

September 2, 1994

ROTTLER MANUFACTURING

F4EB

BORING MACHINE

MACHINE SERIAL NUMBER

OPERATIONS AND MAINTENANCE
MANUAL



MANUFACTURED BY:

ROTTLER MANUFACTURING COMPANY
8029 South 200th Street
Kent Washington 98032
USA

Phone: (206) 872-7050

Fax: (206) 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**

DESCRIPTION

The model F4EB boring machine is a precision, single point tool, boring unit. It is equipped with tooling and accessories for reboring most American passenger car and truck engines, inline, 90 degree and 60 degree V types. F4EB machines can be readily tooled to rebore a wide range of engines including European and Asian engines as well as perform a wider variety of boring operations.

This machine is designed for two purposes:

1. The alignment of cylinder bores relative to the pan rails and main bearing locations, as has 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 is realized as a result of fast block clamping, inverted centering fingers, and air operated clamping and lifting devices.

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

All feeds and rapid travels are power operated. An auxiliary hand feed travel is located at the base of the feed screw to be used for counterboring and facing sleeves, etc.

Power is furnished by a 205/245 volt 50/60 hertz, single phase, variable speed AC motor Controller. A high and low range pulley drive and a variable AC controller provide speeds from 75 rpm to 545 rpm.

LIMITED WARRANTY

Rottler Manufacturing Company model F4EB 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 instruction in this manual.

Standard air and electric components are warranted by their respective manufacturers (NOTE: their individual warranty periods may vary significantly 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.

IMPORTANTOPERATING SAFETY AND EMERGENCY PROCEDURES

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 your hands, fingers, and face. NOTE - Eye protection is a necessity when working in this area.

2. CUTTING TOOL AREA - Any operation involving hand 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 this lever to make sure that the upper lever position will lock out the spindle clutch when the detent is engaged.

3. BORING - Eye protection must be worn during this operation and hand must be kept completely away from cutter head.
4. UPPER HOUSING CONTROLS - Learn to identify and independently operate these control functions by habit while developing the awareness of keeping your 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.
TURN OFF MOTOR IMMEDIATELY.

NOTE: You can keep your finger on the stop button, if you wish to insure instant shut down.

After finding out what the problem is, methodically organize the controls to return the spindle to it's up position, without causing more problems.

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 it's 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 F4EB machine is extremely important. A slow travel (6' to 10'min) power hoist, operated from either a bridge crane or a jib crane arrangement works very satisfactorily. A 1000-lb. hoist is generally adequate for lifting the engine block and V-fixture combination. 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 would 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 F4EB machine, being careful not to use force on any part of the spindle unit.

Remove the SJ4 sharpening fixture from the deck and preferably place at a bench close to the machine. The SJ4 sharpening fixture is available in 115V 60Hz or 220/230V 50/60Hz. If it is necessary to mount this fixture on the F4EB base with an angle plate, mount it so that the sharpening wheel is below the top face of the machine base, and the sharpening grit will not be thrown on top of the base.

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, clean thoroughly the cylinder block clamp arm assembly. Rust inhibitor is applied to the machine at the time of shipment, and any of this inhibitor left on the machine will result in considerable collecting of cast iron dirt and possible slipping of the clamp arms.

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.

MACHINE SETUP

Remove sheet metal cover #502-35-41A on the back side of the spindle unit, by removing it's 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 float/neutral/clamp 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 appropriate slot. Now slide the spindle unit from side to side and further clean the rust inhibitor from the table.

Attach an air source to the appropriate intake at the air filter on the side of the rear control enclosure.

NOTE: AIR SUPPLY IN "F" SERIES MACHINES

It is very important your air source for "F" series boring machines 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.

POWER SUPPLY

This machine requires 205V to 245V AC 50/60Hz, single phase, (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 to 120 V. Connect per electrical hook-up directions below. ***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 208/240V 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.

REPLACE THE COVER
AFTER HOOKING UP POWER.

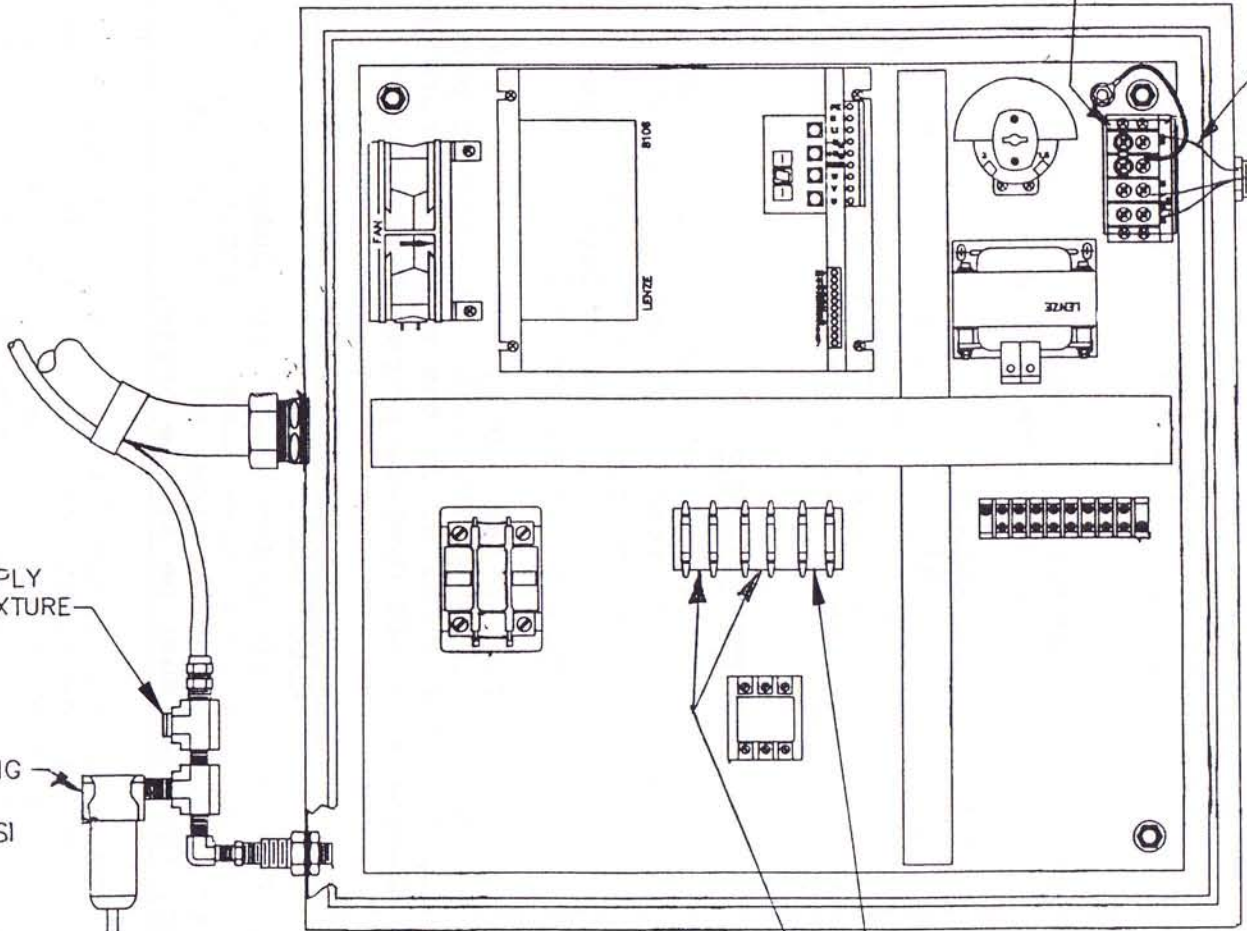
GREEN GROUND
WIRE

INCOMING POWER
208V TO 240VAC
SINGLE PHASE,
50/60 Hz.
IMPORTANT
ELECTRICALLY CONNECT
IN ACCORDANCE WITH
LOCAL AND NATIONAL
ELECTRICAL CODES.

AIR SUPPLY
TO V-FIXTURE

INCOMING
AIR
100 PSI

502-37-53A
FUSE MDA 20A
(2 REQ'D)
6456L
FUSE MDL1A
(4 REQ'D)



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.

Move the clamp selector switch to the left (float) position, slide the spindle unit from side to side and in and out to make sure it slides freely. The necessary effort to slide this will decrease when the shipping oil is entirely removed from the machine base. Spindle base should float easily without pulsating. If adjustment is required, first adjust the air regulator (#502-27-17) in the end cap on the rear of the spindle base, if further adjustments are required, a needle valve is located in the rear of the spindle unit, which controls the air flow to the rear float. Bar should float easily and smoothly, without pulsating. Pulsating is an indication of too much air being applied.

Move the clamp selector to the right (clamp) and check proper operation of the clamp assembly and proper release and movement of the base when turned back to float.

Replace sheet metal cover on the spindle unit.

CONTROLS

We suggest that before attempting any cylinder boring, the operator should actuate the controls to become familiar with the operation of the machine.

1. CLAMP (FLOAT) SWITCH

Move the clamp switch to the right to energize the spindle hold down clamp. When this switch is moved to the left, air is exhausted from the bottom of the spindle unit, providing easy movement of the spindle.

CAUTION: Motor must be stopped when positioning bar. Inadvertent spindle rotation engagement could injure the operators hands or damage the cutter head parts.

It is important to note that the clamp switch may be left in the neutral straight position so that the spindle is neither floated nor clamped. You will find it often useful to use this position on your machine for dial indicating purposes in

bores, and to make slight adjustments in order, either to correct or introduce a desired, total indicator runout reading.

2. FEED AND RAPID RETURN LEVER

The feed lever is the latching lever on the side of the bar. Press down until the lever latches to engage the cutting feed. To disengage, press the feed release arm which will unlatch the lever and allow it to return to the neutral position. Lift the feed lever until it latches to engage the rapid return travel. The bar will automatically return to neutral upon reaching the top of the travel. If you wish to return the bar to neutral while it is in rapid travel, again press feed release arm which will unlatch the lever and allow it to return to neutral position. You will note the stop rod that is held in the hand feed cap by the set screw, has a round shaped end which will release the cutting feed when it contacts the latching lever. This most conveniently raised up and locked by its set screw in the proper position on the completion of the first bore cut. This rod should not be used to hold close tolerance shoulders.

3. FAST DOWN LEVER

CAUTION: F4EB Machines must be set to 300 spindle RPM or lower to operate fast down.

The fast down travel lever is located to the right of the feed lever. Check the feed lever to see that it is in neutral position before actuating. LEVER SHOULD BE PULLED DOWN QUICKLY AND FIRMLY AND NOT ALLOWED TO RATCHET. Control is spring loaded and will release when you release the pressure.

To become familiar with the rapid down travel, we suggest that you place a tool holder in the tool holder slot and practice running this tool holder down rapidly (in the fast spindle speed) to an exact point, and returning it to the upper position. This can be done rapidly and very accurately with a little practice.

4. SPINDLE CLUTCH CONTROL

Spindle clutch control is located to the left side of the feed lever. A pull release rapid down movement will engage the spindle rotation and the reverse action will disengage. In that this is a jaw clutch, we recommend stopping the motor or jogging the motor to engage the clutch on the HIGH SPINDLE RPM. Standard procedure is to throw out the clutch upon completion of the bore. Turn the cutter head around to the indexing detent, to position the tool to the front, then reverse the travel. The lower knob on the spindle of the upper housing may be used for manually turning the spindle when necessary.

5. MANUAL HAND FEED

The 1-7/8" manual travel is actuated by rotating the handle attached to the spline at the top of the spindle base.

CAUTION: THIS TRAVEL SHOULD ALWAYS BE LEFT IN FULL UP POSITION AFTER USING, BEFORE THE SPINDLE IS RETURNED TO FULL UP POSITION.

Normal procedure is to rapid travel or feed bar to point requiring manual travel. If back feeding is necessary, run the hand travel down first and then rapid travel down to where the tool can be inserted.

This manual hand feed travel is available for facing sleeves and counterboring, etc. It is completely separate from the power 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.

6. LOW AND HIGH RANGE F4EB

Change spindle speed by moving a V-belt on stepped pulleys in the motor gear box. Turn off motor. Loosen knob 514-6-86 and rotate side cover 502-9-25D out of the way. Loosen adjustable handle 502-9-27C and pivot motor forward towards spindle. Move V-belt to desired pulley groove (Top groove - low range - bottom groove high range). Slide motor back and tighten adjustable handle. Replace side cover and tighten knob.

SPINDLE RPM KNOB

This knob adjusts the spindle rotational speed and downward feed speed. Speed can be adjusted: in low range 75 to 360 rpm in high range 110 to 540 rpm.

An optimum boring speed for rapid stock removal and good tool life is 380 surface feet per minute on normal oversize cuts. A guideline to secure this surface speed is the following list of spindle Rpm's of different bore diameters:

3" BORE	-	470 RPM
4" BORE	-	360 RPM
6" BORE	-	240 RPM

NOTE: Refer to the chart in the back of the manual for speed recommendation.

7. CENTERING KNOB

The centering knob, knob on left front side 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 the cylinder or they will come completely out of the pinion drive.

CAUTION: Motor must be stopped when centering. Inadvertent spindle rotation engagement could injure the operators hands or damage cutter head parts.

8. TWO FEED SPEED CONTROL

The two feeds provided on your F4EB are controlled by a sliding key arrangement, operated by a small knob on the top of the upper housing. This knob is raised to engage a low speed rate of .0025 per revolution and lowered to secure a higher feed rate of .0055 per revolution. To operate this knob, lift the feed shift lever to neutral and operate the knob as required, allowing the shift lever to return to feed position. It will take a moment for the sliding key to drop into drive position. This control may be operated while the machine is actually in a boring operation, although the dwell of the tool may leave a witness mark in the bore.

9. EMERGENCY STOP BUTTON (large red)

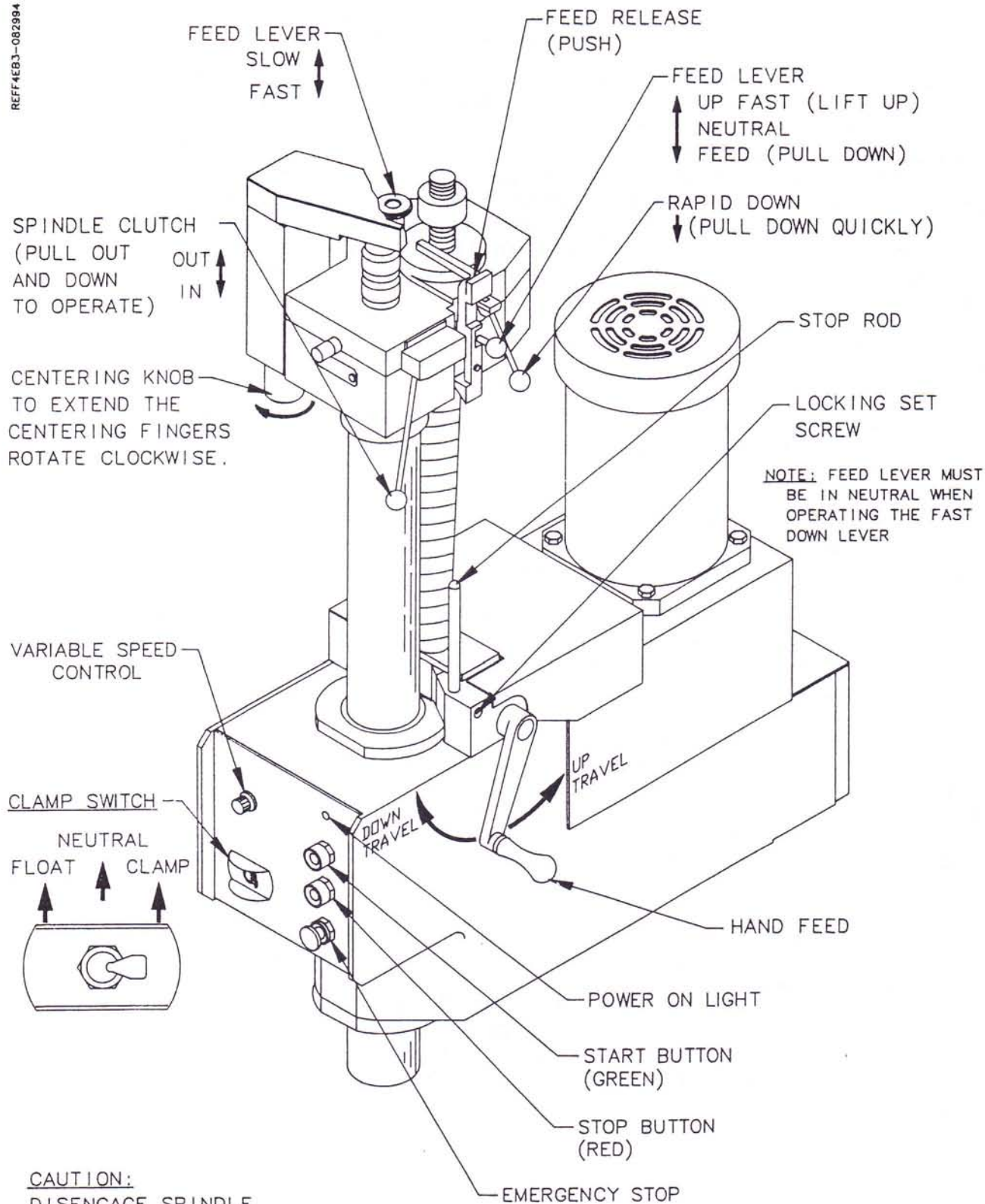
The Emergency Stop button will stop the machine in an emergency situation. Power will be turned off to the motor drive, located in the rear electrical enclosure.

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

To turn the machine back on, turn the EMERGENCY STOP button clockwise and it will pop back out.

F4EB Operating Controls

REF F4EB3-082994



CAUTION:
 DISENGAGE SPINDLE CLUTCH AND STOP MOTOR BEFORE PLACING HANDS NEAR THE CUTTER HEAD.

CONTROLS

-B TYPE CUTTER HEADSALTERNATE CUTTER HEAD ARRANGEMENTS

Your F4EB is equipped with a single draw bolt through the inner spindle assembly so that a number of different styles of cutter heads, tool, and indicators may be rapidly, interchanged. A spanner wrench is provided for locking and unlocking the cutter head, it is used on the upper knob (600-18-1) of the spindle. Engage spindle clutch to hold spindle from turning. When inserting alternate tools, make sure the sprocket is absolutely clean and while threading in place, make sure the spline is easily engaged without burring. Disengage spindle clutch.

PRODUCTION CUTTER HEAD 600-8-4H or G

(This production cutter head will give the best all-around performance in this machine.)

The production cutter head with a standard bore capacity of 3.25" to 8" may be quickly attached to the F4EB machine by use of the draw bolt.

It is used in the F4EB machine to simplify and speed up the operation, eliminating the necessity of removing the tool every time you center the spindle in a new bore.

CAUTION: Care must be taken to determine that the lower body of this head does not interfere with lower extremities of the block such as bosses and hubs of main bearing bores.

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

Note: Some V-6 blocks (GM 60 degree) have a bad interference problem at the bottom of the bore, which will require the use of a special offset tool bit #100-29-7. This bit has to be used with a 6" micrometer #900-2-5 and an offset micrometer anvil #501-34-7.

A dampener weight is also provided in the cutter head to improve performance of the boring spindle. This requires little or no maintenance as long as liquids or contamination do not enter the weight cavity. Should this occur, the operator will experience chatter problems with this head and it will have to be disassembled and cleaned. It is simply done by removal of the three flat head screws. Carefully disassemble, clean and reassemble.

BLIND HOLE CUTTER HEAD (OPTIONAL) 600-20

This cutter head is attached and operates in the same manner as a production cutter head except the centering fingers are located above the cutter tool, requiring tool removal to center each bore. An offset tool bit is provided so that extreme blind bores may be processed. A dampener weight is also provided in the cutter head which requires the same maintenance as a production cutter head.

STUB BORING BAR (OPTIONAL 1.875 (48mm) 502-9

This stub boring head with a capacity of 1.875" to 4.1" (48mm to 104mm) diameter x 8" (203mm) depth, may be quickly attached to the F4EB boring machine. At all times the work should be located in the machine so the end of the stub boring head is no further than 1" from the beginning of the work when the spindle is in the upper limit of travel.

Unlike the production cutter head, centering fingers are located above the cutting tool, requiring tool removal to center each bore.

Two sets of centering fingers are provided, the smaller has a 1.875" to 3.5" bore diameter range and the larger a 2.312" to 4.1" diameter bore range.

If centering fingers require dressing after a period of use, apply the same lapping procedure noted on page 36. The micrometer may also be periodically calibrated as noted on page 37.

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

IMPORTANT GENERAL INFORMATIONFOR THE BEST USE OFTHE MODEL 1.875 STUB BORING TOOLING

CAUTION: Inner Spindle Adjustment (see page 44) must be correct for precision use of stub boring heads.

Since the extended Stub Boring Head design has considerable over hang with a small shaft diameter, the cutting tool "B" land must be kept very narrow, (.005" to .015") (.127mm to .381mm) wide. This will ensure best results with no chatter at the bottom of the bore.

The small head will also be inclined to deflect with increasingly heavy cuts. You may expect, with properly sharpened tools, that after a .040" (1.016mm) (on diameter) cut, a second pass of the tool will remove close to .001" (.0254mm) material on the diameter. A second pass following a lesser first cut will remove less metal.

The .040" (1.016mm) cut will also leave a light drag back mark in the cylinder that can in turn be eliminated by the second pass.

The drag back mark is generally eliminated in any event by the finish honing. It may also be eliminated by repositioning the boring spindle away from the tool position on the return stroke.

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

In general size variations in a typical cycle bore will approximate .0007" (.01778mm). A second pass will reduce these variations to generally 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.

The boring head assembly as noted in stub bar illustration, is equipped with a dampening weight, part #502-9-6A. This requires little or no maintenance as long as liquids or contamination do not enter the weight cavity. Should this occur, the operator will experience chatter problems with this head and it will have to be disassembled and cleaned.

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

CAUTION: It is very important that after inserting tool holder into the stub boring cutter head and pushing it firmly back to it's indexing point, that you remove all finger pressure from the tool holder and the tool bit, before locking it with it's locking set screw. This is especially important when using the offset blind hole tool bit. Failure to follow the above instruction will result in size variation.

1.5 (SHORT) STUB BORING BAR (OPTIONAL) 600-8-8A

This Stub Boring Head, with a capacity of 1.5" to 4.1" diameter (38 to 104mm) x 3" depth (76mm), attaches and operates the same as the 502-9 cutter head. It is designed especially to be used with the production full width single cut VW head facing tool. It can also be used for general purpose boring where a rigid stub boring head is required.

If you already have a 600-2 or a 502-9 stub cutter head, you may use it's tooling for this head.

OPERATING INSTRUCTIONS

We recommend, particularly for operators unfamiliar with boring bar, to practice on a junk block in order to become acquainted with all controls and details connected with the use of the machine.

BORING AUTOMOBILE AND SMALL TRUCK BLOCKSLOADING IN-LINE CYLINDER BLOCKS

Place a Chevrolet, Ford, or Plymouth 6 cylinder block in the machine on top of the 5" parallel fixture, and apply weight to the top of the block at each end to determine there is no burr or dirt under the pan rails that will result in the block not being clamped properly to all four points of the pan rails. (You will 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 parallel fixture and should be shimmed at proper front support to eliminate rock.

Place the block into the machine, so that the holes are in a position to approximately locate boring spindle in the middle of it's 1-3/4" in and out travel, when centered.

You will note that it is possible to put engines in this machine in such a way that the spindle unit may be forced to the limits of either it's in or out travel and not enable it to be centering properly.

Swing clamp arms out so that the toe of the shoe will contact the center of the ends of the cylinder block.

Lock clamp handles firmly and lower the toe firmly on the block with the cam handle straight up. Lock ball handles firmly and lower cam handle to clamp block. If the block is exceptionally long, such as straight 8's, operate the two cam handles simultaneously so that locking the first handle does not tend to rock the opposite side of the block up.

You will note that the parallel fixture is designed with an "L" shape. The purpose of this is to extend the back portion of the "L" outboard to prevent cylinder blocks from rocking when first clamp is applied.

CAUTION: The standard production-type cutter head with centering fingers below the tool bit must be checked for interference with main bearing bosses or other protrusions on engines other than typical American passenger car and truck engines. F4EB machines may have other cutter heads substituted to avoid this difficulty.

Operating Instructions Con'tMICROMETER

Determine the cylinder bore size you wish to cut and place a tool bit into the tool holder and use the micrometer to set to size. Choose a tool holder that will allow minimum tool bit overhang, for the size you wish to bore. 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. Particular attention should be paid to inserting the holder in the micrometer without allowing the spring loaded tool bit to snap against the micrometer anvil. Caution should be used to lightly lock the tool bit. Then turn the micrometer spindle away from reading and firmly lock the tool bit. Then re-check the micrometer reading.

BORING

Insert the tool holder into the boring bar spindle and push firmly back to the index point. Lightly lock the tool lock screw with the plastic handled hex driver provided in your tool box.

Make sure spindle clutch is out (lever in up position) and the spindle is placed near the center of the hole but slightly to the rear. Operate fast-down to travel the cutter down to within 1/8" of the cut. If you should travel the cutter into the bore, operate return lever to properly reposition tool, STOP motor.

CENTERING WITH CENTERING FINGERS

Move clamp selector to the left, (float position) turn centering knob clock-wise to extend centering fingers. Make sure they will extend and contact the cylinder wall. Continue to hold a firm rotary pressure on the centering knob and move clamp selector to the right (clamp position.) When moving clamp selector switch, a slight pause is required in the straight up or neutral position, to assure good centering. This pause will allow the float air to dissipate and the spindle to settle evenly before the clamp cylinders engage.

NOTE: Do not pull knob toward you during centering. This is the most common cause of centering error.

Turn centering Knob counter-clockwise to return fingers to "IN" position. Engage spindle clutch, start motor and engage feed lever. If you wish to check the bore size, allow the machine to bore a sufficient depth above the ring travel. Disengage feed, disengaging spindle clutch, turn the centering knob counter-clockwise until the inner spindle contacts the spring detent, which will index the cutting tool toward the front of the machine, lift feed lever to rapid return position and allow the machine to return to its full up position.

TURN OFF MOTOR

Check bore diameter, adjust if necessary and re-insert tool then rapid travel down to job again; then engage spindle clutch and feed. Do not unclamp during this checking operation.

When cutter has completed boring operation, set stop rod to stop feed. The stop should be set promptly after machine finishes cutting as the inverted style of cutter head does not have a large amount of end clearance above main bearing bosses on some engine models.

After feed has stopped, lift spindle clutch lever, turn lower spindle knob, (600-18-2) clock-wise until detent is contacted then engage rapid return to return the spindle to the top.

NOTE: If a cut of .005 or less, on diameter is to be taken, the following centering procedure is required - move float clamp switch to its neutral position, then center spindle by using a dial indicator attached to the cutter head. Then turn the clamp selector to the right (clamp position).

AIR V6/V8 COMBINATION FIXTURE502-1-72

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

NOTE: 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.

The Model 502-1-72 V6/V8 cylinder block 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 cylinder boring.

The block is most effectively handled with the main bearing caps in place and at least the outboard caps torqued. Care must be taken to assure the side contact edge of the locator bar is above the cap split surface. A pair of 3/8" and 1/2" spacers are provided for blocks with large main bearing bores, to enable the locator to locate above the main bearing split line.

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 90 degree option placement of frame to suit block length, or main bearing caps will interfere with frame.

Y BLOCKS

(Blocks with main bearing 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 502-1-21C wear pads are used for most automotive blocks. The 502-1-21C 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.

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.

The fixture may be easily repositioned on the machine wear pads (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 from 60 degree to 90 degree.

AIR V6/V8 COMBINATION FIXTURE

CAUTION: Large blocks requiring removal of wear pads, lift directly from the block bank surface, DO NOT USE the 502-1-95 block handler assembly on these blocks.

The normal operation procedure on smaller V blocks is to first attach the block handler assembly on to the block making sure the cam lifters are COMPLETELY engaged and that the lift hook is approximately centered in block lengthwise. Place the 502-1-82F locator bar assembly through the main bearings and hoist the block into the fixture, using the locator bar handle upright to help guide the locator bar into place. Pulling the block towards you, with the locator bar against the guides, will prevent jamming in the slot of the guides during loading and unloading operation. After locator is engaged in guides - pivot block outwards as you lower it.

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, or can be caused by failure to remove a main bearing insert. Locator has a relief for blocks with small main bearing or seal. Use upper switch on control tower to activate locator bar clamp fingers.

Depress the valve button in the tube tower and push back into bore position. There is a guide block (502-1-45G/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 while depressing the valve button. Lift the block out with the block handler, turn the block 180 degrees and reload to duplicate the operation on the other bank. Use upper switch on control tower to release locator bar clamp fingers.

For safety, the air float will also cease when the fixture is at it's outer limit of travel, when on the 502-1-21C wear pads.

Use lift hook 502-1-103 to lift V6/V8 fixture from main base.

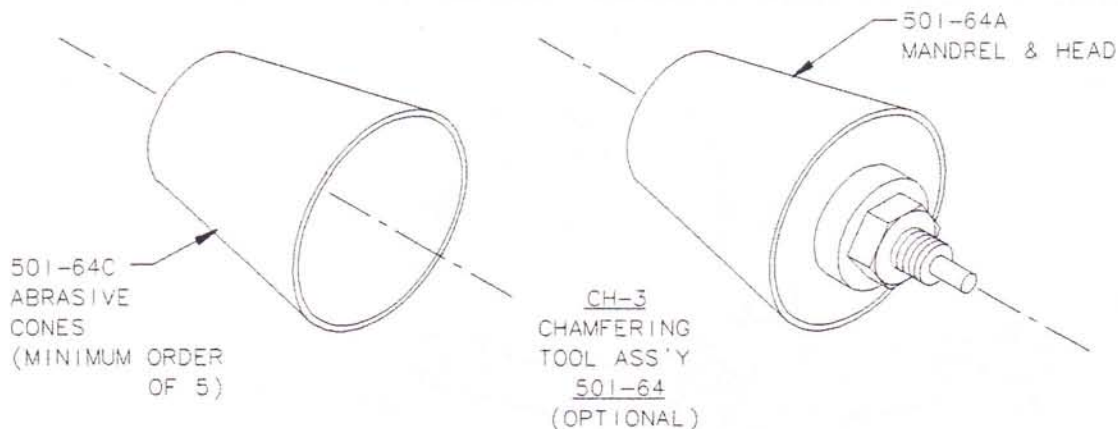
BORING LARGE TRUCK BLOCK

The F4EB 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 (502-1-21C) and place the block directly on the main base (502-8-2E). The blocks are then bored according to the instructions.

CHAMFERING

A special tool is available for chamfering. Tool may be set by either inserting in the head and approximately setting or placing in a micrometer and set approximately .100 over the bore size. Chamfering can be done either by using slow feed and releasing when adequate chamfer has been developed or by use of the hand feed.

Chamfering may also be simply done most effectively when an optional model CH-3 abrasive tool driven by a drill motor. This method will not require boring bar and develops a smooth burr free entry for 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.

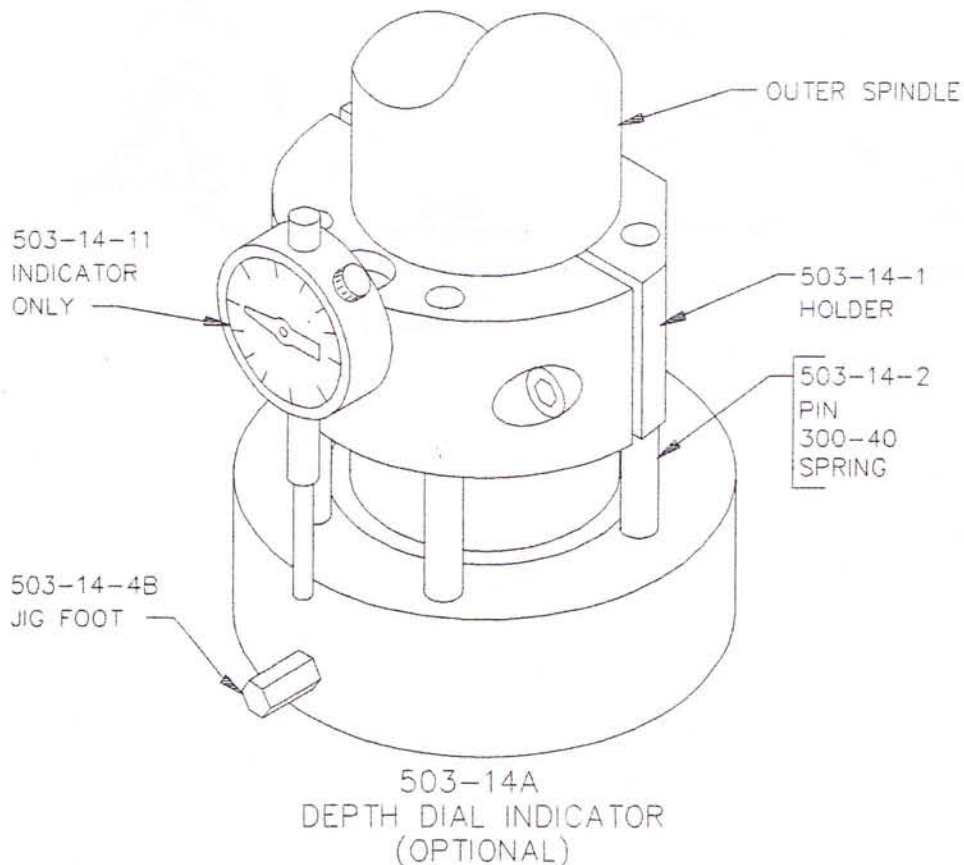
UPPER AND LOWER DECK REPAIR OF DIESEL CYLINDER BLOCKS

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. Counter bore is exactly square with the concentric upper and lower deck bore fit diameters.

Counterboring may be best accomplished by the use of an optional 1" travel dial indicator assembly, 503-14A



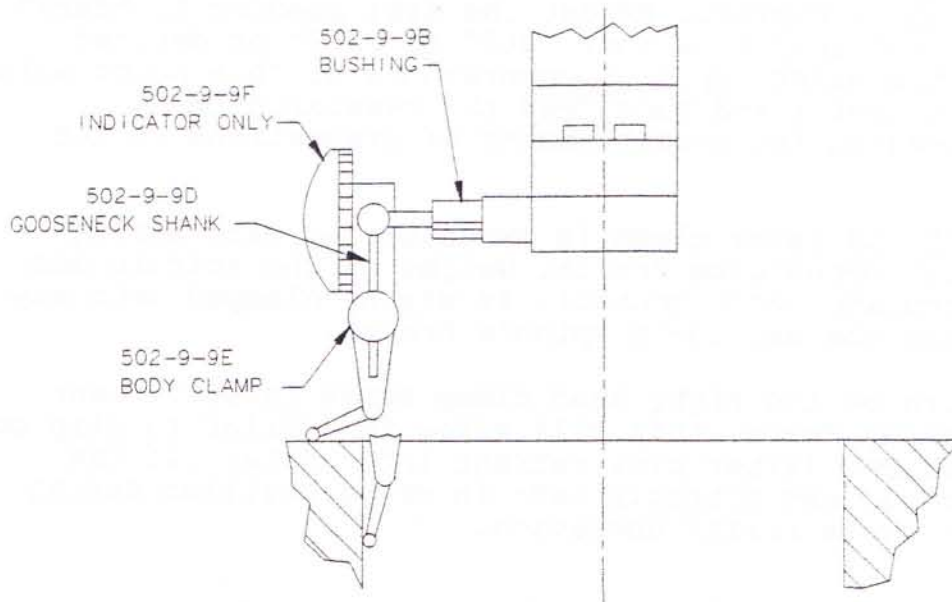
Counterboring con't

To counterbore to a close tolerance depth, carefully hand feed the RF type cutter 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 column, (after pins retract into collar), if the collar is inadvertently left in wrong position during normal cycle boring operation.

INSTRUCTIONS FOR USE OF OPTIONAL
MECHANICAL DIAL RUN-OUT INDICATOR (#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.

Instructions for Use of Optional Mechanical Dial
Run-out Indicator con't

Turn the spindle, and the indicator now will read the total run-out. This will be exactly double the distance 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 portion 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.

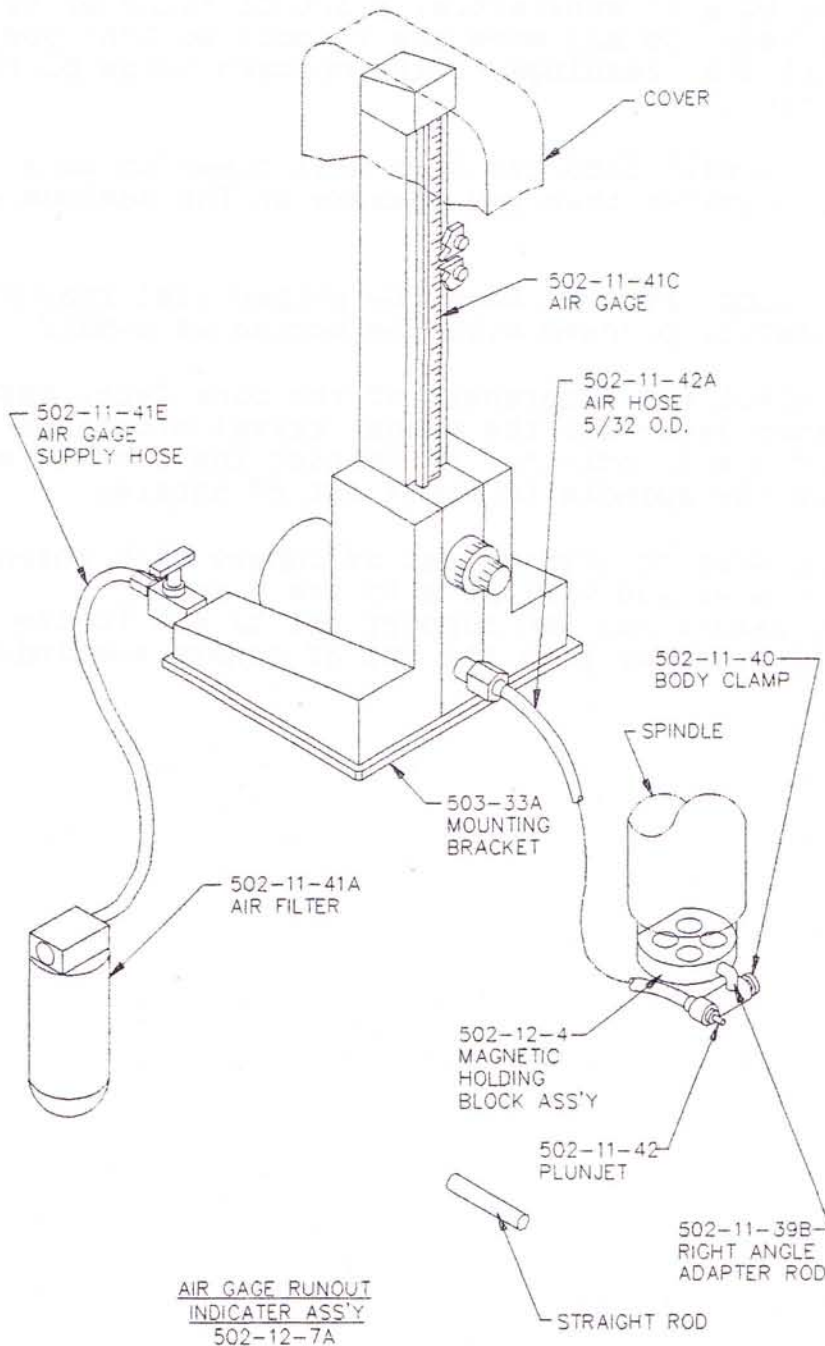
If you wish to check the squareness of the bore face, reset the dial indicator lever for the proper travel direction and adjust the spindle and indicator to contact the surface above the bore. Rotate the spindle to check out of square.

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.

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



OPTIONAL DIESEL 'V' BLOCK FIXTURE ASSEMBLY
OPERATING INSTRUCTIONS

MOUNTING OF FIXTURE-

Thread the three socket head capscrews 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 all three cap screws.

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 'Vs' of the yoke. 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.

Locate and actuate the block clamps. Use max. clamp force on sleeve cuts only.

BLOCK ALIGNMENT

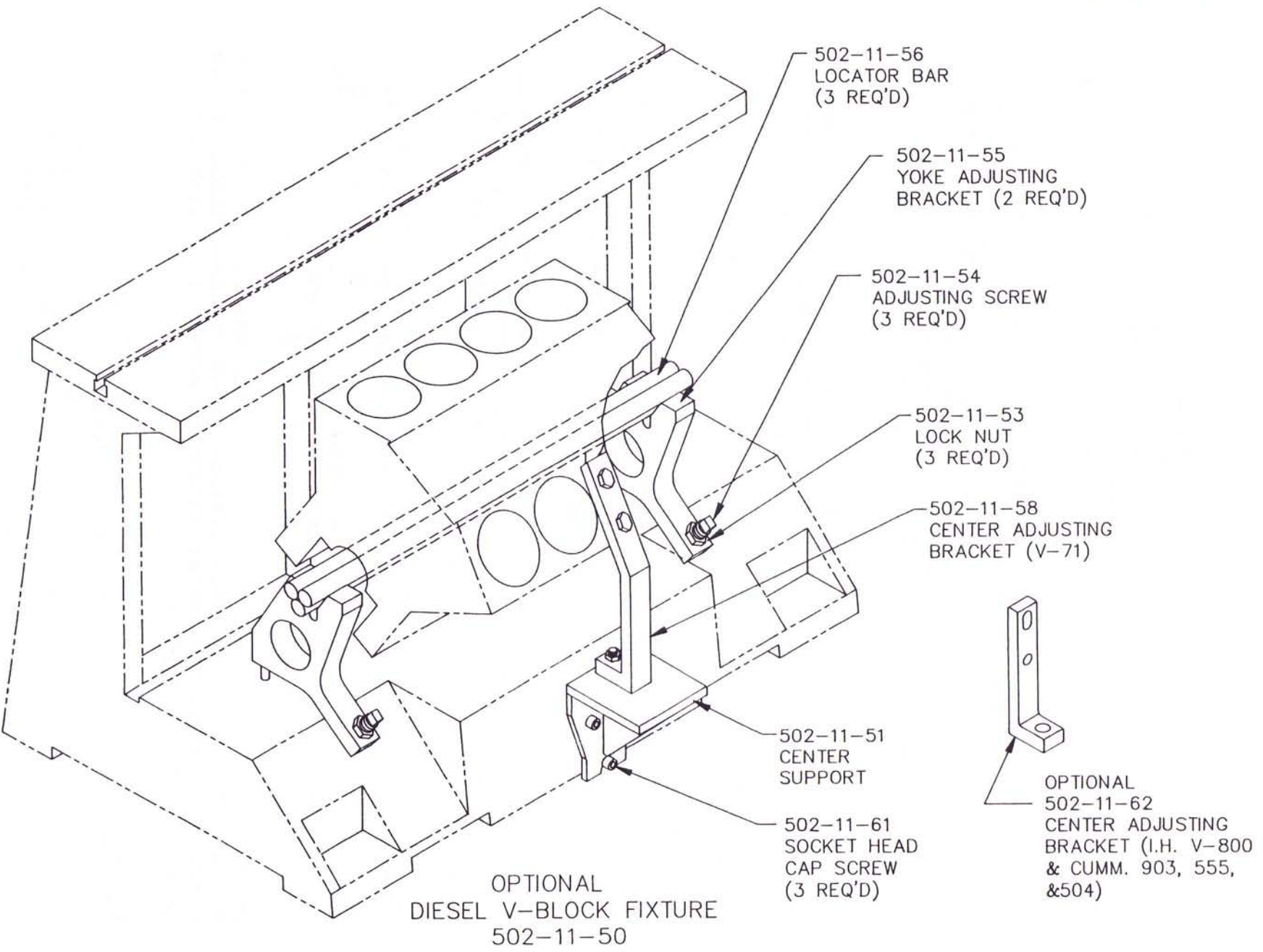
Diesel block with head held sleeves must be aligned so that the cylinder counter bores are parallel to the head mounting surface. Cylinder bores must also be held perpendicular to this same surface within close limits.

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 adjusting.

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 bore area.



OPTIONAL
OPERATING INSTRUCTIONS
FOR F4EB SPINDLE WHEN USED ON
BLOCK MOUNTING ADAPTER #502-8-60

To utilize the F4EB spindle for off base boring you must place the block, you are going to work on, close enough to the boring machine base, so that the wiring air harness will not be twisted or stretched when boring bar is in use.

CLAMPING

Assemble hold down assembly by first selecting the proper length stud required. Screw stud into both the adjusting tube and the clevis. Lock stud to clevis with lock nut. In general the short 5-3/4" stud will accommodate a main bearing to top of block height of 6-1/2" to 11-1/2". These studs increase in length of 3" increments.

CAUTION: Make sure that the adjusting tube and the stud are threaded in at least 1/2".

Place subplate on the block next to the hole you are going to bore. Lower hold down assembly through subplate and block.

Insert main bearing bar through the main bearing bores of block and through clevis. Insert sufficiently far so that the bar rests on the main bearing bores on both sides of clevis.

Rotate adjusting tube finger tight.

CAUTION: Turn off safety toggle switch at rear of spindle unit, before moving spindle.

Attach lift eye to top of feed screw. Remove cover to spindle clamp arms on rear of belt case. Remove cotter pin, nut, and washer from stud of roller key assembly. Carefully lift spindle unit off of stud and place over adjusting tube and subplate.

NOTE: Do not twist or stretch wiring harness.

Place bolt with washer through spindle clamp arm and thread into adjusting tube (finger tight).

Center subplate and spindle over the hole you are going to bore.

Insert rod (502-9-59) into adjusting tube. Tighten adjusting tube.

NOTE: Subplate must be clamped to block with no play in hold down assembly.

Turn on safety toggle switch of spindle unit. Turn clamp switch to float. Move spindle unit back and forth on subplate

and adjust bolt so that it does not bind with the clamp arm of the spindle.

NOTE: Bolt should allow for free movement of spindle unit on subplate, but because of the limited movement of spindle clamp arm, and the necessity of having sufficient clamp pressure, no clearance above $1/32$ " can be allowed between the bolt and the arm.

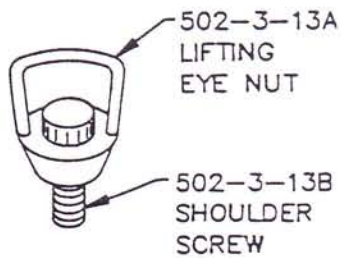
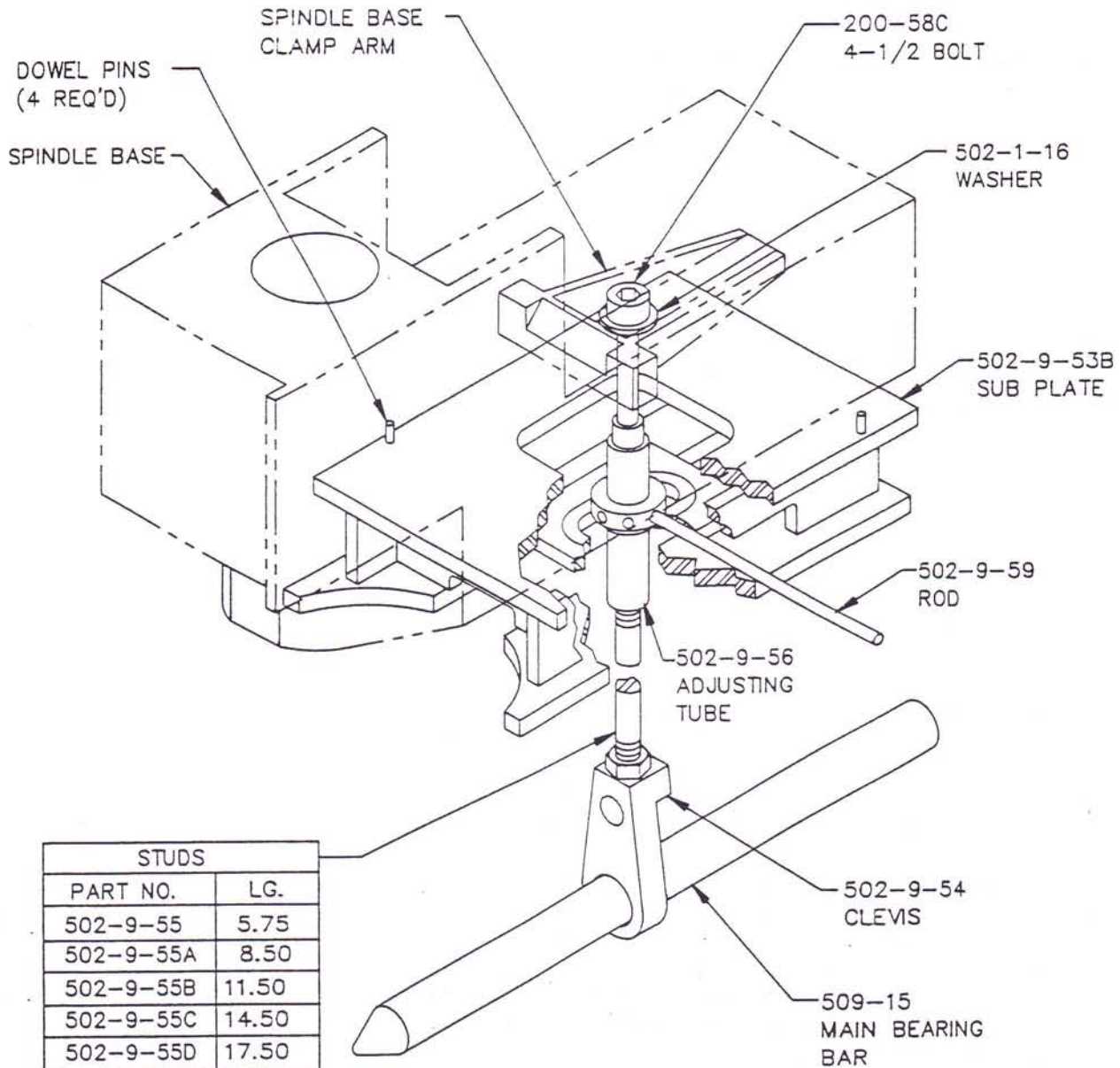
CAUTION: Remove lifting eye before turning on spindle unit, so that the eye does not get entangled in the hook.

Check to see if spindle is in center of hole you wish to bore and has free movement in all directions for center (check dowel pin on subplate for clearance).

Turn clamp switch to clamp and run spindle down for centering.

Proceed with standard centering and boring procedure.

Adapter F4EB Block Mounting
502-8-60 Optional



DEPTHS OF CUT

Proper cutting speeds are arranged so that the high speed range will rapidly take cuts up to .040" on diameter - up to 4" diameters.

Cuts that are taken over this size should be run on low spindle speed to prevent excessive tool wear. Heavier cuts up to .200" on diameter may be taken on low speed.

STUB BORING BAR

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

TOOL BIT SHARPENING

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 SJ4 sharpening unit and sharpen bits on the small diamond wheel 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 a grinding wheel.

If a considerable amount of production is anticipated with your F4EB machine, we would recommend locating a silicon carbide or green grit type of abrasive grinding wheel on a closely located bench, so operator may conveniently 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 convenient 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 tip should be occasionally dressed back .020 to .025.

CAUTION: See page 34 for tool sharpening requirement.

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.

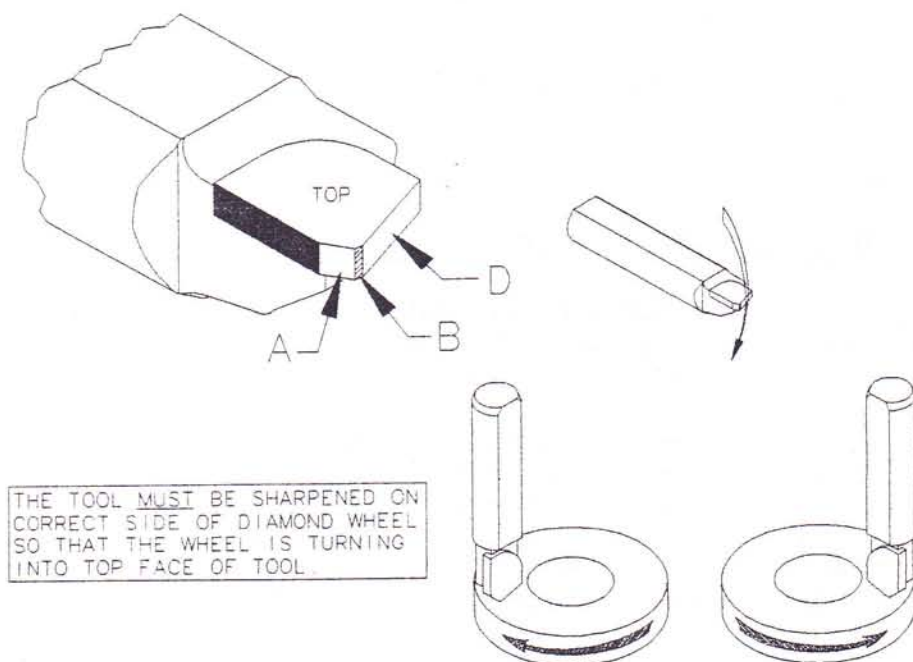
In the event your bar chatters or bores a rough finish at the bottom of the cylinder, it is very probable the "B" land is too wide.

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.



CAUTION: Do not attempt to dress or sharpen the top of the tool bit. Grind or dress the front and sides only.

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.

Three grades of 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.

R4 Square Insert: A coated carbide insert for light oversize cuts only at 500 ft. per min or higher.

CENTERING FINGERS

CHANGING OR INSTALLATION OF CENTERING FINGERS

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 taken out by simply rotating the centering knob clock-wise until fingers can be removed. When they are replaced or reset in the cutter head, they should be replaced in the respective numbered slots and the centering knob first rotated clock-wise and then counter clock-wise to insure that fingers enter pinion teeth simultaneously.

CENTER ACCURACY CHECK

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

Periodically check the centering fingers by boring a hole and then without unclamping the spindle unit, extend the centering 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 by rotating them back and forth in this test bore while holding the fingers against the wall. If this does not quickly bring contact and pressure to all the fingers, it will be necessary to dress carefully the high finger or fingers with a file and repeat the lapping process.

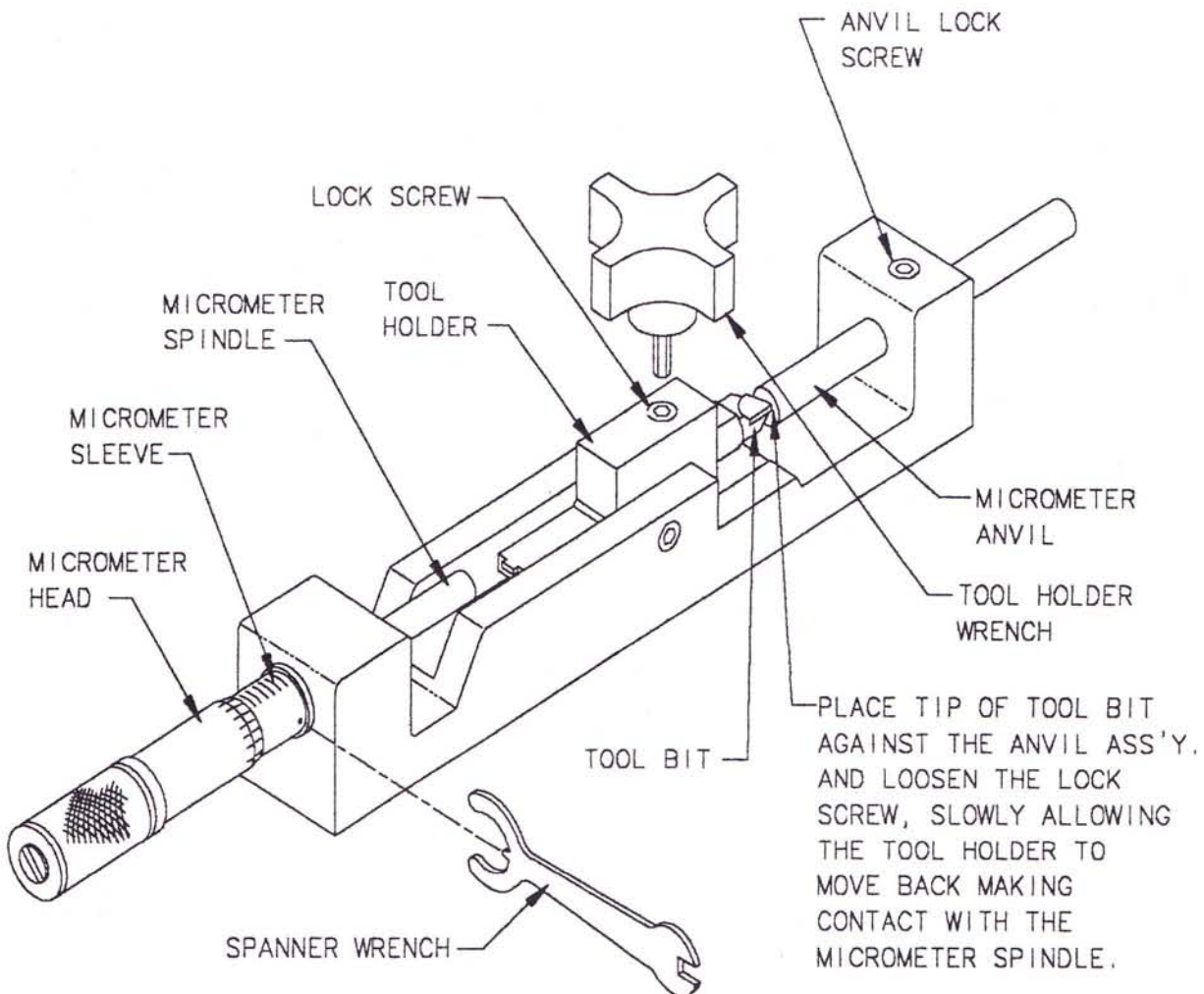
MICROMETER

Your boring micrometer, as with any other measuring tool, should be used delicately and with care to be assured of the greatest accuracy. Particular attention should be paid to inserting the tool in the micrometer without allowing tool bit to snap into micrometer anvil. Care should be used in the method of lightly locking the tool bit before tightening.

After a period of use you will note that the tool bit tip will force a depression in the micrometer anvil. This, of course, will result in the inconsistent sizes, particularly after resharpening the bit. Periodically we would recommend turning the anvil slightly and finally end for end so that a flat surface is exposed to the tool bit tip.

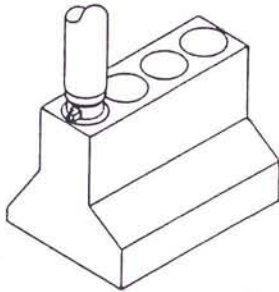
CALIBRATING MICROMETER

1. Bore a hole.
2. Remove tool holder and bit and place in micrometer.
3. Adjust micrometer so that it reads the same size as the hole you have bored. Small variations may be made by turning the micrometer with spanner wrench provided. Larger changes should be made by moving the anvil.

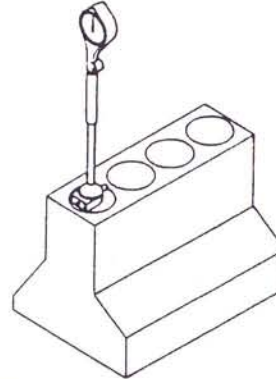


PROCEDURE FOR CALIBRATING MICROMETER

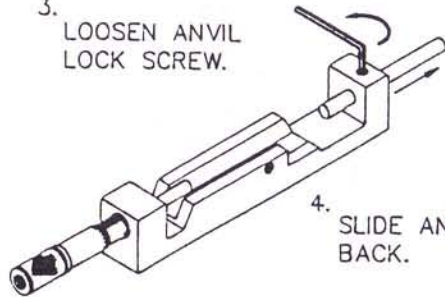
1. USE THE BORING MACHINE TO BORE A HOLE IN A SCRAP BLOCK. WITHOUT CHANGING ANY SIZE SETTING REMOVE TOOL HOLDER.



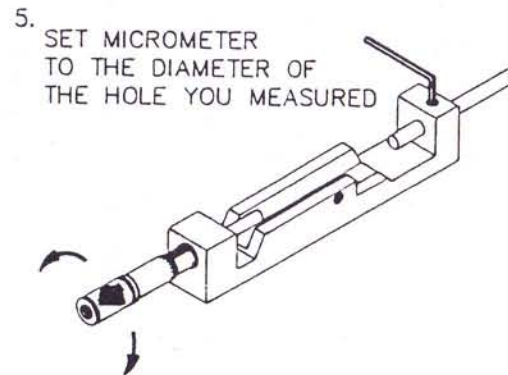
2. MEASURE THE HOLE THAT YOU BORED.



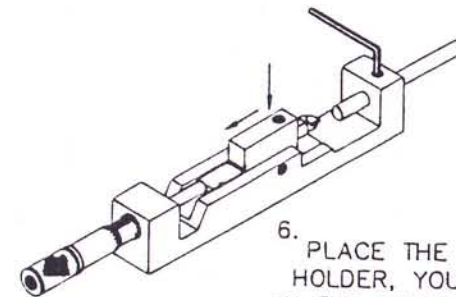
3. LOOSEN ANVIL LOCK SCREW.



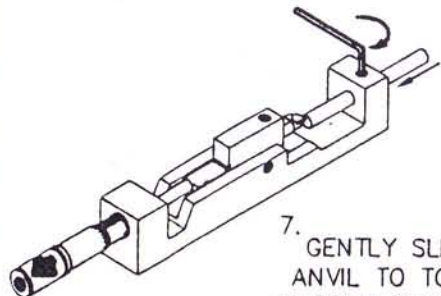
4. SLIDE ANVIL BACK.



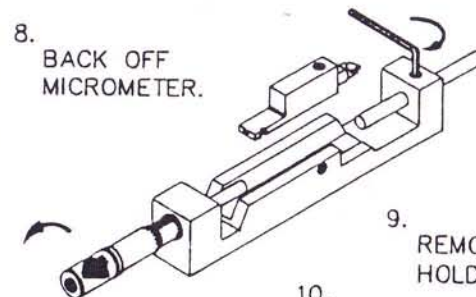
5. SET MICROMETER TO THE DIAMETER OF THE HOLE YOU MEASURED



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

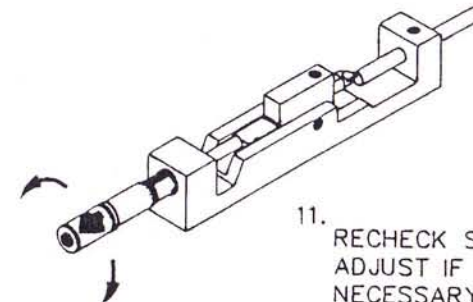


7. GENTLY SLIDE ANVIL TO TOUCH CUTTING CHIP. AND LIGHTLY TIGHTEN LOCK SCREW.



8. BACK OFF MICROMETER.

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



11. RECHECK SIZE. ADJUST IF NECESSARY.

I M P O R T A N T
M A I N T E N A N C E

LUBRICATION

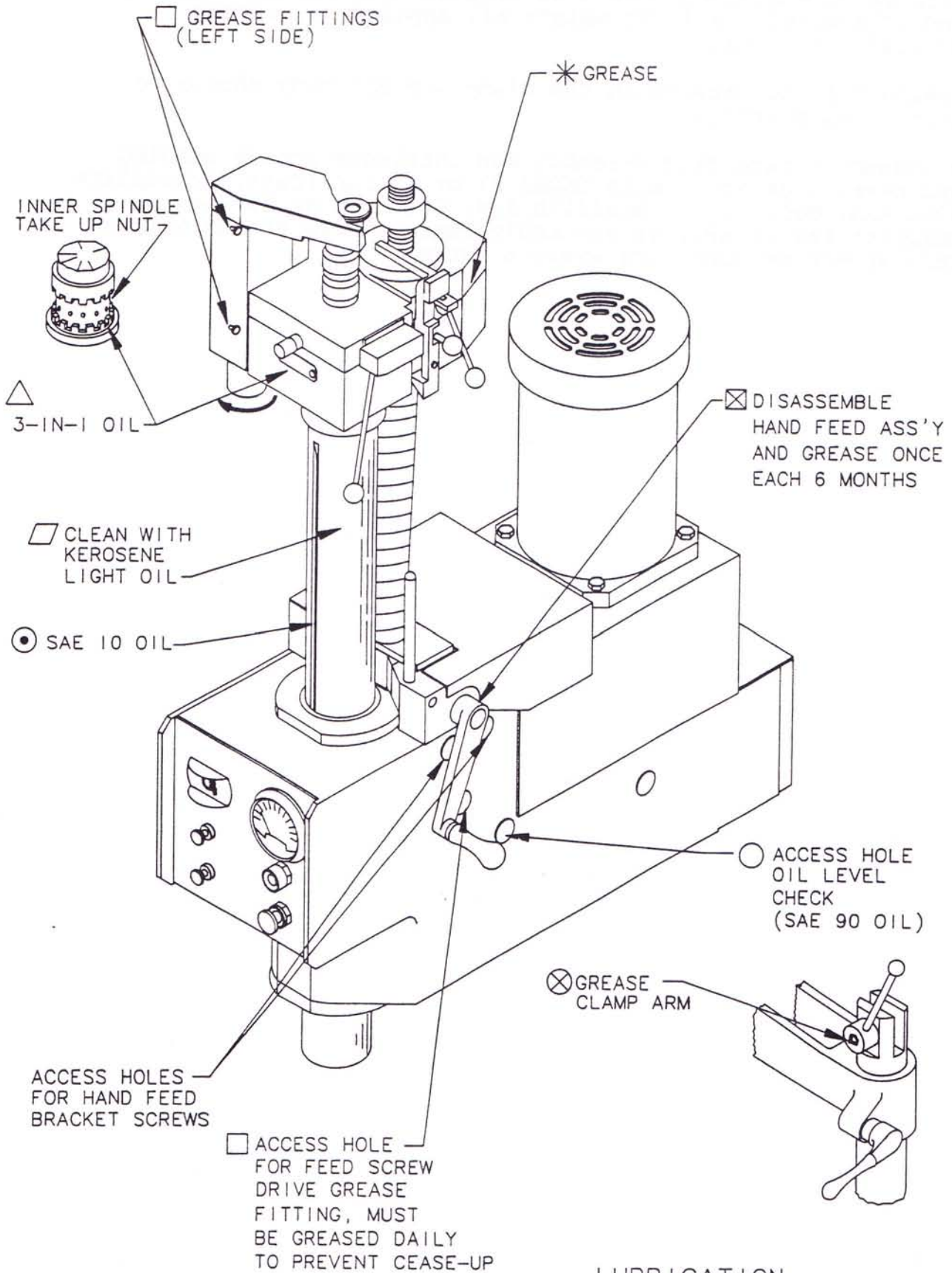
F STYLE

- * The F style Upper Housing Unit should be repacked with mixture of 4 parts grease to 1 part oil. For grease use Union Oil - UNOBA F1 or F2 lube, Mobil oil - Mobilith A.W. Grades 1 or 2, Chevron Durolith 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. Repack approximately every 25,000 boring cycles. When this grease is changed, the Upper Housing Lid should be removed and the original lubricant entirely removed.
- △ The Upper Housing Spindle Drive Gear Bearing should be lubricated MONTHLY, by adding a few drops of three and one oil, or Union Oil - Union 75, or a very light spindle or sewing machine oil (less than S.A.E. 5) to the bearing. Add by removing the small cover on the front of the Upper Housing and add lubricant to take up nut area between the clutching teeth.
- The lower gear box oil level should be checked MONTHLY. Check by removing 7/8" diameter snap plug and pipe plug on the right side of the spindle base, oil level should be just up to the bottom of this hole (see illustration).
- CAUTION: When adding oil for refilling, DO NOT OVER FILL.
- Change this gear lubricant every 40,000 boring cycles. Use Union SAE 90 Multipurpose gear lubricant or any equivalent SAE 90 gear lubricant.
- If your F style machine is operated on a continuous basis, grease fittings at the top of the Spindle Unit and at the bottom of Feed Screw Drive, should be lightly lubricated daily, or less often if the machine is not used continuously. Lubricate with UNOBA F1 or F2 lubricant, Lubriplate #9930AAA, Mobil oil - Mobilith A.W. Grades 1 or 2, Chevron Durolith EP1 or EP2, or any equivalent Lithium Barium Grease.
- Two or three drops of Union Oil - 315 Turbine Oil, or Union Oil 315 Klondyke Oil, or any SAE 10 Oil (nondetergent Motor Oil) can be added weekly to the hole in the key way in the Main Spindle to insure fluidity of Main Spindle Bearing lubricant. Note: If all the oil is removed from the Spindle, add approximately 1 pint of the same SAE 10 oil, through the hole in the key way.

Lubrication, F Style con't

- Main Spindle surface should be cleaned with Kerosene weekly and occasionally a light weight oil applied to prevent excessive dryness.
- Grease fitting located on the clamp arm cam body should be lubricated monthly.
- Disassemble hand feed assembly and lubricate bronze bushing and bevel gear shaft with UNOBA F1 or F2 lubricant, Lubriplate #930 AAA, Mobil Oil - Mobilith A.W. Grades 1 or 2, Chevron Duroolith EP1 or EP2, or any equivalent Lithium Barium Grease. This should be done once every 6 months.

4VB-1B



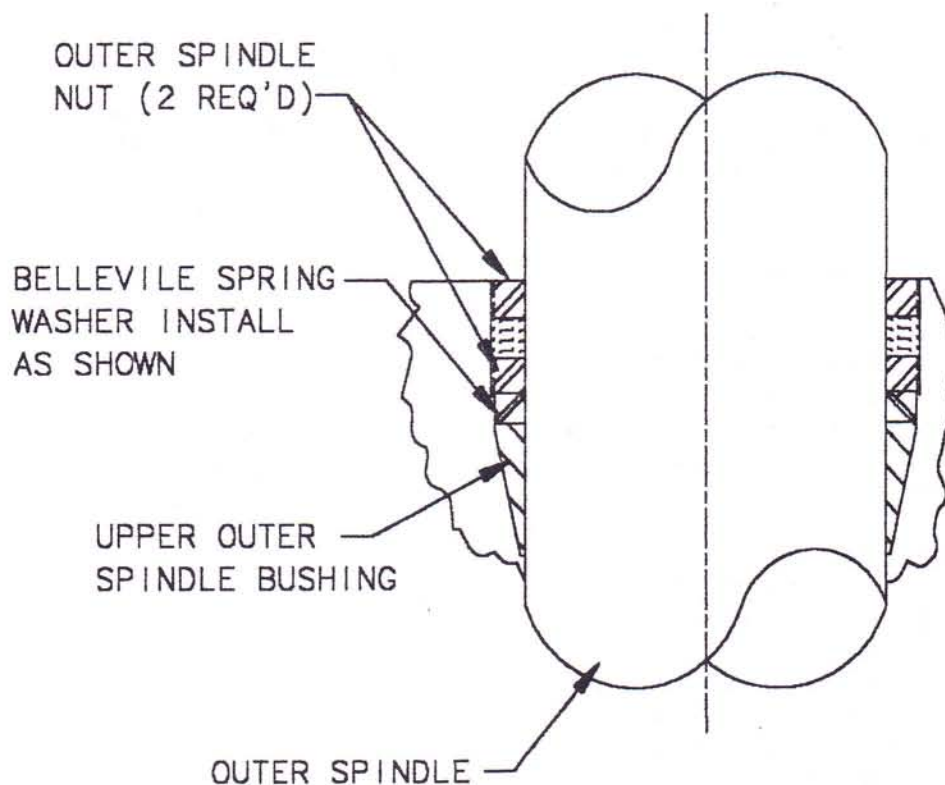
LUBRICATION

ADJUSTMENT OF OUTER SPINDLE

Main spindle bearings are tapered split cast iron rings held in seat by the adjustment nut. Tension on the bearings is normally adequate requiring no adjustment for many boring cycles.

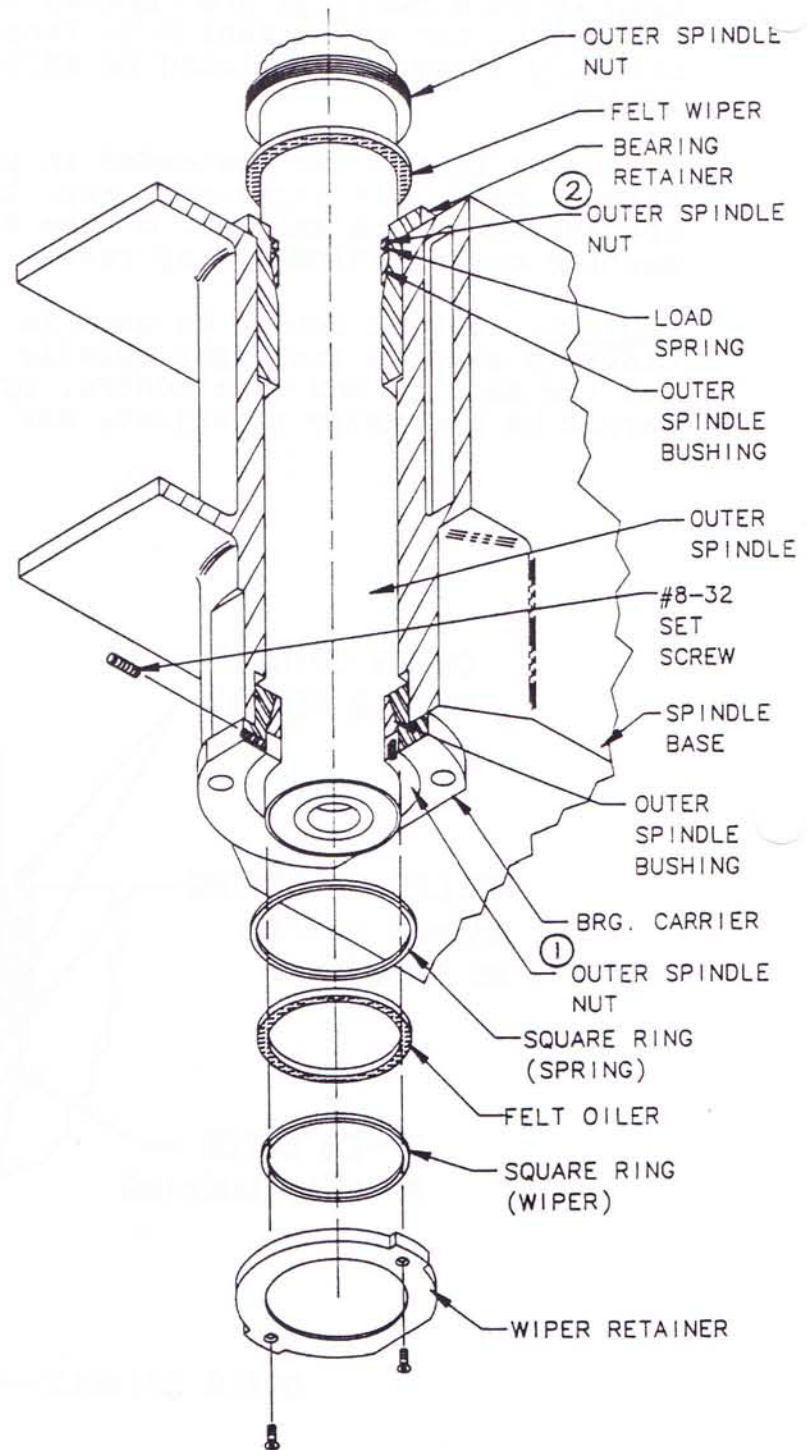
The upper bearing is preloaded in place by a Belleville spring washer, below the adjustment nut. This adjustment should be checked after the shipment of the machine, since shock to the machine during shipment may result in some set of the spring.

CAUTION: Caution should be used in adjusting these bearings in order to avoid a too tight spindle which only serves to wear out the machine and make control operation difficult. If it should be necessary to adjust, see next page.



VITAL OUTER SPINDLE ADJUSTMENT

1. Run spindle down approx. 4" to 6" loosen the #8-32 screw & loosen all outer spindle nuts (503-18 & 502-35-55)
2. Tighten the lower bushing (502-35-54) by tightening the outer spindle nut marked ①, until 10 to 15 lbs. of effort is required to operate the hand feed handle. Lightly tighten #8-32 set screw.
3. Repeat this sequence (2) on the upper bushing, by tightening the outer spindle nut marked ②, take care that the hand feed operates only slightly tighter or 15 to 20 lbs. of effort is required to operate feed handle.
4. Traverse the bar at all points of travel and make sure the hand feed works easily. Spindles are ground slightly tapered to secure max. rigidity at lower limits of travel.
5. Spindle adjustment may also be checked by hand feeding the spindle down and pulling the slack out of feed mechanism by pulling down the upper gear housing. Pressure required at tightest point is indicated in chart below.



STYLE MACH.	PRESSURE REQUIRED
F -4 E B	60 - 80 LBS

Vital Outer Spindle Adjustment con't

In order to recheck the friction on the spindle it is necessary to crank down again to create backlash.

6. Avoid excessive tension on upper outer spindle nut 2 otherwise tool bit dragback marks will appear in bore.
7. Excessive tightening of the outer spindle nuts will cause strain on feed gears and cause spindle to have an audible, excess resistance.

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.

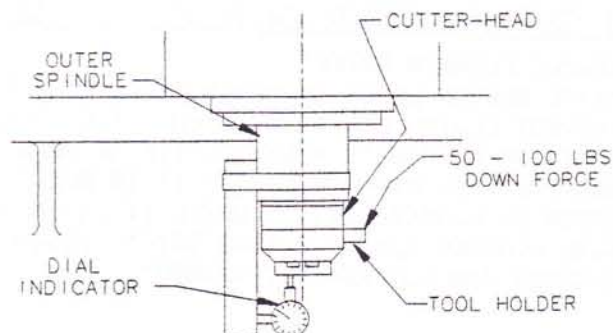
The bearings are correctly adjusted when a down force of 50 to 100 lbs. on the inner spindle will move the inner spindle .0002 to .0007 out of the outer spindle, SEE ILLUSTRATION

ADJUSTMENT

1. Remove two screws and small cover on the front side of the upper housing.
2. Remove the stop screw restricting the up travel of the spindle clutch lever and move the lever to full up position (See detail J). Rotate the spindle approximately 1/2 turn away from the detent spring. Position the tool holder slot to the rear.
3. Insert a pin (diameter .180 or less) in one of the holes provided in the O.D. of the take up nut. (See Inner Spindle Nut). 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 to 1-1/2 notches. Check for the .0002 to .0007 movement as stated before.

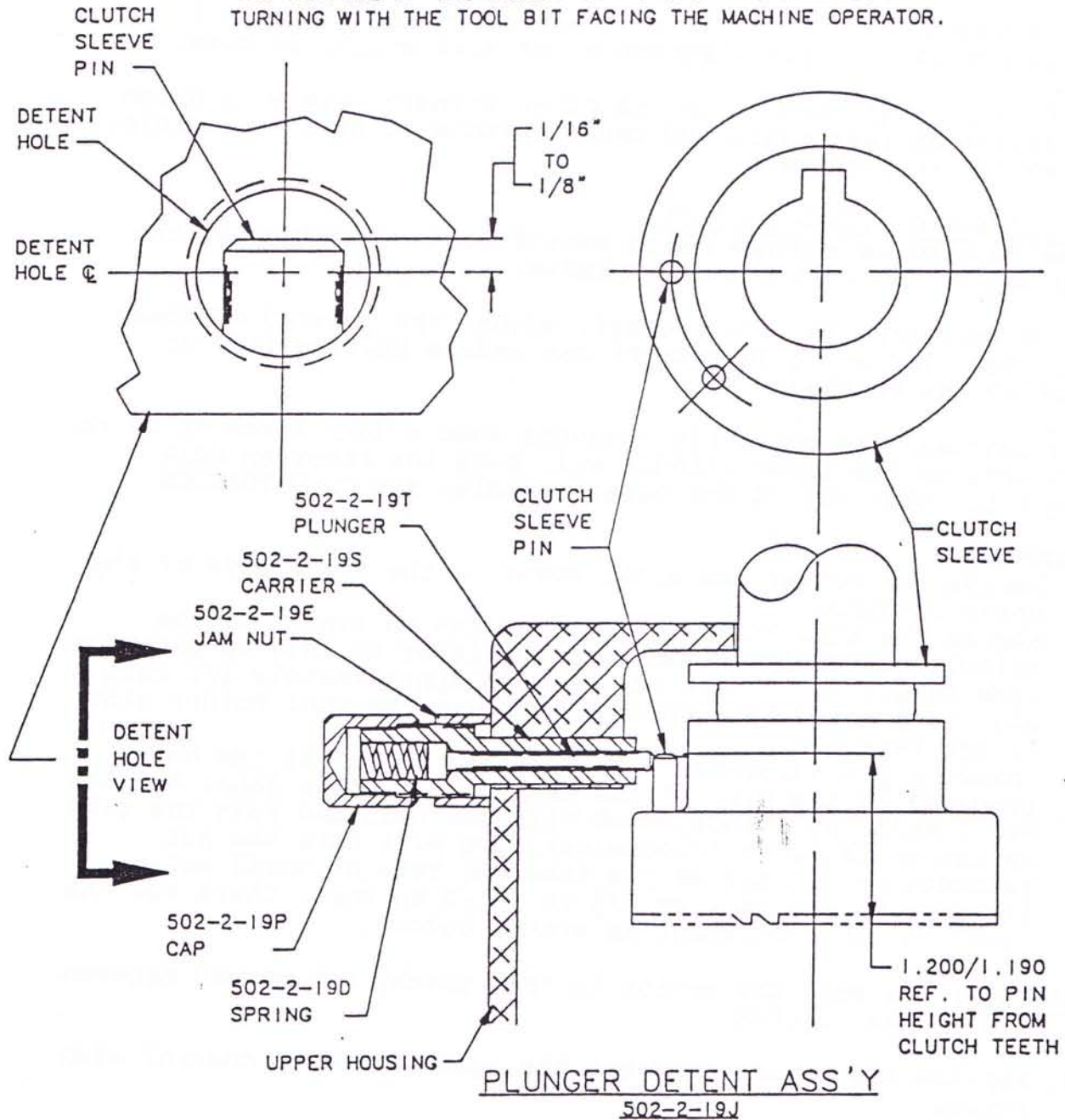
CAUTION: Be sure the detent is in a notch, not midway between the notches.

4. Replace the cover. Readjust the spindle clutch control stop screw.



SPINDLE STOP DETENT ADJUSTMENT

THE PURPOSE OF THE DETENT IS TO STOP THE SPINDLE FROM TURNING WITH THE TOOL BIT FACING THE MACHINE OPERATOR.



TO SET PLUNGER DETENT IN POSTION

- (1) REMOVE PLUNGER DETENT
- (2) RAISE CLUTCH LEVER TO UPPER DETENT POSITION.
- (3) INSPECT CLUTCH PIN THRU DETENT HOLE TO BE SURE TOP OF PIN IS ABOVE CENTER OF HOLE (SEE ABOVE VIEW). REPLACE PIN IF IT IS BELOW ϕ
- (4) SCREW IN PLUNGER DETENT UNTIL IT TOUCHES PIN.
- (5) TURN PLUNGER $3/4$ TO 1 TURN BEYOND TOUCH POSITION.
- (6) TIGHTEN JAM NUT AGAINST GEARBOX.

UPPER HOUSING BACK FEED ADJUSTMENT

TO ADJUST THE FEED SCREW PLAY IN THE UPPER HOUSING:

First loosen and back off approximately 1/16" the three round head screws around the feed screw, in the upper housing. Then loosen the three adjusting screw lock nuts, then adjusting screws.

Alternating between each screw, turn the adjusting screws, evenly in, until you have compressed the spring washer, (all screws must be turned in the same amount).

NOTE: A light touch is required in adjusting this bearing clearance. Spring should be flat, but no pressure above that which is required to flatten spring, should be used.

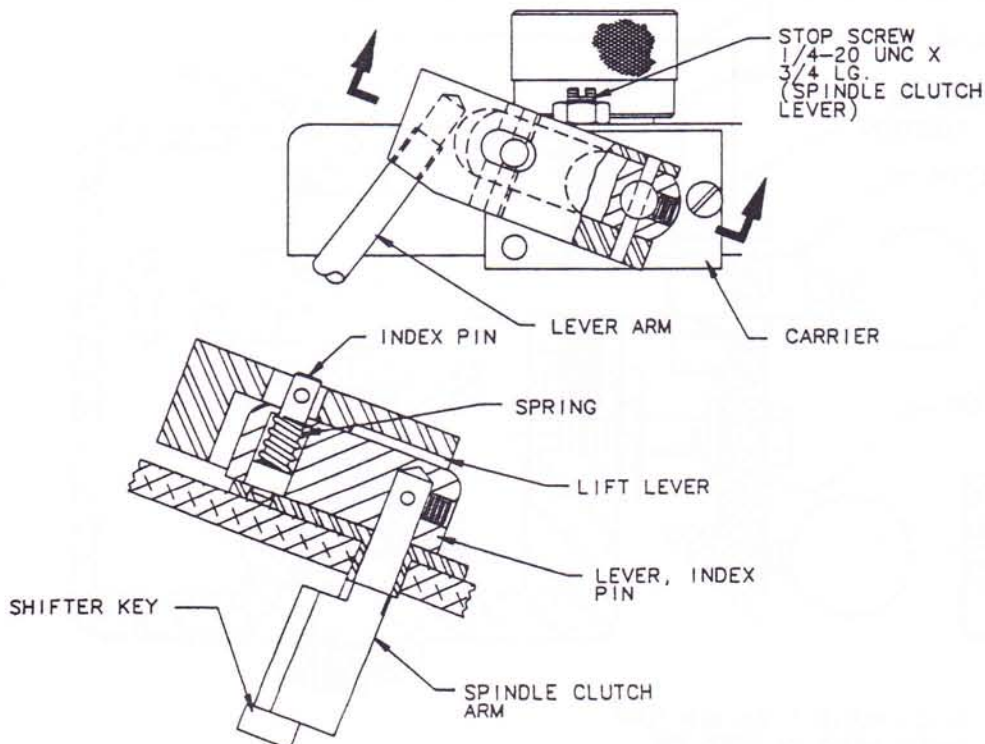
Turn adjusting screw back 1/3 turn to allow for running clearance. Hold adjusting screw with an allen wrench and lock them with lock nut.

Run motor with lower gear box engaged, so that the feed screw is turning, to center bearing retainer. Turn off motor, tighten evenly the three upper round head screws.

SPINDLE CLUTCH CONTROL LEVER ADJUSTMENT

To re-adjust the spindle control lever, first loosen the stop screw lock nut, then the stop screw.

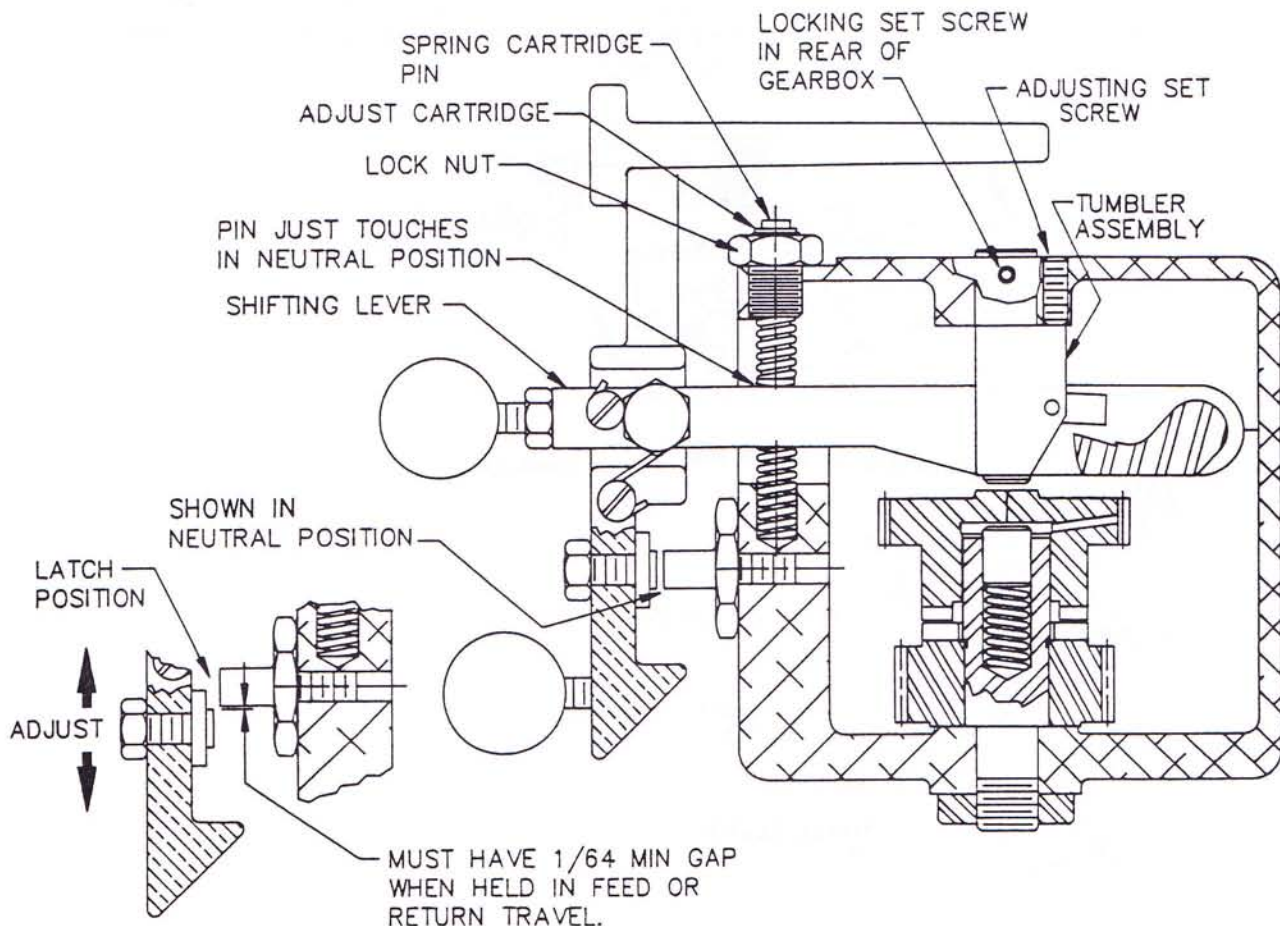
Raise the control lever to its neutral (up) position (detent pin engaged) adjust the stop screw so that the lever will not go any higher, lock with the lock nut.



RAPID RETURN ADJUSTMENT

If the boring machine should ever fail or hesitate to return to the top of travel when shift lever is lifted and latched, the following procedure may be used to adjust return traverse clutches.

1. Run boring spindle down approximately 6" or more.
2. Loosen horizontal locking set screw at top and back of upper housing. (See below)
3. Find neutral position of shifting lever by rotating feed screw, while engaging fast down lever. Neutral position must have fast down lever fully engaged with fast down pin at full depth in 500-1 clutch sleeve gear.
4. Pin in spring cartridge assembly should just touch shift lever, when shift lever is in neutral. Adjust by loosening lock nut and turning cartridge.
5. Adjust tumbler shaft so that clutches do not chatter when shift lever is in neutral. Clutches should start to ratchet as the pin in the spring cartridge is raised approximately $1/32"$, when lifting the shifting lever. If clutches ratchet after the pin is raised more than $1/32"$ reset tumbler lower, by turning vertical set screw inward, which will result in a deeper engagement of clutches. If clutches ratchet in neutral or before pin is raised $1/32"$ reset tumbler higher, by first backing off the vertical set screw in the top of the housing, then force the tumbler up with the shift lever.
6. Tighten locking set screw to relock shaft. Check to see that adjustment has not been changed by the locking set screw.



Belt Replacement and Adjustment

Belt Removal and replacement

CAUTION: Disconnect all power before proceeding.

Open side cover by loosening knob and rotate side cover out of the way. Unlock motor adjusting plate and pivot motor all the way forward. Slip belt off one pulley, then off the other pulley. Reassembly is the reverse of the removal.

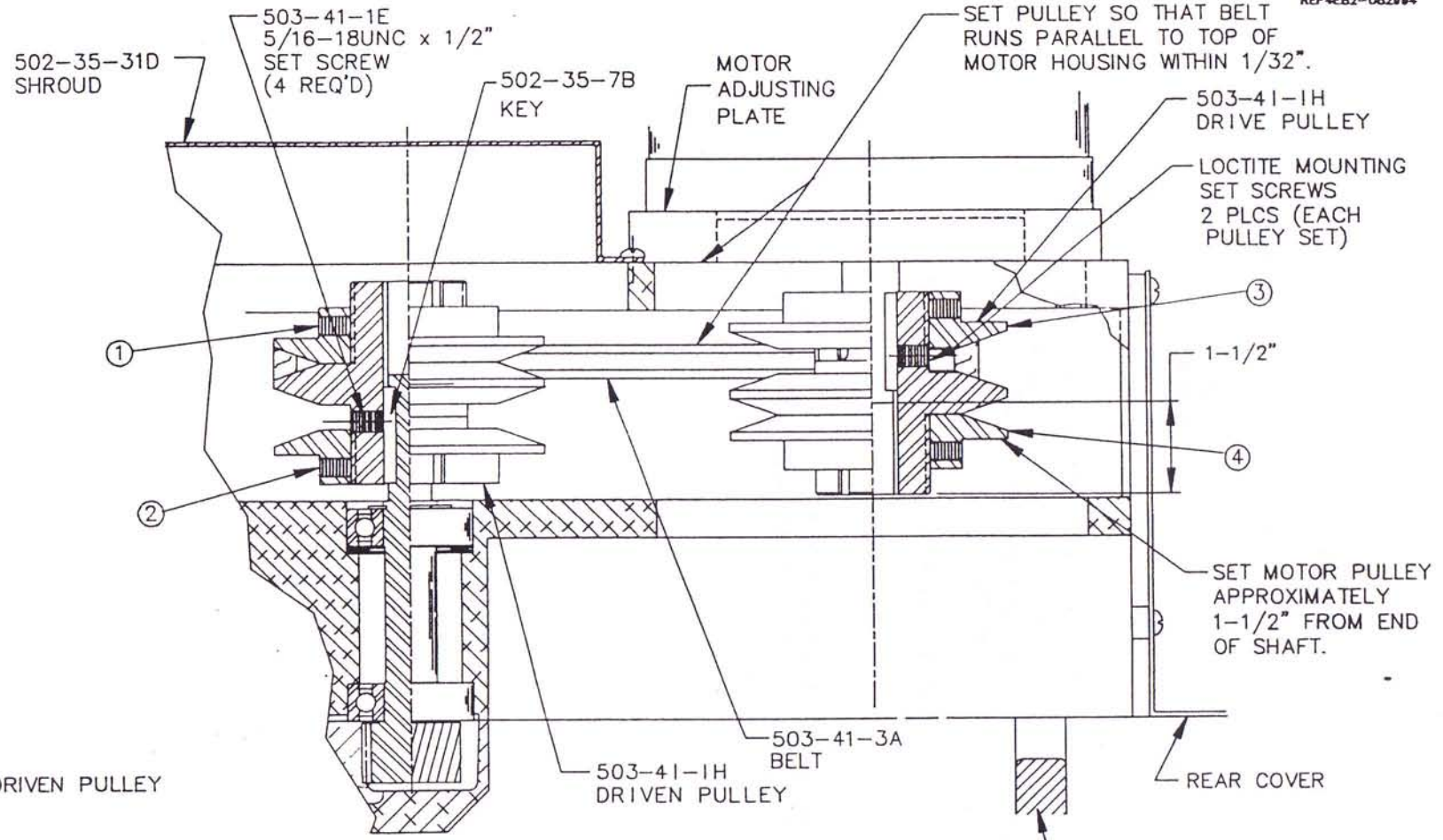
Check Belt Alignment

Rotate the pulleys and see if the belt runs parallel (within $1/32$) to the top surface of the motor gear housing, or main base upper deck. Adjust one of the pulleys if not correct by loosening (2) set screws in the pulley.

NOTE: If case vibrates severely check belt alignment.

Belt Tension

The drive belt should have approximately $1/4$ " of play when tightened. If the belt is too tight it will create noise, if too loose, the belt will slip.



DRIVE AND DRIVEN PULLEY SET UP

1. TIGHTEN THE TOP HALF OF THE PULLEY UNTIL IT TOUCHES THE MIDDLE SECTION. TURN BACK UNTIL A SET SCREW HOLE LINES UP, WITH ONE OF THE FLATS, ON THE THREADS. LOCTITE THE TWO SET SCREWS, INSTALL AND TIGHTEN.
2. TIGHTEN THE BOTTOM HALF OF THE PULLEY UNTIL IT TOUCHES THE MIDDLE SECTION. TURN BACK APPROXIMATELY 5 TURNS. LINE UP A SET SCREW HOLE, WITH THE NEAREST FLAT, ON THE THREADS. LOCTITE THE TWO SET SCREWS, INSTALL AND TIGHTEN.

3. TIGHTEN THE TOP HALF OF THE PULLEY UNTIL IT TOUCHES THE MIDDLE SECTION. TURN BACK 5 TURNS. LINE UP A SET SCREW HOLE WITH THE NEAREST FLAT, ON THE THREADS. LOCTITE THE TWO SET SCREWS, INSTALL AND TIGHTEN.
4. TIGHTEN THE BOTTOM HALF OF THE PULLEY UNTIL IT TOUCHES THE MIDDLE SECTION. TURN BACK UNTIL A SET SCREW HOLE LINES UP WITH THE NEAREST FLAT, ON THE THREADS. LOCTITE THE TWO SET SCREWS, INSTALL AND TIGHTEN.

CAUTION:
DISCONNECT ALL POWER BEFORE MAKING ADJUSTMENTS

DRIVE BELT ADJUSTMENT
F-4EB

EXCESSIVE LOADS

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

NOTE: If excessive loads are imposed on your boring machine the following occurs.

THRUST OVERLOAD

If an excessive thrust load of approximately 3,000 pounds is imposed on your F4EB machine spindle the threads of the nut (500-41, Section A-A, HAND FEED) will shear. This load could typically occur by either rapid traveling or feeding the spindle into the top of the block. This accident could happen with the spindle either rotating or stationary.

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

DISASSEMBLY NECESSARY FOR REPLACEMENT IS:

1. Remove the shroud (502-35-31D), by removing three round head screws and three rubber grommets. Remove the two snap plugs, in the spindle base, covering the access holes to 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 cover (500-96-7C). Lift the hand feed bracket, along with the cap attached, 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), beneath the bevel pinion. Remove the four countersunk screws and the housing bearing carrier (502-35-13).
2. Raise the assembly, hold in the rapid down lever (502-27-11), while hand rotating the feed screw counter clockwise. This will raise the lower assembly out of the spline. 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 reassemble, 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. To restart, Press the E-stop button and wait 20 seconds for it to reset, then turn the E-stop button and let it pop out to restart.

REMOVAL OF MOTOR ASSEMBLY

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

Loosen and remove clamp handle and rotate motor forward. Remove drive belt. Remove locknut on motor adjusting plate pivot. Lift motor and adjusting plate straight up out of hear housing. Remove drive pulley by loosening (2) set screws in pulley. Adjusting plate can now be removed from motor by removing (4) flat head screws from bottom of plate.

NOTE: To reassemble reverse the above description and read carefully the section on belt installation and adjustment.

DISASSEMBLY OF MOTOR GEAR HOUSING

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

1. REMOVAL OF HAND FEED HOUSING (Section A-A)
Remove the shroud(502-35-31D), by removing it's six round head screws and three rubber grommets.

Remove the two snap plugs in the spindle base, covering the access holes to 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 cover (500-96-7). Lift the hand feed bracket, along with the cap attached, 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), beneath the bevel pinion.

Remove the four countersunk screws and the housing bearing carrier (502-35-13). Lift out feed screw, or if upper housing is still intact, hold in rapid down lever (502-27-11) and rotate feed screw (502-35-13) counter-clockwise until feed screw is clear of motor gear housing.

Disassembly of Motor Gear Housing, con't2. REMOVAL OF FEED SLEEVE AND BEARING (Section A-A)

Remove snap ring (506-10), and press sleeve assembly (502-35-12) off bearing. Back out socket set screw from bronze thrust nut and screw off nut. Bearing may now be removed.

3. REMOVAL OF MOTOR GEAR HOUSING

To remove the motor gear housing, remove the six socket head cap screws attaching the motor gear housing to the spindle base (three screws located on left and three on the right side of motor gear housing).

NOTE: In reassembly, motor gear housing alignment must be checked after screw sleeve is in place before the motor gear housing screws are permanently locked. Use surface plate over feed screw and spindle to establish side to side alignment. In-out alignment must be within .003" and can only be done by measuring.

4. REMOVAL OF DRIVEN PULLEY (Section B-B, Motor Gear Housing)

Assuming motor is already removed, loosen (2) set screws in driven pulley. Slide driven pulley off pinion.

5. MOTOR GEAR HOUSING DISASSEMBLY (Section B-B, Motor Gear Housing)

To disassemble the motor gear housing, remove eight socket head cap screws, and the screw plug located in the middle, bottom of the lower gear box (502-35-8). Remove the retaining ring (6059) from the driven pulley pinion (502-35-7A). Remove the retaining ring (502-10-16) and thrust washer (502-35-9) from the feed screw drive gear (502-35-4). Tap both gear and pinion lightly with mallet and the lower gear box will separate from the motor gear housing.

Pinion shaft (502-35-5) with micarta gear (502-35-6A) may be tapped out through the center hole in the bottom of the lower gear box.

NOTE: If it should become necessary to remove the upper bearings (500-60 or 502-35-14) from the motor gear housing. Be careful not to lose the preload springs located under them, and reassemble with the preload springs stacked in the same manner.

DISASSEMBLY OF UPPER HOUSING
AND SPINDLE REMOVAL

Remove cutter head, centering rod and draw bar, Remove centering housing by removing its four screws. Remove 502-10-11 knob by removing its screw. Note: left hand thread Remove 600-18-2 knob by releasing socket set screw. You may then remove the draw tube. Unscrew the spindle clutch lever stop pin. Raise the lever to the extreme top, which will allow the removal of the countersunk screw, and lever assembly. Remove capscrew to disassemble trip lever 500-35A. Remove 6 screws holding upper housing sections together and lift off the upper lid, 502-9-14C.

Shift lever, 500-38D, with spring may be removed along with 500-25 upper fast return gear with plunger and spring, spindle clutch (and key) 500-3. Remove ball bearing (with take up spring) 500-14, (be sure spring is reassembled properly), sleeve gear, 500-1, feed nut, 500-2, and feed gear 502-10-12A with its thrust washer.

Remove the snap ring 502-10-16 from the two speed feed shafts, upper feed drive gear 502-10-8A, thrust washer 501-21, lower feed drive gear, 502-10-9A, then remove the retainer, 502-9-15, bend lockwasher, now press the feed shaft and gear 502-10-10, out of bearing, 500-74.

If the bar is in a vertical spindle position, we suggest you place something under the spindle nose to prevent inner spindle from falling out and then remove 500-5 spindle nut. Nut can be started off through adjusting access hole and then hand turned. Now drive gear 503-6-1, may be worked off along with 500-4, spacer, woodruff key and two Belleville washers 502-9-72A. Inner spindle may now be removed. Press off tapered roller bearing 502-9-67. When reassembling make sure cone and cup are solidly seated against their shoulders.

NOTE: Do not hit or damage bearing case.

Press off ball bearing 502-9-72B out of outer spindle.

NOTE: Direction of thrust and reassemble the same way.

Hex cap screws in upper housing should be removed and housing may be driven off spindle. Heat on housing will simplify removal of this sweat fit.

Lift off of feed screw.

Nut should be removed from 500-29 shaft and shaft pressed out with gear.

DISASSEMBLY OF UPPER HOUSING & SPINDLE REMOVAL, CON'T

500-7 long gear with radial and thrust bearings may be removed along with oil seal.

NOTE: On reassembly, thrust bearing has one race with a small I.D. which is mounted "UP" in gear housing.

Extreme care should be taken when removing long gear out of seal or seal out of housing. Seal is fragile and garter spring will come out easily. When reassembling, open seal as long gear is pushed in to prevent garter spring from snapping out.

COMMON CAUSES OF TROUBLE

(POOR FINISH, INACCURATE HOLES, EXCESSIVE TOOL BIT HEAT, EXCESSIVE TOOL DRAG LINES, ETC.)

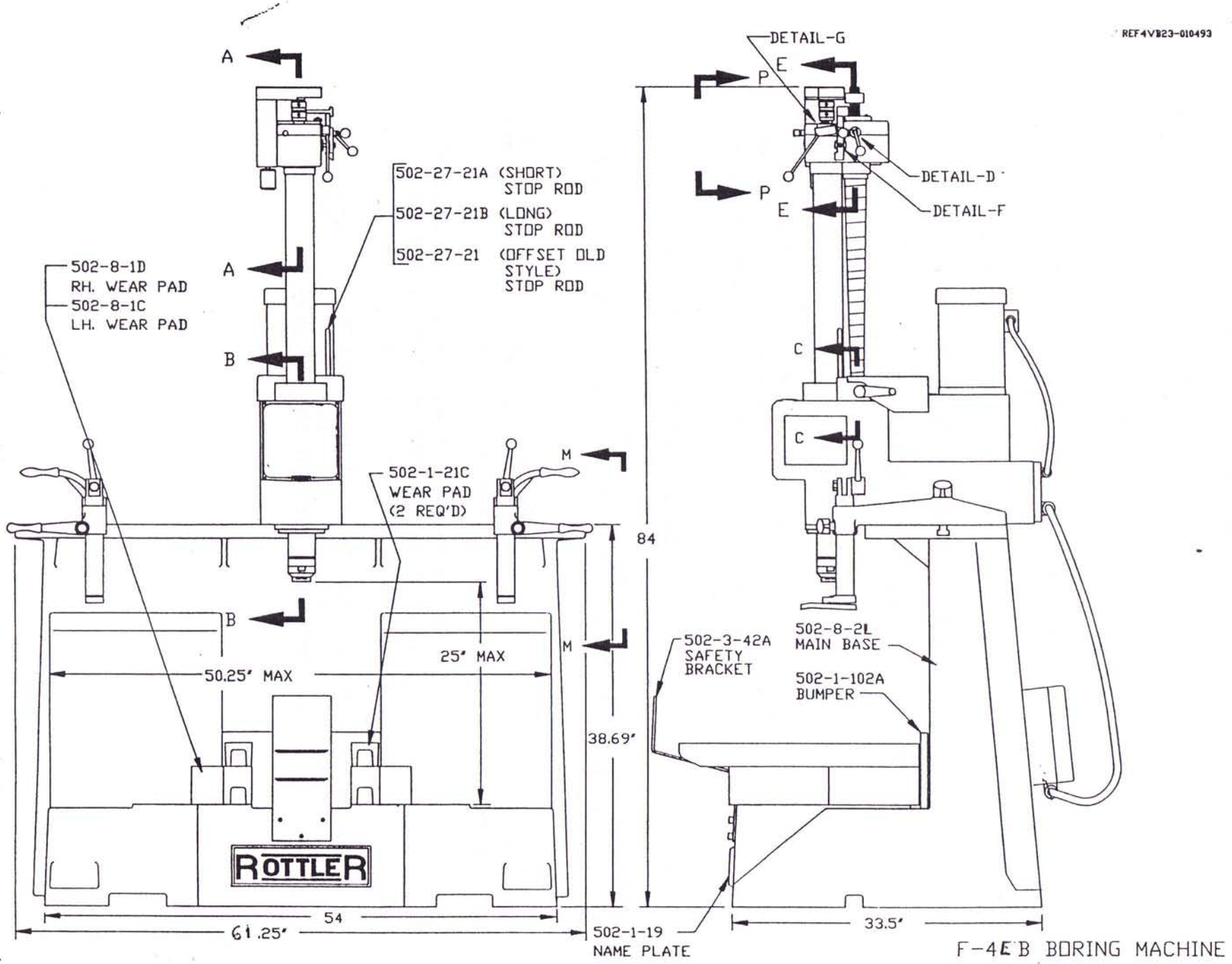
The great majority of these problems are a result of tool bit sharpening. Check to make sure tool bit "B" land is of proper width, with keen sharp faces and that the top of the bit is free from flaws, with original rake angle and smooth finish. Frequently, a minute flaw, not visible to the naked eye, will prevent a fine finish.

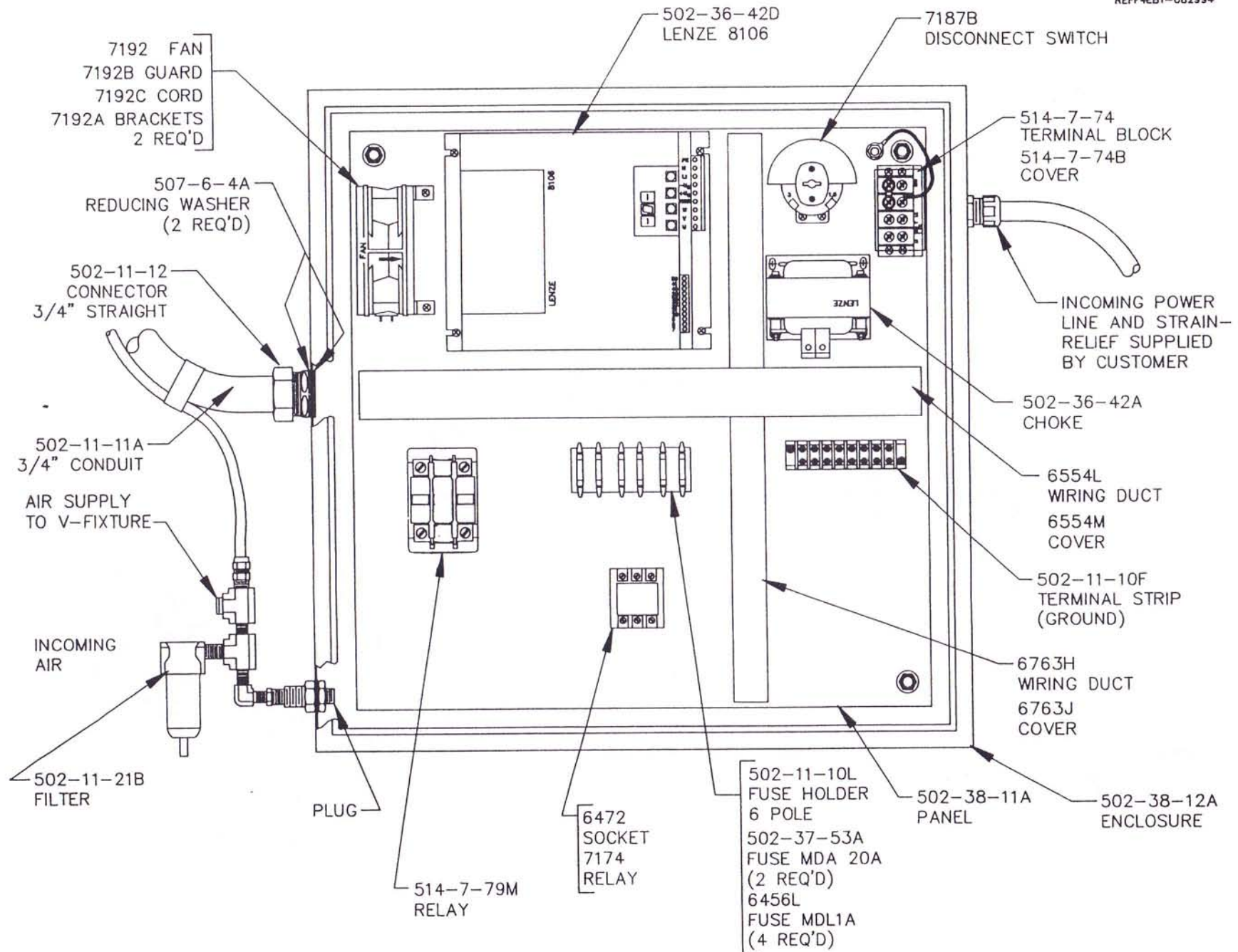
It is possible dirt or lubricant used to clean outer spindle may enter lower cutter, and the assembly containing a chatter dampening device. (502-2-43). The result of this would be to encounter spindle chatter at bottom of bore, particularly on long bores.

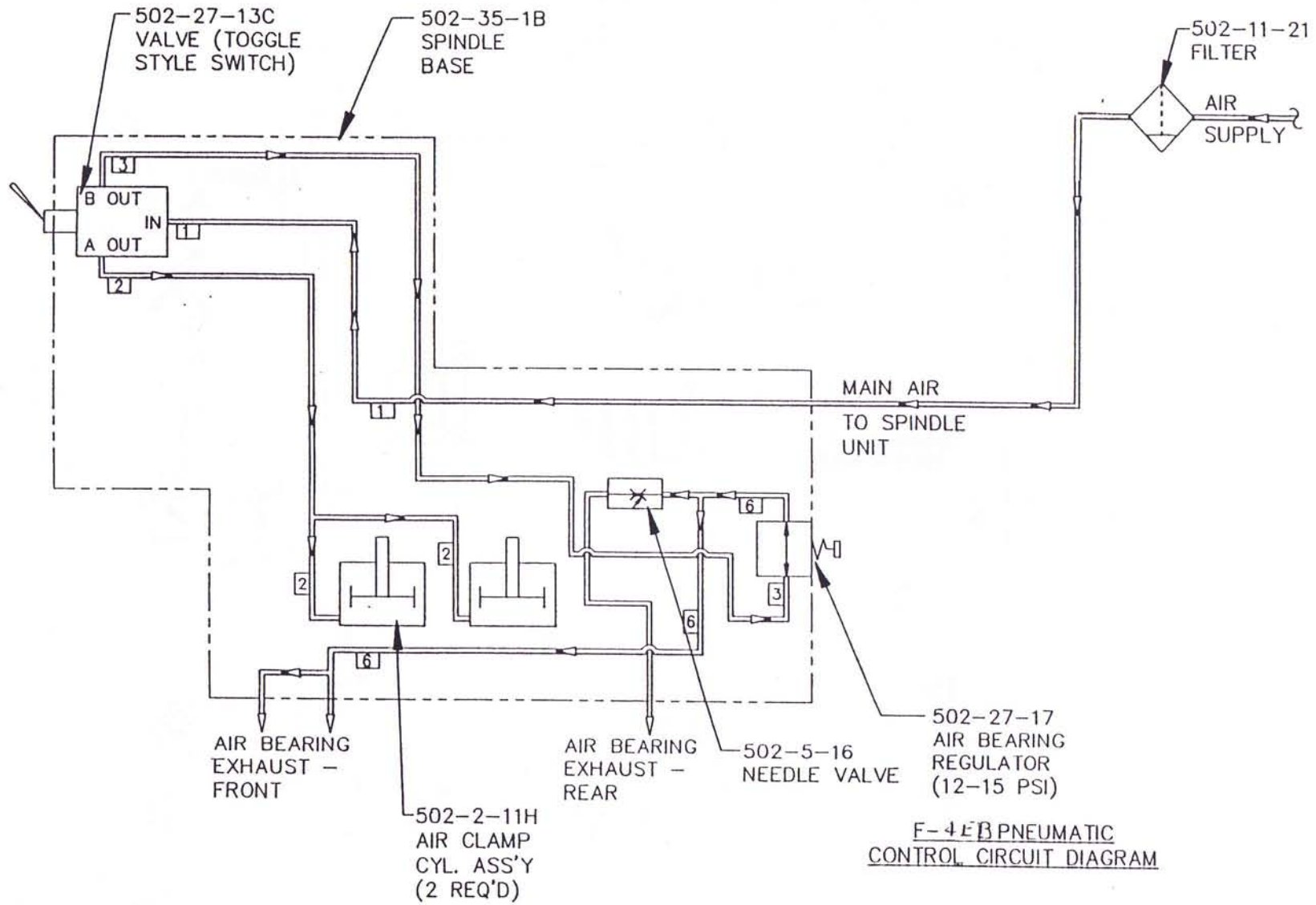
Clean the inside of this assembly extremely cautiously and thoroughly, leaving completely dry. Tolerances on these parts are extremely close and much care should be used.

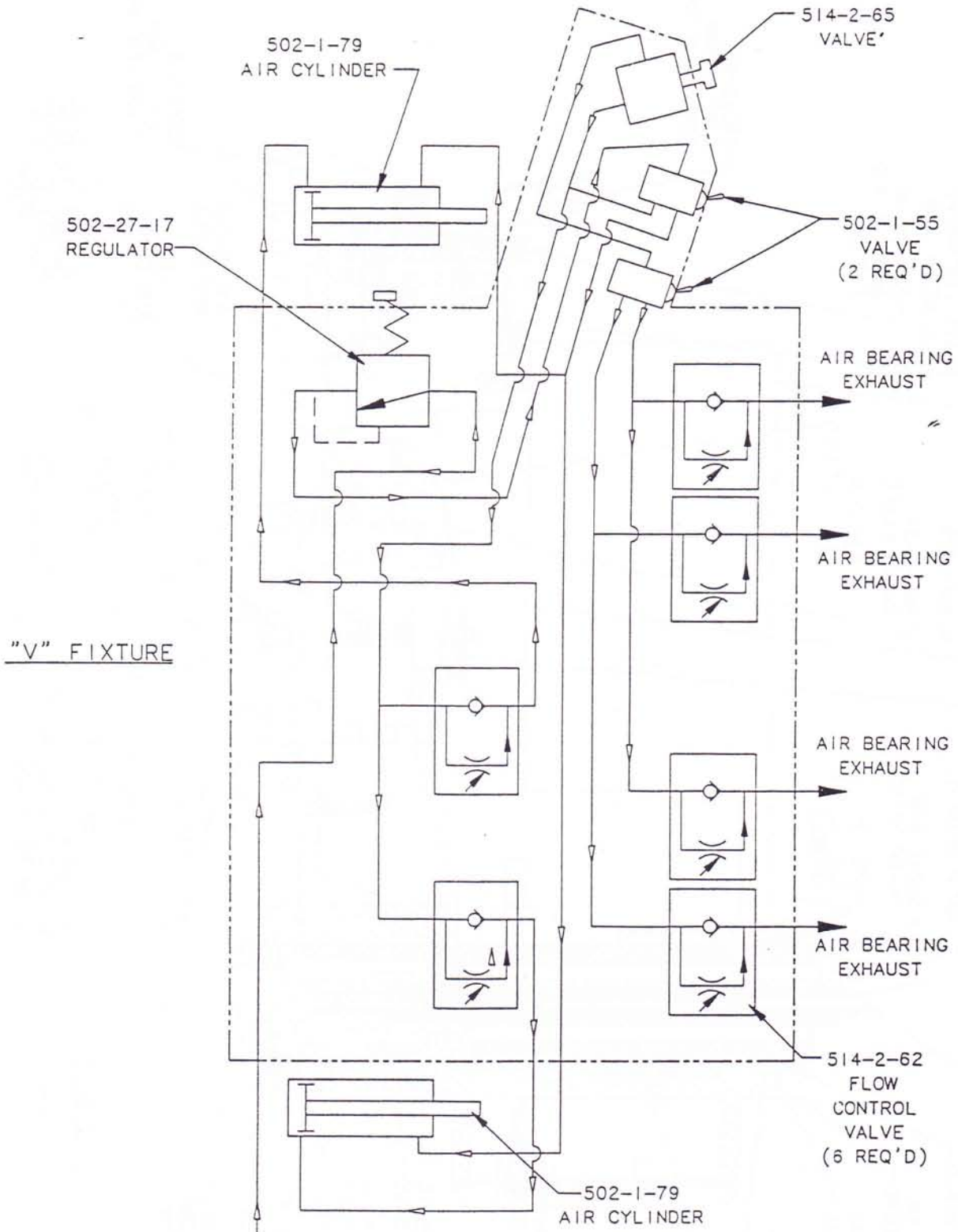
Holes with inconsistent patterns and excessive chipping of tool bits in interrupted cuts at bottom of bore are an indication of a loose inner spindle bearing.

A loose outer spindle bearing will not generally result in taper or inaccurate bores, but can allow spindle to drop slack in feed nut, resulting in a mark in the cylinder.



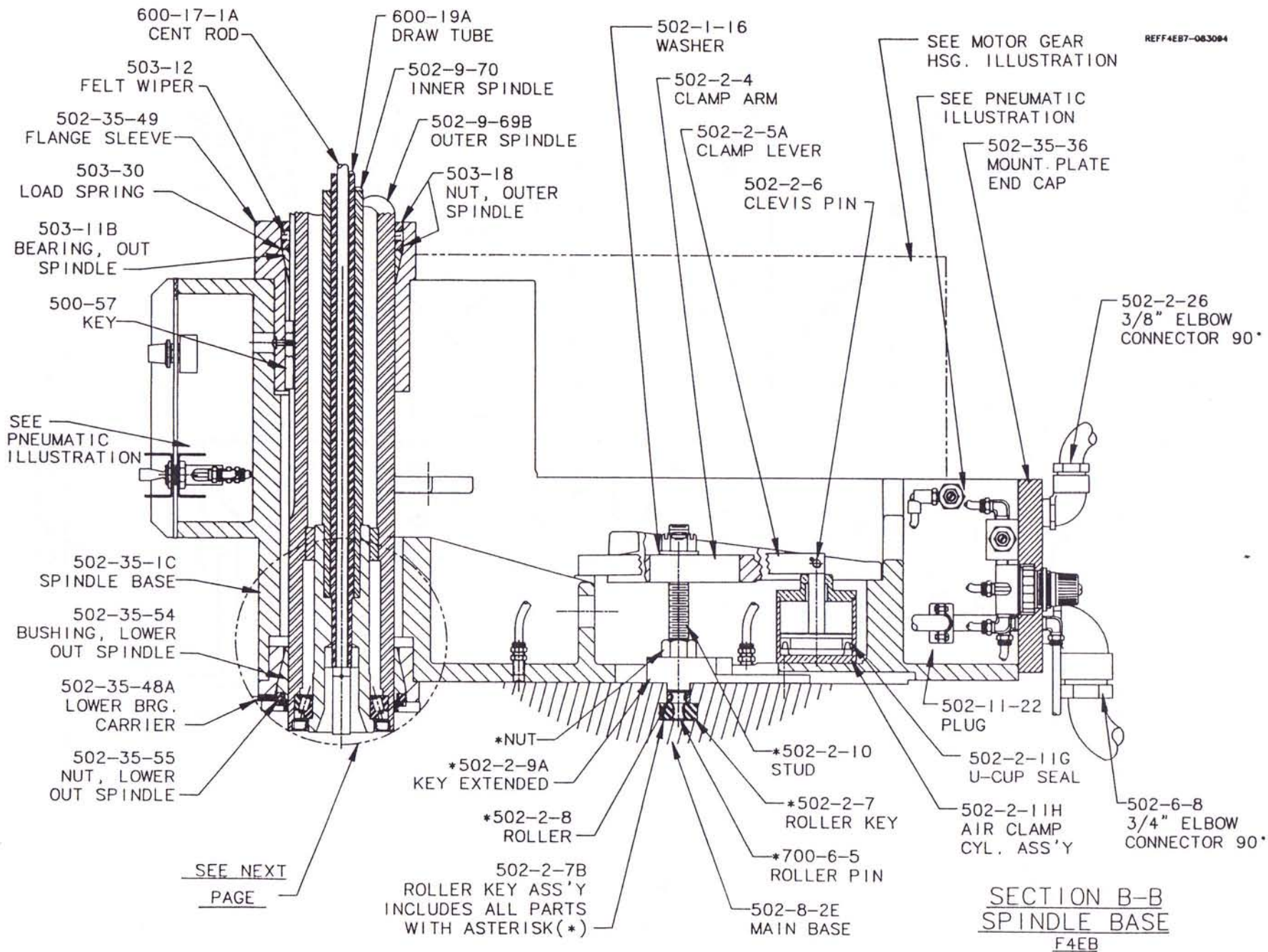


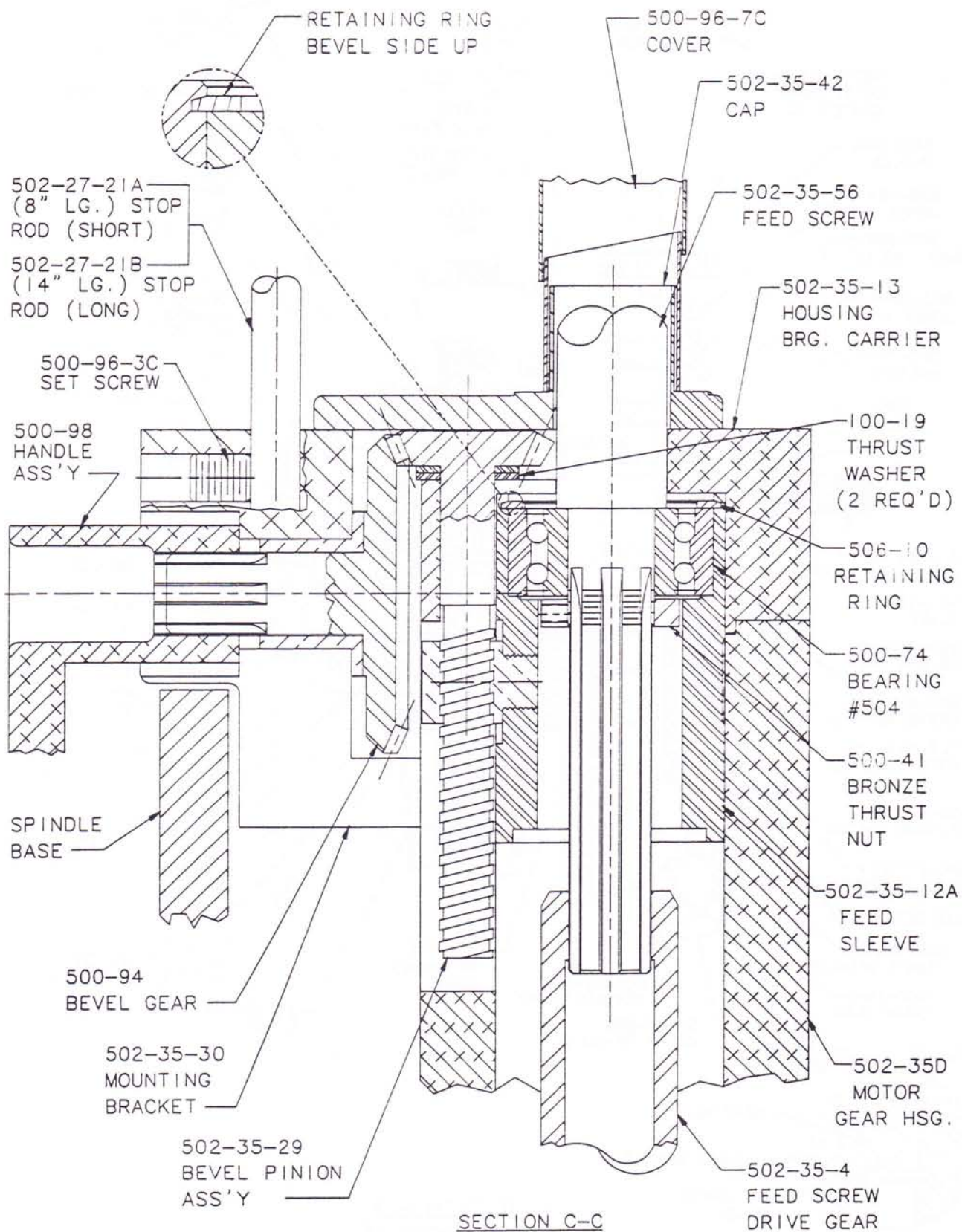




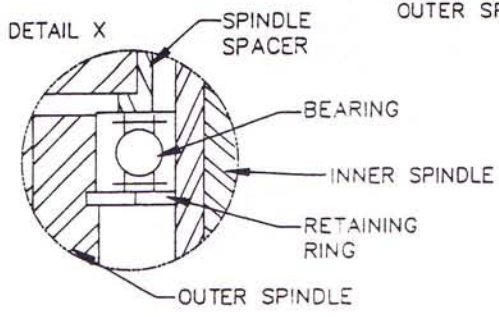
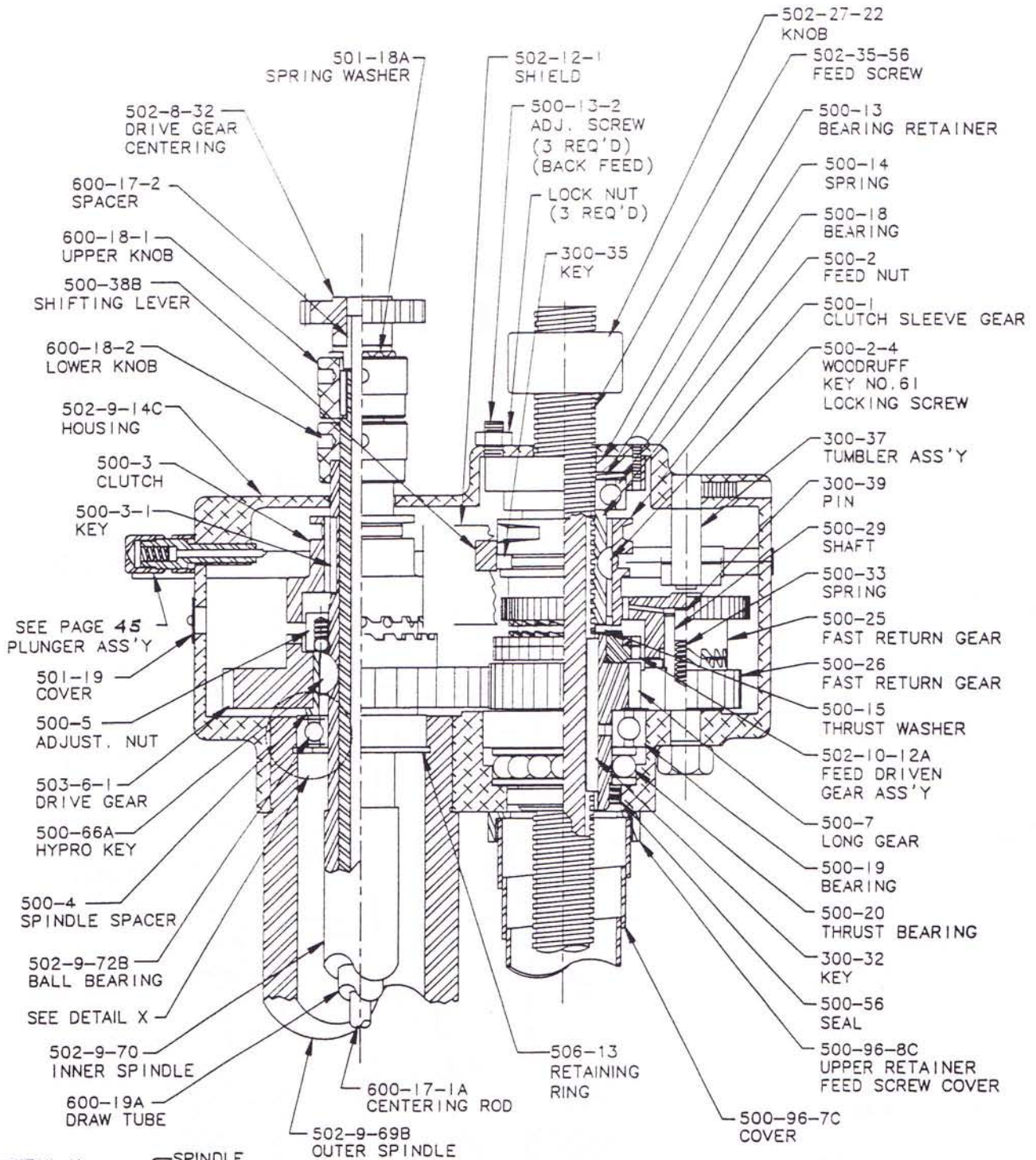
"V" FIXTURE

"V" FIXTURE
PNEUMATIC CONTROL
CIRCUIT DIAGRAM

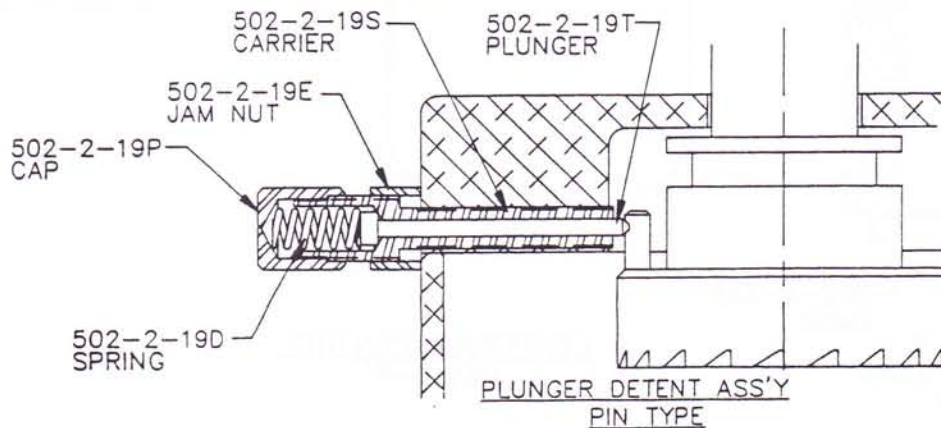
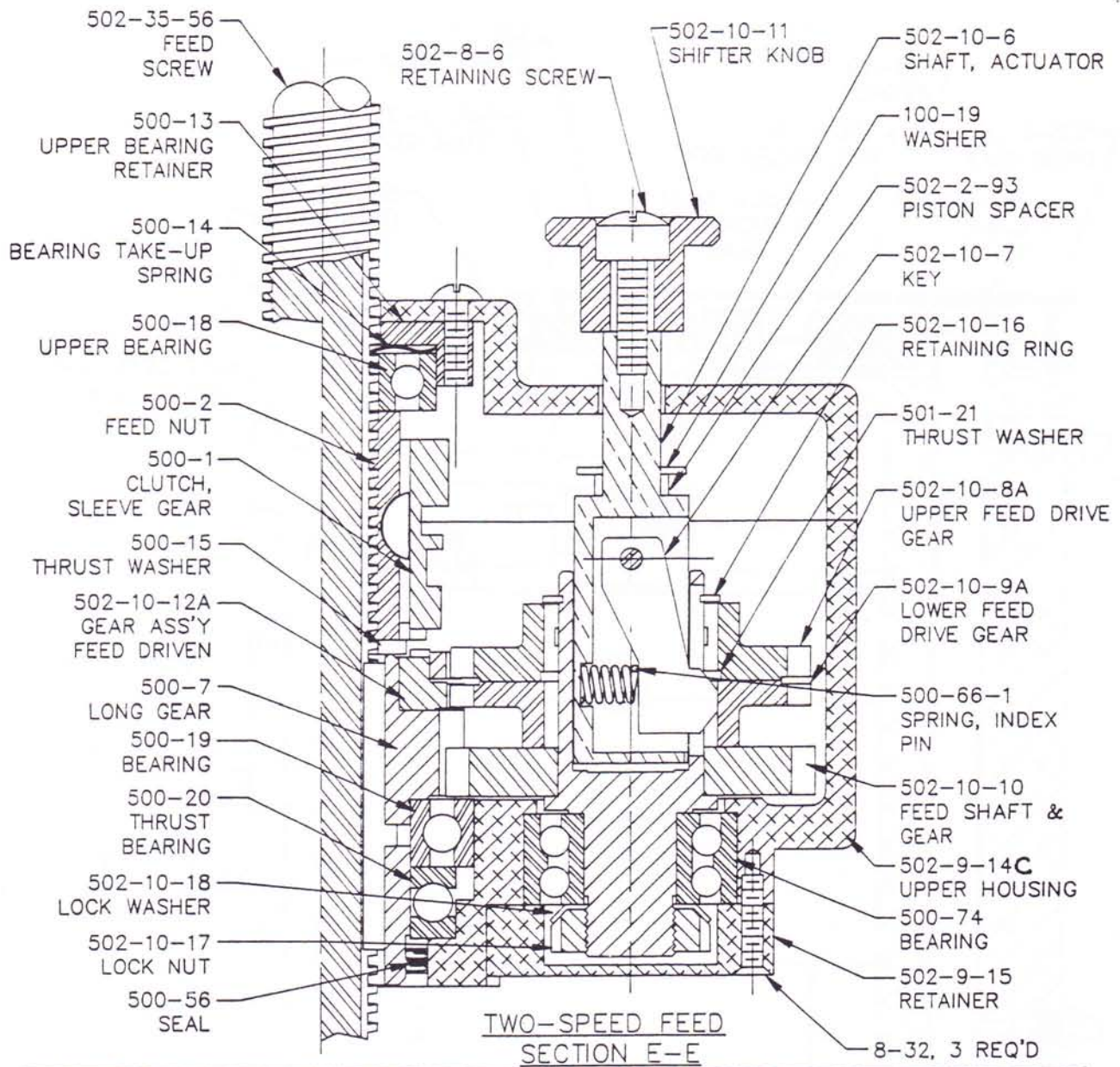


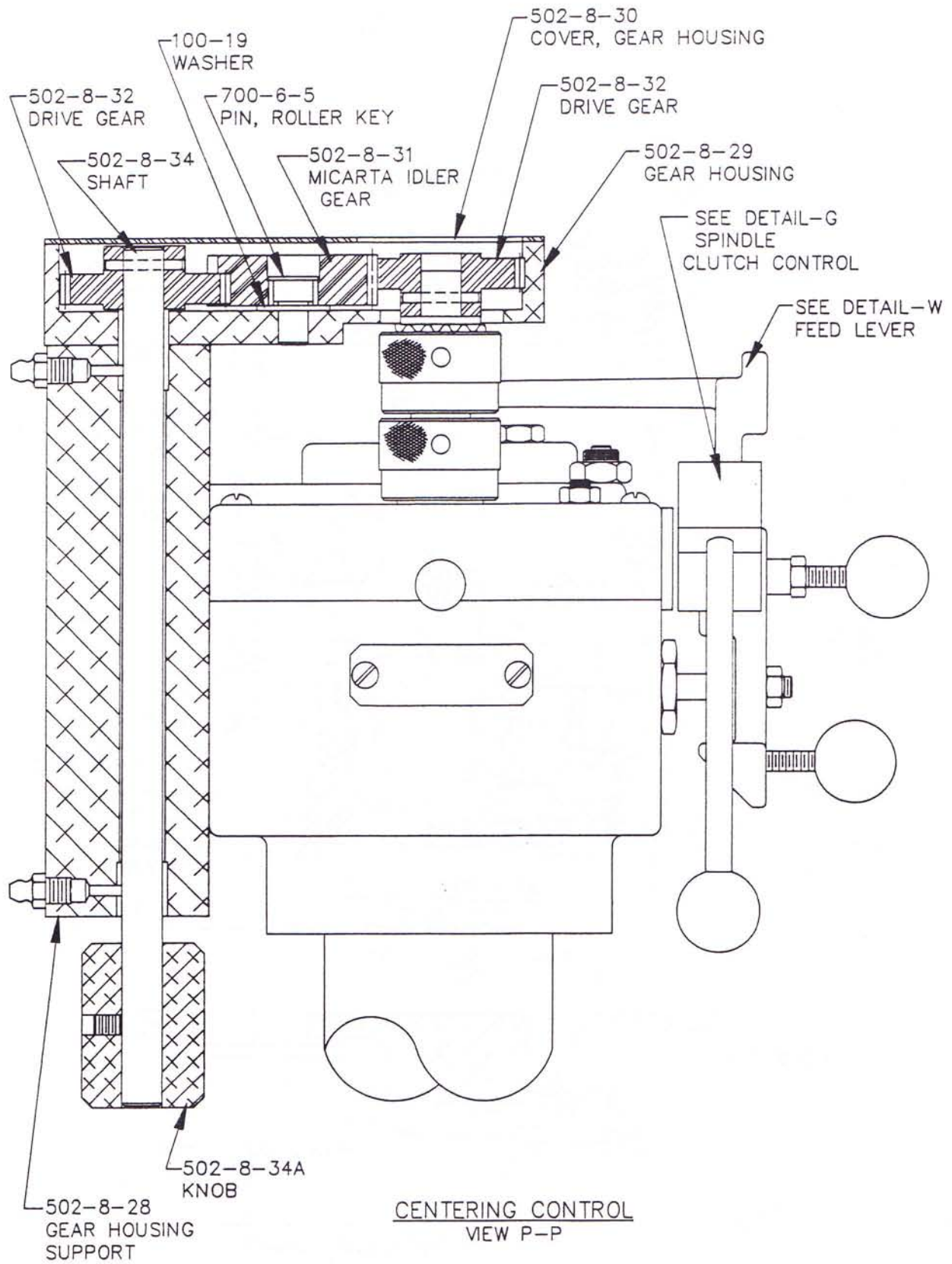


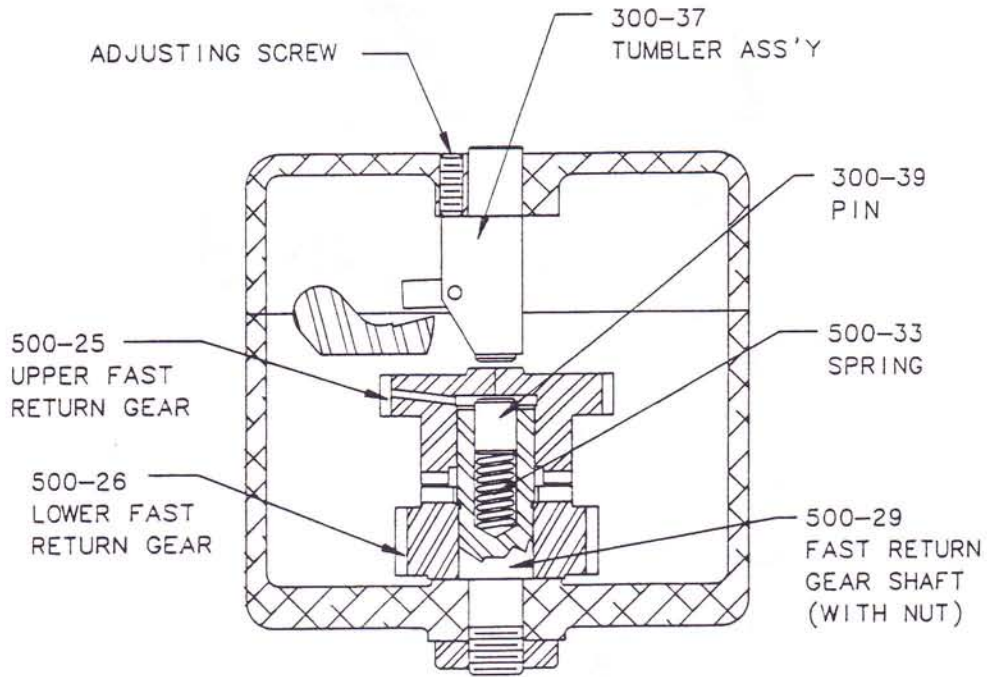
SECTION C-C
HAND FEED
F-4VB



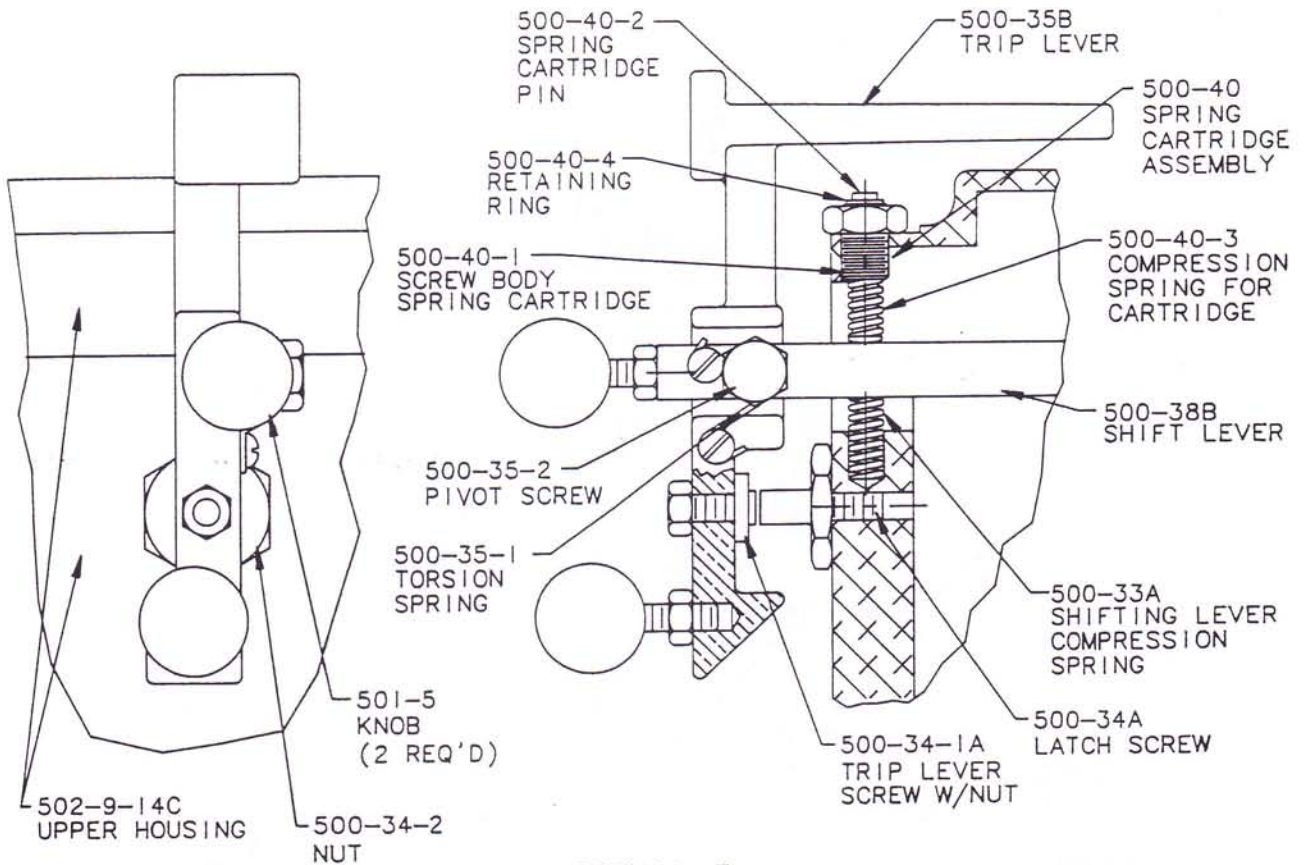
SECTION A-A
UPPER HOUSING





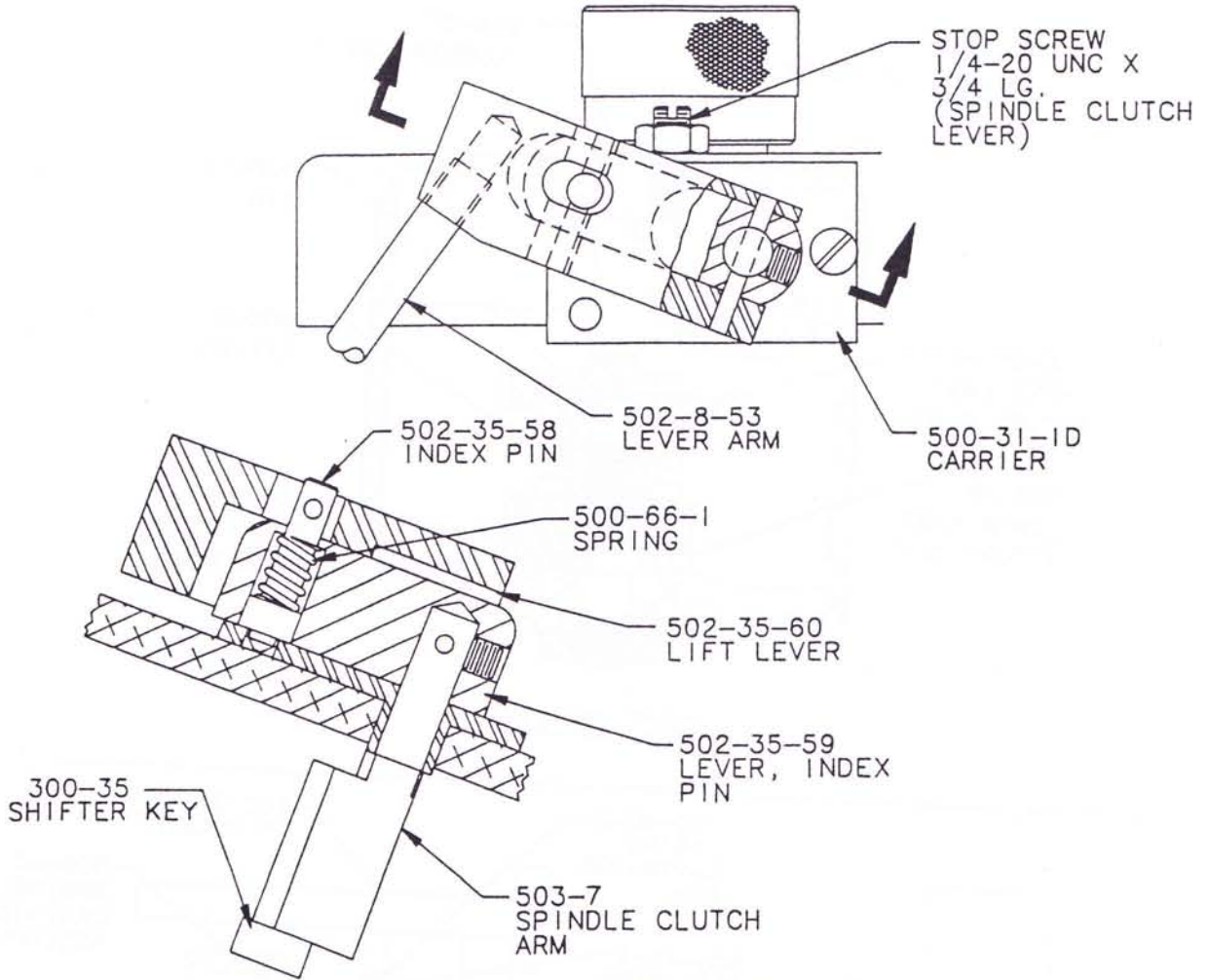


SECTION Z-Z

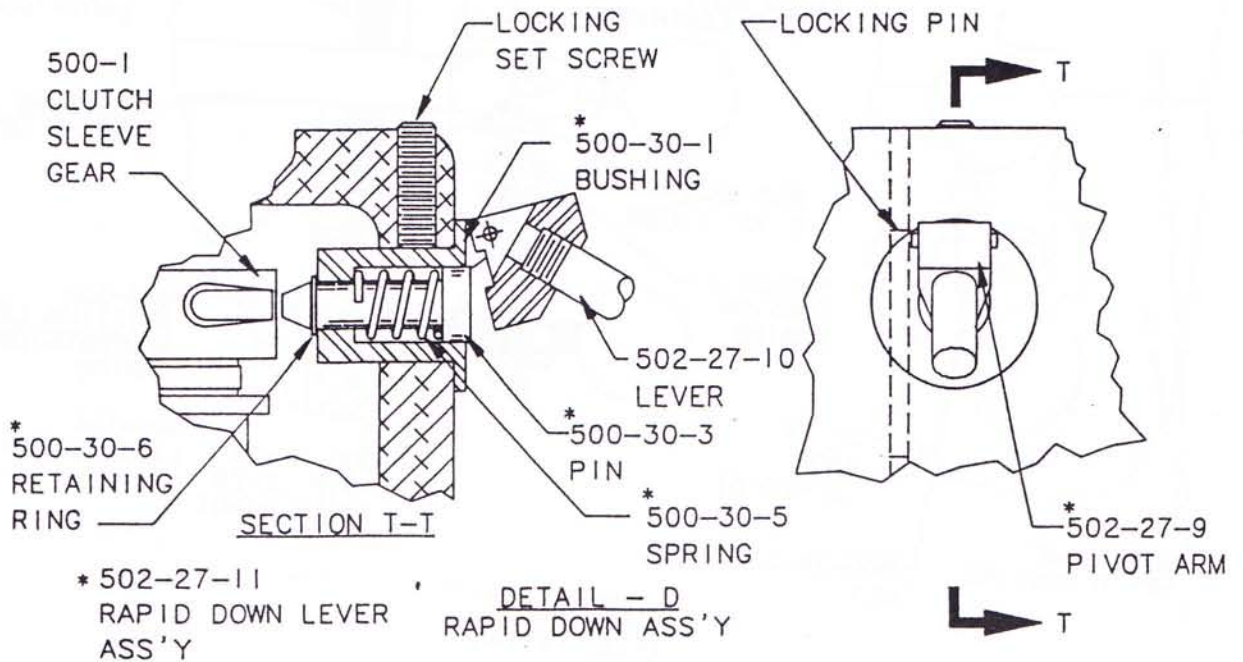


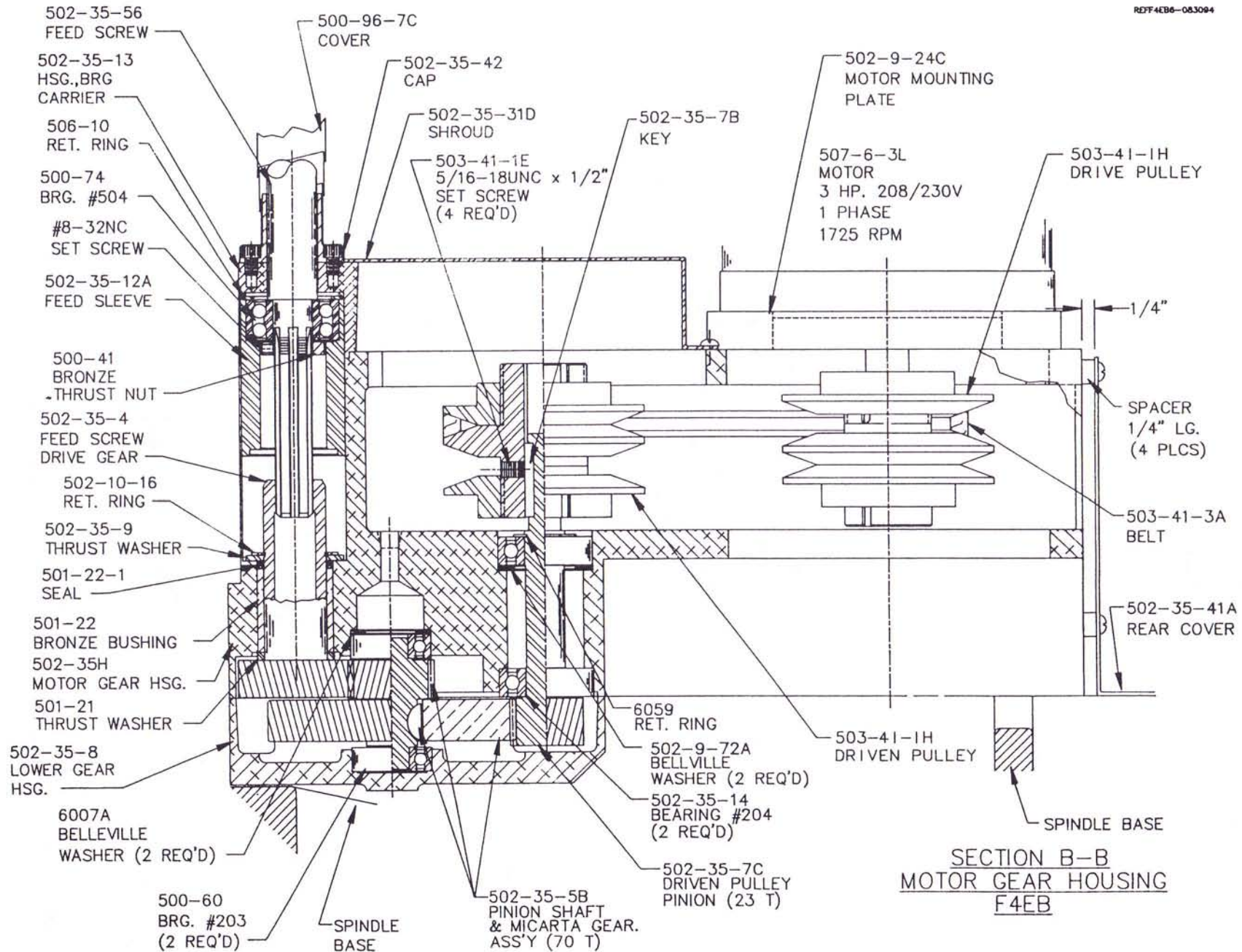
DETAIL F
(FEED LEVER)

4VB-34

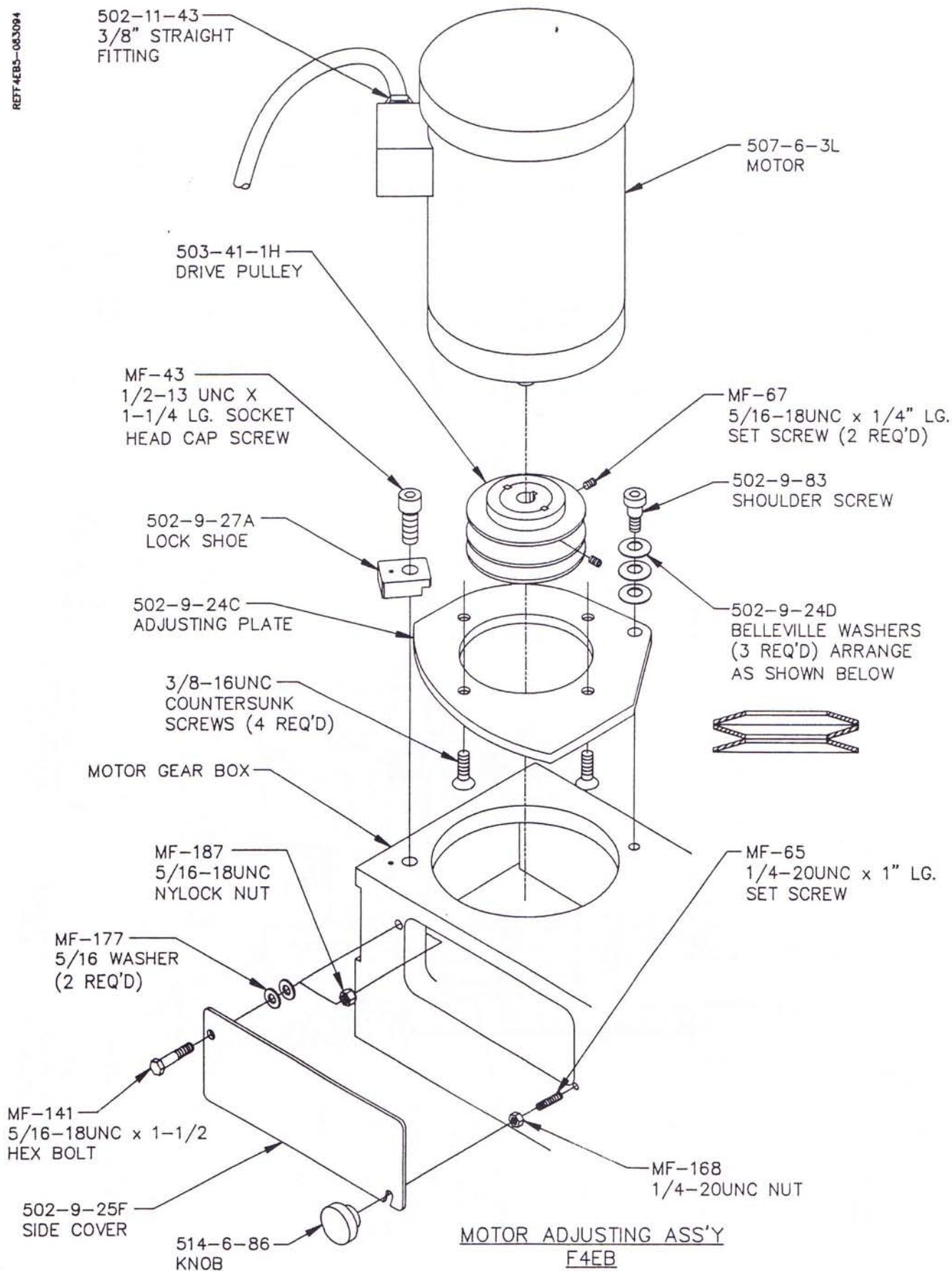


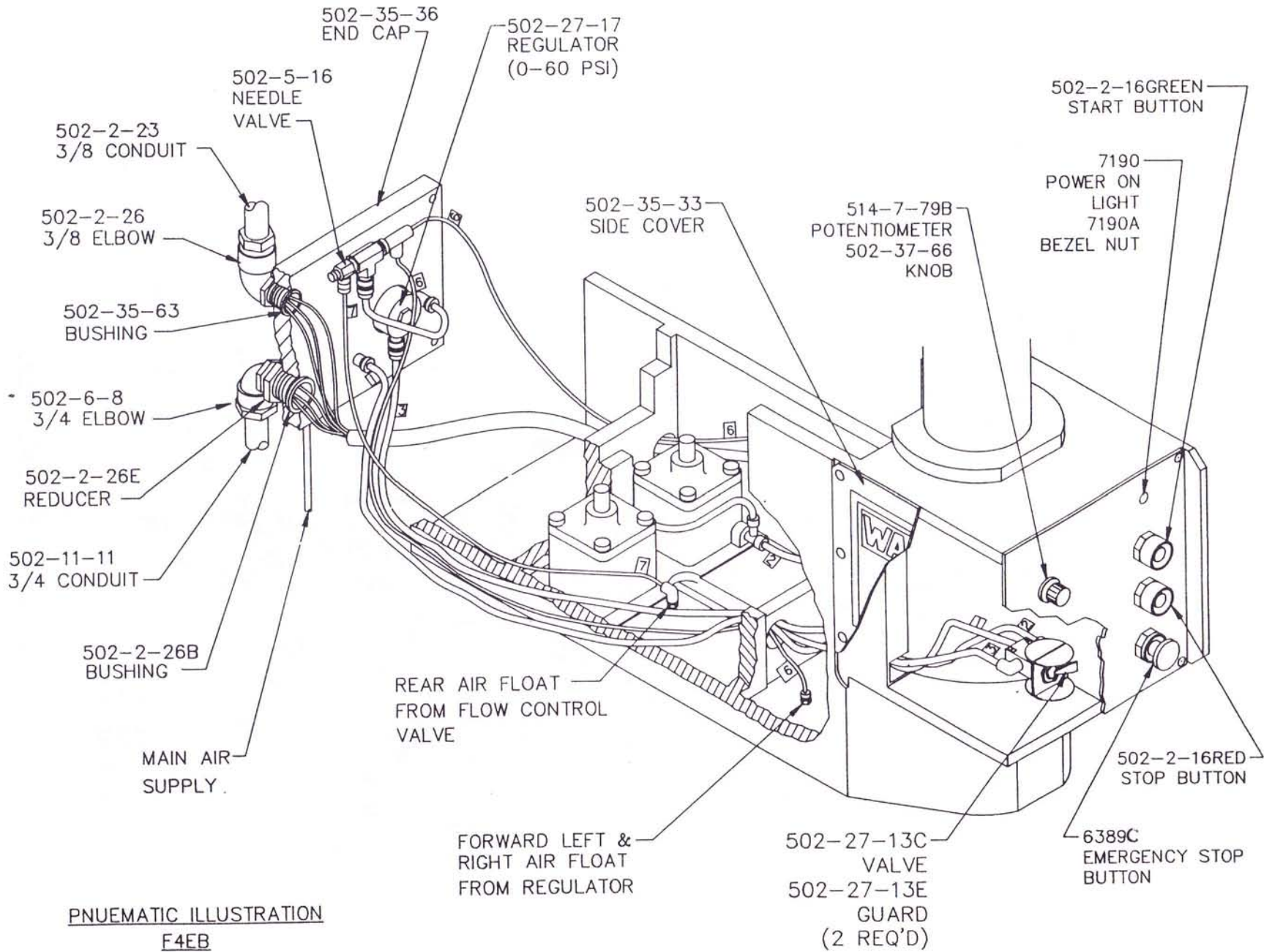
DETAIL G
SPINDLE CLUTCH CONTROL



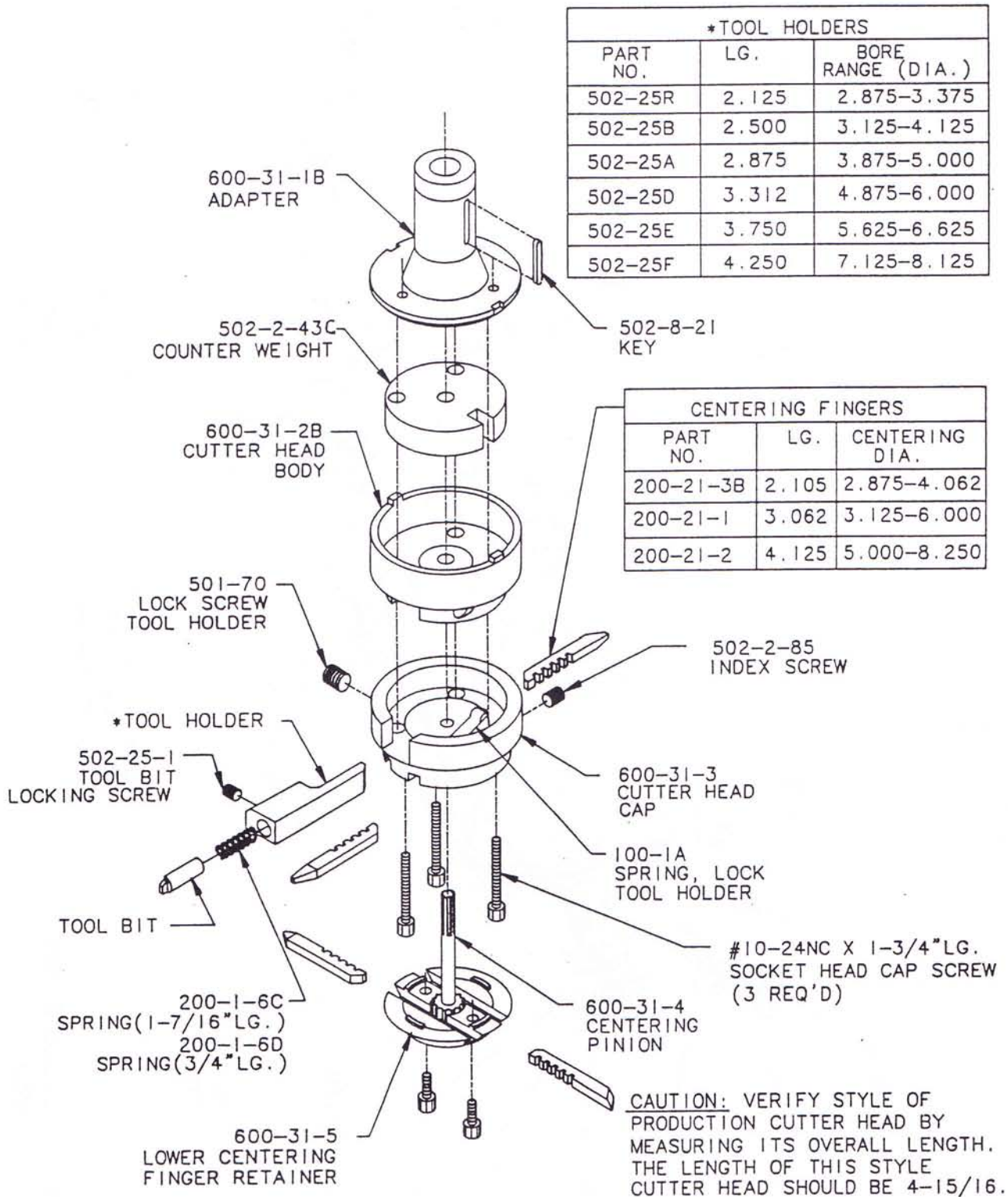


REF: 4EB5-083094





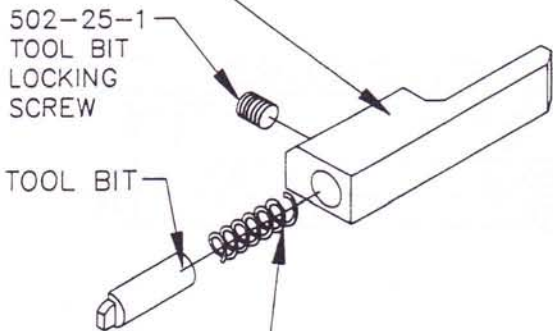
PNEUMATIC ILLUSTRATION
F4EB



PRODUCTION CUTTER HEAD #2 ASS'Y
 600-8-4G W/TOOLING
 600-8-4H W/OUT TOOLING

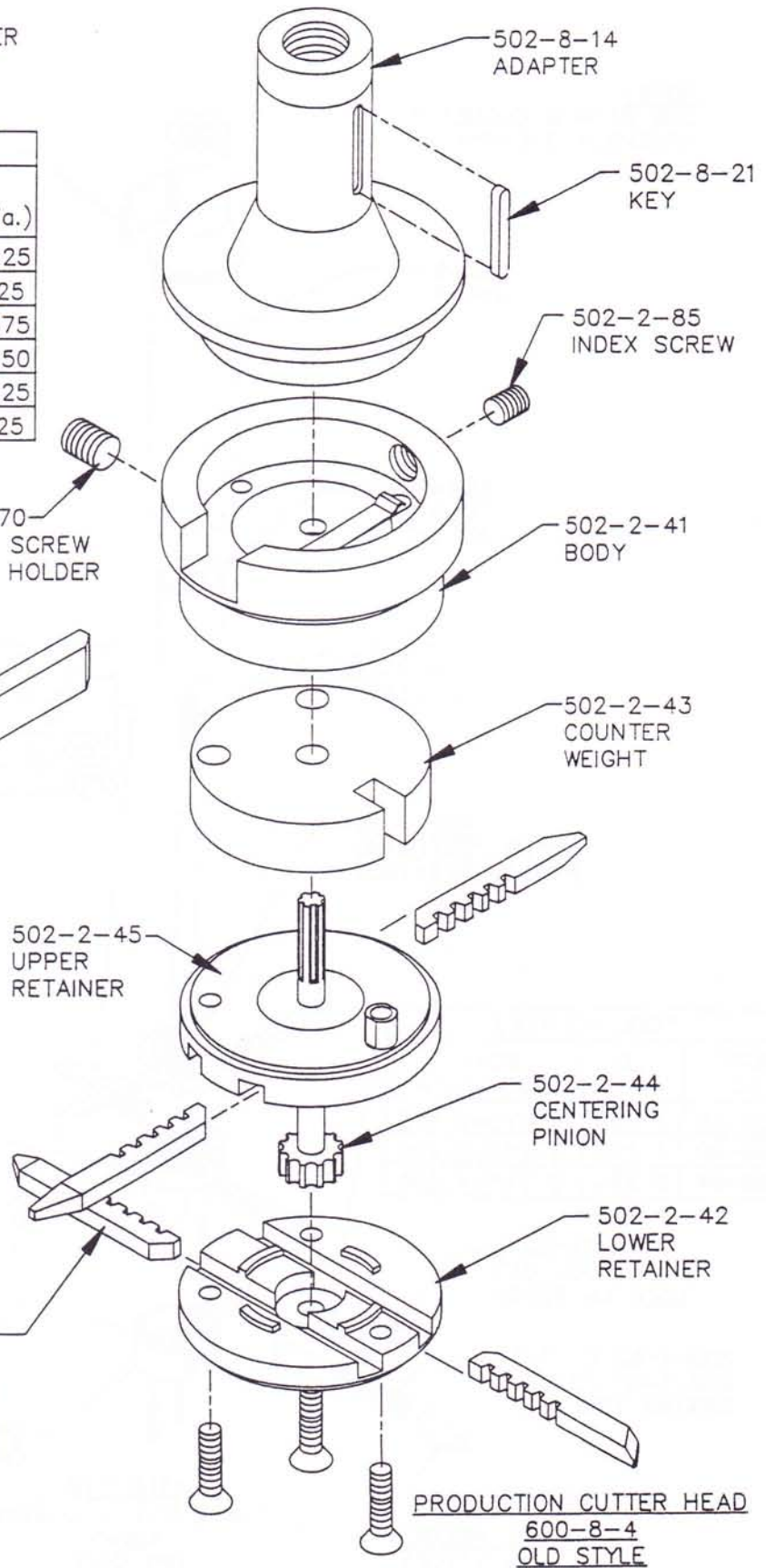
NOTE:
USE WITH MICROMETER
ASSEMBLY 900-2-5

TOOL HOLDERS		
PART No.	LG.	BORE RANGE (Dia.)
502-25C	2.250	2.875-3.625
502-25B	2.500	3.125-4.125
502-25A	2.875	3.875-4.875
502-25D	3.312	5.750-5.750
502-25E	3.750	5.625-6.625
502-25F	4.250	7.125-8.125

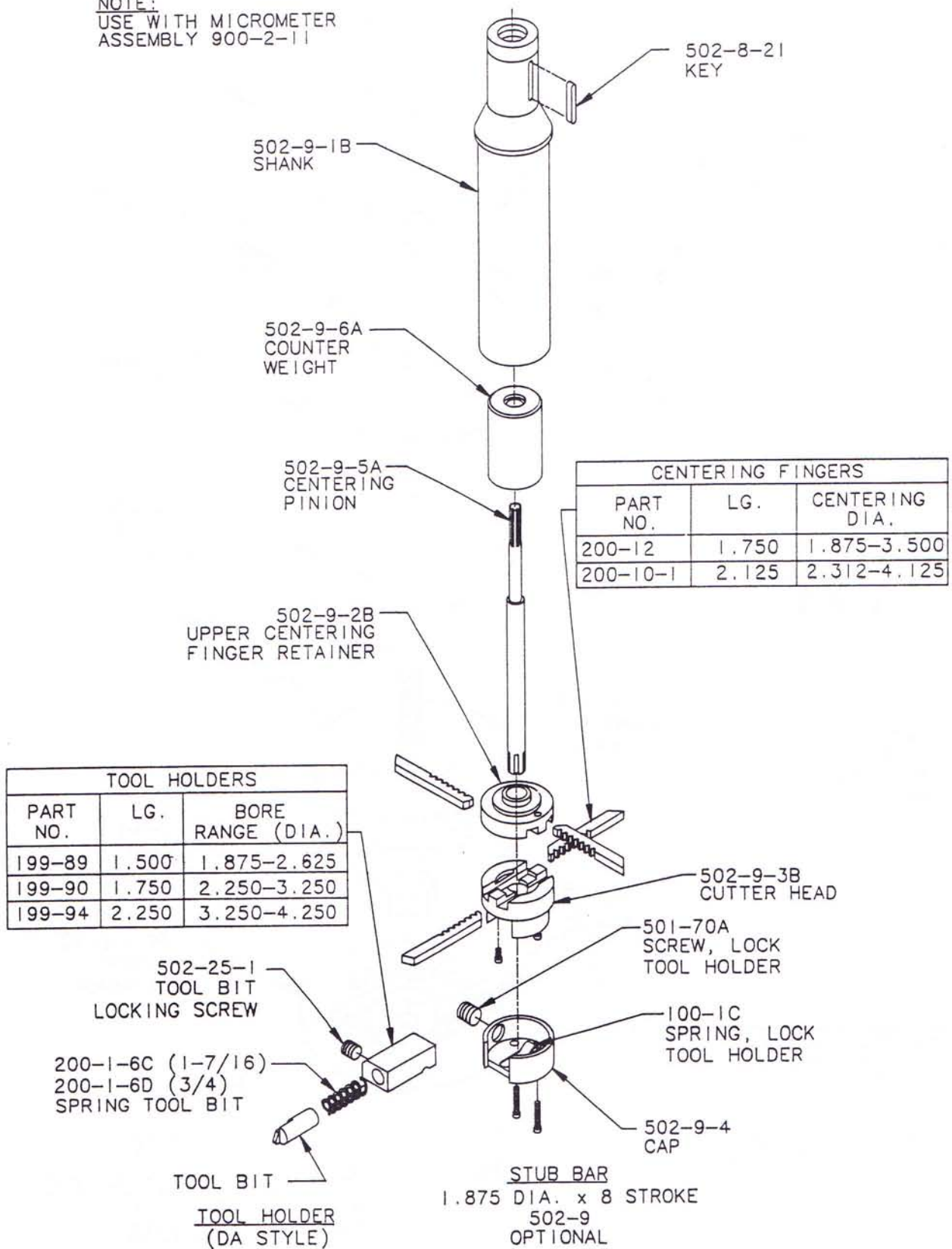


200-1-6C
(1-7/16)
200-1-6D
(3/4)
SPRING, TOOL
BIT

CENTERING FINGERS		
PART No.	LG.	CENTERING DIA.
200-21-3	2.312	2.875-4.500
200-21-1	3.062	3.125-6.000
200-21-2	4.125	5.000-8.250



NOTE:
USE WITH MICROMETER
ASSEMBLY 900-2-11

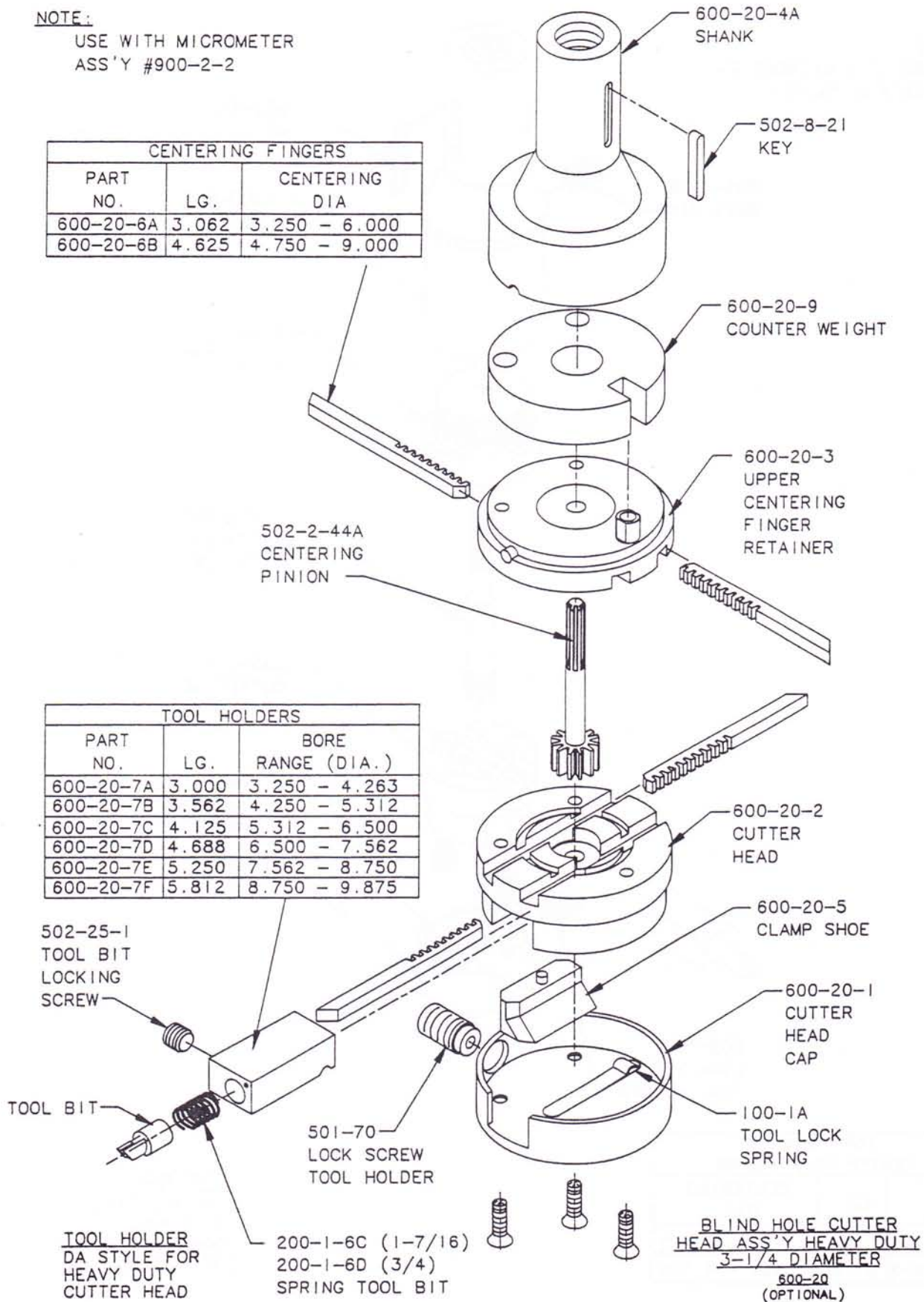


NOTE:

USE WITH MICROMETER
ASS'Y #900-2-2

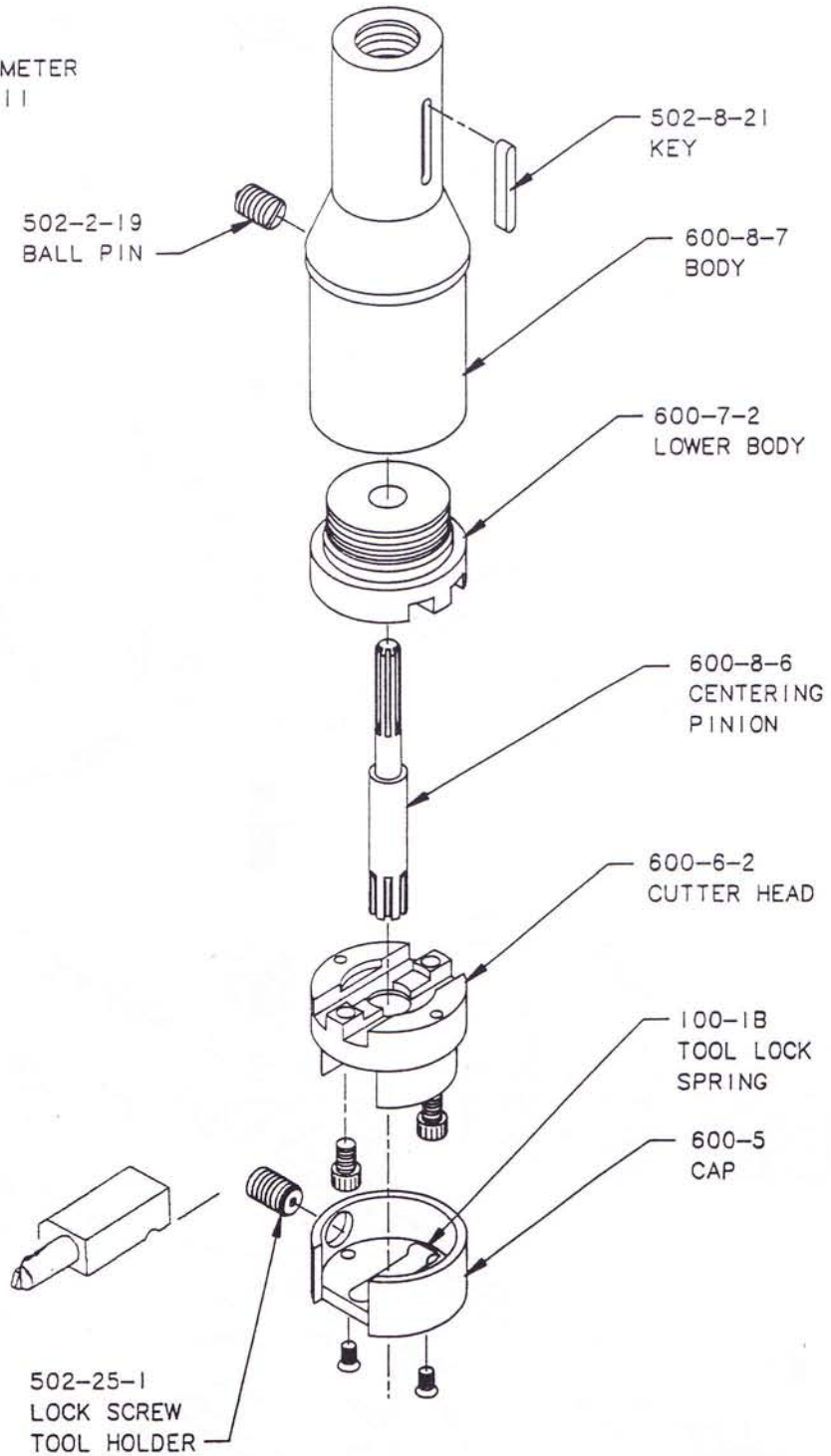
CENTERING FINGERS		
PART NO.	LG.	CENTERING DIA
600-20-6A	3.062	3.250 - 6.000
600-20-6B	4.625	4.750 - 9.000

TOOL HOLDERS		
PART NO.	LG.	BORE RANGE (DIA.)
600-20-7A	3.000	3.250 - 4.263
600-20-7B	3.562	4.250 - 5.312
600-20-7C	4.125	5.312 - 6.500
600-20-7D	4.688	6.500 - 7.562
600-20-7E	5.250	7.562 - 8.750
600-20-7F	5.812	8.750 - 9.875



NOTE

USE WITH MICROMETER
ASS'Y # 900-2-11

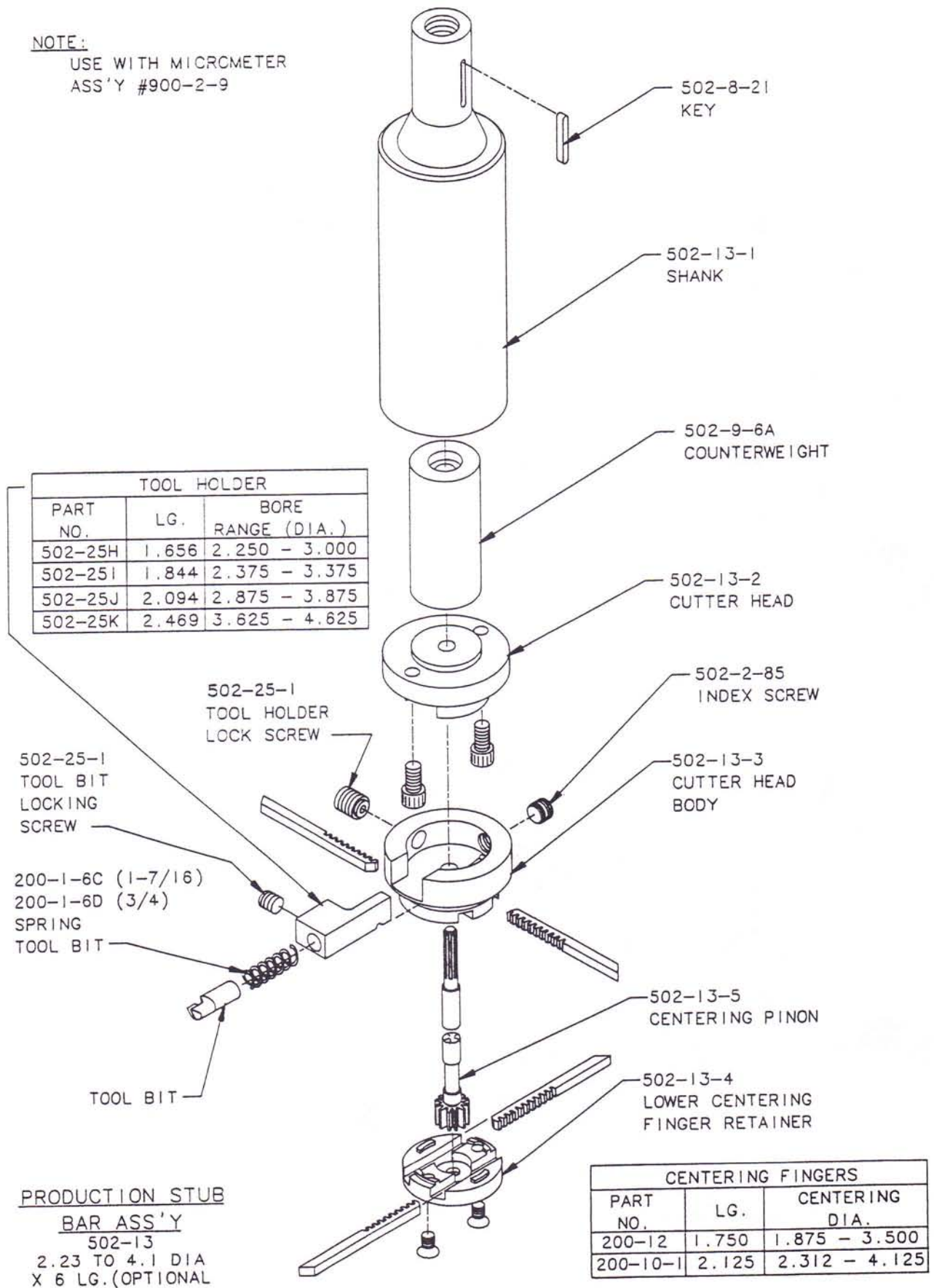


(OPTIONAL) CENTERING FINGERS		
PART NO.	LG.	CENTERING DIA.
200-26-1	1.375	1.500 - 2.625
200-26-2	2.125	2.625 - 4.125

STUB BAR
1.5 TO 4.1 DIA.
X 3" STROKE
600-8-8A
(OPTIONAL)

NOTE:

USE WITH MICROMETER
ASS'Y #900-2-9



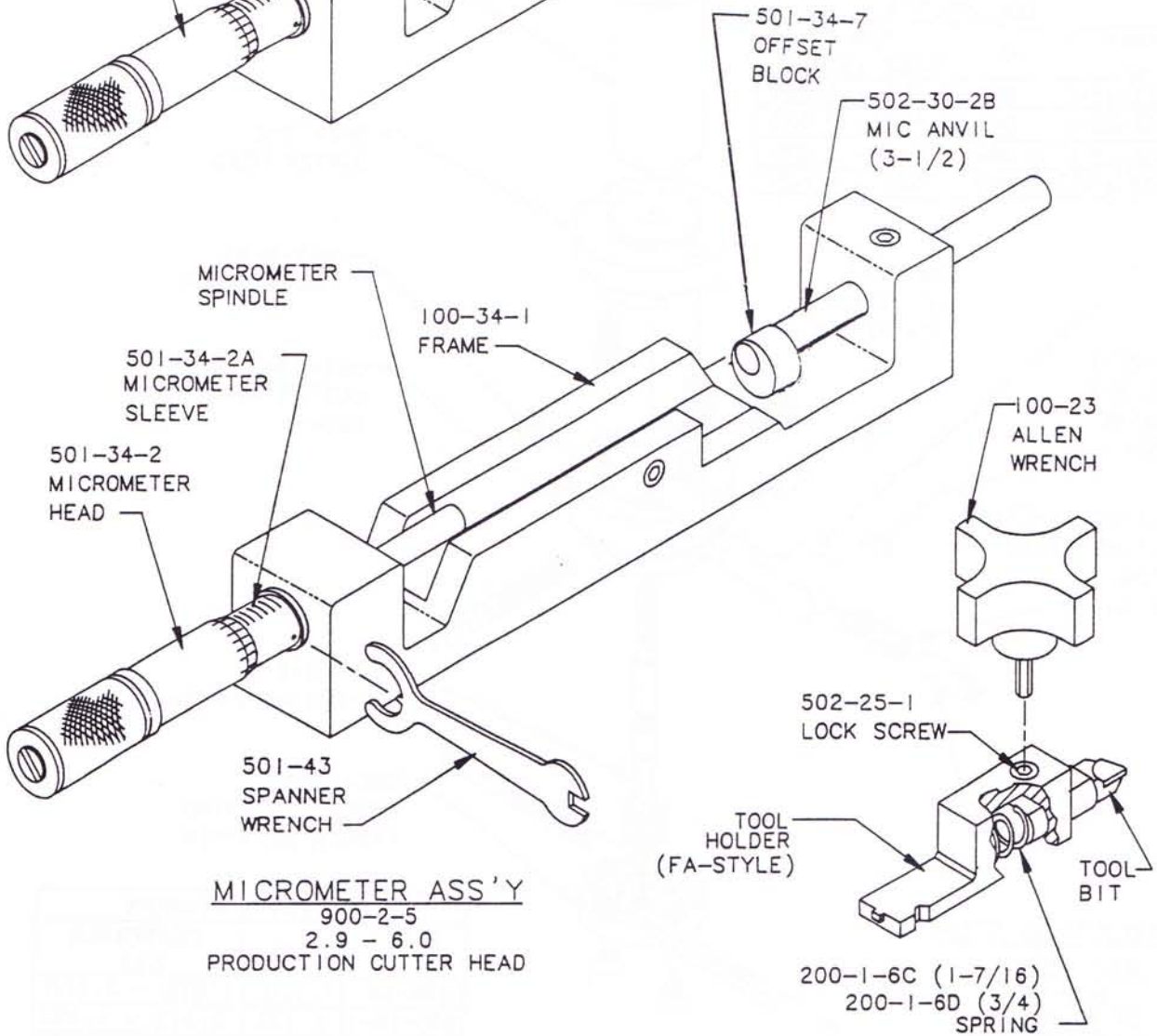
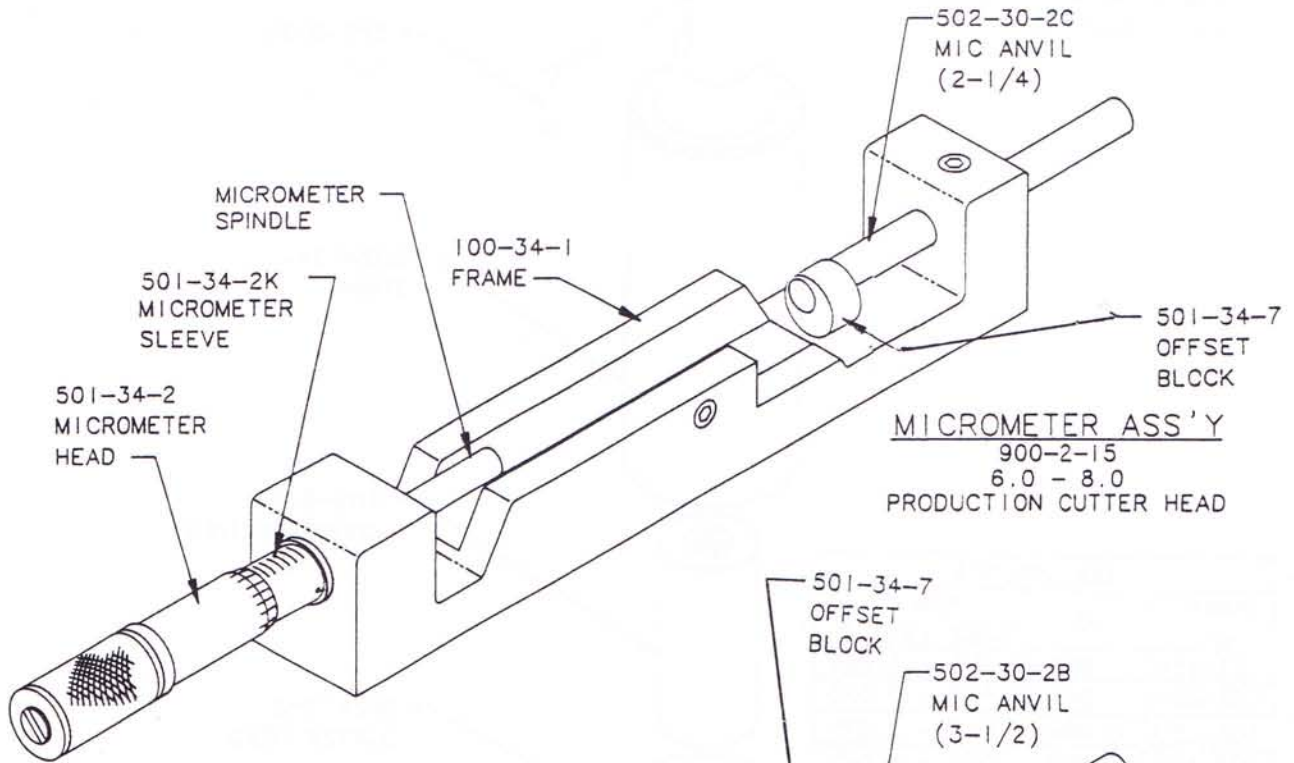
TOOL HOLDER		
PART NO.	LG.	BORE RANGE (DIA.)
502-25H	1.656	2.250 - 3.000
502-25I	1.844	2.375 - 3.375
502-25J	2.094	2.875 - 3.875
502-25K	2.469	3.625 - 4.625

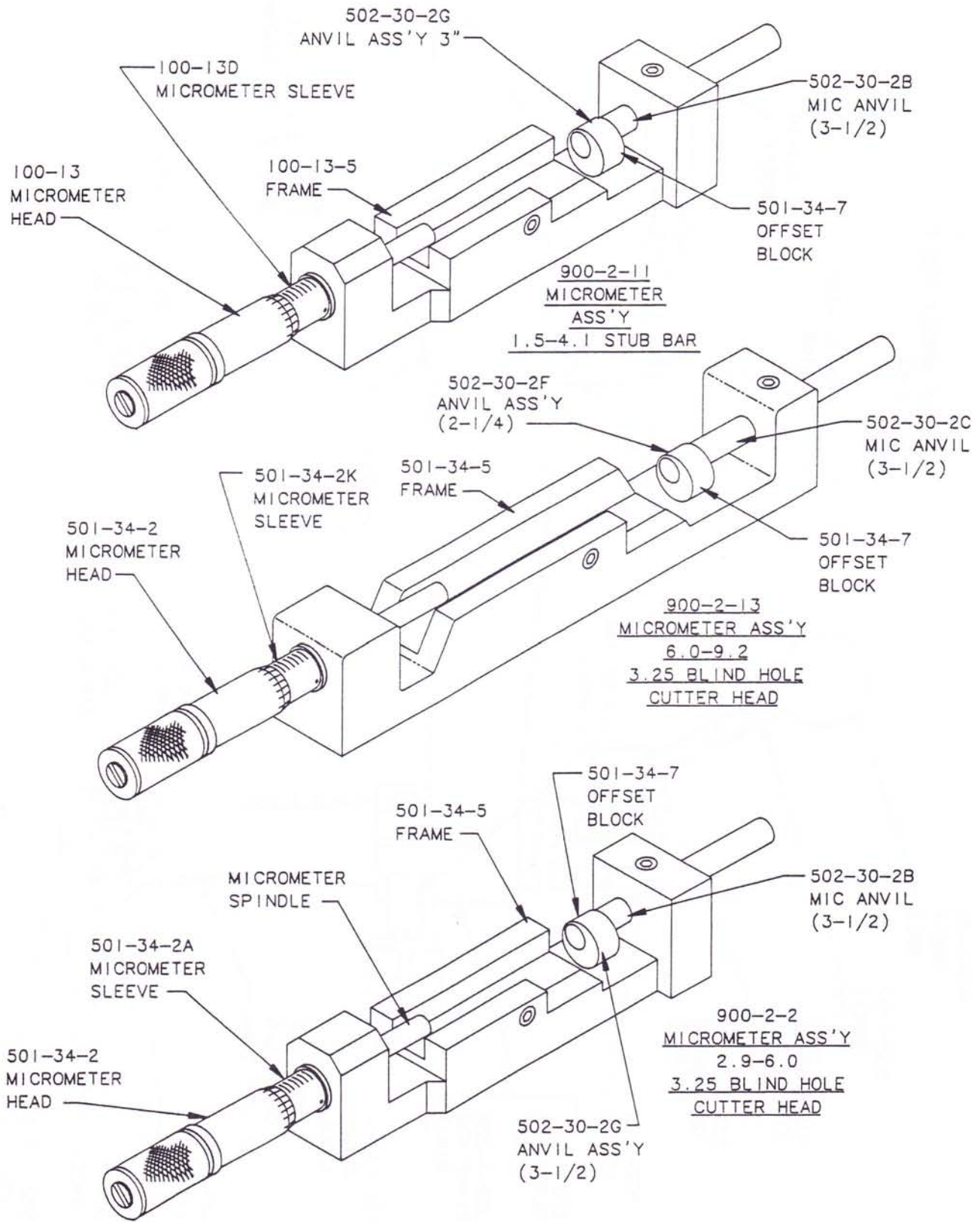
- 502-25-1 TOOL BIT LOCKING SCREW
- 200-1-6C (1-7/16)
- 200-1-6D (3/4) SPRING
- TOOL BIT
- TOOL BIT

- 502-8-21 KEY
- 502-13-1 SHANK
- 502-9-6A COUNTERWEIGHT
- 502-13-2 CUTTER HEAD
- 502-2-85 INDEX SCREW
- 502-13-3 CUTTER HEAD BODY
- 502-13-5 CENTERING PINON
- 502-13-4 LOWER CENTERING FINGER RETAINER

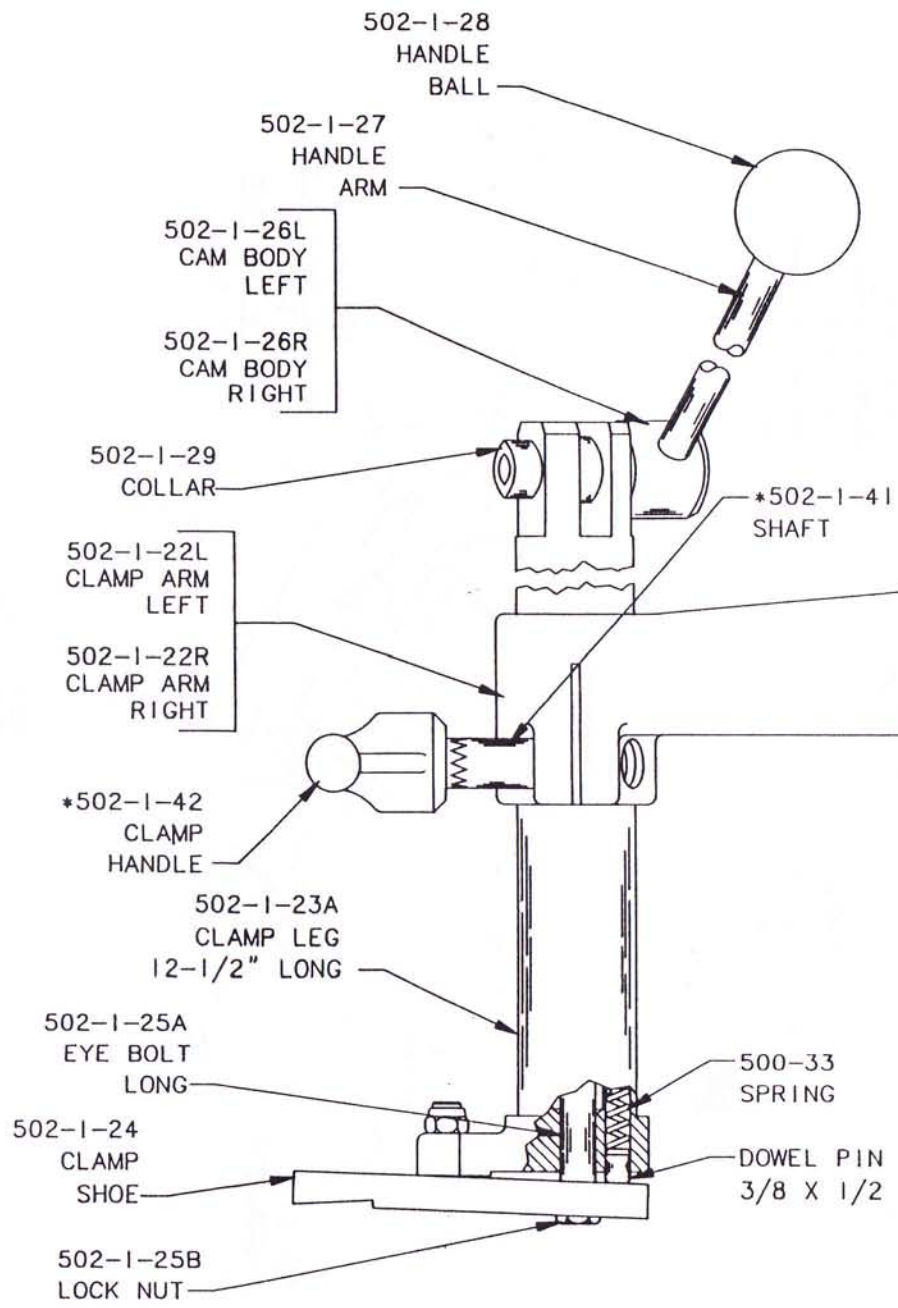
PRODUCTION STUB
BAR ASS'Y
502-13
2.23 TO 4.1 DIA
X 6 LG.(OPTIONAL)

CENTERING FINGERS		
PART NO.	LG.	CENTERING DIA.
200-12	1.750	1.875 - 3.500
200-10-1	2.125	2.312 - 4.125

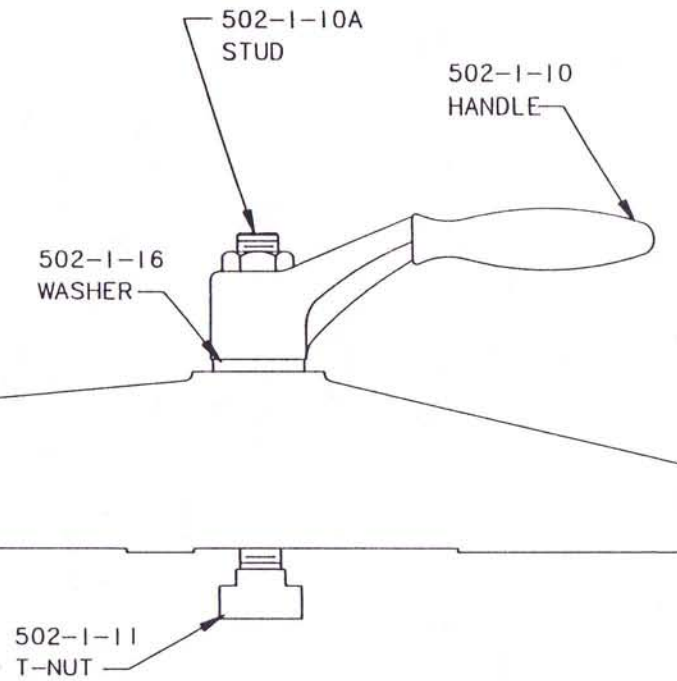




OPTIONAL
MICROMETERS

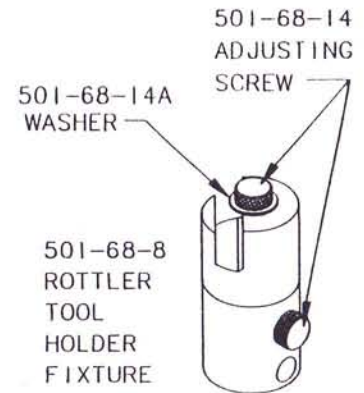
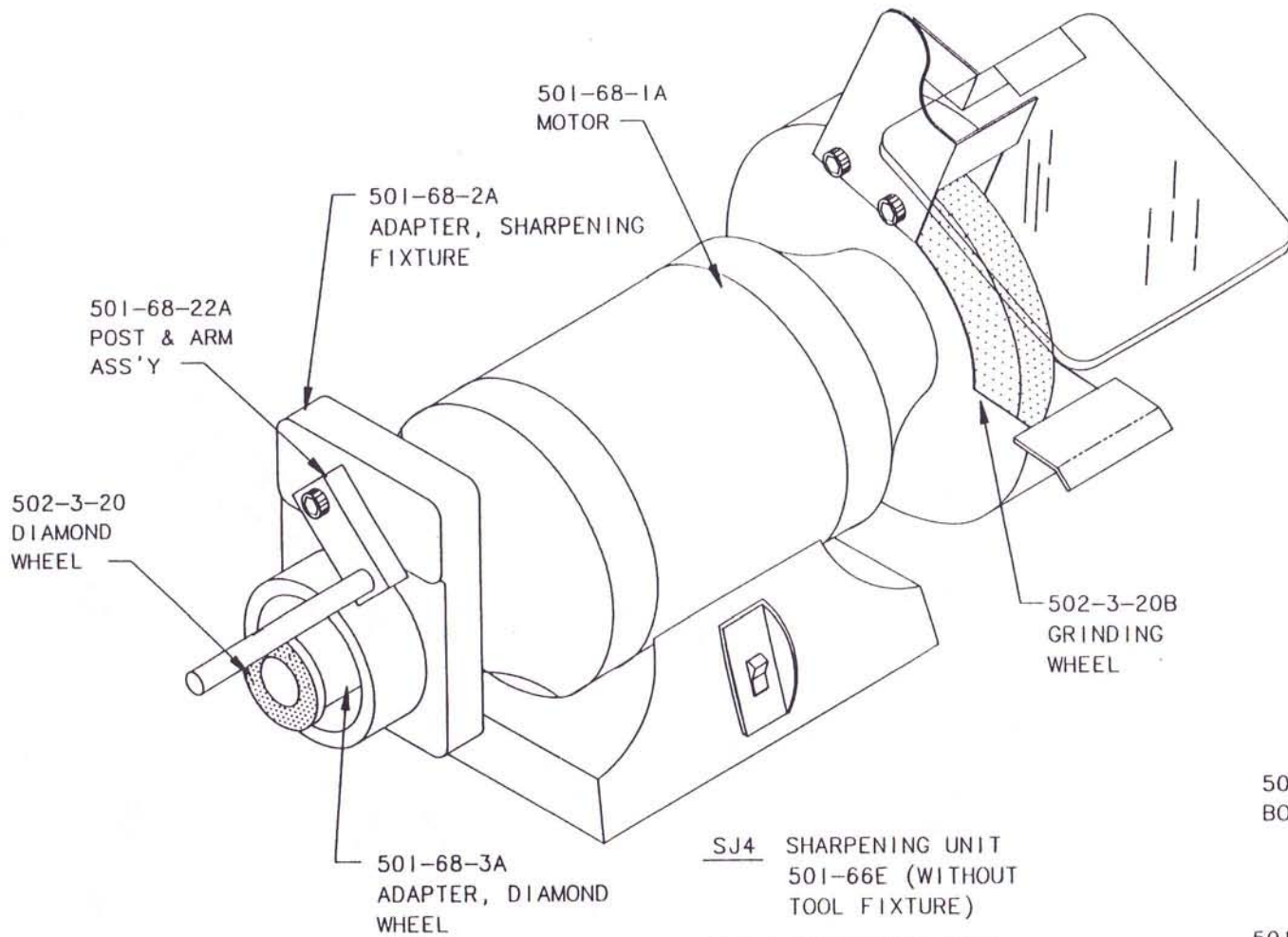


*CLAMP HANDLE ASS'Y
502-1-43

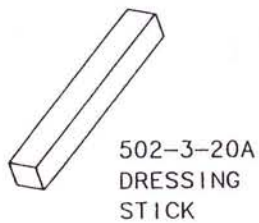
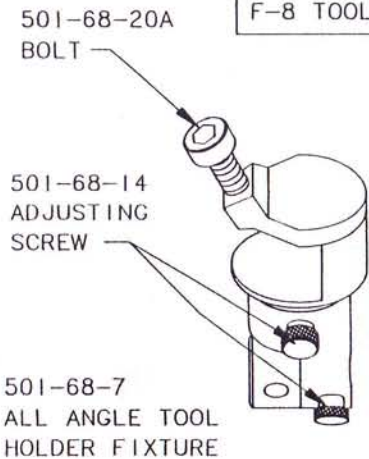


NOTE
1 LH. & 1 RH. PER
MACHINE. RH. SHOWN.

BLOCK HOLD DOWN CLAMP
VIEW M-M
502-1-30 ASS'Y



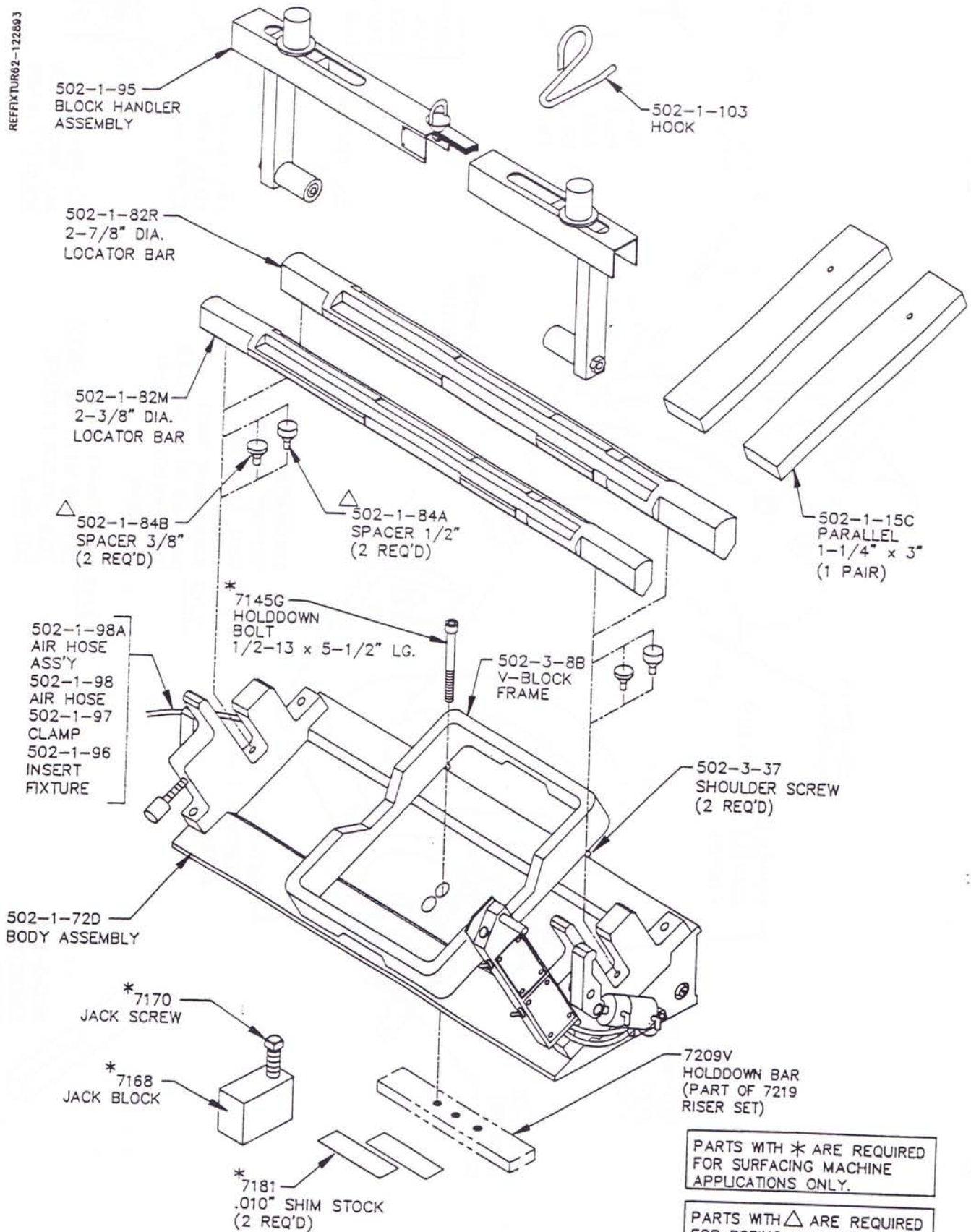
5418A
OPT. ROTTLER
TOOL HOLDER
FIXTURE FOR
F-8 TOOLING



- SJ4 SHARPENING UNIT
501-66E (WITHOUT
TOOL FIXTURE)
- SJ4B SHARPENING UNIT
501-66B WITH ROTTLER
TOOL HOLDER FIXTURE
501-68-8
- SJ4A SHARPENING UNIT
501-66D WITH ALL ANGLE
TOOL HOLDER FIXTURE
501-68-7

V6/V8 Fixture Assembly With Air Float

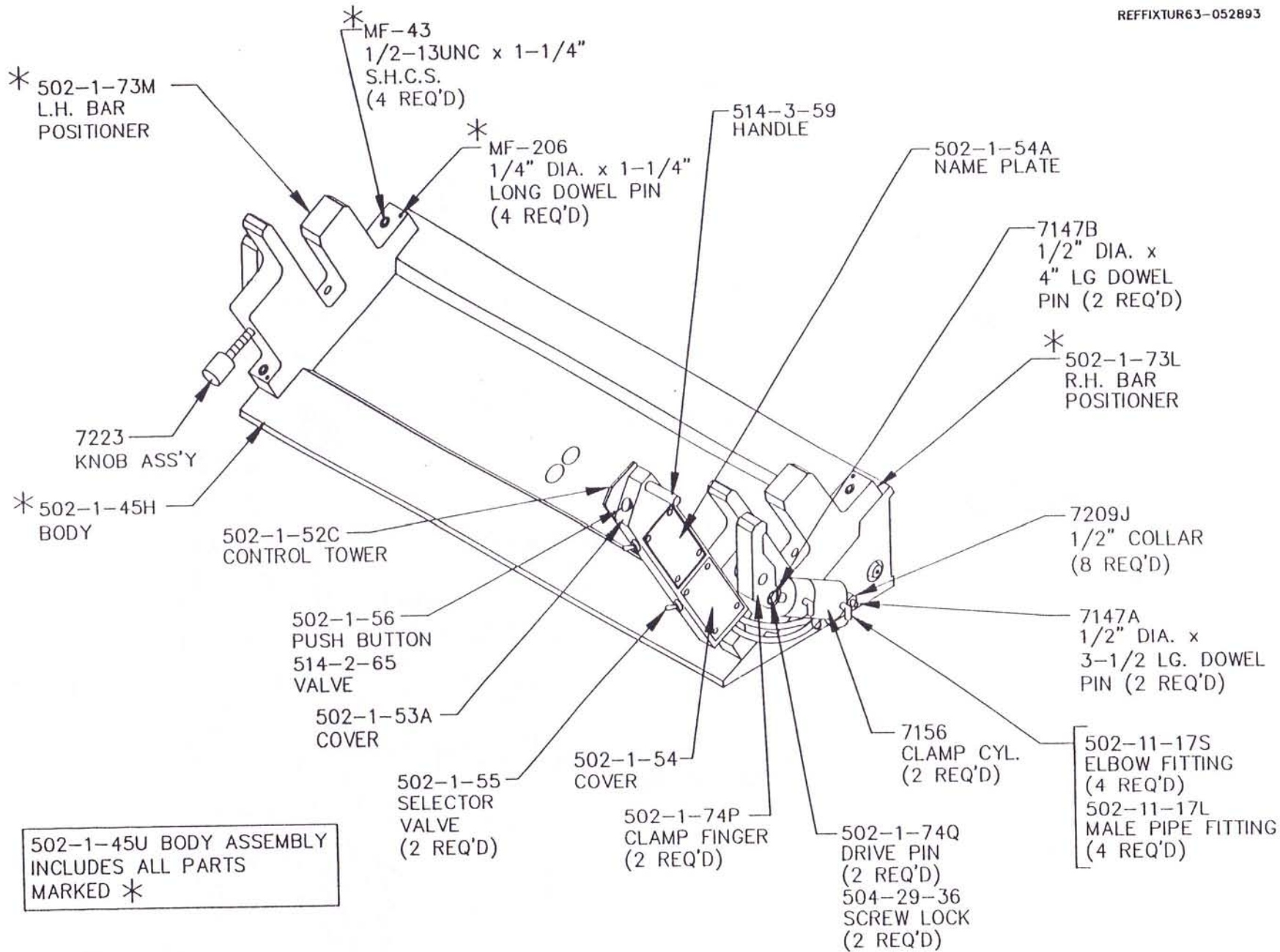
REFFIXTUR62-122893



PARTS WITH * ARE REQUIRED FOR SURFACING MACHINE APPLICATIONS ONLY.

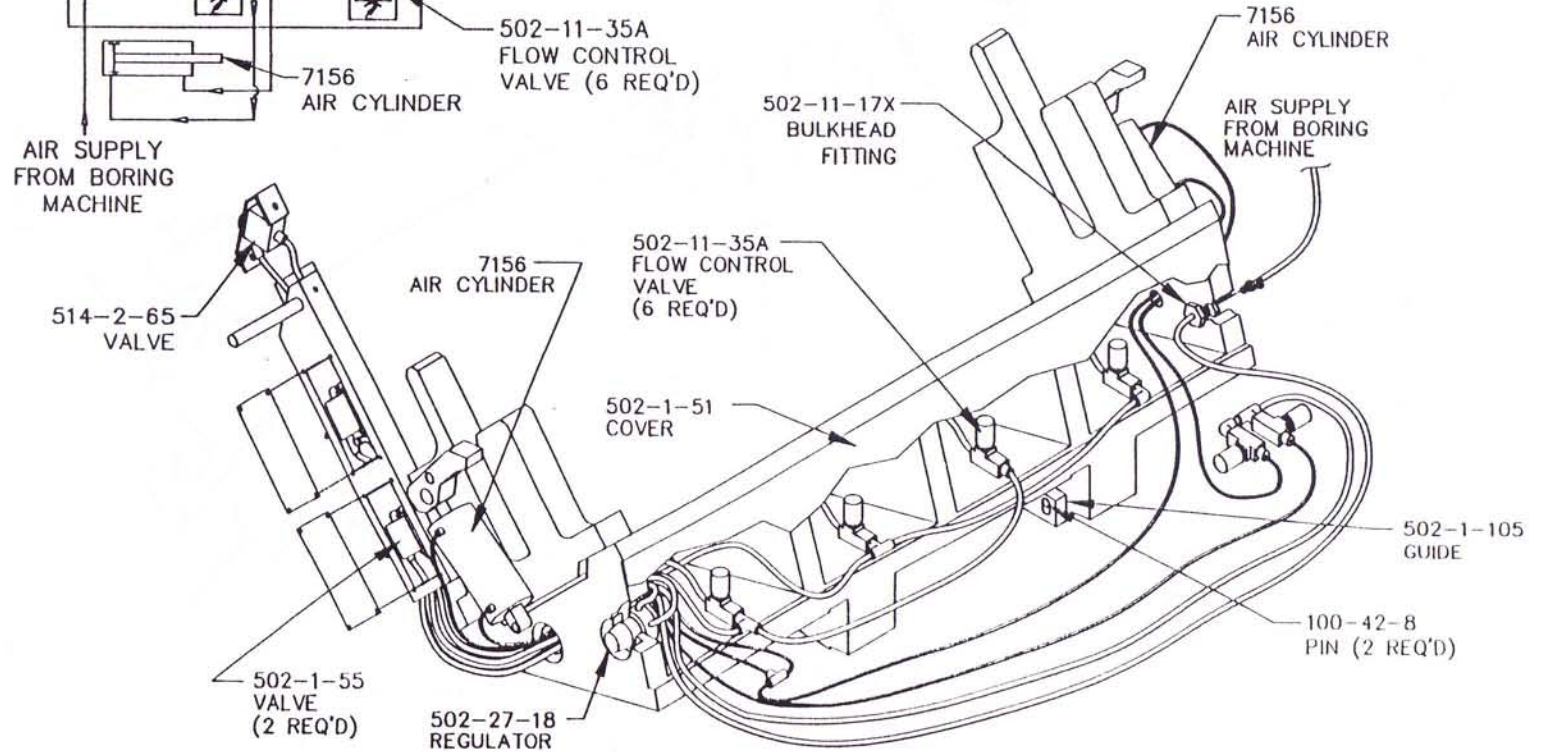
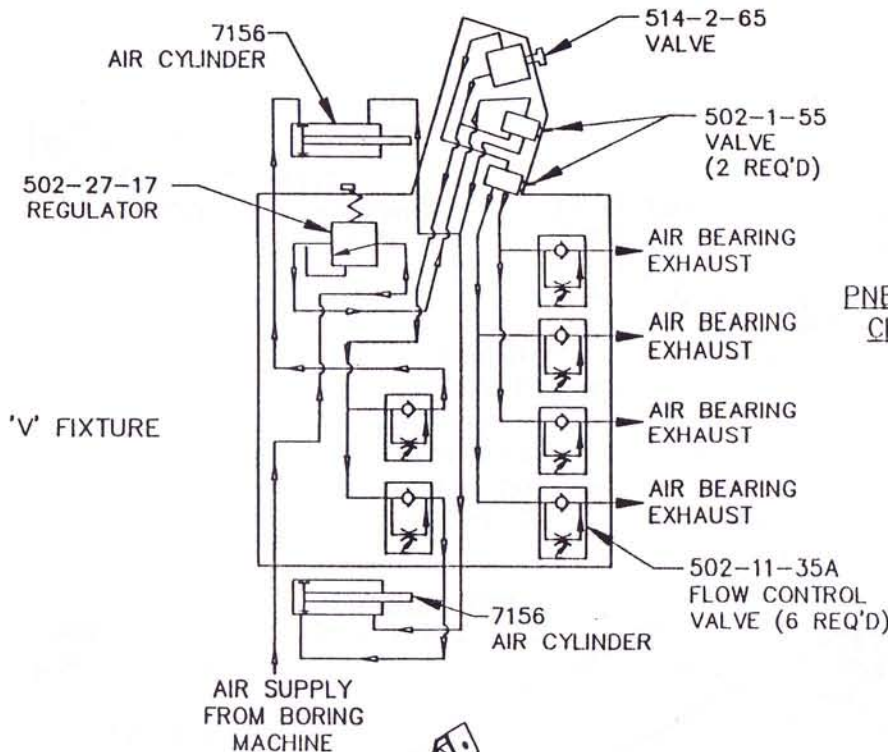
PARTS WITH Δ ARE REQUIRED FOR BORING MACHINE APPLICATIONS ONLY.

V6/V8 Air Fixture Body Assembly
502-1-72D

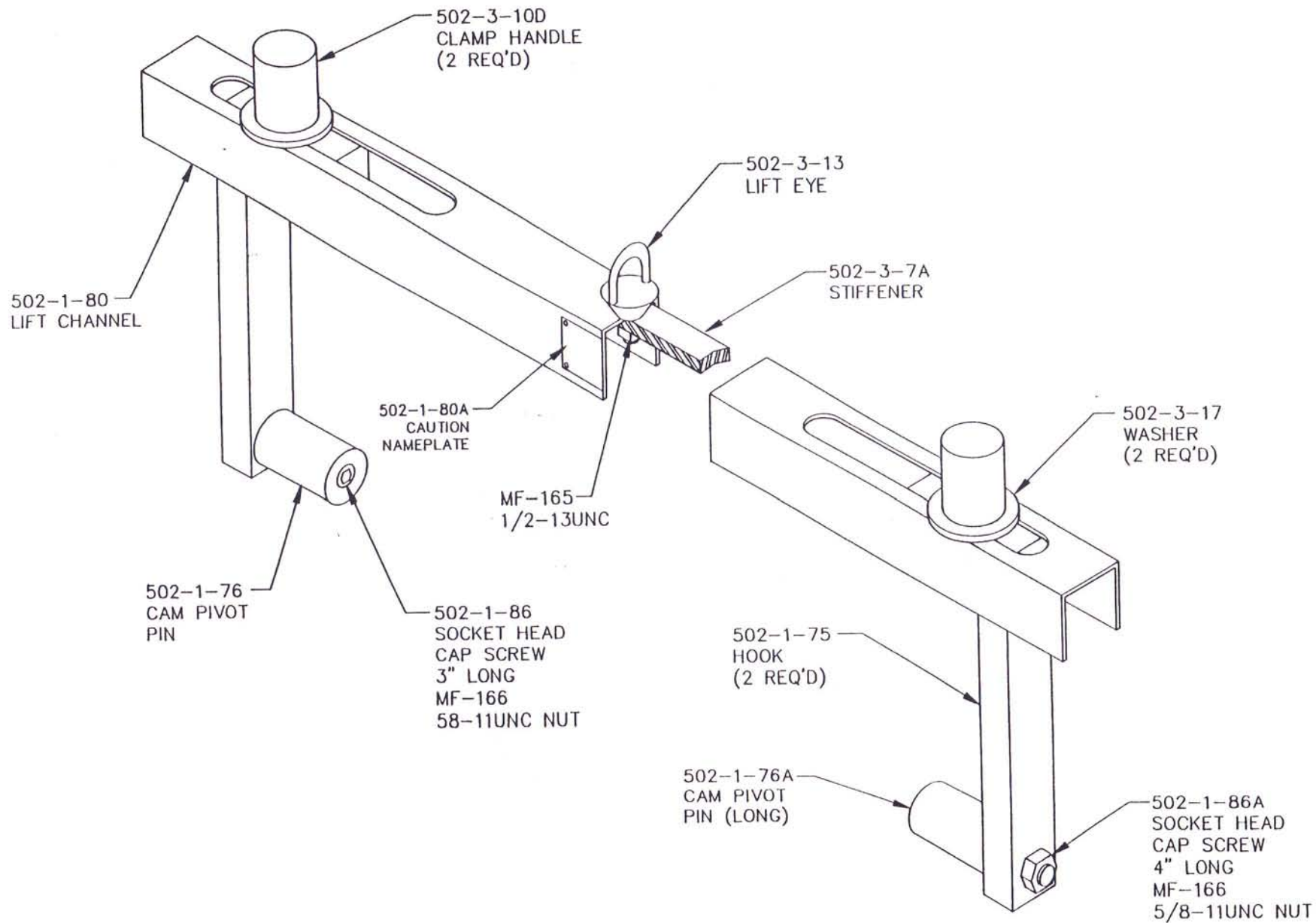


502-1-45U BODY ASSEMBLY INCLUDES ALL PARTS MARKED *

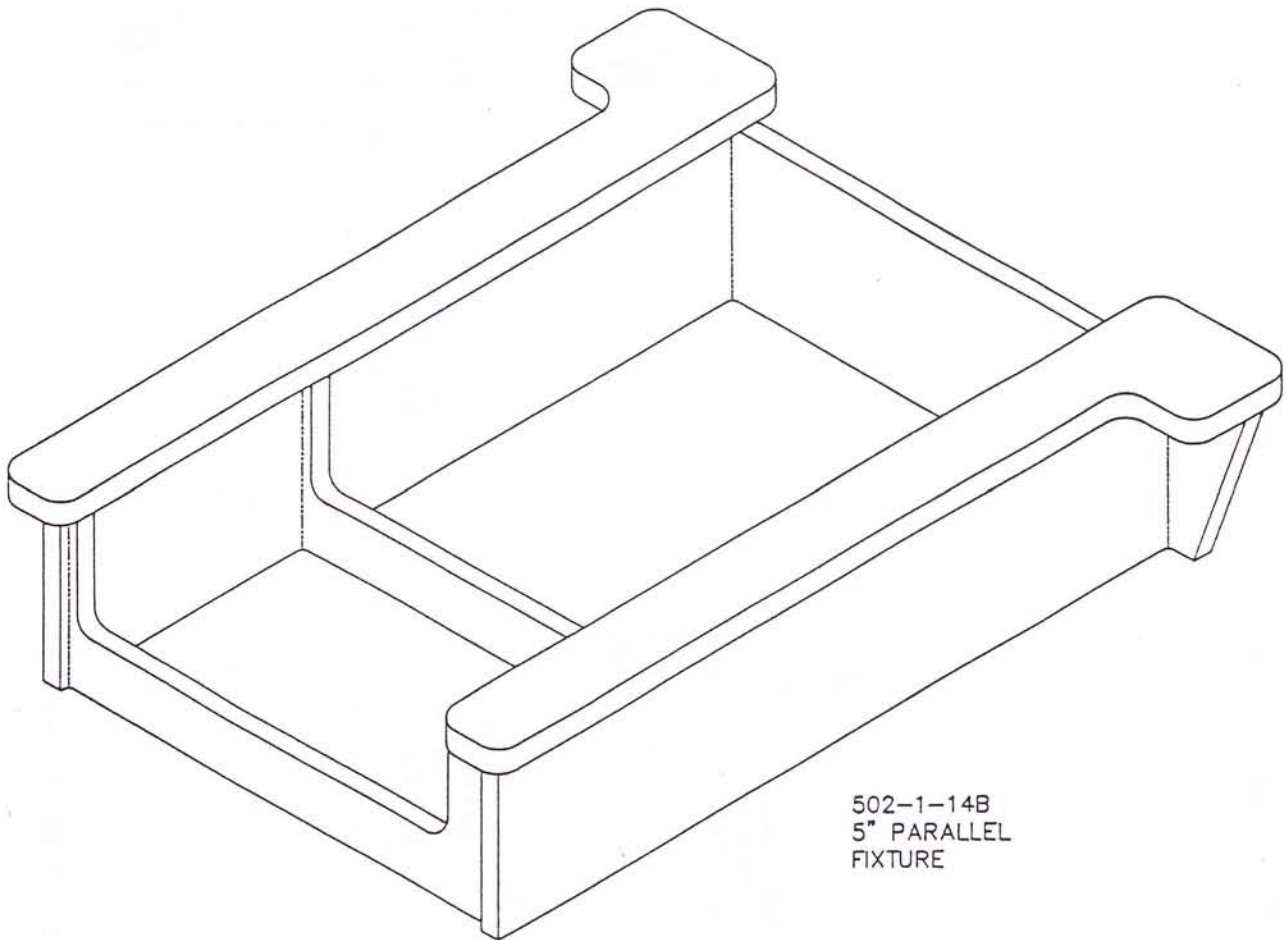
V6/V8 Air Fixture Body Assembly
Back View 502-1-72D



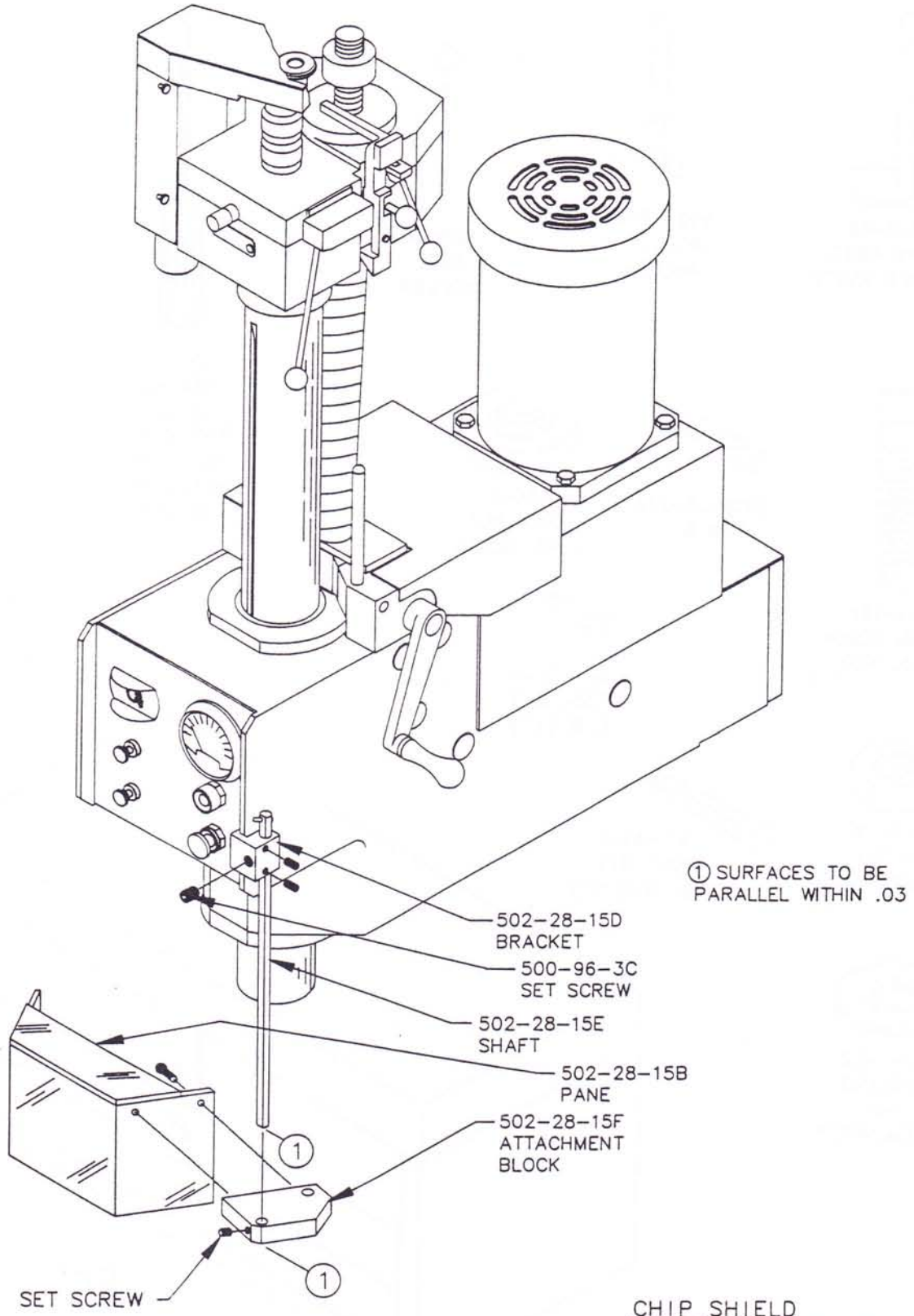
Block Handler Assembly
502-1-95

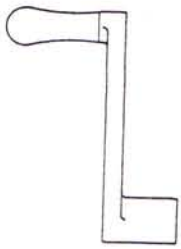


STANDARD ON AIR V6/V8 FIXTURE (502-1-72B)



502-1-14B
5" PARALLEL
FIXTURE





500-98
HAND FEED
HANDLE ASS'Y



502-12-2
SPANNER
WRENCH



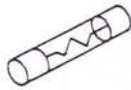
100-24
TOOL
PULLER



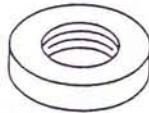
501-72
7/32" HEX
DRIVER
(OPTIONAL
501-72A
(5/32) HEX
DRIVER



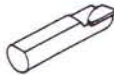
502-1-12A
JACKING SCREW
(4 REQUIRED)



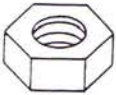
502-27-32B
FNM 8/10



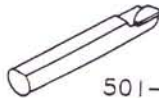
500-41
LOCK NUT
FEED SCREW



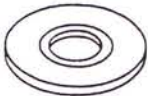
501-31-1
TOOL BIT
R 8 (1")



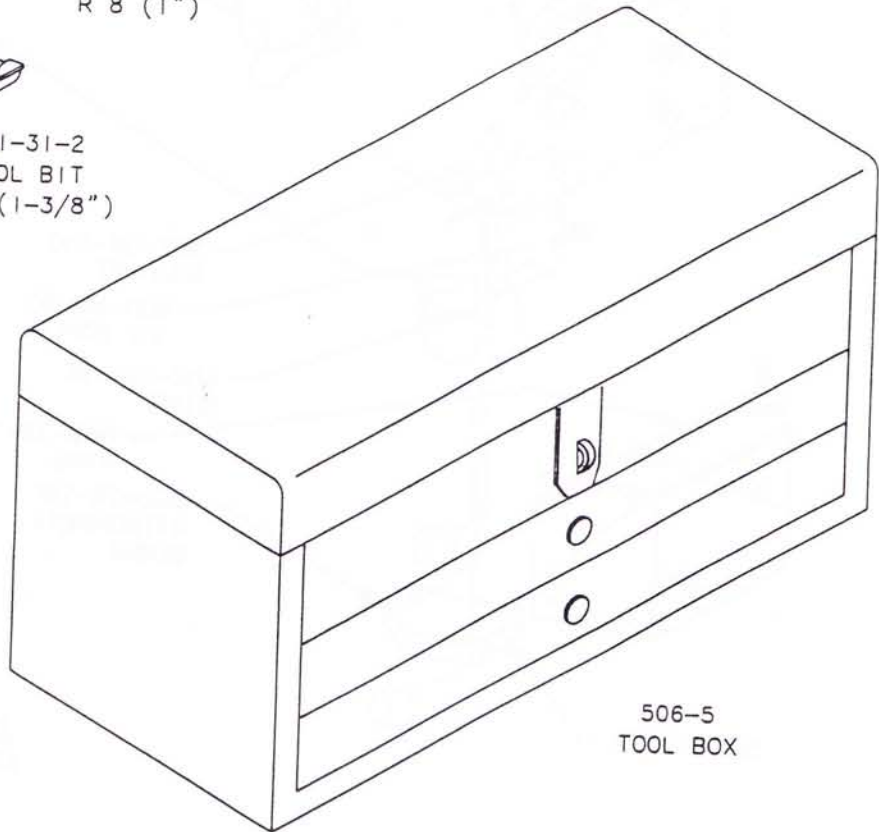
502-1-12F
JAM NUT
(4 REQUIRED)



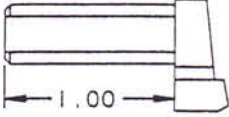

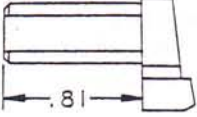

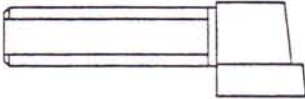

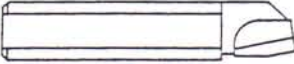

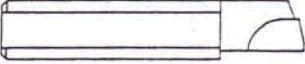

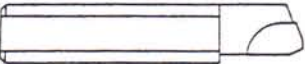

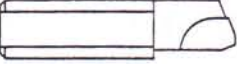

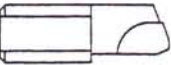

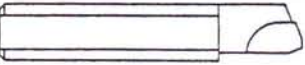

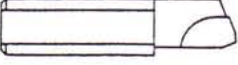

501-31-2
TOOL BIT
R 8 (1-3/8")


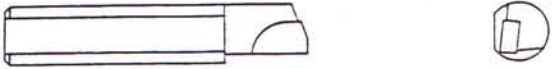
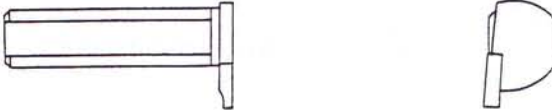
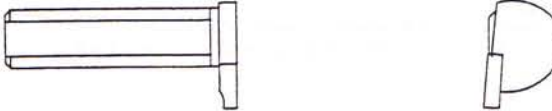
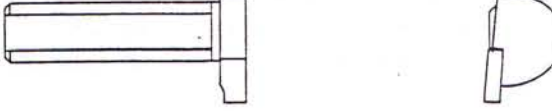


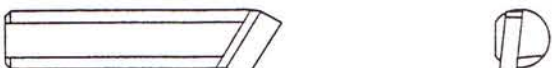
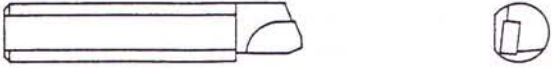



502-1-12
LEVELING
PAD
(4 REQUIRED)



506-5
TOOL BOX

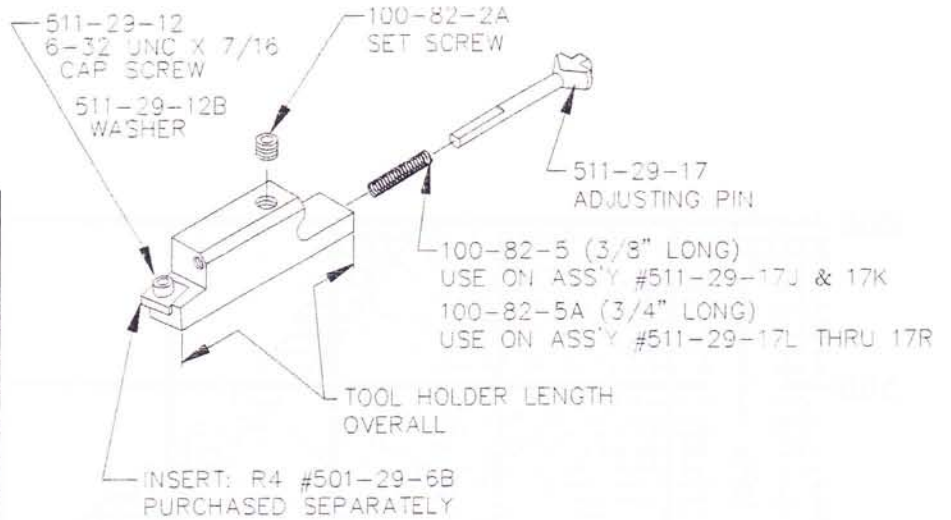
<u>PART NUMBERS</u>	<u>DESCRIPTION</u>
100-29 	 <u>OFFSET TOOL BIT</u> (for boring blind cylinder holes)
100-29-7 	 <u>OFFSET TOOL BIT</u> (for boring GM 60° V6)
100-76 	 <u>OFFSET TOOL BIT</u> (for boring blind cylinder holes)
501-28 	 <u>C.C. Steel Cutting Tool Bit</u> w/chip curler to break up chips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

<u>PART NUMBERS</u>		<u>DESCRIPTION</u>
501-31-1		<u>R8</u> Carbide Tool Bit, short 1"
501-31A		<u>C.C.B.</u> Cummins Counter Boring Tool Bit, for counterboring of cummins diesel cylinder block.
501-32-3		<u>.037</u> Grooving Tool Bit
501-32-1		<u>.048</u> Grooving Tool Bit
501-32-2		<u>.072</u> Grooving Tool Bit
501-32-4		<u>.152</u> Grooving Tool Bit
501-33B		<u>15°</u> Cummins Chamfer Tool Bit (chamfering cummins blocks)
501-33D		<u>30°</u> Chamfer Tool Bit (for general purpose chamfering cast iron)
501-33-1		<u>R8 (12° Rake)</u> Long Roughing Cut
501-33-2		<u>R1-Vega (12° Rake)</u>

Indexable Cartridge Tool Holders:

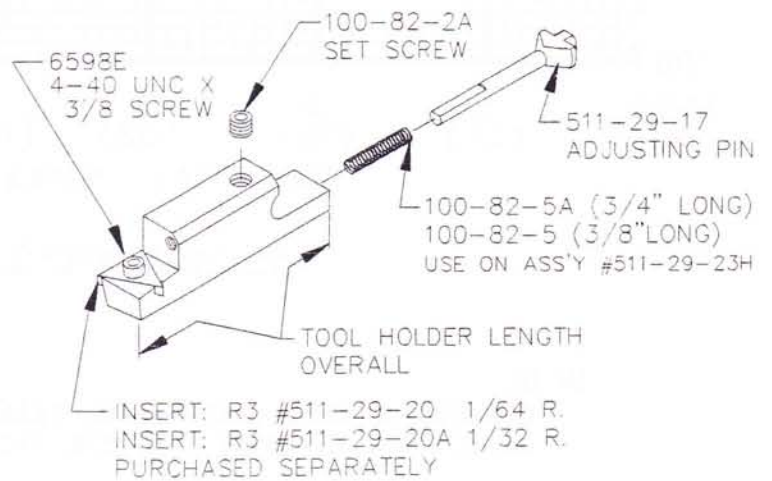
Square Cartridge Tool Holder Negative Rake

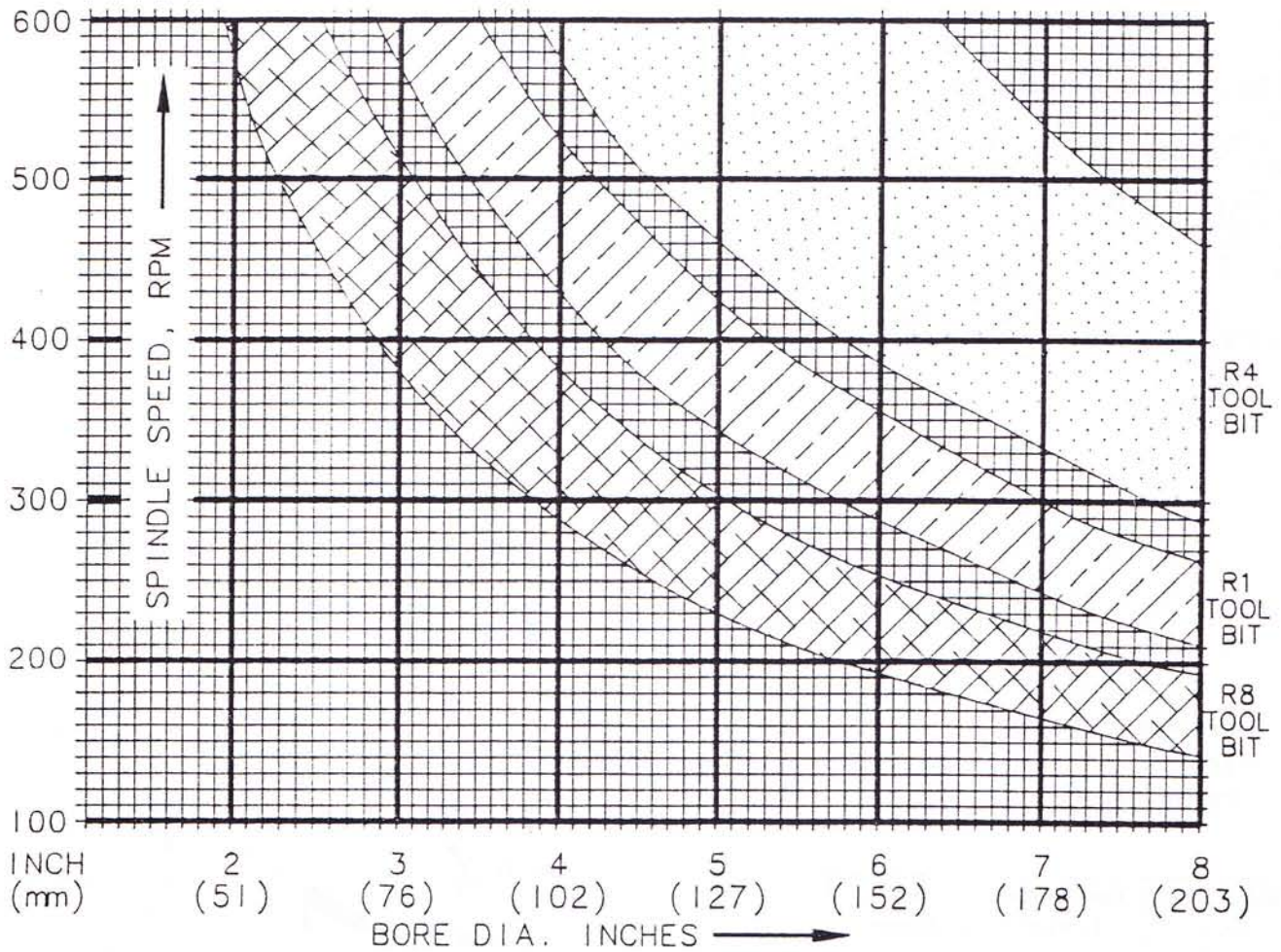
Tool Holder ass'y Part No.	Tool Holder Length	Bore Range
511-29-17J	1.95"	2.90 - 3.12
511-29-17K	2.15"	3.12 - 3.52
511-29-17L	2.35"	3.52 - 3.92
511-29-17M	2.55"	3.92 - 4.32
511-29-17N	2.75"	4.32 - 4.72
511-29-17P	2.95"	4.72 - 5.12
511-29-17Q	3.15"	5.12 - 5.52
511-29-17R	3.98"	6.77 - 7.17



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





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.