



COGSDILL TOOL PRODUCTS, INC.

Deburring

Deburring

TOOLS

**DEBURR BOTH SIDES
IN ONE PASS**

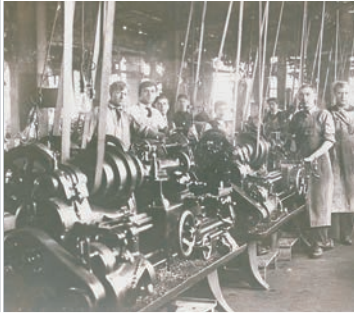


FEATURING COMPLETE TOOL AND SPARE PART NUMBERS

Cogsdill

ENGINEERED SPECIALTY TOOLING SOLUTIONS

FOR THE WORLDWIDE MACHINE TOOL INDUSTRIES



In 1914 Stuart A. Cogsdill set up shop in Detroit as a cutting tool regrinding and repair service. He soon began designing and manufacturing special tools for early automotive pioneers such as Henry Ford and the Dodge brothers, who relied on Cogsdill to develop innovative tooling solutions for tough manufacturing problems.

Currently owned and operated by the second and third generation of Stuart Cogsdill's descendants,

Cogsdill offers its 21st century customers the same commitment that inspired its founder: we will develop and build innovative tooling solutions for your tough manufacturing problems.

Cogsdill has two operating units, one in the United

States and one in the United Kingdom:

■ Cogsdill Tool Products, Inc. of Camden,
South Carolina, USA - corporate headquarters

■ Cogsdill-Nuneaton Ltd. of Nuneaton, England -
subsidiary of Cogsdill Tool Products



TOOLMAKERS
SINCE
1914

Deburring

Deburring
TOOLS

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One pass deburring

Deburring holes is usually a costly and time-consuming operation. The back sides of holes are particularly difficult, as they are frequently inaccessible with conventional deburring tools.

*Cogsdill Tool Products offers you a better way to get rid of those troublesome burrs. BURRAWAY® and BURR-OFF® mechanical hole-deburring tools remove burrs on the front, back, or both sides of drilled holes in **one pass**. . . fast, easy, and economical solutions for your hole-deburring problems!*

overview

The BURRAWAY® features a replaceable and inexpensive cutting blade which can be adjusted to control the amount of edge break for consistent results from part to part. The tool can remove feather edges or heavier burrs, on both sides of the hole, working from one side only. The BURRAWAY can be used in fixed spindles or in portable power tools – no need for complicated fixturing, and no special operator skills are required.

The BURR-OFF® is suited to high-production, automated deburring operations; the open-slot design allows chips to clear easily. The original “clothespin” tool, with its integral cutting edges, deburrs thousands of holes and may be reground for even longer life.

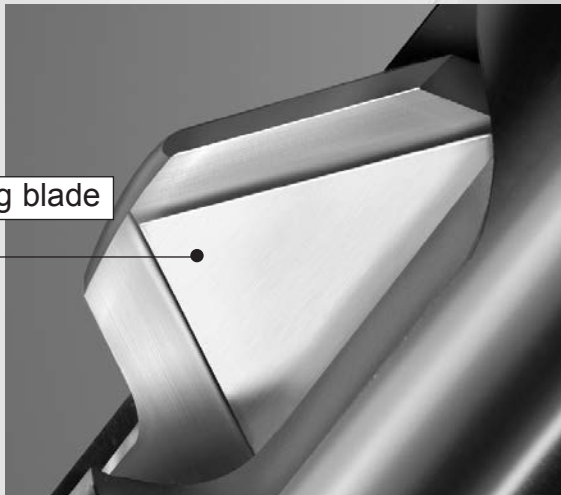
Other, more specialized hole-deburring and countersinking tools are also available from Cogsdill:

The MICRO-LIMIT drive with piloted countersink is designed for precision depth-controlled countersinking of holes. Depth of cut can be pre-set for accurate and consistent results.

The ELLIPTI-BUR® deburrs irregular hole surfaces which are generated by drilling into curved surfaces, or by drilling at an angle.

The NOBUR® Tool is a manually actuated deburring tool for low production requirements. The tool is used on multi-walled parts or intersecting holes, and for removing severe burrs or producing non-qualified chamfers.

cutting blade



Deburr both sides
of holes in
one **fast** pass

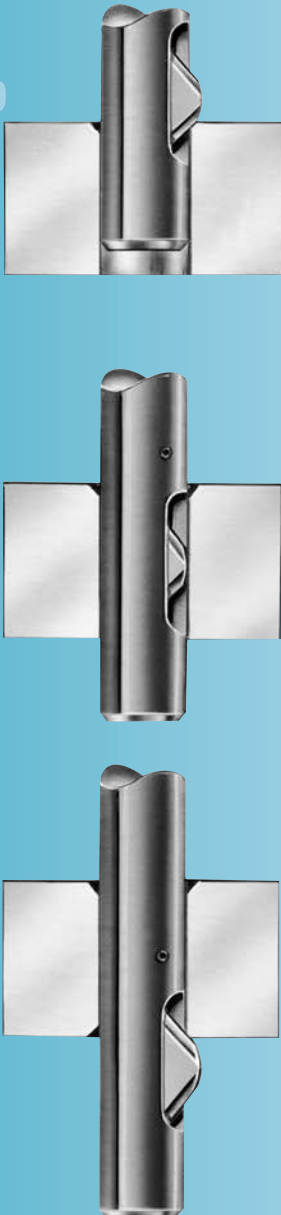
Deburring TOOLS



*We are pleased to offer the
broadest array of hole-deburring tools
in the marketplace. Let us help you meet
your production needs with fast, easy,
and inexpensive solutions
to tough deburring problems.*

COGSDILL TOOL PRODUCTS, INC.

How it works



- 1.** Upon entry, spring tension holds the *replaceable* and *adjustable* cutting blade in the extended position as it removes the burr on the front of the hole.
- 2.** As the feed load increases, the pre-set spring tension is exceeded and the blade retracts automatically as the tool passes through the workpiece. (The crowned and polished top surface of the blade will *not* mar the inside surface of the hole.)
- 3.** Spring tension again causes the blade to extend as it emerges from the ID of the part; the burr is removed on the back side of the hole on the return stroke.

A one-pass solution
to your
hole-deburring
problems!

*BURRAWAY® tools are available in both **inch** and **metric** programs (see tool specifications, pages 6-9). Tools for the **inch** program feature imperial (inch) hardware (adjusting screw); tools for the **metric** program have metric screws. Both are available from stock at standard prices.*



Burraway tools feature an inexpensive, replaceable cutting blade which adjusts to control the amount of edge break.

Design features

All BURRAWAY® tools operate on the same basic principle, but vary slightly in design as determined by tool size:

Type A tools (inch program; for hole sizes from .093 through .203 in.) and **Type MA** tools (metric program; sizes from 2 to 5mm) are a two-piece construction (arbor assembly and adapter). All Type A and MA arbor assemblies are interchangeable with their respective shank adapters.

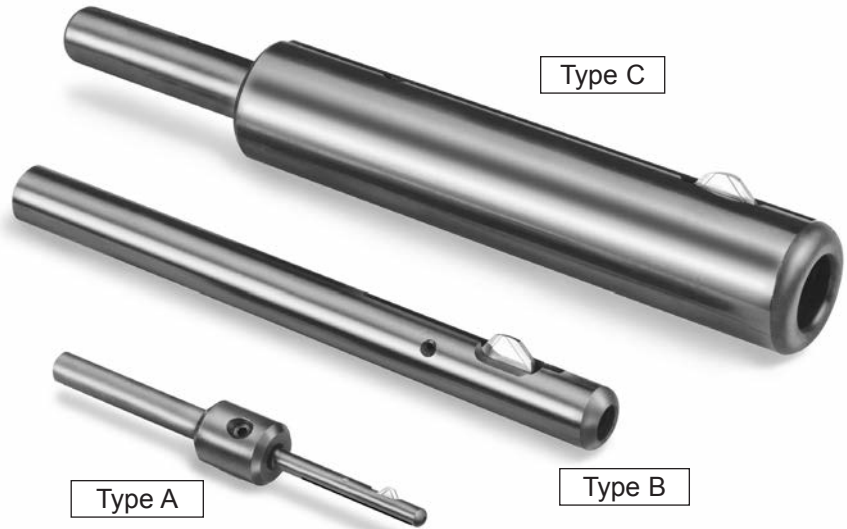
Type B tools (inch program; for hole sizes from .218 through 1.00 in.) and **Type MB** tools (metric program; sizes from 5.5 through 19mm) are a single-piece construction.

Type C tools (inch program; for hole sizes from .750 through 2 in.) and **Type MC** tools (metric program; sizes from 20 through 50mm) are also a single-piece construction.

A tension adjustment mechanism controls the amount of edge break for consistent results from piece to piece. Types A, MA, B, and MB tools have a tension adjustment screw located in the shank end; Types C and MC tools control depth of cut with a tension adjustment rod.

Blade options

BURRAWAY tools are furnished with double-acting blades for burr removal on both the front and back sides of the hole. Blades for front-cutting or back-cutting only are available from stock at no additional charge.



Various blade rake angles and spring tension options are available and recommended for deburring specific material types (see page 10).

Carbide-tipped blades are available upon request for nominal hole sizes of 3/16 inch (4.76mm) and larger. TiN-coated blades are also available upon request.

Standard drill sizes are available from stock. Custom tools – larger sizes, altered standards, or special designs – can also be supplied to suit your particular requirements.

Please furnish a part print and request a quotation. Or, inquire about our free trial and evaluation service: Let us show you how Cogsdill's BURRAWAY tool can help you produce *better-quality parts, with faster production, and at a lower cost!*

A variety of tool designs to meet your needs

Standard BURRAWAY tools are available for *both inch and metric* hole sizes (see pages 6–9).



Burraway tools are available from stock for standard drill sizes. The tool can deburr two or more in-line holes in one pass.

Standard tool specifications

Inch program

Type B (Inches)

HOLE SIZE	COMPLETE TOOL #	BLADE #	DIM. A	DIM. B	DIM. C
7/32	YB-02188	YB-DAP-1	4.50	0.87	0.56
15/64	YB-02344				
1/4	YB-02500				
17/64	YB-02656				
9/32	YB-02812				
19/64	YB-02969	YB-DAP-2	5.00	0.96	0.68
5/16	YB-03125				
21/64	YB-03281				
11/32	YB-03438				
23/64	YB-03594	YB-DAP-3	5.00	1.00	
3/8	YB-03750				
25/64	YB-03906				
13/32	YB-04062				
27/64	YB-04219	YB-DAP-3-1/2	5.50	1.09	0.72
7/16	YB-04375				
29/64	YB-04531				
15/32	YB-04688				
31/64	YB-04844				
1/2	YB-05000				
33/64	YB-05156				
17/32	YB-05312				
35/64	YB-05469	YB-DAP-4	6.44	1.31	0.90
9/16	YB-05625				
37/64	YB-05781				
19/32	YB-05938				
39/64	YB-06094				
5/8	YB-06250				
41/64	YB-06406				
21/32	YB-06562				
43/64	YB-06719				
11/16	YB-06875				
3/4	YB-07500	YB-DAP-5	6.75	1.00	1.56
7/8	YB-08750				
1.00	YB-10000				

Type A (Inches)

HOLE SIZE	COMPLETE TOOL #	BLADE #	DIM. A	DIM. B	DIM. C
3/32	YA-00938	YA-DAP-3/32	3.37	0.45	0.28
7/64	YA-01094				
1/8	YA-01250	YA-DAP-1/8			0.25
9/64	YA-01406				
5/32	YA-01562	YA-DAP-5/32			
11/64	YA-01719				
3/16	YA-01875	YA-DAP-3/16	4.12	0.72	0.44
13/64	YA-02031				

Note: For YA-00938 and YA-01094 blade replacement, refer to page 10 for preferred recommendation(s)

Type C (Inches)

HOLE SIZE	COMPLETE TOOL #	BLADE #
3/4	YC-07500	YC-DAP-110
13/16	YC-08125	
7/8	YC-08750	
15/16	YC-09375	
1.00	YC-10000	
1 1/16	YC-10625	
1 1/8	YC-11250	
1 3/16	YC-11875	
1 1/4	YC-12500	
1 5/16	YC-13125	
1 3/8	YC-13750	
1 1/2	YC-15000	
1 5/8	YC-16250	
1 3/4	YC-17500	
1 7/8	YC-18750	
2.00	YC-20000	

* All tools assembled with a Double-Acting Positive 4° rake (DAP) blade unless otherwise specified.

* Please refer to Blade Data on page 10 for blade options (including Carbide) to suit all materials and applications.

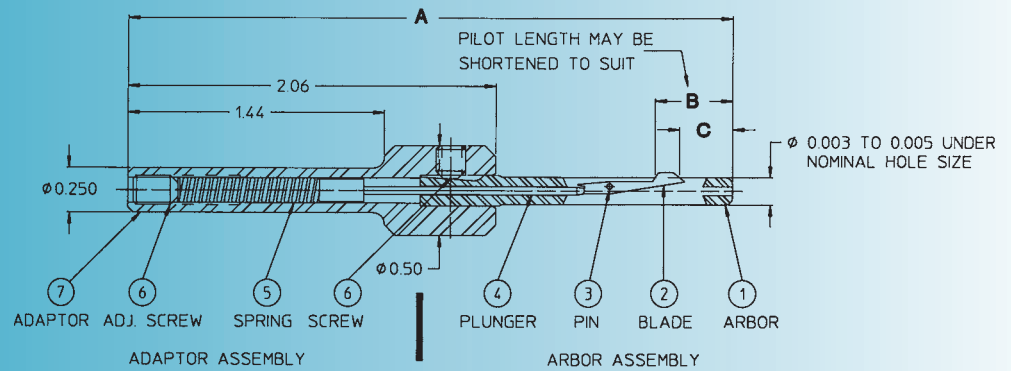
* For tools ordered with any blade other than the DAP series, add -M to the complete tool number and specify blade option required.

* Intermediate and larger sizes available upon request for Type A, Type B, and Type C series.

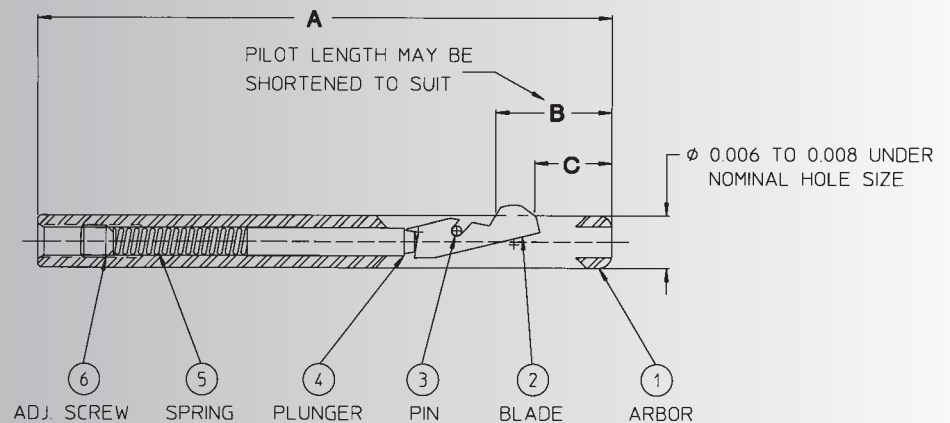
* Complete tool and spare blade numbers are beside the respective hole size. Please refer to page 29 for additional spare parts.

* Optional light duty (LD) spring available upon request when less tension is required for softer materials. Please contact Cogsdill for more information.

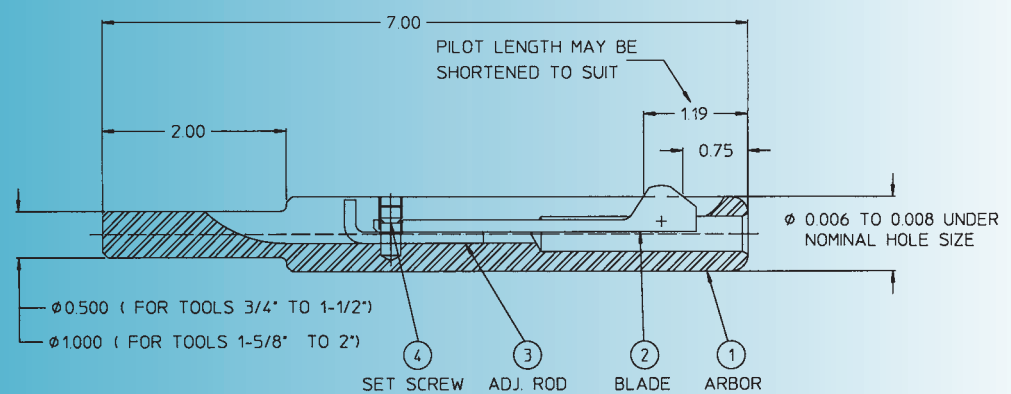
Type A



Type B



Type C



Standard tool specifications

Metric program

Type MB (Metric)

HOLE SIZE	COMPLETE TOOL #	BLADE #	DIM. A	DIM. B	DIM. C
5.5	MYB-5.5	YB-DAP-1	114.0	22.1	14.2
6.0	MYB-6.0				
6.5	MYB-6.5				
7.0	MYB-7.0				
7.5	MYB-7.5	YB-DAP-2	127.0	24.4	17.3
8.0	MYB-8.0				
8.5	MYB-8.5				
9.0	MYB-9.0	YB-DAP-3	140.0	25.4	18.3
9.5	MYB-9.5				
10.0	MYB-10.0	YB-DAP-3-1/2	165.0	33.3	22.9
10.5	MYB-10.5				
11.0	MYB-11.0				
11.5	MYB-11.5				
12.0	MYB-12.0				
12.5	MYB-12.5	YB-DAP-4	165.0	33.3	22.9
13.0	MYB-13.0				
13.5	MYB-13.5				
14.0	MYB-14.0				
14.5	MYB-14.5				
15.0	MYB-15.0				
15.5	MYB-15.5				
16.0	MYB-16.0				
16.5	MYB-16.5				
17.0	MYB-17.0				
17.5	MYB-17.5				
18.0	MYB-18.0				
18.5	MYB-18.5				
19.0	MYB-19.0				

Type MA (Metric)

HOLE SIZE	COMPLETE TOOL #	BLADE #	DIM. A	DIM. B	DIM. C
2.0	MYA-2.0	YA-DAP-2MM	84.6	11.4	6.4
2.3	MYA-2.3	YA-DAP-3/32			
2.5	MYA-2.5	YA-DAP-3MM			
3.0	MYA-3.0	YA-DAP-1/8			
3.5	MYA-3.5	YA-DAP-5/32	103.4	18.3	11.2
4.0	MYA-4.0	YA-DAP-3/16			
4.5	MYA-4.5				
5.0	MYA-5.0				

Note: For MYA-2.0, MYA-2.3, and MYA-2.5 blade replacement, refer to page 10 for preferred recommendation(s)

Type MC (Metric)

HOLE SIZE	COMPLETE TOOL #	BLADE #
20.0	MYC-20.0	YC-DAP-110
25.0	MYC-25.0	
30.0	MYC-30.0	
35.0	MYC-35.0	
40.0	MYC-40.0	
45.0	MYC-45.0	
50.0	MYC-50.0	

* All tools assembled with a Double-Acting Positive 4° rake (DAP) blade unless otherwise specified.

* Please refer to Blade Data on page 10 for blade options to suit all materials and applications.

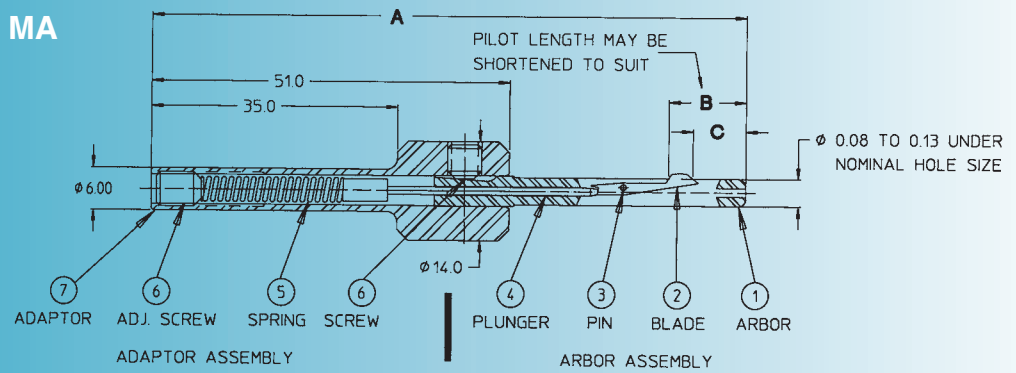
* For tools ordered with any blade other than the DAP series, add -M to the complete tool number and specify blade option required.

* Intermediate and larger sizes available upon request for Type MA, Type MB, and Type MC series.

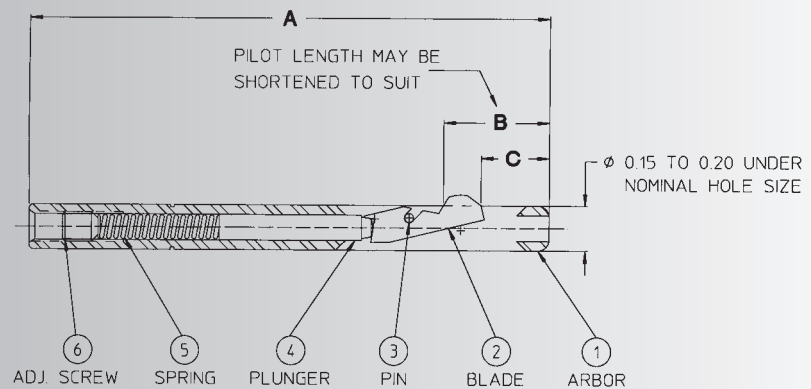
* Complete tool and spare blade numbers are beside the respective hole size. Please refer to page 30 for additional spare parts.

* Optional light duty (LD) spring available upon request when less tension is required for softer materials. Please contact Cogsdill for more information.

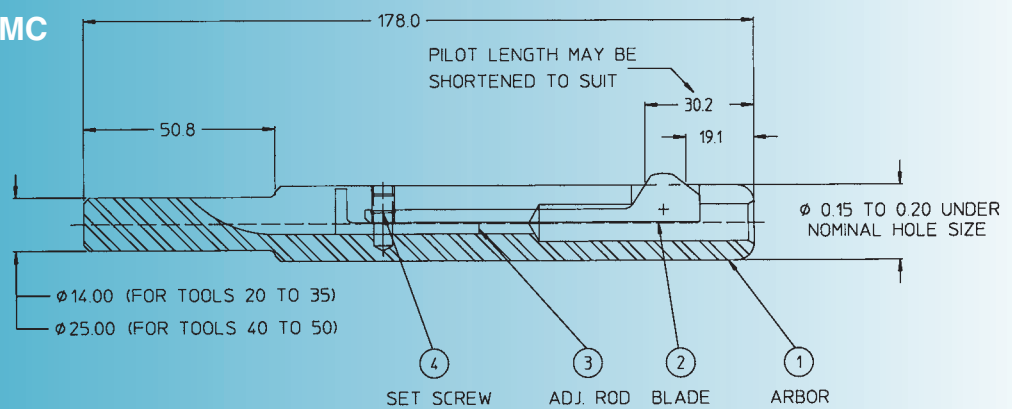
Type MA



Type MB



Type MC



Blade data

Three Blade Styles



Double-Acting (DA)
For deburring both front and back of holes



Back-Acting (BA)
For deburring back of hole only



Front-Acting (FA)
For deburring front of hole only

Speed / Feed Recommendations and Blade Rake Angle Options

MATERIAL	HSS BLADES / CP TOOLING		CARBIDE BLADES (0° ONLY)		BLADE STYLE RECOMMENDATION
	SFM	FEED (IPR)	SFM	FEED (IPR)	
Machine Steel	80-130	.005-.008	240-270	.005-.008	4° Positive Rake Blade (DAP, BAP, or FAP)
Tool Steel	40-50		60-120		
Steel Forgings					
Malleable Iron	80-90	.005-.008	80-180	.005-.008	
Monel Metal	30-50				
Stainless Steel	30-50	.005-.008	80-250	.005-.008	
Titanium	25-45				
Cast Iron	40-60	.005-.008	105-240	.008-.012	0° Neutral Rake Blade (DAZ, BAZ, or FAZ)
Aluminum	100-160		250-400		
Brass & Bronze	100-300	.005-.010	175-300	.006-.010	4° Negative Rake blade (DAN, BAN, or FAN)
Plastic / Nylatron					
Composites	Not Recommended		150-200	.001-.010	0° Neutral Rake (DAZ, BAZ, FAZ)

* All tools are assembled with Double-Acting Positive (DAP) blades unless otherwise specified

* Coated blades available upon request. Please contact Cogsdill for pricing and availability.

* For Carbide Blades 3MM & 1/8 series and above, specify "C" in place of the three letter blade style (DAP, etc):
Example: YA-DAP-1/8 carbide blade is coded "YA-C-1/8"

* Above noted speeds and feeds are basic guidelines and may vary per application

Feed / Speed Formulas:

Inches

$$\text{RPM} = (3.82 \times \text{SFM}) \div \text{Diameter}$$

$$\text{SFM} = 0.262 \times \text{Diameter} \times \text{RPM}$$

$$\text{IPM} = \text{IPR (feed)} \times \text{RPM (speed)}$$

Metric

$$\text{RPM} = (318 \times \text{M/min}) \div \text{Diameter}$$

$$\text{M/Min} = (\text{RPM} \times \text{Diameter}) \div 318$$

$$\text{Mm/Min} = \text{RPM} \times \text{Mm/Rev}$$

Blade Replacement: Type A / Type B Tooling

Blade replacement is performed with ease for tools from .118 (3.0mm) and larger. When the tension adjustment screw located at the end of the shank is loosened, the open ended slot allows the blade to slide out freely. The replacement blade can be installed and the adjustment screw retightened back to the desired spring tension.



Blade Replacement: Type C Tooling

For Type C tooling, loosen the tension adjustment screw located on the arbor OD and slide out both the blade and the tension adjustment rod. Replace in reverse order making sure the adjustment screw is seated securely in the notched area at the blade rear.



Blade Replacement: YA-00938, YA-01094 / MYA-2.0, MYA-2.3, & MYA-2.5 Tooling

Note: BURRAWAY™ blades for nominal tool sizes 3/32 & 7/64 (.093 & .109) in our inch program, and blades for 2.0, 2.3, & 2.5 mm tools in our metric program are designed with a pinhole for assembly instead of the slotted blade design. The open-ended slot is not feasible in this size range due to the small blade size. The blade can only be replaced by removing the pivot pin from the arbor, which can cause damage or breakage. We do not recommend blade replacement in these smallest tool sizes. We recommend that the entire arbor assembly be replaced, which consists of the blade, arbor, and plunger. Please refer to pages 29-30 for correct part number and arbor assemblies.



Tool adjustment & operating recommendations

Versatile and easy to use

The BURRAWAY® can be used on portable power tools and drill motors, drill presses, automatic equipment, CNC machines, or on virtually any type of shop equipment. No special operator skills are required.

Fast and easy adjustment

The amount of stock removed will vary with the hardness of the material. Adjust the set screw in the shank end of the tool to obtain the desired edge break. (Caution: Be careful not to over-adjust; if the spring is compressed to a solid condition, the blade will not be able to retract.)

If adjustment fails to produce the desired results, a different blade rake angle or a light-duty spring may be required. Please submit part prints for development of the most efficient tooling for the application.

Speeds and feeds

Refer to Speed and Feed chart on page 10.

Blade life and regrinding

BURRAWAY blades generally last about four to ten times longer than the drill used to make the hole. Due to the low cost of replacement blades, most of our customers prefer to replace worn blades with new ones.

However, the blades can be reground and reused. Blades can generally take from five to ten regrinds of .010 inch (0.25mm) each before they must be discarded. Regrind clearance angles as shown in Figure 1 below.

Tool maintenance

The BURRAWAY tool should be inspected periodically for chips, grit, and foreign particles in the slot from which the blade projects. Clean as necessary.

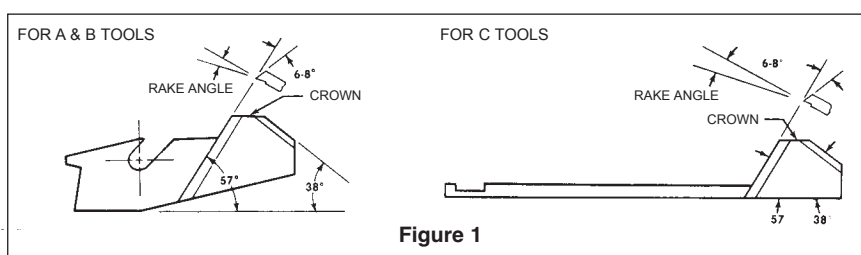


Figure 1

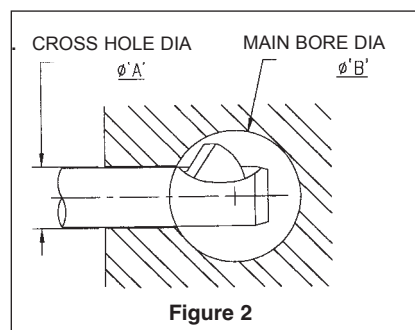


Figure 2

Cross-hole deburring

Burraway tools will tend to cut an elliptical chamfer when deburring a hole drilled through the wall of a larger hole (i.e., the amount of edge break will be inconsistent). If the ratio of the main bore diameter "B" to the cross-hole diameter "A" is less than 3/1 (refer to Figure 2), the Burraway is not recommended. If the ratio is 3/1 or greater, the standard Burraway tool should be tested and may provide satisfactory results. If not, consider using a tool with a special Burraway blade with a 45° angle, run at speeds of 40-100 RPM; contact our engineering department.

If the ratio is questionable, our Burr-Off tool may be considered (see page 12). While it will tend to cut a greater ellipse, it will also resist breakage on steep side walls. Neither the Burraway nor the Burr-Off is recommended for holes that do not intersect squarely or diametrically.

Burraway® Kit



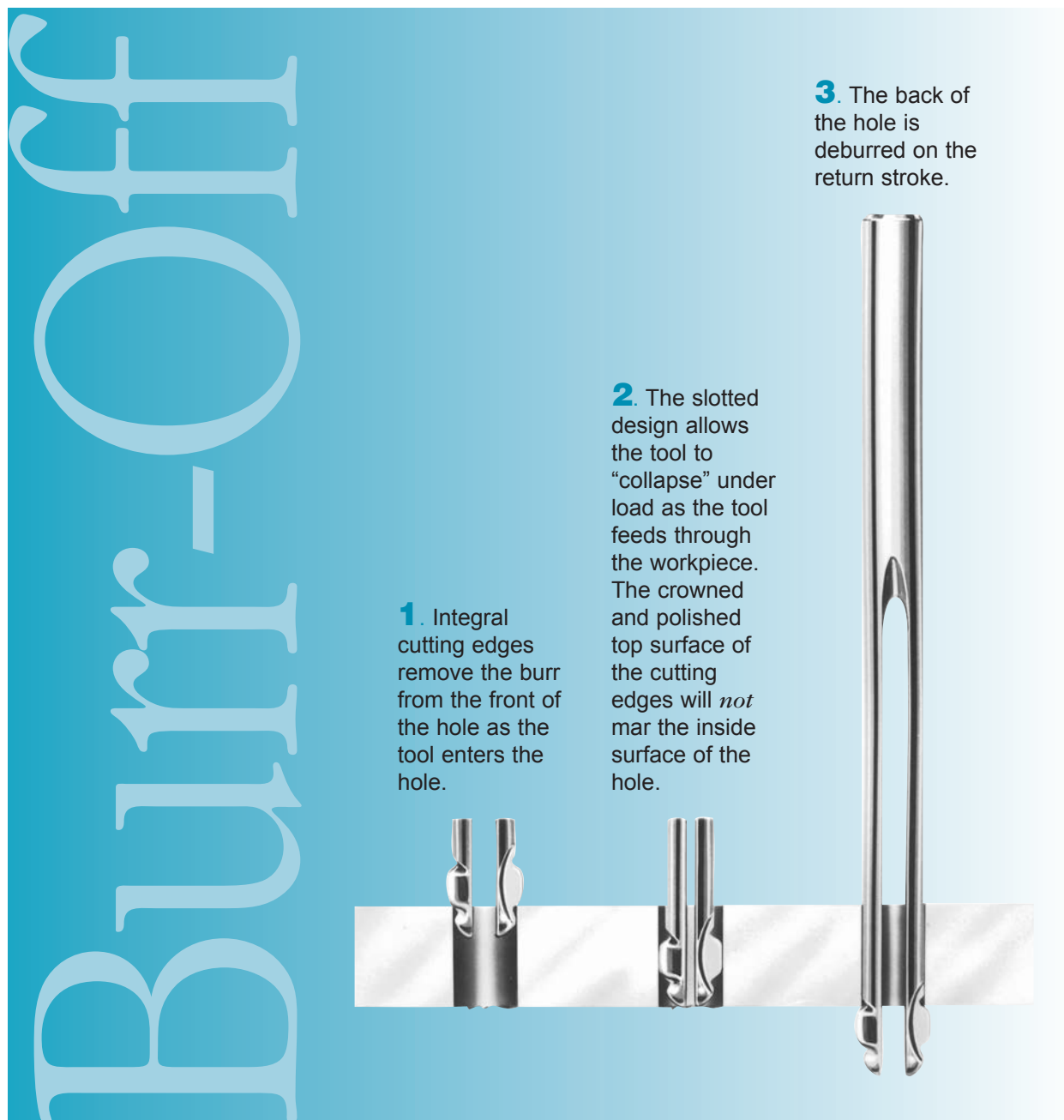
Our BURRAWAY® Kit contains five deburring tools in popular hole sizes:

- 1/8 in. • 5/32 in. • 3/16 in.
- 7/32 in. • 1/4 in.

A replacement blade for each tool is included. The kit is packaged in a durable box. The BURRAWAY Kit enables you to have on hand the solution to burr removal problems for hole sizes most frequently encountered.

PART #: BURRAWAY KIT

How it works



The BURR-OFF® operates on the same basic principle as the BURRAWAY®, but is designed for high-production, automated deburring operations. The open-slot design of the “clothespin tool” allows chips to clear easily, which makes the tool ideal for automatic equipment and multi-spindle machines.

Just like the BURRAWAY, the BURR-OFF deburrs the front, back, or both sides of holes in one fast pass.

Design features

The BURR-OFF® is a simple one-piece construction. The integral cutting edges can be altered upon request for front or back-cutting only.

Standard and special tool designs to suit your requirements

In addition to our standard BURR-OFF tools, custom tools are available upon request. Larger sizes, altered standards, and special designs can be supplied to suit your requirements.

Furnish a part print for a quotation, or inquire about our free trial and evaluation service.



CP-04 through CP-13, for hole sizes from .062 inch (1.57mm) through .219 inch (5.56mm), have a single cutting edge. CP-14 and larger tools feature two cutting edges.

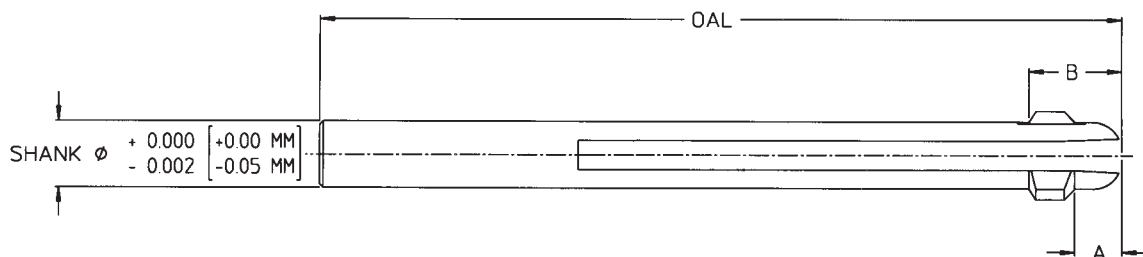
Standard tool specifications

Burr-Off®

TOOL NUMBER	RANGE OF HOLE SIZES		SHANK DIAMETER		OVERALL LENGTH		DIM. A		DIM. B	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
CP-04	.062-.078	1.57-1.98	.061	1.55	3.00	76.2	.08	2.11	.22	5.56
CP-05	.078-.094	1.98-2.39	.077	1.96	3.00	76.2	.08	2.11	.22	5.56
CP-06	.093-.109	2.36-2.77	.092	2.34	4.00	101.6	.09	2.36	.25	6.35
CP-07	.109-.125	2.77-3.17	.108	2.74	4.00	101.6	.09	2.36	.25	6.35
CP-08	.125-.140	3.17-3.55	.124	3.14	4.00	101.6	.13	3.30	.30	7.62
CP-09	.140-.156	3.55-3.96	.139	3.53	4.00	101.6	.13	3.30	.30	7.62
CP-10	.156-.172	3.96-4.36	.155	3.93	4.00	101.6	.13	3.30	.30	7.62
CP-11	.172-.187	4.36-4.74	.171	4.34	4.00	101.6	.13	3.30	.30	7.62
CP-12	.187-.203	4.74-5.15	.186	4.72	4.00	101.6	.13	3.30	.37	9.39
CP-13	.203-.219	5.15-5.56	.202	5.13	4.00	101.6	.13	3.30	.37	9.39
CP-14	.219-.234	5.56-5.94	.218	5.53	4.00	101.6	.25	6.35	.50	12.7
CP-15	.234-.250	5.94-6.35	.233	5.91	4.00	101.6	.25	6.35	.50	12.7
CP-16	.250-.266	6.35-6.75	.249	6.32	4.00	101.6	.25	6.35	.50	12.7
CP-17	.266-.281	6.75-7.13	.265	6.73	4.00	101.6	.25	6.35	.50	12.7
CP-18	.281-.297	7.13-7.54	.280	7.11	4.00	101.6	.25	6.35	.50	12.7
CP-19	.297-.313	7.54-7.95	.296	7.51	4.00	101.6	.29	7.36	.54	13.71
CP-20	.313-.328	7.95-8.33	.312	7.92	4.00	101.6	.29	7.36	.54	13.71
CP-21	.328-.343	8.33-8.71	.327	8.3	4.00	101.6	.29	7.36	.54	13.71
CP-22	.343-.359	8.71-9.11	.342	8.68	4.00	101.6	.29	7.36	.54	13.71
CP-23	.359-.375	9.11-9.52	.358	9.09	4.00	101.6	.29	7.36	.54	13.71
CP-24	.375-.390	9.52-9.9	.374	9.49	4.43	112.5	.32	8.12	.55	13.97
CP-25	.390-.406	9.9-10.31	.389	9.88	4.43	112.5	.32	8.12	.55	13.97
CP-26	.406-.422	10.31-10.71	.405	10.28	4.43	112.5	.32	8.12	.55	13.97
CP-27	.422-.437	10.71-11.09	.420	10.66	4.43	112.5	.32	8.12	.55	13.97
CP-28	.437-.453	11.09-11.5	.436	11.07	5.50	139.7	.35	8.89	.62	15.74
CP-29	.453-.468	11.5-11.88	.452	11.48	5.50	139.7	.35	8.89	.62	15.74
CP-30	.468-.484	11.88-12.29	.467	11.86	5.50	139.7	.35	8.89	.62	15.74
CP-31	.484-.500	12.29-12.7	.483	12.26	5.50	139.7	.35	8.89	.62	15.74
CP-32	.500-.515	12.7-13.08	.499	12.67	7.00	177.8	.38	9.65	.68	17.27
CP-33	.515-.531	13.08-13.48	.514	13.05	7.00	177.8	.38	9.65	.68	17.27
CP-34	.531-.547	13.48-13.89	.530	13.46	7.00	177.8	.38	9.65	.68	17.27
CP-35	.547-.563	13.89-14.3	.545	13.84	7.00	177.8	.38	9.65	.68	17.27
CP-36	.563-.578	14.3-14.68	.562	14.27	7.50	190.5	.42	10.66	.82	20.82
CP-37	.578-.594	14.68-15.08	.577	14.65	7.50	190.5	.42	10.66	.82	20.82
CP-38	.594-.609	15.08-15.46	.593	15.06	7.50	190.5	.42	10.66	.81	20.57
CP-39	.609-.625	15.46-15.87	.608	15.44	7.50	190.5	.42	10.66	.81	20.57
CP-40	.625-.641	15.87-16.28	.624	15.84	7.50	190.5	.45	11.43	.88	22.35

Tools for larger hole sizes up to 1.000 inch (25.4mm) are available; request quotation.

*CP-04 through CP-13 tools have a single deburring edge. CP-14 and above have two (2) deburring edges as shown below.



Tool adjustment & operating recommendations

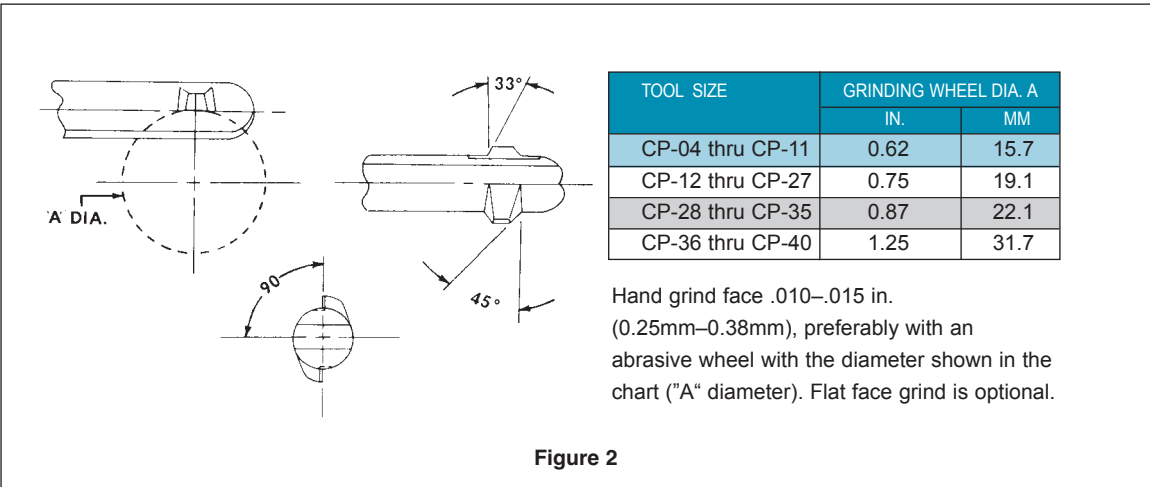
Speeds and feeds

Refer to Speed and Feed chart on page 10.

Tool maintenance and edge resharpener

The BURR-OFF should be inspected periodically for grit and foreign particles, and cleaned as necessary.

The cutting edges may be reground up to four times in order to extend tool life. Refer to Figure 2 below for the proper regrind procedure.

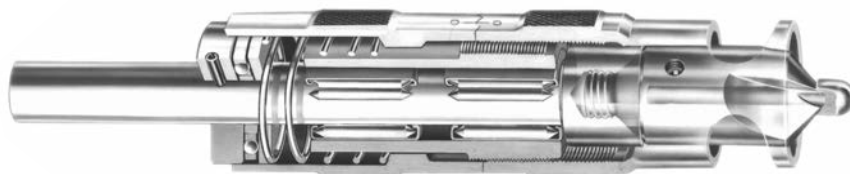


Design features

The Micro-Limit drive is designed and built for rugged production work. The thrust load is taken up on ball bearings through a hardened steel stop collar. The drive shaft rides on needle bearings. This design makes our drive the longest lasting in the industry.

Adjustment is in increments of .001 inch (.025mm).

Three drive models cover a wide range of hole sizes.



Countersinks & pilots

An array of interchangeable countersinks and pilots are available as standard (refer to tool specifications on page 18).

Countersinks are offered with three standard angles. Special angles and carbide-tipped countersinks are available upon request.

Pilots for hole sizes from .125 to .500 inch (3.17 to 12.7mm) are standard; intermediate sizes are available upon request.

Optional overtravel feature

The MICRO-LIMIT is also offered with an overtravel unit built into the standard drive.* Ideally suited to automatic applications, the overtravel feature compensates for variations in part thickness and for overtravel of the machine spindle up to .125 inch (3.17mm).

The MICRO-LIMIT with overtravel also simplifies set-up for applications on multiple spindles.

*Available only on ML-300 and ML-400 drives.

Custom designs available to suit your requirements

Altered standards and special designs are available upon request. Furnish a part print for a quotation.



MICRO-LIMIT drive with overtravel (ML-300-OT shown)

Standard tool specifications

Drives

TOOL NUMBER	"A"		"B"		"C"		"D"		"E"		"F"	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
ML-200	.187	4.75	.92	23.36	3.87	98.29	.62	15.74	.47	11.93	.62	15.74
ML-300	.312	7.92	1.04	26.41	4.25	107.95	.84	21.33	.62	15.74	.75	19.05
ML-300-OT*	.500	12.7	1.50	38.1	6.50	165.1	.84	21.33	.62	15.74	.75	19.05
ML-400	.312	7.92	1.04	26.41	4.81	122.17	.84	21.33	1.03	26.16	1.18	29.97
ML-400-OT*	.500	12.7	1.50	38.1	7.25	184.15	.84	21.33	1.03	26.16	1.18	29.97

*With overtravel.

Countersinks { When ordering, use ML, the series number, and the included angle.
Ex: ML-20-082 for a 20 series countersink with an 82° included angle.

TOOL NUMBER	SERIES	STANDARD ANGLES*	"A"		"B"		"C"	
			in		mm		in	
ML-200	20	82°	5/16-32		.390		.125	
ML-300 & ML-300-OT	30	90°	1/4-28		.500		.125	
ML-400 & ML-400-OT	40	100°	7/16-20		.875		.218	

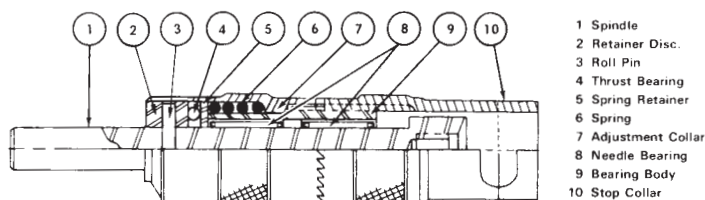
*Standard angles shown are available for each series; other angles are available upon request.
Carbide-tipped countersinks are also available upon request.

Pilots { When ordering, use ML, the series number, and the hole diameter to be piloted.
Ex: ML-3-0125 for a 3 series pilot for a .125 diameter hole.

TOOL NUMBER	SERIES	STANDARD PILOT HOLE SIZES (IN.)	"A"	
			in	mm
ML-200 ML-300 ML-300-OT	3	.125	.093	2.36
		.128		
		.156		
		.161		
		.187		
		.250		
ML-400 ML-400-OT	4	.312	.187	4.74
		.250		
		.375		
		.500		

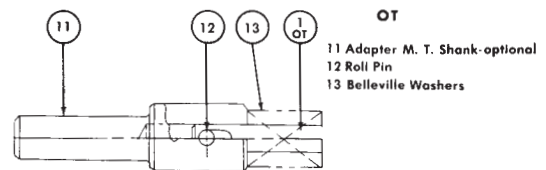
Available in intermediate diameters.

Standard Drive Details

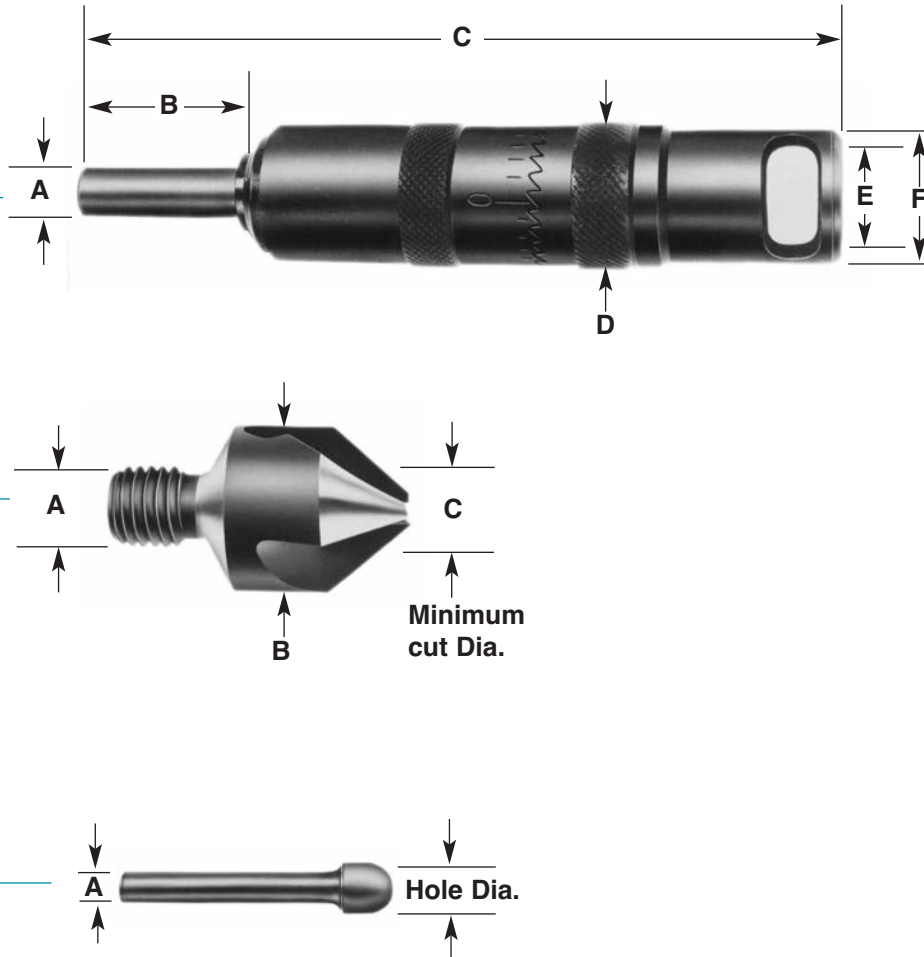


- 1 Spindle
- 2 Retainer Disc.
- 3 Roll Pin
- 4 Thrust Bearing
- 5 Spring Retainer
- 6 Spring
- 7 Adjustment Collar
- 8 Needle Bearing
- 9 Bearing Body
- 10 Stop Collar

Overtravel



- 11 Adapter M. T. Shank (optional)
- 12 Roll Pin
- 13 Belleville Washers



Tool adjustment & operating recommendations

Versatile, easy to use

Use the MICRO-LIMIT on virtually any type of shop equipment. No special operator skills are required.

Quick and easy adjustment

Adjustments are made by hand-indexing the castellated adjustment collar to control the depth of cut. Adjustment is in increments of .001 inch (.025mm).

Speeds and feeds

Use approximately the same speed and feed rate as with a standard HSS drill. However, the greater the depth of cut, the slower the speed required to avoid chatter.

Tool maintenance

For long tool life, the MICRO-LIMIT should be kept free of grit, chips,

and foreign matter.

The countersink should be replaced when the cutting edges become dull. Loosen the set screw in the side of the countersink to remove the pilot. Unscrew the countersink to remove it from the drive spindle, and replace with a new one.

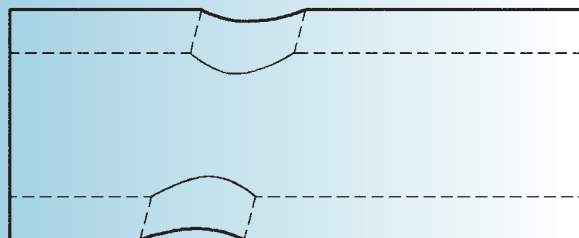
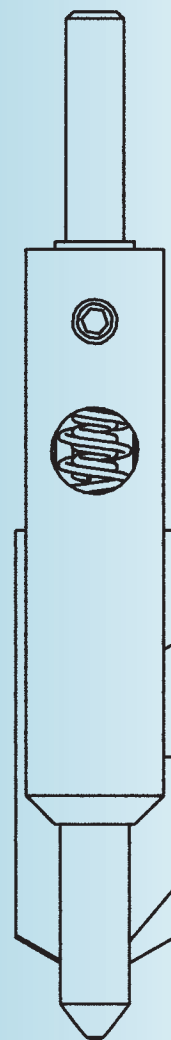
How it works

The ELLIPTI-BUR® is designed for deburring irregular hole surfaces, such as those which are generated by drilling into curved surfaces, or by drilling at an angle. The ELLIPTI-BUR enables the user to perform these difficult deburring operations quickly and accurately, and without jigs, fixtures, or special operator skills.

As the pilot of the tool is located in the hole, the tool is seated and centered. As the tool is advanced, the pilot is forced into the tool body against the shank spring, and the blade comes into contact with the edge of the hole. As the tool continues to advance, the pilot is further pressed into the body and the blade is driven into the workpiece.

The blade remains free to react to the irregular surface geometry of the hole, allowing for both radial and axial displacement- radial displacement resulting from the elliptical shape of angularly-drilled holes, and axial displacement ("rise and fall") from the saddle-shaped configuration of holes drilled in cylindrical surfaces.

This automatic self-guiding feature produces a relatively uniform break on the edge of the hole.



Design features

The ELLIPTI-BUR features a spring-loaded and self-centering conical pilot to locate and seat the tool for consistent results. All essential tool parts are hardened and ground for durability.

Three models cover a range of hole sizes from 5/32 to one inch (3.96 to 25.4mm).

The blade, which has two diametrically opposed cutting edges, is made from hardened high-speed steel and finish ground. A supplemental surface treatment provides for increased wear resistance.



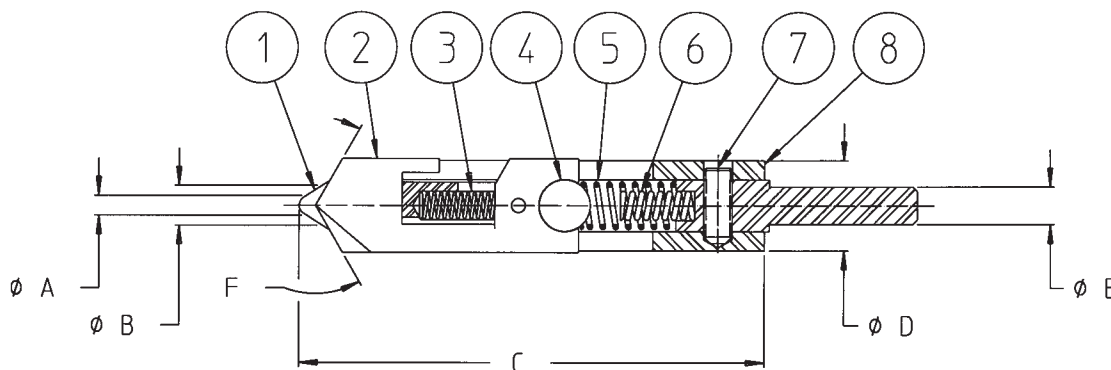
Standard tool specifications

Ellipti-Bur®

TOOL NO.	OPERATING RANGE				"C" LENGTH		"D" BODY		"E" SHANK		"F" DEGREE
	"A" (min.)		"B" (max.)								
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	
EL-5 (0130000)	.156	3.96	.312	7.93	3.125	79.37	.625	15.87	.250	6.35	120°
*EL-5XT (0130050)	.156	3.96	.312	7.93	3.125	79.37	.625	15.87	.250	6.35	120°
EL-8 (0135000)	.250	6.35	.500	12.7	3.250	82.55	.750	19.05	.250	6.35	120°
EL-16 (0140000)	.375	9.52	1.000	25.4	4.750	120.65	1.000	25.4	.500	12.7	120°

*Blades for the EL-5XT are made from a premium grade high speed steel and recommended for applications where longer tool life is desired, such as when coolant is unavailable.

Note: Operating range is determined by pilot diameter, not by cutter width.



Ellipti-Bur® Spare Parts

PART DESCRIPTION	EL-5	EL5-XT	EL-8	EL-16
1) Pilot	0131000		0135300	0140400
2) Cutter Blade	0130300	0130350	0130300	0140200
3) Pilot Spring	0130400			0140500
4) Pivot Ball	0130001			0140003
5) Cutter Spring	0130601			0140300
6) Shank-Spring Assembly	0130900			0140100
7) Set Screw	0130002			0140001
8) Body	0130100		0135400	0140100

Note: The EL-16 tool has a single piece design for the shank and body

Tool adjustment & operating recommendations

Versatile, fast, safe, and easy

ELLIPTI-BUR® tools can be used on portable power tools and drill motors, drill presses, automatic equipment, CNC machines, or on virtually any type of shop equipment.

The tool is fast, safe, and easy to handle. The pilot engages the hole. The blade, *not* the tool body, reacts to accommodate the irregular hole geometry.

Speeds and feeds

The most desirable speed for a particular application can best be determined by trial. Spindle speeds must be relatively slow to enable the blade to accommodate a continuously changing path in the course of each revolution.

The speed recommendations below will serve as a guideline:

- Speeds up to 600 RPM are generally recommended where the following conditions exist:
 - (1) Where holes are drilled into a flat surface at an angle not exceeding 15°.
 - (2) Where holes are drilled into a cylindrical part with a diameter which is 6 or more times *greater* than the hole size.
- Speeds of 100-300 RPM may be required where more difficult conditions exist, such as:
 - (1) Holes drilled at a severe angle.
 - (2) Holes drilled into a cylindrical part where the diameter is *less* than 6 times the hole size.

Feeds are not a critical issue with the ELLIPTI-BUR. Only a light

contact pressure is required to deburr and produce a small edge break. The amount of stock removal is determined by the pressure applied and the dwell time.

Application considerations

A proper drilling technique is necessary in order to maximize the effectiveness of the ELLIPTI-BUR. The following guidelines will help you *avoid creating an excessive burr*:

- Drill points should have a 130-150° included angle, rather than the conventional 118°.
- Slow-spiral drills generally allow better breakthrough than fast-spiral drills.
- A uniformly controlled feed rate (preferably power feed) is required in order to prevent an accelerated advance of the drill at the point of breakthrough.
- The workpiece should be held securely.

Application restrictions

The ELLIPTI-BUR is generally *not* recommended for:

- Extremely soft, ductile metals.
- Applications where the diameter of a cylindrical part having a cross-drilled hole is *less* than 2-1/2 times the diameter of the drilled hole. (Note: The softer and more ductile the material, the more this limitation applies.)

Blade replacement and regrinding

The ELLIPTI-BUR blade can be easily replaced by following this procedure (refer to the details drawing on page 22):

- 1.Remove Detail 7 Retaining Screw. (*Note*: Tool is spring-loaded.)
- 2.Remove Det. 6 Shank Spring Assembly.
- 3.Remove Det. 3 Blade Spring.
- 4.Remove Det. 4 Chrome Steel Retaining Ball.
- 5.Slide Det. 1 Pilot and Det. 2 Blade from Det. 8 Tool Body.
- 6.Remove Pilot from Blade. (*Note*: spring-loaded.)
- 7.Replace Blade.
- 8.Reassemble in reverse order. (*Important*: Blade must be inserted in tool body so that it can float freely.)

Replacement blades are inexpensive; however, the blades can be reground in the user's shop. Please refer to Figure 3 for proper regrind procedure.

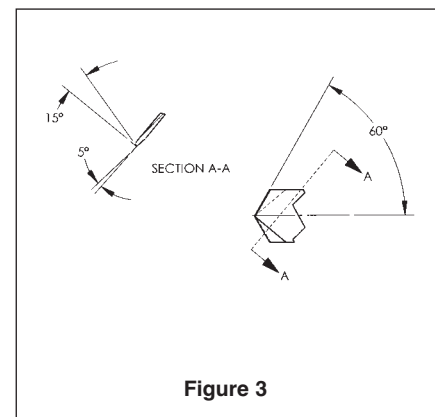


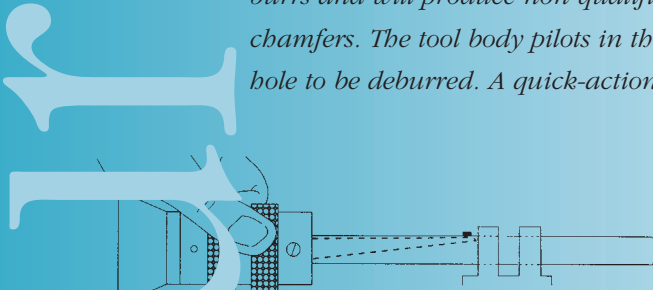
Figure 3

How it works

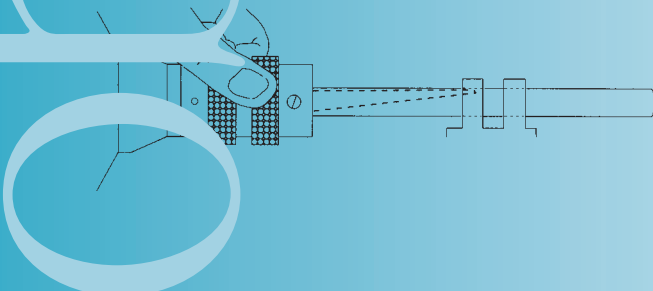
The NOBUR[®] Tool is a manually actuated deburring and chamfering tool for use where production requirements are low. The tool is used on multi-walled parts and on intersecting holes. It will remove severe burrs and will produce non-qualified chamfers. The tool body pilots in the hole to be deburred. A quick-action

sliding sleeve extends the retractable, double-edged cutting blade to deburr or chamfer the front, back, or both sides of holes, in one pass of the tool.

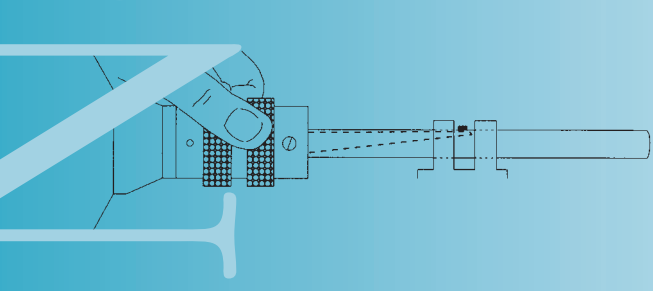
Since the tool is manually actuated while the spindle continues to run, there is no "on-off" down time.



- 1.** The tool should be running in a spindle with the cutting blade in the extended position. The tool is fed into the workpiece. The burr on the outer edge of the first wall is quickly and easily removed.



- 2.** The sliding sleeve is moved backwards to retract the blade. The workpiece is advanced to such a position that, when the blade is again extended by a forward movement of the sleeve, it will lie between the two walls. The burr on the inner edge of the first wall is then easily removed.



- 3.** Continued advancement of the tool allows the inner edge of the second wall to be deburred. The sleeve is moved backwards once again to retract the blade so that it can pass through the hole in the second wall. The blade is again extended to deburr the outer edge of the second wall.

The above steps can be repeated as many times as necessary, depending upon the number of walls in the part. Work is performed continuously, without having to stop the spindle.

Design features

The NOBUR Tool has a free-rolling knurled sleeve, mounted on ball bearings, which allows for fast and easy manual retraction and extension of the blade. The pilot is chrome-plated for long tool life.

Standard sizes range from 3/32 to one inch (2.38 to 25.4mm). Work lengths range from 9/16 to 4-3/4 inch (14.28 to 120.65mm).



Blade options for intersecting holes

Three different blade options are available for intersecting hole applications. Blade selection is based upon the ratio of the diameters of the two holes (refer to page 27).

Special designs available

Custom tools – including altered standards and special sizes and designs – are available upon request. Please furnish a part print and request a quotation.

Standard tool specifications

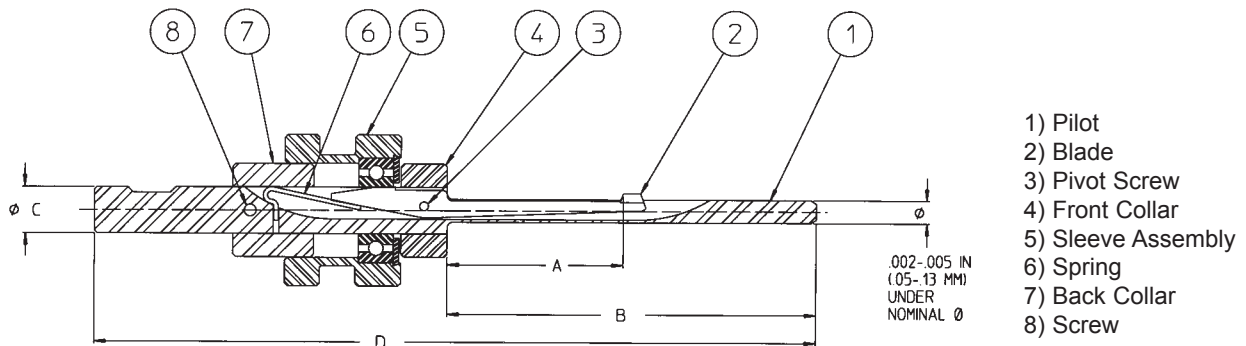
Nobur® Tool

WITH STANDARD CUTTER		WITH MODIFIED CUTTER-1*		WITH MODIFIED CUTTER-2**		Hole Size		"A" Working Depth		"B" Pilot Length		"C" Shank Diameter		"D" Overall	
Tool #	Chamfer Angle	Tool#	Chamfer Angle	Tool #	Chamfer Angle	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
DS 3/32 (0030014)	45°	DS 3/32-1	45°	N/A	N/A	.093	2.38	.56	14.28	2.43	61.91	.375	9.52	6.12	155.57
DS 1/8 (0030018)	20°	DS 1/8-1	45°	DS 1/8-2	45°	.125	3.17	1.50	38.1	2.40	79.37	.375	9.52	6.81	173.03
DS 5/32 (0030022)	20°	DS 5/32-1	45°	DS 5/32-2	45°	.156	3.97	1.50	38.1	2.40	79.37	.375	9.52	6.81	173.03
DS 3/16 (0030026)	20°	DS 3/16-1	45°	DS 3/16-2	45°	.187	4.76	1.50	38.1	2.40	79.37	.375	9.52	6.81	173.03
DS #10 (0030010)	20°	DS #10-1	45°	DS #10-2	45°	.193	4.91	1.50	38.1	2.40	79.37	.375	9.52	6.81	173.03
AS 3/16 (0010026)	20°	AS 3/16-1	45°	AS 3/16-2	45°	.187	4.76	1.75	44.45	4.00	101.6	.500	12.7	7.81	198.43
AS #10 (0010010)	20°	AS #10-1	45°	AS #10-2	45°	.193	4.91	1.75	44.45	4.00	101.6	.500	12.7	7.81	198.43
AS 7/32 (0010030)	20°	AS 7/32-1	45°	AS 7/32-2	45°	.218	5.55	1.75	44.45	4.00	101.6	.500	12.7	7.81	198.43
AS 1/4 (0010034)	20°	AS 1/4-1	45°	AS 1/4-2	45°	.250	6.35	1.75	44.45	4.00	101.6	.500	12.7	7.81	198.43
AS 9/32 (0010038)	20°	AS 9/32-1	45°	AS 9/32-2	45°	.281	7.14	1.75	44.45	4.00	101.6	.500	12.7	7.81	198.43
AS 5/16 (0010042)	20°	AS 5/16-1	45°	AS 5/16-2	45°	.312	7.94	1.75	44.45	4.00	101.6	.500	12.7	7.81	198.43
AS 11/32 (0010046)	20°	AS 11/32-1	45°	AS 11/32-2	45°	.343	8.73	1.75	44.45	4.00	101.6	.500	12.7	7.81	198.43
AS 3/8 (0010050)	30°	AS 3/8-1	45°	AS 3/8-2	45°	.375	9.52	2.75	69.85	6.00	152.4	.500	12.7	9.81	249.23
AS 13/32 (0010054)	30°	AS 13/32-1	45°	AS 13/32-2	45°	.406	10.31	2.75	69.85	6.00	152.4	.500	12.7	9.81	249.23
AS 7/16 (0010058)	30°	AS 7/16-1	45°	AS 7/16-2	45°	.437	11.11	2.75	69.85	6.00	152.4	.500	12.7	9.81	249.23
AS 15/32 (0010062)	30°	AS 15/32-1	45°	AS 15/32-2	45°	.468	11.9	2.75	69.85	6.00	152.4	.500	12.7	9.81	249.23
AS 1/2 (0010066)	30°	AS 1/2-1	45°	AS 1/2-2	45°	.500	12.7	2.75	69.85	6.00	152.4	.500	12.7	9.81	249.23
AS 9/16 (0010070)	30°	AS 9/16-1	45°	AS 9/16-2	45°	.562	14.28	3.75	95.25	8.00	203.2	.500	12.7	11.81	300.03
AS 5/8 (0010074)	30°	AS 5/8-1	45°	AS 5/8-2	45°	.625	15.87	3.75	95.25	8.00	203.2	.500	12.7	11.81	300.03
AS 11/16 (0010078)	30°	AS 11/16-1	45°	AS 11/16-2	45°	.687	17.46	3.75	95.25	8.00	203.2	.500	12.7	11.81	300.03
AS 3/4 (0010082)	30°	AS 3/4-1	45°	AS 3/4-2	45°	.750	19.05	3.75	95.25	8.00	203.2	.500	12.7	11.81	300.03
CS 13/16 (0020086)	30°	CS 13/16-1	45°	CS 13/16-2	45°	.812	20.63	4.75	120.65	10.00	254	.625	15.87	14.37	365.12
CS 7/8 (0020090)	30°	CS 7/8-1	45°	CS 7/8-2	45°	.875	22.22	4.75	120.65	10.00	254	.625	15.87	14.37	365.12
CS 15/16 (0020094)	30°	CS 15/16-1	45°	CS 15/16-2	45°	.937	23.81	4.75	120.65	10.00	254	.625	15.87	14.37	365.12
CS 1 (0020097)	30°	CS 1-1	45°	CS 1-2	45°	1.000	25.4	4.75	120.65	10.00	254	.625	15.87	14.37	365.12

Note: The DS 3/16 and DS #10 sizes are offered in the "AS" series for light duty applications. The "DS" tool offers more rigid blade support than the comparable "AS" tool and is recommended for applications in steel and for heavy burr removal.

*Used when larger hole is between 6 and 12 diameters larger than smaller hole. Please contact Cogsdill for complete tool and spare part numbers.

**Used when larger hole is between 2-3/4 to 6 diameters greater than smaller hole. Please contact Cogsdill for complete tool and spare part numbers. See Figure 4 on page 27 for reference.



Blade data

Blades for NOBUR® Tools are manufactured from hardened and precision ground high-speed steel. Three styles are available: standard, and two modified designs (see below for application parameters). For applications other than intersecting holes, the standard blade is used.

Blades for intersecting hole applications

Intersecting holes can sometimes create problems when using the NOBUR Tool with the standard blade. The following guidelines apply:

Standard blades may be used for intersecting hole applications where the larger hole “B” is 12 or more times *greater* than the smaller hole “A” (refer to Figure 4).

Modified standard blades are available from stock for intersecting hole applications where the following conditions exist:

- **Modified blade No. 1** is recommended for intersecting holes where the diameter of the larger hole “B” is between 6 to 12 times *greater* than the smaller hole “A.”
- **Modified blade No. 2** is recommended for intersecting holes where the larger hole “B” is 2-3/4 to 6 times *greater* than the smaller hole “A.” (Operating speeds from 25-75 RPM are also recommended for applications within this range of intersecting hole diameter ratios.)

Note: The NOBUR Tool is **not** recommended for lower ratios of diameter or for holes which do not intersect squarely.

Nobur® Spare Pilots and Cutters

TOOL #	CUTTER #	PILOT #
DS 3/32 (0030014)	0030601	0031800
DS 1/8 (0030018)	0030602	0030101
DS 5/32 (0030022)	0030603	0030102
DS 3/16 (0030026)	0030604	0030103
DS #10 (0030010)		0030104
AS 3/16 (0010026)	0011401	0010101
AS #10 (0010010)		0010102
AS 7/32 (0010030)	0011403	0010103
AS 1/4 (0010034)	0011502	0010201
AS 9/32 (0010038)	0011503	0010202
AS 5/16 (0010042)	0011504	0010203
AS 11/32 (0010046)		0010204
AS 3/8 (0010050)	0011601	0010301
AS 13/32 (0010054)	0011602	0010302
AS 7/16 (0010058)	0011603	0010303
AS 15/32 (0010062)	0011604	0010304
AS 1/2 (0010066)	0011605	0010305
AS 9/16 (0010070)	0011702	0010502
AS 5/8 (0010074)	0011703	0010504
AS 11/16 (0010078)	0011704	0010602
AS 3/4 (0010082)	0011705	0010604
CS 13/16 (0020086)	0020602	0020102
CS 7/8 (0020090)		0020104
CS 15/16 (0020094)	0020604	0020106
CS 1 (0020097)		0020108

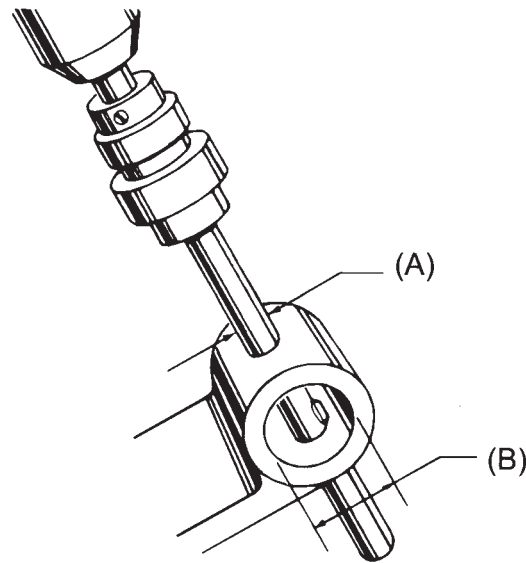


Figure 4

Tool operating recommendations

Tool operation

NOBUR® Tools can be run on a drill press, lathe, or any rotating spindle.

Material types

NOBUR Tools can be applied on steel, stainless steel, brass, bronze, aluminum, or virtually any ferrous or non-ferrous materials.

Speeds

Low operating speeds are recommended for the NOBUR Tool. A range of 50 to 650 RPM is suggested, with slower speeds required for larger tool sizes and heavy parts.

High spindle speeds will not result in faster production, since only three or four revolutions of the tool are required to remove the burr. High spindle speeds are likely to dull the blade edge, create excessive wear on the pilot shaft, or cause chatter. The part should be supported as necessary.

Blade replacement and regrounding

The NOBUR Tool blade can be easily replaced by following this procedure (refer to the schematic drawing on page 26):

For tool numbers #DS 1/8 to #DS 10:

- Remove the back collar.
- Slide the knurled sleeve back to where it just drops free onto the smaller shank diameter.
- Restrict further movement of the blade at this point, and complete the removal of the sleeve.
- Lift the blade out and replace.

For tool numbers #AS 3/16 to #AS 1/2:

- Slide the knurled sleeve against the back collar so that the blade is retracted within the pilot shaft.
- Remove the pivot screw. This frees the front collar and permits the blade to be lifted out.
- Replace the blade. To re-assemble, the cam edge of the blade must be inserted so as to depress the end of the spring which extends beyond the sleeve.
- Align the front collar and replace the pivot screw. A zero (0) mark is stamped on the front collar of tools #AS 5/16 and smaller to indicate that it is to be positioned in line with the slot on the pilot shaft.

For tool numbers #AS 9/16 to #AS 3/4:

- Remove the screw from the back collar. Remove the back collar and sleeve. Remove the pivot screw from the front collar and lift the blade out for replacement.
- To re-assemble, replace parts in reverse order. Insert the blade first in such a manner that the spring is depressed.

For tool numbers, #CS 13/16 to #CS 1:

- Slide the knurled sleeve against the back collar. Remove the pivot screw and lift the blade out and replace.
- To re-assemble, the cam edge of the blade must be inserted in such a manner as to depress the end of the spring which extends beyond the sleeve.

Replacement blades for NOBUR Tools are inexpensive; however, blades may be reground in the user's shop. The blade must be kept

sharp, since a dull blade takes longer to cut and the operator will tend to apply excessive pressure against the work. Refer to Figure 5 for proper regrind procedure.

Short front pilot

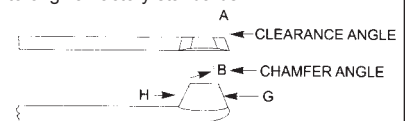
It may be necessary to shorten the front pilot to accommodate blind holes or obstructions. The pilot should be cut off beyond the slot from which the blade projects.

Tool maintenance

Inspect the tool periodically for chips and foreign particles in the slot of the pilot shaft. Clean as necessary.

A few drops of lubricating oil applied between the sliding sleeve and the back collar will extend the life of the bearing.

Resharpener of the cutting blade is accomplished by grinding the faces "G" and "H". The following table is offered as a guide to original factory standards.



TOOL SIZES (Inclusive Range)	ANGLE A	ANGLE B
DS 3/32	6-1/2°	45°
DS 1/8 - DS#10	6-1/2°	20°
AS 3/16 - AS 11/32	6-1/2°	20°
AS 3/8 - AS 1/2	6-1/2°	30°
AS 9/16 - AS 3/4	5°	30°
CS 13/16 - CS 1	Primary 3° Secondary 5°	30°

Figure 5

Spare parts

Inch program

Type A (Inches)

HOLE SIZE	ARBOR #	ARBOR ASSEMBLY#	PLUNGER #	SPRING #	ADAPTER #
3/32	YA-00938-D01	YA-00938-ARB	YA-01250-D04	YA-1-D05	*Complete with adj and lock screws*
7/64	YA-01094-D01	YA-01094-ARB			YA-AA
1/8	YA-01250-D01	YA-01250-ARB			
9/64	YA-01406-D01	YA-01406-ARB			
5/32	YA-01562-D01	YA-01562-ARB			
11/64	YA-01719-D01	YA-01719-ARB			
3/16	YA-01875-D01	YA-01875-ARB			
13/64	YA-02031-D01	YA-02031-ARB	YA-01875-D04		

Type B (Inches)

HOLE SIZE	ARBOR #	PLUNGER #	SPRING #	ADJ SCREW #
7/32	YB-02188-D01	YB-02188-D04	YB-1-D05	YB-1-D06
15/64	YB-02344-D01	YB-02344-D04		
1/4	YB-02500-D01	YB-02500-D04		
17/64	YB-02656-D01			
9/32	YB-02812-D01			
19/64	YB-02969-D01	YB-03125-D04	YB-2-D05	YB-2-D06
5/16	YB-03125-D01	YB-03438-D04		
21/64	YB-03821-D01			
11/32	YB-03438-D01			
23/64	YB-03594-D01	YB-03750-D04	YB-3-D05	YB-3-D06
3/8	YB-03750-D01	YB-04062-D04		
25/64	YB-03906-D01			
13/32	YB-04062-D01			
27/64	YB-04219-D01	YB-04375-D04	YB-4-D05	YB-4-D06
7/16	YB-04375-D01	YB-04688-D04		
29/64	YB-04531-D01			
15/32	YB-04688-D01	YB-05000-D04		
31/64	YB-04844-D01			
1/2	YB-05000-D01	YB-05312-D04		
33/64	YB-05156-D01	YB-05625-D04		
17/32	YB-05312-D01			
35/64	YB-05469-D01	YB-05938-D04	YB-5-D05	YB-5-D06
9/16	YB-05625-D01	YB-06250-D04		
37/64	YB-05781-D01			
19/32	YB-05938-D01			
39/64	YB-06094-D01	YB-06562-D04		
5/8	YB-06250-D01			
41/64	YB-06406-D01	YB-06785-D04		
21/32	YB-06562-D-1			
43/64	YB-06719-D01			
11/16	YB-06875-D01	YB-07500-D04	YB-7-D05	YB-7-D05
3/4	YB-07500-D01	YB-08750-D04		
7/8	YB-08750-D01	YB-10000-D04		
1.00	YB-10000-D01	YB-10000-D04	YB-7-D05	YB-7-D05

Type C (Inches)

HOLE SIZE	ARBOR #	ADJ ROD #	ADJ SCREW #
3/4	YC-07500-D01	YC-110-D03	YC-110-D04
13/16	YC-08125-D01		
7/8	YC-08750-D01		
15/16	YC-09375-D01		
1.00	YC-10000-D01		
1-1/16	YC-10625-D01		
1-1/8	YC-11250-D01		
1-3/16	YC-11875-D01		
1-1/4	YC-12500-D01		
1-5/16	YC-13125-D01		
1-3/8	YC-13750-D01		
1-1/2	YC-15000-D01		
1-5/8	YC-16250-D01		
1-3/4	YC-17500-D01		
1-7/8	YC-18750-D01		
2.00	YC-20000-D01		

Spare parts

Metric program

Type MA (Metric)

HOLE SIZE	ARBOR #	ARBOR ASSEMBLY#	PLUNGER #	SPRING #	ADAPTER #
2.0	MYA-2.0-D01	MYA-2.0-ARB	YA-01250-D04	YA-1-D05	*Complete with adj and lock screws* MYA-AA
2.3	MYA-2.3-D01	MYA-2.3-ARB			
2.5	MYA-2.5-D01	MYA-2.5-ARB			
3.0	MYA-3.0-D01	MYA-3.0-ARB			
3.5	MYA-3.5-D01	MYA-3.5-ARB			
4.0	MYA-4.0-D01	MYA-4.0-ARB	YA-01875-D04		
4.5	MYA-4.5-D01	MYA-4.5-ARB			
5.0	MYA-5.0-D01	MYA-5.0-ARB			

Type MB (Metric)

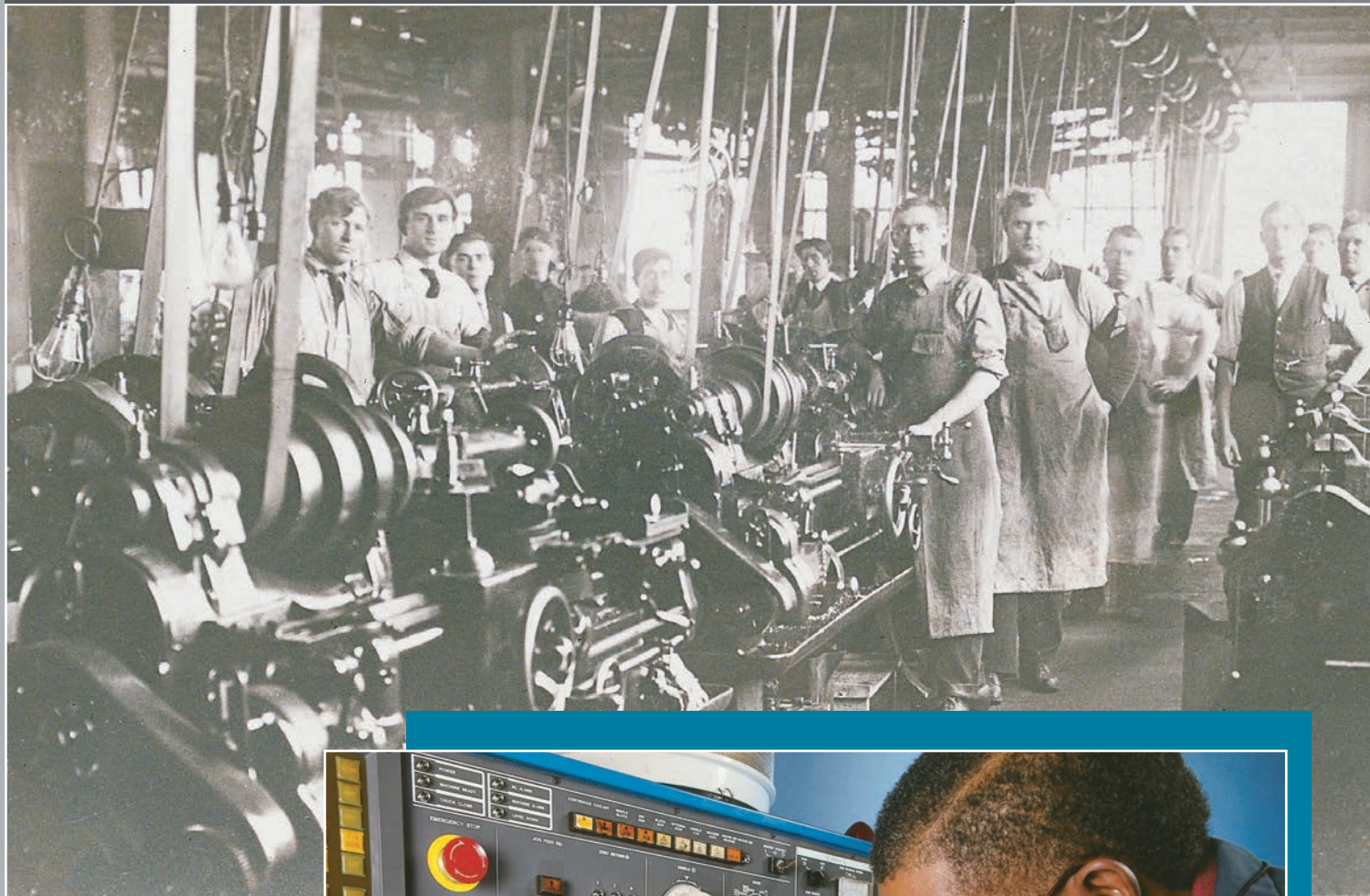
HOLE SIZE	ARBOR #	PLUNGER #	SPRING #	ADJ SCREW #
5.5	MYB-5.5-D01	YB-02188-D04	YB-1-D05	MYB-1-D06
6.0	MYB-6.0-D01	YB-02344-D04		
6.5	MYB-6.5-D01	YB-02500-D04		
7.0	MYB-7.0-D01			
7.5	MYB-7.5-D01	YB-03125-D04	YB-2-D05	MYB-2-D06
8.0	MYB-8.0-D01			
8.5	MYB-8.5-D01	YB-03438-D04		
9.0	MYB-9.0-D01	YB-03750-D04	YB-3-D05	MYB-3-D06
9.5	MYB-9.5-D01			
10.0	MYB-10.0-D01	YB-04062-D04		
10.5	MYB-10.5-D01	YB-04375-D04	YB-4-D05	MYB-4-D06
11.0	MYB-11.0-D01			
11.5	MYB-11.5-D01	YB-04688-D04		
12.0	MYB-12.0-D01			
12.5	MYB-12.5-D01	YB-05000-D04		
13.0	MYB-13.0-D01	YB-05312-D04		
13.5	MYB-13.5-D01			
14.0	MYB-14.0-D01	YB-05625-D04	YB-5-D05	MYB-5-D06
14.5	MYB-14.5-D01	YB-05938-D04		
15.0	MYB-15.0-D01			
15.5	MYB-15.5-D01	YB-06250-D04		
16.0	MYB-16.0-D01	YB-06562-D04		
16.5	MYB-16.5-D01			
17.0	MYB-17.0-D01	YB-06875-D04		
17.5	MYB-17.5-D01	YB-07500-D04		
18.0	MYB-18.0-D01			
18.5	MYB-18.5-D01			
19.0	MYB-19.0-D01			

Type MC (Metric)

HOLE SIZE	ARBOR #	ADJ ROD #	ADJ SCREW #
20.0	MYC-20.0-D01	YC-110-D03	MYC-110-D04
25.0	MYC-25.0-D01		
30.0	MYC-30.0-D01		
35.0	MYC-35.0-D01		
40.0	MYC-40.0-D01		
45.0	MYC-45.0-D01		
50.0	MYC-50.0-D01		

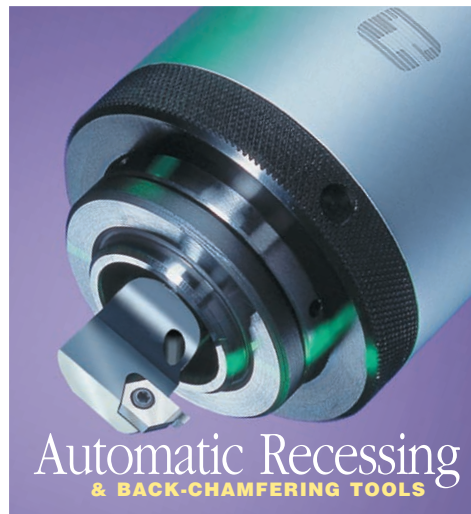
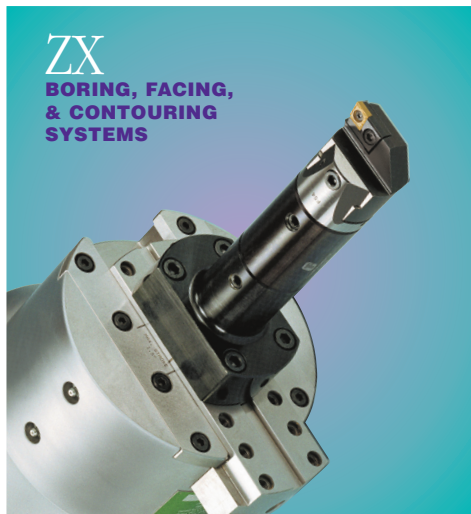
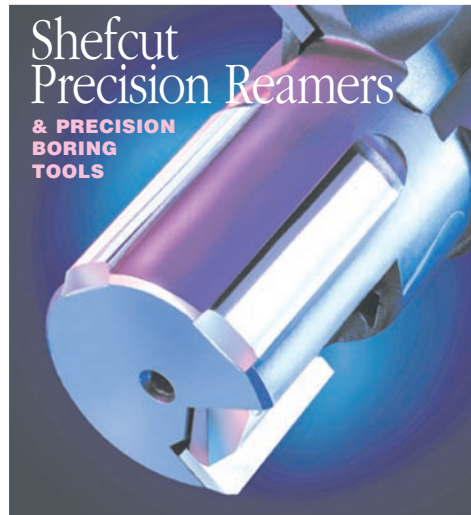
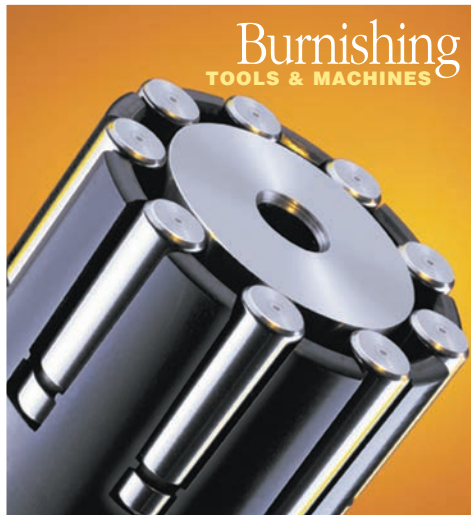
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