

2025

Precision Metal Finishing Tools

# Precision Tool Crib

Elliott Tool Technologies

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# Why Choose Elliott?

## The Elliott Difference

In September 1892, an inventor and manufacturer named Gustav Wiedeke began a small manufacturing business in a modest building at the rear of his Dayton, Ohio home. Today, over 100 years later, Wiedeke Dayton has become Elliott Tool Technologies Ltd. due to Mr. Wiedeke's efforts.

The Wiedeke business continued to operate as a family enterprise for the next 32 years. By this time, Wiedeke products had earned a worldwide reputation for excellence in the industries they served. Wiedeke tools were innovative enough to be covered by various patents and trademarks.

In 1916, William Elliott also recognized the need and opportunity in the industry for efficient tube cleaning equipment. Operating plants in both Ohio and Pennsylvania, the company went through several company name iterations (Lagonda

Springfield and Elliott Springfield) and eventually became known as the Elliott Company. By the late 1960's, Elliott Company also enjoyed a worldwide reputation for its cleaning and turbo-machinery products. And in 1969, acquired the Gustav Wiedeke Company.

Today we are a private company known as Elliott Tool Technologies. Boasting self directed work teams, exceptional customer service, and a continued commitment to produce tools Gustav Wiedeke and William Swan Elliott would be proud of.

Elliott Tool Technologies is proud to represent more than 125 years of manufacturing, sales, and engineering experience.



1892



2025



*This is the oldest known photograph of the employees of the Gustav Wiedeke Company, Predecessor of the Elliott Company in Ohio. It was probably taken around 1906. Gustav Wiedeke, Jr., in vest, second from right.*



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## Contact Us

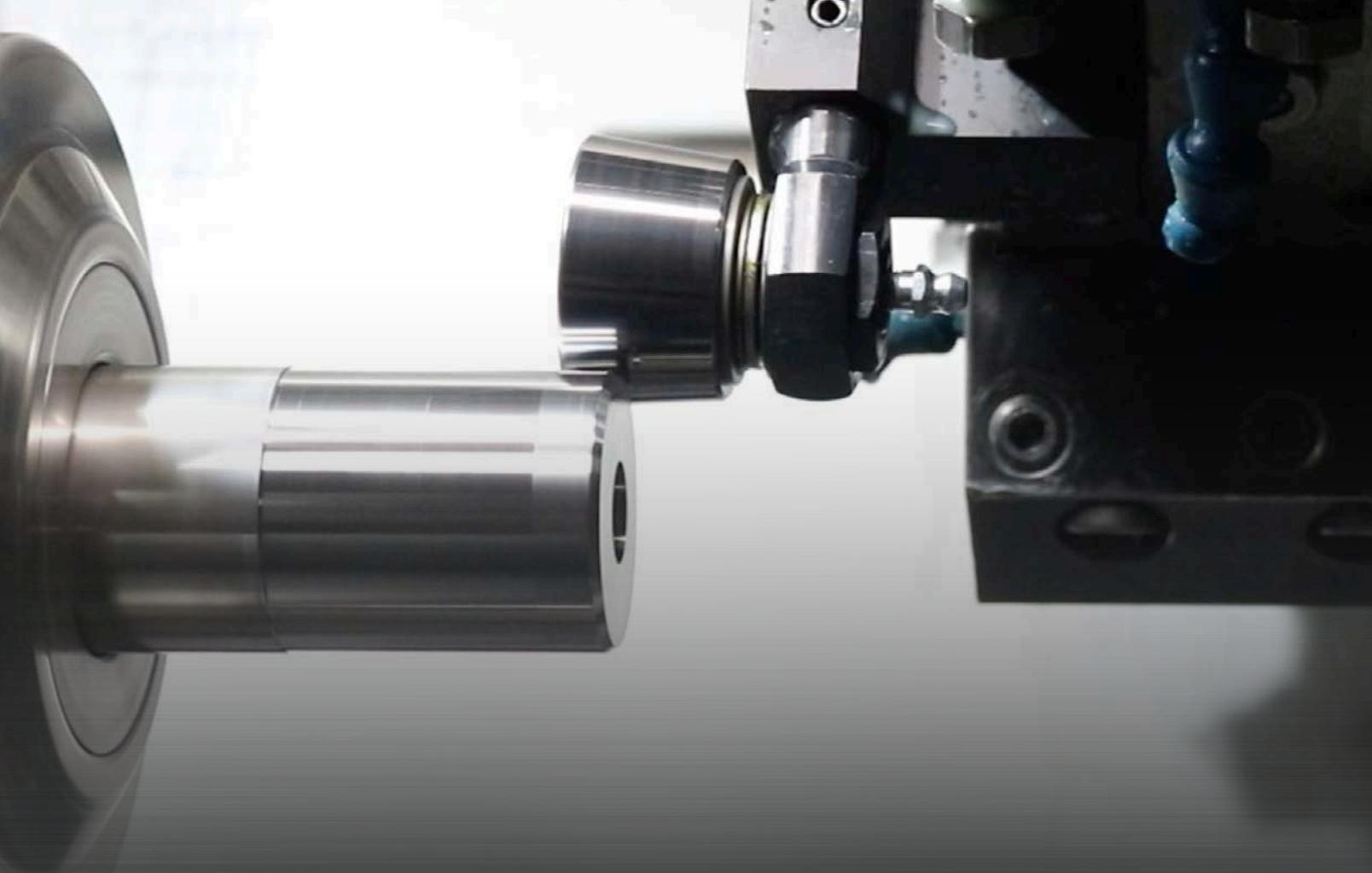
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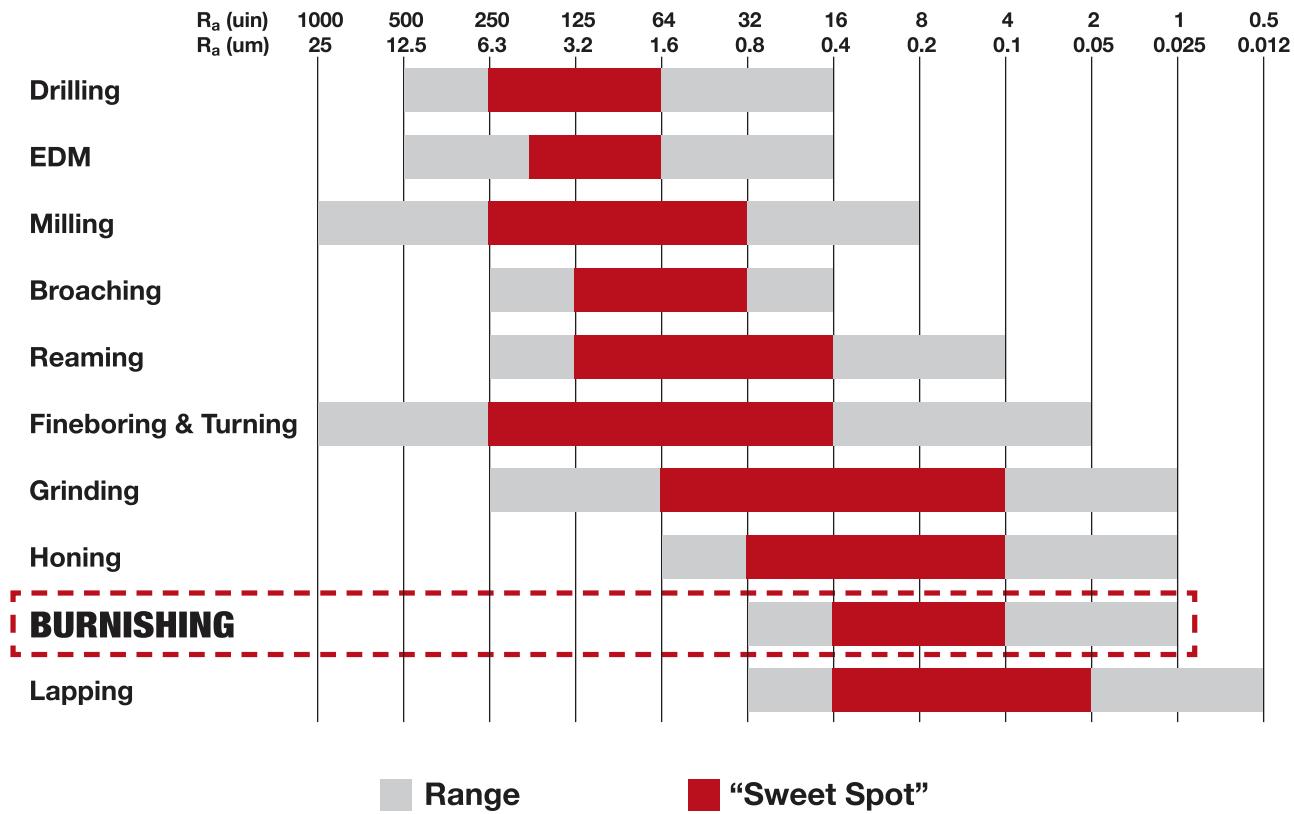
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# What is Burnishing?

## Comparing Burnishing to Traditional Finishing Methods

**Metal Finishing** refers to a wide range of processes that are aimed towards improving performance and minimizing wear over time. This can include everything from cleaning to deburring to surface finishing, depending on the part and end use application.



## Traditional Finishing Methods

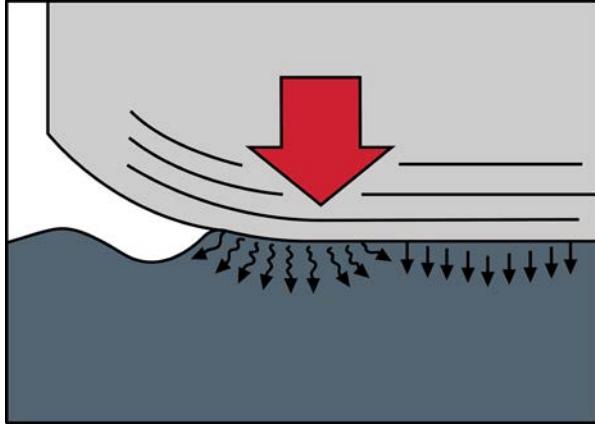
When talking about surface finishing processes, there are several specialized processes that have been around for a very long time. Grinding, Lapping, and Honing are some of the most common methods when trying to produce a smooth surface finish. As it sounds, grinding is the process of shaping the outer surface of a part using a grinding wheel. The benefit of grinding is that it's simple to do, however, there are limits on the shape and size of the part that can be run. Since this process relies on a central axis of rotation it only works with cylindrical surfaces. Additionally, the smaller the part, the more challenging it is to set-up correctly, making it more effective on larger surfaces.

Lapping is another common method of metal surface finishing and is a process where two surfaces are rubbed together with a loose abrasive between them. Generally used on flat surfaces, lapping has the ability to produce a very fine surface finish. Lastly, honing is a process that sizes and finishes the interior of bores or tubing.

This is typically done with honing stones and follows grinding, boring, and drilling operations. While lapping and honing produce high quality results, they are incredibly tedious and time consuming processes. Additionally, due to the specialized equipment required, many customers end up having to outsource parts which can add cost and lead time.

## Burnishing

While traditional finishing methods are effective, they are not very efficient. In many cases, these processes require multiple operations and set-ups to achieve the desired finish and results. This means there's a lot of cost and downtime to change over parts. Additionally, more specialized processes like lapping and honing often require an outside vendor which adds cost and lead-time to manufacturing. Many shops are looking for ways to reduce the number of operations required to save on cost, as well as increase production. Burnishing is an effective and efficient alternative that often eliminates the need for secondary processes entirely.



Burnishing is a machining process that cold works the metal without removing material. Rather it compresses or “irons-out” the peaks of a metal surface into the valleys, resulting in a uniform surface. Depending on the application, a burnishing tool uses either 1 or multiple rolls to exert pressure on the workpiece. This condenses the grain structure of the metal and causes it to elastically deform until it achieves a smooth surface finish.



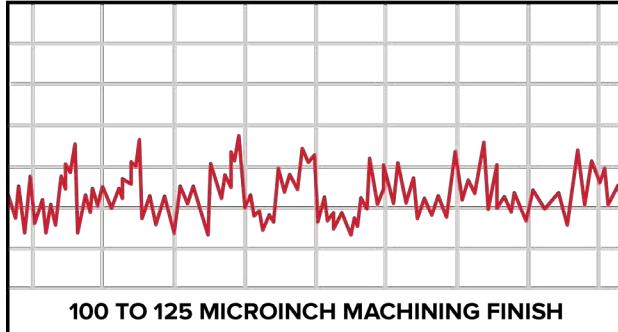
In addition to creating a smooth finish, burnishing also increases the material's resistance to wear by work hardening the surface of the workpiece. This results in better part life, as well as, better abrasion and in some cases corrosion resistance.

In general, most ductile metals can be burnished and achieve a low finish. This includes stainless steel, titanium, aluminum, Inconel, etc. The ending finish will depend on the material and starting finish of the part.

Overall, there are many different existing methods for surface finishing. grinding, lapping, and honing are some of the most common methods used today to achieve finer finishes. While these methods can produce a high-quality finish, they are often high cost and outsourced to a vendor who has specialized equipment. In order to achieve the same fine finishes in house without secondary operations, many shops are turning towards burnishing applications. This allows customers to achieve specified finishes in one machining operation, saving time and money.

# Burnishing Introduction

## Benefits & Advantages



### Benefits & Advantages of Burnishing

Burnishing can achieve a high quality finish which eliminates 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 Introduction

## Material Type & Hardness

### Material Type & Hardness

Burnishing is most suitable for metals up to 40 HRC but harder metals can be burnished in special cases. While harder materials decrease tool life faster, burnishing tools have a well-known reputation for longevity. The components on burnishing tools that wear the most can be replaced without replacing the entire tool.

### 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

	Workpiece Size Range (in)	Internal Surfaces			External Surfaces		
		Stock Allowance (in)	Machined µRa	Roller Burnished µRa	Stock Allowance	Machined µRa	Roller Burnished µRa
High Ductility	0.125 - 0.484"	0.0004	80	8	0.0004	80	8
		0.0007	125	8	0.0005	100	8
	0.500 - 1.000"	0.0007	60	8	0.0005	60	8
		0.0015	125	8	0.001	180	8
	1.031 - 2.000"	0.001	60	8	0.0007	100	8
		0.002	125	8	0.001	180	8
	2.031 - 6.500"	0.0015	60	8	0.001	125	8
		0.002	125	8	0.0015	300	8
		0.003	200	8	0.002	500	8
Low Ductility	0.125 - 0.484"	0.0004	80	18	0.0003	60	18
		0.0007	100	18	0.0005	90	18
	0.500 - 1.000"	0.0007	90	18	0.0005	100	18
		0.001	125	18	0.0007	140	20
	1.031 - 2.000"	0.001	125	18	0.0005	100	18
		0.0015	180	20	0.001	180	20
	2.031 - 6.500"	0.0015	120	18	0.001	125	18
		0.0015	160	18	0.0015	140	18
		0.002	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.

# Burnishing Introduction

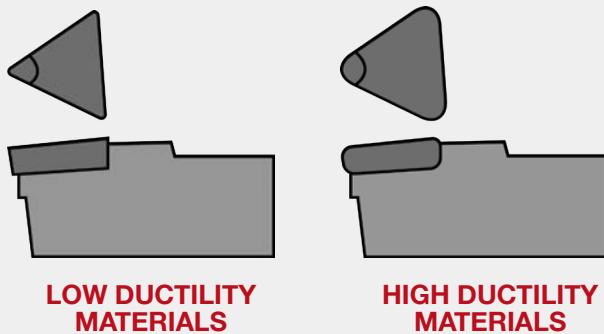
## Burnishing Preparation

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.

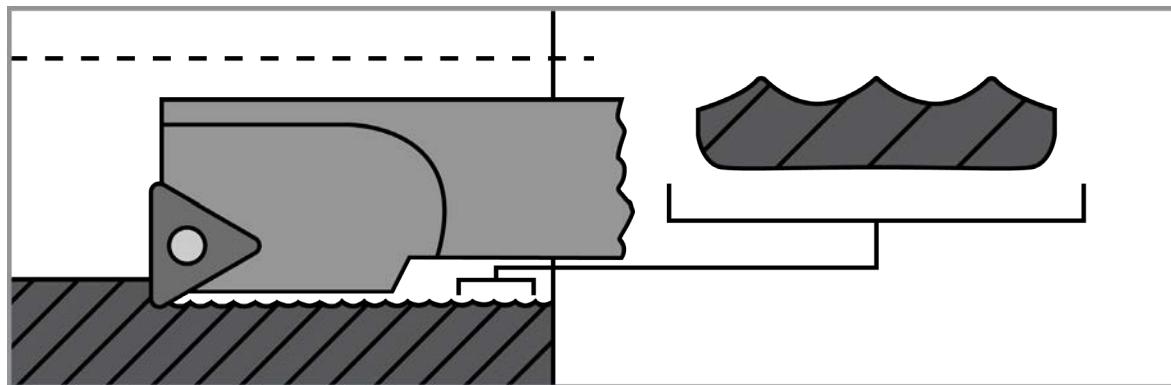
For best results, feed the cutting tool at a feed rate sufficient to produce a surface in the 80 to 120 microinch range with a consistent peak and valley pattern. For less ductile materials, use a feed rate of about 50% less than that of more ductile materials. The result should be a 60 to 100 microinch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



### 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.



# Burnishing Introduction

## Recommended Feeds & Speeds

**Workpieces should be machined to a finish of 60 $\mu$ in Ra to 125 $\mu$ in Ra.**

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	Metric/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.*

# ID Multi-Roller Burnishing Tool



## A Faster & More Accurate Method For Hole Finishing

The multi-roller ID burnishing tools deliver superior results for sizing, finishing, and hardening internal holes and bores.

Eliminating costly secondary processes such as grinding and honing, the ID burnishing tool uses compressive forces to cold work the metal, resulting in a smooth surface finish.

### Features and Benefits:

#### One Step Operation

Produce a 4 – 8 Ra surface finish in one pass.

#### Accurate Sizing

Precision tools allow for minute 0.0001" adjustments, producing accurate hole sizing.

#### Lower Production Costs

Eliminate costly secondary operations such as grinding, honing, and polishing.

#### Suit A Variety Of Hole Styles

Through, blind, and bottom style rolls allow the tool to get as close to the bottom of the bore as necessary.

#### Increase Part Life

Increased surface hardness from cold working the material makes it less susceptible to wear and tear, prolonging the life of the part.

#### Better Part Performance

A smooth hole finish reduces the amount of friction generated while in use, preventing premature failure or excess wear on the part.

### Spares:

- Cages
- Mandrels
- Rolls

# ID Multi-Roller Burnishing Tool

## Standard Sizes & Series

### Standard Sizes & Series

ID Multi-Roller tools are divided into multiple series, each containing a range of standard diameter sizes for holes ranging from 0.157" to 6.500" (3.912 to 165.100mm).

Custom sizes are available.

Tool Series	Size Range (Inches)	Size Range (Metric)
5418	0.157 - 0.501	3.912 - 12.725
5419	0.500 - 0.625	12.700 - 15.875
5433	0.656 - 0.937	16.662 - 23.800
5444	0.968 - 1.187	24.587 - 30.150
5405	1.218 - 1.375	30.937 - 34.925
5406	1.406 - 1.812	35.712 - 46.025
5407	1.843 - 2.187	46.812 - 55.550
5408	2.218 - 2.687	56.337 - 68.250
5409	2.718 - 3.312	69.037 - 84.125
5610	3.343 - 4.062	84.912 - 103.175
5611	4.093 - 5.000	103.962 - 127.000
5612	5.031 - 5.875	127.787 - 139.700
5613	5.530 - 6.500	140.462 - 165.100

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.



# ID Multi-Roller Burnishing Tool

## Tool Styles & Clearance

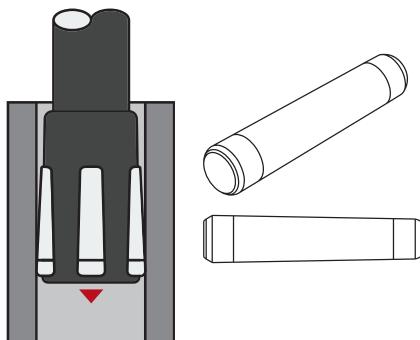
### Clearance

Clearance is the amount of space under the tool required to ensure the machine will not wreck. Each tool style and the diameters within each style require different clearance amounts.

The ID Multi-Roll Tool is available in 3 different styles.

#### Through Style

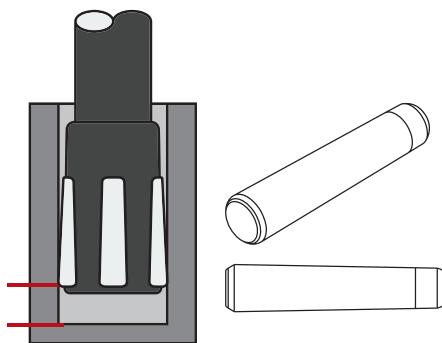
Rolls with greater radius relief are used for through holes. These tools are self-feeding and a release clearance is required. These rolls are interchangeable between blind and through cages.



Tool Size Range	Minimum 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 Style

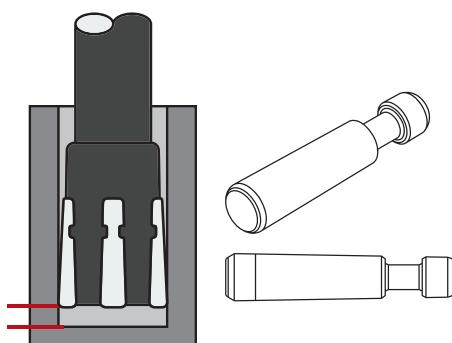
Blind rolls burnish closer to the bottom of a hole than through rolls. These rolls are interchangeable between blind and through cages.



Tool Size Range	Minimum 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 Style

Used in blind hole applications to burnish as close as possible to the bottom of the bore. These rolls are not interchangeable between blind and through cages.

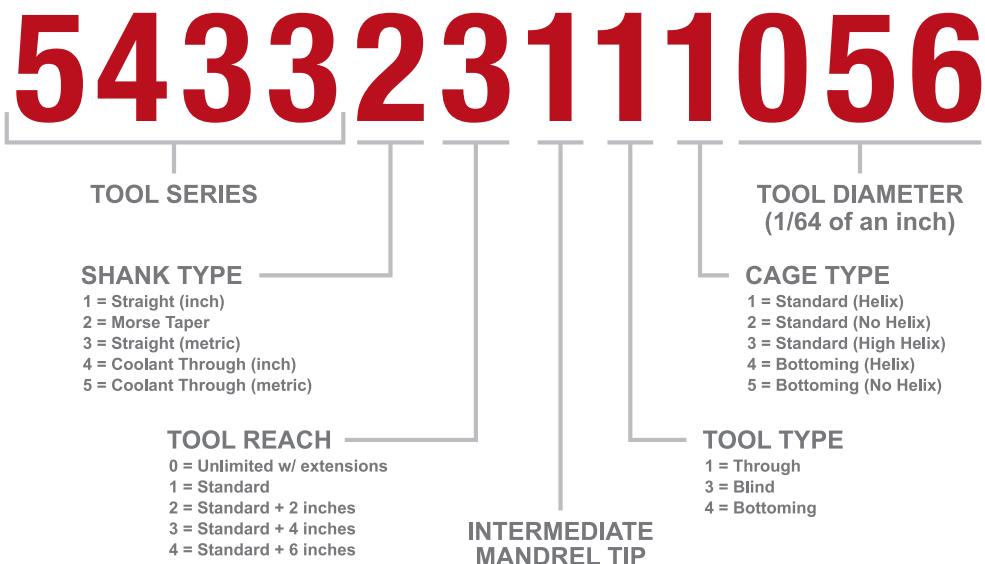


Tool Size Range	Minimum Clearance
0.154 - 0.251	-
0.247 - 0.630	0.035
0.621 - 6.537	0.062

# ID Multi-Roller Burnishing Tool

## Part Number Sequence & Intermediate Mandrels

The seventh digit in the Tool Breakdown will indicate the “Mandrel Tip”



Tool Nominal Diameter	Adjustment Range with Intermediate Sizes (Above Nominal Size)								Intermediate Mandrel Tip Size	
	Bottoming Tools				Through & Blind Tools					
	Inches		Metric		Inches		Metric			
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
0.187" (4.750mm)					(-0.003)	0.001	(-0.076)	0.025	1	
					0.000	0.004	0.000	0.102	2	
					0.003	0.007	0.076	0.178	3	
0.193" (4.750mm)					0.003	0.007	0.076	0.178	3	
					0.006	0.010	0.152	0.254	4	
					0.009	0.013	0.229	0.330	5	
					0.012	0.015	0.305	0.381	6	
0.203 - 0.234" (5.156 - 5.944mm)					(-0.003)	0.001	(-0.076)	0.025	1	
					0.000	0.001	0.000	0.025	2	
					0.003	0.007	0.076	0.178	3	
					0.006	0.010	0.152	0.254	4	
					0.009	0.013	0.229	0.330	5	
					0.012	0.015	0.305	0.381	6	
0.250 - 0.484" (6.350 - 12.294mm)	(-0.003)	0.001	(-0.076)	0.025	(-0.003)	0.001	(-0.076)	0.025	1	
	0.000	0.001	0.000	0.025	0.000	0.001	0.000	0.025	2	
	0.003	0.007	0.076	0.178	0.003	0.007	0.076	0.178	3	
	0.006	0.010	0.152	0.254	0.006	0.010	0.152	0.254	4	
	0.009	0.013	0.229	0.330	0.009	0.013	0.229	0.330	5	
	0.012	0.015	0.305	0.381	0.012	0.015	0.305	0.381	6	
0.500" + (12.700mm +)	(-0.004)	(-0.001)	(-0.102)	0.025	(-0.004)	0.004	(-0.102)	0.102	1	
	0.000	0.003	0.000	0.076	0.000	0.008	0.000	0.203	2	
	0.004	0.007	0.102	0.178	0.004	0.012	0.102	0.305	3	
	0.008	0.011	0.203	0.280	0.008	0.016	0.203	0.406	4	
	0.012	0.015	0.305	0.381	0.012	0.020	0.305	0.508	5	
	0.016	0.019	0.406	0.482	0.016	0.024	0.406	0.610	6	
	0.020	0.023	0.508	0.584	0.020	0.028	0.508	0.711	7	
	0.024	0.027	0.610	0.686	0.024	0.032	0.610	0.813	8	

### Intermediate Mandrels

Most “bottoming” style applications will require an intermediate mandrel

If the bore being burnished is more than a (.006"-.008") deviation from the nominal value of the tool, an intermediate mandrel will be required for adjustment to size.

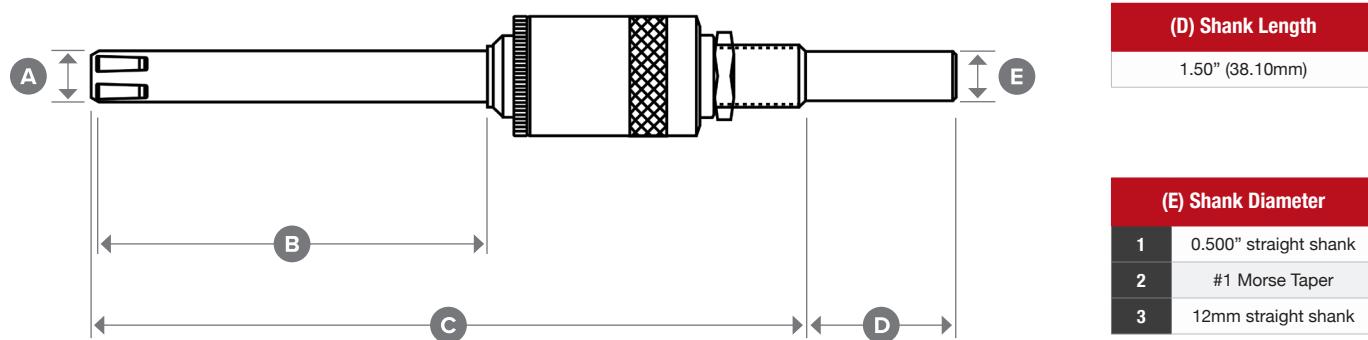
#### Example:

1.266 (Size of Bore)  
1.250 (Nominal Tool Diameter)  
**0.016 (Diameter Difference)**

Could Use Intermediate Sizes:  
#4 (.008-.016)  
#5 (.012-.020)  
#6 (.016-.024)

# 5418 Series - Tool Selector

0.154" - 0.501" (3.912mm - 12.725mm)



When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).  
Example: A short reach, 0.193" diameter blind style tool with a 0.500" straight shank, is part number **5418-111-31011**

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

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

Remaining sizes and styles located on next page.

# 5418 Series - Tool Selector

## 0.154" - 0.501" (3.912mm - 12.725mm)

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach 1.625" (41.275mm) (C) Gage Length 5.000" (127.00mm)		(B) Max Burnishing Reach 3.625" (92.075mm) (C) Gage Length 7.000" (177.80mm)		(B) Max Burnishing Reach 5.625" (142.875mm) (C) Gage Length 9.000" (228.60mm)	
		Blind	Bottoming	Blind	Bottoming	Blind	Bottoming
0.247" - 0.267" (6.274 - 6.782mm)	0.250" (6.350mm)	5418-*11-31016	5418-*12-45016	5418-*21-31016	5418-*22-45016	5418-*31-31016	5418-*32-45016
0.262" - 0.282" (6.655 - 7.163mm)	0.265" (6.731mm)	5418-*11-31017	5418-*12-45017	5418-*21-31017	5418-*22-45017	5418-*31-31017	5418-*32-45017
0.278" - 0.298" (7.061 - 7.569mm)	0.281" (7.137mm)	5418-*11-31018	5418-*12-45018	5418-*21-31018	5418-*22-45018	5418-*31-31018	5418-*32-45018
0.293" - 0.313" (7.442 - 7.950mm)	0.296" (7.518mm)	5418-*11-31019	5418-*12-45019	5418-*21-31019	5418-*22-45019	5418-*31-31019	5418-*32-45019
0.309" - 0.329" (7.849 - 8.357mm)	0.312" (7.925mm)	5418-*11-31020	5418-*12-45020	5418-*21-31020	5418-*22-45020	5418-*31-31020	5418-*32-45020
0.325" - 0.345" (8.255 - 8.763mm)	0.328" (8.331mm)	5418-*11-31021	5418-*12-45021	5418-*21-31021	5418-*22-45021	5418-*31-31021	5418-*32-45021
0.340" - 0.360" (8.636 - 9.144mm)	0.343" (8.712mm)	5418-*11-31022	5418-*12-45022	5418-*21-31022	5418-*22-45022	5418-*31-31022	5418-*32-45022
0.356" - 0.376" (9.042 - 9.550mm)	0.359" (9.119mm)	5418-*11-31023	5418-*12-45023	5418-*21-31023	5418-*22-45023	5418-*31-31023	5418-*32-45023
0.372" - 0.392" (9.449 - 9.957mm)	0.375" (9.525mm)	5418-*11-31024	5418-*12-45024	5418-*21-31024	5418-*22-45024	5418-*31-31024	5418-*32-45024
0.387" - 0.407" (9.830 - 10.338mm)	0.390" (9.906mm)	5418-*11-31025	5418-*12-45025	5418-*21-31025	5418-*22-45025	5418-*31-31025	5418-*32-45025
0.403" - 0.423" (10.236 - 10.744mm)	0.406" (10.312mm)	5418-*11-31026	5418-*12-45026	5418-*21-31026	5418-*22-45026	5418-*31-31026	5418-*32-45026
0.418" - 0.438" (10.617 - 11.125mm)	0.421" (10.693mm)	5418-*11-31027	5418-*12-45027	5418-*21-31027	5418-*22-45027	5418-*31-31027	5418-*32-45027
0.434" - 0.454" (11.024 - 11.532mm)	0.437" (11.100mm)	5418-*11-31028	5418-*12-45028	5418-*21-31028	5418-*22-45028	5418-*31-31028	5418-*32-45028
0.450" - 0.470" (11.430 - 11.938mm)	0.453" (11.506mm)	5418-*11-31029	5418-*12-45029	5418-*21-31029	5418-*22-45029	5418-*31-31029	5418-*32-45029
0.465" - 0.485" (11.811 - 12.319mm)	0.468" (11.887mm)	5418-*11-31030	5418-*12-45030	5418-*21-31030	5418-*22-45030	5418-*31-31030	5418-*32-45030
0.481" - 0.501" (12.217 - 12.725mm)	0.484" (12.294mm)	5418-*11-31031	5418-*12-45031	5418-*21-31031	5418-*22-45031	5418-*31-31031	5418-*32-45031

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5418 Series - Rolls

0.154" - 0.501" (3.912mm - 12.725mm)

Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
0.157" (3.988mm)	-	-	3	5100-704-00049	-	-
0.167" (4.242mm)	-	-	3	5100-704-00049	-	-
0.177" (4.496mm)	-	-	3	5100-704-00049	-	-
0.187" (4.750mm)	-	-	5	5100-704-00062	-	-
0.193" (4.902mm)	-	-	5	5100-704-00062	-	-
0.203" (5.156mm)	-	-	5	5100-704-00062	-	-
0.218" (5.537mm)	-	-	5	5100-704-00070	-	-
0.234" (5.944mm)	-	-	5	5100-704-00070	-	-
0.250" (6.350mm)	-	-	5	5100-704-00078	3	5100-708-00093
0.265" (6.731mm)	-	-	5	5100-704-00078	3	5100-708-00093
0.281" (7.137mm)	-	-	5	5100-704-00086	3	5100-708-00093
0.296" (7.518mm)	-	-	5	5100-704-00086	3	5100-708-00093
0.312" (7.925mm)	-	-	5	5100-704-00093	3	5100-708-00093
0.328" (8.331mm)	-	-	5	5100-704-00093	3	5100-708-00093
0.343" (8.712mm)	-	-	5	5100-704-00109	3	5100-708-00093
0.359" (9.119mm)	-	-	5	5100-704-00109	3	5100-708-00109
0.375" (9.525mm)	-	-	5	5100-704-00109	3	5100-708-00125
0.390" (9.906mm)	-	-	5	5100-704-00109	3	5100-708-00125
0.406" (10.312mm)	-	-	5	5100-704-00125	3	5100-708-00125
0.421" (10.693mm)	-	-	5	5100-704-00125	3	5100-708-00125
0.437" (11.100mm)	-	-	5	5100-704-00125	3	5100-708-00125
0.453" (11.506mm)	-	-	5	5100-704-00148	3	5100-708-00156
0.468" (11.887mm)	-	-	5	5100-704-00148	3	5100-708-00156
0.484" (12.294mm)	-	-	5	5100-704-00148	3	5100-708-00156

# 5418 Series - Mandrels & Cages

0.154" - 0.501" (3.912mm - 12.725mm)

Tool Nominal Diameter	Max Burnishing Reach: 1.625" (41.275mm)			
	Mandrel Tip Part #		Cage Part #	
	Blind	Bottoming	Blind	Bottoming
0.157" (3.988mm)	5418-031-10008	-	5301-011-10008	-
0.167" (4.242mm)	5418-031-10009	-	5301-011-10009	-
0.177" (4.496mm)	5418-031-10010	-	5301-011-10010	-
0.187" (4.750mm)	5418-031-10012	-	5301-011-10012	-
0.193" (4.902mm)	5418-031-10012	-	5301-011-10011	-
0.203" (5.156mm)	5418-031-10013	-	5301-011-10013	-
0.218" (5.537mm)	5418-031-10013	-	5301-011-10014	-
0.234" (5.944mm)	5418-031-10015	-	5301-011-10015	-
0.250" (6.350mm)	5418-031-10015	5418-032-10012	5301-011-10016	5301-015-10016
0.265" (6.731mm)	5418-031-10017	5418-032-10013	5301-011-10017	5301-015-10017
0.281" (7.137mm)	5418-031-10017	5418-032-10015	5301-011-10018	5301-015-10018
0.296" (7.518mm)	5418-031-10019	5418-032-10017	5301-011-10019	5301-015-10019
0.312" (7.925mm)	5418-031-10019	5418-032-10019	5301-011-10020	5301-015-10020
0.328" (8.331mm)	5418-031-10021	5418-032-10021	5301-011-10021	5301-015-10021
0.343" (8.712mm)	5418-031-10019	5418-032-10022	5301-011-10022	5301-015-10022
0.359" (9.119mm)	5418-031-10021	5418-032-10021	5301-011-10023	5301-015-10023
0.375" (9.525mm)	5318-031-10024	5418-032-10019	5301-011-10024	5301-015-10024
0.390" (9.906mm)	5318-031-10025	5418-032-10021	5301-011-10025	5301-015-10025
0.406" (10.312mm)	5318-031-10024	5318-032-10024	5301-011-10026	5301-015-10026
0.421" (10.693mm)	5318-031-10025	5318-032-10025	5301-011-10027	5301-015-10027
0.437" (11.100mm)	5318-031-10028	5318-032-10028	5301-011-10028	5301-015-10028
0.453" (11.506mm)	5318-031-10024	5418-032-10021	5301-011-10029	5301-015-10029
0.468" (11.887mm)	5318-031-10025	5318-032-10024	5301-011-10030	5301-015-10030
0.484" (12.294mm)	5318-031-10028	5318-032-10025	5301-011-10031	5301-015-10031

If an Intermediate Mandrel is required, see page 15.

# 5418 Series - Mandrels & Cages

0.154" - 0.501" (3.912mm - 12.725mm)

Tool Nominal Diameter	Max Burnishing Reach: 3.625" (92.075mm)			
	Mandrel Tip Part #		Cage Part #	
	Blind	Bottoming	Blind	Bottoming
0.157" (3.988mm)	-	-	-	-
0.167" (4.242mm)	-	-	-	-
0.177" (4.496mm)	-	-	-	-
0.187" (4.750mm)	5418-031-20012	-	5301-011-20012	-
0.193" (4.902mm)	5418-031-20012	-	5301-011-20011	-
0.203" (5.156mm)	5418-031-20013	-	5301-011-20013	-
0.218" (5.537mm)	5418-031-20013	-	5301-011-20014	-
0.234" (5.944mm)	5418-031-20015	-	5301-011-20015	-
0.250" (6.350mm)	5418-031-20015	5418-032-20012	5301-011-20016	5301-015-20016
0.265" (6.731mm)	5418-031-20017	5418-032-20013	5301-011-20017	5301-015-20017
0.281" (7.137mm)	5418-031-20017	5418-032-20015	5301-011-20018	5301-015-20018
0.296" (7.518mm)	5418-031-20019	5418-032-20017	5301-011-20019	5301-015-20019
0.312" (7.925mm)	5418-031-20019	5418-032-20019	5301-011-20020	5301-015-20020
0.328" (8.331mm)	5418-031-20021	5418-032-20021	5301-011-20021	5301-015-20021
0.343" (8.712mm)	5418-031-20019	5418-032-20022	5301-011-20022	5301-015-20022
0.359" (9.119mm)	5418-031-20021	5418-032-20021	5301-011-20023	5301-015-20023
0.375" (9.525mm)	5318-031-20024	5418-032-20019	5301-011-20024	5301-015-20024
0.390" (9.906mm)	5318-031-20025	5418-032-20021	5301-011-20025	5301-015-20025
0.406" (10.312mm)	5318-031-20024	5318-032-20024	5301-011-20026	5301-015-20026
0.421" (10.693mm)	5318-031-20025	5318-032-20025	5301-011-20027	5301-015-20027
0.437" (11.100mm)	5318-031-20028	5318-032-20028	5301-011-20028	5301-015-20028
0.453" (11.506mm)	5318-031-20024	5418-032-20021	5301-011-20029	5301-015-20029
0.468" (11.887mm)	5318-031-20025	5318-032-20024	5301-011-20030	5301-015-20030
0.484" (12.294mm)	5318-031-20028	5318-032-20025	5301-011-20031	5301-015-20031

If an Intermediate Mandrel is required, see page 15.

# 5418 Series - Mandrels & Cages

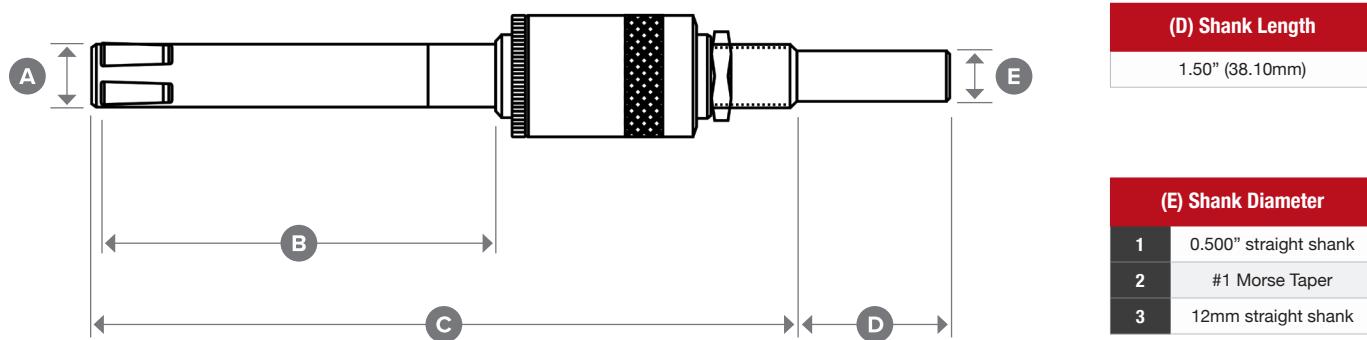
0.154" - 0.501" (3.912mm - 12.725mm)

Tool Nominal Diameter	Max Burnishing Reach: 5.625" (142.875mm)			
	Mandrel Tip Part #		Cage Part #	
	Blind	Bottoming	Blind	Bottoming
0.157" (3.988mm)	-	-	-	-
0.167" (4.242mm)	-	-	-	-
0.177" (4.496mm)	-	-	-	-
0.187" (4.750mm)	5418-031-30012	-	5301-011-30012	-
0.193" (4.902mm)	5418-031-30012	-	5301-011-30011	-
0.203" (5.156mm)	5418-031-30013	-	5301-011-30013	-
0.218" (5.537mm)	5418-031-30013	-	5301-011-30014	-
0.234" (5.944mm)	5418-031-30015	-	5301-011-30015	-
0.250" (6.350mm)	5418-031-30015	5418-032-30012	5301-011-30016	5301-015-30016
0.265" (6.731mm)	5418-031-30017	5418-032-30013	5301-011-30017	5301-015-30017
0.281" (7.137mm)	5418-031-30017	5418-032-30015	5301-011-30018	5301-015-30018
0.296" (7.518mm)	5418-031-30019	5418-032-30017	5301-011-30019	5301-015-30019
0.312" (7.925mm)	5418-031-30019	5418-032-30019	5301-011-30020	5301-015-30020
0.328" (8.331mm)	5418-031-30021	5418-032-30021	5301-011-30021	5301-015-30021
0.343" (8.712mm)	5418-031-30019	5418-032-30022	5301-011-30022	5301-015-30022
0.359" (9.119mm)	5418-031-30021	5418-032-30021	5301-011-30023	5301-015-30023
0.375" (9.525mm)	5318-031-30024	5418-032-30019	5301-011-30024	5301-015-30024
0.390" (9.906mm)	5318-031-30025	5418-032-30021	5301-011-30025	5301-015-30025
0.406" (10.312mm)	5318-031-30024	5318-032-30024	5301-011-30026	5301-015-30026
0.421" (10.693mm)	5318-031-30025	5318-032-30025	5301-011-30027	5301-015-30027
0.437" (11.100mm)	5318-031-30028	5318-032-30028	5301-011-30028	5301-015-30028
0.453" (11.506mm)	5318-031-30024	5418-032-30021	5301-011-30029	5301-015-30029
0.468" (11.887mm)	5318-031-30025	5318-032-30024	5301-011-30030	5301-015-30030
0.484" (12.294mm)	5318-031-30028	5318-032-30025	5301-011-30031	5301-015-30031

If an Intermediate Mandrel is required, see page 15.

# 5419 Series - Tool Selector

0.496" - 0.662" (12.598mm - 16.815mm)



When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A long reach, 0.562" diameter blind style tool with a 12mm straight shank, is part number **5419-331-31036**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach 1.875" (47.625mm) (C) Gage Length 4.930" (125.220mm)			(B) Max Burnishing Reach 3.875" (98.425mm) (C) Gage Length 6.930" (176.020mm)		
		Through	Blind	Bottoming	Through	Blind	Bottoming
0.496" - 0.537" (12.598 - 13.640mm)	0.500" (12.700mm)	-	5419-*11-31032	5419-*12-45032	-	5419-*21-31032	5419-*22-45032
0.527" - 0.568" (13.386 - 14.427mm)	0.531" (13.487mm)	-	5419-*11-31034	5419-*12-45034	-	5419-*21-31034	5419-*22-45034
0.558" - 0.599" (14.173 - 15.215mm)	0.562" (14.275mm)	-	5419-*11-31036	5419-*12-45036	-	5419-*21-31036	5419-*22-45036
0.589" - 0.630" (14.961 - 16.002mm)	0.593" (15.062mm)	-	5419-*11-31038	5419-*12-45038	-	5419-*21-31038	5419-*22-45038
0.621" - 0.662" (15.773 - 16.815mm)	0.625" (15.875mm)	5419-*11-11040	5419-*11-31040	5419-*12-45040	5419-*21-11040	5419-*21-31040	5419-*22-45040

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach 5.875" (149.225mm) (C) Gage Length 8.930" (226.820mm)			(B) Max Burnishing Reach 7.875" (200.025mm) (C) Gage Length 10.930" (277.622mm)		
		Through	Blind	Bottoming	Through	Blind	Bottoming
0.496" - 0.537" (12.598 - 13.640mm)	0.500" (12.700mm)	-	5419-*31-31032	5419-*32-45032	-	5419-*41-31032	5419-*42-45032
0.527" - 0.568" (13.386 - 14.427mm)	0.531" (13.487mm)	-	5419-*31-31034	5419-*32-45034	-	5419-*41-31034	5419-*42-45034
0.558" - 0.599" (14.173 - 15.215mm)	0.562" (14.275mm)	-	5419-*31-31036	5419-*32-45036	-	5419-*41-31036	5419-*42-45036
0.589" - 0.630" (14.961 - 16.002mm)	0.593" (15.062mm)	-	5419-*31-31038	5419-*32-45038	-	5419-*41-31038	5419-*42-45038
0.621" - 0.662" (15.773 - 16.815mm)	0.625" (15.875mm)	5419-*31-11040	5419-*31-31040	5419-*32-45040	5419-*41-11040	5419-*41-31040	5419-*42-45040

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5419 Series - Rolls, Cages, & Mandrels

0.496" - 0.662" (12.598mm - 16.815mm)

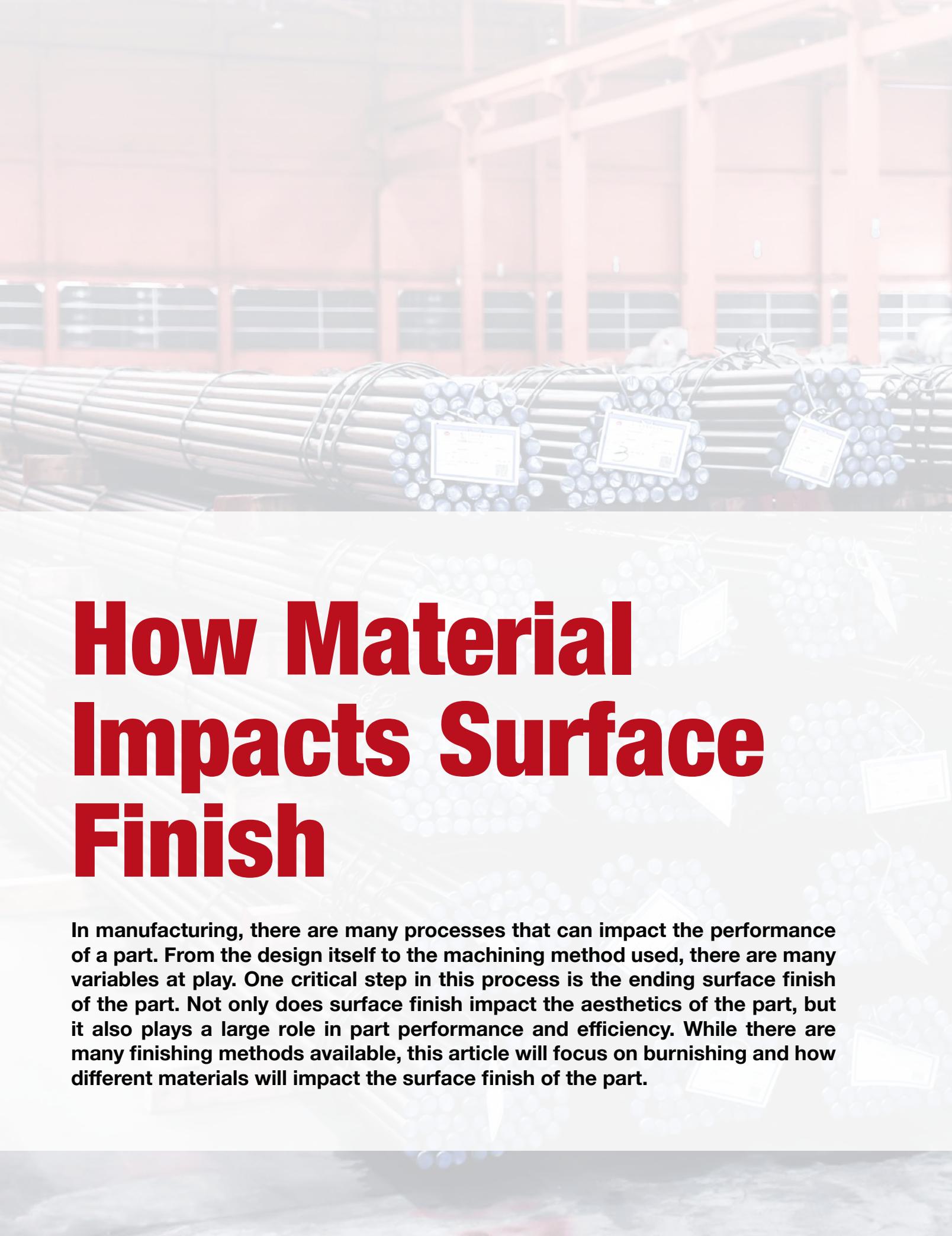
Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
0.500" (12.700mm)	-	-	5	5100-704-00156	5	5100-708-00156
0.531" (13.487mm)	-	-	5	5100-704-00156	5	5100-708-00156
0.562" (14.275mm)	-	-	5	5100-704-00172	5	5100-708-00172
0.593" (15.062mm)	-	-	5	5100-704-00172	5	5100-708-00172
0.625" (15.875mm)	5	5100-701-00187	5	5100-704-00187	5	5100-708-00187

Tool Nominal Diameter	Max Burnishing Reach: 1.875" (47.625mm)				Max Burnishing Reach: 3.875" (98.425mm)			
	Mandrel Tip Part #		Cage Part #		Mandrel Tip Part #		Cage Part #	
	Blind	Bottoming	Blind	Bottoming	Blind	Bottoming	Blind	Bottoming
0.500" (12.700mm)	5319-031-10032	5319-032-10032	-	-	5319-031-20032	5319-032-20032	5151-400-00500	5135-400-00500
0.531" (13.487mm)	5319-031-10034	5319-032-10034	-	-	5319-031-20034	5319-032-20034	5151-400-00531	5135-400-00531
0.562" (14.275mm)	5319-031-10034	5319-032-10034	-	-	5319-031-20034	5319-032-20034	5151-400-00562	5135-400-00562
0.593" (15.062mm)	5319-031-10038	5319-032-10038	-	-	5319-031-20038	5319-032-20038	5151-400-00593	5135-400-00593
0.625" (15.875mm)	5319-031-10038	5319-032-10038	-	-	5319-031-20038	5319-032-20038	5151-400-00625	5135-400-00625

If an Intermediate Mandrel is required, see page 15.

Tool Nominal Diameter	Max Burnishing Reach: 5.875" (149.225mm)				Max Burnishing Reach: 7.875" (200.025mm)			
	Mandrel Tip Part #		Cage Part #		Mandrel Tip Part #		Cage Part #	
	Blind	Bottoming	Blind	Bottoming	Blind	Bottoming	Blind	Bottoming
0.500" (12.700mm)	5319-031-30032	5319-032-30032	-	-	5319-031-40032	5319-032-40032	-	-
0.531" (13.487mm)	5319-031-30034	5319-032-30034	-	-	5319-031-40034	5319-032-40034	-	-
0.562" (14.275mm)	5319-031-30034	5319-032-30034	-	-	5319-031-40034	5319-032-40034	-	-
0.593" (15.062mm)	5319-031-30038	5319-032-30038	-	-	5319-031-40038	5319-032-40038	-	-
0.625" (15.875mm)	5319-031-30038	5319-032-30038	-	-	5319-031-40038	5319-032-40038	-	-

If an Intermediate Mandrel is required, see page 15.



# How Material Impacts Surface Finish

In manufacturing, there are many processes that can impact the performance of a part. From the design itself to the machining method used, there are many variables at play. One critical step in this process is the ending surface finish of the part. Not only does surface finish impact the aesthetics of the part, but it also plays a large role in part performance and efficiency. While there are many finishing methods available, this article will focus on burnishing and how different materials will impact the surface finish of the part.

# What is Surface Finish?

Surface finish is the measurement of a material's texture and is made up of three key parts: lay, waviness, and roughness.

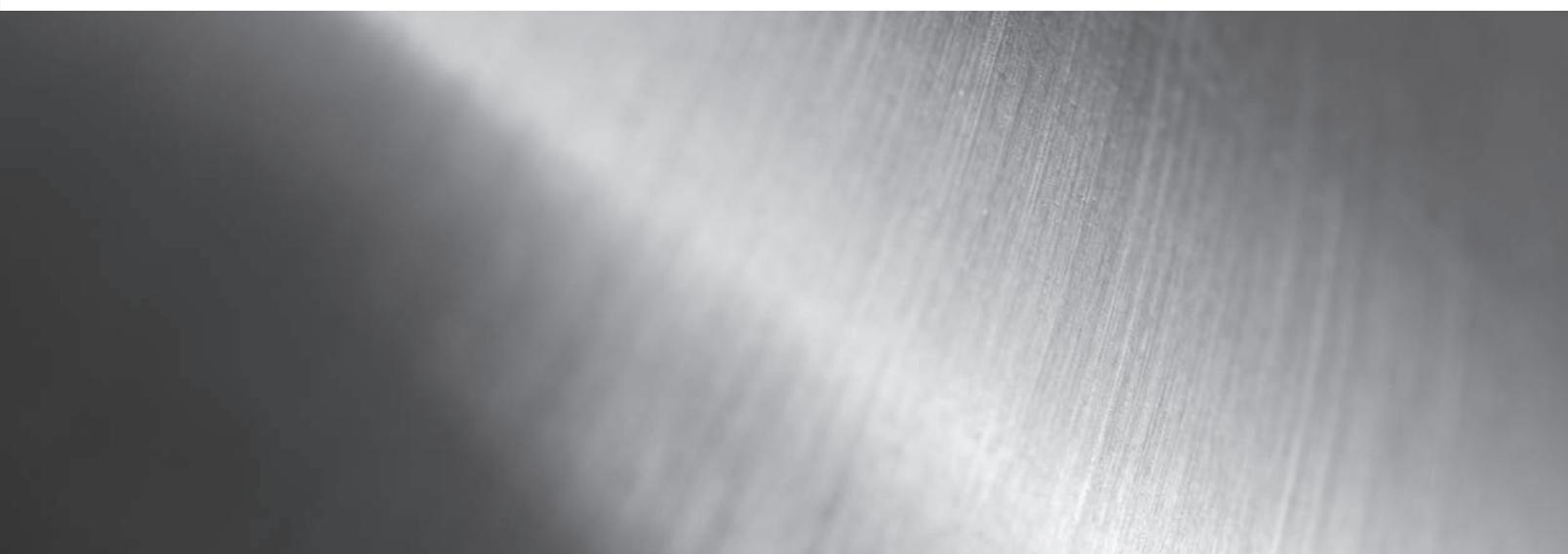
- **Lay** describes the direction of the surface pattern on the material and is generally a result of the manufacturing process used
- **Waviness** refers to large irregularities or deviations on the surface of the material
- **Roughness**, like waviness, evaluates smaller irregularities in material and is used to calculate its smoothness

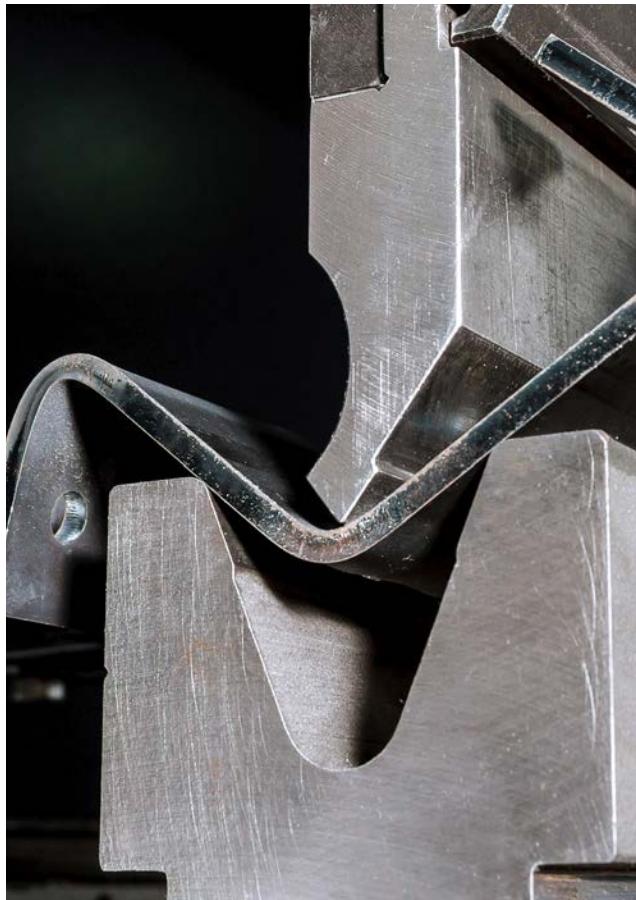
Depending on the end use of the part, the acceptable range for surface finish will vary, however, most machined workpieces will require a lower finish. For example, mating surfaces or

parts that will interact with others while in operation will utilize a lower finish to help reduce friction and increase efficiency of the part. Burnishing can also improve corrosion resistance and part life due to surface hardening.

## Units of Measurement

The two most common units of measurements for material roughness are Ra and Rz. Ra refers to the average roughness of a material, where Rz refers to an average vertical distance of the highest peak and lowest valley. Ra is most used in the United States and Rz is used internationally. In both cases, a lower number (ie. 16) indicates a finer finish where a higher number (ie. 80 – 100) indicates a rougher finish.





## Materials & Surface Finish

The ending surface finish of a part will depend on a few different factors, the first being the material itself. When it comes to burnishing, not all materials will behave the same way. Ductility refers to a material's ability to bend or deform before breaking.

*“Since burnishing uses compressive forces to iron out the peaks and valleys of a material, the material must be ductile.”*

The hardness of the material will determine the achievable final finish. In general, ductile materials will respond better and be more capable of achieving a finer finish compared to hardened materials.

## Surface Preparation

To get the best finish, it's important that the surface of the material is prepared appropriately. Burnishing requires a prominent peak and valley pattern to get a finer finish, because it provides more surface area for the material to be moved. As a result, it's important that softer materials start with a coarser finish, such as 80 – 125 Ra, to allow the burnishing tool to work correctly.



When working with less ductile materials, a finer machined finish will be required before the burnishing operation to reduce the amount of material that needs to be moved during the process. Regardless of the material, gouges and tears in the surface caused by drilling, reaming, or turning will be difficult to remove during the burnishing process. As a result, they will likely remain visible after the burnishing operation is completed.

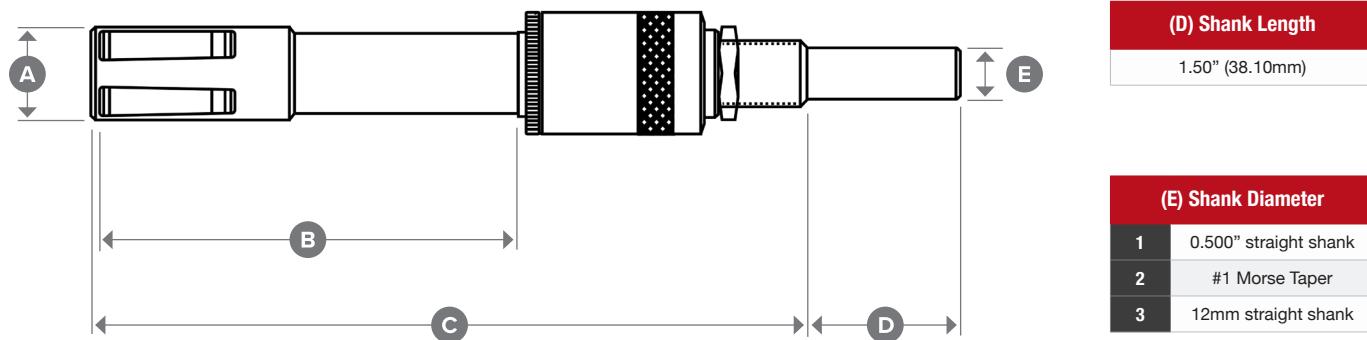
Once the surface has been prepped accordingly, the burnishing operation can begin. In high ductile materials, lower “mirror” finishes such as 4 Ra are possible. In harder materials, a finish of 16 Ra will often be the most common target. Generally, it’s recommended that a few test pieces

are set up and run to determine the right pressure and feed rate required to achieve the desired finish.

Overall, surface finish plays a critical role in determining the performance and longevity of a part. Finer finishes are often used to improve mating surfaces and reduce friction in rotating pieces. One of the easiest methods to achieve a low surface finish is through burnishing, as it is an easy one step operation. However, it’s important to understand what materials can be burnished and how material impacts the finish that can be achieved. With this in mind, operators will be able to determine the steps required to prepare the part for burnishing, as well as the optimal feeds and speeds required to achieve the desired finish.

# 5433 Series - Tool Selector

0.652" - 0.974" (16.561mm - 24.740mm)



When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A medium reach, 0.781" diameter bottoming style tool with a 0.500" straight shank, is part number **5433-122-45050**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach 1.625" (41.275mm) (C) Gage Length 5.038" (127.97mm)			(B) Max Burnishing Reach 3.625" (92.075mm) (C) Gage Length 7.038" (178.77mm)			(B) Max Burnishing Reach 5.625" (142.875mm) (C) Gage Length 9.038" (229.57mm)		
		Through	Blind	Bottoming	Through	Blind	Bottoming	Through	Blind	Bottoming
0.652" - 0.693" (16.561 - 17.602mm)	0.656" (16.662mm)	5433-*11-11042	5433-*11-31042	5433-*12-45042	5433-*21-11042	5433-*21-31042	5433-*22-45042	5433-*31-11042	5433-*31-31042	5433-*32-45042
0.683" - 0.724" (17.348 - 18.390mm)	0.687" (17.450mm)	5433-*11-11044	5433-*11-31044	5433-*12-45044	5433-*21-11044	5433-*21-31044	5433-*22-45044	5433-*31-11044	5433-*31-31044	5433-*32-45044
0.714" - 0.755" (18.136 - 19.177mm)	0.718" (18.237mm)	5433-*11-11046	5433-*11-31046	5433-*12-45046	5433-*21-11046	5433-*21-31046	5433-*22-45046	5433-*31-11046	5433-*31-31046	5433-*32-45046
0.746" - 0.787" (18.948 - 19.990mm)	0.750" (19.050mm)	5433-*11-11048	5433-*11-31048	5433-*12-45048	5433-*21-11048	5433-*21-31048	5433-*22-45048	5433-*31-11048	5433-*31-31048	5433-*32-45048
0.777" - 0.818" (19.736 - 20.777mm)	0.781" (19.837mm)	5433-*11-11050	5433-*11-31050	5433-*12-45050	5433-*21-11050	5433-*21-31050	5433-*22-45050	5433-*31-11050	5433-*31-31050	5433-*32-45050
0.808" - 0.849" (20.523 - 21.565mm)	0.812" (20.625mm)	5433-*11-11052	5433-*11-31052	5433-*12-45052	5433-*21-11052	5433-*21-31052	5433-*22-45052	5433-*31-11052	5433-*31-31052	5433-*32-45052
0.839" - 0.880" (21.311 - 22.352mm)	0.843" (21.412mm)	5433-*11-11054	5433-*11-31054	5433-*12-45054	5433-*21-11054	5433-*21-31054	5433-*22-45054	5433-*31-11054	5433-*31-31054	5433-*32-45054
0.871" - 0.912" (22.123 - 23.165mm)	0.875" (22.225mm)	5433-*11-11056	5433-*11-31056	5433-*12-45056	5433-*21-11056	5433-*21-31056	5433-*22-45056	5433-*31-11056	5433-*31-31056	5433-*32-45056
0.902" - 0.943" (22.911 - 23.952mm)	0.906" (23.012mm)	5433-*11-11058	5433-*11-31058	5433-*12-45058	5433-*21-11058	5433-*21-31058	5433-*22-45058	5433-*31-11058	5433-*31-31058	5433-*32-45058
0.933" - 0.974" (23.698 - 24.740mm)	0.937" (23.800mm)	5433-*11-11060	5433-*11-31060	5433-*12-45060	5433-*21-11060	5433-*21-31060	5433-*22-45060	5433-*31-11060	5433-*31-31060	5433-*32-45060

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5433 Series - Rolls, Mandrels, & Cages

0.652" - 0.974" (16.561mm - 24.740mm)

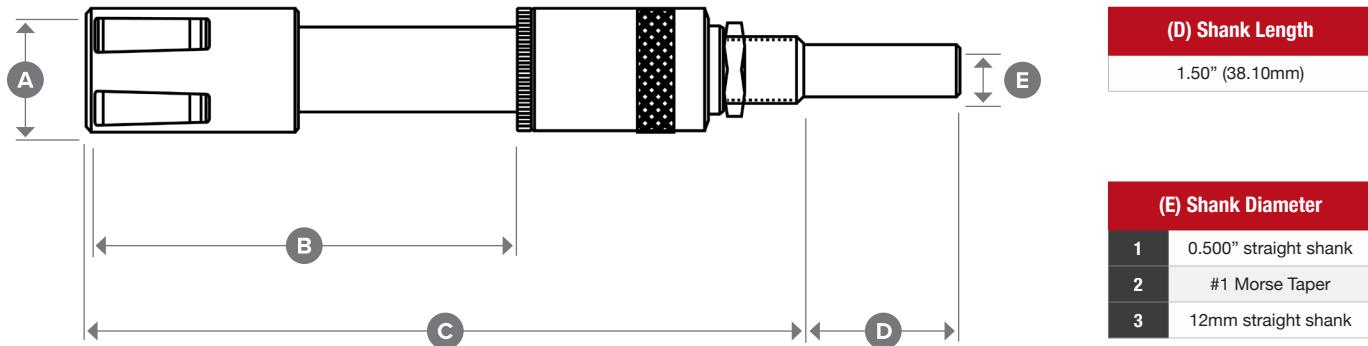
Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
0.656" (16.662mm)	5	5100-701-00187	5	5100-704-00187	5	5100-708-00187
0.687" (17.450mm)	5	5100-701-00187	5	5100-704-00187	5	5100-708-00187
0.718" (18.237mm)	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
0.750" (19.050mm)	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
0.781" (19.837mm)	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
0.812" (20.625mm)	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
0.843" (21.412mm)	5	5100-701-00218	5	5100-704-00218	5	5100-708-00218
0.875" (22.225mm)	5	5100-701-00265	5	5100-704-00265	5	5100-708-00265
0.906" (23.012mm)	5	5100-701-00265	5	5100-704-00265	5	5100-708-00265
0.937" (23.800mm)	5	5100-701-00265	5	5100-704-00265	5	5100-708-00265

Tool Nominal Diameter	Max Burnishing Reach: 1.625" (41.275mm)			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
0.656" (16.662mm)	5333-031-00042	5333-032-00042	5403-011-00042	5403-015-00042
0.687" (17.450mm)	5333-031-00044	5333-032-00044	5403-011-00044	5403-015-00044
0.718" (18.237mm)	5333-031-00042	5333-032-00042	5403-011-00046	5403-015-00046
0.750" (19.050mm)	5333-031-00044	5333-032-00044	5403-011-00048	5403-015-00048
0.781" (19.837mm)	5333-031-00050	5333-032-00050	5403-011-00050	5403-015-00050
0.812" (20.625mm)	5333-031-00052	5333-032-00052	5403-011-00052	5403-015-00052
0.843" (21.412mm)	5333-031-00054	5333-032-00054	5403-011-00054	5403-015-00054
0.875" (22.225mm)	5333-031-00050	5333-032-00050	5403-011-00056	5403-015-00056
0.906" (23.012mm)	5333-031-00052	5333-032-00052	5403-011-00058	5403-015-00058
0.937" (23.800mm)	5333-031-00054	5333-032-00054	5403-011-00060	5403-015-00060

If an Intermediate Mandrel is required, see page 15.

# 5444 Series - Tool Selector

0.964" - 1.224" (24.486mm - 31.090mm)



When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A long reach, 1.125" diameter through style tool with a #1 Morse Taper shank, is part number **5444-231-11072**

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

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5444 Series - Rolls, Mandrels, & Cages

0.964" - 1.224" (24.486mm - 31.090mm)

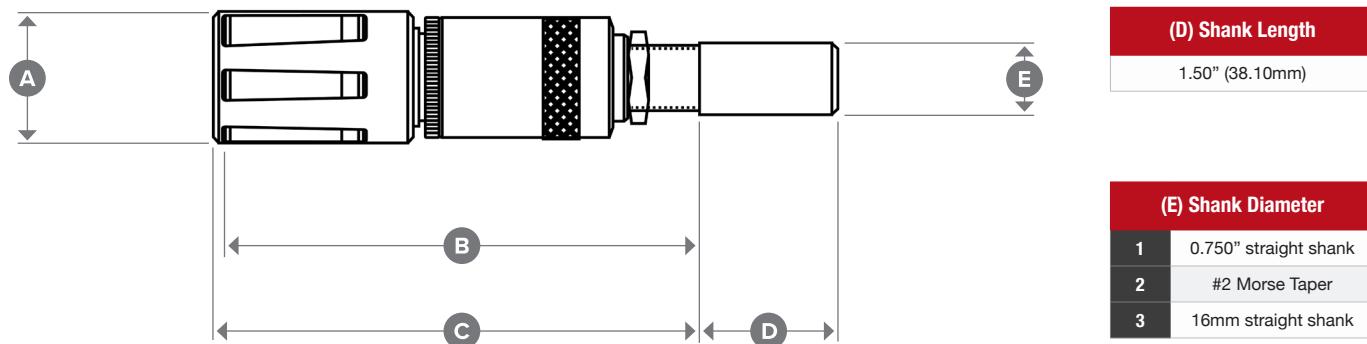
Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
0.968" (24.587mm)	5	5100-701-00265	5	5100-704-00265	5	5100-708-00265
1.000" (25.400mm)	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
1.031" (26.187mm)	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
1.062" (26.975mm)	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
1.093" (27.762mm)	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
1.125" (28.575mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
1.156" (29.362mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
1.187" (30.150mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312

Tool Nominal Diameter	Max Burnishing Reach: 1.875" (47.625mm)			
	Mandrel Tip Part #		Cage Part #	
	Through & Blind	Bottoming	Through & Blind	Bottoming
0.968" (24.587mm)	5344-031-00062	5344-032-00062	5404-011-00062	5404-015-00062
1.000" (25.400mm)	5344-031-00064	5344-032-00064	5404-011-00064	5404-015-00064
1.031" (26.187mm)	5344-031-00066	5344-032-00066	5404-011-00066	5404-015-00066
1.062" (26.975mm)	5344-031-00068	5344-032-00068	5404-011-00068	5404-015-00068
1.093" (27.762mm)	5344-031-00070	5344-032-00070	5404-011-00070	5404-015-00070
1.125" (28.575mm)	5344-031-00066	5344-032-00066	5404-011-00072	5404-015-00072
1.156" (29.362mm)	5344-031-00068	5344-032-00068	5404-011-00074	5404-015-00074
1.187" (30.150mm)	5344-031-00070	5344-032-00070	5404-011-00076	5404-015-00076

If an Intermediate Mandrel is required, see page 15.

# 5405 Series - Tool Selector

1.214" - 1.412" (30.826mm - 35.865mm)



When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A standard reach 1.281" diameter blind style tool with a 0.750" straight shank, is part number **5405-101-31082**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 5.188" (131.76mm)		
		Through	Blind	Bottoming
1.214" - 1.255" (30.836 - 31.877mm)	1.218" (30.937mm)	5405-*01-11078	5405-*01-31078	5405-*02-45078
1.246" - 1.287" (31.648 - 32.690mm)	1.250" (31.750mm)	5405-*01-11080	5405-*01-31080	5405-*02-45080
1.277" - 1.318" (32.436 - 33.477mm)	1.281" (32.537mm)	5405-*01-11082	5405-*01-31082	5405-*02-45082
1.308" - 1.349" (33.223 - 34.265mm)	1.312" (33.325mm)	5405-*01-11084	5405-*01-31084	5405-*024-5084
1.339" - 1.380" (34.011 - 35.052mm)	1.343" (34.112mm)	5405-*01-11086	5405-*01-31086	5405-*02-45086
1.371" - 1.412" (34.823 - 35.865mm)	1.375" (34.925mm)	5405-*01-11088	5405-*01-31088	5405-*02-45088

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5405 Series - Rolls, Mandrels, & Cages

1.214" - 1.412" (30.826mm - 35.865mm)

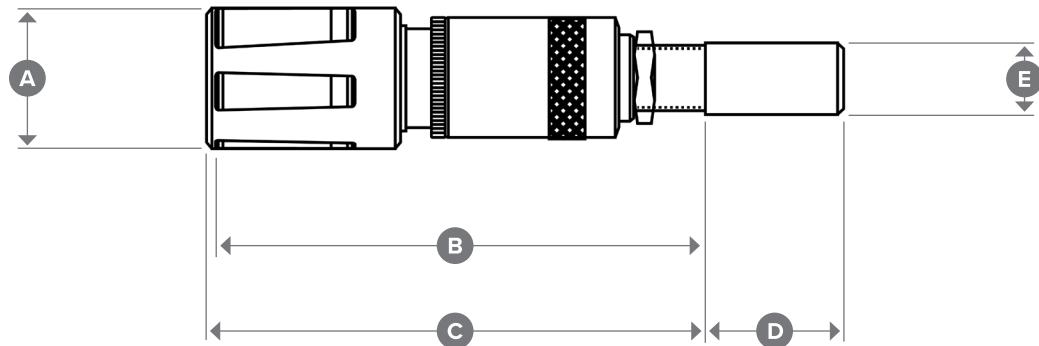
Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
1.218" (30.937mm)	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
1.250" (31.750mm)	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
1.281" (32.537mm)	7	5100-701-00265	7	5100-704-00265	5	5100-708-00265
1.312" (33.325mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
1.343" (34.112mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
1.375" (34.925mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
1.218" (30.937mm)	5305-031-00078	5305-032-00078	5405-011-00078	5405-015-00078
1.250" (31.750mm)	5305-031-00080	5305-032-00080	5405-011-00080	5405-015-00080
1.281" (32.537mm)	5305-031-00082	5305-032-00082	5405-011-00082	5405-015-00082
1.312" (33.325mm)	5305-031-00078	5305-032-00078	5405-011-00084	5405-015-00084
1.343" (34.112mm)	5305-031-00080	5305-032-00080	5405-011-00086	5405-015-00086
1.375" (34.925mm)	5305-031-00082	5305-032-00082	5405-011-00088	5405-015-00088

If an Intermediate Mandrel is required, see page 15.

# 5406 Series - Tool Selector

1.402" - 1.849" (35.611mm - 46.965mm)



(D) Shank Length

1.50" (38.10mm)

(E) Shank Diameter

1	0.750" straight shank
2	#2 Morse Taper
3	16mm straight shank

When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A standard reach 1.593" diameter bottoming style tool with a #2 Morse Taper shank, is part number **5406-202-45102**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 5.188" (131.76mm)		
		Through	Blind	Bottoming
1.402" - 1.443" (35.611 - 36.652mm)	1.406" (35.712mm)	5406-*01-11090	5406-*01-31090	5406-*02-45090
1.433" - 1.474" (36.938 - 37.440mm)	1.437" (36.500mm)	5406-*01-11092	5406-*01-31092	5406-*02-45092
1.464" - 1.505" (37.186 - 38.227mm)	1.468" (37.287mm)	5406-*01-11094	5406-*01-31094	5406-*02-45094
1.496" - 1.537" (37.998 - 38.040mm)	1.500" (38.100mm)	5406-*01-11096	5406-*01-31096	5406-*02-45096
1.527" - 1.568" (38.786 - 39.827mm)	1.531" (38.887mm)	5406-*01-11098	5406-*01-31098	5406-*02-45098
1.558" - 1.599" (39.573 - 40.615mm)	1.562" (39.675mm)	5406-*01-11100	5406-*01-31100	5406-*02-45100
1.589" - 1.630" (40.361 - 41.402mm)	1.593" (40.462mm)	5406-*01-11102	5406-*01-31102	5406-*02-45102
1.621" - 1.662" (41.173 - 42.215mm)	1.625" (41.275mm)	5406-*01-11104	5406-*01-31104	5406-*02-45104
1.652" - 1.693" (41.961 - 43.002mm)	1.656" (42.062mm)	5406-*01-11106	5406-*01-31106	5406-*02-45106
1.683" - 1.724" (42.748 - 43.790mm)	1.687" (42.850mm)	5406-*01-11108	5406-*01-31108	5406-*02-45108
1.714" - 1.755" (43.536 - 44.577mm)	1.718" (43.637mm)	5406-*01-11110	5406-*01-31110	5406-*02-45110
1.746" - 1.787" (44.348 - 45.390mm)	1.750" (44.450mm)	5406-*01-11112	5406-*01-31112	5406-*02-45112
1.777" - 1.818" (45.136 - 46.177mm)	1.781" (45.237mm)	5406-*01-11114	5406-*01-31114	5406-*02-45114
1.808" - 1.849" (45.923 - 46.965mm)	1.812" (46.025mm)	5406-*01-11116	5406-*01-31116	5406-*02-45116

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5406 Series - Rolls, Mandrels, & Cages

1.402" - 1.849" (35.611mm - 46.965mm)

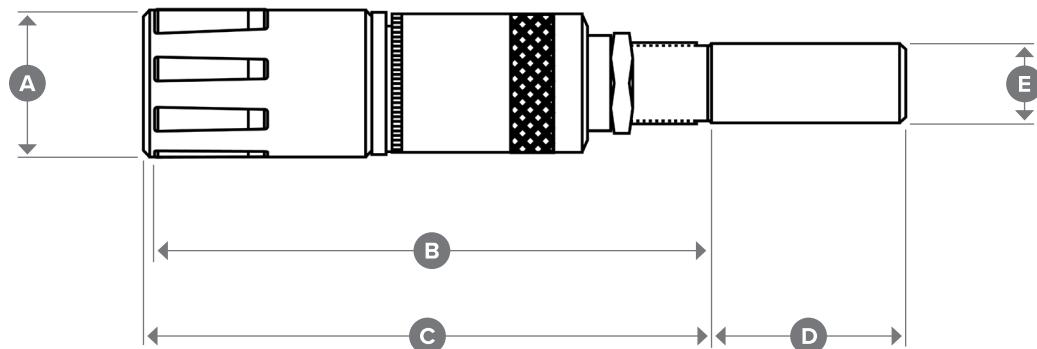
Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
1.406" (35.712mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
1.437" (36.500mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
1.468" (37.287mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
1.500" (38.100mm)	7	5100-701-00312	7	5100-704-00312	5	5100-708-00312
1.531" (38.887mm)	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
1.562" (39.675mm)	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
1.593" (40.462mm)	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
1.625" (41.275mm)	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
1.656" (42.062mm)	7	5100-701-00406	7	5100-704-00406	5	5100-708-00406
1.687" (42.850mm)	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
1.718" (43.637mm)	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
1.750" (44.450mm)	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
1.781" (45.237mm)	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468
1.812" (46.025mm)	7	5100-701-00468	7	5100-704-00468	5	5100-708-00468

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
1.406" (35.712mm)	5306-031-00090	5306-032-00090	5406-011-00090	5406-015-00090
1.437" (36.500mm)	5306-031-00092	5306-032-00092	5406-011-00092	5406-015-00092
1.468" (37.287mm)	5306-031-00094	5306-032-00094	5406-011-00094	5406-015-00094
1.500" (38.100mm)	5306-031-00096	5306-032-00096	5406-011-00096	5406-015-00096
1.531" (38.887mm)	5306-031-00080	5306-032-00080	5406-011-00098	5406-015-00098
1.562" (39.675mm)	5306-031-00082	5306-032-00082	5406-011-00100	5406-015-00100
1.593" (40.462mm)	5306-031-00090	5306-032-00090	5406-011-00102	5406-015-00102
1.625" (41.275mm)	5306-031-00092	5306-032-00092	5406-011-00104	5406-015-00104
1.656" (42.062mm)	5306-031-00094	5306-032-00094	5406-011-00106	5406-015-00106
1.687" (42.850mm)	5306-031-00082	5306-032-00082	5406-011-00108	5406-015-00108
1.718" (43.637mm)	5306-031-00090	5306-032-00090	5406-011-00110	5406-015-00110
1.750" (44.450mm)	5306-031-00092	5306-032-00092	5406-011-00112	5406-015-00112
1.781" (45.237mm)	5306-031-00094	5306-032-00094	5406-011-00114	5406-015-00114
1.812" (46.025mm)	5306-031-00096	5306-032-00096	5406-011-00116	5406-015-00116

If an Intermediate Mandrel is required, see page 15.

# 5407 Series - Tool Selector

1.839" - 2.224" (46.711mm - 56.490mm)



(D) Shank Length

2.50" (63.50mm)

(E) Shank Diameter

1	1.000" straight shank
2	#3 Morse Taper
3	25mm straight shank

When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).  
Example: A standard reach 1.937" diameter bottoming style tool with a 25mm straight shank, is part number **5407-302-45124**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 7.188" (182.50mm)		
		Through	Blind	Bottoming
1.839" - 1.880" (46.711 - 47.752mm)	1.843" (46.812mm)	5407-*01-11118	5407-*01-31118	5407-*02-45118
1.871" - 1.912" (47.523 - 48.565mm)	1.875" (47.625mm)	5407-*01-11120	5407-*01-31120	5407-*02-45120
1.902" - 1.943" (48.311 - 49.352mm)	1.906" (48.412mm)	5407-*01-11122	5407-*01-31122	5407-*02-45122
1.934" - 1.974" (49.124 - 50.140mm)	1.937" (49.200mm)	5407-*01-11124	5407-*01-31124	5407-*02-45124
1.964" - 2.005" (49.886 - 50.927mm)	1.968" (49.987mm)	5407-*01-11126	5407-*01-31126	5407-*02-45126
1.996" - 2.037" (50.698 - 51.740mm)	2.000" (50.800mm)	5407-*01-11128	5407-*01-31128	5407-*02-45128
2.027" - 2.068" (51.486 - 52.527mm)	2.031" (51.587mm)	5407-*01-11130	5407-*01-31130	5407-*02-45130
2.058" - 2.099" (52.273 - 53.315mm)	2.062" (52.375mm)	5407-*01-11132	5407-*01-31132	5407-*02-45132
2.089" - 2.130" (53.061 - 54.102mm)	2.093" (53.162mm)	5407-*01-11134	5407-*01-31134	5407-*02-45134
2.121" - 2.162" (53.873 - 54.915mm)	2.125" (53.975mm)	5407-*01-11136	5407-*01-31136	5407-*02-45136
2.152" - 2.193" (54.661 - 55.702mm)	2.156" (54.762mm)	5407-*01-11138	5407-*01-31138	5407-*02-45138
2.183" - 2.224" (55.448 - 56.490mm)	2.187" (55.550mm)	5407-*01-11140	5407-*01-31140	5407-*02-45140

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5407 Series - Rolls, Mandrels, & Cages

1.839" - 2.224" (46.711mm - 56.490mm)

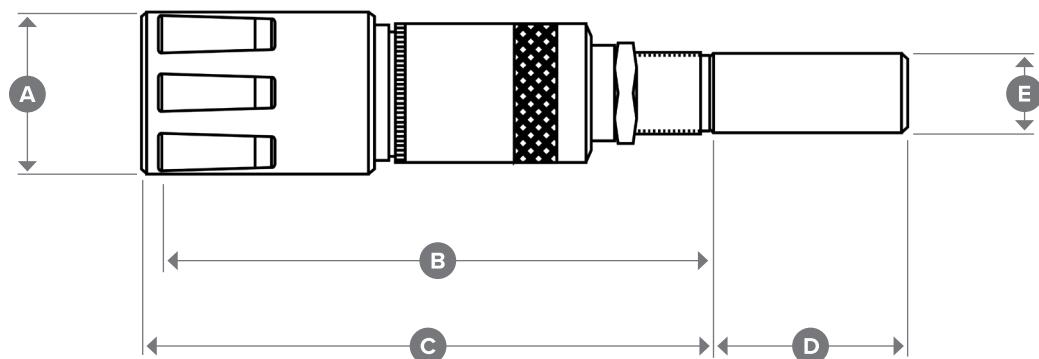
Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
<b>1.843"</b> (46.812mm)	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
<b>1.875"</b> (47.625mm)	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
<b>1.906"</b> (48.412mm)	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
<b>1.937"</b> (49.200mm)	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
<b>1.968"</b> (49.987mm)	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
<b>2.000"</b> (50.800mm)	9	5100-701-00312	9	5100-704-00312	7	5100-708-00312
<b>2.031"</b> (51.587mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.062"</b> (52.375mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.093"</b> (53.162mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.125"</b> (53.975mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.156"</b> (54.762mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.187"</b> (55.550mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
<b>1.843"</b> (46.812mm)	5307-031-00118	5307-032-00118	5407-011-00118	5407-015-00118
<b>1.875"</b> (47.625mm)	5307-031-00120	5307-032-00120	5407-011-00120	5407-015-00120
<b>1.906"</b> (48.412mm)	5307-031-00122	5307-032-00122	5407-011-00122	5407-015-00122
<b>1.937"</b> (49.200mm)	5307-031-00124	5307-032-00124	5407-011-00124	5407-015-00124
<b>1.968"</b> (49.987mm)	5307-031-00126	5307-032-00126	5407-011-00126	5407-015-00126
<b>2.000"</b> (50.800mm)	5307-031-00128	5307-032-00128	5407-011-00128	5407-015-00128
<b>2.031"</b> (51.587mm)	5307-031-00118	5307-032-00118	5407-011-00130	5407-015-00130
<b>2.062"</b> (52.375mm)	5307-031-00120	5307-032-00120	5407-011-00132	5407-015-00132
<b>2.093"</b> (53.162mm)	5307-031-00122	5307-032-00122	5407-011-00134	5407-015-00134
<b>2.125"</b> (53.975mm)	5307-031-00124	5307-032-00124	5407-011-00136	5407-015-00136
<b>2.156"</b> (54.762mm)	5307-031-00126	5307-032-00126	5407-011-00138	5407-015-00138
<b>2.187"</b> (55.550mm)	5307-031-00128	5307-032-00128	5407-011-00140	5407-015-00140

If an Intermediate Mandrel is required, see page 15.

# 5408 Series - Tool Selector

2.214" - 2.724" (56.236mm - 69.190mm)



(D) Shank Length

2.50" (63.50mm)

(E) Shank Diameter

1	1.000" straight shank
2	#3 Morse Taper
3	25mm straight shank

When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A standard reach 2.437" diameter through style tool with a #3 Morse Taper shank, is part number **5408-201-11156**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 7.188" (182.50mm)		
		Through	Blind	Bottoming
2.214" - 2.255" (56.236 - 57.277mm)	2.218" (56.337mm)	5408-*01-11142	5408-*01-31142	5408-*02-45142
2.246" - 2.287" (57.048 - 58.090mm)	2.250" (57.150mm)	5408-*01-11144	5408-*01-31144	5408-*02-45144
2.277" - 2.318" (57.836 - 58.877mm)	2.281" (57.937mm)	5408-*01-11146	5408-*01-31146	5408-*02-45146
2.308" - 2.349" (58.623 - 59.665mm)	2.312" (58.725mm)	5408-*01-11148	5408-*01-31148	5408-*02-45148
2.339" - 2.380" (59.411 - 60.452mm)	2.343" (59.512mm)	5408-*01-11150	5408-*01-31150	5408-*02-45150
2.371" - 2.412" (60.223 - 61.265mm)	2.375" (60.325mm)	5408-*01-11152	5408-*01-31152	5408-*02-45152
2.402" - 2.443" (61.011 - 62.052mm)	2.406" (61.112mm)	5408-*01-11154	5408-*01-31154	5408-*02-45154
2.433" - 2.474" (61.798 - 62.840mm)	2.437" (61.900mm)	5408-*01-11156	5408-*01-31156	5408-*02-45156
2.464" - 2.505" (62.586 - 63.627mm)	2.468" (62.687mm)	5408-*01-11158	5408-*01-31158	5408-*02-45158
2.496" - 2.537" (63.3988 - 64.440mm)	2.500" (63.500mm)	5408-*01-11160	5408-*01-31160	5408-*02-45160
2.527" - 2.568" (64.186 - 65.227mm)	2.531" (64.287mm)	5408-*01-11162	5408-*01-31162	5408-*02-45162
2.558" - 2.599" (64.973 - 66.015mm)	2.562" (65.075mm)	5408-*01-11164	5408-*01-31164	5408-*02-45164
2.589" - 2.630" (65.761 - 66.802mm)	2.593" (65.862mm)	5408-*01-11166	5408-*01-31166	5408-*02-45166
2.621" - 2.662" (66.573 - 67.615mm)	2.625" (66.675mm)	5408-*01-11168	5408-*01-31168	5408-*02-45168
2.652" - 2.693" (67.361 - 68.402mm)	2.656" (67.462mm)	5408-*01-11170	5408-*01-31170	5408-*02-45170
2.683" - 2.724" (68.148 - 69.190mm)	2.687" (68.250mm)	5408-*01-11172	5408-*01-31172	5408-*02-45172

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5408 Series - Rolls, Mandrels, & Cages

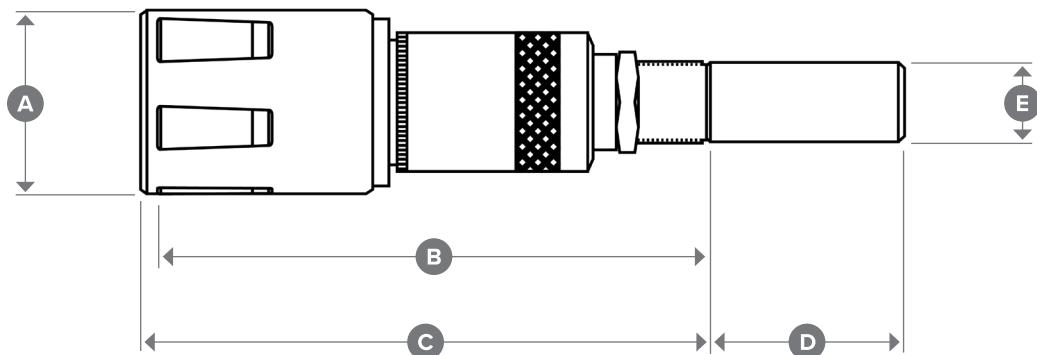
**2.214" - 2.724" (56.236mm - 69.190mm)**

Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
<b>2.218"</b> (56.337mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.250"</b> (57.150mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.281"</b> (57.937mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.312"</b> (58.725mm)	9	5100-701-00406	9	5100-704-00406	7	5100-708-00406
<b>2.343"</b> (59.512mm)	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
<b>2.375"</b> (60.325mm)	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
<b>2.406"</b> (61.112mm)	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
<b>2.437"</b> (61.900mm)	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
<b>2.468"</b> (62.687mm)	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
<b>2.500"</b> (63.500mm)	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
<b>2.531"</b> (64.287mm)	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
<b>2.562"</b> (65.075mm)	9	5100-701-00468	9	5100-704-00468	7	5100-708-00468
<b>2.593"</b> (65.862mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.625"</b> (66.675mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.656"</b> (67.462mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.687"</b> (68.250mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
<b>2.218"</b> (56.337mm)	5308-031-00142	5308-032-00142	5408-011-00142	5408-015-00142
<b>2.250"</b> (57.150mm)	5308-031-00144	5308-032-00144	5408-011-00144	5408-015-00144
<b>2.281"</b> (57.937mm)	5308-031-00146	5308-032-00146	5408-011-00146	5408-015-00146
<b>2.312"</b> (58.725mm)	5308-031-00148	5308-032-00148	5408-011-00148	5408-015-00148
<b>2.343"</b> (59.512mm)	5308-031-00142	5308-032-00142	5408-011-00150	5408-015-00150
<b>2.375"</b> (60.325mm)	5308-031-00144	5308-032-00144	5408-011-00152	5408-015-00152
<b>2.406"</b> (61.112mm)	5308-031-00146	5308-032-00146	5408-011-00154	5408-015-00154
<b>2.437"</b> (61.900mm)	5308-031-00148	5308-032-00148	5408-011-00156	5408-015-00156
<b>2.468"</b> (62.687mm)	5308-031-00158	5308-032-00158	5408-011-00158	5408-015-00158
<b>2.500"</b> (63.500mm)	5308-031-00160	5308-032-00160	5408-011-00160	5408-015-00160
<b>2.531"</b> (64.287mm)	5308-031-00162	5308-032-00162	5408-011-00162	5408-015-00162
<b>2.562"</b> (65.075mm)	5308-031-00164	5308-032-00164	5408-011-00164	5408-015-00164
<b>2.593"</b> (65.862mm)	5308-031-00158	5308-032-00158	5408-011-00166	5408-015-00166
<b>2.625"</b> (66.675mm)	5308-031-00160	5308-032-00160	5408-011-00168	5408-015-00168
<b>2.656"</b> (67.462mm)	5308-031-00162	5308-032-00162	5408-011-00170	5408-015-00170
<b>2.687"</b> (68.250mm)	5308-031-00164	5308-032-00164	5408-011-00172	5408-015-00172

# 5409 Series - Tool Selector

2.714" - 3.349" (68.936mm - 85.065mm)



(D) Shank Length

2.50" (63.50mm)

(E) Shank Diameter

1	1.000" straight shank
2	#3 Morse Taper
3	25mm straight shank

When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A standard reach 2.906" diameter blind style tool with a 1.000" straight shank, is part number **5409-101-31186**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 7.188" (182.50mm)		
		Through	Blind	Bottoming
2.714" - 2.755" (68.936 - 69.977mm)	2.718" (69.037mm)	5409-*01-11174	5409-*01-31174	5409-*02-45174
2.746" - 2.787" (69.748 - 70.790mm)	2.750" (69.850mm)	5409-*01-11176	5409-*01-31176	5409-*02-45176
2.277" - 2.818" (70.536 - 71.577mm)	2.781" (70.637mm)	5409-*01-11178	5409-*01-31178	5409-*02-45178
2.808" - 2.849" (71.323 - 72.365mm)	2.812" (71.425mm)	5409-*01-11180	5409-*01-31180	5409-*02-45180
2.839" - 2.880" (72.111 - 73.152mm)	2.843" (72.212mm)	5409-*01-11182	5409-*01-31182	5409-*02-45182
2.871" - 2.912" (72.923 - 73.965mm)	2.875" (73.025mm)	5409-*01-11184	5409-*01-31184	5409-*02-45184
2.902" - 2.943" (73.711 - 74.752mm)	2.906" (73.812mm)	5409-*01-11186	5409-*01-31186	5409-*02-45186
2.933" - 2.974" (74.498 - 75.540mm)	2.937" (74.600mm)	5409-*01-11188	5409-*01-31188	5409-*02-45188
2.964" - 3.005" (75.286 - 76.327mm)	2.968" (75.387mm)	5409-*01-11190	5409-*01-31190	5409-*02-45190

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

Remaining sizes and styles located on next page.

# 5409 Series - Tool Selector

## 2.714" - 3.349" (68.936mm - 85.065mm)

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 7.188" (182.50mm)		
		Through	Blind	Bottoming
2.996" - 3.037" (76.098 - 77.140mm)	3.000" (76.200mm)	5409-*01-11192	5409-*01-31192	5409-*02-45192
3.027" - 3.068" (76.886 - 77.927mm)	3.031" (76.987mm)	5409-*01-11194	5409-*01-31194	5409-*02-45194
3.058" - 3.099" (77.673 - 78.715mm)	3.062" (77.775mm)	5409-*01-11196	5409-*01-31196	5409-*02-45196
3.089" - 3.130" (78.461 - 79.502mm)	3.093" (78.562mm)	5409-*01-11198	5409-*01-31198	5409-*02-45198
3.121" - 3.162" (79.273 - 80.315mm)	3.125" (79.375mm)	5409-*01-11200	5409-*01-31200	5409-*02-45200
3.152" - 3.193"" (80.061 - 81.102mm)	3.156" (80.162mm)	5409-*01-11202	5409-*01-31202	5409-*02-45202
3.183" - 3.224" (80.848 - 81.890mm)	3.187" (80.950mm)	5409-*01-11204	5409-*01-31204	5409-*02-45204
3.214" - 3.255" (81.636 - 82.677mm)	3.218" (81.737mm)	5409-*01-11206	5409-*01-31206	5409-*02-45206
3.246" - 3.287" (82.448 - 83.490mm)	3.250" (82.550mm)	5409-*01-11208	5409-*01-31208	5409-*02-45208
3.277" - 3.318" (83.236 - 84.277mm)	3.281" (83.337mm)	5409-*01-11210	5409-*01-31210	5409-*02-45210
3.308" - 3.349" (84.023 - 85.065mm)	3.312" (84.125mm)	5409-*01-11212	5409-*01-31212	5409-*02-45212

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5409 Series - Rolls

**2.714" - 3.349" (68.936mm - 85.065mm)**

Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
<b>2.718"</b> (69.037mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.750"</b> (69.850mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.781"</b> (70.637mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.812"</b> (71.425mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.843"</b> (72.212mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.875"</b> (73.025mm)	9	5100-701-00531	9	5100-704-00531	7	5100-708-00531
<b>2.906"</b> (73.812mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>2.937"</b> (74.600mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>2.968"</b> (75.387mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>3.000"</b> (76.200mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>3.031"</b> (76.987mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>3.062"</b> (77.775mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>3.093"</b> (78.562mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>3.125"</b> (79.375mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>3.156"</b> (80.162mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>3.187"</b> (80.950mm)	9	5100-701-00625	9	5100-704-00625	7	5100-708-00625
<b>3.218"</b> (81.737mm)	9	5100-701-00687	9	5100-704-00687	7	5100-708-00687
<b>3.250"</b> (82.550mm)	9	5100-701-00687	9	5100-704-00687	7	5100-708-00687
<b>3.281"</b> (83.337mm)	9	5100-701-00687	9	5100-704-00687	7	5100-708-00687
<b>3.312"</b> (84.125mm)	9	5100-701-00687	9	5100-704-00687	7	5100-708-00687

# 5409 Series - Mandrels & Cages

2.714" - 3.349" (68.936mm - 85.065mm)

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
2.718" (69.037mm)	5309-031-00174	5309-032-00174	5409-011-00174	5409-015-00174
2.750" (69.850mm)	5309-031-00176	5309-032-00176	5409-011-00176	5409-015-00176
2.781" (70.637mm)	5309-031-00178	5309-032-00178	5409-011-00178	5409-015-00178
2.812" (71.425mm)	5309-031-00180	5309-032-00180	5409-011-00180	5409-015-00180
2.843" (72.212mm)	5309-031-00182	5309-032-00182	5409-011-00182	5409-015-00182
2.875" (73.025mm)	5309-031-00184	5309-032-00184	5409-011-00184	5409-015-00184
2.906" (73.812mm)	5309-031-00174	5309-032-00174	5409-011-00186	5409-015-00186
2.937" (74.600mm)	5309-031-00176	5309-032-00176	5409-011-00188	5409-015-00188
2.968" (75.387mm)	5309-031-00178	5309-032-00178	5409-011-00190	5409-015-00190
3.000" (76.200mm)	5309-031-00180	5309-032-00180	5409-011-00192	5409-015-00192
3.031" (76.987mm)	5309-031-00182	5309-032-00182	5409-011-00194	5409-015-00194
3.062" (77.775mm)	5309-031-00184	5309-032-00184	5409-011-00196	5409-015-00196
3.093" (78.562mm)	5309-031-00198	5309-032-00198	5409-011-00198	5409-015-00198
3.125" (79.375mm)	5309-031-00200	5309-032-00200	5409-011-00200	5409-015-00200
3.156" (80.162mm)	5309-031-00202	5309-032-00202	5409-011-00202	5409-015-00202
3.187" (80.950mm)	5309-031-00204	5309-032-00204	5409-011-00204	5409-015-00204
3.218" (81.737mm)	5309-031-00198	5309-032-00198	5409-011-00206	5409-015-00206
3.250" (82.550mm)	5309-031-00200	5309-032-00200	5409-011-00208	5409-015-00208
3.281" (83.337mm)	5309-031-00202	5309-032-00202	5409-011-00210	5409-015-00210
3.312" (84.125mm)	5309-031-00204	5309-032-00204	5409-011-00212	5409-015-00212

If an Intermediate Mandrel is required, please reference the Intermediate Mandrel table on page 11

# 3 Considerations When Selecting the Right Roller Burnishing Tool



Roller burnishing is a quick and effective method for achieving smooth surface finishes on metal work pieces. With a variety of burnishing tools on the market, it can be challenging to determine which will work best for a specific application. From multi-roll tools to diamond burnishing, each style is designed to provide a very fine finish, increase surface hardness, and reduce the need for multiple finishing operations. To choose the right tool, it's important to understand how each works, the limitations of the tool, and the variations available.

## 1. Define the Part Type

Determining the part type and the area that needs to be burnished is the first step in choosing the type of tool required. For example, burnishing the exterior of a valve body will be different than burnishing the ID of a cylinder. When burnishing internal bores, a multi-roll style tool is generally going to be the most effective, as it helps maintain the size of the bore and can produce a very low surface finish. For external diameters, faces, tapers, and radii, carbide roll burnishing tools will be the best option, as they are the most versatile tools.



## 2. Bore Depth & Type

For internal burnishing applications, the depth of the bore and finished area are necessary in choosing the right roll type. Overall, there are 3 main types of roll styles for internal burnishing: Through, Blind, and Bottoming rolls. In open hole applications like lamination stacks, through style rolls would be the best option. This means that there is nothing obstructing the path of the tool as it burnishes the through hole. In situations where you're burnishing an enclosed space, like a piston rod, blind or bottoming rolls should be used. In addition to the type of hole, the depth of the hole is also important to know to determine the appropriate reach of the tool. Depending on the tool, longer shanks or additional extensions can be used to meet the required reach.

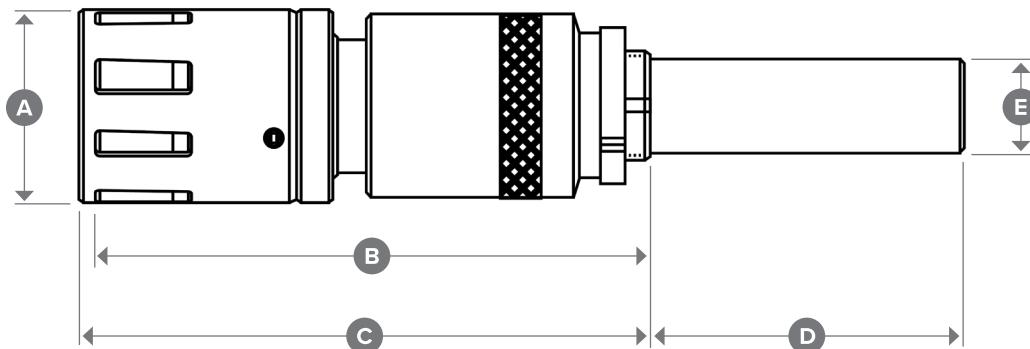
## 3. Machine Type

Identifying the machine that the tool will run on is necessary when determining the appropriate shank style or “hand” placement. The “hand” refers to the side that the tool mounts on in relation to the part that is being burnished, either the right or left. Additionally, depending on the machining application, it may narrow down the type of tool that can be used. For example, some tools require the part to spin, while others only work if the tool is rotating. As a result, it's important to understand the application and the machine the tool will be operating on.

Overall, choosing the right roller burnishing tool will depend on several different factors such as, the part type, bore characteristics, and the machine it will be used on. Understanding these different features and how they apply to your application will allow you to select a tool that is the best fit for the application.

# 5610 Series - Tool Selector

3.339" - 4.099" (84.811mm - 104.115mm)



(D) Shank Length

5.00" (127.00mm)

(E) Shank Diameter

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

When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A standard reach 3.375" diameter bottoming style tool with a 1.000" straight shank, is part number **5610-102-45216**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 9.125" (231.78mm)		
		Through	Blind	Bottoming
3.339" - 3.380" (84.811 - 85.852mm)	3.343" (84.912mm)	5610-*01-11214	5610-*01-31214	5610-*02-45214
3.371" - 3.412" (85.623 - 86.665mm)	3.375" (85.725mm)	5610-*01-11216	5610-*01-31216	5610-*02-45216
3.402" - 3.443" (86.411 - 87.452mm)	3.406" (86.512mm)	5610-*01-11218	5610-*01-31218	5610-*02-45218
3.433" - 3.474" (87.198 - 88.240mm)	3.437" (87.300mm)	5610-*01-11220	5610-*01-31220	5610-*02-45220
3.464" - 3.505" (87.986 - 89.027mm)	3.468" (88.087mm)	5610-*01-11222	5610-*01-31222	5610-*02-45222
3.496" - 3.537" (88.798 - 89.840mm)	3.500" (88.900mm)	5610-*01-11224	5610-*01-31224	5610-*02-45224
3.527" - 3.568" (89.586 - 90.627mm)	3.531" (89.687mm)	5610-*01-11226	5610-*01-31226	5610-*02-45226
3.558" - 3.599" (90.373 - 91.415mm)	3.562" (90.475mm)	5610-*01-11228	5610-*01-31228	5610-*02-45228
3.589" - 3.630" (91.161 - 92.202mm)	3.593" (91.262mm)	5610-*01-11230	5610-*01-31230	5610-*02-45230
3.621" - 3.662" (91.973 - 93.015mm)	3.625" (92.075mm)	5610-*01-11232	5610-*01-31232	5610-*02-45232

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

Remaining sizes and styles located on next page.

# 5610 Series - Tool Selector

3.339" - 4.099" (84.811mm - 104.115mm)

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 9.125" (231.78mm)		
		Through	Blind	Bottoming
3.652" - 3.693" (92.761 - 93.802mm)	3.656" (92.862mm)	5610-*01-11234	5610-*01-31234	5610-*02-45234
3.683" - 3.724" (93.548 - 94.590mm)	3.687" (93.650mm)	5610-*01-11236	5610-*01-31236	5610-*02-45236
3.714" - 3.755" (94.336 - 95.377mm)	3.718" (94.437mm)	5610-*01-11238	5610-*01-31238	5610-*02-45238
3.746" - 3.787" (95.148 - 96.190mm)	3.750" (95.250mm)	5610-*01-11240	5610-*01-31240	5610-*02-45240
3.777" - 3.818" (95.936 - 96.977mm)	3.781" (96.037mm)	5610-*01-11242	5610-*01-31242	5610-*02-45242
3.808" - 3.849"" (96.723 - 97.85mm)	3.812" (96.825mm)	5610-*01-11244	5610-*01-31244	5610-*02-45244
3.839" - 3.880" (97.511 - 98.552mm)	3.843" (97.612mm)	5610-*01-11246	5610-*01-31246	5610-*02-45246
3.871" - 3.912" (98.323 - 99.365mm)	3.875" (98.425mm)	5610-*01-11248	5610-*01-31248	5610-*02-45248
3.902" - 3.943" (99.111 - 100.152mm)	3.906" (99.212mm)	5610-*01-11250	5610-*01-31250	5610-*02-45250
3.933" - 3.974" (99.898 - 100.940mm)	3.937" (100.000mm)	5610-*01-11252	5610-*01-31252	5610-*02-45252
3.964" - 4.005" (100.686 - 101.727mm)	3.968" (100.787mm)	5610-*01-11254	5610-*01-31254	5610-*02-45254
3.996" - 4.037" (101.498 - 102.540mm)	4.000" (101.600mm)	5610-*01-11256	5610-*01-31256	5610-*02-45256
4.027" - 4.068" (102.286 - 103.327mm)	4.031" (102.387mm)	5610-*01-11258	5610-*01-31258	5610-*02-45258
4.058" - 4.099" (103.073 - 104.115mm)	4.062" (103.175mm)	5610-*01-11260	5610-*01-31260	5610-*02-45260

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5610 Series - Rolls

**3.339" - 4.099" (84.811mm - 104.115mm)**

Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
<b>3.343"</b> (84.912mm)	11	5100-701-00468	9	5100-704-00468	9	5100-708-00468
<b>3.375"</b> (85.725mm)	11	5100-701-00468	11	5100-704-00468	11	5100-708-00468
<b>3.406"</b> (86.512mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.437"</b> (87.300mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.468"</b> (88.087mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.500"</b> (88.900mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.531"</b> (89.687mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.562"</b> (90.475mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.593"</b> (91.262mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.625"</b> (92.075mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.656"</b> (92.862mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.687"</b> (93.650mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.718"</b> (94.437mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.750"</b> (95.250mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.781"</b> (96.037mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.812"</b> (96.825mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.843"</b> (97.612mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.875"</b> (98.425mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.906"</b> (99.212mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.937"</b> (100.000mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>3.968"</b> (100.787mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.000"</b> (101.600mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.031"</b> (102.387mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.062"</b> (103.175mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531

# 5610 Series - Mandrels & Cages

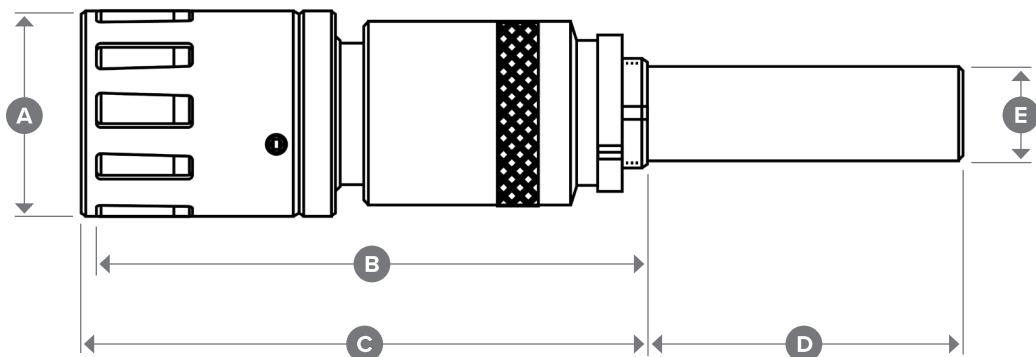
3.339" - 4.099" (84.811mm - 104.115mm)

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
3.343" (84.912mm)	5155-059-10001	5155-059-10002	5610-011-00214	5610-015-00214
3.375" (85.725mm)	5155-060-10001	5155-060-10002	5610-011-00216	5610-015-00216
3.406" (86.512mm)	5155-061-10001	5155-061-10002	5610-011-00218	5610-015-00218
3.437" (87.300mm)	5155-062-10001	5155-062-10002	5610-011-00220	5610-015-00220
3.468" (88.087mm)	5155-063-10001	5155-063-10002	5610-011-00222	5610-015-00222
3.500" (88.900mm)	5155-064-10001	5155-064-10002	5610-011-00224	5610-015-00224
3.531" (89.687mm)	5155-065-10001	5155-065-10002	5610-011-00226	5610-015-00226
3.562" (90.475mm)	5155-066-10001	5155-066-10002	5610-011-00228	5610-015-00228
3.593" (91.262mm)	5155-067-10001	5155-067-10002	5610-011-00230	5610-015-00230
3.625" (92.075mm)	5155-068-10001	5155-068-10002	5610-011-00232	5610-015-00232
3.656" (92.862mm)	5155-069-10001	5155-069-10002	5610-011-00234	5610-015-00234
3.687" (93.650mm)	5155-070-10001	5155-070-10002	5610-011-00236	5610-015-00236
3.718" (94.437mm)	5155-071-10001	5155-071-10002	5610-011-00238	5610-015-00238
3.750" (95.250mm)	5155-072-10001	5155-072-10002	5610-011-00240	5610-015-00240
3.781" (96.037mm)	5155-073-10001	5155-073-10002	5610-011-00242	5610-015-00242
3.812" (96.825mm)	5155-074-10001	5155-074-10002	5610-011-00244	5610-015-00244
3.843" (97.612mm)	5155-075-10001	5155-075-10002	5610-011-00246	5610-015-00246
3.875" (98.425mm)	5155-076-10001	5155-076-10002	5610-011-00248	5610-015-00248
3.906" (99.212mm)	5155-077-10001	5155-077-10002	5610-011-00250	5610-015-00250
3.937" (100.000mm)	5155-078-10001	5155-078-10002	5610-011-00252	5610-015-00252
3.968" (100.787mm)	5155-079-10001	5155-079-10002	5610-011-00254	5610-015-00254
4.000" (101.600mm)	5155-080-10001	5155-080-10002	5610-011-00256	5610-015-00256
4.031" (102.387mm)	5155-081-10001	5155-081-10002	5610-011-00258	5610-015-00258
4.062" (103.175mm)	5155-082-10001	5155-082-10002	5610-011-00260	5610-015-00260

If an Intermediate Mandrel is required, see page 15.

# 5611 Series - Tool Selector

4.089" - 5.037" (103.861mm - 127.940mm)



(D) Shank Length

5.00" (127.00mm)

(E) Shank Diameter

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

When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).  
Example: A standard reach 4.250" diameter bottoming style tool with a 40mm straight shank, is part number **5611-302-45272**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 9.125" (231.78mm)		
		Through	Blind	Bottoming
4.089" - 4.130" (103.861 - 104.902mm)	4.093" (103.920mm)	5611-*01-11262	5611-*01-31262	5611-*02-45262
4.121" - 4.162" (104.673 - 105.715mm)	4.125" (104.775mm)	5611-*01-11264	5611-*01-31264	5611-*02-45264
4.152" - 4.193" (105.461 - 106.502mm)	4.156" (105.562mm)	5611-*01-11266	5611-*01-31266	5611-*02-45266
4.183" - 4.224" (106.248 - 107.290mm)	4.187" (106.350mm)	5611-*01-11268	5611-*01-31268	5611-*02-45268
4.214" - 4.255" (107.036 - 108.077mm)	4.218" (107.137mm)	5611-*01-11270	5611-*01-31270	5611-*02-45270
4.246" - 4.287" (107.848 - 108.890mm)	4.250" (107.950mm)	5611-*01-11272	5611-*01-31272	5611-*02-45272
4.277" - 4.318" (108.636 - 109.677mm)	4.281" (108.737mm)	5611-*01-11274	5611-*01-31274	5611-*02-45274
4.308" - 4.349" (109.423 - 110.465mm)	4.312" (109.525mm)	5611-*01-11276	5611-*01-31276	5611-*02-45276
4.339" - 4.380" (110.211 - 111.252mm)	4.343" (110.312mm)	5611-*01-11278	5611-*01-31278	5611-*02-45278
3.371" - 4.412" (111.023 - 112.065mm)	4.375" (111.125mm)	5611-*01-11280	5611-*01-31280	5611-*02-45280
4.402" - 4.443" (111.811 - 112.852mm)	4.406" (111.912mm)	5611-*01-11282	5611-*01-31282	5611-*02-45282
4.433" - 4.474" (112.589 - 113.640mm)	4.437" (112.700mm)	5611-*01-11284	5611-*01-31284	5611-*02-45284

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

Remaining sizes and styles located on next page.

# 5611 Series - Tool Selector

## 4.089" - 5.037" (103.861mm - 127.940mm)

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions		
		Through	Blind	Bottoming
4.464" - 4.505" (113.386 - 114.427mm)	4.468" (113.487mm)	5611-*01-11286	5611-*01-31286	5611-*02-45286
4.496" - 4.537" (114.198 - 115.240mm)	4.500" (114.300mm)	5611-*01-11288	5611-*01-31288	5611-*02-45288
4.527" - 4.568" (114.986 - 116.027mm)	4.531" (115.087mm)	5611-*01-11290	5611-*01-31290	5611-*02-45290
4.558" - 4.599" (115.773 - 116.815mm)	4.562" (115.875mm)	5611-*01-11292	5611-*01-31292	5611-*02-45292
4.589" - 4.630" (116.561 - 117.602mm)	4.593" (116.662mm)	5611-*01-11294	5611-*01-31294	5611-*02-45294
4.621" - 4.662" (117.373 - 118.415mm)	4.625" (117.475mm)	5611-*01-11296	5611-*01-31296	5611-*02-45296
4.652" - 4.693" (118.161 - 119.202mm)	4.656" (118.262mm)	5611-*01-11298	5611-*01-31298	5611-*02-45298
4.683" - 4.724" (118.948 - 119.990mm)	4.687" (119.050mm)	5611-*01-11300	5611-*01-31300	5611-*02-45300
4.714" - 4.755" (119.736 - 120.777mm)	4.718" (119.837mm)	5611-*01-11302	5611-*01-31302	5611-*02-45302
4.746" - 4.787" (120.548 - 121.590mm)	4.750" (120.650mm)	5611-*01-11304	5611-*01-31304	5611-*02-45304
4.777" - 4.818" (121.336 - 122.377mm)	4.781" (121.437mm)	5611-*01-11306	5611-*01-31306	5611-*02-45306
4.808" - 4.849" (122.123 - 123.165mm)	4.812" (122.225mm)	5611-*01-11308	5611-*01-31308	5611-*02-45308
4.839" - 4.880" (122.911 - 123.952mm)	4.843" (123.012mm)	5611-*01-11310	5611-*01-31310	5611-*02-45310
4.871" - 4.912" (123.723 - 124.765mm)	4.875" (123.825mm)	5611-*01-11312	5611-*01-31312	5611-*02-45312
4.902" - 4.943" (124.511 - 125.552mm)	4.906" (124.612mm)	5611-*01-11314	5611-*01-31314	5611-*02-45314
4.933" - 4.974" (125.298 - 126.340mm)	4.937" (125.400mm)	5611-*01-11316	5611-*01-31316	5611-*02-45316
4.964" - 5.005" (126.086 - 127.127mm)	4.968" (126.187mm)	5611-*01-11318	5611-*01-31318	5611-*02-45318
4.996" - 5.037" (126.898 - 127.940mm)	5.000" (127.000mm)	5611-*01-11320	5611-*01-31320	5611-*02-45320

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5611 Series - Rolls

**4.089" - 5.037" (103.861mm - 127.940mm)**

Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
<b>4.093"</b> (103.92mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.125"</b> (104.775mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.156"</b> (105.562mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.187"</b> (106.350mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.218"</b> (107.137mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.250"</b> (107.950mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.281"</b> (108.737mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.312"</b> (109.525mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.343"</b> (110.312mm)	11	5100-701-00531	11	5100-704-00531	11	5100-708-00531
<b>4.375"</b> (111.125mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.406"</b> (111.912mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.437"</b> (112.700mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.468"</b> (113.487mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.500"</b> (114.300mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.531"</b> (115.087mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.562"</b> (115.875mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.593"</b> (116.662mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.625"</b> (117.475mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.656"</b> (118.262mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.687"</b> (119.050mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.718"</b> (119.837mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.750"</b> (120.650mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.781"</b> (121.437mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.812"</b> (122.225mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.843"</b> (123.012mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.875"</b> (123.825mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.906"</b> (124.612mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.937"</b> (125.400mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>4.968"</b> (126.187mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.000"</b> (127.000mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531

# 5611 Series - Mandrels & Cages

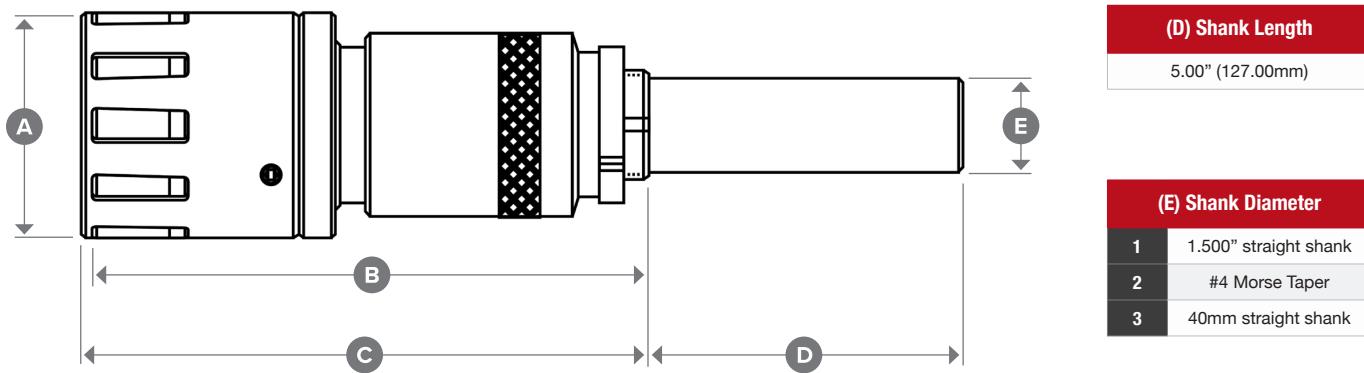
4.089" - 5.037" (103.861mm - 127.940mm)

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
4.093" (103.92mm)	5155-083-10001	5155-083-10002	5611-011-00262	5611-015-00262
4.125" (104.775mm)	5155-084-10001	5155-084-10002	5611-011-00264	5611-015-00264
4.156" (105.562mm)	5155-085-10001	5155-085-10002	5611-011-00266	5611-015-00266
4.187" (106.350mm)	5155-086-10001	5155-086-10002	5611-011-00268	5611-015-00268
4.218" (107.137mm)	5155-087-10001	5155-087-10002	5611-011-00270	5611-015-00270
4.250" (107.950mm)	5155-088-10001	5155-088-10002	5611-011-00272	5611-015-00272
4.281" (108.737mm)	5155-089-10001	5155-089-10002	5611-011-00274	5611-015-00274
4.312" (109.525mm)	5155-090-10001	5155-090-10002	5611-011-00276	5611-015-00276
4.343" (110.312mm)	5155-091-10001	5155-091-10002	5611-011-00278	5611-015-00278
4.375" (111.125mm)	5155-092-10001	5155-092-10002	5611-011-00280	5611-015-00280
4.406" (111.912mm)	5155-093-10001	5155-093-10002	5611-011-00282	5611-015-00282
4.437" (112.700mm)	5155-094-10001	5155-094-10002	5611-011-00284	5611-015-00284
4.468" (113.487mm)	5155-095-10001	5155-095-10002	5611-011-00286	5611-015-00286
4.500" (114.300mm)	5155-096-10001	5155-096-10002	5611-011-00288	5611-015-00288
4.531" (115.087mm)	5155-097-10001	5155-097-10002	5611-011-00290	5611-015-00290
4.562" (115.875mm)	5155-098-10001	5155-098-10002	5611-011-00292	5611-015-00292
4.593" (116.662mm)	5155-099-10001	5155-099-10002	5611-011-00294	5611-015-00294
4.625" (117.475mm)	5155-100-10001	5155-100-10002	5611-011-00296	5611-015-00296
4.656" (118.282mm)	5155-101-10001	5155-101-10002	5611-011-00298	5611-015-00298
4.687" (119.050mm)	5155-102-10001	5155-102-10002	5611-011-00300	5611-015-00300
4.718" (119.837mm)	5155-103-10001	5155-103-10002	5611-011-00302	5611-015-00302
4.750" (120.650mm)	5155-104-10001	5155-104-10002	5611-011-00304	5611-015-00304
4.781" (121.437mm)	5155-105-10001	5155-105-10002	5611-011-00306	5611-015-00306
4.812" (122.225mm)	5155-106-10001	5155-106-10002	5611-011-00308	5611-015-00308
4.843" (123.012mm)	5155-107-10001	5155-107-10002	5611-011-00310	5611-015-00310
4.875" (123.825mm)	5155-108-10001	5155-108-10002	5611-011-00312	5611-015-00312
4.906" (124.612mm)	5155-109-10001	5155-109-10002	5611-011-00314	5611-015-00314
4.937" (125.400mm)	5155-110-10001	5155-110-10002	5611-011-00316	5611-015-00316
4.968" (126.187mm)	5155-111-10001	5155-111-10002	5611-011-00318	5611-015-00318
5.000" (127.000mm)	5155-112-10001	5155-112-10002	5611-011-00320	5611-015-00320

If an Intermediate Mandrel is required, see page 15.

# 5612 Series - Tool Selector

5.027" - 5.495" (127.686mm - 140.640mm)



(D) Shank Length

5.00" (127.00mm)

(E) Shank Diameter

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

When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A standard reach 5.187" diameter through style tool with a 1.500" straight shank, is part number **5612-101-11332**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 9.125" (231.78mm)		
		Through	Blind	Bottoming
5.027" - 5.068" (127.686 - 128.727mm)	5.031" (127.787mm)	5612-*01-11322	5612-*01-31322	5612-*02-45322
5.058" - 5.099" (128.473 - 129.515mm)	5.062" (128.575mm)	5612-*01-11324	5612-*01-31324	5612-*02-45324
5.089" - 5.130" (129.261 - 130.302mm)	5.093" (129.362mm)	5612-*01-11326	5612-*01-31326	5612-*02-45326
5.121" - 5.162" (130.073 - 131.115mm)	5.125" (130.175mm)	5612-*01-11328	5612-*01-31328	5612-*02-45328
5.152" - 5.193" (130.861 - 131.902mm)	5.156" (130.962mm)	5612-*01-11330	5612-*01-31330	5612-*02-45330
5.183" - 5.224" (131.648 - 132.690mm)	5.187" (131.750mm)	5612-*01-11332	5612-*01-31332	5612-*02-45332
5.214" - 5.255" (132.436 - 133.477mm)	5.218" (132.537mm)	5612-*01-11334	5612-*01-31334	5612-*02-45334
5.246" - 5.287" (133.248 - 134.290mm)	5.250" (133.350mm)	5612-*01-11336	5612-*01-31336	5612-*02-45336
5.277" - 5.318" (134.036 - 135.077mm)	5.281" (134.137mm)	5612-*01-11338	5612-*01-31338	5612-*02-45338
5.308" - 5.349" (134.823 - 135.865mm)	5.312" (134.925mm)	5612-*01-11340	5612-*01-31340	5612-*02-45340
5.339" - 5.380" (135.611 - 136.652mm)	5.343" (135.712mm)	5612-*01-11342	5612-*01-31342	5612-*02-45342
5.371" - 5.412" (136.423 - 137.465mm)	5.375" (136.525mm)	5612-*01-11344	5612-*01-31344	5612-*02-45344
5.402" - 5.443" (137.211 - 138.252mm)	5.406" (137.312mm)	5612-*01-11346	5612-*01-31346	5612-*02-45346
5.433" - 5.474" (137.998 - 139.040mm)	5.437" (138.100mm)	5612-*01-11348	5612-*01-31348	5612-*02-45348
5.464" - 5.505" (138.786 - 139.827mm)	5.468" (138.887mm)	5612-*01-11350	5612-*01-31350	5612-*02-45350
5.490" - 5.537" (139.598 - 140.640mm)	5.500" (139.700mm)	5612-*01-11352	5612-*01-31352	5612-*02-45352

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5612 Series - Rolls, Mandrels, & Cages

**5.027" - 5.495" (127.686mm - 140.640mm)**

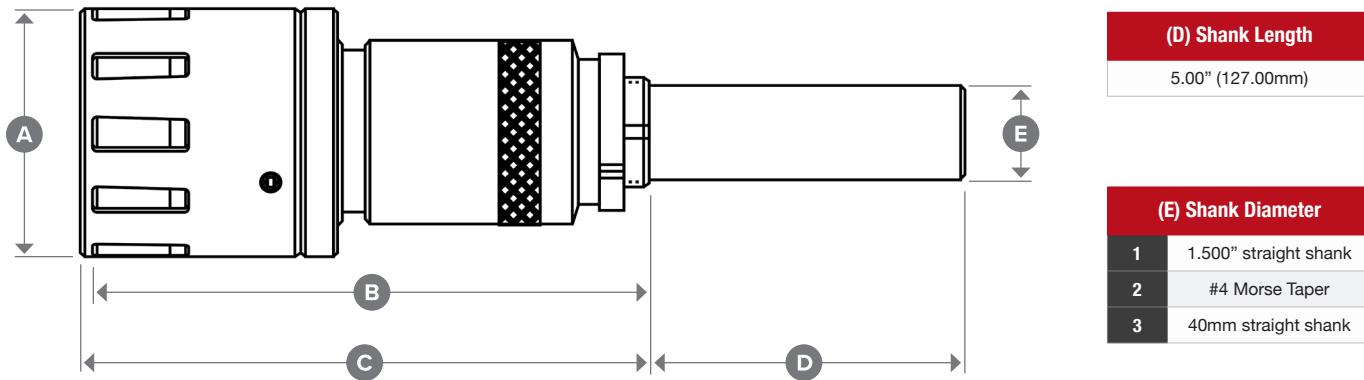
Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
<b>5.031"</b> (127.787mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.062"</b> (128.575mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.093"</b> (129.362mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.125"</b> (130.175mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.156"</b> (130.962mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.187"</b> (131.750mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.218"</b> (132.537mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.250"</b> (133.350mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.281"</b> (134.137mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.312"</b> (134.925mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.343"</b> (135.712mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.375"</b> (136.525mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.406"</b> (137.312mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.437"</b> (138.100mm)	13	5100-701-00531	13	5100-704-00531	13	5100-708-00531
<b>5.468"</b> (138.887mm)	13	5100-701-00531	3	5100-704-00531	13	5100-708-00531
<b>5.500"</b> (139.700mm)	15	5100-701-00531	13	5100-704-00531	15	5100-708-00531

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
<b>5.031"</b> (127.787mm)	5155-113-10001	5155-113-10002	5612-011-00322	5612-015-00322
<b>5.062"</b> (128.575mm)	5155-114-10001	5155-114-10002	5612-011-00324	5612-015-00324
<b>5.093"</b> (129.362mm)	5155-115-10001	5155-115-10002	5612-011-00326	5612-015-00326
<b>5.125"</b> (130.175mm)	5155-116-10001	5155-116-10002	5612-011-00328	5612-015-00328
<b>5.156"</b> (130.962mm)	5155-117-10001	5155-117-10002	5612-011-00330	5612-015-00330
<b>5.187"</b> (131.750mm)	5155-118-10001	5155-118-10002	5612-011-00332	5612-015-00332
<b>5.218"</b> (132.537mm)	5155-119-10001	5155-119-10002	5612-011-00334	5612-015-00334
<b>5.250"</b> (133.350mm)	5155-120-10001	5155-120-10002	5612-011-00336	5612-015-00336
<b>5.281"</b> (134.137mm)	5155-121-10001	5155-121-10002	5612-011-00338	5612-015-00338
<b>5.312"</b> (134.925mm)	5155-122-10001	5155-122-10002	5612-011-00340	5612-015-00340
<b>5.343"</b> (135.712mm)	5155-123-10001	5155-123-10002	5612-011-00342	5612-015-00342
<b>5.375"</b> (136.525mm)	5155-124-10001	5155-124-10002	5612-011-00344	5612-015-00344
<b>5.406"</b> (137.312mm)	5155-125-10001	5155-125-10002	5612-011-00346	5612-015-00346
<b>5.437"</b> (138.100mm)	5155-126-10001	5155-126-10002	5612-011-00348	5612-015-00348
<b>5.468"</b> (138.887mm)	5155-127-10001	5155-127-10002	5612-011-00350	5612-015-00350
<b>5.500"</b> (139.700mm)	5155-128-10001	5155-128-10002	5612-011-00352	5612-015-00352

If an Intermediate Mandrel is required, see page 15.

# 5613 Series - Tool Selector

5.527" - 6.537" (140.386mm - 166.040mm)



When determining tool number, replace the \* with the number determined in the Shank Diameter Table (E).

Example: A standard reach 5.813" diameter blind style tool with a #4 Morse Taper shank, is part number **5613-201-31372**

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 9.125" (231.78mm)		
		Through	Blind	Bottoming
5.527" - 5.568" (140.386 - 141.427mm)	5.531" (140.487mm)	5613-*01-11354	5613-*01-31354	5613-*02-45354
5.559" - 5.600" (141.199 - 142.240mm)	5.563" (141.300mm)	5613-*01-11356	5613-*01-31356	5613-*02-45356
5.590" - 5.631" (141.986 - 143.027mm)	5.594" (142.088mm)	5613-*01-11358	5613-*01-31358	5613-*02-45358
5.621" - 5.662" (142.773 - 143.815mm)	5.625" (142.875mm)	5613-*01-11360	5613-*01-31360	5613-*02-45360
5.652" - 5.693" (143.561 - 144.602mm)	5.656" (143.662mm)	5613-*01-11362	5613-*01-31362	5613-*02-45362
5.684" - 5.725" (144.374 - 145.415mm)	5.688" (144.475mm)	5613-*01-11364	5613-*01-31364	5613-*02-45364
5.715" - 5.756" (145.161 - 146.202mm)	5.719" (145.263mm)	5613-*01-11366	5613-*01-31366	5613-*02-45366
5.746" - 5.787" (145.948 - 146.990mm)	5.750" (146.050mm)	5613-*01-11368	5613-*01-31368	5613-*02-45368
5.777" - 5.818" (146.736 - 147.778mm)	5.781" (146.837mm)	5613-*01-11370	5613-*01-31370	5613-*02-45370
5.809" - 5.850" (147.549 - 148.590mm)	5.813" (147.650mm)	5613-*01-11372	5613-*01-31372	5613-*02-45372
5.840" - 5.881" (148.336 - 149.377mm)	5.844" (148.438mm)	5613-*01-11374	5613-*01-31374	5613-*02-45374
5.871" - 5.912" (149.123 - 150.165mm)	5.875" (149.225mm)	5613-*01-11376	5613-*01-31376	5613-*02-45376

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

Remaining sizes and styles located on next page.

# 5613 Series - Tool Selector

## 5.527" - 6.537" (140.386mm - 166.040mm)

Tool Size Range*	(A) Tool Nominal Diameter	(B) Max Burnishing Reach: Controlled by tool length or shank extensions (C) Gage Length: 9.125" (231.78mm)		
		Through	Blind	Bottoming
5.902" - 5.943" (149.911 - 150.952mm)	5.906" (150.012mm)	5613-*01-11378	5613-*01-31378	5613-*02-45378
5.934" - 5.975" (150.724 - 151.765mm)	5.938" (150.825mm)	5613-*01-11380	5613-*01-31380	5613-*02-45380
5.965" - 6.006" (151.511 - 152.552mm)	5.969" (151.613mm)	5613-*01-11382	5613-*01-31382	5613-*02-45382
5.996" - 6.037" (152.298 - 153.340mm)	6.000" (152.400mm)	5613-*01-11384	5613-*01-31384	5613-*02-45384
6.027" - 6.068" (153.086 - 154.127mm)	6.031" (153.187mm)	5613-*01-11386	5613-*01-31386	5613-*02-45386
6.059" - 6.100" (153.899 - 154.940mm)	6.063" (154.000mm)	5613-*01-11388	5613-*01-31388	5613-*02-45388
6.090" - 6.131" (154.686 - 155.727mm)	6.094" (154.788mm)	5613-*01-11390	5613-*01-31390	5613-*02-45390
6.121" - 6.162" (155.473 - 165.515mm)	6.125" (155.575mm)	5613-*01-11392	5613-*01-31392	5613-*02-45392
6.152" - 6.193" (156.261 - 157.302mm)	6.156" (156.362mm)	5613-*01-11394	5613-*01-31394	5613-*02-45394
6.184" - 6.225" (157.074 - 158.115mm)	6.188" (157.175mm)	5613-*01-11396	5613-*01-31396	5613-*02-45396
6.215" - 6.256" (157.861 - 158.902mm)	6.219" (157.963mm)	5613-*01-11398	5613-*01-31398	5613-*02-45398
6.246" - 6.287" (158.648 - 159.690mm)	6.250" (158.750mm)	5613-*01-11400	5613-*01-31400	5613-*02-45400
6.277" - 6.318" (159.436 - 160.477mm)	6.281" (159.537mm)	5613-*01-11402	5613-*01-31402	5613-*02-45402
6.309" - 6.350" (160.249 - 161.290mm)	6.313" (160.350mm)	5613-*01-11404	5613-*01-31404	5613-*02-454404
6.340" - 6.381" (161.036 - 161.077mm)	6.344" (161.138mm)	5613-*01-11406	5613-*01-31406	5613-*02-45406
6.371" - 6.412" (161.823 - 162.865mm)	6.375" (161.925mm)	5613-*01-11408	5613-*01-31408	5613-*02-45408
6.402" - 6.443" (161.619 - 163.652mm)	6.406" (162.712mm)	5613-*01-11410	5613-*01-31410	5613-*02-45410
6.434" - 6.475" (163.424 - 164.465mm)	6.438" (163.525mm)	5613-*01-11412	5613-*01-31412	5613-*02-45412
6.465" - 6.506" (164.211 - 165.252mm)	6.469" (164.313mm)	5613-*01-11414	5613-*01-31414	5613-*02-45414
6.496" - 6.537" (164.998 - 166.040mm)	6.500" (165.100mm)	5613-*01-11416	5613-*01-31416	5613-*02-45416

\*An Intermediate Mandrel may be required to reach full tool range. Please see the Intermediate Mandrel table on page 15.

# 5613 Series - Rolls

**5.527" - 6.537" (140.386mm - 166.040mm)**

Tool Nominal Diameter	Through Rolls		Blind Rolls		Bottoming Roll	
	# of Rolls	Part #	# of Rolls	Part #	# of Rolls	Part #
<b>5.531"</b> (140.487mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.563"</b> (141.300mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.594"</b> (142.088mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.625"</b> (142.875mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.656"</b> (143.662mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.688"</b> (144.475mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.719"</b> (145.263mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.750"</b> (146.050mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.781"</b> (146.837mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.815"</b> (147.650mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.844"</b> (148.438mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.875"</b> (149.225mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.906"</b> (150.012mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.938"</b> (150.825mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>5.969"</b> (151.615mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.000"</b> (152.400mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.031"</b> (153.187mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.063"</b> (154.000mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.094"</b> (154.788mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.125"</b> (155.575mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.156"</b> (156.362mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.188"</b> (157.175mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.219"</b> (157.963mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.250"</b> (158.750mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.281"</b> (159.537mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.315"</b> (160.350mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.344"</b> (161.158mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.375"</b> (161.925mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.406"</b> (162.712mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.438"</b> (163.525mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.469"</b> (164.315mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531
<b>6.500"</b> (165.100mm)	15	5100-701-00531	15	5100-704-00531	15	5100-708-00531

# 5613 Series - Mandrels & Cages

5.527" - 6.537" (140.386mm - 166.040mm)

Tool Nominal Diameter	Max Burnishing Reach: Controlled by tool length or shank extensions			
	Mandrel Tip Part #		Cage Part #	
	Blind & Through	Bottoming	Blind & Through	Bottoming
5.531" (140.487mm)	5155-129-10001	5155-129-10002	5613-011-00354	5613-015-00354
5.563" (141.300mm)	5155-130-10001	5155-130-10002	5613-011-00356	5613-015-00356
5.594" (142.088mm)	5155-131-10001	5155-131-10002	5613-011-00358	5613-015-00358
5.625" (142.875mm)	5155-132-10001	5155-132-10002	5613-011-00360	5613-015-00360
5.656" (143.662mm)	5155-133-10001	5155-133-10002	5613-011-00362	5613-015-00362
5.688" (144.475mm)	5155-134-10001	5155-134-10002	5613-011-00364	5613-015-00364
5.719" (145.263mm)	5155-135-10001	5155-135-10002	5613-011-00366	5613-015-00366
5.750" (146.050mm)	5155-136-10001	5155-136-10002	5613-011-00368	5613-015-00368
5.781" (146.837mm)	5155-137-10001	5155-137-10002	5613-011-00370	5613-015-00370
5.813" (147.650mm)	5155-138-10001	5155-138-10002	5613-011-00372	5613-015-00372
5.844" (148.438mm)	5155-139-10001	5155-139-10002	5613-011-00374	5613-015-00374
5.875" (149.225mm)	5155-140-10001	5155-140-10002	5613-011-00376	5613-015-00376
5.906" (150.012mm)	5155-141-10001	5155-141-10002	5613-011-00378	5613-015-00378
5.938" (150.825mm)	5155-142-10001	5155-142-10002	5613-011-00380	5613-015-00380
5.969" (151.613mm)	5155-143-10001	5155-143-10002	5613-011-00382	5613-015-00382
6.000" (152.400mm)	5155-144-10001	5155-144-10002	5613-011-00384	5613-015-00384
6.031" (153.187mm)	5155-145-10001	5155-145-10002	5613-011-00386	5613-015-00386
6.063" (154.000mm)	5155-146-10001	5155-146-10002	5613-011-00388	5613-015-00388
6.094" (154.788mm)	5155-147-10001	5155-147-10002	5613-011-00390	5613-015-00390
6.125" (155.575mm)	5155-148-10001	5155-148-10002	5613-011-00392	5613-015-00392
6.156" (156.362mm)	5155-149-10001	5155-149-10002	5613-011-00394	5613-015-00394
6.188" (157.175mm)	5155-150-10001	5155-150-10002	5613-011-00396	5613-015-00396
6.219" (157.963mm)	5155-151-10001	5155-151-10002	5613-011-00398	5613-015-00398
6.250" (158.750mm)	5155-152-10001	5155-152-10002	5613-011-00400	5613-015-00400
6.281" (159.537mm)	5155-153-10001	5155-153-10002	5613-011-00402	5613-015-00402
6.313" (160.350mm)	5155-154-10001	5155-154-10002	5613-011-00404	5613-015-00404
6.344" (161.138mm)	5155-155-10001	5155-155-10002	5613-011-00406	5613-015-00406
6.375" (161.925mm)	5155-156-10001	5155-156-10002	5613-011-00408	5613-015-00408
6.406" (162.712mm)	5155-157-10001	5155-157-10002	5613-011-00410	5613-015-00410
6.438" (163.525mm)	5155-158-10001	5155-158-10002	5613-011-00412	5613-015-00412
6.469" (164.313mm)	5155-159-10001	5155-159-10002	5613-011-00414	5613-015-00414
6.500" (165.100mm)	5155-160-10001	5155-160-10002	5613-011-00416	5613-015-00416

If an Intermediate Mandrel is required, see page 15.

# Compact Burnishing Tools



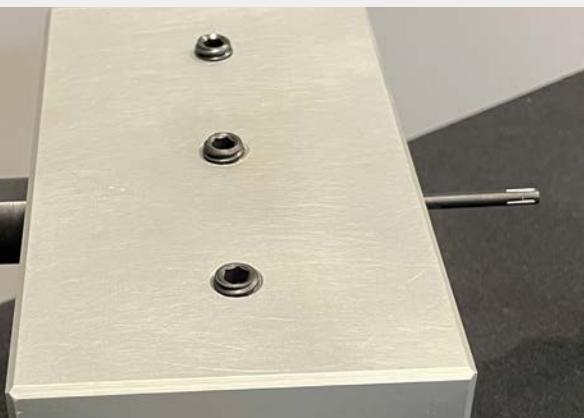
## Ideal for Swiss-Type Machines

Compact Burnishing Tools are designed for applications where the machine working envelope is limited, making them ideal for Swiss-type turning centers and machines.

Compact Burnishing Tools are great for accurate sizing, precision finishing, and surface hardening of bores.

Available in ID Multi-Roll style and stick style.

ID Multi-Roll Styles 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.

# Custom Burnishing Solutions

**Take on the Toughest Applications  
with Custom Engineered Solutions**

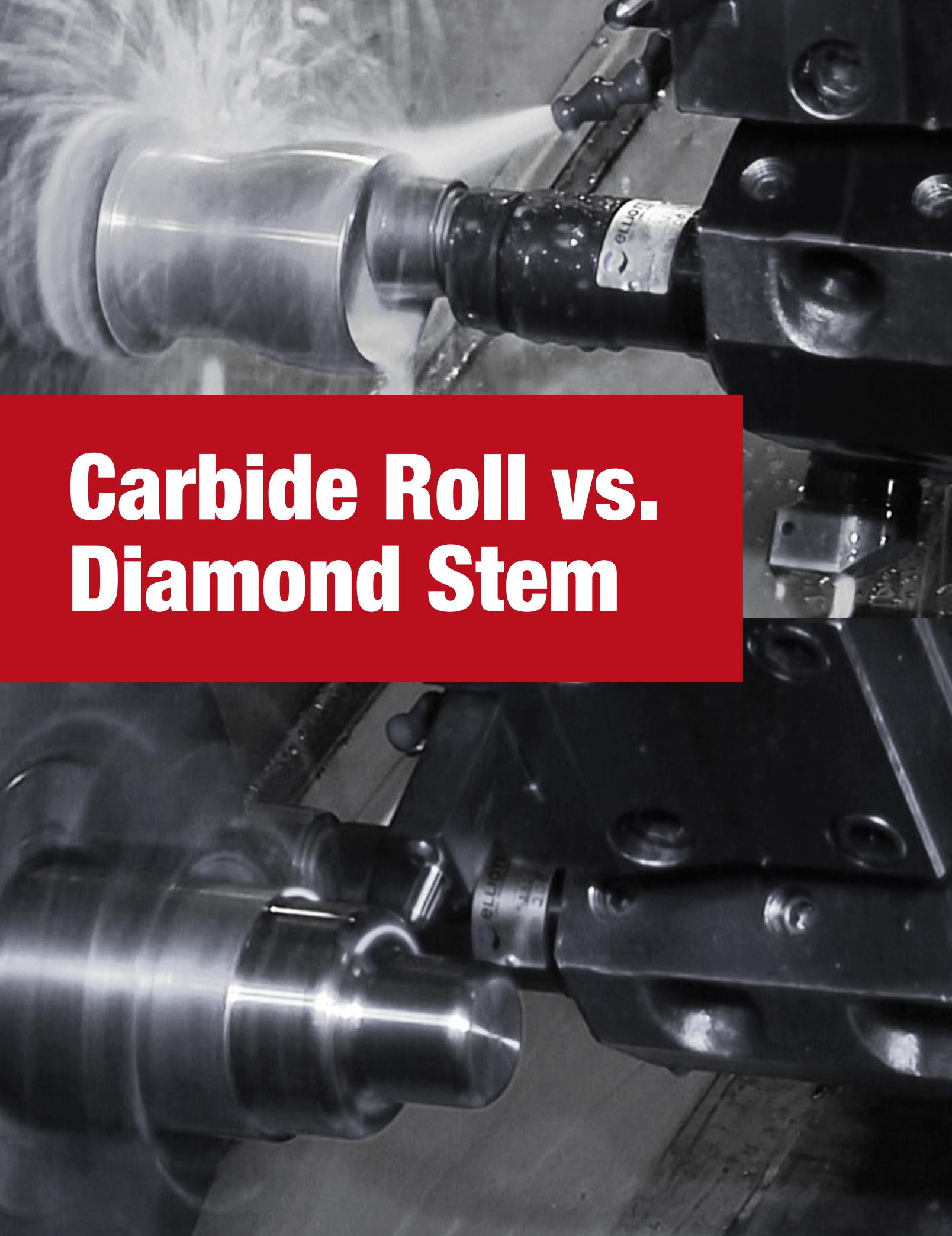
We understand every application is unique, that's why we offer custom burnishing tools designed to meet your specific requirements. Whether you're working with challenging materials, complex part profiles, or high-volume production, we ensure you'll achieve your desired surface finish.



**Contact Us About Custom Solutions!**  
[www.elliott-tool.com/contact-us](http://www.elliott-tool.com/contact-us)



# Carbide Roll vs. Diamond Stem



Burnishing is a fast and easy method to improve the surface finish of a part. When it comes to finishing the face or exterior of a part, there are two primary options, carbide roll burnishing and diamond burnishing. While both options will produce a similar end finish, they may not work in all applications. Understanding the benefits and limitations of each method will ensure that you select the right tool for the job.

There are 3 main factors that will influence how a burnishing tool is selected: Material hardness, volume, and the part profile.



## Material Hardness

Material hardness is one of the most important considerations for burnishing applications, as it helps determine what tool is necessary and the end finish that can be achieved. For harder materials, 45 HRC and above, a diamond burnishing tool will perform the best.

In contrast, a diamond burnishing tool does not handle softer materials like Aluminum, Copper, or Brass very well. Since the material is softer, the diamond tip can deform the material too much and cause build-up on the tip, creating imperfections or dig marks on the surface. In these cases, a carbide roll burnishing tool would be the best option, since it can produce smooth finishes on soft materials.

## Volume

While the volume of production won't have a direct impact on the surface finish achieved, it will impact the number of spare parts required for the job. For high volume production, 3,000 parts or more, a carbide roll tool is recommended.

This is because the tool is extremely durable and more versatile than a diamond tool. The carbide roll itself has a much longer life and less inconsistencies than the diamond stems, which will result in less downtime due to roll changes. Additionally, the carbide roll tool can work on a wider variety of parts, so it can be easily moved to another production line if the job changes.

## Part Profile

The last factor impacting tool selection is the profile of the part itself. Due to the design of the diamond tool, it has to remain perpendicular to the part being burnished. This means that it will only work on straight, linear surfaces. In contrast, a carbide roll tool can burnish curved and concaved surfaces, allowing for more flexibility in the parts it's used on.

Overall, both diamond and carbide roll burnishing tools are great options for creating smooth finishes on the exterior of a part. However, when choosing between the two, diamond style tools are the best equipped for harder materials and linear surfaces, while carbide roll tools are great for high volume production and curved surfaces.

# OD Multi-Roll Burnishing Tools



## Faster, Precise OD Finishing

The multi-roll OD burnishing tools deliver superior results for sizing, finishing, and hardening external surfaces and tube ends.

Eliminating costly secondary processes such as grinding and honing, the OD burnishing tool uses compressive forces to cold work the metal, resulting in a smooth surface finish.

### Features and Benefits:

#### One Step Operation

Produce a 4 – 8 Ra surface finish in one pass.

#### Accurate Sizing

Precision tools allow for minute 0.0001" adjustments, producing accurate sizing.

#### Lower Production Costs

Eliminate costly secondary operations such as grinding, honing, and polishing.

#### Increase Part Life

Increased surface hardness from cold working the material makes it less susceptible to wear and tear, prolonging the life of the part.

#### Better Part Performance

A smooth finish reduces the amount of friction generated while in use, preventing premature failure or excess wear on the part.

#### Great For Small Diameters

Create a smooth, uniform finish on smaller diameter parts that are prone to deformation.

### Spares:

- Rolls



# OD Carbide Roll Burnishing Tools



## Superior Surface Finishes In A Single Operation

The Outside Diameter (OD) Carbide Roll Burnishing Tool is designed to create extremely fine finishes.

This versatile tool is capable of burnishing external diameters, tapers, radii, faces, and large internal bores up to 1" deep.

### Features and Benefits:

#### One Step Operation

Produce a 4 – 8 Ra surface finish in one pass.

#### Dual Spring Design

The tool's innovative spring system enables both the entire head assembly and the carbide roll to deflect independently, ensuring optimal performance on various surfaces.

#### Lower Production Costs

Eliminate costly secondary operations such as grinding, honing, and polishing.

#### Unmatched Versatility

Great for a wide range of applications and materials, providing flexibility and adaptability for diverse applications.

#### Increase Part Life

Increased surface hardness from cold working the material makes it less susceptible to wear and tear, prolonging the life of the part.

#### Easy To Use

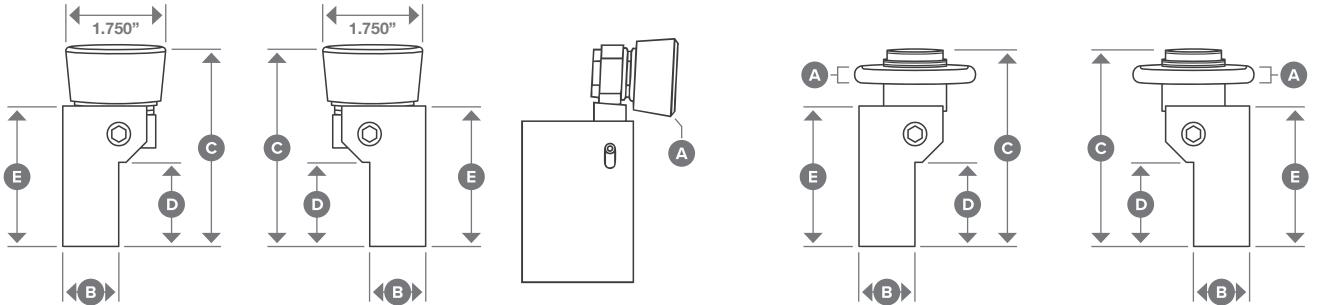
Easy to use and maintain, requiring minimal operator training.

### Spares:

- Rolls
- Spring

# OD Carbide Roll Burnishing Tools

## Standard Tool Styles & Sizes



**Standard Style**

Tool Number	Left or Right Hand	Roll Radius (A)	Shank Size (B)	Overall Height (C)	Clamping Height (D)	Block Height (E)
S2302-00	Left	0.032"	0.750"	3.250"	1.250"	2.250"
S2306-00	Right	0.032"	0.750"	3.250"	1.250"	2.250"
S2427-00	Left	0.093"	0.750"	3.500"	1.250"	2.250"
S2488-00	Right	0.093"	0.750"	3.250"	1.250"	2.250"
S2075-00	Left	0.032"	1.000"	3.500"	1.500"	2.500"
S2121-00	Right	0.032"	1.000"	3.500"	1.500"	2.500"
S2548-00	Left	0.062"	1.000"	3.500"	1.500"	2.500"
S2549-00	Right	0.062"	1.000"	3.500"	1.500"	2.500"
S2233-00	Left	0.093"	1.000"	3.500"	1.500"	2.500"
S2327-00	Right	0.093"	1.000"	3.500"	1.500"	2.500"
S2313-00	Left	0.032"	1.250"	3.500"	1.500"	2.500"
S2384-00	Right	0.032"	1.250"	3.500"	1.500"	2.500"
S2075-00M	Left	0.787mm	25mm	88.90mm	38.10mm	63.50mm
S2121-00M	Right	0.787mm	25mm	88.90mm	38.10mm	63.50mm
S2548-00M	Left	1.570mm	25mm	88.90mm	38.10mm	63.50mm
S2549-00M	Right	1.570mm	25mm	88.90mm	38.10mm	63.50mm
S2233-00M	Left	2.360mm	25mm	88.90mm	38.10mm	63.50mm
S2327-00M	Right	2.360mm	25mm	88.90mm	38.10mm	63.50mm

**Top Hat Style**

Tool Number	Left or Right Hand	Roll Radius (A)	Shank Size (B)	Overall Height (C)	Clamping Height (D)	Block Height (E)
5900-100-80477	Left	0.125"	1.000"	3.450"	1.500"	2.500"
5900-100-80558	Right	0.125"	1.000"	3.450"	1.500"	2.500"
5900-100-80477M	Left	3.175mm	25.40mm	87.63mm	38.10mm	63.50mm
5900-100-80558M	Right	3.175mm	25.40mm	87.63mm	38.10mm	63.50mm

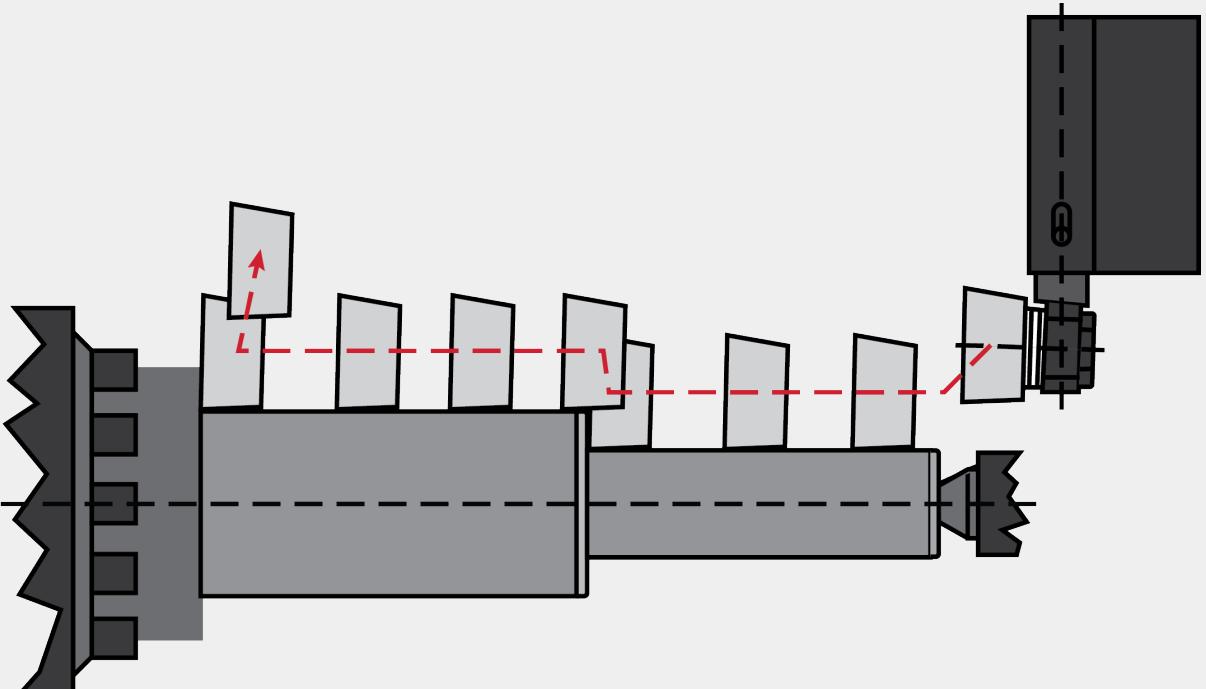


# OD Carbide Roll Burnishing Tools

## Tool Operation Procedure & Roll Path

One series of springs, located in the shank, allows the entire head assembly to deflect when the carbide roll is pushed against a surface. A second spring, located behind the carbide roll, allow the carbide roll to deflect when the tool is fed directly into a face surface or shoulder.

PART PREPARATION:	FEED RATE:	SPEED:	COOLANT PREPARATION:	
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 Carbide Roll Burnishing Tools



## Transform Your Turning Center Into a Fine Finishing Machine

ID/OD Carbide Burnishing Tools are designed to produce a smooth finish on both internal (ID) and external (OD) surfaces.

This versatile tool is capable of burnishing external diameters and large internal bores to a depth of 12".

### Features and Benefits:

#### One Step Operation

Produce a 4 – 8 Ra surface finish in one pass.

#### Dual Spring Design

The tool's innovative spring system enables both the entire head assembly and the carbide roll to deflect independently, ensuring optimal performance on various surfaces.

#### Lower Production Costs

Eliminate costly secondary operations such as grinding, honing, and polishing.

#### Unmatched Versatility

Great for a wide range of applications and materials, providing flexibility and adaptability for diverse applications.

#### Increase Part Life

Increased surface hardness from cold working the material makes it less susceptible to wear and tear, prolonging the life of the part.

#### Easy To Use

Easy to use and maintain, requiring minimal operator training.

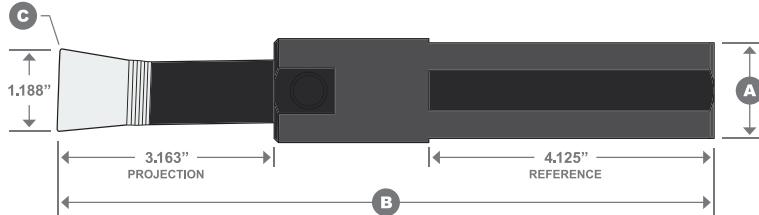
### Spares:

- Rolls
- Spring



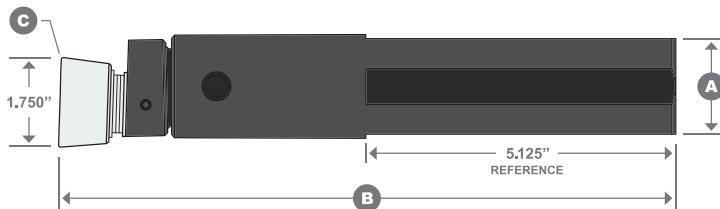
# ID/OD Carbide Roll Burnishing Tools

## Standard Tool Styles & Sizes



### S2289-00

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



### S2320-00

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

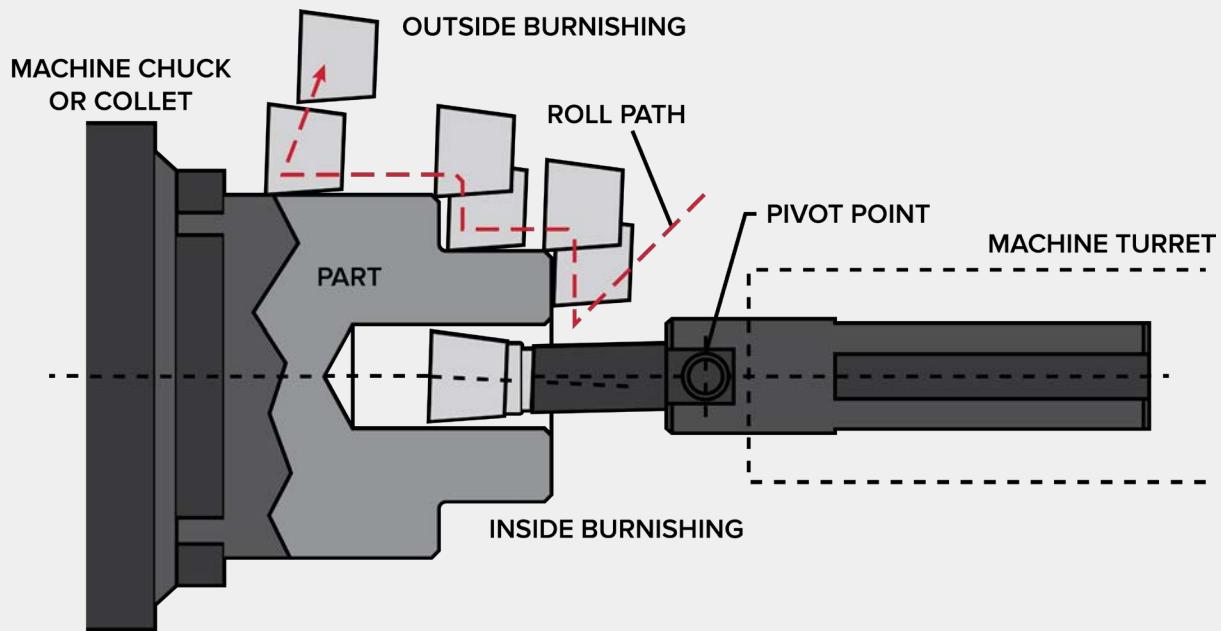
Tool Number	Shank Size (A)	Overall Length (B)	Effective Reach	Roll Radius (C)
S2289-00	1.500"	9.500" (241.300mm)	3.100" (78.740mm)	0.032" (0.787mm)
S2289-00M	40mm	9.500" (241.300mm)	3.100" (78.740mm)	0.032" (0.787mm)
S2289A00	1.500"	9.500" (241.300mm)	3.100" (78.740mm)	0.093" (2.360mm)
S2289A00M	40mm	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)
CB168-00M	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 Carbide Roll Burnishing Tools

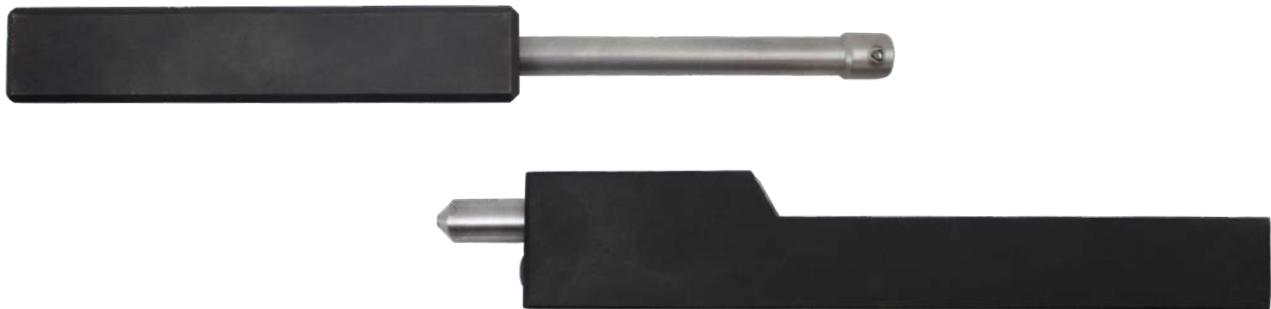
## Tool Operation Procedure & Roll Path

One series of springs, located in the shank, allows the entire head assembly to deflect when the carbide roll is pushed against a surface. A second spring, located behind the carbide roll, allow the carbide roll to deflect when the tool is fed directly into a face surface or shoulder.

PART PREPARATION:	FEED RATE:	SPEED:	COOLANT PREPARATION:	
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



# Diamond Burnishing Tools



## Economical Solution For A Superior Mirror-Like Finish

Diamond burnishing tools are designed for linear applications and used in lathes and similar machines.

The diamond burnishing tools feature replaceable diamond stems in two different styles, making it a cost efficient method to produce an ultra-smooth surface finish on linear surfaces. Great for required surface finishes and surface hardening of bores.

### Features and Benefits:

#### One Step Operation

Produce a 2 - 32 Ra surface finish in one pass.

#### Replaceable Diamond Stems

With two styles of replaceable diamond stems, it offers a cost-effective solution for achieving ultra-smooth surface finishes.

#### Versatile Design

Available in a range of styles to suit various applications, including slim-line square, offset, on-center, and boring bar.

#### Convenient Kits

Available in ready to use kits, that include a complete tool, spare diamond stem, spring, and allen key for easy maintenance and replacement.

#### Increase Part Life

Increased surface hardness from cold working the material makes it less susceptible to wear and tear, prolonging the life of the part.

#### Easy To Use

Easy to use and maintain, requiring minimal operator training.

### Spares:

- Diamond Stem
- Spring
- Screw



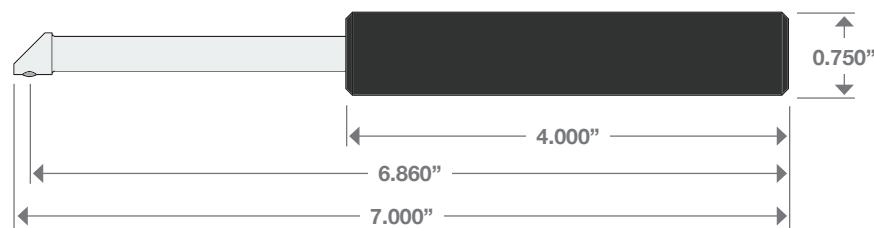
# Diamond Burnishing Tools

## Standard Tool Styles & Sizes



### Stick Style (S2300-00)

The stick design makes the tool ideal for smaller lathes and allows for close approaches. The offset design sets the tool on correct centerline.



### Boring Bar Style (S2295-00)

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

## Standard Diamond Burnishing Tools

Tool Number	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 diamond on center
S2295-00	0.750" square shank with boring bar arm on center

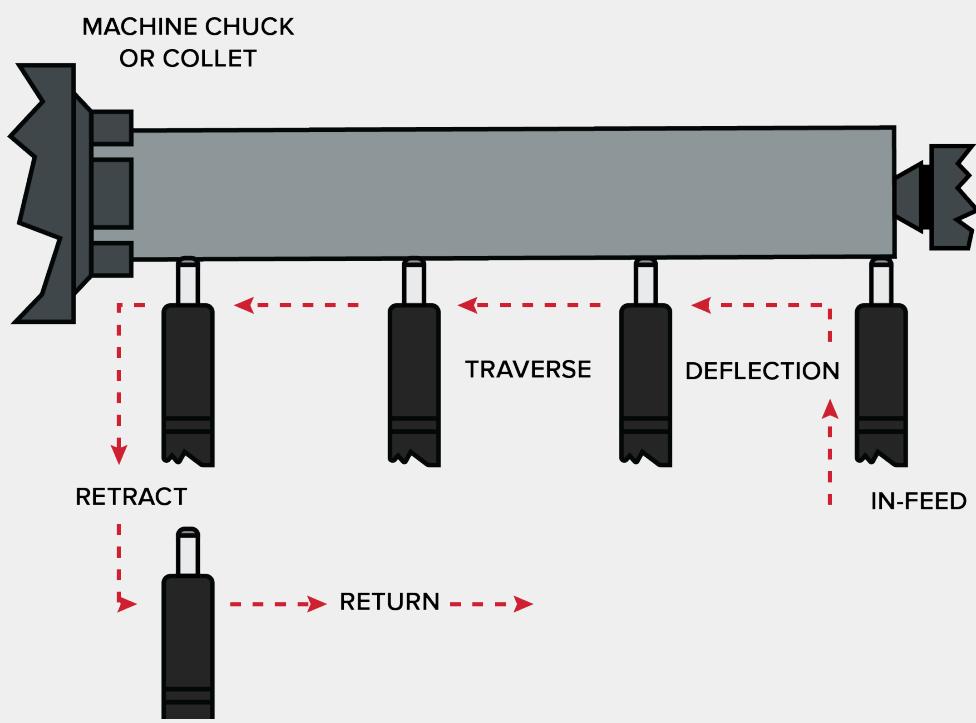
## Replacement Parts

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

# Diamond Burnishing Tools

## Tool Operation Procedure & Roll Path

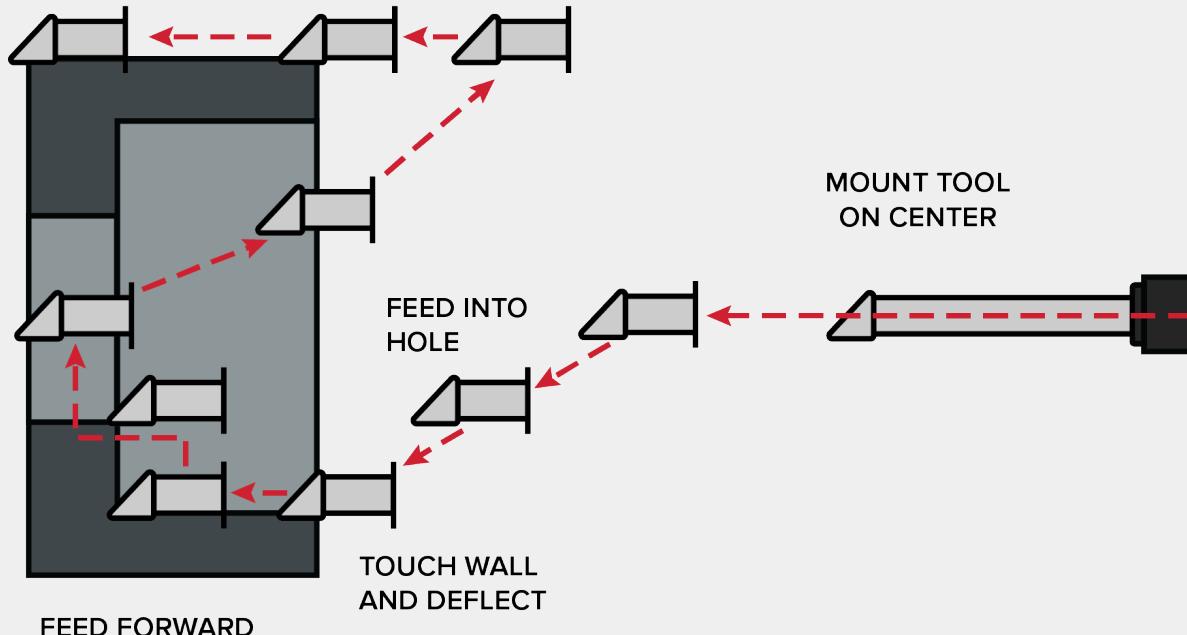
PART PREPARATION:	FEED RATE:	SPEED:	COOLANT PREPARATION:
100/120 RMS	0.003"/0.004"	250 to 500 surface ft. per min (750 max)	Water soluble or oil



# Diamond Burnishing Tools

## Tool Operation Procedure & Roll Path

PART PREPARATION:	FEED RATE:	SPEED:	COOLANT PREPARATION:	MIN. 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"



# Stay Competitive in Your Market

## With Expert Training and Support



Elliott's on-site tube tool and application training can help boost productivity, improve operator retention, and reinforce industry best practices.

- ✓ Burnishing Tools & Compatible Metals
- ✓ Mechanical Joining & Tube Swaging
- ✓ IRU Setup and Operation
- ✓ Metal Finishing Best Practices
- ✓ Overcoming Application Challenges
- ✓ Classroom & Hands On Demonstrations
- ✓ Plus More!



**Schedule Training For Your Team Today!**  
[www.elliott-tool.com/training-services](http://www.elliott-tool.com/training-services)

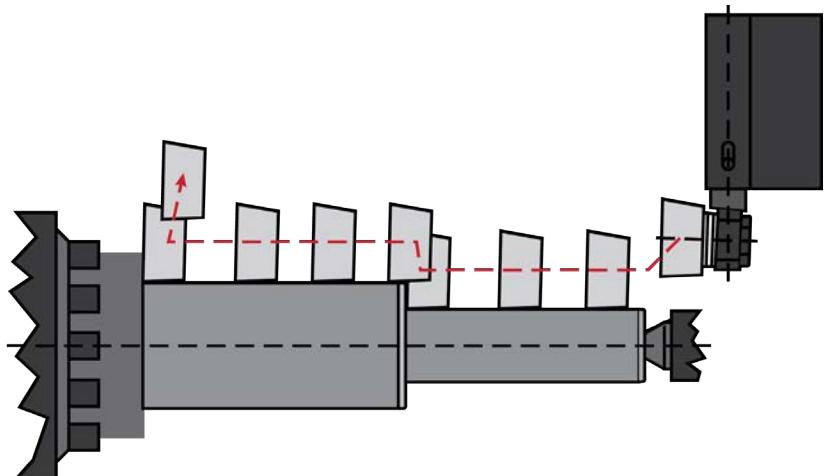




# A Perfect Finish

## How Time, Pressure, & Pre-Finish Impact Surface Finish

While there are many variables that can impact the surface finish of a part, there are 3 key variables that can be leveraged to change the outcome. Time, pressure, and pre-finish play a critical role in the ultimate outcome of the part. Changing any one of these variables could result in dramatically different results, which is why it's important to understand what they are and how they work together to achieve the desired surface finish.



## Time and Feed Rate

Feedrate is the speed at which a tool moves across a workpiece, in this case the time it takes to burnish a part. In general, a slower feed will yield a better finish, but it may not be optimal given the workpiece material. If a feedrate is too low it can cause excessive plastic deformation and an over-compression of the surface. This leads to work hardening and can potentially damage the surface of the part. Additionally, a very slow feedrate coupled with a low pressure won't be able to compress the part material, essentially providing very little finishing to the part.

On the opposite end of the spectrum, if the feedrate is too high, the tool may not spend enough time on the surface to achieve plastic deformation. This can result in a rougher surface finish and leave visible tool marks on the surface. To get the best performance out of the tool, it's important to find the optimal feedrate that allows the tool to deform the surface enough that it creates a smoother and more polished finish. The best feedrate ensures the tool maintains consistent contact with the surface, providing uniform compression and material flow. Depending on the tool itself, a minimum feedrate may be required to produce consistent results.



## Pressure

Like feedrate, the amount of pressure that is applied to the part will determine the amount of plastic deformation and the smoothness of the surface. The pressure of the workpiece can be adjusted a few different ways such as, preloading the pressure on the tool itself or adjusting the gap between the tool and the stock allowance of the part. The method for adjustment will largely depend on the type of tool being used and the part being burnished.

Generally, lower pressure will result in less compression, while higher pressure will result in more. However, like feedrate, the extremes of both can cause problems. Lower pressures may be insufficient in deforming the material, leaving surface irregularities, or producing a rougher finish. Excessive pressure can cause too much

compression, leading to surface damage, work hardening and increased tool wear. As a result, an optimal pressure ensures that there is effective plastic deformation, meaning the tool compresses the surface material properly, reducing peaks and valleys to create a uniform appearance.



## Pre-Finish or Starting Finish

The initial condition of the part surface, or pre-finish, is significant in determining the final burnished finish. A coarse finish with a peak and valley pattern is preferred for materials with a high ductility, while a smoother pre-finish is better for harder materials (45+ HRC). This is because highly ductile materials are better able to compress and change shape, while harder materials are more difficult to move and are more prone to work hardening. While the part material will determine where the pre-finish needs to lean, there are some general principles for varying levels of pre-finish.

Rough pre-finish with significant irregularities is generally not ideal for burnishing. This is because it can increase the pressure required to compress the material which can damage or distort

the part surface. Additionally, there is a higher probability that the irregularities in the starting finish will be visible in the burnished finish. One step down is a coarse pre-finish, 60-120 Ra, which has a consistent peak and valley pattern with minimal defects. This is an optimal starting finish for ductile materials, as it allows for better compression and produces a smoother final finish. Last is a smooth pre-finish, < 40 Ra, which greatly reduces the required burnishing time and pressure. As mentioned, a smoother pre-finish is ideal for harder materials as it allows for efficient material flow and results in a better polished surface after burnishing.



# Angle Burnishing Tools



## Smooth Finishes For Complex Angles

Angle Burnishing tools create smooth, localized finishes in ID or OD angle applications. Best suited for complex part geometries, these tools create a smooth, repeatable finish in hard to reach areas.

Eliminating costly secondary processes such as grinding and honing, the Angle Burnishing tool uses compressive forces to cold work the metal, resulting in a smooth surface finish.

### Features and Benefits:

#### One Step Operation

Produce a 4 – 8 Ra surface finish in one pass.

#### Lower Production Costs

Eliminate costly secondary operations such as grinding, honing, and polishing.

#### Increase Part Life

Increased surface hardness from cold working the material makes it less susceptible to wear and tear, prolonging the life of the part.

#### Better Part Performance

A smooth finish reduces the amount of friction generated while in use, preventing premature failure or excess wear on the part.

#### Great For High Volume

Quickly achieve a single digit finish in a specific area every time.

### Spares:

- Rolls





## Superior Face Finishes, Every Time

Face Burnishing tools create smooth, localized finishes in face or profile applications. Best suited for sealing and mating surfaces, these tools create a smooth, repeatable finish.

Eliminating costly secondary processes such as grinding and honing, the Face Burnishing tool uses compressive forces to cold work the metal, resulting in a smooth surface finish.

### Features and Benefits:

#### One Step Operation

Produce a 4 – 8 Ra surface finish in one pass.

#### Lower Production Costs

Eliminate costly secondary operations such as grinding, honing, and polishing.

#### Increase Part Life

Increased surface hardness from cold working the material makes it less susceptible to wear and tear, prolonging the life of the part.

#### Better Part Performance

A smooth finish reduces the amount of friction generated while in use, preventing premature failure or excess wear on the part.

#### Great For High Volume

Quickly achieve a single digit finish in a specific area every time.

### Spares:

- Rolls

What is

# Mechanical Joining?

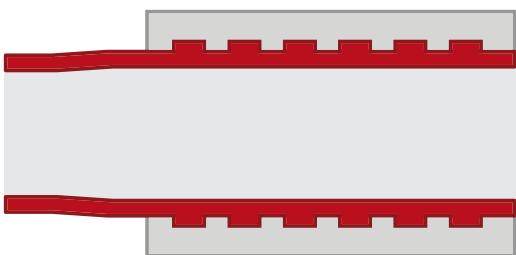


In manufacturing there are numerous applications where tubes need to be joined to flanges or fittings to create a leak proof seal. One common example is joining flexible couplings and hose assemblies for use in aerospace and hydraulic assemblies in heavy industry. While there are a few different ways to achieve the required seal, mechanical joining is one of the most consistent and low-cost methods available.

## The Process



*tube not expanded*



*tube expanded into flanges*

Mechanical joining is a process of joining a tubular element to another component by compressing the outer diameter of the tube against a fixed container, generally a flange or fitting. Virtually any metal can be mechanically joined, including steel, stainless, aluminum, titanium, copper, Inconel, etc. Consisting of a mandrel, roll set, and cage, the mechanical joining tool works by advancing the mandrel forward until the rolls expand and make contact with the inner wall of the tube. This process forces the material out, compressing it into the serrations on the flange ID, creating a tight seal and locking the tube in place.

There are two methods for mechanically joining two components: rolling to torque and rolling to diameter. Depending on the part specifications, the amount of expansion is going to vary. Rolling to a torque is going to be the most accurate in terms of guaranteeing consistent joints, as it accounts for any variations in tube size, thickness, and component ID. On the other hand, rolling to a diameter will ensure that a consistent finished ID size is achieved.

## Benefits of Mechanical Joining

Mechanical joining is best suited for applications that are subject to high vibration, changes in temperature or altitude, and high-pressure applications. This is because mechanical joints can withstand up to 20,000 pounds of hydro-static pressure without leaking or pulling apart. Additionally, the process of mechanical joining is generally lower cost and easier to perform when compared to welding, brazing, or crimping.

In addition to creating a leak-free joint, mechanical joining is also easy to operate and can be used with a variety of installation sources. From handheld motors to assisted rolling systems to CNC machines, there are many power options available.

## Common Applications

Mechanical joining is used in a wide variety of industries such as fluid power, heavy equipment, aerospace, and automotive. Some common applications are hydraulic fittings, transmission blocks, and fluid lines in aircraft.

Overall, mechanical joining is a quick and easy process for creating leak free joints between tubular products and fittings, when compared to welding or brazing operations. This makes it well suited for high vibration and high-pressure applications like aerospace and heavy equipment.

# Mechanical Joining Tools



## Superior Method For Secure, Leak-Proof Joints

The Mechanical Joining Tool is designed to create secure, leak-proof joints between ductile tubular products and fittings, which eliminates the need for welding.

This tool consists of a mandrel and rolls housed inside of a cage, so as the mandrel moves forward, the rolls expand and make contact with the inner wall of the tube, forcing the material to expand into a flange.

### Features and Benefits:

#### Withstand Extreme Pressure

Mechanical joints can withstand over 20,000 pounds of hydro-static pressure.

### Spares:

- Cages
- Mandrels
- Rolls

#### Superior Mechanical Joint

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

#### Cost Effective Solution

Tools are easy to use in a single operation, making them more cost effective compared to welding or brazing.

#### Consistent Expansion

Rolling to torque ensures consistent results regardless of tolerance and variations in tube size.

#### Roll To Size

Rolling to a set diameter guarantees a consistent tube ID, making it easier to “iron out” or increase the ID of the tube.

#### Easy To Use

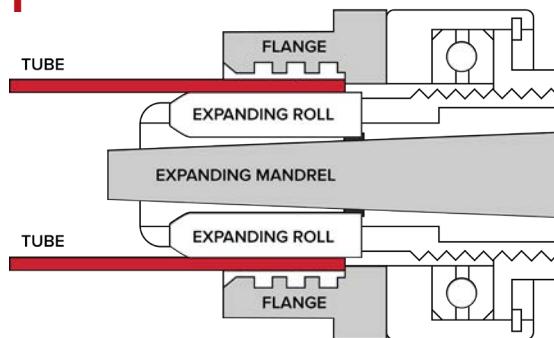
Easy to use and maintain, requiring minimal operator training.

# Mechanical Joining Tools

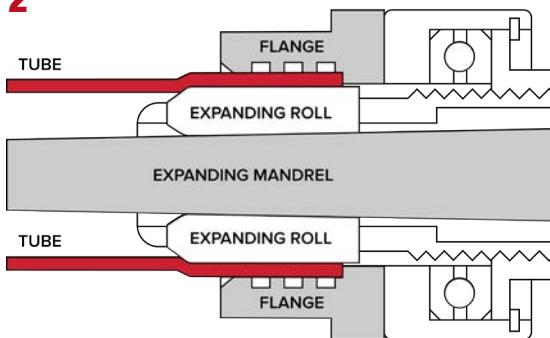
## Tool Operation Procedure

Mechanical Joining Tools can be used on manual electric rolling motors, pneumatic motors, special machines, and in rare cases, on CNC machines.

1



2



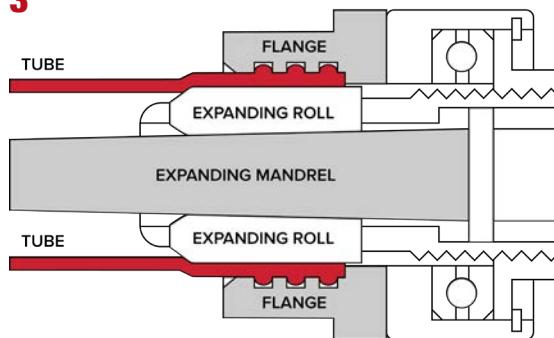
### 0% EXPANSION

The tube is inserted into the flange and the mechanical joining tool is inserted into the tube.

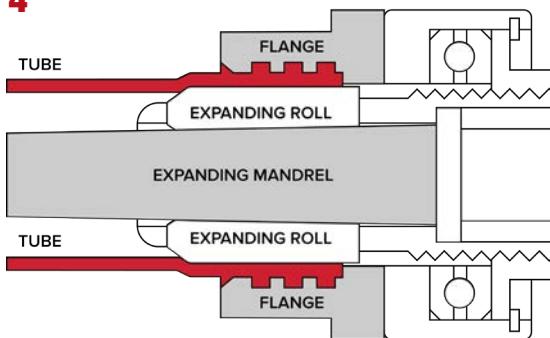
### 25% EXPANSION

When the tube has been rolled to roughly 25% of the total expansion required, the tube will make metal-to-metal contact with the flange.

3



4



### 50% EXPANSION

At this point the tube metal has begun to flow into the grooved serrations of the flange.

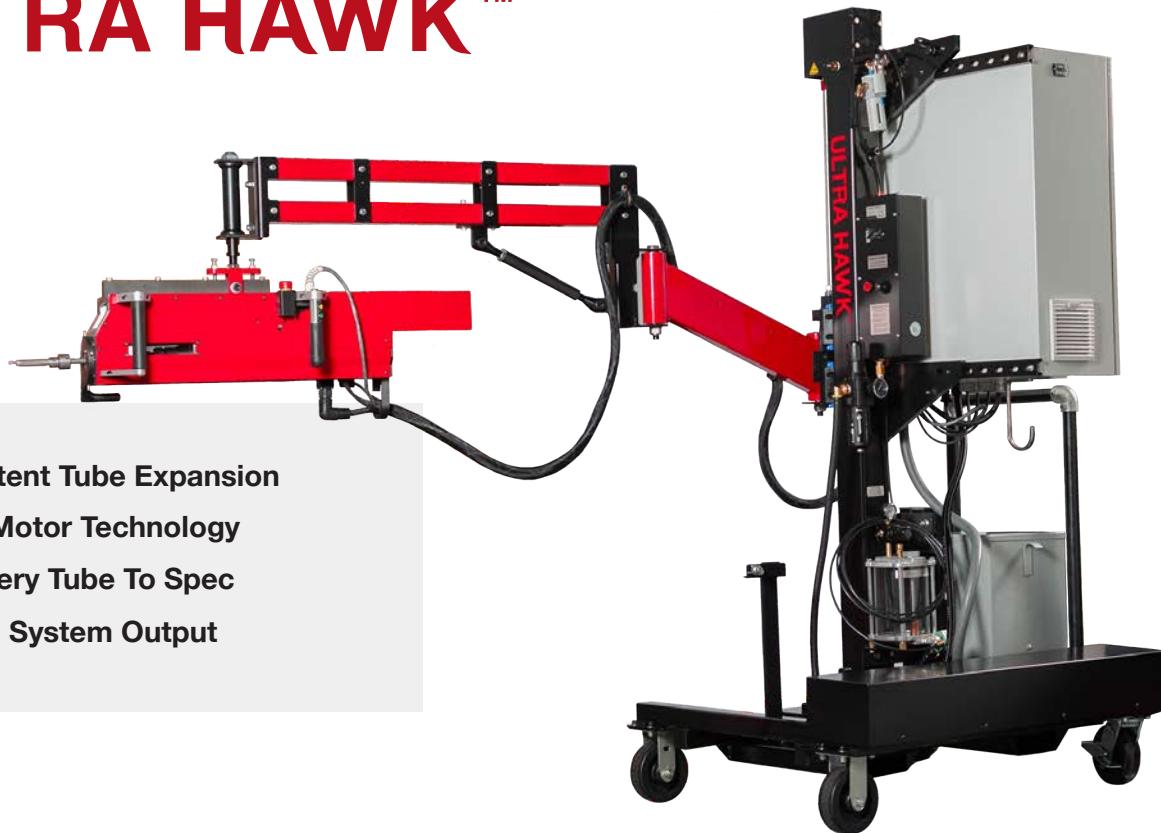
### 100% EXPANSION

Grooved serrations are now filled, and the tube metal has flowed to the point of at least resistance beyond the flange resulting in a mechanically formed joint that will not leak, vibrate loose, or pull apart.

# ULTRA HAWK™

Assisted Tube Rolling System

# ULTRA HAWK™

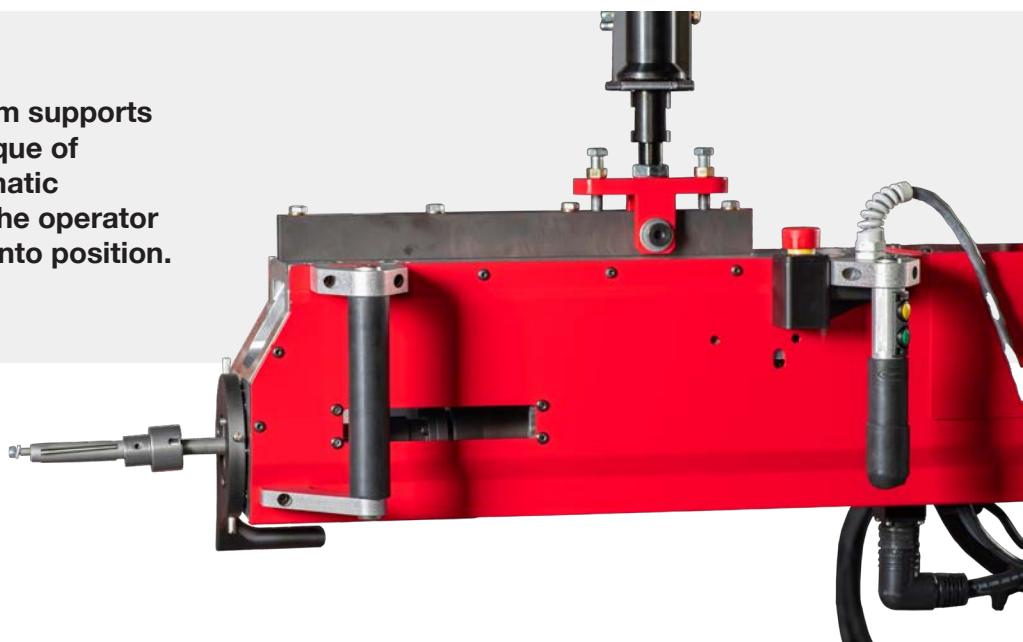


- ✓ Consistent Tube Expansion
- ✓ Servo Motor Technology
- ✓ Roll Every Tube To Spec
- ✓ Record System Output

## 30% Tube Expansion Savings, Guaranteed

The Ultra Hawk is the first of its kind. Offering the speed and productivity of an electric servo motor with the capability to perform parallel pin and traditional expansion. It maximizes productivity by providing the best in class cycle times and eliminating costly rework from less precise methods.

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



# ID Sizing & Finishing Tool



## Precise ID Sizing & Finishing Solution

Sizing and Finishing Tools are designed to operate in a manner similar to the ID Multi-Roller Burnishing Tools. The difference is that the compression on the Sizing and Finishing Tools occurs across the entire length of the roll, as opposed to a single point like with the Multi-Roller Burnishing Tools.

This “parallel rolling” disperses wear, making Sizing and Finishing Tools last longer than other types of burnishing tools. Parallel rolling also allows for faster cycle times compared to traditional burnishing.

All sizing tools are customized to the specific application, ensuring precision and efficiency. Some common applications are bushing seats, lamination stack alignment, reforming the ends of a tube, as well as finishing attachment points.

### Features and Benefits:

#### Machine In One Operation

Most efficient method for deburring and chamfering irregular hole surfaces in a single operation.

#### Self-Centering

The pilot is designed to easily center the cutter in the hole, allowing for accurate alignment every time.

#### Easy To Use

No tool settings required, making the elliptical deburring tool easy to for operators to set-up and operate.

#### Lower Consumable Cost

Coated blades improve tool life and the quality of the cut, reducing replacement costs.

### Spares:

- Cutters
- Cutter Springs
- Pilots
- Pilot Springs



# Elliptical Deburring Tools



## Efficient Deburring For Irregular Holes

The Elliptical Deburring tool is engineered to deburr cylindrical, elliptical, or other irregular hole surfaces.

Simply position the pilot within the hole to center the tool, then as the tool advances, the pilot is retracted into the tool body allowing the blade to engage with the edge. As the tool rotates, the blade works to deburr and chamfer the edge.

### Features and Benefits:

#### Machine In One Operation

Most efficient method for deburring and chamfering irregular hole surfaces in a single operation.

#### Self-Centering

The pilot is designed to easily center the cutter in the hole, allowing for accurate alignment every time.

#### Easy To Use

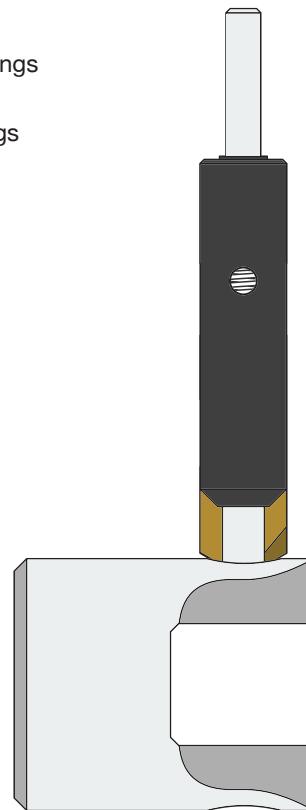
No tool settings required, making the elliptical deburring tool easy to for operators to set-up and operate.

#### Lower Consumable Cost

Coated blades improve tool life and the quality of the cut, reducing replacement costs.

### Spares:

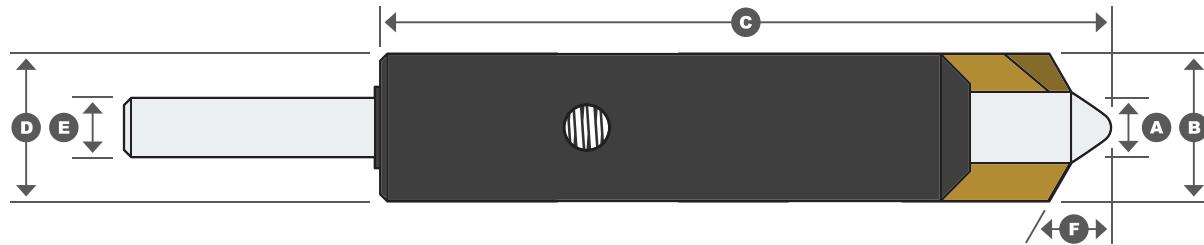
- Cutters
- Cutter Springs
- Pilots
- Pilot Springs



**Preferred method  
for deburring  
crankshaft holes.**

# Elliptical Deburring Tools

## Standard Tool Sizes & Replacement Parts



### Standard Sizes and Dimensions

Operating Range Min. (A)	Operating Range Max. (B)	Length (C)	Body (D)	Shank (E)	Degrees (F)	Tool Number
0.156"	0.313"	3.116"	0.625"	0.250"	120	0430052
0.250"	0.500"	3.145"	0.750"	0.250"	120	0435052
0.375"	1.000"	4.152"	1.000"	0.500"	120	0440000

### Replacement Parts

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





# Cutting Lands in Spool Bore Valves & Valve Bodies

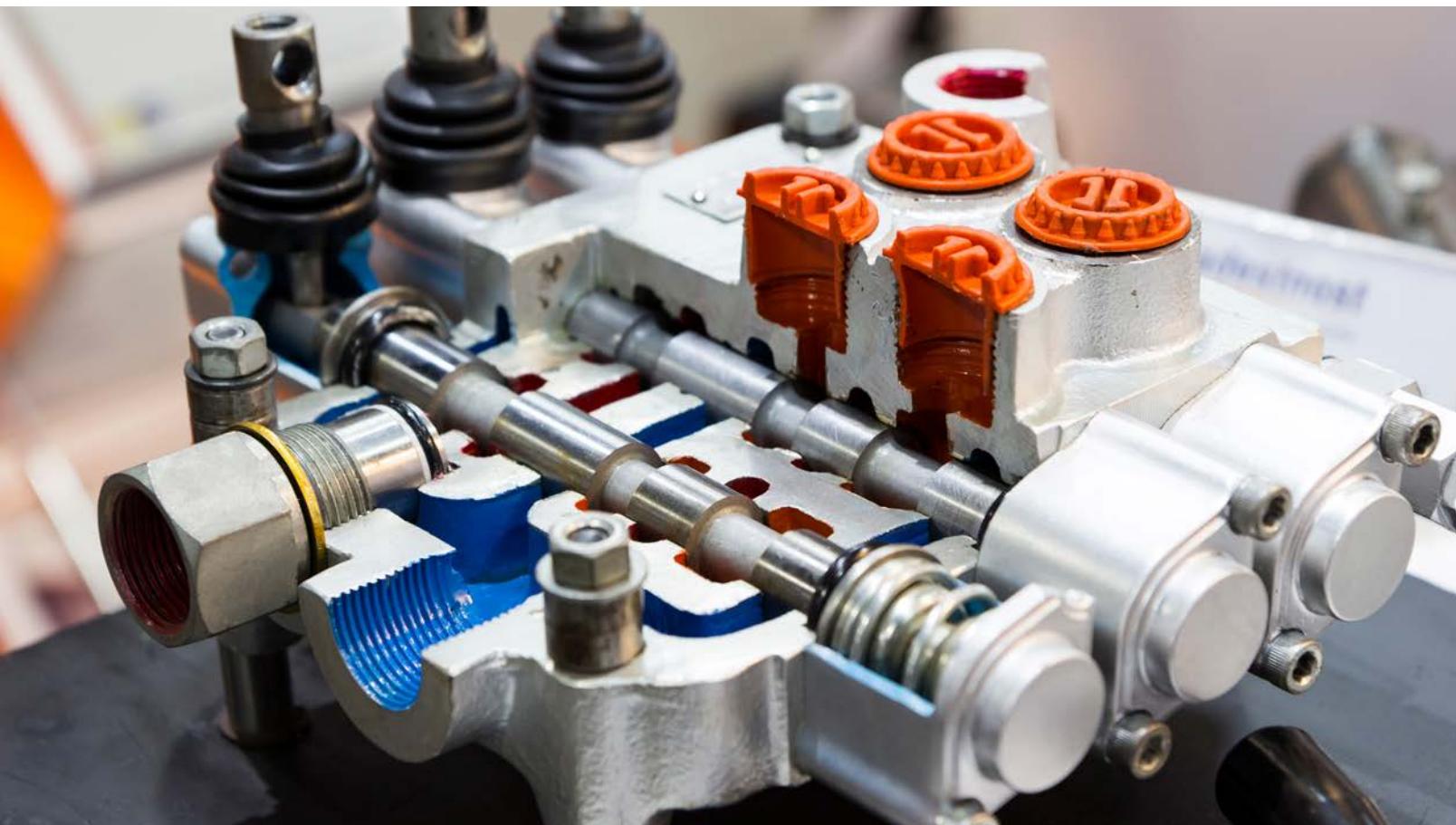
Spool bore valves and valve bodies are common components in many heavy industries. From forklifts to land excavators, valves are used to regulate the flow of fluid through the machine, impacting the functionality of the machinery. For these large pieces of equipment to handle fine movements and adjustments, it's important that the grooves and lands inside of the valve body are cut precisely. In the article, we will discuss spool bore valves and valve bodies: The design, how they work, as well as the processes for cutting grooves and lands.

# What are Spool Valves?

Spool valves are commonly used to control the flow of fluid or air in a piece of equipment. In heavy machinery, these are commonly used in excavators, forklifts, and other pieces construction equipment. Composed of a cylinder with an internal bore and a piston, actuating the valve causes the piston to move back and forth, opening and closing off different grooved pathways. The grooved areas of the bore consist of different configurations of hooks and bumps, also sometimes referred to

as lands. These are small areas that have been notched out in the groove space, allowing for more precise fluid pathways.

As the valve is actuated, often with a lever or electronic controller, the piston moves to a specific position in the bore, allowing hydraulic fluid to fill the open space. This creates a change in pressure that is enough to allow for finite movements of the machine.



## Cutting Grooves & Lands

Generally, the internal bore and grooves of a valve body are cast. This allows for easy and consistent production, and eliminates some challenges associated with grooving a finished part. Sometimes, the manufacturer will cast bore, but use a keyway cutter or boring bar to machine out the grooves and lands. While this method can work, it can take a lot longer to manufacture. This means that grooves

need to be cut one at a time, followed by some type of system flush to remove any metal chips or debris.

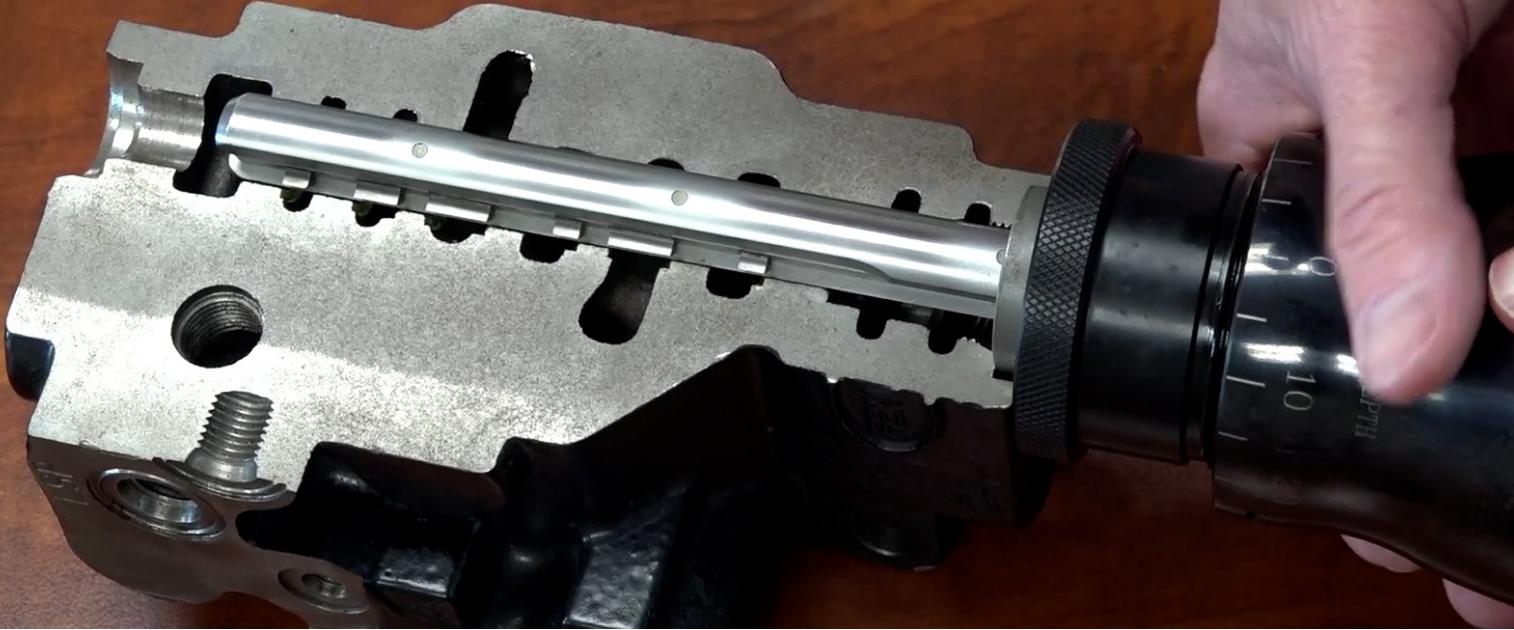
Regardless of the manufacturing type, once the grooves and bore are complete, the lands will still need to be machined out during a separate process. This is because castings are unable to hold the tight tolerances needed to produce the lands and the locations can vary based on the valve body.



## Boring Bar

One traditional method for machining lands is with the use of a boring bar. This consists of a holder, a long bar, and a cutting edge on the end. Generally, boring bars are run on a lathe, so the part is spinning while the tool remains stationary.

While boring bars can work well for cutting lands, it's generally a lot more time consuming and it can produce some inconsistent results. Due to the design of the tool, only one groove can be cut at a time. Additionally, due to the thin nature of the tool, the difference in diameter of the boring bar and the bore diameter poses the risk of deflection. This is when the tool bends and becomes out of alignment when in use. If this occurs, it can result in improper sized lands, cutting in the wrong location, and chatter or vibration, causing poor surface finish.



## Internal Recessing Cutters (IRUs)

One of the most popular and efficient methods for cutting lands is with the use of an Internal Recessing Cutter (IRU). Made up of a pilot, nose piece, and cutter, this tool is an all-in-one solution for cutting valve bodies. Each tool is designed to the specific bore diameter and application requirements of the valve, allowing the tool to sit correctly inside of the part. Proper sizing leaves little room for deflection, allowing for more precise cuts and a better surface finish. Deflection is controlled by allowing the cutting teeth to recess into the pilot as a function of this tool. The cutter is activated once pressure is applied to the operating head and the nose piece engages the part.

In addition to being sized to the application, IRUs also allow all grooves to be cut at the same time. This makes it a much faster process than cutting each groove one at a time. IRUs are also a great method for cutting when working with unusual

geometries. Since each tool is custom, the cutting teeth can be manufactured to suit a variety of different part requirements. Some lands require different shapes or angles of cuts, which can be easily achieved with an IRU style cutter. The cutter can often be re-sharpened to allow for several more cycles to be gained out of the same tool vs. buying a brand-new cutter.

Overall, spool bore valves and valve bodies are a key component in heavy machining applications, as they help regulate movement in large pieces of equipment. Precise machining of the bore, grooves, and lands is critical in order to achieve control over fine movements or adjustments. While there are many different methods for cutting grooves and lands, one of the most efficient methods is an internal recessing cutter or IRU. With the ability to cut all grooves at once and being customized to a particular application, IRU cutters save a significant amount of job time, making it easier to take on high volume parts.

# Internal Recessing Unit (IRU)



## Precision Internal Machining, Redefined

The Internal Recessing Unit (IRU) is engineered to machine multiple grooves and lands simultaneously.

The IRU eliminates deflection, creates precisely machined features, and provides perfect concentricity. It also eliminates the slow and unreliable processes of circular interpolation or circular milling of internal features such as grooves, chamfers, lands, and faces.

### Features and Benefits:

#### Repeatable & Accurate

Get repeatable and accurate cuts with diameter and axial positions of grooves and lands (+/- 0.002").

#### Machine In One Operation

Most efficient method for machining grooves in a single operation, with cycle time of 15 seconds or less.

#### Eliminate Deflection

Designed to support the cutter along its entire length, the IRU eliminates deflection and creates precisely machined features.

#### Consistent Results Every Time

Strategic location of the cams support the cutting teeth, allowing for rigidity and accuracy every time.

#### Easy To Use

With only two settings required for operation, the IRU is easy to for operators to set-up and maintain.

#### Lower Consumable Cost

Carbide cutters can be resharpened 2 – 5 times, reducing replacement costs.

### Spares:

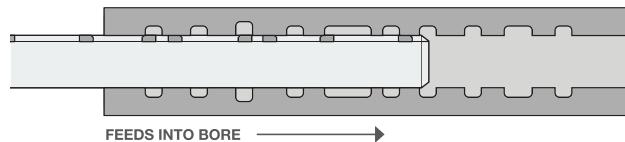
- Carrier Arms
- Cutters
- Nose Pieces
- Pilots



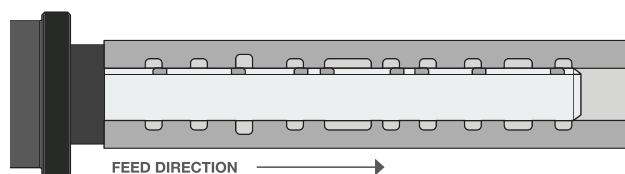
# Internal Recessing Unit (IRU)

## Tool Operation Procedure

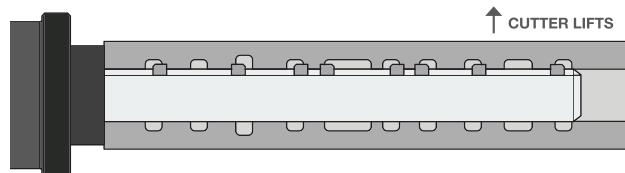
- 1** The IRU is fed into the work-piece at a fast feed rate with the pilot locating within the bore until the nose piece is approximately 0.020" (0.5mm) away from the face of the work-piece.



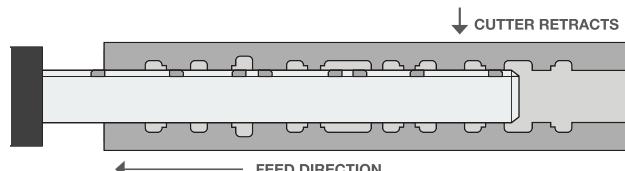
- 2** Feed into the work-piece at a cutting feed rate and make contact with the face of work-piece. At this point, the operating head and nose piece are engaged and will stop rotating.



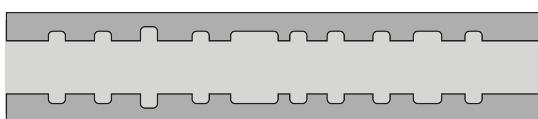
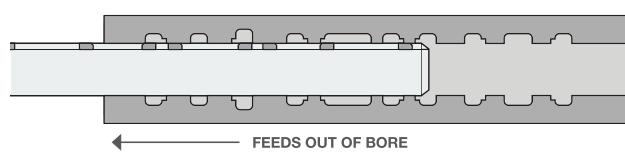
- 3** Continue feeding forward – causing the system to actuate – lifting the cutter perpendicular to the axis of rotation, machining the internal features in the bore.



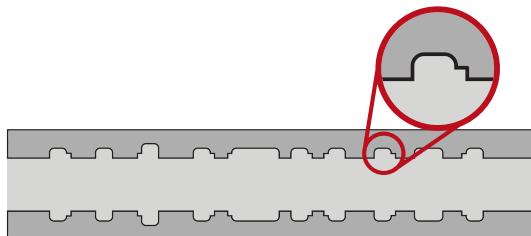
- 4** Retract the IRU three (3) times faster than the cutting feed rate.



- 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.



**BEFORE IRU OPERATION**



**AFTER IRU OPERATION**

# Internal Recessing Unit (IRU)

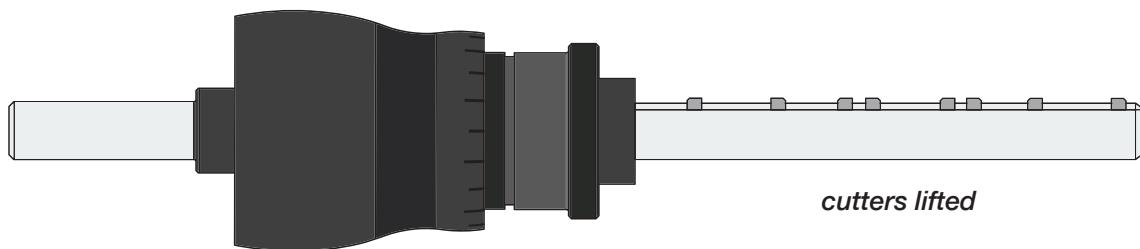
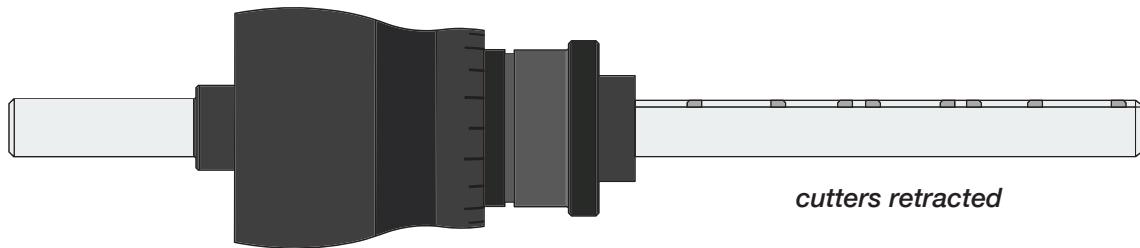
## Feeds & Speeds

### Feeds & 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 - 110
Cast Iron - Nodular	30 - 70
Steel/Forgings	35 - 70
Aluminum and Brass	150 - 160



**Machine multiple grooves and lands simultaneously, quickly, and accurately.**



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## Boring-Bar Style

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

## Stick Style

The stick design makes the tool ideal for smaller lathes and allows for close approaches. The offset design sets the tool on correct centerline.



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