

ROTTLER
MANUFACTURING

FA2EB

BORING MACHINE

MACHINE SERIAL NUMBER

OPERATIONS AND MAINTENANCE
MANUAL



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NOTE: WHEN ORDERING REPLACEMENT PARTS,
PLEASE GIVE THE MODEL AND SERIAL NUMBER.

ORDER BY PART NUMBER.

THERE IS A MINIMUM ORDER OF \$25.00

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ELECTRONIC DEVICE MANUALS (SEE SEPARATE MANUALS
IN ELECTRICAL ENCLOSURE)

Introduction:

This manual is divided into sections as listed in the table of contents.

It is required that the new user of the FA2EB read this manual in particular the sections concerning safety, before operating the machine.

Description:

The model FA2EB boring machine is a precision, single point tool, boring unit. It can be equipped with tooling and accessories for reboring most American passenger car and truck engines, both inline and, 90 and 60 degree V-types.

FA2EB machines may be readily tooled to rebores a wide variety of engines, including European and Asian engines. As well as perform various other boring operations.

This machine is designed for two purposes:

1. The alignment of cylinder bores to the pan rails and main bearing locations, as have been done in the original factory boring. This overcomes the many inaccuracies and out-of-alignment problems associated with clamping portable cylinder boring bars to blocks.
2. A considerable savings in hole-to-hole time and operator involvement as a result of fast block clamping, inverted centering fingers, push button controls, air operated spindle clamping and air floated spindle base positioning.

Change over or resetting time required to set up V-type or in-line engines is a minimum, making this machine highly suited to the jobber shop where engines cannot be run through, in model lots.

The vertical feed and rapid travels are power operated and controlled from the conveniently

located operator control panel. An auxiliary hand feed travel is located at the base of the feed screw to be used for counterboring and facing sleeves, etc..

Power required is 205-245 volt, single phase. This provides power to the variable speed AC motor controller, the operator pendant controller, and various relays and solenoid valves that actuate mechanical controls on the machine to engage feeds and travels as well as clamping and floating of the spindle unit.

Limited Warranty:

Rottler Manufacturing Company model FA2EB parts and equipment are warranted as to materials and workmanship. This limited warranty remains in effect for one year from the date of delivery, provided the machine is owned and operated by the original purchaser and is operated and maintained as per instructions in this manual.

Standard air and electric components are warranted by their respective manufacturers.

(NOTE: individual warranty periods may vary considerably from Rottler Manufacturing policy).

Tools proven defective within the warranty period will be repaired or replaced, at the factory's option.

We accept no responsibility for defects caused by external damage, wear, abuse, or misuse, nor do we accept any obligation to provide compensation for other direct or indirect costs in connection with cases covered by the warranty.

Freight charges on warranty items (non-air shipment only) will be paid by Rottler Manufacturing for a period of 60 days only from date of installation or set-up by a qualified service technician or sales rep.

Freight charges after the 60 day period are the customers responsibility.

Safety Information:

CAUTION:

This machine is capable of causing severe bodily injury.

The operator of this boring machine should be a skilled machinist craftsman who is well versed in the caution, care, and knowledge required to safely operate metal cutting tools.

As with all machine tools eye protection must be worn at all times by the operator and other personnel within the area of the machine.

In particular, the operator should be very cautious of the cutting tool area.

When boring, the machine is capable of projecting chips over 10 feet from the cutting area. Always use guards.

Operator should be very careful to provide adequate clearances around the set-up area when using the machine.

The FA2EB machine operates under computer control and is susceptible to extraneous electrical impulses internally or externally produced. The machine may make moves out of the control of the operator at any time. The operator should work in and around the machine with caution.

The operator and nearby personnel should be familiar with the location and operation of the emergency stop button.

Electrical Power - Make sure all electrical equipment have the proper electrical overload protection.

Machine Operator - Operator of this boring machine should be a skilled machinist craftsman, that is, well versed in the caution,

care, and knowledge required to safely operate a metal cutting tool.

If the operator is not a skilled machinist, the operator must pay strict attention to the operating procedure outlined in this manual, and must get instruction from a qualified machinist in both the productive and safe operation of this boring bar.

Rottler Boring Equipment has the following areas of exposed moving parts, that you must train yourself to respect and stay away from when they are in motion:

1. **Tool Sharpening** - Must be done with care and dexterity to get good bore results, be alert to the light pressure required for sharpening

CAUTION:

Exposed diamond wheel is a potential hazard to you hands, fingers, and face. Eye protection is a necessity when working in this area.

2. **Cutting Tool Area** - Any operation involving hands in the cutter head area, such as centering, changing centering fingers, tool insertion and removal, cutter head changes, size checking, etc. requires that both the drive motor be turned off and that the spindle clutch (spindle rotation) lever be disengaged, in it's full up position.

NOTE: periodically check that the spindle clutch is disengaged when the lower clutch cylinder is fully extended. The spindle clutch lever should stay in the up position, by its spring plunger, when the air supply to the lower cylinder is disconnected.

3. **Boring** - Eye protection must be worn during this operation and hands must be kept completely away from cutter head. Always position the chip guard for protection before starting spindle.

4. **Upper Housing Controls** - Learn to identify and independently operate these control functions by habit while developing the awareness of keeping you fingers and hands well clear of the rotating feed screw and the knobs, both on top of the feed screw and the spindle.
5. **Work Loading and Unloading** - Carefully develop handling methods of loading and unloading work pieces, so that no injury can result if hoist equipment or lift connection should fail.

Periodically check lift components for damage that may cause failure of Block Handler Assembly. Lifting eye can eventually fail if the eye is reset in line with the 502-1-80 lift channel. Eye must be at right angle to this channel.

6. **Machine Maintenance** - Any machine adjustment, maintenance or parts replacement absolutely requires a complete power disconnect to the machine. THIS MUST BE AN ABSOLUTE RULE.

Emergency Procedure:

Assuming one of the following has occurred - tool bit is set completely off size, work or boring spindle is not clamped, Spindle is not properly centered, these mistakes will become obvious the instant the cut starts.

PRESS THE EMERGENCY STOP BUTTON. LOCATED ON THE CONTROL PANEL IMMEDIATELY.

Find out what the problem is, return the spindle to its up position, without causing more problems. To start the machine again turn the emergency stop button until it pops out.

Be alert to quickly stop the motor in the event of a serious disruption of the boring process either at the top or bottom of the bore.

“Remember” metal cutting tools have the speed and torque to severely injure any part of the human body exposed to them.

Machine Installation:

Location:

The productivity of this machine will depend to a great extent on its proper initial installation, particularly the means by which cylinder blocks can be lifted into the machine and flow easily to and from other operations in your shop.

The proper loading arrangement and area location for your FA2EB machine is extremely important.

A slow travel (6' to 10' per minute) power hoist, operated from either a bridge crane or a jib crane arrangement works very well. A 1000-lb. hoist is generally adequate for lifting the engine block. An air hoist with speed control makes an ideal method for fast, convenient loading.

If some production boring with this machine is anticipated, and the cylinder blocks are not directly loaded and unloaded from a conveyor, we would recommend considerable attention be given to the crane so that it covers an adequate area to allow the operator to back up and remove cylinder blocks without cluttering up his own area.

If two machines are to be operated by one operator, we recommend that the open faces be placed at right angles to each other, with the machines approximately three feet apart.

Unpacking:

Use care in removing the crate from the FA2EB machine, being careful not to use force on any part of the spindle unit. This is particularly true of the square tube containing the micro switches on the back of the machine.

If equipped with the optional SJ4 sharpening fixture remove it from the machine deck and preferably place at a bench close to the machine. This fixture will require 115 volt single phase AC current.

Remove the tool box, parallels, V-fixture, located at the lower portion of the machine and completely clean these articles, as well as the machine base pads and upper table, with solvent. Also, thoroughly clean the cylinder block clamp arm assemblies. Rust inhibitor is applied to the machine at the time of shipment, and any of this material left on the machine will result in considerable collecting of cast iron dirt and possible slipping of the clamp arms.

Shipping Hold Down Bolt:

Remove sheet metal cover #502-35-41A on the back side of the spindle unit, by removing its four round head screws.

Pull out the cotter key through the slotted nut of the roller key assembly and loosen the nut. Turn the machine on, switch the auto/neutral/float switch to Neutral. Hand tighten the nut to take out all of the play from the roller key assembly. Loosen the nut approximately 1/12 of a turn. Replace the cotter key in the nearest slot. Now move the spindle unit from side to side and clean the rust inhibitor from the table. This must be done repeatedly until all the rust inhibitor is gone from under the spindle unit.

Switch the float/neutral/clamp switch to Clamp and check for proper operation of the clamp assembly and proper release and movement of the base when switched back to float.

NOTE:

Clamp cylinder rods should move a max. 5/8 inch when spindle base is clamped.

Replace sheet metal cover on the spindle unit.

Leveling:

Four square head set screws (502-1-12A), jam nuts (502-1-12F), and chamfered washers (502-1-12) are provided with the machine for leveling. Insert the screw and nut at the base support points, being careful that the screw point seats in the chamfered washers below.

Use a precision level and level the upper table within .003" per foot in both directions and make sure that the machine weight is equally supported at the four support points of the base.

Air Supply:

It is very important the air source for the FA2EB boring machine be moisture free. Water and oil in the line will result in early cylinder and valve failure. Our recommendation is the installation of a water trap at the machine.

Attach a 100 p.s.i. air source to the appropriate intake at the air filter on the side of the rear control enclosure.

Check the gauge on the air regulator next to the filter on the lower portion of the enclosure to see if it is set to approximately 90 to 95 p.s.i. pressure after the air line is attached.

Power Supply:

This machine requires 205 to 245 v.a.c. single phase, 50/60hz. (measured between L1 and L2). Current requirement is 15 amps. Excessive voltage drop at the power source can cause the machine to malfunction. Check the available voltage at peak use time to see if it will supply the proper voltage.

When using two legs of a three phase supply the voltage from each leg to ground must be between 100 - 120 v.a.c. Connect per electrical hook-up directions following. *If the voltage is outside this range the machine will not operate properly and may be damaged.*

CAUTION: Do not attempt to attach three phase. The three phase spindle motor receives

its power from a three phase variable frequency inverter located in the main electrical enclosure. The input to the frequency inverter must be single phase.

Connect single phase wiring to the 4 pole terminal strip in the upper right side of the electrical enclosure. The machine is not sensitive to neutral/"hot" leg phasing. Two legs of a 208 - 240 v.a.c. 3 phase supply can be used. The power source used to supply this machine should be isolated from other

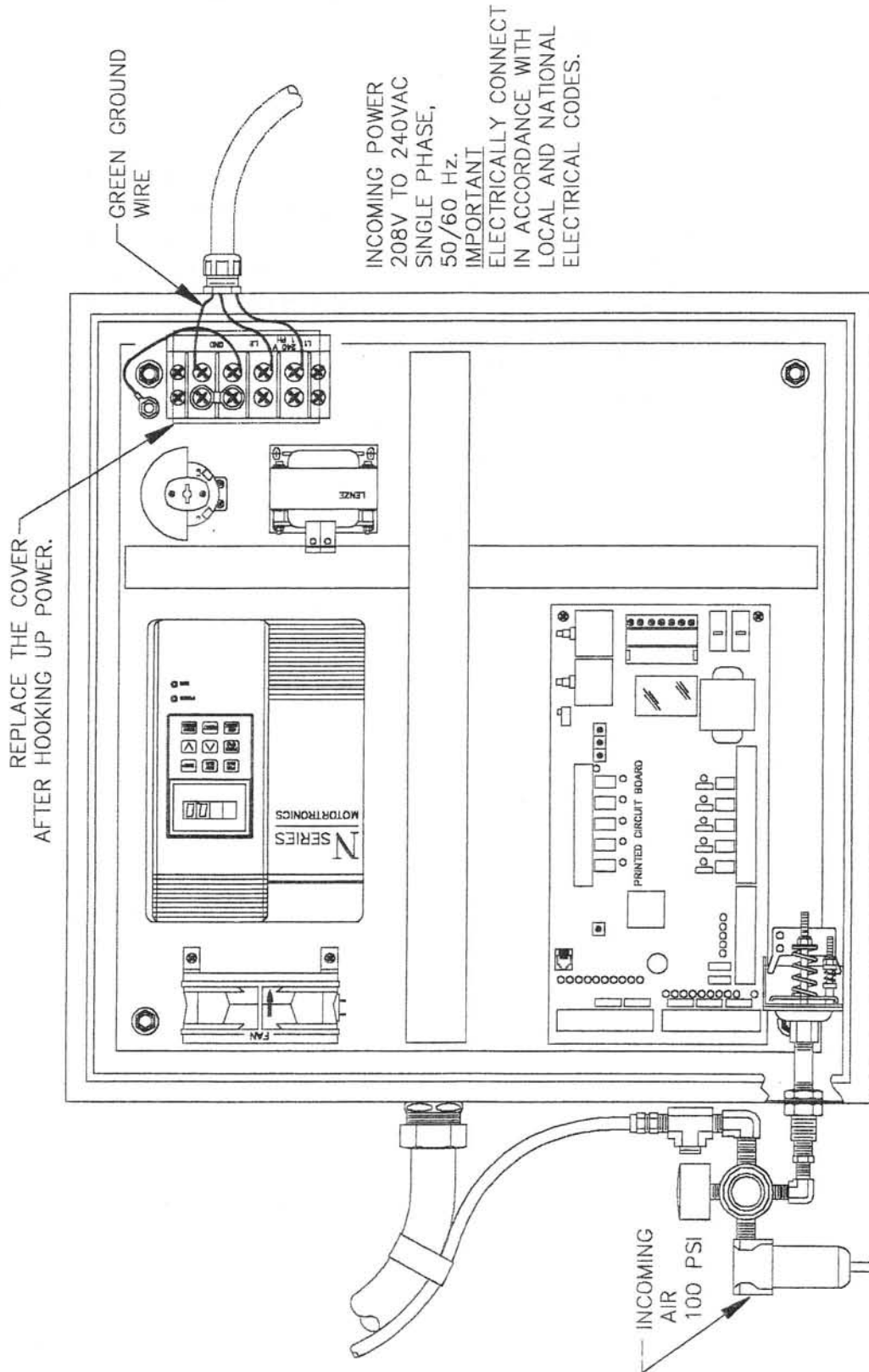
machinery that might cause large electrical noise spikes which could interfere with the machines computer.

CAUTION:

This machine must be connected to a good isolated earth ground, such as a separate ground rod installed for this machine only. Connect the earth ground wire to the terminal with the green grounding wire attached to it, on the terminal strip mounted in the upper right side of the electrical enclosure.

Electrical Hook-up Illustration:

REFFA2EB19-060694



NOTE:

We suggest that before attempting any cylinder boring, the operator should actuate the controls to become familiar with the operation of the machine. (Following these descriptions, are related illustrations.)

Main Power Switch:

The *Main Power Switch* is located on the door of the main electrical enclosure. This switch must be turned off in order to open the door, To reset the machine from an error condition turn the *Main Power Switch* off, wait 40 seconds, then turn it back on.

Down Rapid Travel Button:

(Yellow)

Push and hold this button and the machine will rapid travel down. When the button is released, or when the centering stop rod is contacted, the machine stops.

Feed Button:

(White)

Manual Mode

While pulling down the spindle clutch lever, push the feed button, this will start the spindle turning. The machine is ready to use the hand feed handle.

Auto Mode

While pulling down the spindle clutch lever, push the feed button, this will start the spindle turning and feeding down at the set speed. The machine will continue to feed down until the operator presses the stop button or the lower limit switch is contacted. When the stop button or the lower limit switch is contacted the machine stops feeding, slows rotation, indexes the toolholder to the front then stops.

Auto Return Mode

The operation of the feed button in Auto Return Mode is the same as in Auto Mode,

except when the lower limit switch is contacted the machine automatically activates the up function and returns to the upper limit switch.

Up Button:

(Green)

Manual Mode

The Up Button returns the machine to the upper limit switch. If the machine is running and the Up Button is pressed the machine stops feeding, slows rotation, indexes the toolholder to the front then stops, the Up Button must be pressed again.

Auto Mode

The Up Button in Auto Mode works the same as in Manual Mode.

Auto Return Mode

Pressing the Up Button in Auto Return Mode stops the feed, slows rotation, indexes the toolholder to the front then brings the machine up to the upper limit switch. The Up Button does not need to be pressed twice in Auto Return Mode.

Stop Button:

(Red)

The Stop Button stops the feed, slows rotation, indexes the toolholder to the front then stops the machine. Once the machine is stopped it will wait where it is.

Emergency Stop Button:

(Large Red)

The Emergency Stop Button will stop the machine in an emergency situation, Power will be turned off to the motor drive, and to the computer processor located in the rear electrical enclosure.

Wait 20 seconds before turning the machine back on. The machine requires this time to reset.

To turn the machine back on again turn the Emergency Stop Button clockwise and it will pop back out.

Float Clamp Switch:

Whenever the machine is boring this switch must be in clamp position. The clamp position activates two air cylinders and clamps the spindle base to the table so it won't move. The float position lifts the spindle base up on a cushion of air to make it easy to position the spindle base over a hole for boring.

Spindle R.P.M. Knob:

This knob adjusts the spindle rotational speed and downward feed speed. Speed can be adjusted between 150 and 700 R.P.M.

Manual/ Auto Feed/ Auto Return:

This selector switch adjusts between the three modes.

Manual Mode

For using the manual hand feed.

Auto Feed

The machine feeds to the bottom of the bore and then shuts off.

Auto Return

The machine feeds to the bottom of the bore and then automatically returns to the upper position.

Upper Limit Switch:

The Upper Limit Switch is the top switch on the tower. When the machine returns to the top, this switch turns it off.

Centering Limit Switch:

The Centering Limit Switch is the middle limit switch on the tower. When the fast down button is pressed, and held, the spindle will fast down until this limit switch is contacted. The spindle is stopped, at this point for the purpose of centering the cutter

head in the bore. This limit switch does not work in feed. If it is necessary to manually bypass this stop position, use the feed function and after the centering limit is clear use fast down again.

Lower Limit Switch:

The Lower Limit Switch is the bottom limit switch on the tower.

Manual Mode

In Manual Mode when the lower limit switch is contacted, the machine slows rotation, indexes the toolholder to the front then stops.

Auto Mode

In Auto Mode when the lower limit switch is contacted, the machine stops the feed, slows rotation, indexes the toolholder to the front then stops.

Auto Return Mode

In Auto Return Mode when the lower limit switch is contacted the machine stops the feed, slows rotation, indexes the toolholder to the front then automatically activates the up function and returns to the upper limit switch.

Stop Rods:*Upper Stop Rod*

The upper Stop Rod is the far left rod. The Upper Stop Rod triggers the upper limit switch. This rod may be adjusted so the spindle does not return to the very top of its travel. This is useful in production because it can be set to just clear the top of the work piece, avoiding unnecessary traveling all the way to the top. (NOTE: Do Not set the stop rod any lower than the installed pin as this will cause damage to the machine).

Centering Stop Rod

The Centering Stop Rod is the far right rod. This rod triggers the centering limit switch. This rod is adjusted so the cutterhead stops

inside the bore just far enough to use the centering fingers properly. Be careful not to go to far and crash the tool bit into the work piece.

Lower Stop Rod

The Lower Stop Rod is the middle rod. This rod triggers the lower limit switch, This rod must be adjusted to stop the machine before it crashes at the bottom of the bore. Check carefully the bottom depth of the bore and be sure the rod is set so the cutterhead will not hit any obstructions.

Centering Knob:

The Centering Knob at the top of the upper spindle housing, operates the centering fingers when turned clockwise. Be careful not to over-extend these fingers when the spindle is not in a bore or they will come completely out of the pinion drive.

CAUTION:

Main spindle drive motor must be stopped when centering. Spindle rotation engagement could injure the operator's hands or damage cutter head parts.

Spindle Clutch Lever:

The Spindle Clutch Lever is located at the front right of the upper housing . Pull the lever down as you push the feed button and it will engage the spindle rotation. Do Not pull the lever down after the feed button is pushed the clutch teeth will grind and may result in machine damage.

Manual Hand Feed:

The Manual Hand Feed travel is available for facing sleeves and counterboring, etc.

It is completely separate from the powered spindle travel and should always be returned to the full up position after being used, before the power up travel returns the spindle to the top.

CAUTION:

The automatic feed lever must be disengaged when operating this short hand feed.

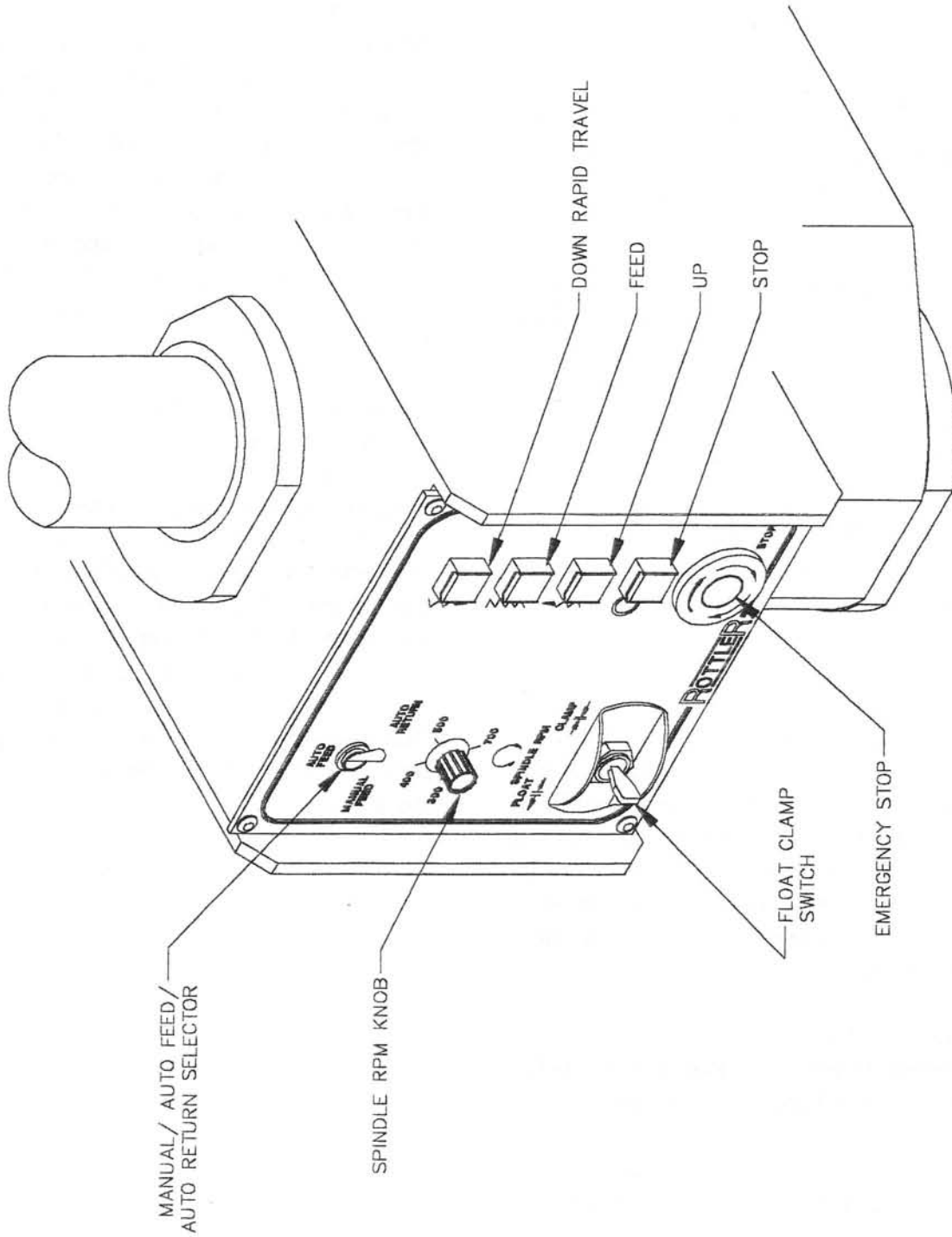
The standard procedure to operate the hand feed is to place the selector switch in manual mode. Move the centering stop rod up to a position out of the way. Rapid travel close to the cutting point. Pull down on the spindle clutch lever and push the feed button (the spindle will only rotate when the selector switch is in manual mode). Place the hand feed handle in the hole on the right side of the spindle base. Turn the hand feed handle counter-clockwise to return the hand feed. Then press the up button to return to the top.

Proximity Sensor Light:

On the right side of the upper housing at the top, is a proximity sensor. The sensor has a small red light on the end. When this light is on, while the spindle is not rotating, it means the spindle is indexed correctly. If the light is not on the spindle is not indexed correctly and none of the functions will work. Turn the knob just below the centering knob on top of the upper housing clockwise (looking from the top) until you feel it hit a stop. The light should be on and the functions should work.

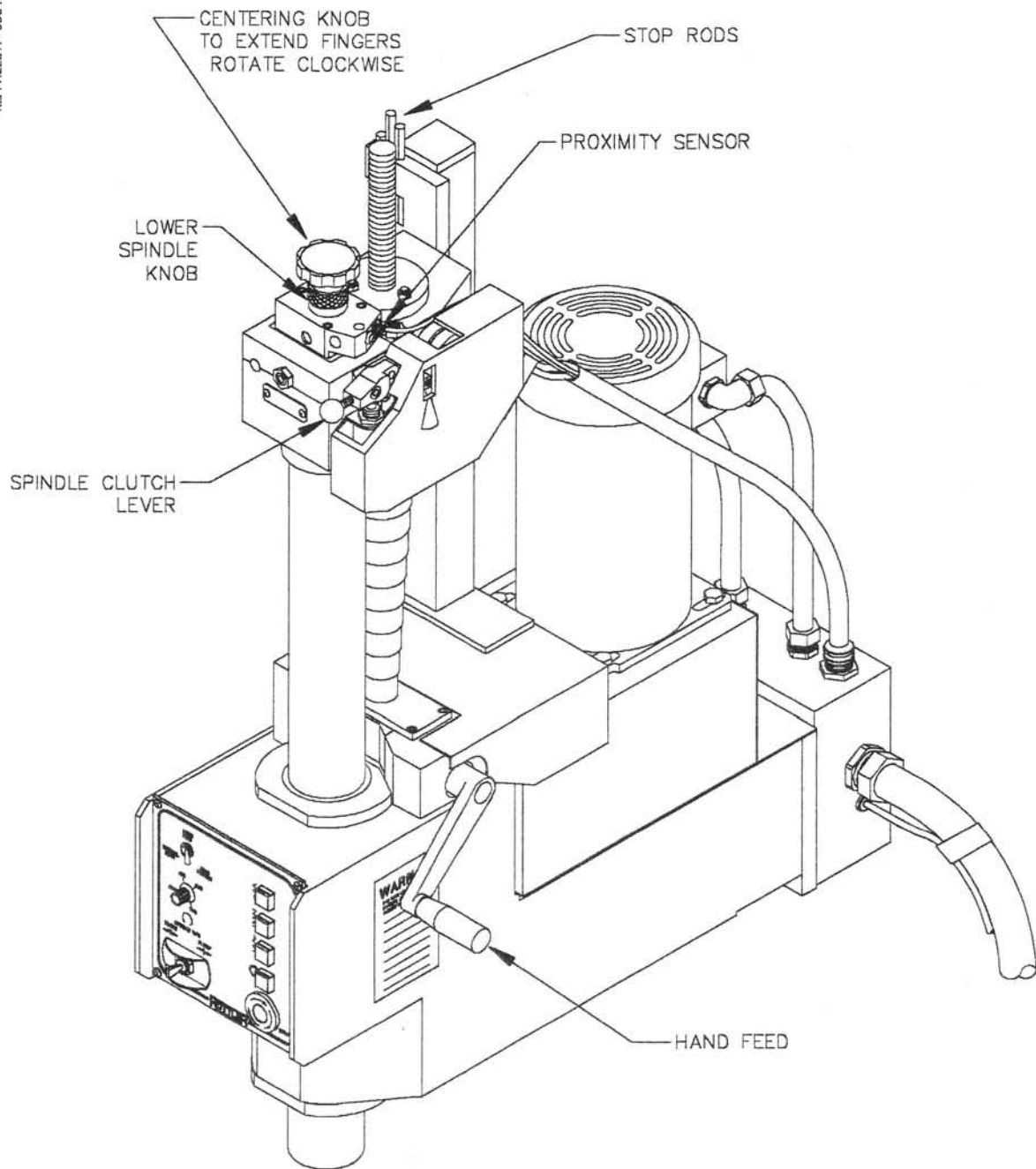
Control Panel:

REFFA2EB12-050494



Upper Housing Controls

REFFA2EB11-050494



We recommend, particularly for operators unfamiliar with boring bar, to practice on a junk block in order to become familiar with the controls and procedures of the boring machine.

Loading In-Line Cylinder Blocks:

Place an inline block in the machine on top of the 5" parallel fixture. Apply weight to the top of the block at each end to be sure the block is supported evenly and does not rock. Dirt or burrs under the pan rails will result in the block not being clamped properly to all four points of the pan rails. (Please note it is necessary to properly deburr and clean pan rails at support points, as opposed to cleaning the top of the cylinder block for a portable bar). You will find that some blocks will rock on the parallel fixture and should be shimmed at proper front support to eliminate this problem.

Locate the block on the parallels so that the cylinders are within the 1-3/4" (in-out travel) centering range of the spindle.

CAUTION:

Blocks can be positioned, forcing the spindle base to its travel limits, causing the spindle not to center. This will cause a mechanical crash.

Block Clamps:

(See block clamp arms at the end of the manual).

Position clamp arms so the front of the shoe will contact the block on the ends approximately in the middle.

Tighten clamp arm handles. Lower the shoe onto the block with the cam handle straight up. Tighten clamp leg handles. Lower the cam handle, to clamp the block. If the block is exceptionally long, such as in-line 8 cylinders, operate the two cam handles simultaneously so that locking the first

handle does not tend to tilt up the opposite side of the block.

The parallel fixture is designed with an "L" shape. The purpose of this is to extend the back portion of the "L" outward to prevent cylinder blocks from tilting up when the first clamp is applied.

Micrometer:

Determine the cylinder bore size you wish to cut. Place a tool bit into the tool holder.

Place the tool bit and tool holder into the micrometer. Loosen the tool bit lock screw (do not allow the tool bit to snap against the anvil). Set the micrometer head to the desired bore size. Lightly tighten the tool bit lock screw. Back off micrometer head. Firmly tighten tool bit lock screw. Recheck micrometer reading.

Choose a tool holder that will require a minimum tool bit overhang. (We recommend a maximum tool bit overhang of 5/8" outside of tool holder.)

Before setting, make sure the tool bit is properly sharpened. (See tool sharpening instructions.)

NOTE:

This micrometer is .050 to a revolution rather than .025 as on a conventional micrometer.

Your boring bar micrometer, as with any other measuring tool, should be used delicately and with care, to be assured of great and continued accuracy.

Centering:

Insert the tool holder into the cutter head and push back to the index point. Tighten the tool lock screw with the plastic handled hex driver provided in your tool box.

Activate the spindle base Float switch. Move the spindle base to the first hole of the engine block. Press the Down Rapid Travel button and hold it until the cutter head is in centering position, (be very careful not to crash the toolbit into the block).

The proper centering position is with the centering fingers approximately 1/4 inch below the surface of the block.

Loosen the set screw holding the Centering Stop Rod. Move the stop rod to the point that it just activates the centering limit switch. Now for the remaining holes you can press the Fast Down button, and hold it, the centering stop limit switch will stop the spindle at the proper centering depth. (Be careful to line the spindle over the hole when the cutter head goes down to centering position).

CAUTION:

Do not center cutterhead with motor running.

With the Float switch still activated reach to the top of the upper housing and turn the Centering Knob clockwise (looking from the top). The centering fingers will extend to the sides of the bore. Hold firm pressure and switch the Float switch to Neutral pause for a couple of seconds then Clamp.

Retract centering fingers turn Centering Knob counter clockwise (looking from the top) while holding the lower spindle knob from turning.

Boring:

Manual Mode

Center the cutterhead as described previously. Switch to Manual Feed. With the tool bit close to the work piece, (within 1") pull down on the Spindle Clutch Lever and push the Feed Button. The spindle will rotate

but, will not feed down when the selector switch is in manual mode.

Place the Hand Feed handle in the hole on the right side of the spindle base. Turn the handle clockwise to feed the spindle down and make the cut. Turn the handle counter-clockwise to return the hand feed. (The hand feed must be brought back up manually before the up button is pressed). Press the up button to return the spindle to the top.

Auto Feed Mode

Center the cutter head as described previously. Switch to Auto Feed. Pull down on the Spindle Clutch Lever and push the Feed Button. The spindle will start turning and feeding into the bore. The spindle RPM can be adjusted at any time throughout the cut, the feed will automatically compensate.

After boring through the cylinder set the Lower Stop Rod so that it just actuates the Lower Limit Switch. The lower stop rod is set so that the machine will stop at the same depth in the following bores. If the block style changes the lower limit setting will also change. Watch for obstructions at the bottom of the bores. Be sure the machine will stop before hitting anything.

The Stop Button can be pressed at any time during the cut.

When the Stop Button is pressed or the Lower Limit Switch is activated the machine stops the feed, slows rotation, indexes the toolholder to the front then stops the machine. To return the machine to the top, press the Up Button.

Auto Return Mode

The Auto Return mode works the same as Auto Feed with this exception.

When the Lower Limit Switch is actuated, or when the Up Button is pressed, during a boring cut, the machine stops the feed, slows the rotation, indexes the tool holder to the front then automatically activates the Up

function and returns to the Upper Limit Switch.

Boring Large Truck Blocks:

The FA2EB boring machine has the capacity to bore truck engines such as the in-line Mack and the in-line GMC series 71. It is necessary when boring these large blocks to remove the wear pads (502-1-21) and place the block directly on the main base (502-1-20). The blocks are then bored according to the instructions.

Depths of Cut:

Cuts under .040" on diameter can be taken using the R4 insert style tool bits. 600 RPM should be used for diameters up to 5". Heavy cuts up to .180" on diameter may be taken using the R8 brazed carbide tool bits. Slower RPM's must be used, between 150 and 350 RPM, depending on diameter and depth of cut.

Stub Boring Bar:

Heavy cuts up to .150" on the diameter can be made with the stub boring bar using low spindle speed.

Centering Fingers - Remove & Replace:

CAUTION:

Motor must be turned off and spindle clutch lever must be in the up detent position during any centering finger operation.

Centering fingers can be removed by rotating the centering knob clockwise until the fingers can be pulled out. When they are replaced in the cutter head, they should be placed in the respective numbered slots. First rotate

centering knob clockwise and the counter-clockwise to insure that fingers enter pinion teeth simultaneously.

Centering Accuracy Check:

Centering fingers should be kept accurate, to center the new bore within .002" of the center of the worn hole. Centering fingers should be lapped periodically to obtain near perfect centering.

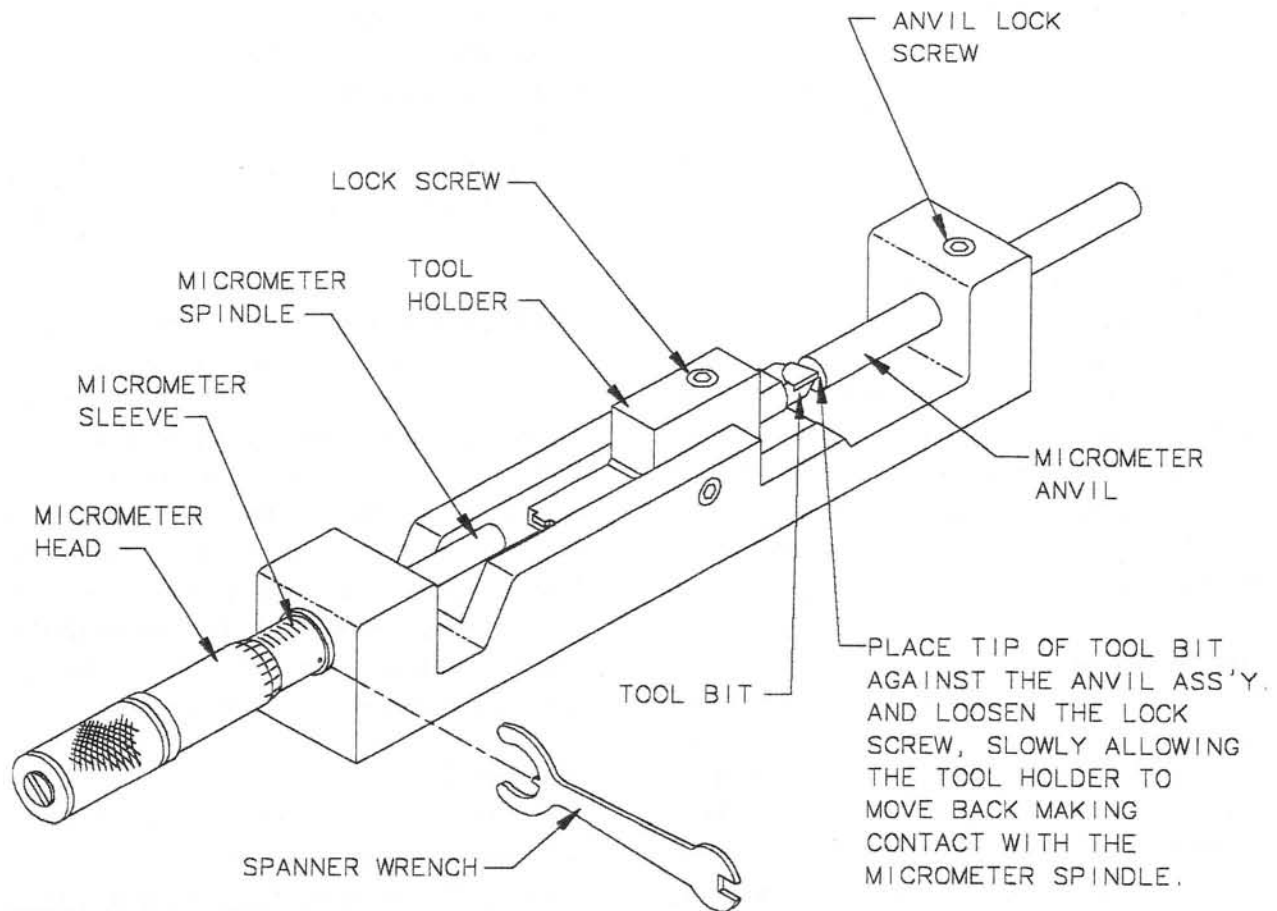
Check the centering fingers by boring a hole and then without moving the spindle unit, extend the fingers against the wall, checking to see that each finger tip will lock a .001" shim. If the fingers will not do this, they should be lapped. Rotate them back and forth in the test bore while pressing the fingers against the wall. If this does not quickly bring contact and pressure to all the fingers, carefully file the high finger or fingers, and repeat the lapping process.

Micrometer:

The boring micrometer should be used delicately to assure continued accuracy. Inserting the tool into the micrometer is very important. Do not let the tool bit snap against the anvil. This will cause nicks in the anvil. This will reduce the accuracy of the micrometer.

Lightly tighten the tool bit lock screw, back off the micrometer head, then fully tighten toolbit.

After a period of use the tool bit will force a depression in the micrometer anvil. This will result in inconsistent sizes, particularly after resharpening the bit. As necessary turn the anvil slightly, so that a flat surface is always exposed to the tip.



Optional Capacity To 8" Diameter:

For setting FA2EB micrometer to high and low scale using micrometer with a 2.90" to 6.00" reading.

CAUTION:

The standard for your FE2EB micrometer is not set at the factory. It must be set with a micrometer by adjusting the lock screw.

NOTE: Read directly on the micrometer sleeve.

Follow the procedure for calibrating the micrometer (Refer to page 3.6).

To set the standard, set the micrometer to 6.00". Place the standard in the micrometer with the adjusting screw towards the anvil. Loosen the adjusting screw until the pin contacts the anvil. Lightly tighten the adjusting screw. Back off the micrometer and remove the standard. Finish tightening the adjusting screw. Recheck and adjust as necessary.

To bore from 2.90" to 6.00", place standard in the micrometer and adjust the anvil so the micrometer reads 6.00".

To bore from 4.9" to 8.0" place the standard in the micrometer and adjust the anvil so the micrometer reads 4.0". The micrometer will read 2.9" to 6.0" but will actually set tool

from 4.9" to 8.0". When the micrometer is set for larger bores, remember the bar will bore 2" larger than the micrometer reads.

Install and Remove Toolholders:

Use the 7/32" hex driver to loosen the set screw in the side of the cutterhead. This screw only needs to be loosened it does not need to be removed.

Use the tool puller for removing the tool holder. Obviously it is not necessary to use the tool puller on long tool holders, but you will find it very useful on short ones. Thread the puller in a few turns and gently pull.

Install and Remove Cutterheads:

CAUTION:

Turn off power to machine before changing cutterhead.

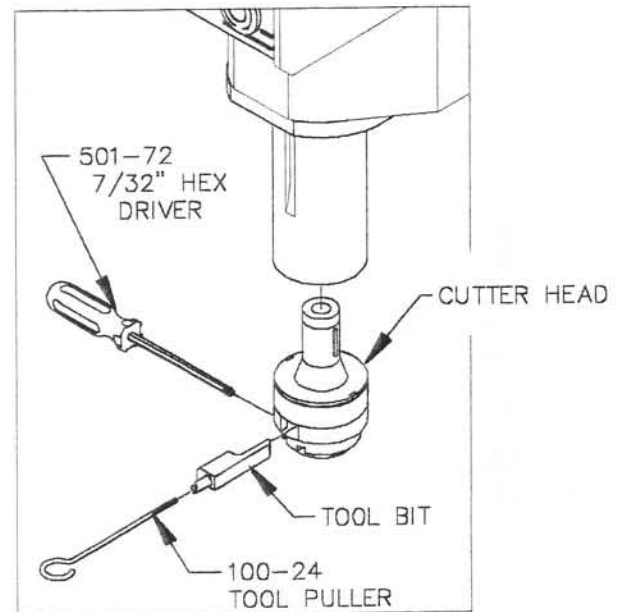
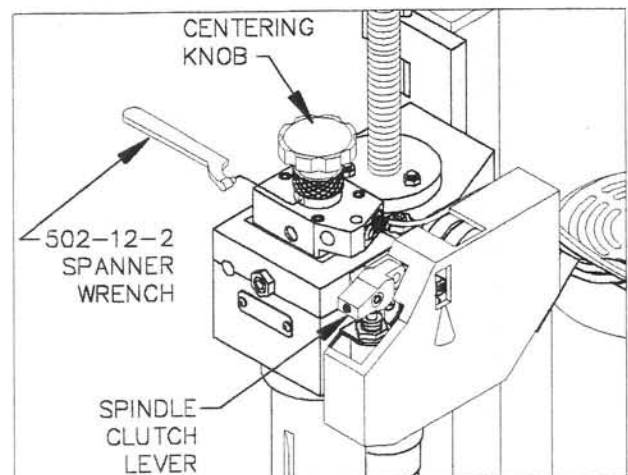
Centering fingers must be removed before changing cutterheads. Damage to the centering fingers could result if they are left in.

Use the spanner wrench in the upper knob on the upper housing. Turn the knob counter clockwise (looking from the top). The knob will be tight. There are a couple of ways to get it to come loose. Pull the spindle clutch lever down and hold it while sharply turning the knob. It may be necessary to insert a long tool holder in the cutterhead to use for leverage. Be careful to avoid damage.

Unscrew the knob the rest of the way. Keep your hand under the cutterhead so it doesn't fall out.

Thoroughly clean the end, including the threads, of the cutterhead that is going to be installed. Be sure the spindle clutch lever is in the up position. Line up the key in the cutterhead, with the key way in the inner spindle and lift the cutterhead in.

Turn the centering knob on top of the machine, to engage spline inside cutterhead. Holding the cutterhead firmly lock upper knob with spanner wrench.

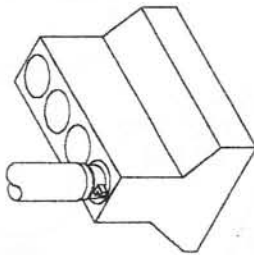


Calibrating Micrometer:

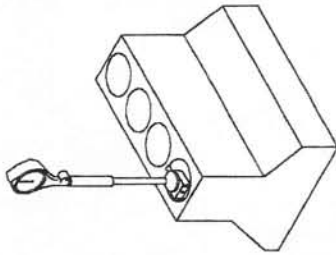
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PROCEDURE FOR CALIBRATING MICROMETER

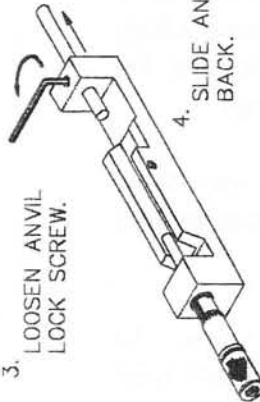
1. USE THE BORING MACHINE TO BORE A HOLE IN A SCRAP BLOCK. WITHOUT CHANGING ANY SIZE SETTING REMOVE TOOL HOLDER.



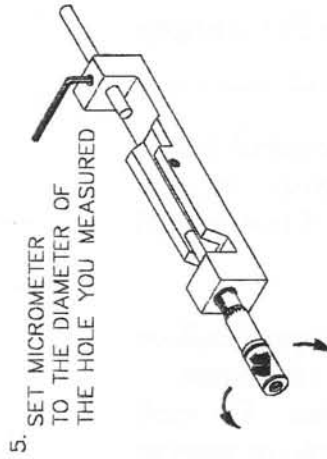
2. MEASURE THE HOLE THAT YOU BORED.



3. LOOSEN ANVIL LOCK SCREW.

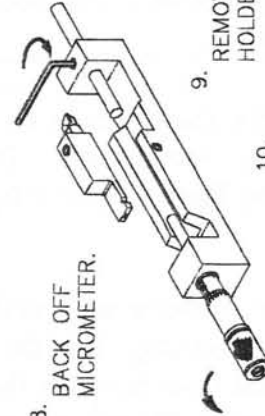


4. SLIDE ANVIL BACK.

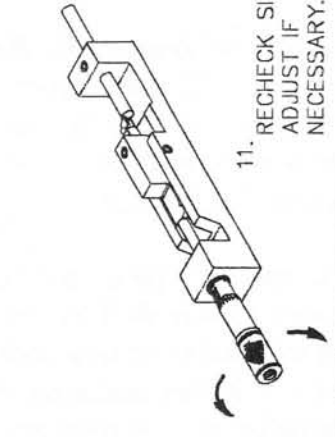


5. SET MICROMETER TO THE DIAMETER OF THE HOLE YOU MEASURED

8. BACK OFF MICROMETER.

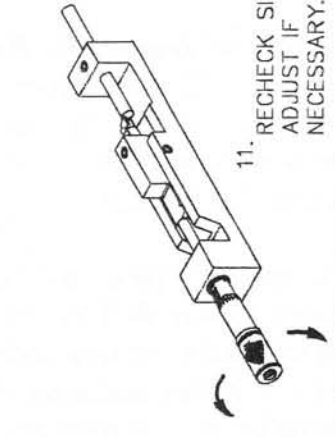
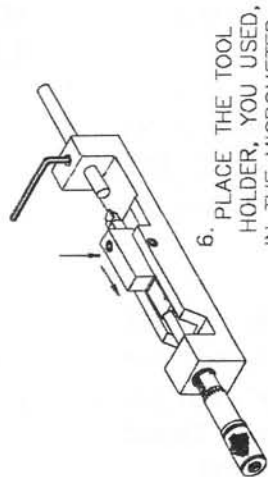


9. REMOVE TOOL HOLDER.
10. TIGHTEN LOCK SCREW.



6. PLACE THE TOOL HOLDER, YOU USED, IN THE MICROMETER FRAME.

11. RECHECK SIZE. ADJUST IF NECESSARY.



Lubrication:

Refer to illustration on page 4.4. Below are directions explaining where and how to add oil to the systems.

Upper Housing:

The upper housing is located on top of the outer spindle.

Every 2,000 hours, the Upper Housing should be opened up and the old grease removed. Repack with a mixture of **4 parts grease to 1 part oil**. For grease use **Union Oil-Unoba F1 or F2 lubrication, Mobil oil-Mobilith A.W. grades 1 or 2, Chevron Duroolith EP1 or EP2**, or any equivalent lithium barium grease. For oil use **Union Oil - 315 Klondyke, Union Oil - turbine oil 68**, or any **SAE 10 (non detergent) motor oil**.

Spindle Drive Gear Bearing:

The spindle drive gear bearing is behind the small cover on the front of the upper housing.

Every 175 hours, remove the small cover on the upper housing. Add a few drops of **three and one oil, or Union Oil-Union 75, or a very light spindle or sewing machine oil (less than SAE 5)**. Add lubricant to the take up nut area between the clutch teeth.

Motor Gear Housing:

The motor gear housing is located at the base of the feed screw. This gear box drives the feed screw.

Every 175 hours, check the oil level of the motor gear housing. Remove the snap plug located on the right side of the spindle base (see illustration). Remove the exposed pipe plug. Fill to the bottom of this hole with **Union SAE 90 Multi Purpose gear lube or any equivalent SAE 90 gear lube**.

Do not over fill.

Every 4,000 hours, the gear lube needs to be suctioned out of the fill hole and new gear lube added.

Feed Screw Drive:

The feed screw drive fitting is located on the right side of the spindle base.

Every 8 hours, remove the snap plug covering the feed screw grease fitting (see illustration). Lightly lubricate with **Unoba F1 or F2 lubricant, Lubriplate #9930AAA Mobil Oil - Mobilith A.W. grades 1 or 2, Chevron Duroolith EP1 or EP2**, or any equivalent lithium barium grease.

Inner Spindle:

The inner spindle turns inside the outer spindle.

Every 40 hours, remove the bolt at the top of the spindle. Add two or three drops of **Union Oil 315 Klondyke oil, or any SAE 10 oil**. (non detergent motor oil).

Every 175 hours, run the spindle down to expose the grease fitting in the outer spindle keyway. Add 1 shot of **Union Oil - Unoba F1 or F2 lube, Lubriplate #930AAA, Mobil Oil Mobilith A.W. grades 1 or 2, Chevron Duroolith EP1 or EP2**, or any equivalent lithium barium grease.

If the inner spindle is removed, clean the lower tapered bearing and repack it with the same grease. A light coating of grease should be applied to the middle bearing at this time also.

IMPORTANT:

Do Not fill cavity between these bearings with Grease.

Outer Spindle:

The outer spindle is the chromed cylinder that travels up and down. It is supported in two outer spindle bushings.

Every 40 hours, the outer spindle surface should be cleaned with kerosene. Occasionally a light weight oil should be wiped onto the outer spindle to prevent excessive dryness.

Hand Feed Assembly:

Every 1000 hours, disassemble the hand feed assembly (see page 4.13). Lubricate

bronze bushing and bevel gear shaft with *Unoba F1 or F2 lubricant, Lubriplate #9930AAA., Chevron Duroloth EP1 or EP2,* or any equivalent lithium barium grease.

General Lubrication:

There is a grease fitting located on each clamp arm cam body.

Every 175 hours, the miscellaneous grease fittings should be lubricated with *F2 Multi purpose grease, or Unoba F1 grease, or equivalent.*

Quick Reference Lubrication Chart

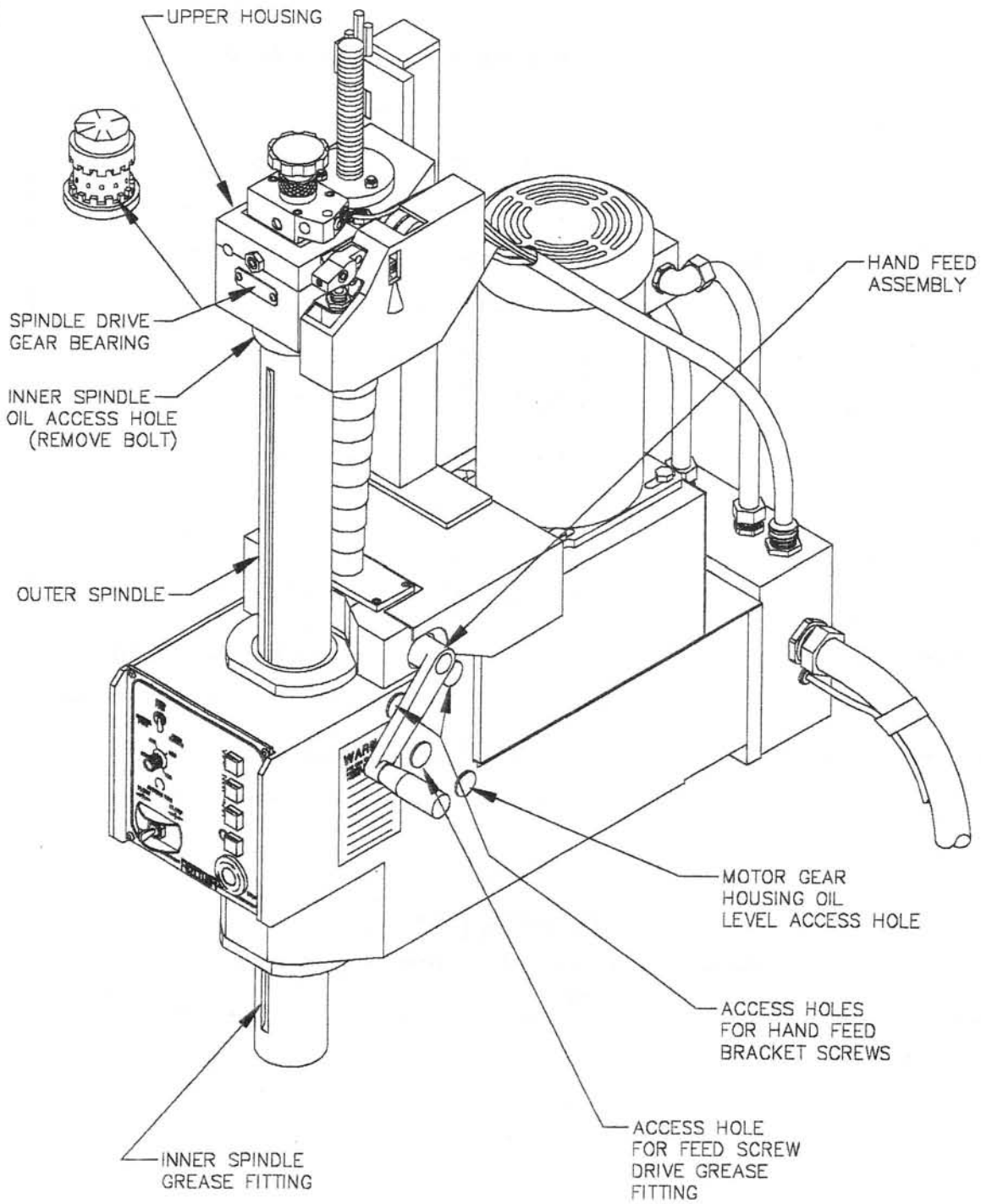
Assembly	Frequency	Lube Operation
Upper Housing	2,000 hrs	Change grease
Spindle drive Gear Bearing	175 hrs	A few drops of oil
Motor Gear Housing	175 hrs 4,000 hrs	Fill with oil Change oil
Feed Screw Drive	8 hrs	Grease
Inner Spindle	40 hrs 175 hrs	add oil Grease
Outer Spindle	40 hrs	Clean and wipe with oil
Hand Feed Assembly	1000 hrs	Grease

IMPORTANT:

Do not over fill any of the lubrication points serious
electrical damage may result.

Spindle Base Lubrication:

REFFA2EB20-060794



Adjustment of Outer Spindle:

The main spindle bearings are tapered split cast iron rings, held in a seat by an adjustment nut. The bearings normally require no adjustment for many boring cycles.

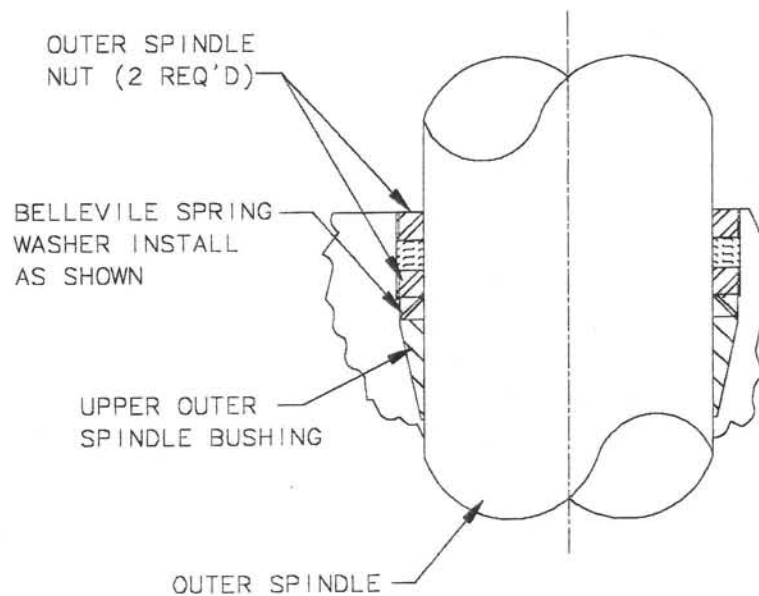
The upper bearing is preloaded in place by a Belleville spring washer, below the adjustment nut. This adjustment should be checked after the shipment of the machine.

Shock to the machine during shipment may result in some setting of the spring.

CAUTION:

Be careful not to over tighten these bearings. An over tight condition only serves to wear out the machine and make control operation difficult.

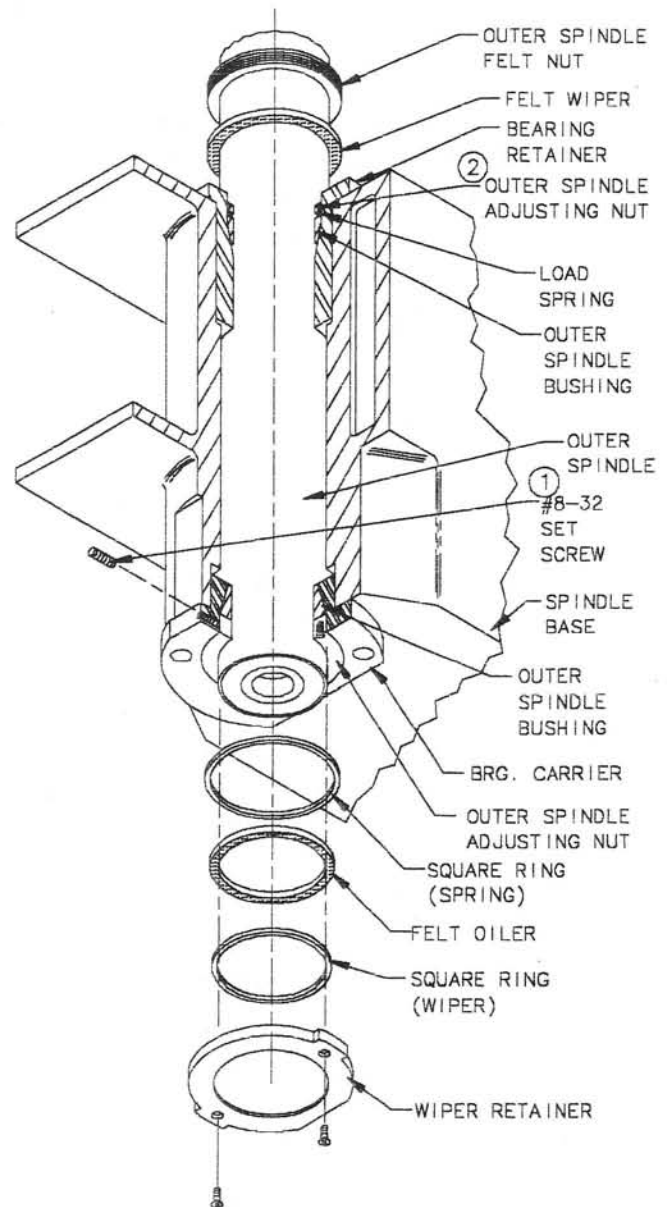
If it should be necessary to adjust, see the following page.



REFFE24A45-050797

Outer Spindle Adjustment:

1. Run spindle down approx. 4 to 6 inches. Loosen the #8-32 set screw and loosen all outer spindle nuts (500-77 & 502-35-27)
2. Tighten the lower bushing (502-35-26) by tightening the lower outer spindle nut, until 10 to 15 lbs. of effort is required to operate the hand feed handle. (See step 4.4). Lightly tighten #8-32 set screw.
3. Remove the first upper outer spindle nut from the top of the spindle base, then the felt washer. Under the felt washer is another nut this is the one you adjust. Adjust so the hand feed operates only slightly tighter. 15 to 20 lbs. of effort total required to operate feed handle.
4. Operate the hand feed throughout the spindle travel. The hand feed should work easily at all points of spindle travel. Spindles are ground slightly tapered for maximum rigidity at lower limits of travel.
5. This procedure is also used to check the spindle adjustment. Travel the spindle down approximately 4" from the top. Operate the hand feed 2 turns leaving the handle in the horizontal position pointing to the back of the machine. Using both hands on top of the upper housing, pull down. You will feel the spindle drop and the hand feed handle will swing down. It should require 50-75 lbs. to cause the spindle to drop. In order to recheck using this procedure it is necessary to operate the hand feed 2 turns leaving it in the horizontal position.
6. Avoid excessive tension on upper outer spindle nut otherwise tool bit dragback marks will appear in the bore.
7. Excessive tightening of the outer spindle nuts will cause a strain on feed gears and cause spindle to have an audible, excess resistance.



REFFE24A44-1207B5

Adjustment of Inner Spindle:

This machine is equipped with anti-friction bearings at the top and bottom of the inner spindle.

It is very important to properly adjust the preload of these bearings. The wrong adjustment can reduce bearing life or destroy the bearings.

The bearings are correctly adjusted when a down force of 50 to 100 lbs. on the inner spindle will move the inner spindle .0002 to .0007 out of the outer spindle, see illustration below.

Adjustment:

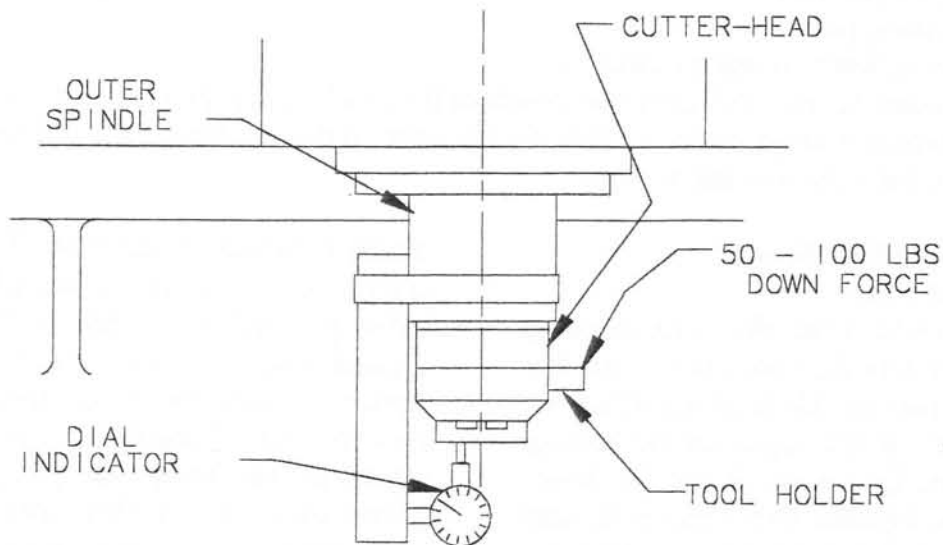
1. Remove two screws and small cover on the front side of the upper housing.
2. Spindle clutch lever must be in the full up position.

3. Insert a pin (diameter .180 or less) in one of the holes provided in the O.D. of the take up nut. (see page 5.12). Hold the spindle knob with one hand and turn the take up nut to the left (clockwise). You will note the nut ratchets in notches as you take up. Take up until nut tightens up and back up $3/4 - 1-1/2$ notches. Check for the .0002 to .0007 movement as stated before.

CAUTION:

Be sure the detent is in a notch, not midway between.

4. Replace the cover.



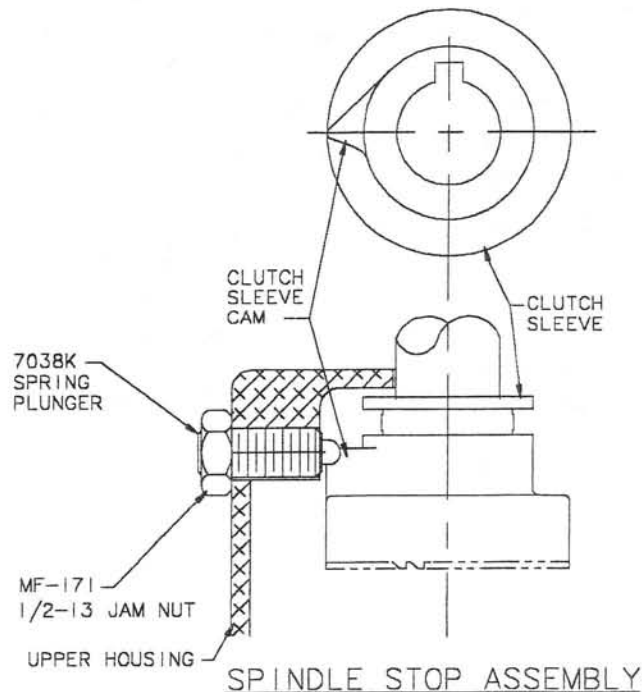
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Spindle Stop Adjustment:

The purpose of the spindle stop is to stop the spindle from turning with the tool bit facing to the front.

CAUTION:

Disconnect all power to the machine before continuing.



REFFE24A58-050797

To set plunger in position:

1. Remove spring plunger.
2. Raise clutch lever to upper position.
3. Look through the hole and turn inner spindle so the cam lobe is in line with the hole.
4. Screw in spring plunger until it touches the high spot on the cam lobe. Turn in 2 turns.
5. Tighten jam nut against gear housing.

Set the Spindle Stop Sensor:

(refer to page 5.11)

Rotate the cutter head clockwise (looking from the top) until the clutch sleeve cam just touches the plunger. Look at the sensor on the right side of the upper sensor housing and see if the light is on. If not, the lower knob must be adjusted. First remove the snap plugs from the front of the sensor housing. Looking in the hole, turn the cutterhead so you can see how far the index pin is away from the sensor. It should be .02-.03 away. If necessary adjust the sensor to the proper

distance. Rotate the cutter head so you can see the set screw, one is located below the index pin and the other is 90 degrees. Loosen both the set screws. Turn the cutterhead until the clutch sleeve pin just touches the plunger. Rotate the knob clockwise until the pin goes just past the end of the sensor and the light goes off. Rotate back until the light just comes on and stop. Turn cutterhead until you can reach the setscrews and tighten them. Be careful not to move the knob while tightening.

Upper Housing Back Feed Adjustment:

Loosen the three round head screws located on top of the upper housing around the feed screw. Loosen the three adjusting set screw lock nuts. Loosen the three adjusting set screws.

Screw in the three adjusting set screws until they just touch the spring washer inside. Alternating between each screw, turn the screws in, evenly, until you compress the spring washer.

IMPORTANT:

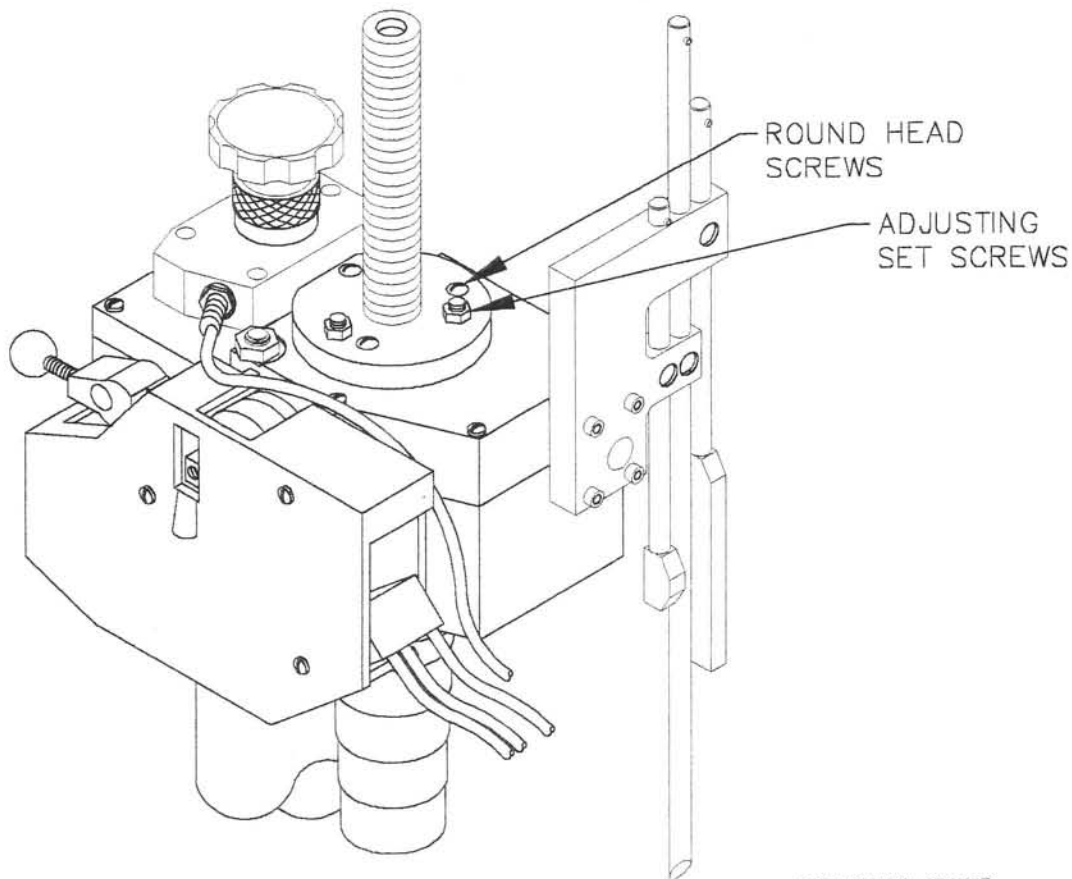
All screws must be turned in the same amount. A light touch is required, use no more screw pressure than is required to flatten spring washer.

Turn adjusting screws back approximately 1/4 turn. The hand feed handle should have 1/4 turn of free play when the back feed is adjusted properly. Hold the adjusting screws with an allen wrench and tighten the lock nut.

Run the motor with lower gear box engaged, so the feed screw turns, to center the bearing retainer.

Turn off motor.

Tighten, evenly, the three upper, round head screws.

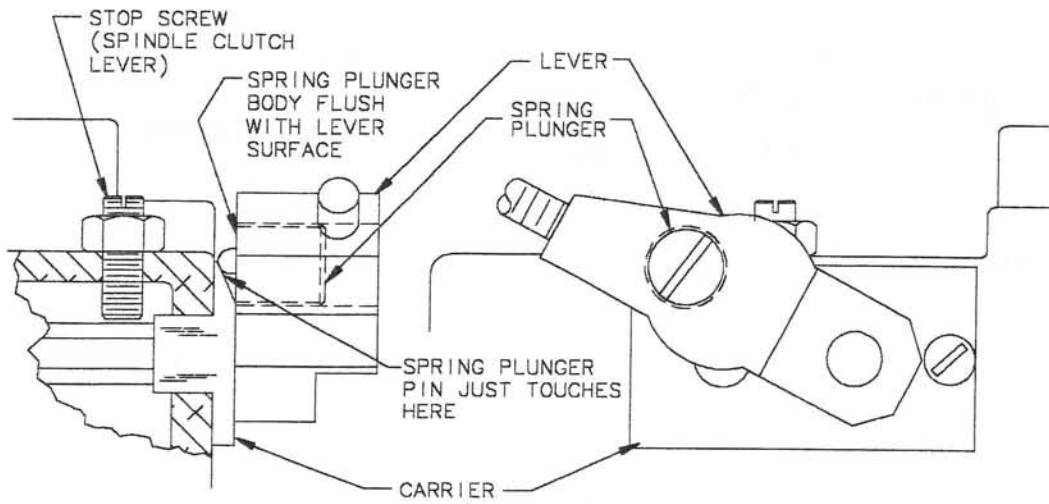


REFFA2EB21-050797

Spindle Clutch Lever Adjustment:

Check spring plunger body to see if it is flush with lever (see illustration below). Loosen the stop screw lock nut then the stop screw. Raise the control lever till the pin in the

spring plunger is just touching the edge of the carrier as shown. Set stop so that the lever will not go any higher. Lock with locknut.

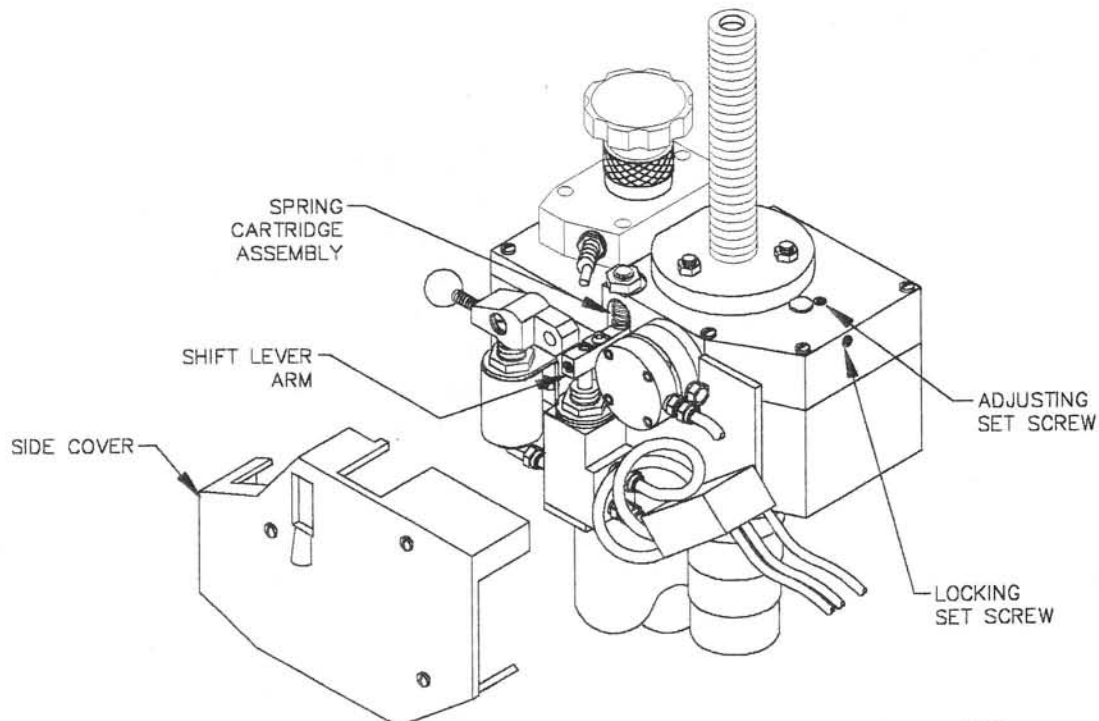


REFFA2EB22-050797

Rapid Return Adjustment:

If the machine fails to go up when the up button is pressed the rapid return gears may need to be adjusted. (Usually there will be a grinding noise as the clutch teeth are trying to mesh.)

1. Remove the side cover on the upper housing.
2. Run the boring spindle down 6 inches or more.
3. Open the air enclosure and locate the neutral dwell solenoid, (the second one down from the top). See page 5.3. On top of the solenoid there is a round white button, this is a manual override. Press this button and hold it in and the neutral cylinder will actuate.
4. Have someone hold the button in. Find the spring cartridge assembly (see illustration) located just above the shift lever arm. Loosen the lock nut on the spring cartridge assembly and set at approximately $1/32''$ off the shift lever arm with the neutral cylinder actuated. Tighten lock nut. Release the solenoid override button.
5. Place the machine in manual mode and press the feed button. The spindle will rotate but will not feed.
6. Loosen the tumbler assembly locking set screw, (located at the rear of the upper housing near the top).



The clutches should just start to chatter when the spring cartridge pin is pushed up about 1/32". (Lift the shift lever arm to push the pin). If the pin moves more than 1/32" before the clutches start to chatter, the adjusting screw will need to be screwed in a little. If the pin is not pushed at all or if less than 1/32" and the clutches start to chatter the adjusting screw will need to be screwed out a little. (The tumbler assembly must be forced up by lifting the shift lever arm).

7. Tighten the locking set screw. Recheck to be sure the setting has not moved.

Drive Belt Removal:

CAUTION:

Disconnect all power before proceeding.

Remove the sheet metal cover from the rear of the spindle unit. Loosen the four motor mount bolts and slide the motor forward. Reach in through the rear of the spindle unit and remove the belt.

Drive Belt Installation:

Installation of belt is the opposite of removal.

Adjust belt tension for 1/8" to 3/8" play in belt when the belt is pushed between the two pulleys.

Excessive Loads:

CAUTION:

Disconnect all electrical and air power to the boring machine before attempting any repairs.

Thrust Overload:

If a vertical thrust load of approximately 3,000 pounds is imposed on your FA2EB machine spindle, the threads of the 500-41 bronze thrust nut will shear. This happens when the spindle is stopped by an external force, for example traveling down into the top of the block. It makes no difference if the spindle is turning or not.

The motor will continue to run, with no feed or down travel. If the machine continues to run in down travel, the drive spline will be pulled out of mesh and the feed screw will not turn. A spare nut, 500-41, is provided in the tool box, in the event an excessive vertical load occurs.

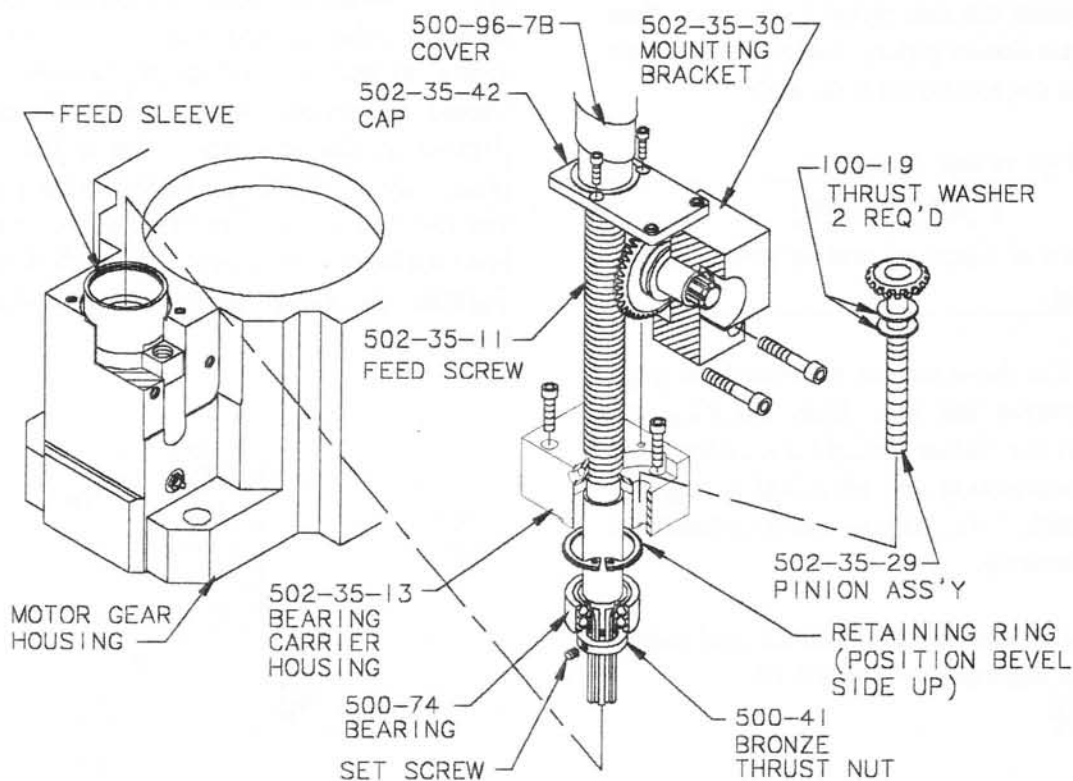
Disassembly For Replacement of Thrust Nut: (see page 5.10)

Remove the six round head screws and three rubber grommets that attach the shroud (502-35-67). Move the shroud to the side. Remove the two snap plugs, in the spindle base, that cover the hand feed bracket screws. Remove the two socket head cap screws to the hand feed bracket (502-35-30). Remove the two socket head cap screws in the cap (502-35-42), which are closest to the feed screw cover (500-96-7B). Lift the hand feed bracket and the attached cap, out of the way. Turn out of the way. Turn out (counter clockwise) the bevel pinion (502-35-29). Be careful not to lose the two thrust washers (100-19). Remove the four screws and the bearing carrier housing (502-35-13). Raise the assembly.

Open the air enclosure on the back of the spindle base. Locate the fast down solenoid valve (the top valve). See page 5.3. On top of the solenoid there is a round white button, this is a manual override. Press this button and hold it in, the fast down cylinder will actuate.

While holding the button in, rotate the feed screw counter clockwise by hand. This will raise the lower assembly out of the spline.

If necessary, remove the upper housing side cover, and the air line to the large flat cylinder located on the top side, of the upper housing. Attach an air line to this cylinder and apply steady air at approximately 80 psi.



REFFE24A50-050797

Remove the retaining ring (506-10), and press feed sleeve assembly (502-35-12), off bearing (500-74). Back out set screw from bronze thrust nut (500-41) and screw off nut. On reassembly, be sure to replace the retaining ring with the bevel side up, and make sure you bolt the hand feed bracket back in place without binding the gear action.

Mechanical Failure Due To Overload:

Rotary deceleration loads which stall the motor will cause the Lenze drive to trip, or the driven pulley key to shear. To reset the Lenze drive, power down the entire machine, wait for the trip light to go out, and power back up. Replacing the shear key. Remove the six round head screws and the three rubber grommets that attach the shroud. Move the shroud to the side. Remove the belt as described on page 4.12. Remove the collar, loosen the two nylon capscrews, then remove the driven pulley. Lightly tighten the two nylon capscrews on reassembly.

Removal of Motor Assembly:

CAUTION:

Disconnect all electrical and air power before continuing.

Remove the drive belt as described on page 4.12. Remove the four bolts securing the motor, lift the motor straight up. Disconnect conduit connection and electrical wiring. Be sure to mark wires so you can reconnect the wiring correctly.

Assembly is the reverse. Install and adjust the belt as described on page 4.12.

Removal of Motor Gear Housing:

NOTE:

Motor and motor gear housing may be removed without disassembly of upper housing and feed screw.

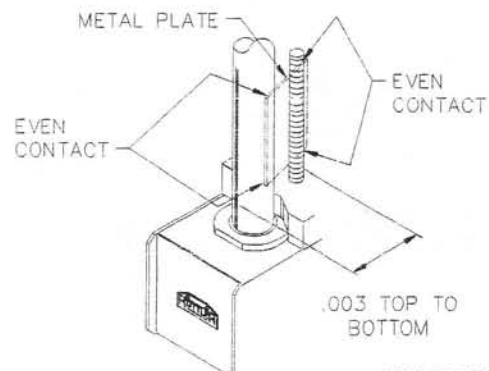
Remove and disassemble hand feed assembly as described on page 4.13.

There are six screws holding the motor gear housing on to the spindle base. After the screws have been removed lift off the motor gear housing.

Replacing Motor Gear Housing:

Set the motor gear housing in place. Put the mounting bolts in but do not tighten them. Reassemble the hand feed. (See page 4.13).

Alignment of the motor gear housing is crucial. Measure from the outside of the outer spindle to the outside of the feed screw, at the top and at the bottom. They should be parallel within .003. Check for parallel at the side also. Use a flat metal plate. Lay the plate against the outer spindle and the feed screw. The plate should contact both surfaces evenly over a six inch distance. Tighten the motor gear housing mounting bolts.

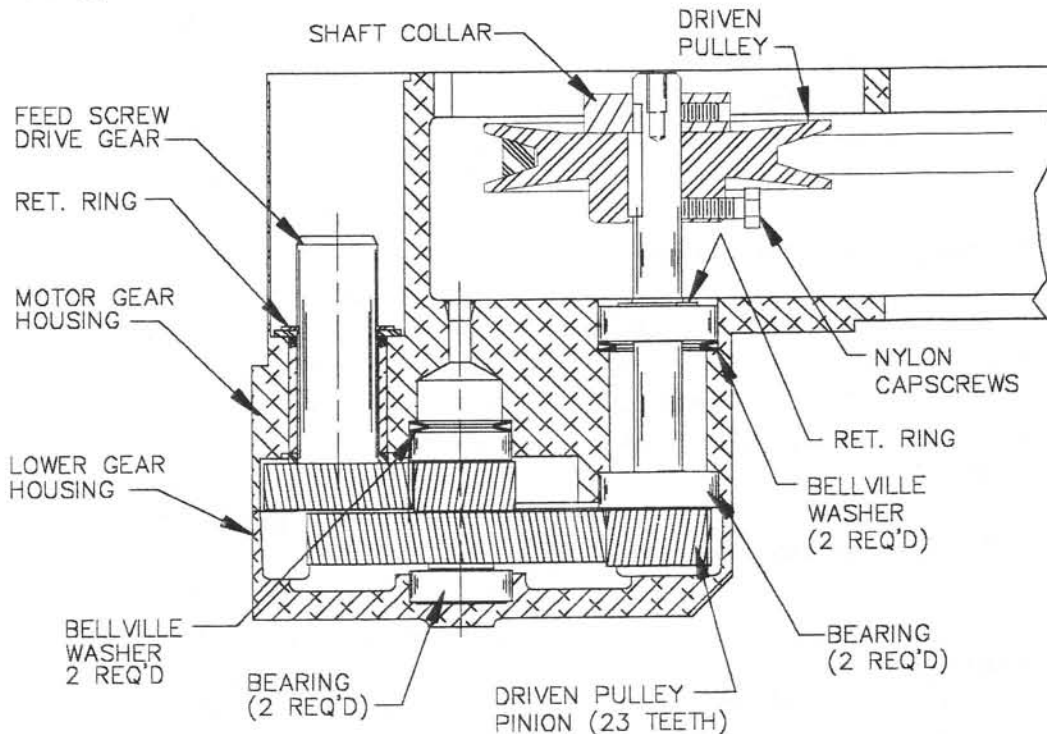


Disassembly of Motor Gear Housing:

Remove shaft collar, loosen the two nylon capscrews and then remove the driven pulley. Take out the plug in the side of the motor gear housing and drain the oil. Remove the retaining ring from the driven pulley pinion. Remove the retaining ring and thrust washer from the feed screw drive gear. Remove the eight socket head cap screws located in the bottom of the lower gear housing.

Inside the motor gear housing, near the driven pulley pinion, there is a set screw plug. Remove this plug. Use a long blunt punch and tap the gears and lower gear housing off.

Be careful when removing the bearings inside the motor gear housing. The spring washers located behind the bearings must be reinstalled in the correct direction.



REFFE24A52-050797

Failure Due To Low Airline Pressure:

A pressure switch PS2 (located on the bottom of the electrical control panel, see page 5.4) has normally open contacts that close when the airline pressure reaches 80 to 85 psi. As long as the line pressure is above this, the machine will operate. If the line pressure falls below this value the switch contacts open, shutting off power to the entire control circuit and thereby stopping the machine.

This is a protective device to prevent the machine from operating when there is insufficient air pressure available to operate the air clamp and air controls.

Centering Rod and Draw Bar Removal:

(see page 5.12)

Remove the cutter head by holding it and unscrewing the upper spindle knob. When the cutterhead is off the draw bar centering shaft ass'y can be pulled straight up and out of the inner spindle.

Disassembly Of Upper Housing and Spindle Removal:

(see page 5.12)

Move the spindle all the way to the top of it's travel. Move spindle unit all the way to the lift of it's travel. Tighten the upper spindle adjusting nut snug to keep the spindle from dropping. (refer to page 4.6).

CAUTION:

Disconnect all air and electrical power to the machine before attempting any repairs.

Remove the draw bar assembly as described above. Remove three mounting screws holding the proximity sensor housing. Lay the housing aside. Remove the lower knob, 600-18-2C, by loosening two locking set screws. Lift the knob straight up (be careful not to lose the key as you lift it off. Remove control cover 502-38-19. from the side of

the upper housing. Loosen the spindle clutch lever, stop screw, lock-nut. (see page 4.10).

Back off the stop screw. Lift the spindle clutch lever as high as it will go. Loosen the two mounting screws for the spindle clutch lever mounting carrier. Carefully pull the lever and the carrier out of the upper housing cover. Remove spring 502-2-48. See page 4.11. Remove control base plate 500-47.

Remove the six screws holding the upper housing cover and lift it off. Remove the shift lever (500-38-1B) (see page 5.13). Remove the upper fast return gear (500-25), the plunger and spring. Remove the spindle clutch (500-3E) (see page 5.12), and key (500-3-1). Remove bearing (500-18) and spring (500-14) from the feed screw. Be sure to reassemble the spring washer in the proper direction. Lift the clutch sleeve gear straight up off the feed screw. Lift the clutch sleeve gear straight up off the feed screw. Unscrew the feed nut (500-2) to remove it. Remove from the feed screw, the thrust washer and feed gear (500-8-1).

Place something under the end of the inner spindle to keep it from falling out. Unscrew the spindle adjusting nut (500-5A). Loosen the nut through the access hole in the upper housing, remove the rest of the way by hand from inside the gear housing. The drive gear assembly can be worked off along with the flanged spacer (500-4G). Remove the inner spacer and the high pro key. The inner spindle may now be lowered out of the machine.

NOTE:

Some lubrication will run out when spindle is removed.

Replacing the Inner Spindle and Reassembling the Upper Housing:

When reassembling the inner spindle and upper housing be careful to install gears and bearings and spring washers in the correct thrust directions as shown in the illustrations. After assembly be sure to go back to the beginning of the maintenance section and follow all of the adjustment procedures to readjust the machine. Relubricate as directed in lubrication section (page 4.1).

Removal of Upper Gear Housing:

Disassemble upper gear housing as described above. Remove the two hex head screws at the top of the outer spindle. Apply heat with a torch to the upper housing at the collar area where the bolts were. Lift the upper housing while tapping with a soft faced hammer. Remove nut on the fast return gear shaft (500-29) (see page 5.13). Press the shaft and gear off. Long gear (500-7) may be removed. Be careful of the oil seals at the bottom of the housing do not damage them.

Reassembly of The Upper Housing:

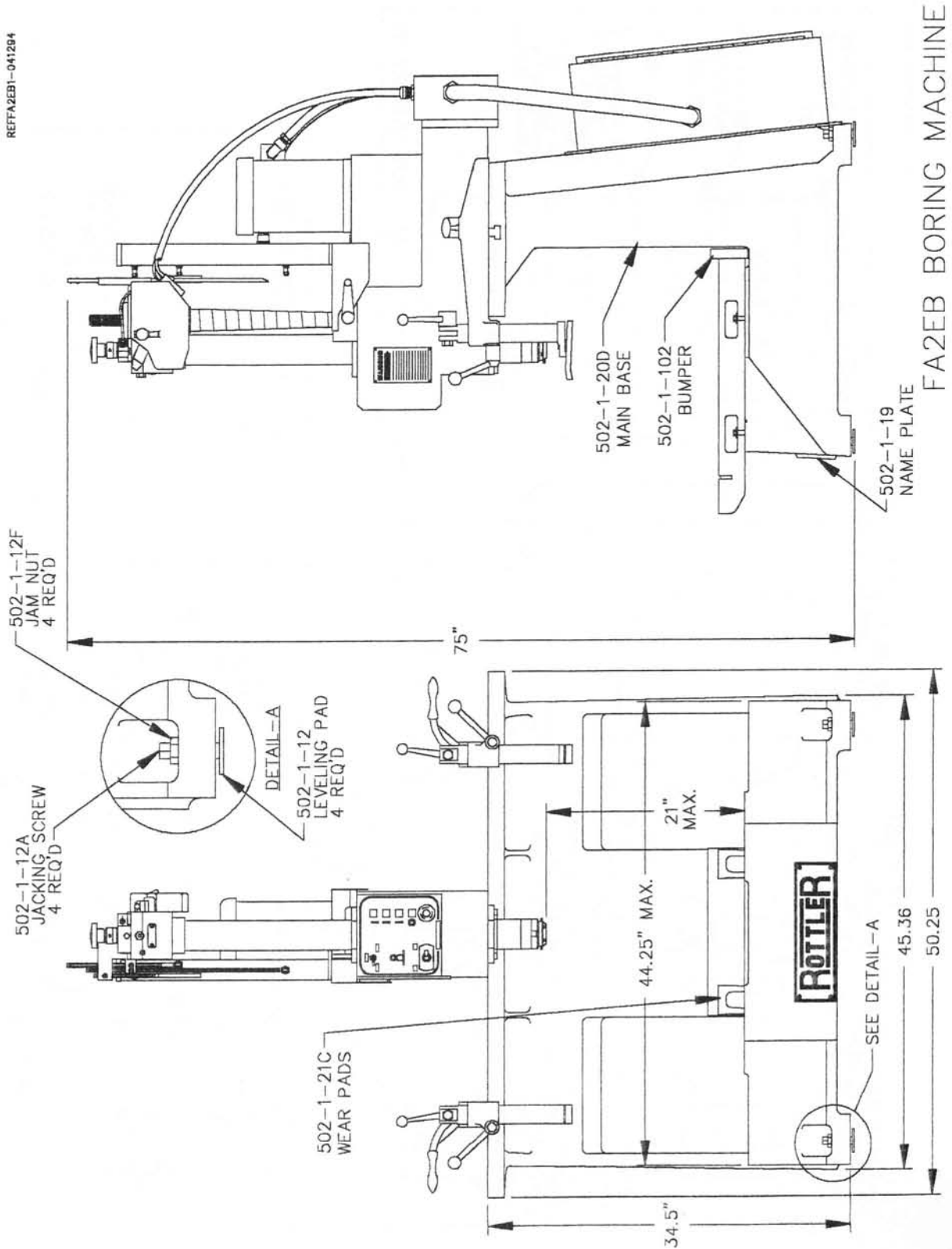
Before slipping the long gear back into the oil seal open the seal to prevent the garter spring from snapping out. When placing the thrust bearing in be sure the race with the small I.D. is placed 'up'. To put upper housing back on outer spindle, apply loctite to the top area of the outer spindle. Heat the housing as was done in disassembly. Place the housing on the outer spindle and turn to the correct position quickly.

IMPORTANT:

After placing upper housing on the outer spindle, before it cools you must set the parallelism between the outer spindle and the feed screw.

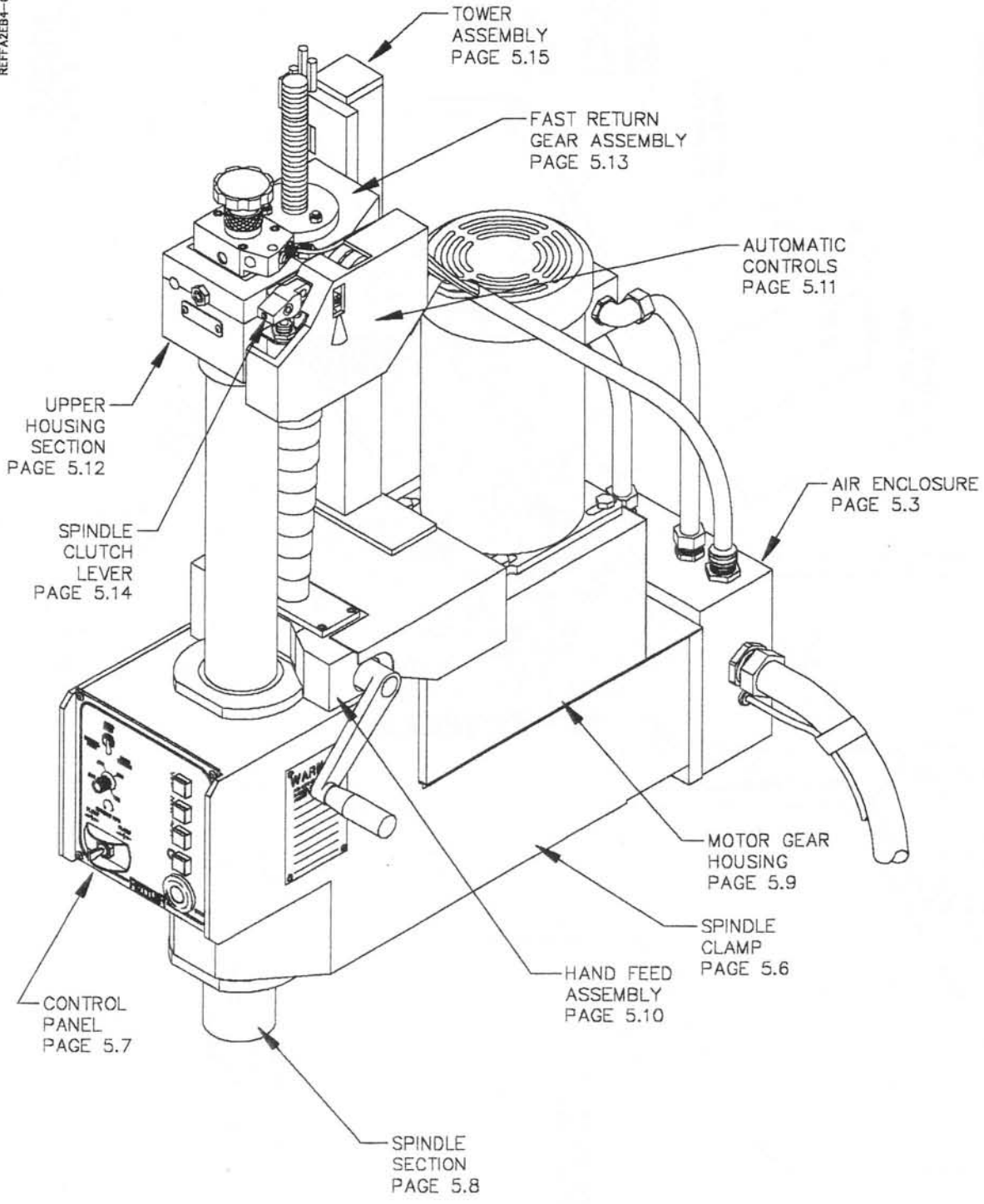
(refer to page 4.14)

Front Right Side View:

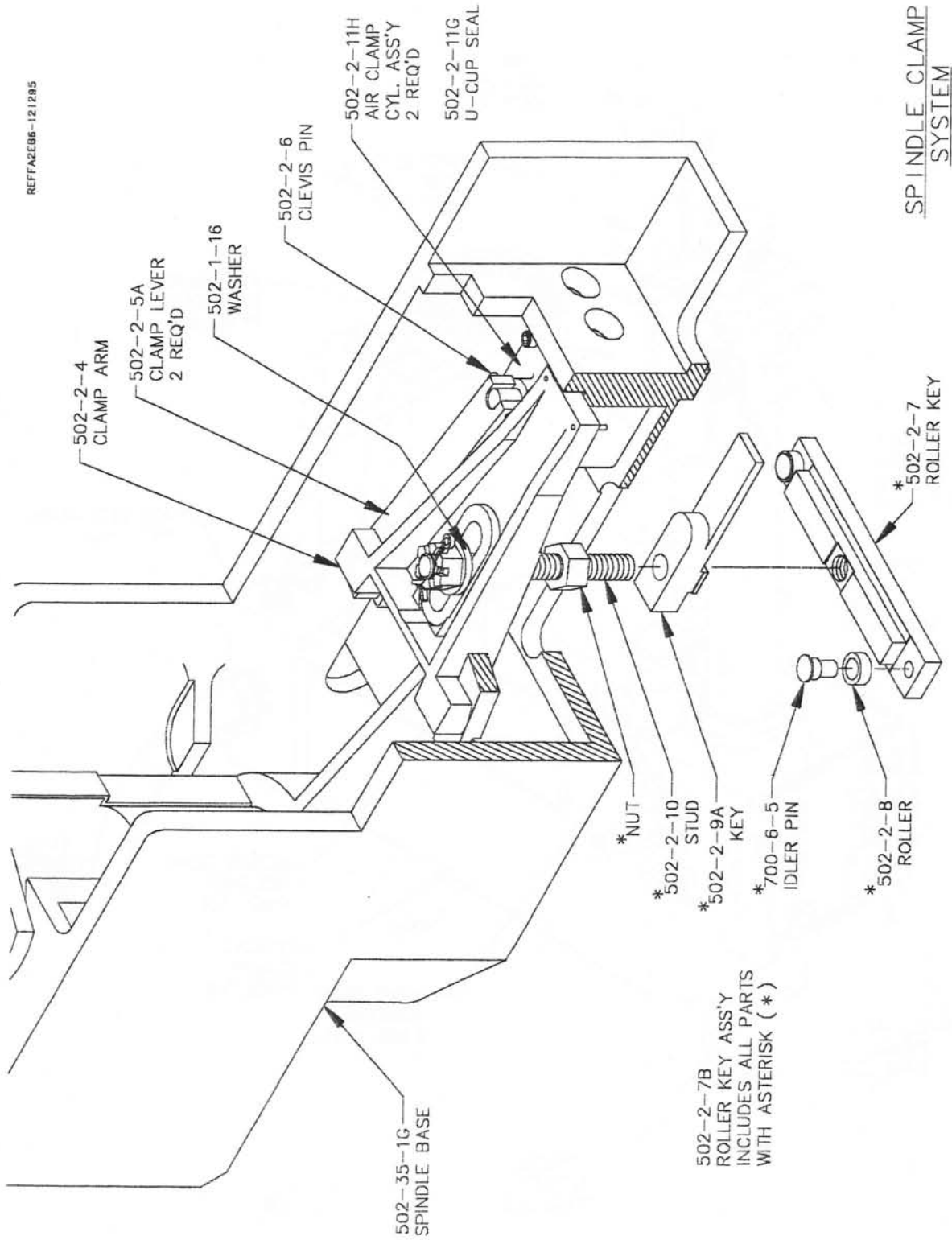


Spindle Base Assembly Illustration:

REF:FA2EB4-051394

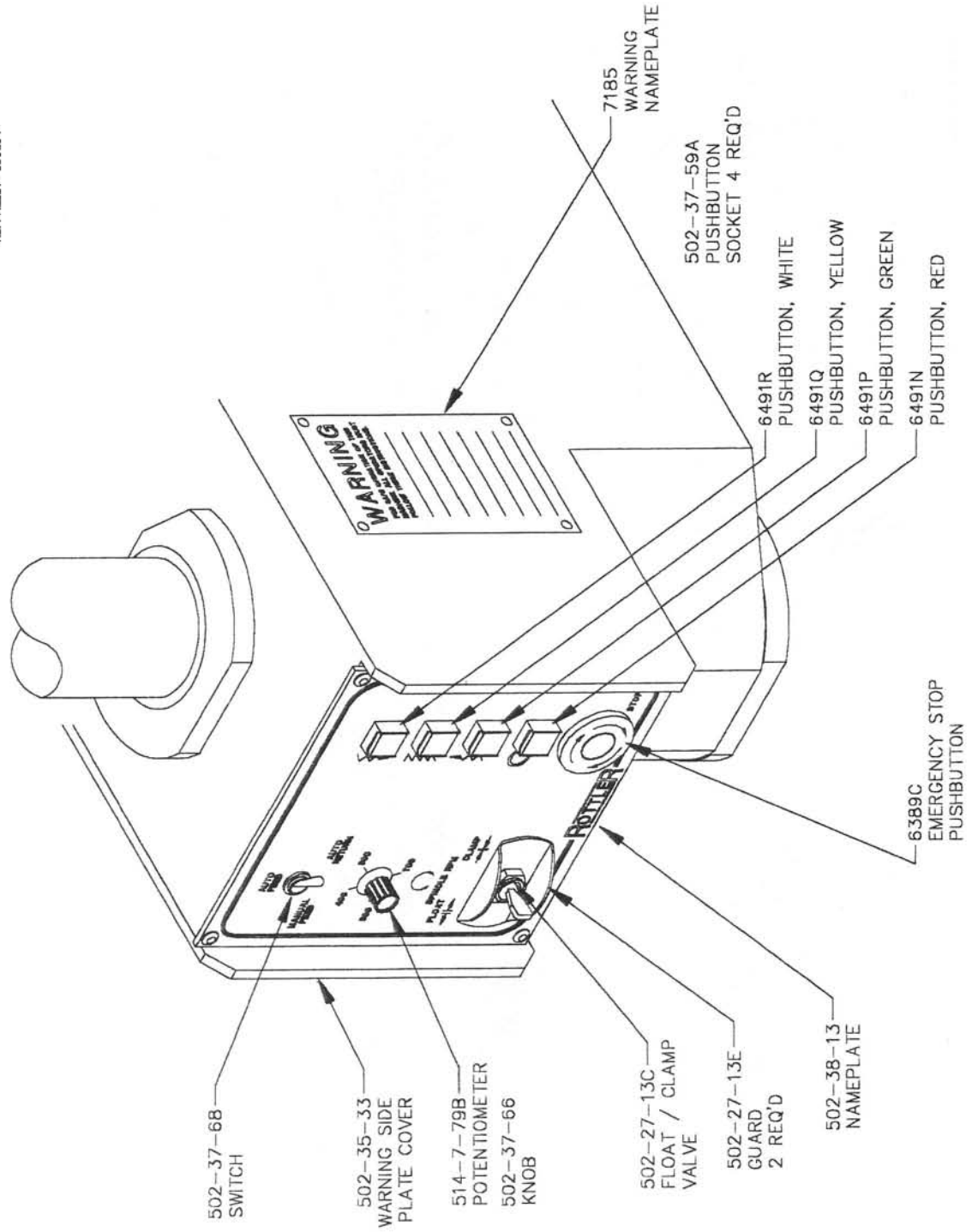


Spindle Clamp System:



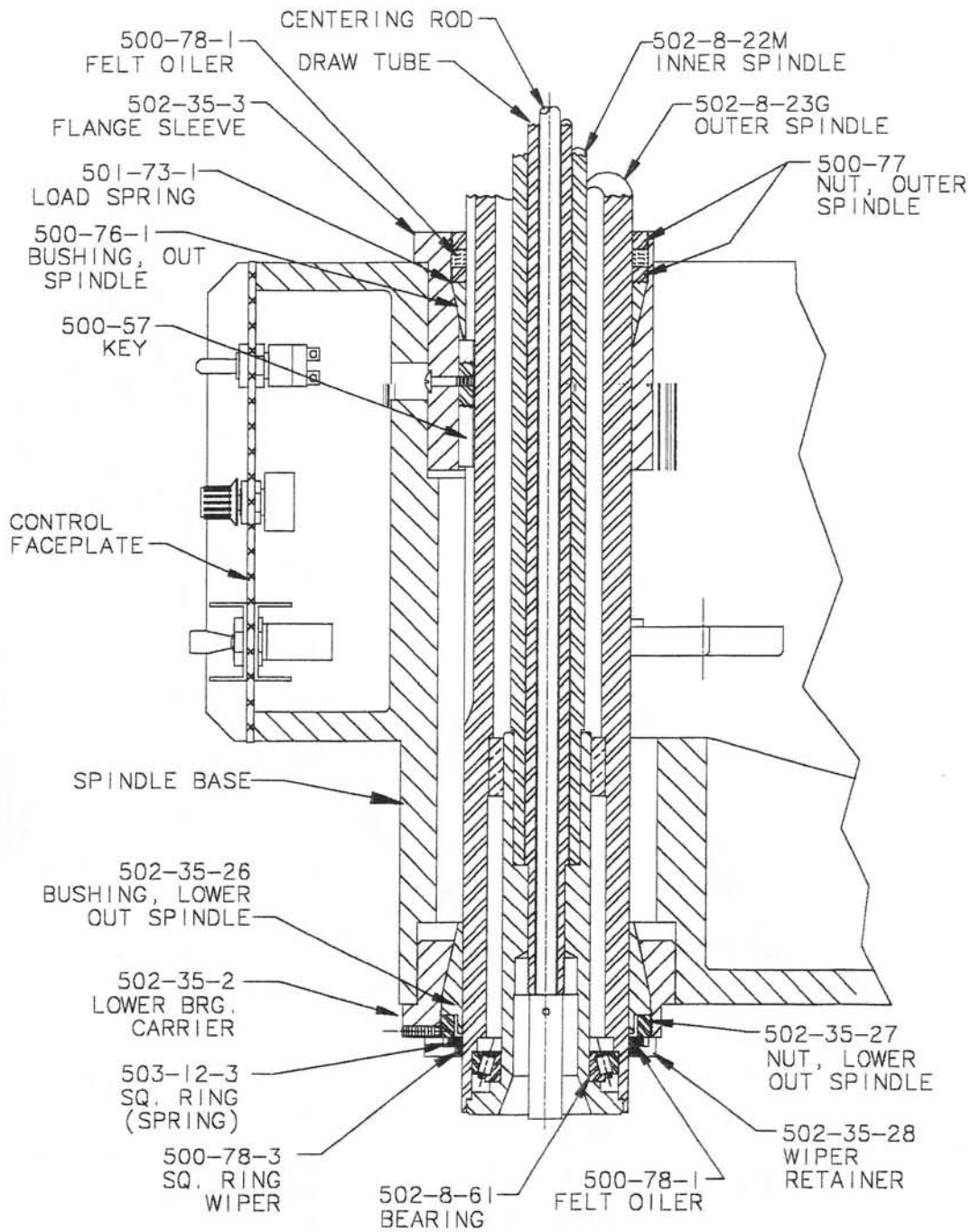
Control Panel:

REF FA2EB7-050294



Spindle Section:

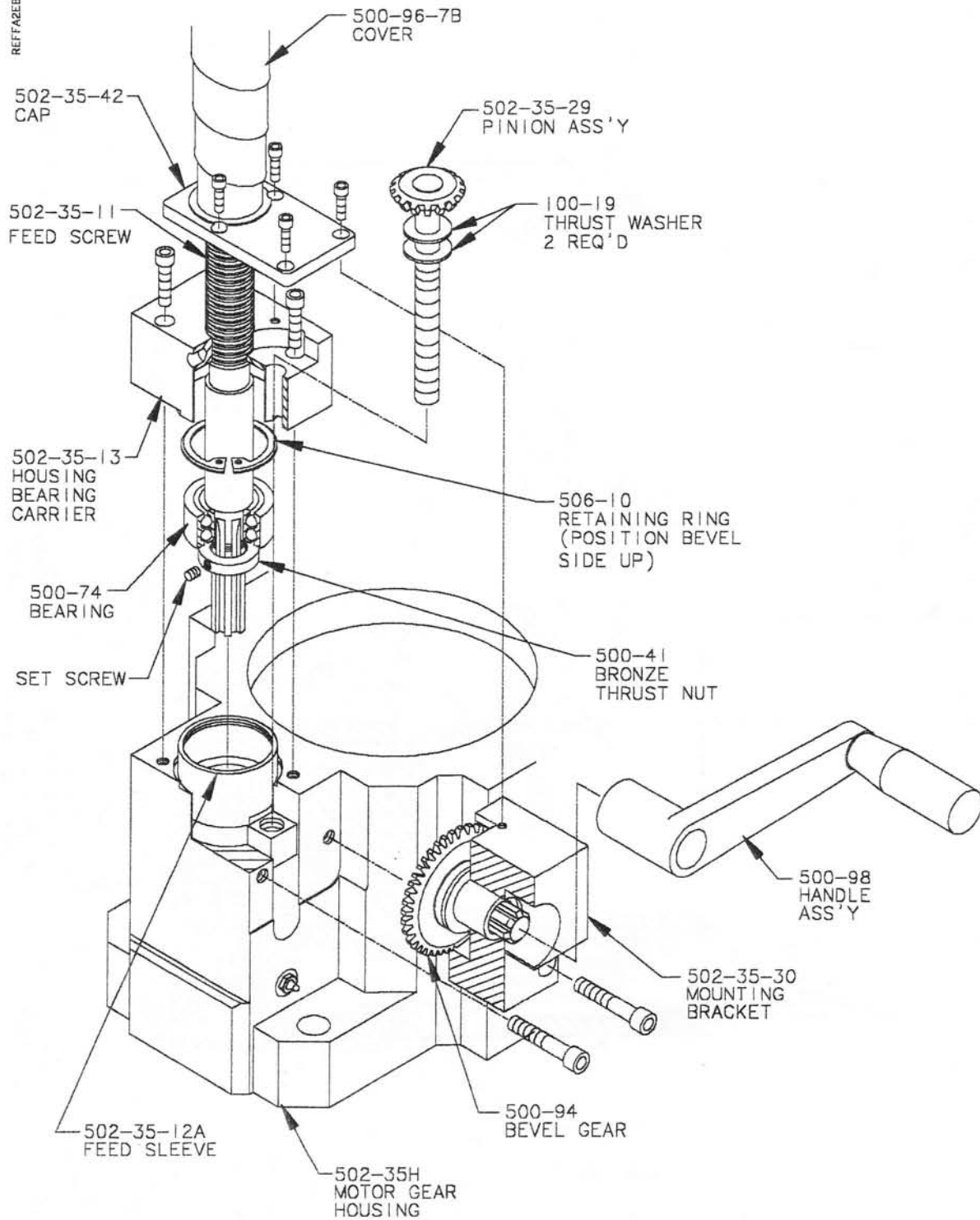
REFFA2EB10-050394



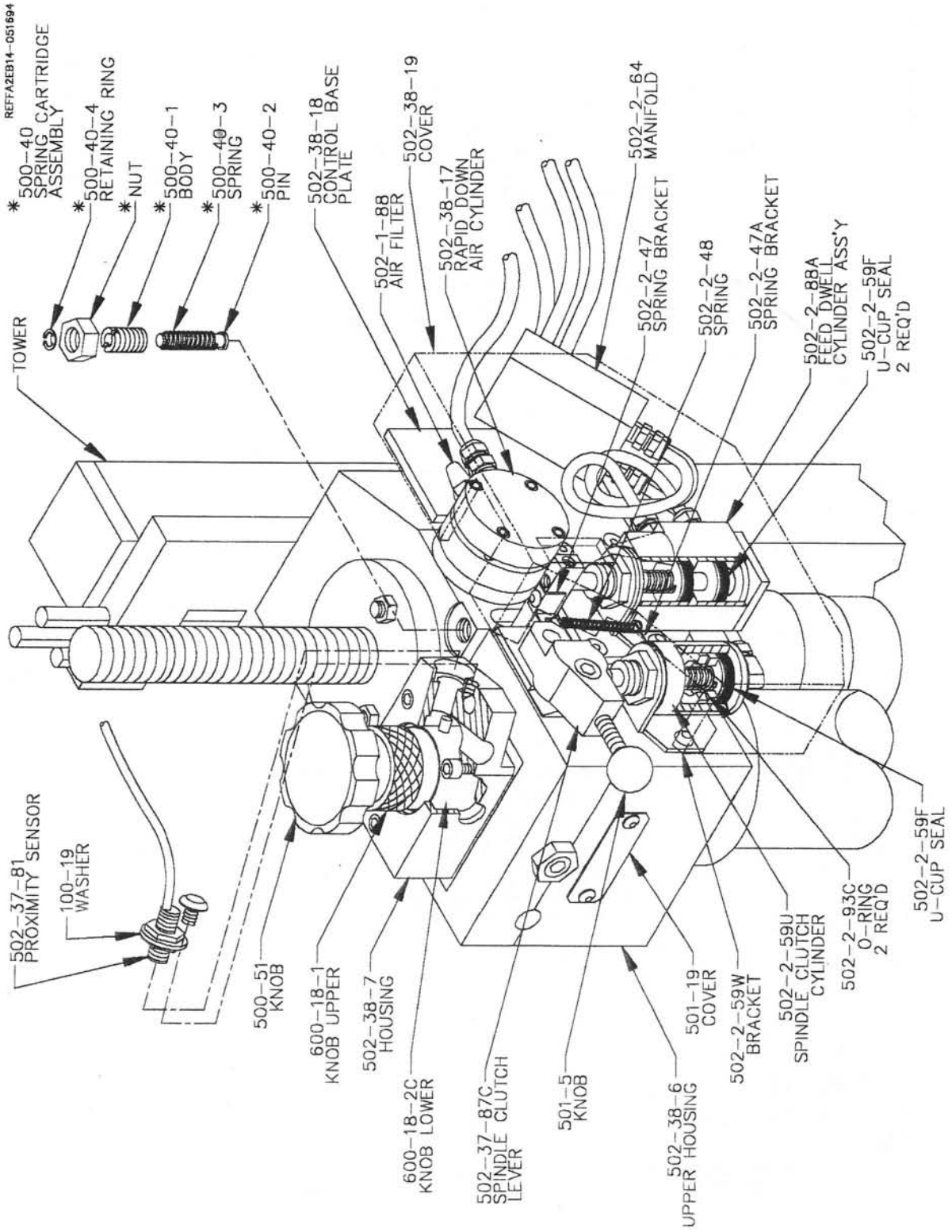
SECTION THRU
SPINDLE
FA2EB

Hand Feed Assembly:

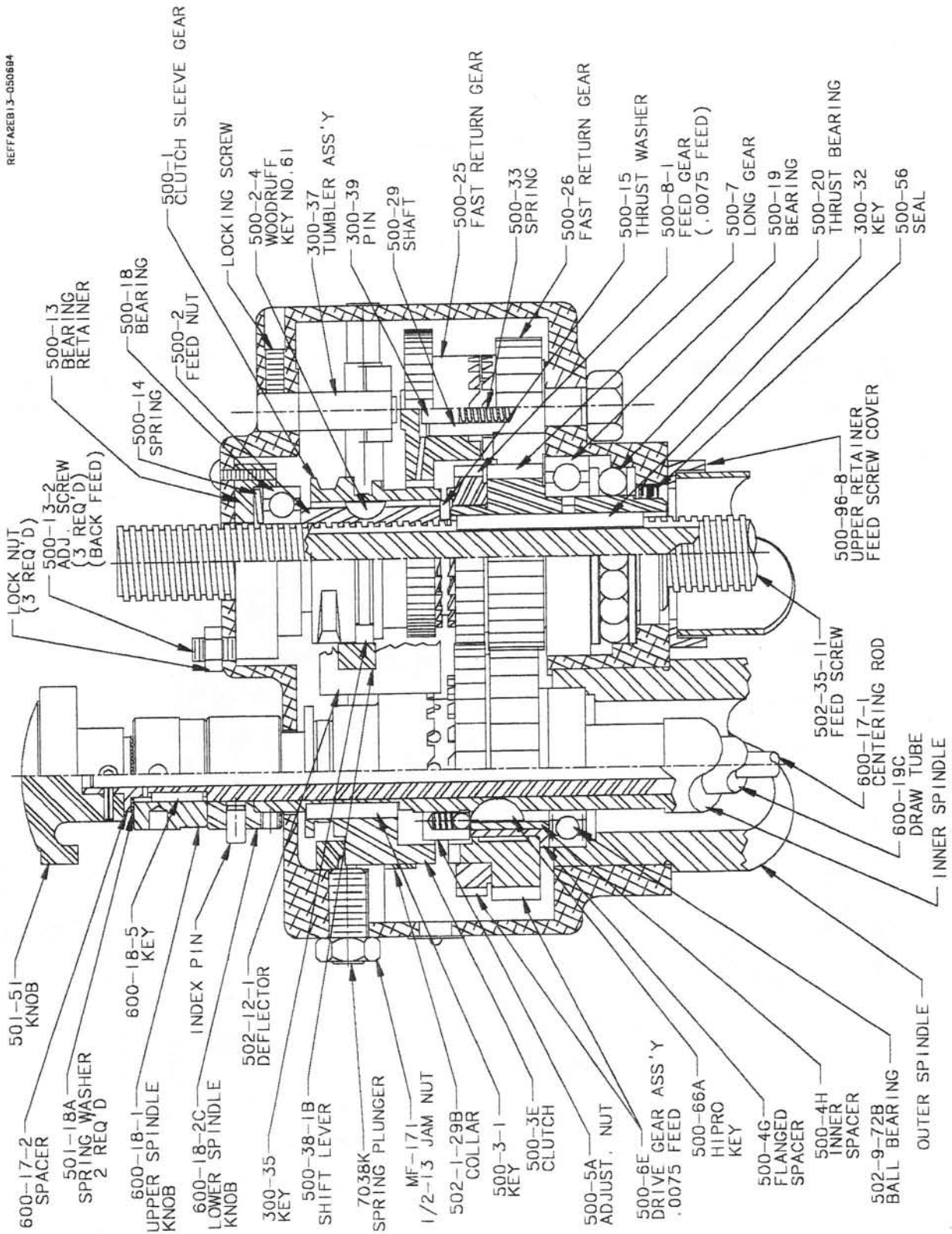
REF:FA2EBB-050384



Upper Housing Automatic Controls:

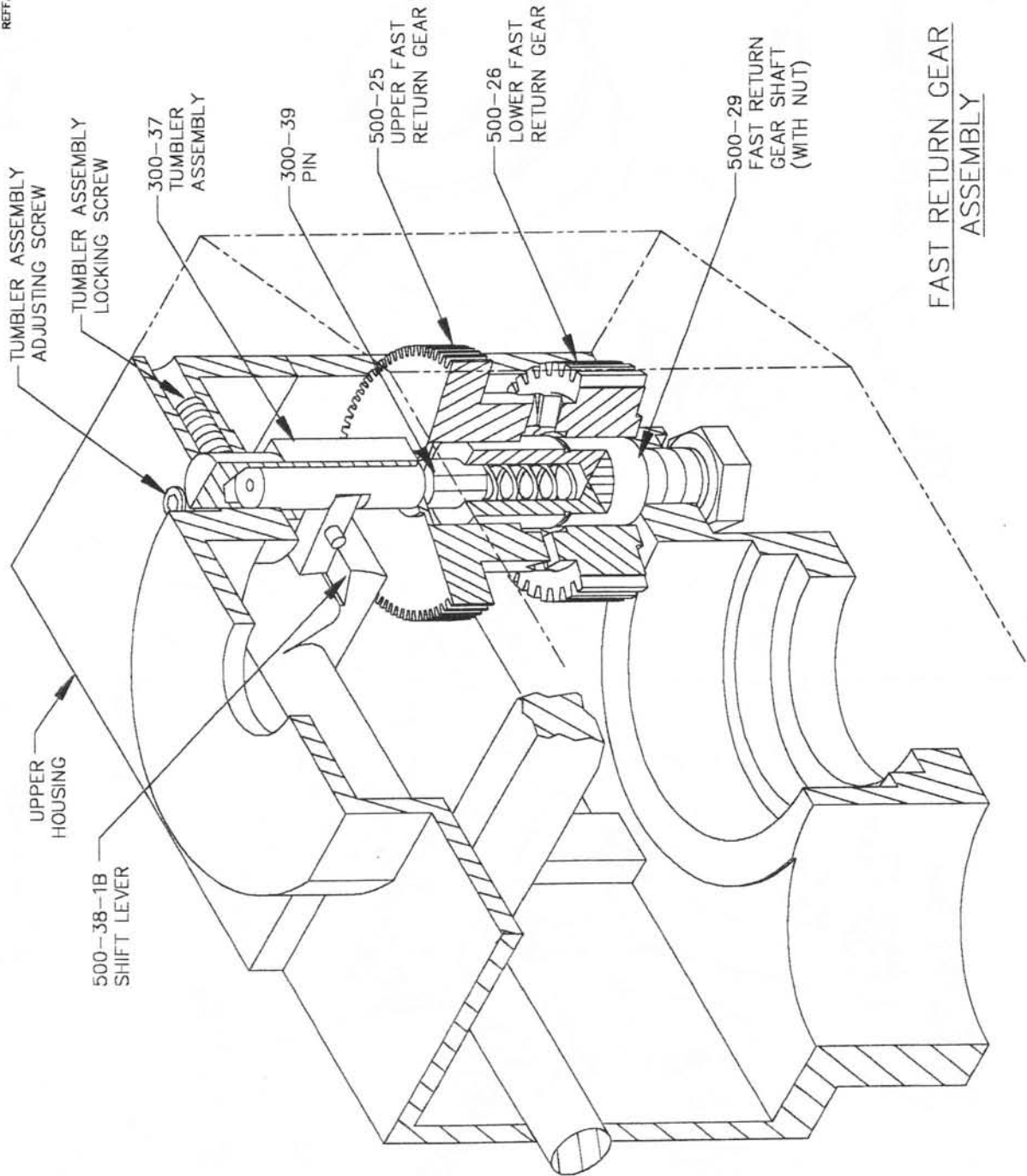


Upper Housing Section:



Fast Return Assembly:

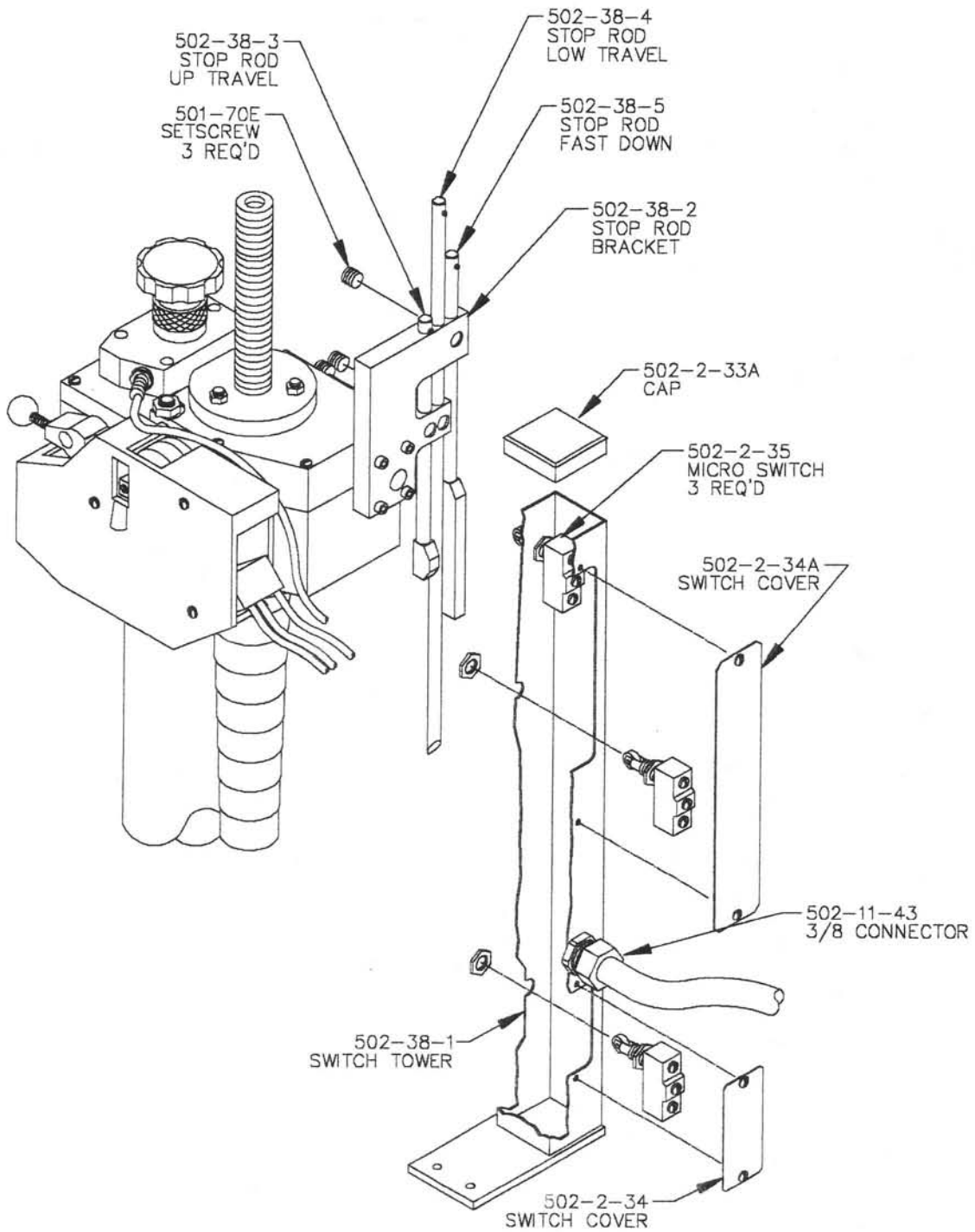
REF:FA2EB15-050984



FAST RETURN GEAR ASSEMBLY

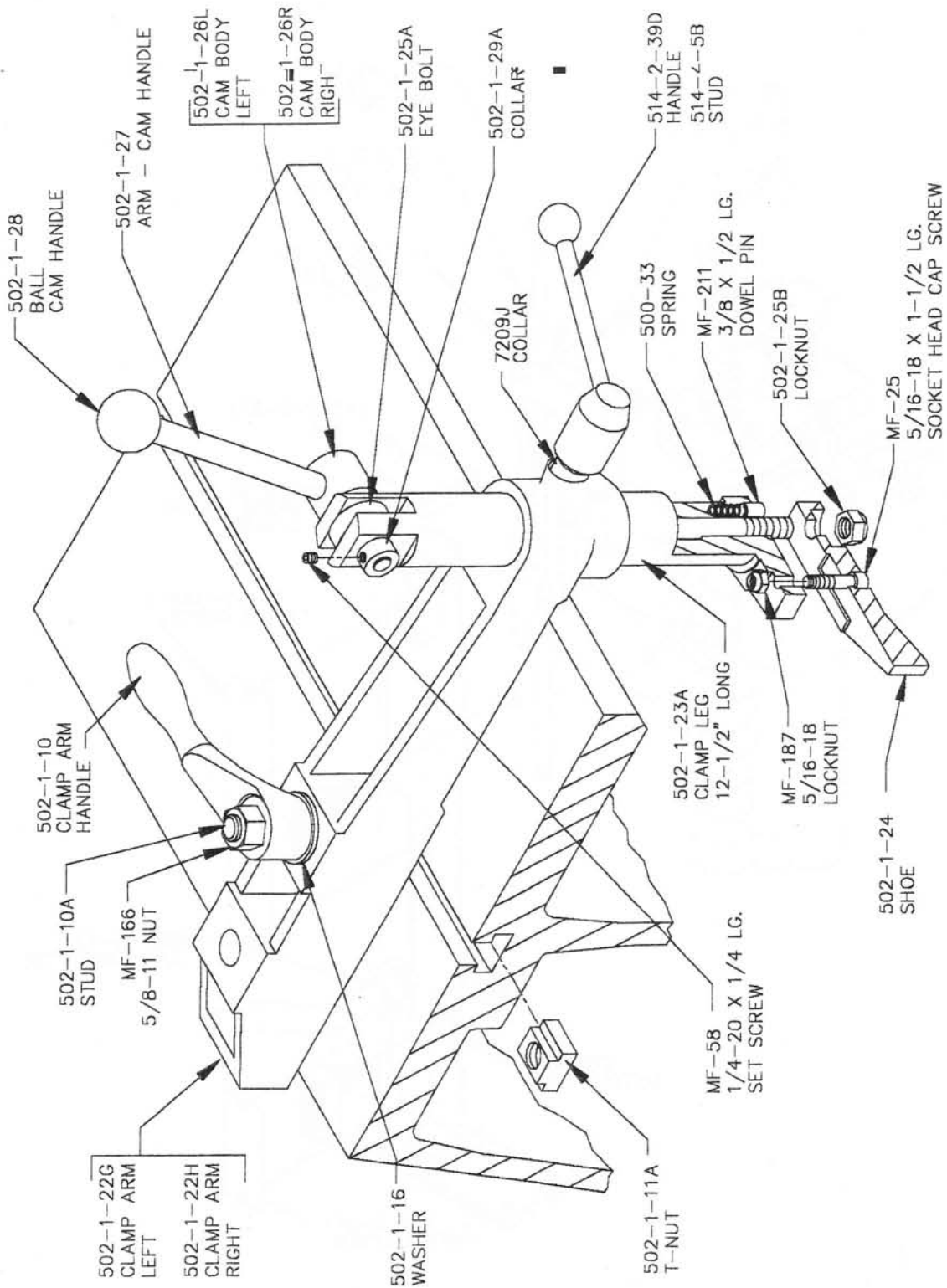
Switch Tower Assembly:

REFFA2EB17-010495

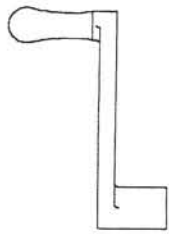


Block Clamp Assembly:

REF:FA2EB24-010595



Tools:



500-98
HAND FEED
HANDLE ASS'Y



502-12-2
SPANNER
WRENCH



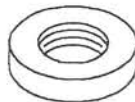
100-24
TOOL
PULLER



501-72
7/32" HEX
DRIVER
(OPTIONAL
501-72A
(5/32) HEX
DRIVER



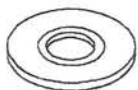
502-1-12A
JACKING SCREW
(4 REQUIRED)



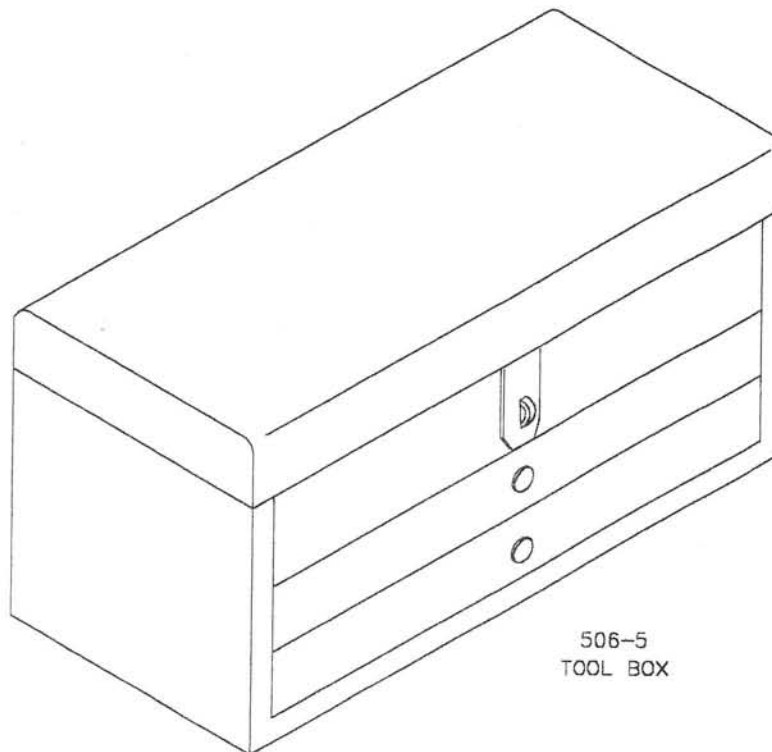
500-41
LOCK NUT
FEED SCREW



502-1-12F
JAM NUT
(4 REQUIRED)



502-1-12
LEVELING
PAD
(4 REQUIRED)



506-5
TOOL BOX

ROTTLER

MANUFACTURING

F2 Series Options

OPERATIONS AND MAINTENANCE
MANUAL



MANUFACTURED BY:

ROTTLER MANUFACTURING COMPANY
8029 South 200th Street
Kent Washington 98032 USA
Phone: (253) 872-7050
Fax: (253) 395-0230

NOTE: WHEN ORDERING REPLACEMENT PARTS,
PLEASE GIVE THE MODEL AND SERIAL NUMBER.

ORDER BY PART NUMBER.

THERE IS A MINIMUM ORDER OF \$25.00

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1.5" Blind Hole Cutterhead.....	1.7
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CUTTERHEADS

CAUTION:

Turn off machine before
changing cutterhead

Remove the centering fingers before changing cutterheads.

Insert the spanner wrench in the knob on the upper housing. Hold the cutterhead from turning. Break the knob loose (turn counter-clockwise). Hold the knob and unscrew the cutterhead.

Thoroughly clean the end, including the threads, of the cutterhead that is going to be put in. Be sure the spindle clutch lever is in the up position. Line up the key in the cutterhead with the keyway on the inner spindle and lift the cutterhead in.

Turn the centering knob, on top of the machine, to engage spline inside cutterhead. Screw cutterhead in, holding the cutterhead, firmly lock upper knob with spanner wrench.

A dampener weight is in most Rottler boring cutterheads, to improve the performance of the boring machine. The dampener weight requires little or no maintenance. Occasionally, the dampener weight will get contaminated with dirt or liquids. If this happens, the operator will experience chatter problems. The cutterhead will have to be removed, disassembled and cleaned. Disassembly is done by removing the screws located in the bottom of the cutterhead. (see illustrations following).

Production Cutterhead

600-8-4L With Tooling
600-8-4M Without Tooling

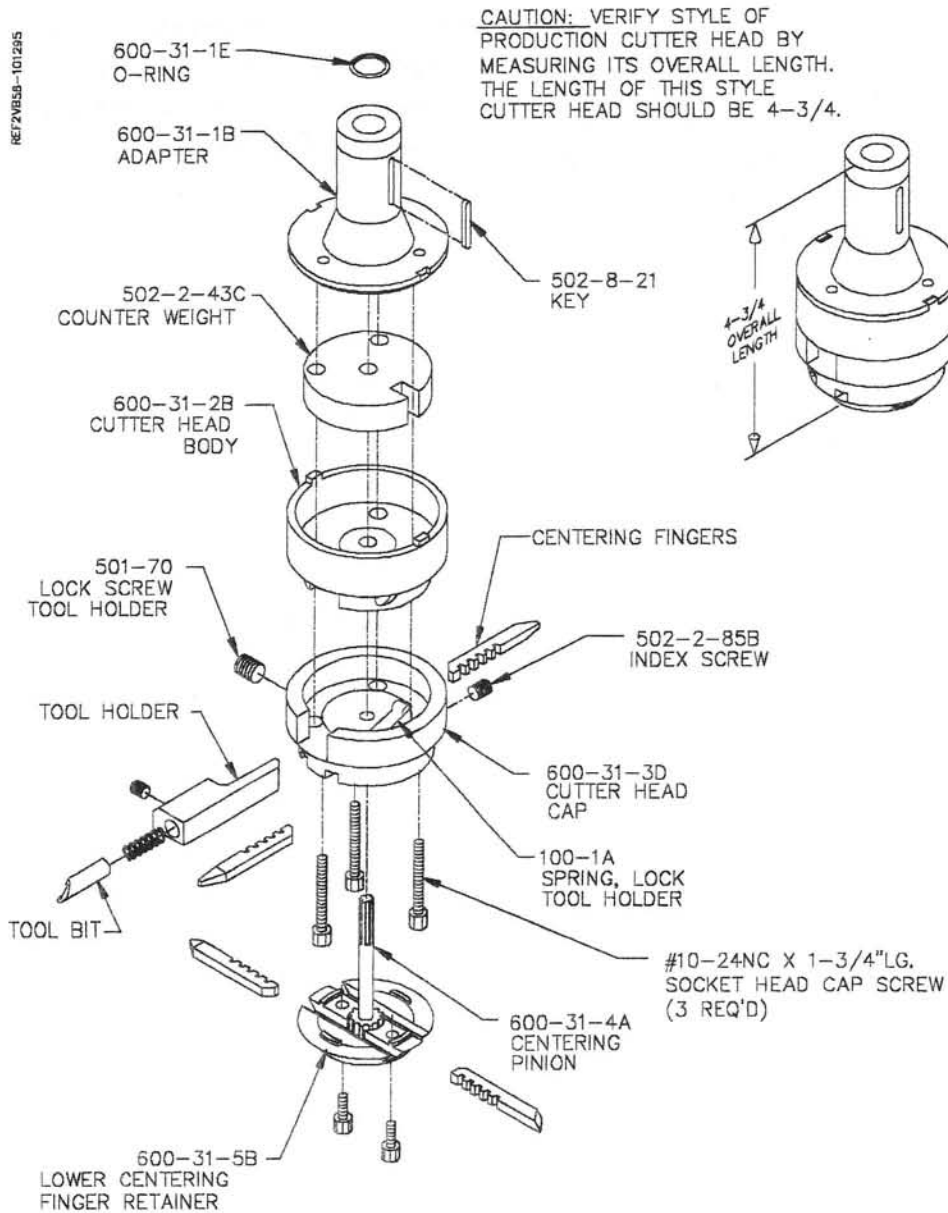
The production cutter head has a standard bore capacity of 2.875" to 6".

The production cutterhead, simplifies and speeds up the boring operation. It eliminates the need to remove the tool every time you center the spindle in a new bore.

CAUTION:

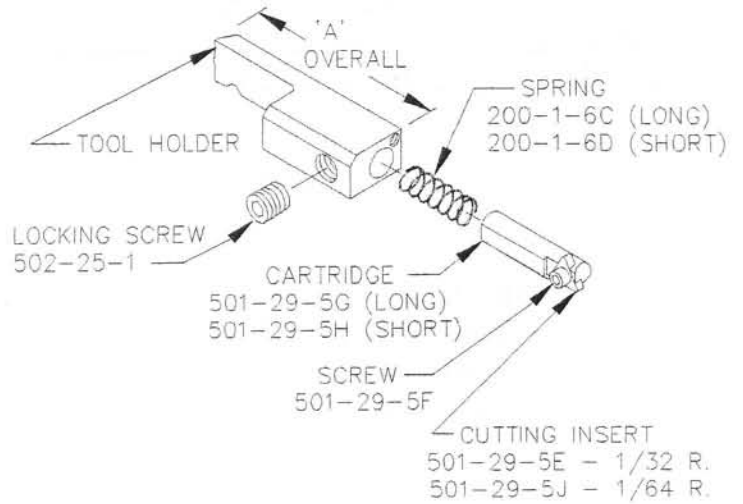
Be sure that this head does not interfere with lower extremities of the block, such as bosses and hubs.

The cutter head is designed to clear most all obstructions in U.S. passenger car and truck engines.

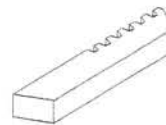


Production Cutterhead Tooling

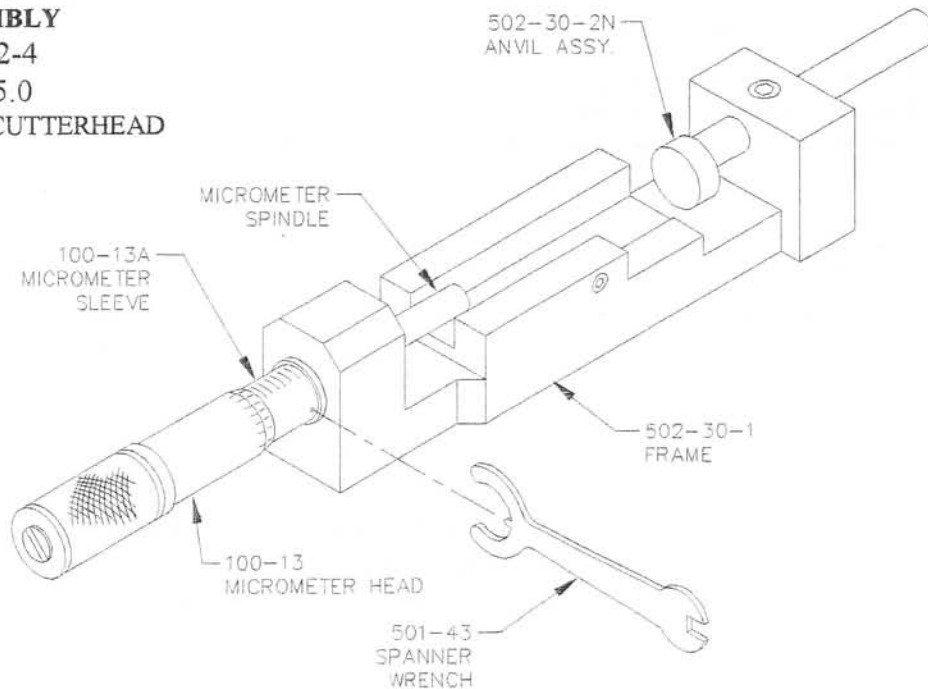
Tool Holder Dim 'A'	Cartridge	Spring	Bore Range
502-25R / 2.13	Short	Short	2.85 - 3.25
502-25C / 2.25	Short	Short	3.05 - 3.55
	Long	Short	3.50 / 3.85
502-25B / 2.50	Short	Short	3.50 - 3.95
	Long	Short	3.65 - 4.40
502-25A / 2.88	Long	Long	4.35 - 5.20



Centering Fingers	Length	Centering Diameter
200-21-3B	2.125	2.875 - 4.062
200-21-1	3.062	3.125 - 6.00

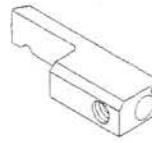


**MICROMETER
ASSEMBLY**
900-2-4
2.6-5.0
PRODUCTION CUTTERHEAD

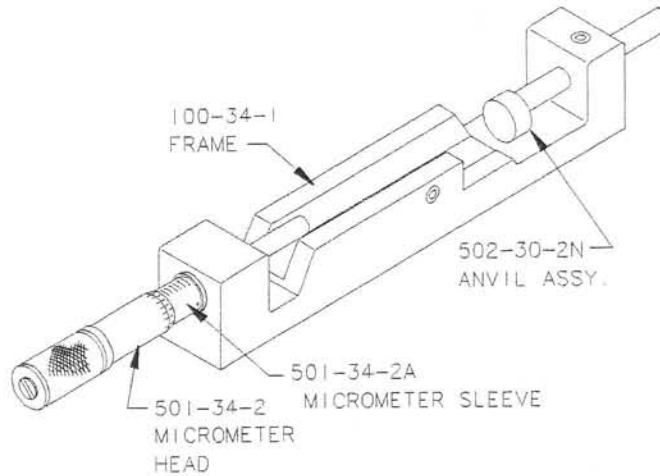


Optional Tooling to 6.00"
600-21B

Tool Holder Dim 'A'	Cartridge	Spring	Bore Range
502-25D / 3.31	Long	Long	5.15 - 6.00



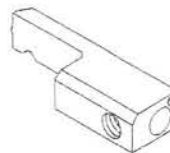
**MICROMETER
ASSEMBLY**
900-2-5
2.9 - 6.0



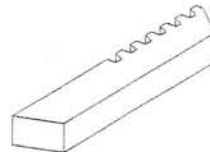
Optional Tooling to 8.00"
600-21

(Used with 600-21B 6.00" tooling)

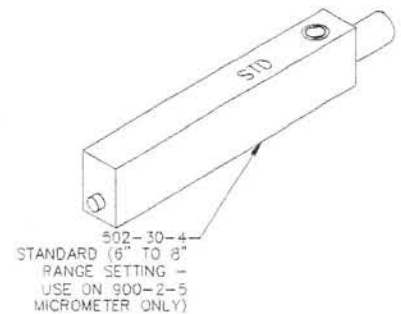
Tool Holder Dim 'A'	Cartridge	Spring	Bore Range
502-25E / 3.75	Long	Long	6.00 - 6.85
502-25P / 4.06	Long	Long	6.65 - 7.50
502-25F / 4.50	Long	Long	7.50 - 8.00



Centering Fingers	Length	Centering Diameter
200-21-2	4.187	5.00 - 8.00



502-30-4
Standard
(For resetting the micrometer
see machine manual, micro-
meter section for instructions).



Blind Hole Cutterhead

600-8-5 With Tooling
600-8-5A Without Tooling

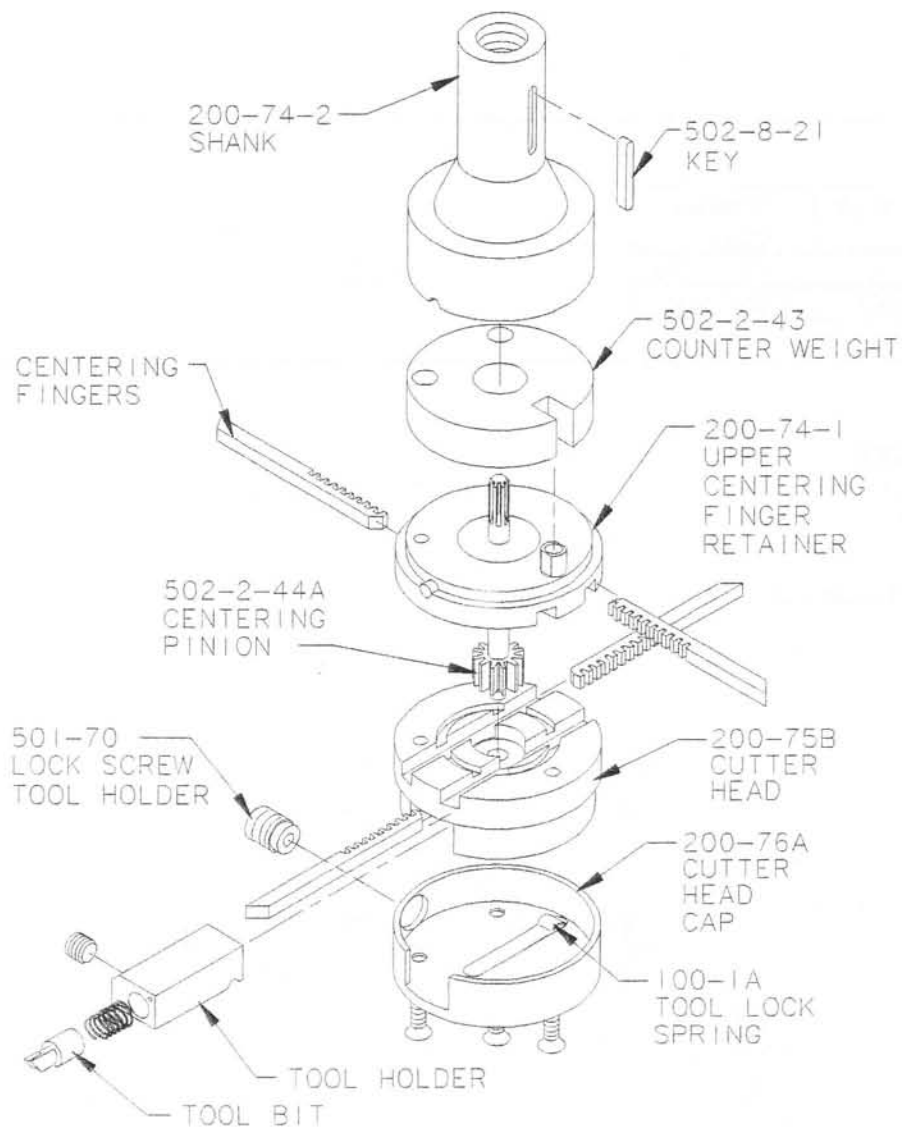
The Blind Hole cutterhead has a standard bore capacity of 2.875 - 6.00.

The blind hole cutterhead is attached and operates in basically the same manner as a production cutter head. The difference is the centering fingers are located above the cutter tool. This allows the cutter head to reach very

near the bottom of a blind hole or one that has an obstruction near the bottom. The tool holder must be removed to center each bore.

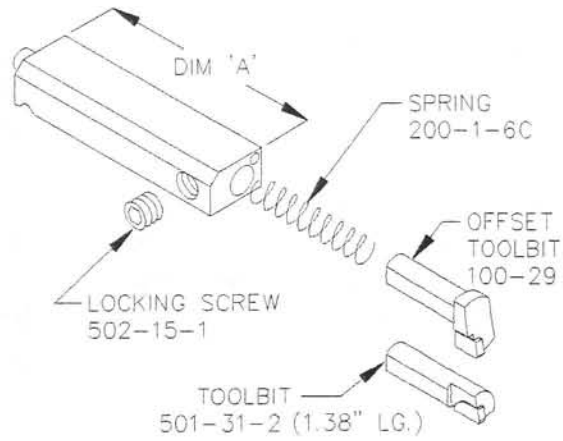
An offset tool bit is provided so that extreme blind holes may be bored.

See page 1.1 for dampener weight cleaning procedure.

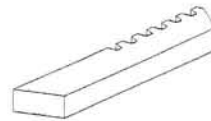


Blind Hole Cutterhead Tooling

Tool Holder Dim 'A'	Toolbit	Bore Range
199-94 / 2.25"	100-29	2.875 - 3.375
	501-31-2	2.875 - 3.375
200-1 / 2.50"	100-29	3.270 - 4.270
	501-31-2	3.000 - 4.060
200-2 / 3.00"	100-29	4.270 - 5.270
	501-31-2	4.000 - 5.150
200-3 / 3.56"	501-31-2	5.100 - 6.000



Centering Fingers	Length	Centering Diameter
200-21-3	2.312	2.875 - 4.500
200-21-1	3.062	3.125 - 6.00

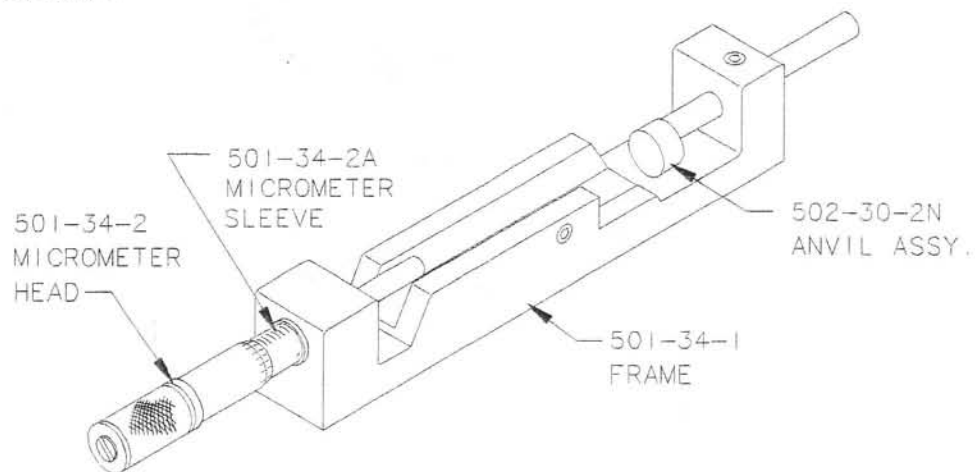


**MICROMETER
ASSEMBLY**

900-2-7

2.9-6.0

BLIND HOLE CUTTERHEAD



1.5 " Blind Hole Cutterhead

600-2 With Tooling

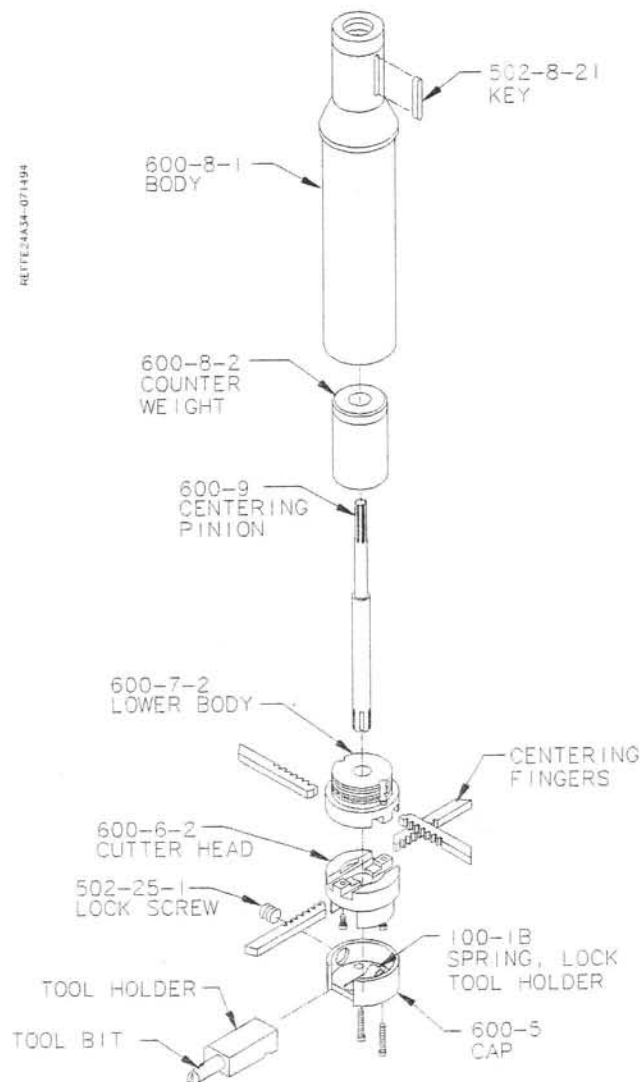
600-2-1 Without Tooling

The 1.5" (38mm) stub boring head has a capacity of 1.5" to 4.1" (38mm to 104mm) diameter x 6.5" (165mm) depth. The 1.5" stub boring head is attached and operates basically the same as the other Rottler cutterheads. This cutterhead is a blind hole cutterhead. The tool bit must be removed to center each bore.

Locate the work piece so the end of the stub boring head is no further than 1" from the beginning of the cut when the spindle is in the upper limit of travel.

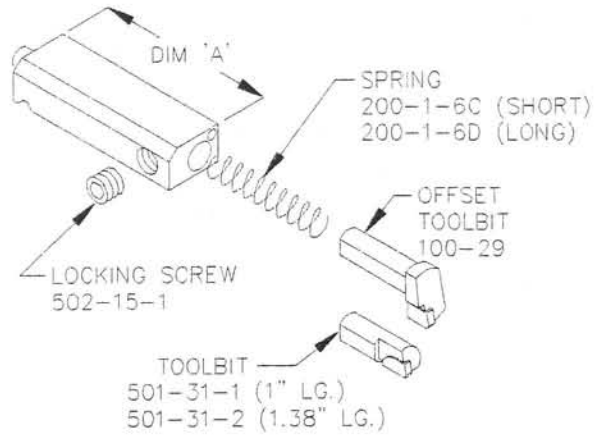
An offset tool bit is also provided in order to bore to the extreme bottom of blind holes.

See page 1.1 for dampener weight cleaning procedure.

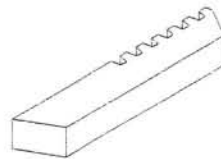


Blind Hole Stub Bar Tooling

Tool Holder Dim 'A'	Toolbit	Bore Range
199-96 / 1.25"	100-29	2.32 - 2.69
	501-31-1	1.56 - 2.19
	501-31-2	2.37 - 2.69
199-89 / 1.50"	100-29	2.32 - 3.19
	501-31-1	1.94 - 2.69
	501-31-2	2.38 - 3.19
199-90 / 1.75"	100-29	2.81 - 3.69
	501-31-1	2.44 - 3.88
	501-31-2	2.64 - 3.69
199-94 / 2.25"	100-29	3.82 - 4.69
	501-31-1	3.44 - 3.69
	501-31-2	3.50 - 4.69

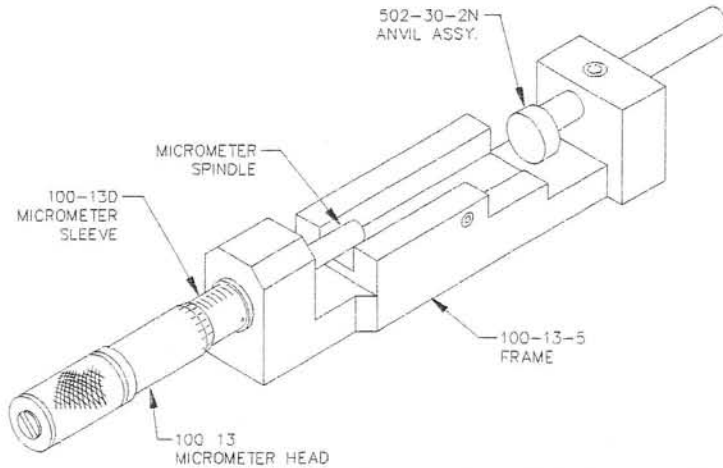


Centering Fingers	Length	Centering Diameter
200-26-1	1.38"	1.50 - 2.62
200-26-2	2.13"	2.62 - 4.13

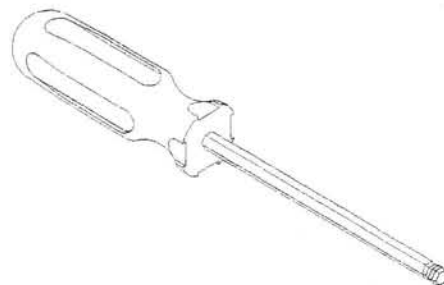


MICROMETER ASSEMBLY

900-2-11
1.5 - 4.1



5/32 Hex Driver
501-72A



**IMPORTANT INFORMATION FOR
THE BEST USE OF THE 1.5" STUB BAR
TOOLING.**

CAUTION:

Inner spindle adjustment (see machine manual) must be correct for precision use of stub boring heads.

The extended Stub Boring Head has considerable over hang, with a small shaft diameter, therefore the cutting tool "B" land must be kept very narrow, (.005" to .015") (.127mm to .3810mm). This will produce the best results with no chatter at the bottom of the bore.

The 1.5" cutterhead will tend to deflect slightly with heavy cuts. If a hole is bored .040 oversize, and is bored again, without changing the tool holder size, it will bore close to .001 more. If the first cut was lighter, the second cut will be proportionately lighter.

You can use the second pass performance (second pass must be made without re-centering) to provide a very precise bore.

Generally, size variations in a typical cycle bore will be approximately .0007". A second pass will usually reduce these variations to less than half and provide a fine finish. This finish will require very little stock removal with a hone in order to cross hatch for an excellent ring seating condition.

Performance of the stub boring bar is closely related to the proper lubrication and adjustment of the inner spindle bearing. Check the inner spindle adjustment two to three times a year to make sure clearance is correct.

IMPORTANT:

After inserting the tool holder into the stub bar and pushing it firmly back to it's indexing point, remove all finger pressure from the tool holder and the tool bit, before locking the locking set screw. This is especially important when using the offset tool bit.

Failure to follow the above instruction will result in size variation.

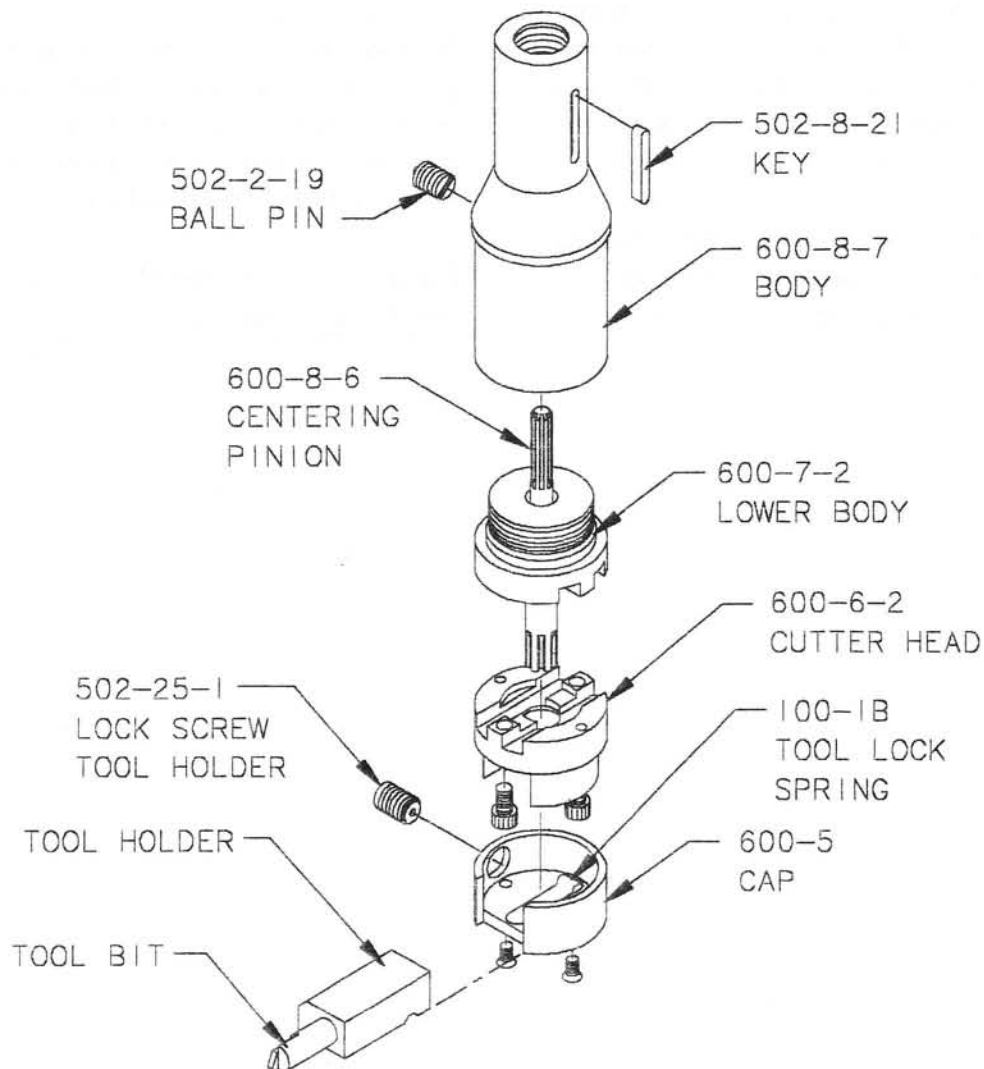
1.5 " Blind Hole Cutterhead (short)

600-8-8A With Tooling
600-8-8B Without Tooling

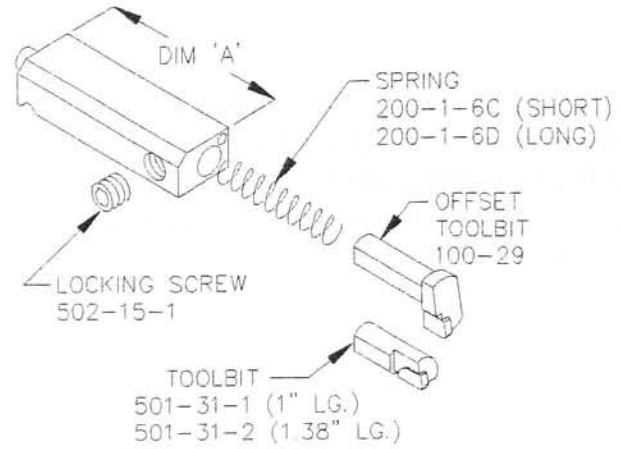
The 1.5" (38mm) (short) stub boring head has a capacity of 1.5" to 4.1" (38mm to 104mm) diameter x 3" (76mm) depth. The 1.5" (short) stub boring head is attached and operates basically the same as the other Rottler cutter heads. This cutter head is a blind hole cutterhead. The tool bit must be removed to center each bore.

The 1.5" (short) stub boring head is designed especially to be used for general purpose boring where a rigid stub boring head is required.

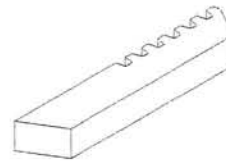
If you already have a 1.5" (600-2) stub boring head, the tooling can be used on this head.



Tool Holder Dim 'A'	Toolbit	Bore Range
199-96 / 1.25"	100-29	2.32 - 2.69
	501-31-1	1.56 - 2.19
199-89 / 1.50"	501-31-2	2.37 - 2.69
	100-29	2.32 - 3.19
199-90 / 1.75"	501-31-1	1.94 - 2.69
	501-31-2	2.38 - 3.19
199-90 / 1.75"	100-29	2.81 - 3.69
	501-31-1	2.44 - 3.88
199-94 / 2.25"	501-31-2	2.64 - 3.69
	100-29	3.82 - 4.69
199-94 / 2.25"	501-31-1	3.44 - 3.69
	501-31-2	3.50 - 4.69

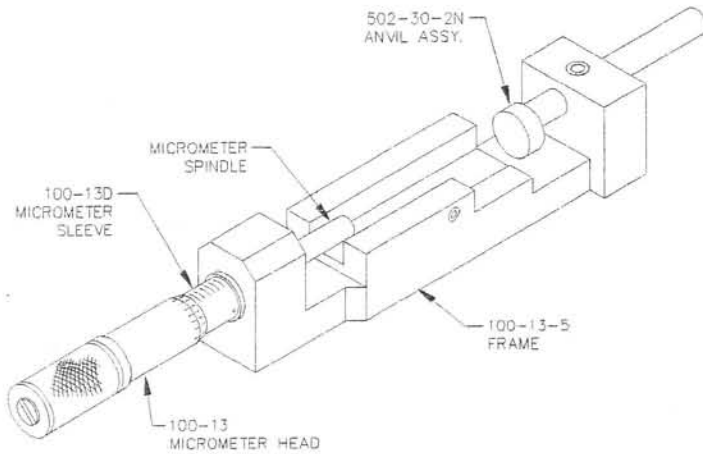


Centering Fingers	Length	Centering Diameter
200-26-1	1.38"	1.50 - 2.62
200-26-2	2.13"	2.62 - 4.13

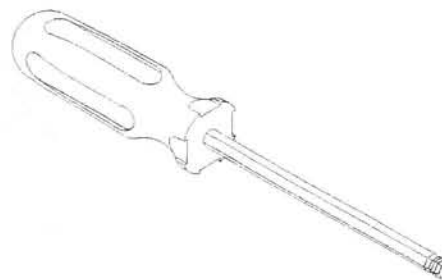


**MICROMETER
ASSEMBLY**

900-2-11
1.5 - 4.1



5/32 Hex Driver
501-72A



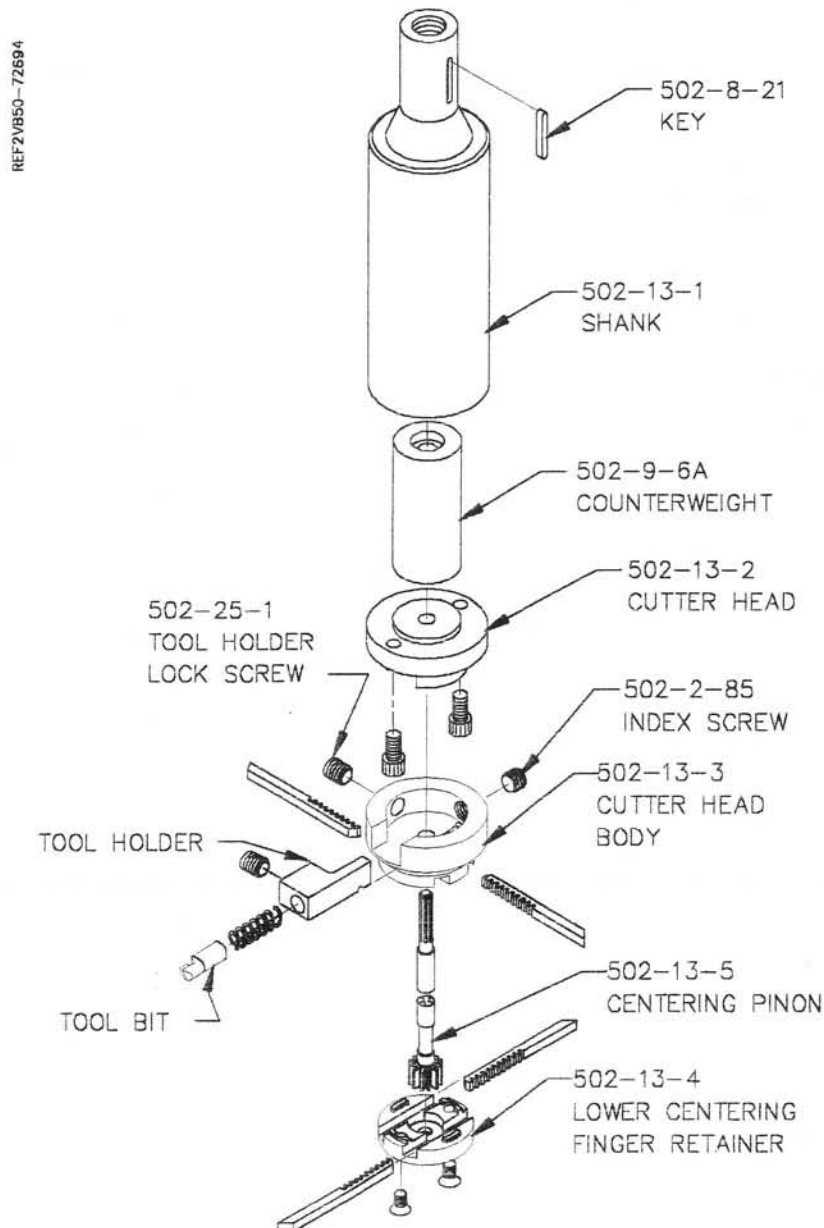
Production Stub Bar
 502-13 With Tooling
 502-13H Without Tooling

The Production Stub Boring Head has a capacity of 2.23" to 4.10" (57mm to 104mm) diameter x 6.00" (152mm) depth. This cutterhead eliminates the need to remove the tool every time you center the spindle in a new bore.

CAUTION:

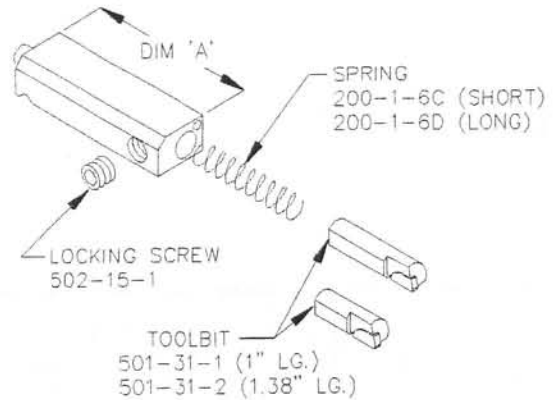
Be sure that this head does not interfere with lower extremities of the block, such as bosses and hubs.

The cutter head is designed to clear most all obstructions in U.S. passenger car and truck engines.

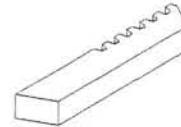


PRODUCTION STUB BAR TOOLING

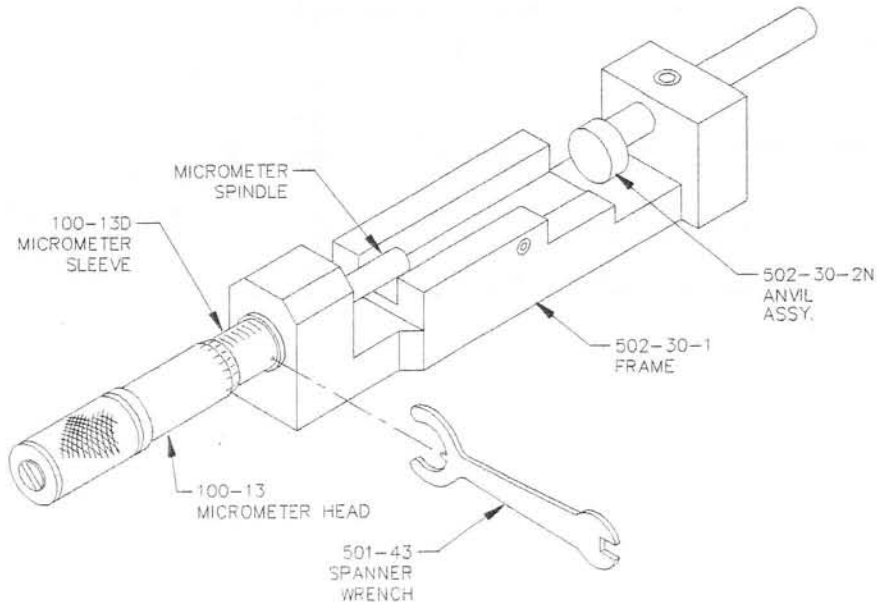
Tool Holder Dim 'A'	Toolbit	Bore Range
502-25H / 1.66"	501-31-1	2.54 - 2.91
	501-31-2	-----
502-25I / 1.84"	501-31-1	2.65 - 3.27
	501-31-2	3.39 - 3.77
502-25J / 2.09	501-31-1	3.15 - 3.77
	501-31-2	3.33 - 4.27



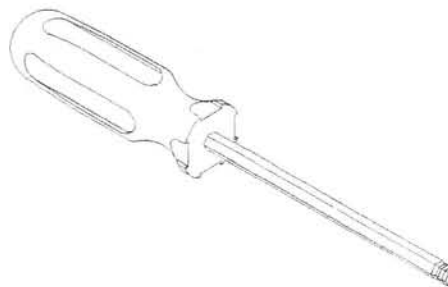
Centering Fingers	Length	Centering Diameter
200-12	1.75	1.875 - 3.50
200-10-1	2.13	2.31 - 4.10



**Micrometer
Assembly
900-2-9
1.5 - 4.1**

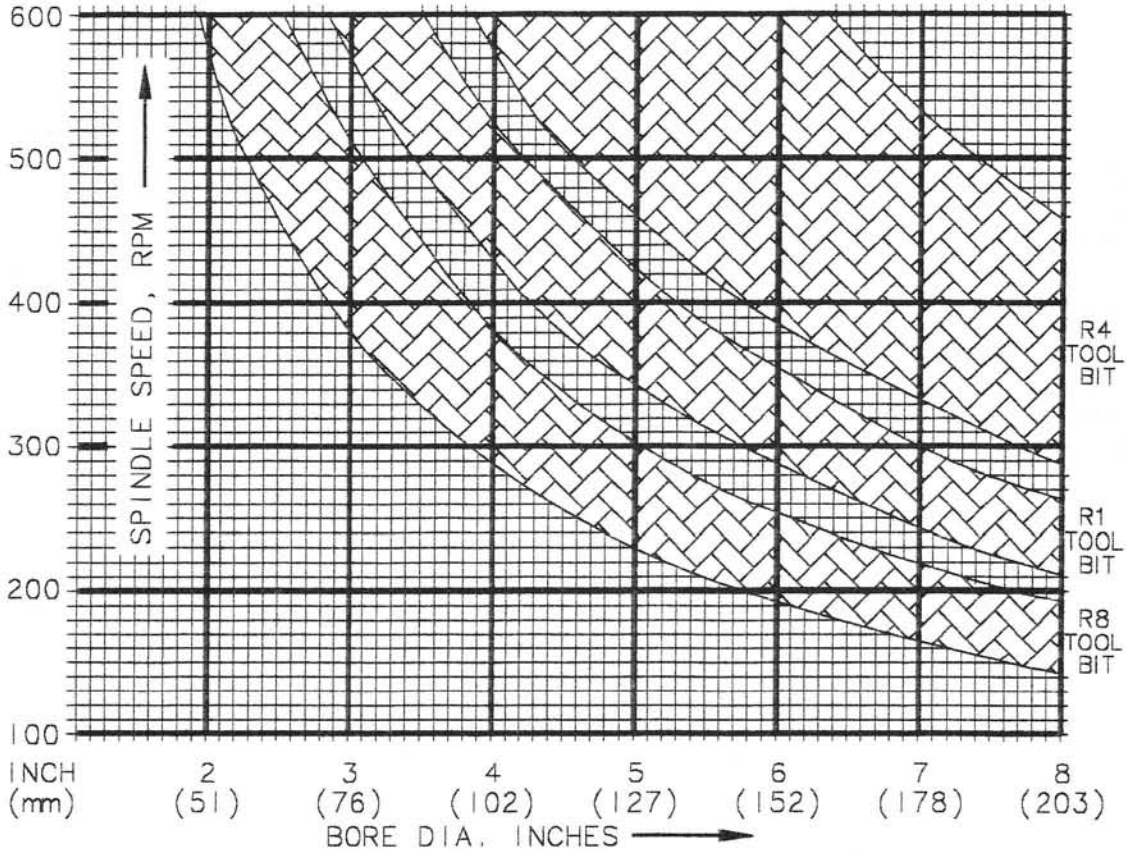


**5/32 Hex Driver
501-72A**



SPINDLE SPEED GRAPH

refcub42-080884



SPINDLE SPEED VS. BORE

NOTE:

SPINDLE SPEEDS SHOWN WILL YIELD BEST RESULTS FOR NORMAL CUTS ON CAST IRON (APPROX. 110 TO 220 BHN).

USE 2/3 SPEED FOR HEAVY CUTS.

USE 1/4 SPEED FOR HARD MATERIAL (Rc 35-50, BHN 327-475).

BORE SIZE MAY VARY DUE TO HEAT BUILD UP.

ACRA BORE

The purpose of this tooling is to increase speed and accuracy of the boring operation. Checking the bore size, and adjusting the toolholder (in the machine) eliminates the time necessary to handle the toolholder separately. Greater accuracy is realized because adjustment is made as a complete assembly. Accumulated tolerances, tool bit wear, and heat of the assembly are compensated with this tool.

1. Set up a tool holder in the standard micrometer frame. Bore the first hole. Determine the actual bored size with a bore gauge. Compare the actual size with the needed size and determine how far to move the tool holder.

REMEMBER:

A .001" adjustment to the toolholder will result in .002" diameter change in the bore.

2. Assemble the dial indicator onto the frame as shown.

3. Attach the frame assembly to the cutter head by placing the magnets on the bottom of the cutterhead. Remove all burrs, so magnets will seat flat.

4. Loosen the thumbscrew securing the dial indicator, adjust so that the tip of the tool bit touches the contact point and advances the indicator approximately 1/2 of its travel. Tighten the thumbscrew.

5. Loosen the toolholder lock screw. Adjust the toolholder in or out using the set screw on the back of the cutterhead. Before you change the set screw adjustment, notice where the location mark is, on the set screw, in relation to the mark on the cutterhead. Always keep this reference so you can return to zero.

NOTE:

Always be sure to return the set screw back to zero before changing toolbits. Failure to do this will result in incorrect bore size.

CAUTION:

DO NOT turn more than 2 full turns in either direction as this will cause the toolholder to not seat correctly.

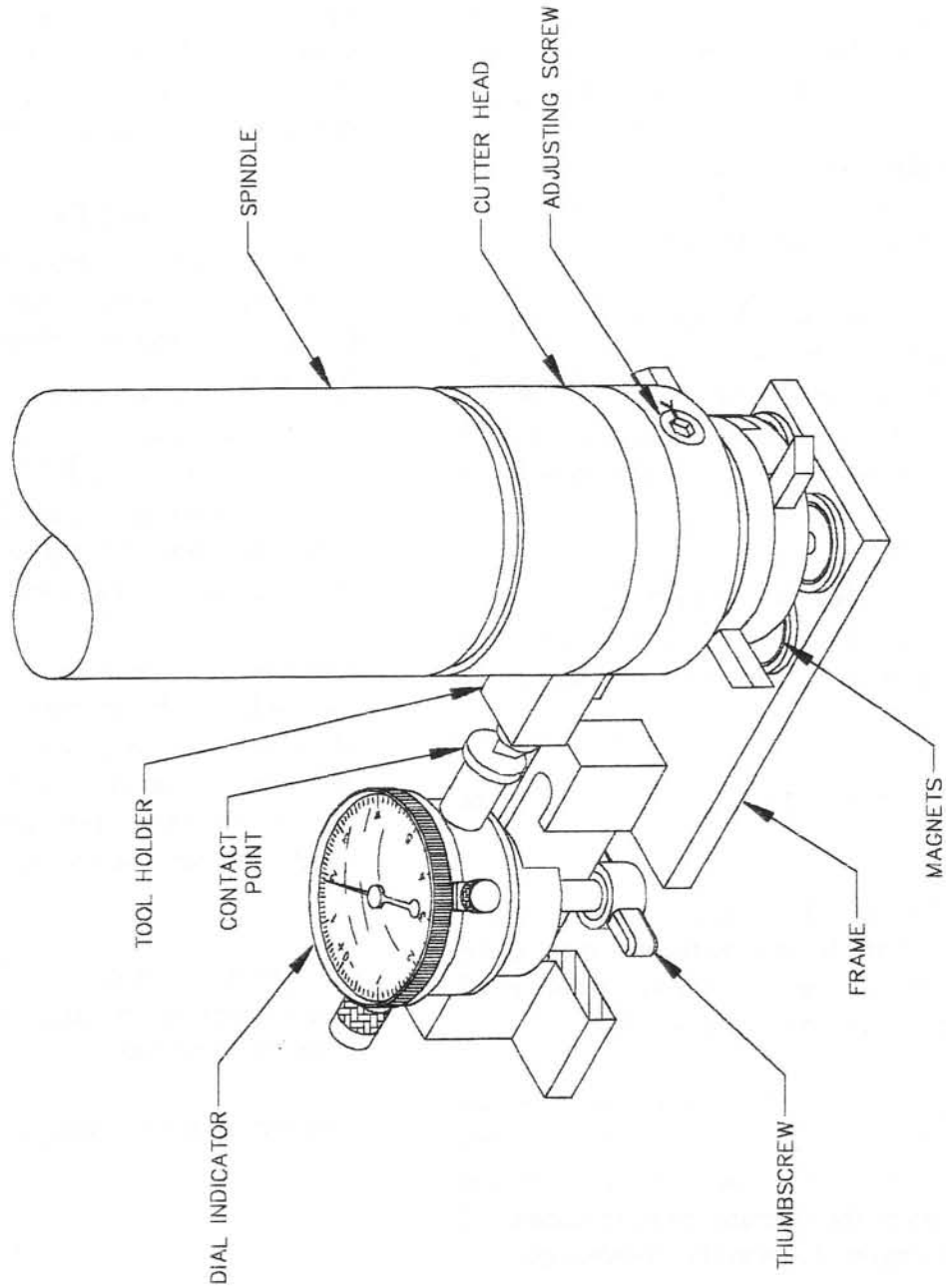
Exercise extreme care in adjusting the toolholder in this manner. One full turn of the set screw will move the toolholder .025". So a quarter of a turn will move the toolholder approximately .006" which will increase the bore diameter by .012".

6. Tighten the toolholder lock screw. Be sure to remove the dial indicator frame from the cutter head.

You are ready to continue boring.

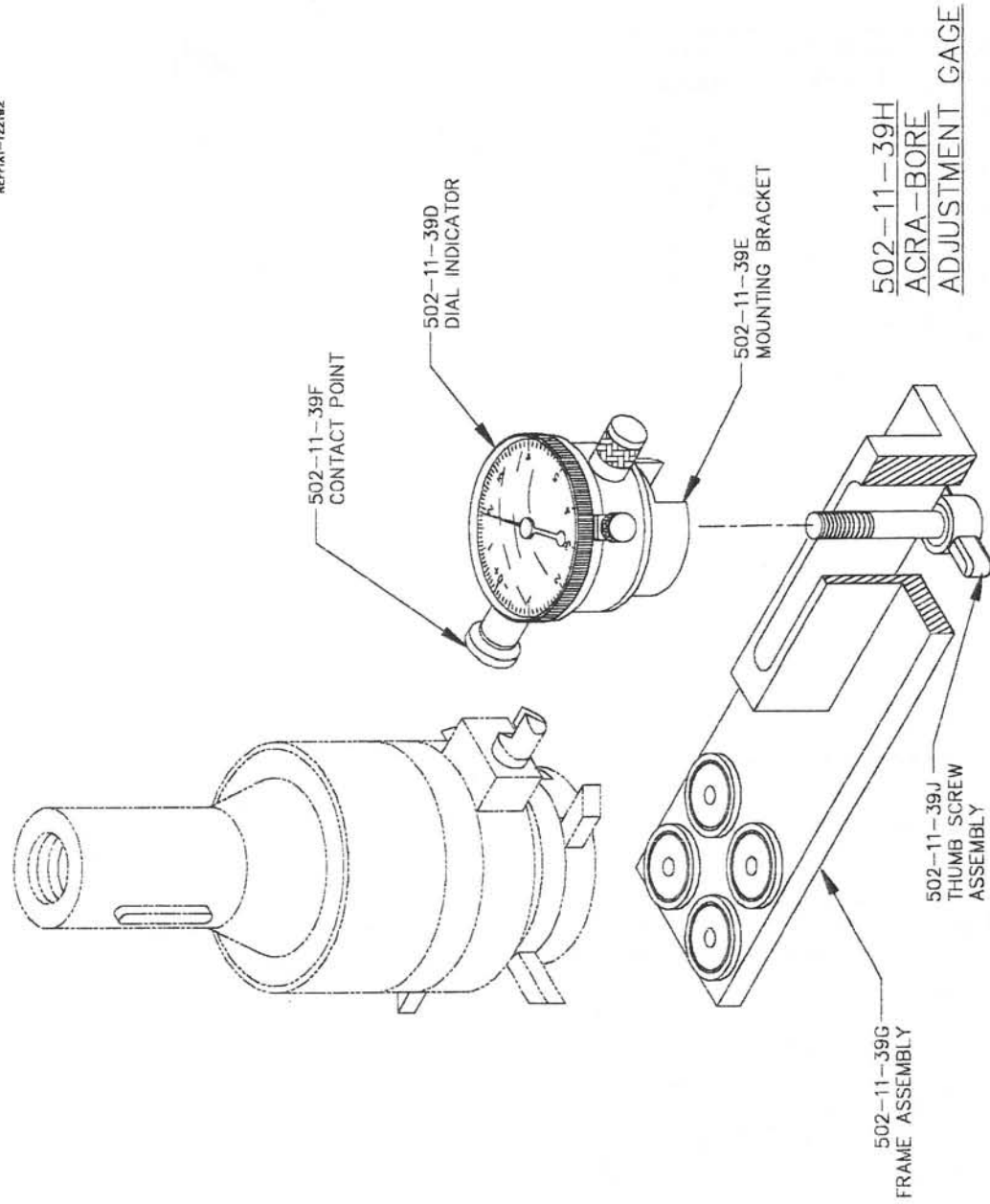
Acra Bore Set-up:

REFTR12-020593



Acra Bore Assembly:

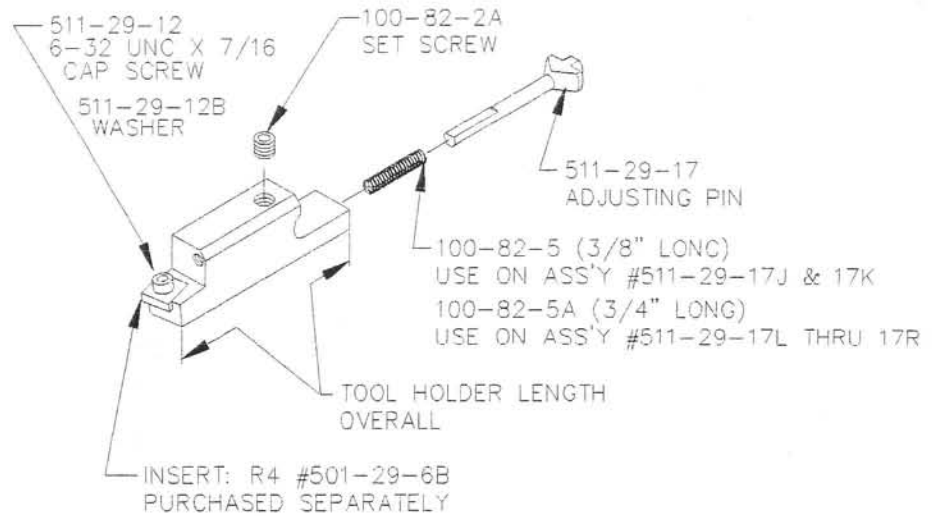
REFFIX1-122192



Indexable Cartridge Tool Holders:

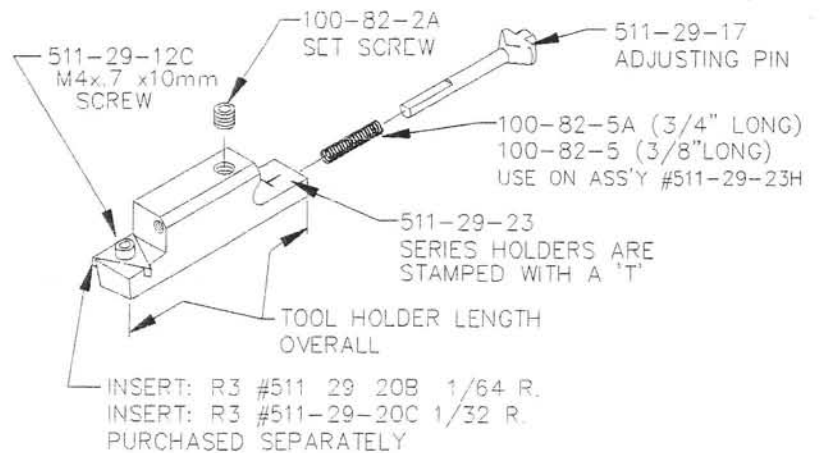
**Square Cartridge
Tool Holder
Negative Rake**

Tool Holder ass'y Part No.	Tool Holder Length	Bore Range
511-29-17J	1.95"	2.90 - 3.12
511-29-17K	2.15"	3.12 - 3.52
511-29-17L	2.35"	3.52 - 3.92
511-29-17M	2.55"	3.92 - 4.32
511-29-17N	2.75"	4.32 - 4.72
511-29-17P	2.95"	4.72 - 5.12
511-29-17Q	3.15"	5.12 - 5.52
511-29-17R	3.98"	6.77- 7.17



**Triangle Cartridge
Tool Holder
Positive Rake**

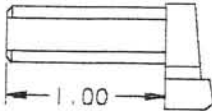

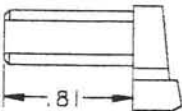
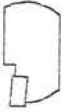


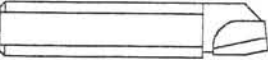

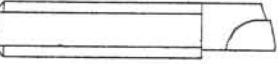

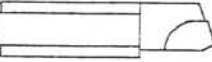

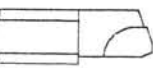

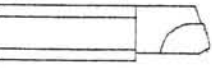



Tool Holder ass'y Part No.	Tool Holder Length	Bore Range
511-29-23H	2.13"	3.10 - 3.50
511-29-23A	2.33"	3.50 - 3.88
511-29-23B	2.53"	3.88 - 4.28
511-29-23C	2.73"	4.28 - 4.68
511-29-23D	2.93"	4.68 - 5.08
511-29-23E	3.13"	5.08 - 5.48
511-29-23F	3.33"	5.48 - 5.88
511-29-23G	3.53"	5.88 - 6.28



** FOR TOOLHOLDERS WITHOUT THE 'T' DESIGNATION, USE:
 INSERT: R3 #511-29-20 1/32 R.
 INSERT: R3 #511-29-20A 1/32 R.
 6598E (4-40 UNC X 3/8 SCREW)
 PURCHASED SEPARATELY

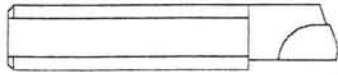
Brazed Carbide Toolbits

Description

<p>100-29</p> 		<p>Offset Tool Bit (for boring blind cylinder holes)</p>
<p>100-29-7</p> 		<p>Offset Tool Bit (for boring GM 60 degree V6)</p>
<p>100-76</p> 		<p>Offset Tool Bit (for boring blind cylinder holes)</p>
<p>501-28</p> 		<p>C.C. Steel Cutting Tool Bit w/chip curler to break up chips while boring.</p>
<p>501-29A</p> 		<p>RF Facing & Counterboring Tool Bit for facing and counterboring of cylinder block, for cutting off sleeve.</p>
<p>501-30-2</p> 		<p>R1 Carbide Tool Bit, medium, 1-3/8"</p>
<p>501-30-1</p> 		<p>R1 Carbide Tool Bit, short, 1"</p>
<p>501-31-2</p> 		<p>R8 Carbide Tool Bit, long 1-3/4" (for general purpose & heavy cuts, cast iron) (recommended for interrupted cuts)</p>
<p>501-31-1</p> 		<p>R8 Carbide Tool Bit, short 1"</p>

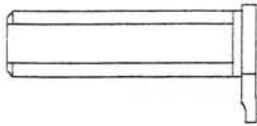
Brazed Carbide Toolbits**Description**

501-31A



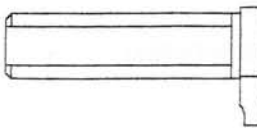
C.C.B. Cummins Counter Boring Tool Bit, for counterboring of Cummins diesel cylinder block.

501-32-3



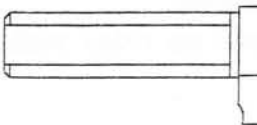
.037 Grooving Tool Bit

501-32-1



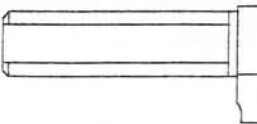
.048 Grooving Tool Bit

501-32-2



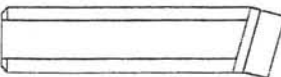
.072 Grooving Tool Bit

501-32-4



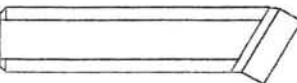
.152 Grooving Tool Bit

501-33B



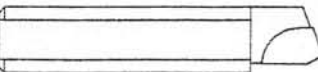
15 degree Cummins Chamfer Tool Bit (chamfering Cummins blocks)

501-33D



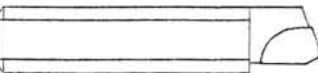
30 degree Chamfer Tool Bit (for general purpose chamfering cast iron)

501-33-1



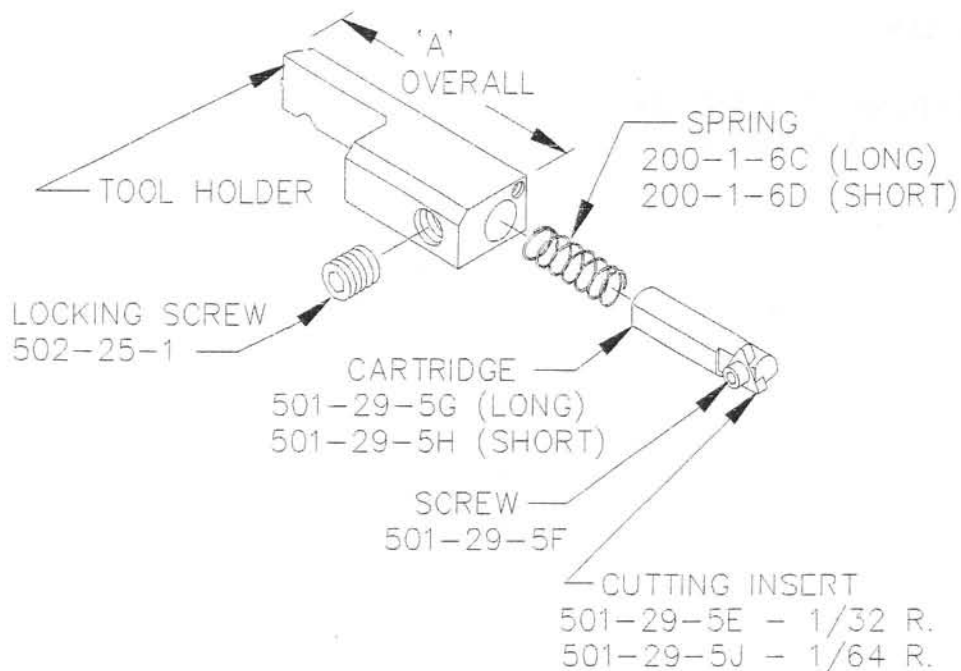
R8 (12 degree rake) Long Roughing Cut

501-33-2



R1 Vega (12 degree Rake)

**Indexable Toolbits and
502-25 Series Toolholders**

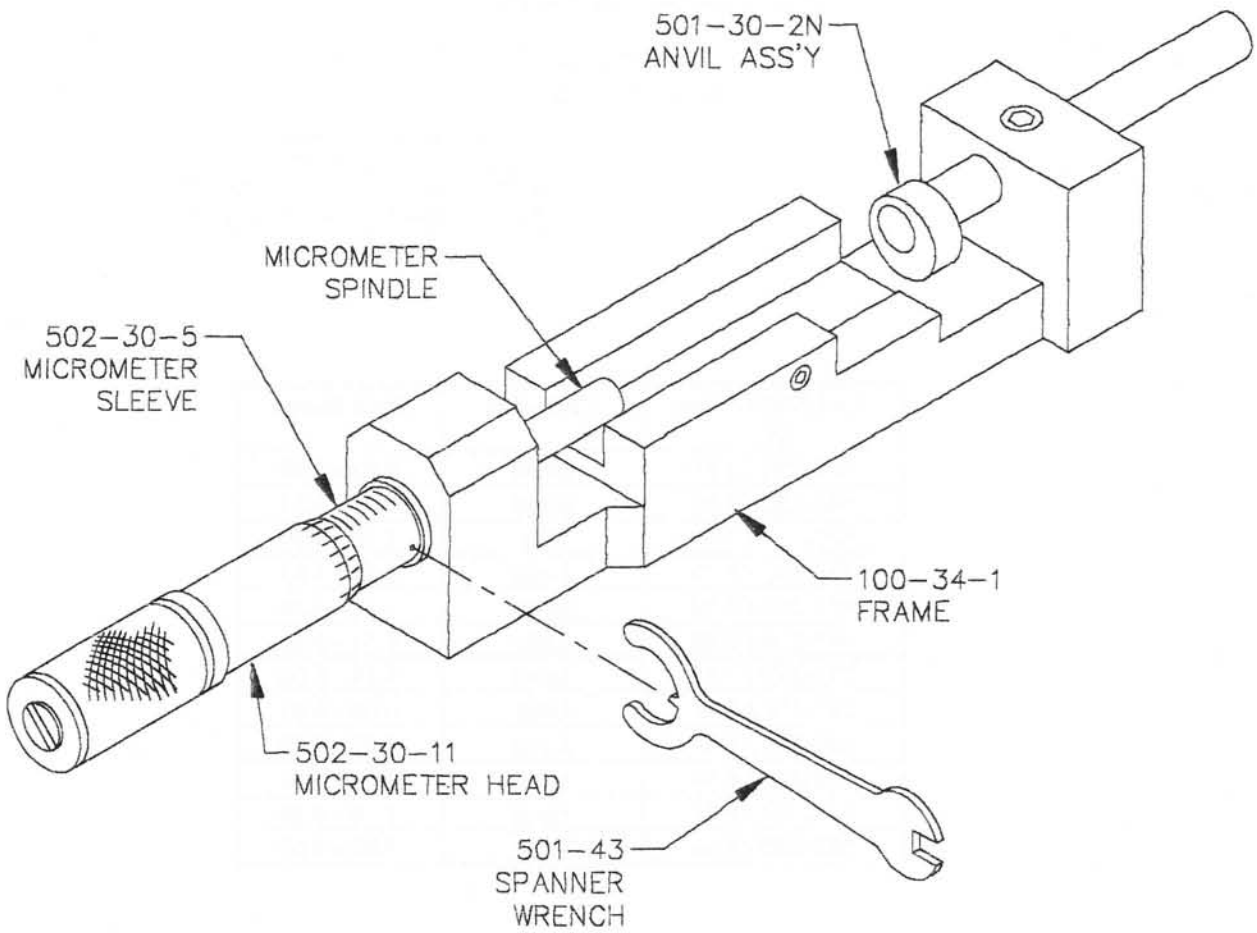


Tool Holder Dim 'A'	Cartridge	Bore Range
502-25R / 2.13	Short	2.85 - 3.25
502-25C / 2.25	Short	3.05 - 3.55
502-25B / 2.50	Short	3.50 - 3.95
502-25C / 2.25	Long	3.50 - 3.85
502-25B / 2.50	Long	3.65 - 4.40
502-25A / 2.88	Long	4.35 - 5.20
502-25D / 3.31	Long	5.15 - 6.00
502-25E / 3.75	Long	6.00 - 6.85
502-25P / 4.06	Long	6.65 - 7.50
502-25F / 4.50	Long	7.50 - 8.00
502-25S / 2.44	Long	3.50 - 4.20
502-25G / 2.66	Long	3.85 - 4.65

**METRIC
MICROMETER
ASSEMBLIES**

**PRODUCTION CUTTERHEAD
MICROMETER ASSEMBLY**

900-2-4M
63-145mm
(2.5-5.7)



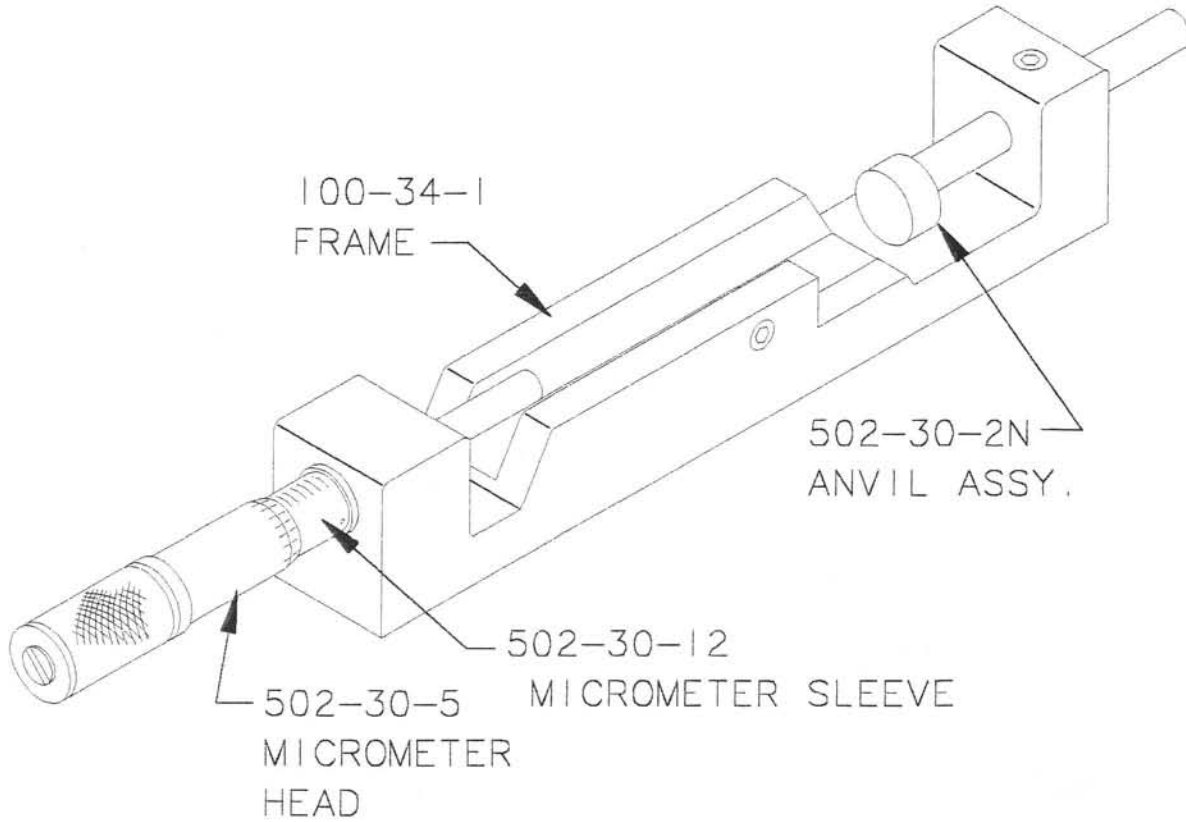
PRODUCTION CUTTERHEAD

MICROMETER ASSEMBLY

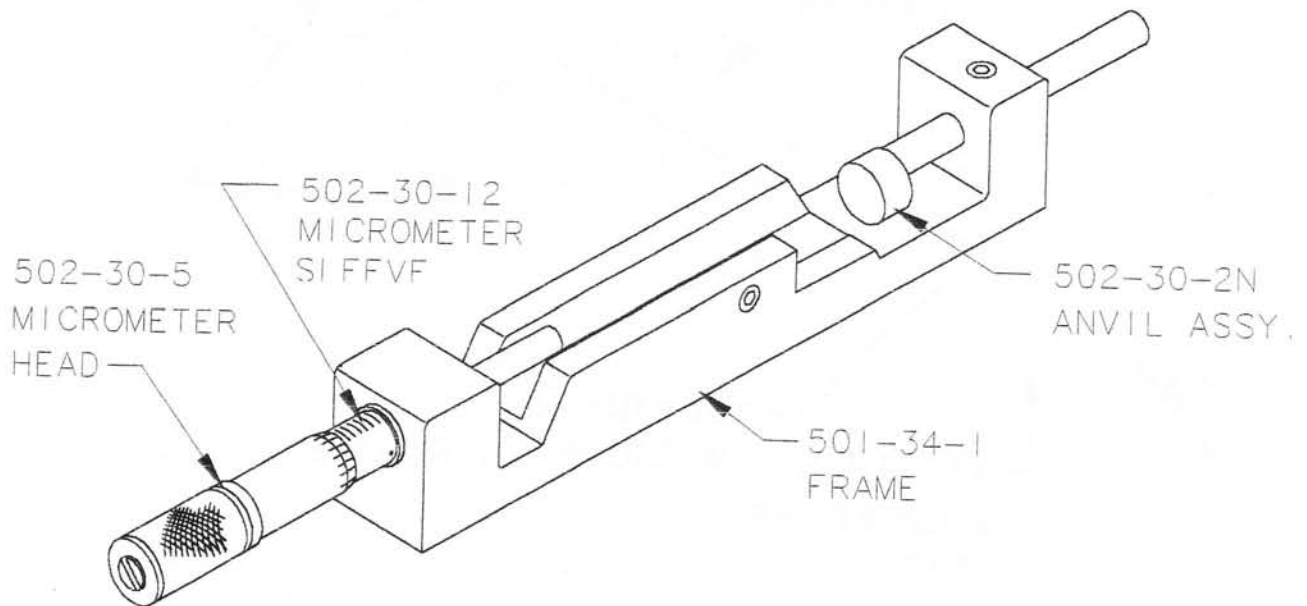
900-2-5M

73-152mm

(2.9-6.0)



**BLIND HOLE CUTTERHEAD
MICROMETER ASSEMBLY**
900-2-7M
73-152mm
(2.9-6.0)

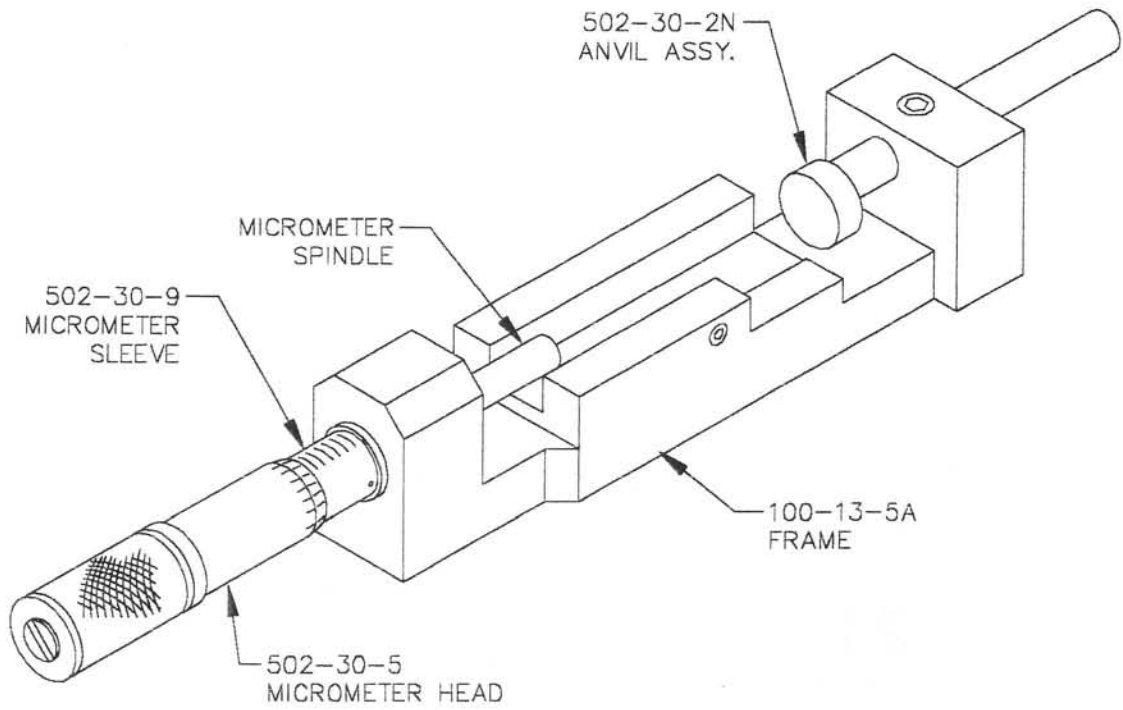


**BLIND HOLE STUB BAR
MICROMETER ASSEMBLY**

900-2-11M

38-120mm

(1.5-4.1)



BLIND HOLE CUTTERHEAD

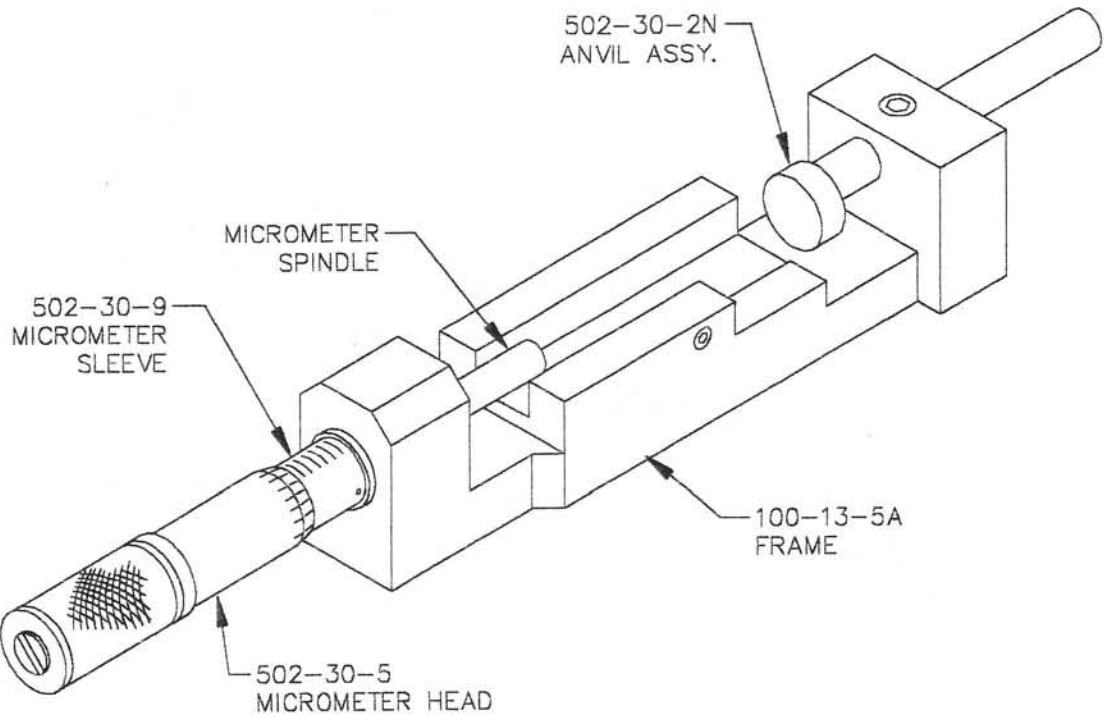
(SHORT)

MICROMETER ASSEMBLY

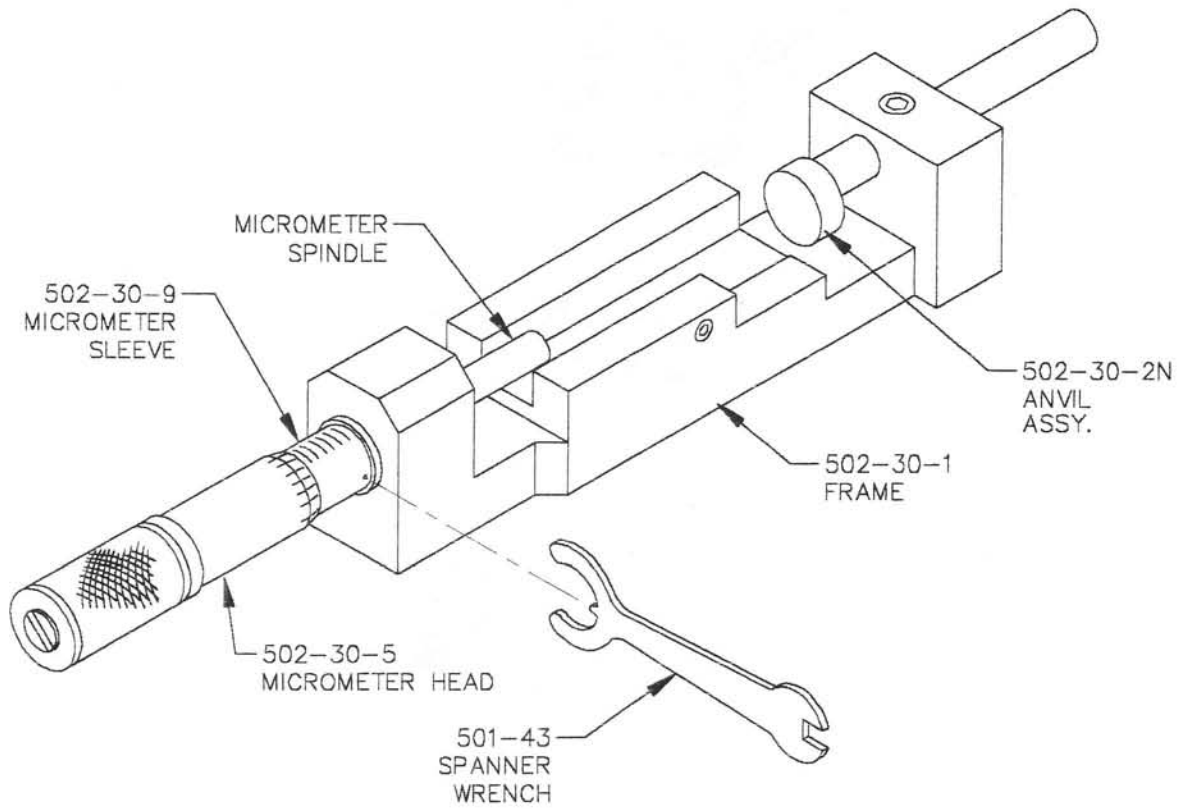
900-2-11M

38-120mm

(1.5-4.1)

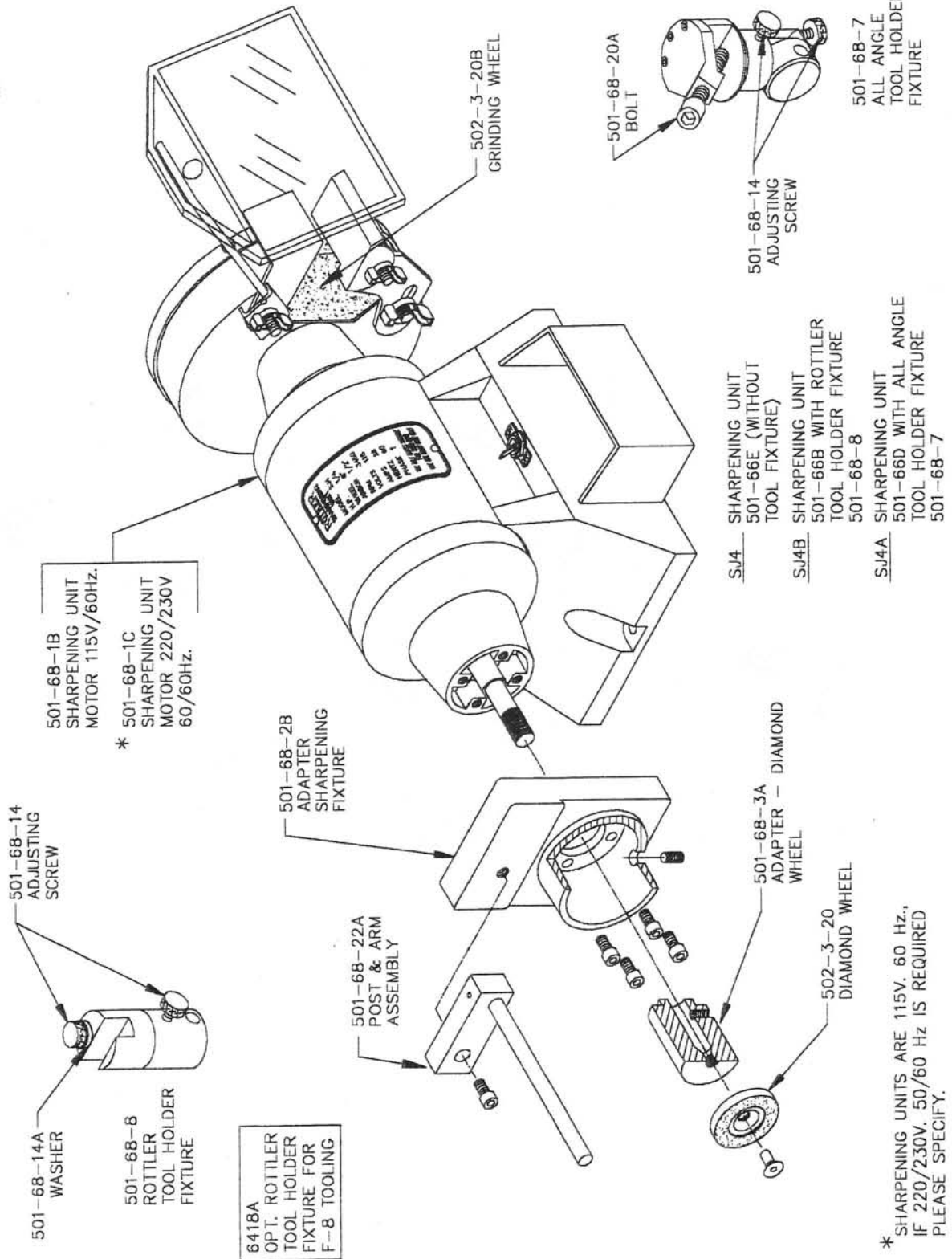


**PRODUCTION STUB BAR
MICROMETER ASSEMBLY**
900-2-9M
38-120mm
(1.5-4.0)



SJ-4 Sharpening Fixture

REFFE24A65-040794



Tool Bit Sharpening

NOTE:

F-2 boring machines come with replaceable carbide cutting inserts. The optional SJ-4 sharpening fixture is only required to sharpen optional tool bits which have brazed on chips.

CAUTION:

EYE PROTECTION MUST BE WORN WHEN SHARPENING TOOL BITS

The performance of your boring bar and the quality of work it will do, is almost entirely dependent on the care of the cutting tool. It is the most frequent cause of size and finish problems in boring.

To sharpen the carbide bit, insert the tool holder in the sharpening jig slot. Place the jig over the pin provided on the sharpening unit and sharpen bits on the small diamond provided on the motor shaft. Always make sure you sharpen the tool on the side of the diamond wheel that is running toward the top face of the bit. Sharpening the wrong side can readily chip the point. When sharpening, use very light pressure, moving the tool back and forth across the diamond wheel, to improve cutting and prevent grooving

of the diamond wheel. After sharpening a number of times, dress excess steel away from the carbide with the grinding wheel provided on the other side of the sharpening unit.

The operator will need to occasionally dress steel away from the carbide and grind away unused portions of the carbide lands to allow faster diamond wheel touch up. This will also be used in the event a small fracture occurs in the carbide and will reduce wear on the diamond wheel. The top surface will crater .010 to .015 back of the tip with considerable boring, so the top should be occasionally dressed back .020 to .025.

See next page for tool sharpening requirements.

The Diamond wheel is designed for carbide only and is not intended for rapid stock removal. Steel tends to load it. A tool bit used for aluminum boring should never alternately be used for cast iron or steel. Iron weld on top of the bit will cause a rough finish on aluminum work.

Tool Sharpening Requirements

In the accompanying illustration; letters A, B, D correspond to the letters indicated on your sharpening fixture, in other words, when your jig is set in the "A" position, it will sharpen the "A" land as shown in the illustration.

The most critical point of this sharpening is the width of the "B" land (as indicated by the diagonal line shading). This width should be maintained at about .015 to .025. This width is held by cutting back the "D" land as required. The "B" land must be reduced to .005 to .015 on all stub boring heads and long bore operations.

In the event your bar chatters or bores a rough finish at the bottom of the cylinder, it is very probable the "B" land is too wide.

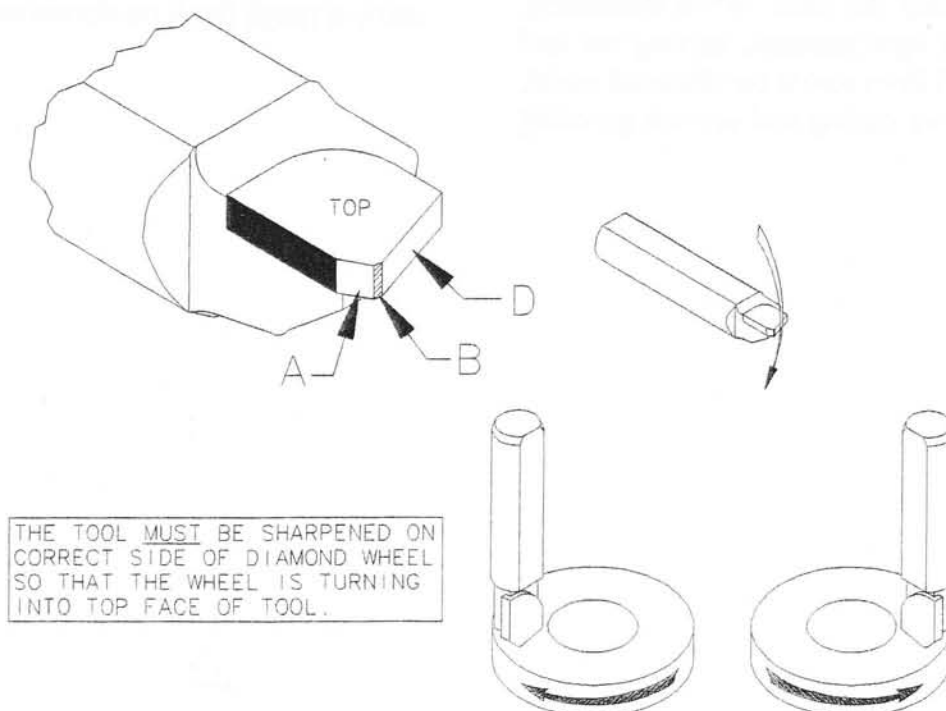
The "A" land is not critical to width but should be maintained in good condition

to obtain free cutting, particularly on heavy cuts.

The top surface of the bit is finely finished at the factory and requires no further resurfacing. This also means no honing or in any way attempting to break off the chip that sometimes seems to be apparent. The practice of doing these things will inevitably result in poor surface finish and impair the accuracy of the machine.

The frequency of sharpening the bit will vary depending on the type of iron being bored.

To produce the best result at the extreme length capacity, use an RF facing tool, 501-59A, and do not sharpen an "A" land. This tool bit is particularly useful for heavy stock removal on long bores.



Care of the diamond wheel

If the diamond wheel is handled with care it will provide many years of service.

An abrasive stone is furnished with your diamond wheel for use in honing the face of the wheel. You should use this stone frequently to remove the particles that tend to load this wheel, otherwise you will not produce the keen edge on the tool that allows the machine to bore accurate holes with a fine surface finish.

Tool Life

With tools sharpened to a precision edge, it should be possible to bore approximately 20 oversize cylinders on high speed.

This applies to most American passenger car bores under 4" provided no hard spots or foreign materials are in the cylinders. The same number of sleeving cuts can be made on low speed, without further sharpening. Provided the tool has an original keen edge.

Two grades of optional carbide tool bits are available:

R8 Tool Bit: A tough grade of carbide for heavy and interrupted cuts and general boring.

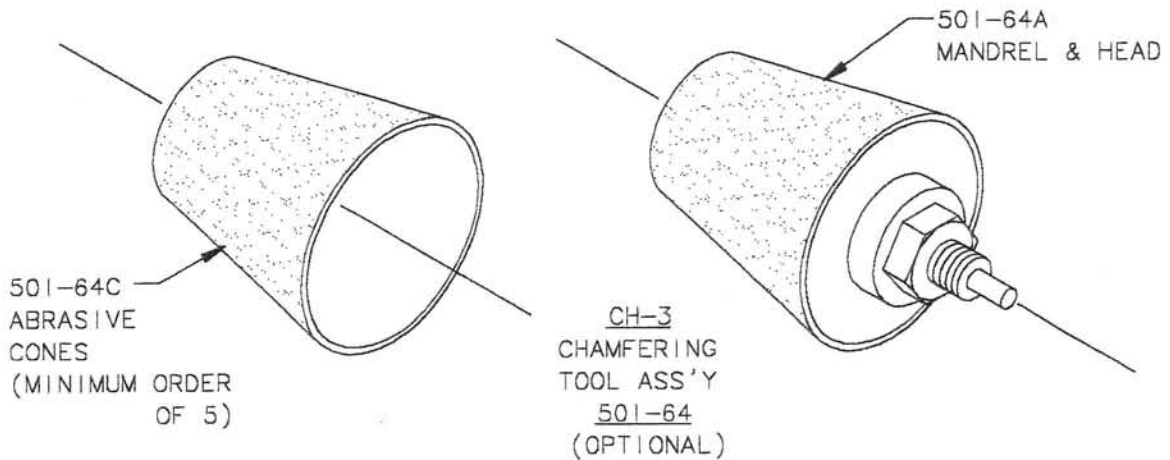
R1 Tool Bit: A harder carbide with better wear characteristics, to be used for normal boring with improved tool life. Suggested for production re-boring.

Chamfering Cones

Several tool bits are available for chamfering a cylinder bore. (See brazed tool bit lists.) The chamfering tool can be set to size in two different ways. First, insert tool into the holder, then the holder into the cutterhead. Approximately set for the desired size chamfer. Be sure to tighten the tool bit into the holder before boring. The second method is to place the chamfering bit in a tool holder, then use the correct micrometer ass'y and set to approximately .100" over the bore size.

Rapid travel the machine close to the cutting point and cut the chamfer with the hand feed for best control of the chamfer depth.

Chamfering can also be done quickly and very effectively using a model CH-3 abrasive tool driven by a drill motor. This Method will not require the use of the boring bar and develops a smooth burr free entry for the rings.



Counterboring

Counterboring will often be required in re-sleeving large engine blocks, and frequently a close tolerance must be maintained in order to properly secure the sleeve installation.

NOTE: Use hand feed.

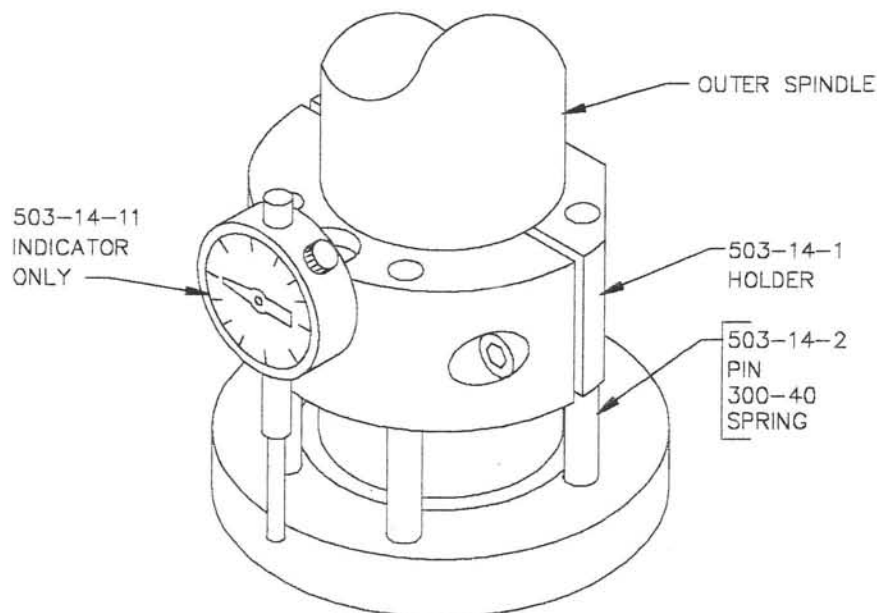
UPPER AND LOWER DECK REPAIR OF DIESEL CYLINDER BLOCKS

Most diesel blocks use the cylinder head to clamp the lip of the wet sleeve against the counterbore, and at the same time, location of the sleeve is determined by the upper and lower fit.

This requires a good deal of caution to determine that:

1. Counterbore is parallel to the top deck.
2. Counterbore is exactly square with the concentric upper and lower bore fit diameters.

Counterboring is best accomplished by the use of an optional 1" travel dial indicator assembly, 503-14F.



503-14F
DEPTH DIAL INDICATOR
(OPTIONAL)

Counterboring Continued

To counterbore to a close tolerance depth, carefully hand feed the RF type tool bit down until the cutter is slightly touching the block surface. Adjust the dial reading to "zero" and hand feed cut down to within .003" to .007" of desired depth. Check the exact depth of counterbore at this point with your depth micrometer and hand feed the remaining depth required by reading the proper number of graduations on the indicator.

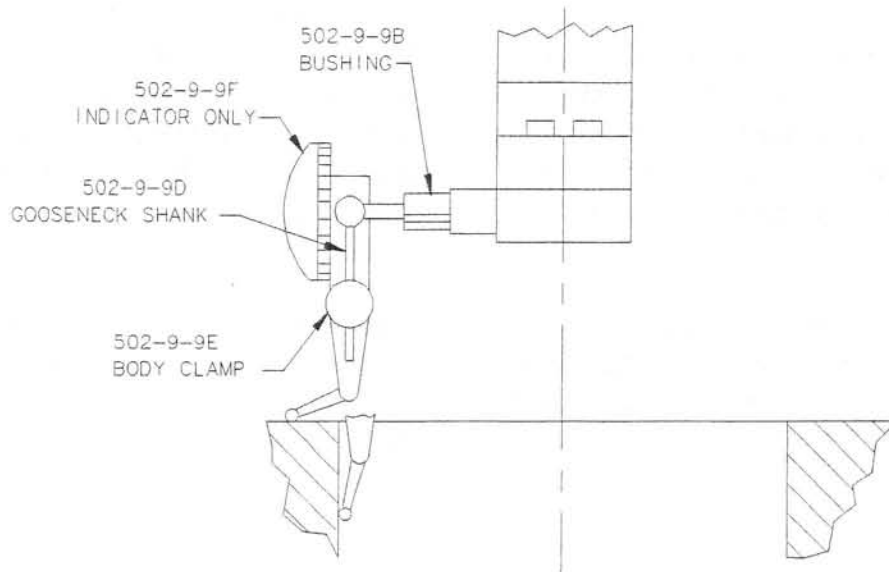
The dial depth indicator clamp is manufactured with spring pins so it will

compensate for the weight of the spindle and allow very accurate depth control. It may be clamped into any position within the machine's spindle travel.

NOTE:

1/4 turn of the right hand clamp screw is sufficient tightening force. This will allow the collar to slip on the spindle (after pins retract into the collar) if the collar is accidentally left in the wrong position during normal cycle boring operation.

Instructions For Use of the Mechanical Dial Run-out Indicator (#502-9-9A)



Dial Runout Indicator Assembly
502-9-9A

The #502-9-9A mechanical dial run-out indicator may be used for checking and if necessary for correcting the centering or bore concentricity. It may also be used for checking face squareness of the work piece to the boring spindle.

The principle use in checking centering will be for engines requiring an absolute minimum oversize, particularly when irregular wear and score areas can be found.

To use the indicator, simply place the gooseneck shank in the split bushing provided and insert the appropriate size tool holder. The indicator may be used on any style of cutter head.

Center the spindle by normal use of the centering fingers.

Turn float clamp switch to neutral or straight position.

Now raise the spindle out of the bore and insert the indicator. Make sure the indicator lever is set properly so the dial will travel in the right direction.

Lower the spindle and adjust the indicator mount with either gooseneck, or tool holder lock screw so the probe makes contact.

Turn the spindle, and the indicator now will read the total run-out. This will be exactly double the distance it is out of center.

To clean up a bore, it will be necessary to set the tool about the amount of this run-out in addition to the basic bore size

measure. If you bump the spindle unit lightly with your hand you will find you can easily reduce the reading to near "zero" for minimum stock removal.

Similarly if the bore is substantially out of round or has scored wear grooves, you may move the spindle so that you get two maximum equal dial readings at the opposed large portions of the out of round.

Achieving this you will find the bore will clean up on a slightly larger diameter than you measure at the maximum out of round area.

Turn switch to clamp when you have the proper dial reading, remove the indicator, proceed with the boring as usual.

If you wish to check the squareness of the bore face, reset the dial indicator lever for the proper travel direction and adjust the spindle and indicator to contact the surface above the bore. Rotate the spindle to check out of square.

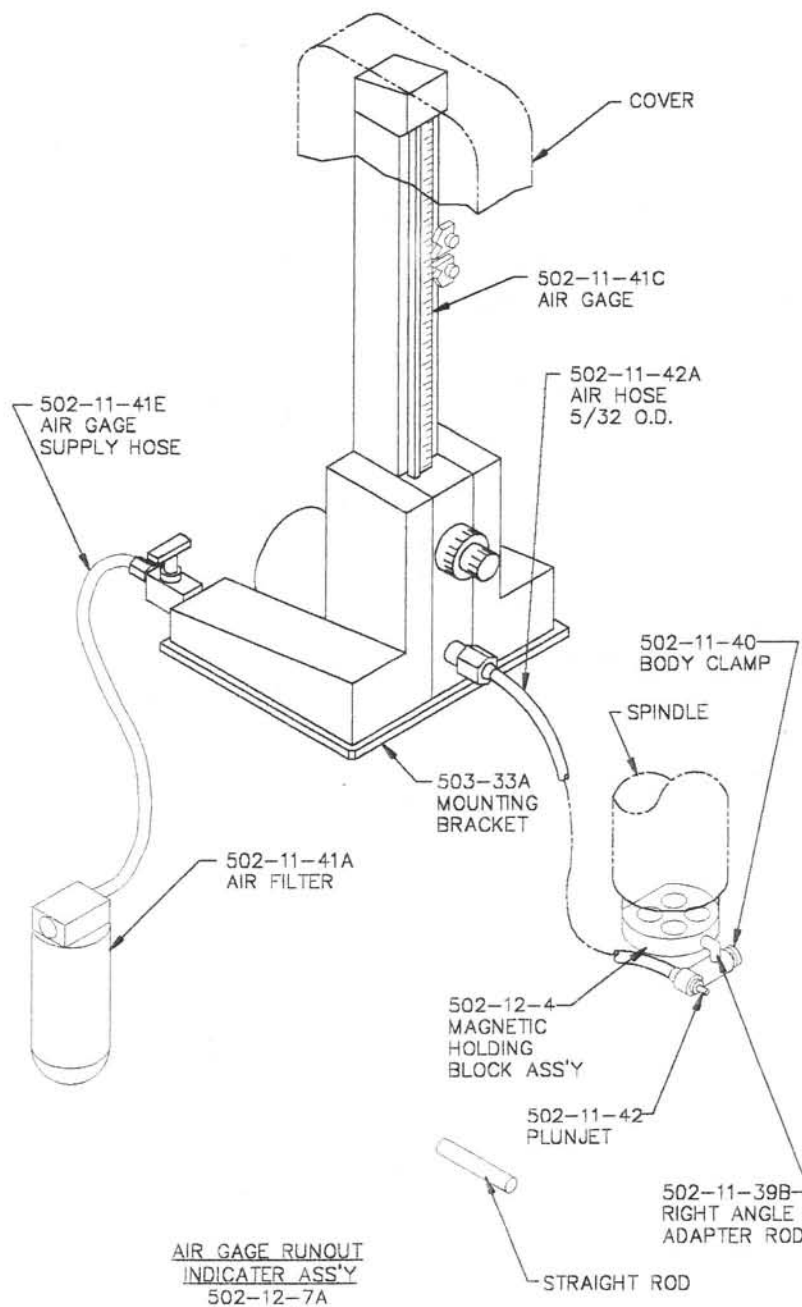
Remember, if you wish to correct out of square with shims under the work piece, you will have to use a shim proportionately larger (as the support points are to the indicator travel extreme) than the out of square reading.

Remote Runout Indicating System 502-12-7A

An optional remote indication air probe and gauge system is also available to check bore and face runout.

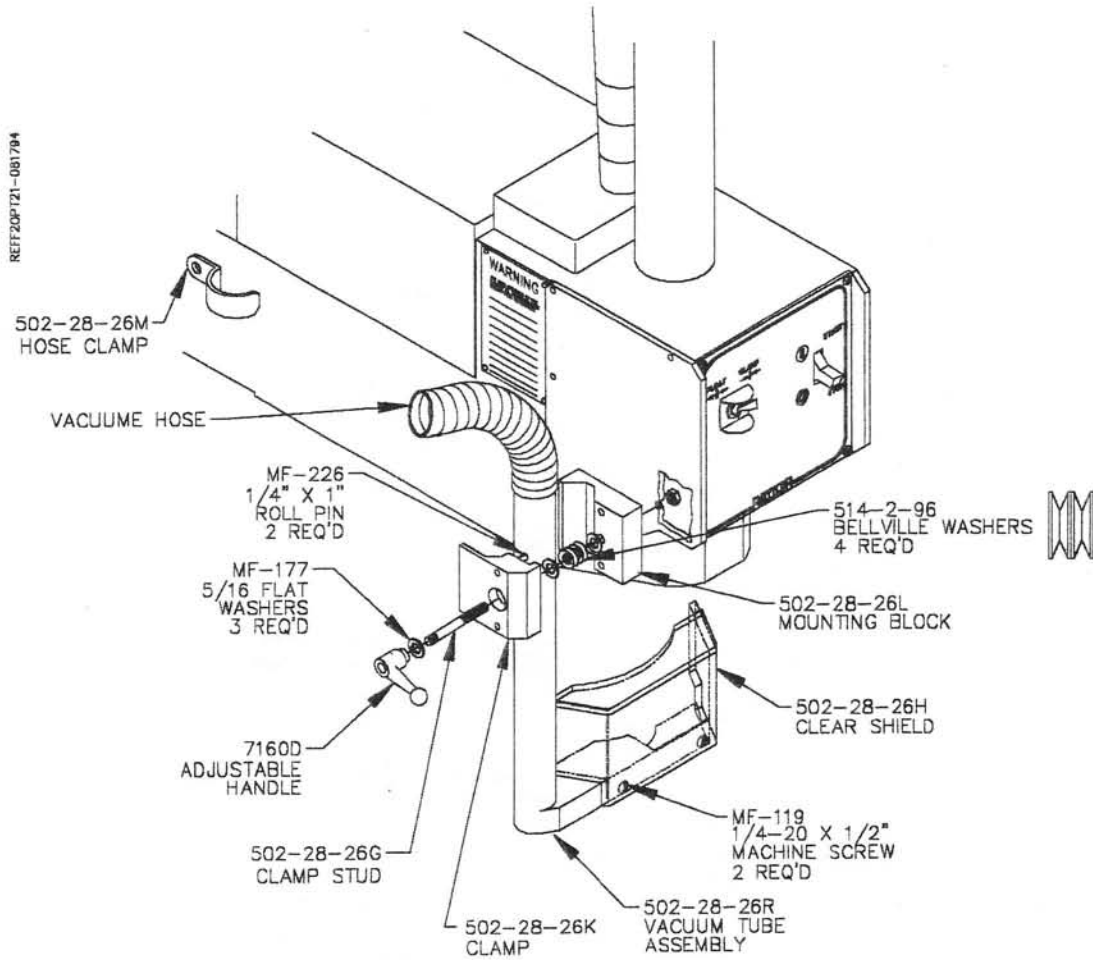
extremities where the mechanical dial indicator cannot be seen. The air probe can be used in a considerably smaller bore size relative to the spindle diameter.

The stationary indicator allows easier reading and can be used in lower bore



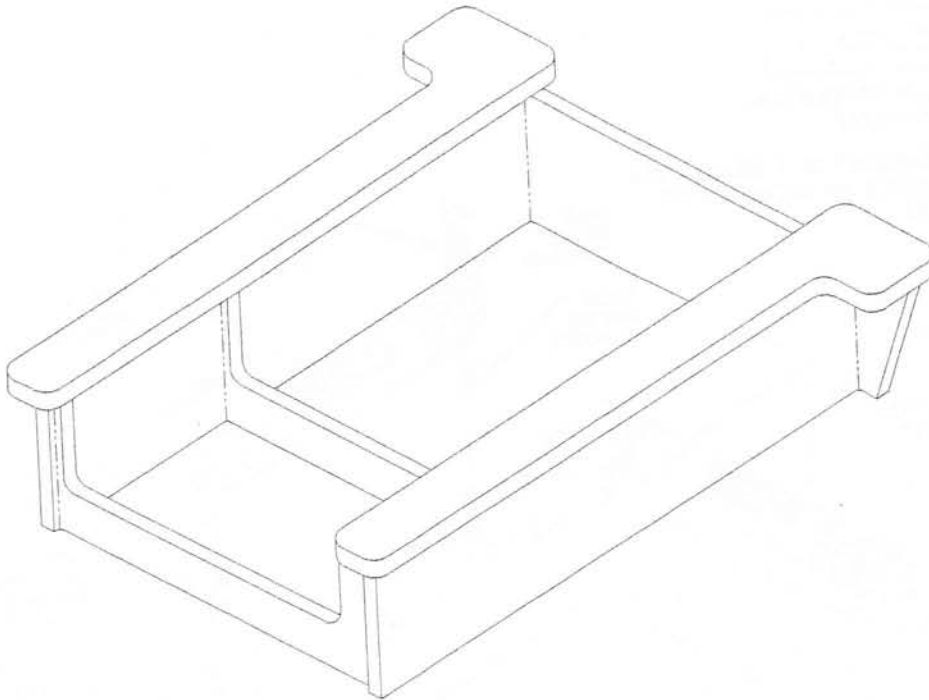
Dust Pickup With Chip Shield Assembly #502-28-26

This dust pickup assembly is designed to pickup dust created from boring. The customer must provide the vacuum. We recommend an industrial , 2 stage vacuum with a 1-1/2" hose.

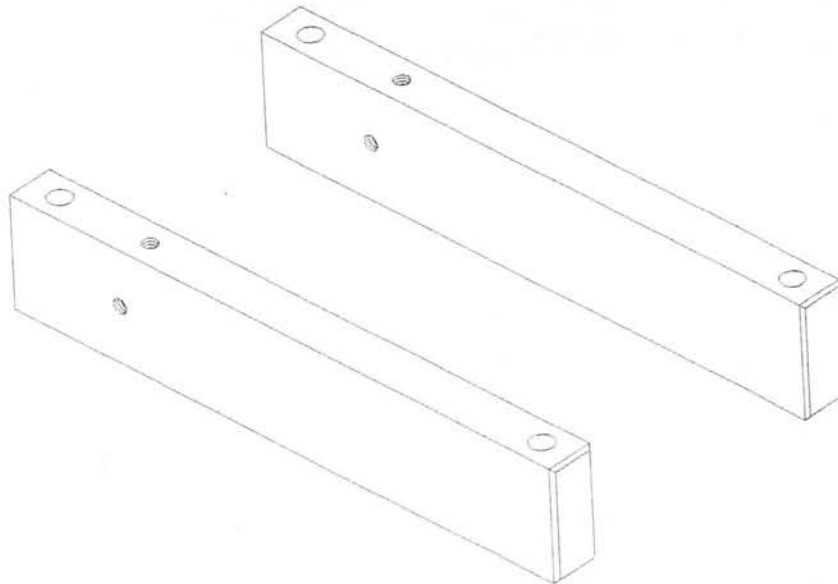


Optional Tooling

502-1-14B
5" Parallel Fixture



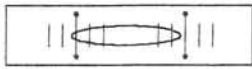
502-1-15C
1-1/4" x 3" parallel set



7153T

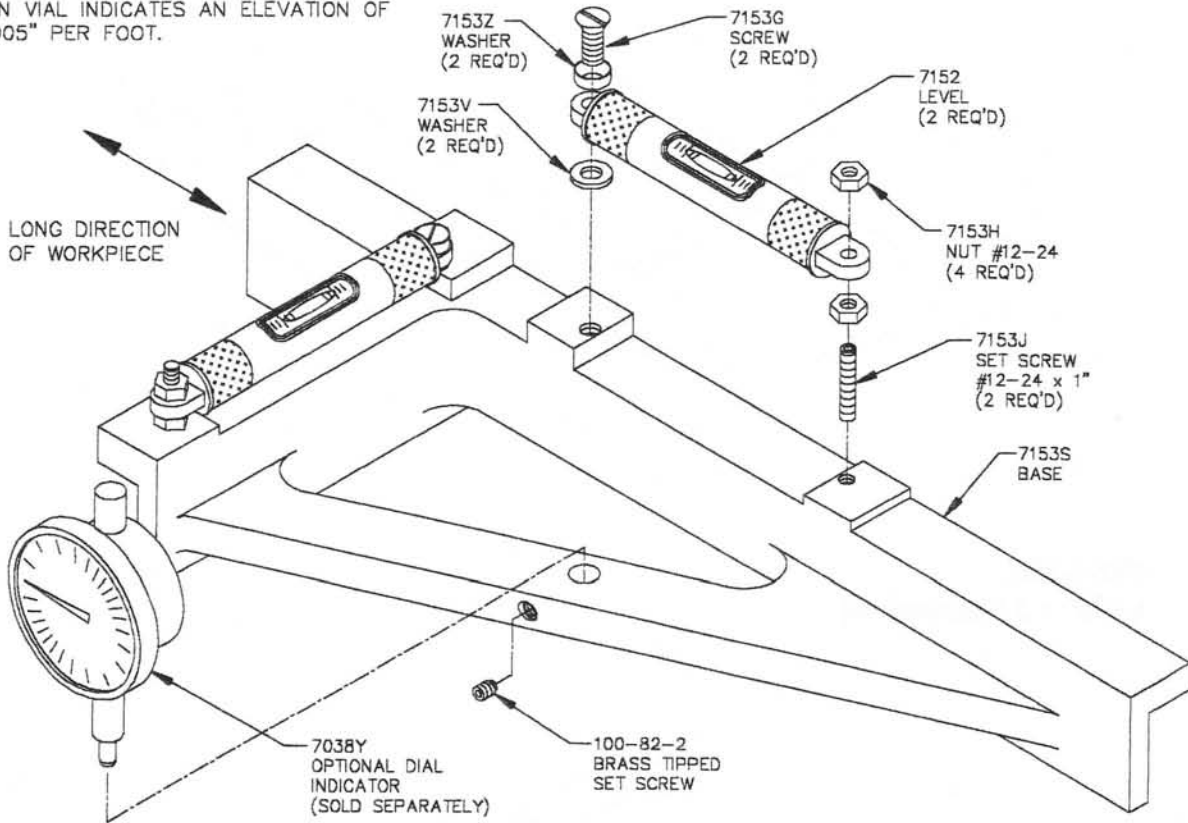
Level Assembly

(Does Not Include 7038Y dial indicator)



BUBBLE, 1/4 GRADUATION
TO THE LEFT

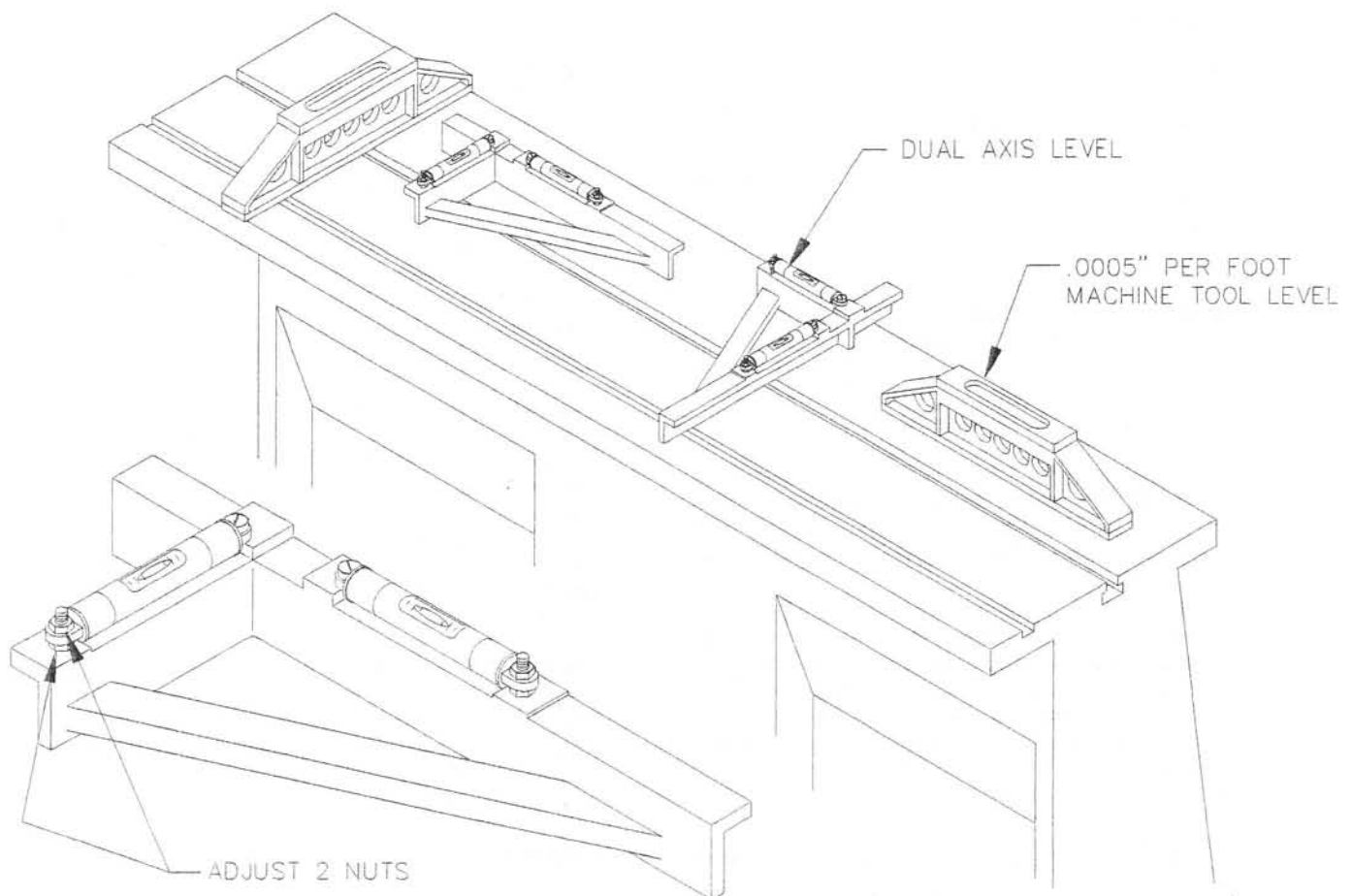
A BUBBLE MOVEMENT OF 1 GRADUATION
ON VIAL INDICATES AN ELEVATION OF
.005" PER FOOT.



Use & Verification of Dual Axis Level Part No. 7153T

Method of leveling set up and periodic verification of Rottler main base.

1. Level machine main frame with a .0005/foot machine tool level so that the top table (front and center) is level within .0005/foot in both axis.
2. Now Place the dual axis level, part no. 7153T, on the table top. It should read level in both vials, so the vials will have to be adjusted if they do not read level. Turn level 90 degrees and check in this direction also.
3. The leveling check should be made frequently on a new machine since typical floor support conditions take a while to permanently seat in. Then a weekly re-check should be adequate unless you have reason to doubt accuracy.



V6/V8 COMBINATION AIR FIXTURE
502-1-72F

CAUTION: Handle block and fixture with **EXTREME** care and guidance. **A block hoist is required.** Mishandling of a heavy engine block and fixture could result in the dropping of a heavy piece and possible personal injury. **BE CAREFUL!**

The Model 502-1-72F V6/V8 combination air fixture is a fast, simple and universal system to properly and accurately hold most 60 degree and 90 degree V-type engine blocks for either cylinder boring or deck surfacing.

BORING MACHINE APPLICATION

NOTE: The block must have the main bearing caps in place and torqued.

Care must be taken to assure the contact edges of the locator bar are near the cap split line. A pair of 3/8", & 1/2" spacers are provided for blocks with large main bearing bores, to enable the bar to locate near the main bearing split line. (See figure 2.)

V-Blocks (blocks with main bearing center lines no more than 1/2" higher than the pan rail plane) are mounted with the 502-3-8B V-block frame in place. Select the 90 degree option placement of the frame to suit block length, or main bearing caps will interfere with frame. Rotate frame 90 degrees by moving its shoulder screws to alternate set of holes.

Y-Blocks (blocks with main bearing center lines 2-3/8" to 3-1/2" higher than the pan rail plane) are mounted directly on the fixture. Some Y-blocks (GM 60 degree) have too narrow pan rails and some have too low main bearing location which will require the use of the 502-1-15C precision 1-1/4" x 3" parallel set to raise and or support the block. Use the shoulder screws from the V-block frame and hook the parallels over the back of the V-fixture.

This fixture may be easily repositioned on the support parallels (without a block in place) to shift from the 60 degree support surface to the 90 degree support surface or vice versa. Trip lower toggle switch on control tower to switch float capability from 60 degree to 90 degree surfaces.

F4 main base only: 2-1/2" (502-1-21C) wear pads must be bolted on top of the 4" wear pads when using this fixture at elevated position. Remove only for largest V8 and or large inlines. (See page 3).

The 502-1-21C wear pads are used for most automotive blocks. These wear pads must be removed to accommodate large blocks including the Ford Super Duty Truck Series, the Caterpillar 3208, and the International V 401, 446, 549, and 550 series. On F2 main bases the fixture will rest directly on the deck of the main base. On F4 main bases the fixture will rest on the 4" wear pads.

CAUTION: Extreme care must be taken by operator whenever handling large blocks. Large blocks may cause fixture to tip when floated too far outward. We recommend leaving hoist attached when moving

these blocks. Large blocks should be lifted from the block bank surface. **DO NOT** use the 502-1-95 block handler assembly on these blocks.

NORMAL OPERATION PROCEDURE

The normal operation procedure on smaller V-blocks is to first attach the block handler assembly to the block making sure the cam lifters are **COMPLETELY** engaged and that the lift hook is approximately centered in block lengthwise. Place the 502-1-82X locator bar thru the main bearings and hoist the block into the fixture. Pulling the block towards you, with the locator against the positioners, will prevent jamming in the slot of the guides during the loading and unloading operations. The locator bar is positioned with the word 'UP' that is printed on the end of the bar facing **up** and away from the operator. (See figure 1.) After the locator bar is engaged in the positioners, pivot block outwards as you lower it. Slide block to the far left (this is the non-adjustable position).

Make sure the block is firmly seated in place and not resting on pan-rail burrs or other interference points. Accurate seating can also be a problem with extremely warped, distorted blocks. Another cause of problems is failure to remove main bearing inserts. The locator bar has a relief for blocks with a small main bearing or seal. Activate locator bar clamp by switching the upper toggle on the control tower.

Warped or distorted blocks may require leveling of the deck surface in the long direction. This is possible with the handscrew assembly in the lefthand bar positioner. Disengage the locator bar clamp and slide the locator bar to the far right position. Reactivate the locator bar clamp. Raise or lower the handscrew as required. For the non-adjustable position slide locator bar to the far left. (See illustration page 4).

Depress the valve button in the control tower and push fixture back into bore position. There is a guide block (502-1-105) attached to the bottom of the fixture to aid in guiding the fixture along the support ways. Lack of air float support will indicate you are moving off the center of the support ways.

Operate the block clamp arms, bore, and pull fixture back to the load position.

Lift the block with the block handler, turn the block 180 degrees and reload to duplicate the operation on the other bank.

After turning the engine block 180 degrees the locator bar must be twisted 180 degrees also. Again the word 'UP' must enter into the positioners facing up and away from the operator. (See figure 1)

Figure 1 502-1-82X main bearing locator bar indexes at point *A*. when bank is reversed and the bar is twisted 180 degrees, point *A* still indexes the main bearing.

Point *C* holds the block down. When bank is reversed and the bar is twisted 180 degrees, point *B* holds the block down.

Figure 2 502-1-82X main bearing locator bar indexes near bearing split line. Point *C* does not contact the bearing cap but rests on matched spacers that are provided to fit into the bar positioner slot. If there is a means of holding the block down such as F2 boring machine clamps, this method may be used in large bores in order to properly index near the bearing split line. *If extreme care is used this method may be used to index blocks without bearing caps attached. (Optional clamp down must be provided.)*

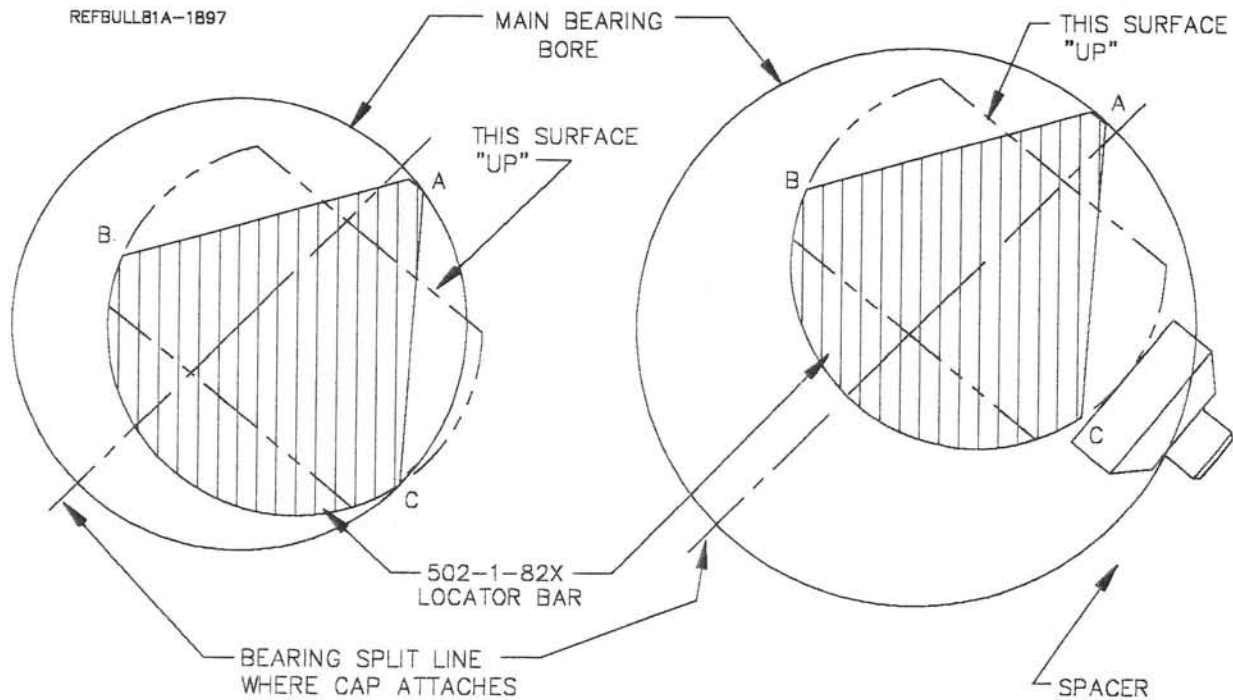
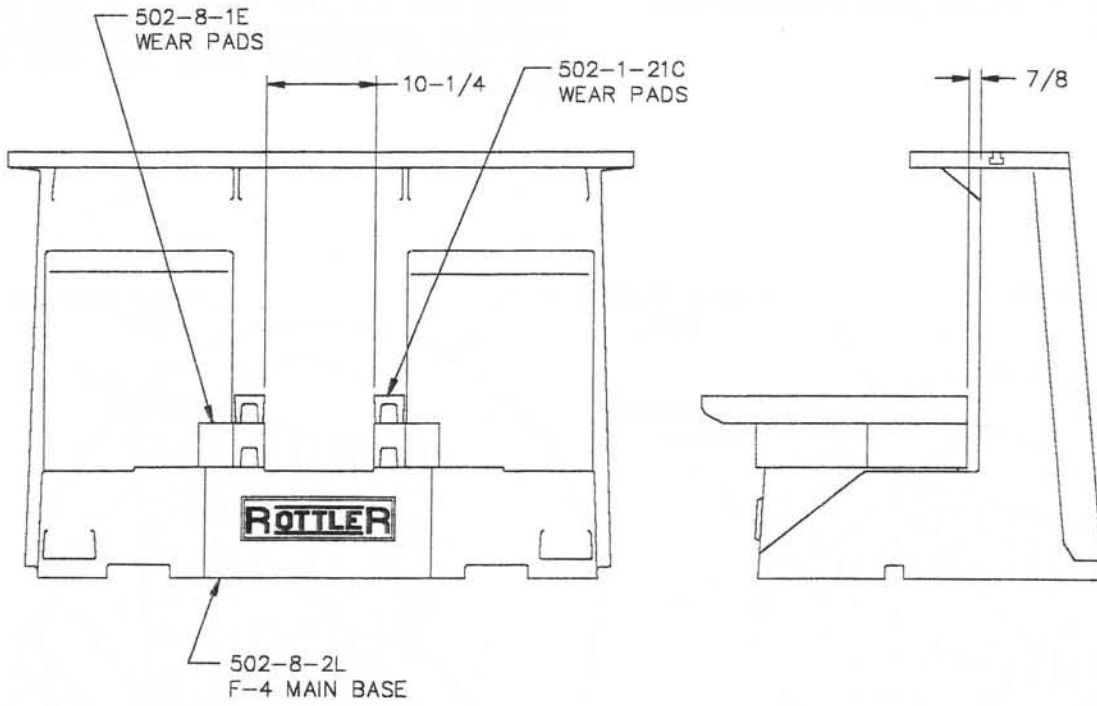


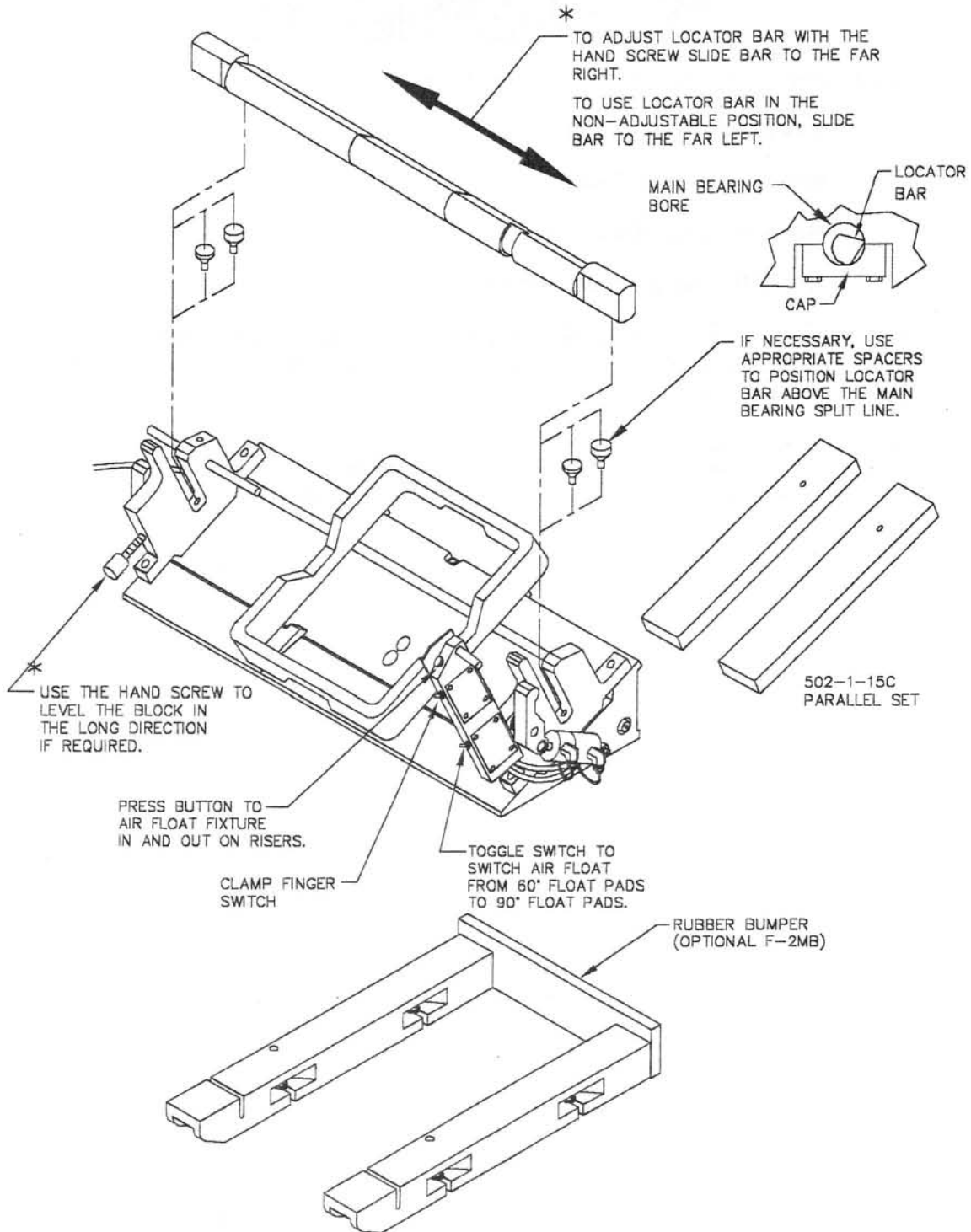
FIGURE 1

FIGURE 2

Wear Pad Mounting Dimensions
F-4 & F-24 Machines Only



REF:FIXTUR73-110397



502-1-72F
V6/V8 Fixture Assembly With Air Float
Boring Machine Application

**PROCEDURES FOR BORING FORD 2800 cc V-6 and
GM V-6 CITATION CYLINDER BLOCKS**

Cutter heads that clear main bearing bosses of these blocks are:

#600-2 Stub bar 6-1/2" long

#600-8-8A Stub bar 3" long

#600-8-6 Blind hole cutter head

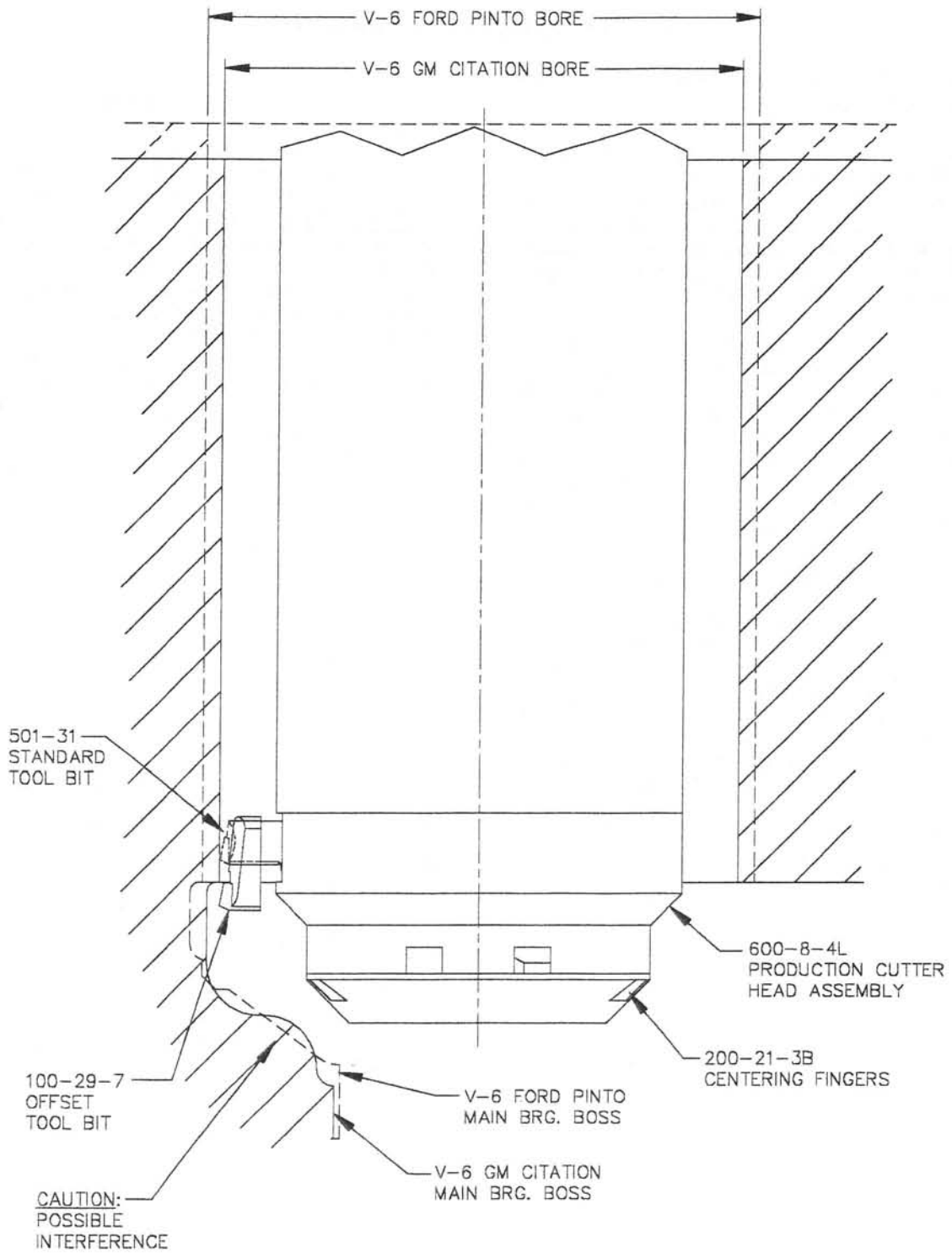
#502-13D Short production stub bar

NOTE: Production cutter head, part #600-8-4, will not clear main bosses of these blocks. New production cutter head, part #600-8-4L, will clear main bosses with offset tool #100-29-7 (see page 6).

If 6-1/2" long stub bar is used, remove the 2-1/2" wear pads and place fixture on main base (F4 bases - place fixture on 4" wear pads).

If 3" long stub bar, blind hole cutter head, or #502-13M production stub bar is used, place fixture on 2-1/2" wear pads.

REFBUL19-100192



Ford & GM Citation V-6 Block Main Bearing Boss Interference Illustration

SURFACING MACHINE APPLICATION

NOTE: The block must have the main bearing caps in place and torqued.

V-Blocks (blocks with main bearing center lines no more than 1/2" higher than the pan rail plane) are mounted with the 502-3-8B V-block frame in place. Select the 90 degree option placement of the frame to suit block length, or main bearing caps will interfere with frame. Rotate frame 90 degrees by moving its shoulder screws to alternate set of holes.

Y-Blocks (blocks with main bearing center lines 2-3/8" to 3-1/2" higher than the pan rail plane) are mounted directly on the fixture. Some Y-blocks (GM 60 degree) have too narrow pan rails and some have too low main bearing location which will require the use of the 502-1-15C precision 1-1/4" x 3" parallel set to raise and or support the block. Use the shoulder screws from the V-block frame and hook the parallels over the back of the V-fixture.

The fixture may be easily repositioned on the support parallels (without a block in place) to shift from the 60 degree support surface to the 90 degree support surface or vice versa. First loosen and remove the clamp bolt. Switch the fixture to the desired support surface. Be sure the fixture is back touching both dowel pins in the support parallels. Place .010 thick shims under the back of the fixture as shown (See page 8.) Insert the clamp bolt into the appropriate hole in the fixture and tighten the clamp bar.

CAUTION: Large blocks should be lifted from the block bank surface. **DO NOT** use the 502-1-95 block handler assembly on these blocks.

NORMAL OPERATION PROCEDURE

The normal operation procedure on smaller V-blocks is to first attach the block handler assembly to the block making sure the cam lifters are **COMPLETELY** engaged and that the lift hook is approximately centered in block lengthwise. Place the 502-1-82X locator bar thru the main bearings and hoist the block into the fixture. Pulling the block towards you, with the locator against the positioners, will prevent jamming in the slot of the guides during the loading and unloading operations. The locator bar is positioned with the word "UP" that is printed on the end of the bar facing *up* and away from the operator. (See figure 1 Page 2.) After the locator bar is engaged in the positioners, pivot block outwards as you lower it. Slide block to the far left (this is the non-adjustable position).

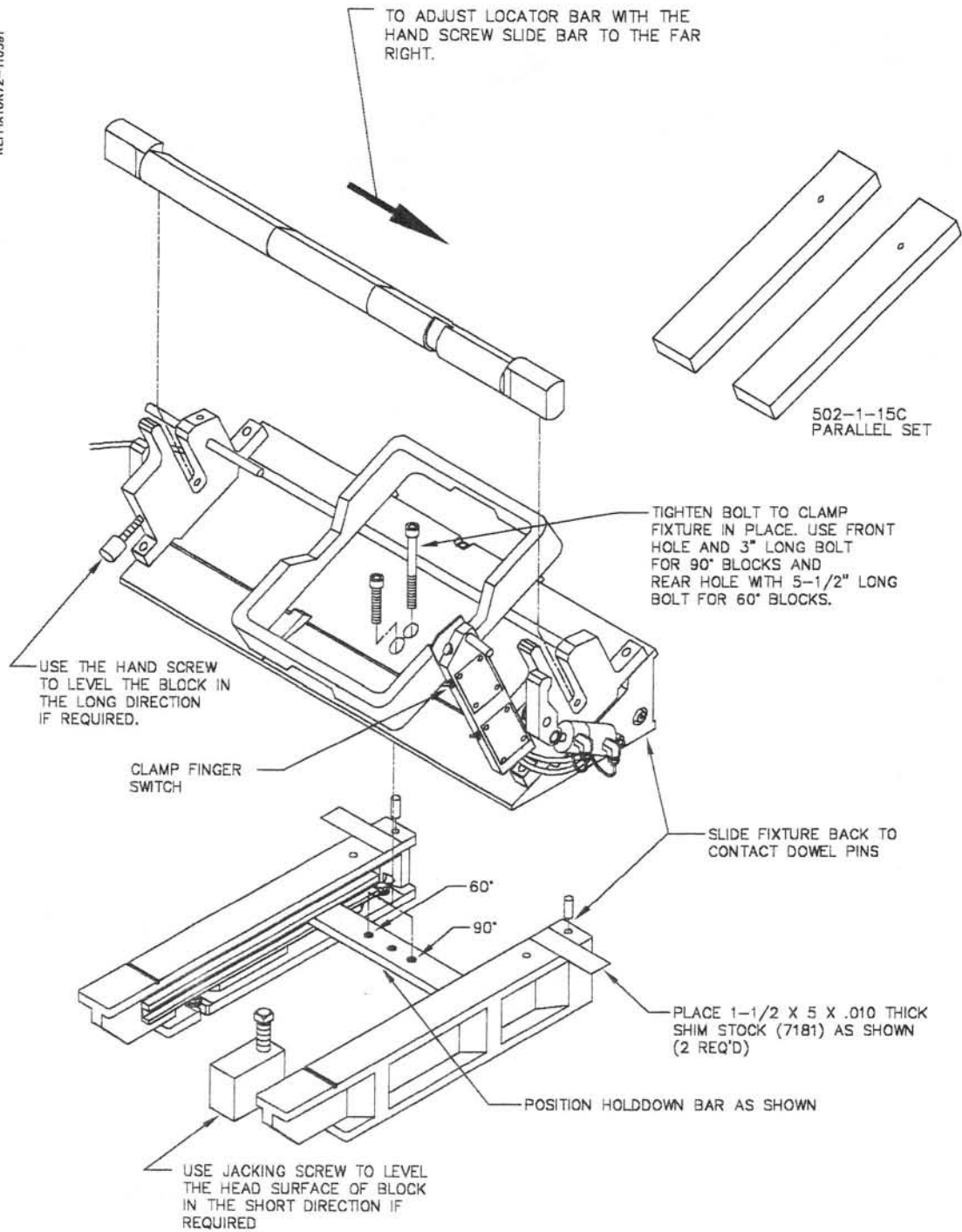
Make sure the block is firmly seated in place and not resting on pan-rail burrs or other interference points. Accurate seating can also be a problem with extremely warped, distorted blocks. Another cause of problems is failure to remove main bearing insert. The locator bar has a relief for blocks with small main bearing or seal.

Activate locator bar clamp by switching the upper toggle on the control tower.

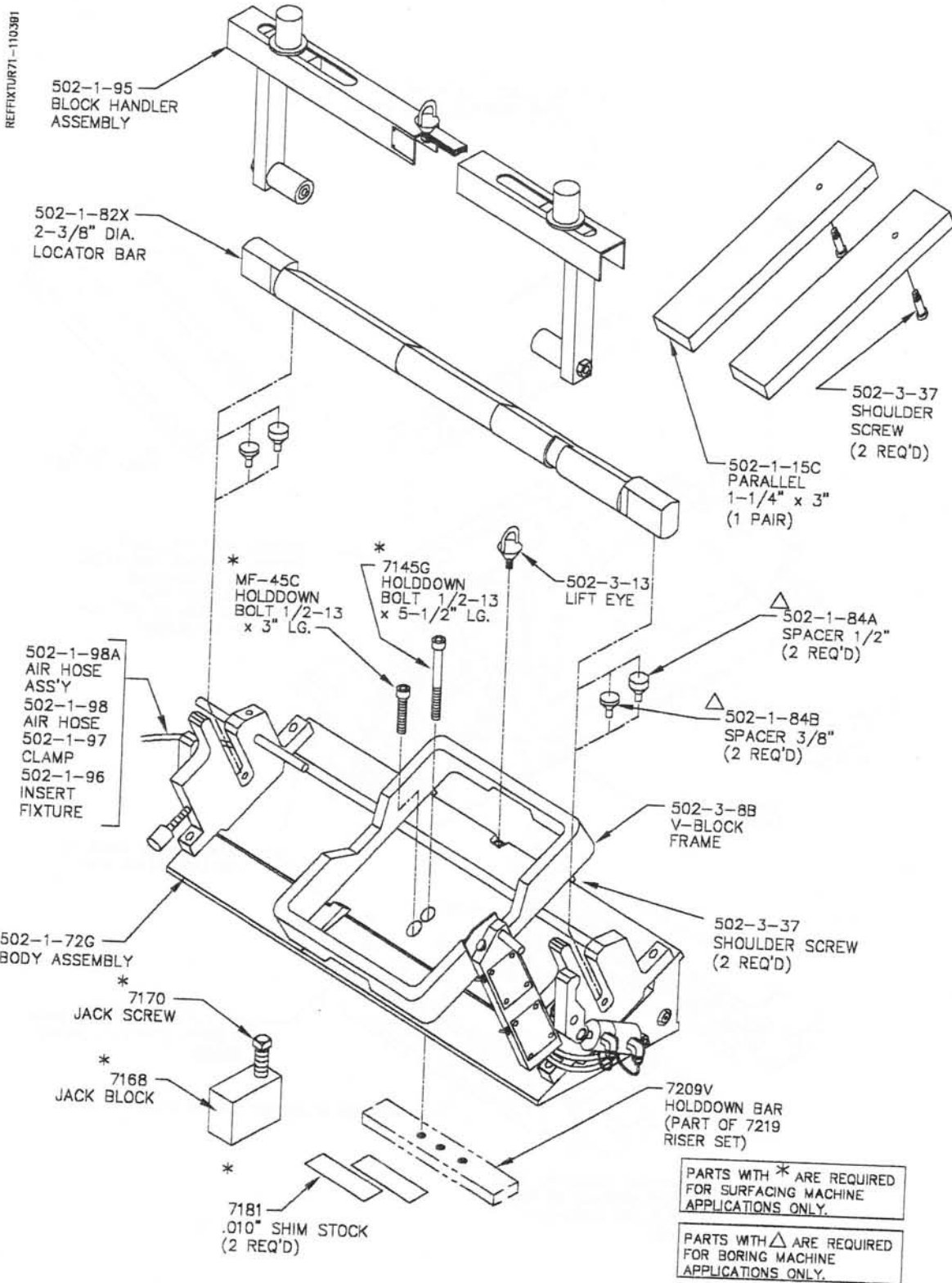
The block now must be leveled. Place a precision level on the deck surface of the block. If the block needs to be adjusted in the long direction, use the handscrew, located on the lefthand bar positioner. (**NOTE:** the locator bar must be in its far right position for the handscrew to work properly). Raise or lower the jacking screw, as required, to level the block in the short direction (See illustration page 8). Use upper switch on control tower to activate locator bar clamp fingers, and commence with surfacing. Lift the block with the block handler, turn the block 180 degrees and reload to duplicate the operation on the other bank.

After turning the engine block 180 degrees the locator bar must be twisted 180 degrees also. Again the word 'UP' must enter into the positioners facing *up* and away from the operator. (See figure 1 Page2.)

REFFIXTUR72-110391



502-1-72F
V6/V8 Fixture Assembly With Air Float
Surfacing Machine Application

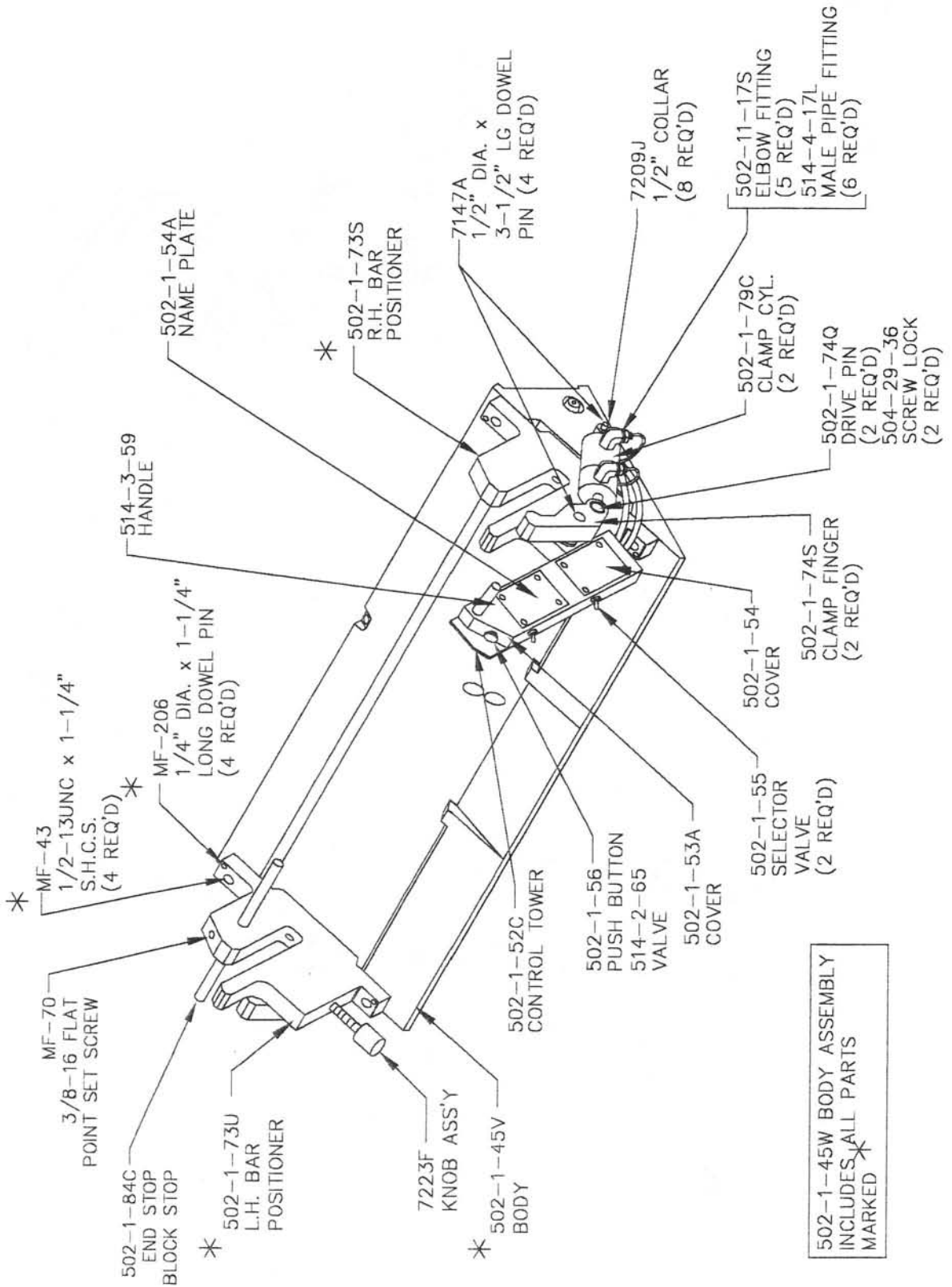


502-1-72F
V6/V8 Fixture Assembly With Air Float

502-1-72G

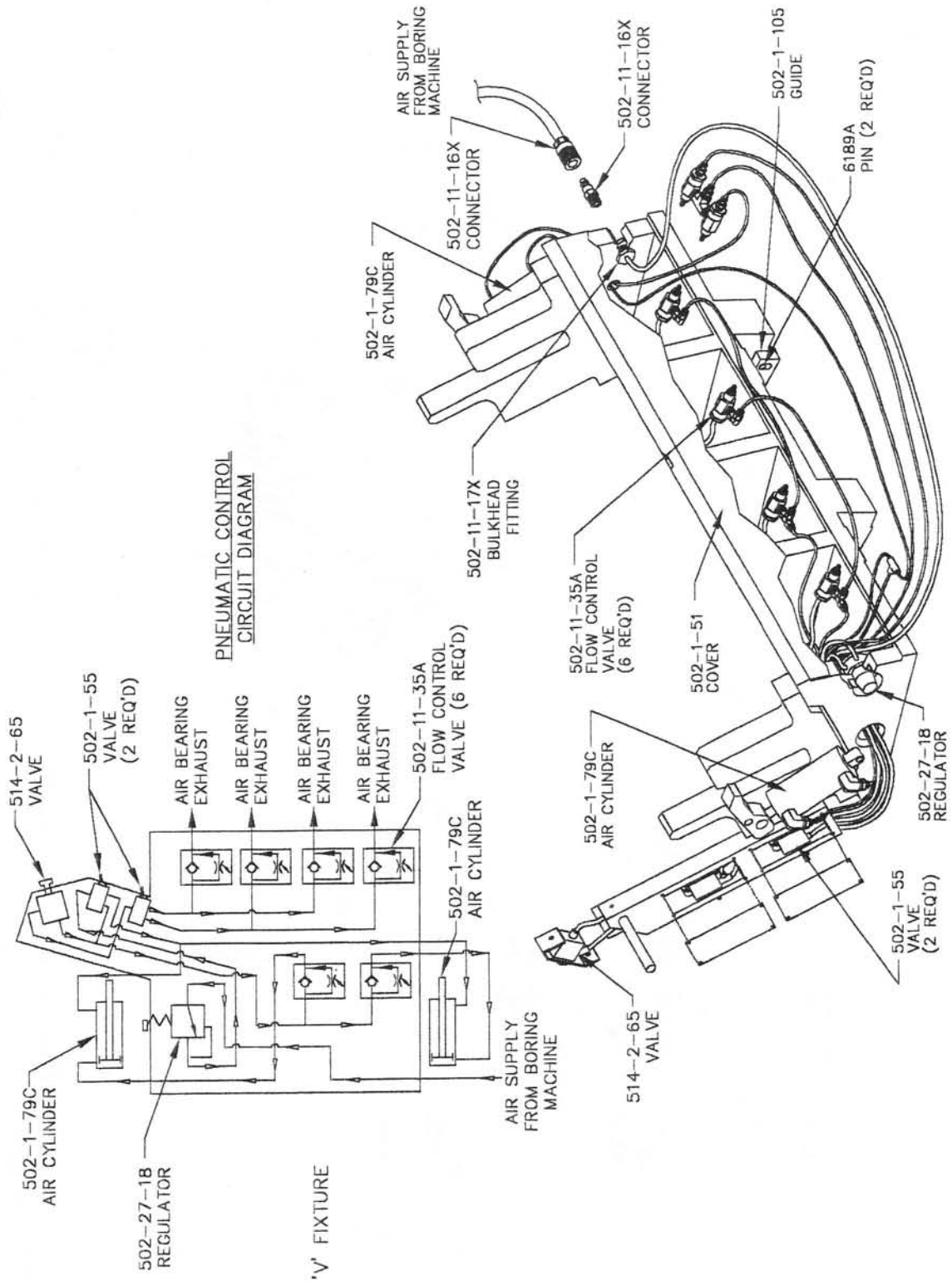
V6/V8 Air Fixture Body Assembly

REFFITUR69-110397



501-1-72G
V6/V8 Air Fixture Body Assembly
Back View

REFFIXTUR70-110397

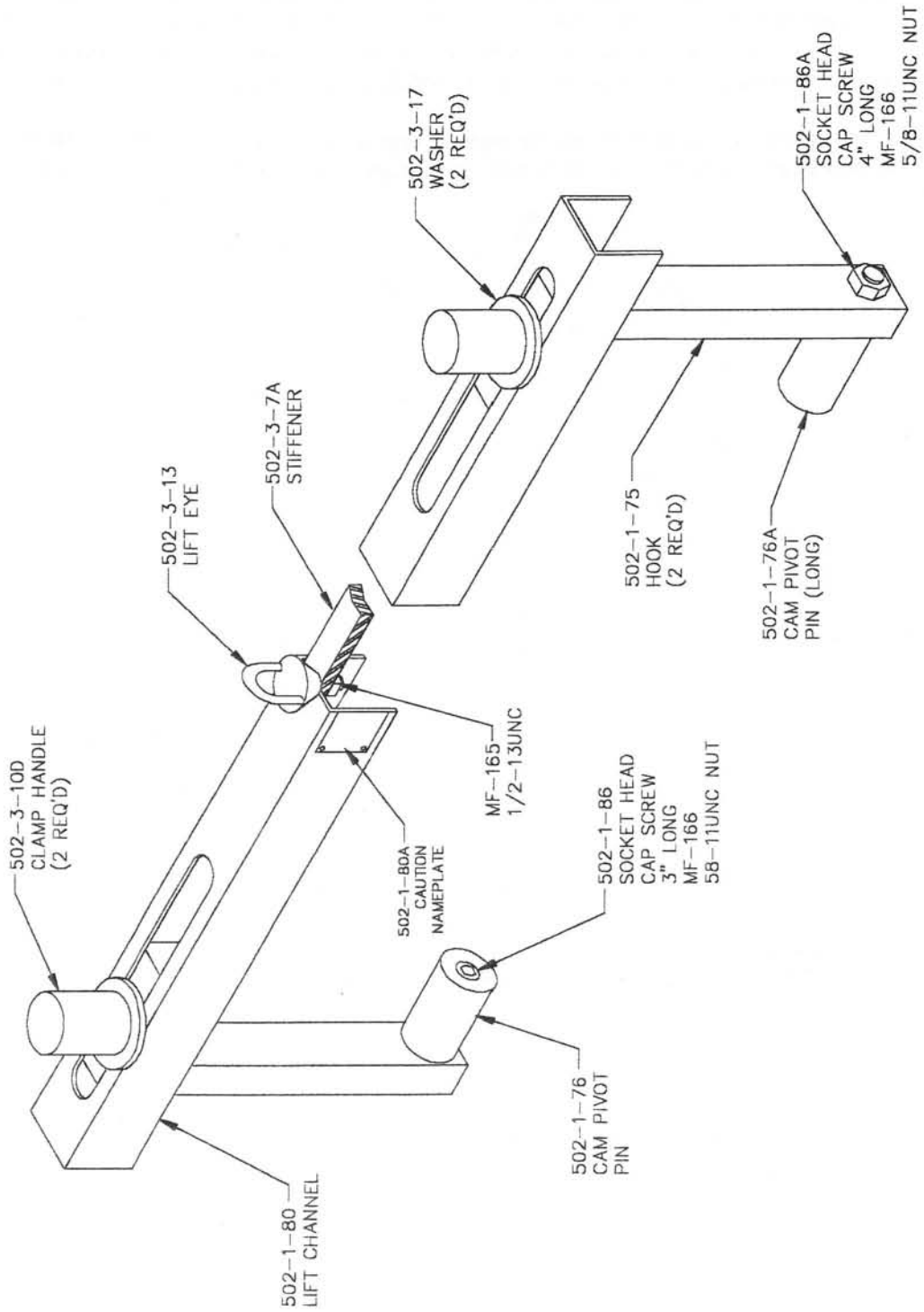


502-1-95

Block Handler Assembly

Standard on V6/V8 Fixture (502-1-72F)

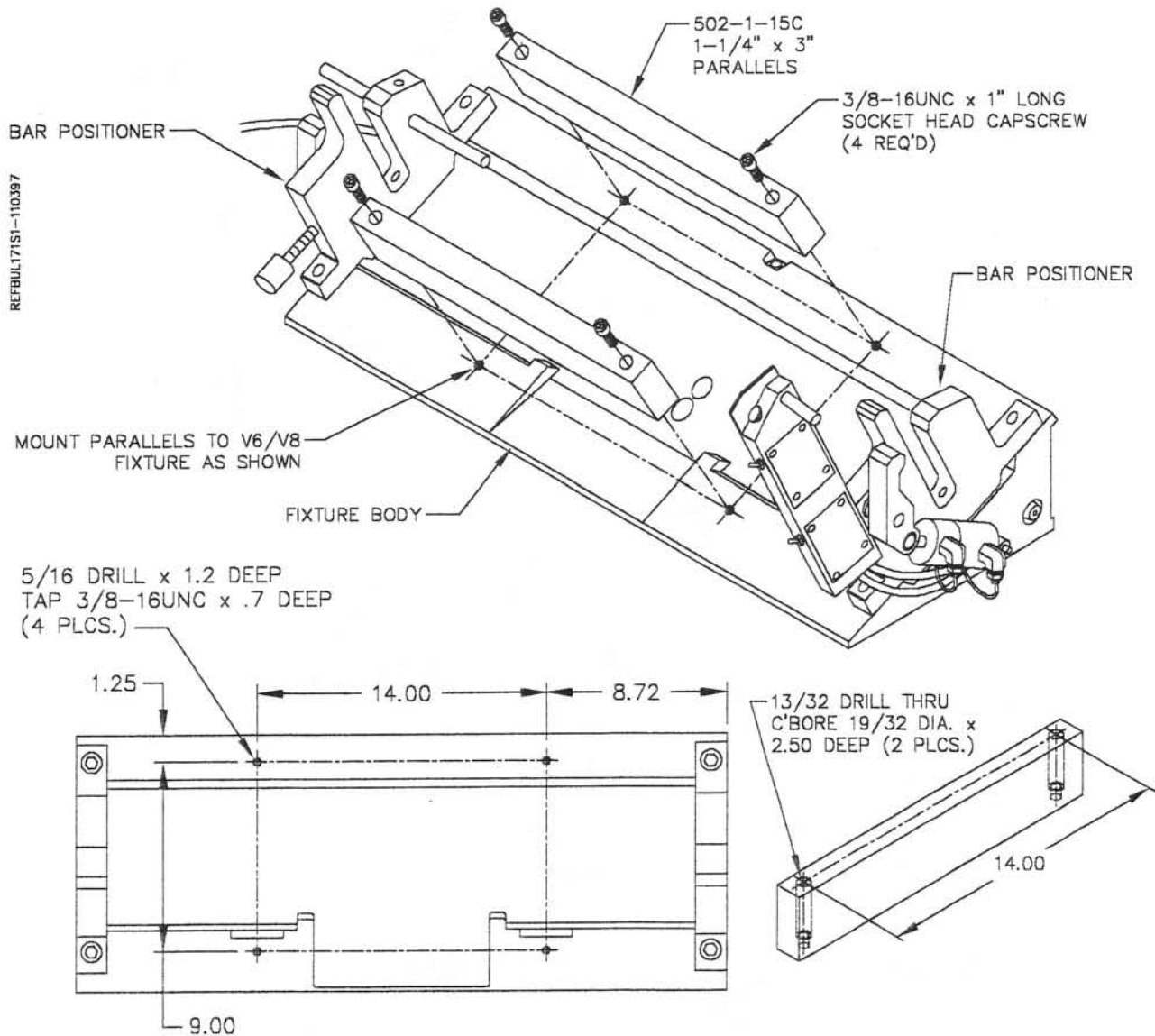
REF2MB17-031993



Retrofitting 502-1-15C Parallels to V6/V8 Combination Fixture (Special Applications)

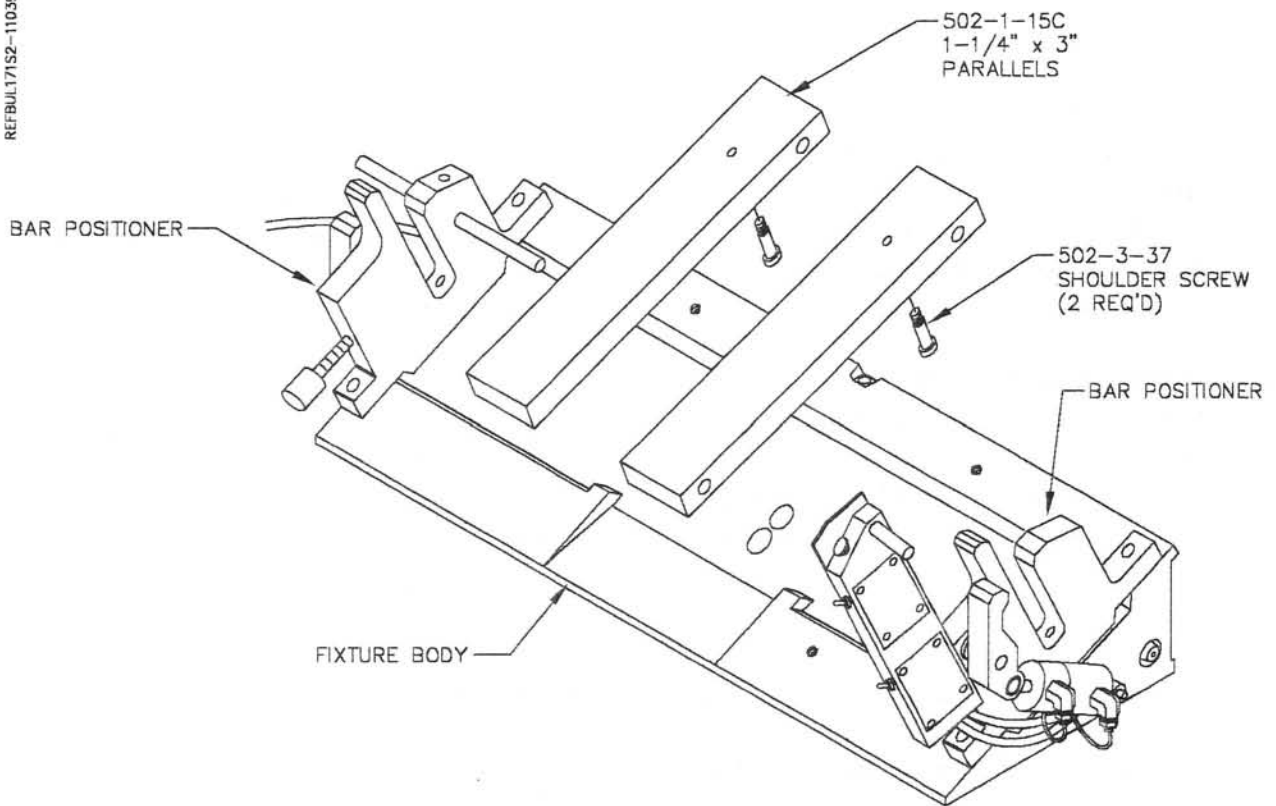
Some engine blocks with large main bores (3-1/8" and larger) cause a problem of the locator bar bottoming out in the bar positioners and/or the V-shaped reliefs of the 502-3-8B V-block frame before clamping the block properly. Mounting the 502-1-15C parallel set as shown below in place of the V-block frame will provide proper clearance for clamping. Older style fixtures and parallels can be modified to this configuration using illustrations below.

V-6 blocks with one-piece 'caged' main bearing caps (all caps are connected) can interfere with 502-3-8B V-block frame. The parallel arrangement shown below will allow proper support and clamping of these blocks.



Some V-6 engine blocks (for example Buick V-6) have main bearing bores that are too low in respect to the pan rails. This presents a problem of the locator bar bottoming out in the bar positioners before the block is properly clamped. Positioning the 502-1-15C parallel set as shown below will raise the block enough to provide proper clamping.

REFBUL171S2-110397



Economy "V" Block Fixture 7232

CAUTION:

Handle block and fixture with extreme care and guidance a block hoist is required. Mishandling of the engine block or the fixture could result in the dropping of a heavy piece, and possible personal injury. Be careful.

The model 7232 economy "V" block fixture is a simple and universal system to properly and accurately hold most "V" type automotive and light truck engine blocks for cylinder boring.

Normal Operation Procedure:

Load fixture on to the wear pads and align center line of pivot bar yoke to center line of spindle, when spindle base is in the mid-point of its in - out travel. We suggest moving the spindle base to the right side of the main base for loading.

NOTE:

The engine block must have the main bearing caps in place and torqued. All main bearing inserts should be removed. The pivot bar has a relief for blocks with a small, end main bearing, or seal groove.

Attach a lifting eye to the engine block. Select a point on the head surface of the cylinder bank you want to bore. The block should be balanced when you lift it.

Place the bar through the main bearing bores of the block. Hoist the block into the fixture, and lower until the pivot bar is resting in the frame cradle. Adjusting screws should not be touching the pivot bar.

Place the jack body on the wear pads as shown in illustration. Serrated end of jacking screw should be facing up. Select a boss or surface on the side of the block, that will keep the jack body secure and not allow it to slip or tip over.

Finish lowering the engine block so the weight is on the pivot bar and the jacking screw. Do Not ~~remove~~ the hoist from the engine block until you check, and are sure that; the jack body is flat on the wear pads, and the jacking screw is secure and won't slip.

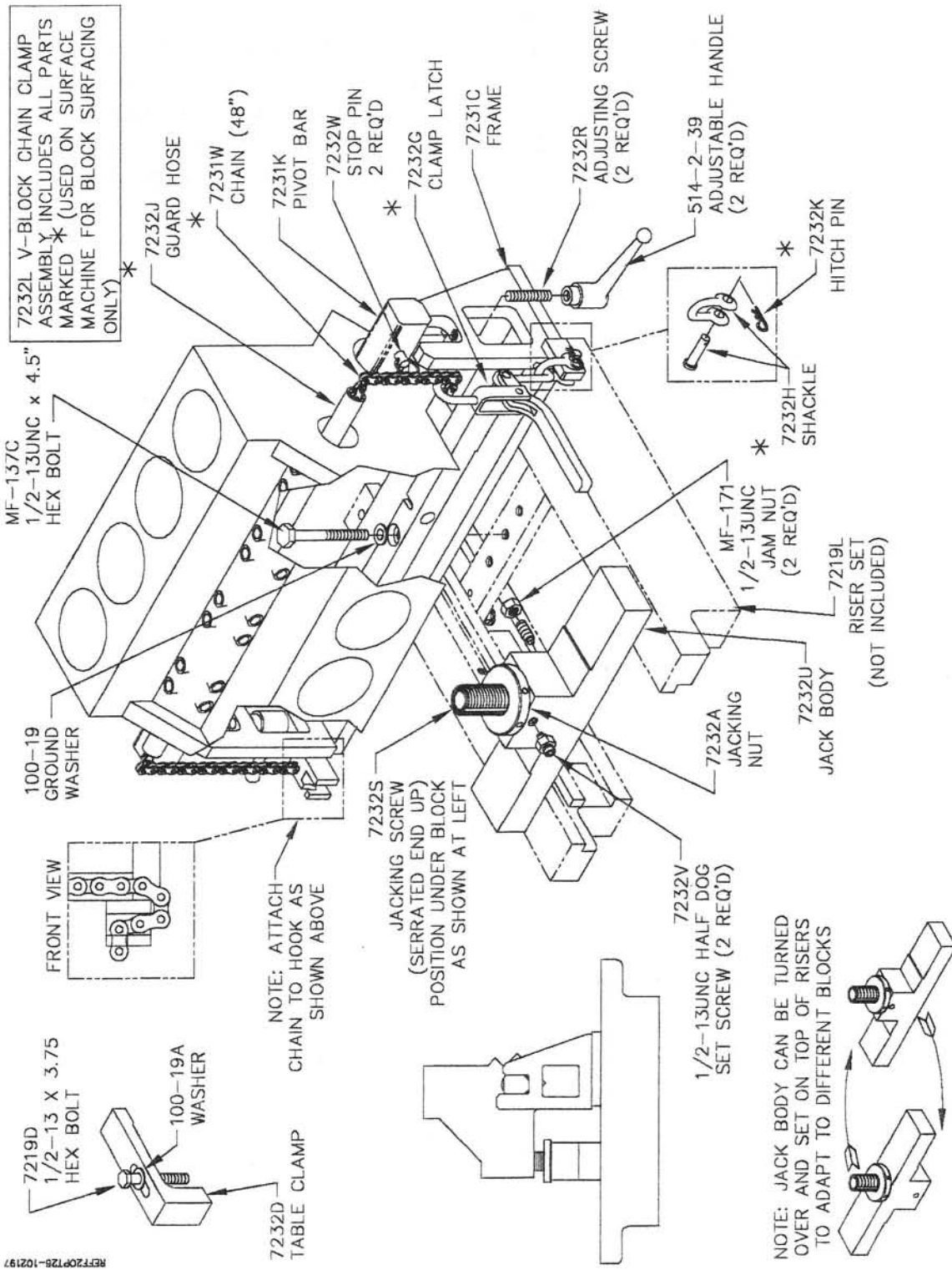
Position the main base clamp arms. The clamp arms must clamp on the head surface, between the pivot bar and the jack assembly. See illustration. Clamp lightly until block is leveled.

Remove the hoist and lift eye from block use a dial runout indicator or a level to check the squareness of the head surface. If necessary adjust the squareness by raising or lowering the jacking screw (front to back adjustment) or the adjusting screws (left to right adjustment) The adjusting screws are located on each end of the frame. The adjusting handles can be ratcheted by pulling down on the handle and turning it while the screw stays still. Check that the jack assembly is still holding the block securely.

Clamp the block firmly with the clamp arms using even pressure on both clamp arms. Recheck squareness and readjust if necessary.

Bore the cylinders normally. After boring the top bank, reattach hoist, unclamp, remove block. Move the lifting eye to the other cylinder bank, reload the block into the fixture and duplicate the operation.

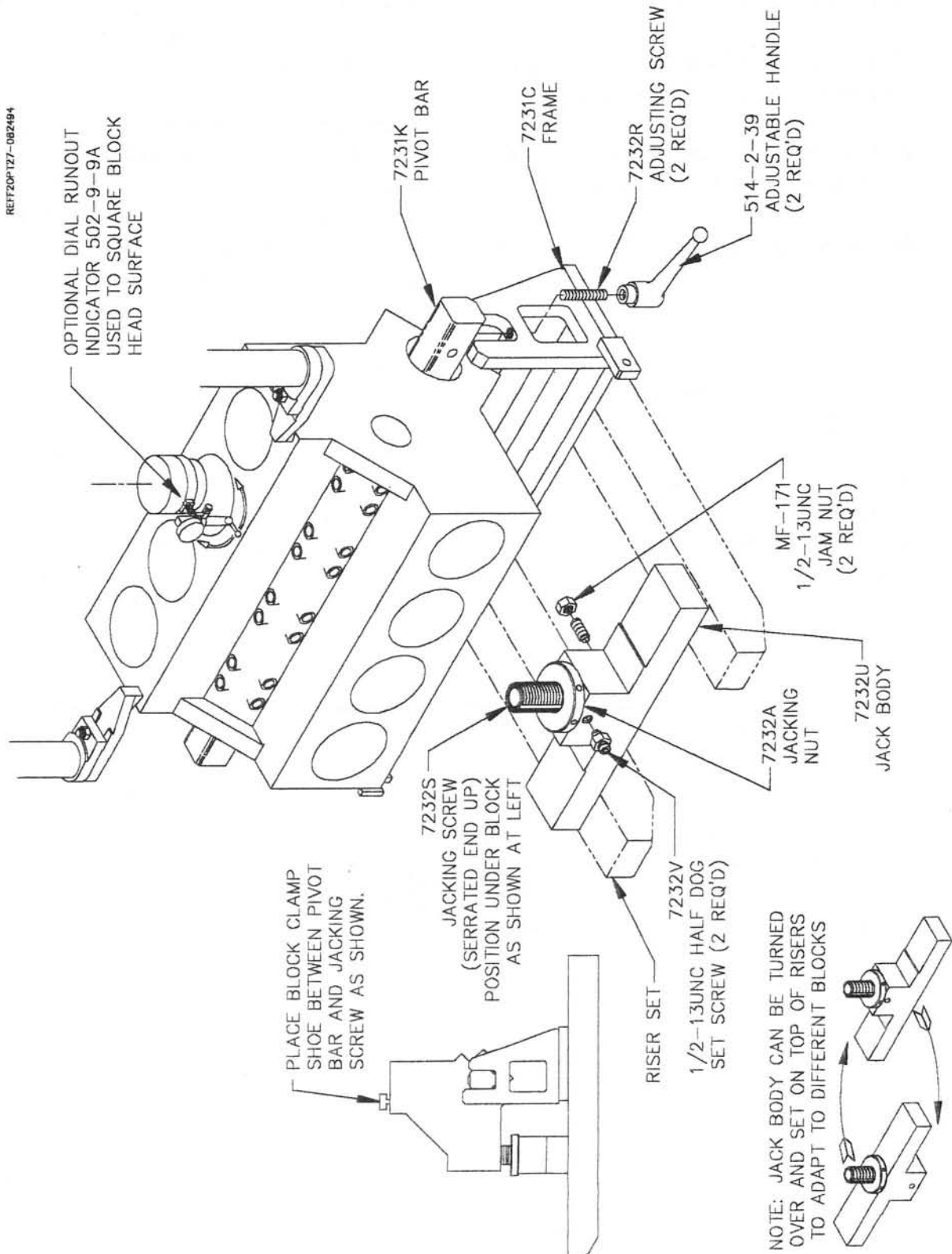
Economy "V" Block Boring and Surfacing Fixture (V Blocks Only) 7232



**Economy "V" Block Fixture
Boring Machine Application
(V Blocks Only)**

7232

REFZOP1Z7-082494



**Performance Surfacing & Boring
Fixture Assembly Instructions
502-1-46D**

Mounting fixture to machine main base:

F2 Main Bases: Mount fixture directly to main base using 3/8-16 UNC screws.

F4 Main Bases: Mount fixture to 4" high parallels using 3/8-16 UNC screws.

Mounting Index Plate Assembly to Block:

The easiest method of mounting the index plate assembly is to lift the block with an eyehook in the surface that is to be bored.

Slide the locator bar (502-1-46K) through the main bearing bores of the block with the appropriate main bearing locators.

Slide the two index plates on each end of the locator bar, leaving them approximately 6" away from the block.

Install the cam bore locators (502-1-46B or 502-1-46C) into the index plates by sliding them through the slot, turning 90 degrees, and sliding them the rest of the way into the index plate. Now slide the index plates up against the block with the cam locators inserted in the cam bores.

Loosely tighten the 1/2-13 capscrews through the adjusters (502-1-46L) into the locators. NOTE: There are 5 different length screws to accommodate various blocks. An approximate guide is to measure the distance from main bearing bore centerline to cam bearing bore centerline. Using this measurement, choose the screw from the chart below:

Distance Main Centerline to Cam Centerline	Capscrew Part No.	Capscrew Length
5.8" to 6.3"	MF - 43	1-1/4"
6.3" to 6.8"	MF - 44A	1-3/4"
6.8" to 7.3"	MF - 41C	2-1/4"
7.3" to 7.8"	MF - 45B	2-3/4"
7.8" to 8.3"	MF - 41D	3-1/4"

Install 5/8-11 threaded rod (502-1-46G) through cam bearing locators and cam bore of block. Install washers (502-3-17), cam bar knob (502-1-46N), and cam bar fast clamp knob (502-1-46P) onto threaded rod. Lightly tighten both knobs onto threaded rod. Lightly tighten adjuster screws until locators are seated evenly into cam bores. Now tighten knobs on both ends of threaded rod.

CAUTION:

Do not over tighten adjuster bolts or cam bar knobs.

Check for overtightening by looking at mating surfaces between cam bearing locators and index plates. These surfaces should be flush. Either cam adapter tilted at an angle, is a sign of overtightening.

Some operators may choose to only use one cam bearing locator in this fixture. In this case, a washer (502-3-17) should still be between the cam bar knob and the index plate to prevent galling.

Mounting Block into Fixture:

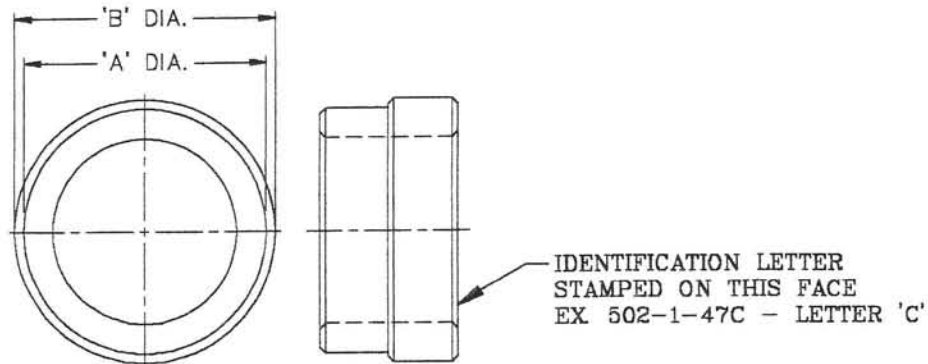
Set block in fixture frame with button jacks (502-1-46J) resting directly on support plate (502-1-46E). Slide block back to contact clamp supports (502-1-46G). Hand tighten clamp knobs (502-1-46M) to hold block in place.

NOTE:

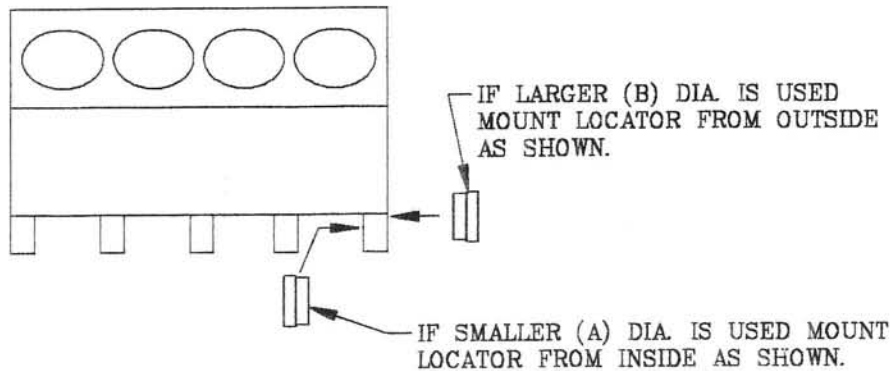
Button jacks (502-1-46J) are preset at the factory and should need no further adjustment.

Main Bearing Lockator Selection List and Installation Instructions

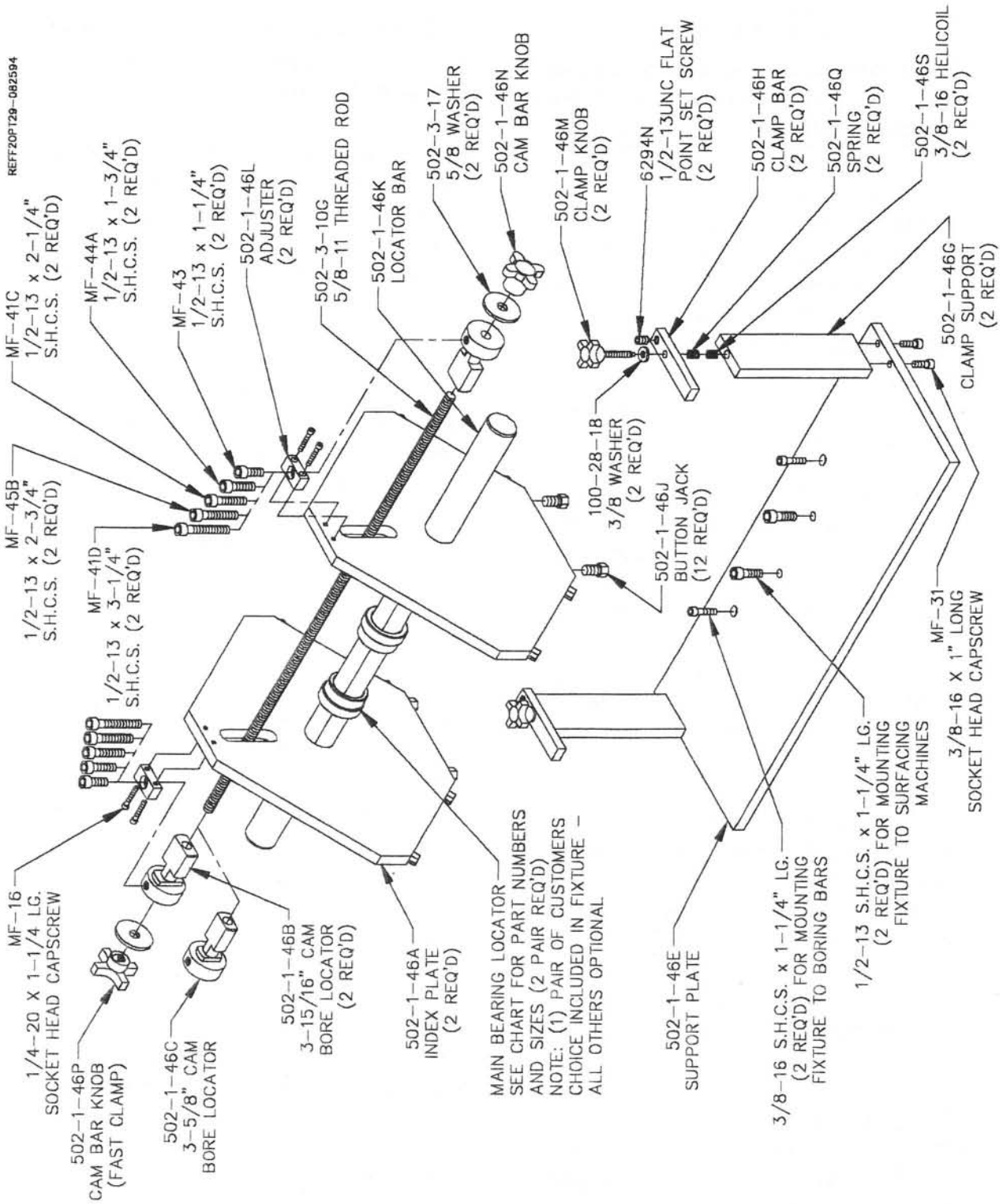
Part Number	Make	Displacement CU. IN.	Main Locator Diameter	
			"A" Dia.	"B" Dia.
502-1-47A	Chev V/8	350	2.6391 ^{+0.0010} / _{-.0000}	
	Chev V/8	400 SB		2.8390 ^{+0.0010} / _{-.0000}
502-1-47B	Chev V/8	396/ 427/ 454		2.9365 ^{+0.0010} / _{-.0000}
	Buick V/6	231	2.6855 ^{+0.0010} / _{-.0000}	
502-1-47C	Buick/Olds/Pontiac V/8	350/ 389/ 400	3.1865 ^{+0.0010} / _{-.0000}	
	Buick/Pontiac V/8	421/ 428/ 455		3.4365 ^{+0.0010} / _{-.0000}
502-1-47D	Ford V/8	351C	2.9402 ^{+0.0010} / _{-.0000}	
	Ford V/8	351W/ 429/ 460		3.1907 ^{+0.0010} / _{-.0000}
502-1-47E	Ford V/8	289/ 302	2.4397 ^{+0.0010} / _{-.0000}	
	Mopar V/8	360		3.0010 ^{+0.0010} / _{-.0000}
502-1-47F	Mopar V/8	318/ 340	2.6910 ^{+0.0010} / _{-.0000}	
	Mopar V/8	426/ 440		2.9410 ^{+0.0010} / _{-.0000}



NOTE: EACH LOCATOR COVERS (2) BEARING DIA'S ('A' DIA. & 'B' DIA.). WHICHEVER DIA. IS USED, THE OTHER DIA. MUST BE PLACED INSIDE THE BLOCK TO PREVENT INTERFERENCE WITH THE INDEX PLATES.



**Performance Surfacing & Boring
Fixture Assembly 502-1-46D**



**Diesel "V" Block Fixture Assembly
Operating Instructions
502-11-50**

CAUTION:

This fixture can only be used on F2 series machines mounted on F4 main bases, example F24MB, FA24EB, FE24A.

Mounting Of Fixture:

Thread the tree socket head cap screws into the three tapped holes in lower front of the main base. Leave a 1" gap behind the head of the cap screws. Place the center support (502-11-51) over the heads of these three screws. Slide the support down until it engages all three cap screws, tighten them.

Attach the yoke adjusting bracket (502-11-55) by placing its dowel pins into the 3/4" diameter holes in the main base. Lock one of the adjusting screws with its lock nut on one of the yokes. Place all three locator bars (502-11-56) into the "V" of the yokes. Attach the center adjusting bracket in the center of one of the banks of the block, using two head mounting screw holes.

Lift the block onto the fixture so that the block mains are resting on the locator bars, and the adjusting screw of the center adjusting bracket is resting on the center support.

Position and actuate the block clamps. Use maximum clamp force on sleeve cuts only.

Block Alignment:

Diesel blocks with head held sleeves must be aligned so that the cylinder counter bores are parallel to the head

mounting surface. Cylinder bores must also be held perpendicular to this same surface within close limits.

Check the block top surface first with a dial indicator or air gauge probe mounted on the cutter head. Travel the spindle the length of the block to determine that the parallelism is as close to .0005 as possible.

If the block is not parallel, you can raise or lower the end of the block by turning one of the yoke adjusting screws. The other one should be locked. Locator bars may be deflected up to .003" with the clamps on working position. You may have to loosen the block clamps to make this adjustment. Lock the adjusting screw with its lock nut after this adjustment is made.

Rotate the cutter head to check the flatness front to back. If not within .0005 desirable limits, raise or lower front of the block by turning the center adjusting screw. Lock with its lock nut after adjusting.

NOTE:

With all adjusting screws locked and block clamp actuated, recheck your readings. Remember some top of block surfacing processes create a wave like condition along the block and will be higher at sections between cylinders and at ends of block. Dial indicator readings should be taken at those points and not at the bore area.

Diesel V-Block Fixture 502-11-50

REFZOPT30-082994

