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ROTTLER
MANUFACTURING

F2MB
BORING MACHINE

MACHINE SERIAL NUMBER
220V, 50 Hz, 1 phase

OPERATIONS AND MAINTENANCE
MANUAL



MANUFACTURED BY:

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

**ORDER BY PART NUMBER.
THERE IS A MINIMUM ORDER OF \$25.00**

DESCRIPTION

The model F-2MB 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. F-2MB 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 220 volt, 1 phase, totally enclosed motor with an outboard fan. (Optional electrical ratings are available.) A manually operated two speed pulley system provides speed changes.

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Introduction:

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

It is required that the new user of the F2MB read this manual, in particular the sections concerning safety, before operating the machine.

Description:

The model F2MB boring machine is a precision, single point tool, boring unit. It can be equipped with tooling and accessories for reboring most American passenger car and truck engines, both inline and, 90 and 60 degree V-types.

F2MB machines may be readily tooled to rebore a wide variety of engines, including European and Asian engines. As well as perform various other boring operations.

This machine is designed for two purposes:

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

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

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

Power is supplied by a single phase, totally enclosed motor with an outboard fan. This motor will run on either 115 volts, or 208-230 volts. (Optional electrical ratings are available.) A manually operated two speed pulley system provides speed changes.

Limited Warranty:

Rottler Manufacturing Company model F2MB parts and equipment are warranted as to materials and workmanship. This limited warranty remains in effect

for one year from the date of delivery, provided the machine is owned and operated by the original purchaser and is operated and maintained as per instructions in this manual.

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

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

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

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

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

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

Safety Information:

CAUTION:

This machine is capable of causing severe bodily injury.

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

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

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

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

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

The operator and nearby personnel should be familiar with the location and operation of the off switch.

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

Machine Operator - Operator of this boring machine should be a skilled machinist craftsman, that is, well versed in the caution, care, and knowledge required to safely operate a metal cutting tool.

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

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

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

CAUTION:

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

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

NOTE: periodically check 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 hands 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 you fingers and hands well clear of the rotating feed screw and the knobs, both on top of the feed screw and the spindle.
5. **Work Loading and Unloading** - Carefully develop handling methods of loading and

unloading work pieces, so that no injury can result if hoist equipment or lift connection should fail.

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

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

Emergency Procedure:

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

IMMEDIATELY TURN OFF THE MACHINE BY FLIPPING THE ON/OFF SWITCH LOCATED ON THE FRONT PANEL OF THE MACHINE

Find out what the problem is, return the spindle to its up position, without causing more problems. To start the machine turn the switch back to on.

Be alert to quickly stop the motor, if the boring process is disrupted. A common cause of this is crashing the tool bit into a casting web, at the bottom of a bore.

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

Machine Installation:

Location:

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

The proper loading arrangement and area location for your F2MB machine is extremely important.

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

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

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

Unpacking:

Use care in removing the crate from the F2MB machine, being careful not to use force on any part of the spindle unit. This is particularly true of the outer spindle and the feed screw.

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

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

Shipping Hold Down Bolt:

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

Pull out the cotter key through the slotted nut of the roller key assembly and loosen the nut. 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 nearest slot. Now move the spindle unit from side to side and clean the rust inhibitor from the table. This must be done repeatedly until all the rust inhibitor is gone from under the spindle unit.

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

NOTE:

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

Replace sheet metal cover on the spindle unit.

Leveling:

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

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

Air Supply:

It is very important the air source for the F2MB boring machine be moisture free. Water and oil in the line will result in early cylinder and valve failure. Our recommendation is the installation of a water trap at the machine.

Attach a 100 P.S.I. air source to the appropriate intake at the air filter on the side of the rear control enclosure.

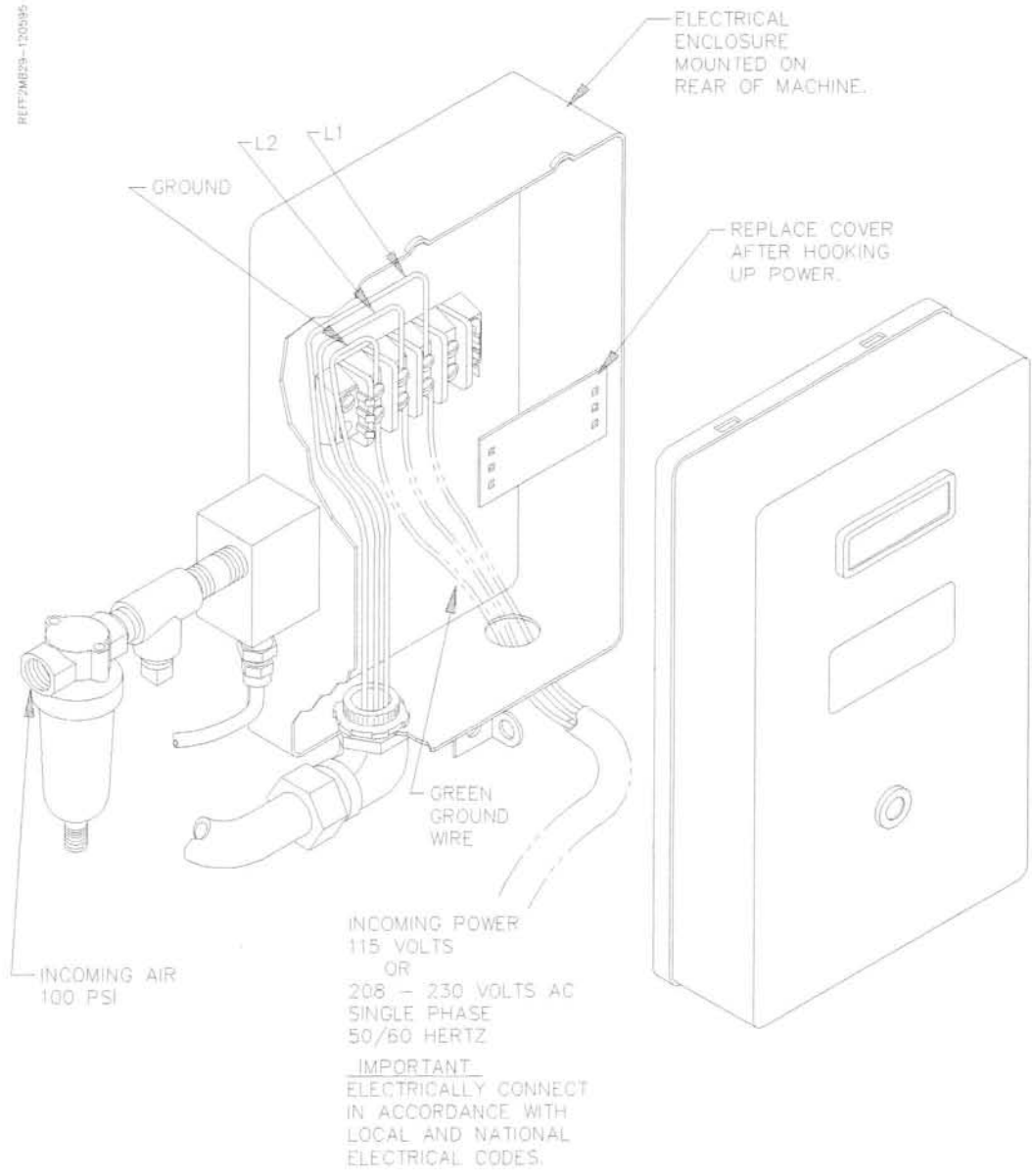
Power Supply:

This machine requires either 115 volts AC or 208 to 230 volts AC single phase, 50/60hz. (measured between L1 and L2). Current requirement is 15 amps. Excessive voltage drop at the power source can cause the machine to malfunction. Check the available voltage at peak use time to see if it will supply the proper voltage.

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

Connect single phase wiring to the terminal strip in the electrical enclosure located on the rear of the machine.

Electrical Hook-up Illustration:



Controls:

NOTE:

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

Clamp / Neutral / Float Switch:

Move this switch to the right most position to activate the spindle base clamp. This energizes two air cylinders which push up on the roller key bolt which locks the spindle base down to the main base.

Move the switch to the center position to put the machine in a neutral position. In this position the spindle is neither floated or clamped. You will find it often useful to use this position for fine adjustments, particularly when using a dial indicator to center the cutterhead in a bore. With the spindle base in neutral it is still relatively easy to move it by tapping the spindle base with the palm of your hand.

Move the switch to the far left position to activate the spindle base float. With the float turned on it is very easy to move the spindle base around. When float is activated air is exhausted out from under the spindle base, this makes the spindle base ride up on a cushion of air.

CAUTION:

Motor must be stopped when positioning the spindle base. Accidental spindle engagement could injure the operator or damage the machine or workpiece.

Spindle Clutch Lever:

The spindle clutch lever is the first lever on the right side of the upper housing. The knob is spring loaded, pull the knob straight out to release the detent. With the motor running, hold the knob out, and pull down quickly to engage the spindle rotation. Pull the knob out again and raise the lever to disengage the spindle rotation

The spindle is actuated and driven by a toothed clutch. If the spindle clutch lever is pulled down too slowly the teeth on the clutch will chatter and not engage. When using *high spindle R.P.M.*, engage the spindle clutch lever with the motor turned off, or jog the motor with the start switch while pulling down on the spindle clutch lever.

At the end of a cut, stop the feed, then disengage the spindle clutch. Grasp the lower of the two upper knobs and use it to turn the cutterhead around clockwise until

the detent stop is felt. The tool bit should now be pointing straight to the front. Use the rapid return lever to bring the spindle back up to the home position.

Feed and Rapid Return Lever:

The second lever on the upper housing is the feed lever. With the motor on and the spindle engaged, pull down on the feed lever to start downward travel. Pull the lever down until it latches on the pin so it will stay.

To disengage the feed, press the release arm (square pad at the top of the feed lever) this will unhook the feed lever from the pin, and shift it back to neutral. Lift the feed lever until it latches to engage the rapid return travel. The machine will automatically shift back to neutral when it reaches the top of its travel. If you want to return the machine to neutral before it reaches the top of the travel, press the feed lever release arm. This will unlatch the lever and shift it back to neutral.

In the spindle base there is a rod with a rounded end on it. This is the stop rod. When the boring bar reaches the bottom of the first bore stop it by pressing the feed release arm. Loosen the set screw that secures the stop rod. Raise the stop rod to a position that will trip the feed lever, and tighten the set screw. Now for the rest of the bores in this engine block the machine will automatically stop at this point. *The stop rod should not be used to hold close tolerance shoulder cut depths.*

Fast Down Lever:

The third lever on the upper housing is the rapid down lever. The *feed lever must be in the neutral position* before actuating. Lever must be pulled down quickly and firmly and not be allowed to chatter or grind. This lever is spring loaded and will release when you release the pressure.

The operator should be familiar with the function of the fast down lever. Place a tool holder in the cutterhead, and practice using the fast down lever to rapid travel the tool holder down to an exact position and stopping it. With a little practice this operation can be done very quickly and accurately.

Manual Hand Feed:

The manual hand feed travel is available for facing sleeves and counterboring, or wherever there is a need for precise and accurate depth control.

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

CAUTION:

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

This is the standard procedure for operating the manual hand feed. Be sure the feed lever is disengaged. Use the rapid down lever to bring the tool bit down close to the starting point of the cut. Actuate the spindle clutch lever to start the spindle turning. Place the hand feed handle in its hole on the right side of the spindle base. Turn handle clockwise to lower the cutterhead into the bore. After the cut is made turn the handle counter clockwise to return the hand feed. The maximum travel of the manual hand feed is approximately 2". Use the fast return lever to bring the boring cutterhead back up to the top, after returning the hand feed up to its top position.

Two Speed Drive:

The speed of the machine is controlled by a V-Belt on a stepped pulley arrangement. To change speed, turn off motor. Loosen knob 514-6-86 and rotate side cover 502-9-52D out of the way. Loosen the bolt, securing the

motor on the left side, and pivot the motor forward, towards the spindle. Move the V-Belt to the desired pulley groove. (*Top groove - 200 R.P.M. , Bottom groove - 400 R.P.M.)* Slide motor back and tighten the bolt. Replace side cover and tighten knob.

Centering Knob:

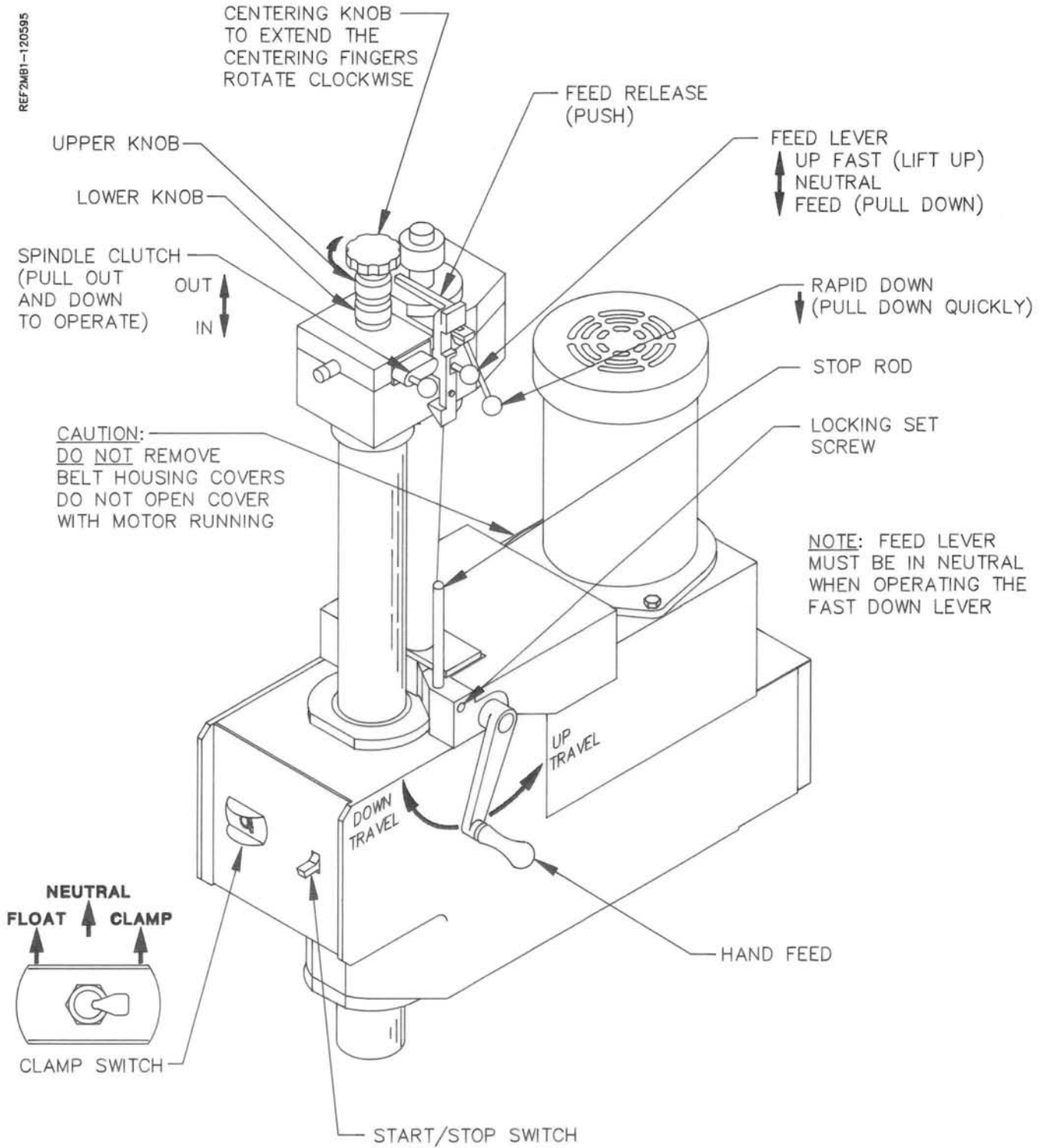
The centering knob is the black knob on top of the spindle. To extend the centering fingers turn the knob clockwise. Be careful not to over extend these fingers, if the cutterhead is not in a cylinder bore, they will come out too far and disengage the centering pinion. To retract the centering fingers, hold the lower inner spindle knob or the cutterhead, and turn the centering knob counter clockwise.

CAUTION:

The motor must be stopped when centering. Accidental spindle rotation engagement could injure the operators hands or damage cutter head parts.

Controls Illustration:

REF2MB1-120595



CAUTION:
 DO NOT REMOVE
 BELT HOUSING COVERS
 DO NOT OPEN COVER
 WITH MOTOR RUNNING

NOTE: FEED LEVER
 MUST BE IN NEUTRAL
 WHEN OPERATING THE
 FAST DOWN LEVER

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

CONTROLS

NOTE:

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

Loading In-Line Cylinder Blocks:

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

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

CAUTION:

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

Block Clamps:

(See block clamp arms at the end of the manual). Position clamp arms so the front of the shoe will contact the block on the ends approximately in the middle.

Tighten clamp arm handles. Lower the shoe onto the block with the cam handle straight up. Tighten clamp leg handles. Lower the cam handle, to clamp the block. If the block is exceptionally long, such as in-line 8 cylinders, operate the two cam handles simultaneously so that locking the first handle does not tend to tilt up the opposite side of the block.

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

Micrometer:

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

Place the tool bit and tool holder into the micrometer. Loosen the tool bit lock screw (do not

allow the tool bit to snap against the anvil). Set the micrometer head to the desired bore size. Lightly tighten the tool bit lock screw. Back off micrometer head. Firmly tighten tool bit lock screw. Recheck micrometer reading.

Choose a tool holder that will require minimum tool bit overhang. (It is recommended, a maximum tool bit overhang of 5/8" past the end of tool holder.)

Before setting, make sure the tool bit is properly sharpened. (See tool sharpening instructions.) If you are using an insert style tool bit make sure the cutting edge is sharp and not chipped or damaged.

NOTE:

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

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

Centering:

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

Switch the spindle base Clamp / Float switch, to the Float position. Move the spindle base over to the cylinder to be bored, and place it approximately in the center of the hole. Activate the fast down lever, and rapid travel the cutter head down into centering position. (*Be very careful not to crash the toolbit into the block*).

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

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

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

Boring:

Center the cutterhead as described previously. Engage the spindle clutch lever. Start the motor and engage the feed lever. The machine will start boring, and continue until the feed lever is disengaged. Immediately after boring through the cylinder, set the stop rod so it just disengages the feed lever. This stop rod is set so the machine will stop at the same depth in the next cylinder bores. If the block style changes the lower limit setting will also change. Watch for obstructions at the bottom of the bores. *(Be sure the machine will stop before crashing into anything).*

Disengage spindle clutch. The spindle should turn on or two more turns, then it should stop with the cutting tool facing forward. If it doesn't face forward when it stops, turn the spindle knob on the upper housing, clockwise until the spindle detent is reached. This will index the cutting tool to the front of the machine. Lift Feed Lever to the rapid up position. When the cutterhead clears the top of the cylinder block, disengage Feed Lever. Switch the Clamp / Float switch to the Float position. Slide the spindle base over to the next hole, and repeat the boring process.

If you want to check the bore diameter before boring a full cylinder, stop the feed just deep enough to get the measuring device in. Disengage the spindle clutch. Index the cutting tool to the front. Rapid up travel to the top. Turn off motor. Check bore diameter, adjust tool bit if necessary. Continue boring the remainder of this cylinder. Do not unclamp or move the machine during the measuring process.

For a cut that is to remove .005" diameter or less, use the following centering procedure. Switch the Clamp / Float switch to the middle (Neutral) position. With a dial indicator attached to the cutterhead, use your hand to bump the spindle base around until the spindle is centered over hole. Switch to Clamp.

Boring Large Truck Blocks:

The F2MB boring machine has the capacity to bore truck engines such as the in-line Mack and the in-line GMC series 71. It is necessary when boring these large blocks to remove the wear pads (502-1-21) and place the block directly on the main base (502-1-20). The blocks are then bored according to the instructions.

Depths of Cut:

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

Stub Boring Bar:

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

Centering Fingers - Remove & Replace:

CAUTION:

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

Centering fingers can be removed by rotating the centering knob clockwise until the fingers can be pulled out. When they are replaced in the cutter head, they should be placed in the respective numbered slots. First rotate centering knob clockwise and then counter-clockwise to insure that the fingers enter the pinion teeth simultaneously.

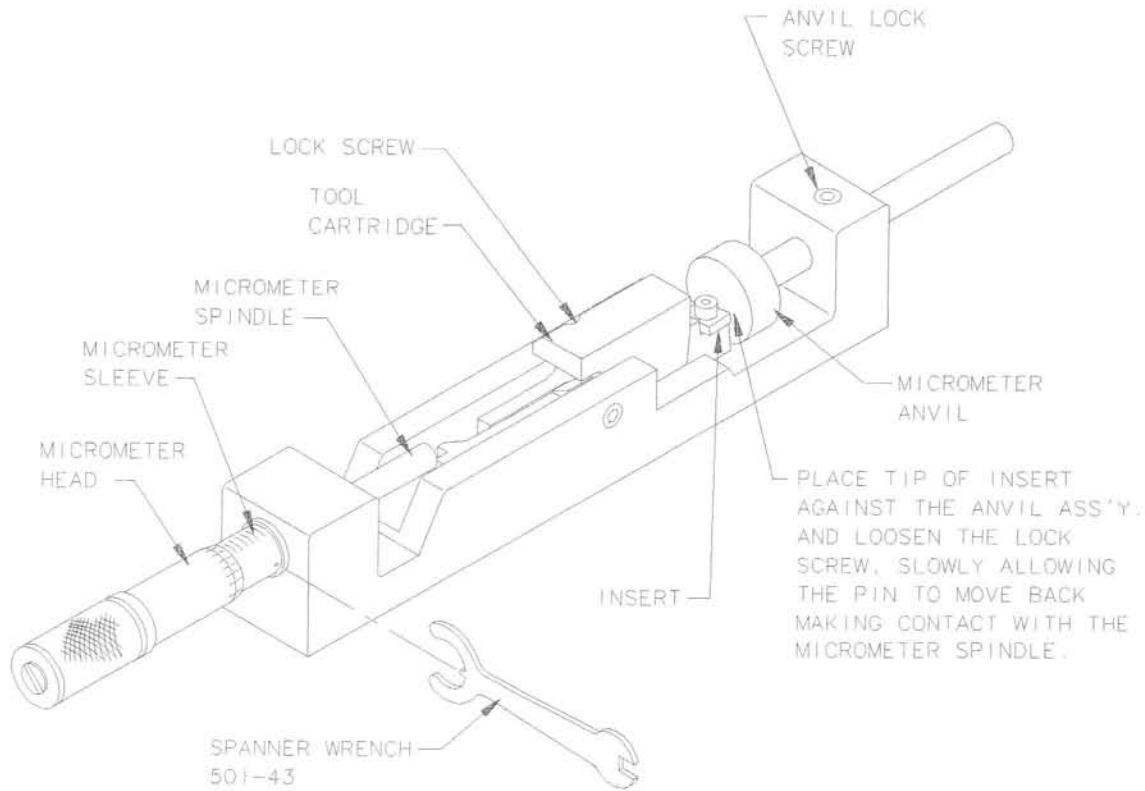
Centering Accuracy Check:

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

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

Micrometer:

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



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

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

Optional Micrometer Capacity To 8" Diameter:

The 2.90" to 6.0" micrometer can be reset to a 4.9" to 8.0" micrometer.

Calibrate the micrometer per instructions - page 3.5. Set the micrometer to 6.00", place the 'Standard' in the micrometer frame and release the adjustable pin. Be sure the standard is touching both the anvil and

the micrometer head. Tighten the set screw and check size. The standard is now set. With the micrometer set in this range, read directly on the micrometer sleeve for size setting.

To reset the micrometer for boring in the 4.9" to 8.0" range, adjust the micrometer to read 4.00". Loosen the set screw on the micrometer anvil. Slide the anvil back and put in the standard. Adjust the anvil up to the standard and lock it by tightening the set screw. With the micrometer set in this range, it will read 2.9" to 6.0" but will actually set tool from 4.9" to 8.0". When the micrometer is set for larger bores, remember the bar will bore 2" larger than the micrometer reads.

Install and Remove Toolholders:

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

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

Install and Remove Cutterheads:**CAUTION:**

Turn off power to machine before changing cutterhead.

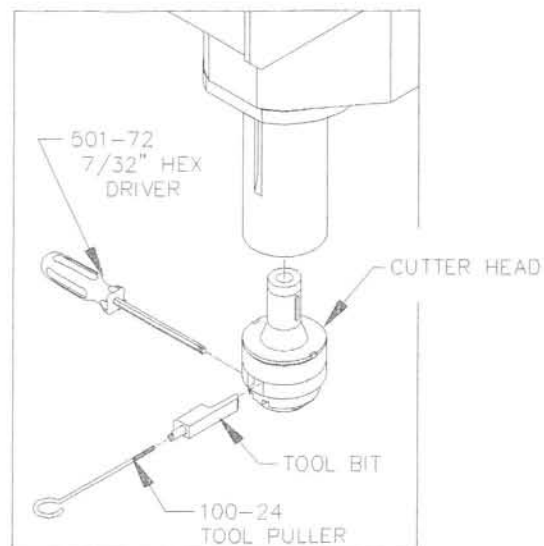
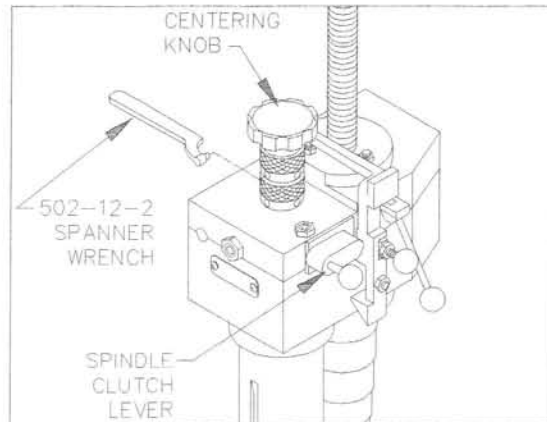
Centering fingers must be removed before changing cutterheads. Damage to the centering fingers could result if they are left in.

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

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

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

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

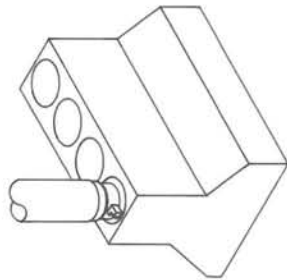


Calibrating Micrometer:

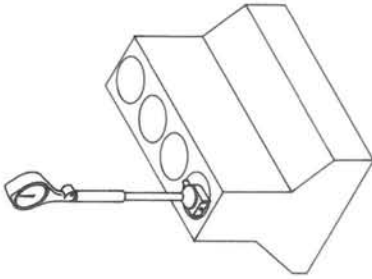
REFAVB69-120695

PROCEDURE FOR CALIBRATING MICROMETER

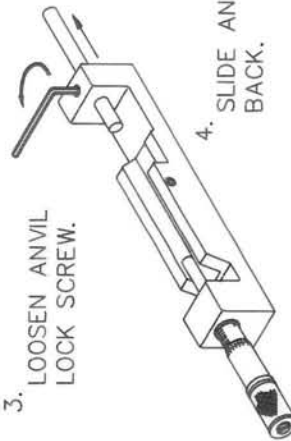
1. USE THE BORING MACHINE TO BORE A HOLE IN A SCRAP BLOCK. WITHOUT CHANGING ANY SIZE SETTING REMOVE TOOL HOLDER.



2. MEASURE THE HOLE THAT YOU BORED.

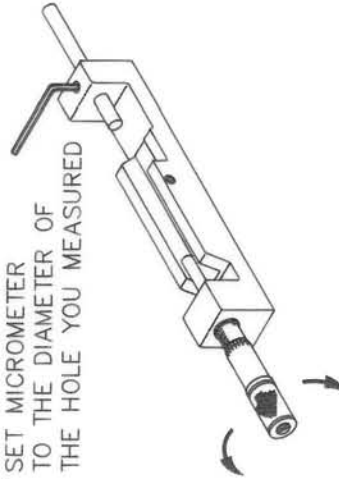


3. LOOSEN ANVIL LOCK SCREW.

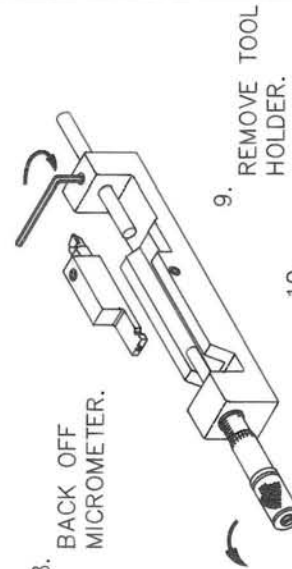


4. SLIDE ANVIL BACK.

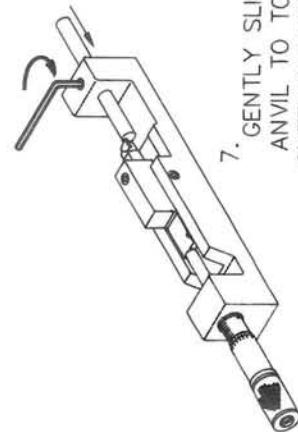
5. SET MICROMETER TO THE DIAMETER OF THE HOLE YOU MEASURED



8. BACK OFF MICROMETER.



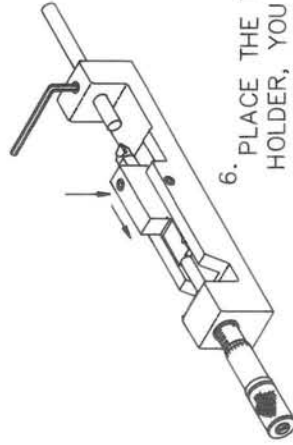
7. GENTLY SLIDE ANVIL TO TOUCH CUTTING CHIP. AND LIGHTLY TIGHTEN LOCK SCREW.



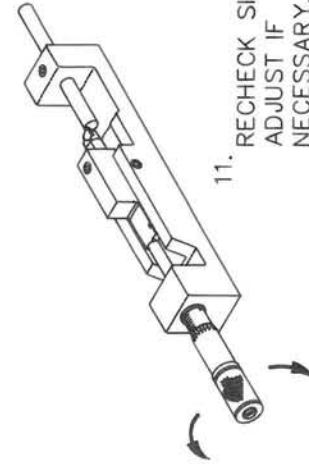
9. REMOVE TOOL HOLDER.

10. TIGHTEN LOCK SCREW.

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



11. RECHECK SIZE. ADJUST IF NECESSARY.



Lubrication:

Refer to illustration on page 4.3. Below are directions explaining where and how to lubricate the systems.

Upper Housing:

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

Every 2,000 hours, the Upper Housing should be opened up and the old grease removed. Repack with a mixture of *4 parts grease to 1 part oil*. For grease use *Union Oil-Unoba F1 or F2 lubrication, Mobil oil-Mobilith A.W. grades 1 or 2, Chevron 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*.

Spindle Drive Gear Bearing:

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

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

Motor Gear Housing:

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

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

Do not over fill.

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

Feed Screw Drive:

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

Every 8 hours, remove the snap plug covering the feed screw grease fitting (see illustration).Lightly lubricate with *Unoba F1 or F2 lubricant, lubriplate*

#9930AAA Mobil Oil - Mobilith A.W. grades 1 or 2, Chevron Durolith EP1 or EP2, or any equivalent lithium barium grease.

Inner Spindle:

The inner spindle turns inside the outer spindle.

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

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

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

IMPORTANT:

Do Not fill cavity between these bearings with Grease.

Outer Spindle:

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

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

Hand Feed Assembly:

Every 1000 hours, disassemble the hand feed assembly (see page 4.13). Lubricate bronze bushing and bevel gear shaft with *Unoba F1 or F2 lubricant, Lubriplate #9930AAA., Chevron Durolith EP1 or EP2*, or any equivalent lithium barium grease.

General Lubrication:

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

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

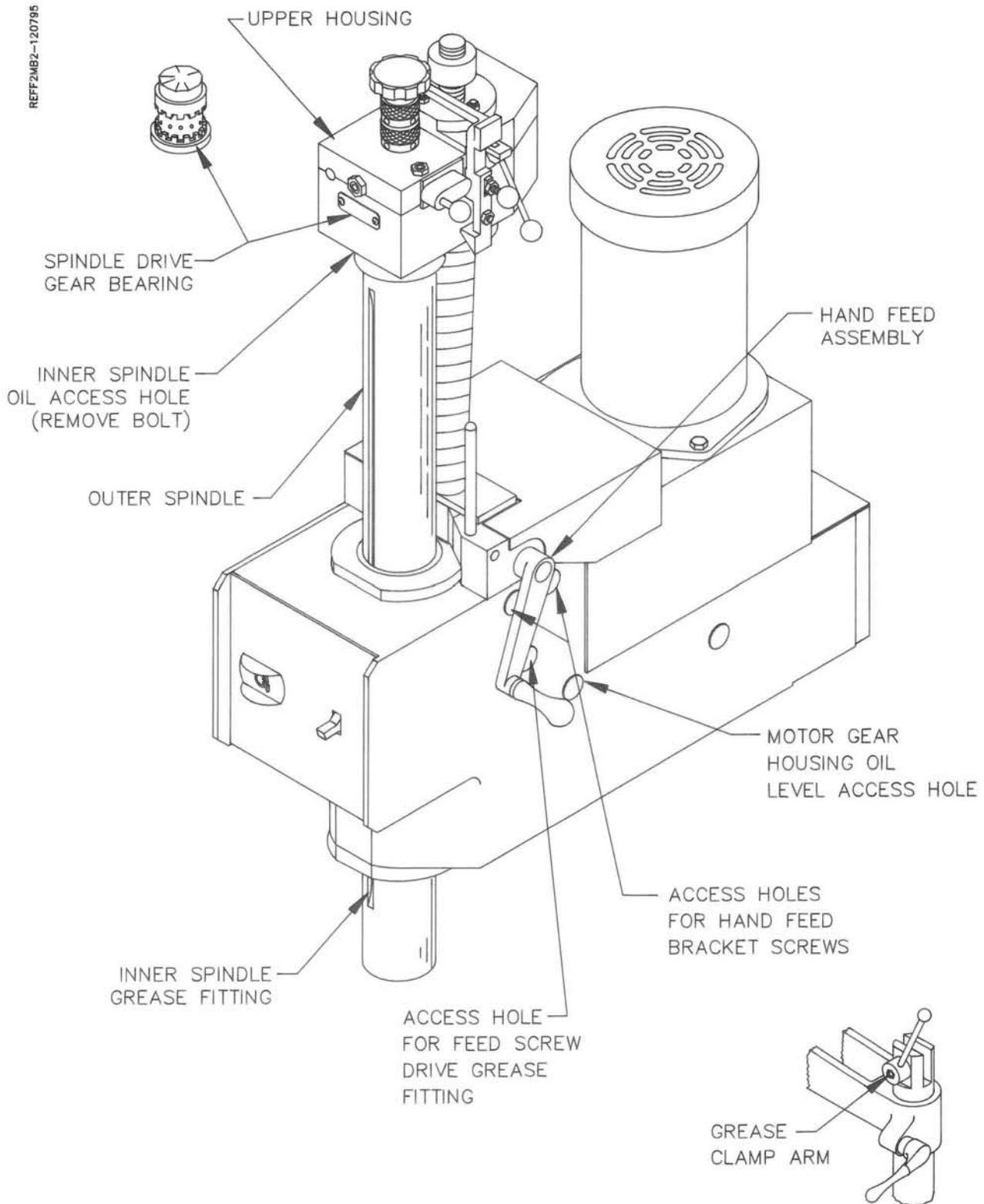
Quick Reference Lubrication Chart

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

IMPORTANT:

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

Spindle Base Lubrication:



LUBRICATION

Adjustment of Outer Spindle:

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

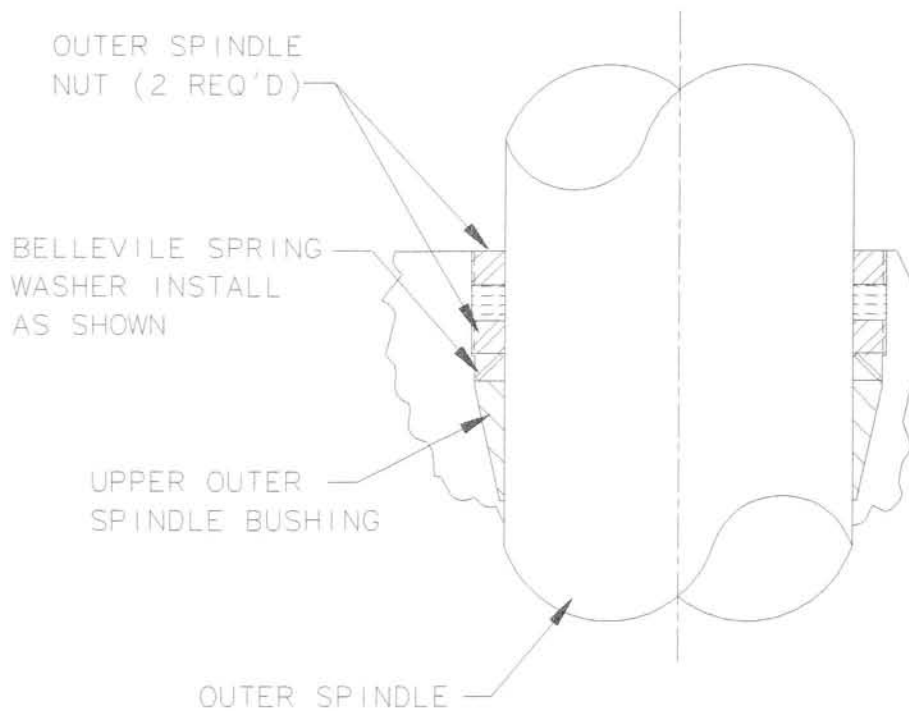
The upper bearing is preloaded in place by a Belleville spring washer, below the adjustment nut. This adjustment should be checked after the shipment of the machine.

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

CAUTION:

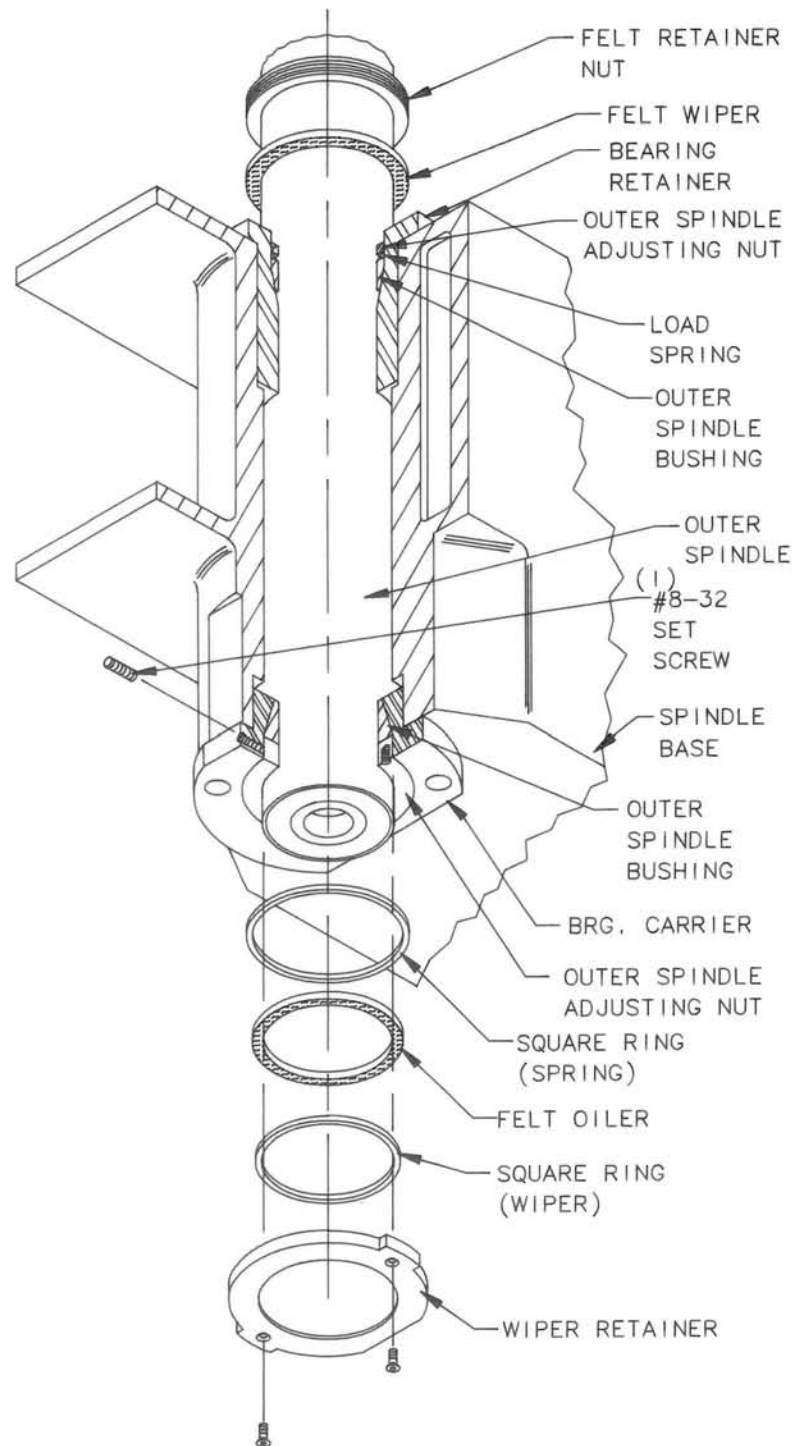
Be careful not to over tighten these bearings. An over tight condition only serves to wear out the machine and make control operation difficult.

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



Outer Spindle Adjustment:

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



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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 lb. on the inner spindle will move it .0002 to .0007 out of the outer spindle, see illustration below.

Adjustment:

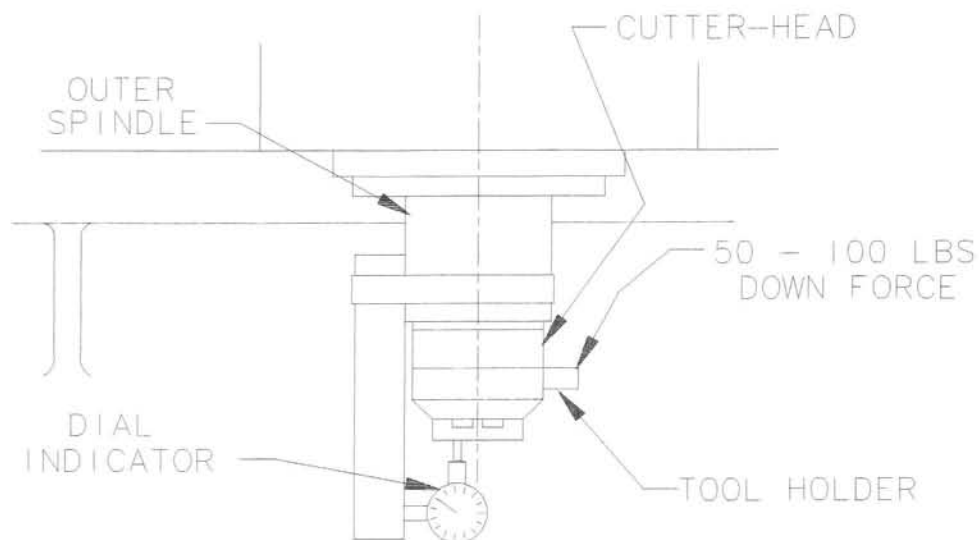
1. Remove two screws and small cover on the front of the upper housing.
2. Remove the spindle clutch lever stop screw (see page x.xx). Move the spindle clutch lever to full up position (it will go up further than normal).
3. Position the tool holder slot of the cutterhead to the rear of the machine.

4. Locate, through the slot in the upper housing, the inner spindle adjustment nut 500-5A (see page x.xx). Insert a pin (.180 diameter or less) in one of the holes provided in the O.D. of the adjustment nut. Hold the spindle knob and turn the adjustment nut to the left (clockwise). You will note the nut ratchets as you turn it. Tighten nut fully, then back off 3/4 to 1-1/2 notches. Check for the .0002 to .0007 movement as described previously.

CAUTION:

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

5. Replace the front cover.
6. Reinstall the spindle clutch lever stop screw. adjust it as described on page x.xx.

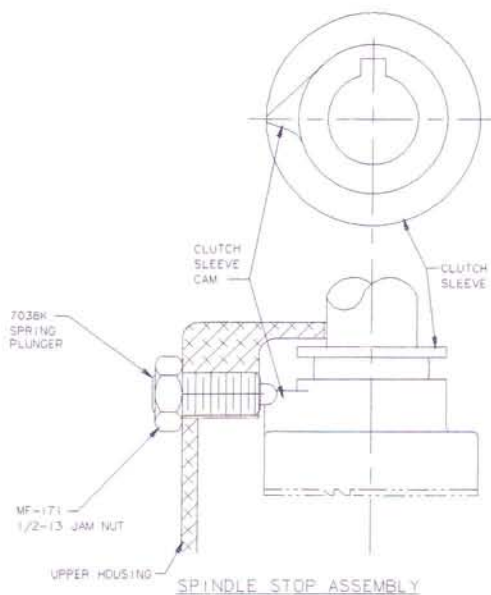


Spindle Stop Adjustment:

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

CAUTION:

Disconnect all power to the machine before continuing.



To set plunger in position:

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

Upper Housing Back Feed Adjustment:

On top of the upper housing, around the feed screw, are three round head screws and three set screws with locknuts. Loosen the three round head screws about 1/16 inch. Loosen the locknuts and back off the set screws.

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

IMPORTANT:

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

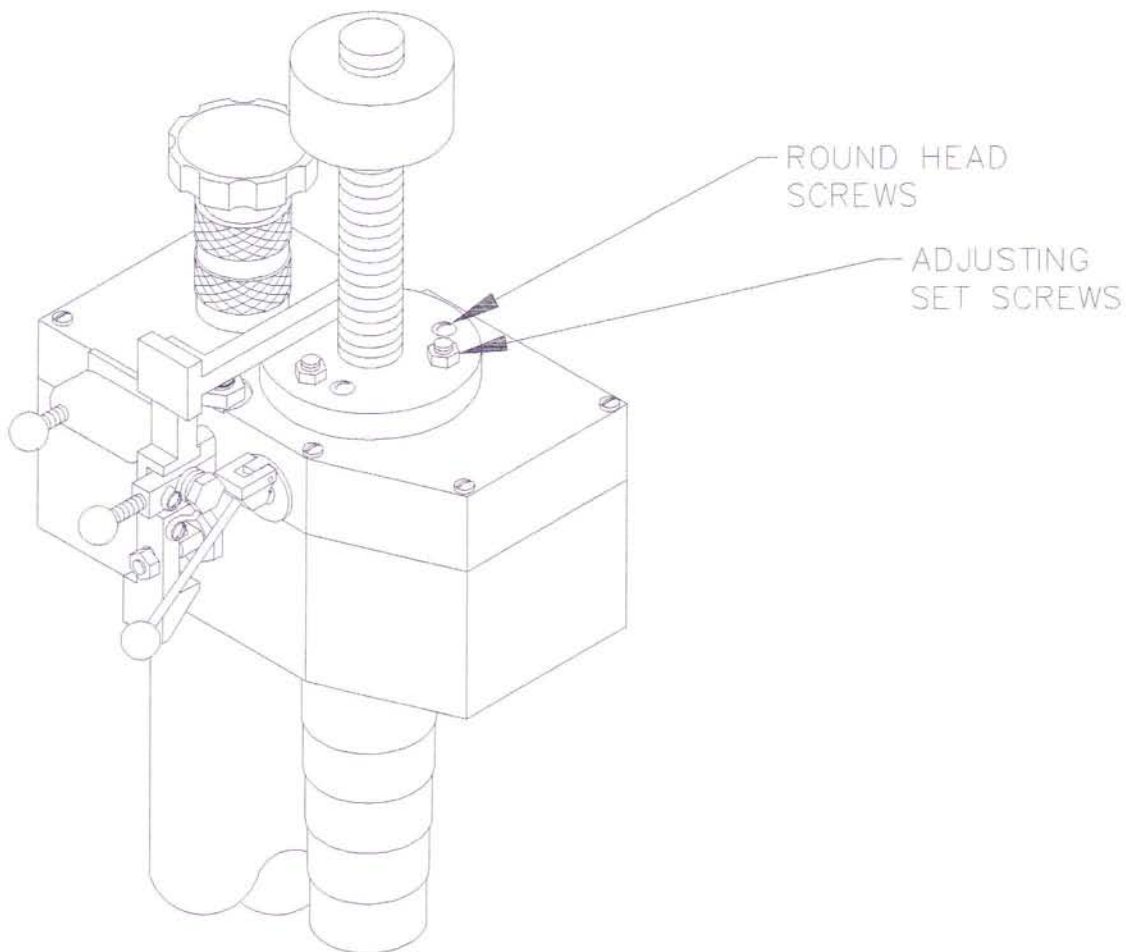
Turn adjusting screws back approximately 1/4 turn. Hold the adjusting screws with an allen wrench and tighten the lock nut.

Check the adjustment. Insert the hand feed handle into the spindle base. When the back feed is adjusted properly the hand feed handle will have 1/4 turn of free play.

Turn on the motor. As the feed screw turns the bearing retainer will center itself.

Turn off motor.

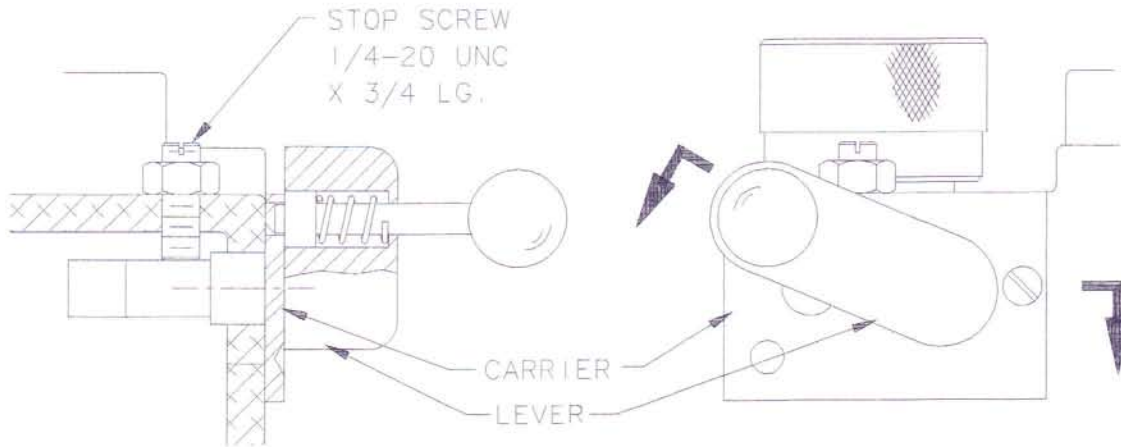
Tighten the three round head screws, evenly.



Spindle Clutch Lever Adjustment:

The spindle clutch lever stop screw is located on top of the upper housing directly above the spindle clutch lever. Loosen the lock nut, then the set screw.

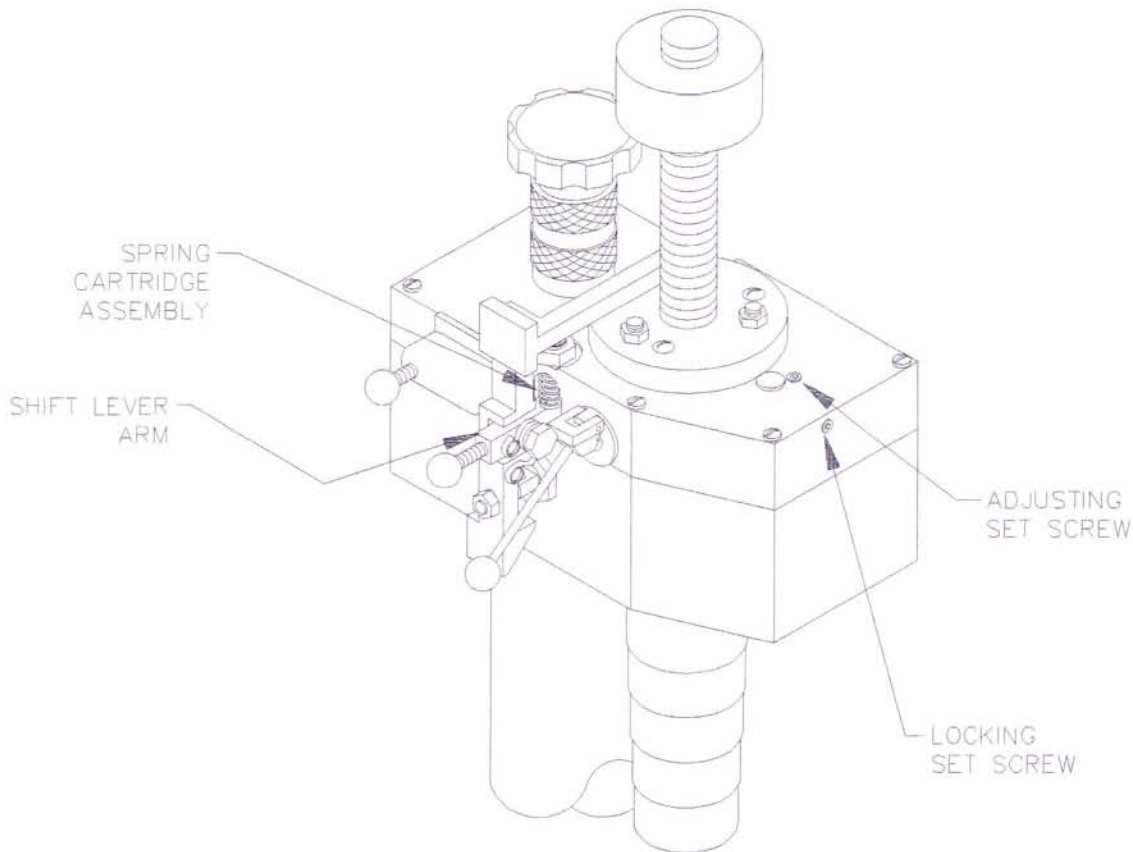
Raise the spindle clutch lever to its neutral (up) position. Be sure the spring loaded knob and pin is in its detent hole. Adjust the stop screw so that the lever will not go any higher, lock with the lock nut.



Rapid Return Adjustment:

If the machine fails or hesitates to go up when the shift lever is lifted and latched, the rapid return gears may need to be adjusted. (Usually there will be a grinding noise as the clutch teeth are trying to mesh.)

1. Travel the machine down at least 6 inches.
2. At the back of the gear box, near the top is a small set screw. Loosen this locking set screw.
3. Find the neutral position of the shifting lever. *With the motor off*, pull down on the rapid down lever and turn the feed screw until the rapid down lever drops in. **Or;** *with the motor on*, engage rapid down and while still holding the rapid down lever turn the motor switch off.
4. While holding the rapid down lever, adjust the pin in the spring cartridge so it just touches the feed shift lever. Adjust by loosening the lock nut on top of the gear box and turning the cartridge ass'y.
5. Turn the motor on. With the feed shift lever in neutral position, the rapid down clutch teeth should not be chattering. Lift the feed lever slowly. As the pin in the cartridge assembly is raised approximately 1/32 inch, the fast down clutch teeth should just start to chatter. If the feed shift lever must be raised higher than 1/32 inch, before the clutch teeth start to chatter then the tumbler must be reset lower in the upper housing. Turn the adjusting screw in to lower the tumbler. If the clutch teeth chatter, while the feed shift lever is in neutral or, before the pin is raised 1/32 inch, then the tumbler must be reset higher. Back off the adjusting set screw, then lift the feed shift lever quickly a couple of times to push it up.
6. Tighten the locking set screw at the rear of the upper housing. Check to see that the adjustment has not been changed. Readjust if necessary.



Drive Belt Removal:**CAUTION:**

Disconnect all power before proceeding.

Loosen the knob 514-6-86 and rotate side cover 502-9-52D out of the way. Loosen the bolt, securing the motor on the left side, and pivot the motor forward, towards the spindle. Remove the belt

Drive Belt Installation:

Installation of belt is the opposite of removal.

Drive Belt Tension:

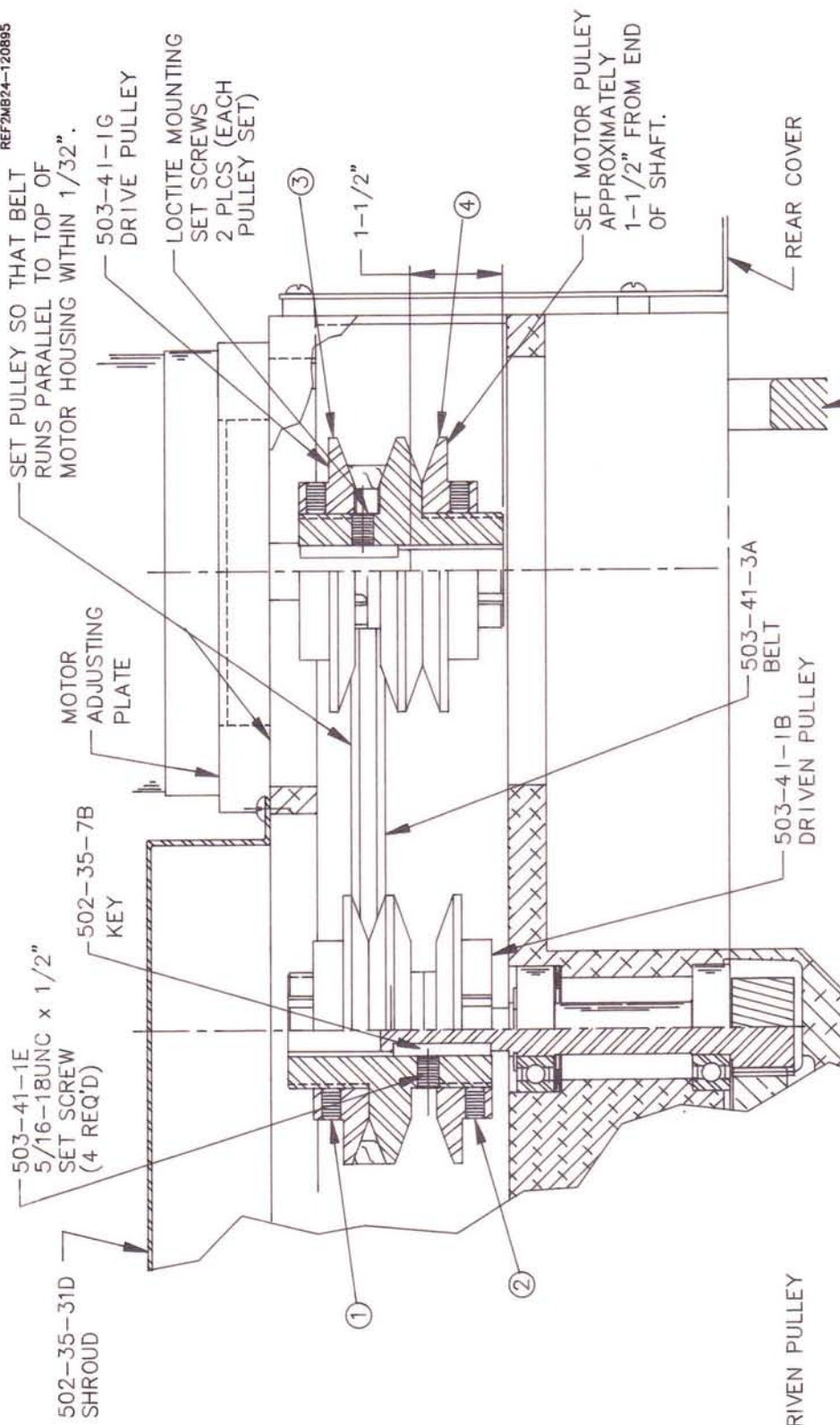
The drive belt should have approximately 1/4" of play when tightened. If the belt is too tight it will create noise, if it is too loose, it will slip.

NOTE:

If motor gear housing vibrates severely
check belt alignment.

Drive Belt Adjustments:

REF F2MB24-120895



SET PULLEY SO THAT BELT RUNS PARALLEL TO TOP OF MOTOR HOUSING WITHIN 1/32".

503-41-1G
DRIVE PULLEY
LOCTITE MOUNTING SET SCREWS
2 PLCS (EACH PULLEY SET)

MOTOR ADJUSTING PLATE

502-35-7B
KEY

503-41-1E
5/16-18UNC x 1/2"
SET SCREW (4 REQ'D)

502-35-31D
SHROUD

1-1/2"

SET MOTOR PULLEY APPROXIMATELY 1-1/2" FROM END OF SHAFT.

REAR COVER

SPINDLE BASE

503-41-3A
BELT

503-41-1B
DRIVEN PULLEY

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 4 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 4-1/2 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 1-1/2 TURNS. LINE UP A SET SCREW HOLE 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-2MB

Excessive Loads:**CAUTION:**

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

Thrust Overload:

If a vertical thrust load of approximately 3,000 pounds is imposed on your F2MB machine spindle, the threads of the 500-41 bronze thrust nut will shear. This happens when the spindle is stopped by an external force, for example traveling down into the top of the block. It makes no difference if the spindle is turning or not.

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

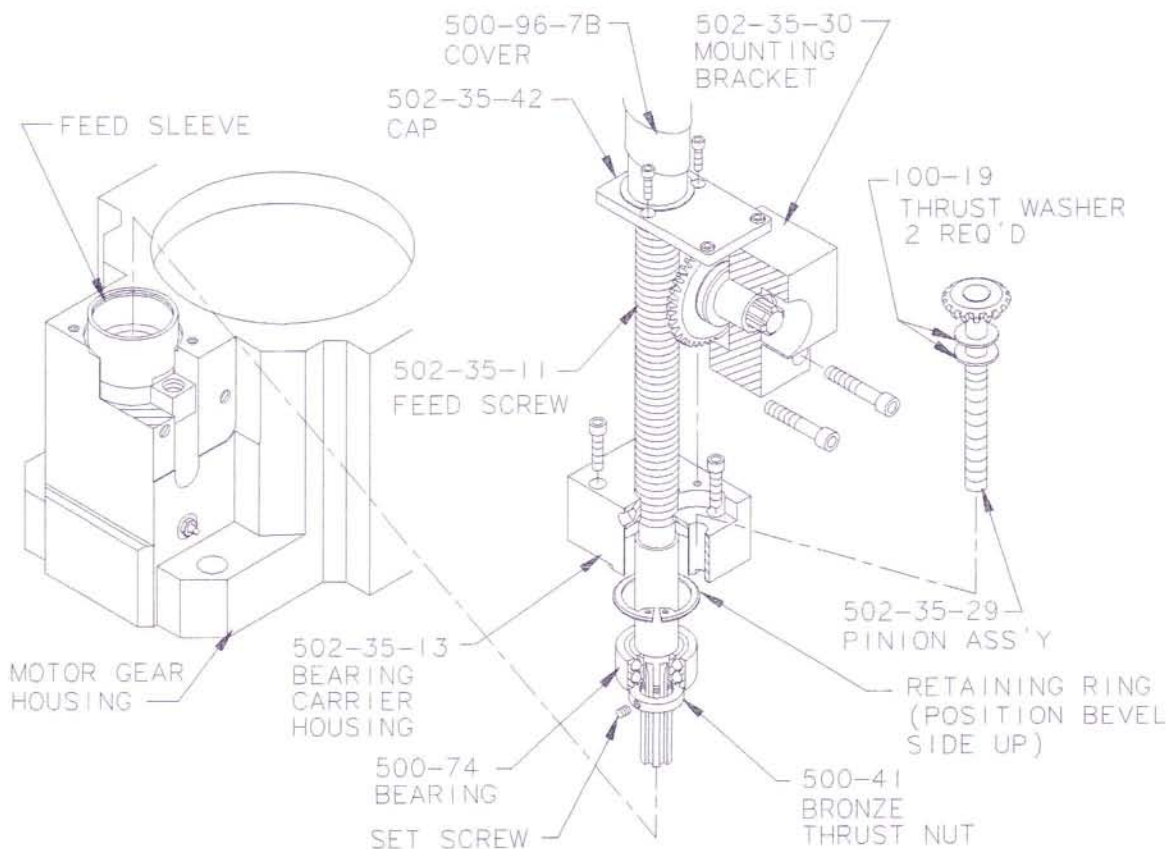
Disassembly For Replacement of**Thrust Nut:** (see page x.xx)

Remove the three round head screws that attach the shroud 502-35-31D. Remove the two snap plugs, in the spindle base, that cover the hand feed bracket

screws. Remove the two socket head cap screws to the hand feed bracket 502-35-30. Remove the two socket head cap screws in the cap 502-35-42, which are closest to the feed screw cover 500-96-7B. Lift the hand feed bracket and the attached cap, out of the way. Turn out (counter clockwise) the bevel pinion 502-35-29. Be careful not to lose the two thrust washers 100-19. Remove the four screws and the bearing carrier housing 502-35-13. Raise the assembly.

Hold down 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 of the bearing 500-74. Back out set screw from bronze thrust nut 500-41 and unscrew the nut.

Reassembly is the reverse. Be sure the retaining ring is installed with the bevel side up. Make sure the gear action of the hand feed bracket doesn't bind after it is bolted back in place.



Rotational Overload:

If the cutterhead is stopped suddenly while it is turning, the motor overload will drop out to protect the motor circuit. This condition is usually caused by boring through the cylinder and hitting a web or a boss. To correct this, switch the motor off. Disengage the spindle clutch by lifting it to the neutral position. Switch the motor on. Operate the controls to return the cutter head to the top of the cylinder.

Removal of Motor Assembly:

Remove the drive belt as described on page 4.11. Remove the lock screw and clamp on the motor mount plate. Remove the pivot bolt and spring washers (make note of how the spring washers are arranged). Disconnect the wiring from the small enclosure on the side of the motor, be sure to mark the wires so they can be rewired correctly. Disconnect the conduit fitting at this enclosure also.

Drive Pulley:

Lift the motor and adjusting plate straight up out of the motor gear housing. Refer to page 4.12. Loosen the two set screws securing the top section of the pulley assembly. Turn just the top section of the pulley up, this uncovers the two mounting set screws. Loosen these two set screws and remove the pulley assembly. The mounting plate can be removed by taking out the four flat head mounting screws.

Driven Pulley:

Remove the motor as described previously. Refer to page 4.12. Loosen the two set screws securing the bottom section of the pulley assembly. Turn the bottom section of the pulley down, this will uncover the two mounting set screws. Loosen these two set screws and remove the pulley assembly.

Reverse the above descriptions to reassemble. Refer to page 4.12 for assembly and adjustment instructions on the pulley.

Removal of Motor Gear Housing:**CAUTION:**

Disconnect all electrical and air power before continuing.

NOTE:

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

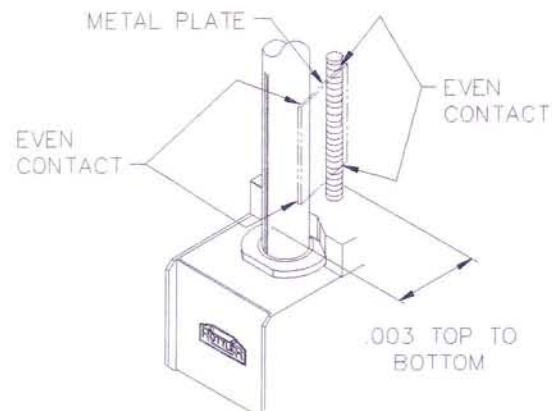
Remove and disassemble hand feed assembly as described on page 4.13.

Remove the six socket head cap screws that attach the motor gear housing to the spindle base. The front two screws are located down in next to where the feed screw attaches.

Replacing Motor Gear Housing:

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

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

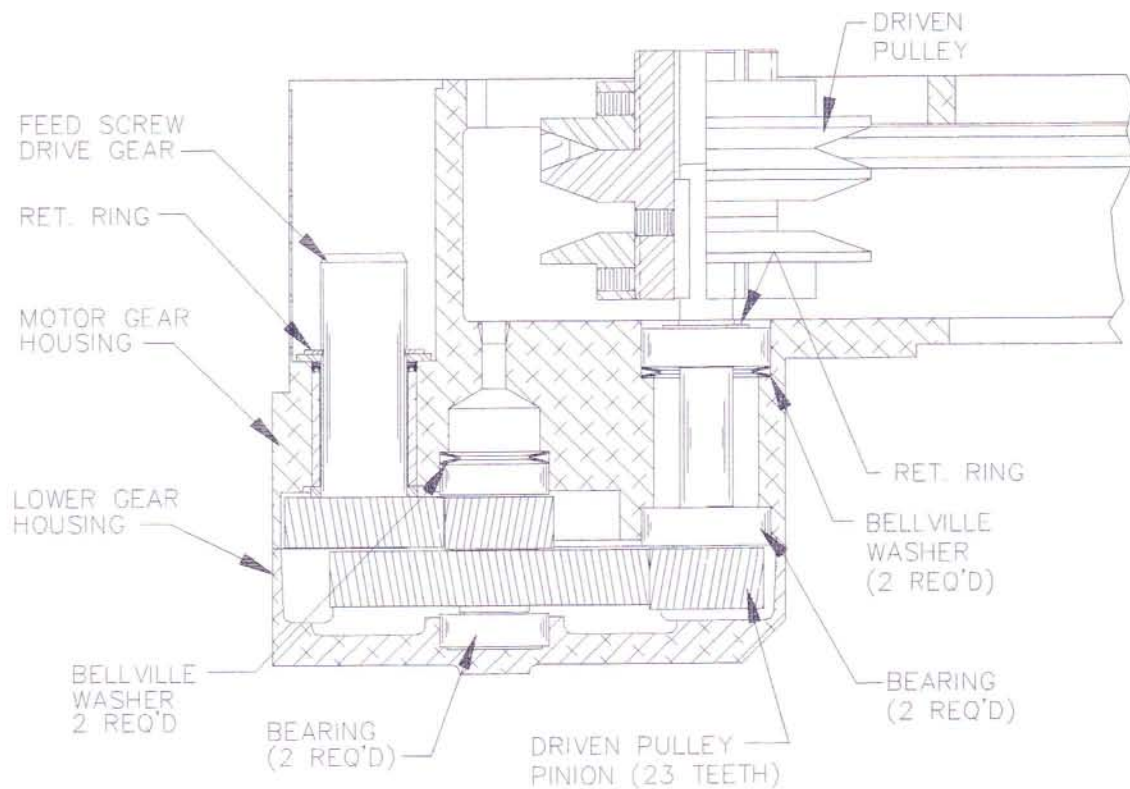


Disassembly of Motor Gear Housing:

Take out the plug in the side of the motor gear housing and drain the oil. Remove the retaining ring from the driven pulley pinion. Remove the retaining ring and thrust washer from the feed screw drive gear. Remove the eight socket head cap screws located in the bottom of the lower gear housing.

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

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



Centering Rod and Draw Bar Removal:

(see page 5.12)

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

Disassembly Of Upper Housing and Spindle Removal:

(see page 5.12)

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

CAUTION:

Disconnect all air and electrical power to the machine before continuing.

Remove the draw bar assembly as described above. Remove the lower knob, 600-18-2, by loosening two locking set screws. Lift the knob straight up (be careful not to lose the key as you lift it off. Loosen the spindle clutch lever, stop screw, lock-nut. (see page 4.10).

Back off the stop screw. Lift the spindle clutch lever as high as it will go. Loosen the two mounting screws for the spindle clutch lever mounting carrier. Carefully pull the lever and the carrier out of the upper housing cover. Loosen and remove pivot screw 500-35-2 to disassemble trip lever 500-35A from shift lever 500-38C

CAUTION:

Do not lose trip spring.

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

Place something under the end of the inner spindle to keep it from falling out. Unscrew the spindle

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

NOTE:

Some lubricant will run out when spindle is removed.

Replacing the Inner Spindle and Reassembling the Upper Housing:

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

Removal of Upper Gear Housing:

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

Reassembly of The Upper Housing:

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

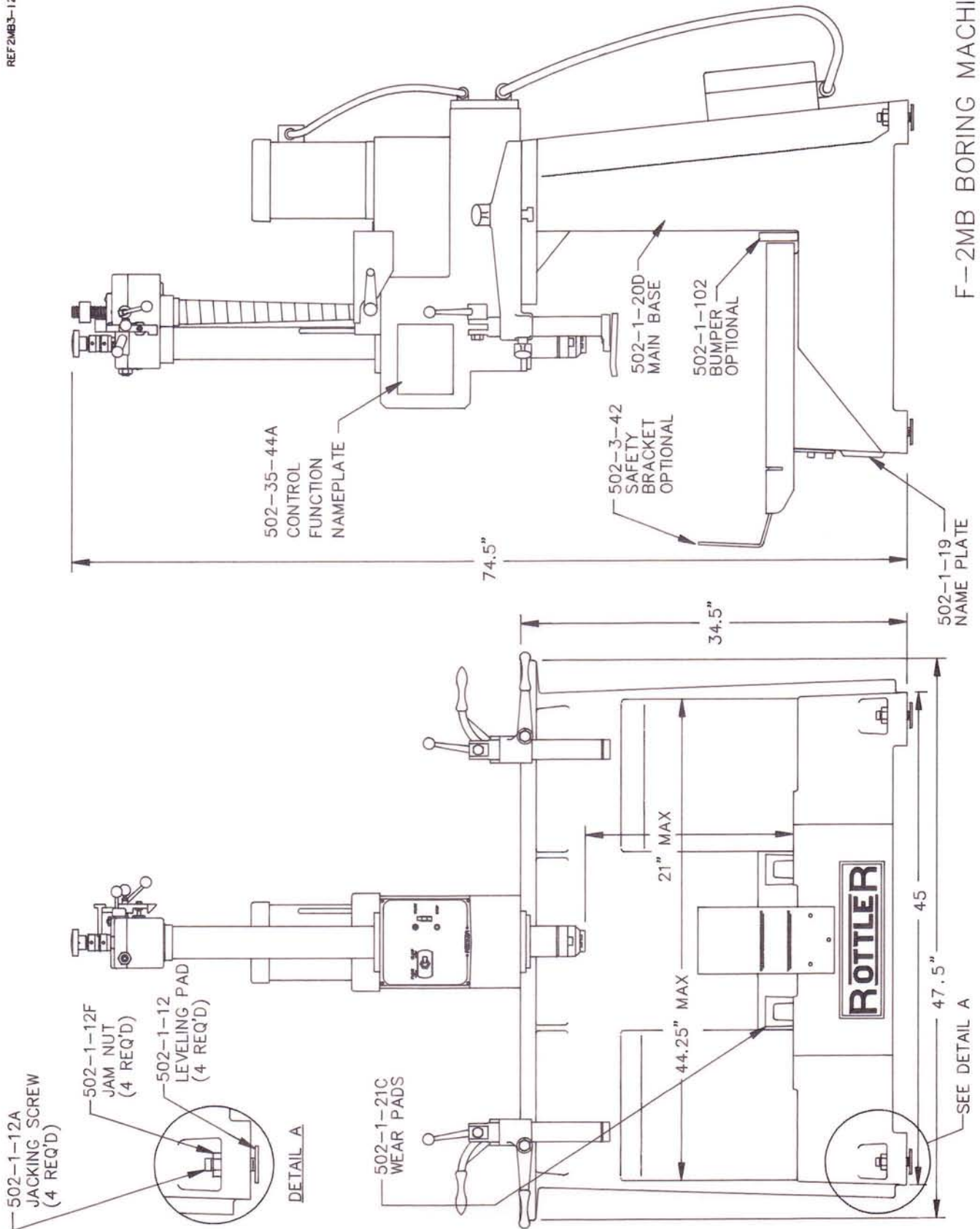
IMPORTANT:

After placing upper housing on the outer spindle, before it cools you must set the parallelism between the outer spindle and the feed screw. (refer to page 4.14)

Front / Right Side View F2MB:

F-2MB BORING MACHINE

REF 2MB3-121195



502-1-12A
JACKING SCREW
(4 REQ'D)

502-1-12F
JAM NUT
(4 REQ'D)

502-1-12
LEVELING PAD
(4 REQ'D)

DETAIL A

502-1-21C
WEAR PADS

SEE DETAIL A

ROTTLE

502-35-44A
CONTROL
FUNCTION
NAMEPLATE

74.5"

502-3-42
SAFETY
BRACKET
OPTIONAL

502-1-20D
MAIN BASE

502-1-102
BUMPER
OPTIONAL

502-1-19
NAME PLATE

34.5"

21" MAX

44.25" MAX

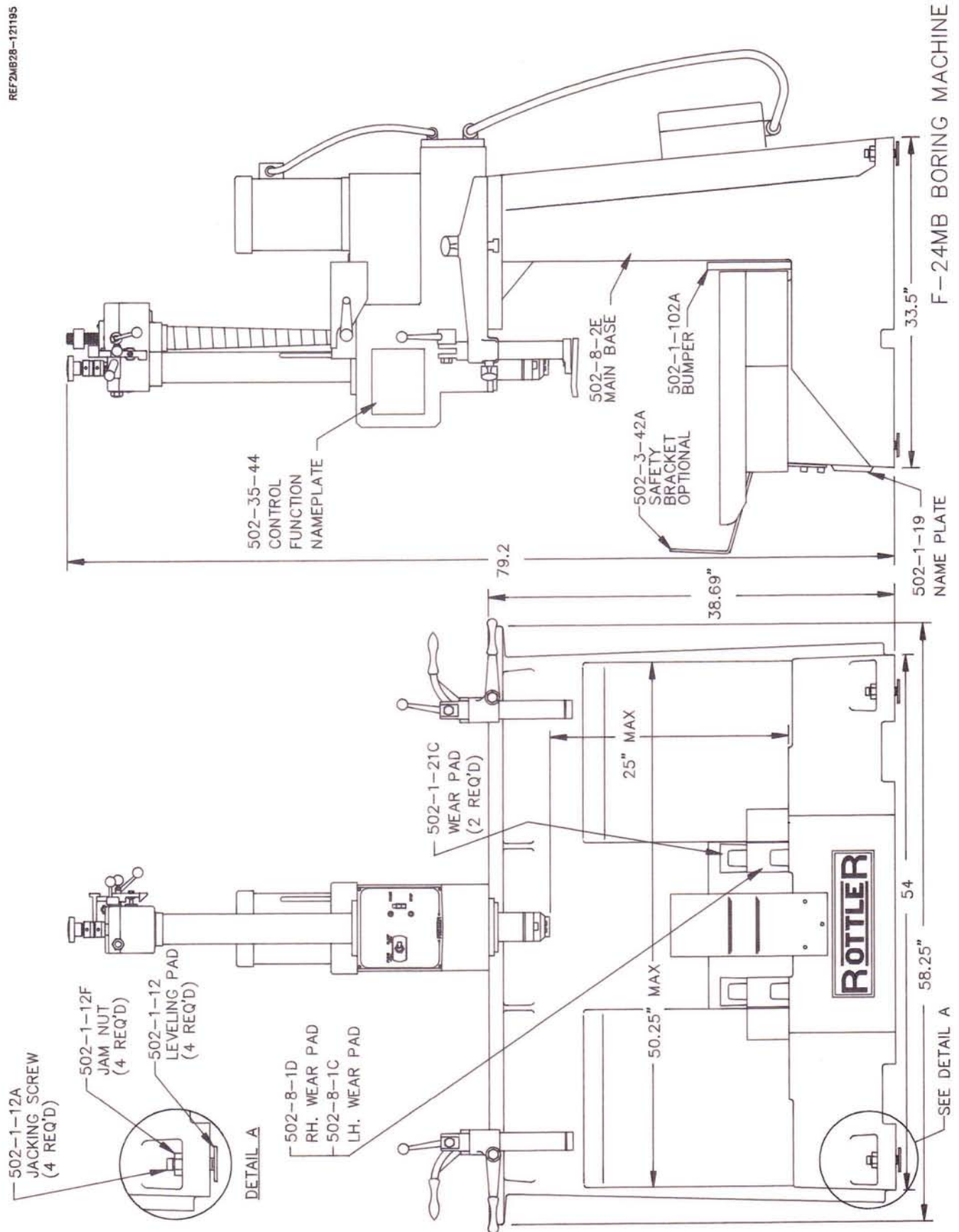
45

47.5"

Front / Right Side View F24MB:

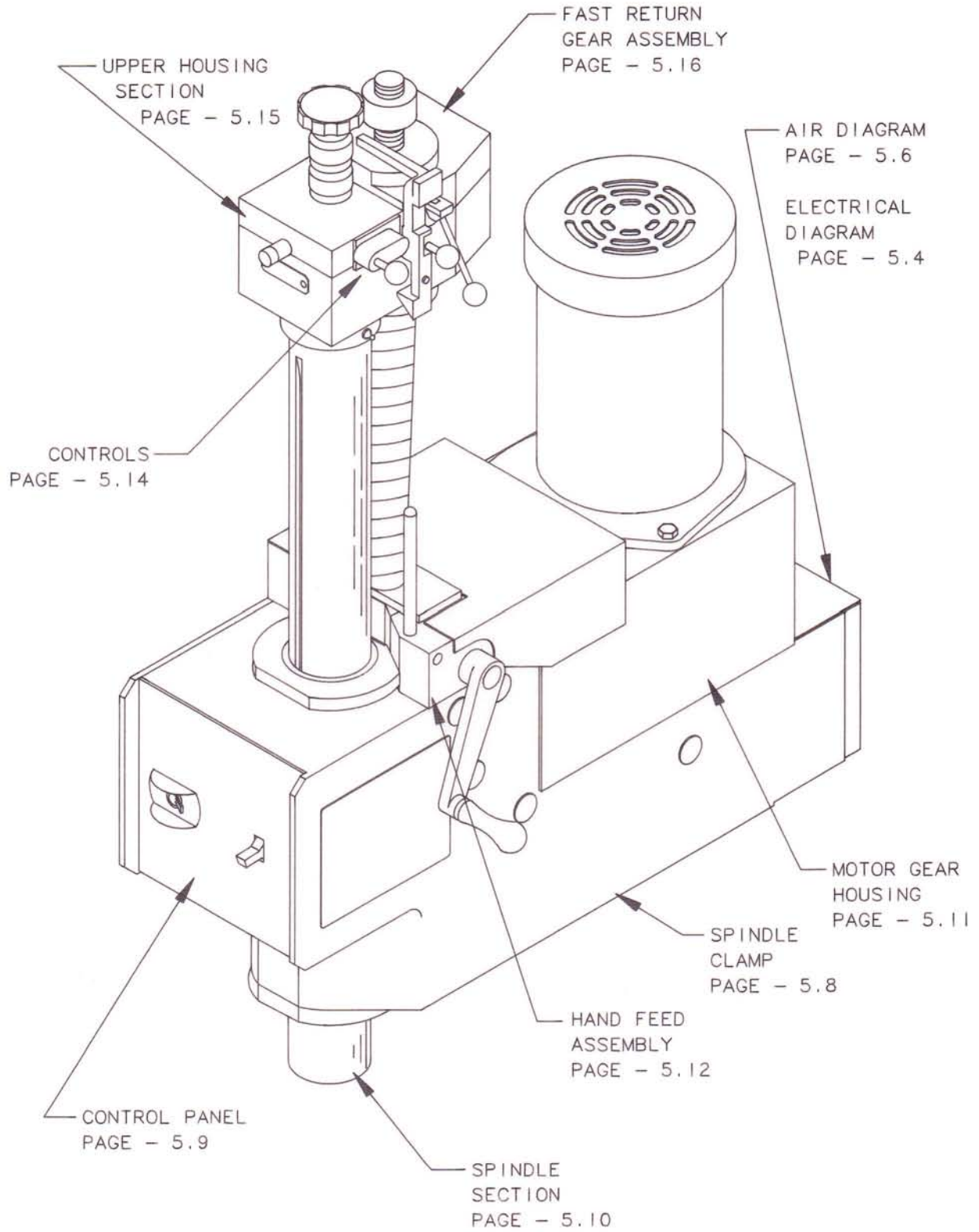
REF24MB28-121185

F-24MB BORING MACHINE



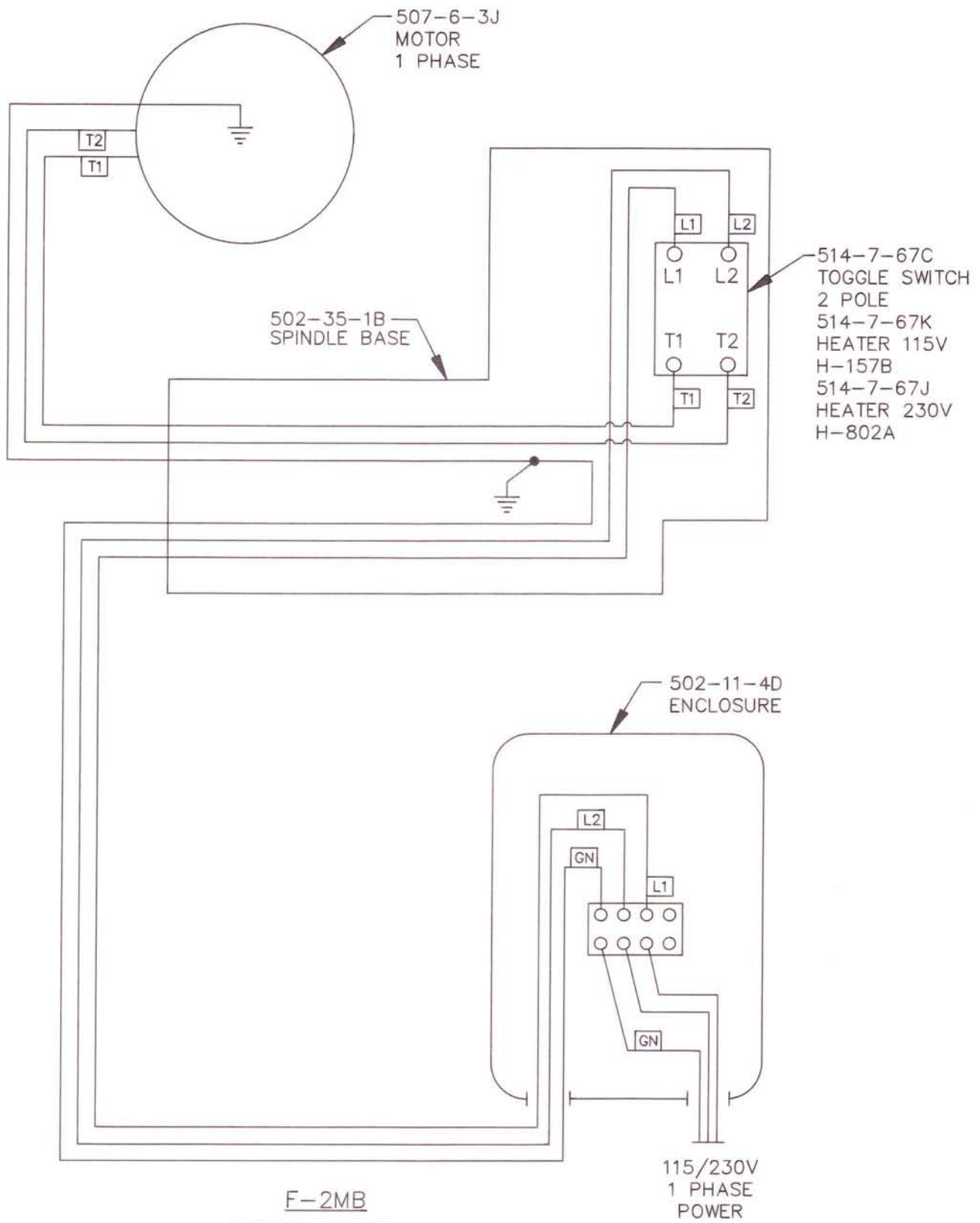
Spindle Base Assembly Illustration:

REF F2MB37-121295



Wiring Diagram:

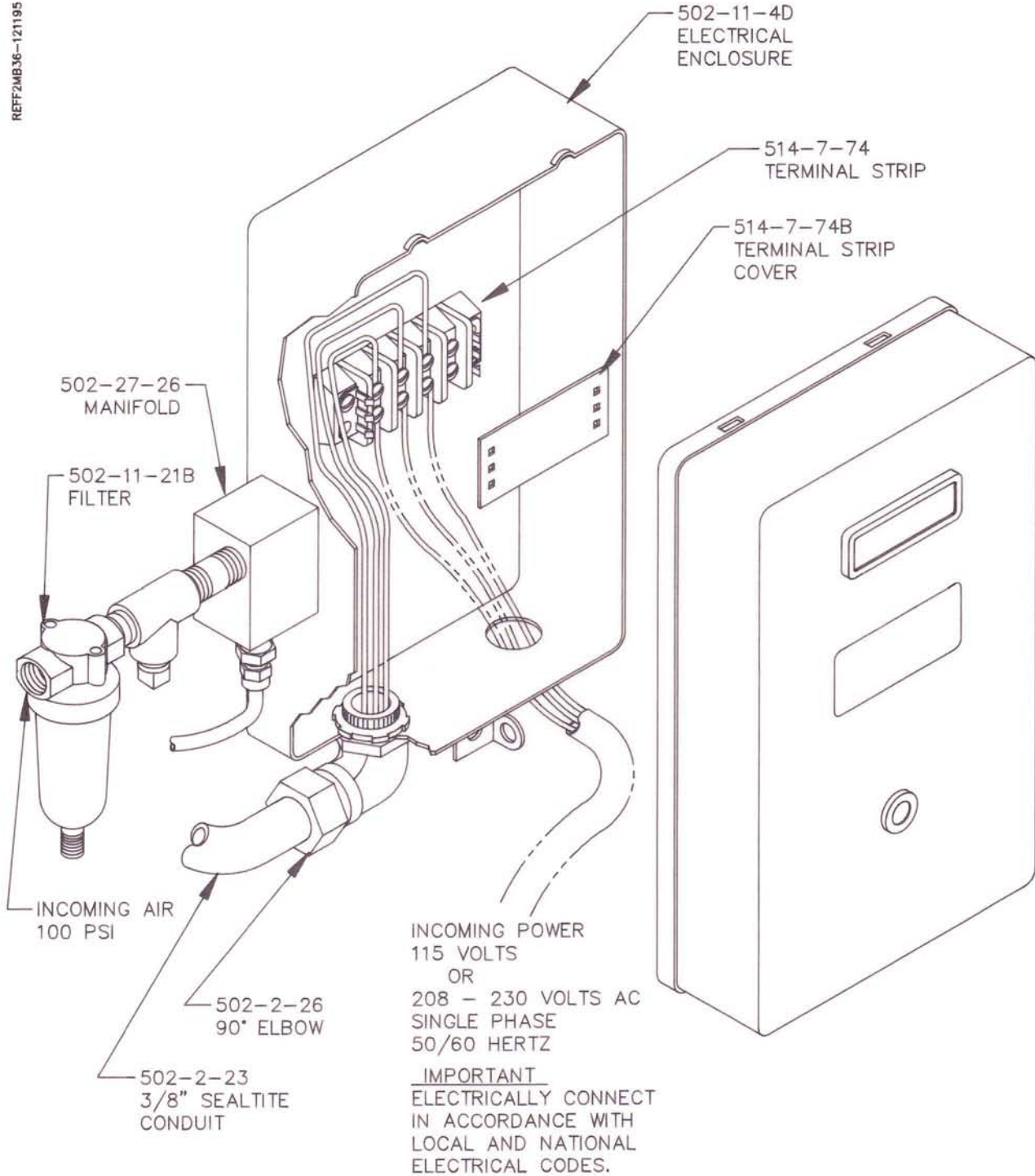
REF F2MB6-121295



F-2MB
WIRING DIAGRAM

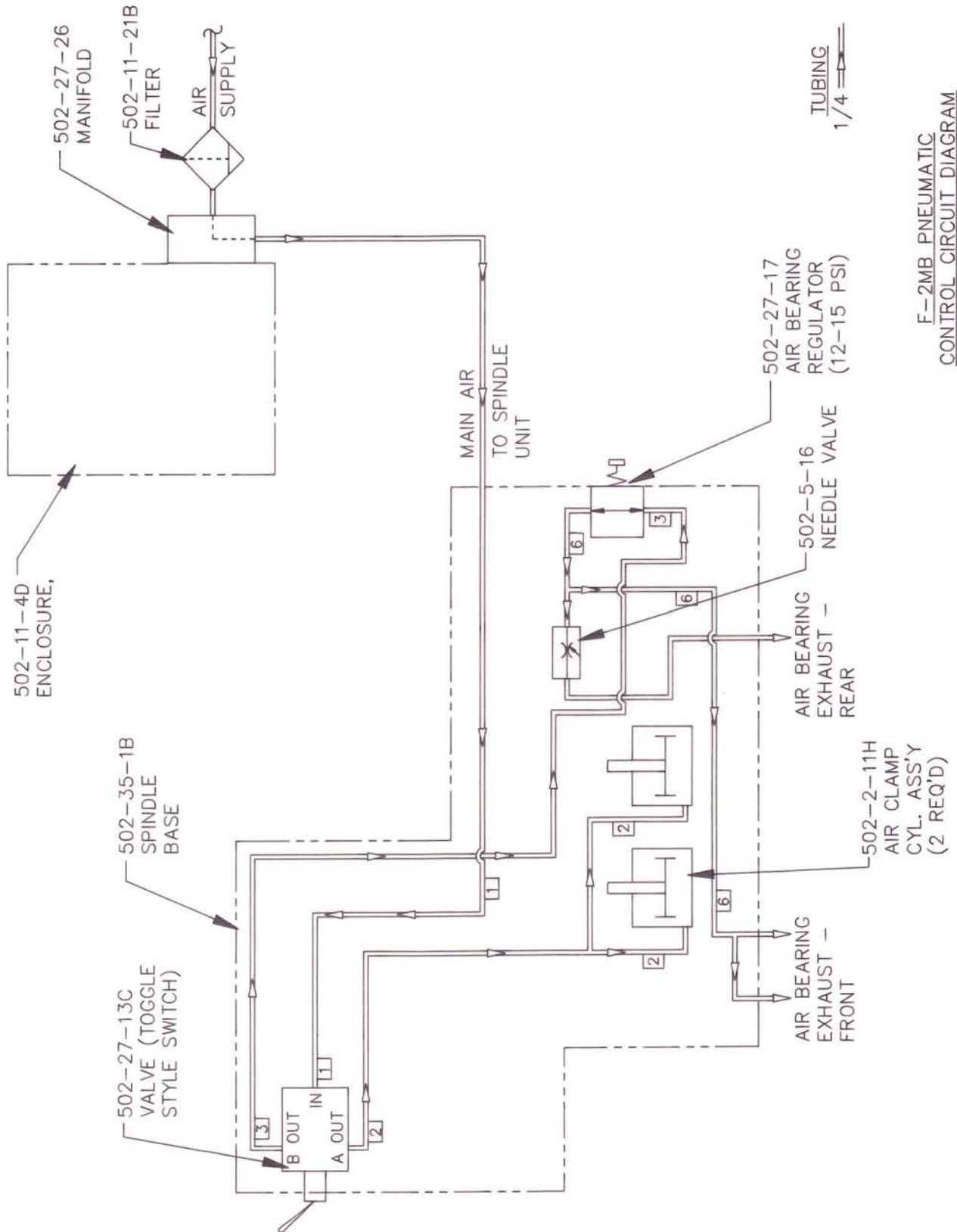
Electrical Enclosure:

REF F2MB36-121195



Pneumatic Diagram:

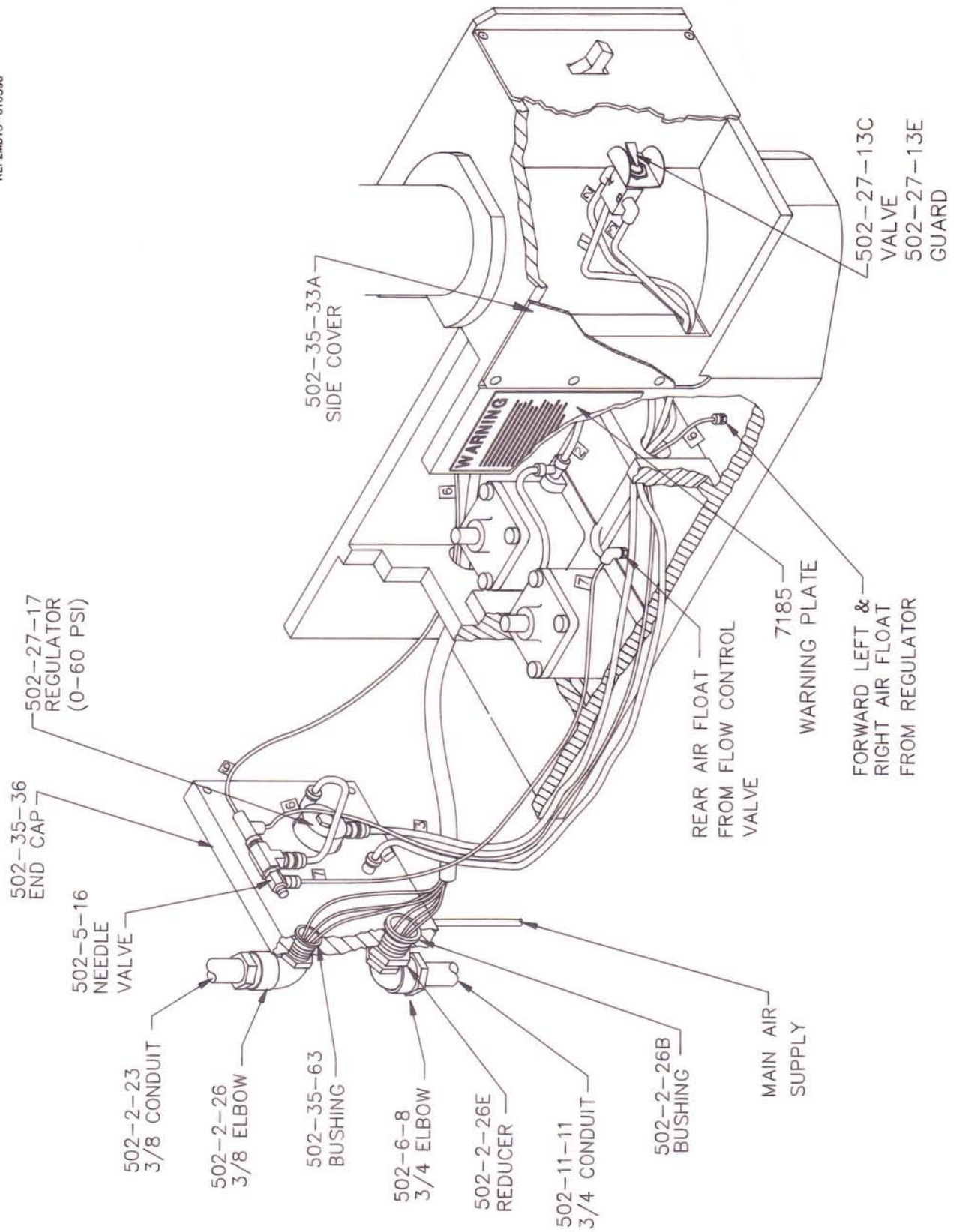
REF2MB5-121295



F-2MB PNEUMATIC CONTROL CIRCUIT DIAGRAM

Pneumatic Illustration:

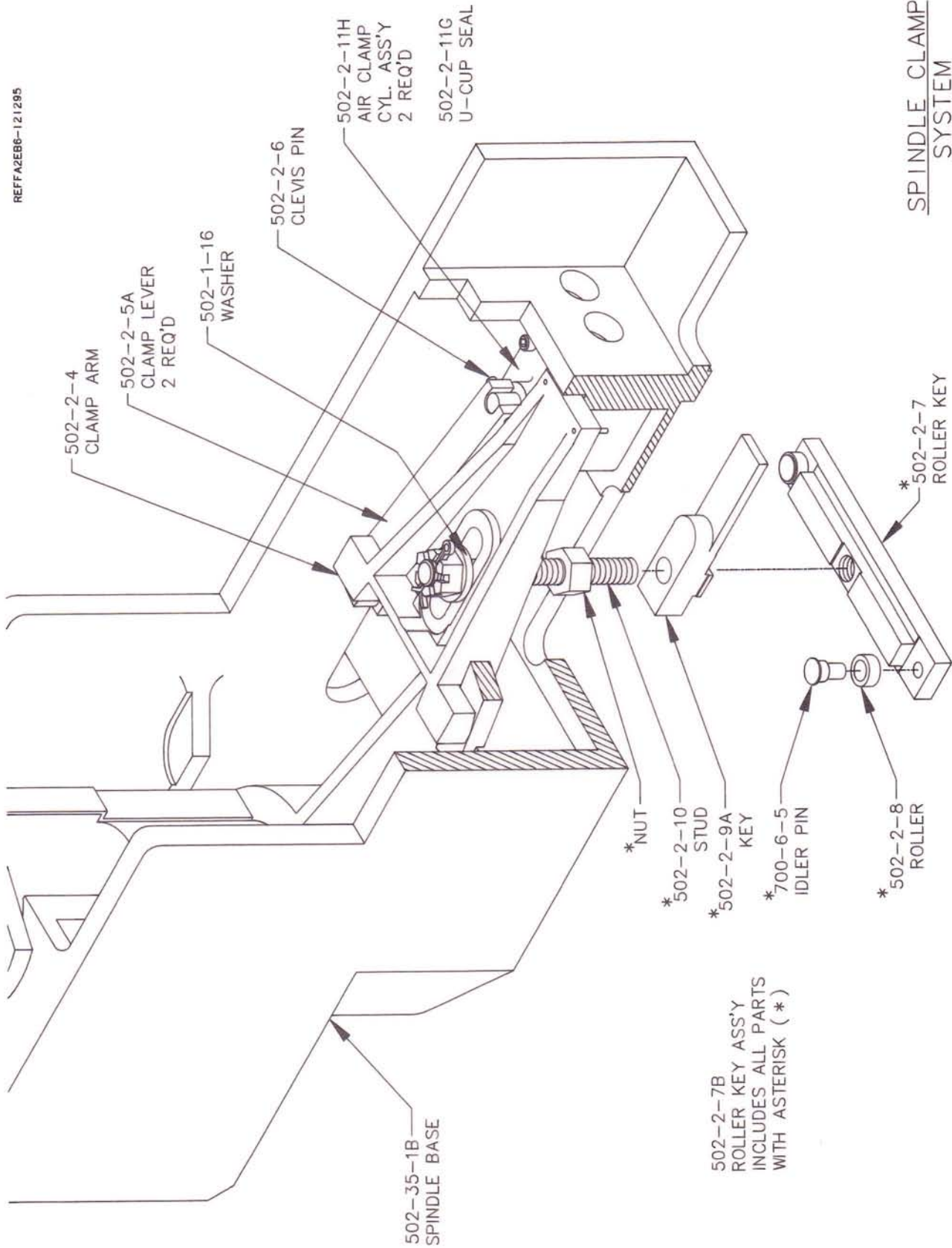
REF2MB13-010396



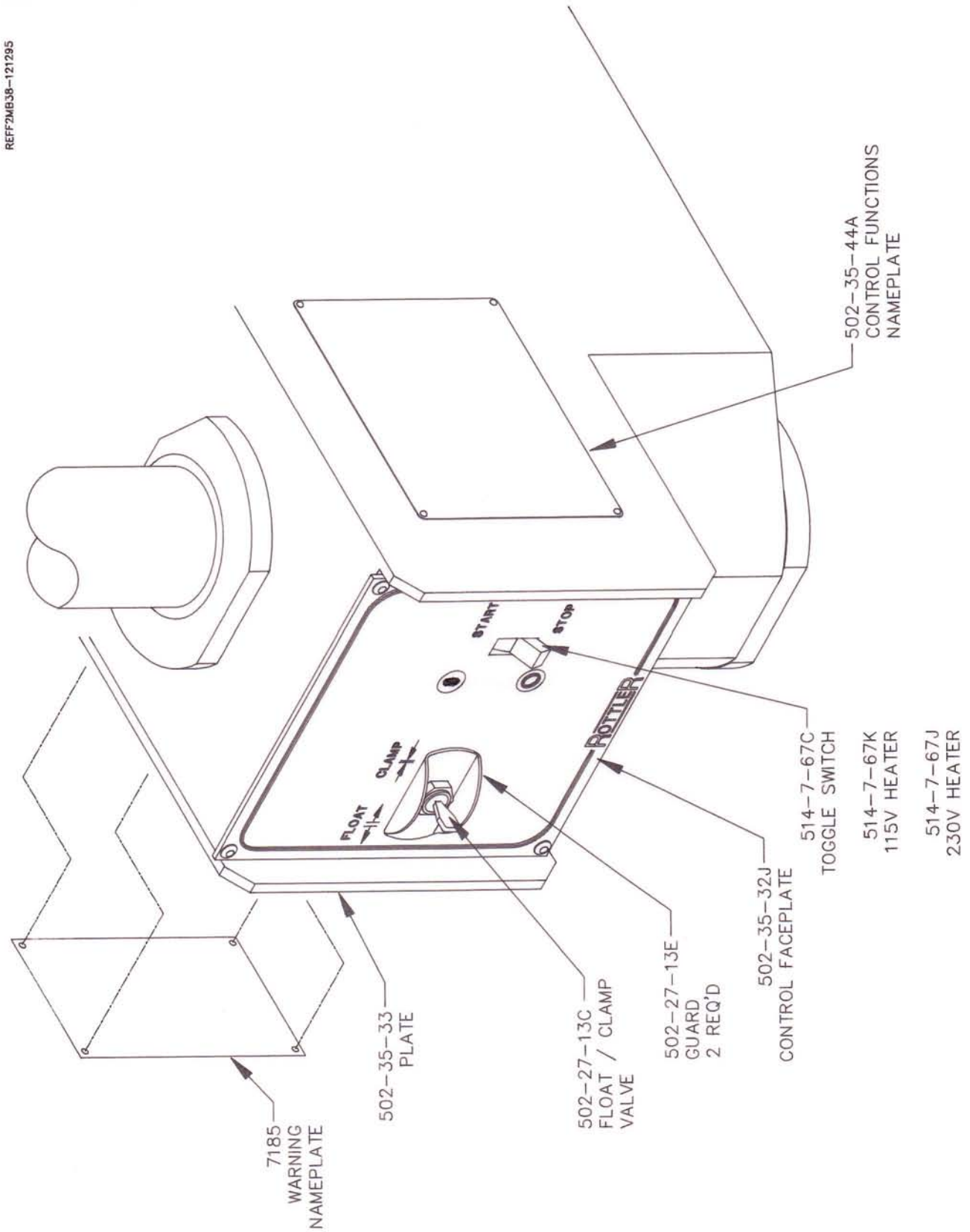
Spindle Clamp System:

SPINDLE CLAMP SYSTEM

REFFA2EB6-121295

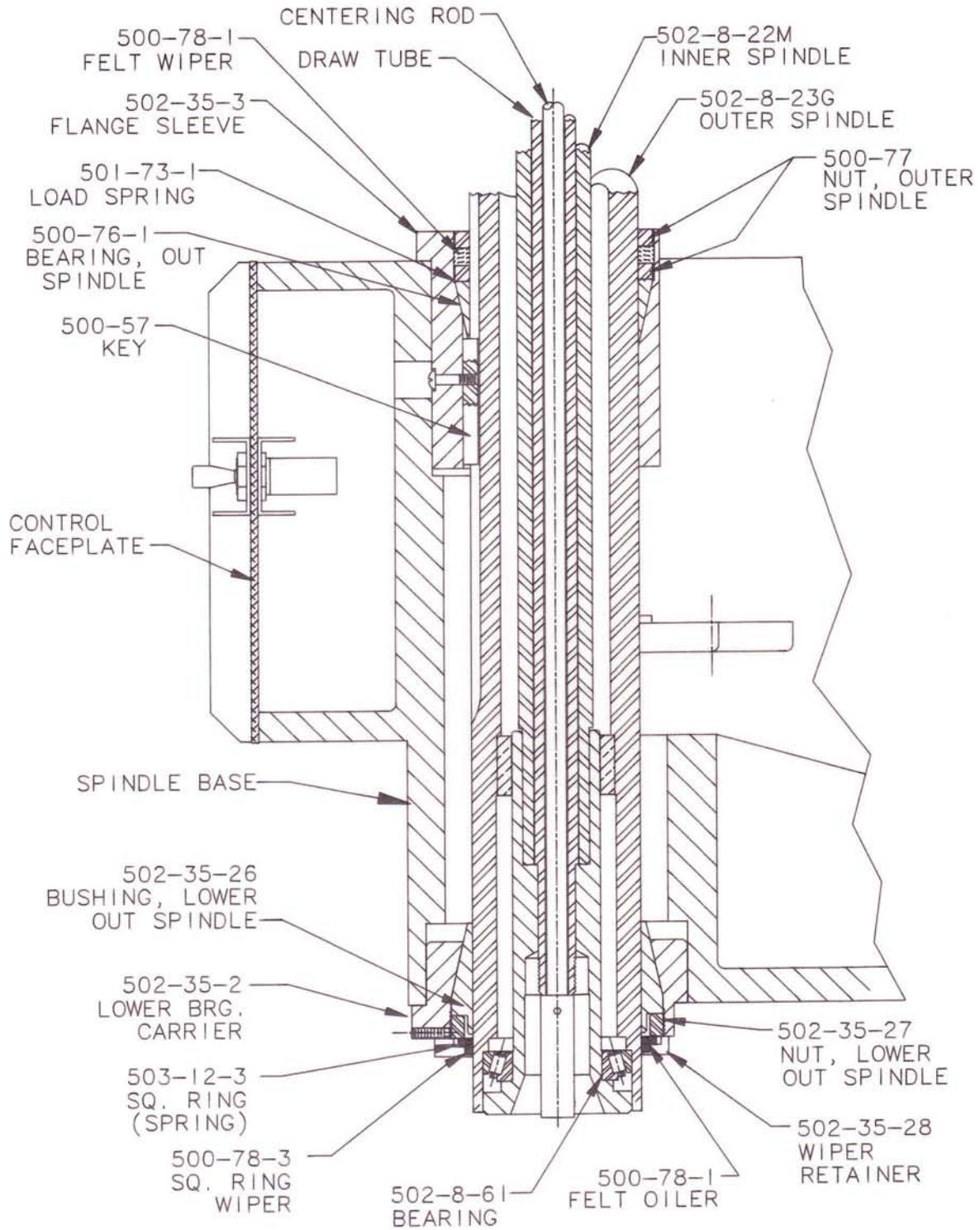


Control Panel:



Spindle Section:

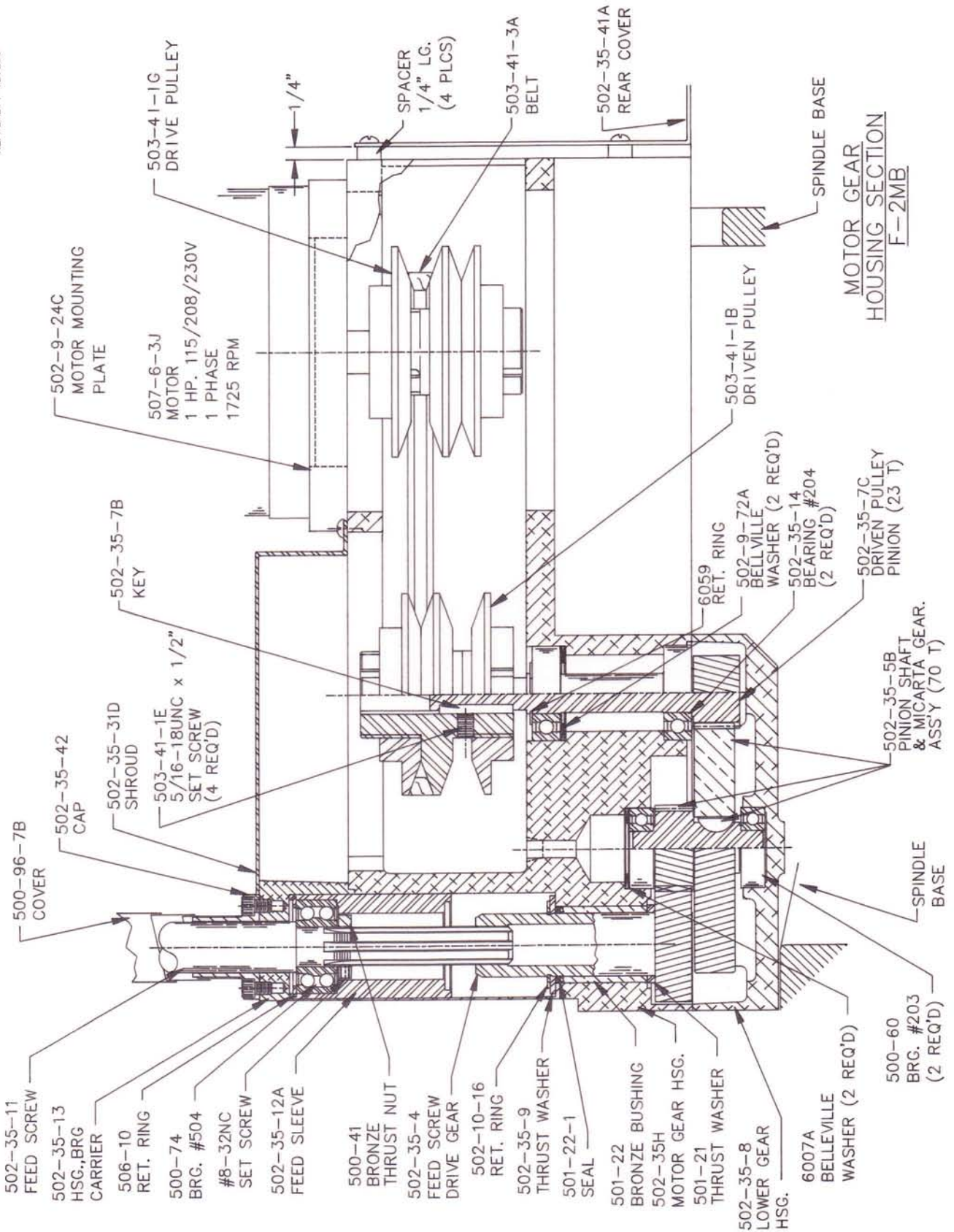
REF F2MB39-121295



SECTION THRU
SPINDLE

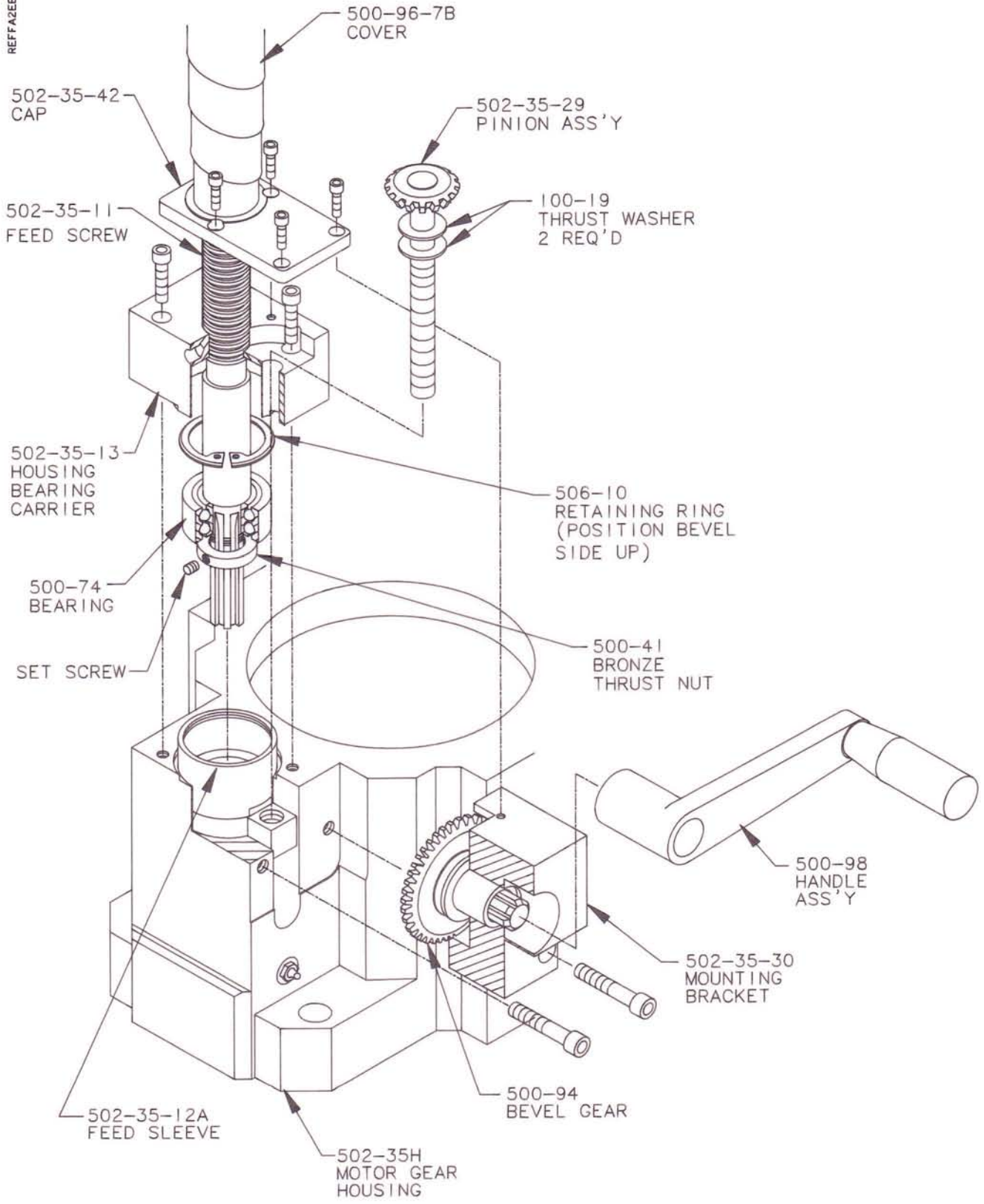
Motor Gear Housing Section:

REF F2MB11-121295



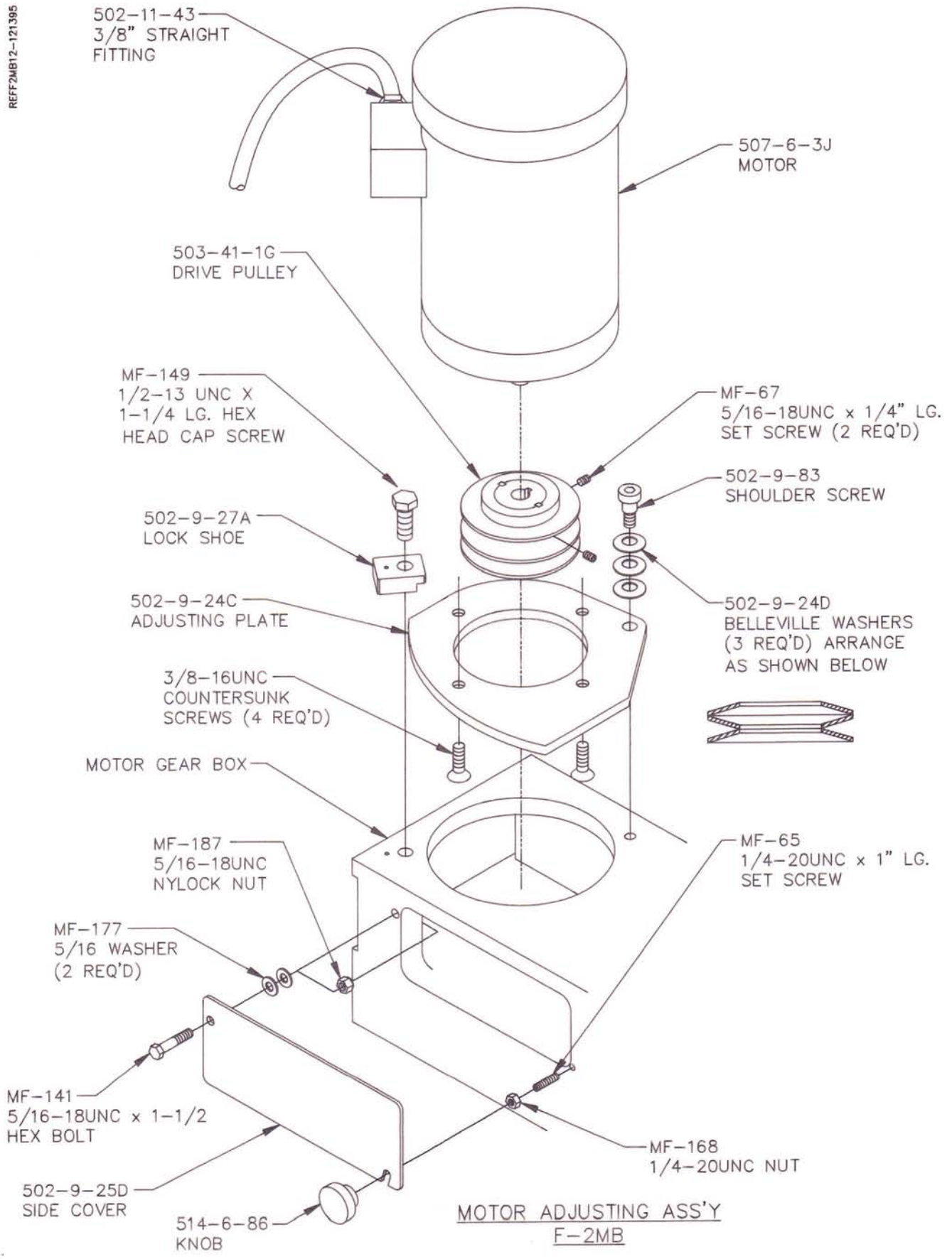
Hand Feed Assembly:

REFFA2EB9-050394



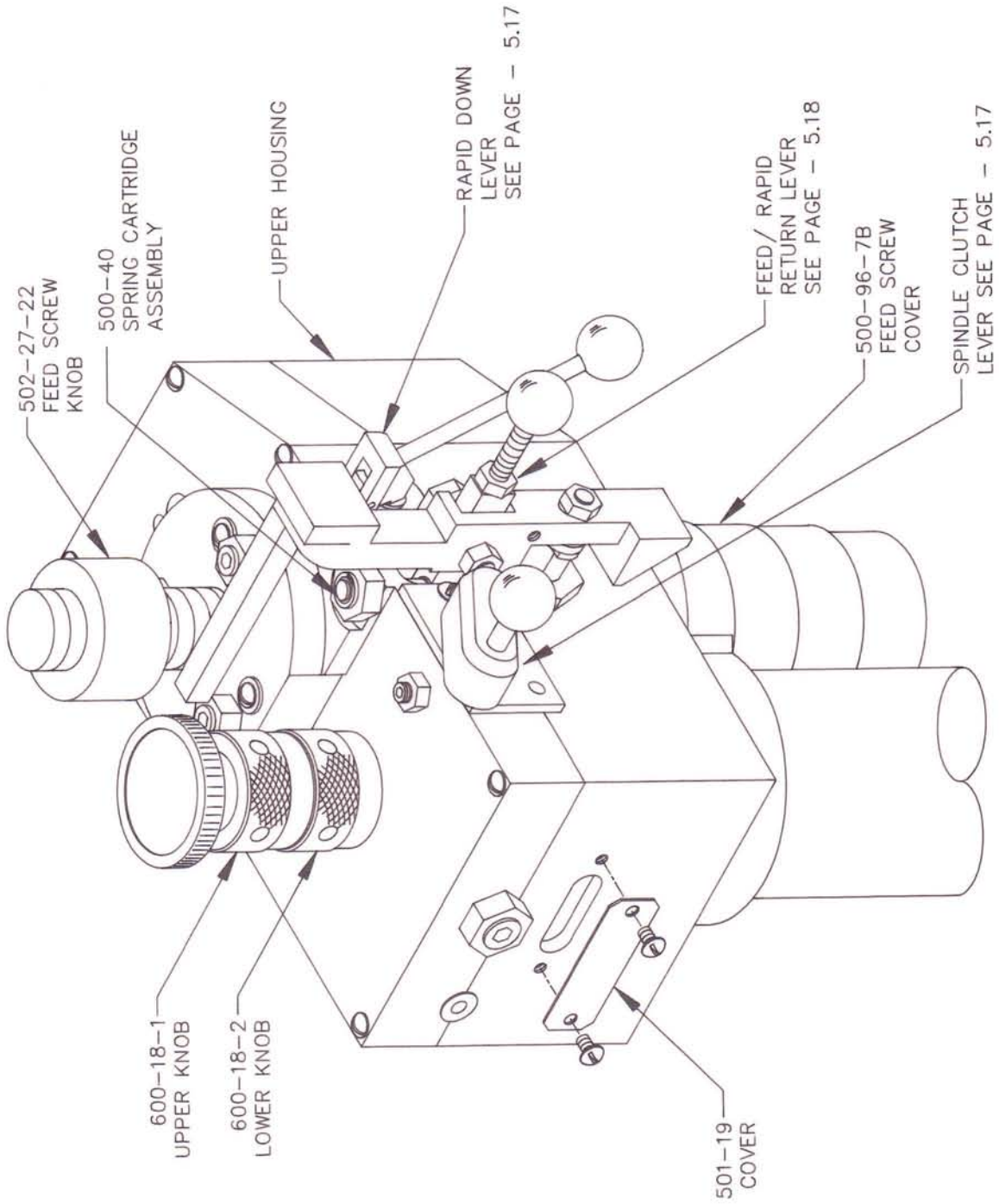
Motor Adjusting Assembly:

REF F2MB12-121395

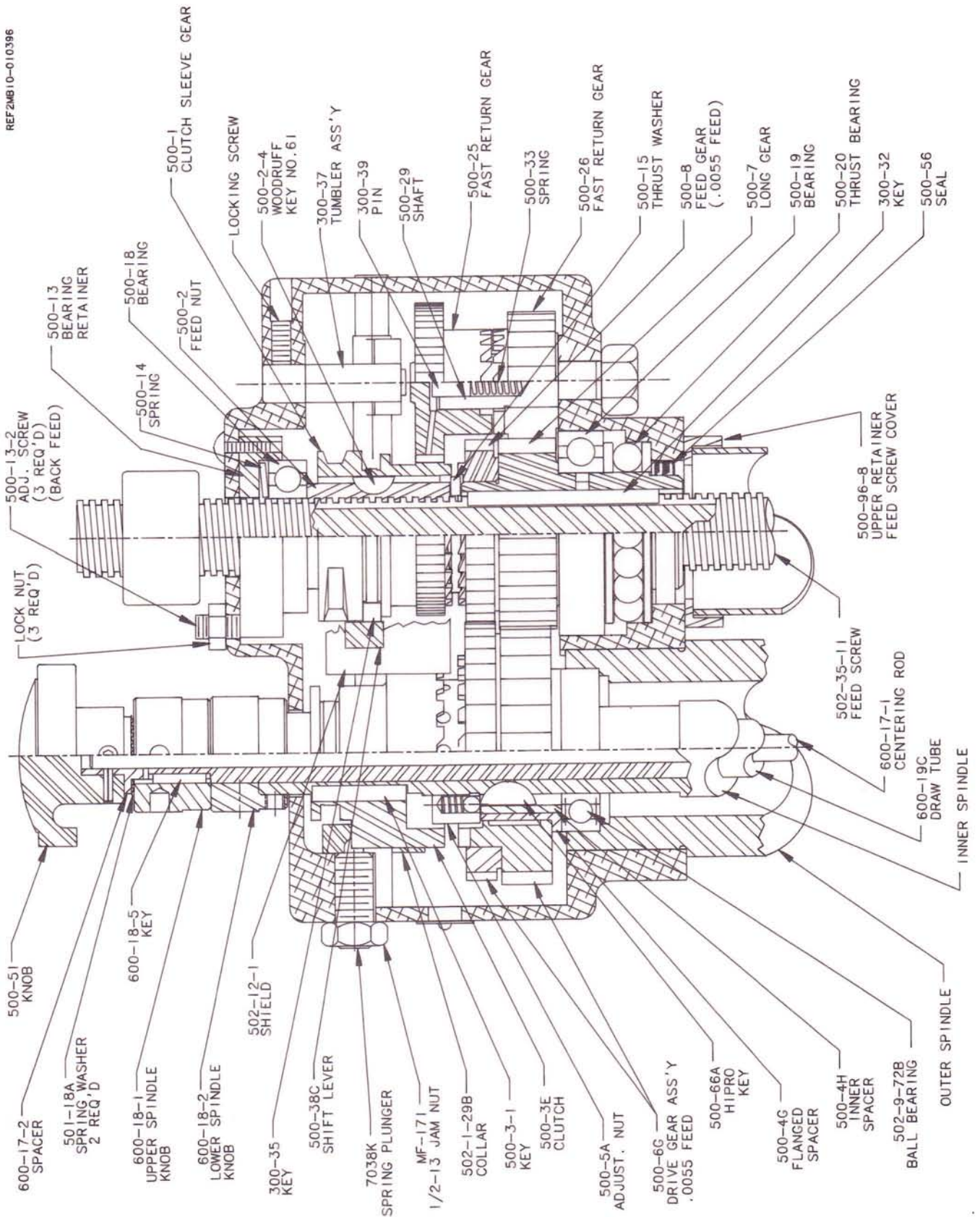


Upper Housing Controls:

REF F2MB40-010496

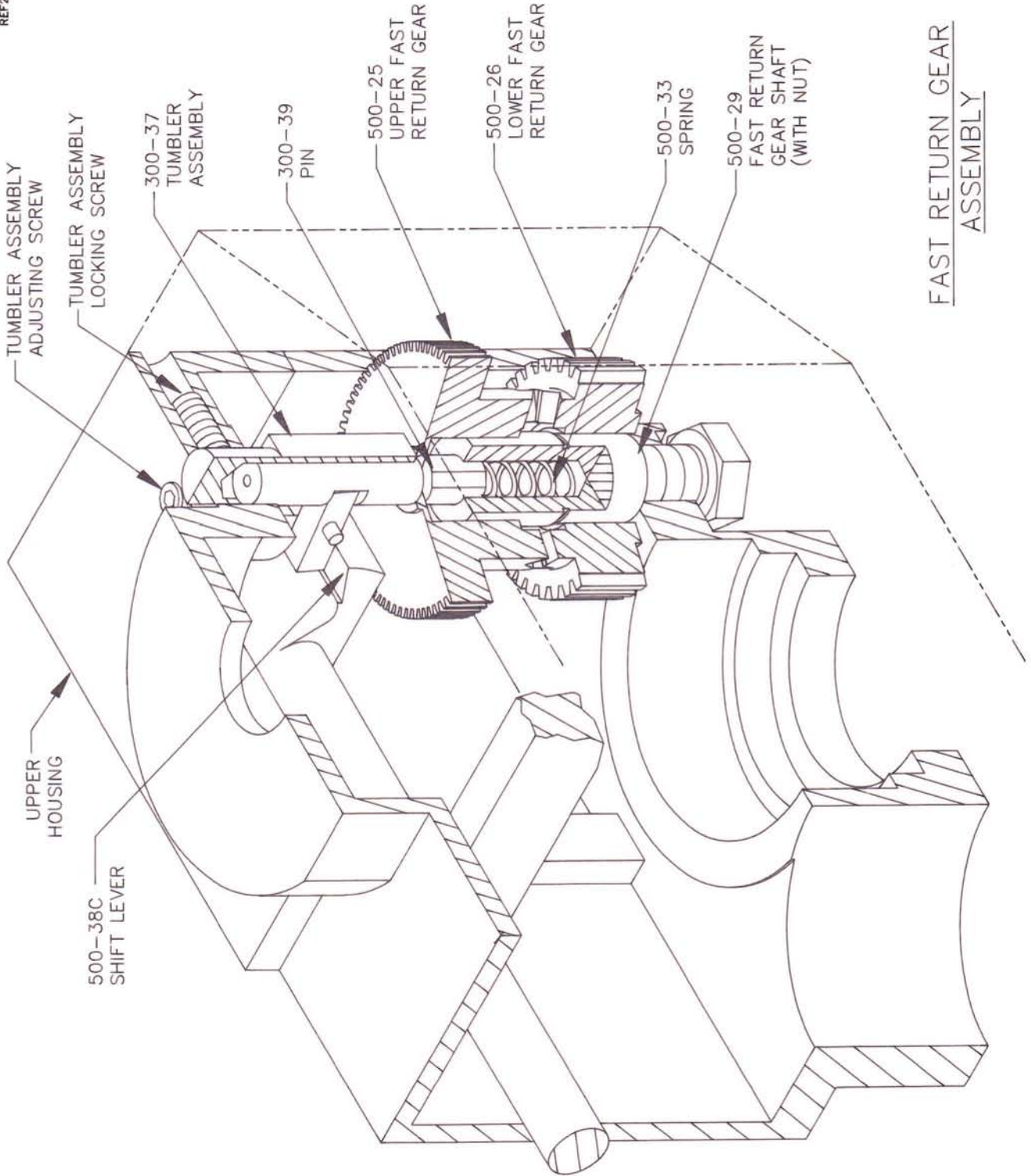


Upper Housing Section:



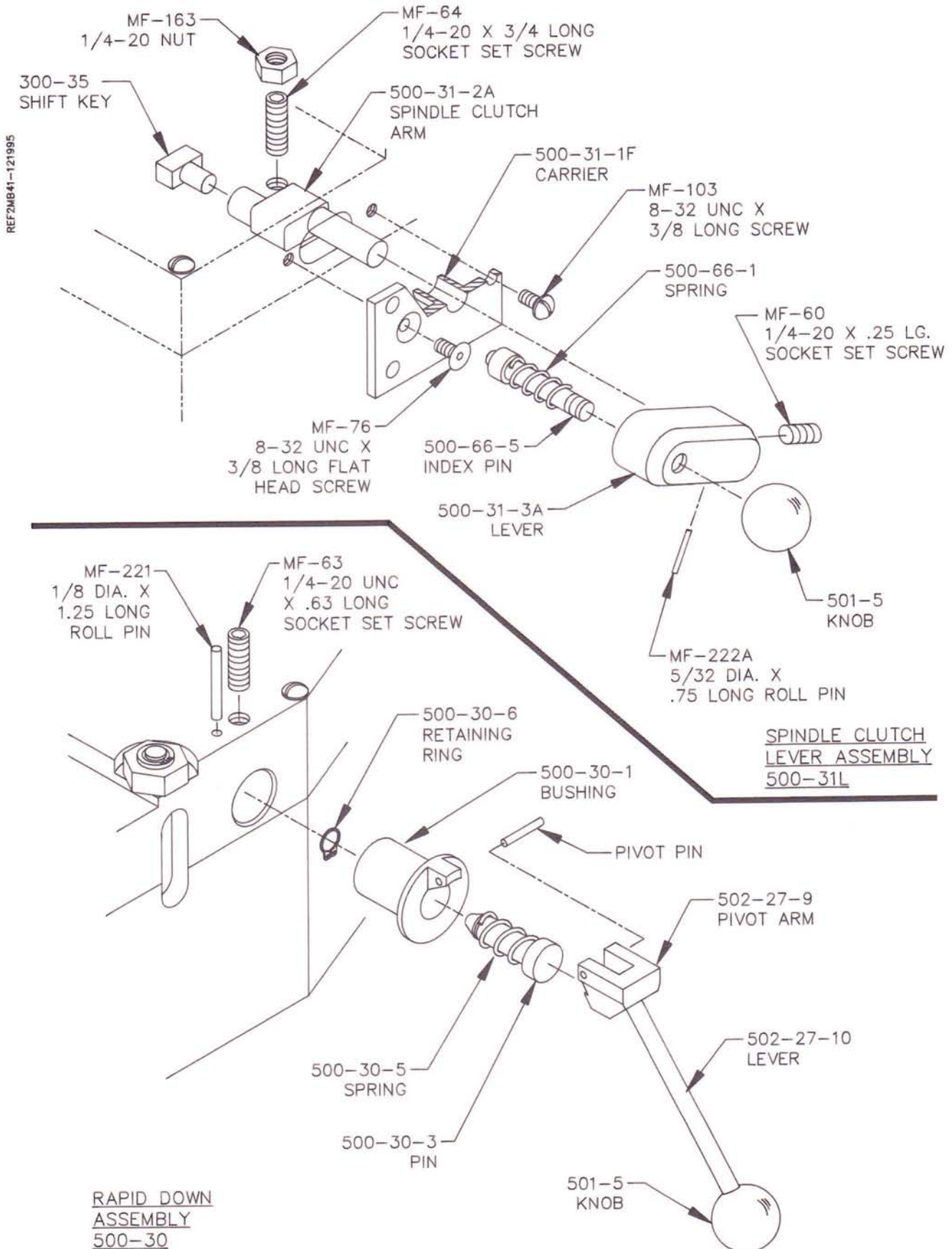
Fast Return Assembly:

REF2MB43-010396

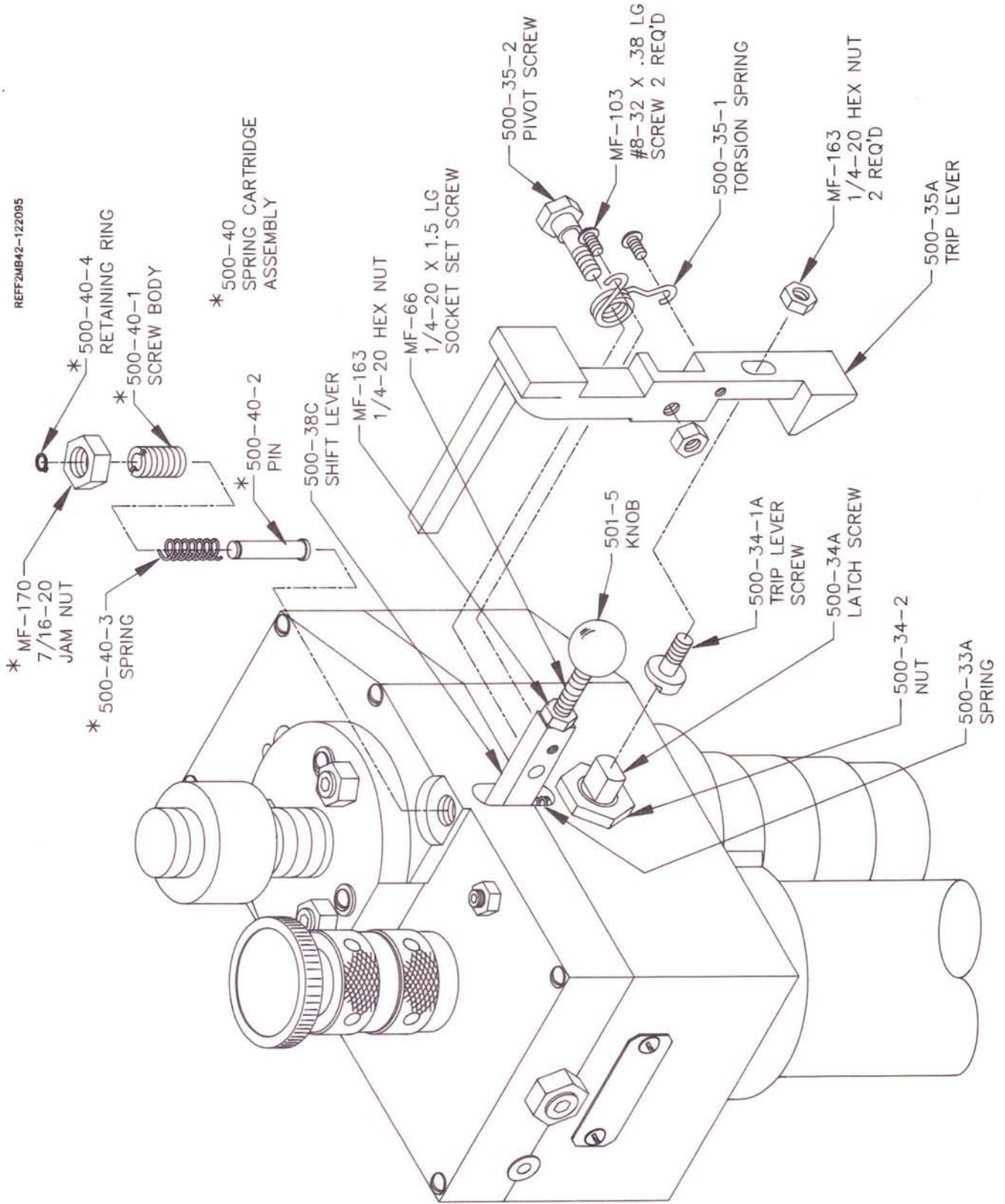


FAST RETURN GEAR ASSEMBLY

Rapid Down / Spindle Clutch Lever Assembly:



Trip Lever Assembly:



Block Clamp Assembly:

REFFA2EB24-010595

