

Precision Honing Mandrels and Accessories



MANDRELS AND ACCESSORIES

PRECISION HONING EQUIPMENT

RANGE 1.14mm – 79.37mm

A SELECTION CATALOGUE
from DELAPENA
THE HONING SPECIALISTS

DELAPENA HONING EQUIPMENT LTD

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Delapena – the Company

The Delapena factory is situated at Cheltenham, Gloucestershire, England and occupies over 1,700 square metres. Delapena's wide range of honing machines and associated accessories are all manufactured at this factory.

Delapena and honing

It is now half a century since Delapena entered the honing field. Since then the technique has developed from a simple method of producing good surface finish and geometry in bores to a versatile and flexible process with a very wide variety of applications.

These developments have resulted in the Delapena honing process receiving world wide acceptance from all types of industry. Not only as a method of producing bores to extremely close tolerances coupled with consistent surface finishes, but as an economical stock removal process.

Delapena – the equipment

This catalogue contains details of the full range of Delapena mandrels and accessories available for use with the range of small horizontal honing machines manufactured by Delapena.

Although the design and performance of the honing machines has been improved and advanced over the years Delapena have always retained the same method of mandrel location thus ensuring that the comprehensive range of mandrels listed can be used with every model of horizontal honing machine manufactured by Delapena Honing Equipment.

Most items of tooling listed in the catalogue are available off the shelf. Details of discontinued and non standard mandrels available on request.

Delapena – Marketing & Sales – Worldwide

Delapena is the major supplier of Honing Equipment in the United Kingdom. A high proportion of the production from the Cheltenham Plant is exported throughout the world where the Company maintains an International network of Agents. The Agents responsible maintain stocks of tooling and, in some cases, machines to ensure efficient service to customers.

A condition of appointment of Agents is that their salesmen and engineers are fully trained at Delapena in the correct use of the equipment.

Delapena – R & D

One of Delapena's most valuable contributions to honing is the flow of information which issues from the Delapena Works in Cheltenham.

The investigation of potential applications is an essential part of the Delapena source. Detailed reports and recommendations are issued without cost or obligation and include data on surface finishes, cycle times and recommendations on the best equipment for the job.

Over the years there has scarcely been an important innovation in the development of the honing process related to bores in which Delapena has not been involved.

Application training

Delapena regularly run a variety of Training Courses for customers at low cost. These cover all user requirements whether Manager – Supervision or operators. Details of these will be gladly given on application directly to Head Office or via Agents.

Exhibitions

Delapena regularly exhibit their extensive range of Machines and accessories at major exhibitions throughout the world.

Each individual Honing Unit consist of the Adaptor(s) Mandrel, Wedge, Honing Stone and Truing Sleeve.

Adaptors

The range of Mandrel Adaptors available enables Mandrels of widely varied shank diameters to be fitted into the spindle nose of any Delapena Horizontal Honing machine.

Collet Adaptor

For use with the range of CCS mandrels 1.14 – 3.05mm (.045 – .120") and is used in conjunction with the MA 156/4A adaptor.

Mandrels

See page 7 – Mandrel Design.

Wedge

Wedges must be ordered separately for all CCS mandrels. All other Delapena Mandrels are supplied complete with wedge. Blind hole wedges can be supplied for all mandrels above 3.05mm (.120") diameter. Hardened steel wedges are available on request. See page 31 – Replacement wedges.

Honing Stones

See pages 8 – 11 Honing Stone Coding:–
Guide to Stone Selection.
Stone Selection Chart.
Diamond & CBN Borazon Stones.

Truing Sleeve

Manufactured from high grade close grained cast iron. Delapena truing sleeves are used DRY to true in all new stones and to maintain the accuracy of stones in use. The truing sleeve indicates when the honing stone requires dressing. Refer to Technical Information – Stone Dressing.

CCS Type Range 1.14 – 3.05mm (.045 – .120")

A range of collet located mandrels of tubular design for use with the 1651 collet adaptor. The fully circular mandrel workhead is chrome plated for increased life. Used in conjunction with wire wedges which must be ordered separately. CCS mandrels are NOT suitable for blind hole use.

HS Type Range 3.05 – 25.91mm (.120 – 1.020")

A range of through hardened mandrels made from special alloy steel. Mandrels up to 6.22mm (.245") diameter have fully circular workheads. Above 6.22mm (.245") diameter the unique design of the mandrel workhead, having assymetrically spaced contact points, ensures rapid correction of errors in roundness. This design also incorporates leading edge stone expansion which eliminates chatter. Supplied complete with steel wedge and recommended for general use and essential when honing abrasive and hard materials.

Available with a choice of short and long series tooling lengths these mandrels can be adapted for blind hole use. (Refer Technical Information – Blind bores.)

B Type Range 3.05 - 15.62mm (.120 - .615")

A range of brass mandrels incorporating the same design features as the HS Type. These mandrels are particularly suitable for high class polishing operations. Above this range standard PT mandrels with brass shoes can be used.

SS Type Range 6.22 – 15.62mm (.245 – .615")

A range of soft steel mandrels made from free cutting EN1A and incorporating the same design features as above. Recommended for honing soft metals and such materials as stainless steel where difficulty is experienced in all machining operations. Also useful when high degrees of surface finish are required. Available in short series tooling length only. Contact Delapena for details of long series tooling. These mandrels can be adapted for blind hole use.

PT Type Range 15.62 – 79.37mm (.615 – 3.125")

A range of mandrels incorporating the same design features as the HS type but consisting of a permanent mandrel body and a replaceable bronze guide shoe. When the shoe is worn out it is simply removed and a new shoe fitted. Replacement shoes are available in a choice of materials (Refer Technical Information – Replacement Shoes).

Recommended for similar application to the SS type and for all holes over 25.40mm (1.00") diameter. Available in short and long series tooling lengths. Mandrels above 25.40mm (1.00") diameter are supplied for open hole work. If the mandrel is required for blind hole work this must be stated at the time of ordering. Blind hole wedges can be supplied separately.

Mandrels below 25.40mm (1.00") diameter can be adapted for blind hole use.

HSK Type Range 6.22 – 25.91mm (.245 – 1.020")

A range of through hardened mandrels designed specifically for honing bores containing standard I.S.O or B.S. Keyway slots. Based on the HS type design but incorporating two stones mounted side by side on a stoneholder giving an overall stone width approximately twice that of the Keyway. Available in short series tooling length only and NOT suitable for blind hole use.

PTK Type Range 25.40 – 66.68mm (1.00 – 2.625")

A range of permanent type mandrels incorporating the same design features as the HSK type, and fitted with replaceable cast iron shoes as standard which must be machined to the specific bore size to be honed. (Refer to Technical Information – Keyway Mandrels.)

Available in short, long and extra long series tooling lengths but NOT suitable for blind hole use.

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.

Mandrels above 13.97mm (.550") can be extended in length to suit special applications such as shotgun barrels, extrusion barrels etc..

Remember:- Always true in each new stone before use. The operation only takes a few minutes but can save time and money especially on production honing.

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.

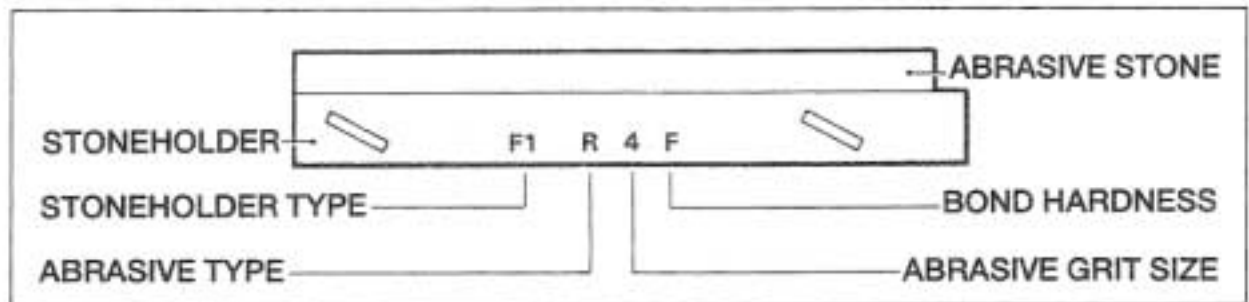
Many stock removal problems can be attributed to the incorrect grade of, or inadequately filtered supply of honing fluid. Use the correct type of honing fluid. Honing fluids should NOT be mixed or substituted by other fluids such as paraffin or cutting oils.

Delapena Extra – Honing Fluid

Developed for use with single and multi stone tools, using conventional abrasives, Diamond or C.B.N.

A wide range of materials can be honed, including carbide, hard and soft steels, bronze, aluminium and stainless steels.

Delapena Extra is non hazardous, PCB free and meets current legislation with regard to health and safety. It is light in colour and does not suffer the odour normally associated with honing oils.



Types of Abrasive

F = Silicon Carbide

A jagged, splinter like type of free cutting abrasive grit. Used on soft materials such as bronze, brass, aluminium and cast iron. Also on very hard materials such as carbon, ceramic, tough 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. Particularly useful on hard chrome materials and hardened steels above HRC 50.

SF = Impregnated Graphite

A range of superfinishing stones which will produce a high degree of surface finish on most materials.

OCO = Cork

A range of fine cork impregnated stones used for polishing especially stainless steels in conjunction with brass mandrels.

Stones that are suffixed 's' are sulphur treated. This treatment uses an extreme pressure lubricant which reduces the heat generated by the honing process. It assists the cutting action of the abrasive and helps to reduce clogging and loading and pick up in soft materials.

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

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 released.

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

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 for the operation and abrasive cost per component, therefore, choosing the correct grade of stone for individual honing applications is of prime importance.

Honing differs from other methods of bore sizing and finishing in that there are a large number of variable factors involved which all play an important part in obtaining optimum honing conditions. These variable factors are listed below:—

Determine choice of stone

- Type of material, hardness, special treatments – tuffriding, anodising etc..
- Bore Condition – taper, ovality, surface roughness prior to honing.
- Bore Characteristic – diameter to length ratio, annular grooves, cross holes, keyways, etc..
- Stock removal allowance and tolerance of this allowance.
- Desired surface finish (Are rough, finish, and polish operations necessary)?

Affect performance of stone

- Surface speed of the honing stone.
- Surface area of the honing stone.
- Stone pressure.
- Reciprocation speed.
- Type of honing fluid.

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

For example:—A long bore component will require a softer grade of stone than a short bore of the same material.

A bore containing cross holes will require a harder grade of stone than a plain bore of the same material.

Delapena have, however, compiled a comprehensive selection chart based on many years experience in all aspects of honing. The stone recommendations are based on average results obtained from trials on materials in each group. See page 10.

The diameter ranges have been conveniently grouped to coincide with each complete range of Delapena Stoneholder references for ease of selection.

The deburring stone is the hardest stone available and is suitable for all materials. The deburring operation prevents damage to the roughing or finishing stone, reduces stone wear and increases production times thus reducing production 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 speeds will vary the stock removal to stone attrition rates, therefore, full use of the infinitely variable rotation speeds should be made to achieve optimum performance.

Rotation speed should be reduced for the harder materials in each group and increased for the softer materials. Likewise rotation speeds should be reduced for the larger diameter in each diameter range and increased for the smaller diameters, this being necessary to maintain the surface speed of the stone throughout the diameter range.

Stones suitable for rough, finish and polish operations 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 then the cross hatch angle is much steeper producing a courser 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 hard slowing down the stone wear rate AND the stock removal rate. If stock removal is very slow, 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' performances. Refer to page 37 – 'Trouble Shooting'.

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 in 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.

STONE SELECTION CHART

DIAMETER RANGE IMPERIAL & METRIC	DEBURR ALL MATERIALS	OP'N	MATERIAL GROUPS					DELAPENA STONEHOLDER TYPES	APPROXIMATE SPEED RANGE (rpm)
			CAST IRON	SOFT STEEL (a) (b)	STAINLESS STEEL (a) (b)	HARD STEEL (a) (b)	NON FERROUS MATERIALS (a) (b)		
.045-.120	R6J	F	F8F	R8F	R6F R6C	R6F R6C	F6F	J0, J1, J2 J3 J4 J5 J6	2500
1.14-3.05		P	F8F	F8F	F8F	F8F	F8F		
.120-.150	R6J	F	F6F	R6F	R6F R6C	R6F R6C	F6F	Y Z	2500
3.05-3.81		P	F8F	F8F	F8F	F8F	F8F		
.150-.185	R6J	F	F6F	R6F	R6F R6C	R6F R6C	F6F	AA NBB	2500
3.81-4.70		P	F8F	F8F	F8F	F8F	F8F		
.185-.245	R6J	R	F4F	R4F R4E	R4F R4C	R4E R4C	F3F F3C	SH WW	2500
4.70-6.23		F P	F6F F8F	R6F F8F	R6F C6C F8F C8C	R6F R6C F8F	F6F F6C F8F F8C		
.245-.365	R3HS	R	F3F	R4F R4E	R4F R4C	R4E R4C	F3F F3C	NA NG NEE K1	2500
6.23-9.27		F P	F6F F8F	R6F F8F	R6F C6C F8F C8C	R6F R6C F8F	F6F F6C F8F F8C		
.365-.490	R3HS	R	F3F	R4F R4E	R3E/S R4C	R4C C3C	F3F F3C	NB NL	1700
9.27-12.45		F P	F6F F8F	R6F R6C F8F	R6F C6C F8F C8C	R6C C6C F8F	F6F F6C F8F F8C		
.490-.615	R3HS	R	F3F	R4F R4E	R3E/S R4C	R4C C3C	F3F F3C	SD NC	1300
12.45-15.82		F P	F6F F8F	R6F R6C F8F	R6F C6C F8F C8C	R6C C6C F8F	F6F F6C F8F F8C		
.615-.770	R3HS	R	F3F	R4F R4E	R3E/S R4C	R4C C3C	F3F F3C	ND GG K6 K7 KK	1000
15.82-19.56		F P	F6F F8F	R6F R6C F8F	R6F C6C F8F C8C	R6C C6C F8F	F6F F6C F8F F8C		
.770-1020	R3HS	R	F3F	R4F R4E	R3E/S R4C	R4C C2C	F3F F3C	ND GG KK K8 K9 K10	800
19.56-25.91		F P	F6F F8F	R6F R6C F8F	R6F C6C F8F C8C	R6C C6C F8F	F6F F6C F8F F8C		
1.00 -2.00	R3HS	R	F2F	R4F R4E	R3E/S R4C	R4C C2C	F2F F3C	F1 F2 K11 K12 K13	600
25.4-50.8		F P	F6F F8F	R6F R6C F8F	R6F C6C F8F C8C	R6C C6C F8F	F6F F6C F8F F8C		
2.00 -3.00	R3HS	R	F2F	R4F R4E	R3E/S R4C	R4C C2C	F2F F3C	F1 F2	300
50.8-79.37		F P	F6F F8F	R6F R6C F8F	R6F C6C F8F C8C	R6C C6C F8F	F6F F6C 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 the 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.

Diamond honing stones in metallic and resinoid bond have been used successfully for many years. 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 hones can result in a reduction in honing costs. Examples of applications in these areas are:

Hardened Steels above HRC 63

Cast Iron

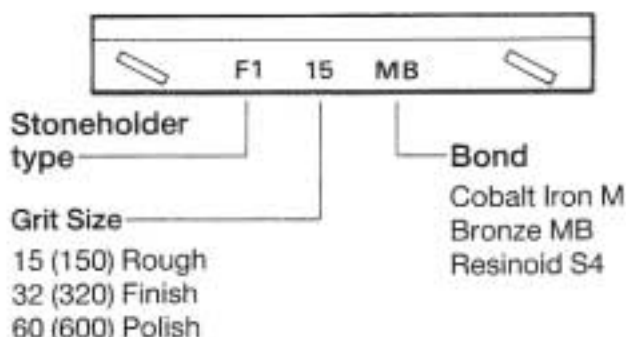
Components having interrupted bores such as uneven annular grooves and cross holes.

Diamond hones are available in three grit sizes 150, 320 and 600. Delapena use the coding 15, 32 and 60 respectively for the grit size notation.

Three bonding materials are used; Cobalt Iron, Bronze and Resinoid. These bonding materials also determine the hardness of the diamond hone. Cobalt iron being the hardest through to Resinoid, the softest.

The overall height of the honing stone determines the diamond layer depth. Delapena metal bonded hones have a layer depth of 1.5mm (0.060") in cases where the overall height of the honing stone exceeds this dimension. On stones having an overall height of less than 1.5mm (0.060") the layer depth of diamond will be 90-100% of the total height of the honing stone. With all resinoid bonded diamond stones the layer depth is 100%.

Delapena Coding System for Diamond Hones



Diamond hones are available to suit every range of Delapena mandrels.

Honing Tungsten Carbide

The cobalt content of the carbide determines its hardness, the lower the cobalt level the harder the carbide. The choice of diamond hone is based on the general rule of soft material – hard stone.

Cobalt Content	Diamond Bond
25%	Cobalt Iron – M.
11% – 25%	Bronze – MB.
Below 11%	Resinoid – S4.

Other types of material commonly honed with Diamonds are Cast Iron, especially valve bodies where close control of size and shape is required. Hardened steels with hardness values in excess of HRC 63. Hard chrome plating, glass, ceramics quartz and many sintered materials. Diamond stones can be subjected to higher working pressures and rotational speeds than standard abrasives.

C.B.N. Borazon.

C.B.N. is available in two types of bond:- Resinoid and bronze.

Resinoid 22BR and 40BR. Resinoid bonded stones having a 100% layer depth, and available to suit every Delapena mandrel above 3.05mm (.120") diameter.

Used on tough and hardened steels up to HRC 63. Also suitable for certain sintered materials such as Alnico and special alloys like Inconel.

Generally used at higher speeds and lower pressures than diamonds or 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.

Bronze 22BB and 40BB. Bronze bonded stones available to suit every Delapena mandrel above 3.05mm (.120") diameter.

22BB should be used for components having interrupted bores i.e. cross holes, annular grooves, etc., or where the surface finish prior to honing is very poor. Because the bonding material is harder it can be used at higher pressure than the resinoid stone and can therefore be used if the 22BR does not give satisfactory results.

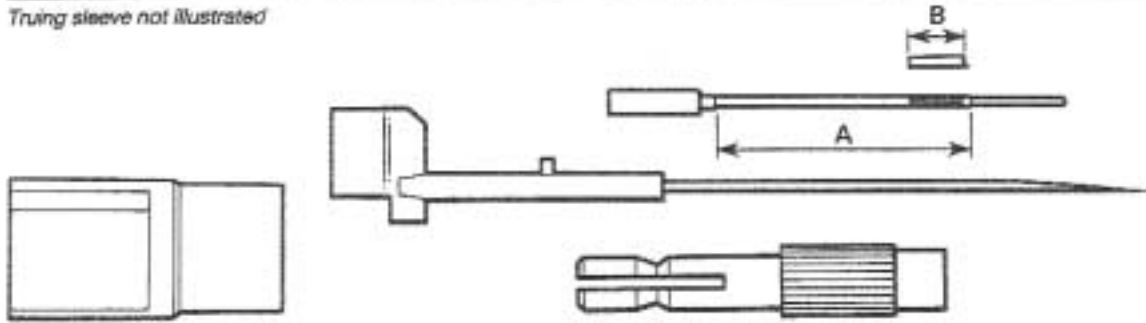
C.B.N. stones can be supplied in various grit sizes and concentrations.

Diameter Range 1.14 – 3.05mm (.045 – .120")

Diameter mm	ins	Mandrel	Truing Sleeve	Wedge	Adaptor	Stone Types
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MANDREL LENGTH A = CCS 045 – CCS 055 = 28 mm (1.10")
 CCS 060 – CCS 090 = 40 mm (1.57") STONE LENGTH B = 11.00mm (.437").

Truing sleeve not illustrated



1.14 – 1.27	.045 – .050	CCS045/J0	ST045	10901	MA156/4A and 1651	J0
1.27 – 1.40	.050 – .055	CCS050/J0	ST050			J0
1.40 – 1.52	.055 – .060	CCS055/J0	ST055			J0
1.52 – 1.65	.060 – .065	CCS060/J1	ST060	10902	MA156/4A and 1651	J1
1.65 – 1.78	.065 – .070	CCS065/J1	ST065			J1
1.78 – 1.90	.070 – .075	CCS070/J2	ST070			J2
1.90 – 2.03	.075 – .080	CCS075/J3	ST075			J3
2.03 – 2.16	.080 – .085	CCS080/J2	ST080	10902	MA156/4A and 1651	J2
2.16 – 2.28	.085 – .090	CCS085/J2	ST085			J2
2.28 – 2.41	.090 – .095	CCS090/J3	ST090			J3*

MANDREL LENGTH A = 53mm (2.08"), STONE LENGTH B = 12.7mm (.500").

2.41 – 2.54	.095 – .100	CCS095/J4	ST095	10903	MA156/4A and 1651	J4
2.54 – 2.67	.100 – .105	CCS100/J5	ST100			J5
2.67 – 2.79	.105 – .110	CCS105/J4	ST105	10904	MA156/4A and 1651	J4
2.79 – 2.92	.110 – .115	CCS110/J5	ST110			J5
2.92 – 3.05	.115 – .120	CCS115/J6	ST115			J6

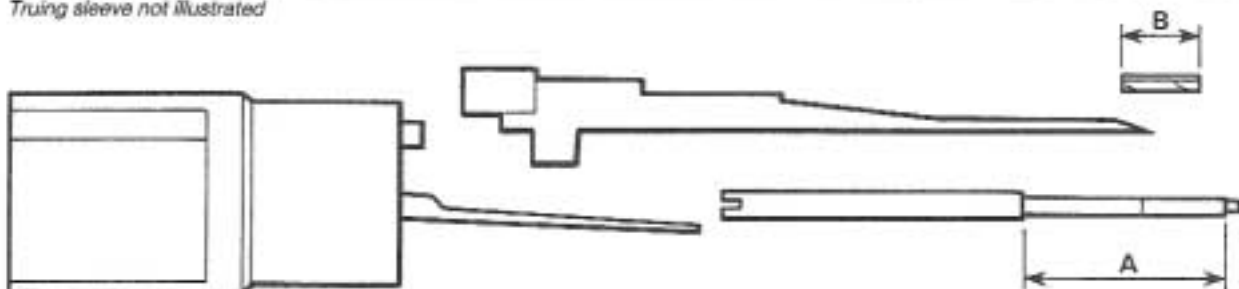
* Use diamond J3A with this mandrel.

Diameter Range 3.05 – 3.81mm (.120 – .150")

Diameter		Mandrel	Truing Sleeve	Adaptor	Stone Types
mm	ins				

SHORT SERIES Y

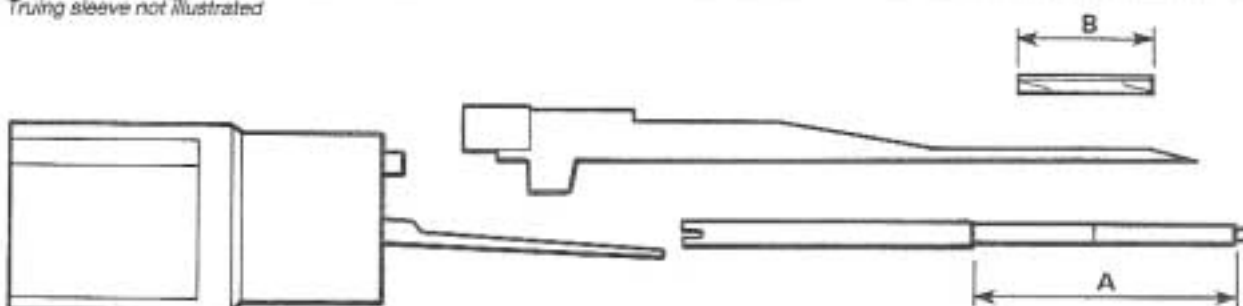
MANDREL LENGTH A = 38mm (1.50"). STONE LENGTH B = 14.5mm (.562").

Truing sleeve not illustrated

3.05 – 3.17	.120 – .125	HS120/Y	ST120		
3.17 – 3.30	.125 – .130	HS125/Y	ST125		
3.30 – 3.43	.130 – .135	HS130/Y	ST130	MA156/22	Y
3.43 – 3.56	.135 – .140	HS135/Y	ST135		
3.56 – 3.68	.140 – .145	HS140/Y	ST140		
3.68 – 3.81	.145 – .150	HS145/Y	ST145		

LONG SERIES Z

MANDREL LENGTH A = 50mm (1.97"). STONE LENGTH B = 25.4mm (1.00").

Truing sleeve not illustrated

3.05 – 3.17	.120 – .125	HS120/Z	ST120		
3.17 – 3.30	.125 – .130	HS125/Z	ST125		
3.30 – 3.43	.130 – .135	HS130/Z	ST130	MA156/22	Z
3.43 – 3.56	.135 – .140	HS135/Z	ST135		
3.56 – 3.68	.140 – .145	HS140/Z	ST140		
3.68 – 3.81	.145 – .150	HS145/Z	ST145		

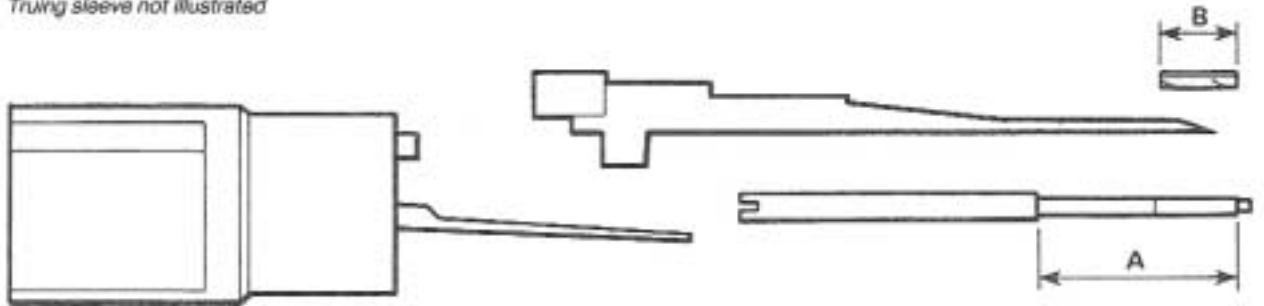
HARD STEEL MANDRELS

Diameter Range 3.81 – 4.70mm (.150 – .180")

Diameter		Mandrel	Truing Sleeve	Adaptor	Stone Types
mm	ins				

SHORT SERIES AA

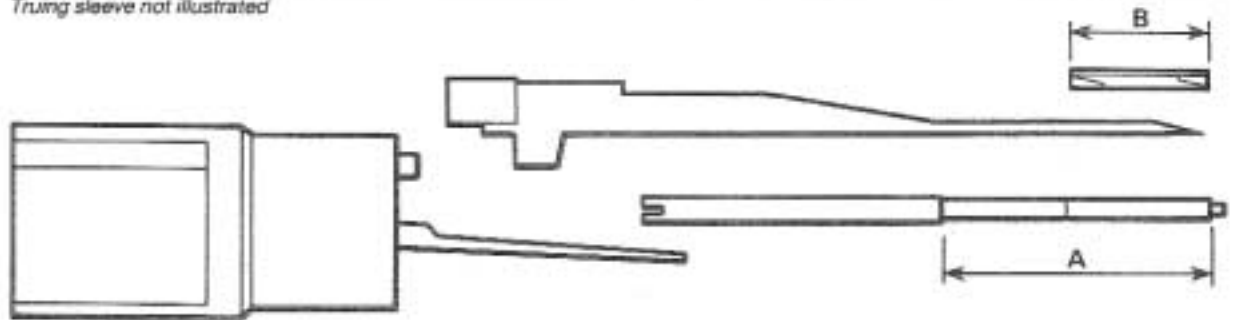
MANDREL LENGTH A = 42mm (1.65"). STONE LENGTH B = 17.5mm (.687").

Truing sleeve not illustrated

3.81–3.94	.150–.155	HS150/AA	ST150		
3.94–4.06	.155–.160	HS155/AA	ST155		
4.06–4.19	.160–.165	HS160/AA	ST160		
4.19–4.32	.165–.170	HS165/AA	ST165	MA156/22	AA
4.32–4.45	.170–.175	HS170/AA	ST170		
4.45–4.57	.175–.180	HS175/AA	ST175		
4.57–4.70	.180–.185	HS180/AA	ST180		

LONG SERIES NBB

MANDREL LENGTH A = 55mm (2.16"). STONE LENGTH B = 31.7mm (1.25").

Truing sleeve not illustrated

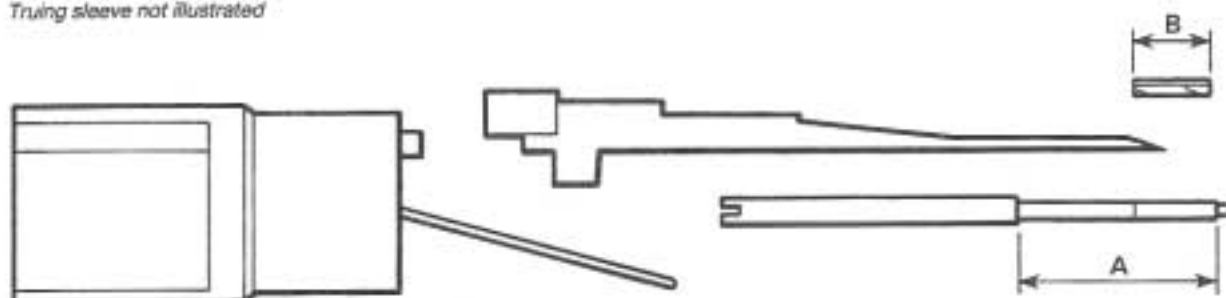
3.81–3.94	.150–.155	HS150/NBB	ST150		
3.94–4.06	.155–.160	HS155/NBB	ST155		
4.06–4.19	.160–.165	HS160/NBB	ST160		
4.19–4.32	.165–.170	HS165/NBB	ST165	MA156/22	NBB
4.32–4.45	.170–.175	HS170/NBB	ST170		
4.45–4.57	.175–.180	HS175/NBB	ST175		
4.57–4.70	.180–.185	HS180/NBB	ST180		

Diameter Range 4.70 – 6.22mm (.185 – .245")

Diameter		Mandrel	Truing Sleeve	Adaptor	Stone Types
mm	ins				

SHORT SERIES SH

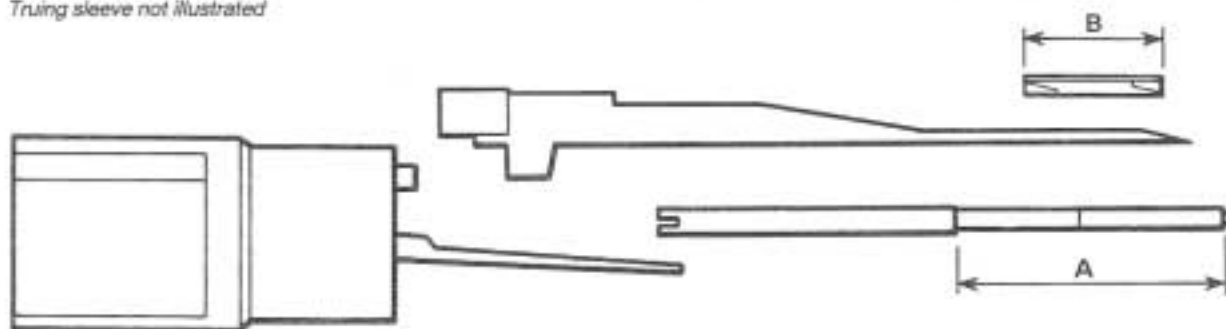
MANDREL LENGTH A = 53mm (2.08"). STONE LENGTH B = 19.05mm (.750").

Truing sleeve not illustrated

4.70–4.83	.185–.190	HS185/2SH	ST185		
4.83–4.95	.190–.195	HS190/2SH	ST190		
4.95–5.08	.195–.200	HS195/2SH	ST195		
5.08–5.21	.200–.205	HS200/2SH	ST200		
5.21–5.33	.205–.210	HS205/2SH	ST205		
5.33–5.46	.210–.215	HS210/2SH	ST210	MA156/1	SH
5.46–5.59	.215–.220	HS215/2SH	ST215		
5.59–5.72	.220–.225	HS220/2SH	ST220		
5.72–5.84	.225–.230	HS225/2SH	ST225		
5.84–5.97	.230–.235	HS230/2SH	ST230		
5.95–6.10	.234–.240	HS235/2SH	ST235		
6.10–6.22	.240–.245	HS240/2SH	ST240		

LONG SERIES WW

MANDREL LENGTH A = 82mm (3.23"). STONE LENGTH B = 35mm (1.375").

Truing sleeve not illustrated

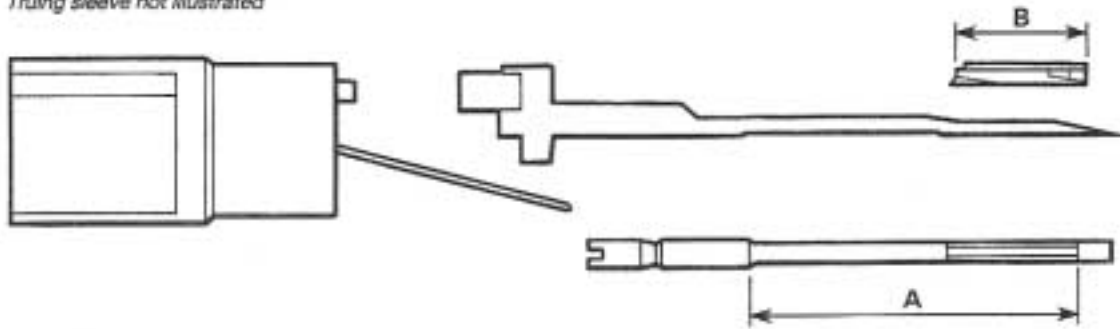
4.70–4.83	.185–.190	HS185/WW	ST185		
4.83–4.95	.190–.195	HS190/WW	ST190		
4.95–5.08	.195–.200	HS195/WW	ST195		
5.08–5.21	.200–.205	HS200/WW	ST200		
5.21–5.33	.205–.210	HS205/WW	ST205		
5.33–5.46	.210–.215	HS210/WW	ST210		
5.46–5.59	.215–.220	HS215/WW	ST215	MA156/36	WW
5.59–5.72	.220–.225	HS220/WW	ST220		
5.72–5.84	.225–.230	HS225/WW	ST225		
5.84–5.97	.230–.235	HS230/WW	ST230		
5.97–6.10	.235–.240	HS235/WW	ST235		
6.10–6.22	.240–.245	HS240/WW	ST240		

Diameter Range 6.22 – 9.27mm (.245 – .365")

Diameter		Mandrel		Truing Sleeve	Adaptor	Stone Types
mm	ins	Hard	Soft			

SHORT SERIES NA, NG

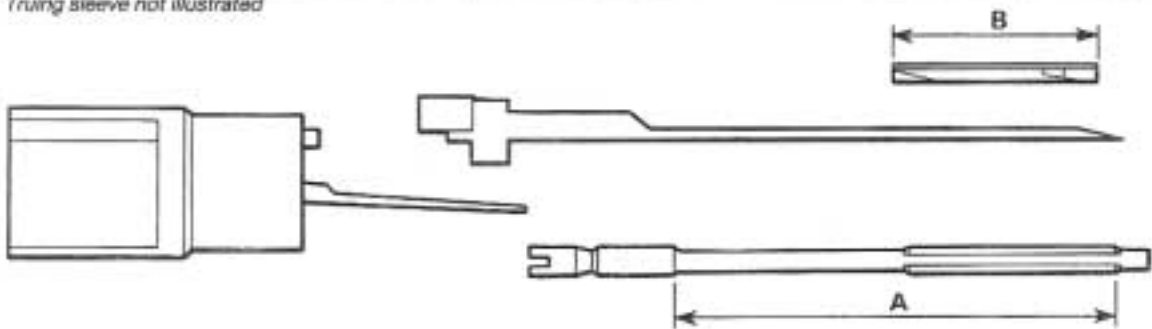
MANDREL LENGTH A = 80mm (3.15"). STONE LENGTH B = 31.7mm (1.25").

Truing sleeve not illustrated

6.22 – 6.60	.245 – .260	HS245/3NA	SS245/3NA	ST245		
6.60 – 6.99	.260 – .275	HS260/3NA	SS260/3NA	ST260		NA
6.99 – 7.37	.275 – .290	HS275/3NA	SS275/3NA	ST275		
7.37 – 7.75	.290 – .305	HS290/3NA	SS290/3NA	ST290		
7.75 – 8.13	.305 – .320	HS305/3NG	SS305/3NG	ST305	MA156/3	
7.90 – 8.40		HS310/3NG		ST310		
8.13 – 8.51	.320 – .335	HS320/3NG	SS320/3NG	ST320		NG
8.51 – 8.89	.335 – .350	HS335/3NG	SS335/3NG	ST335		
8.89 – 9.27	.350 – .365	HS350/3NG	SS350/3NG	ST350		

LONG SERIES NEE

MANDREL LENGTH A = 118mm (4.64"). STONE LENGTH B = 57.1mm (2.25").

Truing sleeve not illustrated

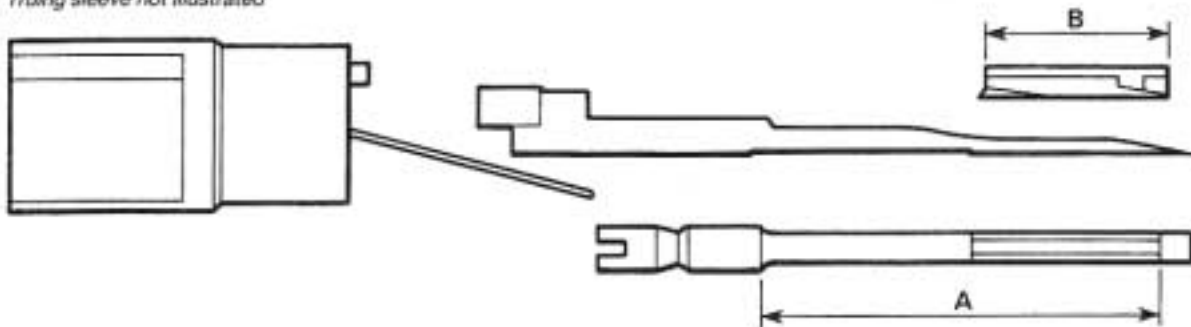
6.22 – 6.60	.245 – .260	HS245/4NEE		ST245		
6.60 – 6.99	.260 – .275	HS260/4NEE		ST260		
6.99 – 7.37	.275 – .290	HS275/4NEE		ST275		
7.37 – 7.75	.290 – .305	HS290/4NEE		ST290		
7.75 – 8.13	.305 – .320	HS305/4NEE		ST305	MA156/45	NEE
8.13 – 8.51	.320 – .335	HS320/4NEE		ST320		
8.51 – 8.89	.335 – .350	HS335/4NEE		ST335		
8.89 – 9.27	.350 – .365	HS350/4NEE		ST350		

Diameter Range 9.27 – 12.45mm (.365 – .490")

Diameter		Mandrel		Truing Sleeve	Adaptor	Stone Types
mm	ins	Hard	Soft			

SHORT SERIES NB

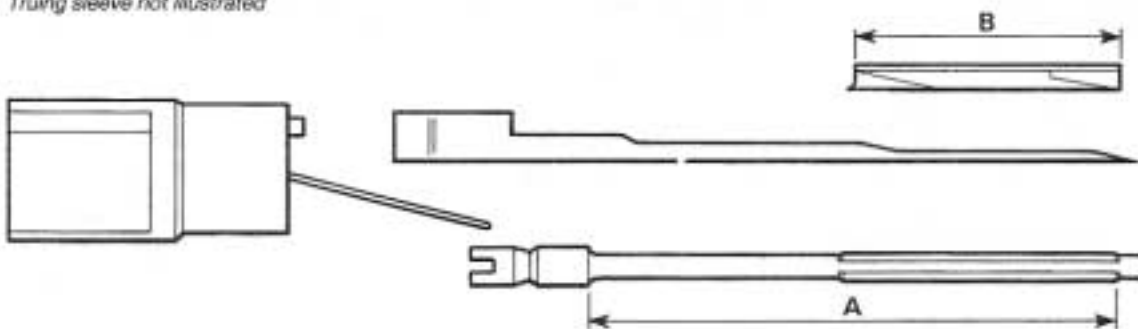
MANDREL LENGTH A = 93mm (3.66"). STONE LENGTH B = 44.4mm (1.75").

Truing sleeve not illustrated

9.27 – 9.65	.365 – .380	HS365/3NB	SS365/3NB	ST365		
9.65 – 10.03	.380 – .395	HS380/3NB	SS380/3NB	ST380		
9.90 – 10.50		HS390/3NB		ST390		
10.03 – 10.41	.395 – .410	HS395/3NB	SS395/3NB	ST395		
10.41 – 10.80	.410 – .425	HS410/3NB	SS410/3NB	ST410	MA156/4	NB
10.80 – 11.18	.425 – .440	HS425/3NB	SS425/3NB	ST425		
11.18 – 11.68	.440 – .460	HS440/3NB	SS440/3NB	ST440		
11.68 – 12.45	.460 – .490	HS460/3NB	SS460/3NB	ST460		
11.90 – 12.50		HS468/3NB		ST468		

LONG SERIES NL

MANDREL LENGTH A = 158mm (6.22"). STONE LENGTH B = 82.5mm (3.25").

Truing sleeve not illustrated

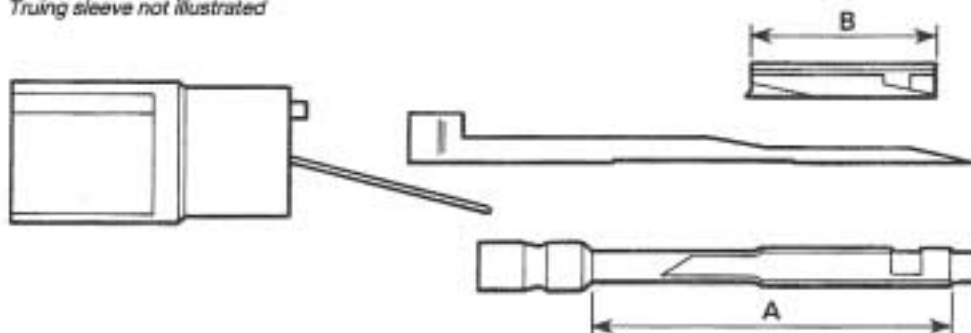
9.27 – 9.65	.365 – .380	HS365/6NL		ST365		
9.65 – 10.03	.380 – .395	HS380/6NL		ST380		
10.03 – 10.41	.395 – .410	HS395/6NL		ST395		
10.41 – 10.80	.410 – .425	HS410/6NL		ST410	MA156/28	NL
10.80 – 11.18	.425 – .440	HS425/6NL		ST425		
11.18 – 11.68	.440 – .460	HS440/6NL		ST440		
11.68 – 12.45	.460 – .490	HS460/6NL		ST460		

Diameter Range 12.45 – 15.62mm (.490 – .615")

Diameter		Mandrel		Truing Sleeve	Adaptor	Stone Types
mm	ins	Hard	Soft			

SHORT SERIES SD

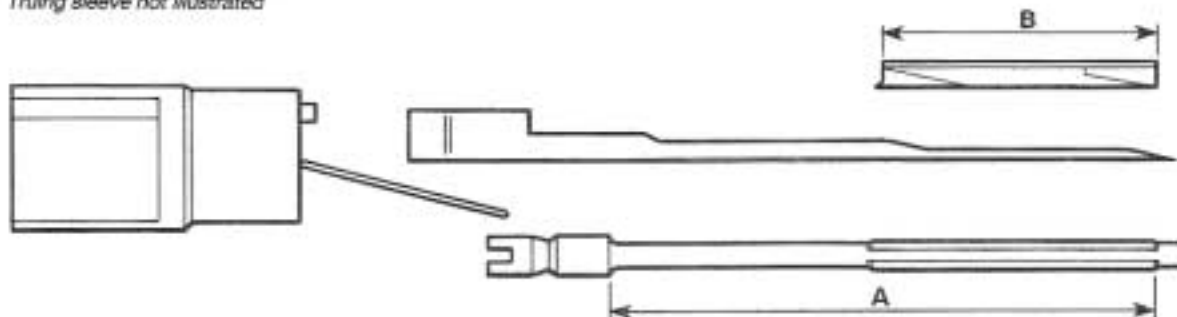
MANDREL LENGTH A = 110mm (4.33"), STONE LENGTH B = 57.1mm (2.25")

Truing sleeve not illustrated

12.45 – 13.21	.490 – .520	HS490/4SD	SS490/4SD	ST490	MA156/5	SD
13.21 – 13.97	.520 – .550	HS520/4SD	SS520/4SD	ST520		
13.80 – 14.50		HS543/4SD		ST543		
13.97 – 14.73	.550 – .580	HS550/4SD	SS550/4SD	ST550		
14.73 – 15.62	.580 – .615	HS580/4SD	SS580/4SD	ST580		

LONG SERIES NC

MANDREL LENGTH A = 160mm (6.30"), STONE LENGTH B = 85.7mm (3.375")

Truing sleeve not illustrated

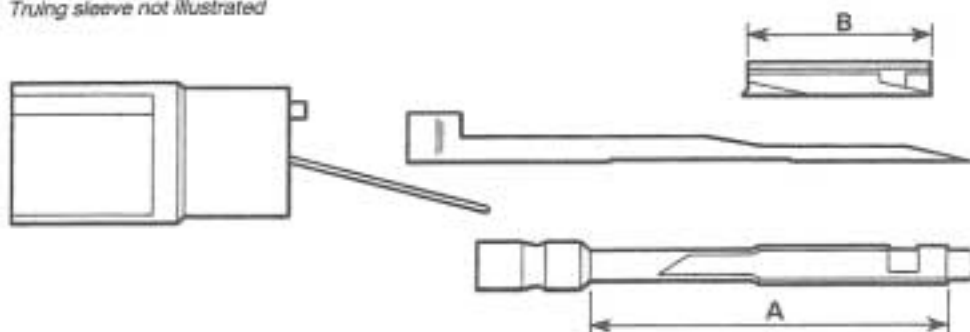
12.45 – 13.21	.490 – .520	HS490/6NC		ST490	MA156/29	NC
13.21 – 13.97	.520 – .550	HS520/6NC		ST520		
13.97 – 14.73	.550 – .580	HS550/6NC		ST550		
14.73 – 15.62	.580 – .615	HS580/6NC		ST580		

Diameter Range 15.62 – 19.56mm (.615 – .770")

Diameter		Mandrel	Truing Sleeve	Adaptor	Stone Types
mm	ins				

SHORT SERIES ND

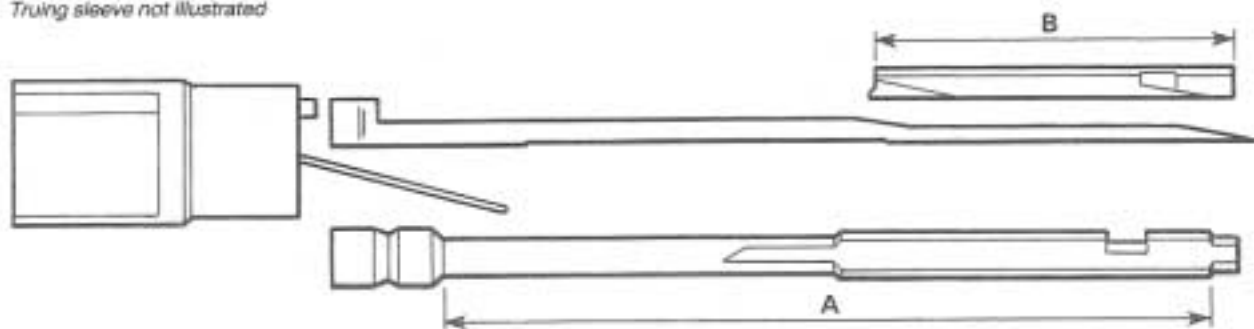
MANDREL LENGTH A = 107mm (4.21"). STONE LENGTH B = 57.1mm (2.25").

Truing sleeve not illustrated

15.62 – 16.38	.615 – .645	HS615/4ND	ST615		
15.80 – 16.50		HS622/4ND	ST622		
16.38 – 17.15	.645 – .675	HS645/4ND	ST645		
17.15 – 17.91	.675 – .705	HS675/4ND	ST675	MA156/6	ND
17.91 – 18.80	.705 – .740	HS705/4ND	ST705		
18.80 – 19.56	.740 – .770	HS740/4ND	ST740		

LONG SERIES GG

MANDREL LENGTH A = 237mm (9.33"). STONE LENGTH B = 114.3mm (4.50")

Truing sleeve not illustrated

15.62 – 16.38	.615 – .645	HS615/8GG	STL615		
16.38 – 17.15	.645 – .675	HS645/8GG	STL645		
17.15 – 17.91	.675 – .705	HS675/8GG	STL675	MA156/50	GG
17.91 – 18.80	.705 – .740	HS705/8GG	STL705		
18.80 – 19.56	.740 – .770	HS740/8GG	STL740		

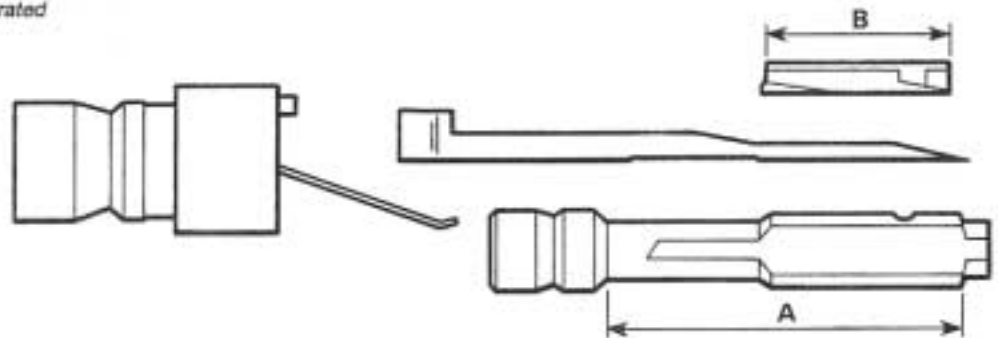
HARD STEEL MANDRELS

Diameter Range 19.56 – 25.91mm (.770 – 1.020")

Diameter		Mandrel	Truing Sleeve	Adaptor	Stone Type
mm	ins				

SHORT SERIES ND

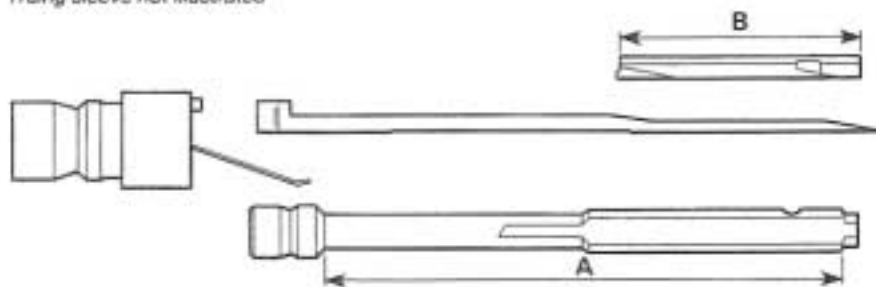
MANDREL LENGTH A = 107mm (4.21"). STONE LENGTH B = 57.1mm (2.25").

Truing sleeve not illustrated

19.56 – 20.32	.770 – .800	HS770/4ND	ST770	MA156/18	ND
20.32 – 21.08	.800 – .830	HS800/4ND	ST800		
21.08 – 21.97	.830 – .865	HS830/4ND	ST830		
21.97 – 22.73	.865 – .895	HS865/4ND	ST865		
22.73 – 23.49	.895 – .925	HS895/4ND	ST895		
23.49 – 24.25	.925 – .955	HS925/4ND	ST925		
24.25 – 25.14	.955 – .990	HS955/4ND	ST955		
24.80 – 25.50	.955 – .990	HS976/4ND	ST976		
25.14 – 25.91	.990 – 1.02	HS990/4ND	ST990		

LONG SERIES GG

MANDREL LENGTH A = 237mm (9.33"). STONE LENGTH B = 114.3mm (4.50").

Truing sleeve not illustrated

19.56 – 20.32	.770 – .800	HS770/8GG	STL770	MA156/51	GG
20.32 – 21.08	.800 – .830	HS800/8GG	STL800		
21.08 – 21.97	.830 – .865	HS830/8GG	STL830		
21.97 – 22.73	.865 – .895	HS865/8GG	STL865		
22.73 – 23.49	.895 – .925	HS895/8GG	STL895		
23.49 – 24.25	.925 – .955	HS925/8GG	STL925		
24.25 – 25.14	.955 – .990	HS955/8GG	STL955		
24.80 – 25.50	.955 – .990	HS976/8GG	STL976		
25.14 – 25.91	.990 – 1.02	HS990/8GG	STL990		

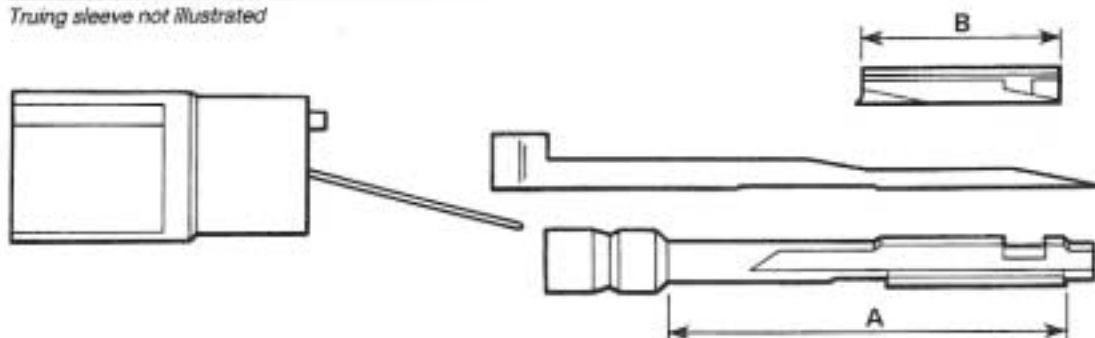
NOTES

Diameter Range 15.62 – 19.56mm (.615 – .770")

Diameter		Mandrel	Truing Sleeve	Replacement Shoes		Adaptor	Stone Type
mm	ins			Bronze	C.I.		

SHORT SERIES ND
MANDREL LENGTH A = 107mm (4.21"). STONE LENGTH B = 57.1mm (2.25").

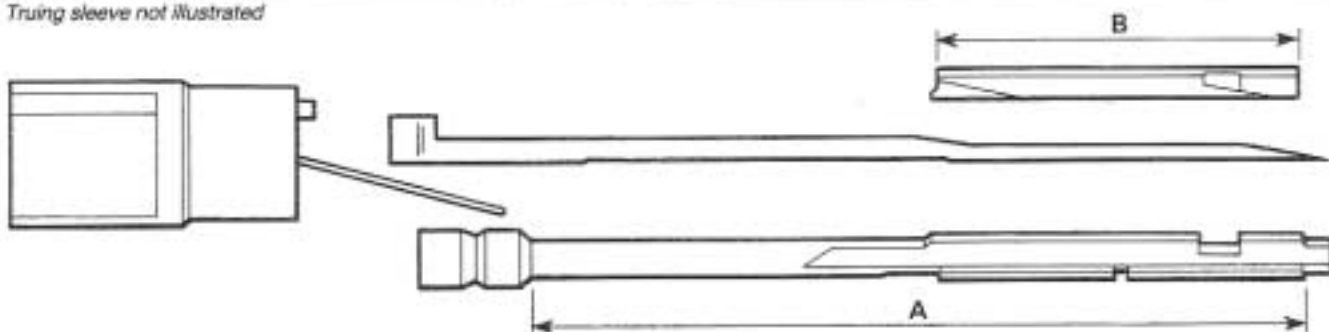
Truing sleeve not illustrated



15.62–16.38	.615–.645	PT615/4ND	ST615				
16.38–17.15	.645–.675	PT645/4ND	ST645				
17.15–17.91	.675–.705	PT675/4ND	ST675	L1057B	L1057C	MA156/6	ND
17.91–18.80	.705–.740	PT705/4ND	ST705				
18.80–19.56	.740–.770	PT740/4ND	ST740				

LONG SERIES GG
MANDREL LENGTH A = 237mm (9.33"). STONE LENGTH B = 114.3mm (4.5")

Truing sleeve not illustrated



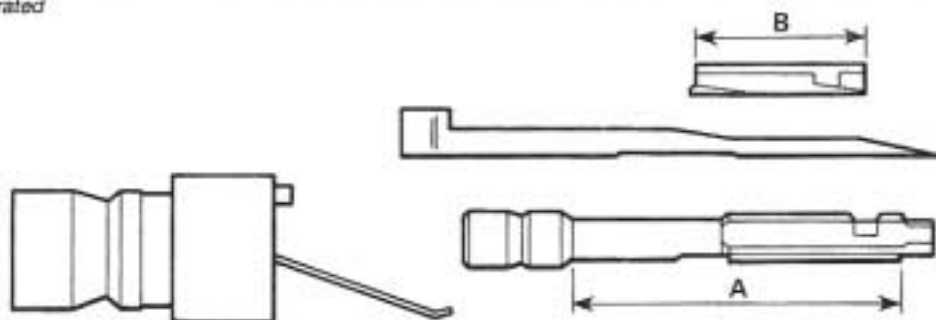
15.62–16.38	.615–.645	PT615/8GG	STL615				
16.38–17.15	.645–.675	PT645/8GG	STL645				
17.15–17.91	.675–.705	PT675/8GG	STL675	L1057B	L1057C	MA156/50	GG
17.91–18.80	.705–.740	PT705/8GG	STL705				
18.80–19.56	.740–.770	PT740/8GG	STL740				

Diameter Range 19.56 – 25.91mm (.770 – 1.020")

Diameter		Mandrel	Truing Sleeve	Replacement Shoes		Adaptor	Stone Type
mm	ins			Bronze	C.I.		

SHORT SERIES ND

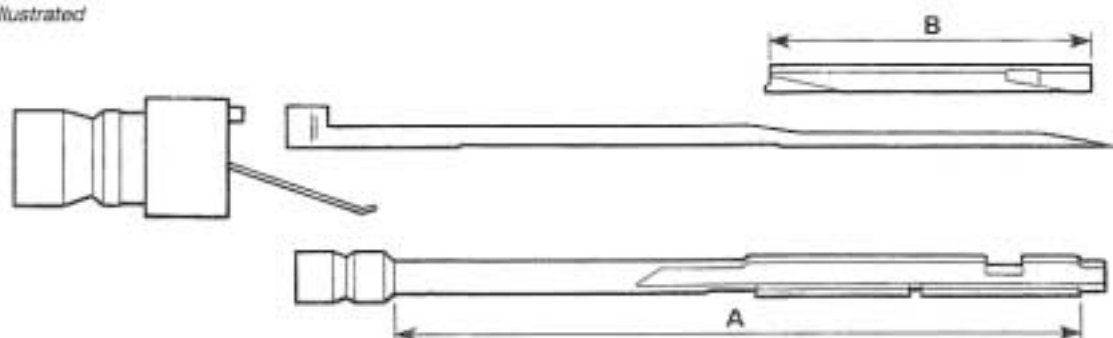
MANDREL LENGTH A = 107mm (4.21"). STONE LENGTH B = 57.1mm (2.25").

Truing sleeve not illustrated

19.56–20.32	.770–.800	PT770/4ND	ST770				
20.32–21.08	.800–.830	PT800/4ND	ST800				
21.08–21.97	.830–.865	PT830/4ND	ST830				
21.97–22.73	.865–.895	PT865/4ND	ST865				
22.73–23.49	.895–.925	PT895/4ND	ST895	L1058B	L1058C	MA156/18	ND
23.49–24.25	.925–.955	PT925/4ND	ST925				
24.25–25.14	.955–.990	PT955/4ND	ST955				
25.14–25.91	.990–1.020	PT990/4ND	ST990				

LONG SERIES GG

MANDREL LENGTH A = 237mm (9.33"). STONE LENGTH B = 114.3mm (4.5")

Truing sleeve not illustrated

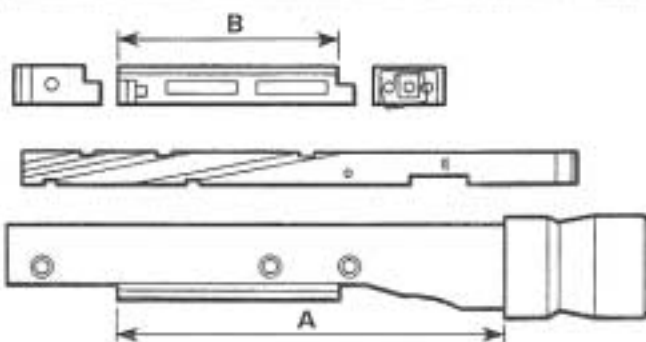
19.56–20.32	.770–.800	PT770/8GG	STL770				
20.32–21.08	.800–.830	PT800/8GG	STL800				
21.08–21.97	.830–.865	PT830/8GG	STL830				
21.97–22.73	.865–.895	PT865/8GG	STL865				
22.73–23.49	.895–.925	PT895/8GG	STL895	L1058B	L1058C	MA156/51	GG
23.49–24.25	.925–.955	PT925/8GG	STL925				
24.25–25.14	.955–.990	PT955/8GG	STL955				
25.14–25.91	.990–1.020	PT990/8GG	STL990				

Diameter Range 25.4 – 66.68mm (1.00 – 2.625")

Diameter		Mandrel	Truing Sleeve	Replacement Shoes		Stone Type
mm	ins			Bronze	C.I.	

SHORT SERIES

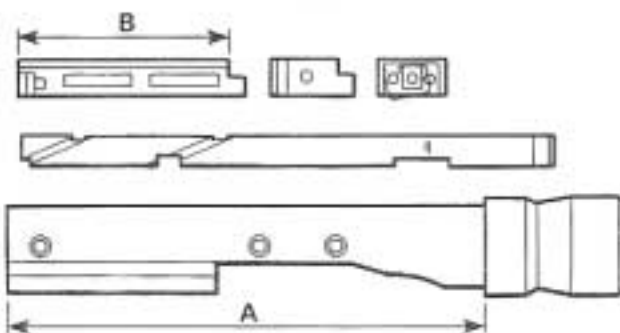
MANDREL LENGTH A = 152mm (5.98"). STONE LENGTH B = 1 x 82.5mm (3.25").



Truing sleeve not illustrated

25.40–28.57	1.000–1.125	PT1000/6	ST1000	L1059B	L1070C	F1 (open hole) or F2 (blind)
28.57–31.75	1.125–1.250	PT1125/6	ST1125	L1060B	L1071C	
31.75–34.93	1.250–1.375	PT1250/6	ST1250	L1061B	L1072C	
34.93–38.10	1.375–1.500	PT1375/6	ST1375	L1062B	L1073C	
38.10–41.28	1.500–1.625	PT1500/6	ST1500	L1063B	L1074C	
41.28–44.45	1.625–1.750	PT1625/6	ST1625	L1064B	L1075C	
44.45–47.63	1.750–1.875	PT1750/6	ST1750	L1064B	L1075C	
47.63–50.80	1.875–2.000	PT1875/6	ST1875			
50.80–53.98	2.000–2.125	PT2000/6	ST2000	L1065B	L1076C	
53.98–57.15	2.125–2.250	PT2125/6	ST2125			
57.15–60.33	2.250–2.375	PT2250/6	ST2250			
60.33–63.50	2.375–2.500	PT2375/6	ST2375	L1066B	L1077C	
63.50–66.68	2.500–2.625	PT2500/6	ST2500			

Truing sleeve not illustrated



BLIND HOLE

MANDREL LENGTH A = 180mm (7.09").
STONE LENGTH B = 82.5mm (3.25").**To convert the mandrel for blind hole use.**

When honing any blind hole the stone must be flush with the end of the mandrel.

The range of mandrels listed above can be converted for blind hole use simply by changing the expansion wedge and stoneholder type and by repositioning the replaceable shoe and front and rear stops.

Refer to page 31 Replacement Wedges., for the correct blind hole wedge.

Use F2 type stoneholders mounted with the appropriate stone grade.

Move the guide shoe forwards until it is flush with the end of the mandrel.

Move the front stop from the first hole at the front of the mandrel to the second hole in the mandrel body.

Move the rear stop to the last hole in the mandrel body.

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

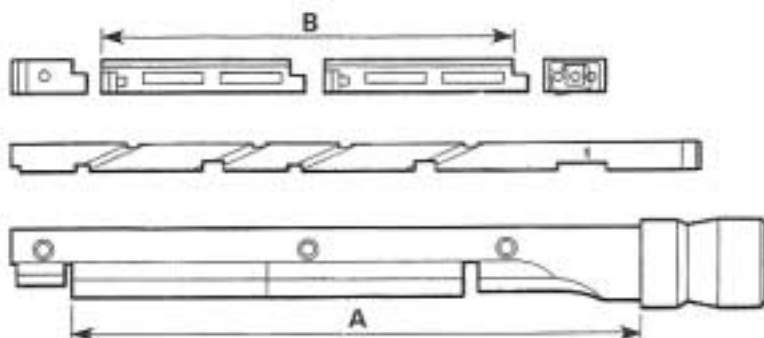
Diameter Range 25.4 – 66.68mm (1.00 – 2.625")

Diameter		Mandrel	Truing Sleeve	Replacement Shoes		Stone Type
mm	ins			Bronze	C.I.	

LONG SERIES

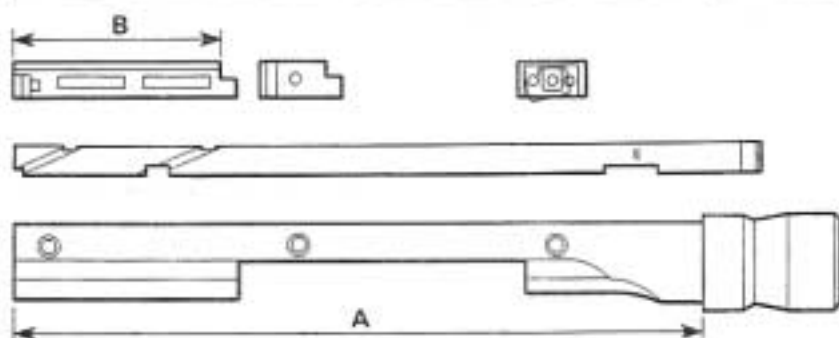
MANDREL LENGTH A = 237mm (9.33"). STONE LENGTH B = 2 x 82.5mm (3.25").

Truing sleeve not illustrated



25.40–28.57	1.000–1.125	PT1000/9	ST1000	L1059B	L1070C	F1 (open) or F2 (blind)
28.57–31.75	1.125–1.250	PT1125/9	ST1125	L1060B	L1071C	
31.75–34.93	1.250–1.375	PT1250/9	ST1250	L1061B	L1072C	
34.93–38.10	1.375–1.500	PT1375/9	ST1375	L1062B	L1073C	
38.10–41.28	1.500–1.625	PT1500/9	ST1500	L1063B	L1074C	
41.28–44.45	1.625–1.750	PT1625/9	ST1625	L1064B	L1075C	
44.45–47.63	1.750–1.875	PT1750/9	ST1750	L1064B	L1075C	
47.63–50.80	1.875–2.000	PT1875/9	ST1875			
50.80–53.98	2.000–2.125	PT2000/9	ST2000	L1065B	L1076C	
53.98–57.15	2.125–2.250	PT2125/9	ST2125			
57.15–60.33	2.250–2.375	PT2250/9	ST2250			
60.33–63.50	2.375–2.500	PT2375/9	ST2375	L1066B	L1077C	
63.50–66.68	2.500–2.625	PT2500/9	ST2500			

Truing sleeve not illustrated



BLIND HOLE

MANDREL LENGTH A = 265mm (10.44").
STONE LENGTH B = 82.5mm (3.25").**To convert the mandrel for blind hole use.**

When honing any blind hole the stone must be flush with the end of the mandrel.

The range of open hole mandrels listed above can be converted for blind hole use simply by changing the expansion wedge and stoneholder type and by repositioning the replaceable shoes and front and rear stops.

Refer to page 31 Replacement Wedges., for the correct blind hole wedge.

Use F2 stoneholders mounted with the appropriate stone grade.

Move the first guide shoe forwards until it is flush with the end of the mandrel.

Remove the second guide shoe.

Move the front stop from the first hole at the front of the mandrel to the second hole in the mandrel body.

Move the rear stop to the last hole in the mandrel body.

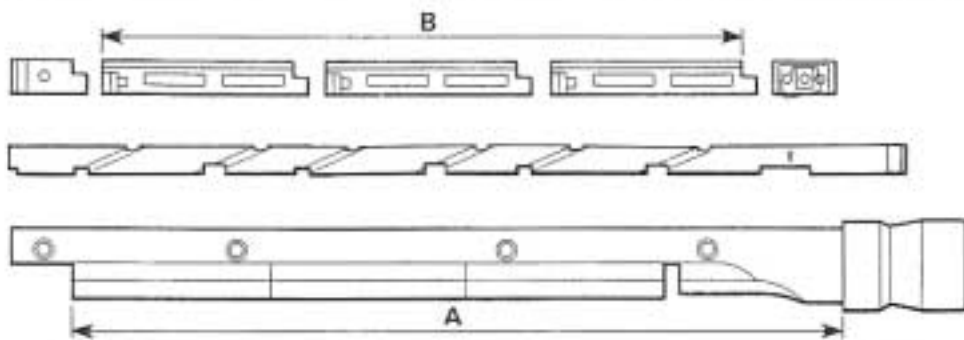
NOTE: Cast iron shoes must be machined to the same diameter as the bore to be honed, before use.

Diameter Range 25.40 – 79.37mm (1.000 – 3.125")

Diameter		Mandrel	Truing Sleeve	Replacement Shoes		Stone Type
mm	ins			Bronze	C.I.	

EXTRA LONG SERIES

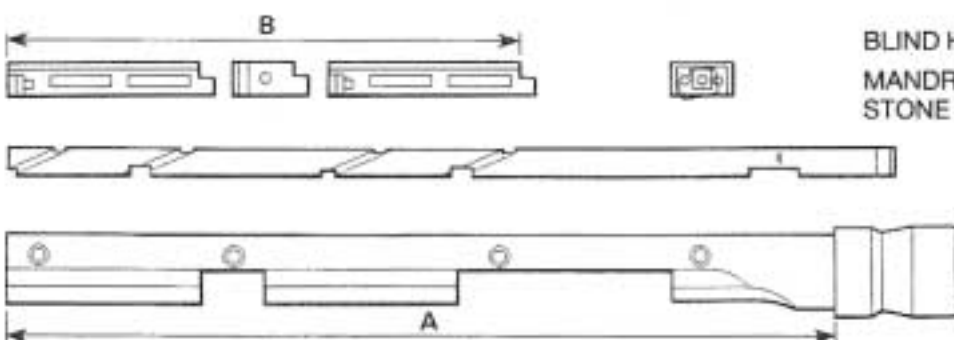
MANDREL LENGTH A = 322mm (12.68"), STONE LENGTH B = 3 x 82.5mm (3.25").



Truing sleeve not illustrated

25.40–28.57	1.000–1.125	PT1000/12	ST1000	L1059B	L1070C	F1 (open) or F2 (blind)
28.57–31.75	1.125–1.250	PT1125/12	ST1125	L1060B	L1071C	
31.75–34.93	1.250–1.375	PT1250/12	ST1250	L1061B	L1072C	
34.93–38.10	1.375–1.500	PT1375/12	ST1375	L1062B	L1073C	
38.10–41.28	1.500–1.625	PT1500/12	ST1500	L1063B	L1074C	
41.28–44.45	1.625–1.750	PT1625/12	ST1625	L1064B	L1075C	
44.45–47.63	1.750–1.875	PT1750/12	ST1750	L1064B	L1075C	
47.63–50.80	1.875–2.000	PT1875/12	ST1875			
50.80–53.98	2.000–2.125	PT2000/12	ST2000	L1065B	L1076C	
53.98–57.15	2.125–2.250	PT2125/12	ST2125			
57.15–60.33	2.250–2.375	PT2250/12	ST2250			
60.33–63.50	2.375–2.500	PT2375/12	ST2375	L1066B	L1077C	
63.50–66.68	2.500–2.625	PT2500/12	ST2500			
66.68–69.85	2.625–2.750	PT2625/12	ST2625			Mazak Only 1705101 Supplied in pairs
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			

The above PT .../12 Mandrels supplied to order only



Truing sleeve not illustrated

BLIND HOLE

MANDREL LENGTH A = 350mm (13.79"),
STONE LENGTH B = 192mm (7.56").**To convert the mandrel for blind hole use.**

When honing any blind hole the stone must be flush with the end of the mandrel.

The range of open hole mandrels listed above can be converted for blind hole use simply by changing the expansion wedge and stoneholder type and by repositioning the replaceable shoes and front and rear stops.

Refer to page 31 Replacement Wedges., for the correct blind hole wedge.

Use F2 type stoneholders mounted with the appropriate stone grade.

Move the first guide shoe forwards until it is flush with the end of the mandrel.

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.

Move the front stop from the first hole at the front of the mandrel to the second hole in the mandrel body.

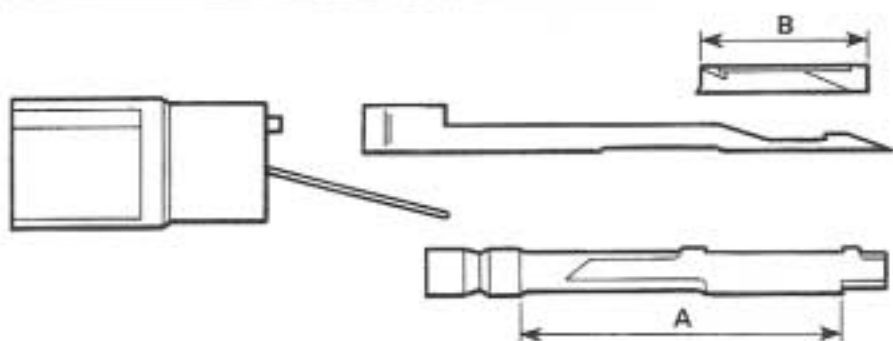
Move the rear stop to the last hole in the mandrel body.

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

Diameter Range 6.23 – 18.80mm (.245 – .740")

Diameter		Mandrel	Truing Sleeve	Adaptor	Stone Type	Max. Keyway Width	
mm	ins.						
MANDREL LENGTH A =		K1	75mm (2.95")	STONE LENGTH B =		K1	22.23mm (.875")
		K2 – K3	87mm (3.42")			K2 – K3	31.75mm (1.25")
		K4 – K10	101mm (3.97")			K4 – K10	44.45mm (1.75")

Truing sleeve not illustrated



6.23 – 6.60	.245 – .260	HSK245/3K1	ST245	MA156/3	K1	3.175mm. .125ins.
6.60 – 6.99	.260 – .290	HSK260/3K1	ST260			
6.99 – 7.37	.275 – .290	HSK275/3K1	ST275			
7.37 – 7.87	.290 – .305	HSK290/3K1	ST290			
7.87 – 8.26	.305 – .325	HSK305/3K1	ST305			
8.26 – 8.51	.325 – .335	HSK325/3K1	ST325	MA156/4	K2	3.962mm. .156ins.
8.51 – 9.017	.335 – .355	HSK335/3K1	ST335			
9.017 – 9.27	.355 – .365	HSK355/3K1	ST355			
9.27 – 9.652	.365 – .380	HSK365/3K2	ST365			
9.652 – 10.003	.380 – .395	HSK380/3K3	ST380			
10.003 – 10.414	.395 – .410	HSK395/3K3	ST395	MA156/5	K3	4.762mm. .1875ins.
10.414 – 10.8	.410 – .425	HSK410/3K3	ST410			
10.8 – 11.18	.425 – .440	HSK425/3K3	ST425			
11.18 – 11.68	.440 – .460	HSK440/3K3	ST440			
11.68 – 12.45	.460 – .490	HSK460/3K3	ST460			
12.45 – 13.21	.490 – .520	HSK490/4K4	ST490	MA156/6	K4	
13.21 – 13.97	.520 – .550	HSK520/4K4	ST520			
13.97 – 14.73	.550 – .580	HSK550/4K5	ST550			
14.73 – 15.62	.580 – .615	HSK580/4K5	ST580			
15.62 – 16.39	.615 – .645	HSK615/4K6	ST615			
16.39 – 17.15	.645 – .675	HSK645/4K6	ST645	MA156/6	K5	
17.15 – 17.91	.675 – .705	HSK675/4K6	ST675			
17.91 – 18.80	.705 – .740	HSK705/4K7	ST705			
18.80 – 19.558	.740 – .770	HSK740/4K7	ST740			
					K7	

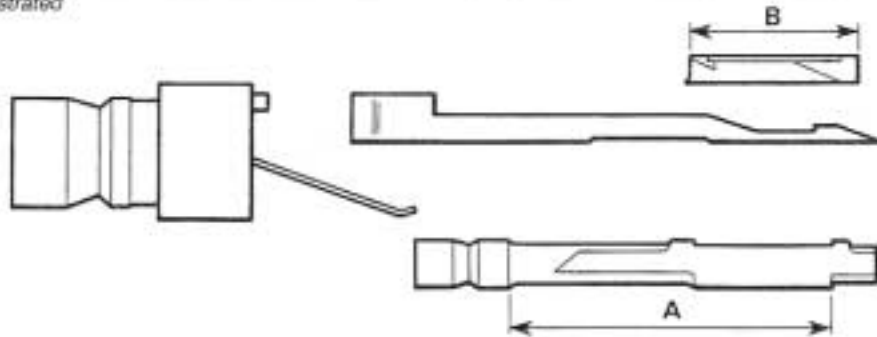
Continued

Diameter Range 19.558 – 25.91mm (.770 – 1.020") Continued

Diameter of Hole		Mandrel	Truing Sleeve	Adaptor	Stone Type	Max. Keyway Width
mm	ins.					

MANDREL LENGTH A = 101mm (3.97"). STONE LENGTH B = K4 – K10 44.45mm (1.75").

Truing sleeve not illustrated



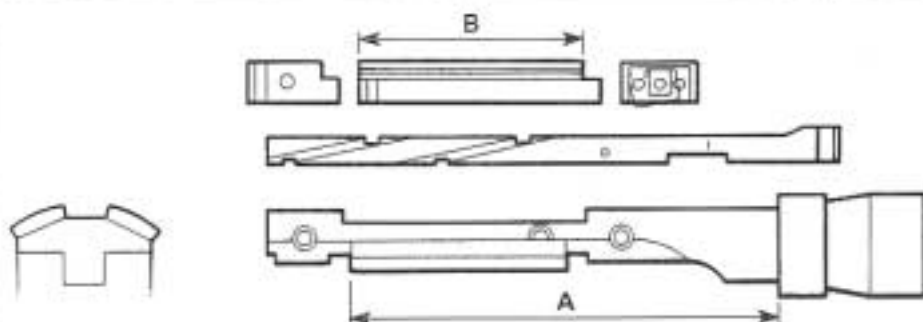
19.558 – 20.32	.770 – .800	HSK770/4K8	ST770	MA156/18	K8	6.35mm. .250ins.
20.32 – 21.08	.800 – .830	HSK800/4K8	ST800			
21.08 – 21.97	.830 – .865	HSK830/4K9	ST830			
21.97 – 22.73	.865 – .895	HSK865/4K9	ST865			
22.73 – 23.49	.895 – .925	HSK895/4K9	ST895			
23.49 – 24.25	.925 – .955	HSK925/4K9	ST925			
24.25 – 25.14	.955 – .990	HSK955/4K9	ST955	K9		
25.14 – 25.91	.990 – 1.020	HSK990/4K10	ST990			K10

Diameter Range 25.4 – 66.68mm (1.00 – 2.625")

Diameter		Mandrel	Truing Sleeve	Rep't Shoes	Stone Type	Keyway Width
mm	ins					

SHORT SERIES MANDREL LENGTH A = 152mm (6.00"). STONE LENGTH B = 82.5mm (3.25").

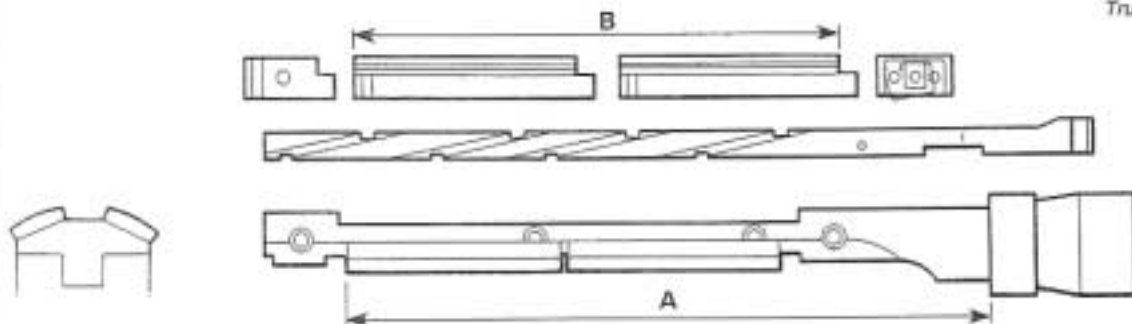
Truing sleeve not illustrated



25.40 – 28.57	1.000 – 1.125	PTK1000/6	ST1000	L1070C	K11	10.00mm (.394")
28.57 – 31.75	1.125 – 1.250	PTK1125/6	ST1125	L1071C		
31.75 – 34.93	1.250 – 1.375	PTK1250/6	ST1250	L1072C		
34.93 – 38.10	1.375 – 1.500	PTK1375/6	ST1375	L1073C	K12	12.00mm (.472")
38.10 – 41.28	1.500 – 1.625	PTK1500/6	ST1500	L1074C		
41.28 – 44.45	1.625 – 1.750	PTK1625/6	ST1625	L1075C		
44.45 – 47.63	1.750 – 1.875	PTK1750/6	ST1750	L1075C	K13	14.00mm (.590")
47.63 – 50.80	1.875 – 2.000	PTK1875/6	ST1875	L1076C		
50.80 – 53.98	2.000 – 2.125	PTK2000/6	ST2000	L1076C		
53.98 – 57.15	2.125 – 2.250	PTK2125/6	ST2125	L1076C	K14	16.00mm (.636")
57.15 – 60.33	2.250 – 2.375	PTK2250/6	ST2250	L1077C		
60.33 – 63.50	2.375 – 2.500	PTK2375/6	ST2375	L1077C	K15	18.00mm (.708")
63.50 – 66.68	2.500 – 2.625	PTK2500/6	ST2500	L1077C		

LONG SERIES MANDREL LENGTH A = 237mm (9.34"). STONE LENGTH B = 2 x 82.5mm (3.25").

Truing sleeve not illustrated



25.40 – 28.57	1.000 – 1.125	PTK1000/9	ST1000	L1070C	K11	10.00mm (.394")
28.57 – 31.75	1.125 – 1.250	PTK1125/9	ST1125	L1071C		
31.75 – 34.93	1.250 – 1.375	PTK1250/9	ST1250	L1072C		
34.93 – 38.10	1.375 – 1.500	PTK1375/9	ST1375	L1073C	K12	12.00mm (.472")
38.10 – 41.28	1.500 – 1.625	PTK1500/9	ST1500	L1074C		
41.28 – 44.45	1.625 – 1.750	PTK1625/9	ST1625	L1075C		
44.45 – 47.63	1.750 – 1.875	PTK1750/9	ST1750	L1075C	K13	14.00mm (.590")
47.63 – 50.80	1.875 – 2.000	PTK1875/9	ST1875	L1076C		
50.80 – 53.98	2.000 – 2.125	PTK2000/9	ST2000	L1076C		
53.98 – 57.15	2.125 – 2.250	PTK2125/9	ST2125	L1076C	K14	16.00mm (.636")
57.15 – 60.33	2.250 – 2.375	PTK2250/9	ST2250	L1077C		
60.33 – 63.50	2.375 – 2.500	PTK2375/9	ST2375	L1077C	K15	18.00mm (.708")
63.50 – 66.68	2.500 – 2.625	PTK2500/9	ST2500	L1077C		

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

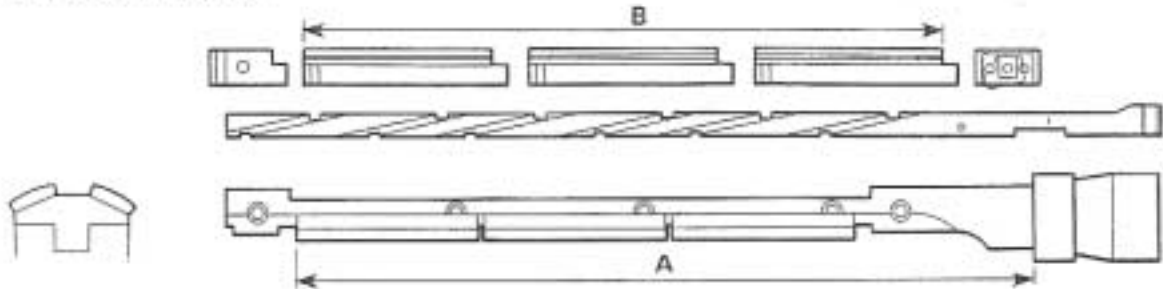
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Diameter Range 25.4 – 66.68mm (1.00 – 2.625") Continued

Diameter		Mandrel	Truing Sleeve	Rep'nt Shoes	Stone Type	Keyway Width
mm	ins					

EXTRA LONG SERIES MANDREL LENGTH A = 322mm (12.69"), STONE LENGTH B = 3 x 82.5mm (3.25").

Truing sleeve not illustrated



25.40 – 28.57	1.000 – 1.125	PTK1000/12	ST1000	L1070C	K11	10.00mm (.394")
28.57 – 31.75	1.125 – 1.250	PTK1125/12	ST1125	L1071C		
31.75 – 34.93	1.250 – 1.375	PTK1250/12	ST1250	L1072C		
34.93 – 38.10	1.375 – 1.500	PTK1375/12	ST1375	L1073C	K12	12.00mm (.472")
38.10 – 41.28	1.500 – 1.625	PTK1500/12	ST1500	L1074C		
41.28 – 44.45	1.625 – 1.750	PTK1625/12	ST1625	L1075C	K13	14.00mm (.590")
44.45 – 47.63	1.750 – 1.875	PTK1750/12	ST1750	L1075C		
47.63 – 50.80	1.875 – 2.000	PTK1875/12	ST1875	L1076C	K14	16.00mm (.636")
50.80 – 53.98	2.000 – 2.125	PTK2000/12	ST2000	L1076C		
53.98 – 57.15	2.125 – 2.250	PTK2125/12	ST2125	L1076C		
57.15 – 60.33	2.250 – 2.375	PTK2250/12	ST2250	L1077C	K15	18.00mm (.708")
60.33 – 63.50	2.375 – 2.500	PTK2375/12	ST2375	L1077C		
63.50 – 66.68	2.500 – 2.625	PTK2500/12	ST2500	L1077C		

The above PTK—/12 Mandrels supplied to order only

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

REPLACEMENT WEDGES – ALL MANDRELS

MANDREL RANGE	WEDGES	
CCS045/J0 – CCS075/J3	10901	
CCS080/J2 – CCS090/J3	10902	
CCS095/J4 – CCS100/J5	10903	
CCS105/J4 – CCS115/J6	10904	
HS120/Y – HS145/Y	10905	
HS120/Z – HS145/Z	10906	
HS150/AA – HS180/AA	10907	
HS150/NBB – HS180/NBB	10908	
HS185/2SH – HS240/2SH	10909	
HS185/WW – HS240/WW	10910	
HS245/3NA – HS350/3NG	10911	
HS245/4NEE – HS350/4NEE	10912	
HS365/3NB – HS468/3NB	10913	
HS365/6NL – HS460/6NL	10914	
HS490/4SD – HS580/4SD	10915	
HS490/6NC – HS580/6NC	10916	
HS615/4ND – HS990/4ND	10915	
HS615/8GG – HS990/8GG	10917	
HS740/9KK – HS990/9KK	10918	
PT615/4ND – PT990/4ND	10915	
PT615/8GG – PT990/8GG	10917	
	Open Hole	Blind Hole
PT1000/6 – PT1750/6	10931	10932
PT1000/9 – PT1750/9	10935	10936
PT1000/12 – PT1750/12	10939	10940
PT1875/6 – PT2500/6	10933	10934
PT1875/9 – PT2500/9	10937	10938
PT1875/12 – PT2500/12	10941	10942
PT2625/12 – PT3000/12	10943	10944
HSK245/3 – HSK355/3	10919	
HSK365/3 – HSK460/3	10920	
HSK490/4 – HSK990/4	10921	
PTK1000/6 – PTK1750/6	10945	
PTK1000/9 – PTK1750/9	10946	
PTK1000/12 – PTK1750/12	10947	
PTK1875/6 – PTK2500/6	10948	
PTK1875/9 – PTK2500/9	10949	
PTK1875/12 – PTK2500/12	10950	

GHA 287 Hone Assembly.

The GHA 287 Hone Assembly has been designed to accommodate bores above 79.4mm (3.125") which are beyond the range of conventional mandrel type tooling.

Based on the popular Standard Head design with interchangeable stone sets to cover all diameters above 68.26mm (2.68") the GHA 287 is a versatile extension to the tooling range.

The Hone Assembly is located into the machine in the same way as conventional mandrels. Linear feed movement in the machine, achieved by depressing the footpedal, is converted, via a helical adaptor, to rotational feed movement in the Hone Assembly. Advancement of the machine's feed control will automatically advance the diameter of the honing stones in the Hone Assembly.

When fitting new stone sets the square hone body must be removed from the assembly and the stone set fitted into the body in the normal manner. The body is then located over the splined expansion pinion. Rapid expansion out to the approximate bore diameter is achieved by rotating the body clockwise before locking into place. Fine expansion is then applied by the feed handwheel of the honing machine.

Stone sets to suit the GHA 287 are available in three types of abrasive, each type with a choice of grit sizes and bond hardnesses.

The diameter range required is achieved by selecting the appropriate stone set or stone carrier and plug in stone sets, e.g.

Diameter

68.26 - 108.00mm (2.68 - 4.25") Use M2 or M4 mounted stones

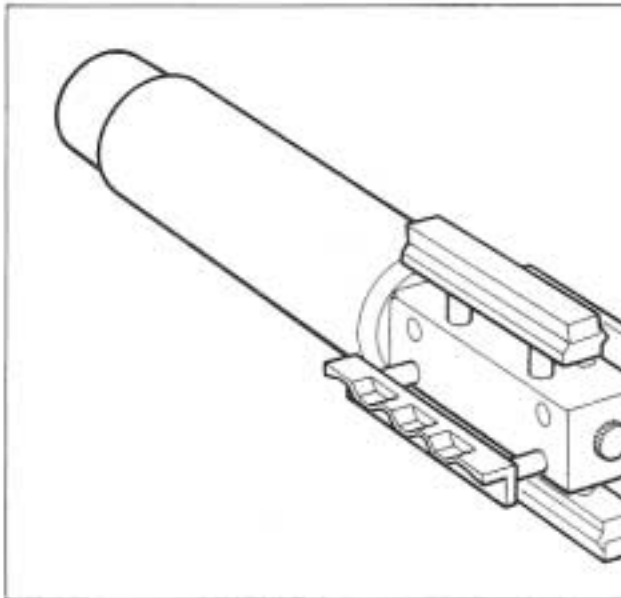
95.25 - 140.00mm (3.75 - 5.50") Use 1231 Stone carrier set

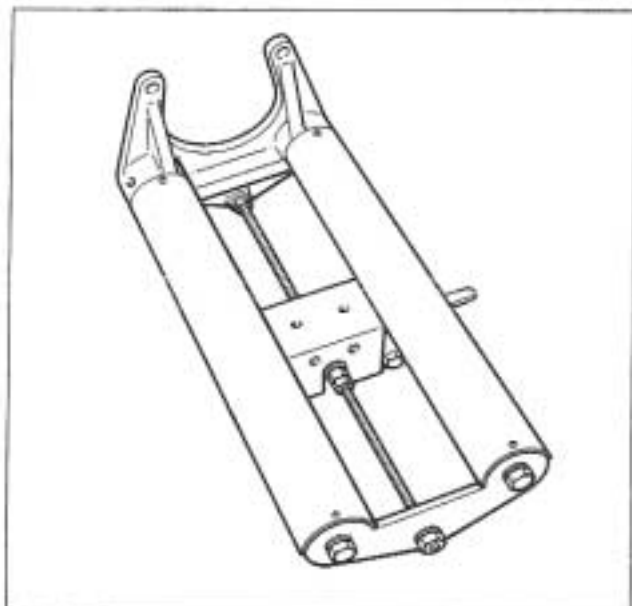
120.60 - 178.00mm (4.75 - 7.00") Use 1232 Stone carrier set

Stone sets PT2 and PT4 must be used in conjunction with all 123- (PT) stone carrier sets.

The full range of M and PT tooling can be found in the Catalogue "Tooling for Vertical Honing".

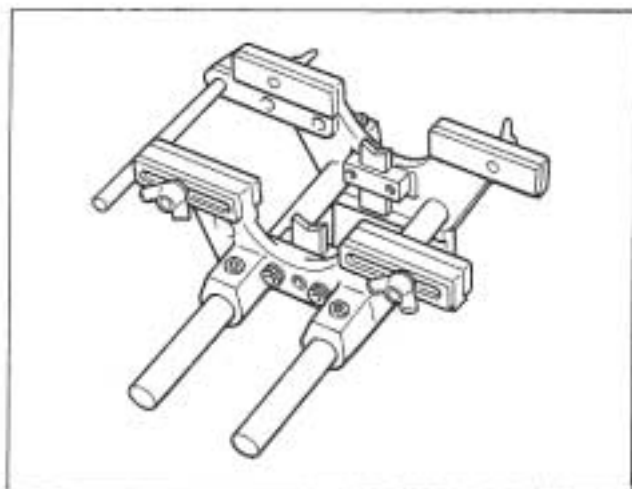
Contact Delapena for details of the tooling required to suit specific bore sizes.





Stroking Fixture. 1801

The stroking fixture is incorporated as standard, on the automatic honing machines. The hand stroking fixture can be added to the manual honing machine when special work holding fixtures are required to locate the components. Especially useful when honing "over square" bores and recessed bores. The fixture incorporates front and rear stops to facilitate repeatability of stroke length and position.

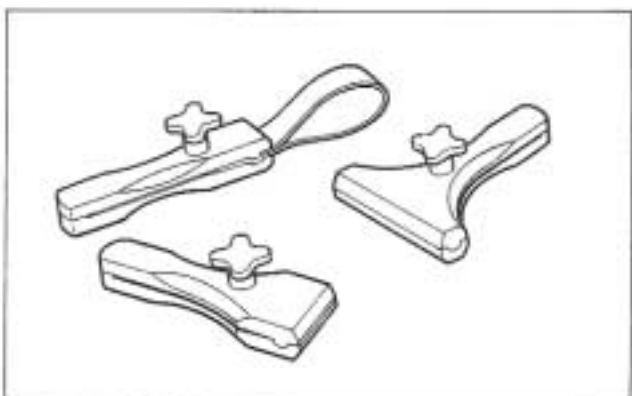


Universal Fixture. 1810

The Universal fixture is the most adaptable and therefore most commonly used of the Delapena Standard fixtures.

The fixture can accept components up to 190mm (7.5") long and cylindrical components up to 112mm (4.5") outside diameter with bore diameters up to 63mm (2.5").

The mandrel supports the work and the fixture restricts linear movement of the component to be honed but moves back and forth with the stroke movement. A torque bar is provided to stop the component rotating with the mandrel. This fixture is not recommended for automatic honing with mandrels below 3.05mm (.125") diameter.



Loop Grip Holders. 1813, 1814 & 1815

Used to prevent the component rotating with the mandrel when using the Universal fixture or honing manually.

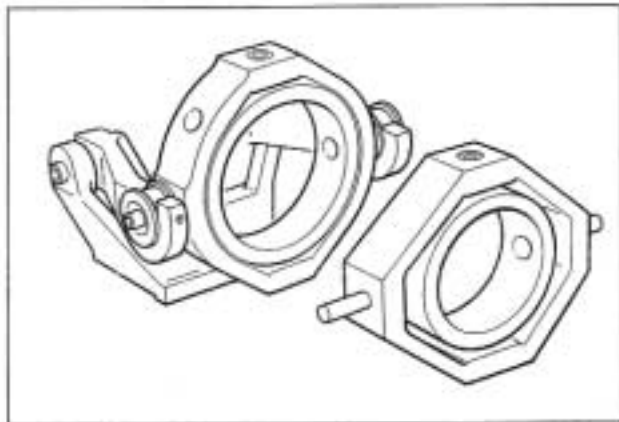
The webbing loop is fixed around the component and held secure by tightening a simple thumb screw.

Available in three widths:-

Type 1813 - 19mm (.75")

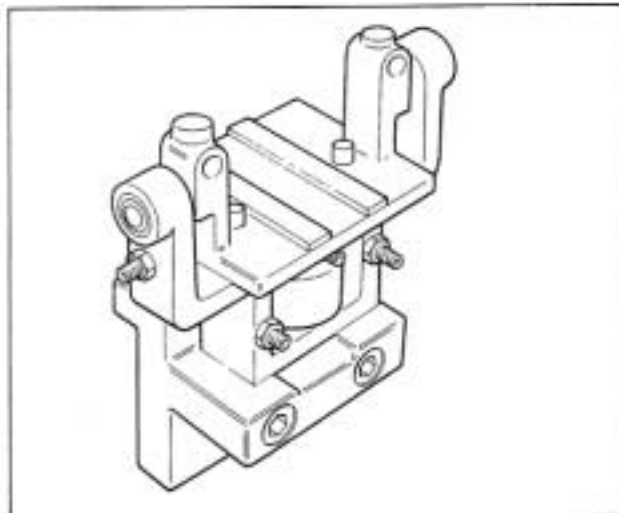
Type 1814 - 38mm (1.5")

Type 1815 - 76mm (3.0")



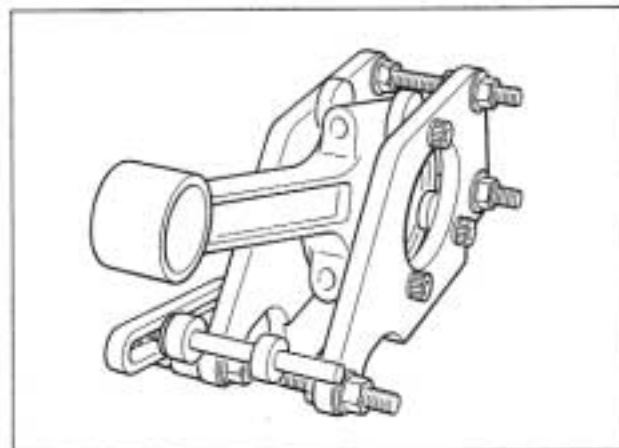
Die Honing Fixture. 1806

Designed primarily for the Heading Die Trade where large bodied, small bore components require honing. 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.



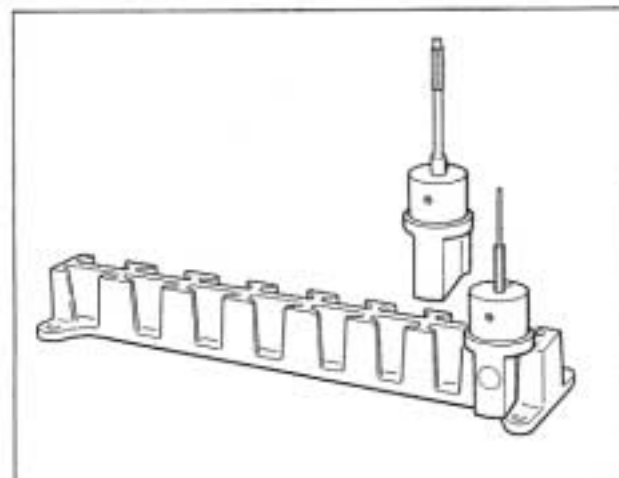
Gimbal Fixture. 1809

Designed for smaller and lighter components which are not suited to the Universal fixture. The fixture consists of a fully floating platform onto which component holding sub-fixtures are located by means of dowels. Designed with a spring counterbalance to counteract the weight of the component. This fixture is ideal for automatic honing with CCS type mandrels.



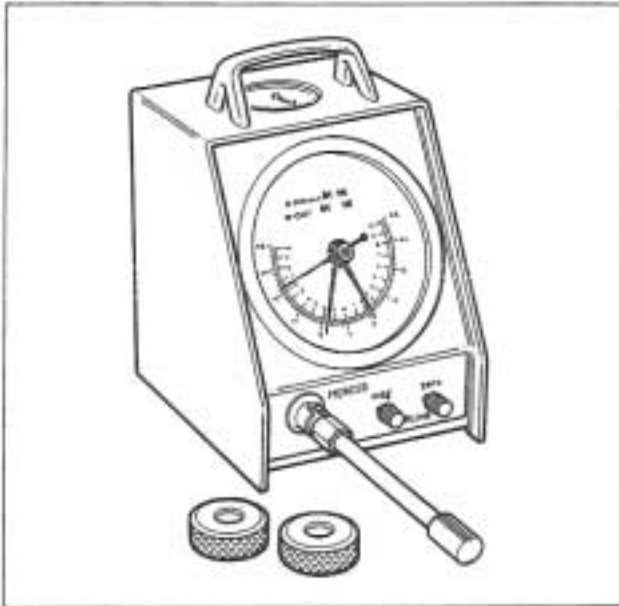
Connecting Rod Fixture. SF45009

An adjustable fixture to suit a wide range of connecting rod sizes. The connecting rod is located in this fixture which ensures squareness of face to bore, this position being maintained during the honing cycle. The fixture can also be supplied "tailor-made" to suit specific rod sizes which is particularly suited for large volume work.



Mandrel Rack. SL29

Designed to accommodate sixteen honing units the Delapena Mandrel Rack is an invaluable accessory enabling the operator to keep assembled honing units readily available.



Mercer Clearline Air Gauging Unit.

The clear, easy to read scale makes this high pressure air gauge unit popular in all workshops.

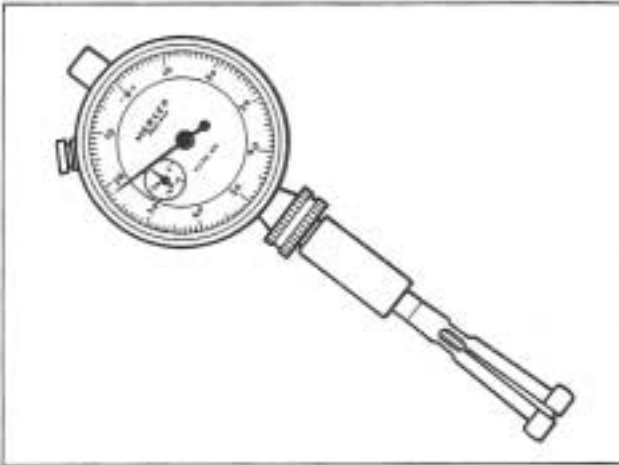
The air probe can be fitted direct to the gauge unit, or connected via a flexible hose extension.

The gauge unit is supplied in two alternative magnifications:

2500/1 Scale range $\pm 0.050\text{mm}$ reading in 0.002mm ($\pm 0.002''$ reading in $0.0002''$)

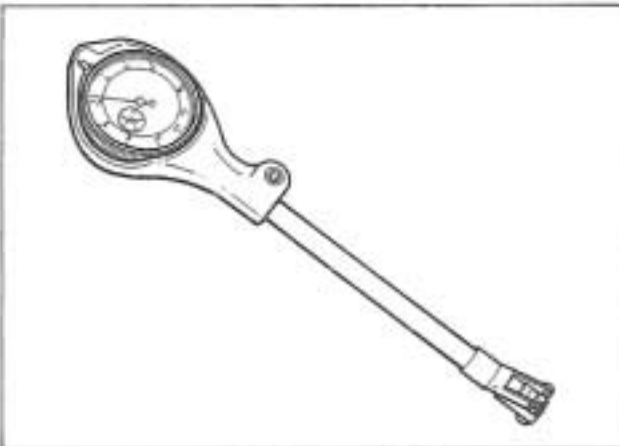
5000/1 Scales range $\pm 0.025\text{mm}$ reading in 0.001mm ($\pm 0.001''$ reading in $0.0001''$)

Air consumption 1.0 cu m/hr at 300KN/m^2 .



Diatest Split Ball Gauges.

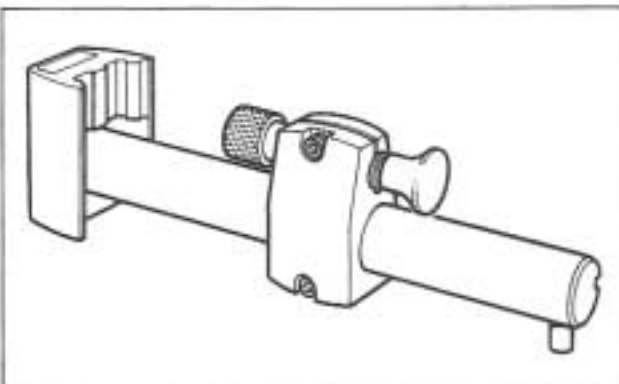
A modular mechanical gauging system consisting of a dial indicator and series of interchangeable probes and master setting rings to cover the range $0.47 - 41.3\text{mm}$ ($0.0185 - 1.620''$). With dial indicators marked in increments of 0.002mm ($0.0001''$) this versatile gauging system is ideal for users who need to measure a wide variety of bore diameters. Contact Delapena for details of ranges available.



Bore Comparators.

More suited to components with long or deep holes the bore comparators are available to cover a range $22.0 - 300\text{mm}$ ($.866 - 11.81''$) diameter up to 1520mm ($60''$) long.

Contact Delapena for details of ranges available.



Bore Comparator Setting Master.

When set to the required size by using slip gauges the setting master provides a reference for setting bore comparators from $50 - 154\text{mm}$ ($2 - 6''$) diameter.

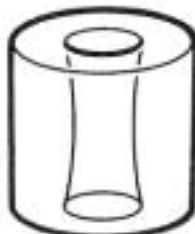


Oval Bores.

Ensure the mandrel is the correct size for the hole to be honed. Thoroughly true stone and shoes, 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. Use keyway tooling for bores containing cut outs, large cross holes, etc..

On the automatic honing machine ensure component is free to float and movement is not restricted by the fixture.



Bellmouthed Bores.

Thoroughly true stone and shoes, preferably to the exact bore diameter. Reduce stroke length. Use mandrel with shorter stone length, if available.

Reduce stone length:- If bore is longer than $\frac{2}{3}$ stone length, shorten STONE ONLY at both ends. If bore is shorter than $\frac{2}{3}$ stone length, reduce stone and shoe equally to $1\frac{1}{2}$ times bore length.

If bellmouthing persists continue to shorten stones only. Use softer stone. Over correction will cause barrelling.



Barrelled Bores.

Thoroughly true stone and shoes, preferably to the exact bore diameter.

Increase stroke length.

Use mandrel with longer stone length, if available.

Shorten shoes only at both ends.

Over correction will cause bellmouthing.



Combined Bellmouth/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 $1\frac{1}{2}$ 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 stones and shoes, preferably to the exact bore size.

If manually honing reverse component on the mandrel frequently.

If honing automatically adjust stroke position to allow more stone to pass through the tight end of the bore.

Taper in Blind Bores.

Shorten stone and shoes to $\frac{2}{3}$ bore length maximum.

Thoroughly true stones and shoes, preferably to exact bore size.

Check truth of stones frequently with truing sleeve.

If bore has insufficient or no relief at blind end, shorten stone further or use stone with hard tip.

Ensure adequate supply of honing fluid to blind end.

Stone Glazed.

Stone does not cut.

Open surface of stone with dressing stick.

Increase pressure.

Reduce rotation speed and increase reciprocation speed.

Use a softer stone.

Stone Loaded.

Stone is clogged with material.

Clean surface of stone with dressing stick.

Increase stroking speed.

Use softer stone.

Use coarser 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.

Excessive Stone Wear.

Reduce pressure.

Increase rotation speed.

Use harder stone.

Use finer stone.

Pick up.

Reduce pressure.

Reduce rotation speed.

Use softer stone.

Use finer grit stone.

Change hard steel mandrel for Permanent type or soft steel type.

Check quality of honing fluid.

Finish too rough.

Thoroughly dress stone and shoes preferably to exact bore size.

Increase rotation speed.

Reduce pressure.

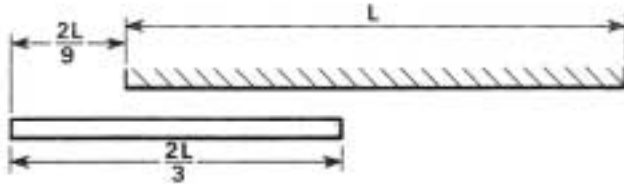
Use finer grit stone.

Check quality of honing fluid.

Change hard steel mandrel for Permanent type or soft steel type.

Ideal Stone Length.

The relationship between the length of the bore, honing stone and reciprocation have a direct effect on the parallelism of the honed hole. For a simple tube type component the length of stone used should not exceed $\frac{2}{3}$ of the length of the component.



If the bore length is L then the stone length will not exceed $\frac{2}{3}L$. To produce a parallel hole the stone must pass out of each end of the bore by one third of its own length i.e. $\frac{2}{9}L$.

This formula is true for a wide variety of applications. If L is fairly long it will not matter if the stone is shorter than $\frac{2}{3}L$ as this rule prescribes the maximum desirable stone length, however the mandrel with the longest stone in accordance with the formula should always be used so that the largest area of abrasive is employed.

Stone Dressing.

It is essential for bore geometry, that the surface of the honing stone is parallel with the mandrel workhead when expanded into the bore. The accumulation of manufacturing tolerances on the stone, wedge and mandrel make parallelism suspect and so every new stone used should be checked with the truing sleeve and dressed in if required as follows:-

The truing/dressing operation should be performed DRY at relatively low speed and light pressure.

The truing sleeve is placed over the mandrel and the stone expanded to contact the bore. Start rotation and stroke the truing sleeve back and forth a few times. When the sleeve is removed the areas of stone it has contacted will be loaded with cast iron and will show up as black spots. These are the high spots and should be dressed down with an abrasive dressing stick, the truing sleeve should be reversed and the process repeated, until the black contact area is evident along the full length of the stone. Reversing the truing sleeves ensures that any taper in the sleeve is not reproduced on the stone. Used stones can be re-checked for truth in the same way. The truing sleeve should be used as a gauge only. Always use a dressing stick to correct the stone.

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 mandrel.

Wedge Wear.

Because of the very nature of the honing process wedges are subject to wear which in turn causes a deterioration in the performance and accuracy achieved.

Wedges should be checked before use and replaced when wear is apparent.

(Refer to page 31 Replacement Wedges). Always destroy worn wedges.

Wedge Collapse.

The thin wedges used with small diameter tooling Y, Z, AA, NBB, can be subject to cratering on the front lift face when used with diamond and CBN stones at higher pressures. This causes the front end of the stone to drop causing errors in shape.

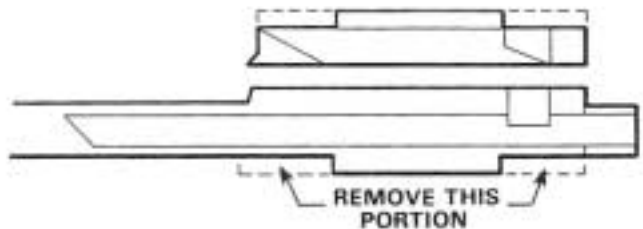
Case hardened wedges are available for use with diamonds and CBN stone in the four sizes stated. (Refer to page 31 Replacement Wedges.)

Modifying Mandrels & Stones.

Although the comprehensive range of Delapena short and long series tooling covers a wide variety of application, it is sometimes necessary to modify the length of the honing stone to achieve specific requirements. Generally speaking both the stone and mandrel should be modified together and identically. To do this:- cut through the abrasive down to the stoneholder and chip or file off the piece not required. The guides on the mandrel workhead should be ground off to leave the remaining section the same length as, and in the same position as the stone.

Short Open Bores.

For "over square" bores i.e. bore length less than bore diameter, the components should be stacked wherever possible to achieve a suitable overall honing length. If stacking is not possible then the length of stone and mandrel workhead should be reduced to $1\frac{1}{2}$ - $\frac{2}{3}$ times the length of the bore. Always start at $1\frac{1}{2}$ times the bore length and reduce as necessary. The stone and mandrel should be reduced equally at both ends to leave the desired portion central about the stone lifting points.



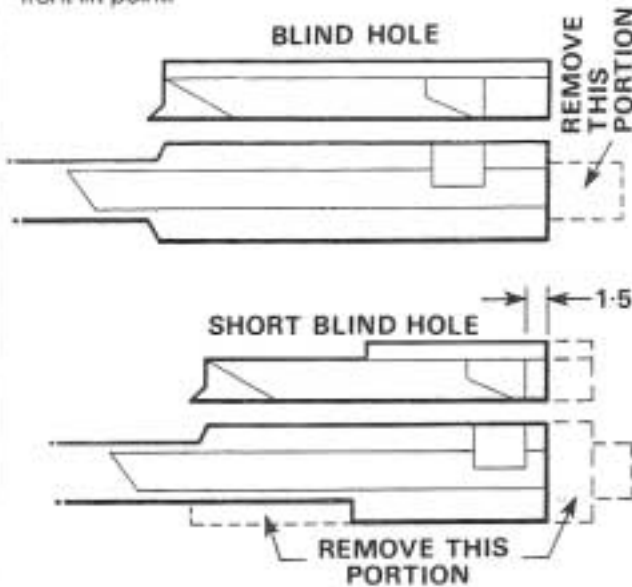
Blind Bores.

The Ideal stone length law applies to blind bores as well as open holes, but because of the inability to overstroke at the blind end, it may be necessary to reduce the stone length further. Ideally blind bores should be undercut and theoretically the width of the undercut should be $\frac{1}{3}$ of the stone length, however the width of the undercut is normally considerably less and so the stone length must be reduced still further, but should never be less than three times the undercut length.

The shorter the stone length, then so the errors in parallelism and bore straightness increase.

All mandrels between 3.05 - 25.4mm ($\frac{1}{8}$ - 1") diameter can be modified for blind hole use. To modify the mandrel remove the pilot end, to ensure that the end of the stone is flush with the end of the mandrel workhead. If necessary reduce the stone and mandrel workhead length to two thirds of the bore length. It is important that at least half the stone length is behind the front lift point to prevent the stone from tipping.

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.



Tipped Stones.

When honing blind bores with no undercut or insufficient run out allowance, results may be improved by using a hard tipped stone, i.e. a stone with a short piece of hard grade abrasive at the front end with a normal grade over the remaining length. The harder abrasive reduces the wear that the stone tip is subjected to when no relief is present.

Replaceable Shoes.

Shoes are available in two materials, bronze, and cast iron in a range of sizes to suit all P.T. mandrels from 15.62mm - 66.68mm (.615" - 2.625") diameter. Mandrels above 66.68mm (2.625") diameter use mazak shoes only.

The design of the die cast bronze shoe enables the shoe to have positive two point contact at any diameter within the range of mandrels.

Cast iron shoes are supplied in a part machined condition and should be machined to the radius of the bore to be honed before use.

All mandrels above 25.4mm (1.00") diameter are supplied with packing strips. The packing strips should be placed between the shoe and the mandrel if the diameter to be honed is in the upper half of the range of the mandrel. This ensures that all the abrasive can be used when honing at the extreme range of the mandrel.

When using mandrels with two or three shoes in line check that all the shoes are the same height and contact the bore along their entire length. If in doubt fit the packing strips supplied and machine the shoes to the radius of the bore to be honed, this is also advantageous when close control of shape is required.

All mandrels are fitted with bronze shoes as standard which are suitable for most honing applications.

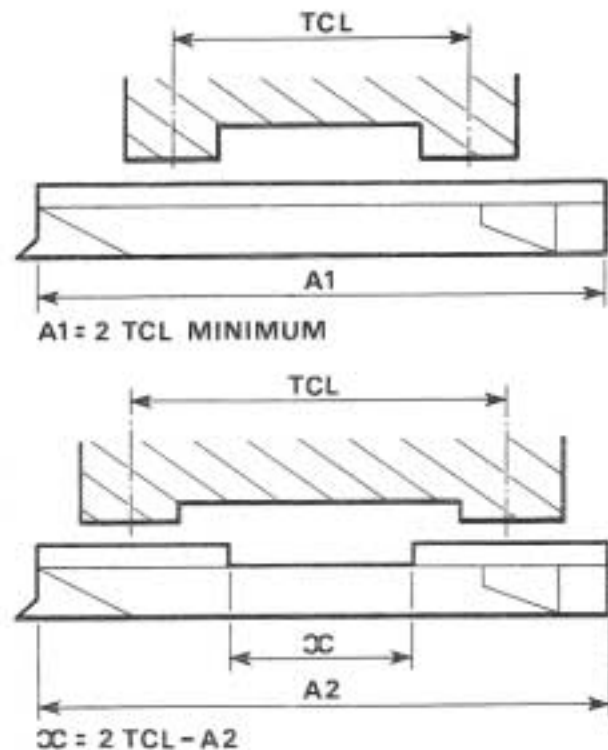
Tandem Bores.

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 at some time during the honing stroke.

To achieve this the stone length must be at least twice the centre to centre distance of the tandem bores.

If the stone length is less than twice the tandem centre lines distance the centre of the stone will not wear out and a resulting lump on the honing unit will bellmouth the inside edges of both bores.

To prevent this the centre portion of the stone must be removed, the amount removed being equal to the amount that the stone length is short of being twice the tandem centre lines (TCL) dimension.



Cast iron shoes are particularly suitable for production honing because of their wear resistance and ability to hold shape. Also recommended when honing with diamonds, and when honing abrasive materials such as ceramic.

Hardened Steel shoes can be supplied to special order.

Keyway Mandrels.

It is essential that Keyway mandrels and stones are dressed to the exact diameter of the bore to be honed. The full form radius on both mandrel and stone is necessary to prevent the leading edges dropping into the Keyway slot which would cause jamming and subsequent damage to the honing unit and/or component.

All P.T. Keyway mandrels are fitted with cast iron shoes which must be turned to the exact bore diameter to be honed. The stone should then be fitted and dressed in.

The stone and shoe cannot be used for any other diameter within the range of the mandrel without first being re-machined and then dressed in to the new diameter.

NOTES



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