PRECISION METAL FINISHING



www.MonaghanTooling.com 800-732-4565

WHY CHOOSE MONAGHAN?

APPLICATIONS, SALES, AND SUPPORT.

WE THRIVE ON PARTNERING WITH OUR CUSTOMERS TO TACKLE THEIR TOUGHEST APPLICATIONS AND MACHINING CHALLENGES.



SUPERIOR CUSTOMER SERVICE

Monaghan is a skilled applications, sales, and support team with the mission of providing the best customer service in the industry. We firmly believe that the combination of our products and our people make us “your hole finishing experts.”

APPLICATION CONSULTING

Whether you are just getting started, tooling up a machine package or improving a process that has run for years, our team of applications experts is committed to helping you succeed.

RELATIONSHIP WITH ELLIOTT TOOL TECHNOLOGIES

Since 1996, Monaghan Tooling Group and Elliott Tool Technologies have been partners in all aspects of making precision metal finishing tools. Elliott provides design engineering, manufacturing, inventory and shipping, while Monaghan provides applications engineering, technical support, sales and marketing of these fine products.

ELLIOTT TOOL TECHNOLOGIES

Quality tools for an “I need it yesterday” world.™

Top tier quality is driven by an in-house 6-sigma Master Blackbelt. Meticulous processes and equipment are in place to handle both the volume of standard tooling production and the variety inherent to making custom tooling.



Elliott stocks most standard precision metal finishing tools and spare parts. They keep a careful watch on ideal stock levels to ensure they have proper inventories available. Every effort is made to ship your items on time.

Elliott inventory support has maintained 94% performance, in addition to 96% on-time shipping for the past 12 months (July 2015).

Upon the request of a customer, we are able to supply Elliott’s internal metrics.



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Elliott Tool Technologies, Ltd., manufactures all of the the precision metal finishing tools shown in this catalog.

Monaghan Tooling Group is the EXCLUSIVE WORLDWIDE MARKETING AGENT for all products shown.

INTRODUCTION TO BURNISHING

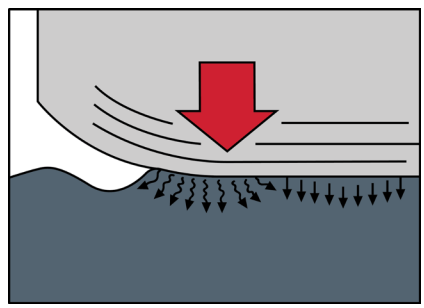
How burnishing works

Burnishing is a chip-less machining method which cold works the metal without cutting or abrading the surface. It removes no metal but rather compresses - or irons out - the peaks of a metal surface into the valleys, generating a dense and uniform surface.

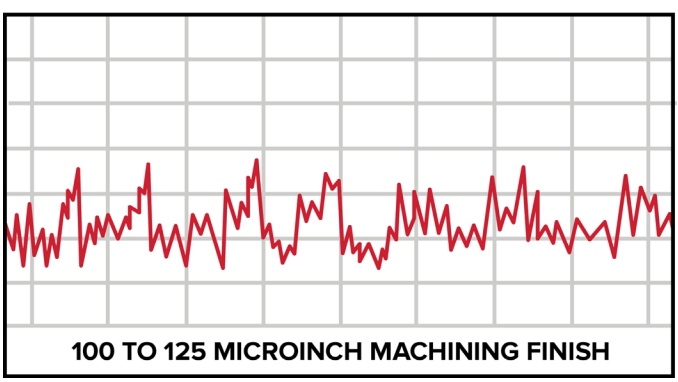
Roller burnishing improves surface finish and results in dimensional accuracy.

Compressive forces

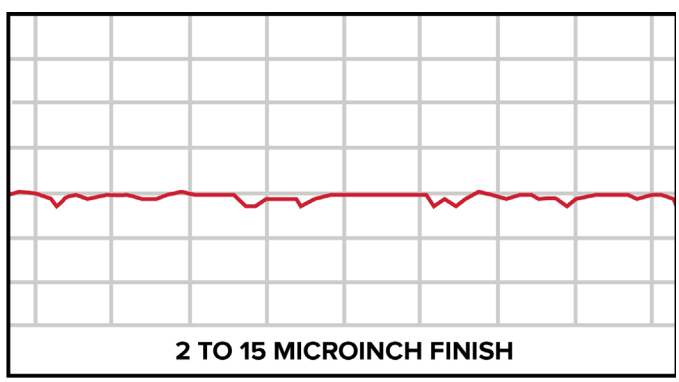
The cold working condenses the grain structure of metal, producing an increase in surface hardness from 50% to 100%, within a penetration of 0.010″ to 0.030″ on the part's surface.



In burnishing, the material is elastically deformed to a given depth below the surface. This happens as a burnishing tool exerts a pressure that surpasses the yield point of the workpiece. This cold work interaction removes minor surface irregularities - such as tool marks - and increases the resistance of the material to fatigue failure.



100 TO 125 MICROINCH MACHINING FINISH



2 TO 15 MICROINCH FINISH

Benefits of burnishing

Burnishing imparts three major characteristics: accurate sizing, a low microinch finish and hardening of the surface.

Burnishing will obtain a high quality finish and eliminate the need for secondary operations such as grinding, honing and lapping.

The low microinch finish, combined with a hardened and denser surface, substantially increases part wear, life and corrosion resistance. The added strength improves the part's fatigue resistance, resulting in decreased failures.

Other benefits include better mating parts, higher bearing capacity, abrasion and corrosion resistance, noise level reduction, stress and friction resistance, heat reduction, fatigue reduction, visual defect elimination, and surface porosity reduction.

BURNISHING ADVANTAGES

LOW MICROINCH FINISH

- Produces a 4 to 8 R_a surface finish in one pass.
- Improves surface irregularities and tool marks.
- Reaches final finish in one pass from rough finish (80-120 R_a).

WORK HARDENING

- Burnishing increases the surface hardness through the cold working process and compressive forces.
- Produces a dense and uniform surface.
- Increases metal's resistance to fatigue and failure at stress points.

PROCESS IMPROVEMENTS

- Burnishing is a repeatable and consistent process.
- Fast cycle times – measured in seconds, not minutes!

EASY-TO-USE

- MTG and Elliott burnishing tools require limited training to operate.
- Easy to maintain and repair.
- Common repair parts are always stocked!

ACCURATE SIZING

- Multi-roller burnishing tools produce accurate sizing in 0.0001" inch (0.0025mm) increments.
- Roller burnishing results in 25% size improvement in steel and up to a 50% improvement in high ductility materials.

PROVEN QUALITY

- The burnishing process has been refined and improved for over 100 years and has a proven record of success.
- MTG and Elliott continue this long tradition by providing the industry's highest quality burnishing tools.

LOW COST

- Eliminates secondary machines and set ups.
- Eliminates secondary processes such as grinding, honing and polishing.
- Elliott burnishing tools feature long lasting and replaceable wear parts reducing total cost over the life of the tool.

VERSATILITY

- Burnishing is effective for many different part configurations.
- Suitable process for a variety of metals – all ductile metals can be burnished!
- Multi-roller burnishing tools are adjustable to cover a size range.
- Engineered product line with interchangable parts.

MATERIAL TYPE AND HARDNESS

Burnishing is most suitable for metals up to 40 HRC. However, harder metals have been successfully burnished. Generally speaking, the harder the material, the greater the tool wear can be expected. In all cases, the burnishing tools' wear surfaces can be replaced without replacing the entire tool. While tool life depends on the application, burnishing tools have a well-known reputation for longevity.

STOCK ALLOWANCE

Stock allowances are based on an 80 to 180 microinch surface finish consisting of uniform peaks and valleys.

The amount of stock allowance varies with job conditions, material properties, wall thickness, nature of the machined surface and quality of surface finish desired. Figures shown are a starting point for part preparation.

HIGH DUCTILITY MATERIALS

Up to 50% elongation and less than Rc32.

Includes:
- annealed steel
- stainless steel
- aluminum
- brass bronze
- malleable iron

LOW DUCTILITY MATERIALS

Less than 20% elongation and a maximum hardness of Rc40.

Includes:
- gray iron
- nodular iron
- heat-treated steel
- magnesium alloys
- hard copper alloys

		Internal Surfaces			External Surfaces		
	Workpiece Size Range Inch	Stock Allowance Inch	Surface Finish		Stock Allowance Inch	Surface Finish	
			Machined R_a (uin)	Roller Burnished R_a (uin)		Machined R_a (uin)	Roller Burnished R_a (uin)
High Ductility	0.125 to 0.484	0.0004	80	8	0.0004	80	8
		0.0007	125	8	0.0005	100	8
	0.500 to 1.000	0.0007	60	8	0.0005	60	8
		0.0015	125	8	0.0010	180	8
	1.031 to 2.000	0.0010	60	8	0.0007	100	8
		0.0020	125	8	0.0010	180	8
	2.031 to 6.500	0.0015	60	8	0.0010	125	8
		0.0020	125	8	0.0015	300	8
		0.0030	200	8	0.0020	500	8
Low Ductility	0.125 to 0.484	0.0004	80	18	0.0003	60	18
		0.0007	100	18	0.0005	90	18
	0.500 to 1.000	0.0007	90	18	0.0005	100	18
		0.0010	125	18	0.0007	140	20
	1.031 to 2.000	0.0010	125	18	0.0005	100	18
		0.0015	180	20	0.0010	180	20
	2.031 to 6.500	0.0015	120	18	0.0010	125	18
		0.0015	160	18	0.0015	140	18
		0.0020	200	24	0.0015	200	20

SURFACE FINISH

In production work involving surface textures having a 100 to 125 microinch machined finish, burnishing tools can produce a 2 to 16 microinch finish in a single pass.

In bronze, aluminum and steel, readings of 2 to 8 microinch can be achieved with a burnishing tool. In cast iron, a 12 to 24 microinch finish can be expected.

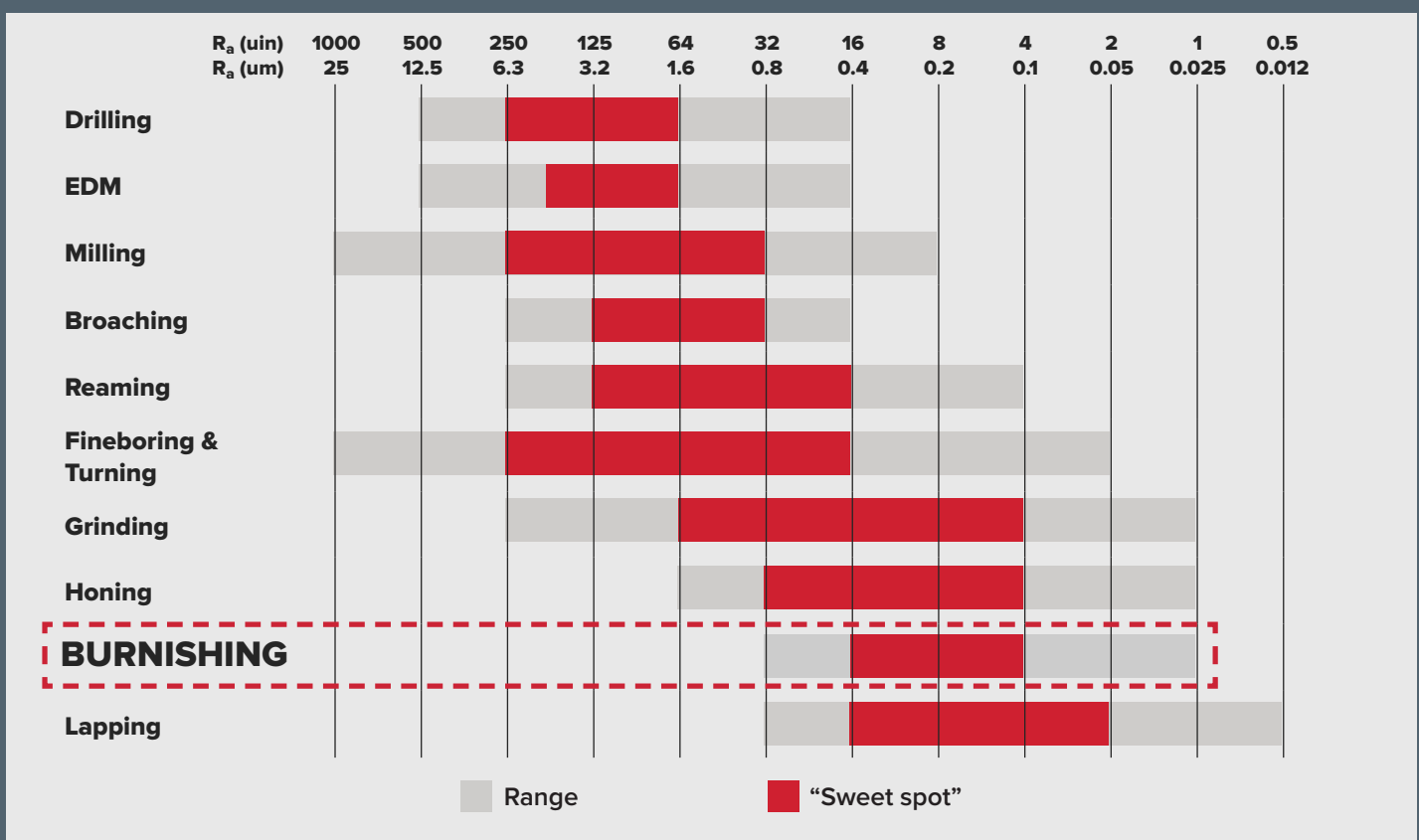
Varying surface finishes are obtained in the machining of mating parts. Machined surfaces result in a loose fit on mating parts. Surfaces which have been roller burnished have a higher bearing capacity and abrasion resistance. Roller burnishing improves this fit by providing a larger contact area between the surfaces.

Pistons, valves, cylinders and other parts with similar functions require continuous lubrication. Roller burnishing will leave valleys in the surface of these parts, which act as oil reservoirs, extending part life. This can be achieved by controlling the burnishing size and hole size.

Roller burnishing has resulted in product improvement and cost savings to the hydraulic cylinder industry.

Heat, resulting from friction, has a direct effect on surface finish. This temperature rise causes dimensional changes that can have an adverse effect on the function of the parts. By roller burnishing, it is possible to reduce friction by up to 30%. The electric motor industry, among others, has derived great benefits from roller burnishing to reduce noise levels in moving parts.

PROCESS COMPARISON



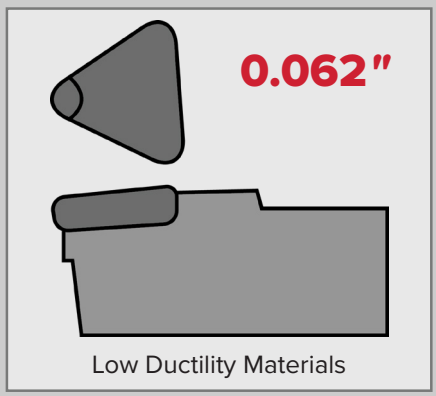
BURNISHING PREPARATION

SEVERAL FACTORS SHOULD BE CONSIDERED IN PREPARATION OF THE WORKPIECE – FEED PATTERN, CUTTING TOOL GEOMETRY, MATERIAL TYPE AND HARDNESS, AND STOCK ALLOWANCE.

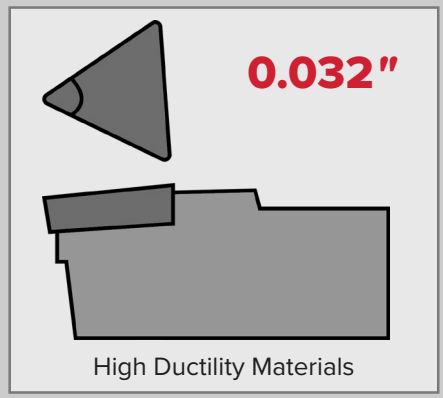
TOOL GEOMETRY

Ductile material with single point tools (a 0.032" nose radius with a minimum 5 degree back taper) is recommended.

For best results, feed the cutting tool at a feed rate sufficient to produce a surface in the 80 to 120 microinch range with a consistent peak and valley pattern. For less ductile materials, use a feed rate of about 50% less than that of more ductile materials. The result should be a 60 to 100 microinch surface finish.



Low Ductility Materials



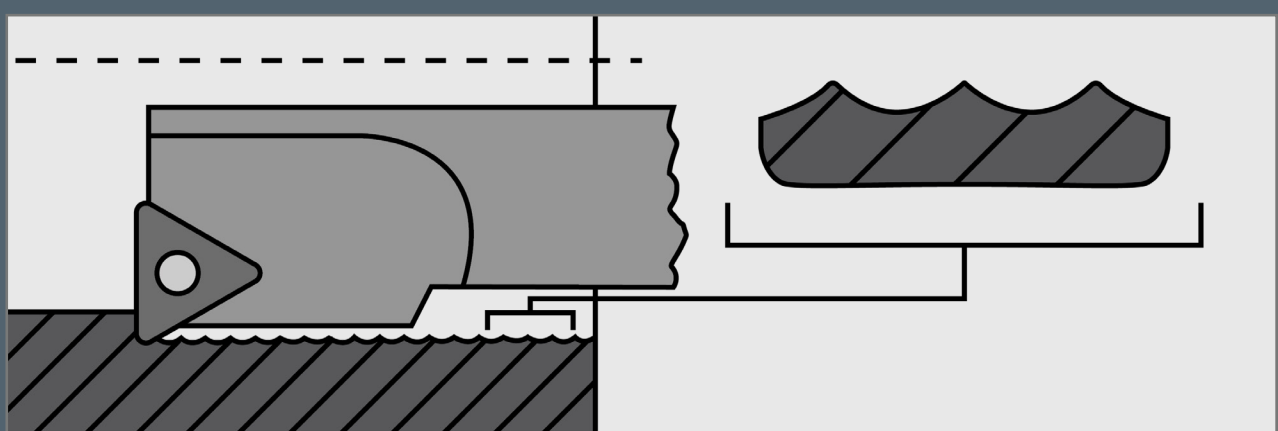
High Ductility Materials

FEED PATTERN

A PEAK AND VALLEY EFFECT GENERATED BY THE CUTTING TOOL IS AN IDEAL SURFACE FINISH FOR ROLLER BURNISHING.

An extremely smooth bore is not required to perform roller burnishing.

However, gouges and tears in the surface caused by the drilling or reaming operation and/ or the single point turning will be very difficult to roller burnish. These gouges and tears will cause a change in the surface finish, as well as a change in the diameter. Deep gouges will remain visible after the burnishing operation.



RECOMMENDED FEEDS AND SPEEDS

Workpieces should be machined to a finish of 60µin. R_a to 125µin. R_a.

A finer machined surface is required before the burnishing operation with less ductile materials, such as cast iron and heat treated steel above Rc35.

Ductile materials, such as brass, aluminum and annealed steels, can have a rougher machined surface.

Very finely machined surfaces can accept only a slight size change when burnished.

Some 25% to 50% less material can be displaced from a reamed surface versus a surface machined with a single point tool. Tools with non-feed cages (full bottom tools) must always be machine fed.

Feeds can be adjusted upward 25% to 50%.

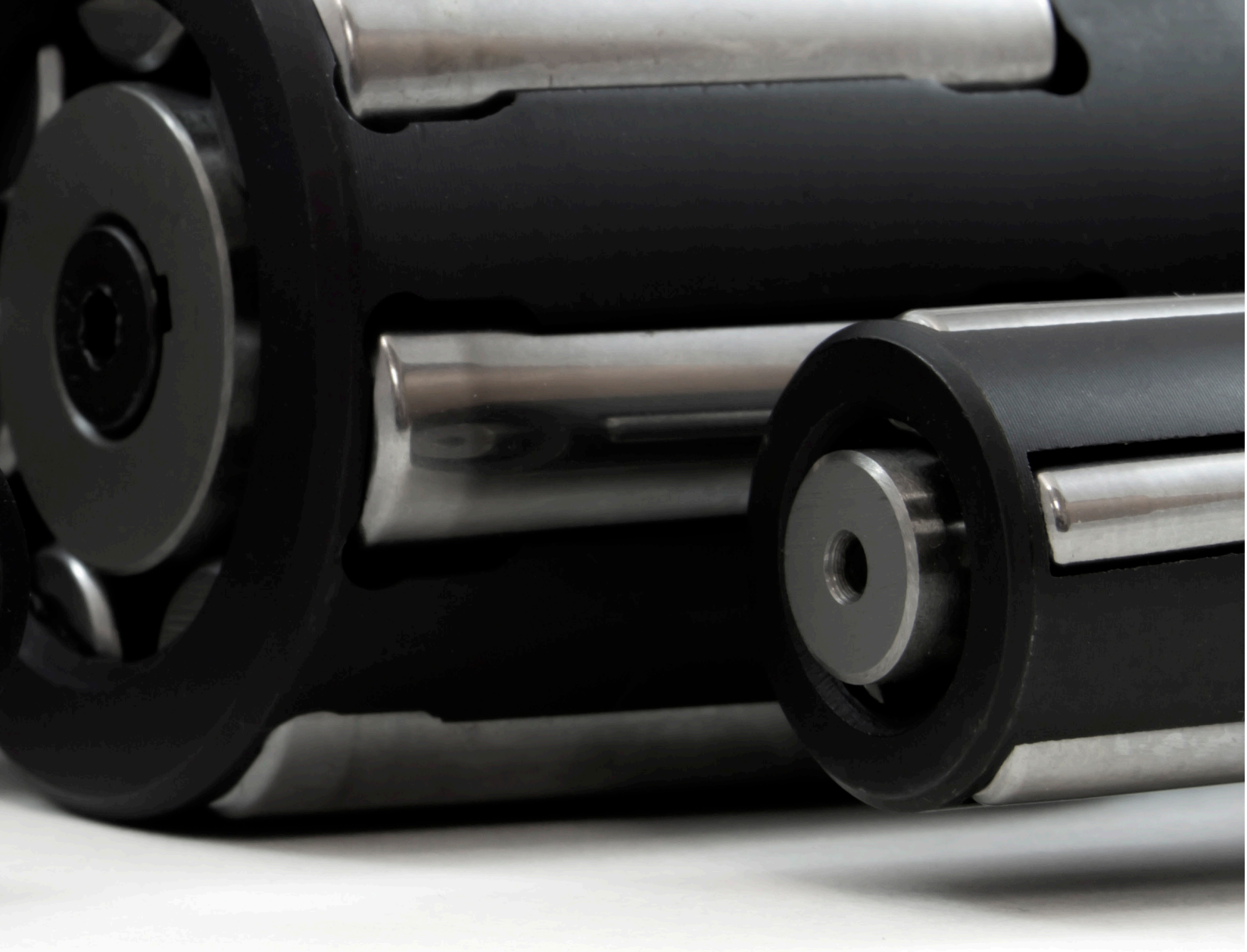
Inch	Metric	Inch/rev	mm/rev	Speed RPM
0.154 - 0.246	3.910 - 6.250	0.005 - 0.009	0.127 - 0.229	1500 to 3000
0.247 - 0.371	6.270 - 9.420	0.008 - 0.012	0.203 - 0.305	1500 to 3000
0.372 - 0.495	9.450 - 12.570	0.012 - 0.019	0.305 - 0.483	1000 to 2000
0.496 - 0.620	12.600 - 15.750	0.014 - 0.020	0.356 - 0.508	1000 to 2000
0.621 - 0.745	15.770 - 18.920	0.019 - 0.027	0.482 - 0.686	600 to 1200
0.746 - 0.870	18.950 - 22.100	0.022 - 0.035	0.559 - 0.889	600 to 1200
0.871 - 0.995	22.120 - 25.270	0.025 - 0.037	0.635 - 0.940	600 to 1200
0.996 - 1.245	25.300 - 31.620	0.032 - 0.049	0.813 - 1.245	300 to 600
1.246 - 1.495	31.650 - 37.970	0.048 - 0.071	1.219 - 1.803	300 to 600
1.496 - 1.745	38.000 - 44.320	0.056 - 0.084	1.422 - 2.134	200 to 400
1.746 - 1.995	44.350 - 50.670	0.057 - 0.086	1.448 - 2.184	200 to 400
1.996 - 2.245	50.700 - 57.020	0.070 - 0.105	1.778 - 2.667	200 to 400
2.246 - 2.495	57.050 - 63.370	0.075 - 0.112	1.905 - 2.845	170 to 340
2.496 - 2.745	63.400 - 69.720	0.082 - 0.124	2.082 - 3.150	170 to 340
2.746 - 2.995	69.750 - 76.070	0.054 - 0.080	1.372 - 2.032	170 to 340
2.996 - 3.245	76.100 - 82.420	0.056 - 0.084	1.422 - 2.134	120 to 240
3.246 - 3.495	82.450 - 88.770	0.061 - 0.091	1.549 - 2.311	120 to 240
3.496 - 3.745	88.800 - 95.120	0.074 - 0.104	1.880 - 2.642	100 to 200
3.746 - 3.995	95.150 - 101.470	0.078 - 0.116	1.981 - 2.946	100 to 200
3.996 - 4.245	101.500 - 107.820	0.081 - 0.121	2.057 - 3.073	100 to 200

Machine settings are approximate. Always set the machine faster than the feed rate of the burnishing tool.



BURNISH YOUR REPUTATION

For producing beautiful parts to spec



...with our standard ID multi-roller burnishing tools.

ID MULTI-ROLLER BURNISHING TOOLS

RBT

A proven method for accurate sizing and finishing of bores.



MULTI-ROLLER BURNISHING TOOLS FOR ACCURATE SIZING, PRECISION FINISHING, AND SURFACE HARDENING OF ID HOLES.

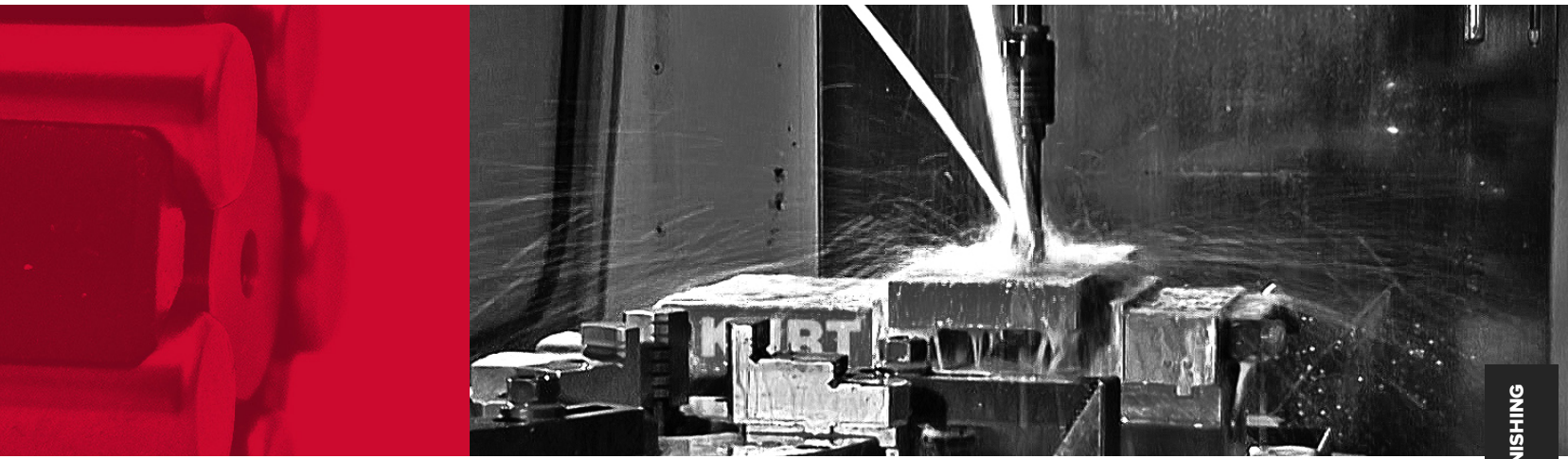
The ID multi-roller burnishing tool consists of a cage, which retains a series of precision tapered rolls rotating around and bearing on an inversely tapered mandrel.



Within the work-piece, the tool is sized so that the roll develops a pressure that exceeds the yield point of the softer work-piece.

The cold working action will improve minor surface irregularities and tool marks resulting in a low microinch surface finish.

ID multi-roller tools are available in standard sizes for holes ranging from 0.157" to 6.500".



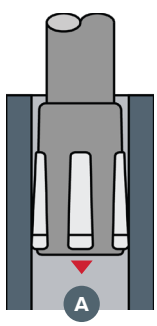
ID BURNISHING ROLL STYLES

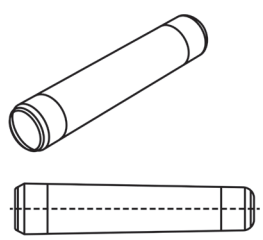
Unique to the Monaghan design, we offer 3 roll designs to more closely address the needs of your close approach applications:

THROUGH ROLLS

Rolls with greater radius relief are used for through holes (Roll Style 1). These tools are self-feeding and a release clearance is required.

These rolls are interchangeable between blind and through cages.



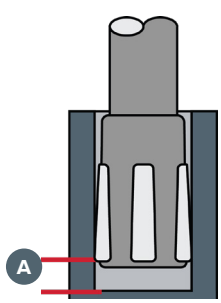


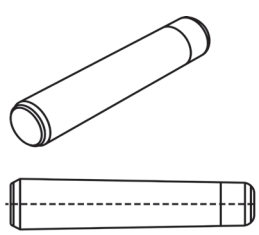
Tool Size Range	A
	Min. Clearance
0.154 - 0.630	N/A
0.621 - 0.662	0.218
0.652 - 0.974	0.265
0.964 - 1.849	0.281
1.839 - 3.349	0.312
3.339 - 6.531	0.350

BLIND ROLLS

Blind rolls burnish closer to the bottom of a hole than through rolls (Roll Style 4).

These rolls are interchangeable between blind and through cages.



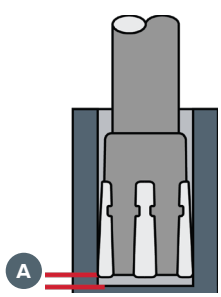


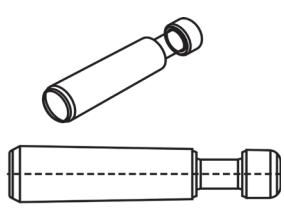
Tool Size Range	A
	Min. Clearance
0.154 - 0.630	0.093
0.621 - 0.974	0.125
0.964 - 1.849	0.141
1.839 - 3.349	0.156
3.339 - 6.537	0.187

BOTTOMING ROLLS

Used in blind hole applications to burnish as close as possible to the bottom of the bore (Roll Style 8).

These rolls <u>are not</u> interchangeable between blind or through cages.





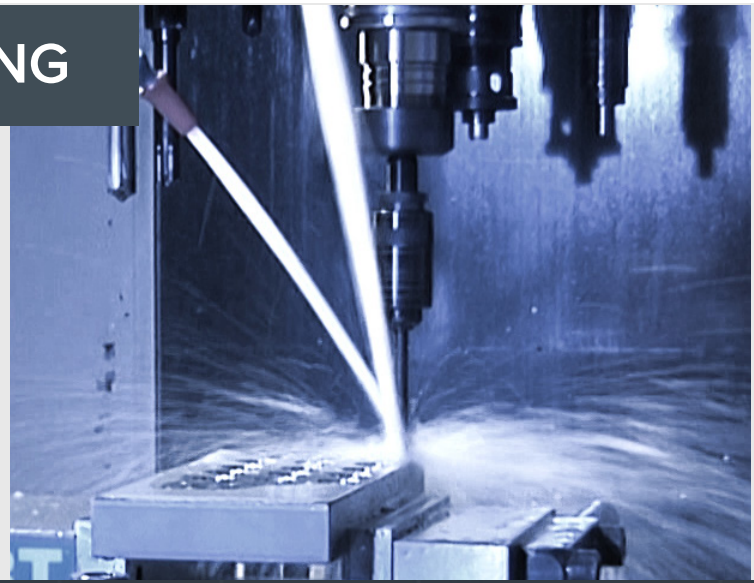
Tool Size Range	A
	Min. Clearance
0.154 - 0.251	---
0.247 - 0.630	0.035
0.621 - 6.537	0.062

A ***Approach to bottom***
Approach includes a release clearance of 0.030" which may be subtracted to obtain absolute minimum approach.

THROUGH HOLE BURNISHING

APPLICATION

Holding **3 tenths** on diameter...



THE JOB

Part Material: 4140 Steel

Diameter: 0.312″

Length: 0.625″

Stock Allowance: 0.0005"-0.0007″ on diameter

Pre Burnish Surface Finish: 83μR_a

THE SOLUTION

Tool Used: 5418-121-31020

Speed: 1000 RPM

Feed: 0.008 IPR

THE RESULTS

Post Burnish Surface Finish: **7μR_a**

Cycle Time: **4.67SEC.**



...while producing a **single-digit** surface finish.

STANDARD DIMENSIONS

ID MULTI-ROLLER BURNISHING

ID MULTI-ROLLER BURNISHING TOOLS ARE AVAILABLE IN THE FOLLOWING DIMENSIONS[1].

INCH

Tool Series	Size Range (Inch)
5418	0.157 - 0.501
5419	0.500 - 0.625
5433	0.656 - 0.937
5444	0.968 - 1.187
5405	1.218 - 1.375
5406	1.406 - 1.812
5407	1.843 - 2.187
5408	2.218 - 2.687
5409	2.718 - 3.312
5610	3.343 - 4.062
5611	4.093 - 5.000
5612	5.031 - 5.875
5613	5.530 - 6.500

METRIC

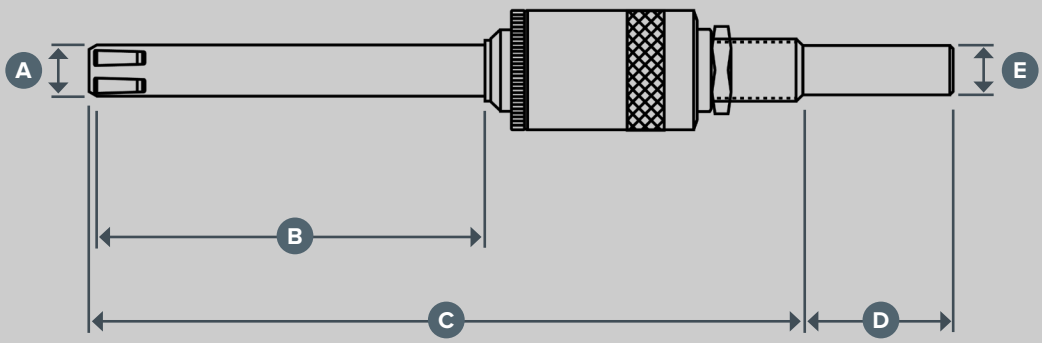
Tool Series	Size Range (mm)
5418	3.9120 - 12.725
5419	12.700 - 15.875
5433	16.662 - 23.800
5444	24.587 - 30.150
5405	30.937 - 34.925
5406	35.712 - 46.025
5407	46.812 - 55.550
5408	56.337 - 68.250
5409	69.037 - 84.125
5610	84.912 - 103.175
5611	103.962 - 127.000
5612	127.787 - 139.700
5613	140.462 - 165.100

[1]Information about custom burnishing "specials" can be found on page 75.



SERIES 5418

0.154IN - 0.251IN
3.912MM - 6.375MM



5418 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	0.500″ straight shank
	2	#1 Morse taper
	3	12mm straight shank

Tool Size Range		A		B		C		D		Tool Number	
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length			
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Standard	Bottoming
0.154 to 0.166	3.912 to 4.216	0.157	3.988	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31008	--
0.164 to 0.176	4.166 to 4.470	0.167	4.242	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31009	--
0.174 to 0.186	4.420 to 4.724	0.177	4.496	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31010	--
0.184 to 0.193	4.674 to 4.902	0.187	4.750	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31012	--
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31012	
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31012	
0.190 to 0.203	4.826 to 5.156	0.193	4.902	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31011	--
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31011	
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31011	
0.200 to 0.220	5.080 to 5.588	0.203	5.156	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31013	--
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31013	
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31013	
0.215 to 0.235	5.461 to 5.969	0.218	5.537	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31014	--
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31014	
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31014	
0.231 to 0.251	5.867 to 6.375	0.234	5.944	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31015	--
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31015	
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31015	

5418 SERIES SHANK OPTIONS EXAMPLE:

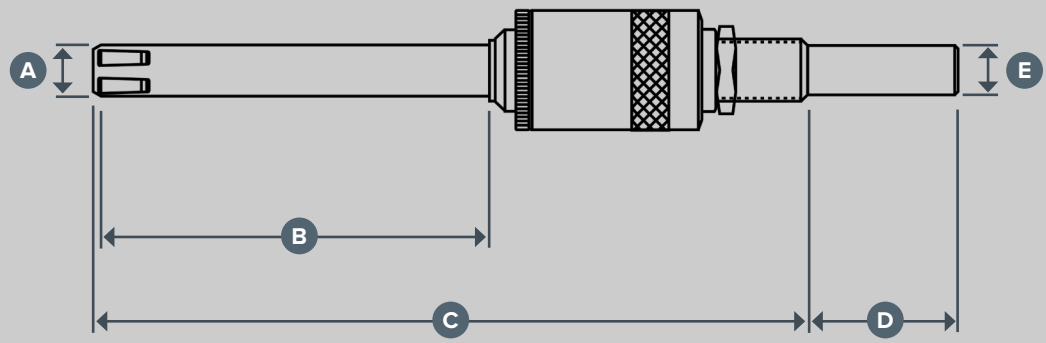
A short reach, 0.193″ dia. standard style tool with a 0.500″ straight shank, would be part #: **5418-111-31011**
Special shank options can be quoted as well.

0.247IN - 0.376IN
6.274MM - 9.550MM
SERIES 5418

5418 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

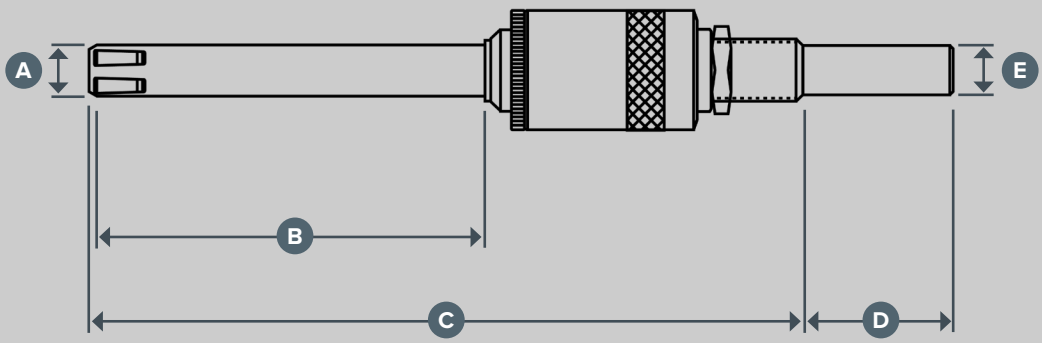
E	1	0.500" straight shank
	2	#1 Morse taper
	3	12mm straight shank



Tool Size Range		A		B		C		D		Tool Number	
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length			
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Standard	Bottoming
0.247 to 0.267	6.274 to 6.782	0.250	6.350	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31016	5418-*12-45016
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31016	5418-*22-45016
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31016	5418-*32-45016
0.262 to 0.282	6.655 to 7.163	0.265	6.731	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31017	5418-*12-45017
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31017	5418-*22-45017
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31017	5418-*32-45017
0.278 to 0.298	7.061 to 7.569	0.281	7.137	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31018	5418-*12-45018
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31018	5418-*22-45018
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31018	5418-*32-45018
0.293 to 0.313	7.442 to 7.950	0.296	7.518	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31019	5418-*12-45019
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31019	5418-*22-45019
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31019	5418-*32-45019
0.309 to 0.329	7.849 to 8.357	0.312	7.925	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31020	5418-*12-45020
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31020	5418-*22-45020
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31020	5418-*32-45020
0.325 to 0.345	8.255 to 8.763	0.328	8.331	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31021	5418-*12-45021
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31021	5418-*22-45021
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31021	5418-*32-45021
0.340 to 0.360	8.636 to 9.144	0.343	8.712	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31022	5418-*12-45022
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31022	5418-*22-45022
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31022	5418-*32-45022
0.356 to 0.376	9.042 to 9.550	0.359	9.119	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31023	5418-*12-45023
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31023	5418-*22-45023
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31023	5418-*32-45023

SERIES 5418

0.372IN - 0.501IN
9.449MM- 12.725MM



5418 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	0.500" straight shank
	2	#1 Morse taper
	3	12mm straight shank

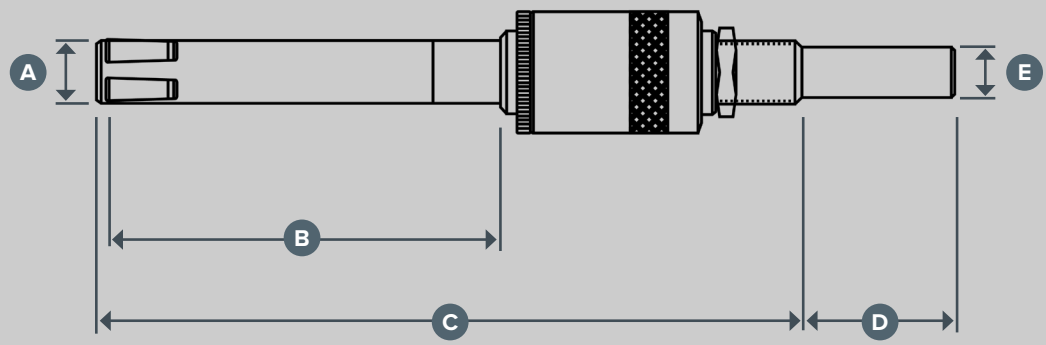
Tool Size Range		A		B		C		D		Tool Number	
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length			
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Standard	Bottoming
0.372 to 0.392	9.449 to 9.957	0.375	9.525	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31024	5418-*12-45024
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31024	5418-*22-45024
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31024	5418-*32-45024
0.387 to 0.407	9.830 to 10.338	0.390	9.906	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31025	5418-*12-45025
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31025	5418-*22-45025
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31025	5418-*32-45025
0.403 to 0.423	10.236 to 10.744	0.406	10.312	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31026	5418-*12-45026
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31026	5418-*22-45026
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31026	5418-*32-45026
0.418 to 0.438	10.617 to 11.125	0.421	10.693	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31027	5418-*12-45027
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31027	5418-*22-45027
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31027	5418-*32-45027
0.434 to 0.454	11.024 to 11.532	0.437	11.100	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31028	5418-*12-45028
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31028	5418-*22-45028
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31028	5418-*32-45028
0.450 to 0.470	11.430 to 11.938	0.453	11.506	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31029	5418-*12-45029
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31029	5418-*22-45029
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31029	5418-*32-45029
0.465 to 0.485	11.811 to 12.319	0.468	11.887	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31030	5418-*12-45030
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31030	5418-*22-45030
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31030	5418-*32-45030
0.481 to 0.501	12.217 to 12.725	0.484	12.294	1.625	41.275	5.000	127.00	1.500	38.10	5418-*11-31031	5418-*12-45031
				3.625	92.075	7.000	177.80	1.500	38.10	5418-*21-31031	5418-*22-45031
				5.625	142.875	9.000	228.60	1.500	38.10	5418-*31-31031	5418-*32-45031

0.496IN - 0.662IN
12.598MM - 16.815MM
SERIES 5419

5419 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	0.500″ straight shank
	2	#1 Morse taper
	3	12mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
0.496 to 0.537	12.598 to 13.640	0.500	12.700	1.875	47.625	4.930	125.22	1.500	38.10		5419-*11-31032	5419-*12-45032
				3.875	98.425	6.930	176.02	1.500	38.10		5419-*21-31032	5419-*22-45032
				5.875	149.225	8.930	226.82	1.500	38.10		5419-*31-31032	5419-*32-45032
				7.875	200.025	10.930	277.622	1.500	38.10		5419-*41-31032	5419-*42-45032
0.527 to 0.568	13.386 to 14.427	0.531	13.487	1.875	47.625	4.930	125.22	1.500	38.10		5419-*11-31034	5419-*12-45034
				3.875	98.425	6.930	176.02	1.500	38.10		5419-*21-31034	5419-*22-45034
				5.875	149.225	8.930	226.82	1.500	38.10		5419-*31-31034	5419-*32-45034
				7.875	200.025	10.930	277.622	1.500	38.10		5419-*41-31034	5419-*42-45034
0.558 to 0.599	14.173 to 15.215	0.562	14.275	1.875	47.625	4.930	125.22	1.500	38.10		5419-*11-31036	5419-*12-45036
				3.875	98.425	6.930	176.02	1.500	38.10		5419-*21-31036	5419-*22-45036
				5.875	149.225	8.930	226.82	1.500	38.10		5419-*31-31036	5419-*32-45036
				7.875	200.025	10.930	277.622	1.500	38.10		5419-*41-31036	5419-*42-45036
0.589 to 0.630	14.961 to 16.002	0.593	15.062	1.875	47.625	4.930	125.22	1.500	38.10		5419-*11-31038	5419-*12-45038
				3.875	98.425	6.930	176.02	1.500	38.10		5419-*21-31038	5419-*22-45038
				5.875	149.225	8.930	226.82	1.500	38.10		5419-*31-31038	5419-*32-45038
				7.875	200.025	10.930	277.622	1.500	38.10		5419-*41-31038	5419-*42-45038
0.621 to 0.662	15.773 to 16.815	0.625	15.875	1.875	47.625	4.930	125.22	1.500	38.10	5419-*11-11040	5419-*11-31040	5419-*12-45040
				3.875	98.425	6.930	176.02	1.500	38.10	5419-*21-11040	5419-*21-31040	5419-*22-45040
				5.875	149.225	8.930	226.82	1.500	38.10	5419-*31-11040	5419-*31-31040	5419-*32-45040
				7.875	200.025	10.930	277.622	1.500	38.10	5419-*41-11040	5419-*41-31040	5419-*42-45040

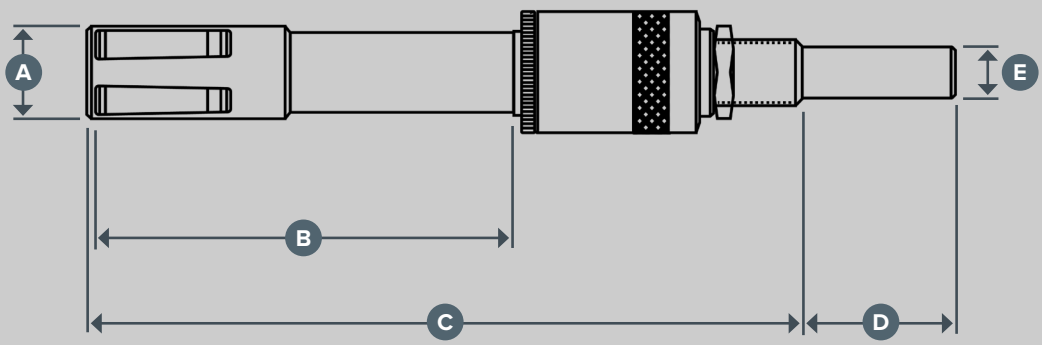
5419 SERIES SHANK OPTIONS EXAMPLE:

A long reach 0.562″ diameter blind style tool with a 12mm dia. straight shank, would be part #: **5419-331-31036**

Special shank options can be quoted as well.

SERIES 5433

0.652IN - 0.974IN
16.561MM - 24.740MM



5433 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	0.500" straight shank
	2	#1 Morse taper
	3	12mm straight shank

Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
0.652 to 0.693	16.561 to 17.602	0.656	16.662	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11042	5433-*11-31042	5433-*12-45042
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11042	5433-*21-31042	5433-*22-45042
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11042	5433-*31-31042	5433-*32-45042
0.683 to 0.724	17.348 to 18.390	0.687	17.45	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11044	5433-*11-31044	5433-*12-45044
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11044	5433-*21-31044	5433-*22-45044
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11044	5433-*31-31044	5433-*32-45044
0.714 to 0.755	18.136 to 19.177	0.718	18.237	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11046	5433-*11-31046	5433-*12-45046
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11046	5433-*21-31046	5433-*22-45046
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11046	5433-*31-31046	5433-*32-45046
0.746 to 0.787	18.948 to 19.990	0.75	19.05	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11048	5433-*11-31048	5433-*12-45048
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11048	5433-*21-31048	5433-*22-45048
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11048	5433-*31-31048	5433-*32-45048
0.777 to 0.818	19.736 to 20.777	0.781	19.837	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11050	5433-*11-31050	5433-*12-45050
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11050	5433-*21-31050	5433-*22-45050
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11050	5433-*31-31050	5433-*32-45050
0.808 to 0.849	20.523 to 21.565	0.812	20.625	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11052	5433-*11-31052	5433-*12-45052
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11052	5433-*21-31052	5433-*22-45052
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11052	5433-*31-31052	5433-*32-45052
0.839 to 0.880	21.311 to 22.352	0.843	21.412	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11054	5433-*11-31054	5433-*12-45054
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11054	5433-*21-31054	5433-*22-45054
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11054	5433-*31-31054	5433-*32-45054
0.871 to 0.912	22.123 to 23.165	0.875	22.225	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11056	5433-*11-31056	5433-*12-45056
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11056	5433-*21-31056	5433-*22-45056
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11056	5433-*31-31056	5433-*32-45056
0.902 to 0.943	22.911 to 23.952	0.906	23.012	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11058	5433-*11-31058	5433-*12-45058
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11058	5433-*21-31058	5433-*22-45058
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11058	5433-*31-31058	5433-*32-45058
0.933 to 0.974	23.698 to 24.740	0.937	23.8	1.625	41.275	5.038	127.97	1.500	38.10	5433-*11-11060	5433-*11-31060	5433-*12-45060
				3.625	92.075	7.038	178.77	1.500	38.10	5433-*21-11060	5433-*21-31060	5433-*22-45060
				5.625	142.875	9.038	229.57	1.500	38.10	5433-*31-11060	5433-*31-31060	5433-*32-45060

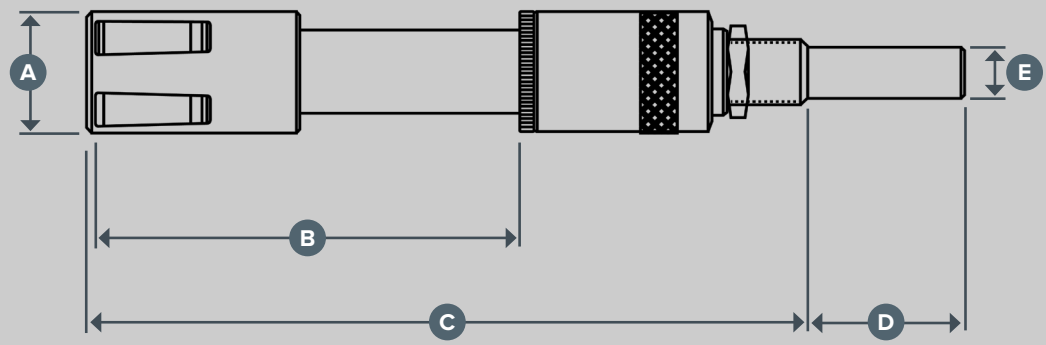
Longer standard reaches (B) available for 5433 series: 7.625", 9.625", 11.625", 13.625", 15.625", 17.625"

0.964IN - 1.224IN
24.486MM - 31.090MM
SERIES 5444

5444 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	0.500" straight shank
	2	#1 Morse taper
	3	12mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
0.964 to 1.005	24.486 to 25.527	0.968	24.587	1.875	47.625	4.930	125.22	1.500	38.10	5444-*11-11062	5444-*11-31062	5444-*12-45062
				3.875	98.425	6.930	176.02	1.500	38.10	5444-*21-11062	5444-*21-31062	5444-*22-45062
				5.875	149.225	8.930	226.82	1.500	38.10	5444-*31-11062	5444-*31-31062	5444-*32-45062
0.996 to 1.037	25.298 to 26.340	1.000	25.400	1.875	47.625	4.930	125.22	1.500	38.10	5444-*11-11064	5444-*11-31064	5444-*12-45064
				3.875	98.425	6.930	176.02	1.500	38.10	5444-*21-11064	5444-*21-31064	5444-*22-45064
				5.875	149.225	8.930	226.82	1.500	38.10	5444-*31-11064	5444-*31-31064	5444-*32-45064
1.027 to 1.068	26.086 to 27.127	1.031	26.187	1.875	47.625	4.930	125.22	1.500	38.10	5444-*11-11066	5444-*11-31066	5444-*12-45066
				3.875	98.425	6.930	176.02	1.500	38.10	5444-*21-11066	5444-*21-31066	5444-*22-45066
				5.875	149.225	8.930	226.82	1.500	38.10	5444-*31-11066	5444-*31-31066	5444-*32-45066
1.058 to 1.099	26.873 to 27.915	1.062	26.975	1.875	47.625	4.930	125.22	1.500	38.10	5444-*11-11068	5444-*11-31068	5444-*12-45068
				3.875	98.425	6.930	176.02	1.500	38.10	5444-*21-11068	5444-*21-31068	5444-*22-45068
				5.875	149.225	8.930	226.82	1.500	38.10	5444-*31-11068	5444-*31-31068	5444-*32-45068
1.089 to 1.130	27.661 to 28.702	1.093	27.762	1.875	47.625	4.930	125.22	1.500	38.10	5444-*11-11070	5444-*11-31070	5444-*12-45070
				3.875	98.425	6.930	176.02	1.500	38.10	5444-*21-11070	5444-*21-31070	5444-*22-45070
				5.875	149.225	8.930	226.82	1.500	38.10	5444-*31-11070	5444-*31-31070	5444-*32-45070
1.121 to 1.162	28.473 to 29.515	1.125	28.575	1.875	47.625	4.930	125.22	1.500	38.10	5444-*11-11072	5444-*11-31072	5444-*12-45072
				3.875	98.425	6.930	176.02	1.500	38.10	5444-*21-11072	5444-*21-31072	5444-*22-45072
				5.875	149.225	8.930	226.82	1.500	38.10	5444-*31-11072	5444-*31-31072	5444-*32-45072
1.152 to 1.193	29.261 to 30.302	1.156	29.362	1.875	47.625	4.930	125.22	1.500	38.10	5444-*11-11074	5444-*11-31074	5444-*12-45074
				3.875	98.425	6.930	176.02	1.500	38.10	5444-*21-11074	5444-*21-31074	5444-*22-45074
				5.875	149.225	8.930	226.82	1.500	38.10	5444-*31-11074	5444-*31-31074	5444-*32-45074
1.183 to 1.224	30.048 to 31.090	1.187	30.150	1.875	47.625	4.930	125.22	1.500	38.10	5444-*11-11076	5444-*11-31076	5444-*12-45076
				3.875	98.425	6.930	176.02	1.500	38.10	5444-*21-11076	5444-*21-31076	5444-*22-45076
				5.875	149.225	8.930	226.82	1.500	38.10	5444-*31-11076	5444-*31-31076	5444-*32-45076

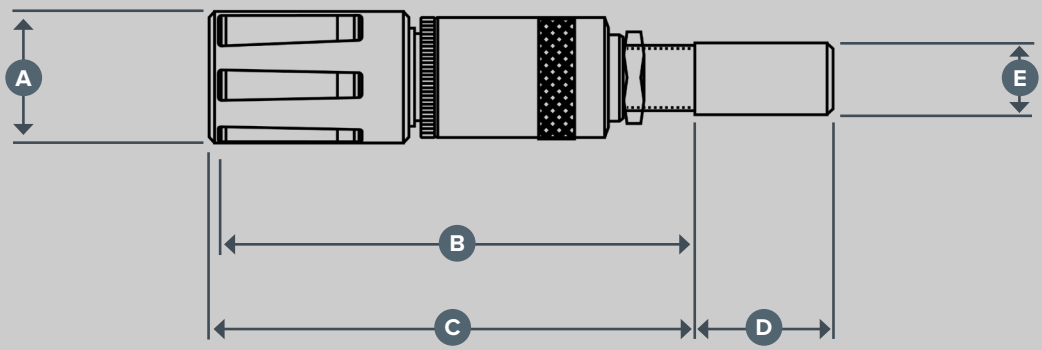
Longer standard reaches (B) available for 5444 series: 7.875", 9.875", 11.875", 13.875", 15.875", 17.875"

5444 SERIES SHANK OPTIONS EXAMPLE:

A medium reach 1.125" diameter through style tool with a #1 Morse taper shank, would be part #: **5444-221-11072**
Special shank options can be quoted as well.

SERIES 5405

1.214IN - 1.412IN
30.826MM - 35.865MM



5405 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	0.750″ straight shank
	2	#2 Morse taper
	3	16mm straight shank

Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
1.214 to 1.255	30.836 to 31.877	1.218	30.937	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5405-*01-11078	5405-*01-31078	5405-*02-45078
1.246 to 1.287	31.648 to 32.690	1.250	31.750	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5405-*01-11080	5405-*01-31080	5405-*02-45080
1.277 to 1.318	32.436 to 33.477	1.281	32.537	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5405-*01-11082	5405-*01-31082	5405-*02-45082
1.308 to 1.349	33.223 to 34.265	1.312	33.325	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5405-*01-11084	5405-*01-31084	5405-*02-45084
1.339 to 1.380	34.011 to 35.052	1.343	34.112	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5405-*01-11086	5405-*01-31086	5405-*02-45086
1.371 to 1.412	34.823 to 35.865	1.375	34.925	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5405-*01-11088	5405-*01-31088	5405-*02-45088

5405 SERIES SHANK OPTIONS EXAMPLE:

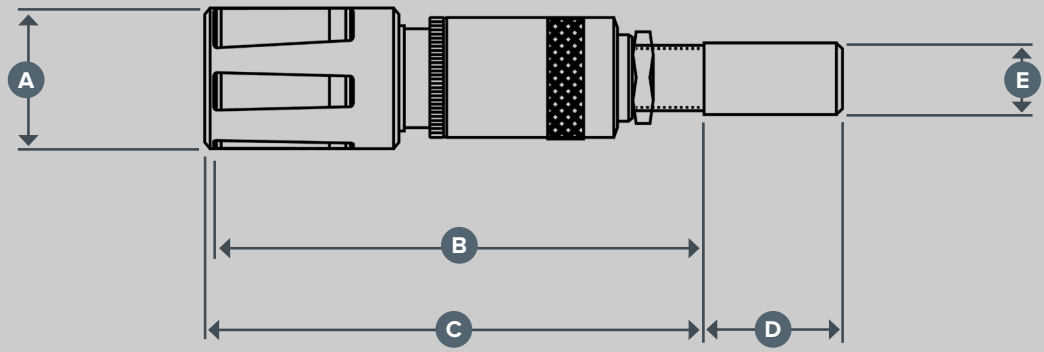
A standard reach 1.281″ diameter blind style tool with a 0.750″ diameter straight shank, would be part #: **5405-101-31082**
Special shank options can be quoted as well.

1.402IN - 1.630IN
35.611MM - 41.402MM
SERIES 5406

5406 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

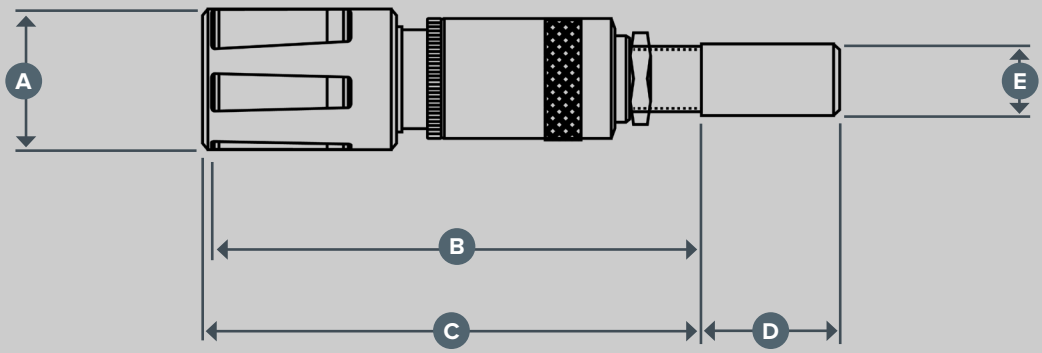
E	1	0.750" straight shank
	2	#2 Morse taper
	3	16mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
1.402 to 1.443	35.611 to 36.652	1.406	35.712	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11090	5406-*01-31090	5406-*02-45090
1.433 to 1.474	36.398 to 37.44	1.437	36.500	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11092	5406-*01-31092	5406-*02-45092
1.464 to 1.505	37.186 to 38.227	1.468	37.287	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11094	5406-*01-31094	5406-*02-45094
1.496 to 1.537	37.998 to 39.04	1.500	38.100	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11096	5406-*01-31096	5406-*02-45096
1.527 to 1.568	38.786 to 39.827	1.531	38.887	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11098	5406-*01-31098	5406-*02-45098
1.558 to 1.599	39.573 to 40.615	1.562	39.675	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11100	5406-*01-31100	5406-*02-45100
1.589 to 1.630	40.361 to 41.402	1.593	40.462	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11102	5406-*01-31102	5406-*02-45102

SERIES 5406

1.621IN - 1.849IN
41.173MM - 46.965MM



5406 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	0.750″ straight shank
	2	#2 Morse taper
	3	16mm straight shank

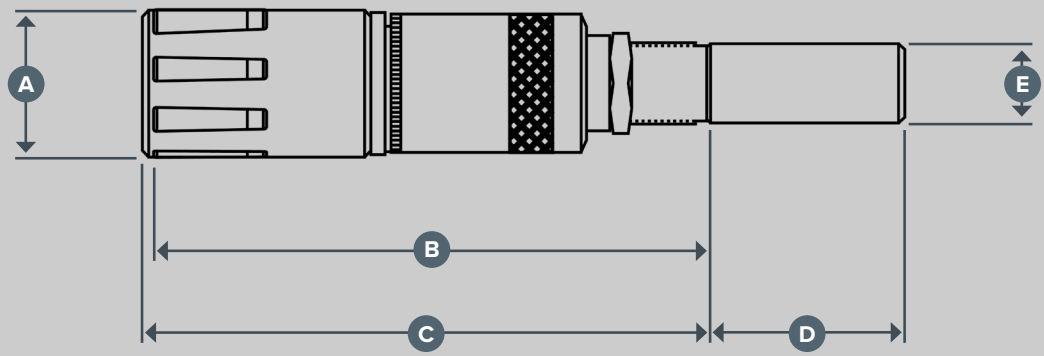
Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
1.621 to 1.662	41.173 to 42.215	1.625	41.275	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11104	5406-*01-31104	5406-*02-45104
1.652 to 1.693	41.961 to 43.002	1.656	42.062	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11106	5406-*01-31106	5406-*02-45106
1.683 to 1.724	42.748 to 43.79	1.687	42.850	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11108	5406-*01-31108	5406-*02-45108
1.714 to 1.755	43.536 to 44.577	1.718	43.637	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11110	5406-*01-31110	5406-*02-45110
1.746 to 1.787	44.348 to 45.39	1.750	44.450	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11112	5406-*01-31112	5406-*02-45112
1.777 to 1.818	45.136 to 46.177	1.781	45.237	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11114	5406-*01-31114	5406-*02-45114
1.808 toi 1.849	45.923 to 46.965	1.812	46.025	Controlled by tool length or shank extensions		5.188	131.76	1.500	38.10	5406-*01-11116	5406-*01-31116	5406-*02-45116

1.839IN - 2.037IN
46.711MM - 51.740MM
SERIES 5407

5407 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.000″ straight shank
	2	#3 Morse taper
	3	25mm straight shank



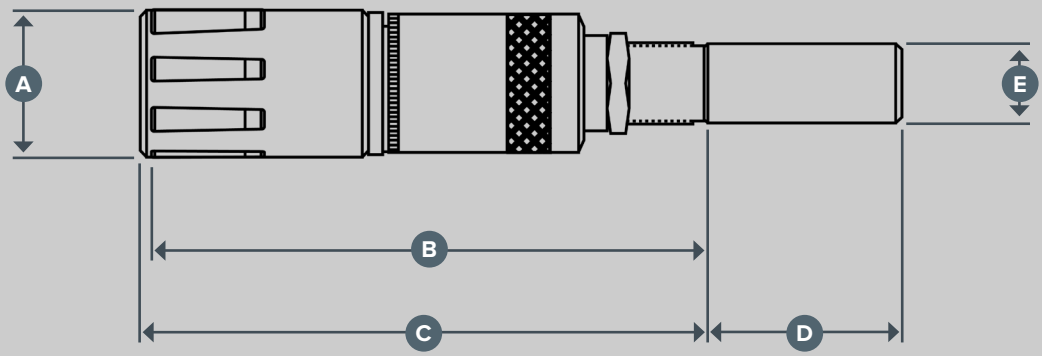
Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
1.839 to 1.880	46.711 to 47.752	1.843	46.812	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11118	5407-*01-31118	5407-*02-45118
1.871 to 1.912	47.523 to 48.565	1.875	47.625	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11120	5407-*01-31120	5407-*02-45120
1.902 to 1.943	48.311 to 49.352	1.906	48.412	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11122	5407-*01-31122	5407-*02-45122
1.934 to 1.974	49.124 to 50.140	1.937	49.200	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11124	5407-*01-31124	5407-*02-45124
1.964 to 2.005	49.886 to 50.927	1.968	49.987	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11126	5407-*01-31126	5407-*02-45126
1.996 to 2.037	50.698 to 51.740	2.000	50.800	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11128	5407-*01-31128	5407-*02-45128

5407 SERIES SHANK OPTIONS EXAMPLE:

A standard reach 1.937″ diameter bottoming style tool with a 25mm straight shank, would be part #: **5407-302-45124**
Special shank options can be quoted as well.

SERIES 5407

2.027IN - 2.224IN
51.486MM - 56.490MM



5407 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.000″ straight shank
	2	#3 Morse taper
	3	25mm straight shank

Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
2.027 to 2.068	51.486 to 52.527	2.031	51.587	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11130	5407-*01-31130	5407-*02-45130
2.058 to 2.099	52.273 to 53.315	2.062	52.375	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11132	5407-*01-31132	5407-*02-45132
2.089 to 2.130	53.061 to 54.102	2.093	53.162	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11134	5407-*01-31134	5407-*02-45134
2.121 to 2.162	53.873 to 54.915	2.125	53.975	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11136	5407-*01-31136	5407-*02-45136
2.152 to 2.193	54.661 to 55.702	2.156	54.762	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11138	5407-*01-31138	5407-*02-45138
2.183 to 2.224	55.448 to 56.490	2.187	55.550	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5407-*01-11140	5407-*01-31140	5407-*02-45140

5407 SERIES SHANK OPTIONS EXAMPLE:

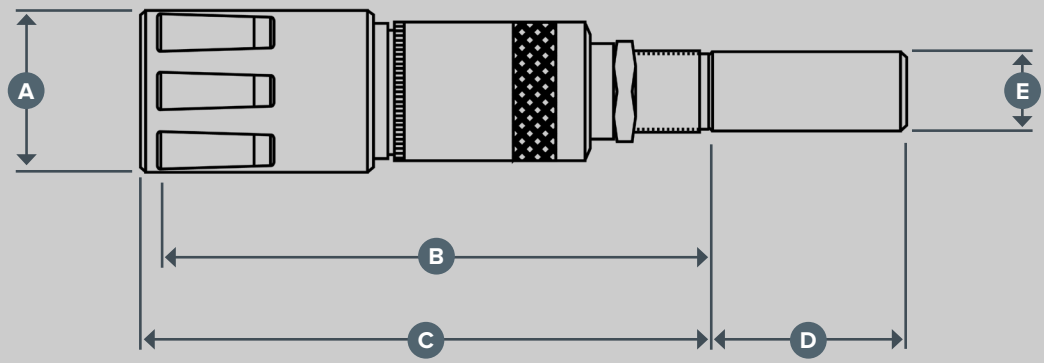
A standard reach 2.125″ diameter through style tool with a #3 Morse taper shank, would be part #: **5407-201-11136**
Special shank options can be quoted as well.

2.214IN - 2.474IN
56.236MM - 62.840MM
SERIES 5408

5408 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

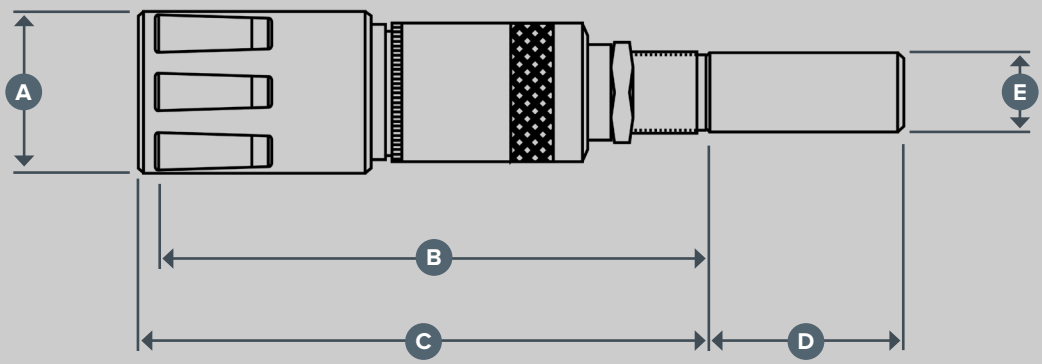
E	1	1.000" straight shank
	2	#3 Morse taper
	3	25mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
2.214 to 2.255	56.236 to 57.277	2.218	56.337	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11142	5408-*01-31142	5408-*02-45142
2.246 to 2.287	57.048 to 58.09	2.250	57.150	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11144	5408-*01-31144	5408-*02-45144
2.277 to 2.318	57.836 to 58.877	2.281	57.937	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11146	5408-*01-31146	5408-*02-45146
2.308 to 2.349	58.623 to 59.665	2.312	58.725	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11148	5408-*01-31148	5408-*02-45148
2.339 to 2.38	59.411 to 60.452	2.343	59.512	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11150	5408-*01-31150	5408-*02-45150
2.371 to 2.412	60.223 to 61.265	2.375	60.325	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11152	5408-*01-31152	5408-*02-45152
2.402 to 2.443	61.011 to 62.052	2.406	61.112	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11154	5408-*01-31154	5408-*02-45154
2.433 to 2.474	61.798 to 62.840	2.437	61.900	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11156	5408-*01-31156	5408-*02-45156

SERIES 5408

2.464IN - 2.724IN
62.586MM - 69.190MM



5408 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.000″ straight shank
	2	#3 Morse taper
	3	25mm straight shank

Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
2.464 to 2.505	62.586 to 63.627	2.468	62.687	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11158	5408-*01-31158	5408-*02-45158
2.496 to 2.537	63.398 to 64.44	2.500	63.500	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11160	5408-*01-31160	5408-*02-45160
2.527 to 2.568	64.186 to 65.227	2.531	64.287	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11162	5408-*01-31162	5408-*02-45162
2.558 to 2.599	64.973 to 66.015	2.562	65.075	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11164	5408-*01-31164	5408-*02-45164
2.589 to 2.63	65.761 to 66.802	2.593	65.862	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11166	5408-*01-31166	5408-*02-45166
2.621 to 2.662	66.573 to 67.615	2.625	66.675	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11168	5408-*01-31168	5408-*02-45168
2.652 to 2.693	67.361 to 68.402	2.656	67.462	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11170	5408-*01-31170	5408-*02-45170
2.683 to 2.724	68.148 to 69.190	2.687	68.250	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5408-*01-11172	5408-*01-31172	5408-*02-45172

5408 SERIES SHANK OPTIONS EXAMPLE:

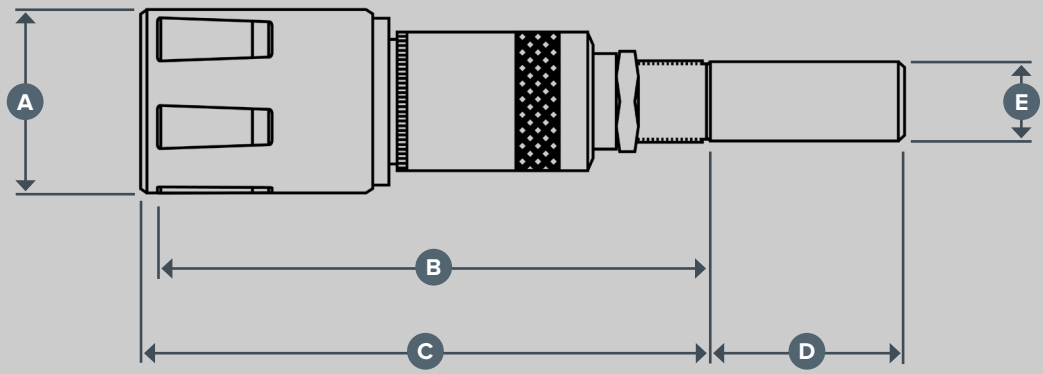
A standard reach 2.656″ diameter blind style tool with a 1.000″ diameter straight shank, would be part #: **5408-101-31170**
Special shank options can be quoted as well.

2.714IN - 3.068IN
68.936MM - 77.927MM
SERIES 5409

5409 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

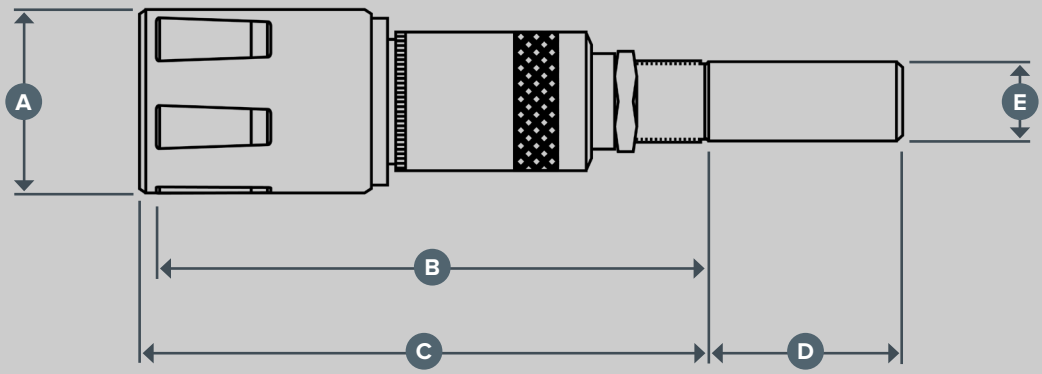
E	1	1.000" straight shank
	2	#3 Morse taper
	3	25mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
2.714 to 2.755	68.936 to 69.977	2.718	69.037	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11174	5409-*01-31174	5409-*02-45174
2.746 to 2.787	69.748 to 70.790	2.750	69.850	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11176	5409-*01-31176	5409-*02-45176
2.777 to 2.818	70.536 to 71.577	2.781	70.637	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11178	5409-*01-31178	5409-*02-45178
2.808 to 2.849	71.323 to 72.365	2.812	71.425	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11180	5409-*01-31180	5409-*02-45180
2.839 to 2.880	72.111 to 73.152	2.843	72.212	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11182	5409-*01-31182	5409-*02-45182
2.871 to 2.912	72.923 to 73.965	2.875	73.025	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11184	5409-*01-31184	5409-*02-45184
2.902 to 2.943	73.711 to 74.752	2.906	73.812	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11186	5409-*01-31186	5409-*02-45186
2.933 to 2.974	74.498 to 75.540	2.937	74.600	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11188	5409-*01-31188	5409-*02-45188
2.964 to 3.005	75.286 to 76.327	2.968	75.387	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11190	5409-*01-31190	5409-*02-45190
2.996 to 3.0370	76.098 to 77.140	3.000	76.200	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11192	5409-*01-31192	5409-*02-45192
3.027 to 3.068	76.886 to 77.927	3.031	76.987	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11194	5409-*01-31194	5409-*02-45194

SERIES 5409

3.058IN - 3.349IN
77.673MM - 85.065MM



5409 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.000″ straight shank
	2	#3 Morse taper
	3	25mm straight shank

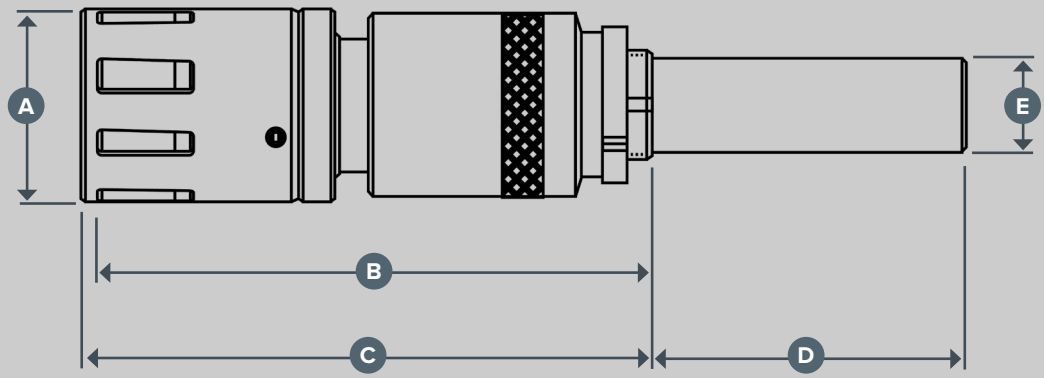
Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
3.058 to 3.099	77.673 to 78.715	3.062	77.775	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11196	5409-*01-31196	5409-*02-45196
3.089 to 3.130	78.461 to 79.502	3.093	78.562	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11198	5409-*01-31198	5409-*02-45198
3.121 to 3.162	79.273 to 80.315	3.125	79.375	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11200	5409-*01-31200	5409-*02-45200
3.152 to 3.193	80.061 to 81.102	3.156	80.162	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11202	5409-*01-31202	5409-*02-45202
3.183 to 3.224	80.848 to 81.890	3.187	80.950	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11204	5409-*01-31204	5409-*02-45204
3.214 to 3.255	81.636 to 82.677	3.218	81.737	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11206	5409-*01-31206	5409-*02-45206
3.246 to 3.287	82.448 to 83.490	3.250	82.550	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11208	5409-*01-31208	5409-*02-45208
3.277 to 3.318	83.236 to 84.277	3.281	83.337	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11210	5409-*01-31210	5409-*02-45210
3.308 to 3.349	84.023 to 85.065	3.312	84.125	Controlled by tool length or shank extensions		7.188	182.50	2.500	63.50	5409-*01-11212	5409-*01-31212	5409-*02-45212

3.339IN - 3.558IN
84.811MM - 91.415MM
SERIES 5610

5610 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank



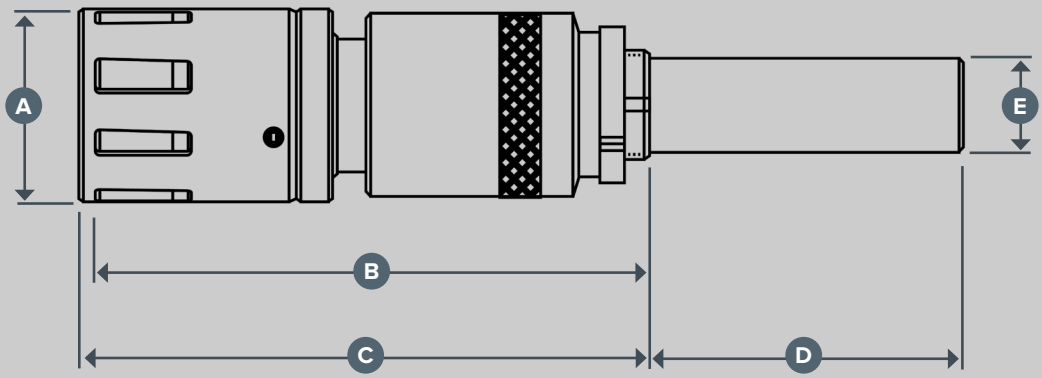
Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
3.339 to 3.380	84.811 to 85.852	3.343	84.912	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11214	5610-*01-31214	5610-*02-45214
3.371 to 3.412	85.623 to 86.665	3.375	85.725	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11216	5610-*01-31216	5610-*02-45216
3.402 to 3.443	86.411 to 87.452	3.406	86.512	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11218	5610-*01-31218	5610-*02-45218
3.433 to 3.474	87.198 to 88.240	3.437	87.300	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11220	5610-*01-31220	5610-*02-45220
3.464 to 3.505	87.986 to 89.027	3.468	88.087	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11222	5610-*01-31222	5610-*02-45222
3.496 to 3.537	88.798 to 89.840	3.500	88.900	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11224	5610-*01-31224	5610-*02-45224
3.527 to 3.568	89.586 to 90.627	3.531	89.687	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11226	5610-*01-31226	5610-*02-45226
3.558 to 3.599	90.373 to 91.415	3.562	90.475	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11228	5610-*01-31228	5610-*02-45228

5610 SERIES SHANK OPTIONS EXAMPLE:

A standard reach 3.375″ diameter through style tool with a 1.500″ diameter straight shank, would be part #: **5610-101-11216**
Special shank options can be quoted as well.

SERIES 5610

3.589IN - 3.849IN
91.161MM - 97.675MM



5610 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank

Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
3.589 to 3.630	91.161 to 92.202	3.593	91.262	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11230	5610-*01-31230	5610-*02-45230
3.621 to 3.662	91.973 to 93.015	3.625	92.075	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11232	5610-*01-31232	5610-*02-45232
3.652 to 3.693	92.761 to 93.802	3.656	92.862	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11234	5610-*01-31234	5610-*02-45234
3.683 to 3.724	93.548 to 94.590	3.687	93.650	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11236	5610-*01-31236	5610-*02-45236
3.714 to 3.755	94.336 to 95.377	3.718	94.437	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11238	5610-*01-31238	5610-*02-45238
3.746 to 3.787	95.148 to 96.19	3.750	95.250	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11240	5610-*01-31240	5610-*02-45240
3.777 to 3.818	95.936 to 96.977	3.781	96.037	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11242	5610-*01-31242	5610-*02-45242
3.808 to 3.849	96.723 to 97.765	3.812	96.825	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11244	5610-*01-31244	5610-*02-45244

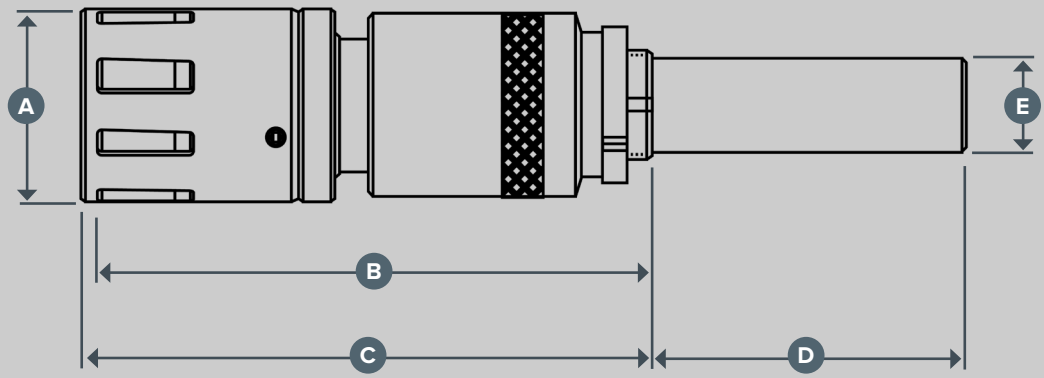
5610 SERIES SHANK OPTIONS EXAMPLE:
A standard reach 3.812″ diameter blind style tool with a #4 Morse taper shank, would be part #: **5610-201-31244**
Special shank options can be quoted as well.

3.839IN - 4.099IN
97.511MM - 104.115MM
SERIES 5610

5610 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

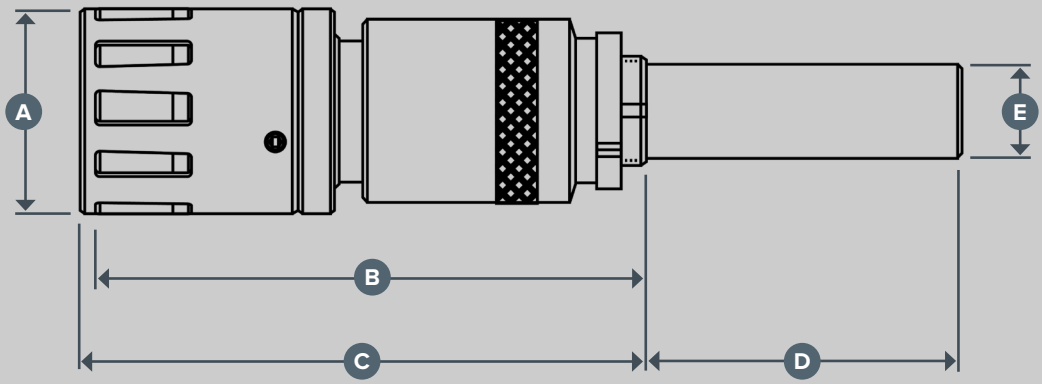
E	1	1.500" straight shank
	2	#4 Morse taper
	3	40mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
3.839 to 3.880	97.511 to 98.552	3.843	97.612	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11246	5610-*01-31246	5610-*02-45246
3.871 to 3.912	98.323 to 99.365	3.875	98.425	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11248	5610-*01-31248	5610-*02-45248
3.902 to 3.943	99.111 to 100.152	3.906	99.212	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11250	5610-*01-31250	5610-*02-45250
3.933 to 3.974	99.898 to 100.94	3.937	100.000	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11252	5610-*01-31252	5610-*02-45252
3.964 to 4.005	100.686 to 101.727	3.968	100.787	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11254	5610-*01-31254	5610-*02-45254
3.996 to 4.037	101.498 to 102.54	4.000	101.600	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11256	5610-*01-31256	5610-*02-45256
4.027 to 4.068	102.286 to 103.327	4.031	102.387	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11258	5610-*01-31258	5610-*02-45258
4.058 to 4.099	103.073 to 104.115	4.062	103.175	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5610-*01-11260	5610-*01-31260	5610-*02-45260

SERIES 5611

4.089IN - 4.349IN
103.861IN - 110.466IN



5611 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank

Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
4.089 to 4.130	103.861 to 104.902	4.093	103.962	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11262	5611-*01-31262	5611-*02-45262
4.121 to 4.162	104.673 to 105.715	4.125	104.775	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11264	5611-*01-31264	5611-*02-45264
4.152 to 4.193	105.461 to 106.502	4.156	105.562	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11266	5611-*01-31266	5611-*02-45266
4.183 to 4.224	106.248 to 107.290	4.187	106.350	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11268	5611-*01-31268	5611-*02-45268
4.214 to 4.255	107.036 to 108.077	4.218	107.137	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11270	5611-*01-31270	5611-*02-45270
4.246 to 4.287	107.848 to 108.89	4.250	107.950	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11272	5611-*01-31272	5611-*02-45272
4.277 to 4.318	108.636 to 109.677	4.281	108.737	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11274	5611-*01-31274	5611-*02-45274
4.308 to 4.349	109.423 to 110.465	4.312	109.525	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11276	5611-*01-31276	5611-*02-45276

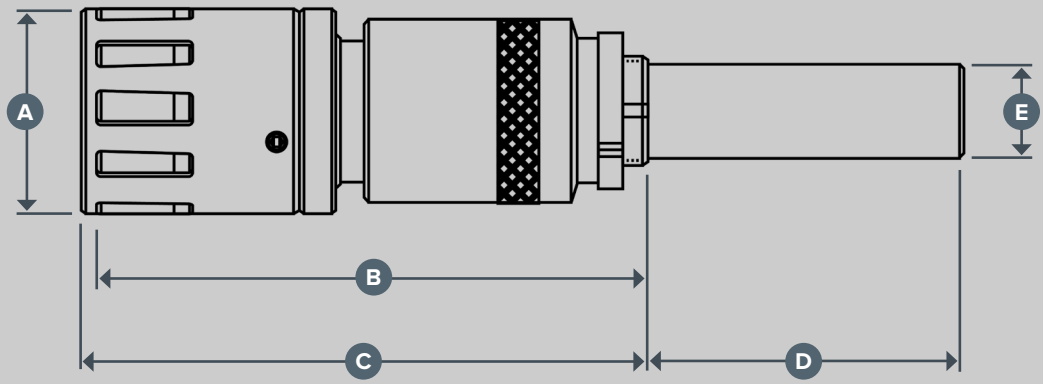
5611 SERIES SHANK OPTIONS EXAMPLE:
A standard reach 4.250″ diameter bottoming style tool with a 40mm straight shank, would be part #: **5611-302-45272**
Special shank options can be quoted as well.

4.339IN - 4.599IN
110.211IN - 116.815IN
SERIES 5611

5611 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

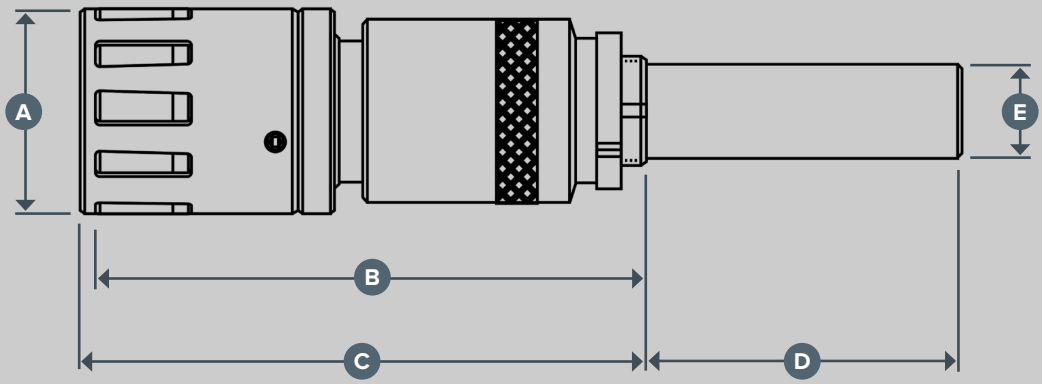
E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
4.339 to 4.380	110.211 to 111.252	4.343	110.312	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11278	5611-*01-31278	5611-*02-45278
4.371 to 4.412	111.023 to 112.065	4.375	111.125	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11280	5611-*01-31280	5611-*02-45280
4.402 to 4.443	111.811 to 112.852	4.406	111.912	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11282	5611-*01-31282	5611-*02-45282
4.433 to 4.474	112.598 to 113.640	4.437	112.700	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11284	5611-*01-31284	5611-*02-45284
4.464 to 4.505	113.386 to 114.427	4.468	113.487	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11286	5611-*01-31286	5611-*02-45286
4.496 to 4.537	114.198 to 115.240	4.500	114.300	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11288	5611-*01-31288	5611-*02-45288
4.527 to 4.568	114.986 to 116.027	4.531	115.087	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11290	5611-*01-31290	5611-*02-45290
4.558 to 4.599	115.773 to 116.815	4.562	115.875	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11292	5611-*01-31292	5611-*02-45292

SERIES 5611

4.589IN - 4.818IN
116.561IN - 122.377IN



5611 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank

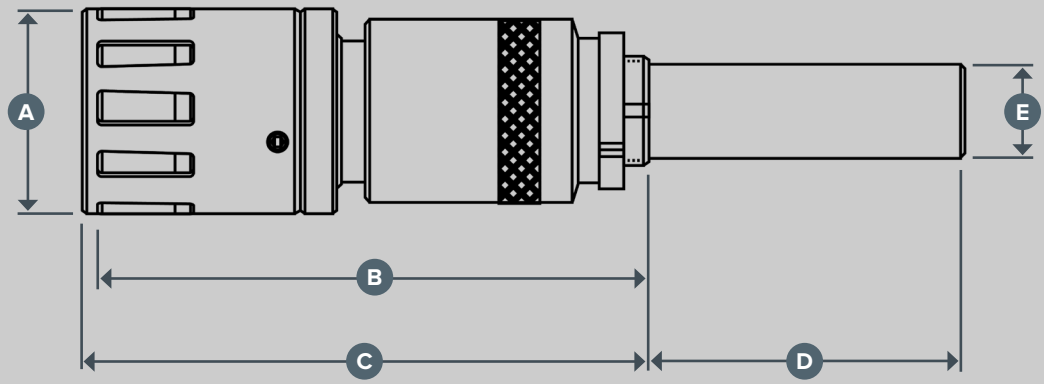
Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
4.589 to 4.630	116.561 to 117.602	4.593	116.662	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11294	5611-*01-31294	5611-*02-45294
4.621 to 4.662	117.373 to 118.415	4.625	117.475	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11296	5611-*01-31296	5611-*02-45296
4.652 to 4.693	118.161 to 119.202	4.656	118.262	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11298	5611-*01-31298	5611-*02-45298
4.683 to 4.724	118.948 to 119.990	4.687	119.050	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11300	5611-*01-31300	5611-*02-45300
4.714 to 4.755	119.736 to 120.777	4.718	119.837	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11302	5611-*01-31302	5611-*02-45302
4.746 to 4.787	120.548 to 121.590	4.750	120.650	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11304	5611-*01-31304	5611-*02-45304
4.777 to 4.818	121.336 to 122.377	4.781	121.437	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11306	5611-*01-31306	5611-*02-45306

4.808IN - 5.037IN
122.123MM - 127.940MM
SERIES 5611

5611 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

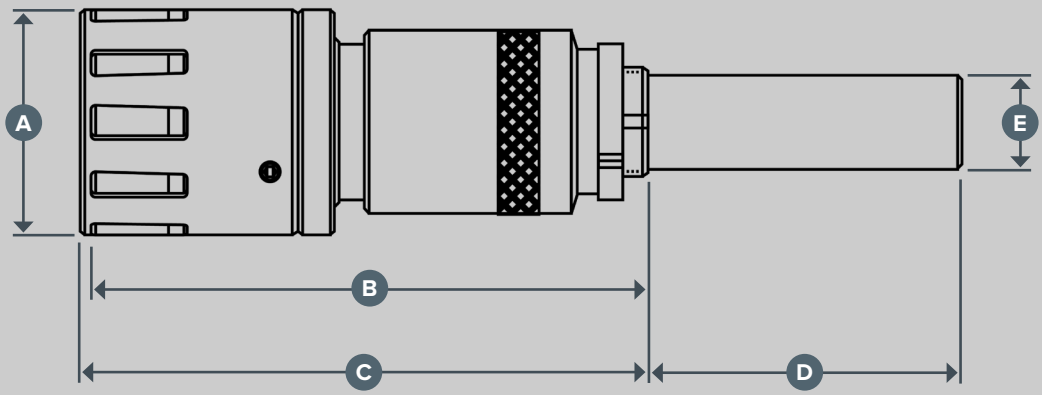
E	1	1.500" straight shank
	2	#4 Morse taper
	3	40mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
4.808 to 4.849	122.123 to 123.165	4.812	122.225	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11308	5611-*01-31308	5611-*02-45308
4.839 to 4.88	122.911 to 123.952	4.843	123.012	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11310	5611-*01-31310	5611-*02-45310
4.871 to 4.912	123.723 to 124.765	4.875	123.825	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11312	5611-*01-31312	5611-*02-45312
4.902 to 4.943	124.511 to 125.552	4.906	124.612	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11314	5611-*01-31314	5611-*02-45314
4.933 to 4.974	125.298 to 126.340	4.937	125.400	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11316	5611-*01-31316	5611-*02-45316
4.964 to 5.005	126.086 to 127.127	4.968	126.187	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11318	5611-*01-31318	5611-*02-45318
4.996 to 5.037	126.898 to 127.940	5.000	127.000	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5611-*01-11320	5611-*01-31320	5611-*02-45320

SERIES 5612

5.027IN - 5.287IN
127.686MM - 134.290MM



5612 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank

Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
5.027 to 5.068	127.686 to 128.727	5.031	127.787	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11322	5612-*01-31322	5612-*02-45322
5.058 to 5.099	128.473 to 129.515	5.062	128.575	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11324	5612-*01-31324	5612-*02-45324
5.089 to 5.130	129.261 to 130.302	5.093	129.362	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11326	5612-*01-31326	5612-*02-45326
5.121 to 5.162	130.073 to 131.115	5.125	130.175	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11328	5612-*01-31328	5612-*02-45328
5.152 to 5.193	130.861 to 131.902	5.156	130.962	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11330	5612-*01-31330	5612-*02-45330
5.183 to 5.224	131.648 to 132.690	5.187	131.750	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11332	5612-*01-31332	5612-*02-45332
5.214 to 5.255	132.436 to 133.477	5.218	132.537	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11334	5612-*01-31334	5612-*02-45334
5.246 to 5.287	133.248 to 134.290	5.250	133.350	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11336	5612-*01-31336	5612-*02-45336

5612 SERIES SHANK OPTIONS EXAMPLE:

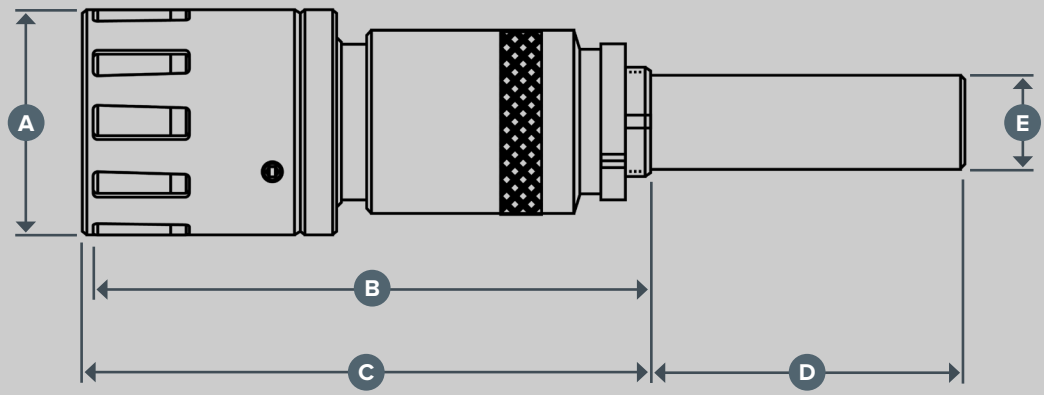
A standard reach 5.187″ diameter through style tool with a 1.500″ diameter straight shank, would be part #: **5612-101-11332**
Special shank options can be quoted as well.

5.277IN - 5.495IN
134.036MM - 140.640MM
SERIES 5612

5612 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank

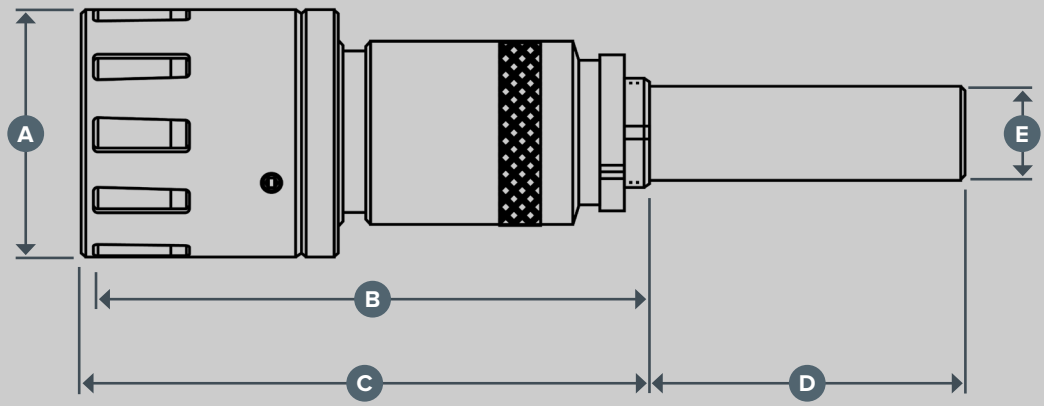


Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
5.277 to 5.318	134.036 to 135.077	5.281	134.137	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11338	5612-*01-31338	5612-*02-45338
5.308 to 5.349	134.823 to 135.865	5.312	134.925	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11340	5612-*01-31340	5612-*02-45340
5.339 to 5.380	135.611 to 136.652	5.343	135.712	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11342	5612-*01-31342	5612-*02-45342
5.371 to 5.412	136.423 to 137.465	5.375	136.525	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11344	5612-*01-31344	5612-*02-45344
5.402 to 5.443	137.211 to 138.252	5.406	137.312	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11346	5612-*01-31346	5612-*02-45346
5.433 to 5.474	137.998 to 139.040	5.437	138.100	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11348	5612-*01-31348	5612-*02-45348
5.464 to 5.505	138.786 to 139.827	5.468	138.887	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11350	5612-*01-31350	5612-*02-45350
5.496 to 5.537	139.598 to 140.640	5.500	139.700	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5612-*01-11352	5612-*01-31352	5612-*02-45352

SERIES 5613

5.527IN - 5.787IN

140.386MM - 146.990MM



5613 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank

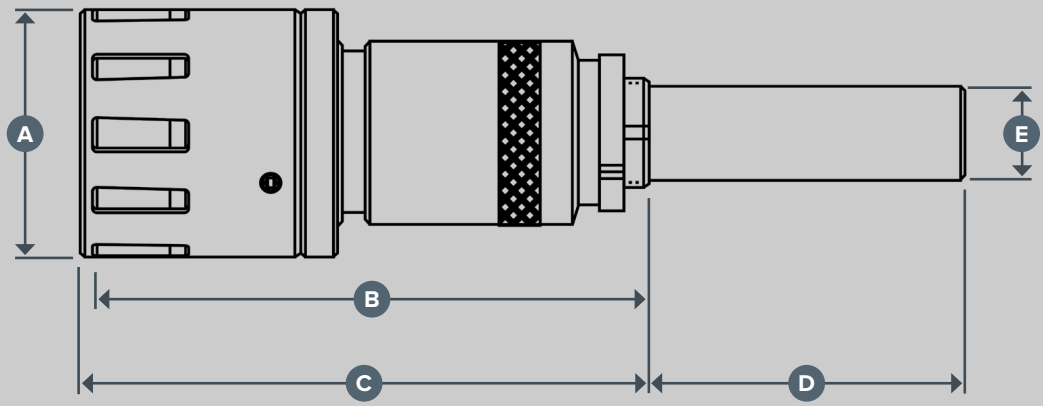
Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
5.527 to 5.568	140.386 to 141.4272	5.531	140.487	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11354	5613-*01-31354	5613-*02-45354
5.559 to 5.600	141.199 to 142.240	5.563	141.300	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11356	5613-*01-31356	5613-*02-45356
5.590 to 5.631	141.986 to 143.027	5.594	142.088	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11358	5613-*01-31358	5613-*02-45358
5.621 to 5.662	142.773 to 143.815	5.625	142.875	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11360	5613-*01-31360	5613-*02-45360
5.652 to 5.693	143.561 to 144.602	5.656	143.662	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11362	5613-*01-31362	5613-*02-45362
5.684 to 5.725	144.374 to 145.415	5.688	144.475	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11364	5613-*01-31364	5613-*02-45364
5.715 to 5.756	145.161 to 146.202	5.719	145.263	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11366	5613-*01-31366	5613-*02-45366
5.746 to 5.787	145.948 to 146.990	5.750	146.050	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11368	5613-*01-31368	5613-*02-45368

5.777IN - 6.037IN
146.736MM - 153.340MM
SERIES 5613

5613 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

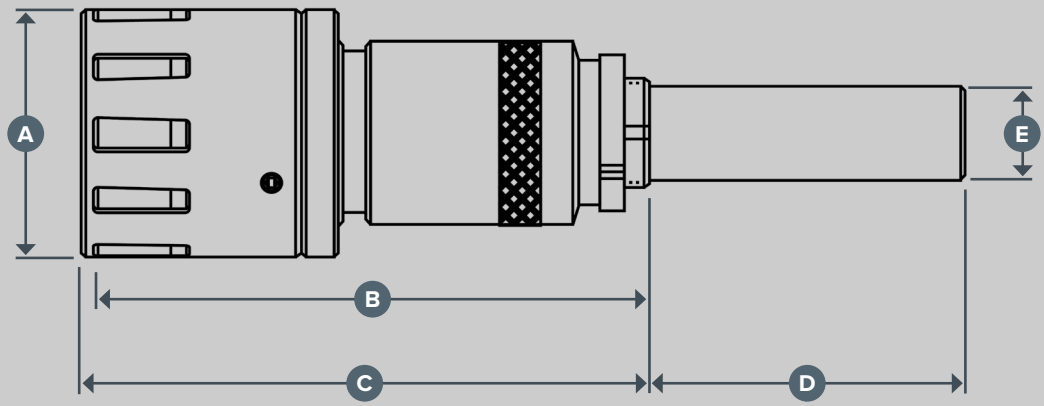
E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
5.777 to 5.818	146.736 to 147.778	5.781	146.837	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11370	5613-*01-31370	5613-*02-45370
5.809 to 5.850	147.549 to 148.590	5.813	147.650	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11372	5613-*01-31372	5613-*02-45372
5.840 to 5.881	148.336 to 149.377	5.844	148.438	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11374	5613-*01-31374	5613-*02-45374
5.871 to 5.912	149.123 to 150.165	5.875	149.225	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11376	5613-*01-31376	5613-*02-45376
5.902 to 5.943	149.911 to 150.952	5.906	150.012	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11378	5613-*01-31378	5613-*02-45378
5.934 to 5.975	150.724 to 151.765	5.938	150.825	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11380	5613-*01-31380	5613-*02-45380
5.965 to 6.006	151.511 to 152.552	5.969	151.613	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11382	5613-*01-31382	5613-*02-45382
5.996 to 6.037	152.298 to 153.340	6.000	152.400	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11384	5613-*01-31384	5613-*02-45384

SERIES 5613

6.027IN - 6.287IN
153.086MM - 159.690MM



5613 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank

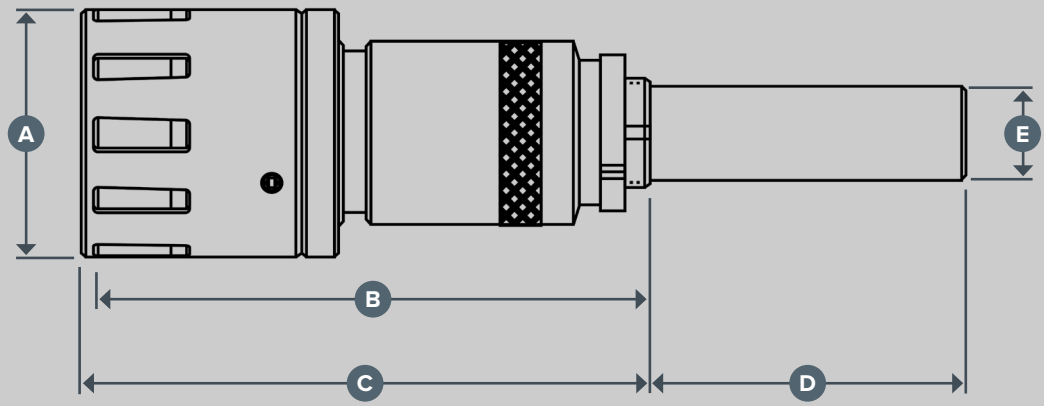
Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
6.027 to 6.068	153.086 to 154.127	6.031	153.187	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11386	5613-*01-31386	5613-*02-45386
6.059 to 6.100	153.899 to 154.940	6.063	154.000	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11388	5613-*01-31388	5613-*02-45388
6.090 to 6.131	154.686 to 155.727	6.094	154.788	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11390	5613-*01-31390	5613-*02-45390
6.121 to 6.162	155.473 to 156.515	6.125	155.575	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11392	5613-*01-31392	5613-*02-45392
6.152 to 6.193	156.261 to 157.302	6.156	156.362	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11394	5613-*01-31394	5613-*02-45394
6.184 to 6.225	157.074 to 158.115	6.188	157.175	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11396	5613-*01-31396	5613-*02-45396
6.215 to 6.256	157.861 to 158.902	6.219	157.963	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11398	5613-*01-31398	5613-*02-45398
6.246 to 6.287	158.648 to 159.690	6.250	158.750	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11400	5613-*01-31400	5613-*02-45400

6.227IN - 6.537IN
159.436MM - 166.040MM
SERIES 5613

5613 SERIES SHANK OPTIONS:

When determining the tool number, please replace the * with one of the following:

E	1	1.500″ straight shank
	2	#4 Morse taper
	3	40mm straight shank



Tool Size Range		A		B		C		D		Tool Number		
		Tool Nominal Diameter		Max Burnishing Reach		Gage Length		Shank Length				
Inches	MM	Inches	MM	Inches	MM	Inches	MM	Inches	MM	Through	Blind	Bottoming
6.277 to 6.318	159.436 to 160.477	6.281	159.537	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11402	5613-*01-31402	5613-*02-45402
6.309 to 6.350	160.249 to 161.290	6.313	160.350	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11404	5613-*01-31404	5613-*02-45404
6.340 to 6.381	161.036 to 162.077	6.344	161.138	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11406	5613-*01-31406	5613-*02-45406
6.371 to 6.412	161.823 to 162.865	6.375	161.925	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11408	5613-*01-31408	5613-*02-45408
6.402 to 6.443	162.619 to 163.652	6.406	162.712	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11410	5613-*01-31410	5613-*02-45610
6.434 to 6.475	163.424 to 164.465	6.438	163.525	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11412	5613-*01-31412	5613-*02-45612
6.465 to 6.506	164.211 to 165.252	6.469	164.313	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11414	5613-*01-31414	5613-*02-45414
6.496 to 6.537	164.998 to 166.040	6.500	165.100	Controlled by tool length or shank extensions		9.125	231.78	5.000	127.00	5613-*01-11416	5613-*01-31416	5613-*02-45416

ID BURNISHING

ROLL REPLACEMENT

Tool Series	Tool Nominal Diameter		Through Rolls		Blind Rolls		Bottoming Rolls	
	Inches	MM	Rolls Per Tool	Part #	Rolls Per Tool	Part #	Rolls Per Tool	Part #
5418	0.157	3.988	--	--	3	5100-704-00049	--	--
	0.167	4.242	--	--	3	5100-704-00049	--	--
	0.177	4.496	--	--	3	5100-704-00049	--	--
	0.187	4.750	--	--	5	5100-704-00062	--	--
	0.193	4.902	--	--	5	5100-704-00062	--	--
	0.203	5.156	--	--	5	5100-704-00062	--	--
	0.218	5.537	--	--	5	5100-704-00070	--	--
	0.234	5.944	--	--	5	5100-704-00070	--	--
	0.250	6.350	--	--	5	5100-704-00078	3	5100-708-00093
	0.265	6.731	--	--	5	5100-704-00078	3	5100-708-00093
	0.281	7.137	--	--	5	5100-704-00086	3	5100-708-00093
	0.296	7.518	--	--	5	5100-704-00086	3	5100-708-00093
	0.312	7.925	--	--	5	5100-704-00093	3	5100-708-00093
	0.328	8.331	--	--	5	5100-704-00093	3	5100-708-00093
	0.343	8.712	--	--	5	5100-704-00109	3	5100-708-00093
	0.359	9.119	--	--	5	5100-704-00109	3	5100-708-00109
	0.375	9.525	--	--	5	5100-704-00109	3	5100-708-00125
	0.390	9.906	--	--	5	5100-704-00109	3	5100-708-00125
	0.406	10.312	--	--	5	5100-704-00125	3	5100-708-00125
	0.421	10.693	--	--	5	5100-704-00125	3	5100-708-00125
	0.437	11.100	--	--	5	5100-704-00125	3	5100-708-00125
	0.453	11.506	--	--	5	5100-704-00148	3	5100-708-00156
	0.468	11.887	--	--	5	5100-704-00148	3	5100-708-00156
	0.484	12.294	--	--	5	5100-704-00148	3	5100-708-00156
5419	0.500	12.700	--	--	5	5100-704-00156	5	5100-708-00156
	0.531	13.487	--	--	5	5100-704-00156	5	5100-708-00156
	0.562	14.275	--	--	5	5100-704-00172	5	5100-708-00172
	0.593	15.062	--	--	5	5100-704-00172	5	5100-708-00172
	0.625	15.875	5	5100-701-00187	5	5100-704-00187	5	5100-708-00187
5433	0.656	16.662	5	5100-701-00187	5	5100-704-00187	5	5100-708-00187
	0.687	17.450	5	5100-701-00187	5	5100-704-00187	5	5100-708-00187
	0.718	18.237	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
	0.750	19.050	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
	0.781	19.837	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
	0.812	20.625	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
	0.843	21.412	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
	0.875	22.225	5	5100-701-00265	5	5100-704-00265	5	5100-708-00265
	0.906	23.012	5	5100-701-00265	5	5100-704-00265	5	5100-708-00265
	0.937	23.800	5	5100-701-00265	5	5100-704-00265	5	5100-708-00265
5444	0.968	24.587	5	5100-701-00265	5	5100-704-00265	5	5100-708-00265
	1.000	25.400	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
	1.031	26.187	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
	1.062	26.975	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
	1.093	27.762	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
	1.125	28.575	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
	1.156	29.362	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
	1.187	30.150	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312

ID BURNISHING

ROLL REPLACEMENT

Tool Series	Tool Nominal Diameter		Through Rolls		Blind Rolls		Bottoming Rolls	
	Inches	MM	Rolls Per Tool	Part #	Rolls Per Tool	Part #	Rolls Per Tool	Part #
5405	1.218	30.937	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
	1.250	31.750	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
	1.281	32.537	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
	1.312	33.325	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
	1.343	34.112	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
	1.375	34.925	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
5406	1.406	35.712	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
	1.437	36.500	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
	1.468	37.287	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
	1.500	38.100	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
	1.531	38.887	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
	1.562	39.675	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
	1.593	40.462	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
	1.625	41.275	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
	1.656	42.062	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
	1.687	42.850	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
	1.718	43.637	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
	1.750	44.450	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
	1.781	45.237	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
	1.812	46.025	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
5407	1.843	46.812	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
	1.875	47.625	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
	1.906	48.412	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
	1.937	49.200	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
	1.968	49.987	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
	2.000	50.800	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
	2.031	51.587	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.062	52.375	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.093	53.162	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.125	53.975	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.156	54.762	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.187	55.550	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
5408	2.218	56.337	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.250	57.150	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.281	57.937	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.312	58.725	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
	2.343	59.512	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
	2.375	60.325	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
	2.406	61.112	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
	2.437	61.900	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
	2.468	62.687	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
	2.500	63.500	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
	2.531	64.287	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
	2.562	65.075	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
	2.593	65.862	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.625	66.675	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.656	67.462	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.687	68.250	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531

ID BURNISHING
ROLL REPLACEMENT

Tool Series	Tool Nominal Diameter		Through Rolls		Blind Rolls		Bottoming Rolls	
	Inches	MM	Rolls Per Tool	Part #	Rolls Per Tool	Part #	Rolls Per Tool	Part #
5409	2.718	69.037	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.750	69.850	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.781	70.637	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.812	71.425	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.843	72.212	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.875	73.025	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
	2.906	73.812	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	2.937	74.600	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	2.968	75.387	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	3.000	76.200	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	3.031	76.987	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	3.062	77.775	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	3.093	78.562	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	3.125	79.375	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	3.156	80.162	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	3.187	80.950	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
	3.218	81.737	9	5100-701-00687	9	5100-704-00687	7	5100-708-00687
	3.250	82.550	9	5100-701-00687	9	5100-704-00687	7	5100-708-00687
	3.281	83.337	9	5100-701-00687	9	5100-704-00687	7	5100-708-00687
	3.312	84.125	9	5100-701-00687	9	5100-704-00687	7	5100-708-00687
5610	3.343	84.912	11	5100-701-00468	9	5100-704-00468	9	5100-708-00468
	3.375	85.725	11	5100-701-00468	11	5100-704-00468	11	5100-708-00468
	3.406	86.512	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.437	87.300	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.468	88.087	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.500	88.900	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.531	89.687	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.562	90.475	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.593	91.262	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.625	92.075	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.656	92.862	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.687	93.650	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.718	94.437	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.750	95.250	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.781	96.037	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.812	96.825	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.843	97.612	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.875	98.425	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.906	99.212	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.937	100.000	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	3.968	100.787	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.000	101.600	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.031	102.387	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.062	103.175	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531

ID BURNISHING
ROLL REPLACEMENT

Tool Series	Tool Nominal Diameter		Through Rolls		Blind Rolls		Bottoming Rolls	
	Inches	MM	Rolls Per Tool	Part #	Rolls Per Tool	Part #	Rolls Per Tool	Part #
5611	4.093	103.962	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.125	104.775	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.156	105.562	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.187	106.350	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.218	107.137	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.250	107.950	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.281	108.737	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.312	109.525	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.343	110.312	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
	4.375	111.125	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.406	111.912	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.437	112.700	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.468	113.487	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.500	114.300	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.531	115.087	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.562	115.875	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.593	116.662	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.625	117.475	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.656	118.262	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.687	119.050	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.718	119.837	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.750	120.650	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.781	121.437	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.812	122.225	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.843	123.012	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.875	123.825	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.906	124.612	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.937	125.400	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.968	126.187	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.000	127.000	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.531	115.087	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.562	115.875	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.593	116.662	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.625	117.475	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.656	118.262	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.687	119.050	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.718	119.837	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.750	120.650	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.781	121.437	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.812	122.225	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.843	123.012	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.875	123.825	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.906	124.612	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.937	125.400	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	4.968	126.187	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.000	127.000	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531

ID BURNISHING

ROLL REPLACEMENT

Tool Series	Tool Nominal Diameter		Through Rolls		Blind Rolls		Bottoming Rolls	
	Inches	MM	Rolls Per Tool	Part #	Rolls Per Tool	Part #	Rolls Per Tool	Part #
5612	5.031	127.787	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.062	128.575	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.093	129.362	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.125	130.175	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.156	130.962	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.187	131.750	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.218	132.537	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.250	133.350	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.281	134.137	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.312	134.925	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.343	135.712	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.375	136.525	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.406	137.312	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.437	138.100	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.468	138.887	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
	5.500	139.700	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
5613	5.531	140.487	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.563	141.300	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.594	142.088	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.625	142.875	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.656	143.662	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.688	144.475	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.719	145.263	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.750	146.050	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.781	146.837	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.813	147.650	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.844	148.438	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.875	149.225	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.906	150.012	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.938	150.825	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	5.969	151.613	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.000	152.400	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.031	153.187	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.063	154.000	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.094	154.788	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.125	155.575	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.156	156.362	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.188	157.175	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.219	157.963	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.250	158.750	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.281	159.537	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.313	160.350	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.344	161.138	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.375	161.925	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.406	162.712	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.438	163.525	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.469	164.313	15	5100-701-00531	15	5100-70400531	15	5100-708-00531
	6.500	165.100	15	5100-701-00531	15	5100-70400531	15	5100-708-00531

MANDREL & CAGE REPLACEMENT

Tool Series	Tool Nominal Diameter		Max Burnishing Reach	Mandrel Tip Part #		Cage Part #	
	Inches	MM		Standard	Bottoming	Standard	Bottoming
5418	0.157	3.988	Reg.	5418-031-10008	--	5301-011-10008	--
	0.167	4.242	Reg.	5418-031-10009	--	5301-011-10009	--
	0.177	4.496	Reg.	5418-031-10010	--	5301-011-10010	--
	0.187	4.750	Stub	5418-031-10012	--	5301-011-10012	--
			Reg.	5418-031-20012	--	5301-011-20012	--
			Long	5418-031-30012	--	5301-011-30012	--
	0.193	4.902	Stub	5418-033-10012	--	5301-011-10011	--
			Reg.	5418-033-20012	--	5301-011-20011	--
			Long	5418-033-30012	--	5301-011-30011	--
	0.203	5.156	Stub	5418-031-10013	--	5301-011-10013	--
			Reg.	5418-031-20013	--	5301-011-20013	--
			Long	5418-031-30013	--	5301-011-30013	--
	0.218	5.537	Stub	5418-031-10013	--	5301-011-10014	--
			Reg.	5418-031-20013	--	5301-011-20014	--
			Long	5418-031-30013	--	5301-011-30014	--
	0.234	5.944	Stub	5418-031-10015	--	5301-011-10015	--
			Reg.	5418-031-20015	--	5301-011-20015	--
			Long	5418-031-30015	--	5301-011-30015	--
	0.250	6.350	Stub	5418-031-10015	5418-032-10012	5301-011-10016	5301-015-10016
			Reg.	5418-031-20015	5418-032-20012	5301-011-20016	5301-015-20016
			Long	5418-031-30015	5418-032-30012	5301-011-30016	5301-015-30016
	0.265	6.731	Stub	5418-031-10017	5418-032-10013	5301-011-10017	5301-015-10017
			Reg.	5418-031-20017	5418-032-20013	5301-011-20017	5301-015-20017
			Long	5418-031-30017	5418-032-30013	5301-011-30017	5301-015-30017
	0.281	7.137	Stub	5418-031-10017	5418-032-10015	5301-011-10018	5301-015-10018
			Reg.	5418-031-20017	5418-032-20015	5301-011-20018	5301-015-20018
			Long	5418-031-30017	5418-032-30015	5301-011-30018	5301-015-30018
	0.296	7.518	Stub	5418-031-10019	5418-032-10017	5301-011-10019	5301-015-10019
			Reg.	5418-031-20019	5418-032-20017	5301-011-20019	5301-015-20019
			Long	5418-031-30019	5418-032-30017	5301-011-30019	5301-015-30019
	0.312	7.925	Stub	5418-031-10019	5418-032-10019	5301-011-10020	5301-015-10020
			Reg.	5418-031-20019	5418-032-20019	5301-011-20020	5301-015-20020
			Long	5418-031-30019	5418-032-30019	5301-011-30020	5301-015-30020
	0.328	8.331	Stub	5418-031-10021	5418-032-10021	5301-011-10021	5301-015-10021
			Reg.	5418-031-20021	5418-032-20021	5301-011-20021	5301-015-20021
			Long	5418-031-30021	5418-032-30021	5301-011-30021	5301-015-30021
	0.343	8.712	Stub	5418-031-10019	5418-032-10022	5301-011-10022	5301-015-10022
			Reg.	5418-031-20019	5418-032-20022	5301-011-20022	5301-015-20022
			Long	5418-031-30019	5418-032-30022	5301-011-30022	5301-015-30022
	0.359	9.119	Stub	5418-031-10021	5418-032-10021	5301-011-10023	5301-015-10023
			Reg.	5418-031-20021	5418-032-20021	5301-011-20023	5301-015-20023
			Long	5418-031-30021	5418-032-30021	5301-011-30023	5301-015-30023
	0.375	9.525	Stub	5318-031-10024	5418-032-10019	5301-011-10024	5301-015-10024
			Reg.	5318-031-20024	5418-032-20019	5301-011-20024	5301-015-20024
			Long	5318-031-30024	5418-032-30019	5301-011-30024	5301-015-30024
	0.390	9.906	Stub	5318-031-10025	5418-032-10021	5301-011-10025	5301-015-10025
			Reg.	5318-031-20025	5418-032-20021	5301-011-20025	5301-015-20025
			Long	5318-031-30025	5418-032-30021	5301-011-30025	5301-015-30025
	0.406	10.312	Stub	5318-031-10024	5318-032-10024	5301-011-10026	5301-015-10026
			Reg.	5318-031-20024	5318-032-20024	5301-011-20026	5301-015-20026
			Long	5318-031-30024	5318-032-30024	5301-011-30026	5301-015-30026

ID BURNISHING

MANDREL & CAGE REPLACEMENT

Tool Series	Tool Nominal Diameter		Max Burnishing Reach	Mandrel Tip Part #		Cage Part #	
	Inches	MM		Standard	Bottoming	Standard	Bottoming
5418	0.421	10.693	Stub	5318-031-10025	5318-032-10025	5301-011-10027	5301-015-10027
			Reg.	5318-031-20025	5318-032-20025	5301-011-20027	5301-015-20027
			Long	5318-031-30025	5318-032-30025	5301-011-30027	5301-015-30027
	0.437	11.100	Stub	5318-031-10028	5318-032-10028	5301-011-10028	5301-015-10028
			Reg.	5318-031-20028	5318-032-20028	5301-011-20028	5301-015-20028
			Long	5318-031-30028	5318-032-30028	5301-011-30028	5301-015-30028
	0.453	11.506	Stub	5318-031-10024	5418-032-10021	5301-011-10029	5301-015-10029
			Reg.	5318-031-20024	5418-032-20021	5301-011-20029	5301-015-20029
			Long	5318-031-30024	5418-032-30021	5301-011-30029	5301-015-30029
	0.468	11.887	Stub	5318-031-10025	5318-032-10024	5301-011-10030	5301-015-10030
			Reg.	5318-031-20025	5318-032-20024	5301-011-20030	5301-015-20030
			Long	5318-031-30025	5318-032-30024	5301-011-30030	5301-015-30030
	0.484	12.294	Stub	5318-031-10028	5318-032-10025	5301-011-10031	5301-015-10031
			Reg.	5318-031-20028	5318-032-20025	5301-011-20031	5301-015-20031
			Long	5318-031-30028	5318-032-30025	5301-011-30031	5301-015-30031
5419	0.500	12.700	Stub	5319-031-10032	5319-032-10032	--	--
			Reg.	5319-031-20032	5319-032-20032	5151-400-00500	5135-400-00500
			Long	5319-031-30032	5319-032-30032	--	--
	0.531	13.487	Stub	5319-031-10034	5319-032-10034	--	--
			Reg.	5319-031-20034	5319-032-20034	5151-400-00531	5135-400-00531
			Long	5319-031-30034	5319-032-30034	--	--
	0.562	14.275	Stub	5319-031-10034	5319-032-10034	--	--
			Reg.	5319-031-20034	5319-032-20034	5151-400-00562	5135-400-00562
			Long	5319-031-30034	5319-032-30034	--	--
	0.593	15.062	Stub	5319-031-10038	5319-032-10038	--	--
			Reg.	5319-031-20038	5319-032-20038	5151-400-00593	5135-400-00593
			Long	5319-031-30038	5319-032-30038	--	--
	0.625	15.875	Stub	5319-031-10038	5319-032-10038	--	--
			Reg.	5319-031-20038	5319-032-20038	5151-400-00625	5135-400-00625
			Long	5319-031-30038	5319-032-30038	--	--
5433	0.656	16.662	Reg.	5333-031-00042	5333-032-00042	5403-011-00042	5403-015-00042
	0.687	17.450	Reg.	5333-031-00044	5333-032-00044	5403-011-00044	5403-015-00044
	0.718	18.237	Reg.	5333-031-00042	5333-032-00042	5403-011-00046	5403-015-00046
	0.750	19.050	Reg.	5333-031-00044	5333-032-00044	5403-011-00048	5403-015-00048
	0.781	19.837	Reg.	5333-031-00050	5333-032-00050	5403-011-00050	5403-015-00050
	0.812	20.625	Reg.	5333-031-00052	5333-032-00052	5403-011-00052	5403-015-00052
	0.843	21.412	Reg.	5333-031-00054	5333-032-00054	5403-011-00054	5403-015-00054
	0.875	22.225	Reg.	5333-031-00050	5333-032-00050	5403-011-00056	5403-015-00056
	0.906	23.012	Reg.	5333-031-00052	5333-032-00052	5403-011-00058	5403-015-00058
	0.937	23.800	Reg.	5333-031-00054	5333-032-00054	5403-011-00060	5403-015-00060
5444	0.968	24.587	Reg.	5344-031-00062	5344-032-00062	5404-011-00062	5404-015-00062
	1.000	25.400	Reg.	5344-031-00064	5344-032-00064	5404-011-00064	5404-015-00064
	1.031	26.187	Reg.	5344-031-00066	5344-032-00066	5404-011-00066	5404-015-00066
	1.062	26.975	Reg.	5344-031-00068	5344-032-00068	5404-011-00068	5404-015-00068
	1.093	27.762	Reg.	5344-031-00070	5344-032-00070	5404-011-00070	5404-015-00070
	1.125	28.575	Reg.	5344-031-00066	5344-032-00066	5404-011-00072	5404-015-00072
	1.156	29.362	Reg.	5344-031-00068	5344-032-00068	5404-011-00074	5404-015-00074
	1.187	30.150	Reg.	5344-031-00070	5344-032-00070	5404-011-00076	5404-015-00076

MANDREL & CAGE REPLACEMENT

Tool Series	Tool Nominal Diameter		Max Burnishing Reach	Mandrel Tip Part #		Cage Part #	
	Inches	MM		Standard	Bottoming	Standard	Bottoming
5405	1.218	30.937	Reg.	5305-031-00078	5305-032-00078	5405-011-00078	5405-015-00078
	1.250	31.750	Reg.	5305-031-00080	5305-032-00080	5405-011-00080	5405-015-00080
	1.281	32.537	Reg.	5305-031-00082	5305-032-00082	5405-011-00082	5405-015-00082
	1.312	33.325	Reg.	5305-031-00078	5305-032-00078	5405-011-00084	5405-015-00084
	1.343	34.112	Reg.	5305-031-00080	5305-032-00080	5405-011-00086	5405-015-00086
	1.375	34.925	Reg.	5305-031-00082	5305-032-00082	5405-011-00088	5405-015-00088
5406	1.406	35.712	Reg.	5306-031-00090	5306-032-00090	5406-011-00090	5406-015-00090
	1.437	36.500	Reg.	5306-031-00092	5306-032-00092	5406-011-00092	5406-015-00092
	1.468	37.287	Reg.	5306-031-00094	5306-032-00094	5406-011-00094	5406-015-00094
	1.500	38.100	Reg.	5306-031-00096	5306-032-00096	5406-011-00096	5406-015-00096
	1.531	38.887	Reg.	5305-031-00080	5305-032-00080	5406-011-00098	5406-015-00098
	1.562	39.675	Reg.	5305-031-00082	5305-032-00082	5406-011-00100	5406-015-00100
	1.593	40.462	Reg.	5306-031-00090	5306-032-00090	5406-011-00102	5406-015-00102
	1.625	41.275	Reg.	5306-031-00092	5306-032-00092	5406-011-00104	5406-015-00104
	1.656	42.062	Reg.	5306-031-00094	5306-032-00094	5406-011-00106	5406-015-00106
	1.687	42.850	Reg.	5305-031-00082	5305-032-00082	5406-011-00108	5406-015-00108
	1.718	43.637	Reg.	5306-031-00090	5306-032-00090	5406-011-00110	5406-015-00110
	1.750	44.450	Reg.	5306-031-00092	5306-032-00092	5406-011-00112	5406-015-00112
	1.781	45.237	Reg.	5306-031-00094	5306-032-00094	5406-011-00114	5406-015-00114
	1.812	46.025	Reg.	5306-031-00096	5306-032-00096	5406-011-00116	5406-015-00116
5407	1.843	46.812	Reg.	5307-031-00118	5307-032-00118	5407-011-00118	5407-015-00118
	1.875	47.625	Reg.	5307-031-00120	5307-032-00120	5407-011-00120	5407-015-00120
	1.906	48.412	Reg.	5307-031-00122	5307-032-00122	5407-011-00122	5407-015-00122
	1.937	49.200	Reg.	5307-031-00124	5307-032-00124	5407-011-00124	5407-015-00124
	1.968	49.987	Reg.	5307-031-00126	5307-032-00126	5407-011-00126	5407-015-00126
	2.000	50.800	Reg.	5307-031-00128	5307-032-00128	5407-011-00128	5407-015-00128
	2.031	51.587	Reg.	5307-031-00118	5307-032-00118	5407-011-00130	5407-015-00130
	2.062	52.375	Reg.	5307-031-00120	5307-032-00120	5407-011-00132	5407-015-00132
	2.093	53.162	Reg.	5307-031-00122	5307-032-00122	5407-011-00134	5407-015-00134
	2.125	53.975	Reg.	5307-031-00124	5307-032-00124	5407-011-00136	5407-015-00136
	2.156	54.762	Reg.	5307-031-00126	5307-032-00126	5407-011-00138	5407-015-00138
	2.187	55.550	Reg.	5307-031-00128	5307-032-00128	5407-011-00140	5407-015-00140
5408	2.218	56.337	Reg.	5308-031-00142	5308-032-00142	5408-011-00142	5408-015-00142
	2.250	57.150	Reg.	5308-031-00144	5308-032-00144	5408-011-00144	5408-015-00144
	2.281	57.937	Reg.	5308-031-00146	5308-032-00146	5408-011-00146	5408-015-00146
	2.312	58.725	Reg.	5308-031-00148	5308-032-00148	5408-011-00148	5408-015-00148
	2.343	59.512	Reg.	5308-031-00142	5308-032-00142	5408-011-00150	5408-015-00150
	2.375	60.325	Reg.	5308-031-00144	5308-032-00144	5408-011-00152	5408-015-00152
	2.406	61.112	Reg.	5308-031-00146	5308-032-00146	5408-011-00154	5408-015-00154
	2.437	61.900	Reg.	5308-031-00148	5308-032-00148	5408-011-00156	5408-015-00156
	2.468	62.687	Reg.	5308-031-00158	5308-032-00158	5408-011-00158	5408-015-00158
	2.500	63.500	Reg.	5308-031-00160	5308-032-00160	5408-011-00160	5408-015-00160
	2.531	64.287	Reg.	5308-031-00162	5308-032-00162	5408-011-00162	5408-015-00162
	2.562	65.075	Reg.	5308-031-00164	5308-032-00164	5408-011-00164	5408-015-00164
	2.593	65.862	Reg.	5308-031-00158	5308-032-00158	5408-011-00166	5408-015-00166
	2.625	66.675	Reg.	5308-031-00160	5308-032-00160	5408-011-00168	5408-015-00168
	2.656	67.462	Reg.	5308-031-00162	5308-032-00162	5408-011-00170	5408-015-00170
	2.687	68.250	Reg.	5308-031-00164	5308-032-00164	5408-011-00172	5408-015-00172

ID BURNISHING

MANDREL & CAGE REPLACEMENT

Tool Series	Tool Nominal Diameter		Max Burnishing Reach	Mandrel Tip Part #		Cage Part #	
	Inches	MM		Standard	Bottoming	Standard	Bottoming
5409	2.718	69.037	Reg.	5309-031-00174	5309-032-00174	5409-011-00174	5409-015-00174
	2.750	69.850	Reg.	5309-031-00176	5309-032-00176	5409-011-00176	5409-015-00176
	2.781	70.637	Reg.	5309-031-00178	5309-032-00178	5409-011-00178	5409-015-00178
	2.812	71.425	Reg.	5309-031-00180	5309-032-00180	5409-011-00180	5409-015-00180
	2.843	72.212	Reg.	5309-031-00182	5309-032-00182	5409-011-00182	5409-015-00182
	2.875	73.025	Reg.	5309-031-00184	5309-032-00184	5409-011-00184	5409-015-00184
	2.906	73.812	Reg.	5309-031-00174	5309-032-00174	5409-011-00186	5409-015-00186
	2.937	74.600	Reg.	5309-031-00176	5309-032-00176	5409-011-00188	5409-015-00188
	2.968	75.387	Reg.	5309-031-00178	5309-032-00178	5409-011-00190	5409-015-00190
	3.000	76.200	Reg.	5309-031-00180	5309-032-00180	5409-011-00192	5409-015-00192
	3.031	76.987	Reg.	5309-031-00182	5309-032-00182	5409-011-00194	5409-015-00194
	3.062	77.775	Reg.	5309-031-00184	5309-032-00184	5409-011-00196	5409-015-00196
	3.093	78.562	Reg.	5309-031-00198	5309-032-00198	5409-011-00198	5409-015-00198
	3.125	79.375	Reg.	5309-031-00200	5309-032-00200	5409-011-00200	5409-015-00200
	3.156	80.162	Reg.	5309-031-00202	5309-032-00202	5409-011-00202	5409-015-00202
	3.187	80.950	Reg.	5309-031-00204	5309-032-00204	5409-011-00204	5409-015-00204
	3.218	81.737	Reg.	5309-031-00198	5309-032-00198	5409-011-00206	5409-015-00206
	3.250	82.550	Reg.	5309-031-00200	5309-032-00200	5409-011-00208	5409-015-00208
	3.281	83.337	Reg.	5309-031-00202	5309-032-00202	5409-011-00210	5409-015-00210
	3.312	84.125	Reg.	5309-031-00204	5309-032-00204	5409-011-00212	5409-015-00212
5610	3.343	84.912	Reg.	5155-059-10001	5155-059-10002	5610-011-00214	5610-015-00214
	3.375	85.725	Reg.	5155-060-10001	5155-060-10002	5610-011-00216	5610-015-00216
	3.406	86.512	Reg.	5155-061-10001	5155-061-10002	5610-011-00218	5610-015-00218
	3.437	87.300	Reg.	5155-062-10001	5155-062-10002	5610-011-00220	5610-015-00220
	3.468	88.087	Reg.	5155-063-10001	5155-063-10002	5610-011-00222	5610-015-00222
	3.500	88.900	Reg.	5155-064-10001	5155-064-10002	5610-011-00224	5610-015-00224
	3.531	89.687	Reg.	5155-065-10001	5155-065-10002	5610-011-00226	5610-015-00226
	3.562	90.475	Reg.	5155-066-10001	5155-066-10002	5610-011-00228	5610-015-00228
	3.593	91.262	Reg.	5155-067-10001	5155-067-10002	5610-011-00230	5610-015-00230
	3.625	92.075	Reg.	5155-068-10001	5155-068-10002	5610-011-00232	5610-015-00232
	3.656	92.862	Reg.	5155-069-10001	5155-069-10002	5610-011-00234	5610-015-00234
	3.687	93.650	Reg.	5155-070-10001	5155-070-10002	5610-011-00236	5610-015-00236
	3.718	94.437	Reg.	5155-071-10001	5155-071-10002	5610-011-00238	5610-015-00238
	3.750	95.250	Reg.	5155-072-10001	5155-072-10002	5610-011-00240	5610-015-00240
	3.781	96.037	Reg.	5155-073-10001	5155-073-10002	5610-011-00242	5610-015-00242
	3.812	96.825	Reg.	5155-074-10001	5155-074-10002	5610-011-00244	5610-015-00244
	3.843	97.612	Reg.	5155-075-10001	5155-075-10002	5610-011-00246	5610-015-00246
	3.875	98.425	Reg.	5155-076-10001	5155-076-10002	5610-011-00248	5610-015-00248
	3.906	99.212	Reg.	5155-077-10001	5155-077-10002	5610-011-00250	5610-015-00250
	3.937	100.000	Reg.	5155-078-10001	5155-078-10002	5610-011-00252	5610-015-00252
	3.968	100.787	Reg.	5155-079-10001	5155-079-10002	5610-011-00254	5610-015-00254
	4.000	101.600	Reg.	5155-080-10001	5155-080-10002	5610-011-00256	5610-015-00256
	4.031	102.387	Reg.	5155-081-10001	5155-081-10002	5610-011-00258	5610-015-00258
	4.062	103.175	Reg.	5155-082-10001	5155-082-10002	5610-011-00260	5610-015-00260

MANDREL & CAGE REPLACEMENT

Tool Series	Tool Nominal Diameter		Max Burnishing Reach	Mandrel Tip Part #		Cage Part #	
	Inches	MM		Standard	Bottoming	Standard	Bottoming
5611	4.093	103.962	Reg.	5155-083-10001	5155-083-10002	5611-011-00262	5611-015-00262
	4.125	104.775	Reg.	5155-084-10001	5155-084-10002	5611-011-00264	5611-015-00264
	4.156	105.562	Reg.	5155-085-10001	5155-085-10002	5611-011-00266	5611-015-00266
	4.187	106.350	Reg.	5155-086-10001	5155-086-10002	5611-011-00268	5611-015-00268
	4.218	107.137	Reg.	5155-087-10001	5155-087-10002	5611-011-00270	5611-015-00270
	4.250	107.950	Reg.	5155-088-10001	5155-088-10002	5611-011-00272	5611-015-00272
	4.281	108.737	Reg.	5155-089-10001	5155-089-10002	5611-011-00274	5611-015-00274
	4.312	109.525	Reg.	5155-090-10001	5155-090-10002	5611-011-00276	5611-015-00276
	4.343	110.312	Reg.	5155-091-10001	5155-091-10002	5611-011-00278	5611-015-00278
	4.375	111.125	Reg.	5155-092-10001	5155-092-10002	5611-011-00280	5611-015-00280
	4.406	111.912	Reg.	5155-093-10001	5155-093-10002	5611-011-00282	5611-015-00282
	4.437	112.700	Reg.	5155-094-10001	5155-094-10002	5611-011-00284	5611-015-00284
	4.468	113.487	Reg.	5155-095-10001	5155-095-10002	5611-011-00286	5611-015-00286
	4.500	114.300	Reg.	5155-096-10001	5155-096-10002	5611-011-00288	5611-015-00288
	4.531	115.087	Reg.	5155-097-10001	5155-097-10002	5611-011-00290	5611-015-00290
	4.562	115.875	Reg.	5155-098-10001	5155-098-10002	5611-011-00292	5611-015-00292
	4.593	116.662	Reg.	5155-099-10001	5155-099-10002	5611-011-00294	5611-015-00294
	4.625	117.475	Reg.	5155-100-10001	5155-100-10002	5611-011-00296	5611-015-00296
	4.656	118.262	Reg.	5155-101-10001	5155-101-10002	5611-011-00298	5611-015-00298
	4.687	119.050	Reg.	5155-102-10001	5155-102-10002	5611-011-00300	5611-015-00300
	4.718	119.837	Reg.	5155-103-10001	5155-103-10002	5611-011-00302	5611-015-00302
	4.750	120.650	Reg.	5155-104-10001	5155-104-10002	5611-011-00304	5611-015-00304
	4.781	121.437	Reg.	5155-105-10001	5155-105-10002	5611-011-00306	5611-015-00306
	4.812	122.225	Reg.	5155-106-10001	5155-106-10002	5611-011-00308	5611-015-00308
	4.843	123.012	Reg.	5155-107-10001	5155-107-10002	5611-011-00310	5611-015-00310
	4.875	123.825	Reg.	5155-108-10001	5155-108-10002	5611-011-00312	5611-015-00312
	4.906	124.612	Reg.	5155-109-10001	5155-109-10002	5611-011-00314	5611-015-00314
	4.937	125.400	Reg.	5155-110-10001	5155-110-10002	5611-011-00316	5611-015-00316
	4.968	126.187	Reg.	5155-111-10001	5155-111-10002	5611-011-00318	5611-015-00318
	5.000	127.000	Reg.	5155-112-10001	5155-112-10002	5611-011-00320	5611-015-00320
5612	5.031	127.787	Reg.	5155-113-10001	5155-113-10002	5612-011-00322	5612-015-00322
	5.062	128.575	Reg.	5155-114-10001	5155-114-10002	5612-011-00324	5612-015-00324
	5.093	129.362	Reg.	5155-115-10001	5155-115-10002	5612-011-00326	5612-015-00326
	5.125	130.175	Reg.	5155-116-10001	5155-116-10002	5612-011-00328	5612-015-00328
	5.156	130.962	Reg.	5155-117-10001	5155-117-10002	5612-011-00330	5612-015-00330
	5.187	131.750	Reg.	5155-118-10001	5155-118-10002	5612-011-00332	5612-015-00332
	5.218	132.537	Reg.	5155-119-10001	5155-119-10002	5612-011-00334	5612-015-00334
	5.250	133.350	Reg.	5155-120-10001	5155-120-10002	5612-011-00336	5612-015-00336
	5.281	134.137	Reg.	5155-121-10001	5155-121-10002	5612-011-00338	5612-015-00338
	5.312	134.925	Reg.	5155-122-10001	5155-122-10002	5612-011-00340	5612-015-00340
	5.343	135.712	Reg.	5155-123-10001	5155-123-10002	5612-011-00342	5612-015-00342
	5.375	136.525	Reg.	5155-124-10001	5155-124-10002	5612-011-00344	5612-015-00344
	5.406	137.312	Reg.	5155-125-10001	5155-125-10002	5612-011-00346	5612-015-00346
	5.437	138.100	Reg.	5155-126-10001	5155-126-10002	5612-011-00348	5612-015-00348
	5.468	138.887	Reg.	5155-127-10001	5155-127-10002	5612-011-00350	5612-015-00350
	5.500	139.700	Reg.	5155-128-10001	5155-128-10002	5612-011-00352	5612-015-00352

ID BURNISHING

MANDREL & CAGE REPLACEMENT

Tool Series	Tool Nominal Diameter		Max Burnishing Reach	Mandrel Tip Part #		Cage Part #	
	Inches	MM		Standard	Bottoming	Standard	Bottoming
5613	5.531	140.487	Reg.	515512910001	515512910002	561301100354	561301500354
	5.563	141.300	Reg.	515513010001	515513010002	561301100356	561301500356
	5.594	142.088	Reg.	515513110001	515513110002	561301100358	561301500358
	5.625	142.875	Reg.	515513210001	515513210002	561301100360	561301500360
	5.656	143.662	Reg.	515513310001	515513310002	561301100362	561301500362
	5.688	144.475	Reg.	515513410001	515513410002	561301100364	561301500364
	5.719	145.263	Reg.	515513510001	515513510002	561301100366	561301500366
	5.750	146.050	Reg.	515513610001	515513610002	561301100368	561301500368
	5.781	146.837	Reg.	515513710001	515513710002	561301100370	561301500370
	5.813	147.650	Reg.	515513810001	515513810002	561301100372	561301500372
	5.844	148.438	Reg.	515513910001	515513910002	561301100374	561301500374
	5.875	149.225	Reg.	515514010001	515514010002	561301100376	561301500376
	5.906	150.012	Reg.	515514110001	515514110002	561301100378	561301500378
	5.938	150.825	Reg.	515514210001	515514210002	561301100380	561301500380
	5.969	151.613	Reg.	515514310001	515514310002	561301100382	561301500382
	6.000	152.400	Reg.	515514410001	515514410002	561301100384	561301500384
	6.031	153.187	Reg.	515514510001	515514510002	561301100386	561301500386
	6.063	154.000	Reg.	515514610001	515514610002	561301100388	561301500388
	6.094	154.788	Reg.	515514710001	515514710002	561301100390	561301500390
	6.125	155.575	Reg.	515514810001	515514810002	561301100392	561301500392
	6.156	156.362	Reg.	515514910001	515514910002	561301100394	561301500394
	6.188	157.175	Reg.	515515010001	515515010002	561301100396	561301500396
	6.219	157.963	Reg.	515515110001	515515110002	561301100398	561301500398
	6.250	158.750	Reg.	515515210001	515515210002	561301100400	561301500400
	6.281	159.537	Reg.	515515310001	515515310002	561301100402	561301500402
	6.313	160.350	Reg.	515515410001	515515410002	561301100404	561301500404
	6.344	161.138	Reg.	515515510001	515515510002	561301100406	561301500406
	6.375	161.925	Reg.	515515610001	515515610002	561301100408	561301500408
	6.406	162.712	Reg.	515515710001	515525710002	561301100410	561301500610
	6.438	163.525	Reg.	515515810001	515525810002	561301100412	561301500612
	6.469	164.313	Reg.	515515910001	515515910002	561301100414	561301500414
	6.500	165.100	Reg.	515516010001	515516010002	561301100416	561301500416

BOTTOMING HOLE BURNISHING

APPLICATION

Exceptional size and finish in **4 seconds** -

THE JOB

Part Material:
Aluminum

Diameter: 0.750"

Length: 0.625"

Stock Allowance:
0.001"-0.0015" on diameter

Pre Burnish Surface Finish:
120 R_a

THE SOLUTION

Tool Used:
5433-122-45048

Speed:
637 RPM

Feed:
0.025 IPR

THE RESULTS

Post Burnish Surface Finish:
6µR_a

Cycle Time:
2.50SEC.

Finished hole held to 0.0004″ tolerance.



tremendous **efficiency** and **ease-of-use**.

COMPACT BURNISHING TOOLS

CBT



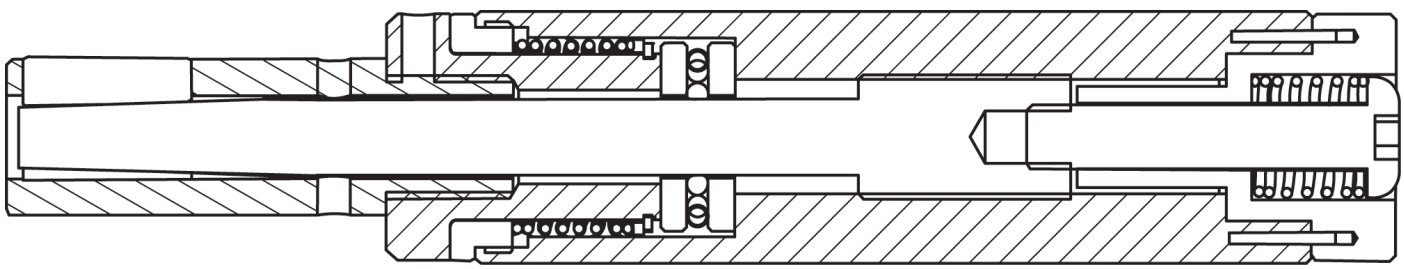
Compact burnishing tools ideal for Swiss-type machines.



IN APPLICATIONS WHERE THE MACHINE WORKING ENVELOPE IS LIMITED, AS IS FOUND IN MOST SWISS-TYPE TURNING CENTERS, MONAGHAN HAS DEVELOPED STANDARD COMPACT ID BURNISHING TOOLS.

ID bores can go down to 4mm in the standard designs.

The 5918 series model locates the tool body completely inside the tool block, allowing adjustment knob to protrude from rear of tool block. This allows the burnishing tool size to be fine tuned without removing it from the tool block.



TURN TWO OPS INTO ONE.



Eliminate secondary processes such as grinding, honing and polishing.

OD CARBIDE ROLL BURNISHING TOOLS

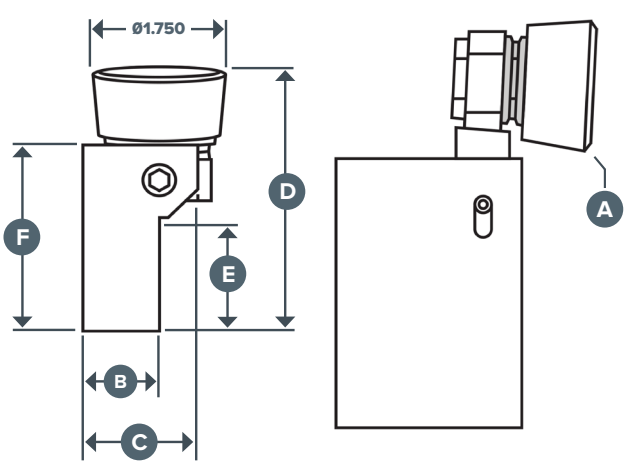
CRB

Replace secondary operations while obtaining superior surface finish.

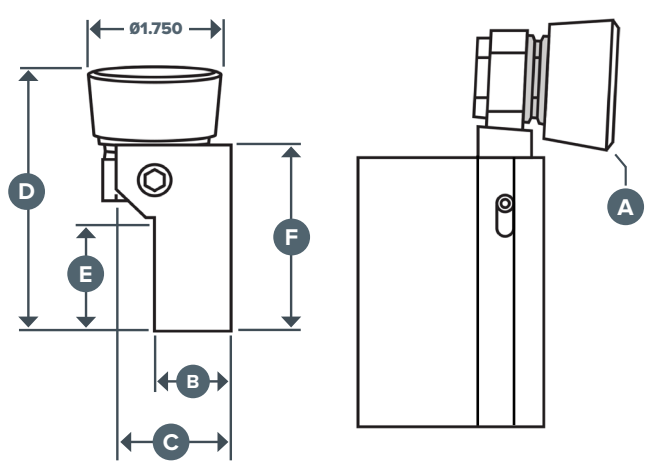


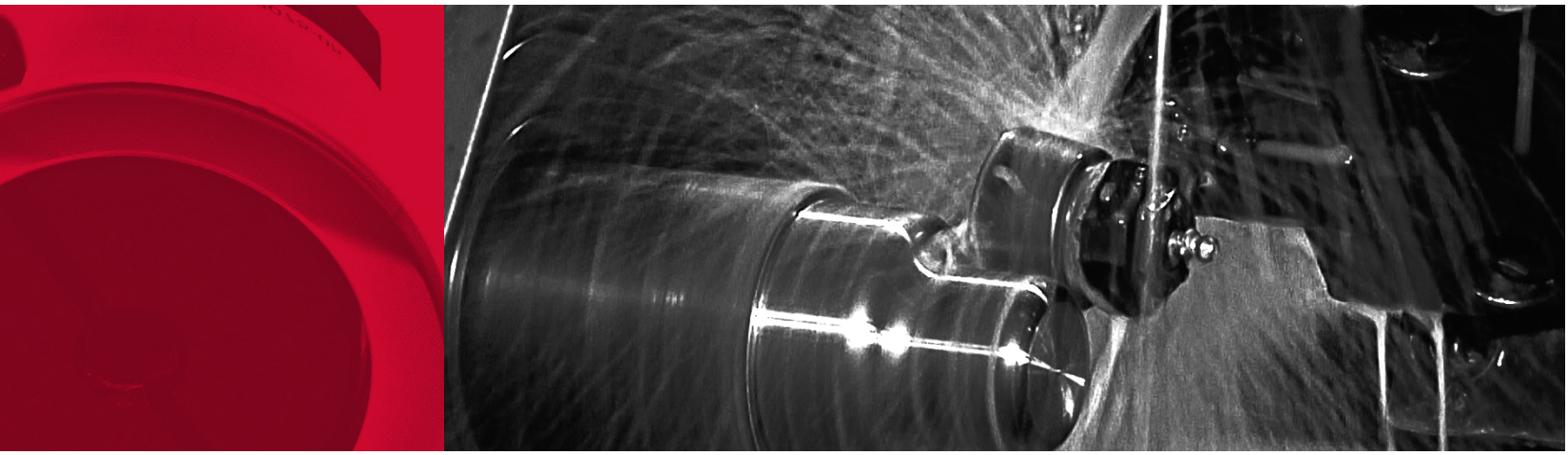
THE VERSATILITY OF THESE TOOLS ALLOWS THE BURNISHING OF EXTERNAL DIAMETERS, TAPERS, RADII, AND FACES - AS WELL AS LARGE INTERNAL BORES.

RIGHT HAND TOOL



LEFT HAND TOOL





The outside diameter burnishing tool is used on turning machines to create extremely fine finishes in most ferrous and non-ferrous materials.

Tool Number	Left/ Right Hand	A		B	C	D	E	F
		Roll Radius (in)	Roll Radius (mm)	Shank Size	Shank Size	OAH*	CH**	Block Height
S2302-00	LH	0.032″	0.787mm	0.750″	1.250"	3.250"	1.250"	2.250"
S2306-00	RH	0.032″	0.787mm	0.750″	1.250"	3.250"	1.250"	2.250"
S2427-00	LH	0.093″	2.36mm	0.750″	1.250"	3.500"	1.250"	2.250"
S2488-00	RH	0.093″	2.36mm	0.750″	1.250"	3.250"	1.250"	2.250"
S2075-00	LH	0.032″	0.787mm	1.000″	1.500"	3.500"	1.500"	2.500"
S2121-00	RH	0.032″	0.787mm	1.000″	1.500"	3.500"	1.500"	2.500"
S2548-00	LH	0.062″	1.57mm	1.000″	1.500"	3.500"	1.500"	2.500"
S2549-00	RH	0.062″	1.57mm	1.000″	1.500"	3.500"	1.500"	2.500"
S2233-00	LH	0.093″	2.36mm	1.000″	1.500"	3.500"	1.500"	2.500"
S2327-00	RH	0.093″	2.36mm	1.000″	1.500"	3.500"	1.500"	2.500"
5900-100-80477	LH	0.125″	3.175mm	1.000″	1.500"	3.250"	1.500"	2.500"
5900-100-80558	RH	0.125″	3.175mm	1.000″	1.500"	3.250"	1.500"	2.500"
S2313-00	LH	0.032″	0.787mm	1.250″	1.750"	3.500"	1.500"	2.500"
S2384-00	RH	0.032″	0.787mm	1.250″	1.750"	3.500"	1.500"	2.500"
S2075-00M	LH	0.032″	0.787mm	25mm	1.485"	3.500"	1.500"	2.500"
S2121-00M	RH	0.032″	0.787mm	25mm	1.485"	3.500"	1.500"	2.500"
S2548-00M	LH	0.062″	1.57mm	25mm	1.485"	3.500"	1.500"	2.500"
S2549-00M	RH	0.062″	1.57mm	25mm	1.485"	3.500"	1.500"	2.500"
S2233-00M	LH	0.093″	2.36mm	25mm	1.485"	3.500"	1.500"	2.500"
S2327-00M	RH	0.093″	2.36mm	25mm	1.485"	3.500"	1.500"	2.500"
5900-100-80477M	LH	0.125″	3.175mm	25mm	1.485"	3.250"	1.500"	2.500"
5900-100-80558M	RH	0.125″	3.175mm	25mm	1.485"	3.250"	1.500"	2.500"

*Overall height
**Clamping height

OPERATING PROCEDURE

The OD carbide roll burnishing tool can be used to burnish ODs, flat face surfaces, and shallow ID parts (Up to 1.000″ deep).

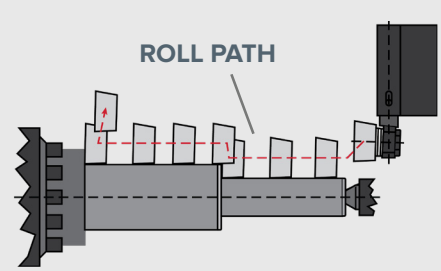
Part Preparations:
100/120 RMS

Feed Rate:
0.004"/0.008"

Speed:
400-800 SFM (Max 1200)

Coolant Required:
water soluble or oil.

Ensure bearings are sufficiently greased at all times.



OD BURNISHING

APPLICATION

A consistent, repeatable process...

THE JOB

Part Material:
4140 Steel

Diameter: 2.000″

Length: 2.500″

Stock Allowance:
0.0005"/0.0010″

Pre Burnish Surface Finish: 80µR_a

THE SOLUTION

Tool Used:
S2075-00

Speed:
750 SFM

Feed:
0.004″ IPR
(slower on radii)

THE RESULTS

Post Burnish Surface Finish:
7µR_a

Cycle Time:
26.18SEC.



that **eliminates** costly **secondary operations**.



FORGET ABOUT SECONDARY OPS.

Roll to the finish with carbide roll tools for both ID and OD surfaces.

ID/OD CARBIDE ROLL BURNISHING TOOLS

CRB

ID/OD BURNISHING

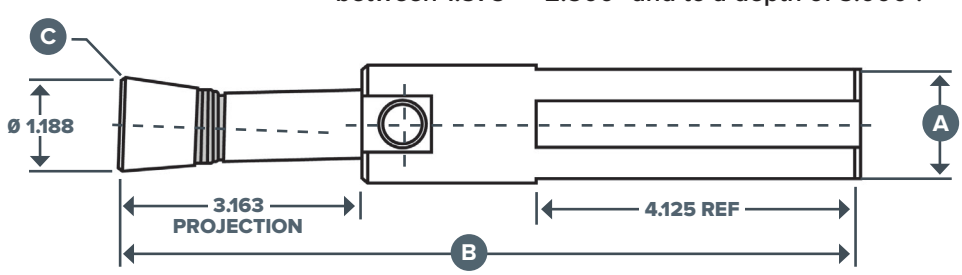
Transform your turning center into a fine finishing machine.



THE BORING BAR STYLE ID/OD TOOL IS USED ON TURNING MACHINES TO BURNISH INTERNAL AND EXTERNAL SURFACES, CREATING EXTREMELY FINE FINISHES IN MOST FERROUS AND NON-FERROUS MATERIALS.

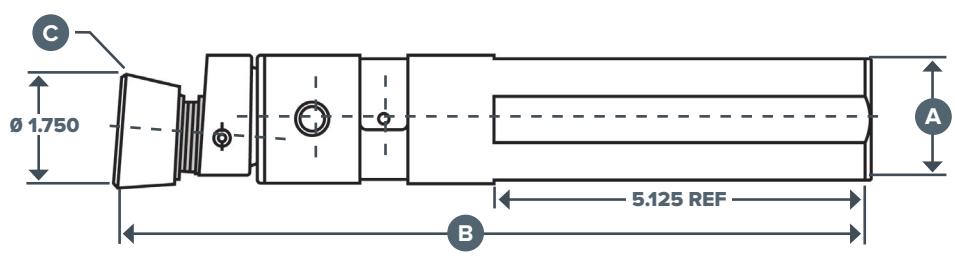
S2289-00

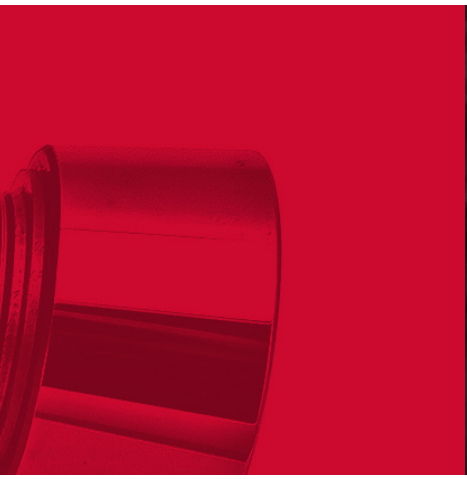
Designed for burnishing parts with a bore diameter between 1.375" – 2.500" and to a depth of 3.000".



S2320-00

Designed for burnishing parts with a bore diameter 2.375" and larger and to a depth of 8.000".







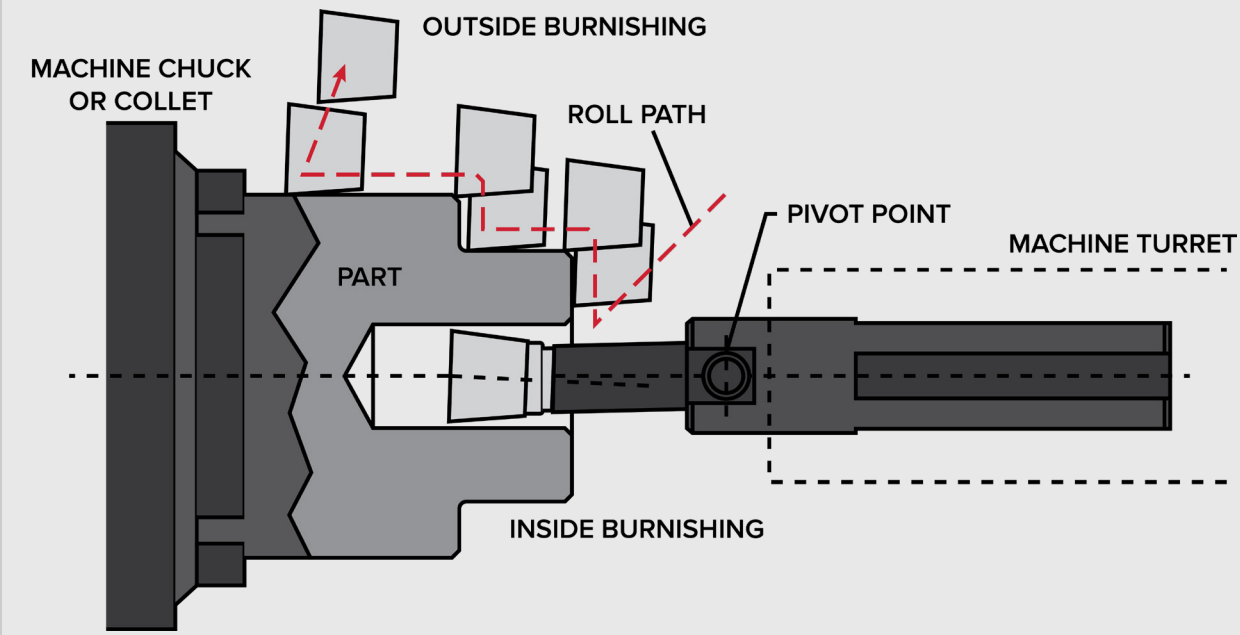
STANDARD DIMENSIONS

	A	B	--	C
Tool Number	**Shank Size**	**OAL**	**Effective Reach**	**Roll Radius**
S2289-00	1.500″	9.500″ (241.300mm)	3.100″ (78.740mm)	0.032″ (0.787mm)
S2289-00M	40mm	9.500″ (241.300mm)	3.100″ (78.740mm)	0.032″ (0.787mm)
S2289A00	1.500″	9.500″ (241.300mm)	3.100″ (78.740mm)	0.093″ (2.360mm)
S2289A00M	40mm	9.500″ (241.300mm)	3.100″ (78.740mm)	0.093″ (2.360mm)
S2289B00	1.500″	9.500″ (241.300mm)	3.100″ (78.740mm)	0.062″ (1.570mm)
S2289B00M	40mm	9.500″ (241.300mm)	3.100″ (78.740mm)	0.062″ (1.570mm)
S2320-00	2.000″	12.000″ (304.800mm)	6.000″ (152.400mm)	0.032″ (0.787mm)
S2320-00M	50mm	12.000″ (304.800mm)	6.000″ (152.400mm)	0.032″ (0.787mm)
S2340-00	2.000″	12.000″ (304.800mm)	6.000″ (152.400mm)	0.093″ (2.360mm)
S2340-00M	50mm	12.000″ (304.800mm)	6.000″ (152.400mm)	0.093″ (2.360mm)
CB127-00	2.000″	12.000″ (304.800mm)	6.000″ (152.400mm)	0.062″ (1.570mm)
CB127-00M	50mm	12.000″ (304.800mm)	6.000″ (152.400mm)	0.062″ (1.570mm)
S2320A00	2.000″	18.000″ (457.200mm)	12.000″ (304.800mm)	0.032″ (0.787mm)
S2320A00M	50mm	18.000″ (457.200mm)	12.000″ (304.800mm)	0.032″ (0.787mm)
CB168-00	2.000″	18.000″ (457.200mm)	12.000″ (304.800mm)	0.062″ (1.570mm)
CD168-00M	50mm	18.000″ (457.200mm)	12.000″ (304.800mm)	0.062″ (1.570mm)
S2340A00	2.000″	18.000″ (457.200mm)	12.000″ (304.800mm)	0.093″ (2.360mm)
S2340A00M	50mm	18.000″ (457.200mm)	12.000″ (304.800mm)	0.093″ (2.360mm)

ID/OD BURNISHING TOOLS

OPERATING PROCEDURE

PART PREPARATION:	FEED RATE:	SPEED:	COOLANT REQUIRED:	
100/120 RMS	0.004"/0.008"	400 to 800 surface ft per min. (1200 Max)	Water soluble or oil	Ensure bearings are sufficiently greased at all times.





ID/OD BURNISHING

APPLICATION

Eliminate grinding & polishing...

THE JOB

Part Material:
Stainless Steel

Diameter: 2.500″

Length: 1.500″

Stock Allowance:
0.0005"/0.0010"

Pre Burnish Surface Finish:
90 R_a

THE SOLUTION

Tool Used:
S2320-00

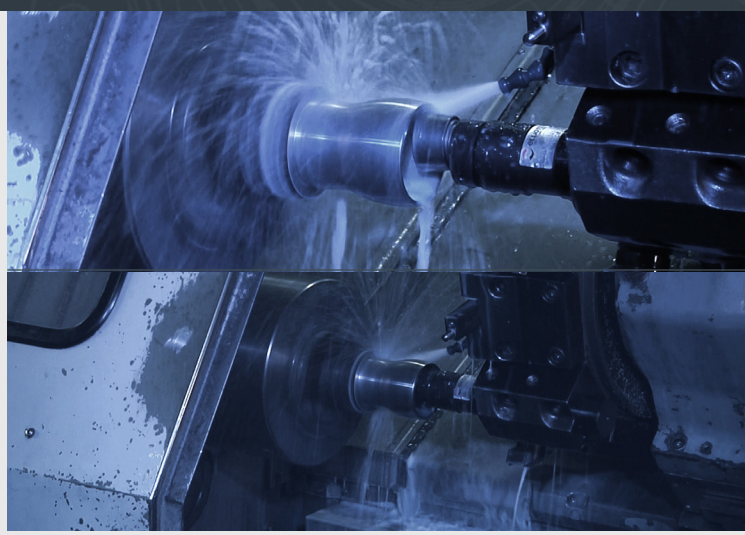
Speed:
400 SFM (611 RPM)

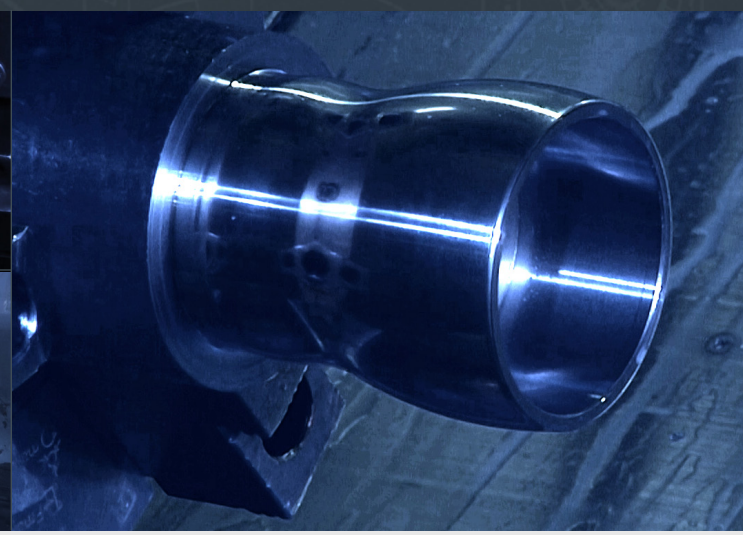
Feed:
0.006″ IPR

THE RESULTS

Post Burnish Surface Finish:
6µR_a

Cycle Time:
24.54SEC.





...of **both ID & OD** surfaces.



SIMPLE SURFACE FINISH.



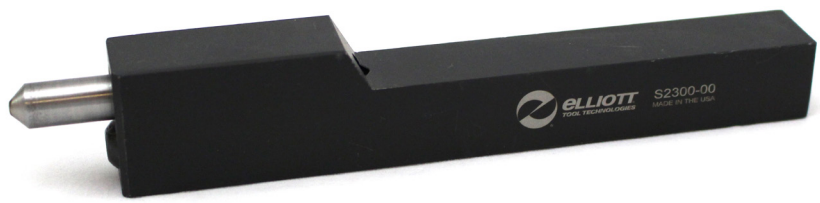


Mirror-like finishes for a fraction of the cost.

DIAMOND BURNISHING TOOLS

DBT

An economical and user-friendly tool for producing a mirror-like surface finish.



DIAMOND BURNISHING TOOLS WITH REPLACEABLE DIAMOND STEMS FOR A LOW COST METHOD TO PRODUCE AN ULTRA-SMOOTH SURFACE FINISH ON LINEAR SURFACES.

The Diamond Burnishing Tool is used in linear applications (ODs, IDs, and face surfaces).

As the part is turned, the diamond, under spring pressure, is fed across at a feed rate of 0.003″ to 0.004″ per revolution at a maximum of 750 SFM.

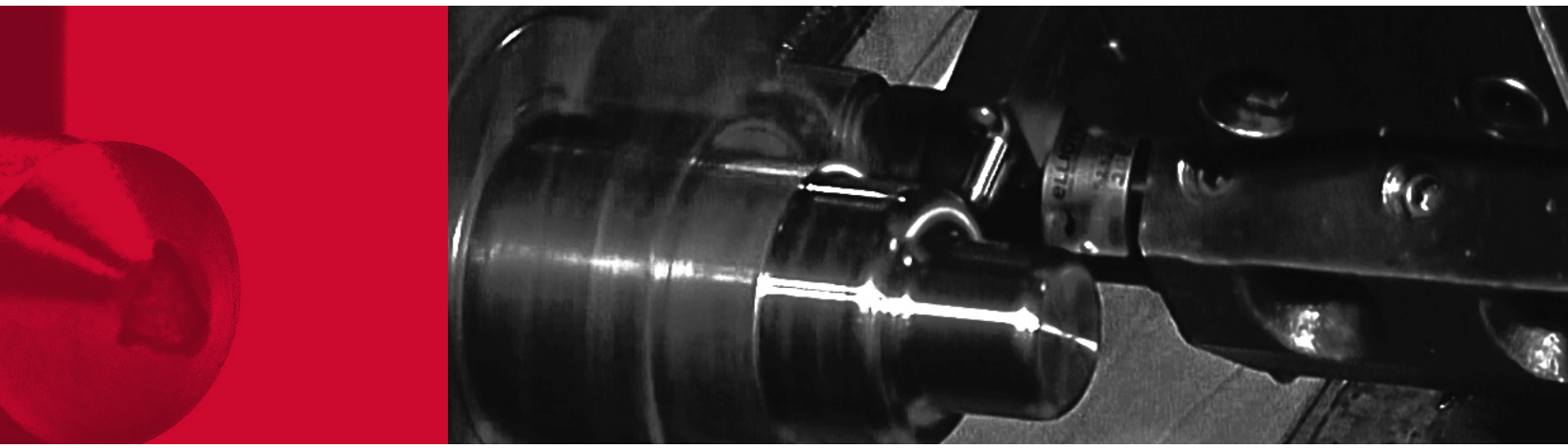
Available in inch and metric slim-line, square, offset, on-center, and boring bar styles.

Diamond Tool Kits

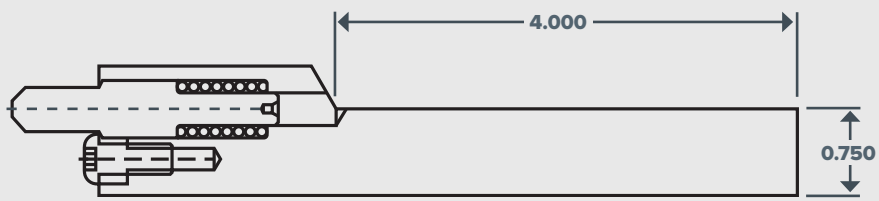
All diamond burnishing tools are also available as kits which contain: a complete tool, spare diamond stem, spring and Allen key.

The kit is in a plastic case that protects and ensures the life of the tool.

The kit option is the most economical to purchase, giving significant savings compared to buying the parts separately.

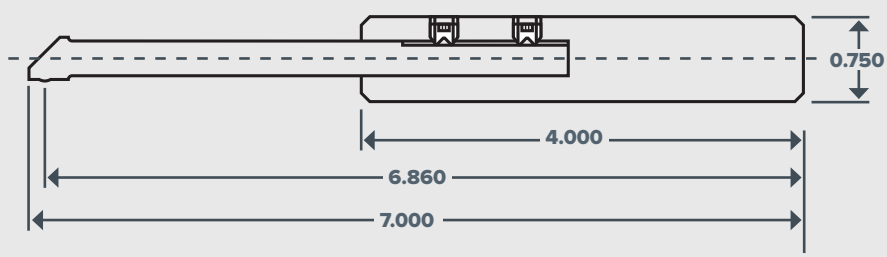


Stick tool style



The stick tool design of the S2300-00 (with the 0.750″ shank) makes the tool ideal for smaller lathes and allows for close approaches.
The offset design sets the tool on correct centerline.

Boring bar style



The boring-bar style tool (S2295-00) is designed for lathes or turning centers to provide an improved surface finish in bores from 0.500″ to approximately 1.375″ diameter x 2.800″ deep. This burnishing tool can be used on most metals with a hardness below Rc40.

OUR STANDARD DIAMOND BURNISHING TOOLS:

Tool #	Description
S2300-00	0.750″ square with offset tool holder
S2300-00M	20mm shank with offset tool holder
S2300A00	1.000″ square with offset tool holder
S2300A00M	25mm square with offset tool holder
S2300M00	1.000″ x 25mm “square" shank with the diamond on center
S2295-00	0.750″ square shank with boring bar arm on center

REPLACEMENT PARTS FOR DIAMOND BURNISHING TOOLS:

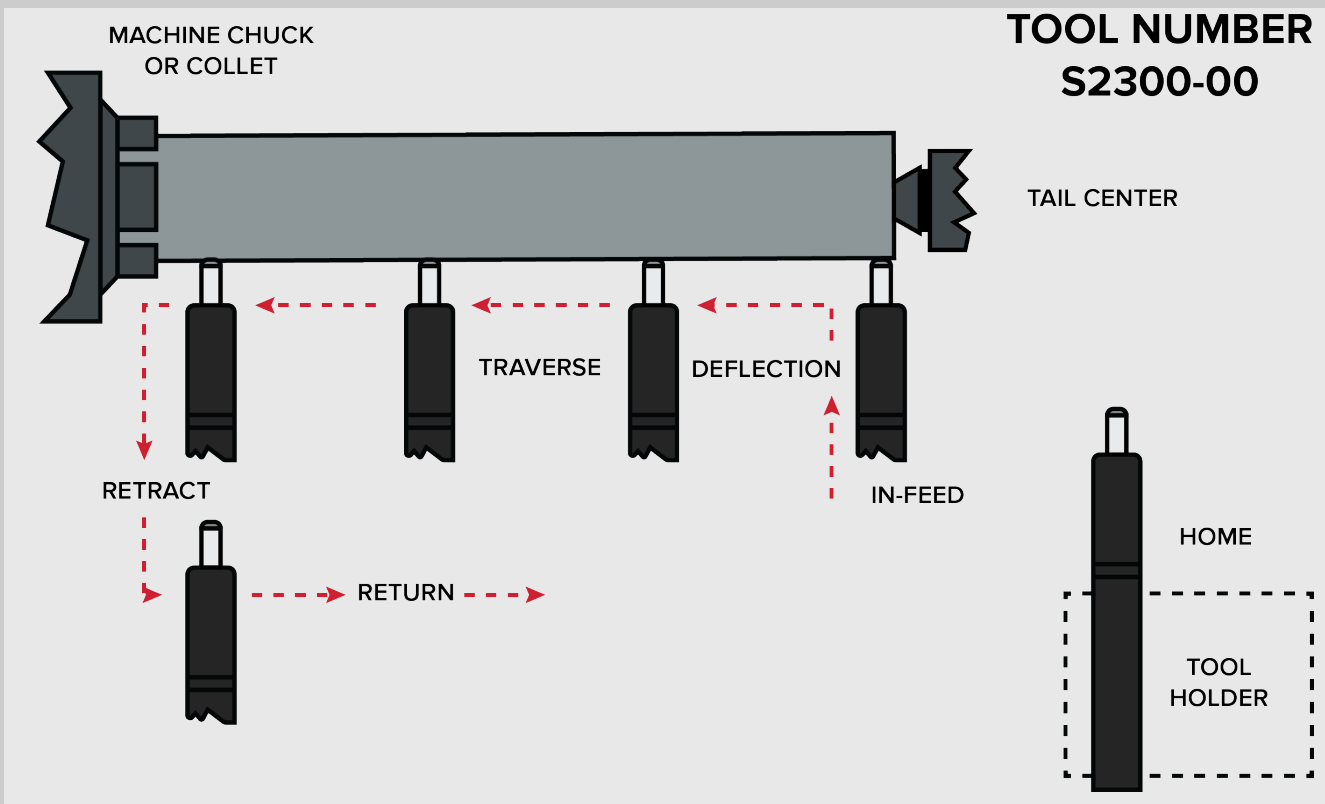
Complete Tool	Diamond Stem	Spring	Screw
S2300-00	S375D1	S375-4-165	P8597-2N
S2300A00	S375D1	S375-4-165	P8597-2N
S2300B00	S375D1	S375-4-165	P8597-2N
S2300M00	S375D1	S375-4-165	128Y
S2295-00	S2295D1	--	548H
S2300-00M	S375D1	S375-4-165	P8597-2N
S2300A00M	S375D1	S375-4-165	P8597-2N
S2300B00M	S375D1	S375-4-165	P8597-2N

STICK TOOL STYLE

OPERATING PROCEDURE

The stick style diamond burnishing tool is designed for use in turning machines. The tool should be mounted so that the diamond is perpendicular and on center to the surface being burnished.

PART PREPARATION:	FEED RATE:	SPEED:	COOLANT REQUIRED:
100/120 RMS	0.003"/0.004"	250 to 500 surface ft per min. (750 Max)	Water soluble or oil

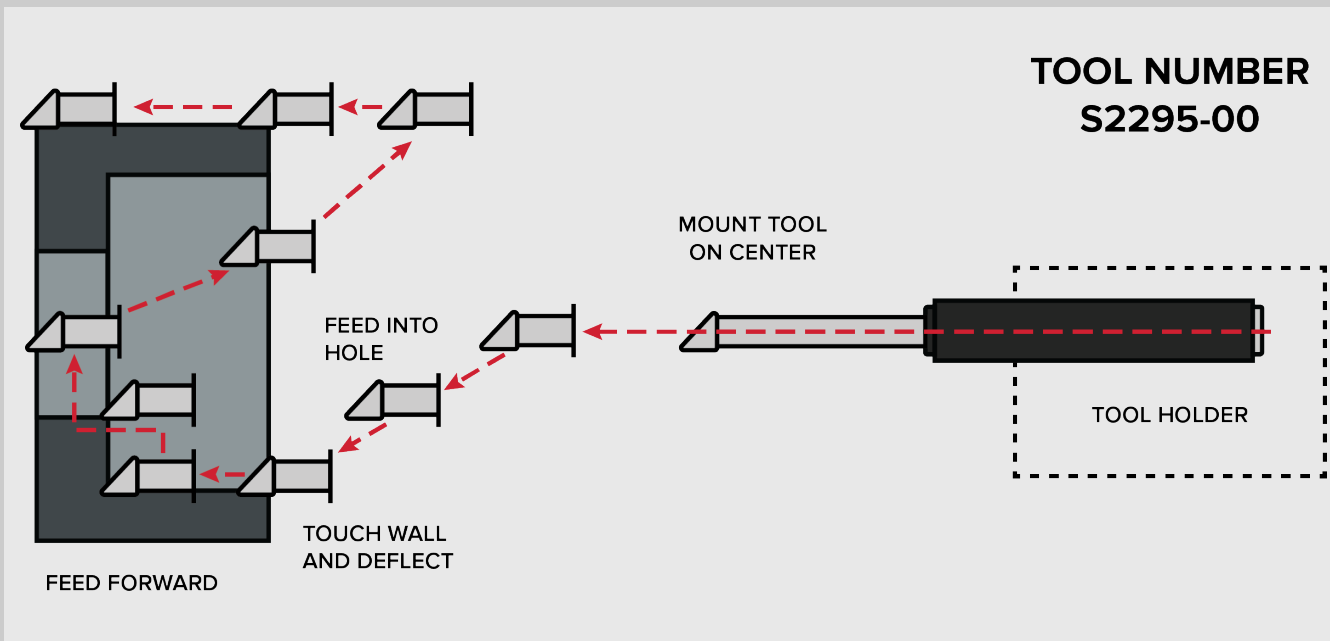


BORING BAR STYLE

OPERATING PROCEDURE

The boring-bar style diamond burnishing tool is designed for turning machines to provide an improved surface finish on a machined part.

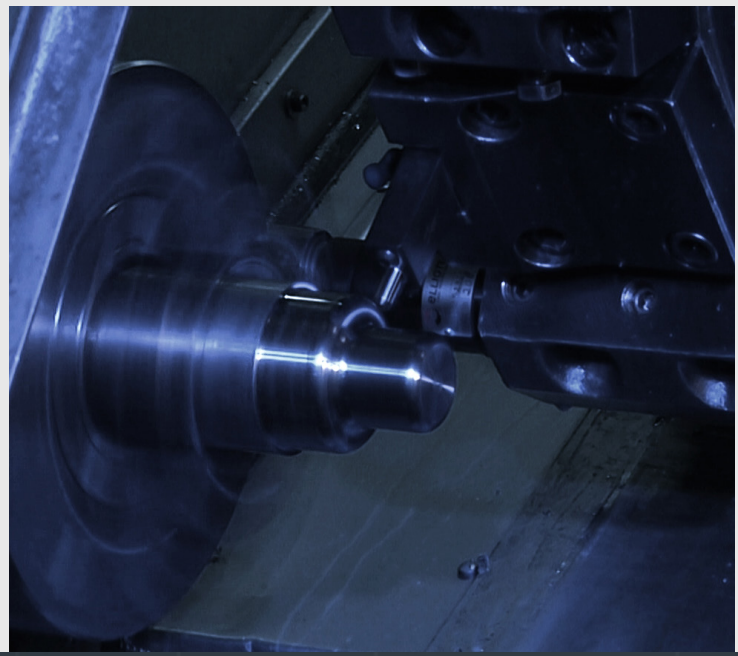
PART PREPARATION:	FEED RATE:	SPEED:	COOLANT REQUIRED:	MINIMUM HOLE DIAMETER:	MAXIMUM TOOL REACH:
100/120 RMS	0.003"/0.004"	250 to 500 surface ft per min. (750 Max)	Water soluble or oil	0.500"	2.861"



Can be used on most metals with a hardness below HRC40.

DIAMOND BURNISHING

APPLICATION



Automate your hand polishing operations...

THE JOB

Part Material:
4140

Diameter: 2.500"

Length: 1.250"

Stock Allowance:
0.0002" - 0.0005"

Pre Burnish Surface Finish:
80µR_a

THE SOLUTION

Tool Used:
S2300-00

Speed:
400 SFM

Feed:
0.004 IPR

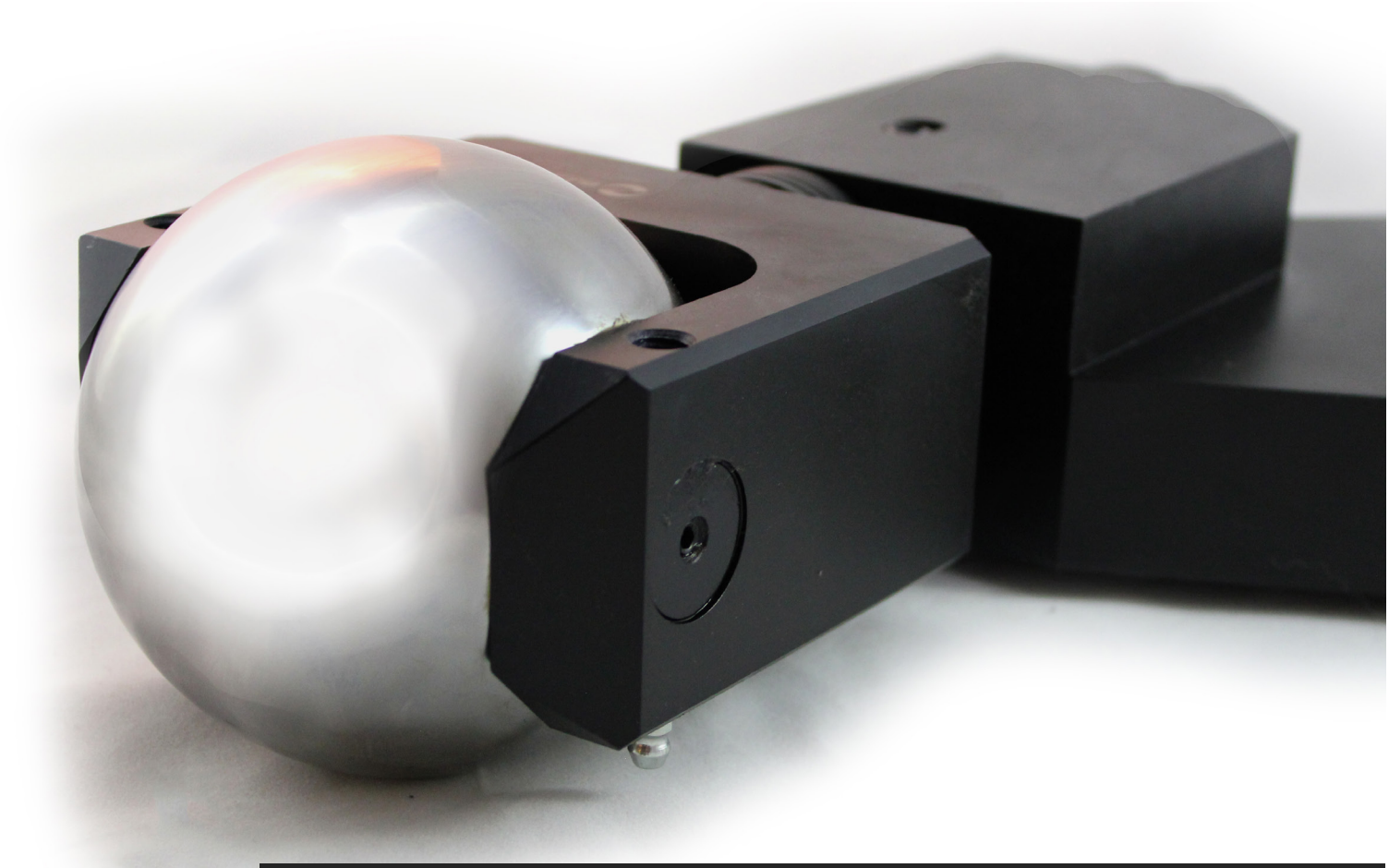
THE RESULTS

Post Burnish Surface Finish:
2µR_a

Cycle Time:
30.68SEC



...and get **consistent ultra-smooth** surface finishes.



CUSTOM TOOLS FOR CHALLENGING APPLICATIONS.

Solutions designed for your success.

CUSTOM BURNISHING TOOLS

Solving the toughest precision finishing challenges with high quality special burnishing tools.

OD MULTI-ROLLER BURNISHING

An OD multiple-roll burnishing tool operates under the same principle as an ID burnishing tool, but in the inverse manner - being sized over the shaft or cylindrical feature it is burnishing.



Pass-through shank designs are available for continuous feeding of parts in high volume applications.

VARIABLE BURNISHING



For tapered bores needing consistent pressure maintained across changing diameters, our variable burnishing tool comes available with coolant-through mandrel design.

ANGLE BURNISHING

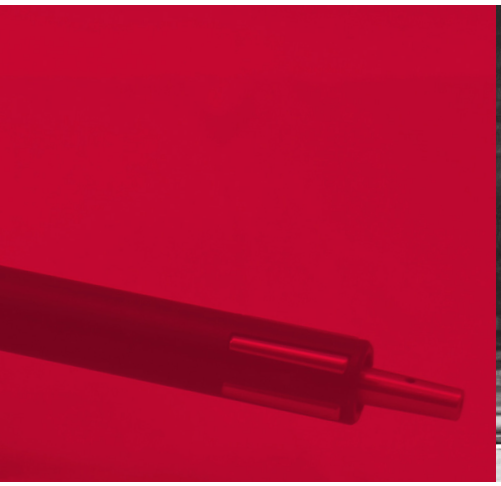
Custom angle multi-roller burnishing designs for final finish requirements on valve seats and other angular surface applications requiring superb finishes.

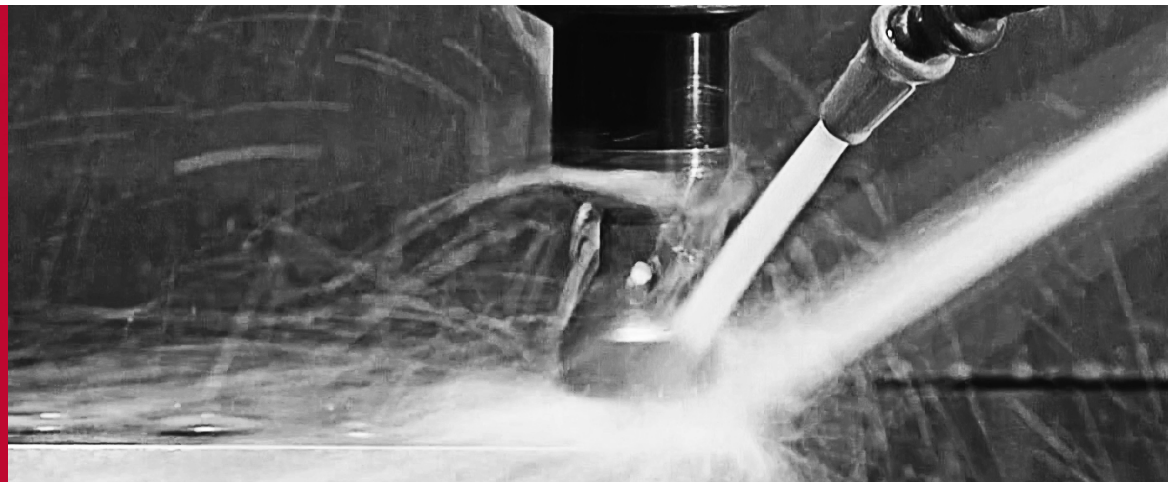


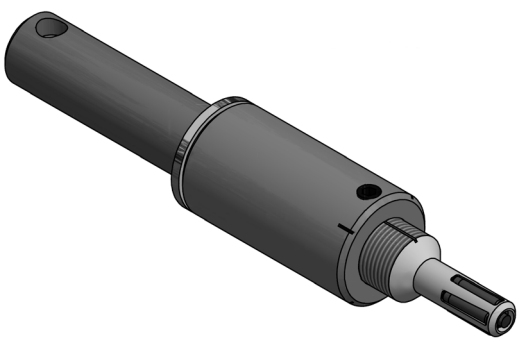
FACE BURNISHING

Custom face burnishing multi-roller designs for surface finish improvement and work hardening of cylindrical surfaces in flat bottom bores, counterbores and shoulders.









SMALL ID BURNISHING

Our standard ID tool designs are available in as small as 4mm diameters.
- Replaceable wear parts.
- Tool sizing provided by adjustable cage.
- Ideal for compact machine work envelopes.

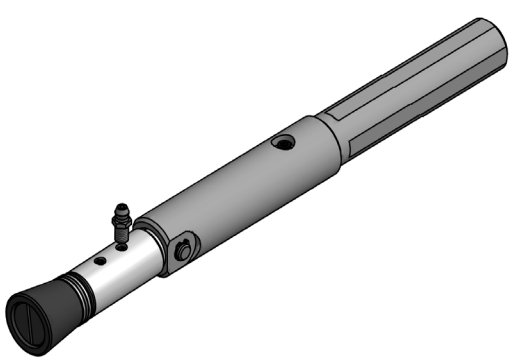


SMALL ID ANGLE BURNISHING

Preferred method for obtaining low surface finishes on tapered holes.
- 45°, 60° and custom included angles available.
- Small IDs of 0.100" are common.
- Ideal for valve seats and bushings.

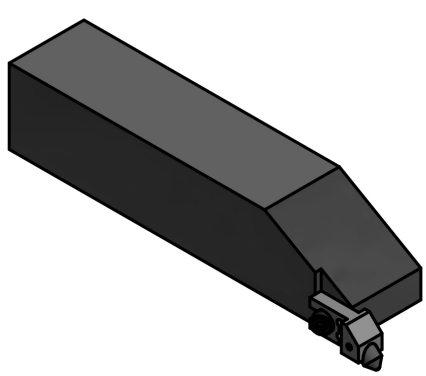
SMALL ROLL CARBIDE ROLL BURNISHING

Custom roll sizes allow for ID/OD burnishing in smaller parts.
- Tool shank can be cut to needed length.
- Tool reach and load pressures can also be customized.



COMPACT ANGLED DIAMOND BURNISHING

Designed to allow for burnishing into a shoulder and up a face or counterbore.
- Replaceable diamond stem.
- Can configure the holder to best fit your application.



SIZING & FINISHING TOOLS

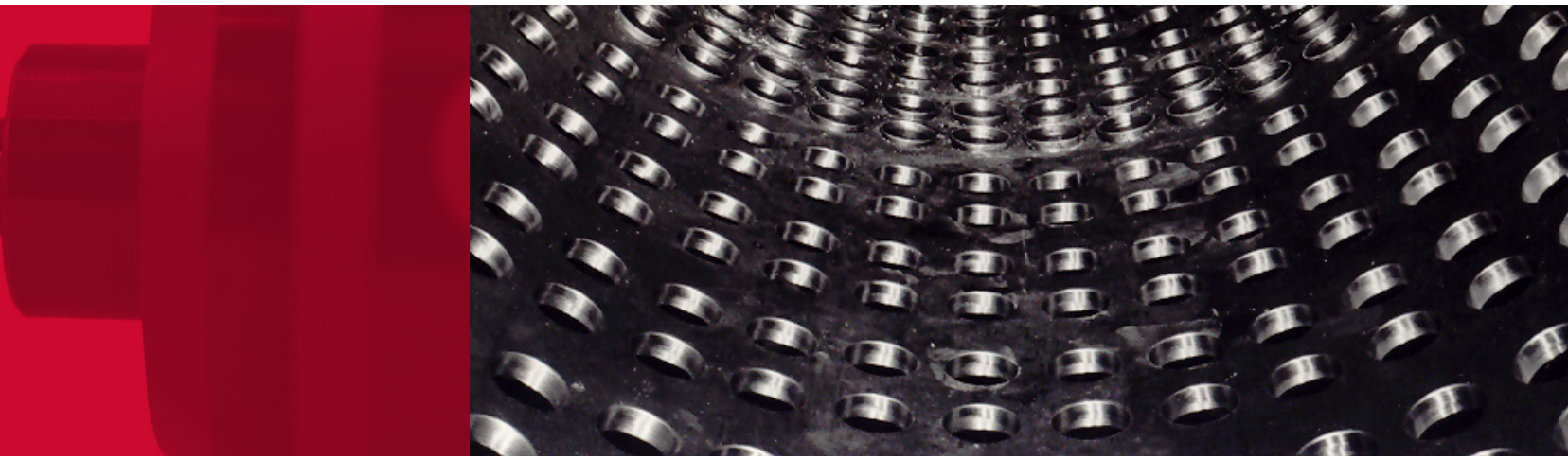
SFT



Tools for size control, aligning, straightening and improving hole roundness - while improving surface finish.

SIZING AND FINISHING TOOLS OPERATE IN A MANNER SIMILAR TO OUR ID MULTI-ROLLER BURNISHING TOOLS. THEY DIFFER IN THAT COMPRESSION OCCURS ACROSS THE ENTIRE LENGTH OF THE ROLL, AS OPPOSED TO OCCURRING AT A SINGLE POINT AS IT DOES ON A MULTI-ROLLER BURNISHING TOOL.

- This “parallel rolling” disperses wear, making sizing and finishing tools last longer than the other types of burnishing tools.
- Parallel rolling allows for much faster cycle times compared to traditional burnishing.
- SFT tools straighten holes and improve hole roundness, while improving surface finish.
- This is particularly beneficial for correcting tapered holes or misalignment between 2 bores, such as the pin bores of a piston.



You can expect an SFT to expand 0.001" - 0.002" on diameter, and hold size within 0.0001" - 0.0002".

AN SFT WILL ENTER THE BORE IN A COLLAPSED STATE AND THEN ACTUATE TO REACH IT'S FINAL SIZE.

SFT actuation can be either mechanical off a qualified part surface or actuation plate, hydraulic, pneumatic, or coolant fed.



MECHANICAL JOINING TOOLS

MJT

The superior method for joining tubing to flanges and fittings.



EASILY CREATE SECURE, LEAK-PROOF JOINTS BETWEEN DUCTILE TUBULAR PRODUCTS AND FITTINGS WITH THE ELLIOTT MECHANICAL JOINING TOOL.

Superior joints

Creates secure, leak-proof joints between ductile tubular products and fittings.

Mechanically joined joints will not leak, pull apart, or come loose due to pressure, vibrations or temperature change.

Superior to a welded, brazed, or crimped joint.

Roll to a torque or diameter spec

Rolling to a torque ensures consistent results regardless of tolerance and variations of the tube OD, wall thickness, and component ID.

Rolling to a diameter guarantees a consistent ID of the tube. This makes it possible to “iron out” and round up the ID of the tube.

Easy-to-use

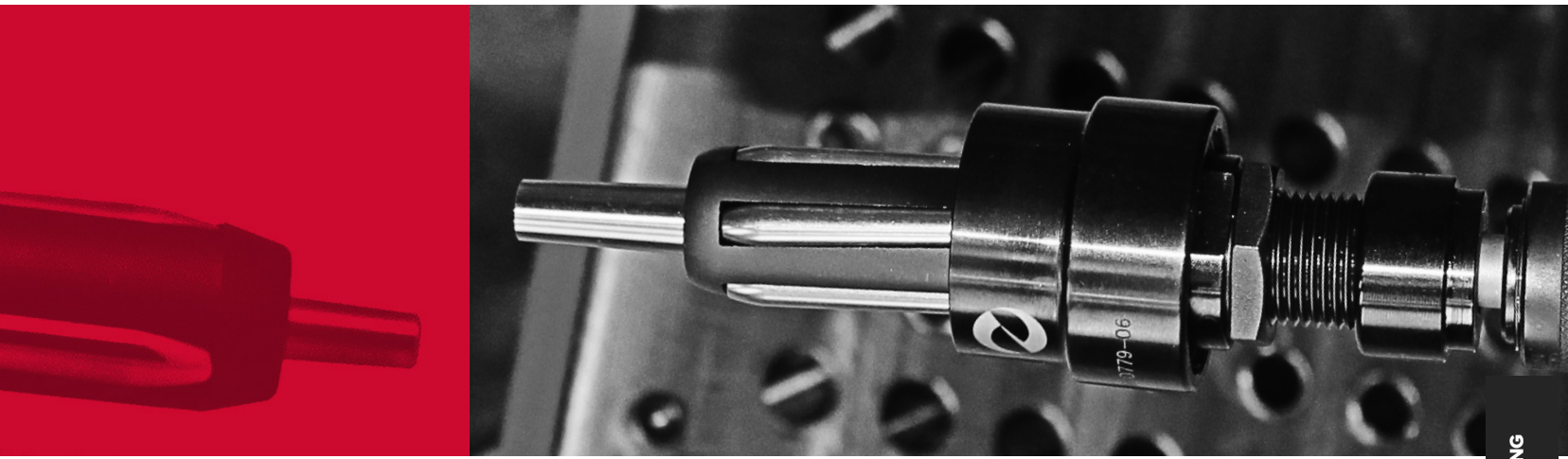
Limited training required to operate.

Used on manual electric rolling motors, pneumatic motors, special machines and in rare cases, on CNC machines.

Materials

Practically every tubing material except plastic can be mechanically joined, providing the tube is annealed or is ductile.

Annealed and ductile materials include:
steel, stainless steel, aluminum, titanium, copper, cupronickel, iconel, etc.



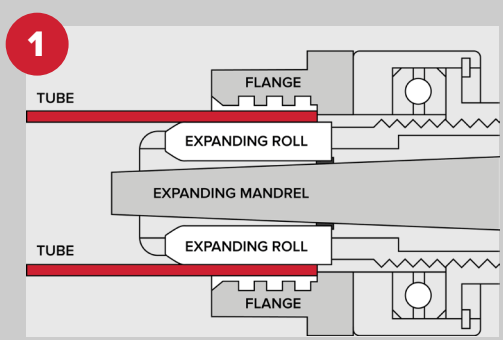
OPERATING PROCEDURE

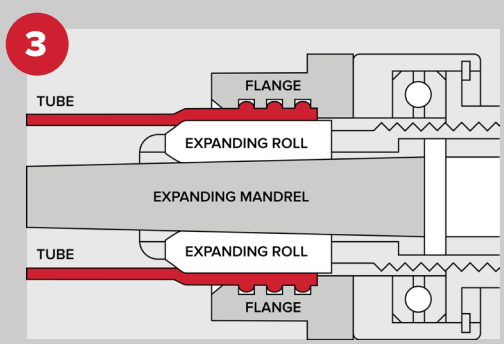
1: 0% EXPANSION

Tube is inserted into flange and mechanical joining tool is then inserted into tube. A generous radius or chamfer should be provided at back side of flange.

At the opposite end, there should be a shoulder against which the tube can butt.
Grooves should always have sharp corners at the top edge and the bottom of the groove.

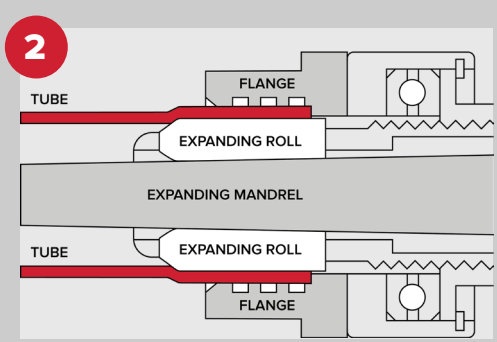
Width of the groove can be 0.062″ to 0.375″ (1.6 to 9.5mm); depth can be from 0.005″ to .0320″ (0.13 to 0.81mm) - both dimensions are dependent on flange width, thickness and hardness of tube.

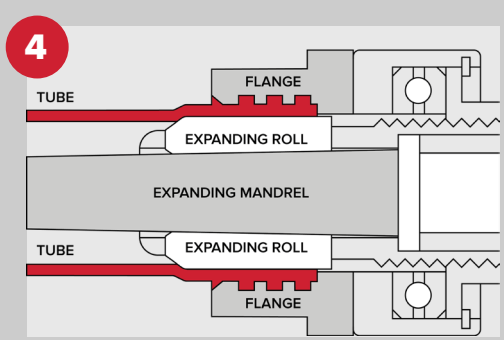




3: 50% EXPANSION

Now the tube metal has begun to flow into the grooved serrations of the flange.





4: 100% EXPANSION

Grooved serrations are now completely filled and tube metal has flowed to the point of least resistance beyond the flange.

2: 25% EXPANSION

When the tube has been rolled to about 25% of total expansion required, it makes metal-to-metal contact with flange.

MECHANICAL JOINING

RAPID HAWK™

Electrically-Driven Mechanical Tube Rolling System

Bold precision, fierce productivity.

Engineered with productivity and precision in mind, Elliott's Rapid Hawk electric tube rolling system consistently and efficiently rolls tubes.

Utilize the Rapid Hawk with its proven electric tube rolling system and complete the job in less time.

The Rapid Hawk's articulated arm supports the weight and absorbs the torque of the rolling motor using a pneumatic counterbalance, which allows the operator to eff ortlessly move the rolling motor into position.

Combining an electric rolling motor and the ELC110220 Electric Torque Controller offers a quick-to-set-up, easy to use electric tube rolling system for achieving consistent tube rolling.

Ergonomically roll a large area of tubes without readjusting the Rapid Hawk, with its large radial reach.

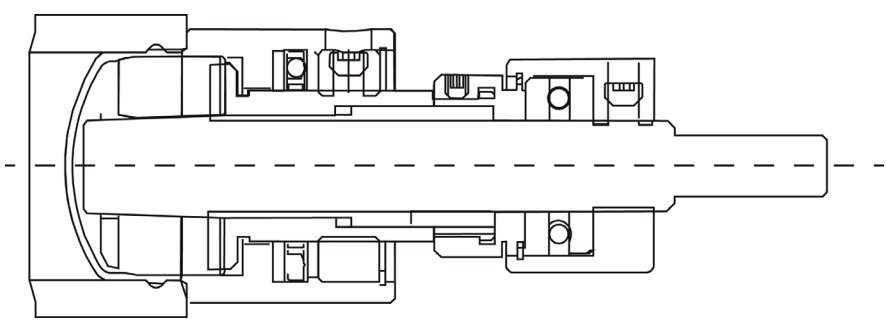
For convenient transportation of the unit, it is equipped with heavy-duty casters, forklift pockets and a hoist ring.



CUP PLUG EXPANDERS

Used to install cups in motor blocks, heads and other similar assemblies.

The cup plug expander offers substantial savings over the pipe or welch plug. It can be used to expand rings or sleeves inside any bore diameters.





APPLICATION

Mechanical joint can withstand...

THE JOB

Part Material:
Stainless steel tube to cast manifold

Tube ID:
0.992″

Tube Wall Thickness:
0.125″

Torque:
45 ft. lbs. using Elliott hydraulic rolling motor

THE SOLUTION

Tool Used:
B10779-00

Entry diameter minimum: 0.975″

Max expansion diameter: 1.062″

Depth: 1.250″
Max depth: 1.750″

Speed:
80 RPM

THE RESULTS

Mechanically joined a stainless steel tube to a cast fitting for a brake line connection.

Cycle Time:
13SEC.



...over 20,000 pounds of hydrostatic pressure.

ELLIPTICAL DEBURRING TOOLS

EDT

Simplify burr removal on exterior surface holes.



SELF-CENTERING ELLIOTT ELLIPTICAL DEBURRING TOOLS FOR AN EVEN EDGE BREAK OF EXTERIOR HOLES. EASILY FOLLOWS ANY ROUNDED HOLE AND PRODUCES AN EVEN CHAMFER OF CURVED HOLE EDGES.



Elliptical Deburring tools are a simple solution to a costly problem!

- Quick, efficient, and simple to use! The constant pressure of the spring combined with the pilot keeps the cutter centered, ensuring a uniform burr removal.
- The tool's pilot easily follows any rounded hole and produces an even chamfer of curved hole edges.
- Premium grade HSS TIN coated cutters are available standard.
- Cutting blades can be resharpened or replaced and are very cost effective against solid carbide chamfer tools.
- The Elliott Elliptical Deburring tool can be used with a hand drill, drill press or CNC machine. No tool settings required!
- "Overtravel" spring design to prevent burr removals from becoming unintended chamfers.





Available in three standard sizes!

STANDARD DIMENSIONS

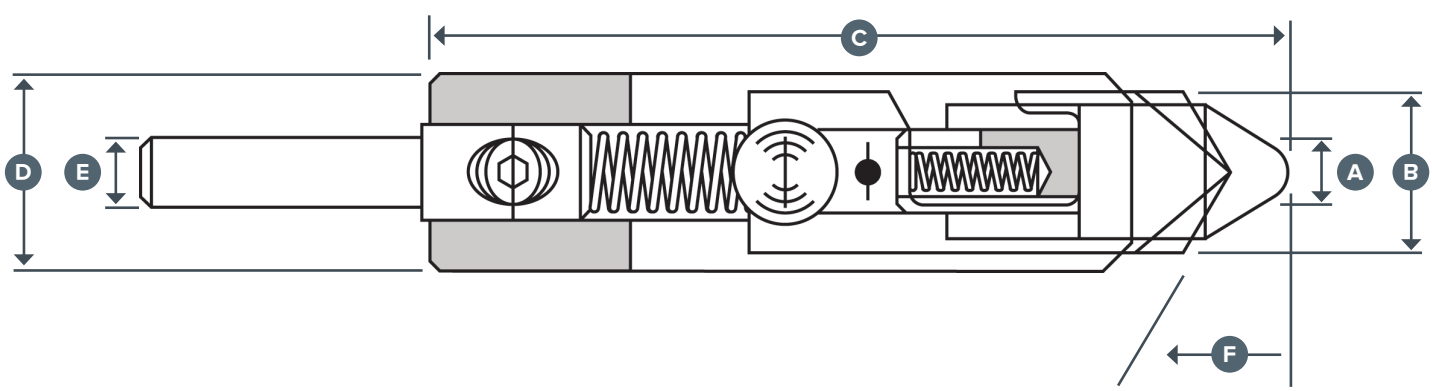
Operating Range Min.	Operating Range Max.	Length	Body	Shank	Degrees	Tool Number
A	B	C	D	E	F	
0.156″	0.313″	0.093″	0.625″	0.250″	120	0430052
0.250″	0.500″	0.125″	0.750″	0.250″	120	0435052
0.375″	1.000″	0.156″	1.000″	0.500″	120	0440000

PREFERRED METHOD OF DEBURRING CRANKSHAFT HOLES.



REPLACEMENT PARTS

Complete Tool	Cutter	Cutter Spring	Pilot	Pilot Spring
0430052	0230350	0230601	0231000	0230400
0435052	0230350	0230601	0235300	0230400
0440000	0440250	0440700	044044	0440500



ELLIPTICAL DEBURRING TOOL

APPLICATION

Even deburring on uneven surfaces at an **even** better price.

THE JOB

Part Material:
Stainless steel

Diameter:
0.1875″

THE SOLUTION

Tool Used:
0430052

Speed:
100 RPM

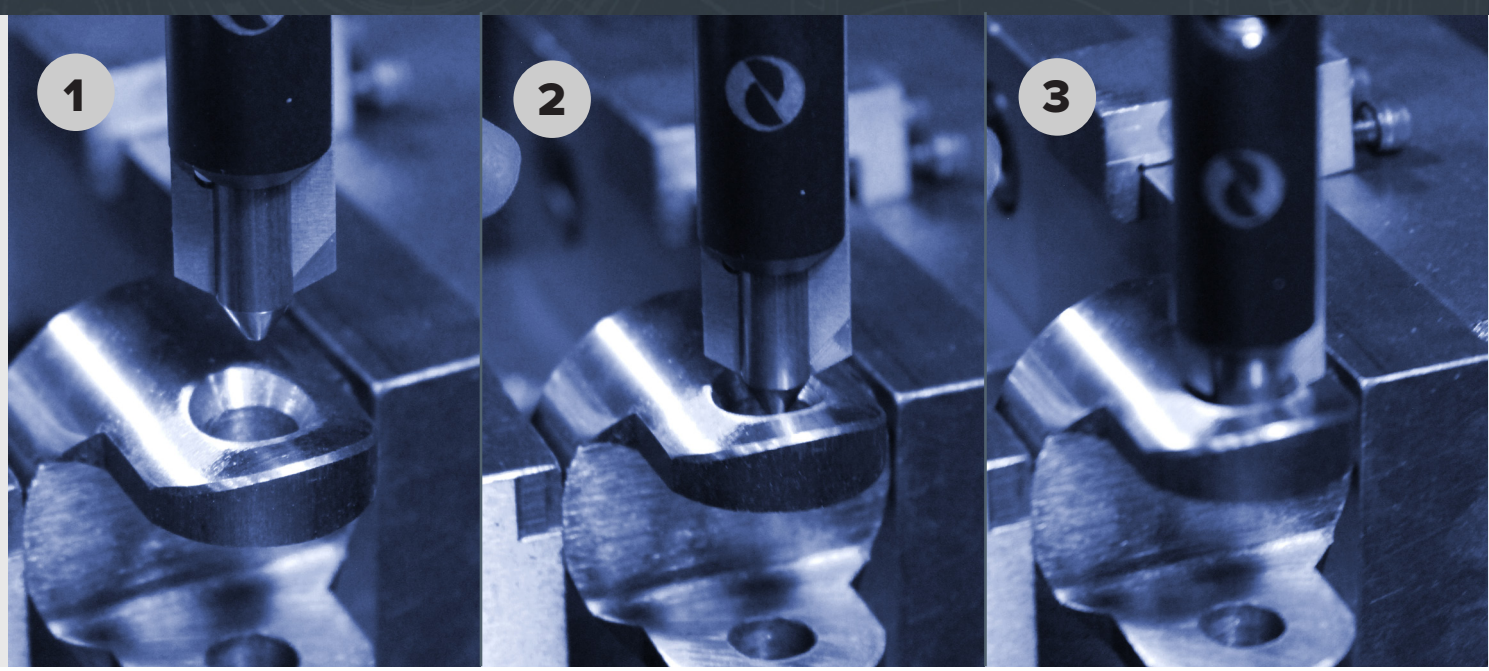
Feed:
Press into part until full contact

THE RESULTS

Evenly deburred elliptical hole.

- Better cosmetic appearance compared to alternative processes

Cycle Time:
3SEC.





ZERO DEFLECTION.
ZERO CHATTER.

Efficiently machine internal grooves with zero problems.

INTERNAL RECESSING UNIT

IRU

The most efficient method of machining internal grooves in one operation.



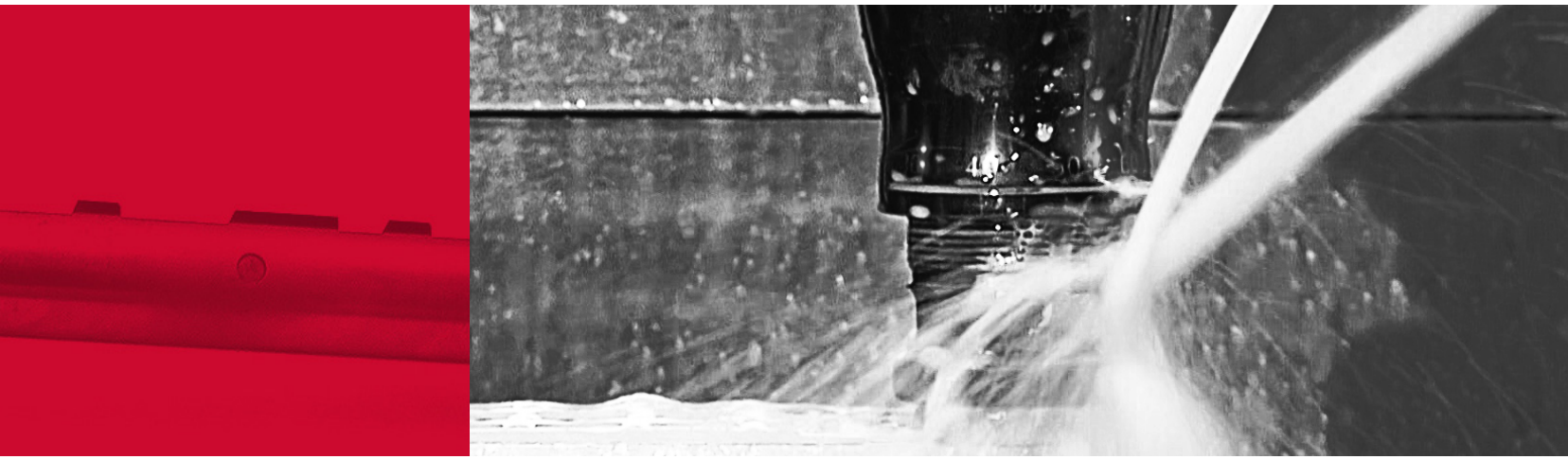
USE THE INTERNAL RECESSING UNIT FOR FAST, EFFICIENT, AND CONSISTENT MACHINING OF INTERNAL GROOVES CONCENTRIC TO BORES. MINIMIZE YOUR CYCLE TIME WHILE ELIMINATING DEFLECTION AND GUARANTEEING REPEATABILITY.

REPEATABLE & ACCURATE

Most efficient method of machining grooves in one operation where close tolerances and finish are critical.

Repeatable and accurate for diameter and axial position of grooves and lands (+/- 0.002")





ELIMINATES DEFLECTION & CHATTER

The IRU is designed to support the cutter along its entire length, eliminating deflection and creating precisely machined features.

The IRU system pilots in the bore, providing perfect concentricity.

Rigidity and accuracy is assured by strategic location of the cams to support the cutting teeth.

FEEDS AND SPEEDS

Feed rates of 0.002 to 0.005 IPR are typical starting points for most applications. For smaller bore diameters (less than 0.500″), decrease the feed rate below 0.002 IPR.

Surface feet per minute are equal to those recommended for multi-fluted reamers (the speeds below can be increased up to 3x).

Material Machined	**Surface ft. per minute**
Cast Iron - Gray	100 to 110
Cast Iron - Nodular	30 to 70
Steel/Forgings	35 to 70
Aluminum and Brass	150 to 160



ECONOMICAL & EFFICIENT

Machine internal grooves in one operation.

Quick cycle time – typical cycle time is less than 15 seconds!

Carbide cutters can be resharpened 2-5 times and can also be replaced.

EASY-TO-USE

Simple to set up and use! There are only two settings required on the Elliott IRU:

1) Positional location
(using the tool's adjustable stop collar)

2) Groove diameter
Manual machine – adjust limiting nut;
CNC/power fed machine – programmed.

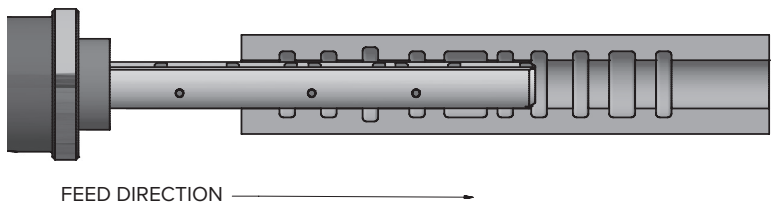
Programming your CNC is straight-forward - axial motion translates to radial cutter lift at a 1:1 ratio on diameter.

Can be used on CNC machining centers, special machines, transfer machines and drill presses.

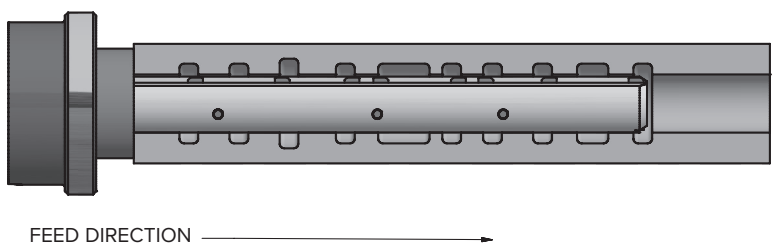
INTERNAL RECESSING UNIT

OPERATING PROCEDURE

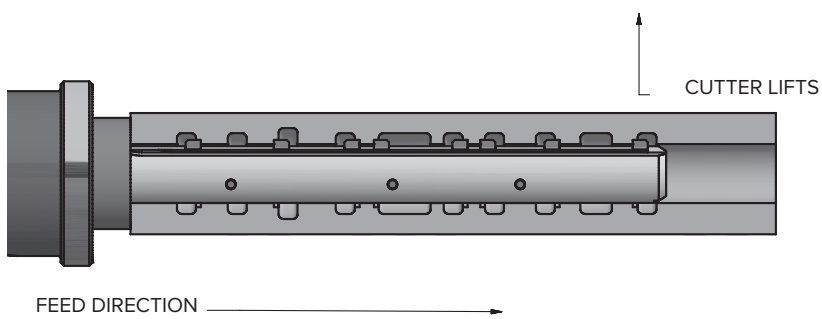
1. The IRU is fed into the work-piece at a fast feed rate with the pilot locating within the bore until the nose piece is approximately .020” (0.5mm) from the face of the work-piece.



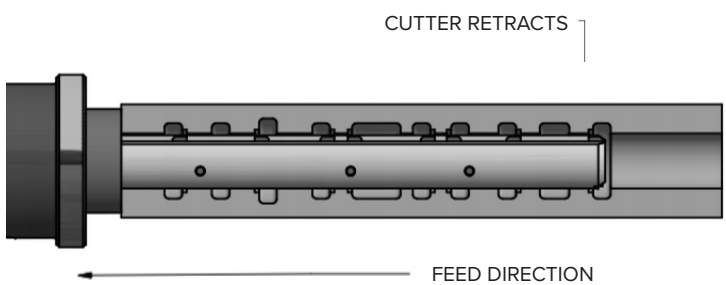
2. Feed into the work-piece at a cutting feed rate and make contact with the face of work-piece. At this point, the operating head and nose piece are engaged and will stop rotating.



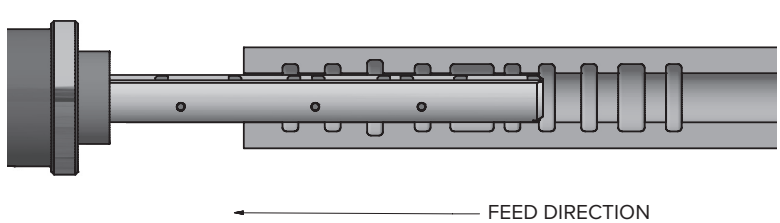
3. Continue feeding forward - causing the system to actuate - lifting the cutter perpendicular to the axis of rotation, machining the internal features in the bore.



4. Retract the IRU three (3) times faster than the cutting feed rate.



5. Once the nose piece is off of the face of the work piece, the cutter has fully retracted back into the pilot and from this point, the IRU can be rapid fed out of the work-piece.



INTERNAL RECESSING UNIT

APPLICATION

THE JOB

Part Material:
Gray iron

Diameter:
0.625″ bore

Job parameters:
Machine 2 internal grooves simultaneously - 0.125″ wide x 0.060″ deep per side

THE SOLUTION

Tool Used:
IRU-0444

Speed:
100 SFM

Cut Feed:
0.003 IPR

Retract Feed:
0.009 IPR

THE RESULTS

- No deflection, good surface finish in grooves

- Groove positions to print and achieved groove diameter of .745”

Cycle Time:
6.1SEC.



Simultaneously **lose problems** and enormous amounts of **cycle time**.



MACHINE PRECISE BACK CHAMFERS.



Eliminate part flipping with the Elliott BCU.

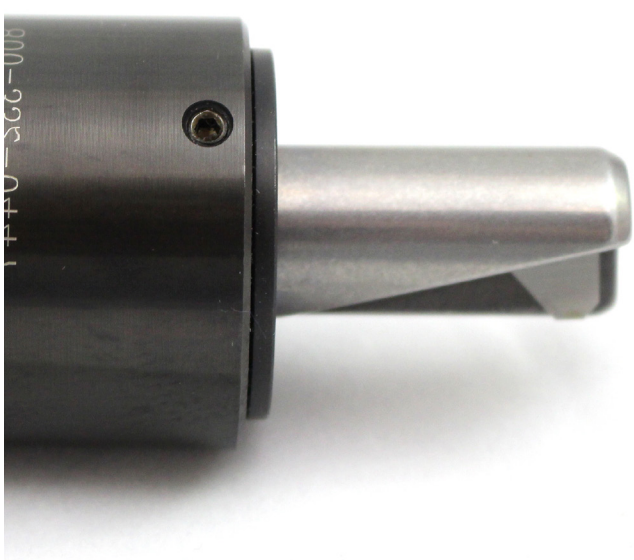
BACK CHAMFERING UNIT

BCU

Eliminate secondary setups and machine precise back chamfers.



Precision back chamfering and deburring of holes with replaceable cutting blades and simle rapid-feed-retract programming.



MACHINE PRECISE BACK CHAMFERS

Positively deburrs the rear of a hole from the front face.

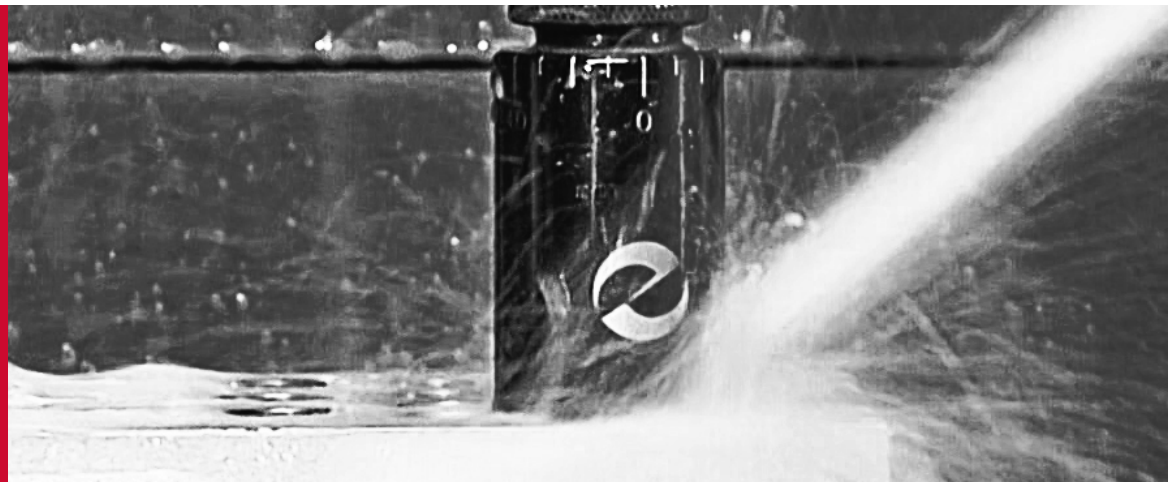
Cutters are mounted within the support pilot – eliminating deflection and chatter – while providing perfectly concentric chamfers.

ECONOMICAL, EFFICIENT AND EASY-TO-USE

Fast cycle time – measured in seconds. Cutting cycle time is typically less than 5 seconds. Blades can be resharpened 1-2 times and can also be replaced.

Excellent for large burr removal on tough to machine materials.





ELIMINATES SECONDARY SET-UPS

By deburring and back chamfering from the front face, part-flipping, secondary set-ups and additional machines are not required.

VERSATILITY

Can be used on CNC machining centers, special machines, transfer machines and drill presses.

CNC machine control for chamfer size. 1:1 ratio on diameter. For manual machines, use diameter limiting nut to set diameter. (Do not use limiting nut on CNC machines)

Micro-adjustment for setting of chamfer location.

CUTTER OPTIONS

Standard cutters for:
Low carbon steel, cast iron, aluminum and other non-ferrous materials.
Premium cutters for:
Alloy steels, steels Rc 30-45, stainless steel and exotic materials.

Standard cutters machine a 45° chamfer. Special chamfer angles, radii and premium cutters quoted on request.

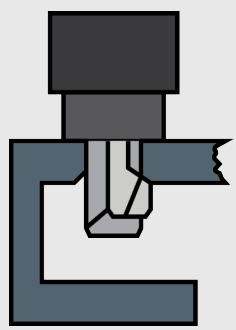
Standard hole diameters from 0.187″ (4.7mm) to 0.787″ (20mm). Special hole diamters from 0.156″ (4mm) to 0.984″ (25mm).

Standard reaches available are 1″ (25.4mm) and 1.77″ (45mm). Longer lengths quoted on request. Minimum part depth of 0.125″ (3.17mm); special lengths up to 10x diameter.

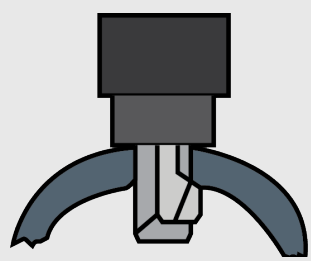
SPEEDS AND FEEDS

Material (IPR)	SFM	Feed Rate
Aluminum	100 to 150	0.006" to 0.012"
Cast iron	50 to 100	0.006" to 0.012"
Steel	30 to 80	0.006" to 0.012"
H.T. steel/exotics	10 to 30	0.006" to 0.012"

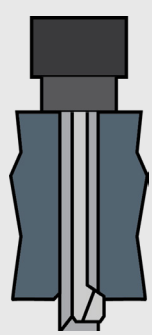
SUITABLE FOR A VARIETY OF SURFACES



Restricted surfaces



Curved surfaces



Long-reach applications

BACK CHAMFERING UNIT

OPERATING PROCEDURE

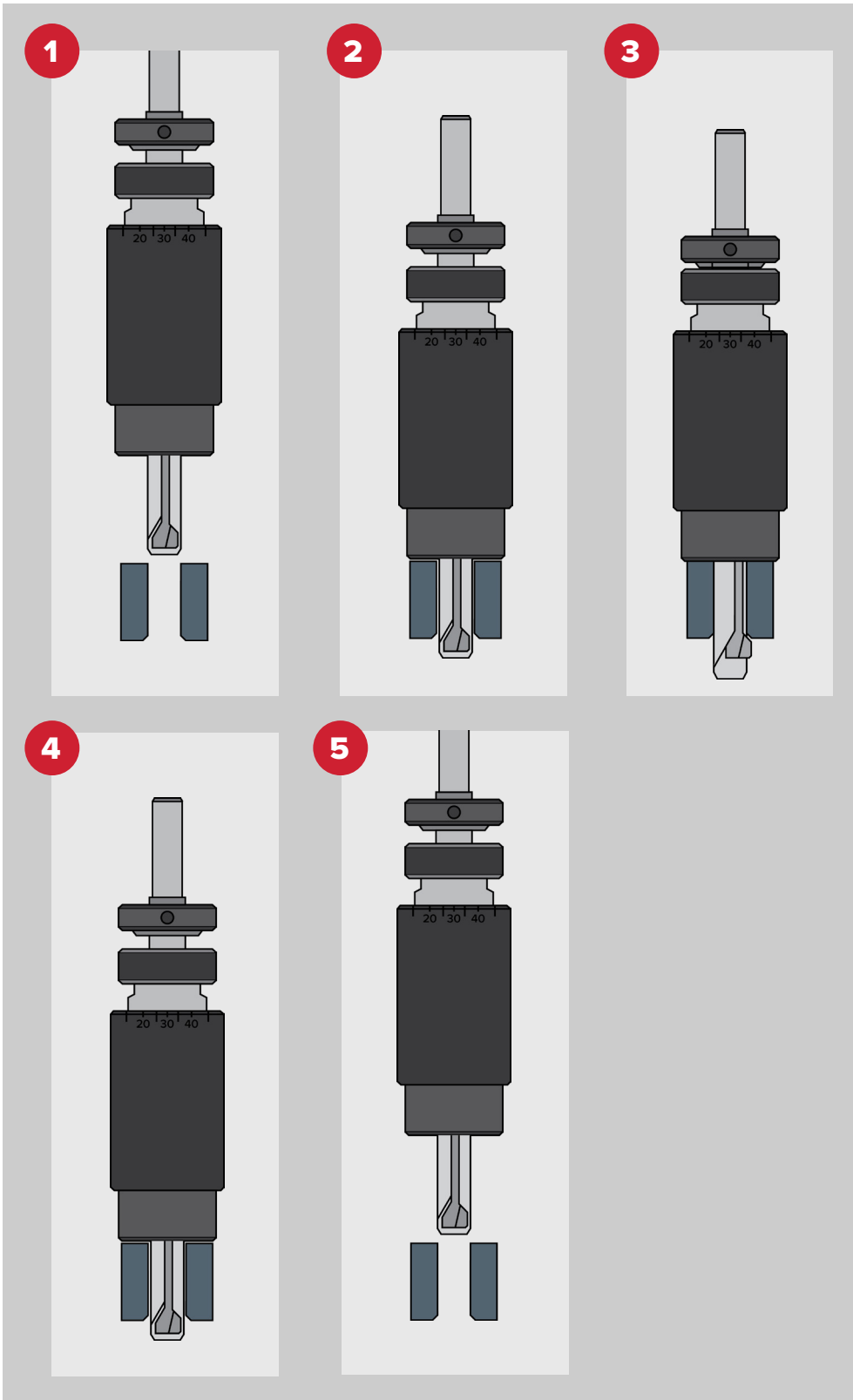
1. Set chamfer diameter: Use adjustable collar to set chamfer distance from nosepiece and use the limiting nut* to set the stroke of the tool and thus control chamfer diameter.

2. Program CNC* to rapid feed BCU into the hole until the part comes in contact with the nose piece.

3. Program CNC to then feed at 0.006″ to 0.012″ IPR. For smaller diameters, decrease the feed rate below 0.003 IPR. Program CNC to feed forward, not exceeding distance set with limiting nut.*

4. Program CNC to retract at 3x cutting feed rate until blade is fully returned within pilot.

5. Program CNC to rapid BCU out of the hole.



EASY TO USE RAPID-FEED-RETRACT PROGRAMMING!

* For manual machines, use diameter limiting nut to set diameter. For CNC machines, back limiting nut way off or remove completely.

BACK CHAMFERING UNIT

APPLICATION

Consistent and repeatable...

THE JOB

Part Material:
4140 Steel

Diameter: 0.596″

Length: 1.000"

Job Parameters:
machine 45 degree back chamfer

THE SOLUTION

Tool Used:
Pilot: 048P25-1515
Cutter: 048C25-1515A

Speed: 513 RPM

Cut Feed:
0.010 IPR

Retract Feed:
0.030 IPR

THE RESULTS

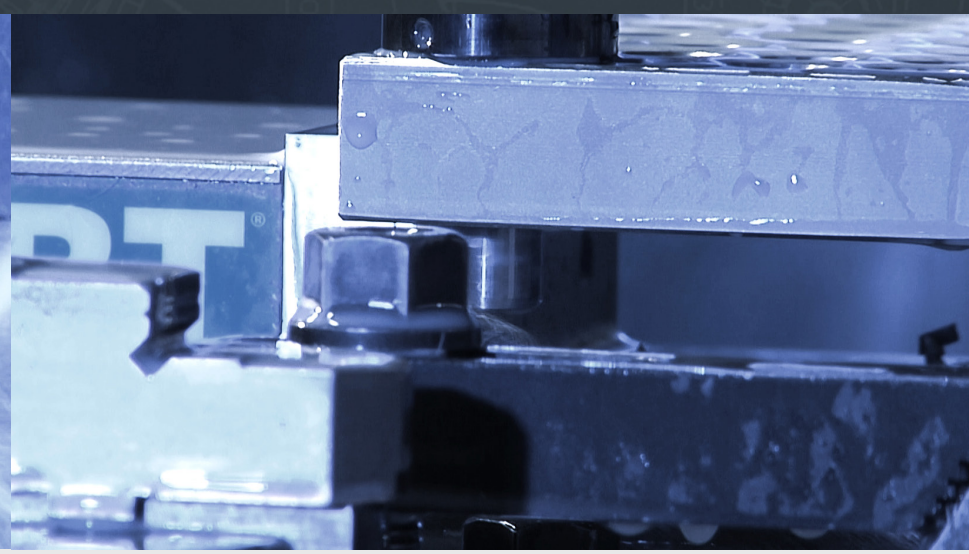
Machined chamfer:
0.090″ x 45°

No flipping or re-fixturing of part.

Cycle Time:
2.8SEC.*

* This is cut and retract of cut. Does not included the feed rate used to go into the part up to the contact of the nose piece.





...chamfers and deburrs without flipping the part.

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