

Mandrels & Accessories

For Honing diameters

1.14 to 79.37 mm (0.045 - 3.125")



CONTENTS

Guide to stone selection		3
Standard abrasives		4
Standard abrasive selection chart		5
Super abrasives		6
Honing oil		7
The honing assembly / Using this catalogue		8
Mandrel design and selection		9
Collet type (CCS)	1.14 - 3.05mm (0.045 - 0.120")	10
Hard steel type (HS)	3.05 - 25.91mm (0.12 - 1.020")	11 - 15
Brass type (B)	3.05 - 15.62mm (0.12 - 0.615")	11 - 14
Soft steel type (SS)	6.22 - 15.62mm (0.245 - 0.615")	13 - 14
Permanent type (PT)	15.62 - 79.37mm (0.615 - 3.125")	15 - 17
Blind hole information		18
Hard steel keyway type (HSK)	6.22 - 25.91mm (0.245 - 1.020")	19
Permanent keyway type (PTK)	25.4 - 66.68mm (1.0 - 2.625")	20
GHA Tools		21
Special Tools		22
Accessories		23 - 24
Technical information		25 - 26
Trouble shooting		27 - 28
Training and servicing		29

GUIDE TO STONE SELECTION

Metal removal by honing is comparable with, often faster and more cost effective than, internal grinding machines. Efficient honing relies on obtaining an ideal balance between actual honing time and abrasive cost per component, therefore, choosing the correct grade of stone for each honing application is very important.

Honing differs from other methods of bore finishing in that there are a number of variable factors involved which all contribute to achieving the optimum honing operation and these are listed below:

Determine choice of stone

1. Type of material
 - i) Hardness
 - ii) Special treatments such as anodising
2. Prehone bore condition
 - i) Taper
 - ii) Ovality
 - iii) Surface roughness
3. Bore characteristics
 - i) Diameter to length ratio
 - ii) Annular grooves
 - iii) Cross holes
 - iv) keyways

Affect performance of stone

1. Surface speed of honing stone
2. Surface area of the honing stone
3. Stone pressure
4. Reciprocation speed
5. Type of honing fluid

These variable factors are mentioned to highlight the problems involved in recommending the ideal honing stone for any situation.

Examples:-

1. A long bore component will require a softer grade of stone than a short bore of the same material
2. A bore containing cross holes will require a harder grade of stone than a plain bore of the same material

Delapena has compiled a comprehensive selection chart based on average results achieved for various material groups. See page.5

The deburring stone is the hardest available and is suitable for most materials. This prevents damage to the roughing or finishing stone, reduces stone wear and reduces production times thus costs.

Common engineering materials can be separated into five groups:

Cast Irons	- Spun, malleable, meehanite, S.G. etc
Soft Steels	- Alloy steels below HRC 55, CDS, etc
Stainless Steels	- Martensitic, austenitic
Hard Steels	- Alloy steels above HRC 55, hard stainless, hard chrome.
Non Ferrous	- Brass, bronze, copper, aluminium

The stones recommended in each group are based on average results. Changes in rotation and reciprocation speeds will affect the stock removal and stone wear rates and so full use of the infinitely variable rotation and reciprocation speeds to achieve

Stones suitable for rough, finish and polishing are shown for each material. Rotation and reciprocation speed will affect the surface finish achieved with each stone.

If the rotation speed is increased and the reciprocation speed decreased the resulting cross hatch angle is very shallow producing a smoother, finer surface finish.

If the rotation speed is decreased and the reciprocation speed increased the resulting cross hatch angle is much steeper producing a coarser finish.

It can be seen that the rotation speed should be higher for polishing than for roughing and finishing.

Rotation speed can also be used to affect the hardness of any stone.

If stone wear is excessive, increasing the rotation speed will make the stone act harder slowing down the stone wear rate AND the stock removal rate.

If stock removal rate is low, decreasing the rotation speed will make the stone act soft, increasing the stone wear AND the stock removal rate.

This is a general rule and may not necessarily work in every situation. Consideration must also be given to other conditions affecting the honing stones performance.

Refer to the "Trouble Shooting " on page. 27

STANDARD ABRASIVES

Abrasive manufacturers use a variety of code numbers to identify the abrasive type, grit size, bond structure and treatments of their individual products. It is not practical to identify the various stones and so Delapena use a coding system that is common for all stone sizes – See "Stone grades chart" on page 5.

Conventional Abrasives

Three types of conventional abrasive grit are commonly used in honing

F Silicon Carbide

A jagged, splinter like type of free cutting abrasive grit. Used on soft materials such as brass, bronze, aluminium and cast iron. Can also be used on very hard materials such as carbon, ceramic and hardened steels.

R Aluminium Oxide

A regular, chunky shaped grit used for deburring all materials and stock removal in most soft steels up to HRC 50.

C Bauxilite

A special purified form of aluminium oxide having a cool cutting action. Used on wear resistant materials such as hard chrome and heat treated steels above HRC 50.

Treatments

/S Sulphur impregnation

Stones that are suffixed "s" are sulphur treated. An extreme pressure lubricant that helps to reduce heat, reduces clogging and loading of the stone surface and reduces pick up in softer materials.

Other Materials

SF Graphite

A range of polishing stones that will produce a high degree of surface finish on most materials.

OCO Cork

A cork stick impregnated with fine abrasive grit used for polishing especially stainless steels.

C6Y Cork

A cork stick used mainly for plateau honing of cylinder bores.

Grit Size

Delapena honing stones are available in grit sizes from 60 - 500 and for ease of identification the following coding is used:

Delapena Code	0	1	2	3	4	6	8
Grit Size	60	80	120	180	220	320	500

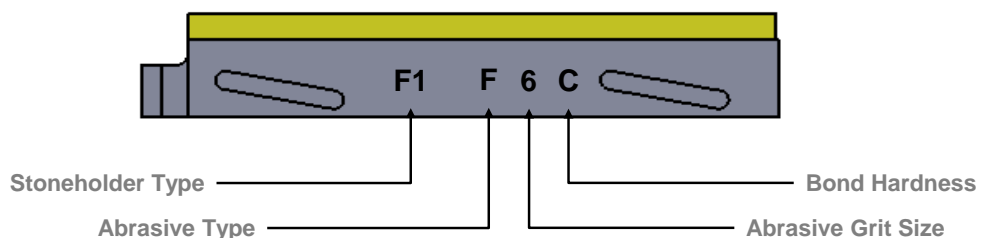
The grit sizes shown above are the most common stone grades in use. Other grades of abrasives, not listed, are available if satisfactory results cannot be obtained by selection from the chart. Please contact Delapena for more details.

Bond Hardness

Hardness or softness of grade is a measure of the tenacity with which the bonding material holds the abrasive particles together. The choice of grade depends on the material being honed. On a hard material a soft grade should be used allowing the abrasive particles to be released as soon as their sharp cutting points have been worn away. A hard grade is used on soft materials since the cutting points of the abrasive particles will wear away more slowly and need to be held together for a longer period before being

The Delapena hardness code is as follows, ranging from A which is soft, to J which is very hard.

Very Soft	A - B
Soft	C - D
Medium	E - F
Hard	H - J



STANDARD ABRASIVE SELECTION CHART

The stone selection chart lists the most common stone grades in use. Other grades of abrasives, not listed, are available if satisfactory results cannot be obtained by selection from the chart. Contact Delapena for details.

Where a choice of stones is given for a material group, the stone in column (a) is harder than the stone if column (b) and would be used for bore containing cross holes, annular grooves, short bores, etc.

While the softer stone would be used for plain bores and long bores.

Diameter Range mm inch	Deburr All Materials	Operation	Material Groups						Delapena Stoneholder Types	Approx Speed Range (rpm)
			Cast Iron	Soft Steel (a) (b)		Stainless Steel (a) (b)		Hard Steel (a) (b)		
1.14 - 3.05			not available (SEE SUPER ABRASIVES ON PAGE.6)							
0.045 - 0.120										
3.05 - 3.81	R6J	F	F6F	R6F	R6F R6C	R6F R6C	F6F	Y Z	2500	
0.120 - 0.150		P	F8F	F8F	F8F	F8F	F8F			
3.81 - 4.70	R6J	F	F6F	R6F	R6F R6C	R6F R6C	F6F	AA NBB	2500	
0.150 - 0.185		P	F8F	F8F	F8F	F8F	F8F			
4.70 - 6.23	R6J	R	F4F	R4F R4E	R4F R4C	R4E R4C	F3F F3C	SH WW	2500	
0.185 - 0.245		F	F6F	R6F	R6F C6C	R6F R6C	F6F F6C			
		P	F8F	F8F	F8F C8C	F8F	F8F F8C			
6.23 - 9.27	R3HS	R	F3F	R4F R4E	R4F R4C	R4E R4C	F3F F3C	NA NG NEE K1	2500 1700	
0.245 - 0.365		F	F6F	R6F	R6F C6C	R6F R6C	F6F F6C			
		P	F8F	F8F	F8F C8C	F8F	F8F F8C			
9.27 - 12.45	R3HS	R	F3F	R4F R4E	R3E/S R4C	R4C C3C	F3F F3C	NB NL K2 K3	1700 1300	
0.365 - 0.490		F	F6F	R6F R6C	R6F C6C	R6C C6C	F6F F6C			
		P	F8F	F8F	F8F C8C	F8F	F8F F8C			
12.45 - 15.62	R3HS	R	F3F	R4F R4E	R3E/S R4C	R4C C3C	F3F F3C	SD NC K4 K5	1300 1000	
0.490 - 0.615		F	F6F	R6F R6C	R6F C6C	R6C C6C	F6F F6C			
		P	F8F	F8F	F8F C8C	F8F	F8F F8C			
15.62 - 19.56	R3HS	R	F3F	R4F R4E	R3E/S R4C	R4C C3C	F3F F3C	ND GG K6 K7	1000 800	
0.615 - 0.770		F	F6F	R6F R6C	R6F C6C	R6C C6C	F6F F6C			
		P	F8F	F8F	F8F C8C	F8F	F8F F8C			
19.56 - 25.91	R3HS	R	F3F	R4F R4E	R3E/S C3C	R4C C3C	F3F F3C	ND GG K8 K9 K10	800 600	
0.770 - 1.020		F	F6F	R6F R6C	R6F C6C	R6C C6C	F6F F6C			
		P	F8F	F8F	F8F C8C	F8F	F8F F8C			
25.4 - 50.8	R3HS	R	F2F	R4F R4E	R3E/S C3C	R4C C3C	F2F F3C	F1 F2 K11 K12 K13	600 300	
1.00 - 2.00		F	F6F	R6F R6C	R6F C6C	R6C C6C	F6F F6C			
		P	F8F	F8F	F8F C8C	F8F	F8F F8C			
50.8 - 79.37	R3HS	R	F2F	R4F R4E	R3E/S C3C	R4C C3C	F2F F3C	F1 F2 K14 K15	300 200	
2.00 - 3.00		F	F6F	R6F R6C	R6F C6C	R6C C6C	F6F F6C			
		P	F8F	F8F	F8F C8C	F8F	F8F F8C			

Operation: R = Roughing F = Finishing P = Polishing

SPEED RANGE

For polishing operations the spindle speed should be increased by 20% from the speed selected for roughing or finishing.

If specified stone is acting too hard i.e. glazing and not cutting, the rotational speed should be reduced.

If the specified stone is acting too soft and stone wear is excessive the rotational speed should be increased.

SUPER ABRASIVES (Diamond & CBN Honers)

Diamond Honers

Diamond honing stones in metallic and resinoid bond have been used successfully for many years. These honers can be subjected to higher working pressures and surface speeds than conventional abrasives.

The main field of application has been honing tungsten carbide and ceramics where, because of the material hardness, conventional vitrified abrasives are unsuccessful. In certain other areas the use of diamond honers can result in a reduction in honing costs. Examples of applications in these areas are:

1. Cast Iron
2. Hardened steels above HRC 63
3. Components having interrupted bores

Three types of bonding materials are used to determine the hardness of the diamond hone.

M Cobalt Iron Bond

A hard bond used for tungsten carbide with cobalt content above 25%. Also used for cast iron, glass, ceramic etc..

MB Bronze Bond

A medium bond used for tungsten carbide with cobalt content 11% - 25% and also used on most heat treated steels above HRC63.

S4 Resinoid Bond

A soft bond used for tungsten carbide with a cobalt content of >11% and also used for other extremely hard materials.

CBN "Borazon" Honers

Two types of bonding materials are used to determine the hardness of the CBN hone. The harder stone should be used for interrupted bores, short bores or when the pre hone finish is poor.

BR Resinoid Bond

A soft bond used for tough hardened steels including titanium up to HRC63. Also suited to sintered materials such as *Alnico* and special alloys like *Inconel*.

Generally used at higher speeds and lower pressure than diamonds or standard abrasives. Always use the lowest pressure that will give a good cutting action. Increasing the pressure beyond this point will result in increased stone wear with very little increase in stock removal.

BB Bronze Bond

A medium bond used for components having interrupted bores (cross holes, annular grooves, etc) or when the surface finish prior to honing is very poor.

Because the bonding material is harder, it can be used at higher pressures than the resinoid stone and can therefore be used if satisfactory results cannot be achieved with the "BR" bond.

Layer Depth

The overall height of the Diamond / CBN stone determines the abrasive depth (layer depth).

Typically Delapena metal bonded (M, MB and BB) honers have a layer depth of 1.5mm (0.060") for honers with a height greater than this. On smaller honers the layer depth will be approximately 90% of the height.

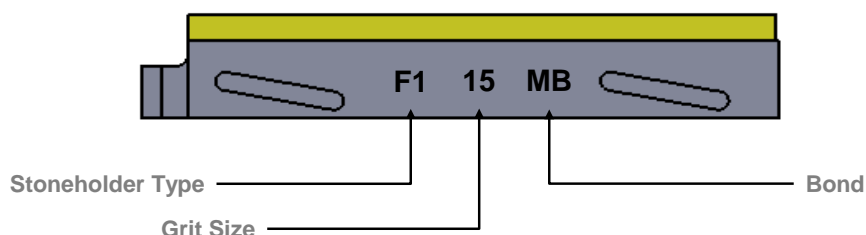
Resinoid (S4 and BR) have 100% layer depth.

Grit Size

Delapena diamond and CBN honing stones are available as standard in grit sizes from 100 - 600 and for ease of identification the following coding is used:

Delapena Code	10	15	22	32	40	60
Grit Size	100	150	220	320	400	600

The grit sizes shown above are the most common in use. Other grit sizes, are available to order. Contact Delapena for details.



HONING OIL

It is essential that the correct type of properly filtered honing fluid is used if the optimum cutting conditions in any given material are to be achieved.

The functions of the honing fluid are:-

- to provide a lubricating film between the mandrel and bore surfaces.
- to keep the surface of the stone clean and open.
- to carry away the used abrasive grits and material swarf and cuttings
- to reduce and dissipate the heat generated in the honing stone and component

Delapena uses our 85 years of experience and dedication to the honing industry to continually work to exceed customer expectations. During the continuing improvement process we focus on a number of key factors to ensure the highest quality of oils are supplied at all times:

- Surface Finish
- Operator Health and Safety
- Oil Longevity
- Environmental Impact
- Lubricity
- Reduced Tool Wear



Delapena Extra

Delapena Extra honing oil is formulated for use on standard applications that require high tolerances. Delapena Extra is light in colour to improve work piece visibility and improve consistency on smaller components such as: cylinders, gears, control bushes and injection pumps

In order to supply optimum oil we included two key additives:

Low misting additives to improve the health and safety standards for the operators using Delapena Extra oil

Anti wear technology is included to reduce tool wear and improved tool life

Delapena Extra also features better lubricity than lower viscosity oils which only have a flushing action. This improved lubricity provides reduced tool wear, better surface finishes and consistency for your components. Delapena Extra is the ideal honing oil for all materials.



Delapena HD Heavy Duty

The Delapena HD heavy duty honing oil is formulated using modern additives and technology to reinvent the "old" heavy sulphurised and chlorinated oils. Delapena HD is classically dark in colour and ideal for heavy duty and large diameter applications, such as industrial cylinders and tube hones.

In order to supply the optimum oil we have included key additives:

- low misting additives to improve the health and safety standards for the operators using Delapena Extra
- anti wear technology is included to reduce tool wear and improved tool life
- anti pick up for stainless steel materials

Delapena HD also features excellent coverage and lubricity for larger diameter bores and tube hones.



THE HONING ASSEMBLY / USING THIS CATALOGUE

The Honing Assembly

A honing assembly comprises the adaptor(s), wedge, mandrel, stone and truing sleeve – details of which are listed in the mandrel selection charts (see pages 10 - 20).

For larger "permanent" type mandrels, shoes are also required in either brass or cast iron (see pages 15 - 17).



CCS Mandrels - additional "Collet Adaptor" required

PT Mandrels - supplied with brass shoes, cast iron on request.

Which Mandrel ?

Each page in this catalogue lists all available mandrels for a particular honing diameter.

Mandrels are available in various designs / materials (see page.9)

All mandrels above diameter 3.05mm can also be modified for "Blind Hole" bores (see pages. 18 and 25)

The smallest Ø represents the smallest bore the tool can enter

The largest Ø represents the maximum diameter that can be honed

Short Series		NA / NG		Long Series		NEE	
Mandrel length A	80mm (3.15")	Mandrel length A	118mm (4.64")	Mandrel length A	118mm (4.64")	Mandrel length A	118mm (4.64")
Stone length B	31.7mm (1.25")	Stone length B	57.1mm (2.25")	Stone length B	57.1mm (2.25")	Stone length B	57.1mm (2.25")

Diameter Range		Mandrel (includes Wedge)			Mandrel (includes Wedge)		Truing Sleeve
mm	Inch	Soft	Hard	Brass	Hard	Brass	
0.22-0.00	0.245-0.260	SS245/3NA	HS245/3NA	B245/3NA	HS245/4NEE	B245/4NEE	ST245
6.60-6.99	0.260-0.275	SS260/3NA	HS260/3NA	B260/3NA	HS260/4NEE	B260/4NEE	ST260
6.99-7.37	0.275-0.290	SS275/3NA	HS275/3NA	B275/3NA	HS275/4NEE	B275/4NEE	ST275

Available types of mandrels

Truing Sleeve

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length
3. When honing bores containing annular grooves, cross holes, cut outs etc, use keyway type mandrels. The extra stone width reduces the tendency for the stone to cut faster around these areas.

As well as the mandrel, you will require a truing sleeve, stone set and adaptor:

eg. diameter 6.7mm honed bore

Order - HS260/3NA Mandrel, ST260 Truing Sleeve with a MA156/3 Adaptor

	MA156/3	MA156/45
Adaptor	MA156/3	MA156/45
Stone Type	NA / NG	NEE
Replacement Wedge	10911	10912
Wedge Lift Angle	10°	

Stone reference is shown for each mandrel (see page 5 for list of grades)

Always true in each new stone before use. This operation takes only a few minutes but can save time and money especially in production honing. (see page 25)

Certain mandrels can be extended in length for special applications such as extrusion and shotgun barrels. (see page 22)

MANDREL DESIGN AND SELECTION

Standard mandrels listed in this catalogue cover the diameter range 1.14 – 79.4mm (0.045 - 3.125").

The mandrel design incorporates a single stone slot to locate the honing stone and the expansion wedge to provide movement of the honing stone. Unless otherwise stated all mandrels are supplied with an expansion wedge for open hole work and, unless otherwise stated, can be modified for blind hole work. (see pages 18 & 25)

CCS Type – Range Ø1.14 - 3.05mm

A tubular mandrel designed for use with the 1651 collet adaptor. The entire mandrel body is hard chrome plated for increased life. These mandrels are NOT supplied with wedges and these must be ordered separately. CCS mandrels are NOT suitable for blind hole work. Note; only "super abrasives" can be used on CCS type mandrels

HS Type – Range Ø3.05 – 25.91mm.

A range of hardened steel mandrels, available in a choice of short and long series working lengths, for general honing use and essential for honing abrasive and hard materials. Mandrels up to Ø6.22mm have a fully circular workhead. Above this diameter the unique three point workhead design eliminates chatter and ensures rapid correction in errors of roundness.

SS Type – Range Ø6.22 – 15.62mm.

A range of soft steel mandrels incorporating the same design features as the HS type. These mandrels are used for honing pick up prone materials and are particularly suitable for super finishing of most materials.

B Type – Range Ø3.05 – 15.62mm.

A range of bronze mandrels incorporating the same design features as the HS type. These mandrels are used for honing pick-up prone materials and are particularly suitable for super finishing of most materials.

PT Type – Range Ø15.62 – 79.4mm

A range of mandrels incorporating the unique three point workhead design and consisting of a permanent mandrel body fitted with a replaceable guide shoe. When the shoe is worn out it is simply removed and a new shoe fitted. Used for similar applications to the B type and for all holes above Ø25.4mm. Available in short, long and extra long series. If mandrels above Ø25.4mm are required for blind hole work this must be stated at the time of ordering.

HSK Type – Range Ø6.22 – 25.91mm

A range of hardened steel mandrels designed specifically for honing bores containing standard ISO keyway slots. Based on the HS type design but with two or more abrasive sticks mounted side by side on the stone holder giving an overall stone width of approximately twice that of the keyway. These mandrels are available in short series working length only and are NOT suitable for blind hole work.

PTK Type – Range Ø15.62 – 66.68mm

A range of permanent type mandrel bodies incorporating the same design features as the HSK type, and fitted with replaceable cast iron shoes that must be machined to the specific diameter to be honed. These mandrels are available in short, long and extra long series working lengths and are NOT suitable for blind hole work.

PLEASE NOTE

Always use the shortest mandrel commensurate with the bore length to be honed.

When honing long bores which require straightness or correction of curvature use the mandrel with the longest stone length.

In certain instances Keyway mandrels have proved superior to standard types on bores having annular grooves, cross holes, cut outs etc in that the extra width reduces the tendency for the stone to cut faster around these areas.

!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

Special Mandrels

In addition to the mandrels listed in this catalogue you can order mandrels to suit your specific application based on the standard mandrels.
i.e. extended, diamond or chrome coated.

Please contact Delapena with your requirements.

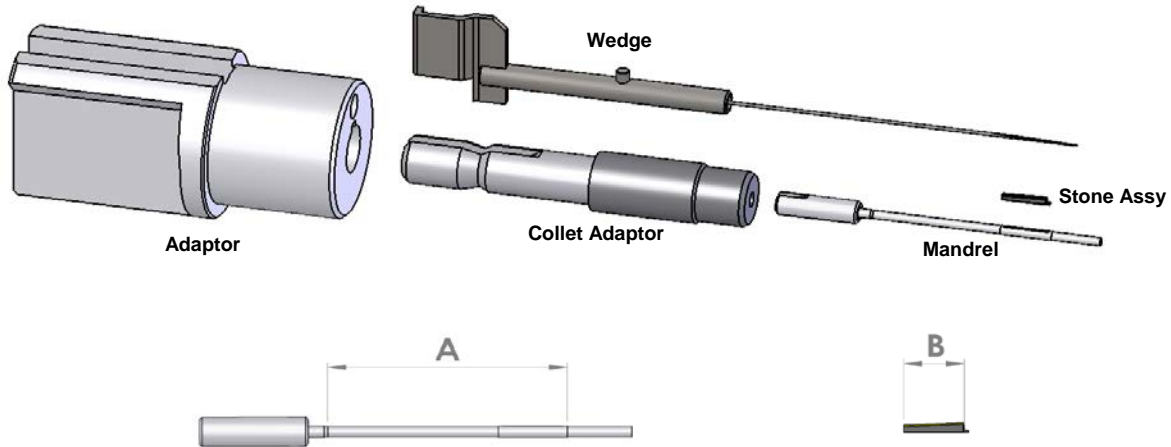
See page 22 for further details

COLLET TYPE MANDRELS (CCS)

Diameter Range 1.14 - 3.05 (0.045 - 0.120")

J0 - J6

Truing sleeve not shown



Short Series	Mandrel Length A	Stone Length B
CCS045 - CCS055	28mm (1.10")	11mm (0.437")
CCS060 - CCS090	40mm (1.57")	11mm (0.437")
CCS095 - CCS115	53mm (2.08")	12.7mm (0.5")

Diameter Range		Mandrel (excludes Wedge)	Truing Sleeve	Stone Type	Wedge
mm	Inch				
1.14-1.27	0.045-0.050	CCS045/J0	ST045	J0	10901
1.27-1.40	0.050-0.055	CCS050/J0	ST050	J0	
1.40-1.52	0.055-0.060	CCS055/J0	ST055	J0	
1.52-1.65	0.060-0.065	CCS060/J1	ST060	J1	
1.65-1.78	0.065-0.070	CCS065/J1	ST065	J1	
1.78-1.90	0.070-0.075	CCS070/J2	ST070	J2	
1.90-2.03	0.075-0.080	CCS075/J3	ST075	J3	
2.03-2.16	0.080-0.085	CCS080/J2	ST080	J2	10902
2.16-2.28	0.085-0.090	CCS085/J2	ST085	J2	
2.28-2.41	0.090-0.095	CCS090/J3	ST090	J3	10903
2.41-2.54	0.095-0.100	CCS095/J4	ST095	J4	
2.54-2.67	0.100-0.105	CCS100/J5	ST100	J5	10904
2.67-2.79	0.105-0.110	CCS105/J4	ST105	J4	
2.79-2.92	0.110-0.115	CCS110/J5	ST110	J5	
2.92-3.05	0.115-0.120	CCS115/J6	ST115	J6	
Collet Adaptor		1651			
Adaptor		MA156/4A			

Wedge Lift Angle	2.5°
------------------	------

Stone Selection - see page 5 for full range of abrasive types available

Note: only "super abrasives" can be used on CCS type mandrels

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length

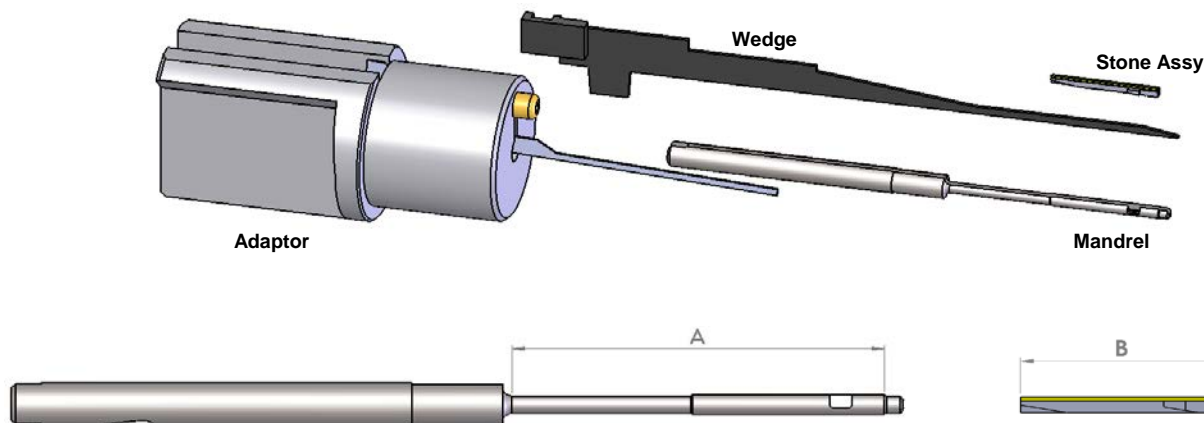
!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

HARD STEEL & BRASS MANDRELS (HS & B)

Diameter Range 3.05 - 4.70 (0.120 - 0.185")

Y Z AA
NBB

Truing sleeve not shown



Short Series	Y	AA	Long Series	Z	NBB
Mandrel length A	38mm (1.5")	42mm (1.65")	Mandrel length A	50mm (1.97")	55mm (2.16")
Stone length B	14.5mm (0.56")	17.5mm (0.69")	Stone length B	25.4mm (1.0")	31.7mm (1.25")

Diameter Range	
mm	Inch
3.05-3.17	0.120-0.125
3.17-3.30	0.125-0.130
3.30-3.43	0.130-0.135
3.43-3.56	0.135-0.140
3.56-3.68	0.140-0.145
3.68-3.81	0.145-0.150
Adaptor	
Stone Type	
Replacement Wedge	

Mandrel (includes Wedge)	
Hard	Brass
HS120/Y	B120/Y
HS125/Y	B125/Y
HS130/Y	B130/Y
HS135/Y	B135/Y
HS140/Y	B140/Y
HS145/Y	B145/Y
MA156/22	
Y	
10905	

Mandrel (includes Wedge)		Truing Sleeve
Hard	Brass	
HS120/Z	B120/Z	ST120
HS125/Z	B125/Z	ST125
HS130/Z	B130/Z	ST130
HS135/Z	B135/Z	ST135
HS140/Z	B140/Z	ST140
HS145/Z	B145/Z	ST145
MA156/22		
Z		
10906		

Diameter Range	
Metric	Inch
3.81-3.94	0.150-0.155
3.94-4.06	0.155-0.160
4.06-4.19	0.160-0.165
4.19-4.32	0.165-0.170
4.32-4.45	0.170-0.175
4.45-4.57	0.175-0.180
4.57-4.70	0.180-0.185
Adaptor	
Stone Type	
Replacement Wedge	

Mandrel (includes Wedge)	
Hard	Brass
HS150/AA	B150/AA
HS155/AA	B155/AA
HS160/AA	B160/AA
HS165/AA	B165/AA
HS170/AA	B170/AA
HS175/AA	B175/AA
HS180/AA	B180/AA
MA156/22	
AA	
10907	

Mandrel (includes Wedge)		Truing Sleeve
Hard	Brass	
HS150/NBB	B150/NBB	ST150
HS155/NBB	B155/NBB	ST155
HS160/NBB	B160/NBB	ST160
HS165/NBB	B165/NBB	ST165
HS170/NBB	B170/NBB	ST170
HS175/NBB	B175/NBB	ST175
HS180/NBB	B180/NBB	ST180
MA156/22		
NBB		
10908		

Wedge Lift Angle

18°

10°

Stone Selection - see page 5 for full range of abrasive types available

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length

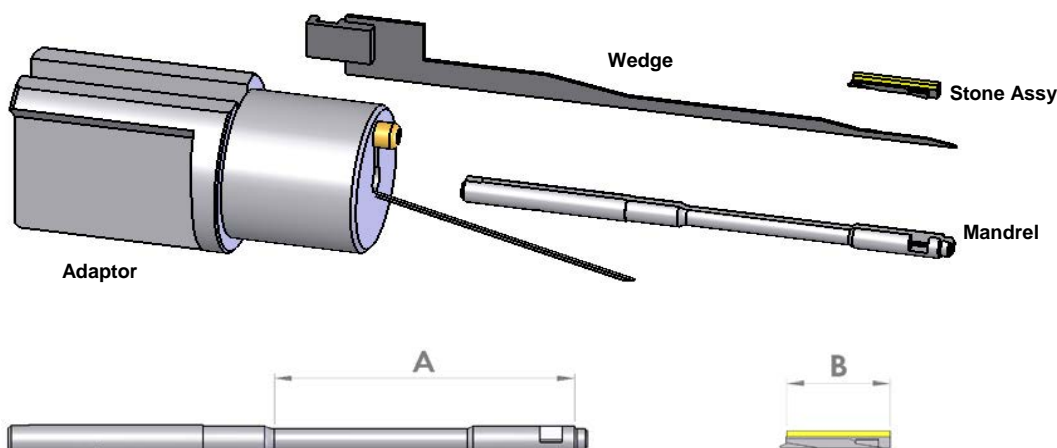
!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

HARD STEEL AND BRASS MANDRELS (HS & B)

Diameter Range 4.70 - 6.22 (0.185 - 0.245")

SH
WW

Truing sleeve not shown



Short Series	SH
Mandrel length A	53mm (2.08")
Stone length B	19mm (0.75")

Long Series	WW
Mandrel length A	82mm (3.23")
Stone length B	35mm (1.37")

Diameter Range	
mm	Inch
4.70-4.83	0.185-0.190
4.83-4.95	0.190-0.195
4.95-5.08	0.195-0.200
5.08-5.21	0.200-0.205
5.21-5.33	0.205-0.210
5.33-5.46	0.210-0.215
5.46-5.59	0.215-0.220
5.59-5.72	0.220-0.225
5.72-5.84	0.225-0.230
5.84-5.97	0.230-0.235
5.97-6.10	0.235-0.240
6.10-6.22	0.240-0.245
Adaptor	
Stone Type	
Replacement Wedge	

Mandrel (includes Wedge)	
Hard	Brass
HS185/2SH	B185/2SH
HS190/2SH	B190/2SH
HS195/2SH	B195/2SH
HS200/2SH	B200/2SH
HS205/2SH	B205/2SH
HS210/2SH	B210/2SH
HS215/2SH	B215/2SH
HS220/2SH	B220/2SH
HS225/2SH	B225/2SH
HS230/2SH	B230/2SH
HS235/2SH	B235/2SH
HS240/2SH	B240/2SH
MA156/1	
SH	
10909	

Mandrel (includes Wedge)		Truing Sleeve
Hard	Brass	
HS185/WW	B185/WW	ST185
HS190/WW	B190/WW	ST190
HS195/WW	B195/WW	ST195
HS200/WW	B200/WW	ST200
HS205/WW	B205/WW	ST205
HS210/WW	B210/WW	ST210
HS215/WW	B215/WW	ST215
HS220/WW	B220/WW	ST220
HS225/WW	B225/WW	ST225
HS230/WW	B230/WW	ST230
HS235/WW	B235/WW	ST235
HS240/WW	B240/WW	ST240
MA156/36		
WW		
10910		

Wedge Lift Angle

10°

Stone Selection - see page 5 for full range of abrasive types available

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

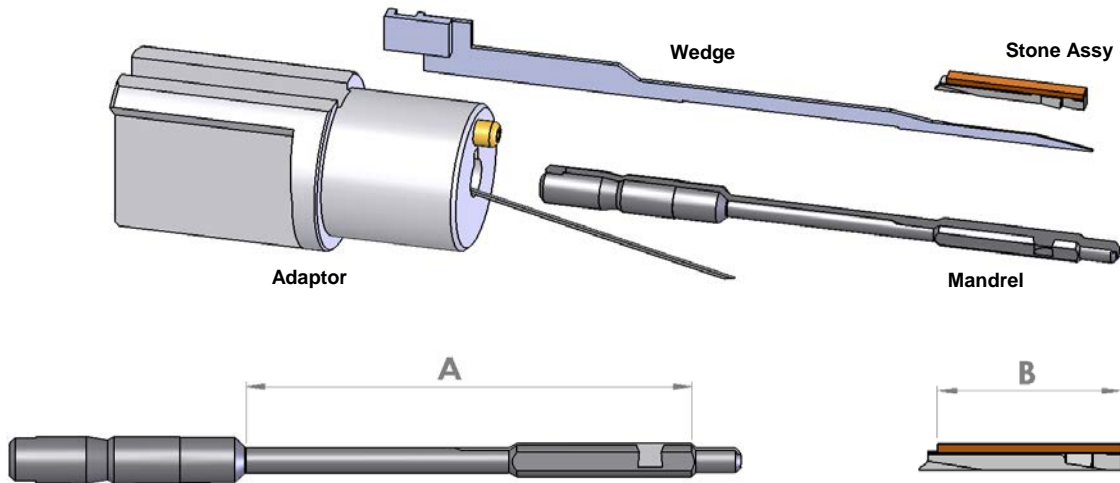
1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length

!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

SOFT, HARD STEEL AND BRASS MANDRELS (SS, HS & B) Diameter Range 6.22 - 9.27 (0.245 - 0.365")

**NA NG
NEE**

Truing sleeve not shown



Short Series	NA / NG
Mandrel length A	80mm (3.15")
Stone length B	31.7mm (1.25")

Long Series	NEE
Mandrel length A	118mm (4.64")
Stone length B	57.1mm (2.25")

Diameter Range		Mandrel (includes Wedge)			Mandrel (includes Wedge)		Truing Sleeve
mm	Inch	Soft	Hard	Brass	Hard	Brass	
6.22-6.60	0.245-0.260	SS245/3NA	HS245/3NA	B245/3NA	HS245/4NEE	B245/4NEE	ST245
6.60-6.99	0.260-0.275	SS260/3NA	HS260/3NA	B260/3NA	HS260/4NEE	B260/4NEE	ST260
6.99-7.37	0.275-0.290	SS275/3NA	HS275/3NA	B275/3NA	HS275/4NEE	B275/4NEE	ST275
7.37-7.75	0.290-0.305	SS290/3NA	HS290/3NA	B290/3NA	HS290/4NEE	B290/4NEE	ST290
7.75-8.13	0.305-0.320	SS305/3NG	HS305/3NG	B305/3NG	HS305/4NEE	B305/4NEE	ST305
7.90-8.40	0.311-0.331		HS310/3NG				ST310
8.13-8.51	0.320-0.335	SS320/3NG	HS320/3NG	B320/3NG	HS320/4NEE	B320/4NEE	ST320
8.51-8.89	0.335-0.350	SS335/3NG	HS335/3NG	B335/3NG	HS335/4NEE	B335/4NEE	ST335
8.89-9.27	0.350-0.365	SS350/3NG	HS350/3NG	B350/3NG	HS350/4NEE	B350/4NEE	ST350
Adaptor		MA156/3			MA156/45		
Stone Type		NA / NG			NEE		
Replacement Wedge		10911			10912		

Wedge Lift Angle	10°
------------------	-----

Stone Selection - see page 5 for full range of abrasive types available

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length

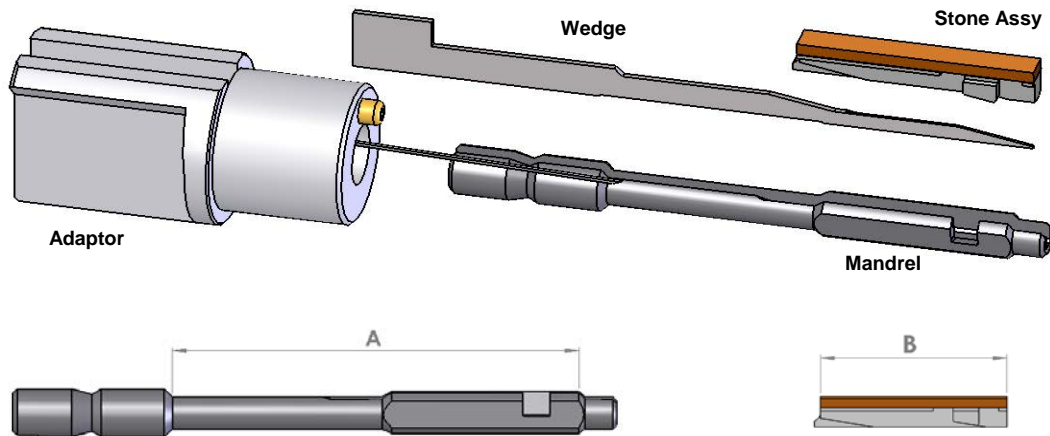
!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

SOFT, HARD STEEL AND BRASS MANDRELS (SS, HS & B)

Diameter Range 9.27 - 15.62 (0.365 - 0.615")

**NB NL
SD NC**

Truing sleeve not shown



Short Series	NB	SD	Long Series	NL	NC
Mandrel length A	93mm (3.66")	110mm (4.33")	Mandrel length A	158mm (6.22")	160mm (6.30")
Stone length B	44.4mm (1.75")	57.1mm (2.25")	Stone length B	82.5mm (3.25")	85.7mm (3.37")

Diameter Range	
mm	Inch
9.27-9.65	0.365-0.380
9.65-10.03	0.380-0.395
9.90-10.50	0.390-0.413
10.03-10.41	0.395-0.410
10.41-10.80	0.410-0.425
10.80-11.18	0.425-0.440
11.18-11.68	0.440-0.460
11.68-12.45	0.460-0.490
11.90-12.50	0.468-0.492
Adaptor	
Stone Type	
Replacement Wedge	

Mandrel (includes Wedge)			Mandrel (includes Wedge)	
Soft	Hard	Brass	Hard	Brass
SS365/3NB	HS365/3NB	B365/3NB	HS365/6NL	B365/6NL
SS380/3NB	HS380/3NB	B380/3NB	HS380/6NL	B380/6NL
	HS390/3NB			
SS395/3NB	HS395/3NB	B395/3NB	HS395/6NL	B395/6NL
SS410/3NB	HS410/3NB	B410/3NB	HS410/6NL	B410/6NL
SS425/3NB	HS425/3NB	B425/3NB	HS425/6NL	B425/6NL
SS440/3NB	HS440/3NB	B440/3NB	HS440/6NL	B440/6NL
SS460/3NB	HS460/3NB	B460/3NB	HS460/6NL	B460/6NL
	HS468/3NB			
MA156/4			MA156/28	
NB			NL	
10913			10914	

Truing Sleeve
ST 365
ST 380
ST 390
ST 395
ST 410
ST 425
ST 440
ST 460
ST 468

Diameter Range	
Metric	Inch
12.45-13.21	0.490-0.520
13.21-13.97	0.520-0.550
13.80-14.50	0.543-0.571
13.97-14.73	0.550-0.580
14.73-15.62	0.580-0.615
Adaptor	
Stone Type	
Replacement Wedge	

Mandrel (includes Wedge)			Mandrel (includes Wedge)	
Soft	Hard	Brass	Hard	Brass
SS490/4SD	HS490/4SD	B490/4SD	HS490/6NC	B490/6NC
SS520/4SD	HS520/4SD	B520/4SD	HS520/6NC	B520/6NC
	HS543/4SD			
SS550/4SD	HS550/4SD	B550/4SD	HS550/6NC	B550/6NC
SS580/4SD	HS580/4SD	B580/4SD	HS580/6NC	B580/6NC
MA156/5			MA156/29	
SD			NC	
10915			10916	

Truing Sleeve
ST 490
ST 520
ST 543
ST 550
ST 580

Wedge Lift Angle

10°

Stone Selection - see page 5 for full range of abrasive types available

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length

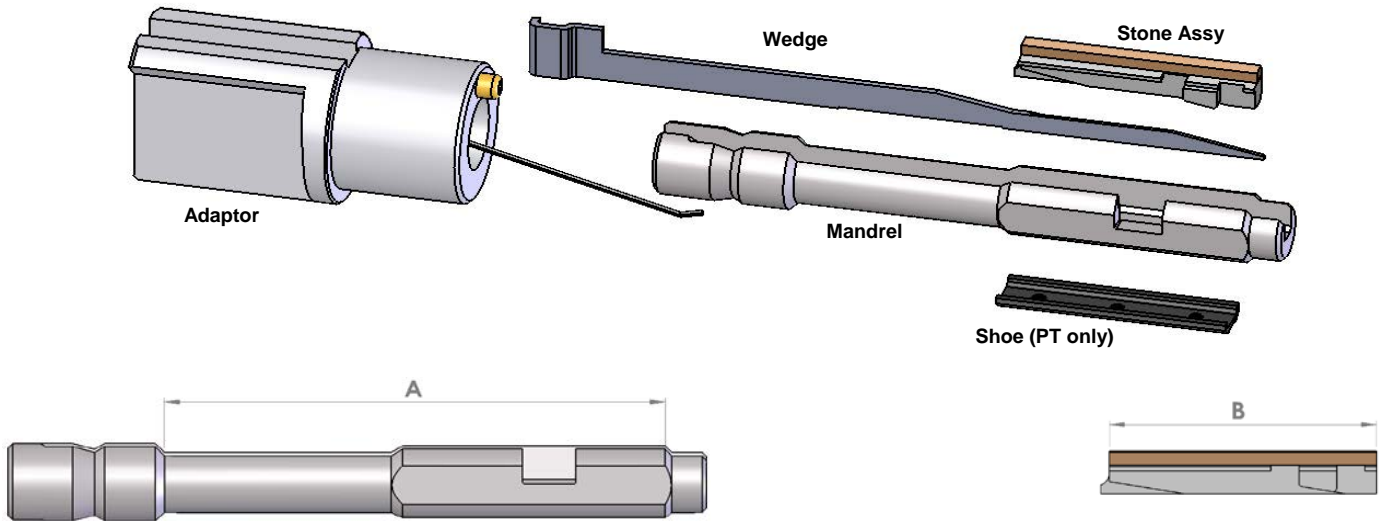
!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

HARD STEEL AND PERMANENT MANDRELS (HS & PT)

Diameter Range 15.62 - 25.91 (0.615 - 1.020")

ND
GG

Truing sleeve not shown



Short Series	ND
Mandrel length A	107mm (4.21")
Stone length B	57.1mm (2.25")

Long Series	GG
Mandrel length A	237mm (9.33")
Stone length B	114.3mm (4.50")

Diameter Range		Mandrel (includes Wedge)		Truing Sleeve	Mandrel (includes Wedge)		Truing Sleeve	Shoe (PT only)	
mm	Inch	Hard	Permanent		Hard	Permanent		Brass	Cast Iron
15.62-16.38	0.615-0.645	HS615/4ND	PT615/4ND	ST 615	HS615/8GG	PT615/8GG	STL 615	L1057B (2-off each for GG mandrels)	L1057C (2-off each for GG mandrels)
15.80-16.50	0.622-0.650	HS622/4ND		ST 622					
16.38-17.15	0.645-0.675	HS645/4ND	PT645/4ND	ST 645	HS645/8GG	PT645/8GG	STL 645		
17.15-17.91	0.675-0.705	HS675/4ND	PT675/4ND	ST 675	HS675/8GG	PT675/8GG	STL 675		
17.91-18.80	0.705-0.740	HS705/4ND	PT705/4ND	ST 705	HS705/8GG	PT705/8GG	STL 705		
18.80-19.56	0.740-0.770	HS740/4ND	PT740/4ND	ST 740	HS740/8GG	PT740/8GG	STL 740		
Adaptor		MA156/6			MA156/50				
Stone Type		ND			GG				
Replacement Wedge		10915			10917				

Diameter Range		Mandrel (includes Wedge)		Truing Sleeve	Mandrel (includes Wedge)		Truing Sleeve	Shoe (PT only)	
Metric	Inch	Hard	Permanent		Hard	Permanent		Brass	Cast Iron
19.56-20.32	0.770-0.800	HS770/4ND	PT770/4ND	ST 770	HS770/8GG	PT770/8GG	STL 770	L1058B (2-off each for GG mandrels)	L1058C (2-off each for GG mandrels)
20.32-21.08	0.800-0.830	HS800/4ND	PT800/4ND	ST 800	HS800/8GG	PT800/8GG	STL 800		
21.08-21.97	0.830-0.865	HS830/4ND	PT830/4ND	ST 830	HS830/8GG	PT830/8GG	STL 830		
21.97-22.73	0.865-0.895	HS865/4ND	PT865/4ND	ST 865	HS865/8GG	PT865/8GG	STL 865		
22.73-23.49	0.895-0.925	HS895/4ND	PT895/4ND	ST 895	HS895/8GG	PT895/8GG	STL 895		
23.49-24.25	0.925-0.955	HS925/4ND	PT925/4ND	ST 925	HS925/8GG	PT925/8GG	STL 925		
24.25-25.14	0.955-0.990	HS955/4ND	PT955/4ND	ST 955	HS955/8GG	PT955/8GG	STL 955		
24.80-25.50	0.976-1.004	HS976/4ND		ST 976					
25.14-25.91	0.990-1.020	HS990/4ND	PT990/4ND	ST 990	HS990/8GG	PT990/8GG	STL 990		
Adaptor		MA156/18			MA156/51				
Stone Type		ND			GG				
Replacement Wedge		10915			10917				

Wedge Lift Angle	10°
------------------	-----

Wedge Lift Angle	9°
------------------	----

Stone Selection - see page 5 for full range of abrasive types available

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length

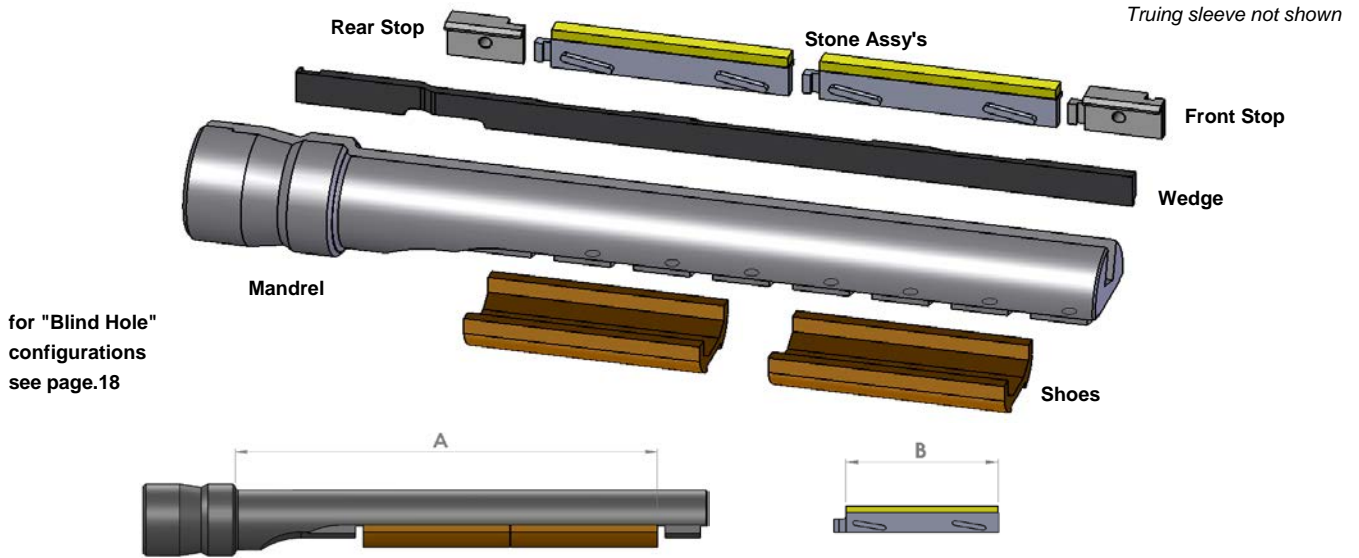
!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

PERMANENT TYPE MANDRELS (PT)

Diameter Range 25.4 - 66.68 (1.000 - 2.625")

F1 / F2

Open / Blind Hole



for "Blind Hole" configurations see page.18

Mandrel Type	Series	Open Hole	
		Length A	Stone B
Short (1 stone)	PT1000/6 - PT2500/6	152mm (5.98")	1 x 82.5mm (3.25")
Long (2 stones)	PT1000/9 - PT2500/9	237mm (9.33")	2 x 82.5mm (3.25")
Extra Long (3 stones)	PT1000/12 - PT2500/12	322mm (12.68")	3 x 82.5mm (3.25")

Range		Short Series	Long Series	Extra Long Series	Truing Sleeves	Shoes	
mm	Inch					Brass	Cast Iron
25.40-28.57	1.000-1.125	PT1000/6	PT1000/9	PT1000/12	ST1000	L1059B	L1070C
28.57-31.75	1.125-1.250	PT1125/6	PT1125/9	PT1125/12	ST1125	L1060B	L1071C
31.75-34.93	1.250-1.375	PT1250/6	PT1250/9	PT1250/12	ST1250	L1061B	L1072C
34.93-38.10	1.375-1.500	PT1375/6	PT1375/9	PT1375/12	ST1375	L1062B	L1073C
38.10-41.28	1.500-1.625	PT1500/6	PT1500/9	PT1500/12	ST1500	L1063B	L1074C
41.28-44.45	1.625-1.750	PT1625/6	PT1625/9	PT1625/12	ST1625	L1064B	1075C
44.45-47.63	1.750-1.875	PT1750/6	PT1750/9	PT1750/12	ST1750		
Stone Type for Open Hole		F1	F1	F1			
Open Hole Replacement Wedge		10931	10935	10939			
Stone Type for Blind Hole		F2	F2	F2			
Blind Hole Replacement Wedge		10932	10936	10940			

Range		Short Series	Long Series	Extra Long Series	Truing Sleeves	Shoes	
Metric	Inch					Brass	Cast Iron
47.63-50.80	1.875-2.000	PT1875/6	PT1875/9	PT1875/12	ST1875	L1065B	L1076C
50.80-53.98	2.000-2.125	PT2000/6	PT2000/9	PT2000/12	ST2000		
53.98-57.15	2.125-2.250	PT2125/6	PT2125/9	PT2125/12	ST2125	L1066B	L1077C
57.15-60.33	2.250-2.375	PT2250/6	PT2250/9	PT2250/12	ST2250		
60.33-63.50	2.375-2.500	PT2375/6	PT2375/9	PT2375/12	ST2375		
63.50-66.68	2.500-2.625	PT2500/6	PT2500/9	PT2500/12	ST2500		
Stone Type for Open Hole		F1	F1	F1			
Open Hole Replacement Wedge		10933	10937	10941			
Stone Type for Blind Hole		F2	F2	F2			
Blind Hole Replacement Wedge		10934	10938	10942			

IMPORTANT:
Cast iron shoes must be machined to the same diameter as the bore to be honed before use.

Wedge Lift Angle	F1 = 11°	F2 = 22°
------------------	----------	----------

Stone Selection - see page 5 for full range of abrasive types available

PT---/12 mandrels are supplied to order only

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

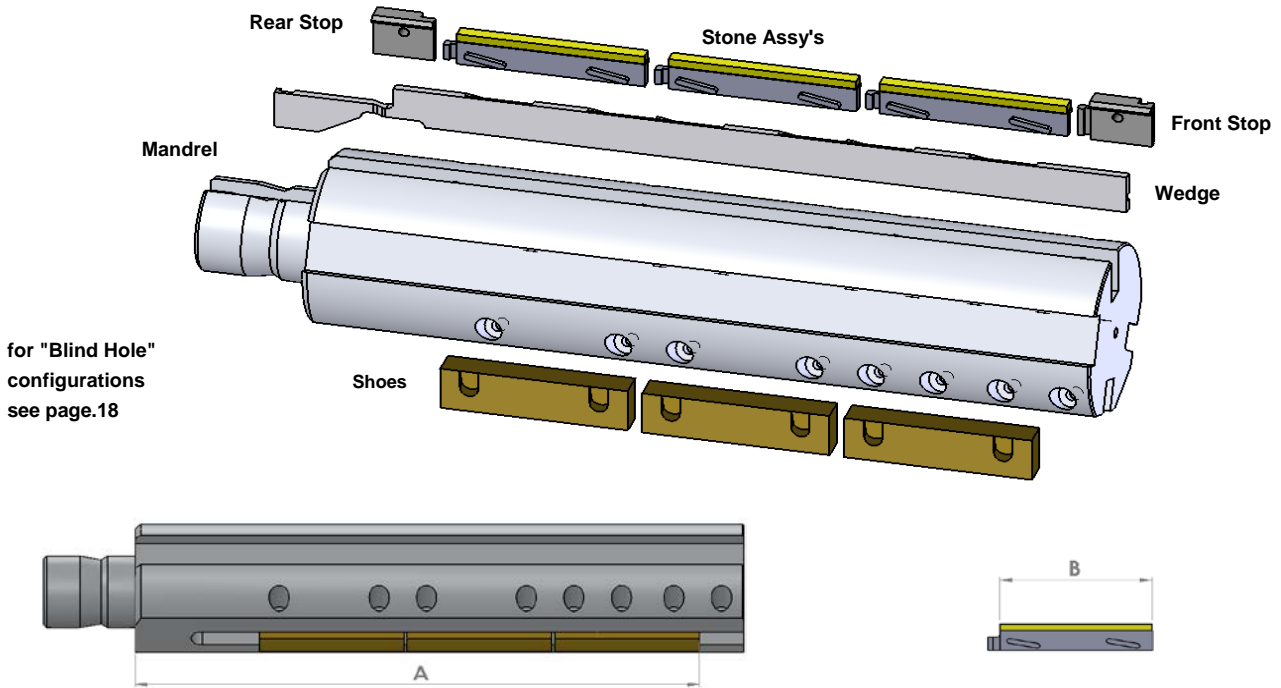
1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length

!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

PERMANENT TYPE MANDRELS (PT)
 Diameter Range 66.68 - 79.37 (2.625 - 3.125")

F1 / F2
 Open / Blind Hole

Truing sleeve not shown



Mandrel Type	Series	Open Hole	
		Length A	Stone B
Extra Long (3 stones)	PT2625/12 - PT3000/12	322mm (12.68")	3 x 82.5mm (3.25")

Range		Mandrel (includes Wedge)	Truing Sleeves	Shoes	
mm	Inch			Brass	Cast Iron
66.68-69.85	2.625-2.750	PT2625/12	ST2625	1705101	MT55630
69.85-73.03	2.750-2.875	PT2750/12	ST2750		
73.03-76.20	2.875-3.000	PT2875/12	ST2875		
76.20-79.37	3.000-3.125	PT3000/12	ST3000		
Stone Type for Open Hole		F1			
Open Hole Replacement Wedge		10943			
Stone Type for Blind Hole		F2			
Blind Hole Replacement Wedge		10944			

Wedge Lift Angle	F1 = 11°	F2 = 22°
------------------	----------	----------

Stone Selection - see page 5 for full range of abrasive types available

PT---/12 mandrels are supplied to order only

IMPORTANT:

Shoes must be machined to the same diameter as the bore to be honed before use.

Where there is a choice of mandrels available for a specific diameter follow the following guidelines:

1. Always use the shortest mandrel commensurate with the bore length to be honed.
2. For bores that require straightness or correction of bend use mandrels with the longest stone length

!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

PERMANENT TYPE MANDRELS (PT)

Diameter Range 25.4 - 79.37 (1.000 - 3.125")

F2
Blind Hole

Mandrel Type	Series	Blind Hole	
		Length A	Stone B
Short (1 stone)	PT1000/6 - PT2500/6	180mm (7.09")	82.5mm (3.25")
Long (1 stone)	PT1000/9 - PT2500/9	265mm (10.44")	82.5mm (3.25")
Extra Long (2 stones)	PT1000/12 - PT3000/12	350mm (13.79")	192mm (7.56")

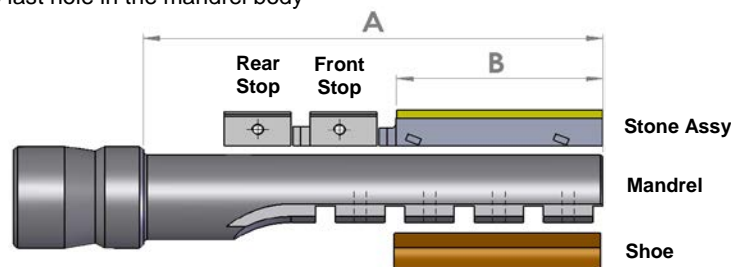
for "Open Hole" configuration see pages 16/17

This range of mandrels can be converted for blind hole use as follows:

PT /6 Series

Change the expansion wedge and stoneholder type and reposition the replaceable shoe, front and rear stops.

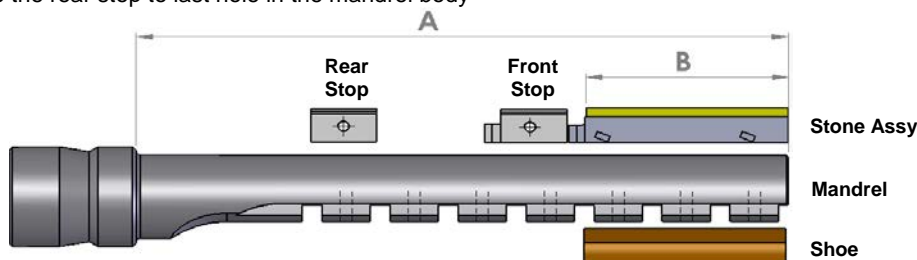
1. Use F2 type stoneholders instead of F1
2. Move guide shoe forwards flush with the end of the mandrel
3. Move front stop from the first hole to the second hole in the mandrel body
4. Move the rear stop to last hole in the mandrel body



PT /9 Series

Change the expansion wedge and stoneholder type and reposition the replaceable shoe, front and rear stops.

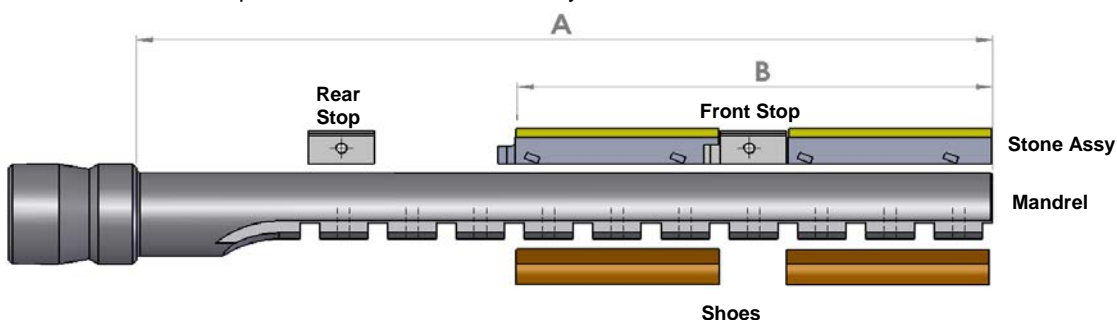
1. Use F2 type stoneholders instead of F1
2. Move first guide shoe forwards flush with the end of the mandrel
3. Remove the second guide shoe
4. Move front stop from the first hole to the second hole in the mandrel body
5. Move the rear stop to last hole in the mandrel body



PT /12 Series

Change the expansion wedge and stoneholder type and by repositioning the replaceable shoe and front and rear stops.

1. Use F2 type stoneholders instead of F1
2. Move first guide shoe forwards flush with the end of the mandrel
3. If one stone only is being used remove the remaining guide shoes, but if two stones are being used remove the last guide shoe only.
4. Move front stop from the first hole to the second hole in the mandrel body
5. Move the rear stop to last hole in the mandrel body

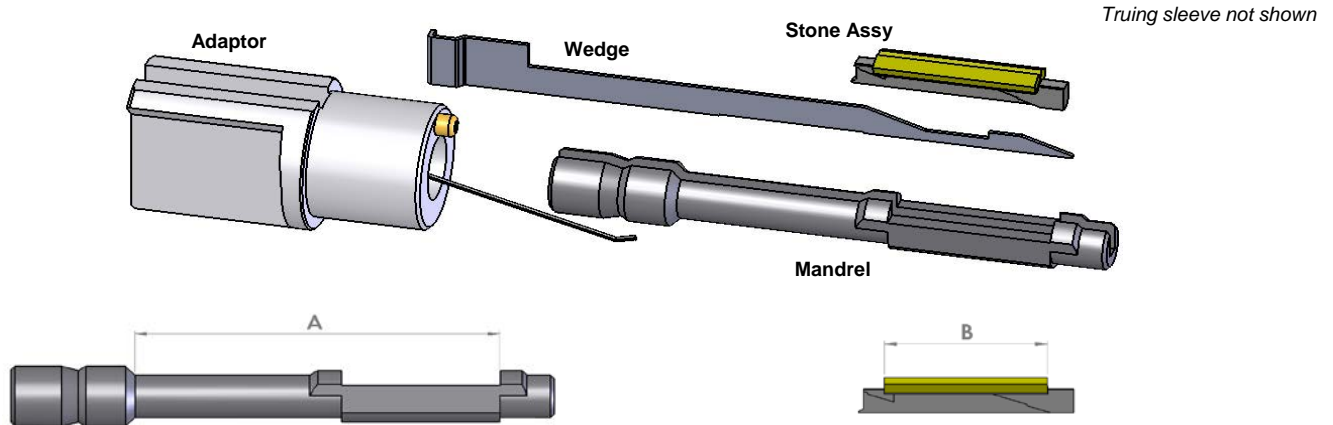


HARD STEEL KEYWAY MANDRELS (HSK)

Diameter Range 6.22 - 25.91 (0.245 - 1.020")

K1 - K10

Use for honing bores containing annular grooves, cross holes, cut outs etc, use keyway type mandrels. The extra stone width reduces the tendency for the stone to cut faster around these areas.



Mandrel Type	Length A	Stone B
HSK245/3 - HSK355/3	75mm (2.95")	22.2mm (.875")
HSK365/3 - HSK460/3	87mm (3.42")	31.7mm (1.25")
HSK490/4 - HSK990/4	101mm (3.97")	44.4mm (1.75")



Note:
2 sticks per stoneholder

Range		Short Series	Truing Sleeves	Stone Type	Replacement Wedge	Adaptor	ISO Keyway
mm	Inch						
6.22-6.60	0.245-0.260	HSK245/3K1	ST245	K1	10919	MA156/3	3.18mm (0.125")
6.60-6.99	0.260-0.275	HSK260/3K1	ST260				
6.99-7.37	0.275-0.290	HSK275/3K1	ST275				
7.37-7.75	0.290-0.305	HSK290/3K1	ST290				
7.75-8.26	0.305-0.325	HSK305/3K1	ST305				
8.26-8.51	0.325-0.335	HSK325/3K1	ST325				
8.51-9.017	0.335-0.355	HSK335/3K1	ST335				
9.017-9.27	0.355-0.365	HSK355/3K1	ST355	K2	10920	MA156/4	3.96mm (0.156")
9.27-9.65	0.365-0.380	HSK365/3K2	ST365				
9.65-10.03	0.380-0.395	HSK380/3K3	ST380	K3	10921	MA156/5	4.76mm (0.1875")
10.03-10.41	0.395-0.410	HSK395/3K3	ST395				
10.41-10.80	0.410-0.425	HSK410/3K3	ST410				
10.80-11.18	0.425-0.440	HSK425/3K3	ST425				
11.18-11.68	0.440-0.460	HSK440/3K3	ST440				
11.68-12.45	0.460-0.490	HSK460/3K3	ST460				
12.45-13.21	0.490-0.520	HSK490/4K4	ST490				
13.21-13.97	0.520-0.550	HSK520/4K4	ST520	K4	10921	MA156/6	6.35mm (0.25")
13.97-14.73	0.550-0.580	HSK550/4K5	ST550				
14.73-15.62	0.580-0.615	HSK580/4K5	ST580	K5	10921	MA156/6	6.35mm (0.25")
15.62-16.38	0.615-0.645	HSK615/4K6	ST615				
16.38-17.15	0.645-0.675	HSK645/4K6	ST645	K6	10921	MA156/6	6.35mm (0.25")
17.15-17.91	0.675-0.705	HSK675/4K6	ST675				
17.91-18.80	0.705-0.740	HSK705/4K7	ST705	K7	10921	MA156/6	6.35mm (0.25")
18.80-19.56	0.740-0.770	HSK740/4K7	ST740				
19.56-20.32	0.770-0.800	HSK770/4K8	ST770	K8	10921	MA156/6	6.35mm (0.25")
20.32-21.08	0.800-0.830	HSK800/4K8	ST800				
21.08-21.97	0.830-0.865	HSK830/4K9	ST830	K9	10921	MA156/18	6.35mm (0.25")
21.97-22.73	0.865-0.895	HSK865/4K9	ST865				
22.73-23.49	0.895-0.925	HSK895/4K9	ST895				
23.49-24.25	0.925-0.955	HSK925/4K9	ST925				
24.25-25.14	0.955-0.990	HSK955/4K9	ST955				
25.14-25.91	0.990-1.020	HSK990/4K10	ST990				

Wedge Lift Angle	K1 = 5°	K2 - K10 = 18°
------------------	---------	----------------

Stone Selection - see page 5 for full range of abrasive types available

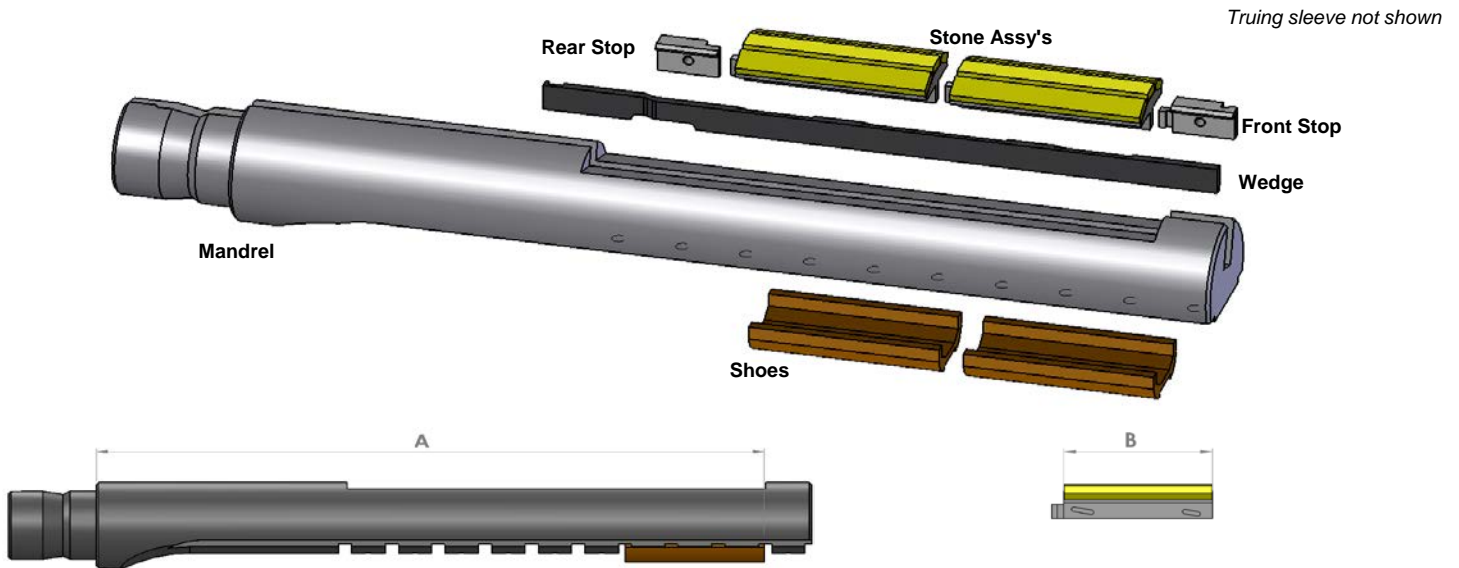
!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

PERMANENT TYPE KEYWAY MANDRELS (PTK)

K11 - K15

Diameter Range 25.4 - 66.68 (1.000 - 2.625")

Use for honing bores containing annular grooves, cross holes, cut outs etc, use keyway type mandrels. The extra stone width reduces the tendency for the stone to cut faster around these areas.



Mandrel Type	Length A	Stone B
PTK1000/6 - PTK2500/6	152mm (6")	1 x 82.5mm (3.25")
PTK1000/9 - PTK2500/9	237mm (9.34")	2 x 82.5mm (3.25")
PTK1000/12 - PTK2500/12	322mm (12.69")	3 x 82.5mm (3.25")

Note:
 K11 = 2 sticks per stoneholder
 K12 - K16 = 3 sticks per stoneholder



Range		Short Series	Long Series	Extra Long Series	Truing Sleeves	Stone Type	Cast Iron Shoes	ISO Keyway
mm	Inch							
25.40-28.57	1.000-1.125	PTK1000/6	PTK1000/9	PTK1000/12	ST1000	K11	L1070C	10mm
28.57-31.75	1.125-1.250	PTK1125/6	PTK1125/9	PTK1125/12	ST1125		L1071C	
31.75-34.93	1.250-1.375	PTK1250/6	PTK1250/9	PTK1250/12	ST1250		L1072C	
34.93-38.10	1.375-1.500	PTK1375/6	PTK1375/9	PTK1375/12	ST1375		L1073C	
38.10-41.28	1.500-1.625	PTK1500/6	PTK1500/9	PTK1500/12	ST1500	K12	L1074C	12mm
41.28-44.45	1.625-1.750	PTK1625/6	PTK1625/9	PTK1625/12	ST1625		L1075C	
44.45-47.63	1.750-1.875	PTK1750/6	PTK1750/9	PTK1750/12	ST1750			
Replacement Wedge		1094500	1094600	1094700				

Range		Short Series	Long Series	Extra Long Series	Truing Sleeves	Stone Type	Cast Iron Shoes	ISO Keyway
Metric	Inch							
47.63-50.80	1.875-2.000	PTK1875/6	PTK1875/9	PTK1875/12	ST1875	K13	L1076C	14mm
50.80-53.98	2.000-2.125	PTK2000/6	PTK2000/9	PTK2000/12	ST2000	K14		L1077C
53.98-57.15	2.125-2.250	PTK2125/6	PTK2125/9	PTK2125/12	ST2125		K15	
57.15-60.33	2.250-2.375	PTK2250/6	PTK2250/9	PTK2250/12	ST2250			
60.33-63.50	2.375-2.500	PTK2375/6	PTK2375/9	PTK2375/12	ST2375			
63.50-66.68	2.500-2.625	PTK2500/6	PTK2500/9	PTK2500/12	ST2500			
Replacement Wedge		1094800	1094900	1095000				

Wedge Lift Angle	11°
------------------	-----

Stone Selection - see page 5 for full range of abrasive types available

PTK---/12 mandrels are supplied to order only

IMPORTANT:

Shoes must be machined to the same diameter as the bore to be honed before use.

!! REMEMBER - ALWAYS TRUE IN EACH NEW STONE BEFORE USE !!

GHA TOOLS

Multi stone honing tools using Delapena vertical stone sets

Delapena vertical tooling heads have been adapted to be used on horizontal honing machines. This gives the user an alternative honing option on smaller diameters (25-79mm) and capability to hone bores above the range of the Delapena mandrel tooling (>79mm).

Tool heads use standard vertical tooling stones sets (see Vertical Tooling Catalogue).



Midget - GHA-281

Diameter Range 25.4 - 38.1mm (1.00 - 1.50")

Head locates in the spindle nose and the linear feed mechanism expands the stones.

Stone types (see Delapena vertical tooling catalogue);

26	Ø25.4 - 31.7mm (1.00 - 1.25")
27	Ø31.7 - 38.1mm (1.25 - 1.50")



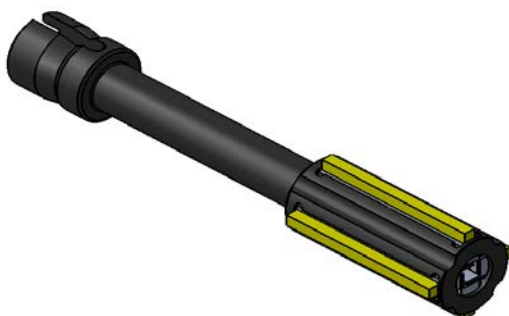
Minor - GHA-283

Diameter Range 38.1 - 55.8mm (1.50 - 2.20")

Head locates in the spindle nose and the linear feed mechanism expands the stones.

Stone types (see Delapena vertical tooling catalogue);

28	Ø38.1 - 44.4mm (1.50 - 1.75")
29	Ø44.4 - 50.8mm (1.75 - 2.00")



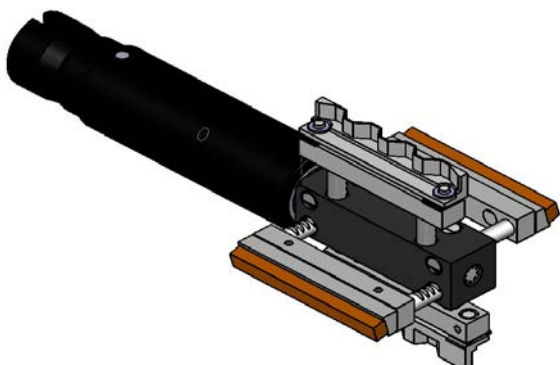
Junior - GHA-285

Diameter Range 50.8 - 68.3mm (2.00 - 2.69")

Head locates in the spindle nose and the linear feed mechanism expands the stones.

Stone types (see Delapena vertical tooling catalogue);

T	Ø50.8 - 55.8mm (2.00 - 2.20")
U	Ø55.8 - 60.9mm (2.20 - 2.40")



Standard - GHA-287

Diameter Range > 65.0mm - (>2.56") #

Head locates in the spindle nose and the linear feed mechanism is converted via a helical adaptor to rotational feed movement in the hone head to expand the stones. When fitting new stone sets the square hone body must be removed from the assembly.

Stone types (see Delapena vertical tooling catalogue);

G	Ø65.0 - 99.0mm (2.56 - 3.90")
M	Ø68.0 - 107.0mm (2.68 - 4.21")

Please note that the maximum honing diameter will depend on the application. Please contact Delapena for advice.

SPECIAL DESIGN TOOLS

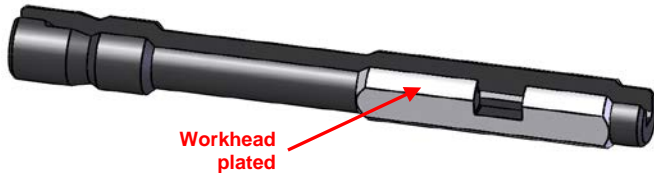
All mandrels in this catalogue can be supplied to suit individual customer requirements such as increased length and coatings. As well as mandrel variants, other types of tools can be supplied, such as multi stone tools. These can also be adapted to fit any honing system.

All special tools are made to order. Please contact Delapena for advice and details of your requirements.

Below are some examples of special tools:

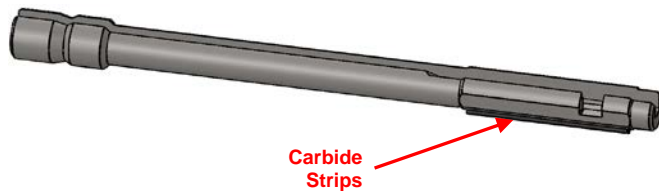
Chrome plated Mandrels

All HS type mandrels within the range $\text{Ø}3.05 - 25.91\text{mm}$ can be supplied with the workhead hard chrome plated for increased strength and wear resistance.



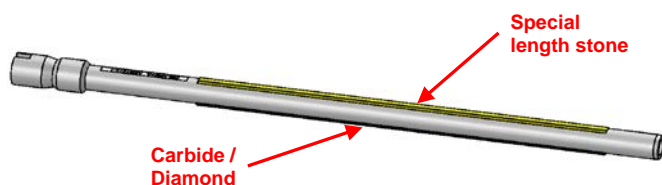
Carbide backed Mandrels

All HS type mandrels within the range $\text{Ø}6.22 - 25.91\text{mm}$ and bronze and cast iron mandrel guide shoes can be supplied with carbide guides for wear resistance. The carbide strips are glued in position and ground to the appropriate diameter.



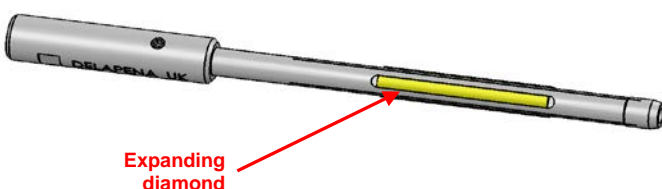
Special Single Stone Mandrels

Designed for special applications such as correction of bend and when standard long series do not offer sufficient stone length. These tubular mandrels can be made for bores over $\text{Ø}3.05\text{mm}$, have limited stone expansion and the mandrel workhead is hard chrome plated or has carbide guides for wear resistance, depending on diameter.



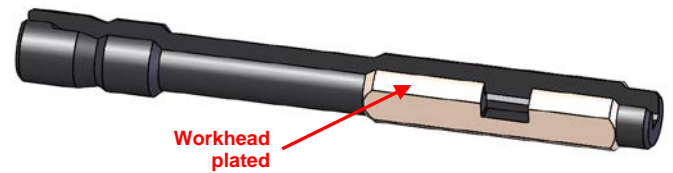
Expanding Diamond Hones

A range of cone expanded diamond honing tools available for bores within the range $\text{Ø}2.0 - \#\#\text{mm}$. These tools can be used with any suitable power source in conjunction with the corresponding micrometer adjustment device and with Delapena honing machines with an appropriate adaptor.



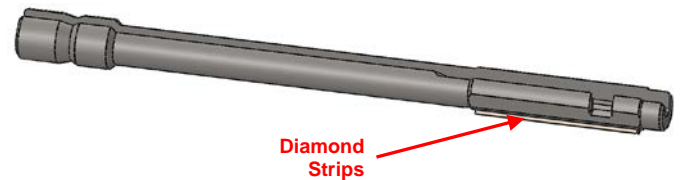
Diamond plated Mandrels

All HS type mandrels within the range $\text{Ø}3.05 - 25.91\text{mm}$ can be supplied with the workhead diamond plated for increased strength and wear resistance.



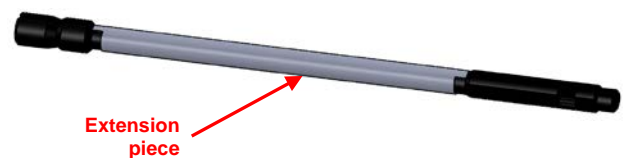
Diamond backed Mandrels

All HS type mandrels within the range $\text{Ø}6.22 - 25.91\text{mm}$ and bronze and cast iron mandrel guide shoes can be supplied with diamond guides for wear resistance. The diamond strips are glued in position and ground to the appropriate diameter.



Extended length Mandrels

All mandrels within the range $\text{Ø}10.0 - 25.91\text{mm}$ can be supplied with extended lengths. The extension is achieved by cutting and sleeving the mandrel shank to achieve the required length. Typical applications include extruder barrel and gun barrel honing.

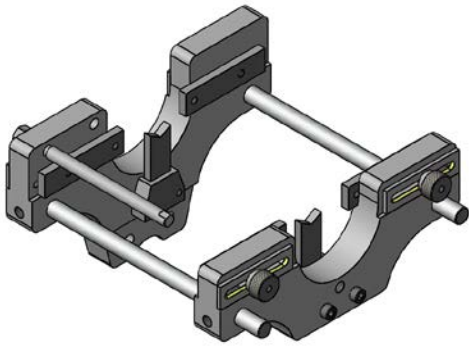


Multi Stone Honing Tools

These cone expanded tools are designed for specific components are generally used for production honing. Available for bores from $\text{Ø}4.0\text{mm}$ these tools can be supplied with 3,4,5, 6 or 8 compact super abrasive hones (depending on diameter). Tools can be designed to fit any honing chuck system and have "spring return" or "positive retract" cone systems.



ACCESSORIES - 1

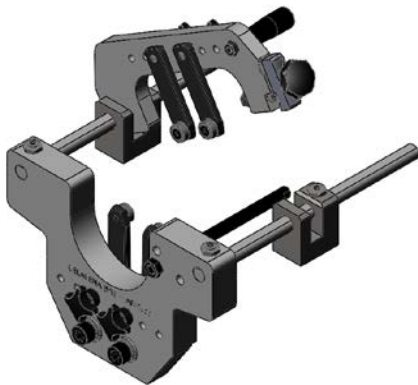


1810 / 1821 Universal Fixtures

The universal fixture takes the linear thrust from the reciprocating carriage. It can accept cylindrical components up to 112mm diameter and 190mm length with bore diameters up to 63mm. The component weight is supported entirely by the mandrel. This fixture is NOT recommended for automatic honing with mandrels below 3.05mm diameter.

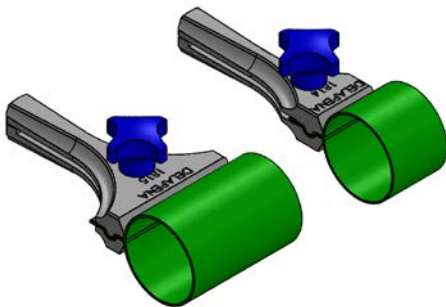
1810 - EA, EAS and E2000S

1821 - E1000S



1826 Hinged Stroking Fixture

The hinged fixture is an alternative to the standard universal fixtures. It can accommodate components as the universal fixtures but has a hinged plate for easy load / unload of parts. It allows the component to be removed whilst it is on the honing mandrel. Includes three pairs of fingers with longwearing, adjustable carbide pads, one pair mounted on an extension piece allowing the honing of two parts in line (not shown).



1813 - 1815 Loop Grip Holders

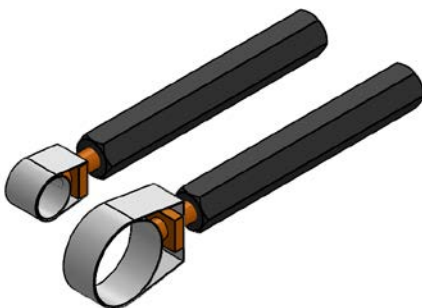
A range of heavy-duty holders used to prevent rotation of the Workpiece when using the above fixtures or honing manually. A webbing loop is placed around the component and held secure by tightening a thumb screw.

Available in three sizes

1813 = 19mm wide

1814 = 38mm wide

1815 = 75mm wide



1850 - 1858 Hone Grip Holders

A range of holders used to prevent rotation of the Workpiece when using the above fixtures or honing manually. A loop is placed around the component and held secure by tightening a thumb screw.

1850 = No.10 - Ø7.9 - 9.5mm

1855 = No.21 - Ø16.7 - 20.4mm

1851 = No.12 - Ø9.3 - 11.9mm

1856 = No.22 - Ø18.7 - 22.2mm

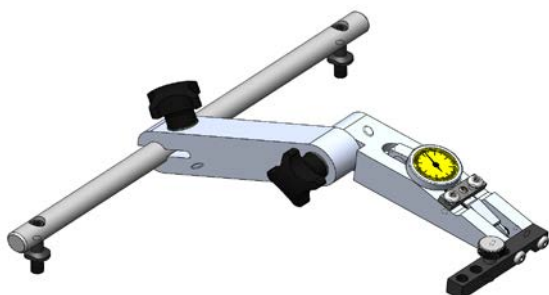
1852 = No.14 - Ø10.0 - 13.7mm

1857 = No.25 - Ø22.0 - 23.7mm

1853 = No.17 - Ø12.5 - 16.2mm

1858 = No.27 - Ø21.5 - 25.4mm

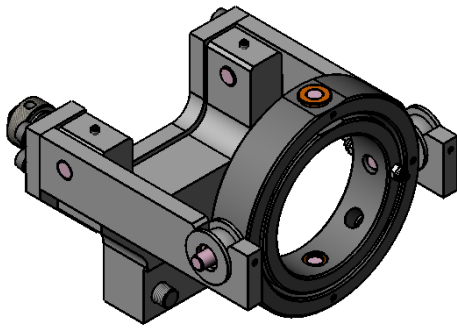
1854 = No.19 - Ø15.3 - 19.0mm



1840 Alignment Gauge Assembly

Unit used for ensuring the component runs concentrically when mounted on the honing mandrel. This is a requirement when using the Delapena multi plain chuck.

ACCESSORIES - 2



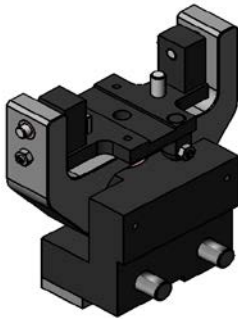
1806 Basic Die Honing Fixture

Suitable for large bodied, small bore components. The fixture comprises of two fully floating workholders to take cylindrical components up to 76mm (3") diameter and 125mm (5") long. The workholders are located into a base unit which incorporates a spring counterbalance to counteract the weight of the component.

Gimbal Ring Sizes:

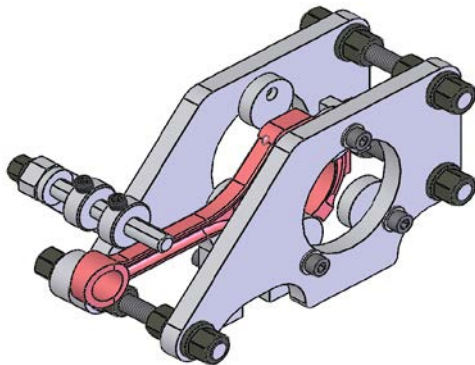
1807 = 50mm capacity

1808 = 75mm capacity



1809 Floating Gimbal Fixture

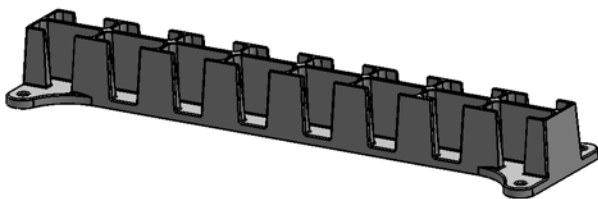
Designed for small, lightweight components that are not suited to the 1810 universal fixture. The fixture has a fully floating platform onto which component holding sub-fixtures are located. Designed with a weight compensating mechanism this fixture is ideal for automatic honing of bores below 3.05mm diameter.



SF45009 Connecting Rod Fixture

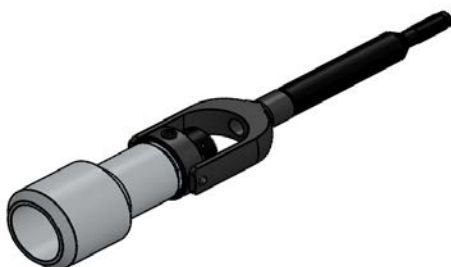
An adjustable fixture to suit a wide range of connecting rods sizes. The fixture ensures squareness of face to bore and can be used for both big and small ends.

The basic fixture design can also be supplied to suit a specific rod size which is particularly suited for large volume work.



SL29 Mandrel Rack

Designed to accommodate sixteen complete honing units for bores up to 25.4mm the Delapena Mandrel Rack is an invaluable accessory enabling the operator to keep assembled honing units readily available.



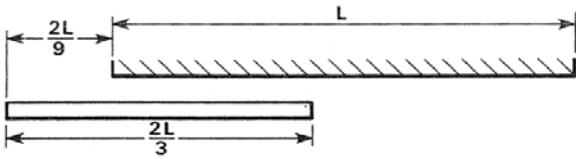
CG100 Mandrel Adaptor

A simple adaptor for use with any external power source such as portable drill, pillar drill, radial arm drill etc. The CG100 will accept all mandrels from $\text{Ø}10 - 79\text{mm}$ and is used when it is not practical to use the hand operated horizontal honing machine. The mandrel is expanded/retracted by turning the knurled knob.

TECHNICAL INFORMATION - 1

Ideal Stone Length

The relationship between the length of the bore, honing stone and stroke length have a direct effect on the parallelism of the honed hole.



If the bore length is L then the stone length should not exceed $\frac{2L}{3}$. To produce a parallel hole the stone must pass out of each end of the bore by one third of its own length. The tool offering the longest stone in accordance with this formula should always be used.

Stack Honing

When the bore length is much shorter than the diameter (over square) then consideration should be given to stacking several parts together to create a suitable honing length.

Stone Dressing (Truing)

Each new stone should be dressed parallel with the tool to prevent shape errors being introduced into the bore.

This operation should be performed DRY at relatively low speed and light pressure.

Ideally the truing sleeve should be the same diameter as the bore to be honed.

Never use a truing sleeve when its diameter exceeds the maximum range of the tool being dressed in.

Wedge Wear

Because of the very nature of the honing process wedges are subject to wear which causes loss of accuracy and performance.

Wedges should be inspected prior to use and replaced when worn or damaged.

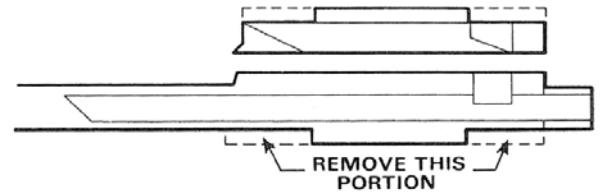
Modifying Mandrels & Stones

Sometimes it is necessary to shorten the stone length to achieve specific requirements.

Generally both the stone and the mandrel workhead should be shortened the same amount.

Short Open Bores

When the bore length is short and stack honing is not possible the stone and mandrel workhead should be reduced at each end to leave a central section $1\frac{1}{2}$ the bore length.



Blind Bores

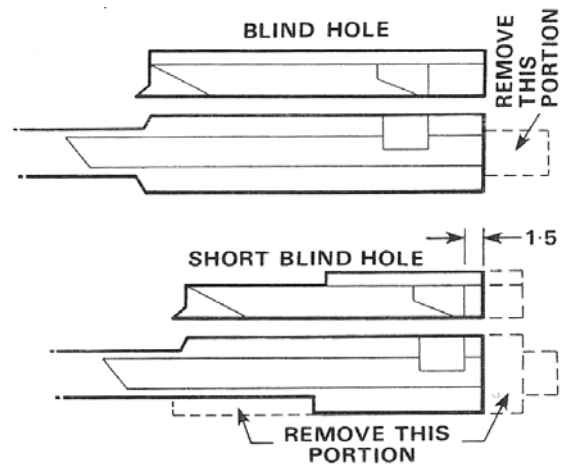
The range of "CCS" mandrels are NOT suitable for blind hole use.

SS, HS, B & PT ~ $\varnothing 3.05 - 25.4\text{mm}$ (0.12"-1.02")

The range of mandrels listed in this catalogue can be converted for blind hole use as follows;

1. Remove pilot end so that end of stone is flush with end of mandrel.
2. If necessary reduce the stone and mandrel workhead length to $\frac{2}{3}$ of the bore length and that at least $\frac{1}{2}$ the stone length is behind the front lift point to prevent tipping.

Note, when honing short blind bores, it may be necessary to modify the stoneholder as well as the mandrel to ensure that at least half the stone length is behind the front lift point.



PT ~ $\varnothing 25.4 - 79.37\text{mm}$ (1.0"-3.125")

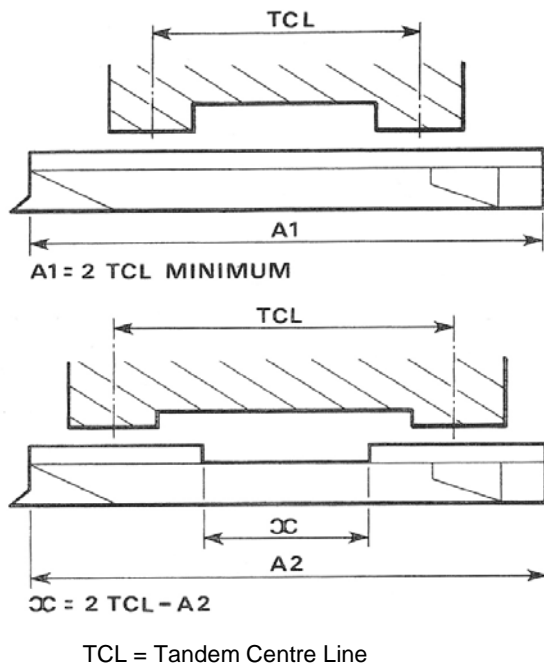
For details on converting PT mandrels for "Blind Hole" use refer to page 15.

TECHNICAL INFORMATION - 2

Tandem Bores

When honing tandem bores the stone should be of sufficient length to ensure that the entire stone surface contacts one or other of the tandem bores during the honing stroke and to achieve this the stone length must be at least twice the center distance of the tandem bores.

If the stone is less than twice the tandem center distance then the center portion of the stone must be removed, the amount being equal to amount that the stone length is than twice the center distance of the tandem bores.



Keyway Bores

It is essential that keyway tooling is dressed to the exact bore diameter to be honed.

Keyway mandrels must have a full form on both the stone and mandrel workhead to prevent the tool from jamming in the slot.

All PTK mandrels are fitted with cast iron shoes that must be machined to the correct diameter before use.

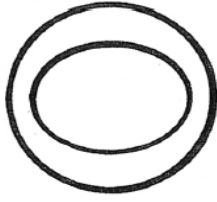
Special stone platforms for use with the 1208 Standard head can be made to hone bores from $\text{Ø}75.00\text{mm}$

Replacement Shoes

All PT mandrels are fitted with bronze shoes as standard and are ready for immediate use.

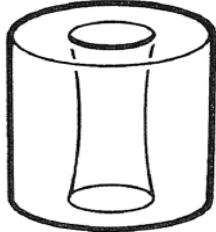
PTK mandrels are fitted with cast iron shoes that must be machined to the correct diameter before use.

All mandrels above $\text{Ø}28.00\text{mm}$ are supplied with packing strips that should be placed between the mandrel body and shoe if the diameter to be honed is in the upper half of the range of the mandrel.



Oval Bores

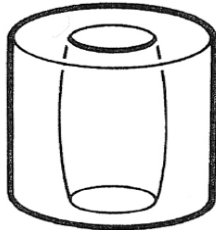
Ensure the tool is the correct size for the bore to be honed. Thoroughly true in the stones, preferably to the exact bore diameter. If the part to be honed is thin walled, reduce the cutting pressure. If the stone stops cutting at reduced pressure, use a softer stone. For bores containing cut outs, large cross holes etc. use keyway type tooling.



Bellmouthed Bores

Thoroughly true in the stones, preferably to the exact bore diameter. Reduce the stroke length and use tool with shorter stone length if available.

If the bore length is less than 50% of the stone length reduce the stone length to 1½ times the bore length. If bell mouth persists continue to shorten stone or use a softer stone. Over correction will cause barreling.



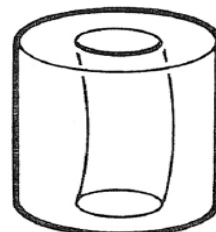
Barrelled Bores

Thoroughly true in the stones, preferably to the exact bore diameter. Increase stroke length and use tool with longer stone length if available. If barreling persists shorten stone at both ends. Over correction will cause bell mouthing.



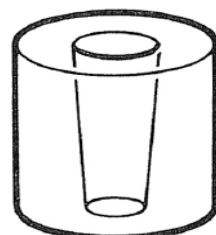
Combined Bellmouthed / Barrel Bores

Typical in bores containing many cross holes, e.g. valve spool. Shorten stone length AND increase stroke length. If problem persists use softer stone



Rainbow Bores (& Waviness)

Use long series tooling. Stone length should be at least 1 1/2 times the bore length. Correction of bent bores may result in bellmouthing. When bend has been corrected any bellmouthing can be corrected as described above.



Tapered Bores

Thoroughly true in the stones, preferably to the exact bore diameter. When honing manually reverse the component frequently. When honing automatically adjust stroke position to allow more stone to pass through the tight end of the bore.

TROUBLE SHOOTING - 2

Taper in Blind Bores

Thoroughly true in the stones, preferably to the exact bore diameter and reduce the stone length to 2/3 bore length.

If the bore has insufficient or no relief at the blind end use short stone first to hone bottom of the bore. Use stone with hard tip. Ensure adequate supply of honing to blind bore.

Bent Bores

Use longest stone length available. Stone length should be at least 1½ times bore length.

Correction of bent bores may result in bell mouthing. When bend has been corrected any bell mouth can be corrected as described above.

Taper in Blind Bores

Thoroughly true in the stones, preferably to the exact bore diameter and reduce the stone length to 2/3 bore length.

If the bore has insufficient or no relief at the blind end use short stone first to hone bottom of the bore. Use stone with hard tip. Ensure adequate supply of honing to blind bore.

Stone Glazed

Stone does not cut
Open surface of stone with dressing stick
Increase stroking speed
Reduce rotation speed
Increase pressure
Use softer stone

Slow Stock Removal

If slow stock removal is not the result of stone glazed or loaded
Increase rotation speed
Increase pressure
Use softer stone
Use coarser stone

Pick Up

Reduce pressure
Reduce rotation speed
Use softer stone
Use finer stone
Change HS type mandrel to bronze or PT type
Ensure good flow of honing fluid
Check quality of honing fluid

Finish Too Fine

Open surface of stone with dressing stick
Increase stroking speed
Reduce rotation speed
Increase pressure
Use coarser stone
Use softer stone

Stone Loaded

Stone surface becomes clogged with material
Clean stone surface with dressing stick
Increase stroking speed
Use softer stone
Use coarser stone

Excessive Stone Wear

Reduce pressure
Increase rotation speed
Use harder stone
Use finer stone

Finish Too Rough

Thoroughly dress stone and shoe preferably to exact bore diameter
Increase rotation speed
Reduce pressure
Use finer stone
Change HS type mandrel to bronze or PT type
Check quality of honing fluid