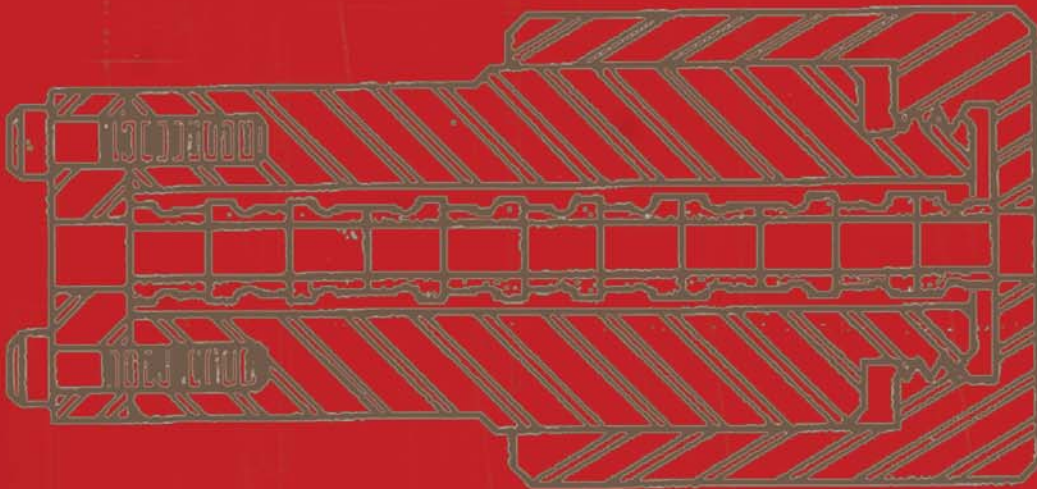




SUNNEN[®] HONING TECHNIQUES

DATA FILE: #102

HONING SHORT BORES



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SHORT BORES

GENERAL

In a "normal" length bore, honing will maintain the pre-machined bore centerline; but as the bore becomes "short" in relation to its diameter, the part becomes less stable, and its centerline can change during honing. Generally, a bore is "short" when the bore length is less than the bore diameter, and it must be honed using one of the short bore honing techniques *described under "Techniques For Honing Short Bores"*. Factors other than bore length can also affect part stability.

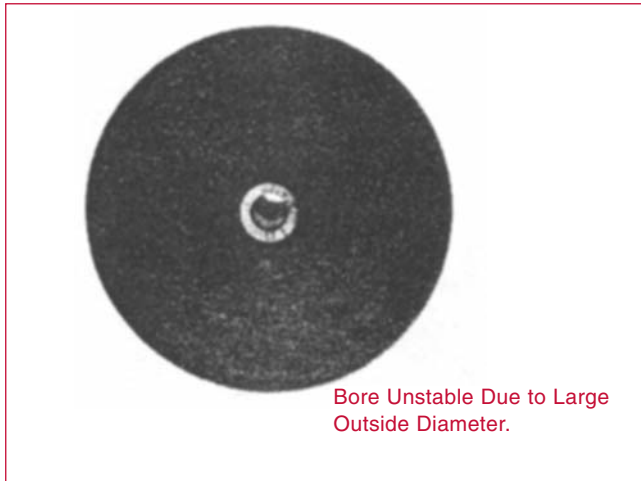


Figure 1, Example 1

Example 1 (*see Figure 1*): The large outside diameter of this part indicates that the bore should be honed using one of the short bore honing techniques. *See "Honing Free- Hand" on page 5.*

Example 2 (*see Figure 2*): Because the bore to be honed is not centered with respect to the weight of the part, one of the short bore honing techniques should be used.

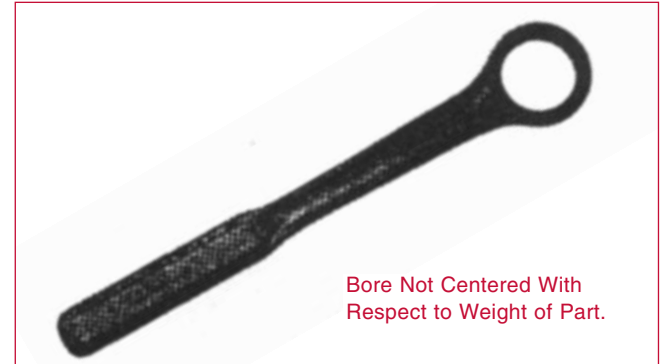


Figure 2, Example 2

TECHNIQUES FOR HONING SHORT BORES

GENERAL

There are three basic techniques used for honing short bores:

- Stacking - clamped or loose.
- Honing Free-Hand - one or two at a time.
- Honing Against a Faceplate.

STACKING (Clamped)

In stacking, short parts are lined up by their bores, end clamped and honed as one long bore (see [Figure 3](#)). This is the preferred method of honing "short" bores because it gives high production rates. The "stacked" bore can be honed and gauged as a single long open bore using standard, unaltered tooling and automatic size control (if your machine is so equipped).

Preconditions for Stacking (clamped):

1. The workpieces must have flat, parallel end surfaces (see [Figure 4](#)).
2. The bores must be close to the same diameter prior to honing (see [Figure 5](#)).
Parts with varying inside diameters can be sorted before stacking. They were all honed to .385" final finished bore size.
3. The bores should be square to their end surfaces prior to honing. Any out-of-squareness will require extra stock removal.
4. Workpieces must not deform under end clamping pressure.

Stacking does not require the workpiece end surfaces to be large, or the workpiece to have any particular outside shape. Workpieces with spherical outside shapes have been stack honed successfully.

How to Stack (clamped)

1. Make the Holding Fixture (see [Figure 6](#)):
The holding fixture is a customer-made device that end clamps a stack of parts to absorb honing torque. Make the inside diameter of the holding fixture large enough to provide sufficient clearance for part alignment (see [Figure 7](#)). Make the hole in the Jam Nut and Holding Cup larger than the finish diameter.
2. Align and End-clip (see [Figure 8](#)):
If there is considerable stock to be removed by honing, and no concentricity to be maintained, the bores can be centered roughly on a solid plug. A better method is to use an expanding mandrel for lining up the bores.
Use the honing tool for precise bore alignment. The honing tool can be used as an expanding mandrel.

Slip the holding cup on first, then the stack of parts, followed by the jam nut. Expand the stone, slip cup over the stack, screw in the jam nut and tighten sufficiently to keep parts from slipping. Remove complete assembly from honing tool and tighten securely before honing.

NOTE: Any misalignment due to size variations will result in loss of concentricity after honing. If concentricity must be maintained, use the loose stacking technique [described on page 4](#).

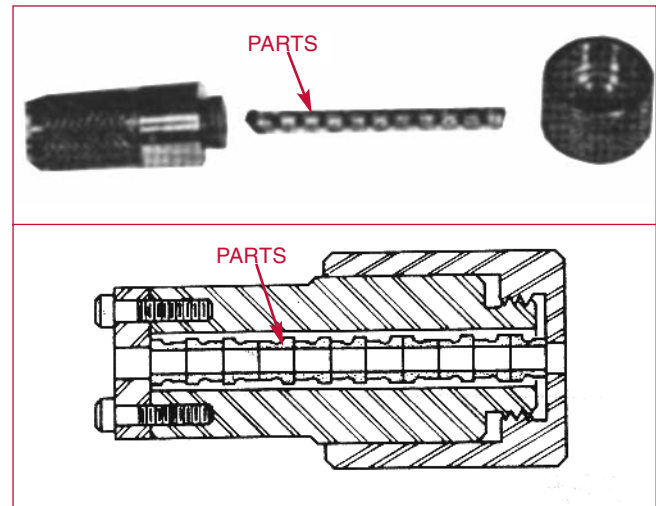


Figure 3, Stacking (Clamped)

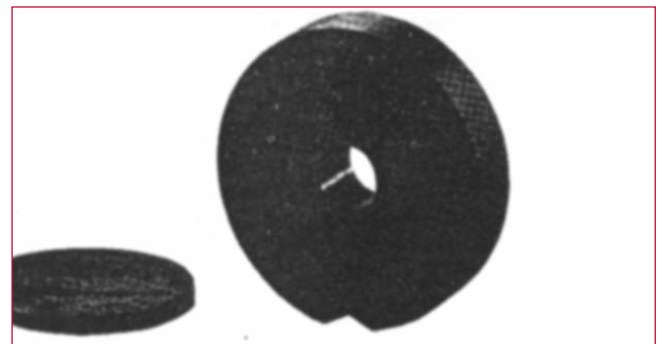


Figure 4, Flat & Parallel

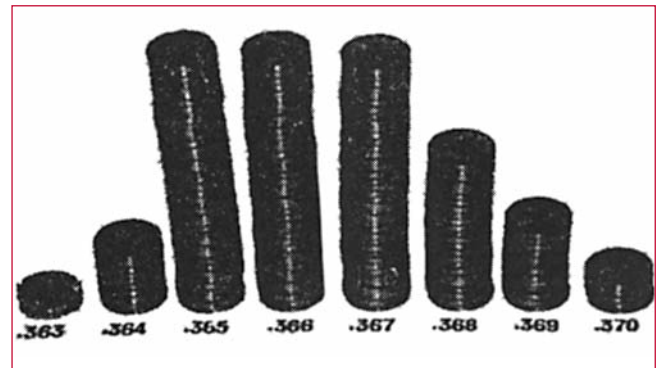


Figure 5, Same Diameter

3. Hone (see Figure 9):

The stacked workpieces can now be honed as one long bore using standard tooling and automatic size control (if your machine is so equipped).



Figure 6, Holding Fixture

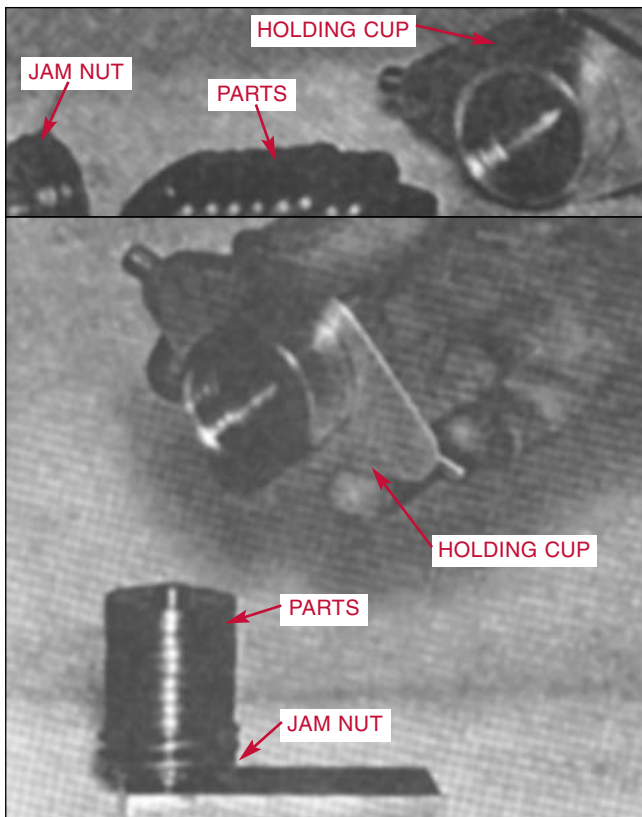


Figure 7, Holding Fixture



Figure 8, Align and End-clamp

STACKING (Loose)

Honing torque on stacked parts can sometimes be absorbed by the outside diameter of each part instead of end clamping the entire stack with a precision holding fixture. This is referred to as loose stacking, and it has different characteristics than clamped stacking.

Fixturing for loose stacking is easier because a precision holding fixture is not required. Also, because parts are not clamped together, individual part concentricity can be maintained despite variation in bore size prior to honing.

Although unaltered standard tooling can be used, automatic size control generally cannot. Keyway tooling must be used on bores with keyways.

Preconditions for Stacking (loose):

1. Workpieces with short bores must have flat, parallel end surfaces.
2. Short bores should be square to their end surfaces prior to honing. Any out-of-squareness will require extra stock removal.
3. The outside diameter of the workpiece must have a shape that allows a torque absorption fixture to easily engage, such as gear teeth (see Figure 10).
4. Loose stacking must be done on a Sunnen power-stroked honing machine or on Sunnen Models MBB-1650 and MBB-1660 (manual) Honing Machines equipped with a KKN-100

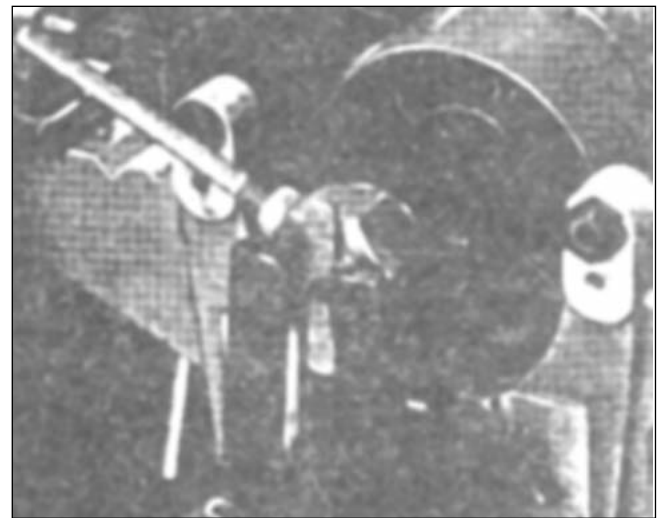


Figure 9, Hone

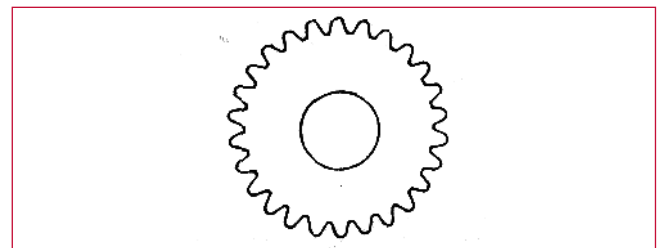


Figure 10, Stacking (Loose)

Two Case Histories of Loose Stacking

Case 1 (see Figure 11)

Setup: Select and install the correct faceplate for your workpiece (see "Tool Selection and Alteration"). Bend a piece of sheet metal as shown above for a torque fixture and install on stroking arm with rod.

Install KKN-615A Flex Pads in place of carbide pads on finger set, and adjust Gate to length of stack. Set the stroke length and position so the stone comes no further than halfway out of each end part during stroking.

Hone: Load workpieces directly onto the mandrel, close the gate, position sheet metal to absorb torque and hone.

Case 2 (see Figure 12)

Setup and honing are the same as in Case One (sheet metal torque fixture), except for the Torque Absorption Fixture. To make this fixture, cut a bar of aluminum slightly shorter than the stack of parts

to be honed. The aluminum bar should be approximately Y2" (13 mm) larger in diameter than the outside diameter of the part.

Lay out a gear on one end of the bar (see Figure 13). Drill a Small Hole located far enough from the center so that more than half the hole will be left after the Large Hole is drilled. Then drill the Large Hole, big enough to make it very easy to insert the gears. Press a pin into what's left of the Small Hole and fasten a Torque Bar, at least 4" long, to the Aluminum Bar, as shown.

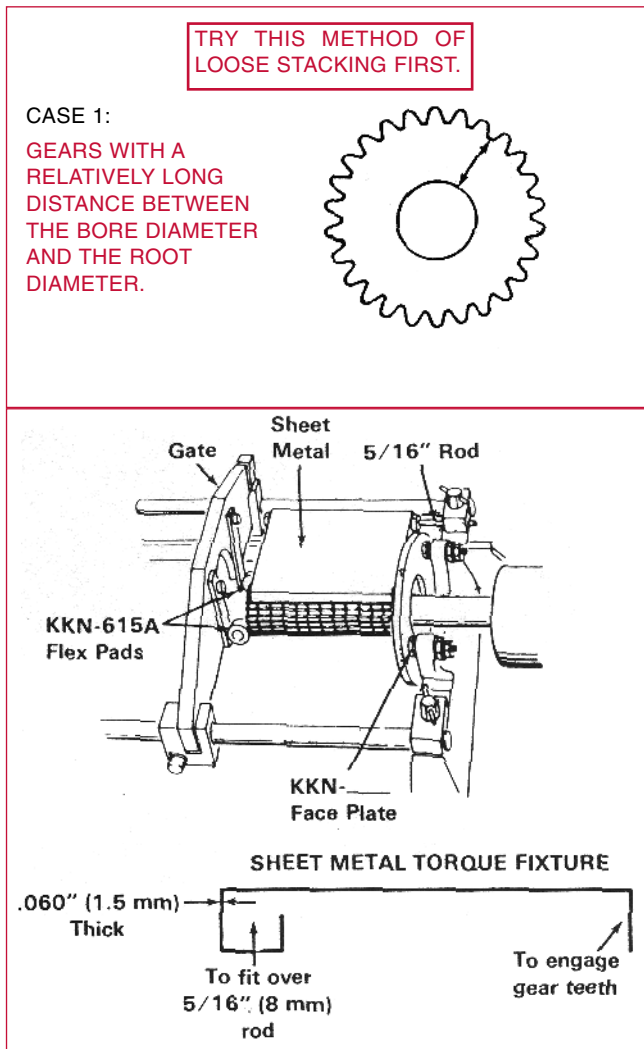


Figure 11, Case 1

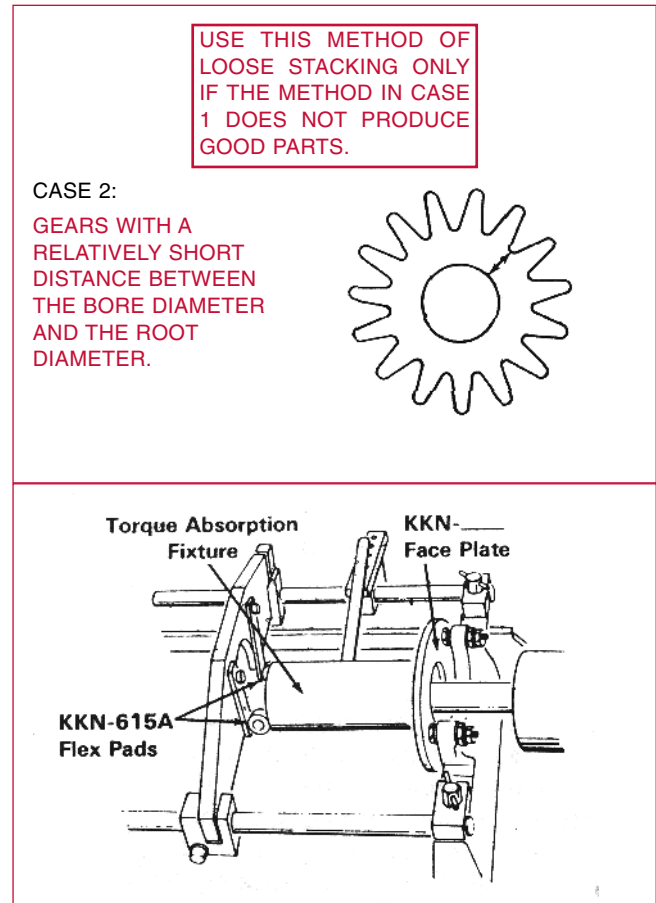


Figure 12, Case 2

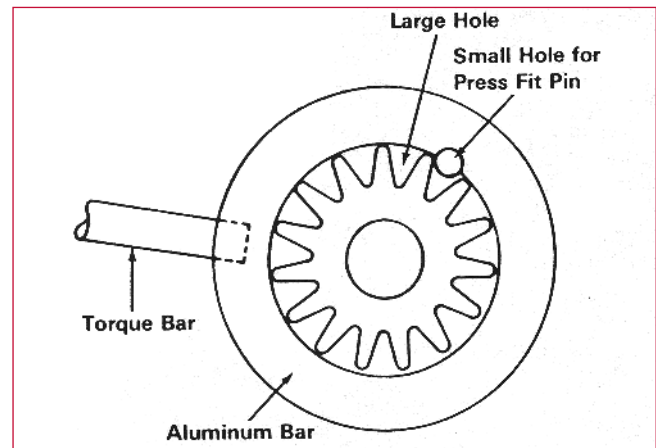


Figure 13, Torque Absorption Fixture

HONING FREE-HAND

One Part at a Time

Almost any workpiece with a bore length equal to or greater than the bore diameter can be honed one workpiece at a time free-hand. Avoid side thrusts on the workpiece by honing with both hands and keeping your fingers as close to the bore as possible (see [Figure 14](#)). Alter tooling as directed in "Tool Selection and Alteration".

Keyway tools, with their wider stones and guide shoes, can be used to better stabilize a short bore if the stock removal is less than .005" (0.13 mm) per part. The keyway tool must be trued close to the finish diameter for good results.



Figure 14, Hand Placement



Figure 15, Faceplate

Two Parts at a Time

Honing two parts at a time has the advantage of doubling the effective bore length. Therefore, less tool alteration is required and the bore centerline is less likely to change. However, production rates will not necessarily be increased over honing one part at a time, because each part must still be gauged individually.

Parts honed in pairs must have at least one flat end that is perpendicular to the bore, and these ends must be held together.

NOTE: These bores can generally be power-stroked against a faceplate. See "Honing Against a Faceplate" below.

HONING AGAINST A FACEPLATE

Many parts have bores which cannot be honed to the required tolerances by any of the techniques previously discussed. These parts may have extremely short bores (too short for honing one or two at a time), or may not have parallel ends to allow stack honing. A good percentage of this work may have a flat face at one end of the bore and can be honed one part at a time while being pressed against a faceplate (see [Figure 15](#)). This technique has been used for honing the straight, narrow sizing lands (at the ends of the tapered approach angles in drawing dies) square to the die base surface.



Short blind holes are usually honed against a faceplate to hold squareness to the workpiece end and to increase stability. Any relief that can be pre-machined in the bottom of a blind hole will greatly facilitate honing; the longer the relief, the easier the honing. Relief allows over-stroking the blind end of the bore and avoids leaving a radius in the blind corner. *For additional information on honing blind bores, ask for Data File No. 103 "Honing Blind Bores".*

Preconditions for honing against a faceplate:

1. Suitable Honing Machine.

Faceplates can be attached on Sunnen power-stroked honing machines and Sunnen Models MBB-1650 & MBB-1660 (manual) Honing Machines when equipped with a KKN-100 Honing Fixture (see [Figure 16](#)).

2. Workpieces must be "short", with a flat face. Honing against a faceplate is only used when parts are too short to be stabilized by the honing tool

SUNNEN HONING TECHNIQUES

alone. Out-of-squareness, caused by previous machining or heat treatment operations can be corrected when the bore length is no longer than one-fourth the bore diameter.

However, if squareness has already been established by a previous machining operation, it can be maintained in longer bores. These are general guidelines, and case history files contain many successful honing exceptions.

3. Capacity to Eliminate Conical Mandrel Runout.

If the mandrel is not perpendicular to the faceplate, conical runout will produce taper when honing a short part against a faceplate. An MBC-345 Adjustable Spindle Nose makes the elimination of conical runout quick and easy (see Figure 17).

The MBC-345 Adjustable Spindle Nose is standard equipment on Sunnen Honing Machine Models MBC-1803 & MBC-1804; retrofit kits are available for many other models.

Order MBC-370 Spindle Nose Kit for Honing Machine Models:

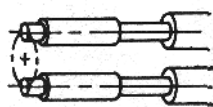
MBB-1660, Serial Number 83569 or lower, which has the optional KKN-100 Honing Fixture installed.
MBB-1690, Serial Number 83569 or lower
MBB-1800, Serial Number 8000 or higher
MBC-1800, Any Serial Number
MBC-1801, Serial Number 83569 or lower
MBC-1802, Serial Number 83569 or lower

Order MBC-365 Spindle Nose Kit for Honing Machine Models:

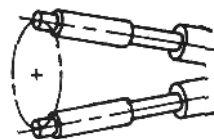
MBB-1660, Serial Number 83570 or higher, which the optional KKN-100 Honing Fixture installed.
MBB-1690, Serial Number 83570 or higher
MBC-1801, Serial Number 83570 or higher
MBC-1802, Serial Number 83570 or higher

Honing machine models other than specified above cannot be fitted with the MBC-345 Adjustable Spindle Nose, so other methods (described below) must be used to eliminate conical runout.

When conical runout is not severe, it can be corrected with the use of a truing sleeve. Use a truing sleeve of the proper diameter and as long as the part, with one end flat and square to the bore. Hold the end of the truing sleeve firmly against the faceplate and



PARALLEL RUNOUT SHOULD BE ELIMINATED, BUT WILL NOT AFFECT ACCURACY UNLESS SEVERE.



CONICAL RUNOUT WILL AFFECT ACCURACY AND MUST BE ELIMINATED..

Figure 17, Runout

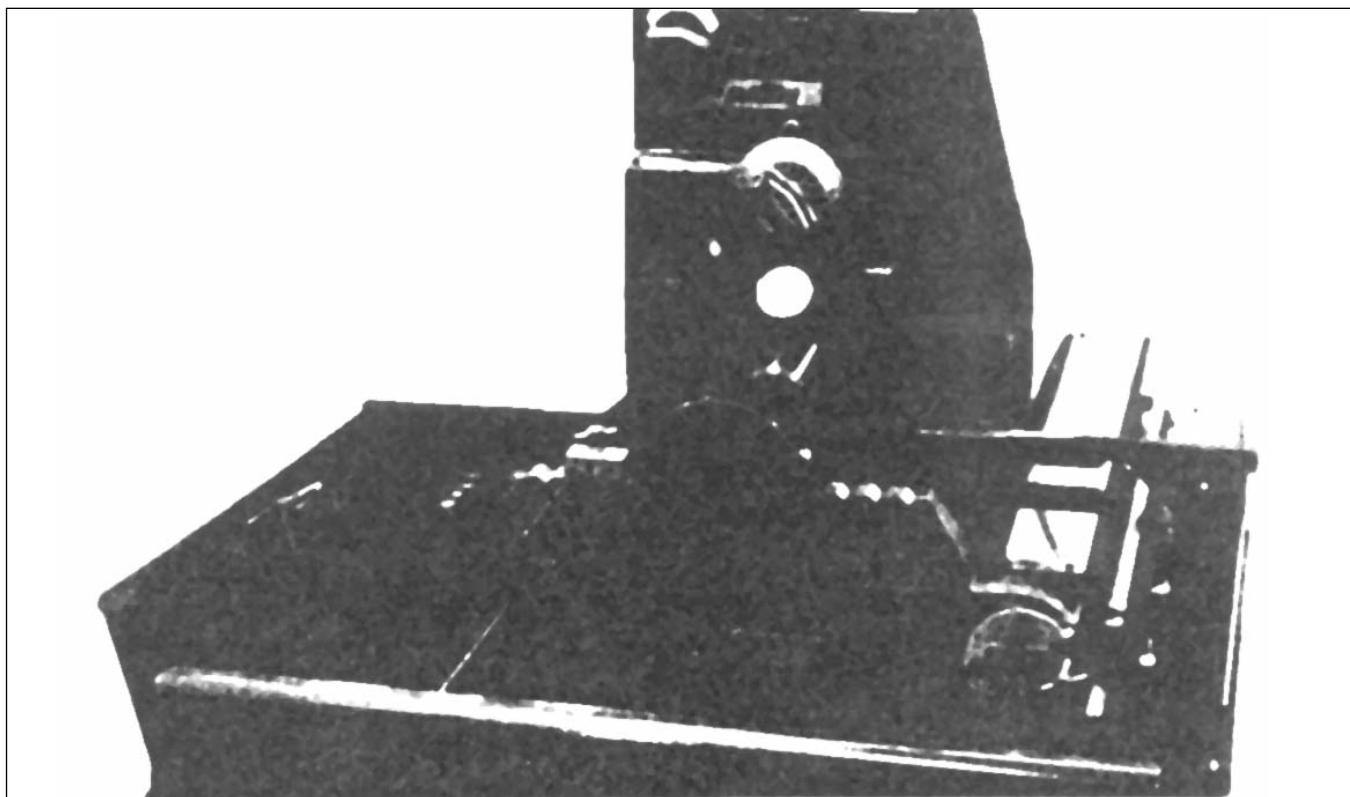


Figure 16, KKN-100 Honing Fixture

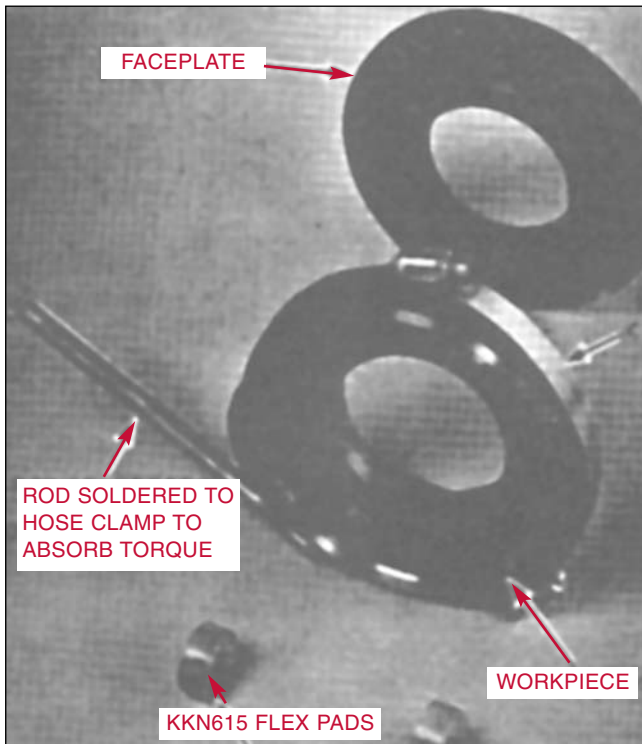


Figure 18, Faceplate

"true-in" the high spots of the stone and guide shoes. If conical runout is severe, try using a new adapter and a new mandrel.

HOW TO HONE AGAINST A FACEPLATE:

Select the proper faceplate (*see "Tool Selection and Alterations"*) and bolt it on the stroking arm of the honing machine (*see Figure 18*). Adjust the ground face of the faceplate, square to the spindle rotation (*see Figure 19*). Complete instructions for this adjustment can be found in the operating instructions for power-stroked honing machines and KKN-100 Honing Fixture. Select and alter the mandrel and stone as detailed in "Tool Selection and Alteration".

During honing, the flat end of the short bore workpiece is held firmly against the faceplate by thumb pressure (manual honing) or flex pad pressure. Do not clamp the workpiece solidly, as it must be free to slide on the faceplate.

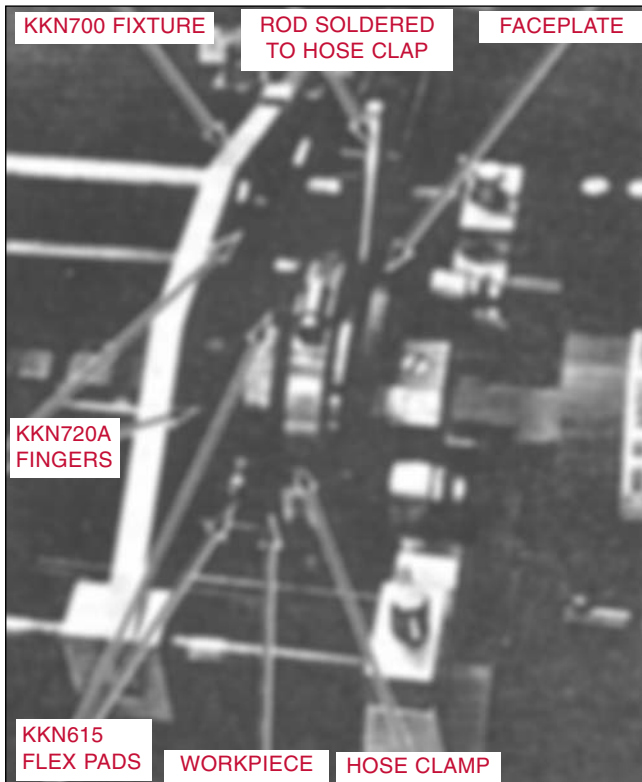


Figure 19, Faceplate Installation

TOOL SELECTION AND ALTERATION

SELECTING A FACEPLATE

Selecting a Faceplate

OUTSIDE DIAMETER RANGE OF WORKPIECE FACE		MAXIMUM INSIDE DIAMETER OF WORKPIECE		FACE PLATE
(inches)	(MM)	(inches)	(mm)	
.345- .380	8,8- 9,7	.200	5,1	KKN-201
.380- .460	9,7-11,7	.230	5,8	KKN-202
.460- .575	11,7-14,6	.290	7,4	KKN-203
.575- .730	14,6-18,5	.380	9,7	KKN-204
.730- .925	18,5-23,5	.510	13,0	KKN-205
.925-1.160	23,5-28,0	.650	17,0	KKN-206
1.160-1.430	28,0-36,0	.820	21,0	KKN-207
1.430-1.740	36,0-44,0	1.030	26,0	KKN-208
1.740-2.090	44,0-53,0	1.270	32,0	KKN-209
2.090-2.480	53,0-63,0	1.540	39,0	KKN-210
2.480-2.820	63,0-72,0	1.850	47,0	KKN-211
2.820-3.190	72,0-81,0	2.190	56,0	KKN-212
3.190 and over	81 and over	2.560	65,0	KKN-213

Selecting a Mandrel

Select the mandrel with the shortest stone and guide shoe length, when honing short parts one or two at a time. Stone and mandrel alterations may still be required (see Figures 20 & 21).

When honing parts in a stack (clamped), select tooling that has a stone length of between 2/3 and 1-1/2 times the stack length. When honing a loose stack, the tooling must have a stone length greater than the stack length.

Selecting a Stone

When honing parts in a stack, use the stone recommended in the Sunnen Supply Catalog. When honing short parts one or two at a time, use a harder stone than recommended in the Catalog. The last number(s) in the stone part number designate stone hardness, with one (K6-A61) being softest and thirteen (K6-A413) being hardest. For example, if the Catalog recommends a P28-A57 stone, order a P28-A59 stone (the next available harder stone) when honing short parts one or two at a time.

Stone and Mandrel Alteration

For short open bores, shorten the stone and guide shoe equally from each end until they are no more than 1Y2 times the bore length. If the stone and guide shoe are left longer, the honed parts may be bellmouthed (bigger on the ends).

For short blind bores, use a front mount alteration. Cut back the stone and stoneholder, mandrel, guide shoe and wedge tip, so that only 1/16" (1.5 mm) extends beyond the front wedge contact (slot). Shorten stone and guide shoe from the back end (opposite of tip) until they are 3/4 of the short bore length. Both steps in this alteration are required before a short blind hole can be honed without taper.

For special problems, contact your local Sunnen Field Engineer or Sunnen Products Company.

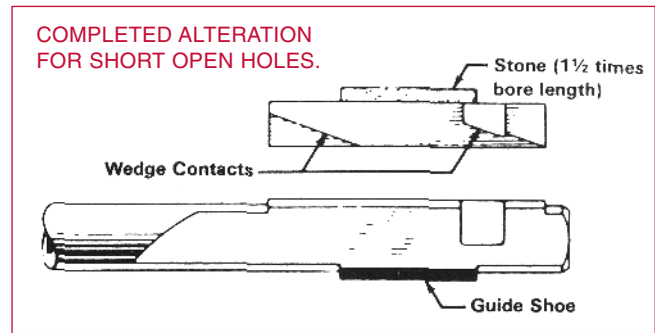


Figure 20, Mandrel Alteration

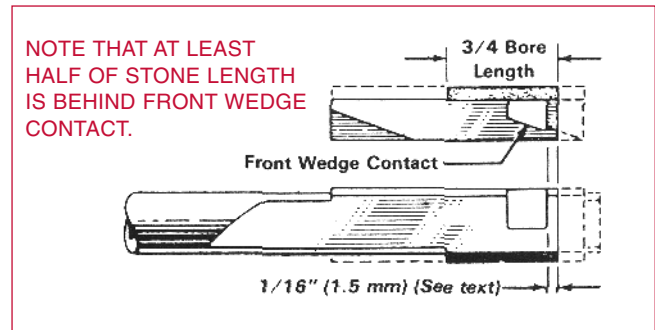


Figure 21, Mandrel Alteration

NOTES

data files

- 101 - Honing Bores With Keyways And Splines
- 102 - Honing Short Bores
- 103 - Honing Blind Holes
- 104 - Obtaining Specified Finishes By Honing
- 105 - Choosing the Right Stone
- 106 - Honing Tandem Holes
- 107 - Making Manual Honing Easier With Workholders
- 108 - Fixturing Parts For Power Stroking
- 109 - Vertical Hone Fixture
- 110 - Honing Small Bores
- 111 -
- 112 - External Honing
- 113 - Fixturing Design Considerations For Automatic Krossgrinding® Machines

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