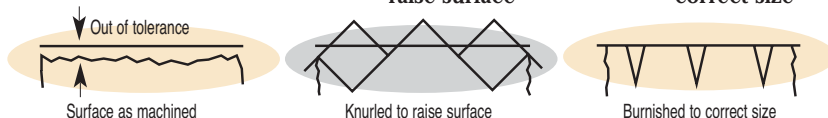


An oversize bore may be machined out-of-tolerance or made oversize by excessive wear. Here's how the KB Process can salvage this part:

Oversize Bore

**1** Knurl to raise surface

**2** Burnish to correct size



2 steps

**1** — A Cogsdill KB Knurling Tool displaces material on the oversize hole diameter, raising the surface as much as .030 inch (.76mm) in a diamond-shaped knurled pattern. The bore is now undersize.

**2** — A Cogsdill Roll-a-Finish Tool cold works the knurled surface, burnishing the hole to correct size.

# The KB process

## Tool operation

Knurling may be performed with either the tool or the part rotating. Any ductile or malleable metal may be knurled including aluminum, brass, bronze, ductile iron, steels (up to 40 Rc) and cast iron (except chilled and white cast). Speeds should approximate drilling speeds, and feed rate starting points can be determined from the table below.

Although hand-fed operations are possible on many machines, power feeding is desirable to obtain a more uniform knurl pattern. Return feeds

may be two to three times the infeed rate.

The operations should be performed under a flood of coolant. A water soluble, high-lubricity oil is recommended. If coolant cannot be used, speeds and feeds should be reduced by two-thirds to ensure reasonable knurl and pin life.

The tools are adjusted using the adjusting screw located in the center of the tool.

Once the tools are set for size, an unskilled operator can obtain consistently good results, even over long work lengths.

Cogsdill knurling tools do not require accurate location, and in most cases it is recommended to have either the tool or part free to float. Each knurling roll depends on the support of the opposing roll to do its work; therefore, the tools are self-centering.

Typical changes in workpiece diameter, after knurling with medium pitch knurling rolls (20 teeth per circular inch), are as follows: for cast iron, .006 inch (.15mm); for steel, .008 inch (.2mm); for bronze, .010 inch (.25mm); and for aluminum, .012 inch (.30mm).

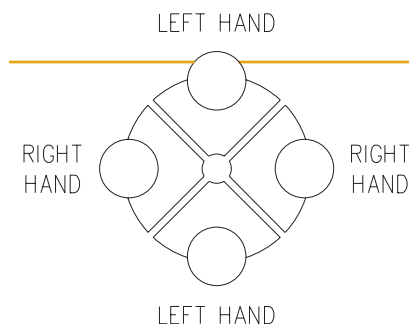
MATERIAL	SPEED		FEED RATE	
	SFPM	SM/MIN.	IPR	MM/REV
Aluminum or brass	200-300	61-91	.030	.76
Leaded steel	125-150	38-46	.030	.76
Soft cast iron carbon steel	80-120	24-37	.018	.46
# 50 cast iron, medium alloy steel	60-90	18-27	.012	.30
# 65 cast iron, alloy steel (35-40 R/C)	25-35	8-11	.008	.20

## Knurling rolls

Worn knurling rolls should be replaced in sets. However, if a knurling roll should be damaged, it may be replaced by a new roll of like hand.

KN-1 and KN-2 knurling rolls are stocked in medium and coarse pitch; KN-3 rolls are stocked in medium

pitch only. (Medium is 20 teeth per circular inch, and coarse is 14 teeth per circular inch.) Please specify medium or coarse pitch when ordering. Standard knurling rolls have knurls set at a 45 degree angle. Special angles and pitches are available on special order.



Cogsdill Knurling Tools require an equal number of left and right hand knurling rolls, placed in opposing stations.

## Special tools

Special Knurling Tools, including external tools, tools for larger diameters, and fully-bottoming tools, are available on special order. When requesting a quotation for a special tool, please furnish the following data:

1. Part description and part number (if any).
2. A blueprint or sketch of your part.
3. Exactly what job is to be performed; i.e. what particular surface of the part is to be knurled.
4. Material type and hardness.
5. If a salvage job is to be performed, advise how much parts are oversized or undersized.
6. Tolerance requirements.
7. Shank requirements.

## Tool design

Standard Cogsdill Knurling Tools are available for internal applications. External tools are available on special order (see “Special Tools”). All standard internal Knurling Tools are of similar design with differences only in the number of knurling rolls and the diameter adjustment mechanism.

Small tools from KBN-625 through KBN-1156 are adjusted by turning a hex-head screw in the side of the tool. Tools in this range have two rolls.

The larger internal tools are adjusted by means of a hex-head screw through the center of the tool. The screw is accessible from the front of the tool.

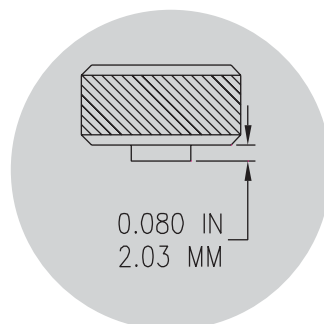
Tools from KBN-1188 through KBN-2926 have four knurling rolls, while those from KBN-3000 through KBN-4000 have six knurling rolls.

All internal Knurling Tools are adjustable over a range of .041 inch, as are Cogsdill Roll-a-Finish tools.

The tool consists of shank, rolls, pins and adjusting screw. Morse taper shanks are standard. The rolls and pins are the only items considered wear parts; these are available from stock. We recommend that at least one spare set of rolls and pins is ordered when a knurling tool is purchased. The pins are retained by a set screw and can be easily removed when it is necessary to replace worn rolls.

All standard tools are designed for through-hole applications. These tools can also be used on semi-bottoming applications; the tool will work to .080 inch (2.03mm) from the bottom of the bore. Bottoming tools are also available, on special order (see “Special Tools”).

# knurling tool design



# Standard tool specifications

Tool No.	Diameter Range		Shank	Overall Length		Pins & Knurls	
	Inches	Millimeters		Inches	MM	Size	Qty. Req.
KBN-625	.621-.662	15.77-16.81	↑	↑	↑	↑	↑
KBN-656	.652-.693	16.56-17.60				#KN-3	
KBN-688	.684-.725	17.37-18.42				(.312 Inch	
KBN-719	.715-.756	18.16-19.20				Dia.)	
KBN-750	.746-.787	18.95-19.99				↑	
KBN-781	.777-.818	19.74-20.78					
KBN-812	.808-.849	20.52-21.56					
KBN-844	.840-.881	21.34-22.38					
KBN-875	.871-.912	22.12-23.16					2
KBN-906	.902-.943	22.91-23.95					
KBN-938	.934-.975	23.72-24.77					
KBN-969	.965-1.006	24.51-25.55					
KBN-1000	.996-1.037	25.30-26.34					
KBN-1031	1.027-1.068	26.09-27.13					
KBN-1062	1.058-1.099	26.87-27.91					
KBN-1094	1.090-1.131	27.69-28.73					
KBN-1125	1.121-1.162	28.47-29.51	#2MT	6.75	171.4		
KBN-1156	1.152-1.193	29.26-30.30					↓
KBN-1188	1.184-1.225	30.07-31.12					↑
KBN-1219	1.215-1.256	30.86-31.90					
KBN-1250	1.246-1.287	31.65-32.69					
KBN-1281	1.277-1.318	32.44-33.48					
KBN-1312	1.308-1.349	33.22-34.26					
KBN-1344	1.340-1.381	30.04-35.08				#KN-2	
KBN-1375	1.371-1.412	34.82-35.86				(.375 Inch	
KBN-1406	1.402-1.443	35.61-36.65				Dia.)	
KBN-1438	1.434-1.475	36.42-37.47					
KBN-1469	1.465-1.506	37.21-38.25					
KBN-1500	1.496-1.537	38.00-39.04					
KBN-1531	1.527-1.568	38.79-39.83					
KBN-1562	1.558-1.599	39.57-40.61					4
KBN-1594	1.590-1.631	40.39-41.43					
KBN-1625	1.621-1.662	41.17-42.21					
KBN-1656	1.652-1.693	41.96-43.00	↓	↓	↓		
KBN-1688	1.684-1.725	42.77-43.82	↑	↑	↑		
KBN-1719	1.715-1.756	43.56-44.60					
KBN-1750	1.746-1.787	44.35-45.39					
KBN-1781	1.777-1.818	45.14-46.18					
KBN-1812	1.808-1.849	45.92-46.96					
KBN-1844	1.840-1.881	46.74-47.78				↓	
KBN-1875	1.871-1.912	47.52-48.56				↑	
KBN-1906	1.902-1.943	48.31-49.35					
KBN-1938	1.934-1.975	49.12-50.17					
KBN-1969	1.965-2.006	49.91-50.95	#3MT	7.75	196.8		
KBN-2000	1.996-2.037	50.70-51.74					
KBN-2031	2.027-2.068	51.49-52.53					
KBN-2062	2.058-2.099	52.27-53.31				#KN-1	
KBN-2094	2.090-2.131	53.09-54.13				(.750 Inch	
KBN-2125	2.121-2.162	53.87-54.91				Dia.)	
KBN-2156	2.152-2.193	54.66-55.70					
KBN-2188	2.184-2.225	55.47-56.52					
KBN-2219	2.215-2.256	56.26-57.30					
KBN-2250	2.246-2.287	57.05-58.09					
KBN-2281	2.277-2.318	57.84-58.88					
KBN-2312	2.308-2.349	58.62-59.66	↓	↓	↓	↓	↓

# Standard tool specifications

Tool No.	Diameter Range		Shank	Overall Length		Pins & Knurls	
	Inches	Millimeters		Inches	MM	Size	Qty. Req.
KBN-2344	2.340-2.381	59.44-60.48	↑	↑	↑	↑	↑
KBN-2375	2.371-2.412	60.22-61.26					
KBN-2406	2.402-2.443	61.01-62.05					
KBN-2438	2.434-2.475	61.82-62.87					
KBN-2469	2.465-2.506	62.61-63.65					
KBN-2500	2.496-2.537	63.40-64.44					
KBN-2531	2.527-2.568	64.19-65.23					
KBN-2562	2.558-2.599	64.97-66.01					
KBN-2594	2.590-2.631	65.79-66.83					
KBN-2625	2.621-2.662	66.57-67.61	#3MT	7.75	196.8		4
KBN-2656	2.652-2.693	67.36-68.40					
KBN-2688	2.684-2.725	68.17-69.22					
KBN-2719	2.715-2.715	68.96-70.00					
KBN-2750	2.746-2.787	69.75-70.79					
KBN-2781	2.777-2.818	70.54-71.58					
KBN-2812	2.808-2.849	71.32-72.36					
KBN-2844	2.840-2.881	72.14-73.18					
KBN-2875	2.871-2.912	71.92-73.96					
KBN-2906	2.902-2.943	73.71-74.75					
KBN-2938	2.934-2.975	74.52-75.57					
KBN-2969	2.965-3.006	75.31-76.35	↓	↓	↓		↓
KBN-3000	2.996-3.037	76.10-77.14	↑	↑	↑		↑
KBN-3031	3.027-3.068	76.89-77.93					
KBN-3062	3.058-3.099	77.67-78.71					
KBN-3094	3.090-3.131	78.49-79.53					
KBN-3125	3.121-3.162	79.27-80.31					
KBN-3156	3.152-3.193	80.06-81.10					
KBN-3188	3.184-3.225	80.87-81.92					
KBN-3219	3.215-3.256	81.66-82.70				#KN-1	
KBN-3250	3.246-3.287	82.45-83.49				(.750 Inch	
KBN-3281	3.277-3.318	83.24-84.28				Dia.)	
KBN-3312	3.308-3.349	84.02-85.06					
KBN-3344	3.340-3.381	84.84-85.88					
KBN-3375	3.371-3.412	85.62-86.66					
KBN-3406	3.402-3.443	86.41-87.45					
KBN-3438	3.434-3.475	87.22-88.27					
KBN-3469	3.465-3.506	88.01-89.05	#4MT	8.75	222.2		6
KBN-3500	3.496-3.537	88.80-89.84					
KBN-3531	3.527-3.568	89.59-90.63					
KBN-3562	3.558-3.599	90.37-91.41					
KBN-3594	3.590-3.631	91.19-92.23					
KBN-3625	3.621-3.662	91.97-93.01					
KBN-3656	3.652-3.693	92.73-93.80					
KBN-3688	3.684-3.725	93.57-94.62					
KBN-3719	3.715-3.756	94.36-95.40					
KBN-3750	3.746-3.787	95.15-96.19					
KBN-3781	3.777-3.818	95.94-96.98					
KBN-3812	3.808-3.849	96.72-97.76					
KBN-3844	3.840-3.881	97.54-98.58					
KBN-3875	3.871-3.912	98.32-99.36					
KBN-3906	3.902-3.943	99.11-100.15					
KBN-3938	3.934-3.975	99.92-100.97					
KBN-3969	3.965-4.006	100.71-100.97					
KBN-4000	3.996-4.037	101.50-102.54					
			↓	↓	↓	↓	↓