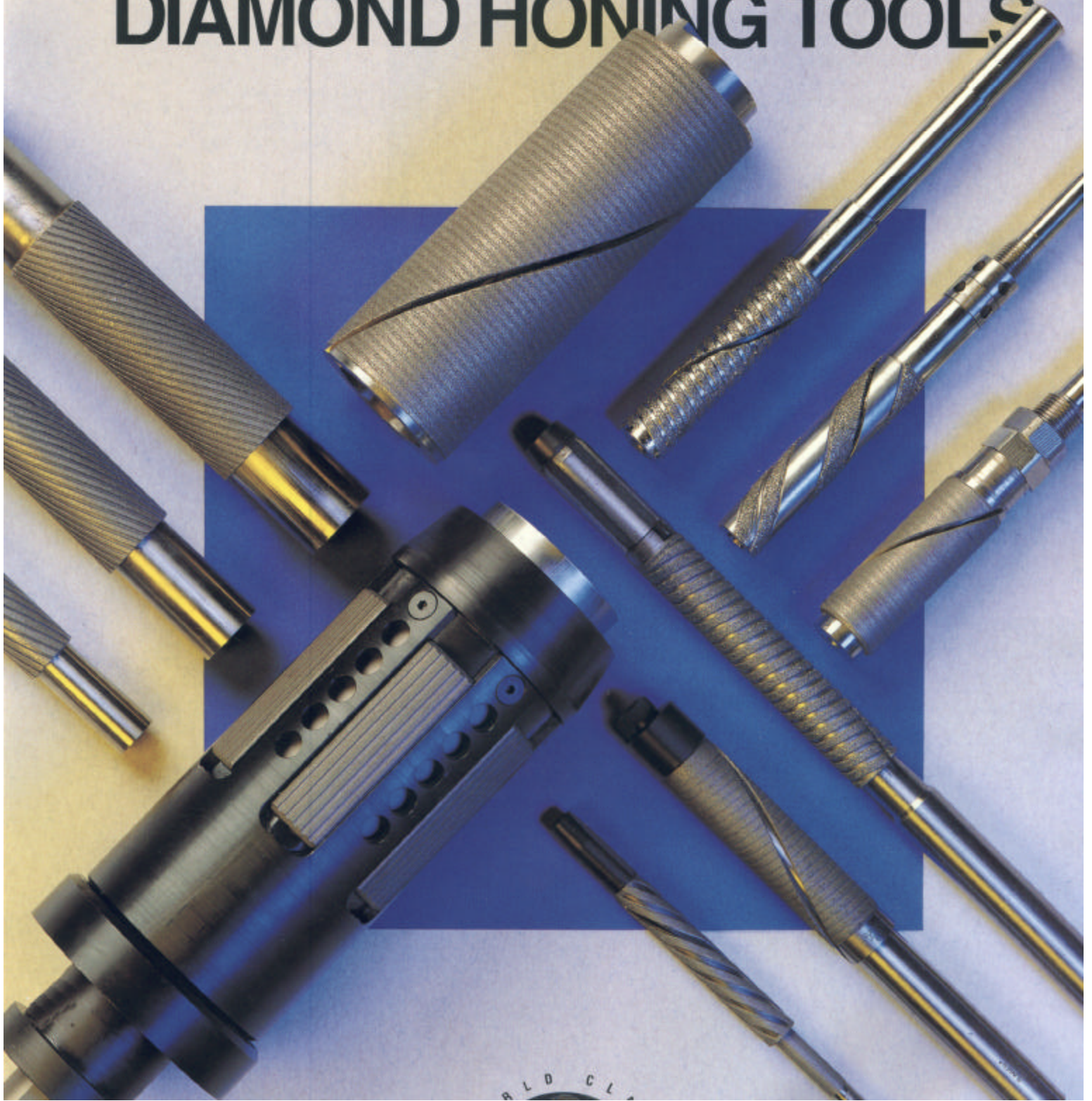


SUNNEN

PRECISION PLATED DIAMOND HONING TOOLS



Sunnen Plated Diamond Honing Tools And Sleeves ...



for precision bore finishing in industrial applications using Sunnen, Nagel, Micromatic, Barnes, Belden, AccuCut, Engis, ITM, Reynolds Machine, Jones & Shipman, Gehring and other types of high production honing equipment — virtually any type of equipment.

Sunnen now supplies plated diamond honing tools and sleeves designed for your specific high production application. Backed by over 20 years of single pass honing technology, these tools incorporate an expandable, superabrasive sleeve mounted on a tapered mandrel for precision bore sizing and finishing — and are designed to be versatile enough to use with almost any finishing equipment.

The mandrels and pilots of Sunnen Single Stroke Honing® Tools are designed for maximum accuracy and fast cycle time. They can be designed to mount in your high production single pass honing machine or to mount in Sunnen's rigid or floating tool holders.

The Bottom Line: Sunnen has the complete resources and capabilities to significantly improve your single pass honing performance and efficiency. Our Technical Services Department has the latest in sophisticated bore geometry analyzing and surface finish measuring equipment ... unmatched by any of our competitors. We'll make a thorough engineering analysis of your application to provide you with a long lasting, quality enhancing, and very profitable solution to your bore sizing and finishing process.



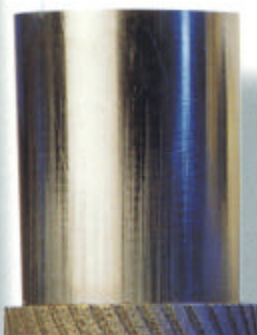
Products such as fuel injectors, hydraulic valves, bearings, gears, connecting rods, ceramics and powdered metal parts often require the precision of plated diamond bore sizing and finishing.



Sunnen stocks a full range of plated diamond tools including steel and cast-iron sleeves, plated diamond shoes, mandrels, and KROSSGRINDING® tools. In addition, the company stocks the industry's largest variety of grit sizes and stone configurations for its general abrasives line.

Check The Many Sunnen Advantages

- Only Sunnen offers both steel and cast-iron plated diamond tools to meet the exact requirements of your bore sizing and finishing application
- Sunnen offers improved designs for greater fluid delivery and efficient chip removal for precision and consistency bore after bore
- A superior plating process ensures longer tool life — lowers your cost per bore while you achieve greater accuracy and increased production efficiencies
- Sunnen will custom design to meet your exact specification
- You have access to the industry's largest and most experienced in-house Technical Support Team and Field Support Staff -- they can easily answer your most highly technical question
- Sunnen stocks all types of tools — ensures immediate shipment to meet your critical production deadlines
- Unlike the competition, Sunnen builds all its tools in-house with the quality that's been in all Sunnen products for over 70 years



Count On Sunnen For: Superior Quality

Sunnen's 70-plus years in precision bore sizing and finishing processes are evident in the quality of Sunnen's plated diamond honing tools. We perform complete design, testing and manufacturing of our tools. This has allowed us to produce plated diamond tools that can be used

with Sunnen bore sizing and finishing equipment such as the KROSSGRINDING® System and the DMS³ BORE-SIZER™ Honing Machine, as well as other high-production honing equipment.

Dependability and Increased Profits

Sunnen plated diamond tools typically finish thousands of parts using a single sleeve. This

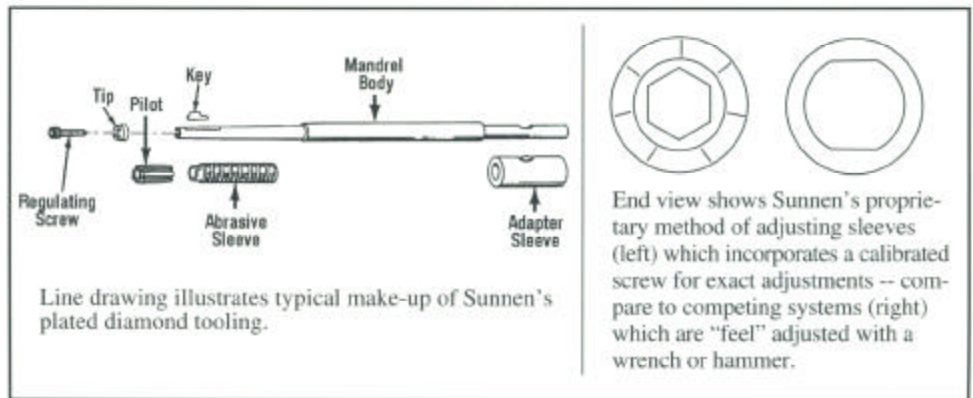
extended tool life can make a substantial difference to your bottom line.

Job Versatility

Sunnen's tools can be coolant fed or supplied with a patented anti-gall coating, enabling you to run parts which previously could not be processed with plated diamond tools.

Sunnen Single Stroke Honing® Offers Speed And Accuracy

The process of Single Stroke Honing® provides a fast and accurate method of sizing certain bores to final size. Sunnen's plated diamond, Single Stroke Honing® Tool has an expandable, superabrasive sleeve mounted on a tapered arbor. The sleeve is expanded only during setup and no adjustments are necessary during the honing operation. The plated diamond honing tool, in most



cases, goes through the bore only once, removing a predetermined amount of stock. The result of this process is a bore

that is to size, straight and round with the desired surface texture — every time.



Sunnen provides its plated diamond tools in both steel and cast iron sleeves and with standard and special purpose cutting surface sculptures. Cast iron sleeves (shown above) are specially designed and allow for deeper fluting, offering advantages over the competition: greater oil flow; better chip removal; better cutting/bore geometry.



Steel sleeves, as compared to cast iron, are more elastic, which provides greater sleeve memory and allows for a wider bore sizing and finishing range.



Sunnen provides both standard and custom tooling to meet your exact requirements.



Product Selection

Sunnen plated diamond tools are available in standard sizes from 5,5 mm (.215 inch) to 32 mm (1.260 inch) and custom sizes from 4 mm (.157 inch) to 101 mm (4 inches). All tools are available in a variety of lengths and grit sizes. Designs are available to work in both vertical and horizontal machines. Grit size is determined by the amount of stock to be removed and the type of finish required. Plated diamond tools are designed to increase the production rate of finishing operations on a wide range of materials.

For complete size and tooling selection information, refer to Sunnen Catalog No. X-SP-5500 — Bore-Sizing and Finishing Supplies — pages 102 - 107, or, call your Sunnen Field Engineer at 1-800-325-3670. (Outside the U.S.A., contact your authorized Sunnen Distributor.)

Selection Hints

Each bore sizing and finishing application is unique. Diameter, length and grit size are available to fit each application. Many of these tools are shipped from stock.

Although actual stock removal capability of the grit sizes offered will vary with your particular

application, the following table is offered as a starting point. It lists the abrasive grit and the stock removal range found useful on various applications of the Sunnen Single Stroke Honing® Tools.

Grit Size	Stock Removed	
	mm	inch
D1 (70 Grit Diamond)	0,03-0,13	.001-.005
D3 (100 Grit Diamond)	0,03-0,10	.001-.004
N3 (100 Grit Diamond)	0,03-0,10	.001-.004
D5 (220 Grit Diamond)	0,01-0,08	.0005-.003
D7 (320 Grit Diamond)	0,01-0,08	.0005-.0025
D8* (400 Grit Diamond)	0,001-0,013	.00005-.0005
DO* (600 Grit Diamond)	0,0006-0,005	.000025-.0002
DOO* (1200 Grit Diamond)	0,0006-0,0013	.000025-.00005

*Use rougher grit sleeve or sleeves first to qualify bore.

Surface Finish

The surface finish produced by a particular grit is affected by many variables such as type of

material, material hardness and tool sharpness. The following table is offered as a guide.

Grit Size	Honing Soft Material		Honing Hard Material	
	Micrometer R _a	Microinch R _a	Micrometer R _a	Microinch R _a
D1	2,29-3,5	90-140	0,51-1,52	20-60
D3	1,14-2,41	45-95	0,25-0,64	10-25
D5	0,71-1,07	28-42	0,20-0,41	8-16
D7	0,51-0,89	20-35	0,13-0,38	5-14
D8	0,25-0,58	10-23	0,08-0,25	3-10
DO	0,20-0,46	8-18	0,05-0,23	2-9
DOO	0,15-0,33	6-13	0,03-0,18	1-7



Advantages Of Sunnen Plated Diamond Tools

Sunnen's plated diamond tooling is the secret to the speed, accuracy and extra long tool life of the Sunnen Single Stroke Honing® System. Diamond abrasives allow for consistency of size, surface finish and bore geometry with no variation from piece to piece. And with a Sunnen plated diamond Single Stroke Honing® Tool, you can size thousands of bores with the same tool. Your cost per bore is minimized while you achieve greater accuracy and increased production.

And each diamond tool is versatile. You can cut a wide variety of materials and diameters since each tool is adjustable within a range specific to the tool's nominal diameter. Single Stroke Honing® Tools are easy to operate and can eliminate labor intensive operations. Any skilled shop person can produce good parts consistently with minimum training.

One of the main advantages of a Sunnen Plated Diamond Tool is that bore size and bore geometry deviation is minimized, which is extremely important considering today's emphasis on SPC (Statistical Process Control). It functions as a finishing tool, correcting any minor flaw left after the initial boring. That's performance that really makes a profitable difference.

Plated Diamond Tooling Makes The Accuracy Of Sunnen's KROSSGRINDING™ System Second To None

The Sunnen KROSSGRINDING™ System combines the benefits of Sunnen honing with the advantages of single stroke diamond tooling in a fully automatic machine. This patented process produces the ultimate in bore geometry and surface tex-

ture. And it's practical and economical for batches of 100 or production runs of 100,000. Typical applications include:

- Fuel Injectors
- Connecting Rods
- Hydraulic Valves
- Precision Gears
- Bearings

Plated Diamond Single Stroke Honing® Tools Can Handle A Multitude Of Jobs

Whatever your finishing needs may be, Sunnen has got the tool to do the job right. Sunnen plated diamond tools are used where precise finishing is required. Here are just a few applications:

- Gears
- Powdered Metals
- Bearings
- More
- Ceramics

Sunnen's DMS³ Bore-Sizer™ Honing Machine Uses Fast-Cutting Single-Stroke® Plated Diamond Tools

When processing long runs of parts, the Sunnen DMS³ produces precision bores at high production rates. It uses Sunnen plated diamond Single Stroke Honing® Tools to size thousands of bores with minimum tool wear. Your cost per bore is reduced and you also save with greater accuracy and faster production.



The Sunnen System

For superior accuracy and efficiency in your honing application, contact us about the Sunnen System — a totally integrated combination of Sunnen machines, gages, tooling, abrasives, honing fluids and technical service — a system that delivers precision and performance you can depend on.

For more information on how Sunnen can help solve your bore sizing and finishing problems, call your Sunnen Field Engineer at 1-800-325-3670 or contact your Sunnen International Distributor.

Fully automatic KROSSGRINDING® System utilizes Plated Diamond Tooling for precision control of bore size and finish. Handles short runs with the same efficiency as large runs, making it perfect for both job shop and production line.

DMS³ High Production Bore Sizer utilizes three (3) or four (4) Plated Diamond Tools to progressively enlarge the bore to exact specifications.



Typical Applications For Sunnen Single Stroke Honing® Tools

APPLICATION — GEAR BLANK

Material:	8620 Steel Soft
Bore Diameter:	19,812 $\frac{3}{16}$ mm (.780 in.) $\frac{1}{1000}$
Bore Length:	16,22 mm (.638 in.)
Process:	Two Pass
Stock Removal:	0,064 mm (.0025 in.)
Cycle Time:	12 Seconds
Results	
Surface Finish:	0,8 μ m R _a (32 μ m R _a)
Tool Life:	100,000 parts per tool
Accuracy Produced -	
Size Control:	0,0025 mm (.0001 in.)
Roundness:	0,0025 mm (.0001 in.)
Straightness:	0,0025 mm (.0001 in.)
Perpendicularity:	0,013 mm (.0005 in.)

APPLICATION — HYDRAULIC MOTOR BODY

Material:	Cast Iron
Bore Diameter:	44,468 mm $\frac{9}{16}$ (1.7507 in.) $\frac{1}{1000}$
Bore Length:	98,43 mm (3.875 in.)
Process:	Three Pass
Stock Removal:	0,127 mm (.005 in.)
Cycle Time:	25 Seconds
Results	
Surface Finish:	0,35 μ m R _a (14 μ m R _a)
Tool Life:	250,000 parts per tool
Accuracy Produced -	
Size Control:	0,0025 mm (.0001 in.)
Roundness:	0,0018 mm (.000070 in.)
Straightness:	0,0025 mm (.0001 in.)

APPLICATION — TRANSMISSION GEAR

Material:	8620 60 Rc
Bore Diameter:	28,042 mm $\frac{3}{8}$ (1.104 in.) $\frac{1}{1000}$
Bore Length:	31,75 mm (1.250 in.)
Process:	One Pass
Stock Removal:	0,076 mm (.003 in.)
Cycle Time:	25 Seconds
Results	
Surface Finish:	0,5 μ m R _a (20 μ m R _a)
Tool Life:	150,000 parts per tool
Accuracy Produced -	
Size Control:	0,0025 mm (.0001 in.)
Roundness:	0,0025 mm (.0001 in.)
Straightness:	0,0025 mm (.0001 in.)

APPLICATION — HYDRAULIC SPOOL VALVE

Material:	12L14
Bore Diameter:	9,5275-9,5301 mm (.3751-.3752 in.)
Bore Length:	50,80 mm (2.000 in.)
Process:	Four Pass
Stock Removal:	0,081 mm (.0032 in.)
Cycle Time:	14 Seconds
Results	
Surface Finish:	0,23 μ m R _a (9 μ m R _a)
Tool Life:	125,000 parts per tool
Accuracy Produced -	
Size Control:	9,5275-9,5288 mm (.3751-.37515 in.)
Roundness:	0,0013 mm (.00005 in.)
Straightness:	0,0013 mm (.00005 in.)

Typical Applications For Sunnen KROSSGRINDING™ Tools

APPLICATION — FUEL PUMP GEAR

Material:	12L14
Bore Diameter:	10,973 mm (0.432 in.)
Bore Length:	6,35 mm (0.25 in.)
Process:	One Operation
Stock Removal:	0,064 mm (0.0025 in.)
Cycle Time:	22 Seconds (for Two Gears)
Results	
Surface Finish:	0,5 μ m R _a (20 μ m R _a)
Tool Life:	240,000 parts
Accuracy Produced -	
Size Control:	0,0025 mm (0.0001 in.)
Roundness:	0,002 mm (0.000080 in.)
Straightness:	0,002 mm (0.000060 in.)

APPLICATION — DIESEL FUEL INJECTOR

Material:	52100
Bore Diameter:	9,0 ± 0,0005 mm (0.3540 in. ± 0.000020 in.)
Bore Length:	30,48 mm (1.20 in.)
Process:	Two Operations
Stock Removal:	0,089 mm (0.0035 in.)
Cycle Time:	Roughing 46 Seconds Finishing 40 Seconds
Results	
Surface Finish:	0,10 μ m R _a (4 μ m R _a)
Tool Life:	Roughing 20,000 Parts Finishing 17,000 Parts
Accuracy Produced -	
Size Control:	0,00051 mm (0.000020 in.)
Roundness:	0,0005 mm (0.000020 in.)
Straightness:	0,00076 mm (0.000030 in.)



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