

# ROTTLER

## F79A CNC MACHINING CENTER

OPERATION AND MAINTENANCE MANUAL





# **MANUAL SECTIONS**

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## **ORDERING PROCEDURE**

Contact your regional Rottler sales rep for assistance in ordering optional equipment, replacement parts, or tooling.

If you are unable to contact your regional Rottler sales rep, call the factory at 253-872-7050 and ask to speak to the parts sales specialist.

Have the following information handy to expedite the ordering process:

1. Your name, business name, and contact number
2. Customer number
3. If you don't have a customer number, your billing address
4. Shipping address if different from billing address
5. Machine model and serial number
6. Part number and description of what you want to order
7. Preferred method of shipment
8. You may also contact us via e-mail with the above information. Send e-mail requests to:  
[parts@rottlermfg.com](mailto:parts@rottlermfg.com)

In some cases you may be requested to send a photo of the part you are ordering if it is a replacement part, or doesn't appear in the database.

If you are unsure which part you need to order, contact our service department and ask to speak to one of our service consultants. They will assist you in determining which part you require.

**THERE IS A MINIMUM ORDER OF \$25.00**

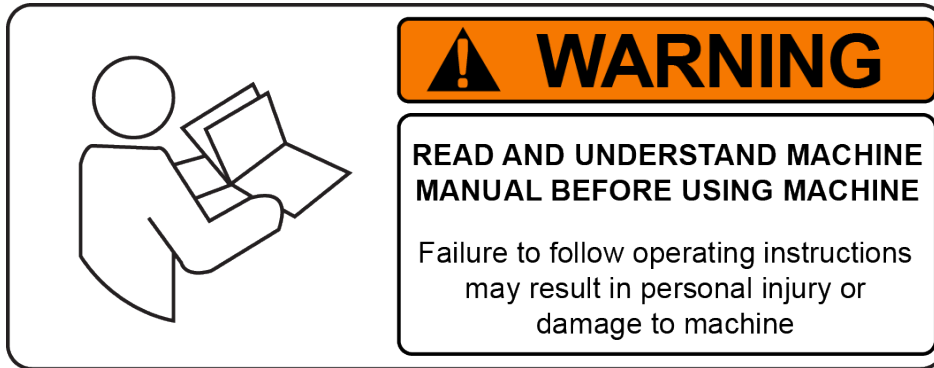


# INTRODUCTION

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## Introduction



**READ THE SAFETY CHAPTER BEFORE INSTALLING MACHINE. THOROUGHLY UNDERSTAND ALL SAFETY ISSUES BEFORE OPERATING MACHINE.**

### **ATTENTION OWNER/BUSINESS MANAGER**

**To validate the warranty on your new Rottler machine, please be sure to sign and complete the “Installation Report” located in the Installation Chapter of this manual.**

We suggest that the new user of the F79A read the CONTROL DEFINITIONS to get an idea how the machine operates.

The Operating Instructions chapter should be read in order to familiarize the user with the actual button pushing sequences required to carry out a job. These chapters in the manual should be considered an introduction. As the operators of the F79A series machines gain experience with using the different functions of the machine, complicated setups and programs will make more sense.

The rest of the manual contains information and part number reference on fixtures, cutting tools, and machine maintenance. The operator should read and become familiar with these areas as well.

## Description

The model F79A machine is a precision, single point boring, and high-speed surfacing unit. The machine can be equipped with tooling and accessories for surfacing and re-boring most American passenger car and truck engines, In-lines, as well as 90 and 60 degree V-types.

F70 machines can be easily tooled, to machine a wide range of engines, including European and Asian engines, also, the machine can be easily adapted to perform other boring and surfacing operations.

The machine is designed, to maintain alignment of cylinder bores, and cylinder head, deck surfaces to the pan rails and main bearing bore locations, as was done in the original factory machining. This overcomes the many inaccuracies and out-of-alignment problems associated with clamping portable boring bars to the cylinder head surface of blocks.

Convenient controls, fast block clamping, precise 3 axis CNC positioning and clamping, means considerable savings in floor to floor time, and operator involvement.

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.

All feeds and rapid travels are power operated and controlled from the control panel.

## Disclaimer

The F79A Manual (henceforth to be referred to as the "Manual") is proprietary to Rottler Manufacturing LLC. ("Rottler Manufacturing") and no ownership rights are hereby transferred. No part of the Manual shall be used, reproduced, translated, converted, adapted, stored in a retrieval system, communicated or transmitted by any means, for any commercial purpose, including without limitation, sale, resale, license, rental or lease, without the prior express written consent of Rottler Manufacturing.

Rottler Manufacturing does not make any representations, warranties or guarantees, express or implied, as to the accuracy or completeness of the Manual. Users must be aware that updates and amendments will be made from time to time to the Manual. It is the user's responsibility to determine whether there have been any such updates or amendments. Neither Rottler Manufacturing nor any of its directors, officers, employees or agents shall not be liable in any manner whatsoever to any person for any loss, damage, injury, liability, cost or expense of any nature, including without limitation incidental, special, direct or consequential damages arising out of or in connection with the use of the Manual.

Rottler Manufacturing and its employees or representatives are not responsible for any information regarding final specifications of any workpiece that is created as a final product when using Rottler equipment. It is the responsibility of the end user of Rottler equipment to determine the final dimensions and finishes of the workpiece that they are working on. Any information regarding final dimensions and finishes that appears in any Rottler literature or that is expressed by anyone representing Rottler is to be regarded as general information to help with the demonstration of or for operator training of Rottler equipment.

## Limited Warranty

Rottler Manufacturing Company Model F79A parts and equipment is warranted as to materials and workmanship. This limited warranty remains in effect for one year from the date of installation or two years from the date of the original shipment from Rottler or whichever date occurs first. This only applies if the machine is owned and operated by the original purchaser and is operated and maintained as per the instructions in the manual. A machine is warranted only if the Installation Report has been properly executed by a certified installation person and received by Rottler at the time of actual installation.

The products are warranted upon delivery to conform to their published specifications and to be free from defects in material and workmanship under normal use for a period of one year from shipment. Should a product not be as warranted, Rottler sole obligation shall be, at its option, to repair, correct or replace the product or to refund the amounts paid for the Product upon its return to a location designated by Rottler. No warranty shall extend to rapid wear Products (including tooling) or to Products which have been subject to misuse (including any use contrary to Rottler instructions), neglect, accident (including during shipment), improper handling or installation, or subject to any modification, repair or service not certified by Rottler. Rottler shall not be liable for any consequential, direct or indirect damages or for any other injury or loss. Buyer waives any right, beyond the foregoing warranty, to make a claim against Rottler. No warranty is provided for any Products not paid in full.

Merchandise cannot be returned to Rottler without prior approval. Customer must contact the Order Department or representative to get approval and to be issued a Return Goods Authorization number (RGR#). Merchandise authorized for return must be returned prepaid. If merchandise is returned with shipping charges collect, the actual amount of these charges may be deducted from any credit which may be due the customer. The RGR # assigned by the Order Department should be written on the shipping label and must appear on a copy of the invoice(s) covering the original shipment. This invoice copy must be included in the box with the parts. Shipment must contain ONLY those items on the RGR as approved for return. Merchandise must be received within 10 days of the date of RGR or the RGR will be canceled. All returned merchandise may be subject to a 20% restocking fee on under \$1,000.00 amount or 10% on any items over \$1,000.00. Parts or tooling over 30 days old are considered as customer property and can only be returned with prior written approval from Rottler Corporation Management and/or Shipping Department.

The issuance of a **RGR DOES NOT** guarantee credit - it is only authorization for the return of the goods. Credit for return merchandise is at the sole discretion of Rottler. Credit will be issued only after inspection of returned goods.

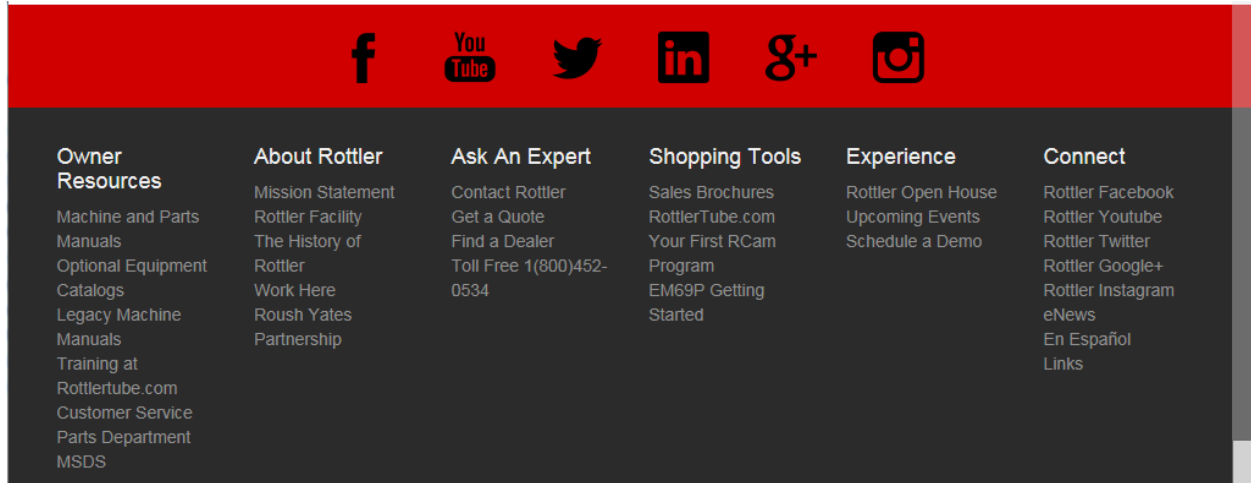
Tools proven to be defective within the warranty period will be repaired or replaced at the factory's option. We accept no responsibility for defects caused by external damage, wear, abuse, or misuse, nor do we accept any obligation to provide compensation for direct or indirect costs in connection with cases covered by the warranty.



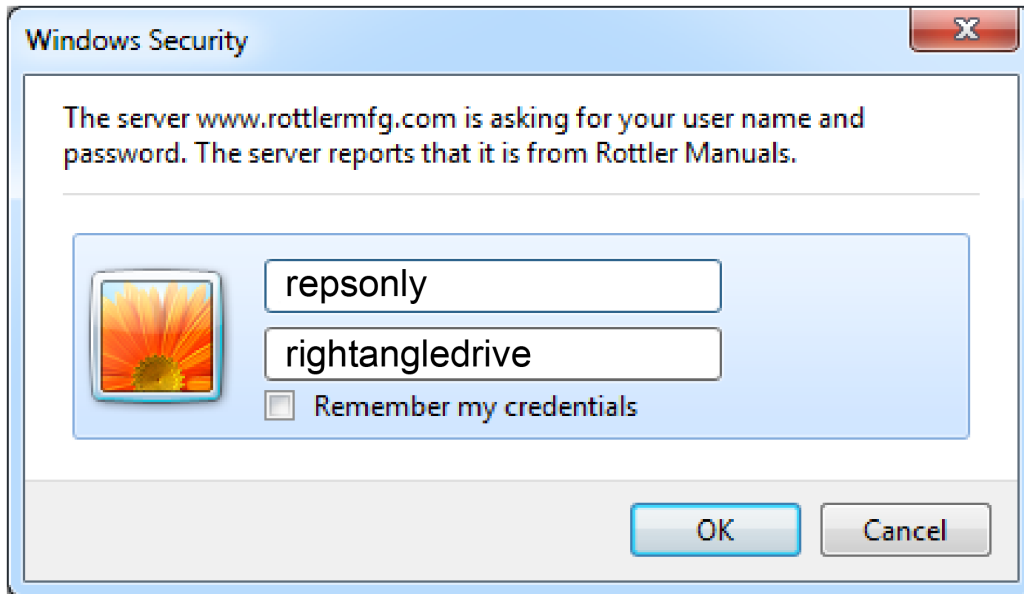
### Online Documentation Access

Online documentation for machines and optional equipment can be accessed at the Rottler website. To access documentation open your browser and navigate to <https://www.rottlermfg.com>.

Scroll to the bottom of the page and under the Owner Resources title click the type of documentation you want to access.



If a log in window pops up asking for user name and password fill in the blanks as shown.



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# INSTALLATION

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## **F79 INSTALLATION PREPARATION REQUIREMENTS**

1. Floor needs to be prepared with anchor bolts installed. Rottler highly recommends the Hilti system.
2. Machine needs to be set in place with a leveling pad under each leveling bolt. After setting the machine in place, check that each anchor bolt nut turns freely and that there is no damage to the anchor bolt threads.
3. Rough level the machine.
4. Electrical connection made to the machine. Provide 208-240 VAC 1, or 3 phase power. Machine can be ordered both ways, so verify power requirements. 40 amp service is required.
5. Ground rod installed and connected.
6. Air supply to the machine. Minimum 100 PSI of clean, dry air.
7. Fixtures removed from the machine bed, and cleaned of rust preventative.
8. Machine cleaned of rust preventative.
9. Machine requires an Internet connection. Preferably wireless.
10. Have a scrap block available for operator training. Preferably a block commonly repaired at your facility.

## **ATTENTION OWNER/BUSINESS MANAGER**

**To validate the warranty on your new Rottler machine, please be sure to sign the installation report after the installation technician has installed the machine and verified the machine is operating correctly and given the operators operation and maintenance training.**

**Thank you for your cooperation and the opportunity to be of service to you.**

***ROTTLER MANUFACTURING***



OFFICE USE ONLY

Route to: Servicer Mgr → Accounting → Andy → Accounting **Warranty Exp Date**

**ROTTLER MANUFACTURING MUST HAVE THIS REPORT RETURNED TO PROPERLY QUALIFY WARRANTY ON EQUIPMENT**

Customer: \_\_\_\_\_ Address: \_\_\_\_\_  
 City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Country: \_\_\_\_\_  
 Machine Model: \_\_\_\_\_ Serial Number: \_\_\_\_\_ Representative: \_\_\_\_\_

**MACHINE INSTALLATION:** Electrical information MUST be complete to validate this report.

\_\_\_\_\_ Customer has read and fully understands importance of machine location as explained in the installation section of the manual.

**The following is the customer’s responsibility prior to the arrival of Rottler technician. Please Initial each item when it is completed.**

*Customer must provide foundation and hold down bolt system, see attached drawing and section F79 Series Foundation and Hold Down Requirements.*



**VERY IMPORTANT:** Modern design machines contain electronic low voltage circuitry that provides great advantages and a better machine life. BUT, you must have an excellent, stable, isolated power supply along with an isolated ground. If not, electrical noise problems are likely to interfere with machine operation unexpectedly.

*Customer is responsible for providing electricity to machine in a manner that meets the local electrical code requirements.*

- \_\_\_\_\_ Have Internet connection available for the machine. Either via Ethernet cable or Wireless. The machine comes equipped with a wireless USB adapter.
- \_\_\_\_\_ Remove machine from truck. Weight: F79A 11,000 lbs (4,990 Kgs).
- \_\_\_\_\_ If the machine was shipped in a container follow the removal procedure in the installation section of the manual.
- \_\_\_\_\_ Remove fixturing and misc. parts from machine and clean.
- \_\_\_\_\_ Install machine on foundation with supplied jack pads under jacking bolts.
- \_\_\_\_\_ Install hold down nuts and bolts, see F79 Series Foundation and Hold Down Requirements section.. – This must be done first.
- \_\_\_\_\_ Rough Level the machine using a precision level so there is equal tension on all bolts.
- \_\_\_\_\_ This machine requires between 208 and 240 Volts AC, Single Phase, 50/60 Hz, isolated power supply. For voltages above 240 or below 208 VAC, a 17kva transformer will be required and is available at Rottler. Please specify voltage when ordering. Measure the incoming voltage between L1 and L2. Current requirements for this machine is 50 amps. Measure the incoming AC voltage at least twice during installation.
  1. L1to L2 \_\_\_\_\_ VAC
  2. L1to L2 \_\_\_\_\_ VAC

\_\_\_\_\_ Measure each leg of the incoming supply to ground.  
 L1 to ground \_\_\_\_\_ VAC      L2 to ground \_\_\_\_\_ VAC



Neutral and machine ground are not the same thing. You should measure an open circuit between Neutral and ground.



**IF VOLTAGE IS OUTSIDE THE CORRECT RANGE AT ANY TIME THE MACHINE WILL NOT OPERATE PROPERLY AND MAY BE DAMAGED.**

- \_\_\_\_\_ Air of the proper pressure and capacity connected to the machine. Air supply must be free from oil and water. Oil or water will damage electrical and air components.
- \_\_\_\_\_ Customer should attempt to have junk work piece available.
- \_\_\_\_\_ Have the operator read through the operation manual before training begins. This will help him be familiar with the button pushing sequences. Have the operator read through the manual again after training and some of the sequences will make more sense.

### The following is the Rottler technician's responsibility

- \_\_\_\_\_ Check column top and spindle base bottom for rust and nicks if spindle must be installed. Clean and stone as required.
- \_\_\_\_\_ When lifting spindle unit, keep in mind the front to back center of gravity is located approximately 12 inches from the front end and has a tendency to lean forward.
- \_\_\_\_\_ Each main system is protected internally by circuit breakers. Green the breaker is "tripped" and red indicates the breaker is "Hot" (conducting electricity).
- \_\_\_\_\_ Clean any rust inhibitor from the machine surfaces. Move the column from side to side continually cleaning the machine base until all inhibitor is removed.
- \_\_\_\_\_ Install spindle unit on column, if required, using one of the methods below. (Spindle unit weighs 1,800 lbs, 800 Kgs.)

#### Using fork lift angle iron brackets:

Bolt brackets to each side of the spindle base.

Use large C-clamps to clamp the fork lift forks to the angle iron brackets. This will prevent any accidental slips. Loosen 1/2 13 x 3 1/2 Inch bolts on pendent arm to allow it to be moved out of the way.

Use a forklift to lift the spindle unit onto the column. Be careful to watch clearance of all items.

- \_\_\_\_\_ Install the Right (Fixed Side Rail) and removable dowel pins. Torque Side Rail bolts to 80 Ft/lbs
- \_\_\_\_\_ Lift spindle unit into place. Push spindle base up against Right Side Rail.
- \_\_\_\_\_ Install the Left Side Rail and removable dowel pins. Torque Side Rail bolts to 80 Ft/lbs.
- \_\_\_\_\_ Measure the protrusion of the Sides Rails above the spindle base and record. These should be between .035" and .040"

Right	Front_____	Rear_____
Left	Front_____	Rear_____

- \_\_\_\_\_ Remove angle iron brackets form spindle base.
- \_\_\_\_\_ Check gib adjustment on side and top rails. (see Section 6 of manual for correct procedure)
- \_\_\_\_\_ Connect air and oil lines per air logic diagram.
- \_\_\_\_\_ Remind customer air of the proper pressure and capacity connected to the machine. Air supply must be free from oil and water. Oil or water will damage electrical and air components.
- \_\_\_\_\_ Connect electrical wires in main rear enclosure if required using machine wiring diagram. Make sure all high power wires are run away from communication wires.

**MACHINE START-UP**

When starting the machine for the first time, it may move out of control. Make sure all hands are clear of machine parts. Be ready to press the Emergency Stop button if needed.

- \_\_\_\_\_ **BEFORE** turning power on to the machine. Check all wires for security by using the correct screw driver and turning CW until movement stops. Stranded wire can “spread” slightly from vibration during transport.
- \_\_\_\_\_ Install electrical component covers inside the electrical enclosure with fasteners provided.
- \_\_\_\_\_ Check to be sure the PCIe card is seated into the Motherboard. Loosen the two (2) screws that hold the PCIe card brackets, put slight pressure onto the PCIe card towards the motherboard. Tighten the two (2) screw.
- \_\_\_\_\_ Press E stop in.
- \_\_\_\_\_ Turn main power on at the main disconnect switch located on the rear enclosure.
- \_\_\_\_\_ Wait for Rottler screen to appear on monitor.
- \_\_\_\_\_ Release E stop.
- \_\_\_\_\_ If machine moves out of control, turn power off and contact factory for help in trouble shooting.
- \_\_\_\_\_ If any of the circuit breakers “trip”, reset and call factory for possible trouble shooting.
- \_\_\_\_\_ Check the computer control options and make sure that you turn on z-axis bit 2 and spindle bit 3.

**MACHINE MOVEMENTS**

- \_\_\_\_\_ Make sure there is nothing obstructing the full vertical, horizontal or In/Out travel of the machine taking special notice of the rear enclosure, way travel and top of the spindle unit.
- \_\_\_\_\_ Put the machine in hand wheel mode and verify Vertical operation. Put an indicator on the cutter head and verify .001” movement per detent in course mode and .0001” in fine mode. If the indicator is jumpy the outer spindle adjustment may be too tight. Refer to manual and re-adjust.
- \_\_\_\_\_ Put the machine in hand wheel mode and verify Horizontal operation. Put an indicator on the cutter head and verify .001” movement per detent in course mode and .0001” in fine mode
- \_\_\_\_\_ Use the rapid buttons and verify proper vertical, horizontal and In/out travel.
- \_\_\_\_\_ Check limit switch operation with handwheel before using the power feed.
- \_\_\_\_\_ Move the machine to its vertical limits to verify proper operation.
- \_\_\_\_\_ Move the machine to its horizontal limits to verify proper operation.
- \_\_\_\_\_ Move the machine to its In/Out limits to verify proper operation.
- \_\_\_\_\_ Start the spindle and verify operation at all speeds.
- \_\_\_\_\_ Use the spindle creep buttons and verify proper operation.
- \_\_\_\_\_ Prime the oiling system. (See maintenance section of manual for complete details.)
- \_\_\_\_\_ Use a precision level and level the machine:

Record machine level readings below (must be within .0005).

Back Way:

P1\_\_\_\_\_ P2\_\_\_\_\_ P3\_\_\_\_\_ P4\_\_\_\_\_

Back to Front Way:

P1\_\_\_\_\_ P2\_\_\_\_\_ P3\_\_\_\_\_ P4\_\_\_\_\_

Record Dial Indicator readings:

Spindle to Back Table:

P1\_\_\_\_\_ P2\_\_\_\_\_ P3\_\_\_\_\_ P4\_\_\_\_\_

Spindle to Front Table:

P1\_\_\_\_\_ P2\_\_\_\_\_ P3\_\_\_\_\_ P4\_\_\_\_\_

- \_\_\_\_\_ Check mill tilt, and lift amounts with Y axis in the middle of travel, and record Amount of tilt\_\_\_\_\_



- \_\_\_\_\_ Check Y-Axis drop or rise
- \_\_\_\_\_ Put standard sweep arm and dial indicator on machine bed.
- \_\_\_\_\_ Move Y-Axis through complete travel and record deviation. \_\_\_\_\_ (Should be less than .0005")

**The following procedures should be shown to personal involved in machine maintenance.**

See maintenance section of manual for complete details. Video of procedure is located at:  
www.rottlertube.com.

- \_\_\_\_\_ Check, and adjust X axis gibs Should be .0002"-.0005" (see maintenance section for details)
- \_\_\_\_\_ Adjust outer spindle bushings.
- \_\_\_\_\_ Adjust inner spindle bearings

- \_\_\_\_\_ Perform spindle sweep adjustment.
- \_\_\_\_\_ Verify ALL axis backlash comp is operating properly, adjust if needed. Record actuals after verification.

Auto	Handwheel
X-Axis _____	_____
Y-Axis _____	_____
Z-Axis _____	_____

- \_\_\_\_\_ Install way cover brackets. Use a straightedge to ensure the brackets are level, and flush, with the machine slideways. Washers may be used as shims between the machine base, and brackets, to adjust for level.
- \_\_\_\_\_ Attach way covers to brackets.
- \_\_\_\_\_ Move the column to the extreme end of travel, and attach the way covers to the column. Lift the way cover up, as much as the slotted holes will allow, and tighten.

Have Internet connection available for the machine. Either via Ethernet cable or Wireless (Wi-Fi). The machine comes equipped with a wireless USB adapter.

- \_\_\_\_\_ Install and test the Internet connection to the machine. DO NOT download any updates unless instructed to do so by Rottler.

**INSTRUCTING THE OPERATOR:**

***Note: Rottler employees and representatives per company policy are not permitted to provide end user of Rottler equipment with any OEM specifications for the workpiece that is created by end user using Rottler equipment.***



- \_\_\_\_\_ Explain to the customer and operator that at NO time is there to be any software or hardware other than Windows Auto Update and Rottler installed on this machine. This includes screen savers, anti-virus software, and any hardware device that installs software on the machine. Installation of screen savers and anti-virus software can cause dangerous control problems. Any installation of software or hardware will void the warranty on the machine.
- \_\_\_\_\_ Explain to the customer and operator that the machine should be hooked up to the Internet anytime it is on. The software on the machine will automatically connect to our server to send back useful information on machine status.
- \_\_\_\_\_ Connect customer supplied Internet to the machine. Verify that the Internet is accessible from the machine.
- \_\_\_\_\_ Once the machine has been fully setup and is ready for operation create a Skype account for the machine following the instructions in the Installation Section of the manual.
- \_\_\_\_\_ Explain to the customer and the operator how the to log onto Skype and communicate with Rottler when needed.

 **WARNING**

\_\_\_\_\_ Computer Viruses will cause the machine control system to become unstable. This may cause the machine to make uncontrolled moves which could create a dangerous environment for the machine operator.

 **IMPORTANT**

\_\_\_\_\_ Refer to Section 4, Introduction/Safety/Installation of the Machine Manual, Section: Computer and Controller System Safety. Explain and discuss this section carefully with Owner/Manager/Operator and have them sign off. Failure to do so will result in the machine warranty being Null and Void.

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Signature / Title

- \_\_\_\_\_ Explain to the customer the importance of backing up the block profiles to a separate device. Any computer failure or possible operator input error can result in the loss of all block profiles that were created for the machine. Refer to Chapter 5 of the machine manual for detailed instructions on backing up and restoring block profiles.
- \_\_\_\_\_ Explain to the customer the proper way for turn the machine off when it is not in use. Do not leave the machine on overnight. It is important to close all programs followed by shutting down Windows before turning the main power switch off. Do not turn the main power switch off before shutting down Windows.
- \_\_\_\_\_ Using the operating manual as a guide explain the function of all buttons.
- \_\_\_\_\_ Cycle all machine movements and supervise the handling of same by operator.
- \_\_\_\_\_ Demonstrate the differences of Manual and Auto operation.
- \_\_\_\_\_ Explain machine parameters and error messages. It is very important that the customer does not change parameter settings without first checking with Rottler Manufacturing. If certain parameters are changed the machine may make uncontrolled moves or not operate at all.
- \_\_\_\_\_ Point out safety features to customer and operator. Do not push any buttons without thinking of safety first.

 **CAUTION**

Do not assume the cutterhead micrometer has been calibrated.

- \_\_\_\_\_ Install a work piece in the machine and perform an under size test bore to qualify the micrometer setting to the customers measuring tools. Note adjustments: + \_\_\_\_\_, - \_\_\_\_\_. Explain precision reset of tool in cutterhead.
- \_\_\_\_\_ The following is a checklist to go through every time the machine is started to begin a cut or automatic cycle.
- Work piece secure
  - RPM set
  - Feed Rate set
  - Correct program in use
  - Program oriented correctly (vertical zero at correct place) Centering range adequate
  - Guards in place
  - Cutterhead secure
  - Tool holder adjusted to the correct size
  - Tool holder locked in place
- \_\_\_\_\_ Proceed to have operator bore block to size.

- \_\_\_\_\_ Demonstrate and explain boring with the electronic hand wheel.
- \_\_\_\_\_ Explain the correct Feed rates and speeds from Cutting Insert Bulletin.
- \_\_\_\_\_ Cutter head change and expected stub bar performance.
- \_\_\_\_\_ Parts ordering, refer to the operating manual for part numbers and description.
- \_\_\_\_\_ Offset tool bits, calibration of micrometer and anvil setting.
- \_\_\_\_\_ Train on ALL Rottler programs even if they need to be run in the air.
- \_\_\_\_\_ If Rottler CAM was provided to the customer train on any programs supplied by Rottler.
- \_\_\_\_\_ Review Emergency stop procedure with operator per operating manual.

### **MAINTENANCE SECTION**

- \_\_\_\_\_ Use the manual as a reference when explaining routine maintenance and lubrication.
- \_\_\_\_\_ Overload devices, There are no mechanical overload devices on this machine. The machine is protected from overload by the motor controllers. If the system is overloaded the controllers shut the motors off. The controllers can be reset by turning the main power off for at least 1 minute, then turning it back on.
- \_\_\_\_\_ Explain again the proper Inner and Outer spindle adjustment to the operator.
- \_\_\_\_\_ Dampener cleaning.
- \_\_\_\_\_ Micrometer and anvil thread adjustment.
- \_\_\_\_\_ Inspection of tool bit hole in tool holders (deformation due to accidental impact).

Rottler Manufacturing and its employees or representatives are not responsible for any information regarding final specifications of any workpiece that is created as a final product when using Rottler equipment. It is the responsibility of the end user of Rottler equipment to determine the final dimensions and finishes of the workpiece that they are working on. Any information regarding final dimensions and finishes that appears in any Rottler literature or that is expressed by anyone representing Rottler is to be regarded as general information to help with the demonstration of or for operator training of Rottler equipment.

Note: Rotter employees and representatives per company policy are not permitted to provide end user of Rottler equipment with any OEM specifications for the workpiece that is created by end user using Rottler equipment.

General remarks on machine performance, adjustments as received and any further organization or parts required to complete the installation.

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Instructions given to: \_\_\_\_\_

Sales/Service Engineer: \_\_\_\_\_ Date \_\_\_\_\_

Shop Foreman/Superintendent or Owner: \_\_\_\_\_ Date \_\_\_\_\_

**Once completed send this form to:**  
**Rottler Manufacturing**  
**attn: Service Manager**  
**8029 S 200 St**  
**Kent, WA 98032 USA**

**Alternately you may send this form via fax or e-mail:**  
**fax: [+1] 253-395-0230**  
**e-mail: service@rottlermfg.com**

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## Removing Machine from Shipping Container

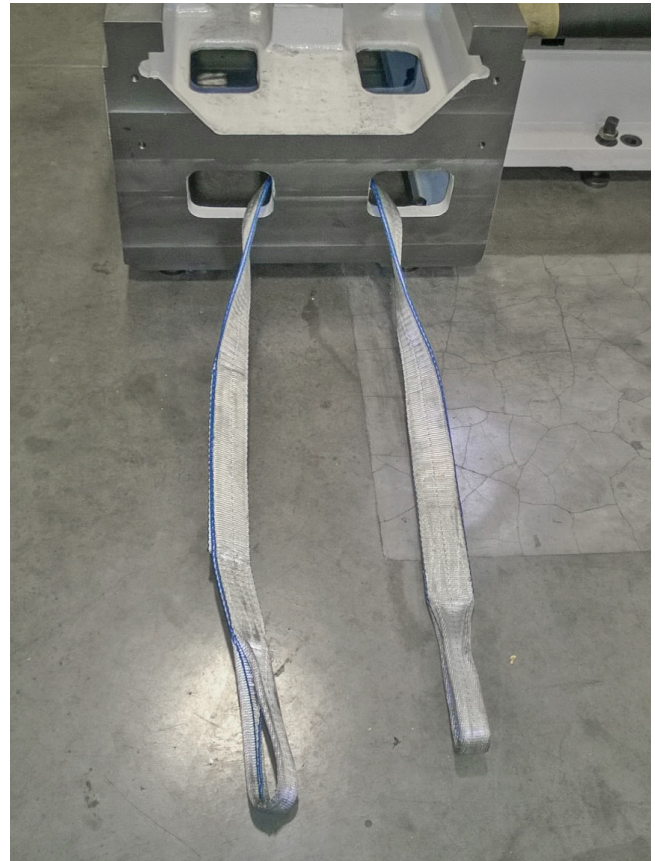
All F79 and F100 series machines shipped in containers will have pulling straps to help in the removal of the machine from the shipping container.

Once all lagging bolts and wedge blocks have been removed, the machines must be fully pulled out from the container using the preinstalled straps.

***Do not attempt to lift the machine while it still in the container. Doing so may cause severe damage to the machine and will void the warranty.***

Rottler recommends that a professional material handling business that is bonded and insured be contracted for unloading machines from containers.

Below is an example of the pull straps that will be sent with machines shipped in containers.



## Installation Procedure

### Rottler F70 and F100 Series Foundation and Hold Down Requirements

Rottler machines require a good concrete foundation and hold down system. It is not recommended to install a machine on a cracked floor or over an expansion joint. The layout/position of the hold down holes can be found on the foundation drawing in the machine's manual. If a new concrete foundation is being cast, it is recommended to install the steel reinforcement bars 7" (180mm) below the floor surface.

There are two methods commonly used by customers:

1. Drill the concrete floor as per drawing layout before arrival of machine.
2. Place machine, mark floor through holes in machine base, move machine away then drill the floor.

The machine is provided with jacking bolts and steel pads to place between the jacking bolts and floor. For shipping, the steel pads are packed in a separate box and marked with yellow/black tape so the box is clearly visible. This allows the machine to be unpacked and removed from the shipping crate, placed on the floor on these steel pads without opening the accessory crates. When placing the machine on the jacking bolts, ALWAYS rough level to be sure that the weight of the machine is evenly distributed over all the jacking bolts.

Rottler recommends HILTI anchoring products. 3/4" (20mm) diameter X 12" (300mm) long studs are recommended. Drill floor approx 7" (180mm) deep with 1" (25mm) drill. As it is difficult to drill concrete exactly on center, it is recommended to drill a pilot hole. After drilling and before injecting epoxy, it is also recommended to move the machine into place and make sure all studs fit thru the holes in the base and travel all the way down into the holes so that approx 5" (130mm) protrude out of the floor. The machine may have to be moved a small amount to allow all studs to fit. Once this is checked, the studs can be removed then the epoxy injected into the bottom of the holes. Make sure all dust is vacuumed out of the holes before the epoxy is injected. Ensure that the epoxy is injected starting at the bottom of the holes to be sure the stud has maximum contact with the epoxy. The size of the holes will determine how much epoxy to inject into the holes before fitting the studs. On average, 1/2 to 2/3 of the hole should be filled with epoxy before the stud is installed. Be sure when the stud is installed, that the epoxy fills the hole to the top. Fit the washer and nut and tighten lightly to align the stud then allow the epoxy 24 hours to harden ready for leveling and final anchoring.

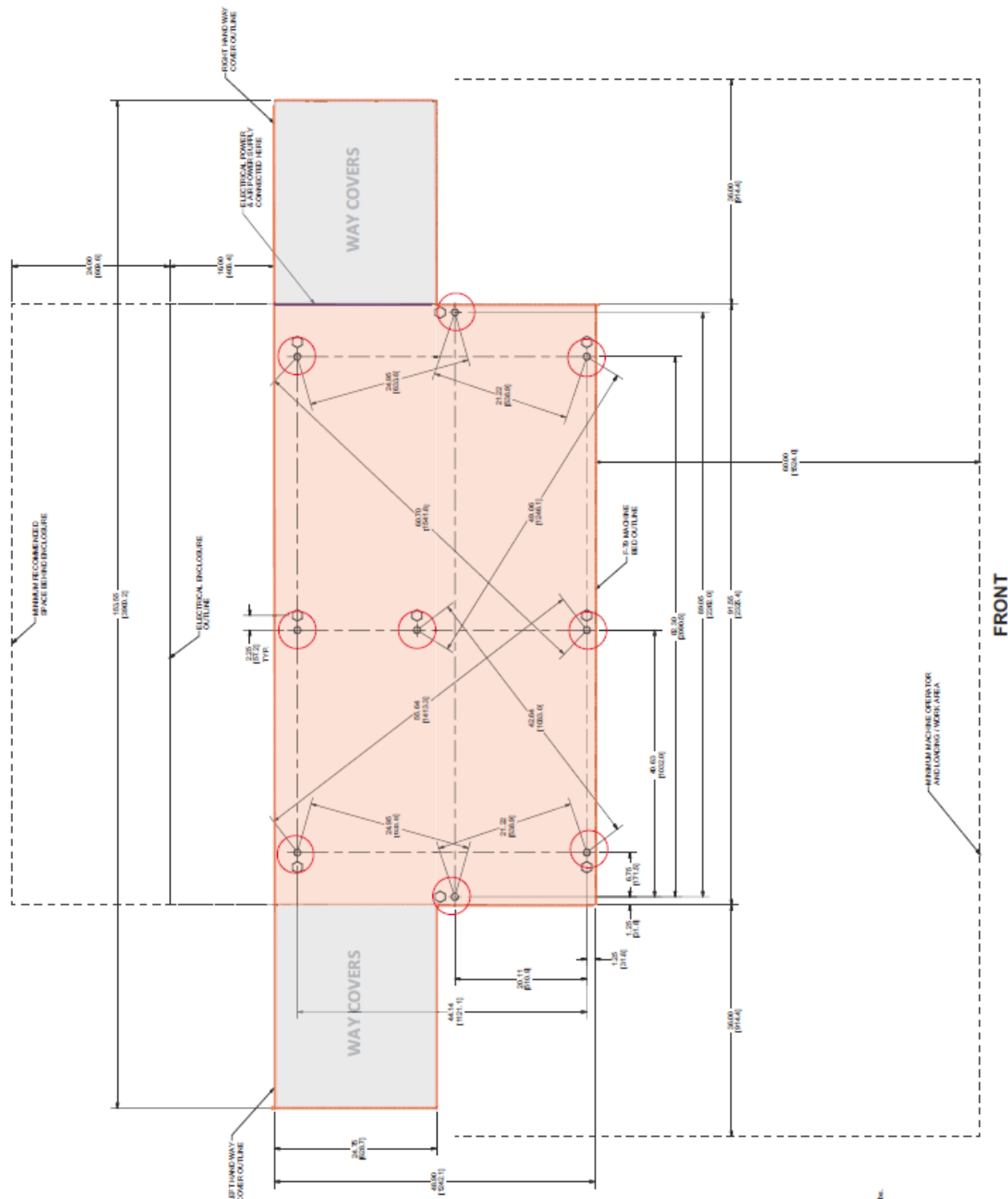
The column is tied down with chains for transport, if it is required to move the column to help with installation of the hold down system, the column tie downs can be removed and manually turn the horizontal ball screw nut by hand to move the column sideways. Be sure that the slideways are clean and lubed under the column before moving.

The following is a MINIMUM recommendation for safe reliable operation.

4000 PSI concrete

Slab thickness of 8" (20cm)

F79A Hold Down and Anchor Bolt Locations

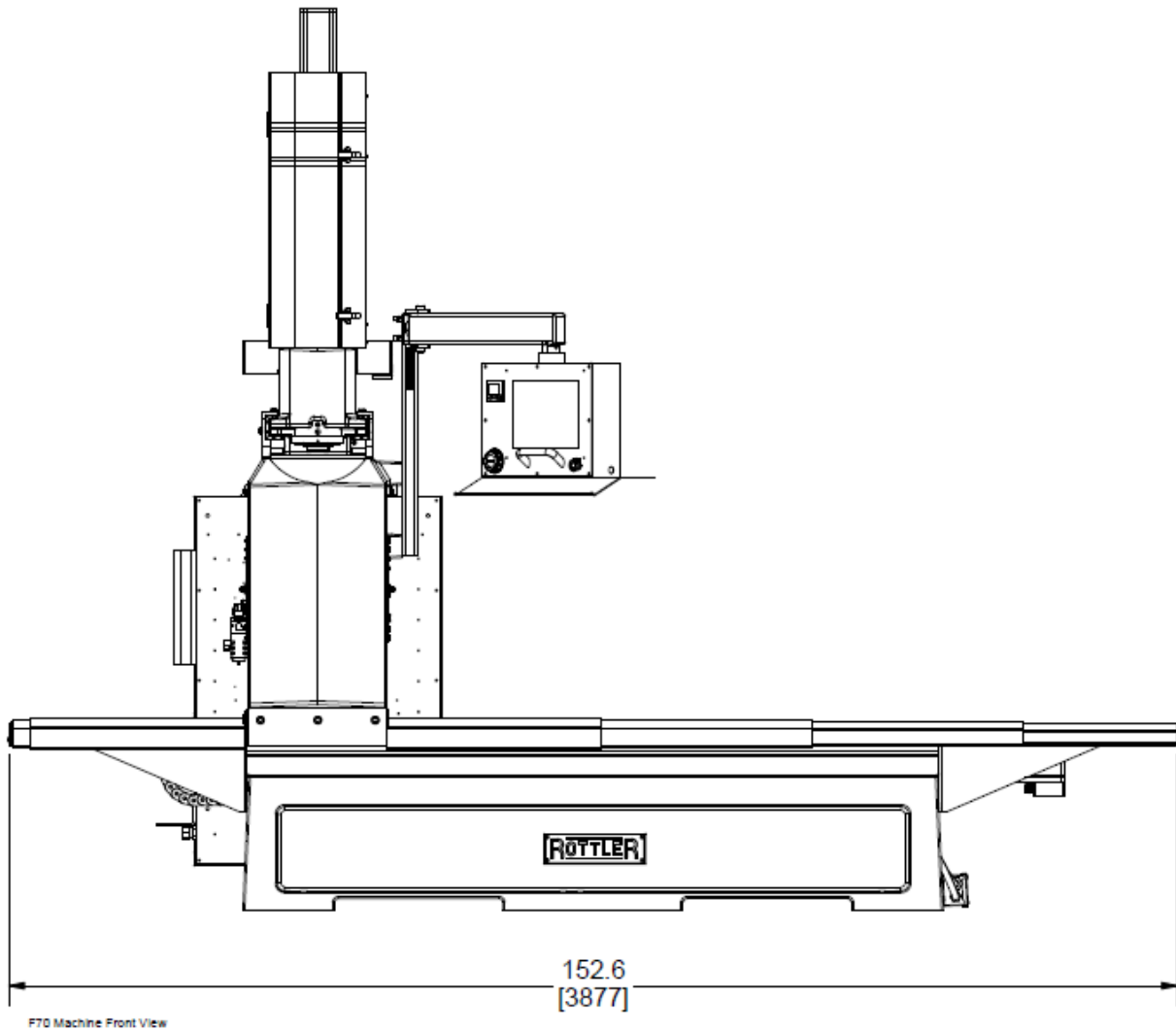


NOTE:  
 (1) POSITION INDICATORS: ○ - ANCHOR BOLTS  
 ○ - ANCHOR BOLTS ARE 3/4" Ø THREAD, 4" LONG BOLTS  
 ○ - WITH A MAXIMUM OF 1000 LB. WEIGHT (11000 Pa.)  
 (2) WITH A MAXIMUM OF 1000 LB. WEIGHT (11000 Pa.)  
 (3) HEIGHT OF MACHINE, TYPE (PART 2)

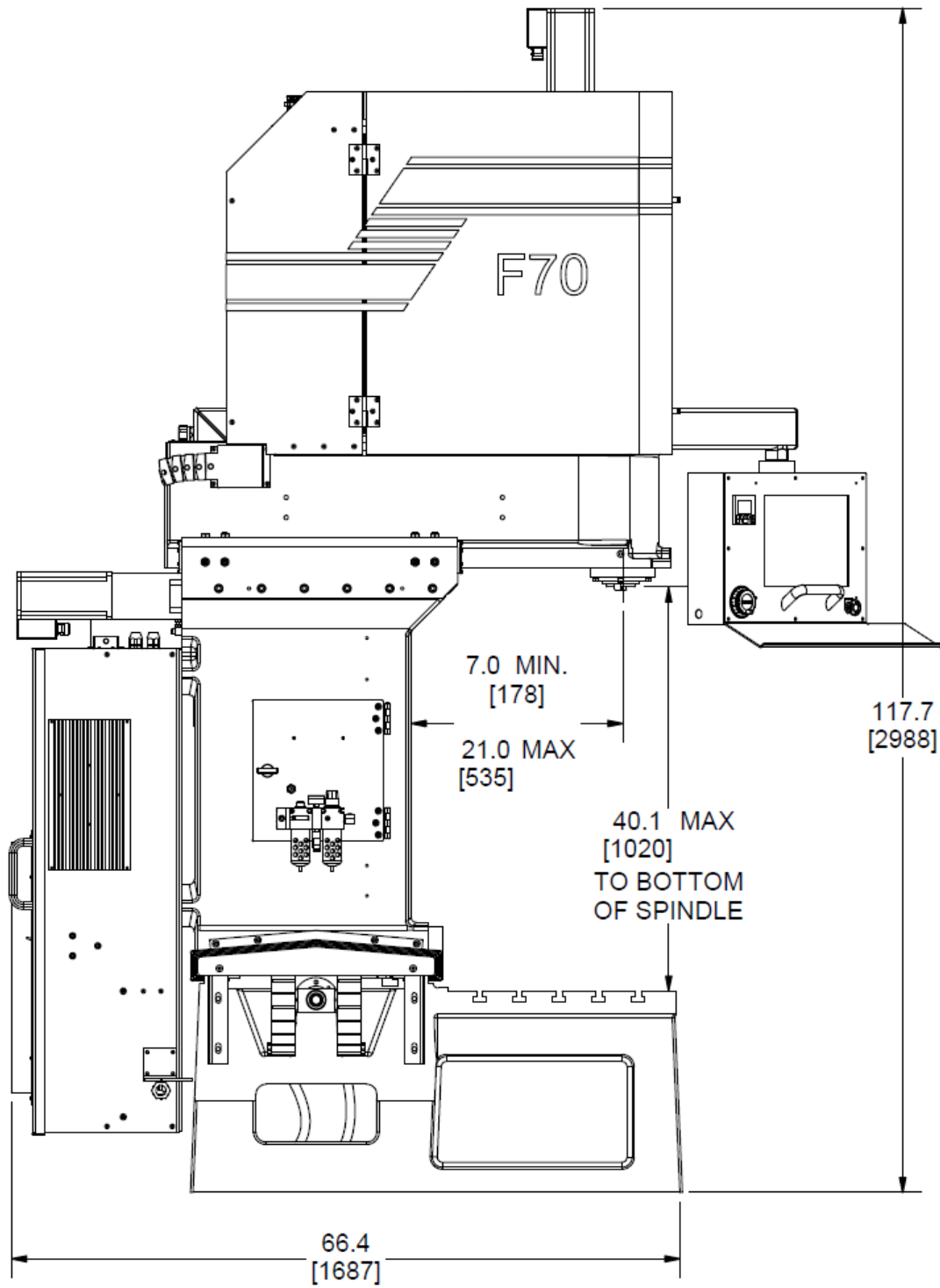


### Machine Dimensions

#### Front View



Left Side View



## Machine Installation



### **IMPORTANT!** Placement of Machine

It is critical that the machine be placed in an area of the facility that has a stable thermal environment. The machine should be kept away from direct sunlight, large heating units, and doorways that would allow outside air direct contact on the machine.

Exposure to the above and other extremes in temperature will cause thermal drift to occur in the machines which could have a detrimental effect on machining accuracy. A number of unrepeatability errors in machine performance have been linked to this condition.

### **Location**

The productivity of this machine will depend a great deal on its proper initial installation. Pay particular attention to the means by which work pieces are lifted into the machine as well as the material handling to and from other operations in your shop.

The proper loading arrangement and area location for your F79A 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. Verify the hoist has a rating that exceeds the load being lifted.

For the shop where large production runs are anticipated, the work pieces should be directly loaded and unloaded from a conveyor. If this is not the case 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 work pieces without creating a dangerous, cluttered work area.

### **Unpacking**

Use care in removing the crate materials from the machine. Be careful not to use force on any part of the machine.

Remove the toolbox, parallels and optional equipment from the machine. Completely clean these articles as well as the rest of the machine with solvent. Rust inhibitor was applied, at the time of shipment. Any of this left on the machine, will allow cast iron dust to collect in that area, which could cause premature wear.

### **Column Hold Down**

The machine was shipped with the column held in place with chains and turnbuckles to the Main bed. Do not attempt to move the machine under power until these restraints have been removed.

Be sure that all jacking bolts have approximately equal weight on them. As you go leveling the base snug the tie down bolts to help hold the main base in place. Recheck all areas of the main base for level.

### **Air Supply**

It is very important the air source for the F79A machine be moisture free. Water and oil in the line will result in early cylinder and valve failure. The factory recommends installing a water trap at the machine.

Attach a 100 PSI air source to the line connection attached to the small enclosure located on the right rear of the machine near the bottom.

**Power Supply**

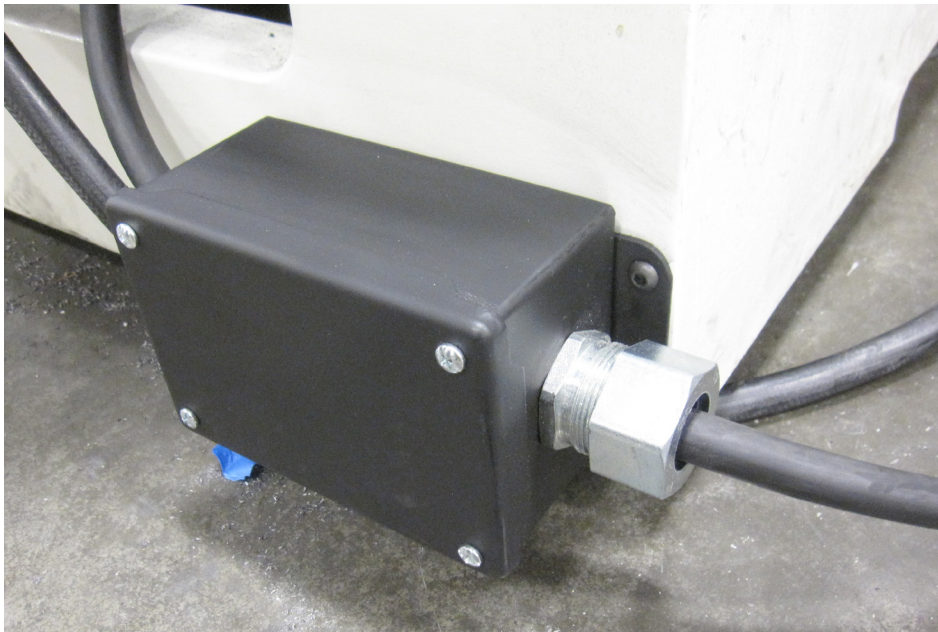
This machine has the following power requirements:

- 208 to 240 VAC
- Single Phase
- 50 or 60 Hertz
- 30 amps

Connect single phase wiring to the electrical box located on the back of the machine in the lower right hand corner.

**IMPORTANT**

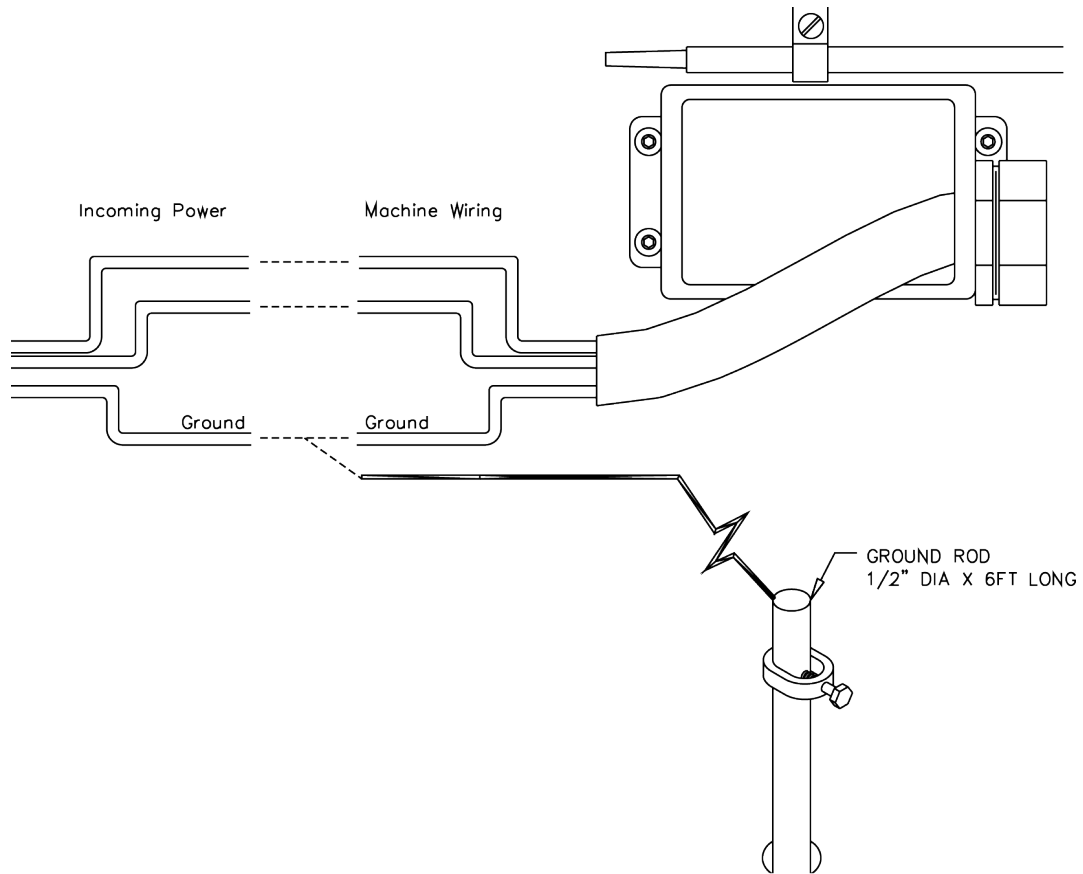
*Electrically connect in accordance with national and local electrical codes.*



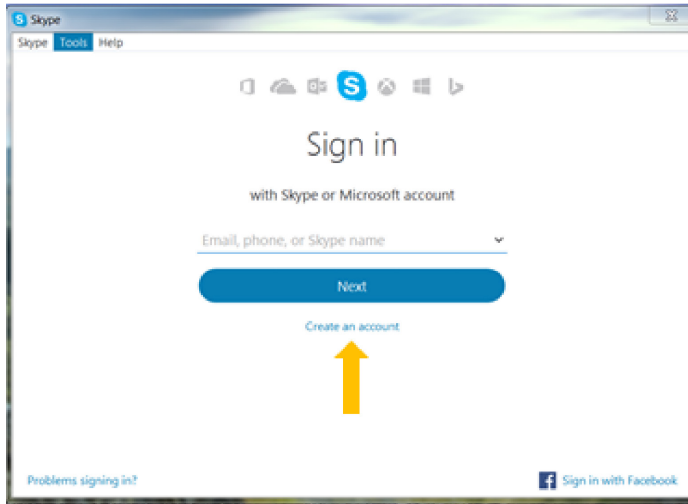
**Note:** For voltages over 240 VAC (380 – 440 VAC) a transformer needs to be installed with the machine.

### Grounding

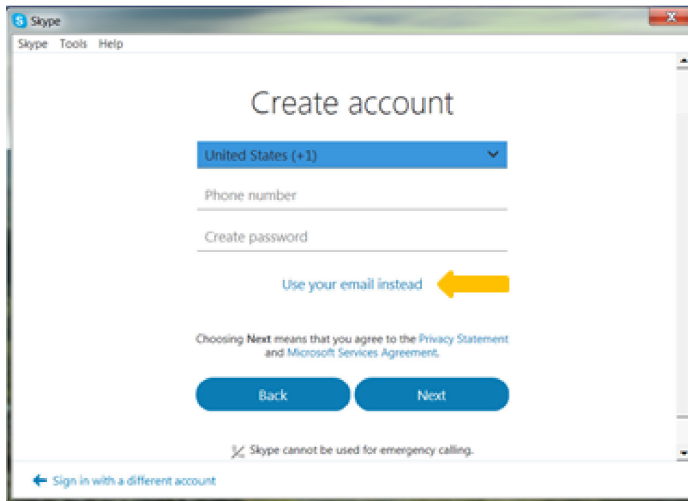
This machine must be connected to a good earth ground rod. A 6 foot, 1/2" diameter, 15 OHM, Copper grounding rod driven into the earth next to the machine is preferred. **Not providing a grounding rod could void factory warranty.**



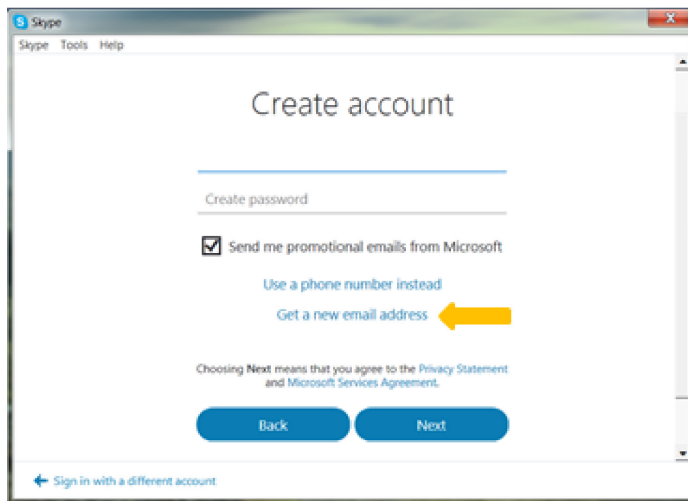
## Creating a Skype Account



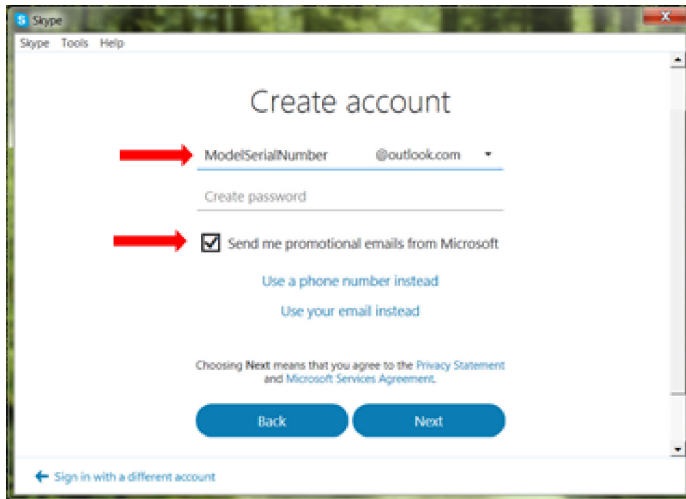
Click on create an account



Click on: Use your email instead



Click on: Get new email address

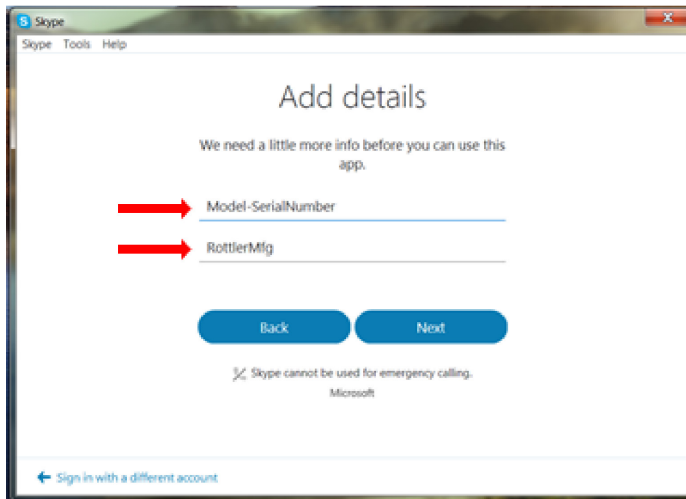


Name the email account using the Rottler machine Model and Serial number.

Ex: H85A111, EM69P001

Create a password that is easy to remember.

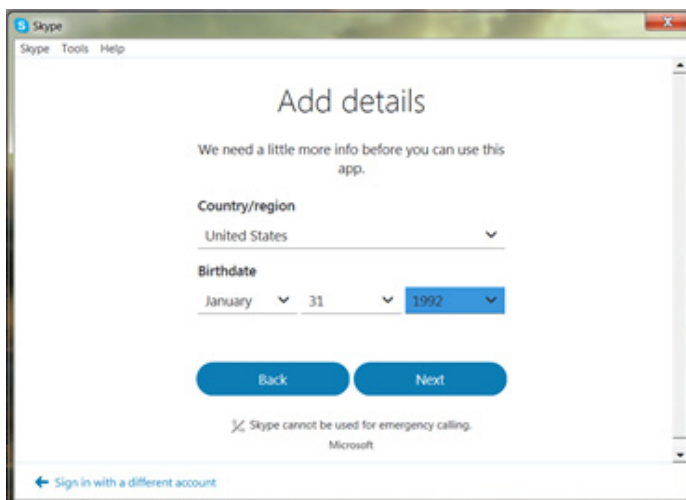
**Uncheck** the box to receive emails from Microsoft.



First Name: Model-Serial Number

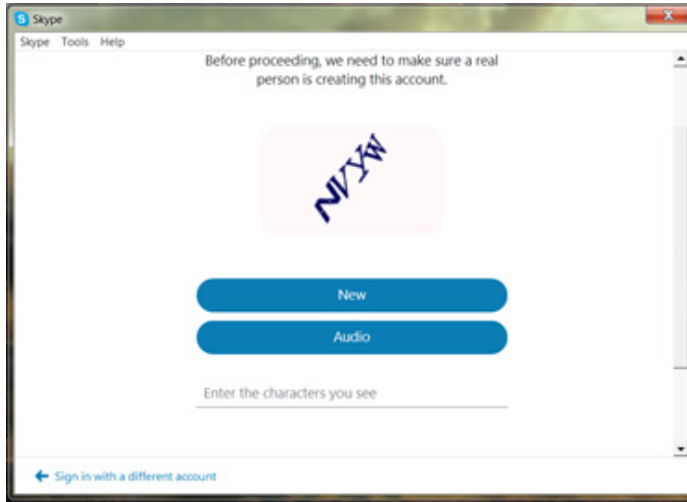
Ex: H85A-111, EM69P-001

Last Name: RottlerMfg



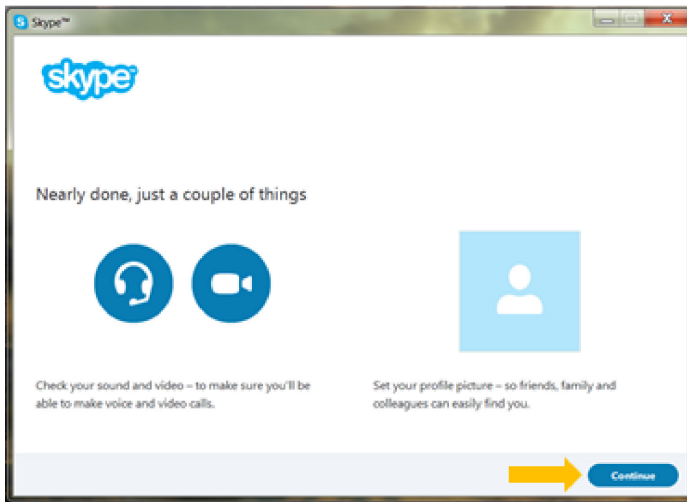
Select your Country/region

Birthday: Today's date, year 1992

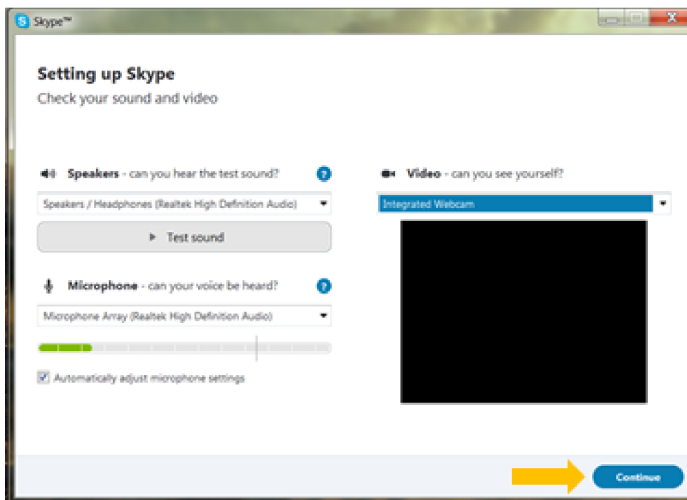


Type the code exactly as it appears.

Click "Next"



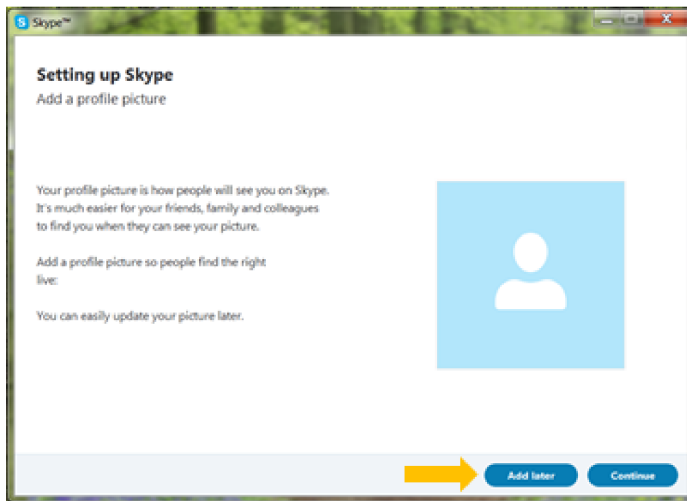
Click "Continue"



If your headset and/or web camera are hooked up you can verify that they are working here.

Otherwise, click "Continue"





Click "Add later" to skip this part.

Your Skype account is set up and ready for use.

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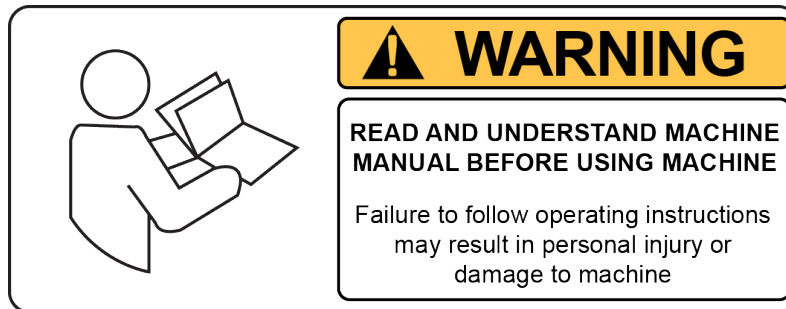
# **SAFETY**

## **Contents**

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## Safety Information

For Your Own Safety Read This Instruction Manual Before Operating This Machine.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in serious injury.



**CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



**CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

### Safety Instructions for Machine Use



This machine is capable of causing severe bodily injury

**ONLY A QUALIFIED, EXPERIENCED OPERATOR SHOULD OPERATE THIS MACHINE. NEVER ALLOW UNSUPERVISED OR UNTRAINED PERSONNEL TO OPERATE THE MACHINE.** Make sure any instructions you give in regards to machine operation are approved, correct, safe, and clearly understood. Untrained personnel present a hazard to themselves and the machine. Improper operation will void the warranty.

**KEEP GUARDS IN PLACE** and in proper working order. If equipped with doors, they must be in the closed position when the machine is in operation.



**KEEP WORK AREA CLEAN.** Cluttered areas and benches invite accidents.

**KEEP CHILDREN AND VISITORS AWAY.** All children and visitors should be kept a safe distance from work area.

**WEAR THE PROPER APPAREL.** **DO NOT** wear loose clothing, gloves, rings, bracelets, or other jewelry which may get caught in moving parts. Non-Slip foot wear is recommended. Wear protective hair covering to contain long hair.

**ALWAYS USE SAFETY GLASSES.** Also use face or dust mask if cutting operation is dusty. Everyday eye glasses only have impact resistant lenses, they are **NOT** safety glasses.



**DO NOT OVER-REACH.** Keep proper footing and balance at all times.

**USE THE RECOMMENDED ACCESSORIES.** Consult the manual for recommended accessories. The use of improper accessories may cause risk of injury.

**CHECK DAMAGED PARTS.** Before further use of the machine, a guard or other part that is damaged should be checked to determine that it will operate properly and perform its intended function. Check for alignment of moving parts, breakage of parts, mounting, and other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.

**NEVER OPERATE A MACHINE WHEN TIRED, OR UNDER THE INFLUENCE OF DRUGS OR ALCOHOL.** Full mental alertness is required at all times when running a machine.

**IF AT ANY TIME YOU ARE EXPERIENCING DIFFICULTIES** performing the intended operation, stop using the machine! Then contact our service department or ask a qualified expert how the operation should be performed.

**DO NOT MODIFY OR ALTER THIS EQUIPMENT** in any way. If modifications are deemed necessary, all such requests must be approved and/or handled by Rottler Manufacturing. Unauthorized modifications could cause injury and/or damage to machine and will void the warranty.

**SAFETY DECALS SHOULD NEVER BE REMOVED.** They are there to convey important safety information and warn of potential hazards.

**ALL LOCAL SAFETY CODES AND REGULATIONS** should be followed when installing this machine.

**ONLY QUALIFIED PERSONAL** should perform service on the electrical and control systems.

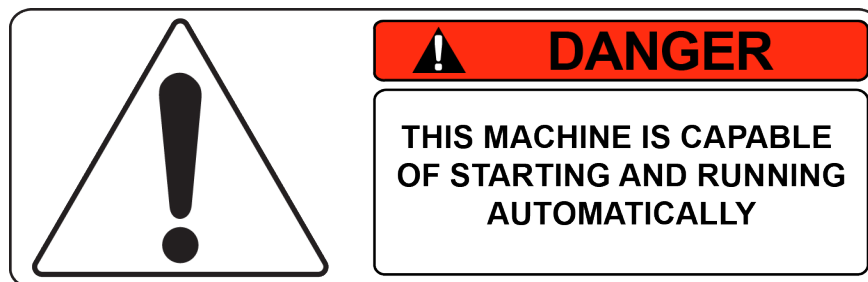
When boring the machine is capable of throwing metal chips over 10- feet from the cutting area. Always use the guards. Eye protection must be worn at all times by the operator and all other personnel in the area of the machine.



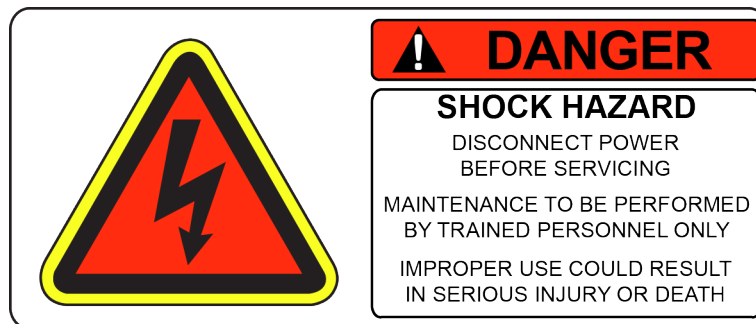
**CAUTION** No list of safety guidelines can be complete. Every piece of shop environment is different. Always consider safety first, as it applies to your individual working conditions. Use this and other machinery with caution and respect. Failure to follow guidelines could result in serious personal injury, damage to equipment or poor work results.

### Electrical Power

**THIS MACHINE IS AUTOMATICALLY CONTROLLED AND MAY START AT ANYTIME**

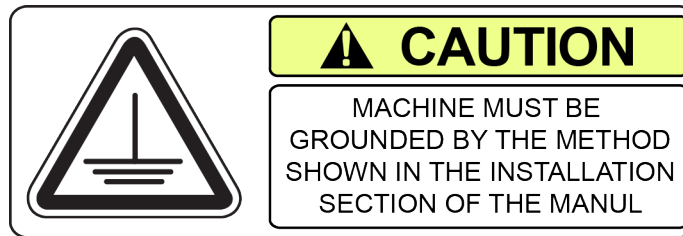



All electrical power should be removed from the machine before opening the rear electrical enclosure.




In the event of an electrical short, grounding reduces the risk of electric shock by providing a path of least resistance to disperse electric current.

Electrocution or a fire can result if the machine is not grounded correctly. Make sure the ground is connected in accordance with this manual. **DO NOT** operate the machine if it is not grounded.



 **CAUTION** No single list of electrical guidelines can be comprehensive for all shop environments. Operating this machinery may require additional electrical upgrades specific to your shop environment. It is your responsibility to make sure your electrical system comply with all local codes and ordinances.

 **WARNING** This machine operates under computerized control and, as is all computerized equipment, and is susceptible to extraneous electrical impulses internally for externally produced. The machine may make moves out of the operator control at any time. The operator should work in and around the machine with caution at all times.

The operator and nearby personnel should be familiar with the location and operation of the Emergency Stop Button.

Make sure all electrical equipment has the proper overload protection. This machine should have a **fully isolated** power supply to prevent damage and uncontrolled movement of the machine. If this machine is on the same power lines that are running to other electrical equipment (grinders, welders, and other AC motors) electrical noise can be induced into this machines electrical system. Electrical noise can cause the controller to see false signals to move. Not supplying a fully isolated supply to the machine may void factory warranty. Refer to the Power supply section located in the Installation section for voltage and amperage requirements of this machine.

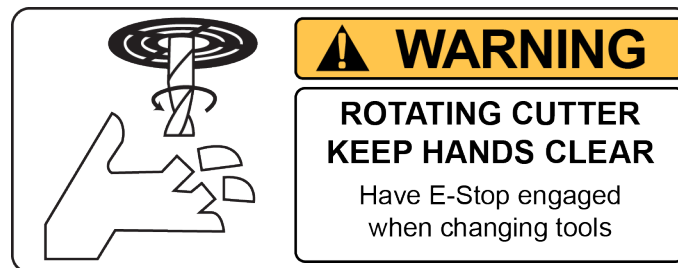
## Machine Operator

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

If the operator is not a skilled machinist he/she must pay strict attention to the Operating Instructions outlined in this manual, and get instruction from a qualified machinist in both production and operation of this machine.

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

**Cutting Tool Area** – Any operation involving hands in the cutter head area, such as inspection or alignment of the cutter head or tools, changing Centering Fingers, tool insertion, and removal, cutter head changes, and size checking etc. requires the machine to be in Neutral.



**Machining** – Eye protection must be worn during all operations of the machine. Hands must be kept completely away from the cutter head. All chip guards must be in position during machine operations.



**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.



**Machine Maintenance** – Any machine adjustment, maintenance or parts replacement absolutely requires a complete power disconnection from the machine.



## Emergency Procedure

Assuming one of the following has occurred: tool bit set completely off size, work piece or spindle base not clamped, spindle is not properly centered, and these mistakes will become obvious the minute the cut starts

**PRESS THE EMERGENCY STOP BUTTON** (on the front control panel) **IMMEDIATELY!**

Find out what the problem is; return the spindle to its up position without causing more damage. To restart the machine, turn the Emergency Stop Button CW until the button pops out

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

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

## Computer and Controller System Safety

The computer and controller are located in the main rear electrical enclosure. This unit is a full computer, running Windows 7 64 Bit operating system. Contact the factory if more information on the computer system is required.

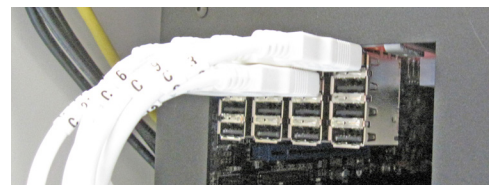
**IMPORTANT** The computer in this machine has the ability to connect to the World Wide Web via Ethernet or Wireless using a USB wireless (Wi-Fi) adapter. Updating the Rottler software should **ONLY** be done when directed to do so by a Rottler service technician. Updating Rottler Software when not directed by Rottler personnel will result in a non-operational machine.

The machine should be hooked up to the Internet anytime it is on. The software on the machine will automatically connect to our server to send back useful information on machine status.

Any “IT” personnel should **ALWAYS** get approval from Rottler before doing ANYTHING on the computer.

**DANGER** This machine is capable of causing severe injury or death. Doing any of the following without Rottler’s direct consent may cause severe injury or death.

**WARNING** Do not attempt to install USB devices in the PCI ports. These ports have high voltage and any attempt to connect a USB device in these ports will result in destruction of that device. There is also the possibility of damage to the computer system of the machine.



**IMPORTANT** Downloading any program or changing any Rottler or Computer settings may cause the machine and/or software to become unstable. **DO NOT** install ANY screen saver, Anti-Virus, Spyware or any type of Security software on the computer. This could create a hazardous environment for the operator and personnel around the machine. Performing any of the above will also result in the machine warranty being NULL and VOID.

**IMPORTANT** **DO NOT** connect any type of external hardware to the computer via USB or any other means. Do not install any type of Device Driver. This could create a hazardous environment for the operator and personnel around the machine. Performing any of the above will also result in the machine warranty being NULL and VOID.

## **Electrical Safety Features Of Rottler DM Controlled Machines**

All Rottler machines that use the DM operational control system are designed to comply with all applicable safety standards. This includes but is not limited to the following systems:

Thermal sensors in all motors and motor controls.

1. Current sensors in all motor control panels.
2. Electrical breakers to prevent voltage surges and spikes from reaching electrical system.
3. Electrical lockout on main electrical enclosure.
4. E-Stop that shuts down all operational systems in an event of an emergency.

All thermal and current limits for motors and motor controls are preset at the factory. In the event that any of those parameters are exceeded during operation of the machine, the machine control system will shut down the machine and a warning of the specific fault will appear on the control screen.

# CONTROL DEFINITIONS

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## Control Definitions

The purpose of this chapter is to define the function of the buttons throughout the various screens. Certain button functions may not make sense right away in this chapter. As the operator reads through the Operating Instructions chapter of this manual, the function of these buttons will become clear.

NOTE: Not all modes of operation will be discussed in this Chapter. The function of several buttons and actions are the same in many modes. The description of a function or button operation will not be repeated if it exists in another mode. All modes of operation will be discussed in the Operations Section of this manual (Chapter 3).

### Computer and Controller System Safety for DM Controlled Machines


The computer and controller are located in the main rear electrical enclosure. This unit is a full computer, running Windows 7 64 Bit operating system. Contact the factory if more information on the computer system is required.


**IMPORTANT:** The computer in this machine has the ability to connect to the World Wide Web via Ethernet or Wireless using a USB wireless (Wi-Fi) adapter. Updating the Rottler software should ONLY be done when directed to do so by a Rottler service technician. Updating Rottler Software when not directed by Rottler personnel could result in a non-operational machine.

It is recommended that the machine be hooked up to the Internet anytime it is on. The software on the machine will automatically connect to our server to send back useful information on machine status. It will also record performance parameters that will be used to evaluate any occurrence of a malfunction.

The Auto Update for the Windows Firewall (Security) and Windows Defender (Anti-Virus) is turned on. The computer will automatically download the updates and then install them when the computer is shut down every Friday night.

Any "IT" personnel should ALWAYS get approval from Rottler before doing ANYTHING on the computer.

 **WARNING** Downloading ANY program from the Internet or by other means when not directed by Rottler is prohibited and will result in the machine warranty being NULL and VOID.

 **WARNING** Downloading any program or changing any Rottler or Computer settings may cause the machine and/or software to become unstable. DO NOT install ANY screen saver, Anti-Virus, Spyware or any type of Security software on the computer. This could create a hazardous environment for the operator and personnel around the machine. Performing any of the above will also result in the machine warranty being NULL and VOID.

### Master Power On/Off Switch

This switch is located on the main electrical control enclosure on the right hand side of the machine. The switch must be in the off position before opening the rear enclosure door.

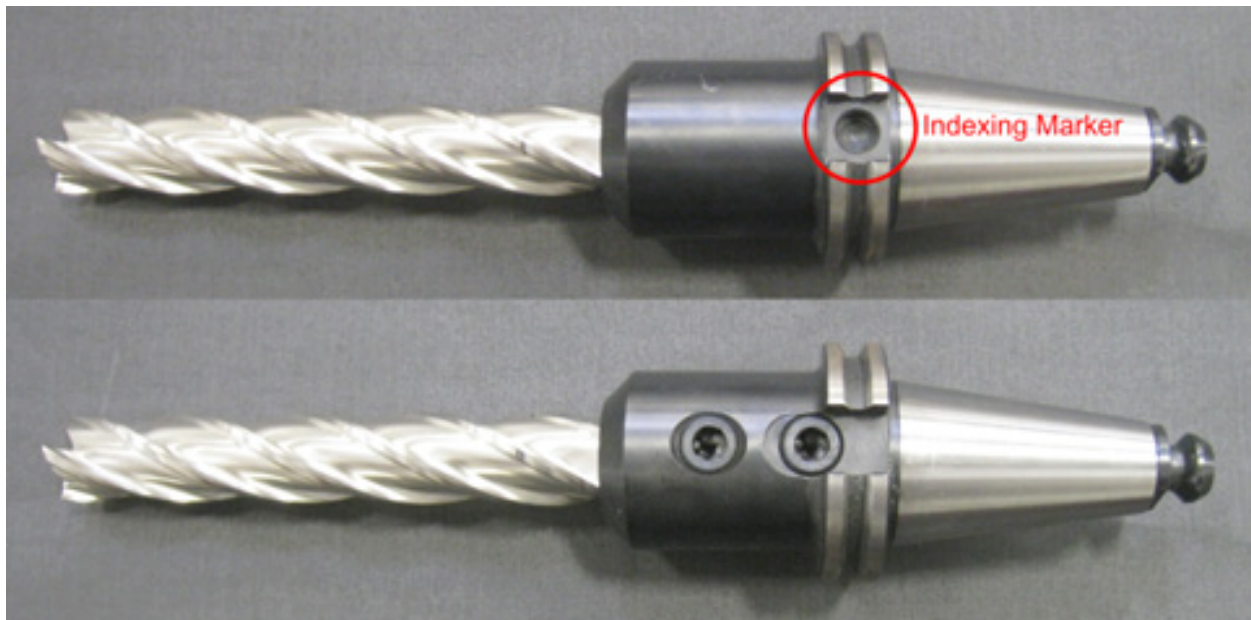
When first applying power to the machine the computer will need to boot up. Be patient, it will take several minutes to complete booting. If the Rottler program does not automatically start, double tap the Rottler\_WPF icon on the screen to start Rottler.

When turning the main power to the machine off there is a specific procedure to follow so as not to damage the computer. The computer must shut down its internal systems before main power is removed from it.

Press the “Start” button in the left-hand side of the Start Bar. This will bring up the “Start Menu”. Press the “Shutdown” line at the bottom of the Start Menu. This will bring up a Pop Up menu, make sure that “shut down computer” is selected and press “OK”.

This will shut down the computer. It is now OK to turn Main Power off to the machine.

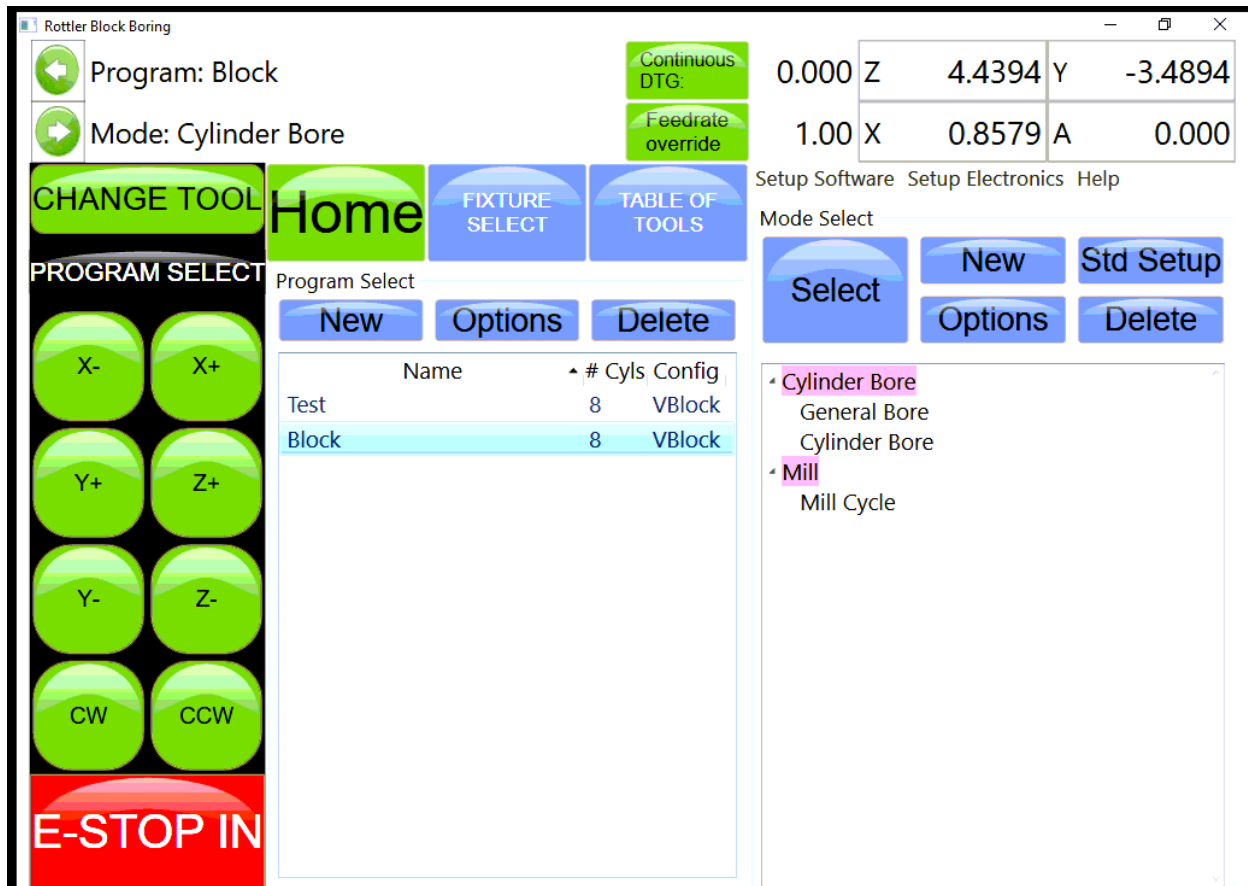
The tool holders have 2 slots for the spindle drive keys. One of which has an indexing marker as shown below.



## Initialization Screen

When the F79A is powered up the Rottler program may or may not automatically start. It may take several minutes for the computer to power. If needed start the Rottler program by double tapping the Rottler\_WPF icon on the desktop. Once the program is started, the Rottler Program Select will appear.

**NOTE: Do not push any buttons or icons on the screen before the Rottler program starts or an error may be caused on the computer.**



## General Information

The Rottler software operates on a Block Model format. You select or create the block you are working with. Then select or create an operation to be performed on that block.

### Home

Pressing this button will cause the machine to home. The machine **MUST** be homed after it is turned on. This is how the machine gets its reference points to operate.

### Program Select

This is the left section of the screen. This is where you create and select blocks you will be working with.

### Change Tool

Pressing the CHANGE TOOL button near the upper left will cause the tool to release from the machine, it will ask you if you really want to change it before it actually releases the tool.

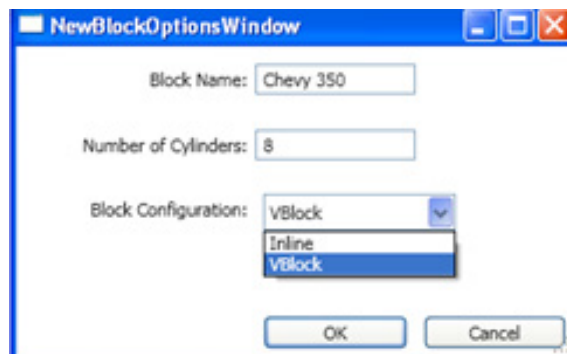


# WARNING

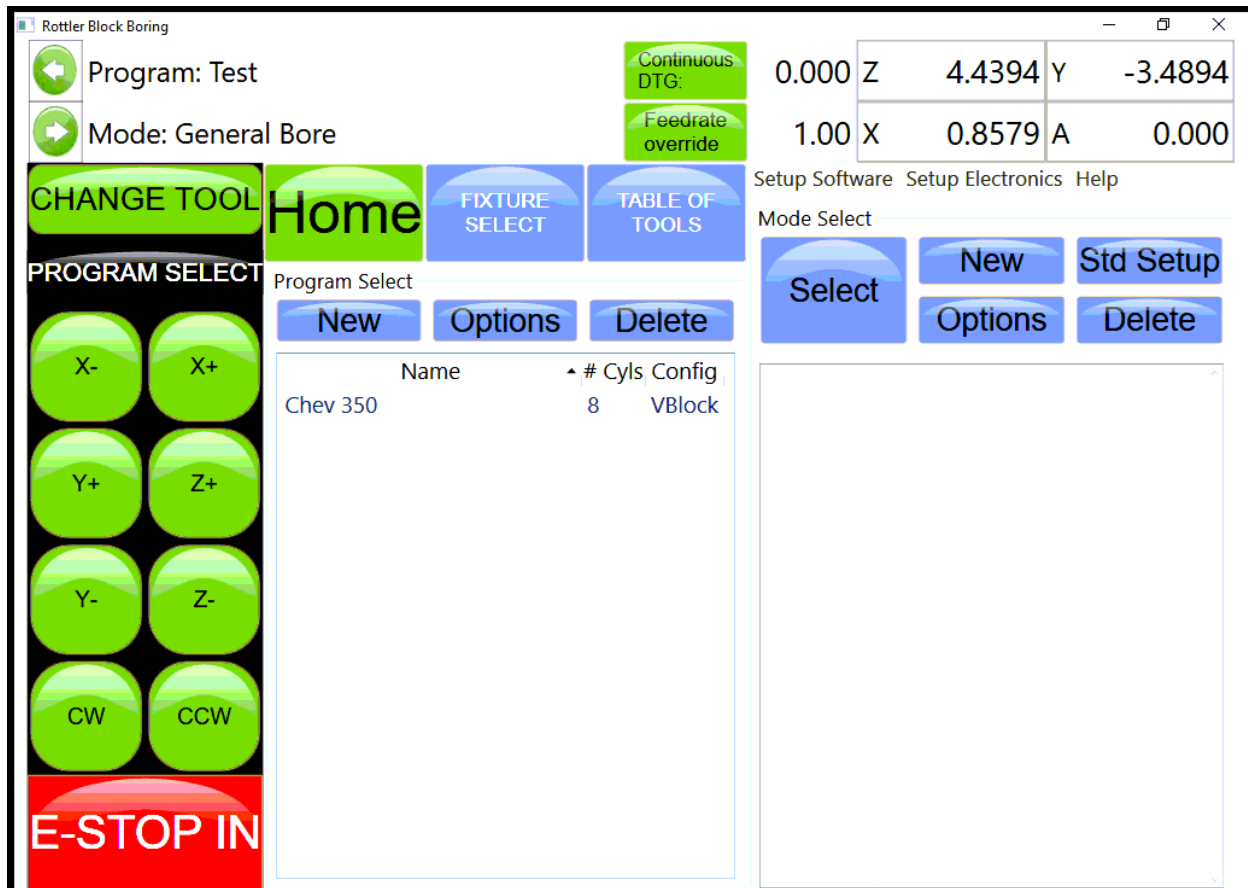
**If there is a tool in the spindle do not press Yes unless holding the tool, or the tool will drop!!**

### New

Pressing this in the Upper level will cause a dialog box to appear. Here is where you name and configure the block, select number of cylinders and Inline or V Block.



Pressing OK will result in the Block Model being inserted into the left hand side of the screen.



### Options

This will bring up the same dialog box as described above if any of the information needs to be changed.

### Delete

This will delete whatever block program is selected. A dialog box will appear to ask you if you want that program deleted.



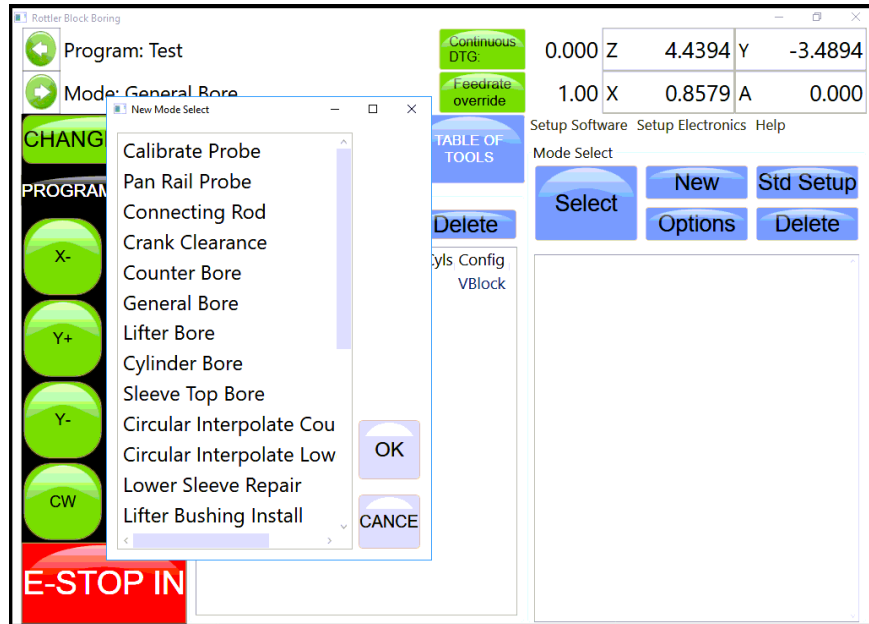
### Mode Select

This is the right section of the screen. This is where you create or select operations to be performed on the selected Block. This area will be blank when you first create a block.

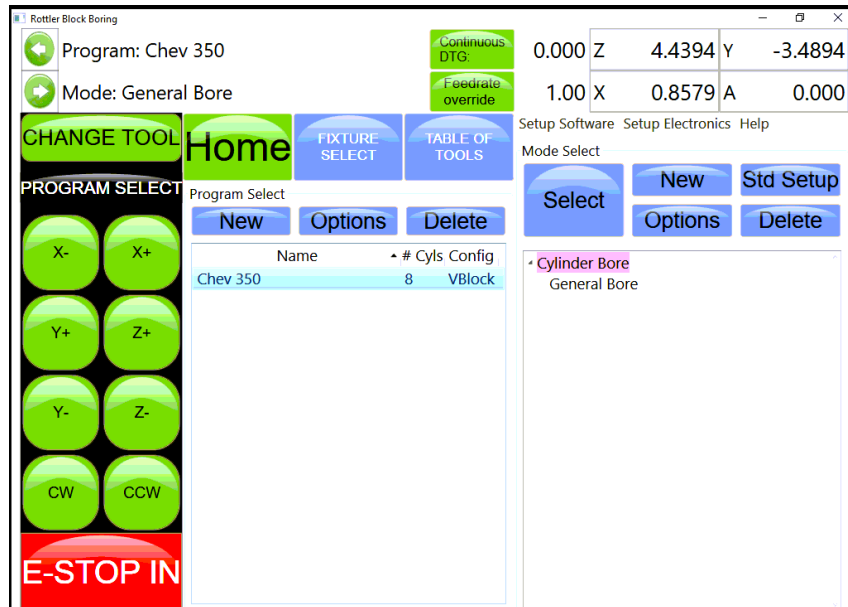
You can create only certain modes you will use on a block or use a standard set up that inserts all modes available. You can also create a new mode and rename if for a specific use.

### New

Pressing this button will bring up a dialog box with Rottler standard operations.



Select the operation you want to create and then press OK. This will place a general Bore operation under the Cylinder bore mode in the right hand section.



To enter General Bore mode highlight it and then press Select. This will take you to the operation screens that will be described later.

## Std (Standard) Setup

Pressing this button will insert all the Rottler operations into the right hand section automatically.



Use the slide bar on the right hand side to scroll through all the operations.

## Options

Press this button to bring up a dialog box to allow positive numbers to be entered in the horizontal stops. Most all programs are from right to left, the farther left you go the larger the negative number. However if a different zero point is used a positive number may be needed. For example, if you zero on the first cylinder on the left bank of a block and then "roll it over" the first cylinder is farther to the right than the zero position. Which would be a positive number. You can also rename the model for a specific application.



**Delete**

This will delete the selected Mode. It will ask you if you want this mode deleted before deleting it.

NOTE: Once the control definition for a particular button has been discussed it will not be repeated in the different modes of operation. Only new buttons or buttons with a different function will be discussed in different modes.

For these descriptions the Tool# and Probe # are not being used. They will be described later in this chapter.

**Basic Machine Controls**

**Fixture**

Axis	Actual Position
X	0.0000
Y	0.0000
Z	0.0000

**Shows the linear position of the axis**

**SPINDLE** 36.04 **Shows the Position of the spindle in 0-360°**

**Double click to zero the axis**

**Handwheel**

0.010 0.001 0.0001 **Move To**

**Click to move handwheel**

**Click to move to a position, a box that lets you enter the position will pop up**

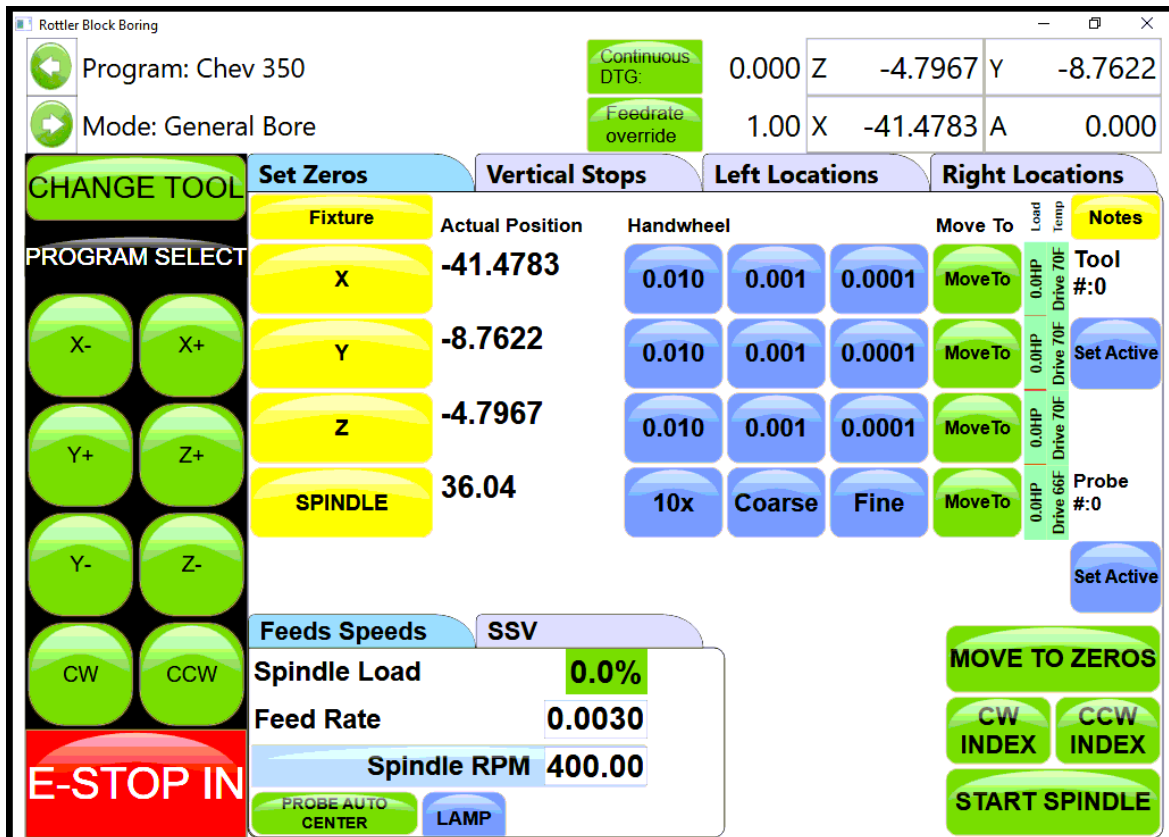
**Notes**

0.0HP Drive 70F **Tool #:0** **Click to select the correct tool**

0.0HP Drive 70F **Set Active** **Used for ATC and setting proper tool offsets**

### Cylinder Bore, General Bore 3 Axis (without Tool Changer)

Each buttons function will be described in this section. In the different MODES, the same buttons will not be described again.



#### Set Zero Tab

##### Actual Position

These are a numerical display showing the actual distance the axis are away from where they have been zeroed.

##### Velocity Override

The Velocity override is displayed in the upper left of the Actual Position display. The default is 100% of the programmed Feed Rate. When operating... turning the handwheel Counter Clockwise will override the axis rapid travel and feed rate 100 and 0% when in an automatic cycle.

##### Zero Buttons

These buttons will erase the actual position display of their associated axis and reset the displayed value to zero.

**Handwheel Buttons**

These buttons will activate their associated axis for use with the handwheel. The left button of each axis will move the machine in .010" per detent, the middle button .010" per detent and the right .0001" per detent of the handwheel. Pressing any of the axis Jog buttons will disengage the handwheel.

**Spindle Start**

This button will start the spindle at the RPM that is specified on the Auto Bore Cycle tab. Once the button has been pressed and the spindle is running the button will turn red and read Spindle Stop. Pressing the button again will stop the spindle and cause the button to go back to green.

**CW and CCW Creep**

These buttons will cause the spindle to rotate slowly CW or CCW direction. The spindle will continue to rotate as long as the button is pressed. The speed at which the spindle will rotate is set in the Machine Parameters and should not be changed unless instructed to do so by the factory.

**Jog Buttons**

These buttons control the rapid travel of the Vertical, Horizontal and In/Out axis. Pressing these buttons will allow you to move the machine through all ranges of its travel unobstructed. If the spindle is turned on these buttons become feed buttons and the machine will feed in whatever direction you have pressed. The rate at which the machine will feed is determined by the value set in the Auto Bore Cycle tab. When in rapid travel, these buttons are momentary contact and you will have to keep them pressed to keep the machine moving. When the spindle is on, they are latching buttons and once they are pressed the travel will continue until they are pressed again.

**Move to**

Pressing these buttons will bring up a dialog box for the associated axis. Enter a value that you want the axis to move to and press ENTER. That axis will then move to that position. You can do multiple "Move To" at the same time. One after another.

**Move To Zeros**

Pressing this button will cause the vertical to move the zero position first. The in/out and horizontal will move after the vertical has moved to zeros.

**CW and CCW Index**

Pressing either of these buttons will cause the spindle to rotate to the index position. Index position is with the tool to the right as you are facing the machine.

### Using SSV (Spindle Speed Variance)

Spindle Speed Variation (SSV) allows you to modify the spindle speed within a range causing it to continuously change. This changes the harmonic frequency of the machining, which can help in the appearance of chatter. Various issues can cause chatter: spindle speed, incorrect feeds, depth of cut, part rigidity, the type of part being machined, thin walls, or diameter-length ratio.

The screenshot displays the Rottler Block Boring control interface. At the top, it shows 'Program: Chev 350' and 'Mode: General Bore'. Below this are various control buttons and a data table. The 'Feeds Speeds' section is active, with 'SSV' selected. The 'SSV Options' panel is open, showing the following settings:

SSV Options	
<input checked="" type="checkbox"/> Enable SSV	
Time per Cycle	0.5000
RPM variation	200.0000

Checking enable SSV- will engage it for the machining process you are doing

Time per Cycle- each cycle is measured as a second.

RPM Variation- How much the rpm can vary up and down from what you set in the program

(NOTE: setting this too extreme can cause Spindle errors and spindle crashes.)

### Setting Spindle Index

## IMPORTANT

Any time the machine has been turned off the spindle index position must be set. Turn the spindle to the index position (tool holder facing to the right at 90 degrees from the operator). Then press the Zero button net to the spindle position read out. This will put a zero value in the display box.

This screen also shows the Spindle Load, programmed Feed Rate and Spindle RPM.

### Probe Auto Center

The Probe is an option on the F79A machine. When this button is pressed a single Probing routine will be run in the position the machine is currently at.

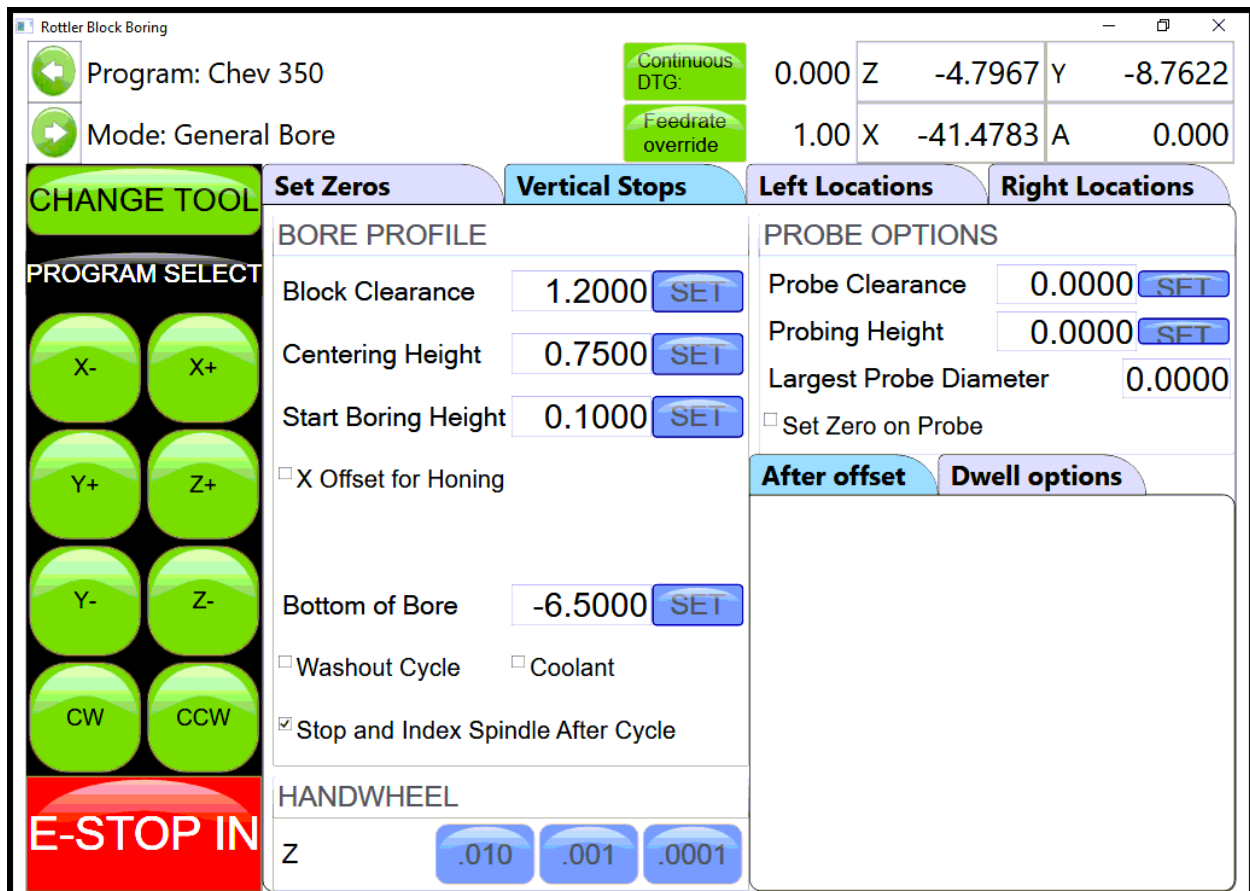
### Vertical Stops Tab

This screen is used to set the Vertical stops the machine will use to bore a cylinder. There are four Vertical stops used on this screen plus two optional Lower Clearance stops.

If the machine is equipped with a probe there are two (2) additional stops, Probe Clearance and Probe Height.

The function of the Vertical stops will be defined in the Operating Instructions chapter in this manual.

To enter any of the Vertical Stops press the Data box next to the Vertical stop you want to enter. A pop-up menu will appear. Press the desired numerical value and then press ENTER. The numerical data will then appear in the data box. You can also move the Vertical physically to the location you want the stop to be at and press the "SET" button next to the Data Box. This will take the current position from the Digital read out and insert it into the associated Data Box.



### Horizontal Offset for Honing

There is often the need to machine out the “webbing” at the bottom of a cylinder to get the correct honing clearance. Checking the box next to “Horizontal Offset for Honing” will bring up an additional screen section on the lower right.

This is where you will set the amount, direction and speed the offset will cut.

The screenshot shows the Rottler Block Boring control interface. At the top, it displays the program name 'Chev 350' and mode 'General Bore'. A 'Continuous DTG' indicator is set to 0.000, and a 'Feedrate override' indicator is set to 1.00. The current coordinates are Z: -4.7967, Y: -8.7622, X: -41.4783, and A: 0.000.

The main interface is divided into several sections:

- Left Panel:** Contains a 'CHANGE TOOL' button, a 'PROGRAM SELECT' section with directional buttons (X-, X+, Y+, Z+, Y-, Z-, CW, CCW), and a large red 'E-STOP IN' button.
- Top Tabs:** 'Set Zeros', 'Vertical Stops', 'Left Locations', and 'Right Locations'. The 'Vertical Stops' tab is currently active.
- BORE PROFILE Section:**
  - Block Clearance: 1.2000 [SET]
  - Centering Height: 0.7500 [SET]
  - Start Boring Height: 0.1000 [SET]
  - X Offset for Honing
  - Start Offset Height: 0.0000 [SET]
  - Bottom of Bore: -6.5000 [SET]
  - Washout Cycle     Coolant
  - Stop and Index Spindle After Cycle
- PROBE OPTIONS Section:**
  - Probe Clearance: 0.0000 [SET]
  - Probing Height: 0.0000 [SET]
  - Largest Probe Diameter: 0.0000
  - Set Zero on Probe
- After offset / Dwell options Section:**
  - AFTER HORIZONTAL OFFSET**
  - Horizontal Offset: 0.0000
  - Change Speeds At Horizontal Offset
- HANDWHEEL Section:**
  - Z: [0.010] [0.001] [0.0001]
- Bottom Right Section:**
  - Left Bank: No Offset
  - Right Bank: No Offset



## Left and Right Locations Tab

This screen is used to set the Horizontal and In/Out stops the machine will use to bore a block. The number of In/Out and horizontal stop on this page will change with the block configuration i.e V6, V8 or inline.

The function of the Horizontal and In/Out stops will be defined in the Operating Instructions chapter of this manual.

To enter any of the Horizontal and In/Out stops press the Data box next to the Horizontal or In/Out stop you want to enter. A pop-up menu will appear. Press the desired numerical value and then press OK. The numerical data will then appear in the data box

## Cylinder Bore – Bore Locations



There are three (3) different modes you can operate the machine in on these screens, Blueprint, Indicated and Probing.

### Blueprint

This mode of operation allows you to enter specific values for the bore locations from a blueprint type document.

It is helpful to have the blue print numbers entered on this screen even if you are not going to bore to the blueprint locations on a particular block. They help to set the general area of the bore if you are manually centering (indicating) or probing the block.

### Move Buttons

When pressed, these buttons will move the machine, under power, to the Horizontal and In/Out positions shown in the data boxes below the Move button. The Vertical will move to the Clearance height before it makes the Horizontal or In/Out moves. After it has moved to the Horizontal and In/Out positions the Vertical will move to the Centering Height. After this, all motion stops.

## Bore Buttons

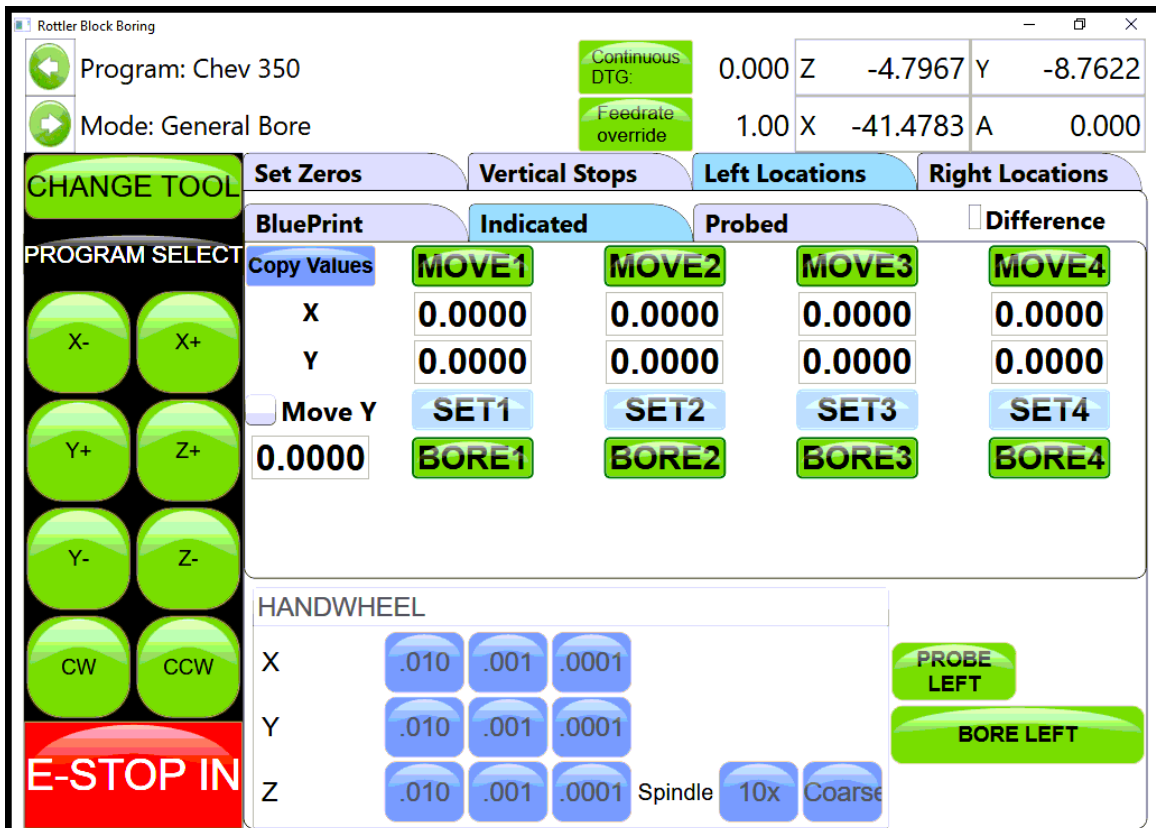
Pressing this button once will cause it to turn yellow. This indicates when the “Bore Left” button is pressed this cylinder will not be bored.

Touching this button again (with a pause in between touches) will turn the button back to green. All green bores will be bored if the “Bore Left” button is pressed. The control will ask you if you sure you want to bore the selected bores.

Double Clicking a Bore button will keep it green and turn all other bore buttons yellow.

## Indicated

This screen is designed to manually indicate each cylinder in for it's specific location.



## Set Buttons

Once a cylinder has been indicate, pressing the associated Set Button will take the current machine position and place the values in the Data Box associated with that cylinder.

## Copy Values

Pressing this button will bring up another window where you can select to copy the In/Out and Horizontal values from Blueprint, Indicated or Probed screen.

## Difference

Checking this Box will cause a green check mark to be placed in the box. The Data Boxes will then display the difference in values from the blueprint screen to the indicated screen. This is helpful to know how far the cylinders actual location is from blueprint values.

## Bore Left and Right

Pressing this button will cause the entire Left or Right bank to be bored automatically. The Bore buttons that are yellow will not be bored though.

**Probing**

The probe is an option on the F79A machine.

This screen is designed to automatically probe one or all of the cylinders.



**Probe Buttons**

Pressing this button will cause a probing routine to be run on the associated cylinder.

**Probe Left or Right**

Pressing this button will cause the entire Left or Right banks to be probed automatically.

**Probed Diameter**

This Data Box will display the diameter of the cylinders as they are probed.

## Probing For The Mill Cycle

The Rottler Milling program is set up to Automatically Probe the Deck height of a block and then Mill it to a set Deck Height. This can be done on a 3 or 4 axis machine. This will also cover Setting Tool Offsets.

### Table of Tools for Milling

You **MUST** use the Table of Tools if you want to Automatically Probe the deck height and cut it to a set height. Once done the Table of Tools Should look similar to the below picture. The 100mm Probe is Tool 1. The 10" Fly Cutter is Tool 2.

Go to Program Select, and then select the block you are working with and then Mill Mode.

Install the Probe physically into the spindle. If you have a 4th axis rotate it to Zero degrees. Indicate the Middle flat on the head stock to be sure it is zero all the way across. There should be a number stamped into the headstock.

This is the distance from the Flat to the center of the Crank. Bring the probe down until it just touches the middle flat.

Open the Table of Tools and double click on Tool1 100 mm Probe. Enter the Measured diameter of your probe. This is not used in the Milling Program but needs to be entered accurately for Probing in the Bore mode.

On the open window select Get Length. This will open another Window. There will be a value, that you can not edit, in the "Z Location from Zero" this is the distance the Vertical Axis is from home when the Probe touches the Middle flat.

In the Data box for "Z Touch off Height" enter the number that is stamped on the Head Stock. This is the distance from the flat to the center line of the Crank.

Select OK on both windows. This will put the Total tool length into the Table of Tools.

The Vertical Digital Read Out will now consider the center of the Crank bore to be the Vertical Zero position. When the Probe tip or Cutting insert touches the Deck the Vertical DRO will be reading out the distance from the center of the Crank bore (Actual Deck Height).

The screenshot shows the Rottler Block Boring control interface. At the top, the program is set to 'Chev 350' and the mode is 'General Bore'. The 'Continuous DTG' is set to 0.000 and the 'Feedrate override' is set to 1.00. The DRO coordinates are Z: -4.7967, Y: -8.7622, X: -41.4783, and A: 0.000.

The 'CHANGE TOOL' window displays a table of tools:

Tool Num...	Tool Name	TC Pocket	Tool Diam...	Tool Length	Type of Tool	Description
0	Default Tool	0	0.5000	0.0000	Drill	
0					Drill	
0					Probe	
0					FlatEndmill	
0					FlatEndmill	
0					Probe	

The 'Tool Options Form' dialog box is open, showing the following fields:

- Name: Probe
- Diameter: 0.2360
- Flute Length: 1.0000
- Length: 0.0000 (with 'Get Length' button)
- Type: Probe
- Probe Number: 1

The 'Tool Changer Options' section includes:

- Tool Changer Pocket: 0
- Fixed Pocket (Large Tool)
- Preceding Reserved Pockets: 0
- Following Reserved Pockets: 0
- Tool Weight: 0.0000

The 'Tool Shank Profile' table is also visible:

Distance from Ball Center	Diameter	Color
0.0000	0.2360	Color [O...]
3.0000	0.3750	Color [O...]

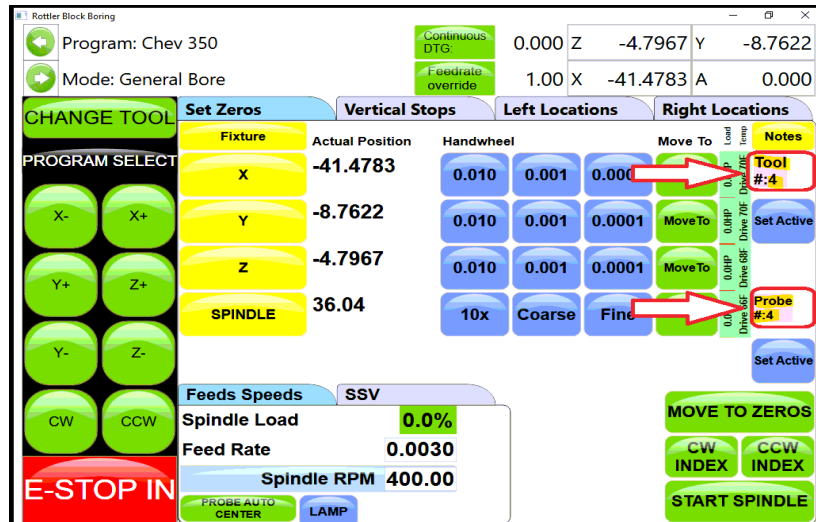
Buttons for 'Add Tool', 'Remove Tool', 'Set Active Tool', 'Set Active w/o moving to TC position', and 'Load ATC' are visible on the right side of the tool table.

### Assigning Tools

From the Set Zero Tab, select Probe#. This will open the Tools Select Form. Select Tool 1, 50 mm Probe and click OK.

Select the Tool#.

This will open The Tool Select Form. Select Tool 2, 10 inch Fly Cutter and click OK.



The tools to be used have now been assigned to the program.

### Left Deck Probe

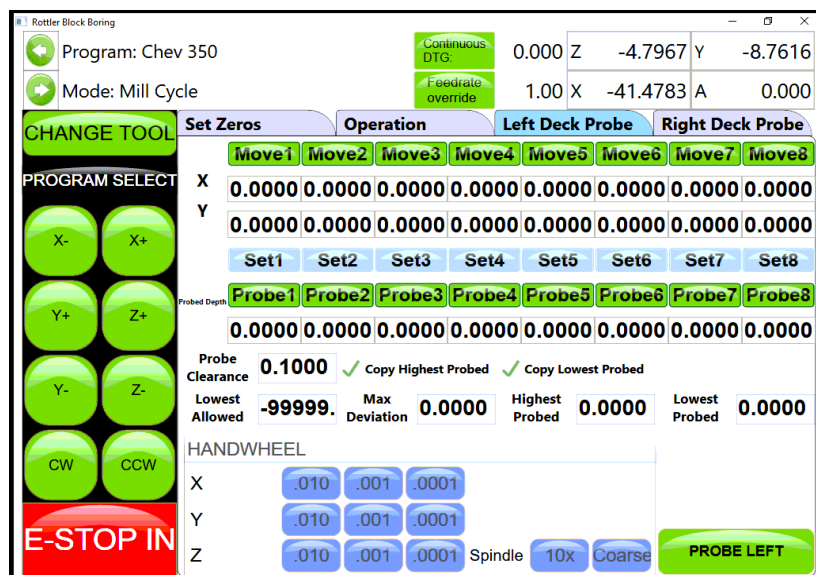
Enter the positions you want the Probe to probe here. You can physically move the probe to the locations on the bank you want to probe and hit the set button also.

### Right Deck Probe

Roll the block over to the Right Bank. Enter the positions you want the Probe to probe here. You can Physically move the probe to the locations on the bank you want to probe and hit the set button also.

### Auto Probing

Press the Start Probing button. The machine will first probe each programmed location on the left bank and record the height. The spindle will move to Vertical Clearance height and the block will roll over to the right bank and probe the programmed locations and record them. If you have a 4th axis The block will then roll back over to the Left bank and the spindle will move to the first Left location and stop.



### Lifter Bore

The Lifter Bore Mode and its buttons operate identical to the Bore Mode with a couple of exceptions.

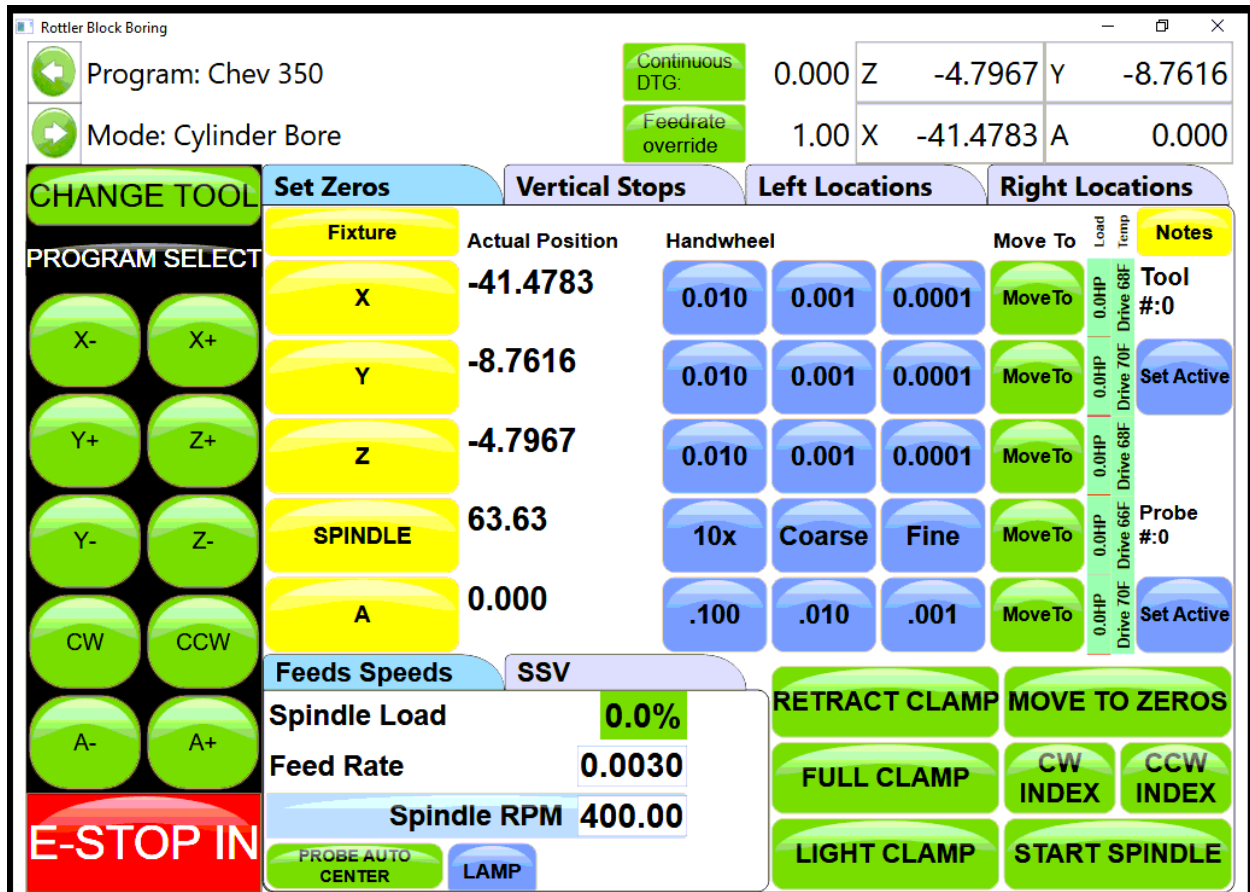
On the Program Vertical Stops screen, lower Clearance Offset is not an option.

After a bore is complete the spindle will not offset .020” for tool clearance unless the “Horizontal Offset after Cycle” box is checked. This is used when a single point boring tool is used for lifter boring.

### Cylinder Bore 4 Axis

Most of the Control Definition in the 4th axis is the same as the 3 axis version of software. Only the differences or new features will be discussed in this section.

#### Set Zero Tab



#### Jog Controls

##### 4Th-:

Pressing this button will cause the 4th axis to rotate in a negative direction while held.

##### 4Th+:

Pressing this button will cause the 4th axis to rotate in a positive direction while held.

##### 4th Axis Degree and Move

Touching the 4th Axis Degree Data Box will bring up a Pop-Up Menu so a degree can be entered. Once a value is entered (even zero), pressing the Move button will move the 4th axis to that position.

**4th axis Brake**

This shows the status of the 4th axis brake as well as manually turning the brake on and off. When the 4th axis is rotated using the jog controls the fixture will automatically switch the brake On and Off.

**Light Clamp**

Pressing this button will cause light pressure to be exerted from the Tail Stock towards the Head stock. When the 4th axis is rotated using the jog controls the fixture will automatically switch from Full to Light clamp and back.

**Full Clamp**

Pressing this button will cause full pressure to be exerted from the Tail Stock towards the Head stock.

**Retract**

Pressing this button will cause the tail stock to fully retract. A dialog box will appear when this button is pressed to assure you want to retract the tail stock. This is to prevent an accidental retraction when a block is in the fixture.

## Table Of Tools

The Table Of Tools is a very powerful feature in this software. Most of the Rottler programs are designed to be used without interacting with the Table Of Tools.

Only the program specific uses will be described here.

### Table Of Tools General Information

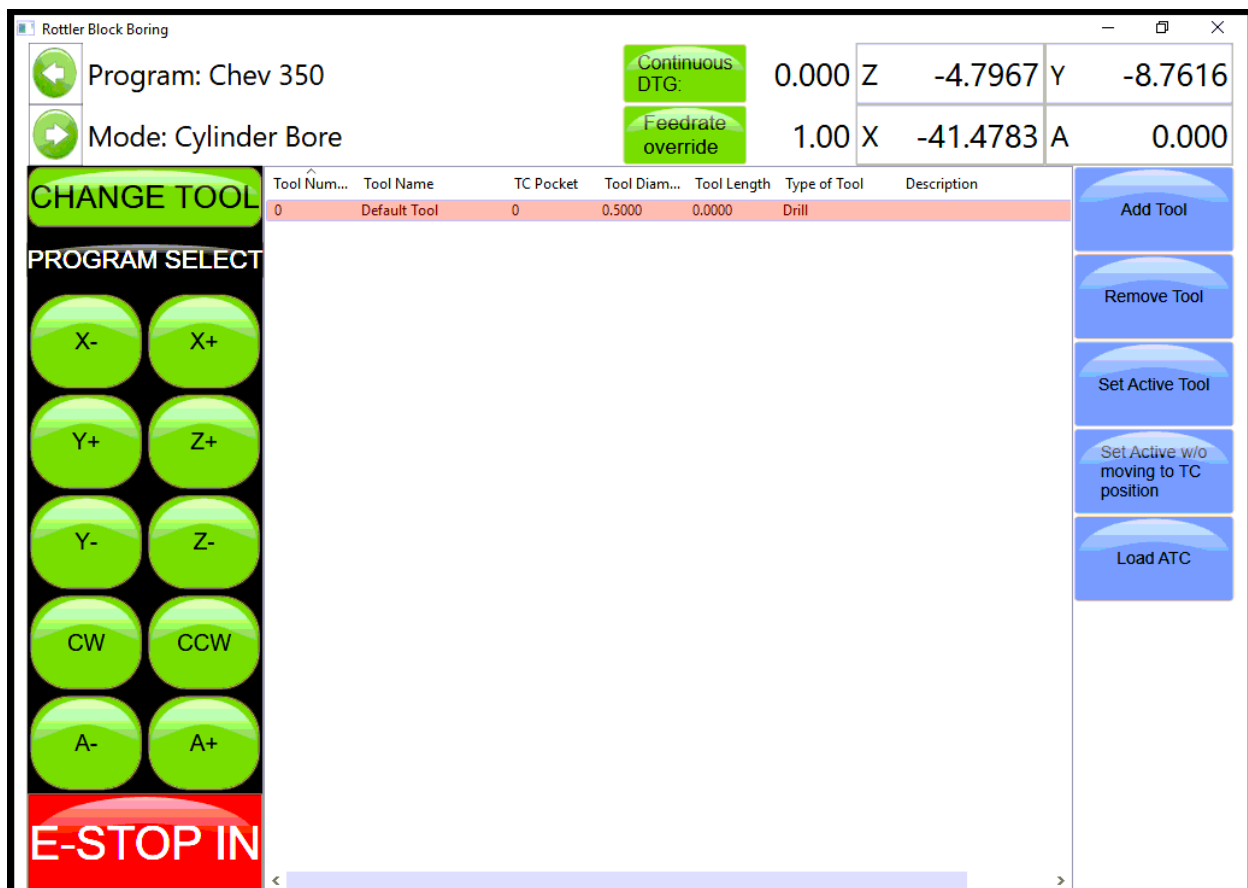
The Table Of Tools is used to set different tool lengths so multiple tools can be used in one program and reference the same vertical zero position.

For Example, if you were to use two boring bars in one program. One boring bar is 8" long and the other is 4" long. There is then a 4" difference in where the cutter of each bar will come into contact with the part to be machined. Using the Table of Tools you can set the 4" difference for one of the boring bars so that both of the cutting tools will come into contact with the material at the same vertical position.

### Accessing Table Of Tools

Select TABLE OF TOOLS from any screen in the upper left hand corner. This will open up the Table Of Tools.

On this screen you will be able to Add, Remove or Set that tool Active (installed in spindle and being used).

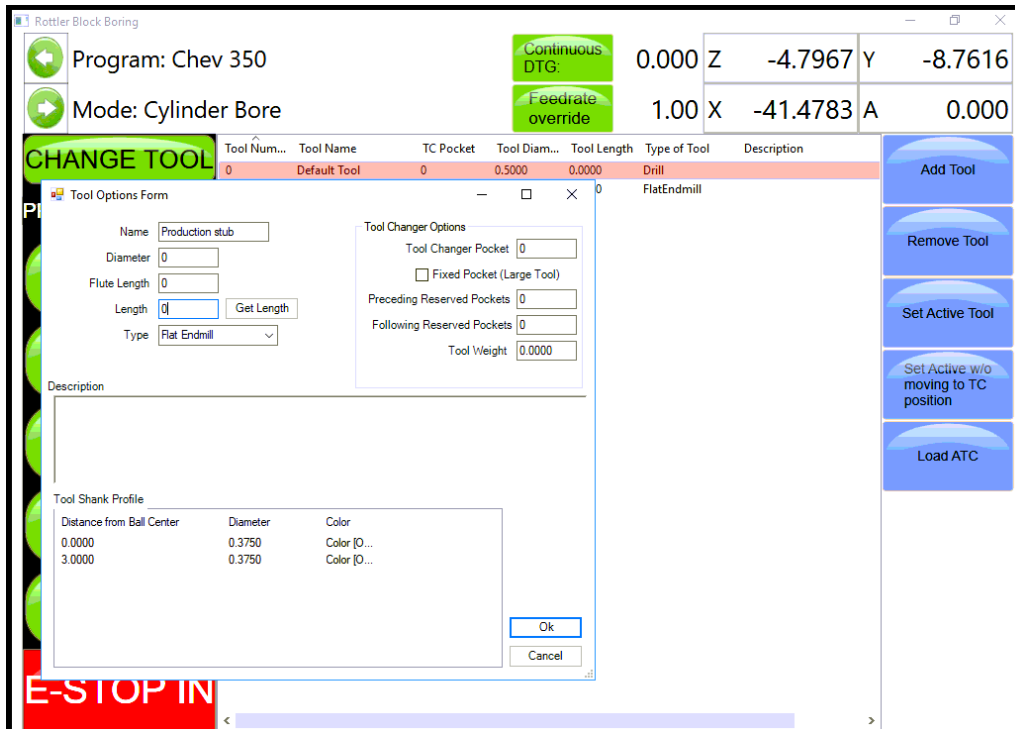


The Table of Tools comes with Tool 0 installed with no offset amount. Tool 0 will remain tool 0 with no offset always. Tool 0 will be set active when you are using programs that do not require tool offsets.

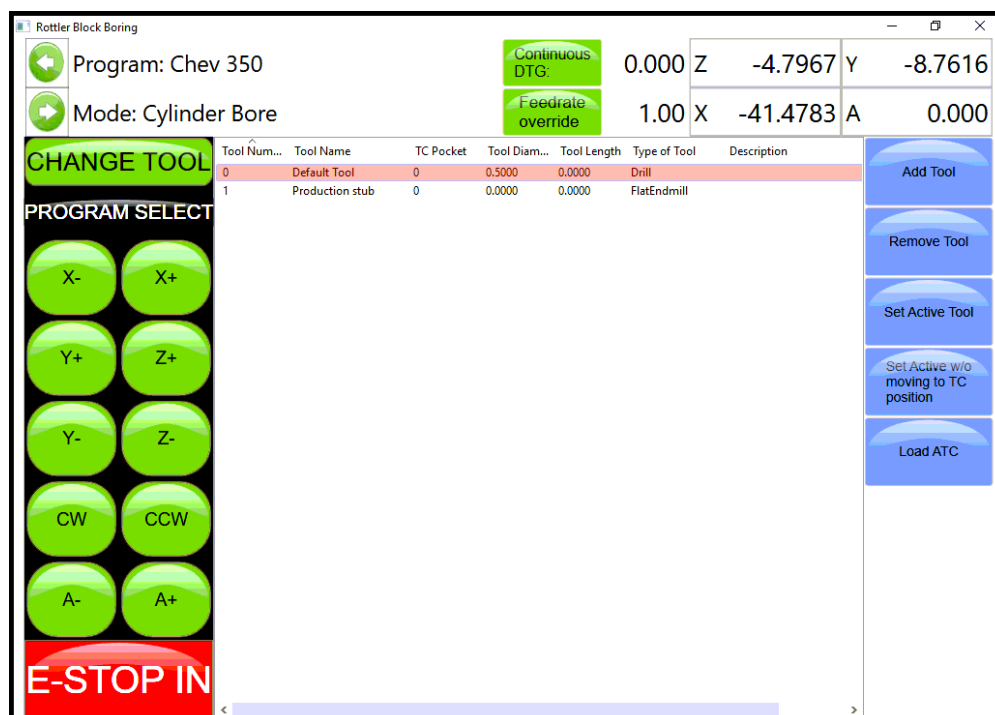


**Add Tool**

To add a tool to the Table of Tools press Add Tool. This will open another window. Here you will name the Tool you are adding. Such as 2.9 production Stub. It is important to give an accurate name to the tool. You want the tool easily identifiable by its name. The only other data box the Rottler software uses is the Length Data Box. This will be discussed later. Press OK.



The Added tool will now show in the Table of Tools.



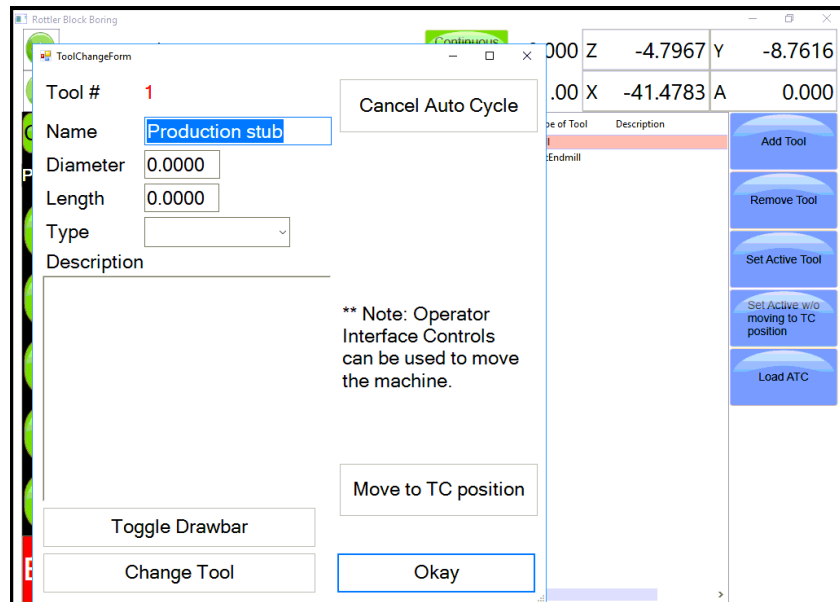
### Remove Tool

Pressing this button will remove the highlighted tool from the Table of Tools.

### Set Active Tool

Pressing this button will set the highlighted tool to an Active Status (tool installed and will be used) Any Vertical offset associated with that tool will be used when a program is run. You can tell which tool is active because it is highlighted in Red. When no offset is required in a program Tool 0, Default Tool should be active.

When setting a tool active another window will open. This is the Tool Change Form. It is basically there to verify the tool information before it is set to an active status. Verify the information and press OK.



This window will open when the machine does an automatic tool change. This will be discussed in Chapter 5 Operating Instructions. After you press OK another window will open. This is a Warning Dialog box to inform the operator of the possibility of the spindle start if the tool change is done in an automatic program. Press OK.



### Setting Tool Offsets

Add all the tools that will need offsets into the table of tools. Leave the Length value at 00.00 when you first enter them.

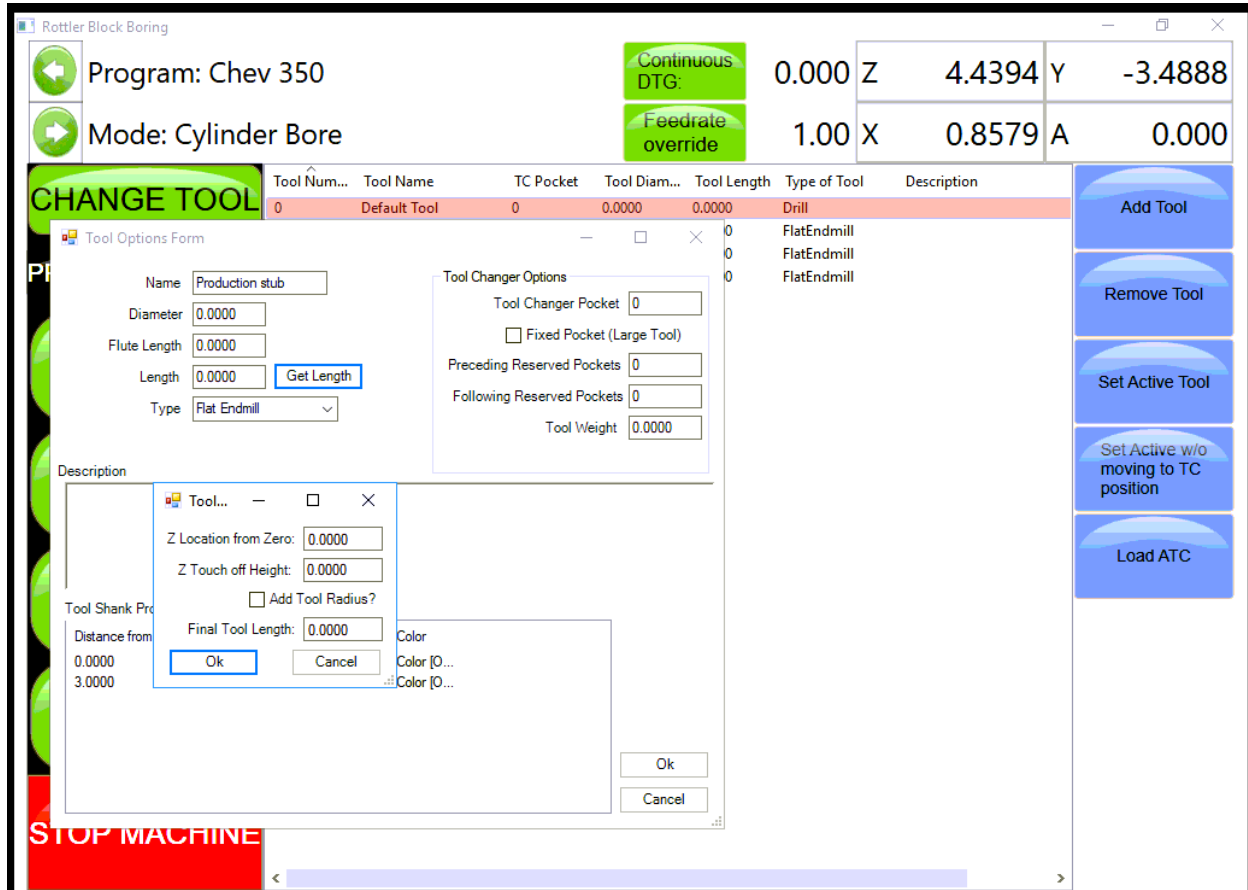
For this example we will be setting offsets for a 2.9 Production Stub, 100mm Probe and a 10 inch Fly cutter. Add these tools to the table of Tools.

**NOTE: Only the Probe will use the Tool Diameter. The Probe will use the Tool Diameter when probing a cylinder, it will not use the Tool Diameter when touch off a surface such as a block deck. Changing this setting will be discussed in later in this Chapter.**



To set Tool Offsets you will need a fixed vertical reference point on the machine that does not change such as the head stock of the 4th axis or Performance Fixture.

Install the first tool such as the 2.9 Production Stub with Cutting insert installed. Bring the cutting insert down until it just touches the flat on the head stock of the 4th axis fixture. Go to the TABLE OF TOOLS and double click the 2.9 Production Stub tool. Select Get Length from that window. This will bring up the Tool Length window.



### Z Location from Zero

This is the distance the Vertical Axis is from the home position. NOT where the operator has set the Vertical Zero in the program. This value is set by the computer automatically. In this example the tool just touched the flat at 8.0000.

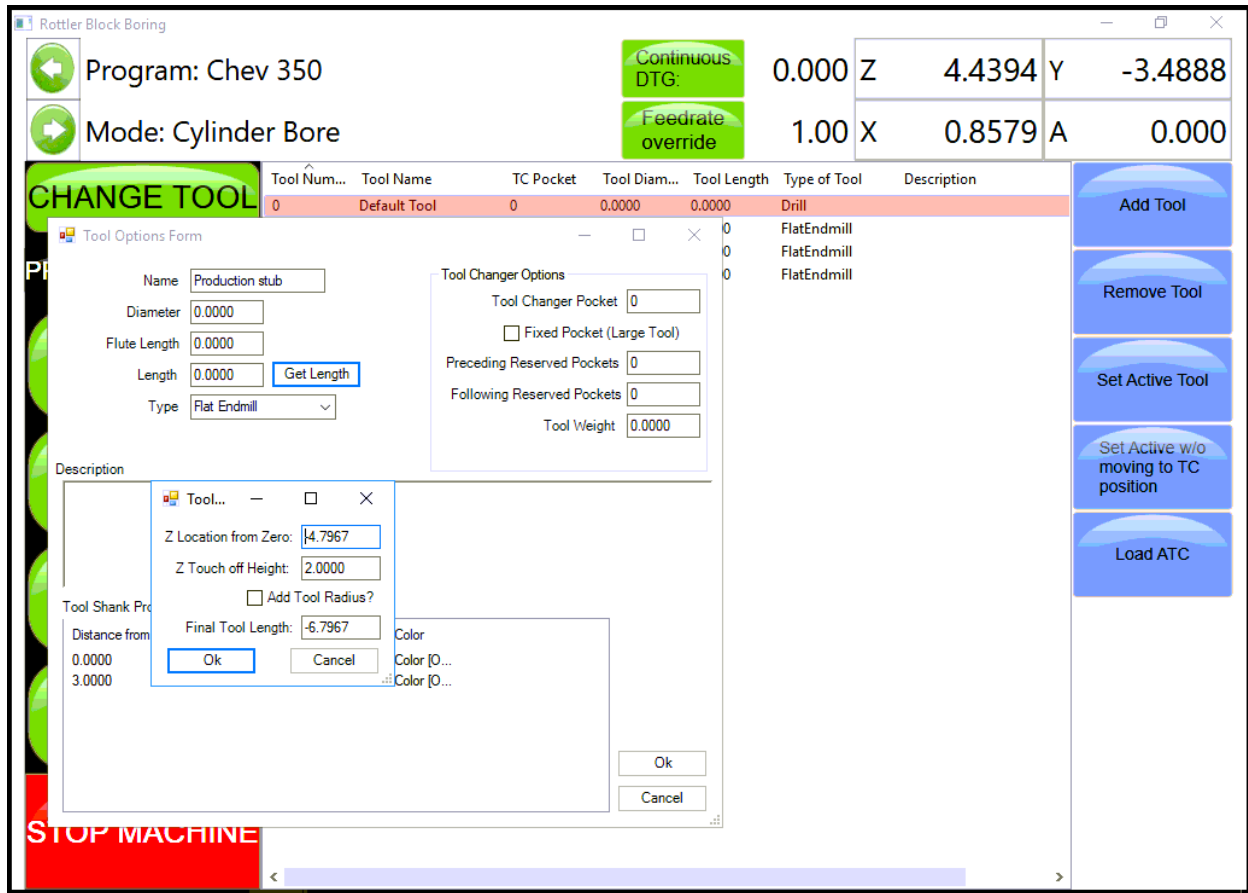
### Z Touch Off Height

This value is an additional value you want added to the Z location from zero. For example, if you wanted to use the center of the Crankshaft as the vertical reference point, but you are touching the tool off of the flat of that head stock, you would enter the distance from where you are touching off to the center of the Crank (this value is stamped into the headstock by Rottler). The values from Z Location from Zero and Z Touch off Height are added together by the computer to get the Final tool Length value. If you are not referencing another vertical position then this value will remain 00.000.

**\*\*You have to set the height for all the tools or none of them\*\***

### Add Tool Radius?

Checking this box will add the Tool Radius to the Final Tool Length. This is not used in the Rottler programs and should remain unchecked for all tools.



Repeat this procedure for each tool. Touch ALL of them off from the same point.

When running a Rottler program the cutting insert for each tool will reference the Vertical Zero the operator set in the program and come into contact with the surface to be machined at the same vertical value.

**\*\*You have to set the height for all the tools or none of them\*\***

### Applying Table of Tools to Rottler Programs

The use of the Table of Tools to specific Rottler programs such as Bore and Mill will be defined in Chapter 5 Operating Instructions.

### Fixture Select

This is also a very powerful tool. It is not generally used in the Rottler Programs. It's basic function is to offset a program and table of tools a set distance on each axis (if desired) and run the same program without resetting axis zero points.

For example, if you have to fixtures that are identical but are set at a different location on the table you can set the difference values in the table of fixtures and run the program.

It is recommended this is not used unless you are a very experienced operator.

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# OPERATING INSTRUCTIONS

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## Operating Instructions

The purpose of this chapter is to explain and then guide the operator from loading a block through running an automatic cycle.


All modes of operation will be discussed in this chapter.

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

### Loading Blocks

#### Small Gas and Diesel

#### Manual V6/V8 Combination Fixture

 **WARNING** Handle the block and fixture with EXTREME care and guidance. A block hoist is REQUIRED. Mishandling of a heavy engine block and fixture may result in the dropping of parts and personal injury.

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

#### Boring Application

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

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

#### V-blocks

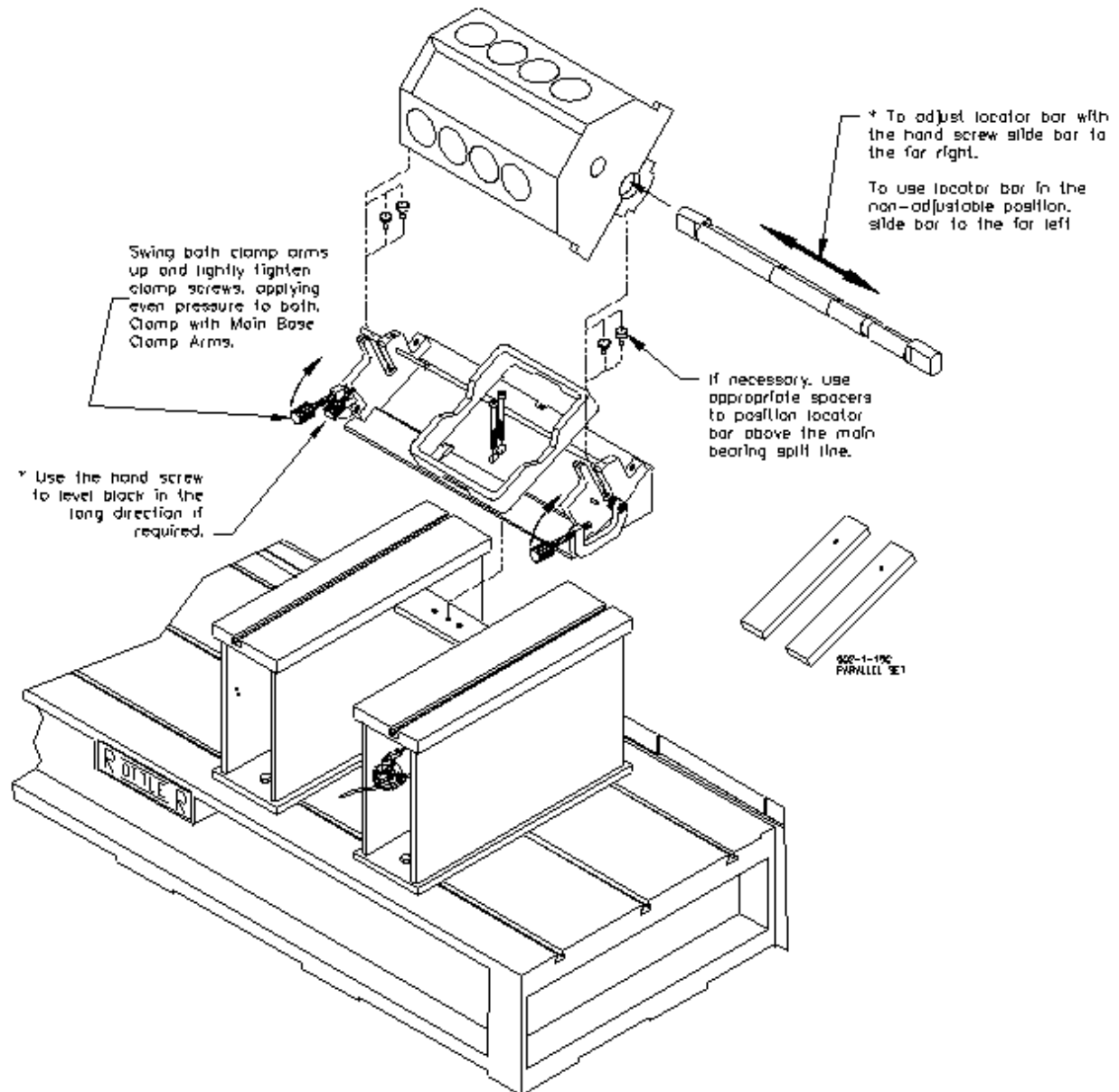
(blocks with main bearing center lines no more than 1/2" higher than the pan rail plane) are mounted with the 502-3-8B V-block frame in place. Select the 90-degree option placement of the frame to suit block length, or main bearing caps will interfere with frame. Rotate frame 90 degrees by moving its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

#### Y-Blocks

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

This fixture may be easily repositioned on the support parallels (without a block in place) to shift from the 60 degree support surface to the 90 degree support surface or vice versa.

**⚠ WARNING** Extreme care must be taken by operator whenever handling large blocks. Large blocks may cause fixture to tip when floated too far outward. We recommend leaving hoist attached when moving these blocks. Large blocks should be lifted from the block bank surface.



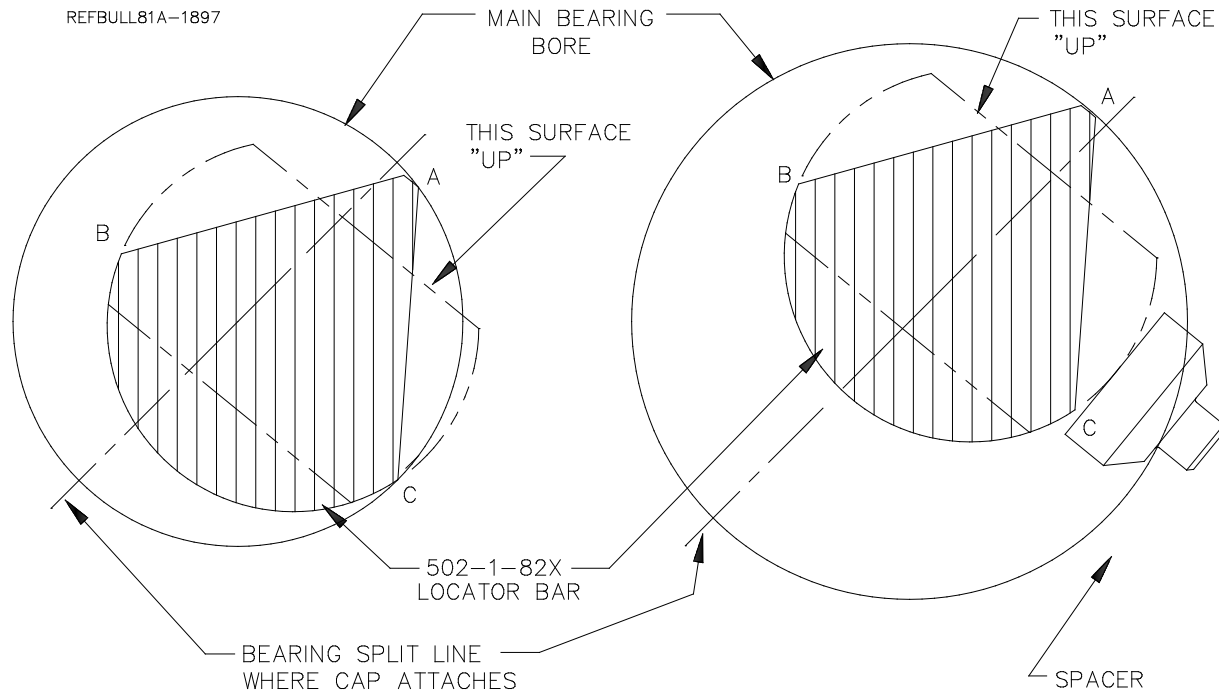


FIGURE 1

FIGURE 2

### Normal Operating Procedure

The normal operation procedure on smaller V-blocks is to first pick up the block. If using the optional 502-1-95 block handler attach it to the block making sure the cam lifters are COMPLETELY engaged, and that the lift hook is approximately centered in the block lengthwise. Place the 502-1-82X locator bar through the main bearings and hoist the block into the fixture. Pulling the block towards you, with the locator against the positioners, will prevent jamming in the slot of the guides during the loading and unloading operations. The locator bar is positioned with the word 'UP' that is on the end of the bar facing up and away from the operator. (see figure 1) After the locator bar is engaged in the positioners, pivot block outwards as you lower it. Slide block to the far left (this is the non adjustable position).

Make sure the block is firmly seated in place and not resting on pan-rail burrs or other interference points. Accurate seating can also be a problem with extremely warped, distorted blocks. Another cause of problems is failure to remove main bearing inserts. The locator bar has a relief for blocks with a small main bearing or seal. Rotate locator bar clamps into position & lightly tighten the hand screws, applying even pressure to both. Clamp the block securely with the main base clamp arms.

Warped or distorted blocks may require leveling of the deck surface in the long direction. This is possible with the hand-screw assembly in the left-hand bar positioner. Loosen both clamp hand-screws and slide the locator bar to the far right position. Retighten both clamp hand-screws. Raise or lower the adjusting hand-screw as required. For the non-adjustable position slide locator bar to the far left.



Push fixture back into bore position. There is a guide block (502-1-105) attached to the bottom of the fixture to aid in guiding the fixture along the support ways.

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

Loosen locator bar hand screws and rotate clamps out of the way. Lift the block, either from the deck surface or with the optional 502-1-95 block handler. Turn the block 180 degrees & reload to duplicate the operation on the other bank.

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

### Figure 1

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

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

### Figure 2

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

### Surfacing Application

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

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

### V-blocks

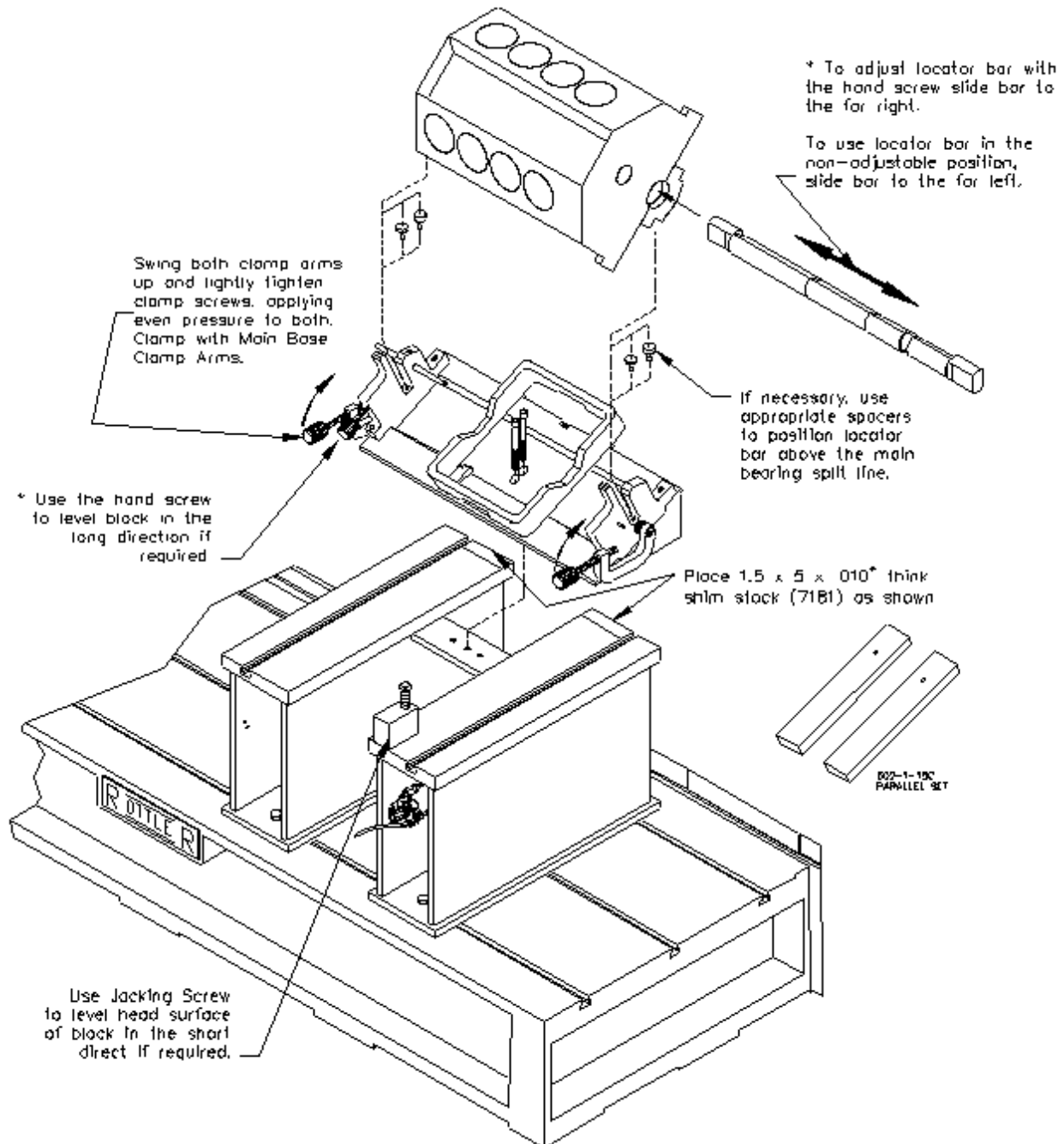
(blocks with main bearing center lines no more than 1/2" higher than the pan rail plane) are mounted with the 502-3-8B V-block frame in place. Select the 90-degree option placement of the frame to suit block length, or main bearing caps will interfere with frame. Rotate frame 90 degrees by moving its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

### Y-Blocks

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

This fixture may be easily repositioned on the support parallels (without a block in place) to shift from the 60 degree support surface to the 90 degree support surface or vice versa.

**⚠ WARNING** Extreme care must be taken by operator whenever handling large blocks. Large blocks may cause fixture to tip when floated too far outward. We recommend leaving hoist attached when moving these blocks. Large blocks should be lifted from the block bank surface. DO NOT use the 502-1-95 block handler assembly on these blocks.



### Normal Operating Procedure

The normal operation procedure on smaller V-blocks is to first pick up the block. Place the 502-1-82X locator bar through the main bearings and hoist the block into the fixture. Pulling the block towards you, with the locator against the positioners, will prevent jamming in the slot of the guides during the loading and unloading operations. The locator bar is positioned with the word 'UP' that is on the end of the bar facing up and away from the operator. (see figure 1) After the locator bar is engaged in the positioners, pivot block outwards as you lower it. Slide block to the far left (this is the non adjustable position).

Make sure the block is firmly seated in place and not resting on pan-rail burrs or other interference points. Accurate seating can also be a problem with extremely warped, distorted blocks. Another cause of problems is failure to remove main bearing inserts. The locator bar has a relief for blocks with a small main bearing or seal. Rotate locator bar clamps into position & lightly tighten the hand screws, applying even pressure to both. Clamp the block securely with the main base clamp arms.

Warped or distorted blocks may require leveling of the deck surface in the long direction. This is possible with the hand-screw assembly in the left-hand bar positioner. Loosen both clamp hand-screws and slide the locator bar to the far right position. Retighten both clamp hand-screws. Raise or lower the adjusting hand-screw as required. For the non-adjustable position slide locator bar to the far left.

Push fixture back into surfacing position with the back of the fixture on the Shim Stock. The shim stock is put in place to raise the back side of the block, you can then use the Jacking Screw to raise and lower the front of the block. There is a guide block (502-1-105) attached to the bottom of the fixture to aid in guiding the fixture along the support ways.

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

Loosen locator bar hand screws and rotate clamps out of the way. Lift the block, either from the deck surface or with the optional 502-1-95 block. Turn the block 180 degrees & reload to duplicate the operation on the other bank.

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

### Figure 1

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

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

### Figure 2

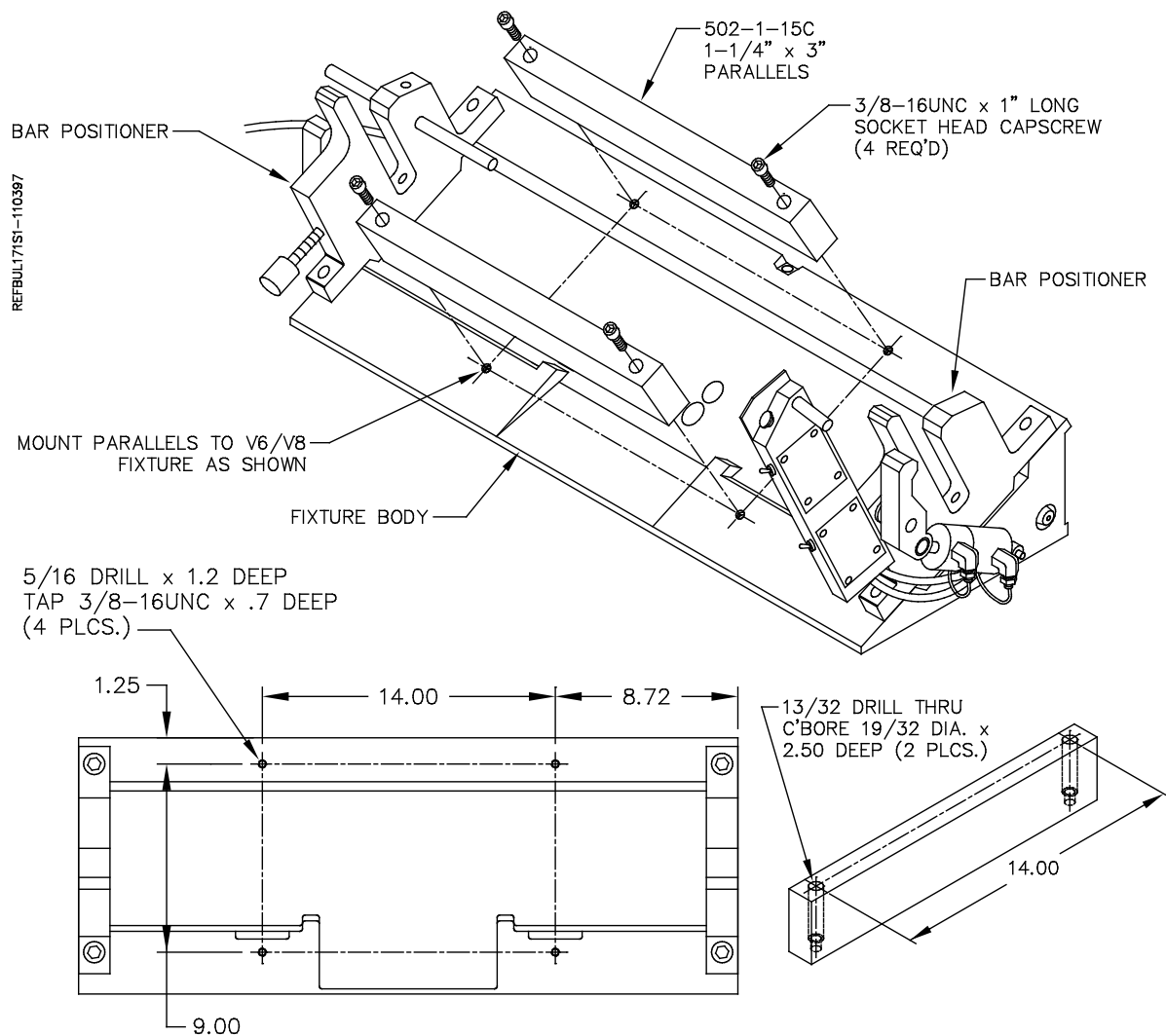
502-1-82X main bearing locator bar indexes near bearing split line. Point C does not contact the bearing cap but rests on matched spacers that are provided to fit in the bar positioners slot. If there is a means of holding the block down such as block clamp towers, this method may be used in large bores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

**Retrofitting 502-1-15C Parallels to V6/V8 Combination Fixture**

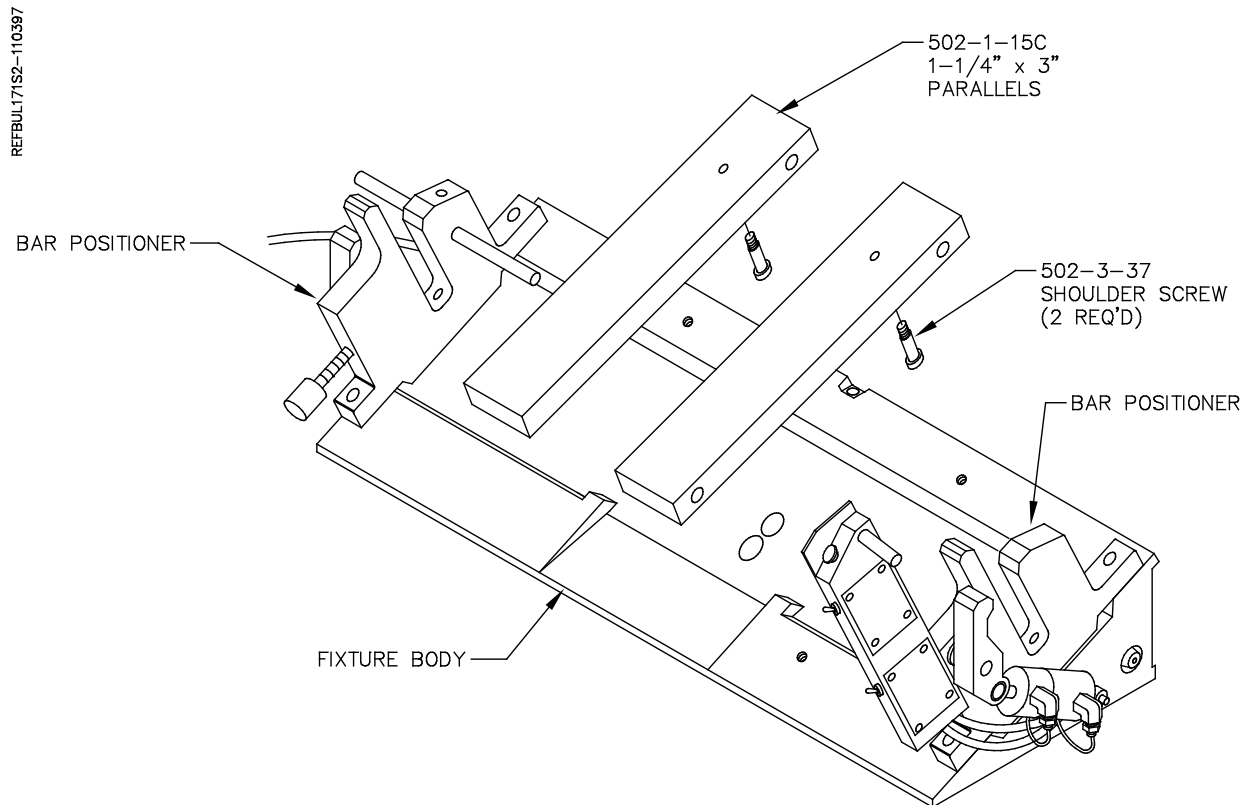
(Special Applications)

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

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



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



## Diesel Blocks

### 6725 Diesel Fixture

#### Small Diesel V Blocks

On these blocks it will be necessary to install the 6370Z, 10" parallels or 6794E, 8" parallels onto the bed of the machine. These parallels are keyed, place them onto the deck surface and then push them toward the rear of the machine. This will locate them evenly on the middle keyway of the machine bed. Place the two 6553F main bearing supports onto the parallels, these are also keyed and fit into the machined slots on the parallels. This will put the two main bearing supports in line with each other. Tighten all bolts to lock the parallels and main bearing support into place. Select the correct size main bearing locators and install them into the mains of the block..

**Note:** *Make sure there are no burrs or debris in the main bearing bores where they will contact the main bearing locators. This can cause the block not to clamp properly and may cause tipping or rocking of the block.*

#### **WARNING**

Handle these large blocks with Extreme care and guidance. A block hoist is required when handling these blocks. These blocks should be lifted from the block bank surface.

Install the main bearing locators into the mains of the engine block. Lower the block so that the locators go into the main bearing support.

#### **DANGER**

The hoist must remain attached to the block until it is firmly clamped into position. The blocks will have a tendency to tip forward until they are properly supported and clamp. When not properly supported and attached to a hoist these blocks will roll forward and out of the fixture. This will cause severe injury or death to operator.

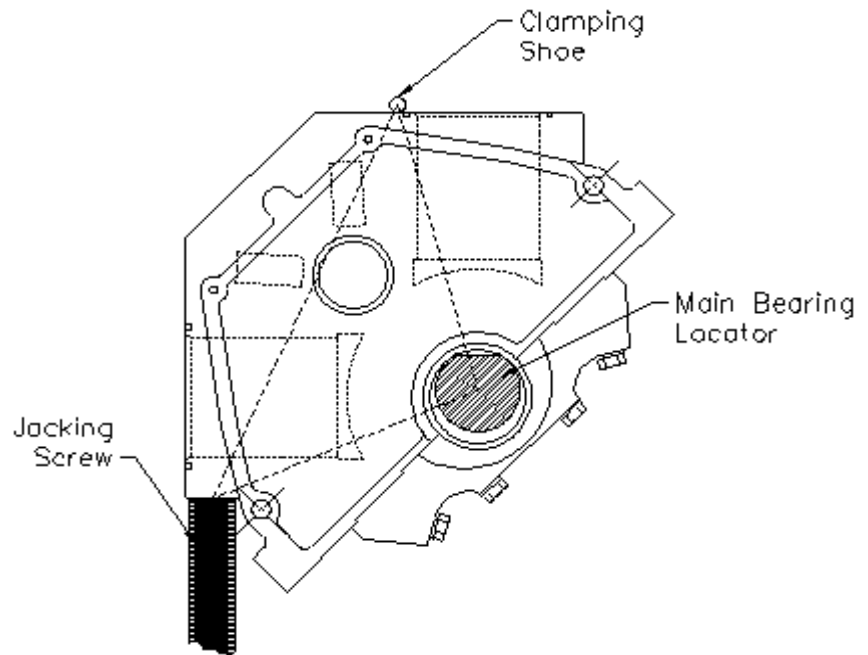
Select the correct jacking screw to reach the block. Place the jacking screws into the jack bodies and place on the parallels in a location they will support the block from rolling forward.

Position the block clamps so the front of the shoe will clamp the block in the middle on both ends. The following illustration shows the correct triangle clamping system that should be used.

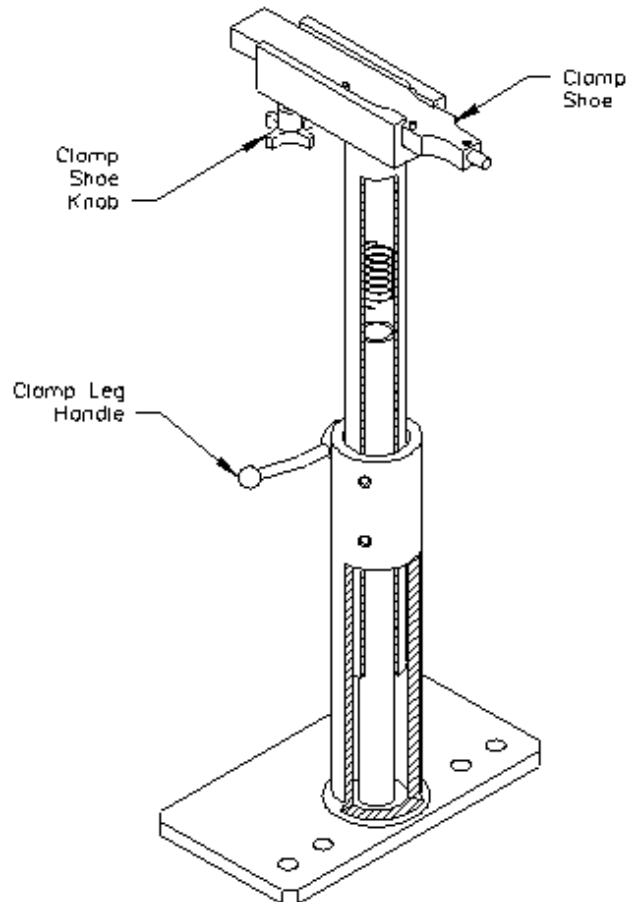
You can raise and lower the ends of the block by rotating the Hex nut located on the ends of the main bearing locators.

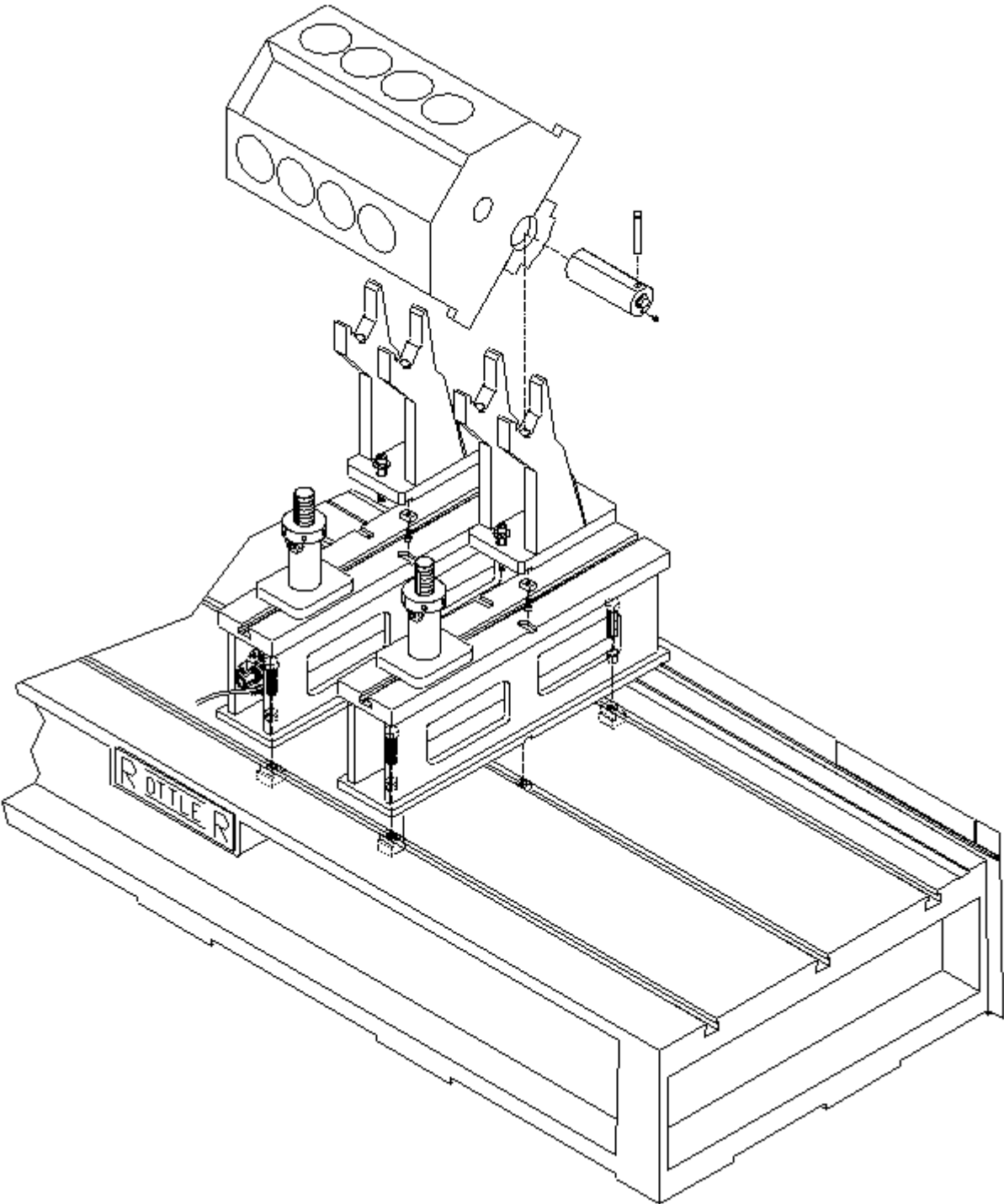
### Triangle Clamping

Adjust the height so the shoes rest on the clamp points. Tighten the clamp leg handles. Actuate the clamp shoes by turning their knobs. Apply pressure to the two clamps as evenly as possible to avoid tipping the block up on one side.



### Block Clamp Arm








### Small Diesel In Line Blocks

On these blocks it will be necessary to install the 6370Z, 10" parallels onto the bed of the machine. These parallels are keyed, place them onto the deck surface and then push them toward the rear of the machine. This will locate them evenly on the middle keyway of the machine bed. Place the two 6553F main bearing supports onto the parallels, these are also keyed and fit into the machined slots on the parallels. Use the forward machined slots. This will put the two main bearing supports in line with each other, and on centerline of the machine bed.


Position the fixtures at a distance apart equal to the outboard main journals. Tighten all bolts to lock the parallels and main bearing support into place. Select the correct size main bearing locators, and install them into the mains of the block. Notice the locators have a flat area. Installing with the flat side up will allow end to end height adjustment of the block by rotating the locator. Installing with the round side up will position the block so all machining operations are parallel and perpendicular to the main bore centerline. This simply requires leveling the block in the front to rear direction.

**Note: Make sure there are no burrs or debris in the main bearing bores where they will contact the main bearing locators. This can cause the block not to clamp properly and may cause tipping or rocking of the block.**

 **WARNING** Handle these large blocks with Extreme care and guidance. A block hoist is required when handling these blocks. These blocks should be lifted from the block bank surface. DO NOT use 502-1-95 Block Handler assembly on these blocks.

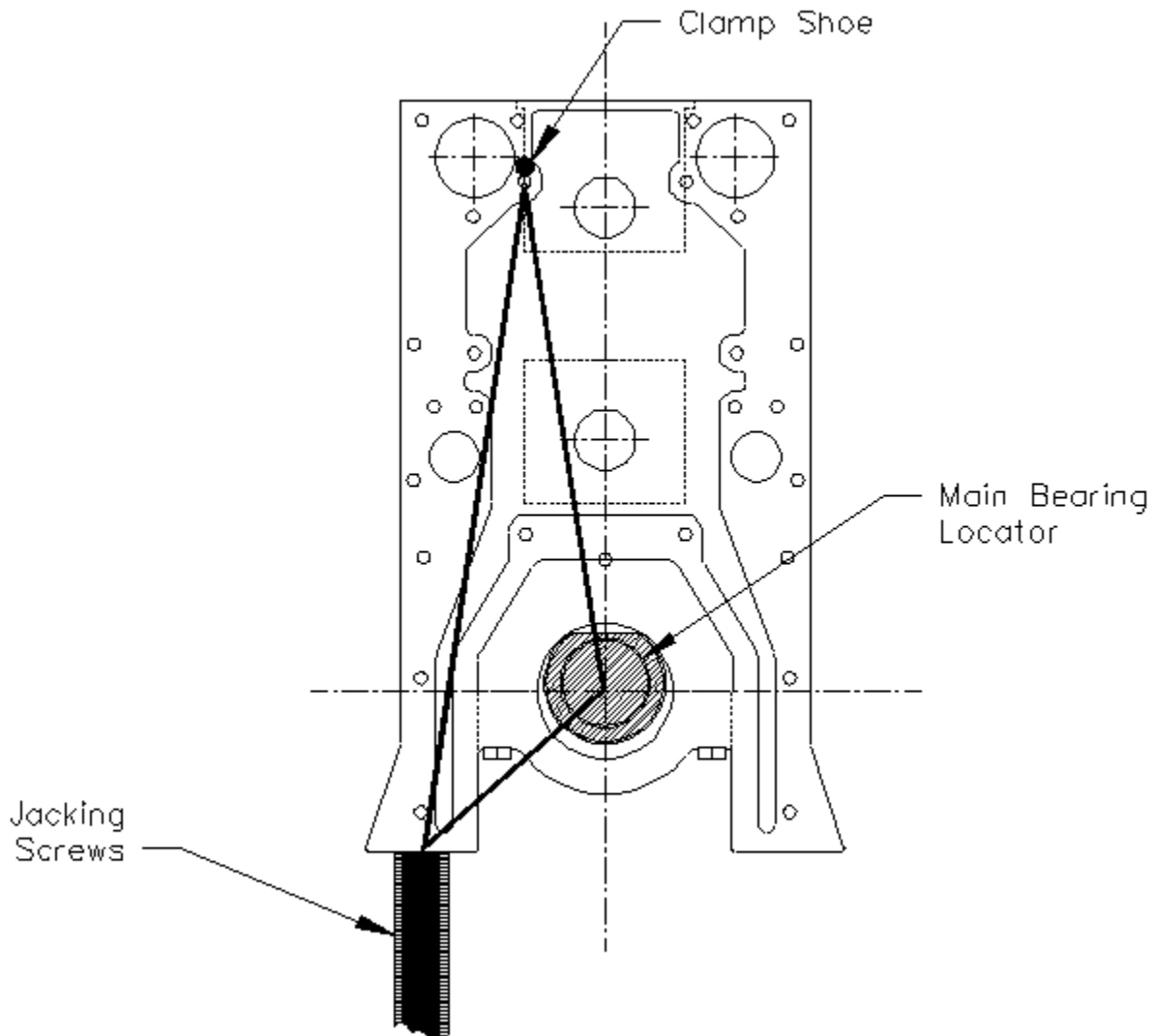
Lower the block so that the locators go into the main bearing support. A clevis pin is provided to keep the locator in position on the main bearing support.

For in-line blocks, load the block with the heavier side towards the front.

 **DANGER** The hoist must remain attached to the block until it is firmly clamped into position. The blocks will have a tendency to tip until they are properly supported and clamp. When not properly supported and attached to a hoist these blocks will roll forward or backwards and out of the fixture. This will cause severe injury or death to operator.

Select the correct jacking screws to reach the block. Place the jacking screws into the jack bodies and place on the machine bed in a location they will support the block from rolling forwards. Rough level the block using a spirit level.

The following illustration shows the correct triangle clamping system that should be used.

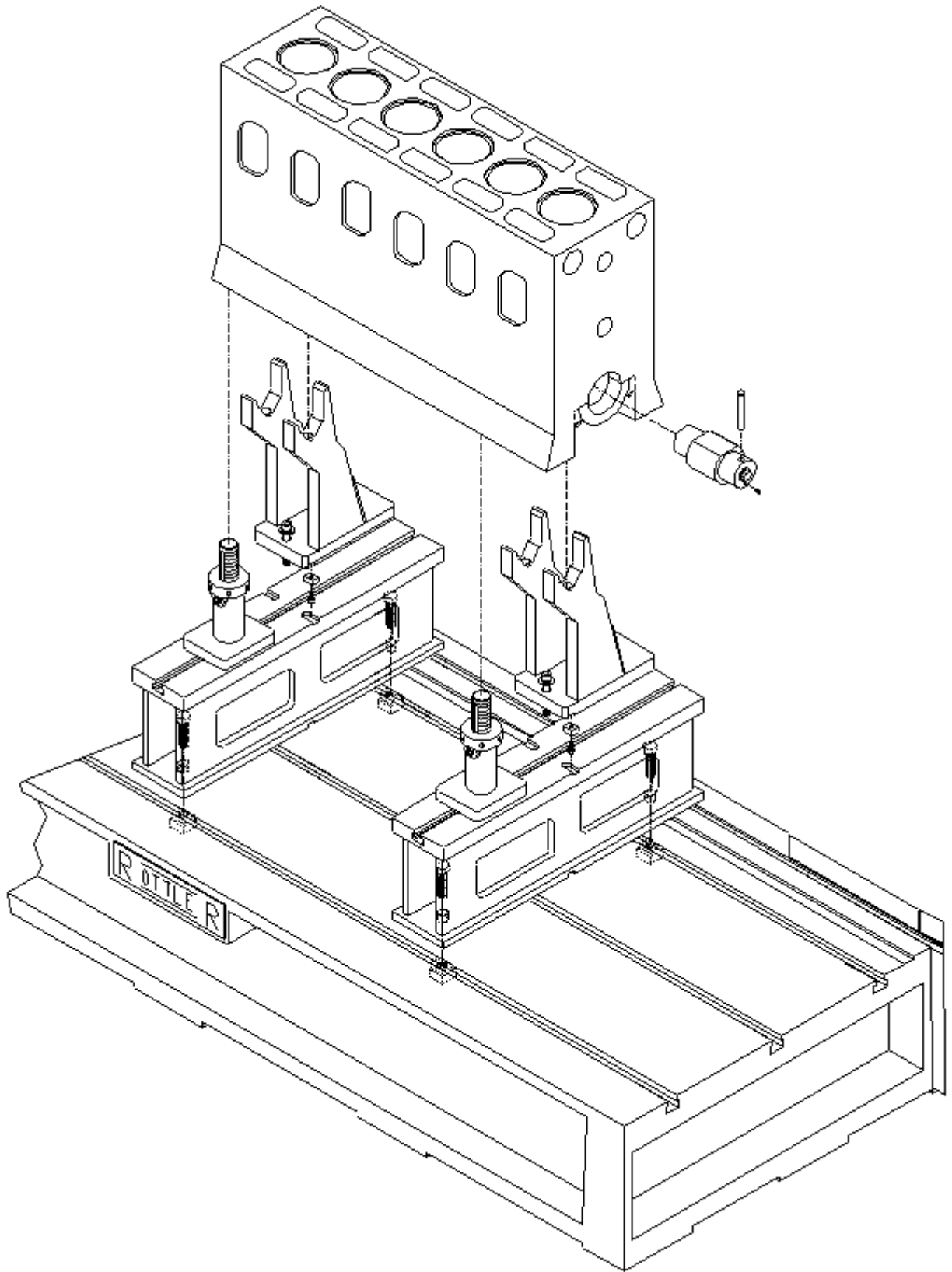
**Triangle Clamping**

Adjust the height so the shoes rest on the clamp points. Tighten the clamp leg handles. Actuate the clamp shoes by turning their knobs. Apply pressure to the two clamps as evenly as possible to avoid tipping the block up on one side.

Be sure the clamp is below the deck surface if you to resurface the block.

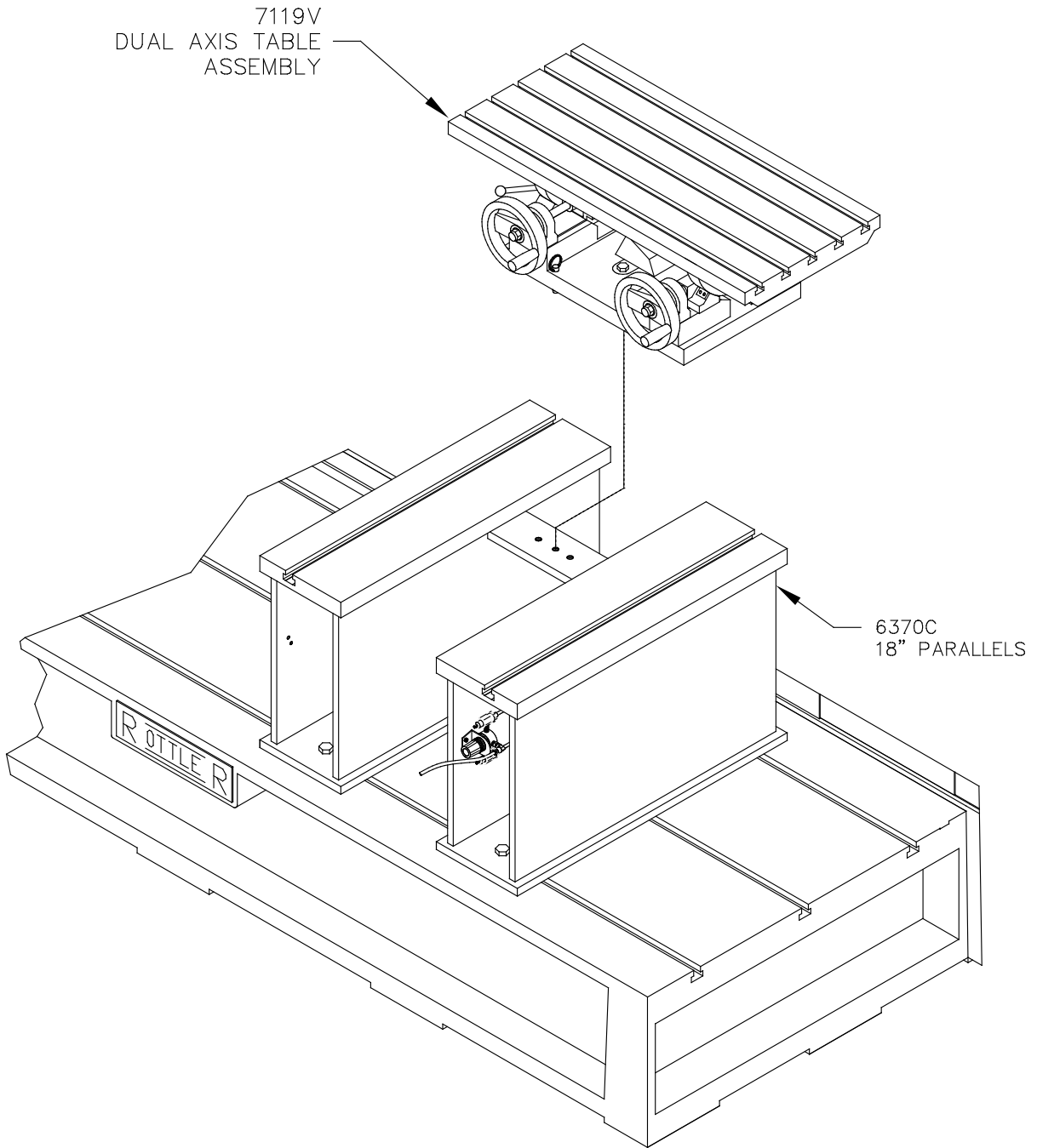
**WARNING**

Do not release the hoist or lifting device from the block until the clamping is secure.



### 7119V Dual Axis Table Assembly

REFBUL90-120197



### Instructions for Small In-Line Blocks

The Dual Axis Table has the capability of holding small (less than 13 ½" from pan rail to head surface) in-line cylinder blocks for resurfacing. This will require the use of parts from the 7119P Universal Head Fixturing package.

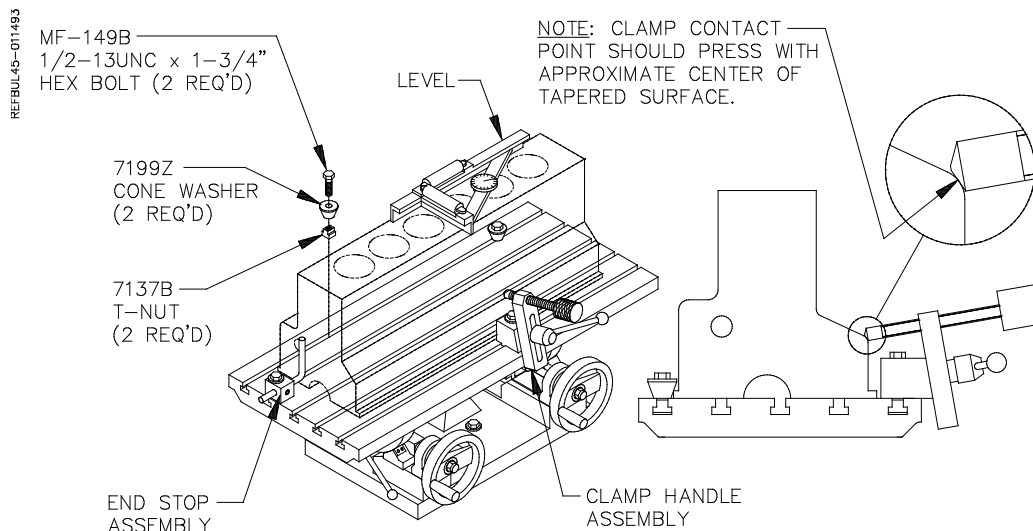
### Mounting Block to Table

There are two (2) methods for mounting blocks to the Table. Blocks with the main caps removed or with the raised main bearings can be mounted directly to the table surface. Block with the main bearing caps installed which are lower than the pan rail surface must be mounted using support blocks from the Universal Fixturing package.

### Blocks with Main Caps Removed or Raised Main Bearings

Remove any burrs from pan rails of block.

Locate cone washers on table to approximately center block in path of cutter-head and 'hook' the edge of the pan rail in the rear. Clamp the block using clamp handle assembly. We suggest you install the stop rod assembly on the left hand end of the block. This is an added safety precaution.



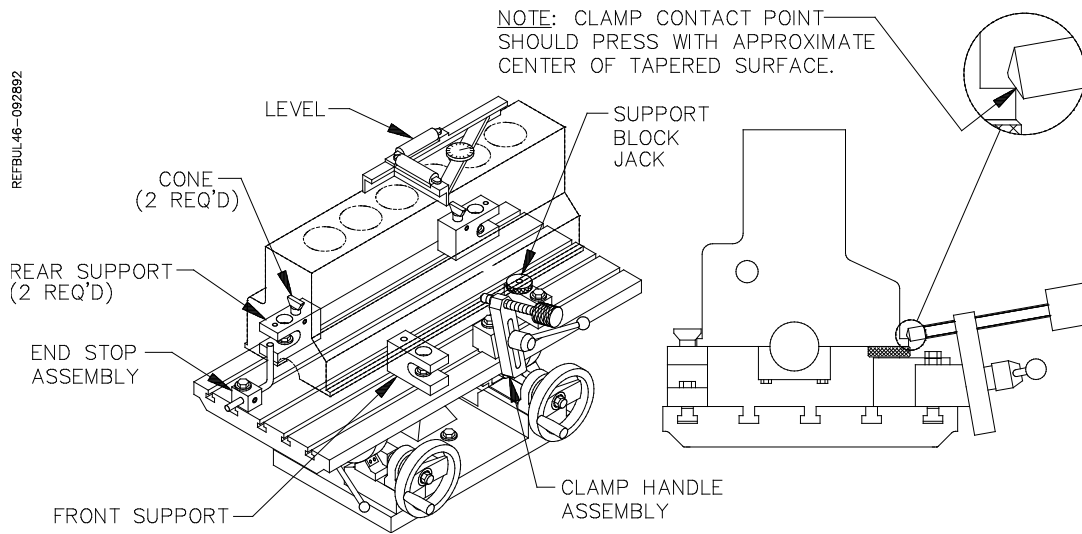
Check that all bolts and hold downs are tight. Loosen table clamp and level head surface of block in both directions. Lock table clamp and recheck block for level.

### Blocks with Main Caps Installed

Remove any burrs from pan rails of block.

Position rear supports and front supports to hold block approximately centered in path of cutter-head. Generally, place the front supports closer together than the rear supports.

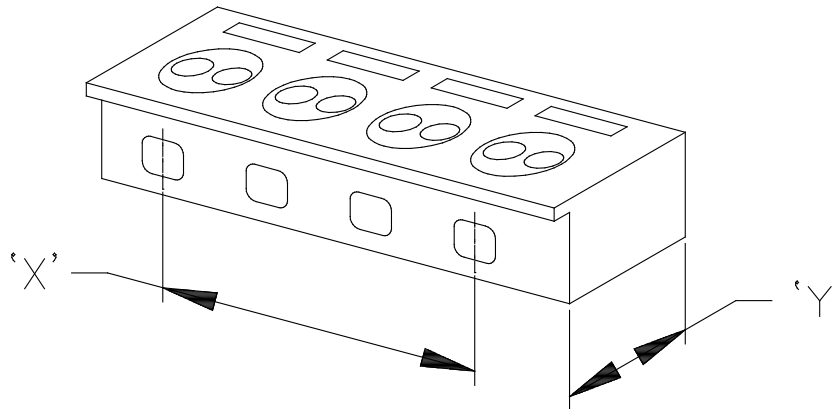
Place the block on the supports. Reposition the supports if necessary to clear main caps. Etc. Elevate the cones to hook the pan rail in the rear. Tighten set screws to lock cones in place. Tighten the hex bolts on the supports. Adjust the support block jack to eliminate any rocking. Lightly apply the clamp handle assembly.



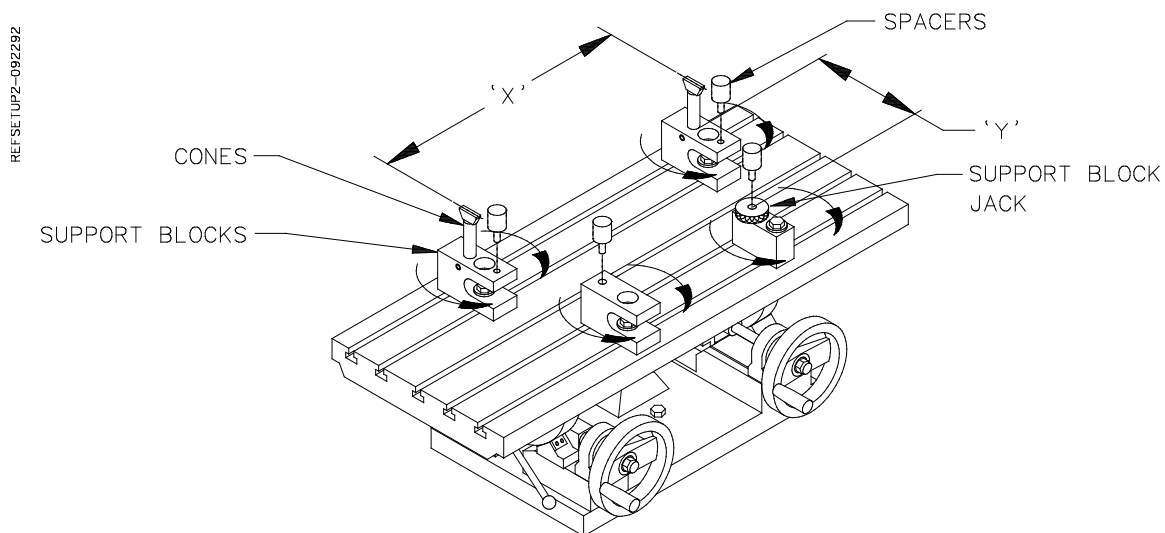
Loosen table clamp and level head surface of block in both directions. Lock table clamp. With the level still on the block tighten clamp handle assembly with appropriate clamp nose on the lower portion of a port or indent near the middle of the block. Tighten the clamp 1/8 to 1/4 turn after contacting the block. Do not over-tighten. Watch the level as you tighten to check for movement or warping. If the block moves or warps, repositioning the front supports inward will generally solve the problem. Check to see that the block cannot be moved in the fixture. We suggest that you install the stop rod assembly on the left hand end of the block. This is an added safety precaution.

### Typical Head Set Up Procedure

Find the desired ports or bosses, in the head, to position cones (long or short) on rear support blocks.  
 Measure the distance between the centerlines of these ports (bosses) within 1/16" (1mm – 5mm).  
 Measure the distance from rear support points to front support points on the head.

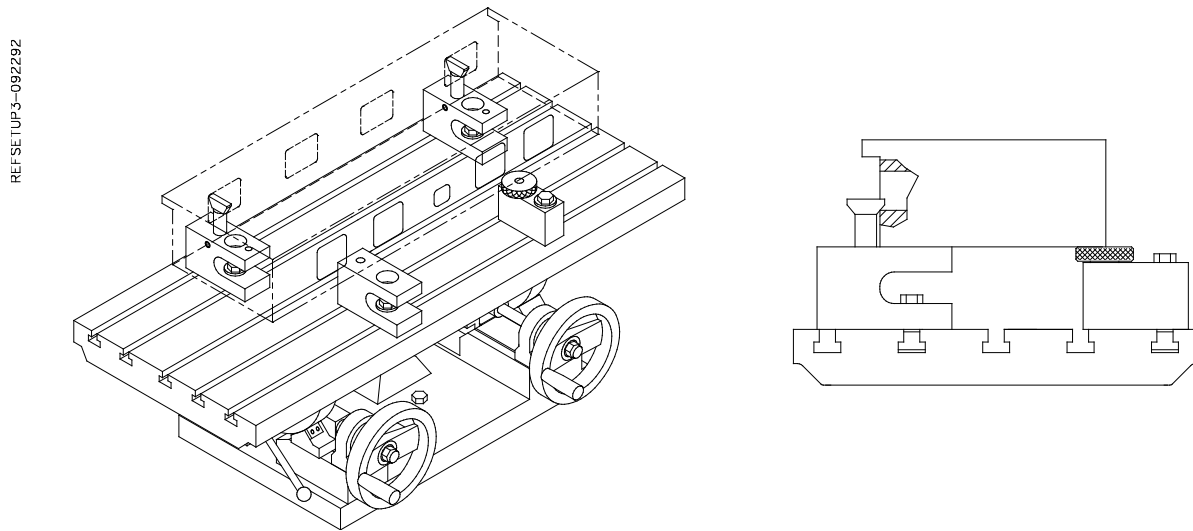


Position rear support blocks and front support blocks to hold the head approximately centered on the table top and spaced apart per dimensions measured in step '1' above. Generally, place the front blocks closer together than the rear blocks. If necessary, use either 2 or 4 spacers to raise the head for clearing studs or to angle the head so the cutterhead clears the head clamp handle assembly.



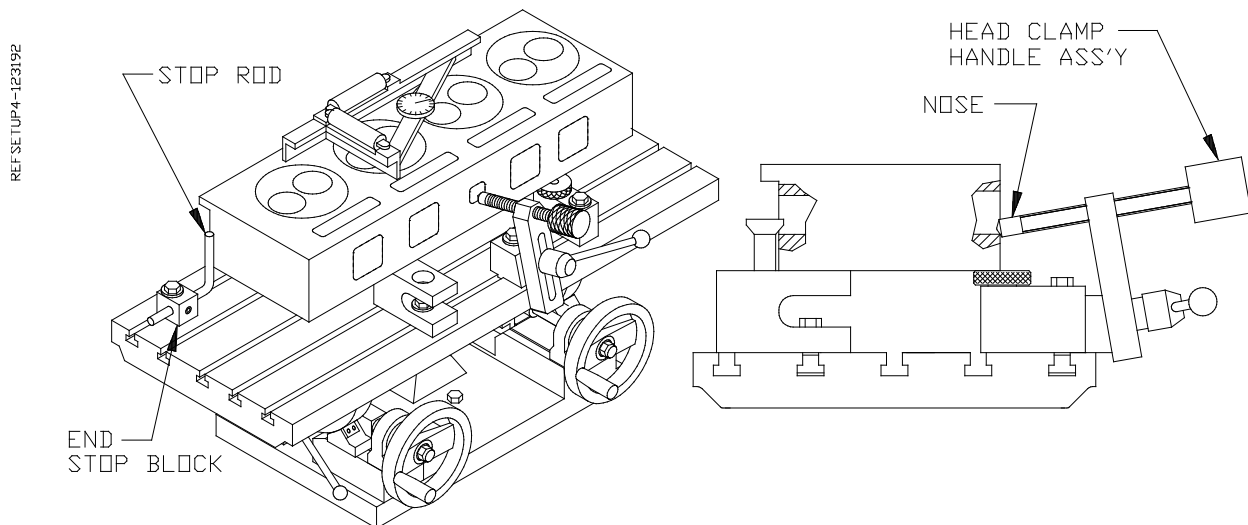
Place the head on the support blocks. Elevate the cones to 'hook' the two ports (bosses) on the head and tighten their set-screws. Adjust the position of the front support blocks if necessary. Tighten the hex bolts on the support blocks. Push the head back firmly into the cones. Adjust the support block jack to eliminate any rocking of the head. Do not tighten the head clamp handle assembly yet.

Unlock the table. Using the two hand-wheels, level the head surface to be cut. Lock the table in this position.



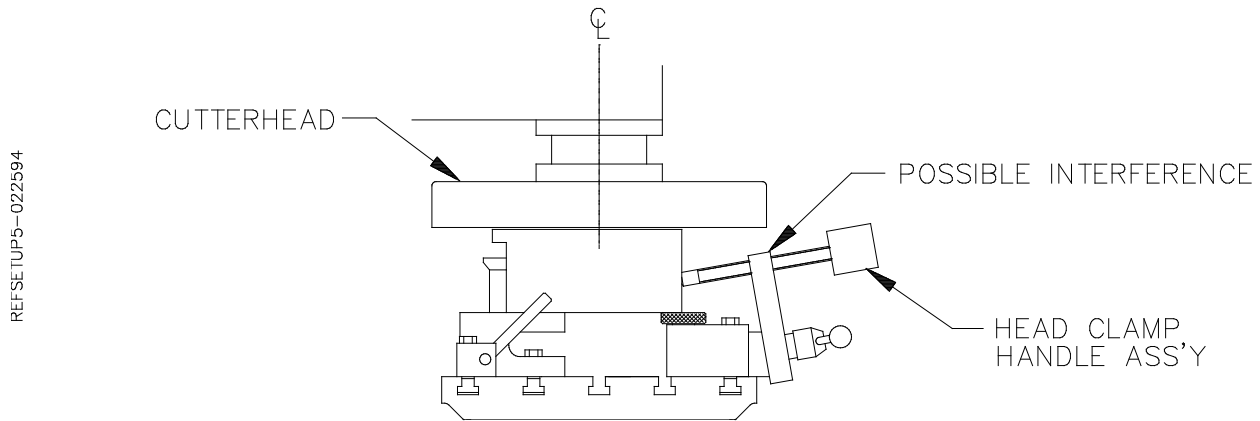
The head clamp handle assembly has a replaceable nose that pushes on the head. With the level still on the head surface, tighten the head clamp handle assembly on the lower edge of a port or indent near the middle of the head. Tighten the clamp 1/8 to 1/4 turn after contacting the head. Do not over tighten. Watch the level as you tighten to check for movement or warping. Some heads are very sensitive to support block placement, and the front support blocks may have to be moved slightly inward to prevent this warping. Check to see that the head cannot be moved in the fixture.

Slide the end stop block up against the left end of the head towards the rear. If possible, rotate the stop rod to contact a machined area on the end of the head. This will aid in loading a run of similar heads.



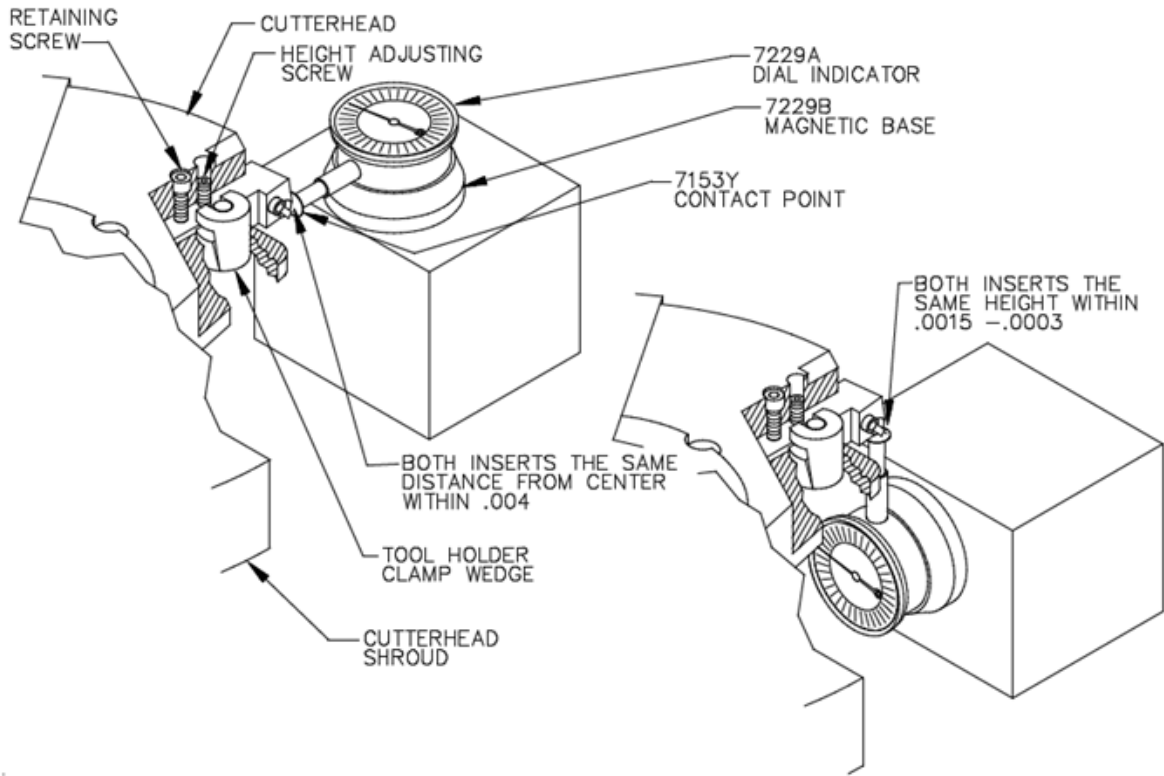


Visually check for clearance between the cutterhead and head fixture tooling pieces, especially the head clamp handle, assembly. The head should be approximately centered in the path of the cutterhead.



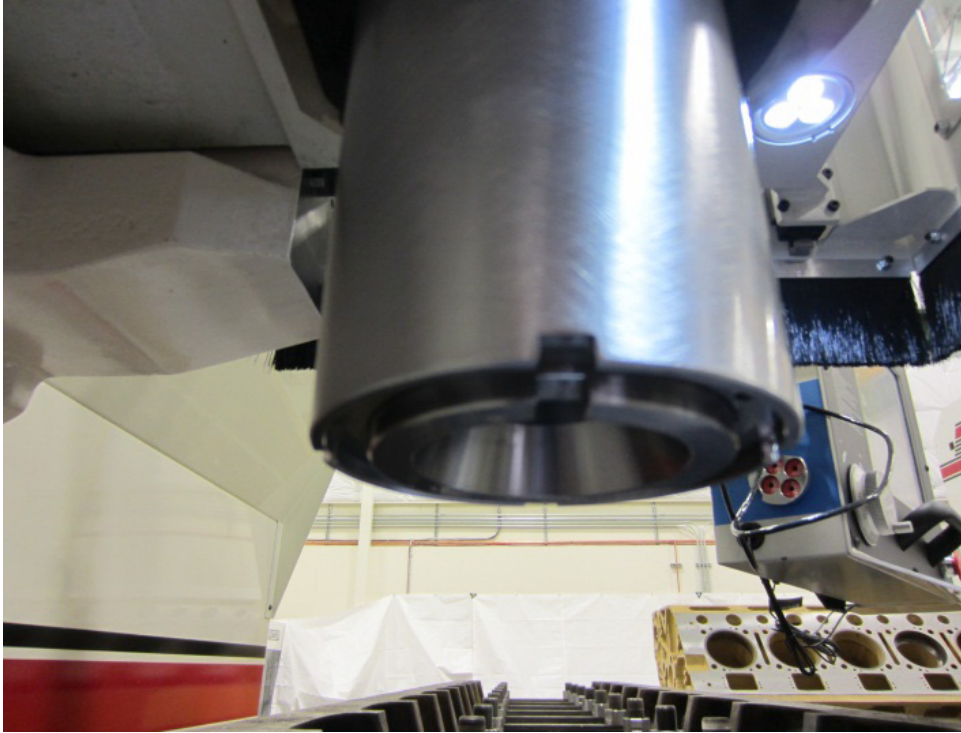
### Setting Up Rottler Fly Cutting Tool With Two Inserts

- Travel the spindle to the center of the machine bed.
- Go to the Rottler home screen on the machine before proceeding.
- Remove the cutter head shroud from the fly cutter. Attach a dial runout indicator to a cylinder head or engine block, etc.
- Rotate cutter head and check to see that both inserts are the same distance from the center of the spindle, within .004.
- If adjustment is necessary loosen the tool holder clamp wedge, and the height adjustment screw. Move tool in or out the required distance. Tighten the clamp wedge. Snug up the height adjustment screw. There is a set screw located at the bottom of the tool holder; it locks a dowel pin in place.
- When the in-out adjustment is set, loosen the set screw, the pin will pop out and hit the back of the slot. Tighten the set screw. This way, when a tool holder is removed and then replaced, it will be located very nearly where it was.
- Insert height will still need to be adjusted.
- Rotate cutter head and check to see that both inserts are the same height within .0015-.0003 The closer you get it the more accurate your surface will be.
- If adjustment is necessary loosen the tool holder clamp wedge, then alternately loosen and tighten the height adjusting screw and the retaining screw, until both inserts are set as desired.
- Retighten the tool holder clamp wedge, and recheck both inserts.

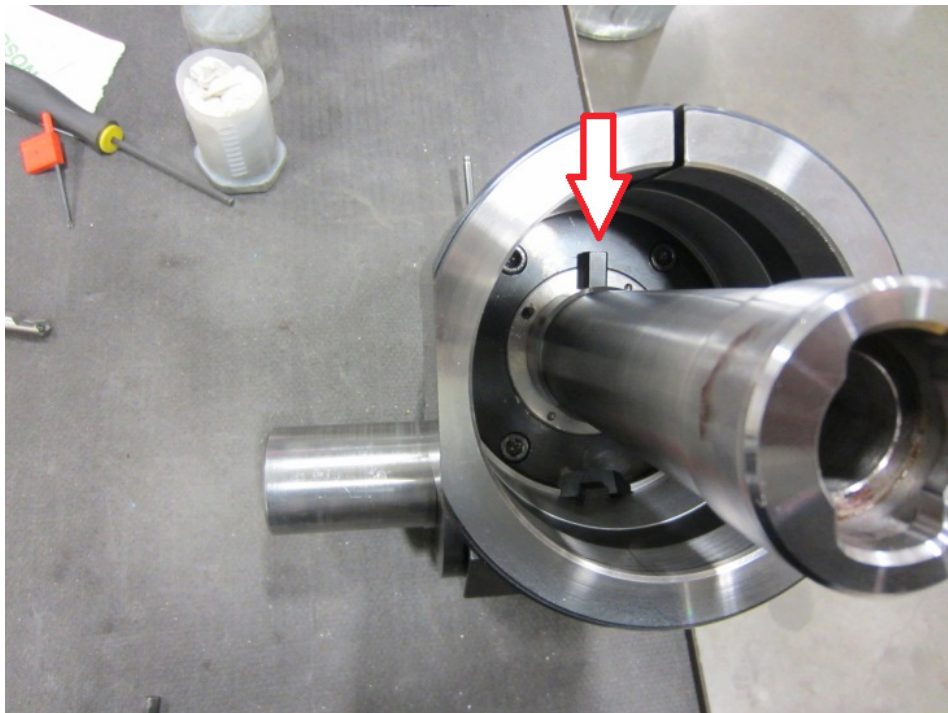


## Right Angle Drive Installation

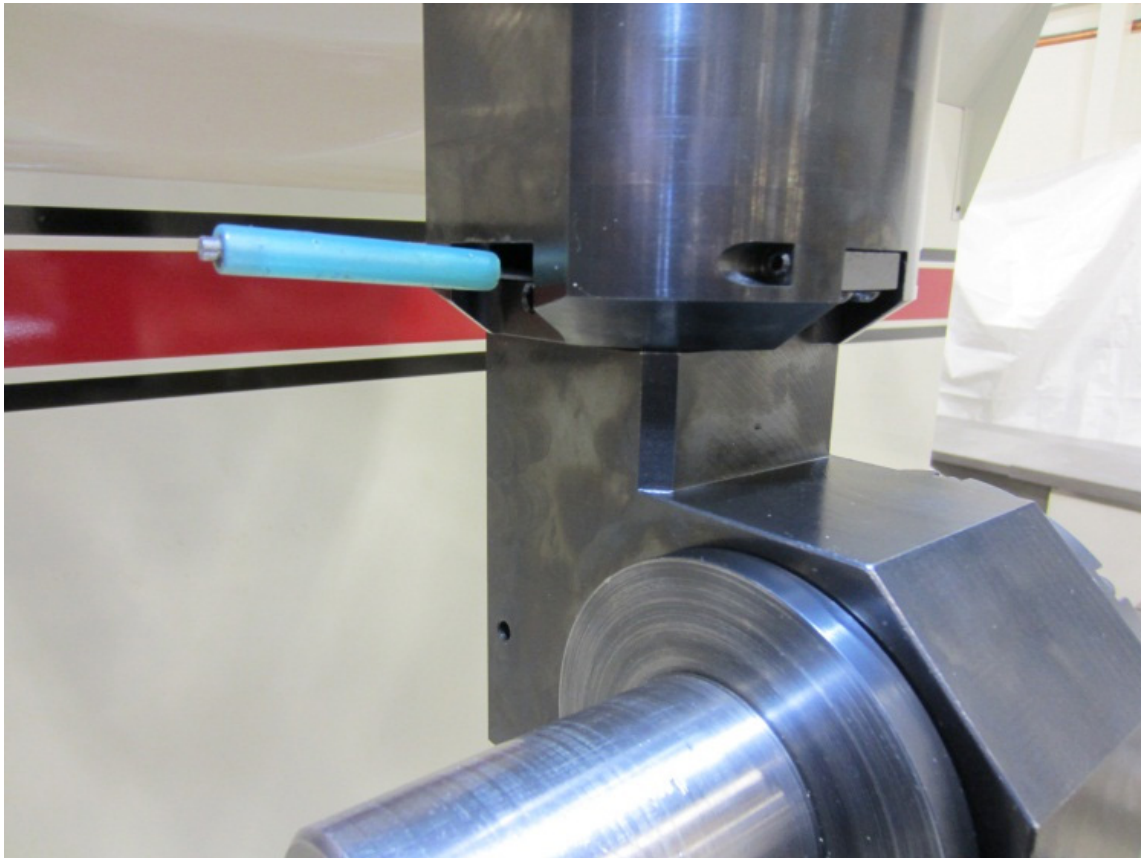
Move the Rotate the inner spindle to position the keyway toward the left, in line with the outer spindle keyway notch. Press the tool release switch to compress the drawbar.



Rotate the RAD driveshaft so the drive key is pointing to the front or rear.



Carefully insert the RAD driveshaft into the inner spindle and lift the unit upward as far as it will go. Rotate the RAD output shaft until the driveshaft key is lined up with the inner spindle keyway. This will be visible through a small window on the left side of the RAD hub. At this point, the RAD will not fall out, so holding it in place is not required.



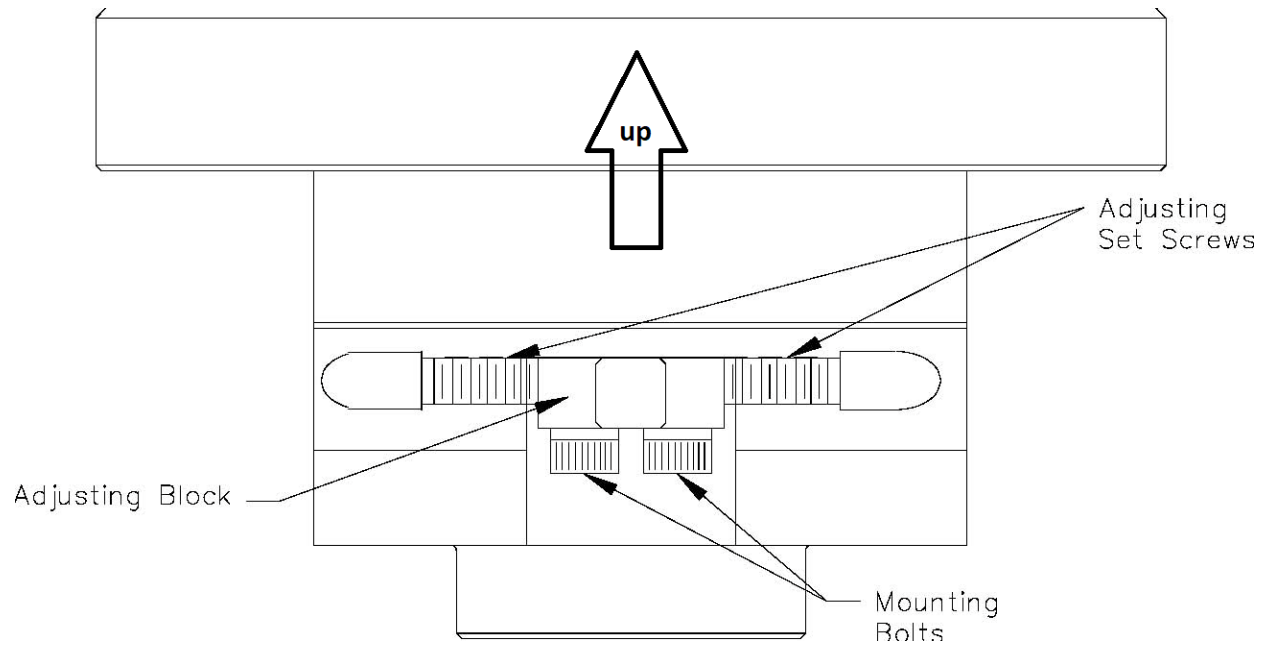
There are two adjustable keys on the RAD mounting hub that need to be lined up with the keyway notches of the outer spindle. It is not possible to see that these are aligned, so it is a little bit of trial and error when installing the unit. If the unit has never been installed on this particular machine, it would be best to temporarily remove these keys during the initial installation.

Before rotating the tool engage the drawbar to finish installing the unit, using a small shim under the inner spindle drive key in case it is not perfectly aligned to prevent bending of the key. A small flat screwdriver works well.

***NOTE: Verify that the RAD hub is against the bottom face of the outer spindle. If not, the inner, or outer keys, are not lined up, repeat the prior procedure until it is correct.***

At this point, the RAD must be aligned so that the hub face is 90° to the travel of the X axis. With an indicator touching the output face of the RAD, move the Y axis back and forth to see the amount of error.

There are two (2) adjusting set screws and an adjustment block on the RAD hub. The two set screws push against the adjustment block to turn the head left or right. The adjusting block is keyed to the outer spindle. The two screws mounting the adjusting block to the hub need to be slightly loose.



Start turning the set screw that will rotate the RAD in the direction you need to go. The set screws will rotate the unit counter clockwise or clockwise. The set screw will move the key on the adjusting block until it hits the keyway in the outer spindle. As you are turning one set screw you will need to keep the opposite set screw backed off, it will stop.

Final alignment results should be less than .0005" (.025mm), or as close as possible.



Tighten the two hub clamping bolts located at the rear of the unit. Tighten to 30 ft. lbs. (41 N m ) Recheck Alignment and re-adjust if necessary.

## Block Blueprint Dimensions

Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.

### Block Dimensions: Cylinder Bore Dimensions

Block Make & Model	Cylinder Location Bank	Bore Left	Cylinder Location Bank	Bore Right	Cylinder Bore Spacing	Cylinder Bank Offset	Cylinder Bore Center from Dowel Pin Location
Dimension From							
C h e v y 302, 305, 307 327, 350, 400	1. 2.40 front 2. 3. 4. 15.60	dowel 6.80 11.20	1. 2.40 front 2. 3. 4. 15.60	dowel 6.80 11.20	4.4	.880 offset	1.42
Chevy 396, 427	1. 2.24 front 2. 3. 4. 16.76	dowel 7.08 11.92	1. 2.47 front 2. 3. 4. 16.99	dowel 7.32 12.15	4.84		1.85
Chevy 454	1. 2.24 front 2. 3. 4. 16.76	dowel 7.08 11.92	1. 2.47 front 2. 3. 4. 16.99	dowel 7.32 12.15	4.84		1.85
Chevy LS1	1. 2.200 front 2. 6.600 3. 11.00 4. 15.400	dowel	1. 2.200 front 2. 6.600 3. 11.00 4. 15.400	dowel	4.4		2.2
Chevy SB 2	1. 2.40 front 2. 3. 4. 15.60	dowel 6.80 11.20	1. 2.40 front 2. 3. 4. 15.60	dowel 6.80 11.20	4.4	.880 offset	1.42
F o r d 289, 302, 351W	1. 2.190 rear 2. 3. 4. 15.33	dowel 6.570 10.950	1. 2.190 front 2. 3. 4. 15.330	dowel 6.570 10.950	4.38		Left Bank 2.115/2.125  Right Bank 2.118/2.122
F o r d 351C, 351M & 400	1. 2.190 rear 2. 3. 4. 15.33	dowel 6.57 10.950	1. 2.190 front 2. 3. 4. 15.330	dowel 6.570 10.950	4.38		Left Bank 2.120  Right Bank 2.120
Ford 390 & 427	1. 2.305/2.325 rear 2. 6.935/6.955 3. 11.565/11.585 4. 16.195/16.215		1. 2.305/2.325 front 2. 6.935/6.965 3. 11.565/11.585 4. 16.195/16.215		4.63		Left Bank 2.220 Right Bank 2.220

Block Model	Make &	Cylinder Location Bank	Bore Left	Cylinder Location Bank	Bore Right	Cylinder Bore Spacing	Cylinder Bank Offset	Cylinder Bore Center from Dowel Pin Location
Dimension From								
Ford 428						4.63		
Ford 429 & 460		1. 2.45 rear 2. 7.35 3. 12.25 4. 17.15	dowel	1. 2.45 front 2. 7.35 3. 12.25 4. 17.15	dowel	4.9		
Ford 4.6 & 5.4						3.937		
Ford V10						3.937		
Chrysler 318,340,360		1. 4.02 rear pan rail 2. 8.48 3. 12.94 4. 17.40	dowel	1. 3.14 rear pan rail 2. 7.60 3. 12.06 4. 16.52	dowel	4.46	0.88	
C h r y s l e r 383, wedge	426	2.52 front 7 . 3 2 1 2 . 1 2 0 16.92	dowel	2.52 front 7 . 3 2 1 2 . 1 2 0 16.920	dowel	4.8		
C h r y s l e r 426 440	Hemi,	2.52 front 7 . 3 2 1 2 . 1 2 0 16.92	dowel	2.52 front 7 . 3 2 1 2 . 1 2 0 16.920	dowel	4.8	9.5	
Chrysler V10 Iron								



**Block Dimensions: Other Dimensions**

Block Model	Make & Location	Lifter Angle	Bore	Lifter Location Bank	Bore Left	Lifter Location Bank	Bore Right	Crank Diameter	Bore	Cam Diameter	Bore	Cam Bore to Crank Bore Centerline	Deck Height
Dimensions From													
Chevy 396, 427	Chevy 396, 427	41 degrees Int & Ex	degrees	1. 1.58 front	3.14	1. 1.48 front	3.04	small journal	1st	Journal	4.521	9.0315	
				2. 3.14	2. 3.04	2. 4.906/2.4916	2. 0.190/2.0210						
				3. 6.16	3. 6.06	late model journal	5th	Journal					
				4. 7.72	4. 7.62	2. 6.406/2.6416	2.009/2.0110						
				5. 10.38	5. 10.28	400 sbc							
				6. 11.94	6. 11.84	2.8406/2.8416							
				7. 14.96	7. 14.86								
				8. 16.52	8. 16.42								
Chevy 454	Chevy 454	45 degrees Int. 38 degrees Ex. Caution Dart & World Blocks are 38.75 degrees	Int.	1. 1.34 front	3.14	1. 1.57 front	3.37	2.9365/2.9375	1st	Journal	5.15	9.8	
				2. 3.14	2. 3.37		2. 1.395/2.1405						
				3. 6.18	3. 6.41		5th	Journal					
				4. 7.98	4. 8.21		2.1295/2.1305						
				5. 11.02	5. 11.25								
				6. 12.82	6. 13.05								
				7. 15.86	7. 16.09								
				8. 17.66	8. 17.89								
Chevy LS1	Chevy LS1	45 degrees Int. 38 degrees Ex. Caution Dart & World Blocks are 38.75 degrees	Int.	1. 1.4004 ft	3.14	1. 1.173 ft	3.37	2.750/2.751	2.3276/2.3295	1st & 5th	Journal	4.885	9.235/9.245
				2. 3.227	2. 3.00								
				3. 5.800	3. 5.573								
				4. 7.627	4. 7.400								
				5. 10.200	5. 9.973								
				6. 12.027	6. 11.800								
				7. 14.600	7. 14.373								
				8. 16.427	8. 16.200								

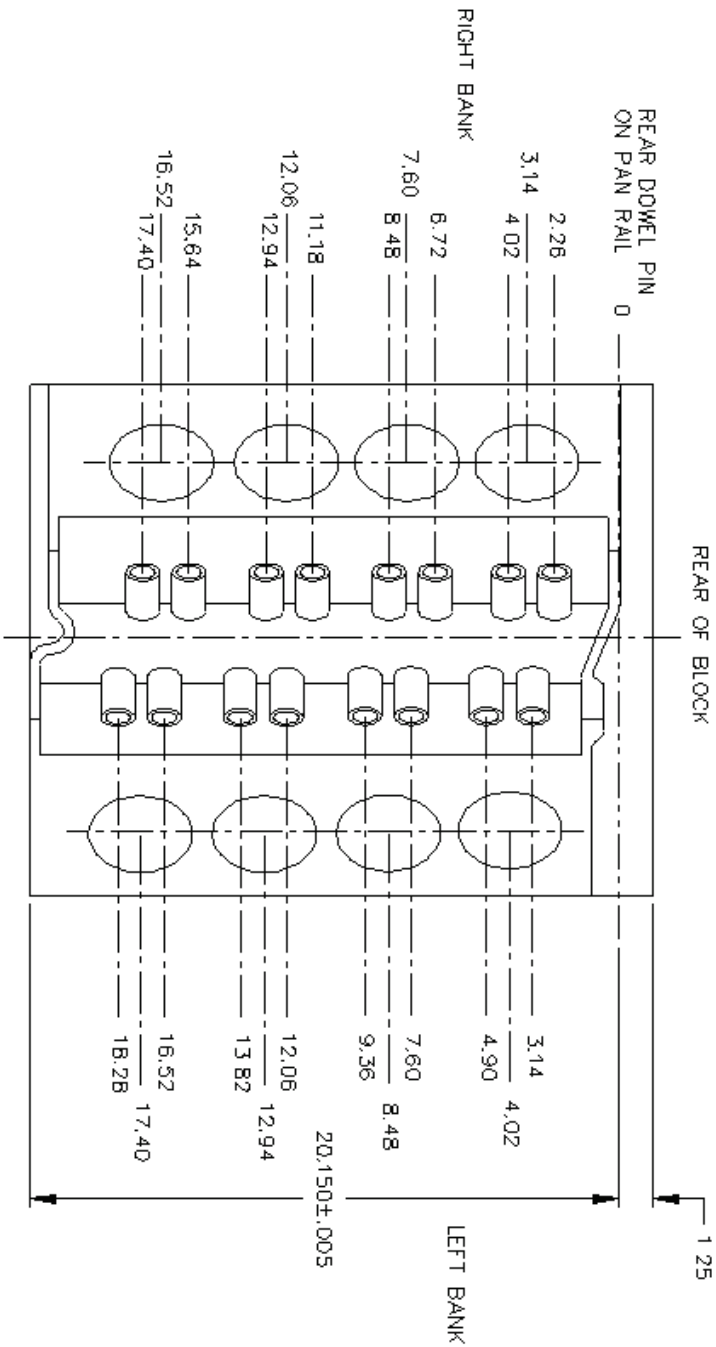
Block Make & Model	Lifter Angle	Bore	Lifter Location Bank	Bore Left	Lifter Location Bank	Bore Left	Crank Diameter	Bore	Cam Diameter	Bore	Cam Bore to Crank Centerline	Bore to Bore	Deck Height	Block
Dimension From														
Chevy SB 2			1. 1.518 front 2. 3.353 3. 5.918 4. 7.753 5. 10.340 6. 12.152 7. 14.740 8. 16.552		1. 2.306 front 2. 4.140 3. 6.706 4. 8.540 5. 11.127 6. 12.940 7. 15.527 8. 17.340		1st Journal		1st Journal 2. 0.190/2.0210 5th Journal 2.009/2.0110		4.521			
Ford 289,302,351W	41degrees Intake & Exhaust	15 min.	1. 1.375 Rear 2. 3.105 3. 5.755 4. 7.485 5. 10.135 6. 11.865 7. 14.515 8. 16.245		1. 1.375 front 2. 3.105 3. 5.755 4. 7.485 5. 10.135 6. 11.865 7. 14.515 8. 16.245		2. 441/2.442 2 8 9 / 3 0 2 3. 1922/3.1930 351W		1st Journal 2. 2041/2.2051 5th Journal 2.1440/2.1450		4.804/4.807		8.206	
Ford 351C, 351M & 400	41 degrees Intake & Exhaust	15 min	1. 1.375 rear 2. 3.105 3. 5.755 4. 7.485 5. 10.135 6. 11.865 7. 14.515 8. 16.245		1. 1.375 front 2. 3.105 3. 5.755 4. 7.485 5. 10.135 6. 11.865 7. 14.515 8. 16.245		2.9417/2.942		1st Journal 2. 2495/2.2505 5th Journal 2.1440/2.1450		5.0435/5.0465		3 5 1 M / 4 0 0 10.292/10.302 3 5 1 C 9.206	
Ford 390 & 427	41 degrees Intake & Exhaust	15 min	1. 1.145/1.165 rear 2. 3.125/3.145 3. 5.775/5.795 4. 7.755/7.775 5. 10.745/10.765 6. 12.725/12.745 7. 15.375/15.395 8. 17.355/17.375		1. 1.145/1.165 front 2. 3.125/3.145 3. 5.775/5.795 4. 7.755/7.775 5. 10.745/10.765 6. 12.725/12.745 7. 15.375/15.395 8. 17.355/17.375		2.9412/2.942		1st Journal 2.3095/2.3105 5th Journal 2.2495/2.2505		5.0475/5.0485			
Ford 428							2.9412/2.942		1st Journal 2.3095/2.3105 5th Journal 2.2495/2.2505		5.044		10.17	

**Chrysler 318 Dimensions**

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
318	6.1215/6.1275	48deg or 59deg (All production small blocks are 59 degrees)	#1 2.1290 / 2.1305 #5 1.6915 / 1.6930	2.6925 / 2.6932

We have heard that these dimensions are the same for 318/340/360 but we have been unable to confirm.

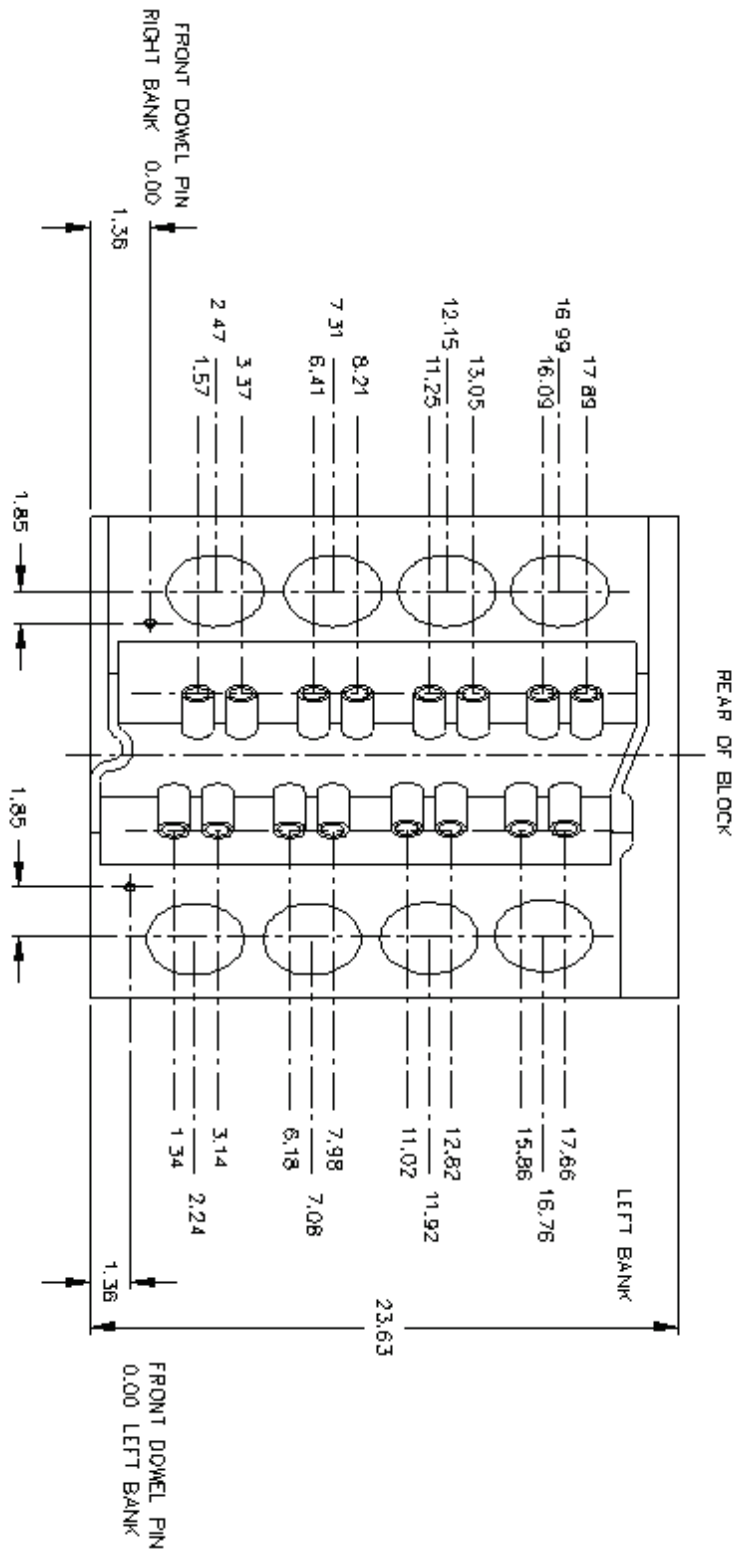
Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.



### Chevrolet Big Block Dimensions

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Big Block Chev.	5.15	45 or 38(Tall Deck)	#1 2.1395 - 2.1405 #5 2.1295 - 2.1305	2.9365 - 2.9375

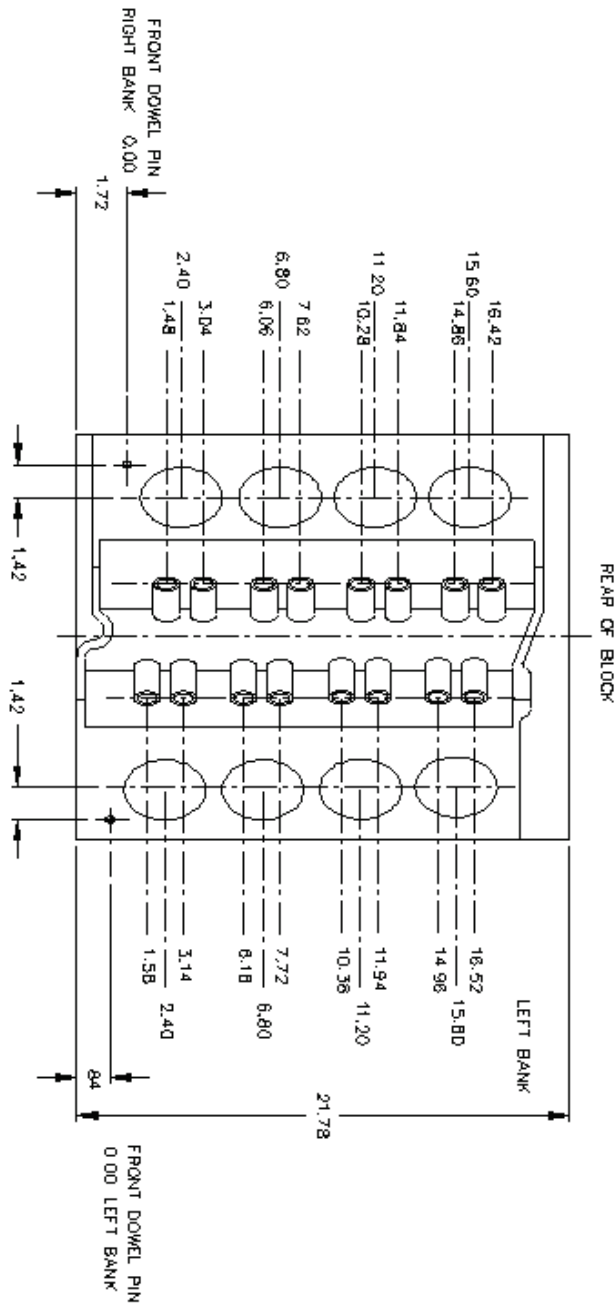
Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. (HP Books "Chevrolet Power" IZBN #1-55788-087-5 available through most book stores) We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year block.



**Chevrolet Small Block Dimensions**

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Small Block Chev.	4.521	49	#1 2.0190 / 2.0210 #5 2.0090 / 2.0110	

Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. (HP Books "Chevrolet Power" IZBN #1-55788-087-5 available through most book stores) We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified; check with OEM to obtain specifications for a particular year block.

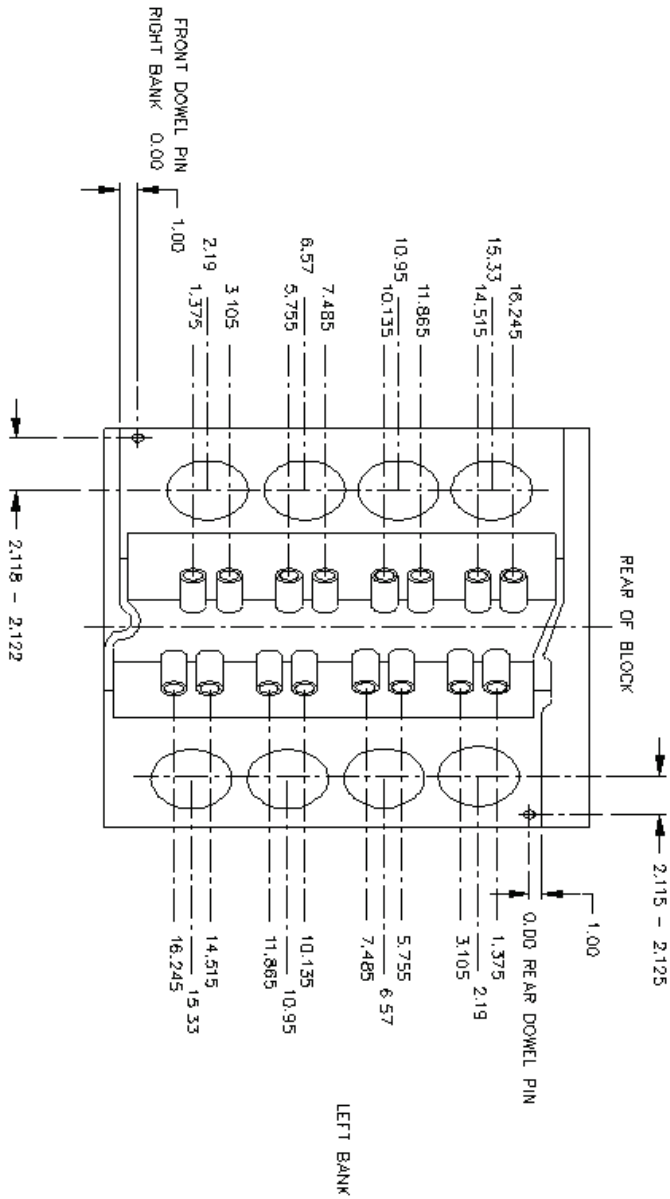


NOTE: REFERENCE DOWEL PIN LOCATION IS DIFFERENT FOR EACH BANK.

Ford 289-302-351W Dimensions

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Ford 289/302/351W Small Blocks	4.804" - 4.807"	41deg 15min / 41deg 45min	2.0925 - 2.0835	2.9417 - 2.9425

Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.

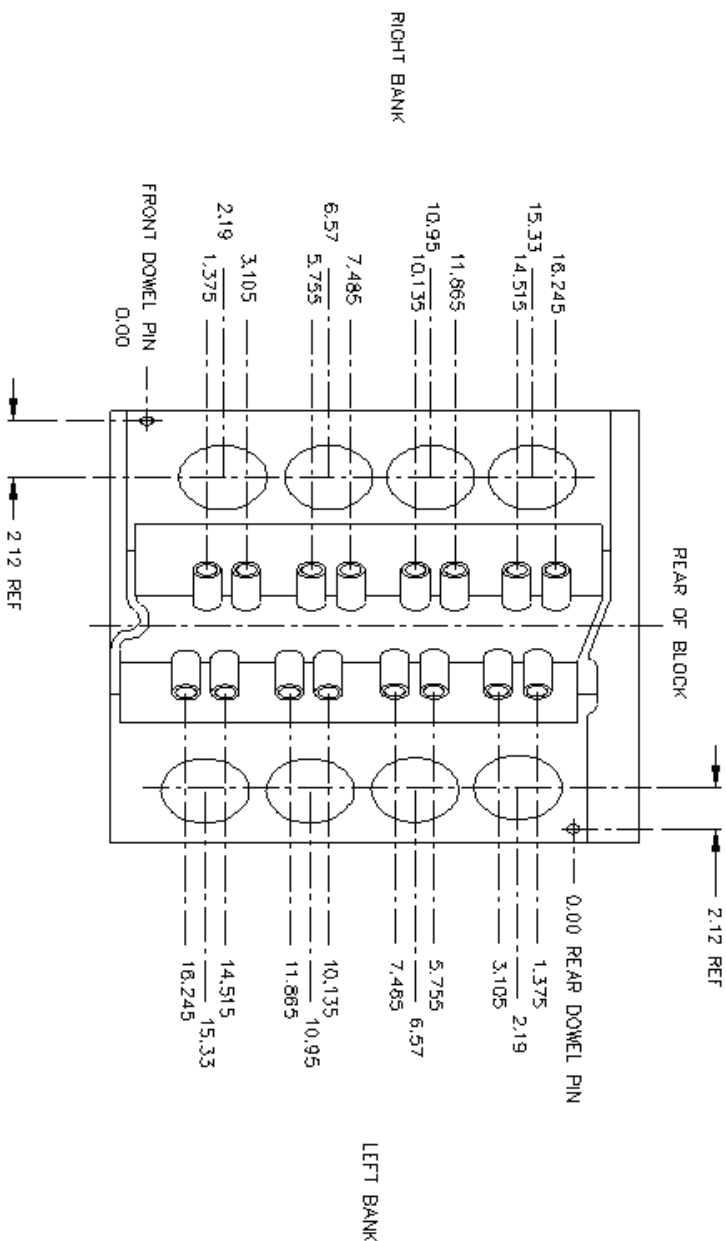


NOTE: REFERENCE DOWEL PIN LOCATION IS DIFFERENT FOR EACH BANK.

**Ford 351C-400 Dimensions**

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Ford 351C/400 BIG Blocks	5.0435 - 5.0465	41deg 15min / 41deg 45min	#1 2.1258 - 2.1268 #5 2.0225 - 2.0235	2.9417 - 2.9425

Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified, check with OEM to obtain specifications for a particular year of block.

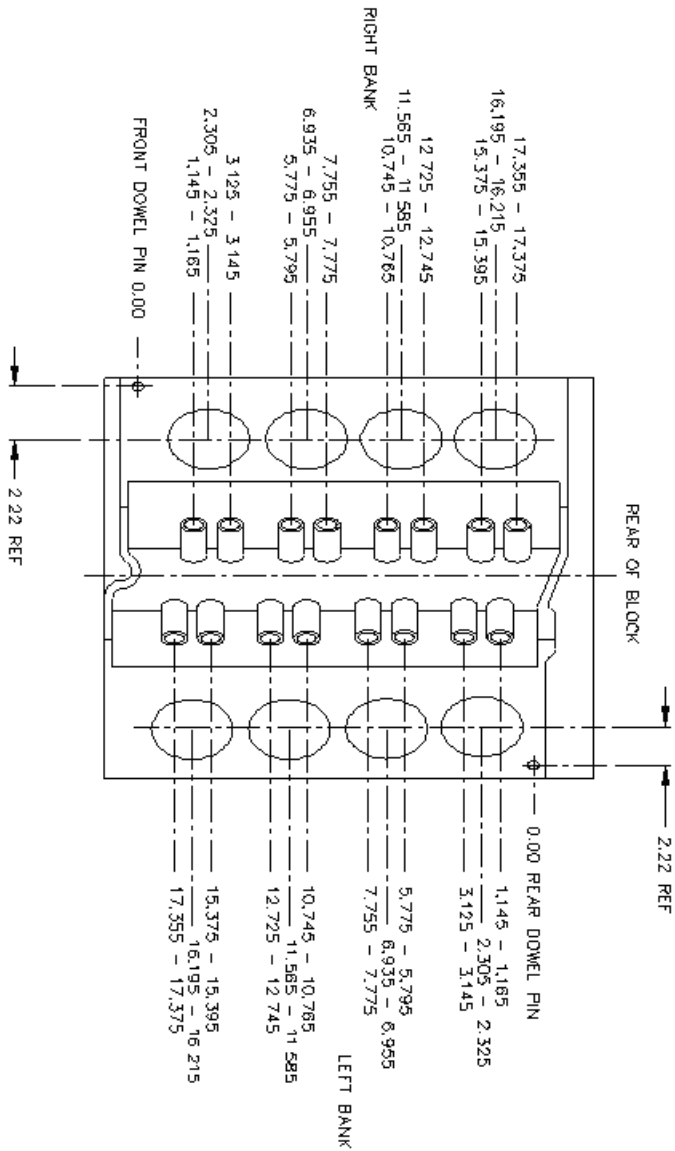


NOTE: REFERENCE DOWEL PIN LOCATION IS DIFFERENT FOR EACH BANK.

Ford 390-427 Dimensions

Block	Cam Bore Center to Crank Bore Center Distance	Lifter Bore Angle	Cam Bore Dia	Crank Bore Dia
Ford 390 / 427 BIG Blocks	5.0475 - 5.0485	41deg 15min / 41deg 45min	#1 2.3095 - 2.3105 #5 2.2495 - 2.2505	2.9417 - 2.9425

Specifications are accurate to the best of our knowledge and have been obtained from reliable sources. We provide no guarantee on dimensional accuracy. OEM specs change frequently and we are not notified; check with OEM to obtain specifications for a particular year of block.



NOTE: REFERENCE DOWEL PIN LOCATION IS DIFFERENT FOR EACH BANK.



## General Machine Information

Before starting to build or use any of the Rottler operating programs it is important to understand how the machine operates internally.

The Rottler F79A model uses Computerized Numeric Control (CNC). The CNC is always operating when the machine is turned on. However, you will not see the CNC controls unless you switch over to the CNC operating screen.

## Homing

The F79A **MUST** be homed anytime it is turned off. If the machine has not been homed the reference positions for all programs will be off.

The purpose of Homing the machine is to set reference points in each axis for the machine to operate from. If the machine is not homed the reference points may be off position. The reference point is set in exactly the same position each time the machine is homed. The machine keeps track of these reference positions internally and the operator will not see them.

## Building Programs

NOTE: The instructions in this section are done WITHOUT using tool or Fixture offset values.

### Create a Block Program

Block Programs are listed on the left hand side of the screen. Mode programs that are for a specific Block Model are listed on the right side of the screen.

#### New

From the Program Select screen select New from the Left hand menu. This will open a window where will enter the Block name and configuration i.e. V6, V8 or Inline and number of cylinders.

NOTE: There is an existing program on start-up of new software called Part Program. This can be deleted after the first Block Program is entered.



#### Share Vertical Zero in Groups

Checking this box will set the Vertical zero in the same position in every mode. If you go into another mode in the same block and zero out the Vertical, the zero position in all modes will change.

#### Share All Values in Groups

Checking this box will set all zero locations and X, Y locations the same in every mode for the selected block. Changing a Zero, any In/Out or Horizontal Stop location will change it for all modes in the selected block.

#### Options

If you need to change the block configuration or name of a block that has already been created, use the Options button. This will bring up the same window as when the block was created.

## Creating Operating Modes for a Block Model

Select the Block model on the left hand side of the screen.

### New

Selecting New will bring up a window that lists all the Modes that can be performed on the selected block model. Highlight the Mode you want to create and press OK.

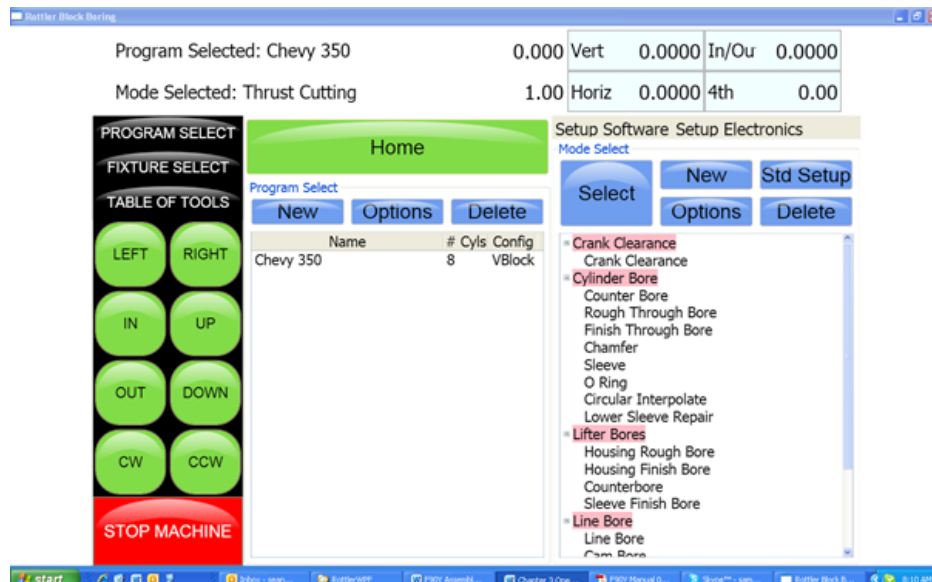


The selected mode will show up on the right hand side of the screen.



## Std (Standard) Setup

Pressing Std Setup will cause all of the available Modes to be inserted into the Modes area on the right hand side.

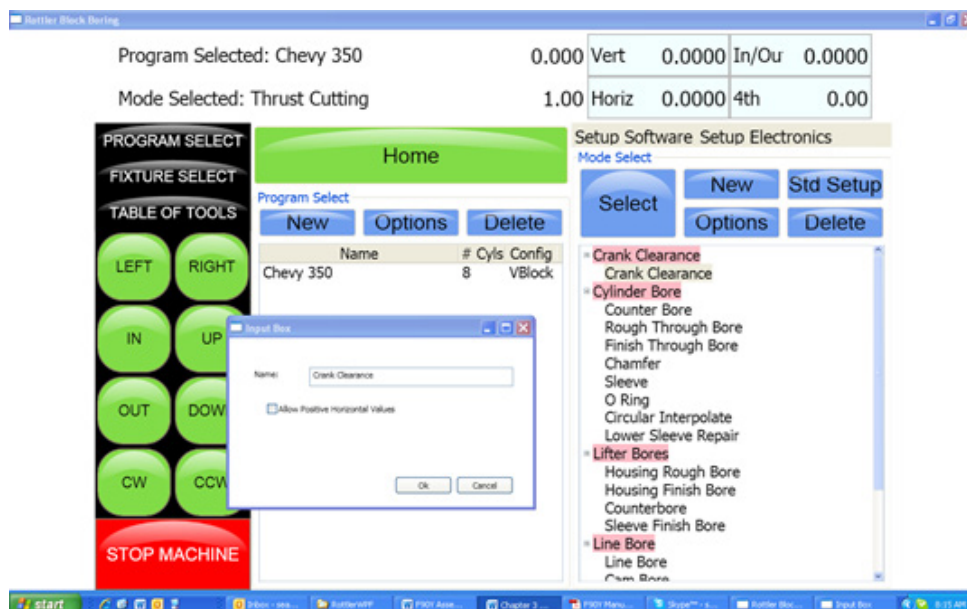


## Select

Pressing Select with a Mode highlighted will open the operations screens for using the program.

## Options

Pressing the Options button with a Mode highlighted will open a window where you can change the mode name. You can change the name of any mode to suit a particular operation you are doing. There is also a check box to allow positive number to be entered into the program where they are normally forced to a negative value.



## Cylinder Bore Mode 3 Axis

Select Cylinder Bore. This will bring up the boring program with the Set Zeros tab shown.

Cylinder Bore, General Bore and Counter Bore are the same programs with different names. They operate identically.

NOTE: Once a certain feature is discussed in a particular mode it will not be discussed again in the following modes. Only the features that are different in the different Modes will be discussed.

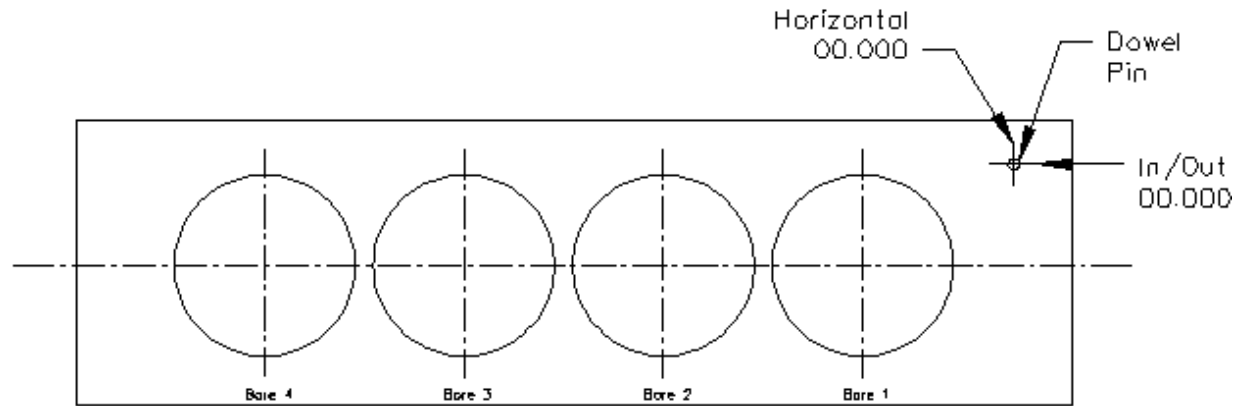


## Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines' travel. Each axis (except the Spindle rotation) will need to have a zero point set for the machine to operate from. Every program will save its individual zero positions. The next time that program is selected the zero position will be the exact same distance from the Home position for each axis.

## Horizontal and In/Out Zero

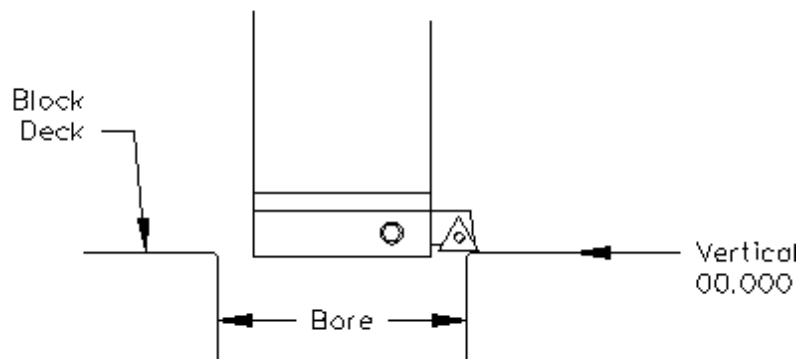
For this example, the Dowel Pin will be our zero point for the Horizontal and In/Out axis. Using an indicator or electronic probe center the spindle on the Dowel Pin then press the Horizontal and In/Out Zero buttons. The display next to these buttons will go to zeros. The Horizontal and In/Out zero positions have now been set.



### Vertical Zero

There are three different ways to use the boring software, Blueprinting, Indicating and Probing. It is not unusual for all three modes to be used on the same size block. The vertical stops for these different operating programs will vary. Be sure the vertical stops are set correctly for the mode you are using.

For this example the deck will be our zero for the Vertical axis. Insert a tool holder into the cutterhead you will be using to bore the block. Center the cutterhead over a cylinder. Using the Vertical Handwheel, bring the cutterhead down until the tool just touches the deck and press the Vertical Zero button. The display next to this button will go to zero. The Vertical zero has now been set.



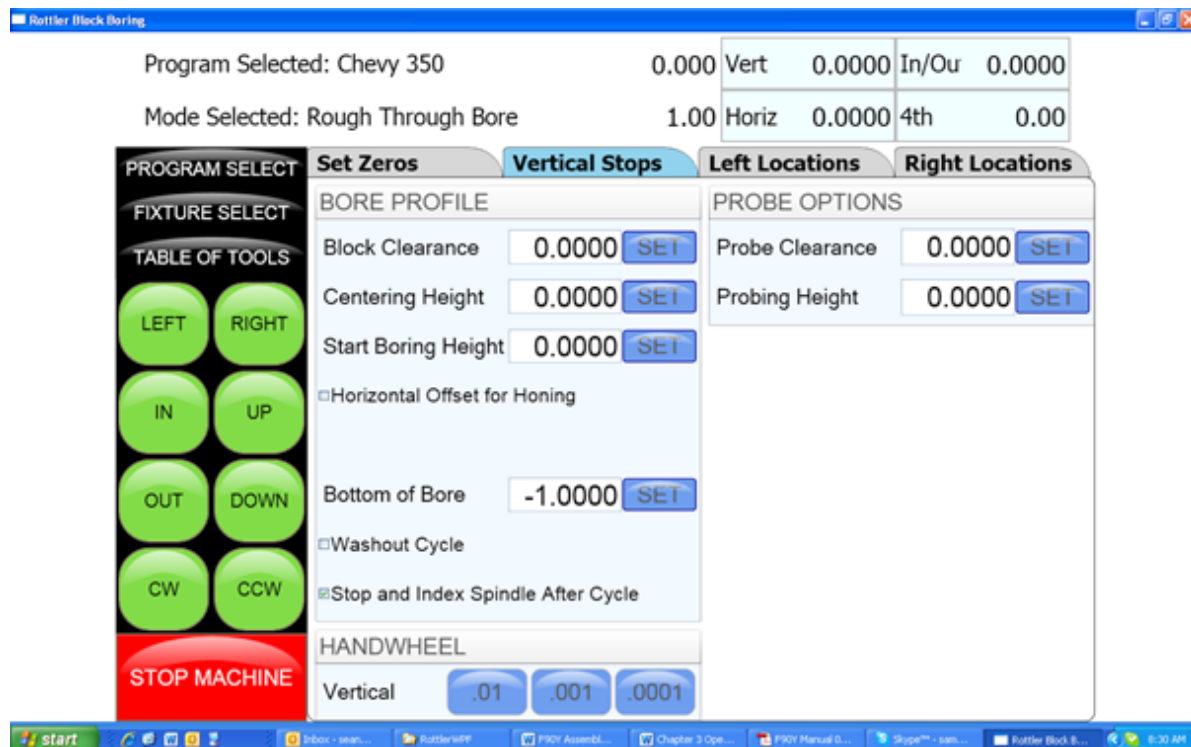
The zeros points for all axis have now been set. All the numbers entered from this point on will reference these zero positions. You are finished with the Set Zeros screen, select the next Tab to the Right, Vertical Stops.

## Blueprinting

Even if you are not going to be boring a block to the blue print specifications it is recommended to have the Blueprint values entered. It will speed up the process of indicating and probing a block by giving the operator a close estimate of bore location.

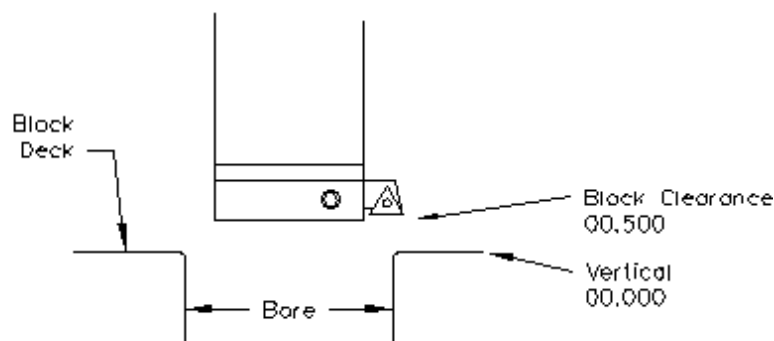
## Programming Vertical Stops

To build a program you must set the Vertical Stops for the program.



## Block Clearance

This is the distance above the zero position or block deck allowing the cutterhead to move to the next bore unobstructed. If you are Blueprinting a block the number will be just enough to allow the cutterhead to clear the block deck.

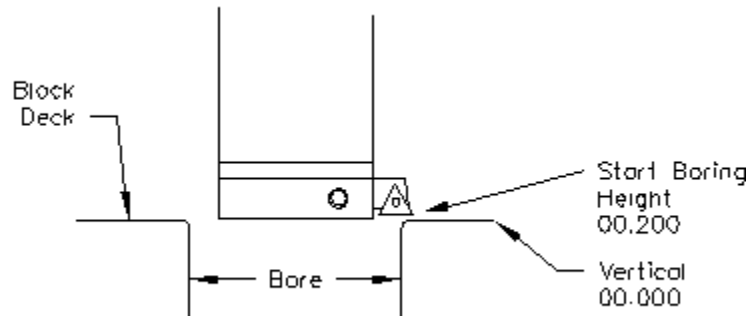


### Centering Height

When Blueprinting this stop is not needed. It should be the same as the block Clearance Height.

### Start Boring Height

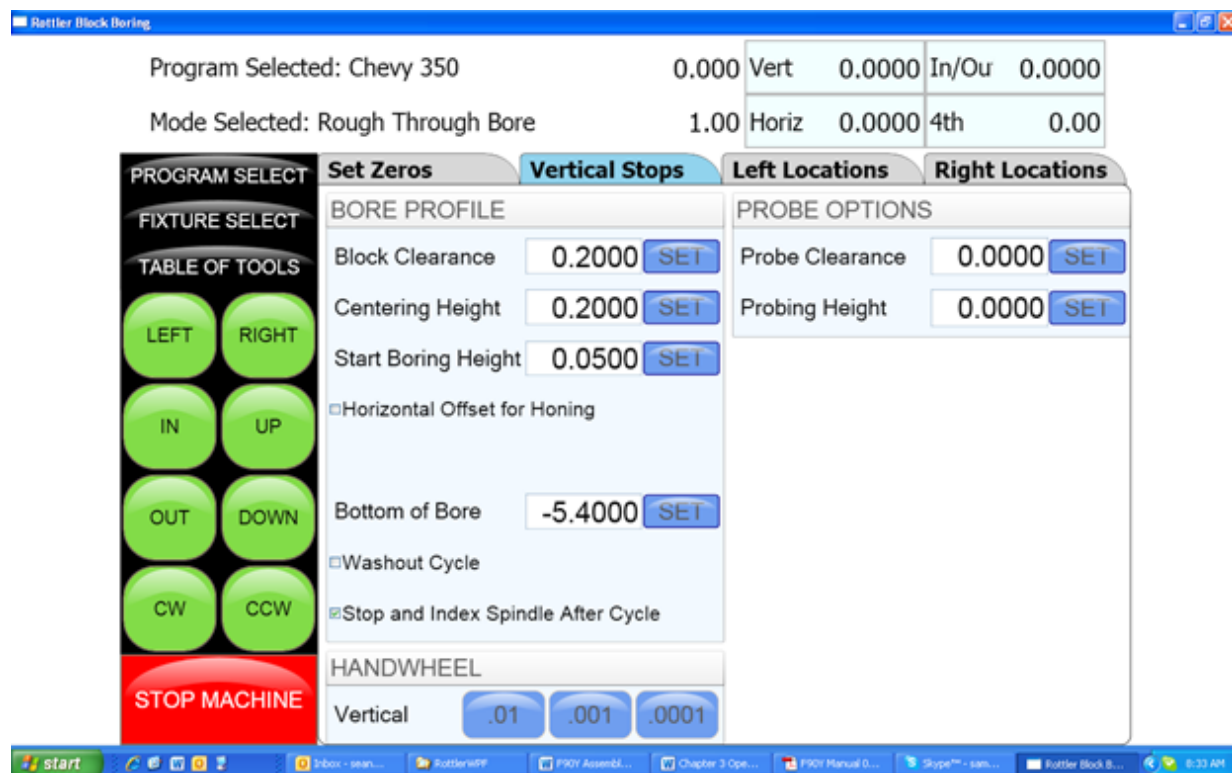
This is the distance above zero or the block deck where you want the cutterhead to start rotating and the downward feed to start. Generally this is just a short distance above the block deck to minimize the amount of time the machine bores through air.



Bottom of the Bore:

This is the distance below zero or the Block deck where you want the machine to stop boring and retract out of the cylinder. When the spindle retracts it will then go to the Block Clearance position.

This is an example of what the above program would look like on the vertical stops.



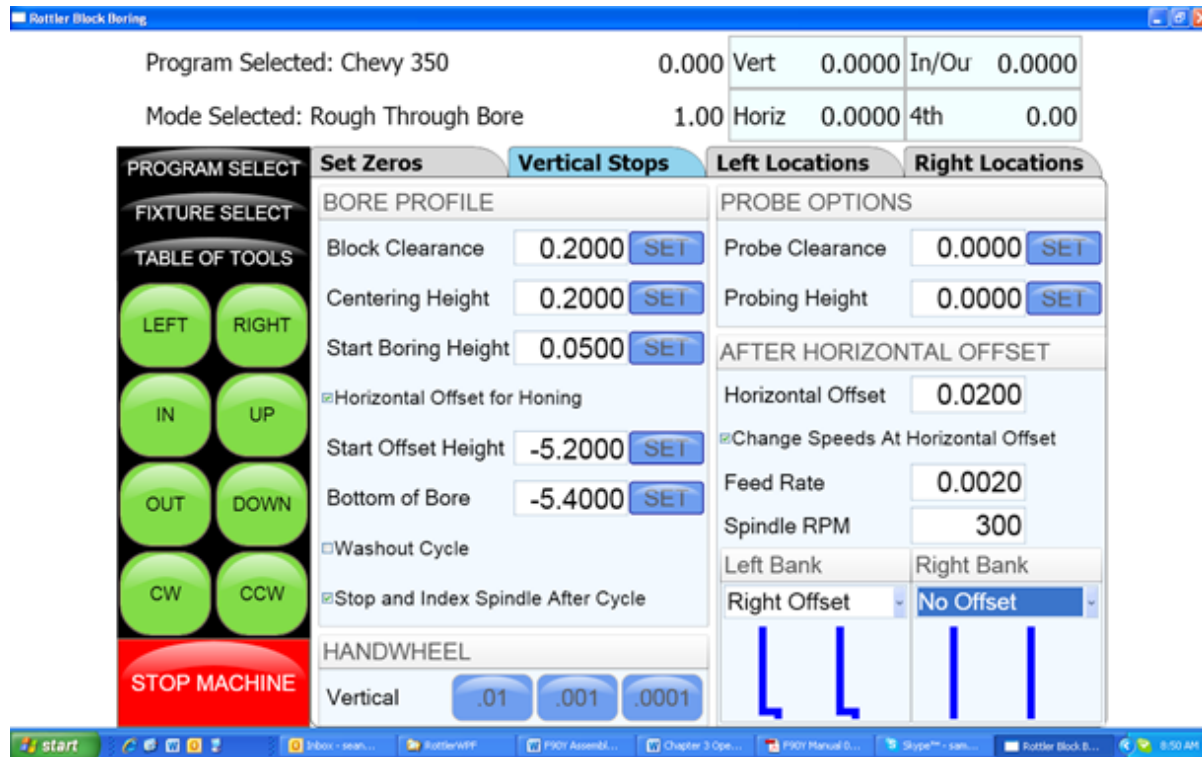
When Blueprinting the Probe is not used. It will be discussed later in this Chapter.



### Horizontal Offset for Honing

This feature is designed to offset the cutter at a certain height in the lower bore to cut out block web intrusions to make room for the honing process.

Checking this box will bring up another value to be entered on the left hand side of the screen.



#### Start Offset Height

This is the vertical depth at which the cutter will shift to the side to start cutting.

#### Horizontal Offset

This is the distance the cutter will offset from the bore center.

#### Change Speeds at Horizontal Offset

Often the clearance cut is much larger than the cut for the rest of the bore. For this you can check this box and enter a different RPM and Feed Rate. If a different speed and feed are not needed do not check this box and the same feed and speed will be used that was used to bore the cylinder.

For each bank (of a V Block) you can select the direction the offset should go.

#### Washout Cycle

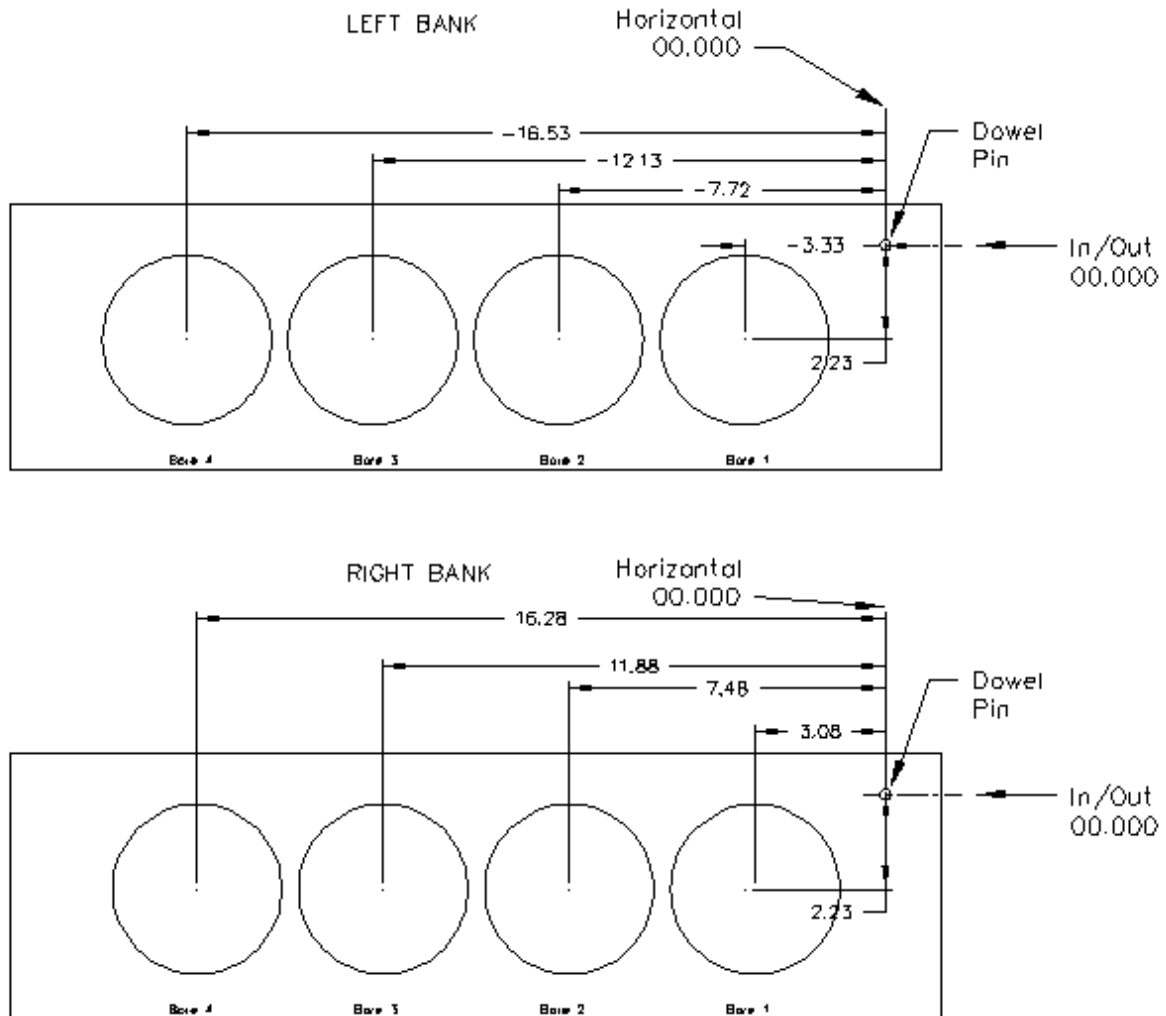
Checking this box will open another window on the right hand side of the screen. Here you can enter the RPM and number of revolutions that will be performed when the cutter reaches the Bottom of Bore position. In Through Boring this is not generally used. This is used when a certain type of finish is required on a counter bore or the bottom of a sleeve cut.

#### Stop and Index Spindle after Cycle

Checking this box will cause the spindle to be indexed to the three O'clock position after the cylinder has been bored but before it retracts. It will also offset to the left before the tool is retracted. This is the default setting. You would not want this check in an operation such as Lifter Boring.

### Bore Locations

To build a program you must set the Horizontal and In/Out Stops for the program. All Horizontal and In/Out stop are based from where their zero positions were set. The following illustration shows how the stop positions were derived. These stops would be used when blueprinting a block.



The following is an example of what the screens would look like for the above block.

**Left Locations**



**Right Locations**



The Horizontal and In/Out stops have now been set.

### Boring a Block

Once the Vertical, Horizontal and In/Out stops have all been entered the Spindle RPM and Feed Rate need to be entered. This is done on the Set Zeros screen. Once this is done you can go to the Left and/or Right Bore location screens and bore the cylinders.

Pressing the Bore Left for Bore Right buttons Will Bore all the cylinders that have Green bore button below them.

Pressing a Bore button once will turn that button Yellow. Any Yellow button will not be bored when the Bore Left or Right button is pressed.

Double clicking any Bore button will turn all the Bore button yellow EXCEPT the one that was double click.

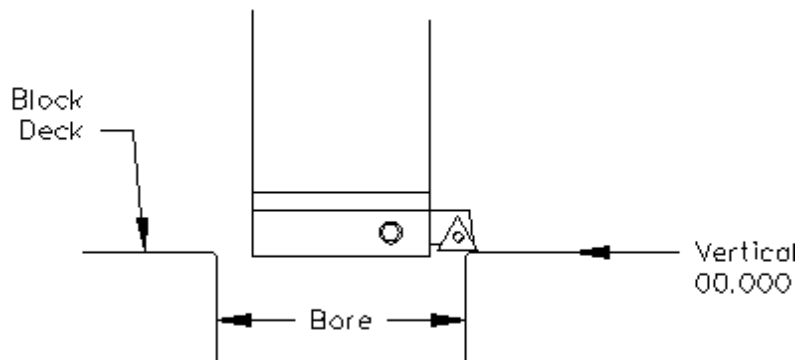
### Indicating

Even if you are not going to be boring a block to the blue print specifications it is recommended to have these values entered. It will speed up the process of indicating and probing a block by giving the operator a close estimate of bore location.

### Vertical Zero

There are three different ways to use the boring software, Blueprinting, Indicating and Probing. It is not unusual for all three modes to be used on the same size block. The vertical stops for these different operating programs will vary. Be sure the vertical stops are set correctly for the mode you are using.

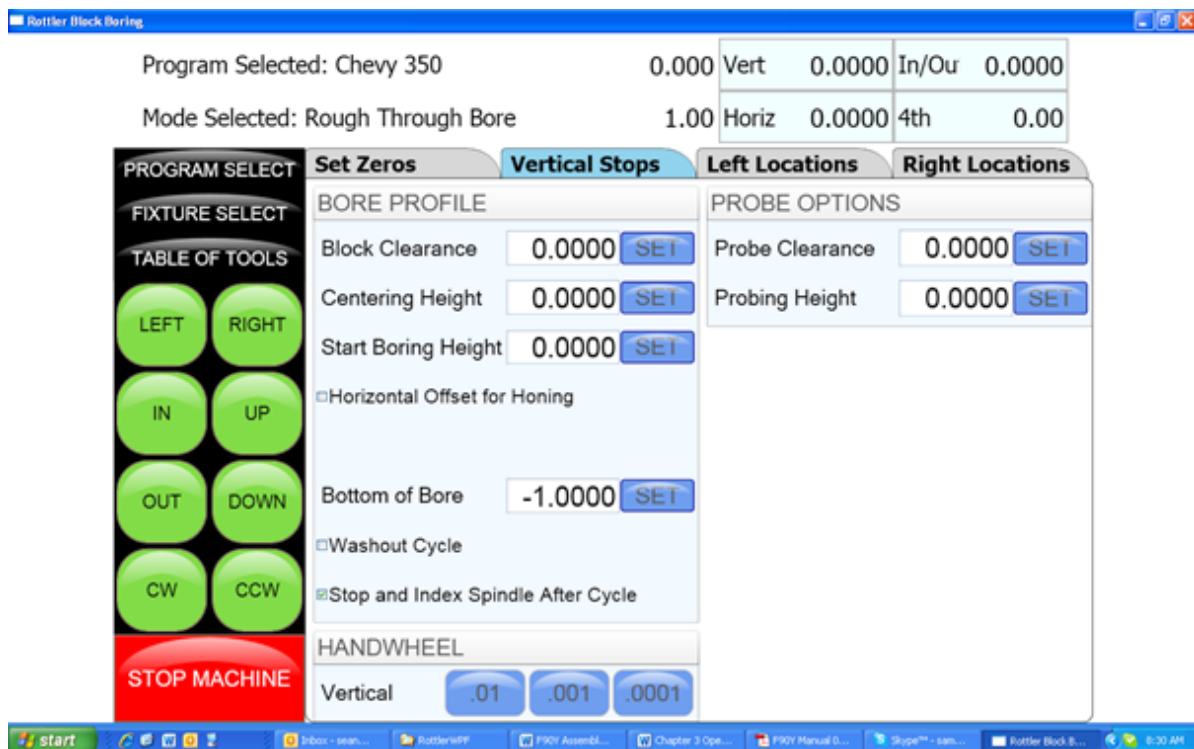
For this example the deck will be our zero for the Vertical axis. Insert a tool holder into the cutterhead you will be using to bore the block. Center the cutterhead over a cylinder. Using the Vertical Handwheel, bring the cutterhead down until the tool just touches the deck and press the Vertical Zero button. The display above this button will go to zero. The Vertical zero has now been set.



The zeros points for all axis have now been set. All the numbers entered from this point on will reference these zero positions. You are finished with the Set Zeros screen, select the next Tab to the Right.

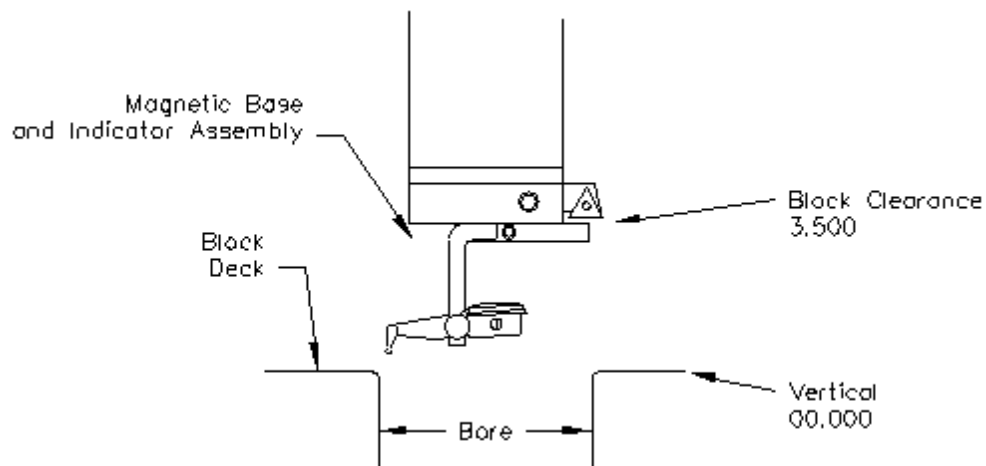
## Programming Vertical Stops

To build a program you must set the Vertical Stops for the program.



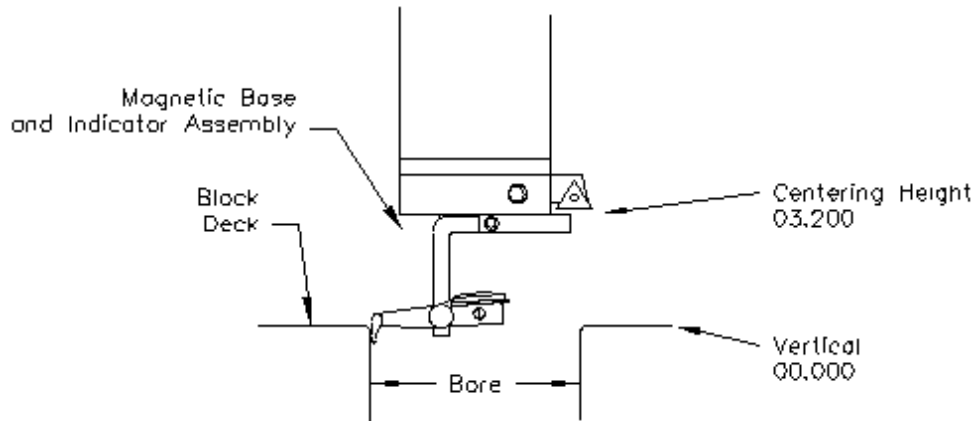
## Block Clearance

This is the distance above the zero position or block deck allowing the cutterhead to move to the next bore unobstructed. When you are indicating the cylinders in you must have this stop set so the indicator will clear the block surface when traveling to the next cylinder.



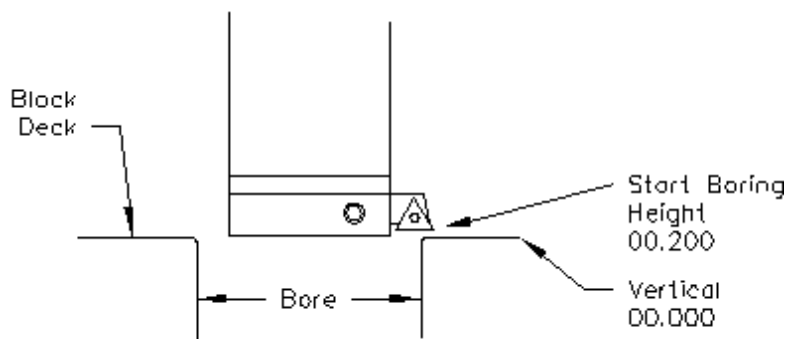
### Centering Height

This is a distance above the vertical zero where you will be manually centering the block. The drawing below is a typical set up for manual centering or indicating a cylinder.



### Start Boring Height

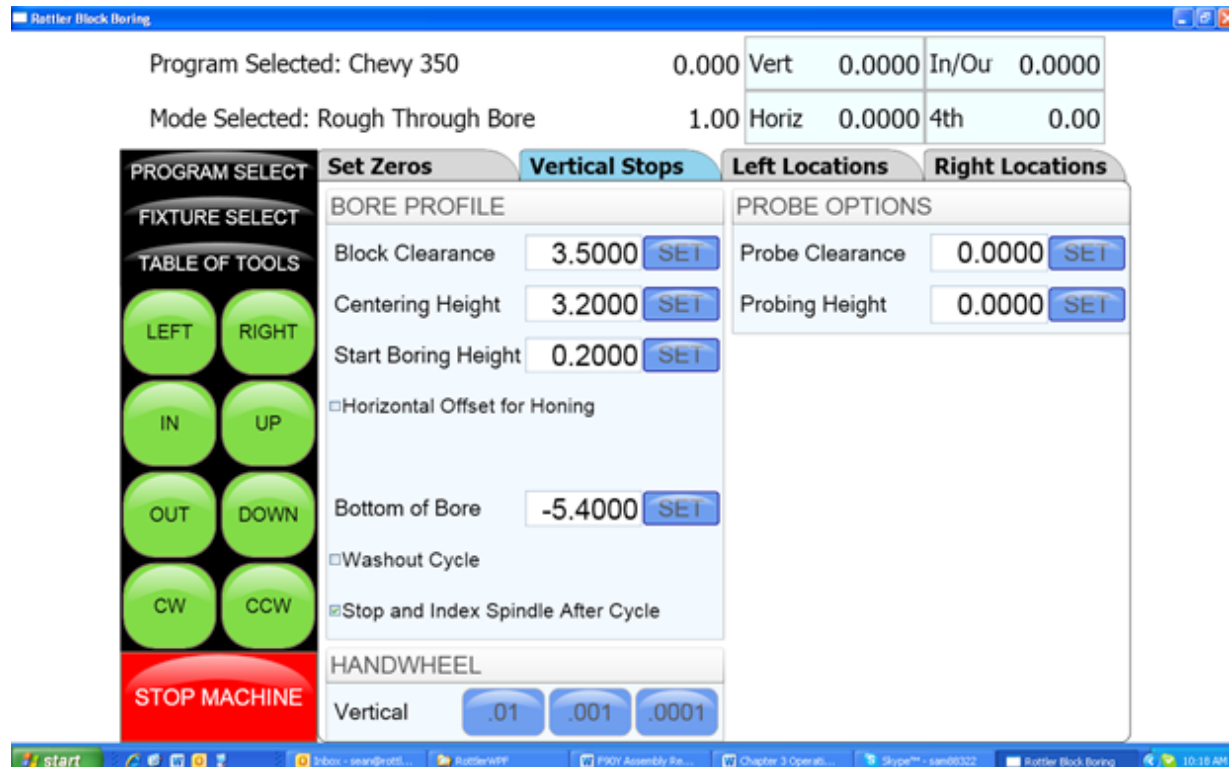
This is the distance above zero or the block deck where you want the cutterhead to start rotating and the downward feed to start. Generally this is just a short distance above the block deck to minimize the amount of time the machine bores through air. This will be a negative number.



### Bottom of the Bore

This is the distance below zero or the Block deck where you want the machine to stop boring and retract out of the cylinder. When the spindle retracts it will then go to the block Clearance position.

This is an example of what the above program would look like on the vertical stops.

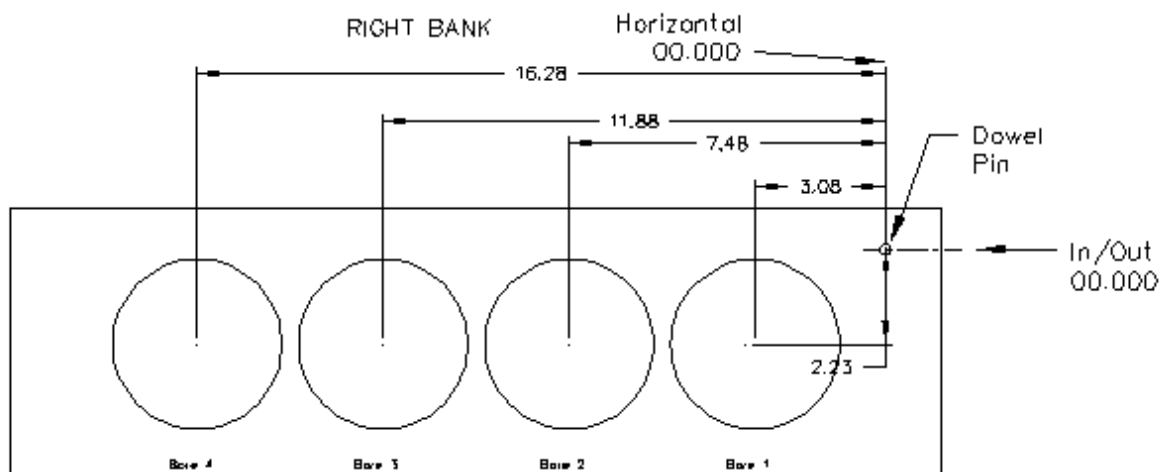
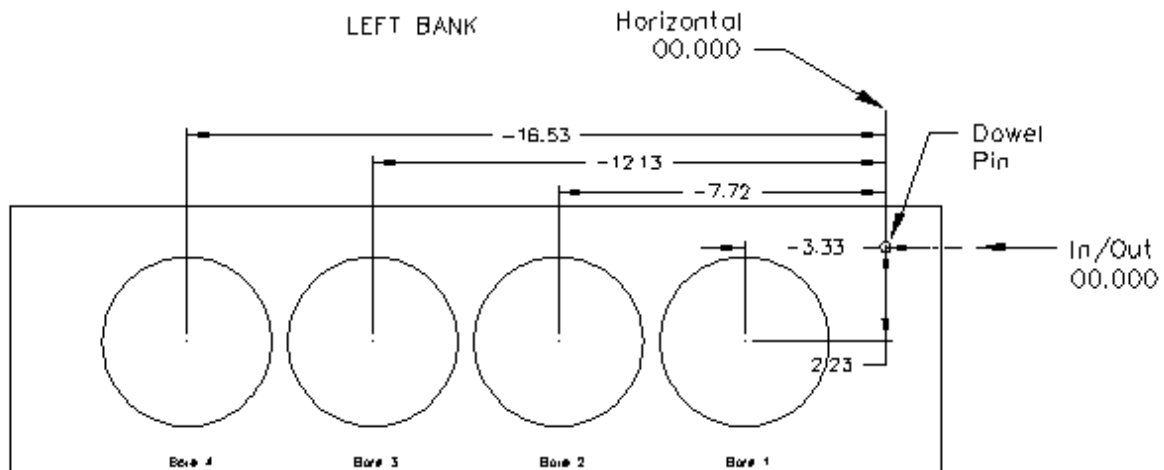


The Vertical stops have now been set. You are finished with the Vertical Stops screen, select Left and/or Right Locations.

### Bore Locations

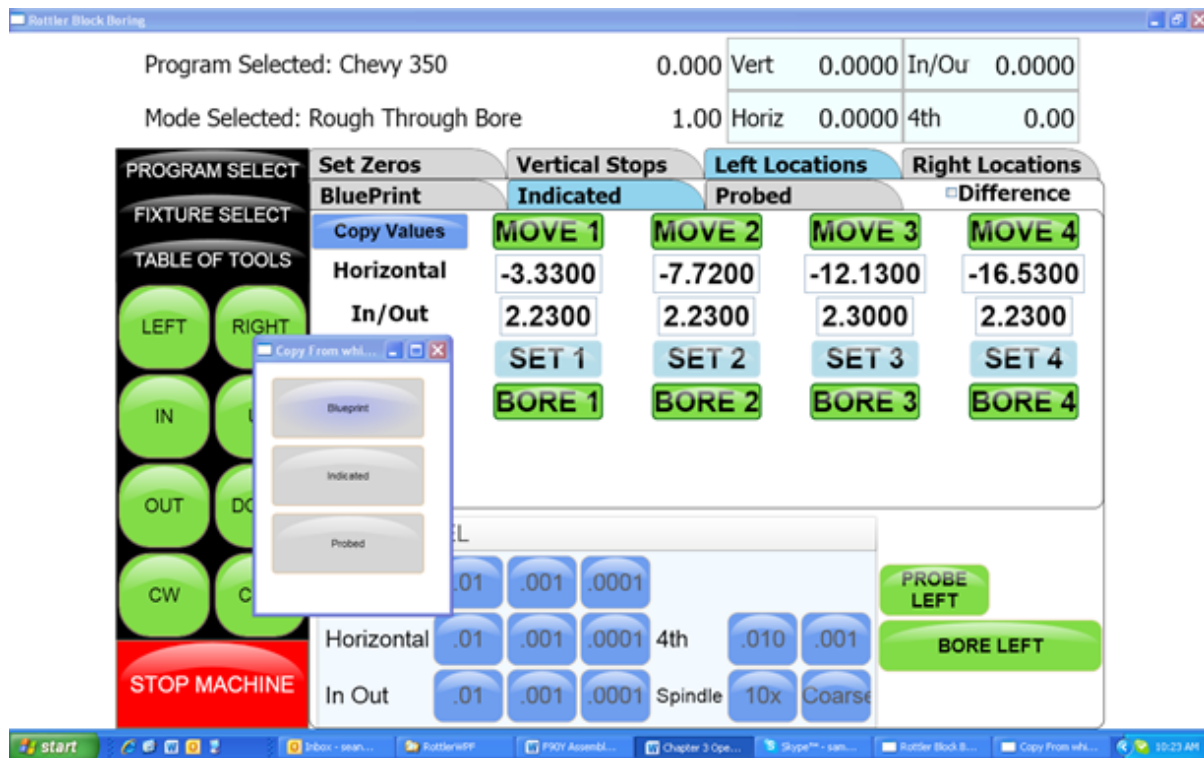
To build a program you must set the Horizontal and In/Out Stops for the program. There are eight (8) Horizontal and In/Out stops used in the boring program. All Horizontal and In/Out stop are based from where their zero positions were set.

Select Left Locations and the Blueprint. Program the blueprint values (or close approximation) into the Horizontal and In/Out stops. Do the same for the Right Locations.





Select Left Locations and then Indicated. If you have programmed the blueprint locations into this program then press Copy Values and then Blueprint. This will cause the values from the Blueprint page to be copied into the Indicated page. This give you a starting point to indicate the individual cylinder from.



Press the Move 1 button. The machine will move to the first cylinder and stop at the centering position. Manually indicate the cylinder in using the Horizontal and In/Out handwheel. Once the cylinder is centered press the Set 1 button. This will transfer the current position of the machine into the first set of Data Boxes. Repeat this process for all the cylinders that need to be indicated.

Press the Right Locations tab and repeat the above procedure for the cylinders to be indicated on the right bank.

### Boring a Block

Once the Vertical, Horizontal and In/Out stops have all been entered the Spindle RPM and Feed Rate need to be entered. This is done on the Set Zeros screen. Once this is done you can go to the Left and/ or Right Bore location screens and bore the cylinders.

Pressing the Bore Left for Bore Right buttons Will Bore all the cylinders that have Green bore button below them.

Pressing a Bore button once will turn that button Yellow. Any Yellow button will not be bored when the Bore Left or Right button is pressed.

Double clicking any Bore button will turn all the Bore button yellow EXCEPT the one that was double click.

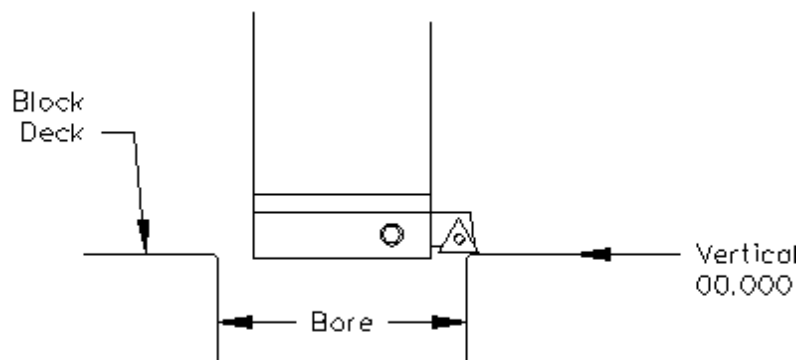
### Probing

Even if you are not going to be boring a block to the blue print specifications it is still recommended to have these values entered. It will speed up the process of indicating and probing a block by giving the operator a close estimate of bore location.

### Vertical Zero

There are three different ways to use the boring software, Blueprinting, Indicating and Probing. It is not unusual for all three modes to be used on the same size block. The vertical stops for these different operating programs will vary. Be sure the vertical stops are set correctly for the mode you are using.

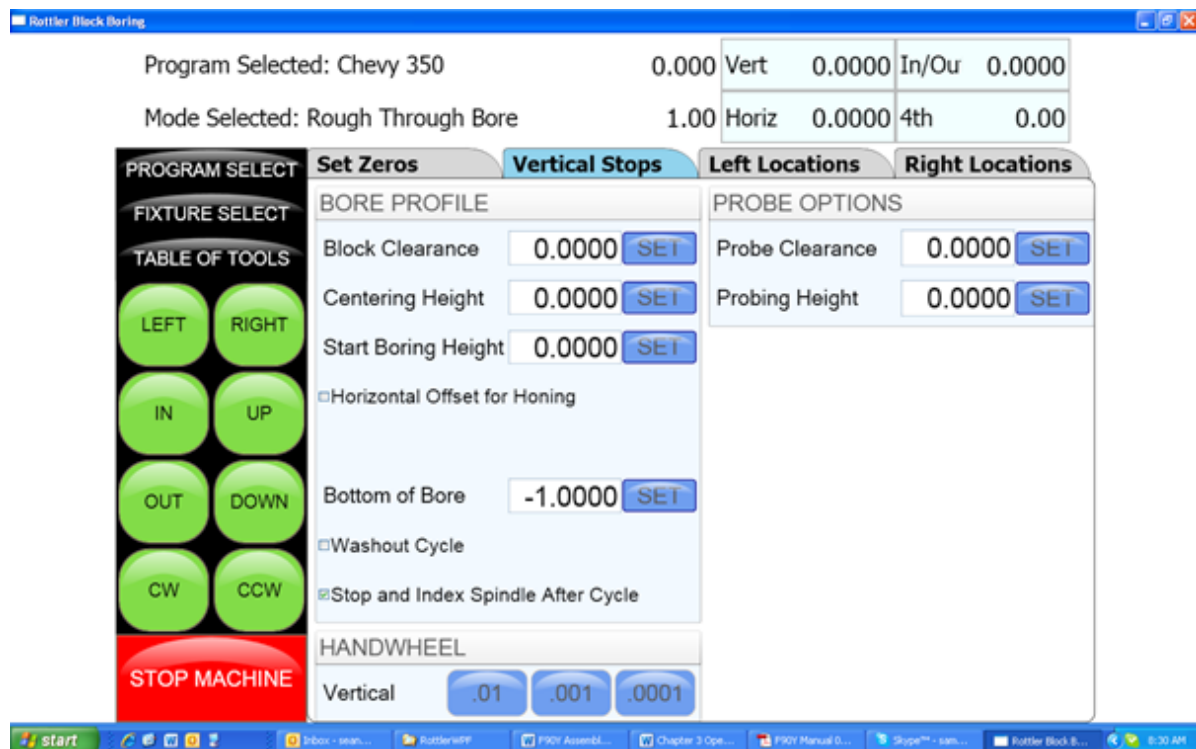
For this example the deck will be our zero for the Vertical axis. Insert a tool holder into the cutterhead you will be using to bore the block. Center the cutterhead over a cylinder. Using the Vertical Handwheel, bring the cutterhead down until the tool just touches the deck and press the Vertical Zero button. The display above this button will go to zero. The Vertical zero has now been set.



The zeros points for all axis have now been set. All the numbers entered from this point on will reference these zero positions. You are finished with the Set Zeros screen, select the next Tab to the Right.

## Programming Vertical Stops

To build a program you must set the Vertical Stops for the program.



### Block Clearance

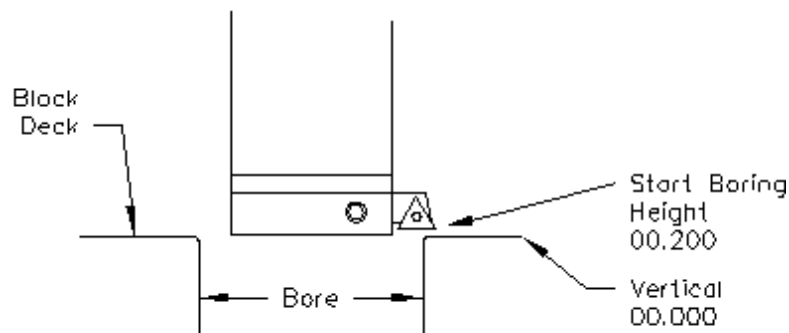
This is the distance above the zero position or block deck allowing the probe to move to the next bore unobstructed.

### Centering Height

This stop is not used when you are using the probing feature. It is recommended that it be set to the same value as the Block Clearance.

### Start Boring Height

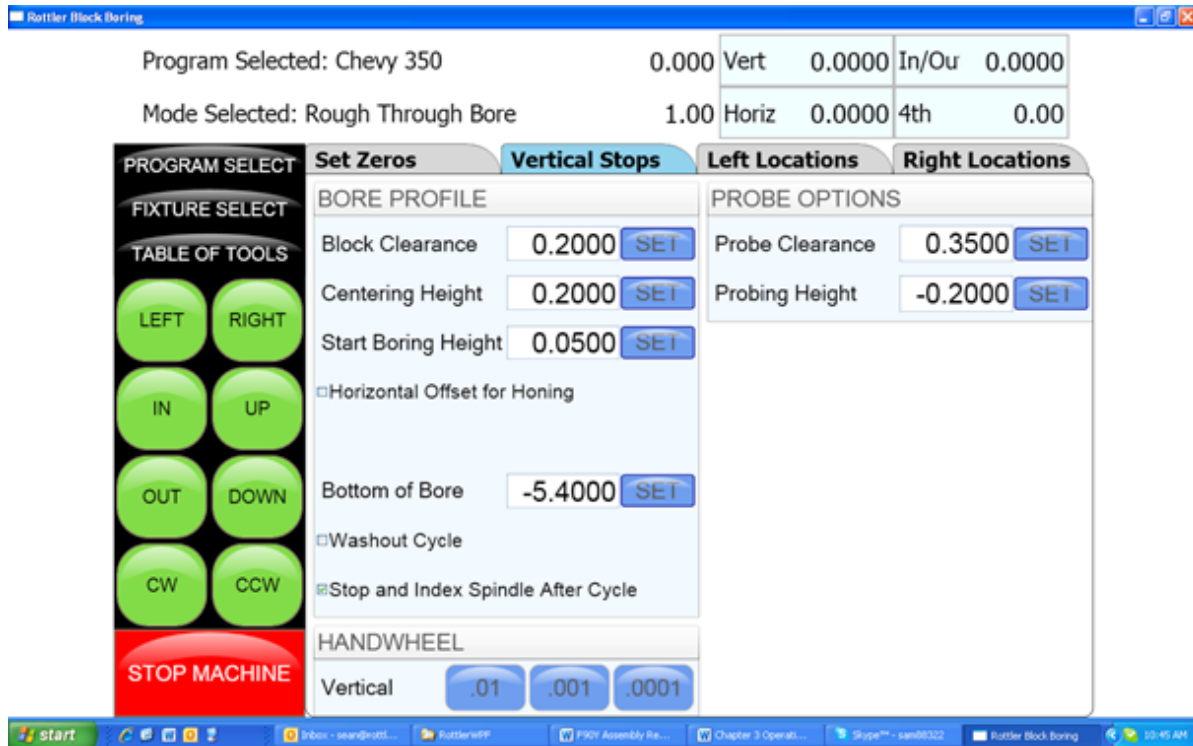
This is the distance above zero or the block deck where you want the cutterhead to start rotating and the downward feed to start. Generally this is just a short distance above the block deck to minimize the amount of time the machine bores through air.



### Bottom of the Bore

This is the distance below zero or the Block deck where you want the machine to stop boring and retract out of the cylinder. When the spindle retracts it will then go to the block Clearance position.

This is an example of what the above program would look like on the vertical stops.



### Probe Height

When using the optional Probe... install the probe into the spindle after your vertical positions have been set using the cutterhead.

Using the handwheel and bring the Probe down to the location in the cylinder you will be probing. Press the SET button next to Probe height. This will set the probing height position.

Using the handwheel move the probe up until it can safely move horizontal to the next cylinder. Press the SET button next to Probe Clearance. This will set the clearance height.

The Vertical stops have now been set. You are finished with the Vertical Stops screen, select Left and/or Right Locations.

### Bore Locations

To build a program you must set the Horizontal and In/Out Stops for the program All Horizontal and In/Out stop are based from where their zero positions were set.

Select Left Locations and the Blueprint. Program the blueprint values (or close approximation) into the Horizontal and In/Out stops. Do the same for the Right Locations.

Select Left Locations and then Probing. You can probe each cylinder individual by pressing the associated Probe button or you can probe the entire bank by pressing the Probe Left Button. This is the same procedure for the Right Bank.

### Probe Auto Center

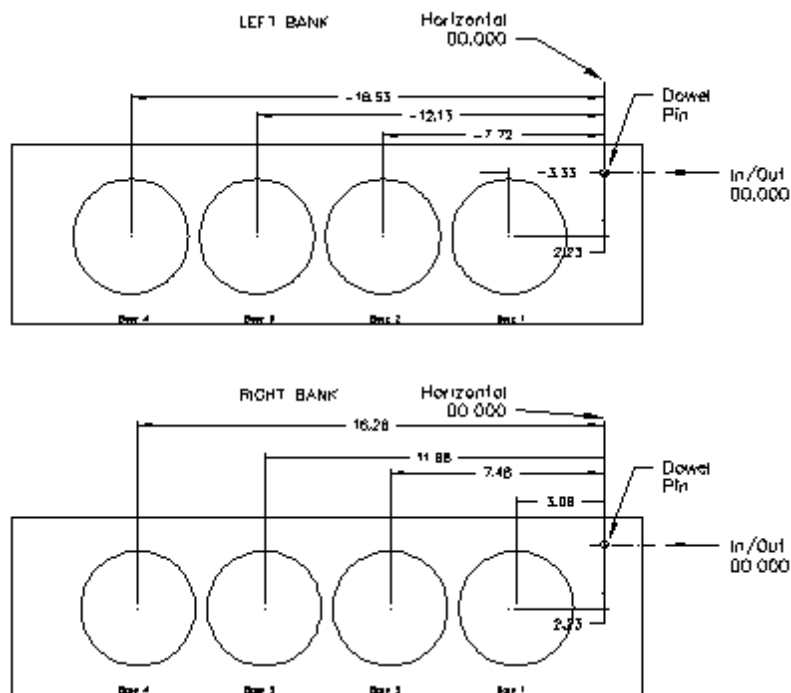
This feature is located on the Set Zero page. This allows easily find the center of a hole or cylinder. Roughly place the probe in the center of a cylinder. Press Probe Auto Center. The cylinder will be probed in 4 places, when finished the probe will move to the center of the probed cylinder. Pressing Horizontal and In/Out zero will then establish the center of that hole.

### Automatic Probing Procedure

The probe will move to the center of the cylinder to be probed. It will then move to the right at a slow rate until the side of the cylinder is touched, it will then back off slightly and touch the same spot again to confirm position. The probe will then touch off the cylinder in three more spots and retract from cylinder.

As each cylinder is probed the Probed Diameter, Horizontal and In/Out positions will be placed into the Data Boxes for the corresponding cylinder.

Press the Right Locations tab and repeat the above procedure for the cylinders to be probed on the right bank.



The Horizontal and In/Out stops have now been set.

### Boring a Block

Once the Vertical, Horizontal and In/Out stops have all been entered the Spindle RPM and Feed Rate need to be entered. This is done on the Set Zeros screen. Once this is done you can go to the Left and/ or Right Bore location screens and bore the cylinders.

Pressing the Bore Left for Bore Right buttons Will Bore all the cylinders that have Green bore button below them.

Pressing a Bore button once will turn that button Yellow. Any Yellow button will not be bored when the Bore Left or Right button is pressed.

Double clicking any Bore button will turn all the Bore button yellow EXCEPT the one that was double click.

### LOWER SLEEVE REPAIR

Lower Sleeve repair is meant to be used when the Upper Bore is smaller in Diameter than the Lower Bore. Therefore the spindle has to offset in the Horizontal to clear the Upper Bore.

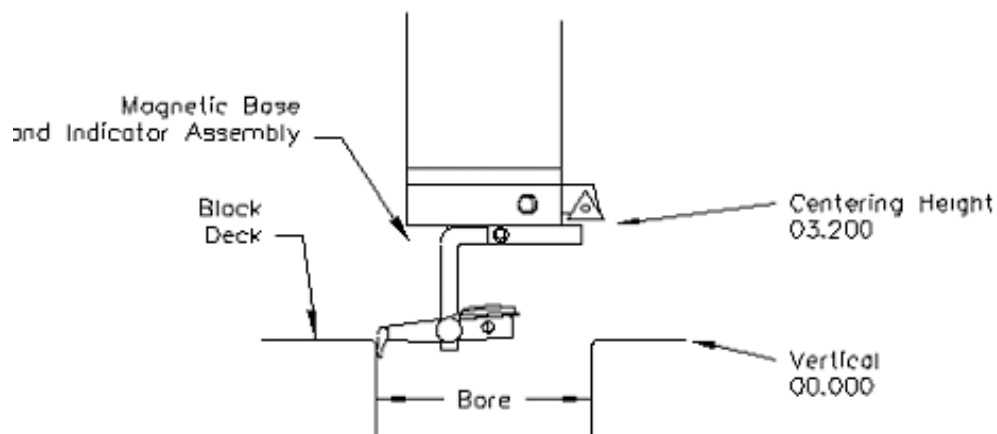
The Lower Sleeve Repair mode operates the same as the Cylinder Bore Mode with the exception of additional parameters in the Vertical Stops Tab.

### Block Clearance

This is the distance above the zero position or block deck allowing the cutter head to move to the next bore unobstructed. If you are blueprinting a block the number will be just enough to allow the tool in the cutter head to clear the block deck.

### Centering Height

This is a distance above the vertical zero where you will be manually centering the block. The drawing Below is a typical set up for manual centering or indexing a cylinder.

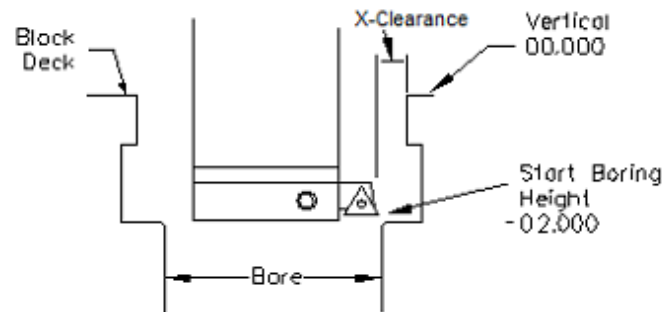


### X-Clearance

This is the parameter will index the cutter pointing in the x+ direction, (right) three O'clock position. The amount you set will allow the tool to move so it clears the block deck of the upper bore does not contact the block or upper bore. See drawing below. Machine moves in the X axis, and can be set to positive or negative movement. Should be set to negative value ex... -.200 (-5mm)

**180 index (check box)**

This will make the spindle index with the tool pointing in the (X-) direction, (left) nine O'clock position. Should set X-clearance to a positive value, ex... .200 (5mm)

**X-Overshoot**

This refers to the amount that it will overshoot the machine to help eliminate any backlash. **IMPORTANT-** If your X-clearance is negative (-) the overshoot should be a positive value, if the X-clearance is positive the overshoot should be negative (-)

**Start Boring Height**

This is the distance above zero or the block deck where you want the cutter head to start rotating and the downward feed to start. Generally this is just a short distance above the lower sleeve to minimize the amount of time the machine bores through air.

**Bottom of the Bore**

This is the distance below zero or the Block deck where you want the machine to stop boring and retract out of the cylinder. When the spindle retracts it will then go to the Block Clearance position.

This is an example of what the above program would look like on the vertical stops.

**Stop and Index Spindle after Cycle**

Checking this box will cause the spindle to be indexed to the three O'clock position after the cylinder has been bored but before it retracts. It will also offset to the left before the tool is retracted. This is the default setting. You would not want this check in an operation such as Lifter Boring.

## Cylinder Bore Mode 4th Axis

**NOTE:** *The program with the 4th axis installed works basically the same as the 3 axis mode. ONLY the differences in operation and screens will be discussed here. Carefully read through the 3 Axis mode and then the 4th axis mode for operation and building programs.*

Select Cylinder Bore and then Through Bore on the control panel. This will bring up the boring program with the Set Zeros tab shown.

### Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines' travel. Each axis (except the Spindle rotation) will need to have a zero point set for the machine to operate from.

### 4th Axis (Rotational) Zero

The Zero position for the 4th (Rotational) Axis should be preset from the factory. If the zero needs to be reset use the following procedure.

There are three (3) flats cut onto the Head Stock Plate. Use the middle flat to set the rotational zero. Using an indicator off of the spindle indicate the middle flat to Zero all the way along it. Use the 4th Axis hand wheel to do this. When the middle flat is indicated in press the 4th Axis Zero button. You 4th (Rotational) Zero is set.

### Finding the In/Out (Y) Axis Zero with 4th Axis

The Head Stock Plate has a hole in it next to the Middle Flat. This hole is centered on the center of the Main and Cam locator shafts.

### Building Programs with the 4th Axis

Programs are built the same as in the 3 Axis mode with the exception of setting the Angle for each Bank. The Left and the Right Locations page each have an Angle Data Box. Here you enter the angle of each bank from the 4th Axis (Rotational) zero position. The zero position is with the Cam and Crank Locators lined up vertically.

**Example:** On a Chevy 350 the Left bank would be positive 45 Degrees and the Right Bank would be a negative -45 Degrees.

### Setting Vertical Clearance with 4th Axis

It is very important when setting your Vertical and Probe Clearance height that you be sure to account for the Roll Over of the block from bank to bank. When in an automatic program the block will roll from the Left Bank to the Right bank at the Left Bank Bore1 position. It will also rotate from the Bore1 position when going from Right Bank to Left.



### Table of Tools for 3 and 4th Axis Bore Mode

**NOTE: The Table of Tools is not needed to run the Rottler automatic programs. It is recommended that it not be used except by the advanced operator.**

Building a Program with Table of Tools:

Build the program as described above for 3 and 4 Axis programs using the same vertical zero locations.

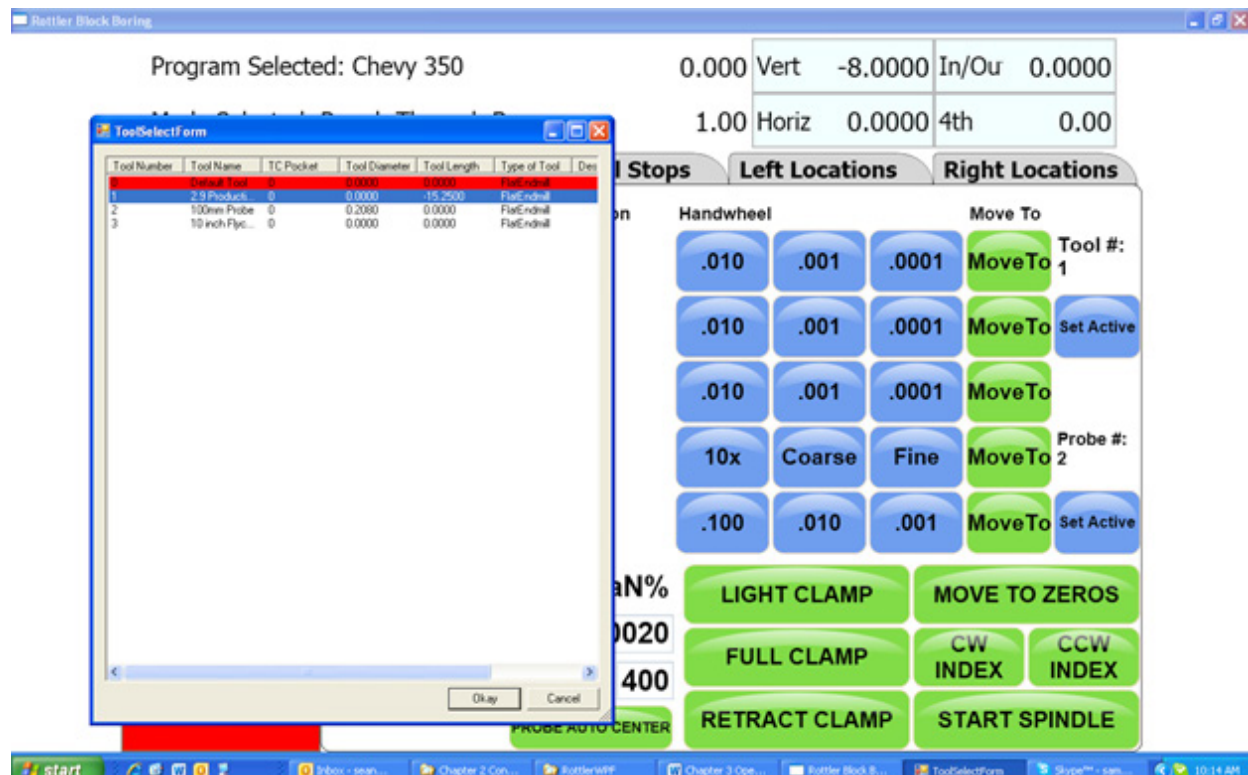
Put the tools to be used into the Table of Tools as described in Chapter 2. In Bore mode you are not referencing another vertical location such as the Crank centerline so the Z Touch off Location will remain at zero.

### Assigning Tools

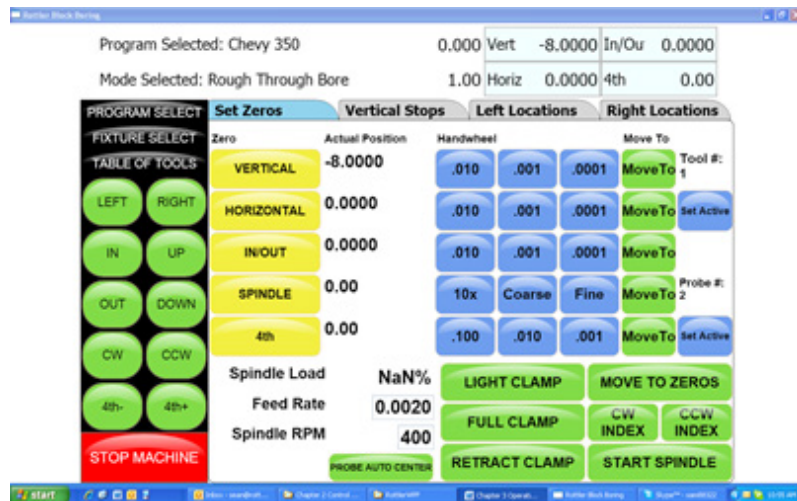
Tools to be used in the boring operations are set on the Set Zeros page. To select a Tool, double click on Tool # on the right side of the screen. This will bring up the Table of Tools window. Highlight the tool you will be using, such as 2.9 Production Stub and select OK.

Do the Same to select the Probe you will be using, such as 100mm Probe.

**NOTE: The Tool highlighted in red is the currently Active tool.**



The following shows what the screen will look like with two tools assigned but none of them active. Default Tool 0 is set active and only shows on the Table of Tools screen.



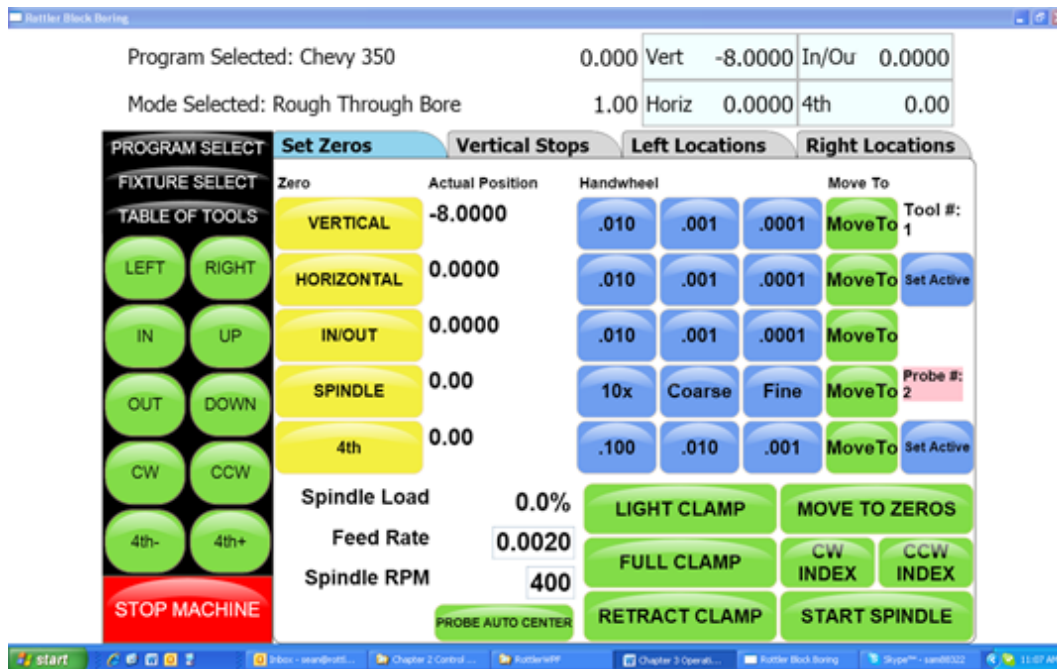
### Setting Tools Active

Physically install the first tool you will be using in the program. For this example physically install the 100mm Probe into the spindle. Press the Set Active button below the Probe #. The Tool Change Form will Open. This is to vary your Vertical Tool Length and Probe Diameter. Select OK and then OK again on the spindle warning page.

**IMPORTANT:** The Tool Diameter on this page is used for the Probe. This must be set to the actual Diameter of the probe when probing cylinders. The Tool Diameter is NOT used for Boring Bars, End Mills etc... in the Rottler Bore program.



The Currently Active tool in a program will be highlighted in Pink on the Set Zero page.

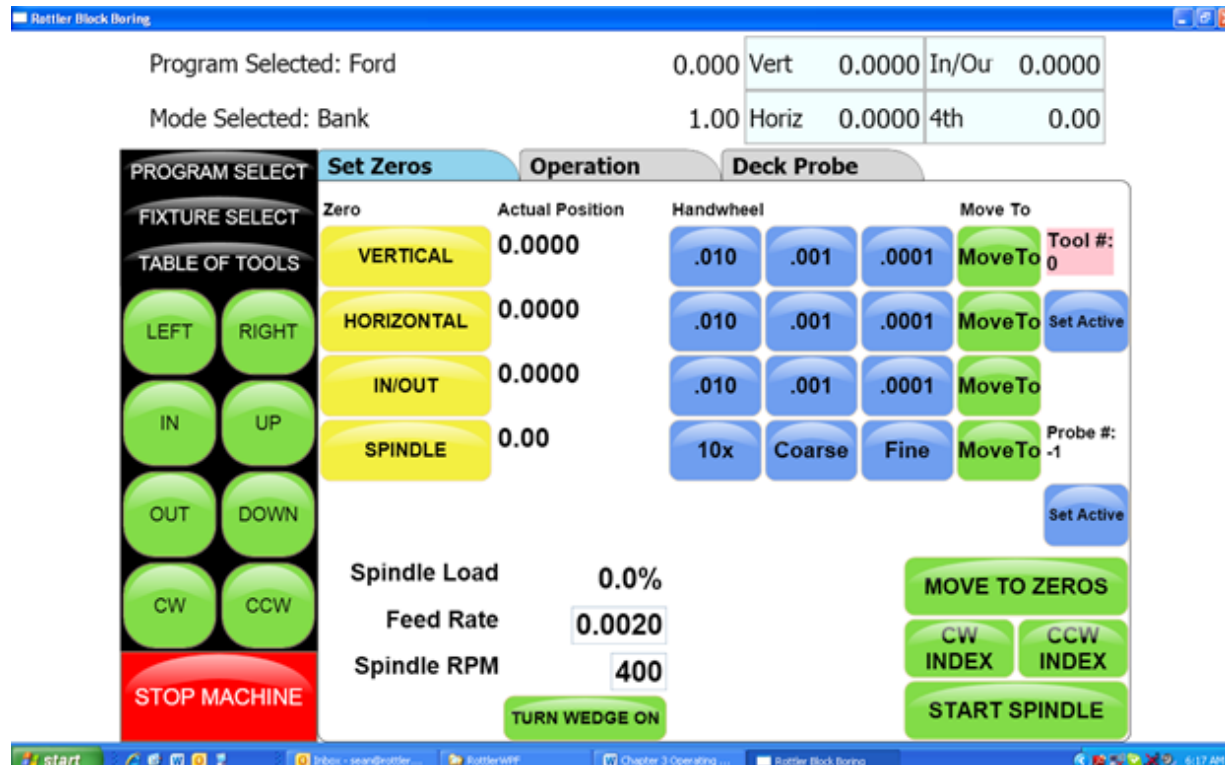


If you attempt to run the Probing Cycle with the Tool # active the machine will automatically move to the Tool Change clearance position and open the Tool Change Window so you can change the tool and vise versa.

## Mill Mode 3 Axis

### Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines' travel. Each axis will need to have a zero point set for the machine to operate from.



### Horizontal Zero

For this example we are going to set the Horizontal Zero approximately 1/4" from the right hand side of the work piece.

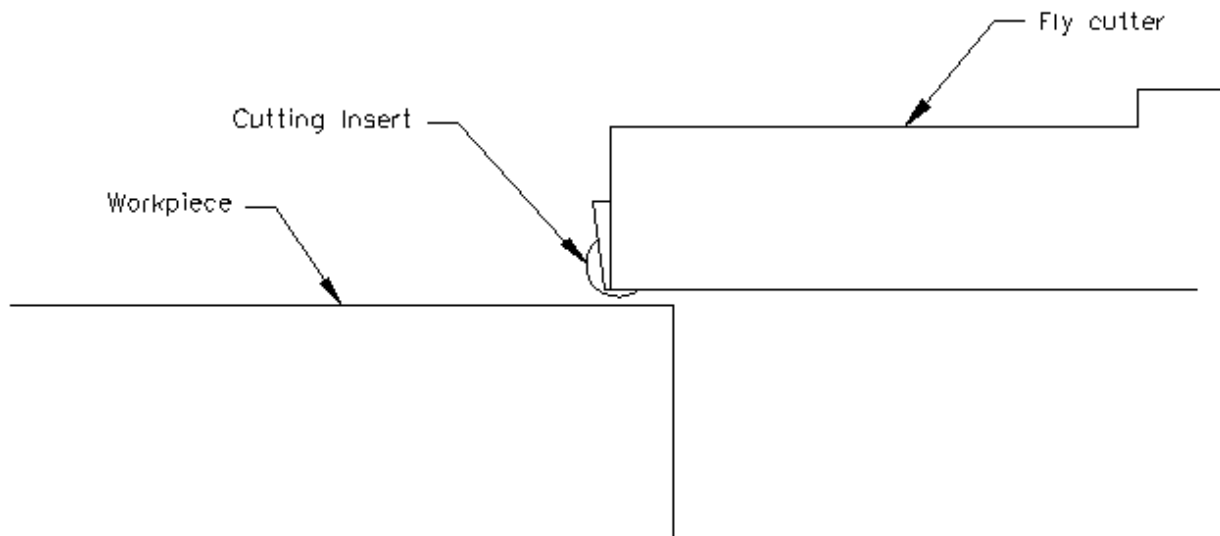
### In/Out Zero

For this example we are going to set the In/Out Zero at the center line of the work piece.

### Vertical Zero

For this example the Vertical Zero will be at the deck height of the work piece.

**Example:** Install the Milling cutterhead you will be using into the machine. Move the In/Out axis and center the work piece under the spindle. Press the In/Out Zero button here. Move the Horizontal Axis to that the cutter is overhanging the work piece about 1/4". Bring the Vertical Axis down until the cutter is just above the work piece. At this time it should look similar to the drawing below.



Set the Spindle RPM and Feed rate on this screen.

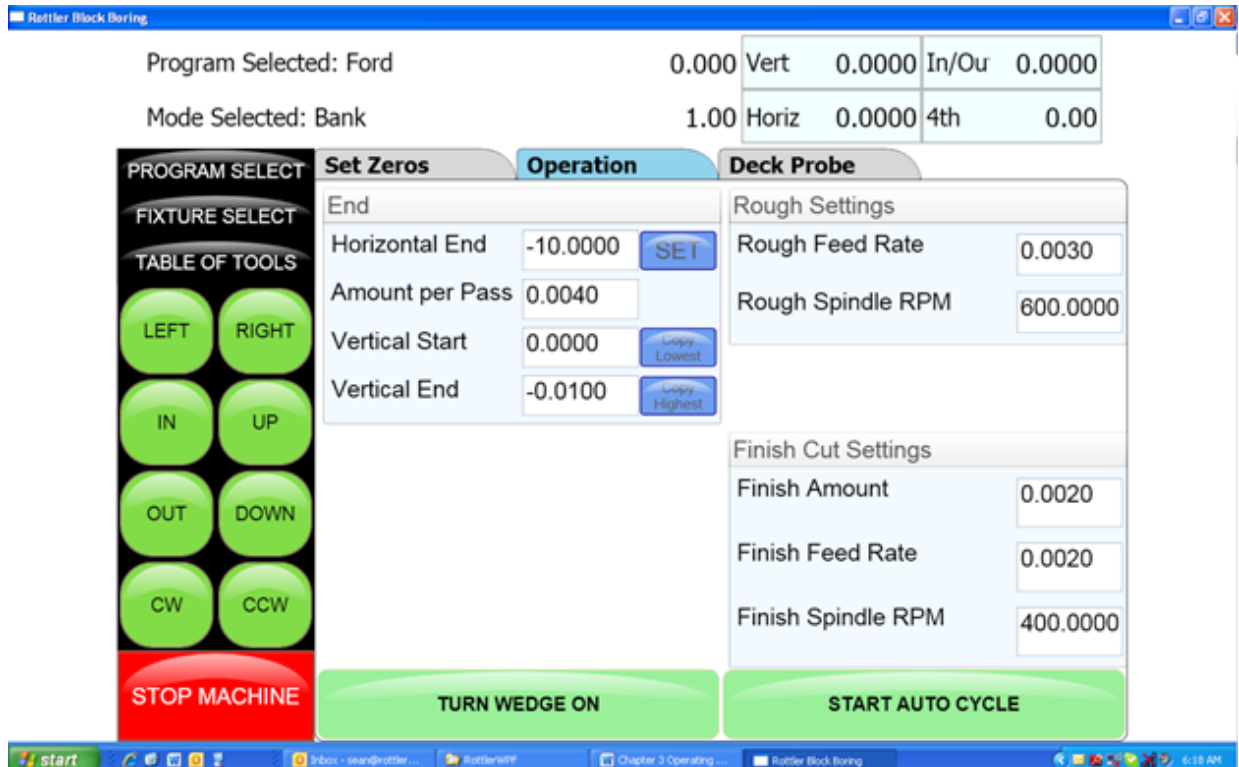
Start the spindle. Press the Vert .001 button to put the handwheel in .001 per detent. Slowly move the spindle downward until you can hear or see the cutter just touch the block. Press your Vertical Zero button here. Press the Right travel button to feed the spindle off of the work piece. When the cutter has cleared the work piece press the Right travel button again to stop the feeding. Press the Horizontal Zero here.

Your zero position for all axis have now been set.

## Mill Operation

**IMPORTANT:** Do not move the machine In/Out with the Wedge on. The Wedge comes on automatically when the Mill program is entered. If you need to move the machine In/Out to center on the work Piece use the turn Wedge On/Off button at the bottom of the page to do so. Make sure the Wedge is back on when you start the cycle.

This screen is used to set certain parameters the F79A will use to run the automatic cycle.



## End

### Horizontal End

This displays the current end stop value. To enter a new value press the display and a pop-up numerical key pad will appear. Press the desired end stop value and then ENTER. This is the distance from where the Horizontal Zero was set. You can move the fly cutter manually to the end of the cut and press the SET button. This will automatically put the Horizontal End value in for you.

### Amount Per Pass

This is the amount of material removed from the work piece on each pass of the cutterhead.

### Vertical Start

This is the Vertical Position the machine will start cutting at. This value is usually Zero which is usually the starting Deck Height.

### Vertical End

This is the Vertical Position the machine will stop cutting at. It is the Total amount of material you want to remove in the Milling process.

### Copy Lowest Copy Highest

These buttons will be discussed in the Mill Probing section of this Chapter.

### Rough Settings

These values are used when taking multiple passes on a work piece. These values can be set high to remove material quickly. The finish on the work piece does not matter in these settings. There will be a final pass that will apply the finish to the work piece.

#### Rough Feed Rate

Enter the desired Roughing Feed Rate;

#### Rough Spindle RPM

Enter the Desired Roughing Spindle RPM.

### Finish Cut Settings

These values will be used for the last pass the machine will make on the work piece. These will determine the finish left on the work piece.

#### Finish Amount

Enter the amount to be removed on the last pass.

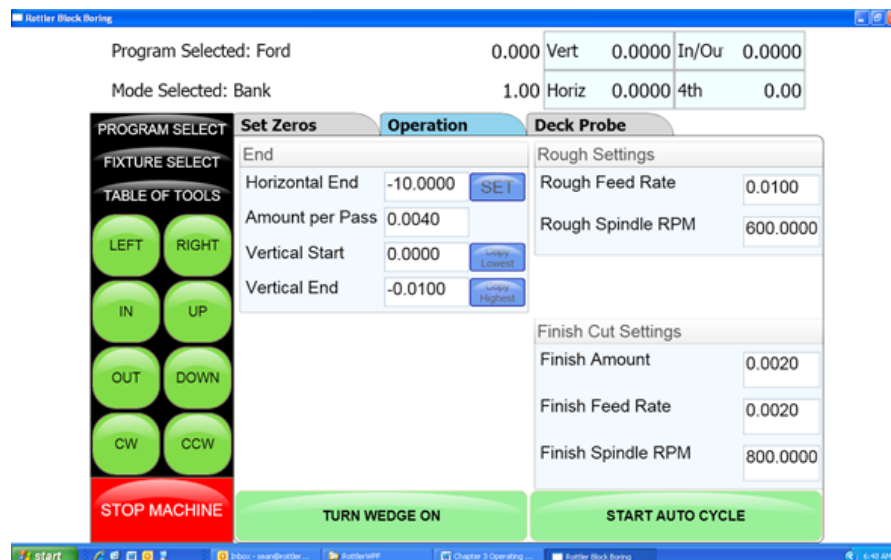
#### Finish Feed Rate

Enter the desired Finish Feed Rate.

#### Finish RPM

Enter the desired Finish Spindle RPM.

NOTE: You do not need to have evenly divisible numbers in these sections. The computer will do the math to remove the correct amount each time and for the final pass to be at the amount you set.



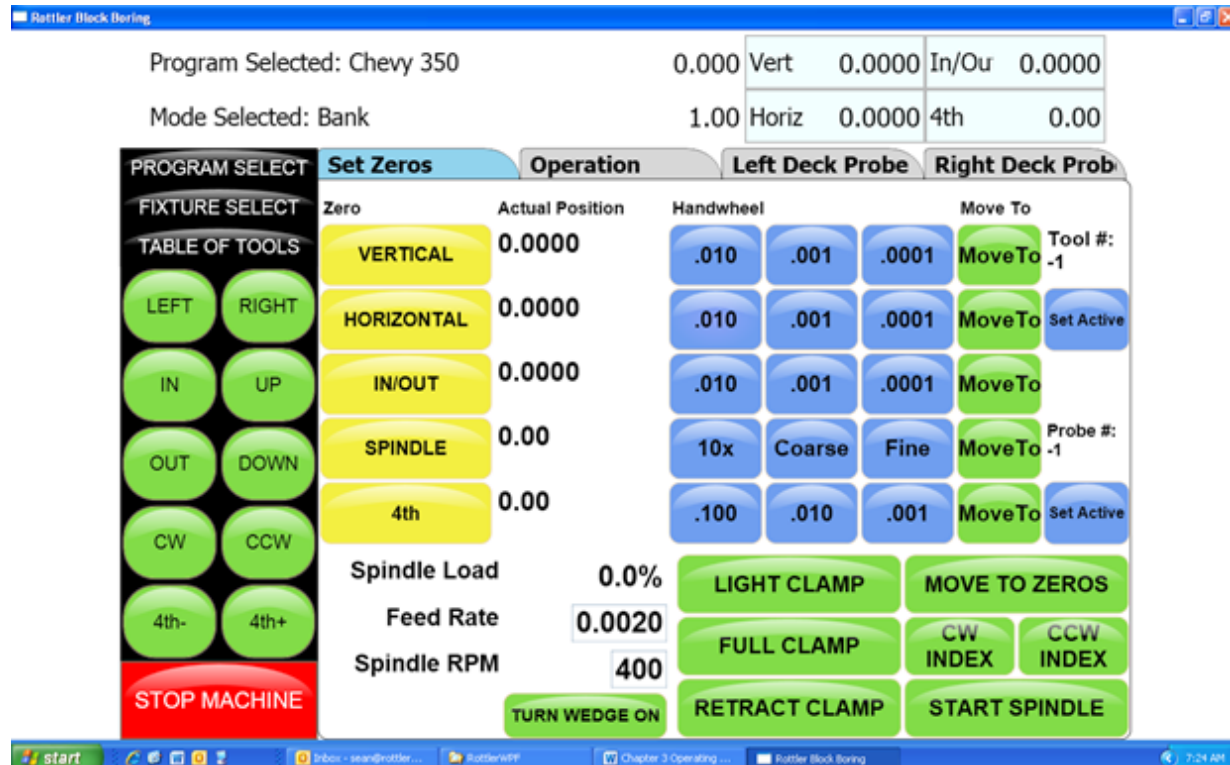
### Start Auto Cycle

Pressing this button will start the machines automatic cycle. The cycle to be run is determined by the setting on this page. If you only require one pass to be made, do not enter any values into the Rough Setting, only the Finish Cut Settings.

## Mill Mode 4th Axis

### Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines' travel. Each axis will need to have a zero point set for the machine to operate from.



### Horizontal Zero

For this example we are going to set the Horizontal Zero approximately  $\frac{1}{4}$ " from the right hand side of the work piece.

### In/Out Zero

For this example we are going to set the In/Out Zero at the center line of the work piece.

### Vertical Zero

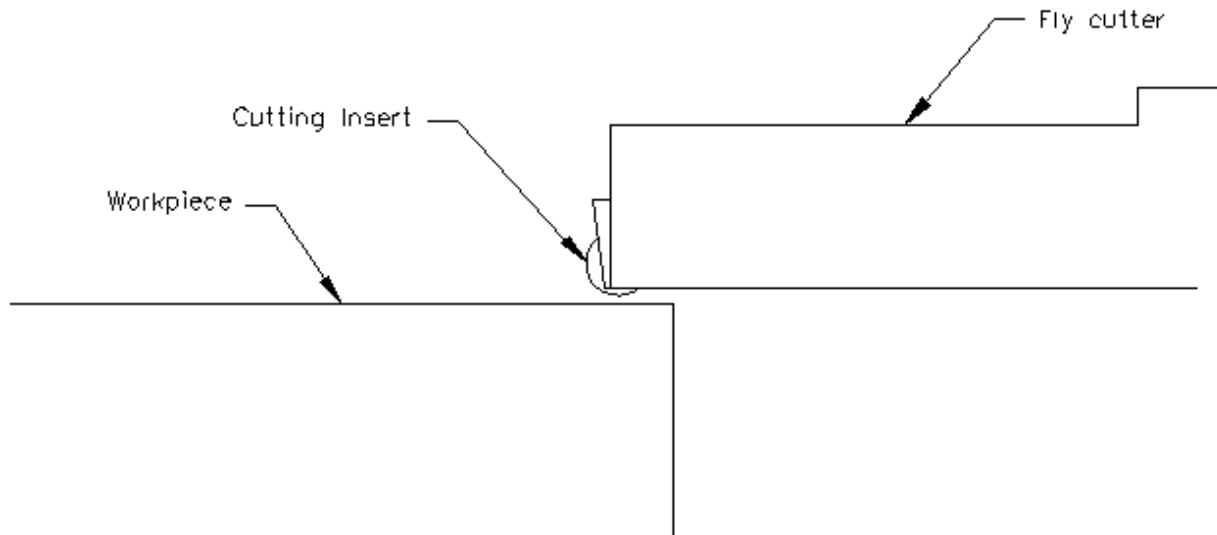
For this example the Vertical Zero will be at the deck height of the work piece.

## CAUTION

When setting the vertical zero it is important to check the deck height on both banks of the block before starting a cycle. It is possible that the right bank may be higher than the left bank where the vertical zero was set. This would cause a crash when the block rotated and the cycle was started on the right side.



**Example:** Install the Milling cutterhead you will be using into the machine. Move the In/Out axis and center the work piece under the spindle. Press the In/Out Zero button here. Move the Horizontal Axis to that the cutter is overhanging the work piece about  $\frac{1}{4}$ ". Bring the Vertical Axis down until the cutter is just above the work piece. At this time it should look similar to the drawing below.



Set the Spindle RPM and Feed rate on this screen.

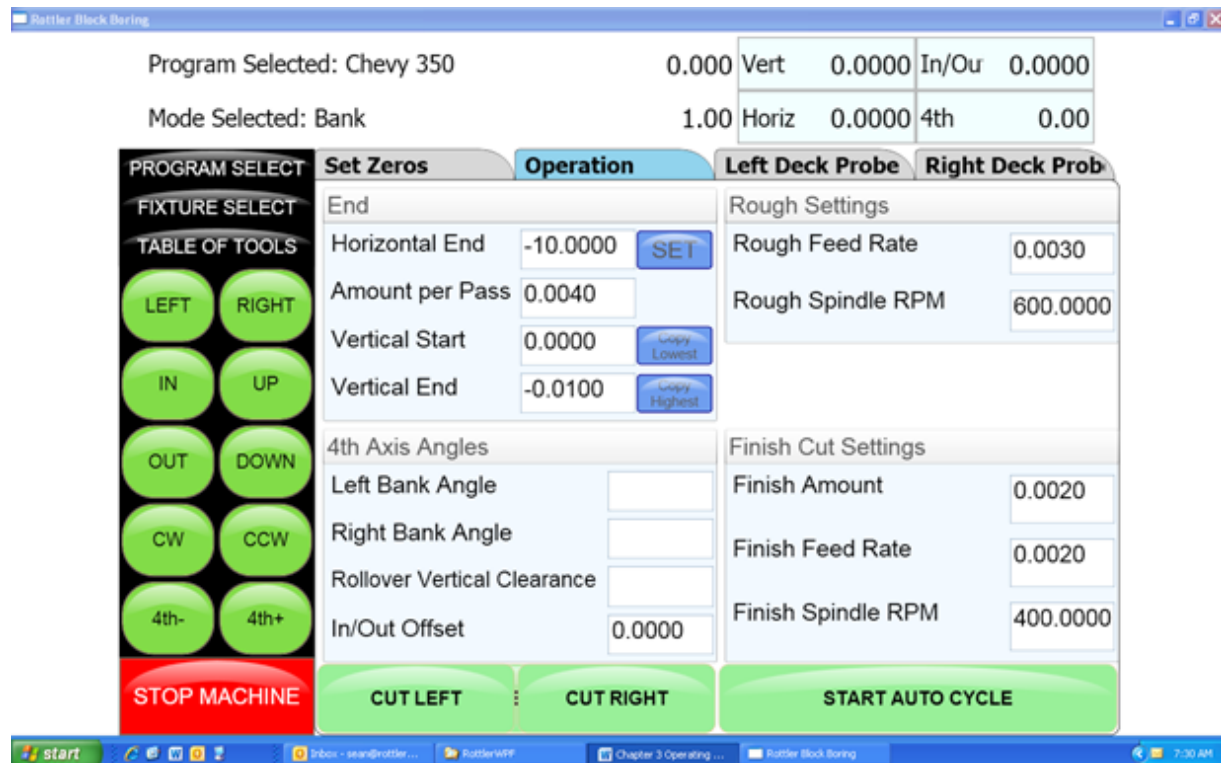
Start the spindle. Press the Vert .001 button to put the handwheel in .001 per detent. Slowly move the spindle downward until you can hear or see the cutter just touch the block. Press your Vertical Zero button here. Press the Right travel button to feed the spindle off of the work piece. When the cutter has cleared the work piece press the Right travel button again to stop the feeding. Press the Horizontal Zero here.

Your zero position for all axis have now been set.

## Mill Operation

**IMPORTANT:** Do not move the machine In/Out with the Wedge on. The Wedge comes on automatically when the Mill program is entered. If you need to move the machine In/Out to center on the work Piece use the turn Wedge On/Off button at the bottom of the page to do so. Make sure the Wedge is back on when you start the cycle.

This screen is used to set certain parameters the F79A will use to run the automatic cycle.



## End

### Horizontal End

This displays the current end stop value. To enter a new value press the display and a pop-up numerical key pad will appear. Press the desired end stop value and then ENTER. This is the distance from where the Horizontal Zero was set. You can move the fly cutter manually to the end of the cut and press the SET button. This will automatically put the Horizontal End value in for you.

### Amount Per Pass

This is the amount of material removed from the work piece on each pass of the cutterhead.

### Vertical Start

This is the Vertical Position the machine will start cutting at. This value is usually Zero which is usually the starting Deck Height.

### Vertical End

This is the Vertical Position the machine will stop cutting at. It is the Total amount of material you want to remove in the Milling process.

**Copy Lowest Copy Highest**

These buttons will be discussed in the Mill Probing section of this Chapter.

**4th Axis Angles****Left Bank Angle**

Enter the angle of the Left Deck. This is the angle of the block in reference to the Cam and Crank bore being lined up Vertically.

**Right Bank Angle**

Enter the angle of the Right Deck. This is the angle of the block in reference to the Cam and Crank bore being lined up Vertically.

**Rollover Vertical Clearance**

Enter the value the Fly Cutter will have to move up vertically to clear the block when it rolls over from bank to bank.

**In/Out Offset**

This is a value that can be entered to center the fly cutter in the middle of the deck. You In/Out center on the Left bank will not be the center of the In/out on the Right bank. Enter the value the In/Out will need to be moved to center on the Right Bank when it rolls over.

**Rough Settings**

These values are used when taking multiple passes on a work piece. These values can be set high to remove material quickly. The finish on the work piece does not matter in these settings. There will be a Final pass that will apply the finish to the work piece.

**Rough Feed Rate**

Enter the desired Roughing Feed Rate;

**Rough Spindle RPM**

Enter the Desired Roughing Spindle RPM.

**Finish Cut Settings**

These values will be used for the last pass the machine will make on the work piece. These will determine the finish left on the work piece.

**Finish Amount**

Enter the amount to be removed on the last pass.

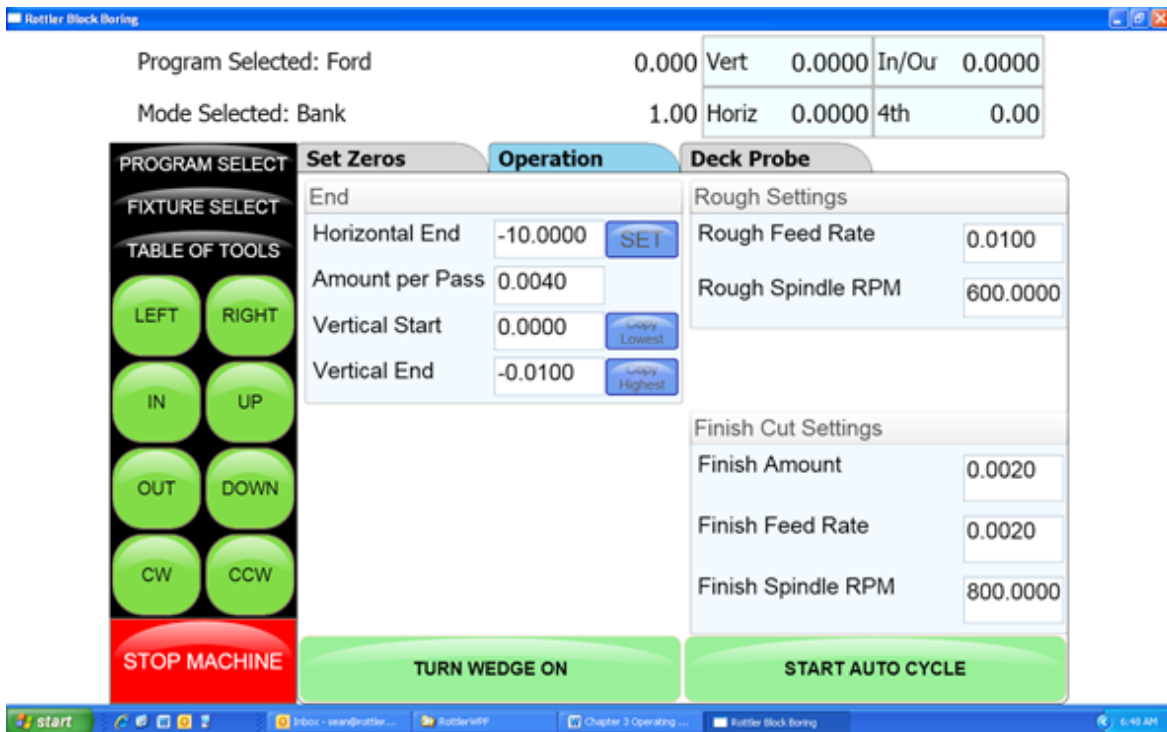
**Finish Feed Rate**

Enter the desired Finish Feed Rate.

**Finish RPM**

Enter the desired Finish Spindle RPM.

**NOTE: You do not need to have evenly divisible numbers in these sections. The computer will do the math to remove the correct amount each time and for the final pass to be at the amount you set.**



### Cut Left and Cut Right

Pressing these buttons will cause the machine to run an automatic cycle (per the parameter defined in the Operations page) on the associated bank.

### Start Auto Cycle

Pressing this button will start the machines automatic cycle. The cycle to be run is determined by the setting on this page. If you only require one pass to be made, do not enter any values into the Rough Setting, only the Finish Cut Settings.

## Milling Using Automatic Deck Probing

The Rottler Milling program is set up to Automatically Probe the Deck height of a block and then Mill it to a set Deck Height. This can be done on a 3 or 4 axis machine.

### Table of Tools for Milling

You MUST use the Table of Tools if you want to Automatically Probe the deck height and cut it to a set height.

Once done the Table of Tools Should look similar to the below picture.



The 100mm Probe is Tool 1. The 10" Fly Cutter is Tool 2.

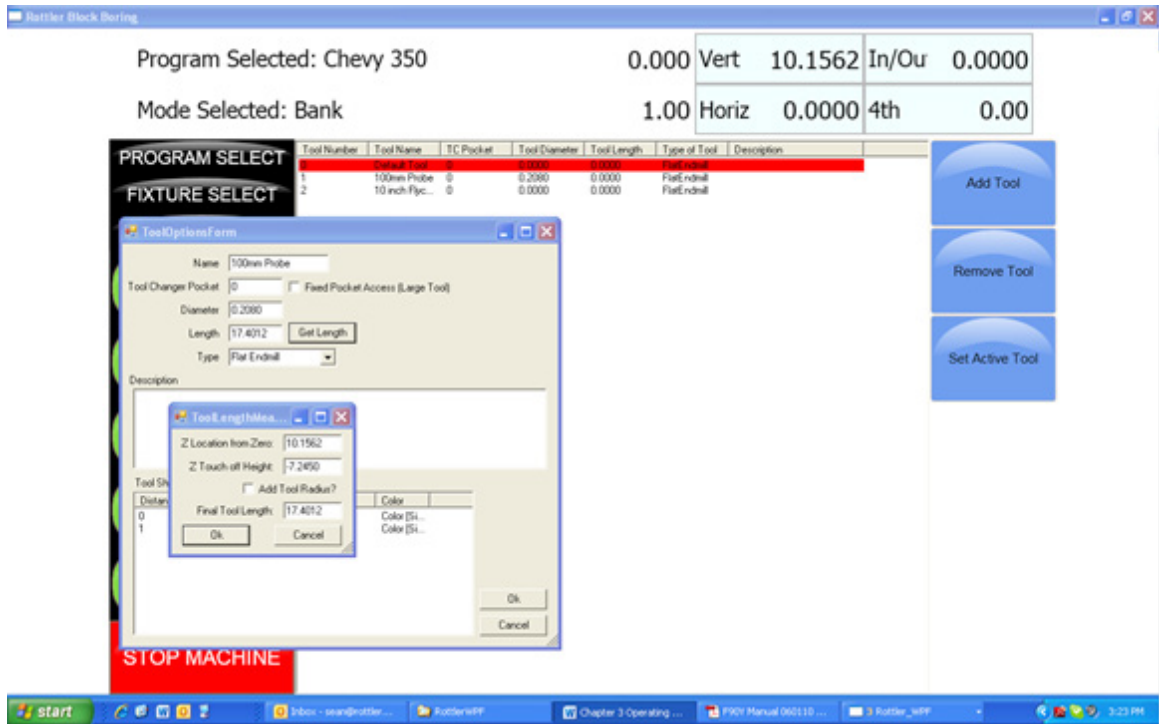
Go to Program Select, then select the block you are working with and then Mill Mode.

Install the Probe physically into the spindle. Rotate the 4th axis to Zero degrees. Indicate the Middle flat on the head stock to be sure it is zero all the way across. There should be a number stamped into the headstock. This is the distance from the Flat to the center of the Crank. Bring the probe down until it just touches the middle flat.

Open the Table of Tools and double click on Tool1 100 mm Probe. Enter the Measured diameter of your Probe. This is not used in the Milling Program but needs to be entered accurately for Probing in the Bore mode.

On the open window select Get Length. This will open another Window. There will be a value, that you cannot edit, in the "Z Location from Zero" this is the distance the Vertical Axis is from home when the Probe touches the Middle flat.

In the Data box for "Z Touch off Height" enter the number that is stamped on the Head Stock. This is the distance from the flat to the center line of the Crank.



Select OK on both windows. This will put the Total tool length into the Table of Tools.

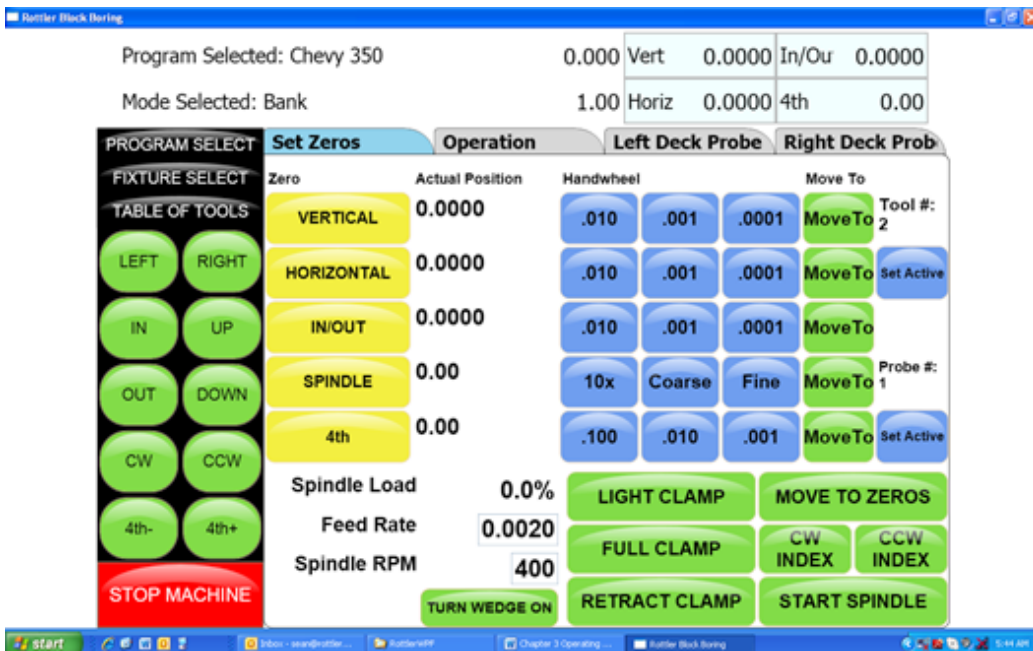
The Vertical Digital Read Out will now consider the center of the Crank bore to be the Vertical Zero position.

When the Probe tip or Cutting insert touches the Deck the Vertical DRO will be reading out the distance from the center of the Crank bore (Actual Deck Height).

### Assigning Tools

From the Set Zero Tab, select Probe#. This will open the Tools Select Form. Select Tool 1, 100 mm Probe and click OK.

Select the Tool#. This will open The Tool Select Form. Select Tool 2, 10 inch Fly Cutter and click OK. The tools to be used have now been assigned to the program.



## Setting Tools Active

To set a Tool Active (tool to be used) Press the Set Active button below that tool. Set the Probe Active. This will bring up the Tool Change Form. Here you can verify the information for the tool. Select OK. Select OK on the Spindle warning form if it appears.

The Probe# will now be highlighted in Pink, this indicates that the tool is active (being used). If you were to open the Table of Tools at this point, Tool 1 will be highlighted in Red. This also indicates that Tool 1 is active.



## Building a Program Using Table of Tools

Enter all the values that were described in 3 and 4 Axis Milling earlier in the chapter.

Physically install the probe into the spindle and set active. Bring the probe down until it just touches the Deck. Look at the value in the Vertical DRO. This is the current deck height at position. Enter that numeric value into the Vertical Start. This gives the Probe a value to start probing the deck at.



### Auto Milling

Go to the Operations Tab.

#### Vertical Start

Press Copy Highest next to Vertical Start. This will copy the Highest Probed point of either bank. This is the Height at which the Start Auto Cycle would start the first cutting pass.

#### Vertical End

Press Copy Highest next to Vertical Start. This will copy the Highest Probed point of either bank. This is the height at which the Start Auto Cycle would end the Final Pass. You would use this value if you just wanted to clean the deck up to the lowest point. If you want to cut the Deck Height to a certain value you would manually enter that value into the Vertical End Data Box.

#### Cut Left or Cut Right

Pressing either of these buttons will Start the Auto Cycle for only the associated bank. That bank will be cut to the set parameters and the machine will stop.

#### Start Auto Cycle

Pressing this button will start the Auto Cycle for Both Banks. First the Left bank will be cut to the set parameters. The spindle will go to the Clearance Height and Roll over to the Right bank and cut it to the set parameters. The Spindle will again go to the Clearance Height and roll over to the Left bank. The machine will go idle at this point.

#### Lowest Allowed

Entering in the lowest allowed, when you probe, the machine will stop if it is out of low tolerance.

The screenshot displays the machine's control interface with the following elements:

- Program:** Part Program
- Mode:** Bank
- Continuous DTG:** 0.000
- Feedrate override:** 1.00
- Coordinate Values:**
  - Z: 0.0000, Y: 0.0000
  - X: 0.0000, A: 0.0000
- Operation Tab:**
  - Set Zeros:** Move1 (-1.0000), Move2 (-5.0000), Move3 (-10.0000), Move4 (-10.0000), Move5 (-5.0000), Move6 (-1.0000), Move7 (0.0000), Move8 (0.0000)
  - Left Deck Probe:** Probe1 (0.0000), Probe2 (0.0000), Probe3 (0.0000), Probe4 (0.0000), Probe5 (0.0000), Probe6 (0.0000), Probe7 (0.0000), Probe8 (0.0000)
  - Right Deck Probe:** (Values are 0.0000 for all probes)
- Probe Settings:**
  - Probe Clearance: 0.1000
  - Lowest Allowed: 4.8550
  - Max Deviation: 0.0000
  - Highest Probed: 0.0000
  - Lowest Probed: 0.0000
  - Checkmarks: Copy Highest Probed, Copy Lowest Probed
- HANDWHEEL:**
  - X: .010, .001, .0001
  - Y: .010, .001, .0001
  - Z: .010, .001, .0001
  - Spindle: 10x, Coarse
- Buttons:** X-, X+, Y+, Z+, Y-, Z-, CW, CCW, STOP MACHINE (red), PROBE LEFT (green)

### Lifter Bore Mode 3 Axis

Lifter Bore programs are built the same as described in the Bore Mode 3 Axis. Only the differences will be discussed in this section.

#### In / Out Zero

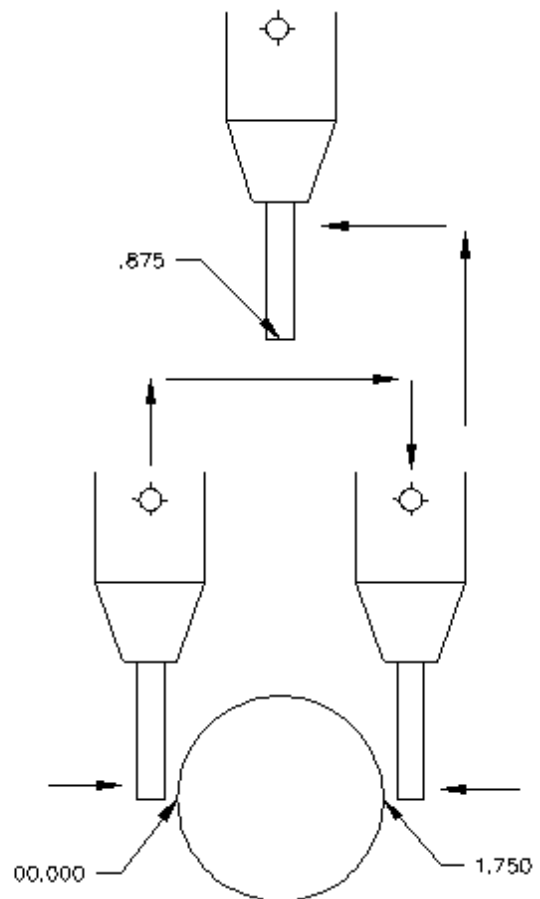
The In/Out zero position for Lifters is the center line of the Cam Bore. An easy way to find the center of the cam line is to use the electronic probe. The following is an example of this procedure. Install the probe into the holder and the holder into the spindle. Bring the probe down until it is in the approximate center of the cam Bar Vertically. Press the Vertical Zero button now (this is only a temporary Vertical Zero position). Using the In/Out handwheel bring the probe up to the Cam Bar until it lights. Press the In/Out zero button here. Move the spindle up enough to clear the Cam Bar, move the probe to the other side of the Cam Bar. Bring the vertical down to the zero position. Hand wheel the probe into the Cam Bar until the light comes on. Note the In/Out position reading. Divide this reading by two. Bring the spindle up until it can clear the Cam Bar. Use the In/Out handwheel and move the In/Out position until it matches the divided number. This is the center line of the Cam Bar. Press the IN/Out Zero button now. The In/Out zero position has been set. The following illustration visual shows the above description.

#### Start Boring Height

Pay particular attention when setting this height, there are often protrusions in the casting that will not allow the End Mill to travel unobstructed all the way to the start of the lifter bore. It is safest to set the Start Boring Height above the Deck.

#### Lifter Bore Angle

Rottler has specific Lifter Bore spacers that are installed on the Cam bar to set the correct angle for lifter boring when using the Performance Fixture.



### Lifter Bore 4th Axis

Lifter Bore programs are built the same as described in the Bore Mode 4th Axis. Only the differences will be discussed in this section.

#### Start Boring Height

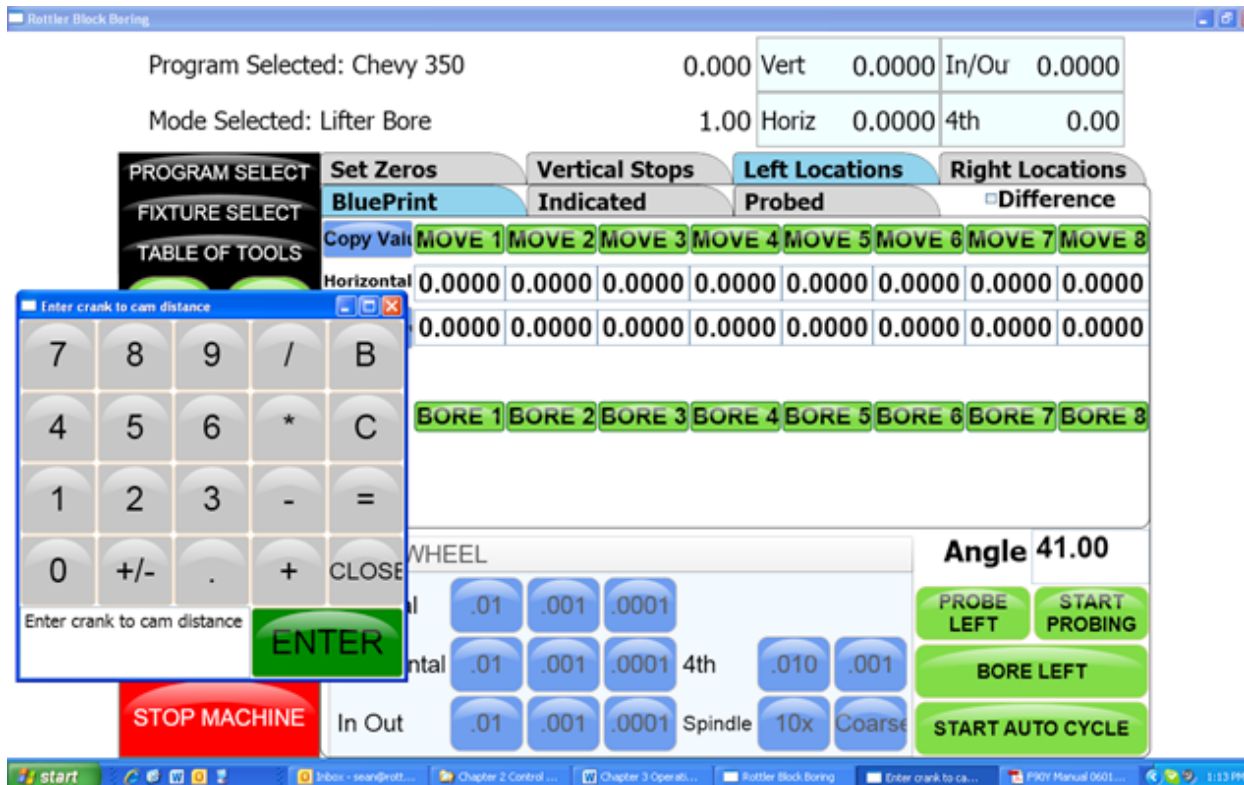
Pay particular attention when setting this height, there are often protrusions in the casting that will not allow the End Mill to travel unobstructed all the way to the start of the lifter bore. It is safest to set the Start Boring Height above the Deck.

#### Lifter Bore Angle

The angle for each bank is located on the associated Locations page. Press the angle numerical value and a pop-up will open so you can type in the Lifter Bore angle.

#### Calculate In/Out

This button is located next to the In/Out Locations for each Bank. You must first have the Correct angle entered into the Angle data box. Then press the Calculate In/Out button. A window will open where you enter the center to center distance of the Cam to Crank bores. The In/Out locations will automatically be filled in.



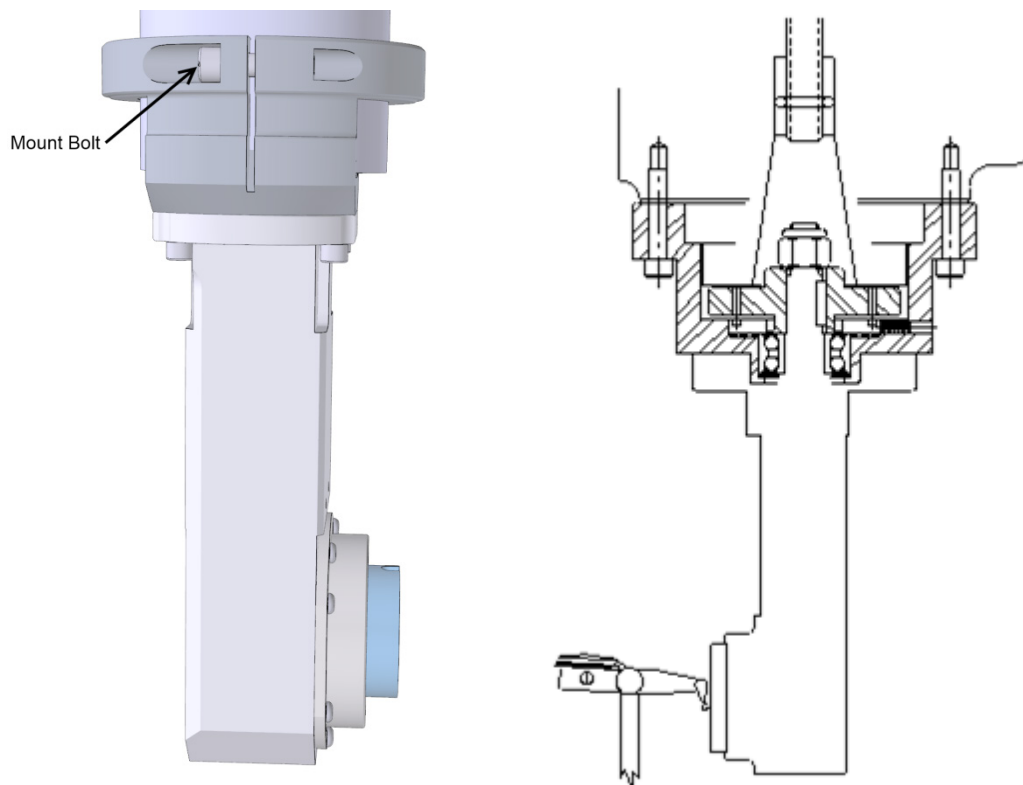
## Line Bore Mode

Select the Line Bore button from the Main Menu. This will bring up the Line Bore Mode with the Set Zeros tab shown.

### Mounting and Aligning the 90 Degree Head

Mount the 90 degree head onto the spindle and just snug the four mounting bolts. Use the following instructions to align the head.

Mount a .001" or .0001" dial indicator to the machine table or block. The 90 degree head has two machined surfaces that can easily be used to align the head. The two surfaces and indicator positions are shown below.



Put some pressure on the indicator. Using the In/Out handwheel move the indicator from one side to the other noting the amount of difference. Keep the indicator on that side of the head and rotate it half of the noted distance. Repeat this procedure until there is less than .0005" variance.

Tighten the four mounting bolts for the head and check the surface again to be sure it did not shift when tightening the head.

### Setting Zeros

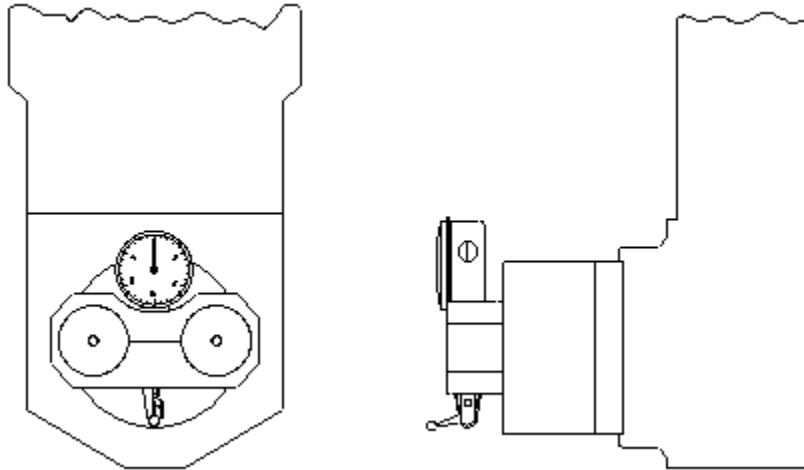
The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines' travel. Each axis (except the Spindle rotation) will need to have a zero point set for the machine to operate from.

### Horizontal Zero

The Horizontal should be set about .050" from the front of the first main to be bored, making sure that that position will allow the head to travel up without interference. Bring the head down and roughly center it in front of the first main. It does not need to be perfectly centered to set the horizontal zero. Press the Horizontal Zero button at this location.

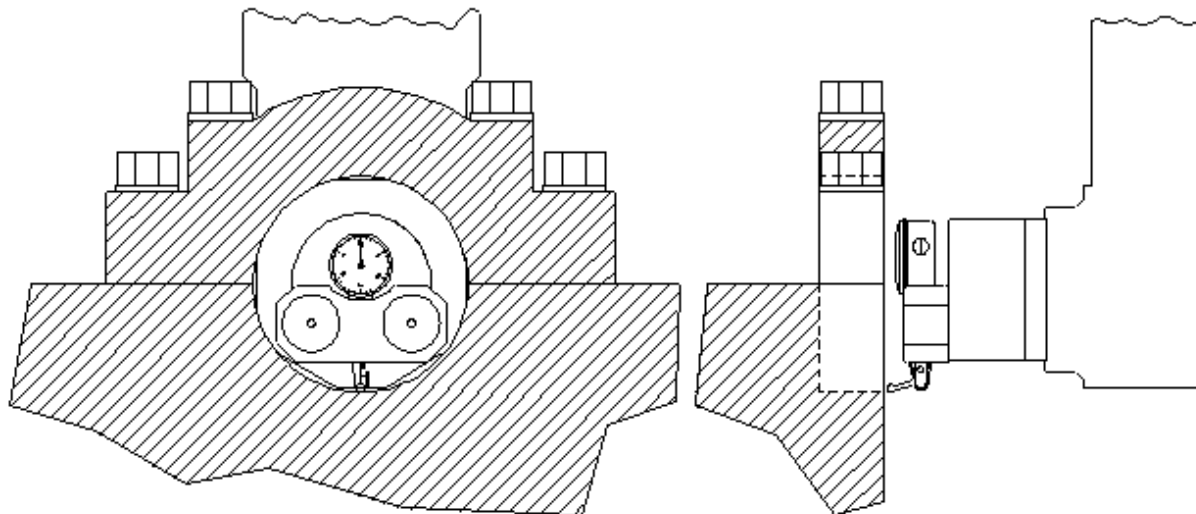
### In/Out and Vertical Zero

Locate the optional Last Word indicator and small magnetic base. Mount on cutterhead as shown below.



Using the Horizontal handwheel move the indicator inside the main bore, making sure the indicator is not touching the main bore at this point. You will be indicating both sides and the bottom of the saddle, generally the cap is not used to indicate from.

Physically move the indicator and mag base on the cutterhead until there is about .010" pressure on it. Start rotating the spindle CW and CCW watching the indicator. As there is too much or too little pressure on the indicator, use the In/Out and Vertical handwheel to adjust the spindle in the bore until all three points are equal. Press the In/Out and Vertical zero buttons at this point.



The Vertical stops have now been set. You are finished with the Program Vertical Stops screen, select the next Tab to the Right.

## Programming Vertical Stops

To build a program you must set the Vertical Stops. There are two (2) vertical stops used in the Line bore mode.

### Bore Centerline

The first vertical stop is on the main bore centerline. The vertical zero was set on the bore centerline. Therefore this stop will always be zero.

### Block Clearance

This stop is set at a **positive** value that will allow the 90 degree head to travel over the top of the cap and bolts to the next main bore unobstructed. In the case that there is not enough clearance to go over the caps, "Clearance Retract Angle" can be used.

### Clearance Retract Angle

When "Block Clearance" is set to zero, the Z axis will move straight up. If set to 90, (degrees) the Y axis will move in, or out to go around the caps because they can't go over the top. The amount specified by the "Block Clearance" value +, or -, will determine the length, and direction the Y axis to clear the caps. Any angle can be entered here, for example is 45 (degrees) is entered, both Y, and Z axis will move together at a 45 degree angle to clear the caps.

### Dwell RPMS

This is used when boring to a "step", maybe where an oil seal would be installed. RPM can be changed when it reaches the end of the "Bore Length" value to smooth out the finish of the step area.

### Dwell Revolutions

Value entered will determine how many times the spindle rotates at the "Dwell RPM's" to give a satisfactory finish of the bore step

### RAD options/Ratio

This is the gear ratio of the Right Angle Drive you are using.

Set Zeros	Vertical Stops	Bore Locations
BORE PROFILE		Dwell Options
Block Clearance	203.200 <input type="button" value="SET"/>	Dwell RPMS
Clearance Retract Angle	0.00	Dwell Revolutions
RAD Options		
Ratio	2.0000	

### Programming Horizontal Stops

The Horizontal Zero was set .050" before the first Main Bore, so the first Horizontal stop will be 00.000. Measure the distance between each main and enter it into the corresponding stop number.

### Programming Bore Length

Measure the length of each Main Bore and enter that value into the corresponding length box

### Deviation from main line

In the rare case where it is possible to probe all bore locations, checking this box will show how far each bore is away from Y, and Z zero

### Graph Probed Values

Used to give a visual picture of the actual main bore before and after

### Running the Auto Cycle

You will need to set a Feed Rate and Spindle RPM on the Set Zeros screen to run an auto cycle. The spindle will move up the Block Clearance distance as entered on the "Vertical Stops " page, move to the horizontal bore location, then will then move down to the zero position, spindle will start and feed to the "Bottom of Bore" length, retract horizontally out of the bore, go back up to "Block Clearance, move horizontally over to the next bore etc.

**CAUTION** If you press the MOVE buttons or the Cycle Start button the machine will not move the In/Out axis to the zero position. You need to move the In/Out axis to the zero position manually before you press Cycle Start.

The machine will go idle at this time. Pressing the "Start Auto Cycle" button will cause the entire cycle to run.

After a program has been completed the machine will move the spindle over to the first Main Bore at the clearance distance.

## Thrust Cutting

Refer to Line Bore in this section for mounting the block and aligning the 90 degree head.

Note: It is important to read through the entire Thrust Bearing Cutting section before entering any values or starting the Auto Cycle. You will better understand how the program operates and how the values affect the operation of the Auto Cycle.

The Thrust Cutting program can cut a single or double thrust face using circular interpolation.

Select the Thrust Bearing Cutting button from the Main Menu. This will bring up the Thrust Bearing Cutting Bore Mode with the Set Zeros tab shown.



## Setting Zeros

The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines' travel. Each axis (except the Spindle rotation) will need to have a zero point set for the machine to operate from.

### Horizontal Zero

To set the Horizontal Zero, bring the cutter in using the Horizontal Hand Wheel until it just touches off the current thrust face. Press the Horizontal Zero Button here. The computer will use this zero point when cutting the depth of the thrust face.

Follow the procedure for setting zeros in the Line Bore Mode section of this chapter. Set the Horizontal zero on the Main Bearing that is to have the Thrust cut.

After the zeros have been set select the nest tab to the right, Dimensions.



## Dimensions & Auto Cycle

There are several values that need to be set on this screen for the program to operate properly. Below is illustration and a description of each of these values.



## Thrust Dimensions

### Outside

This is the Outside dimension of the thrust face to be machined.

### Inside

This is the Inside dimension of the thrust face to be machined.

### Cutter

This is the diameter, from the center of the 90 degree head to the tip of the insert.

## Clearances

### Vertical

This is the distance, from zero, the 90 degree head will have to travel up to clear the main caps on the block.

### Horizontal

This is the distance, from zero, the 90 degree head will have to travel to clear the main for the next vertical move.

## Dimensions

### Main Width

Width of the Main.

**Insert Width**

Width of the Insert.

**Left Depth of Cut**

Depth of left cut.

**Right Depth of Cut**

Depth of right cut.

**Cut Right Side**

If you select Cut Right Side the automatic cycle will cut the thrust face on the right hand side of the Main.

**Cut Left Side**

If you select Cut left Side the automatic cycle will cut the thrust face on the left hand side of the Main.

**Description and Running of the Auto Cycle**

You will need to enter the Feed Rate and Spindle RPM the program will run at.

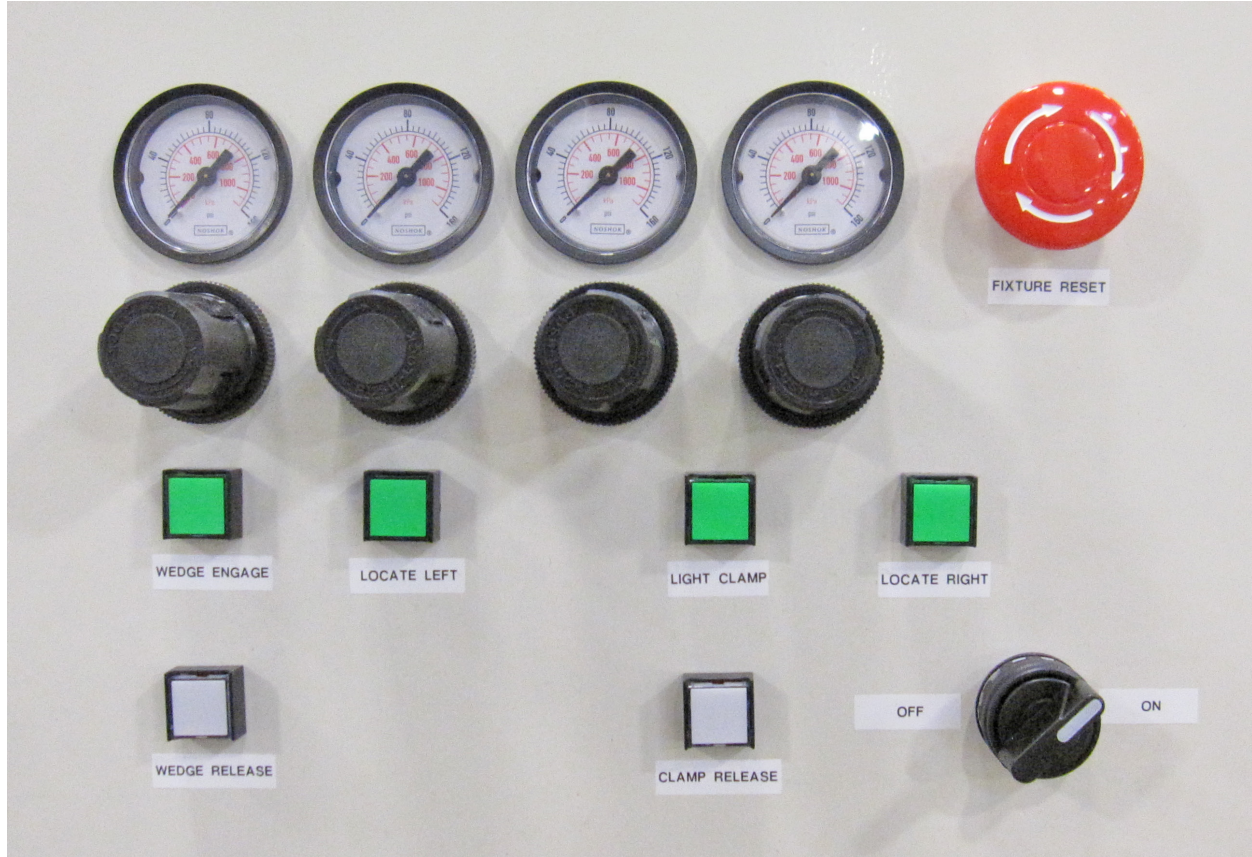
There are no Move to buttons in this program. You **MUST** be at the zero positions when the Auto Cycle is started.

**Start Auto Cycle**

When you are at the zero positions press the Auto Cycle, the spindle will start at the programmed RPM. The vertical feed will start at the programmed rate in an upward direction until the correct Outside diameter is reached. The circular interpolation will start at this point and go 360 degrees. It will then continue the circular interpolation back towards the center of the Main to clear the cutting tool from the thrust face. When the cutterhead is back at the center point (zero positions) of the Main, all motion will stop. The cutterhead will then rapid travel to the left taking the main width and the cutter diameter into account to reach the correct depth on the second thrust face. The same circular interpolation process will then be repeated for the second face. The cutterhead will then retract horizontally to the clearance distance then vertically to the block clearance distance.

When the program is running the "Start Auto Cycle" button will change to "Press to Pause". If this button is pressed the machine will pause the program right where it is. At this point the screens are locked out from changing anything. The button will change to "Press to Resume". If you want to resume press the button and the program will continue from that point on. If you do not wish to continue press the "Stop" button. This will put the machine back in idle mode and changes can be made to the program.

## Con Rod Fixture Control Panel



### Set Up Procedure For Con Rod Fixture

Select the widest big and small end ball locators that will fit inside the con rod big and small end bores.

Press Locate Right and the right hand ball locator will move up and stop against it's end stop, then remove the air pressure supply to the con rod fixture so that the ball locator pivot arms may be moved manually.

Fit the selected ball locators to the right and left hand mounting positions. Be sure there are no chips and that the locators fix exactly in their mounting positions.

Connect the air pressure to the fixture.

Press Locate Right Button, the right hand ball locator will move up and stop against it's end stop.

Select the correct con rod support and place across the con rod fixture.

Place the con rod to be bored into the fixture so that the big end bore touches both the balls of the right hand ball locators.

Adjust the con rod rest so that the rod lies approximately horizontal.

Adjust the 3 big end support pads so that each support pad locates on the side of the big end and does not protrude into the big end bore. This will require removing and refitting the con rod to be sure the 3 support pads are correctly located and their hold down cap screws are tight.

Readjust the con rod support to allow the con rod to lie horizontal with no rock or tilt of the con rod on the 3 big end support pads.

Remove the con rod from the fixture.

Press locate left and the left hand small end ball locating device will lift up.

When the left hand ball locating device is at it's end of travel, place the con rod back in the fixture and adjust the left hand slide assembly so that both the left hand locating balls contact the bore inside the con rod small end.

Remove the con rod from the fixture.

Slide the left hand locating assembly approx 1/2" (12.7mm) to the right and lock both hold down handles securely, this will ensure that the small end ball locators contact the small end with some preload.

Place the con rod in the fixture.

Position the clamp arms so that their feet are approx 1/8" (3mm) above the side of the big end, be sure that they do not protrude into the big end bore to be machined and adjust their travel limit stops and lock the lock nuts.

Press the Light Clamp button, this will place light clamping pressure on the clamp arms and lightly hold the con rod down against the 3 support pads under the big end of the con rod.

Press the Locate Left button, the small end ball locator will move up and contact the bore of the small end of the con rod and firmly press it against the big end and straighten the con rod along the center of the fixture.

Select a set of wedges that will allow the outside of the small end of the con rod to be supported during boring so that there is no chatter or vibration during boring.

Press Wedge Engage button, the wedges will be pressed against the outside of the small end.

The con rod is now ready to be bored.

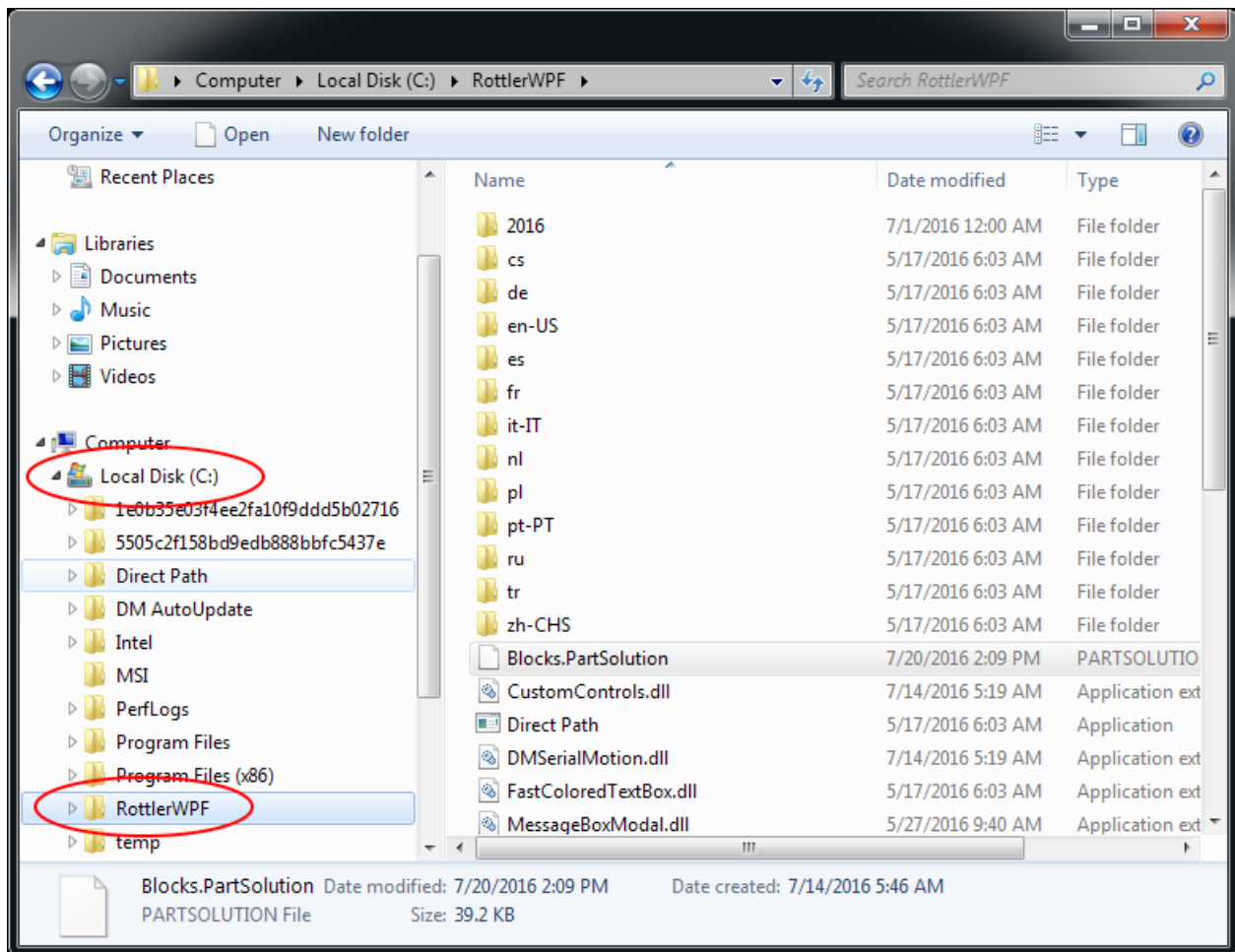
#### Air Pressure Settings

Right Hand Side Air Gage:	Locate Right	100psi	(6.5Bar)
Second from Right Hand Side:	Light Clamp	15psi	(1.0Bar)
Second from Left Hand Side:	Locate Left	30psi	(2.0Bar)
Left Hand Side Air Gage:	Wedge Engage	30psi	(2.0Bar)

## Backing Up and Restoring Block Profiles

This section will explain how to back up and restore the operator created block profiles for DM controlled machines for archival purposes or to transfer to a different machine.

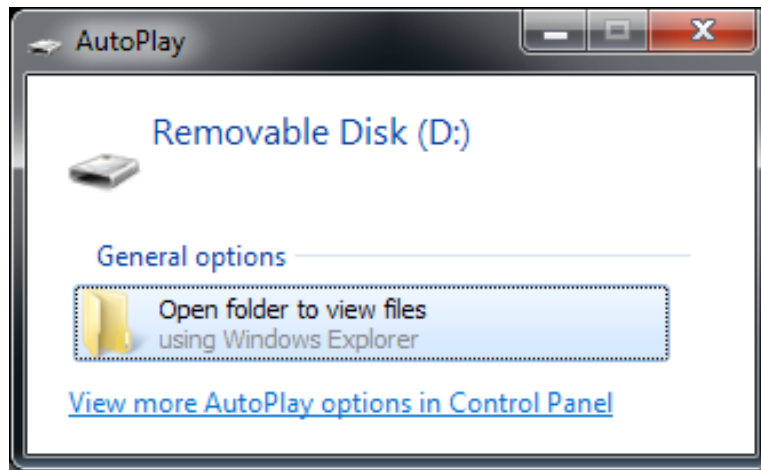
First step is to open your file browser locate and the RottlerWPF file on the C disk drive.



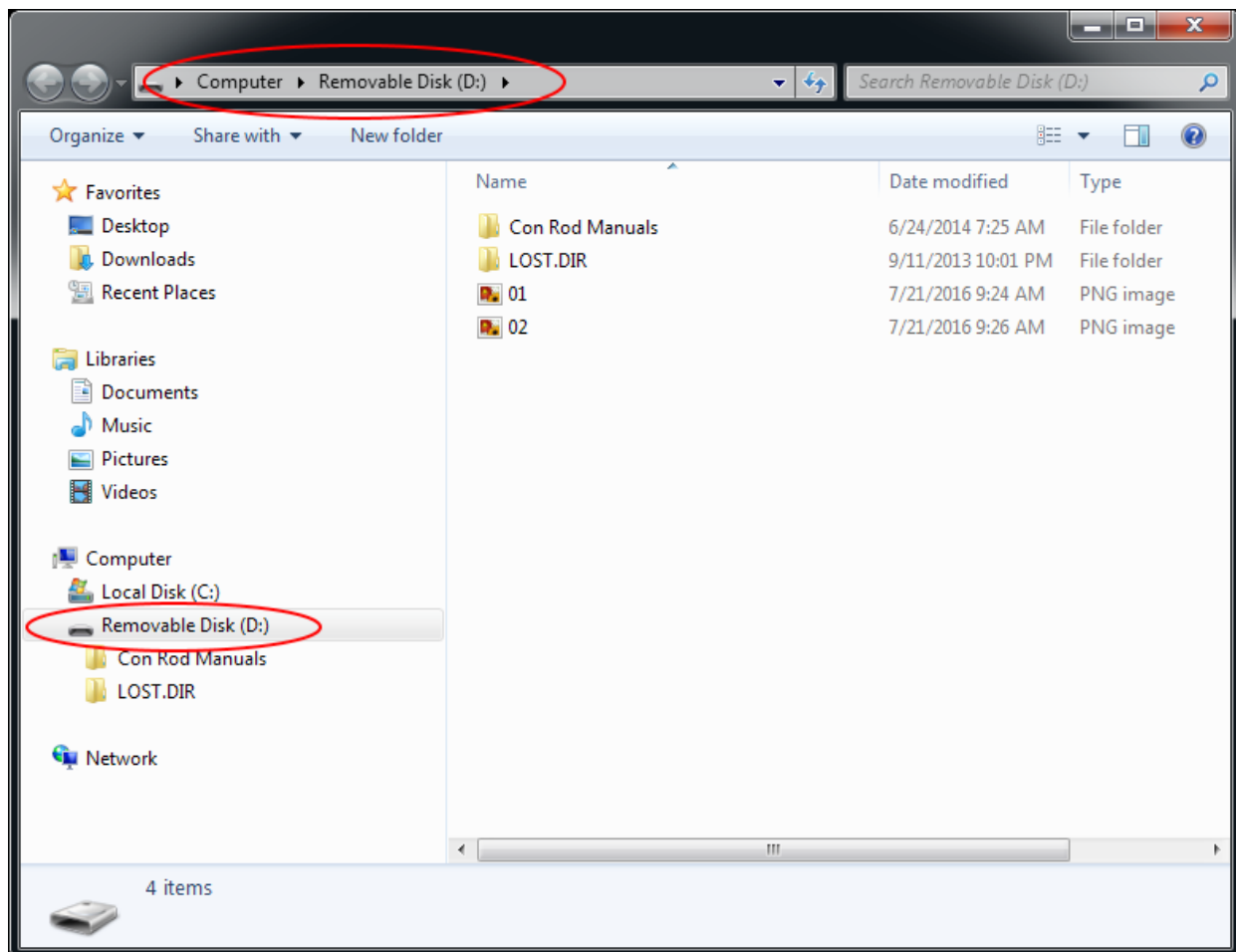
The next step is to plug in a flash drive to an open USB port



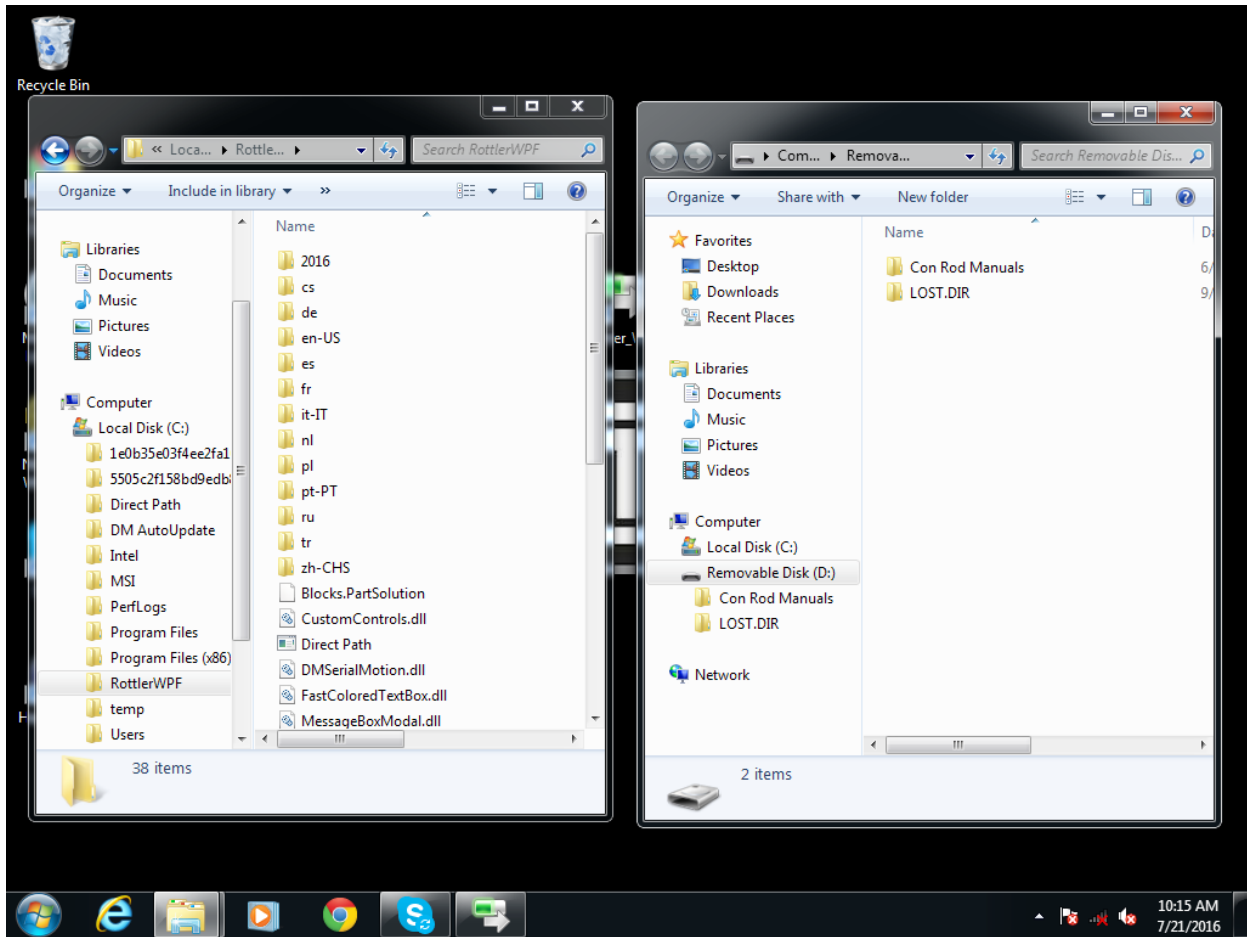
The following pop up box will appear on your screen.



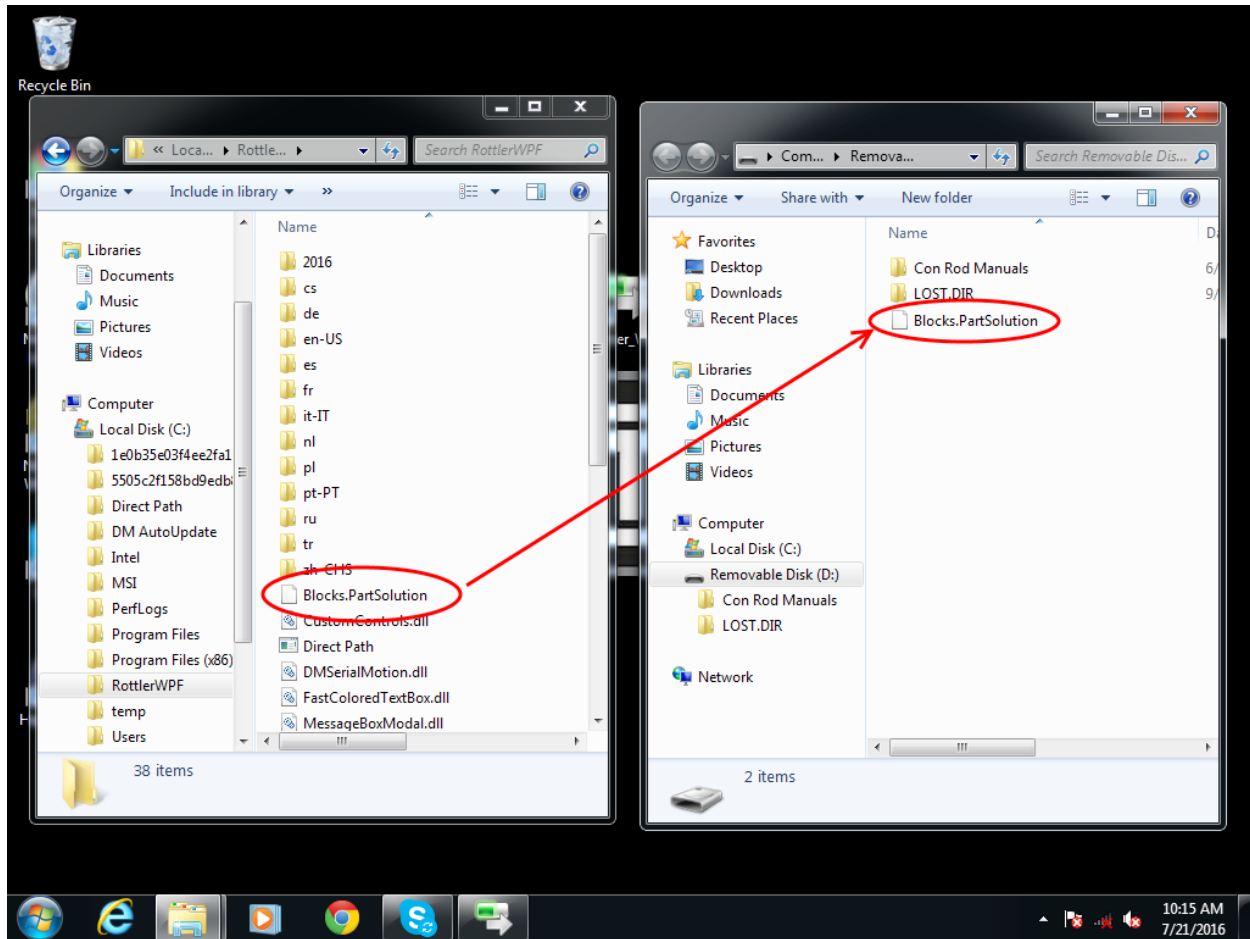
Click on the Open folder to view files option and the following screen will appear. This is the contents of the flash drive you just plugged in.



Next resize and arrange both file browsers so that they are side by side.



Block profiles are backed up each time the machine is run with the current profiles being shown in the RottlerWPF folder. All that needs to be done to back up the current profile is to simply drag it from the RottlerWPF folder to the flash drive folder. A copy of the file will be placed on the flash drive.

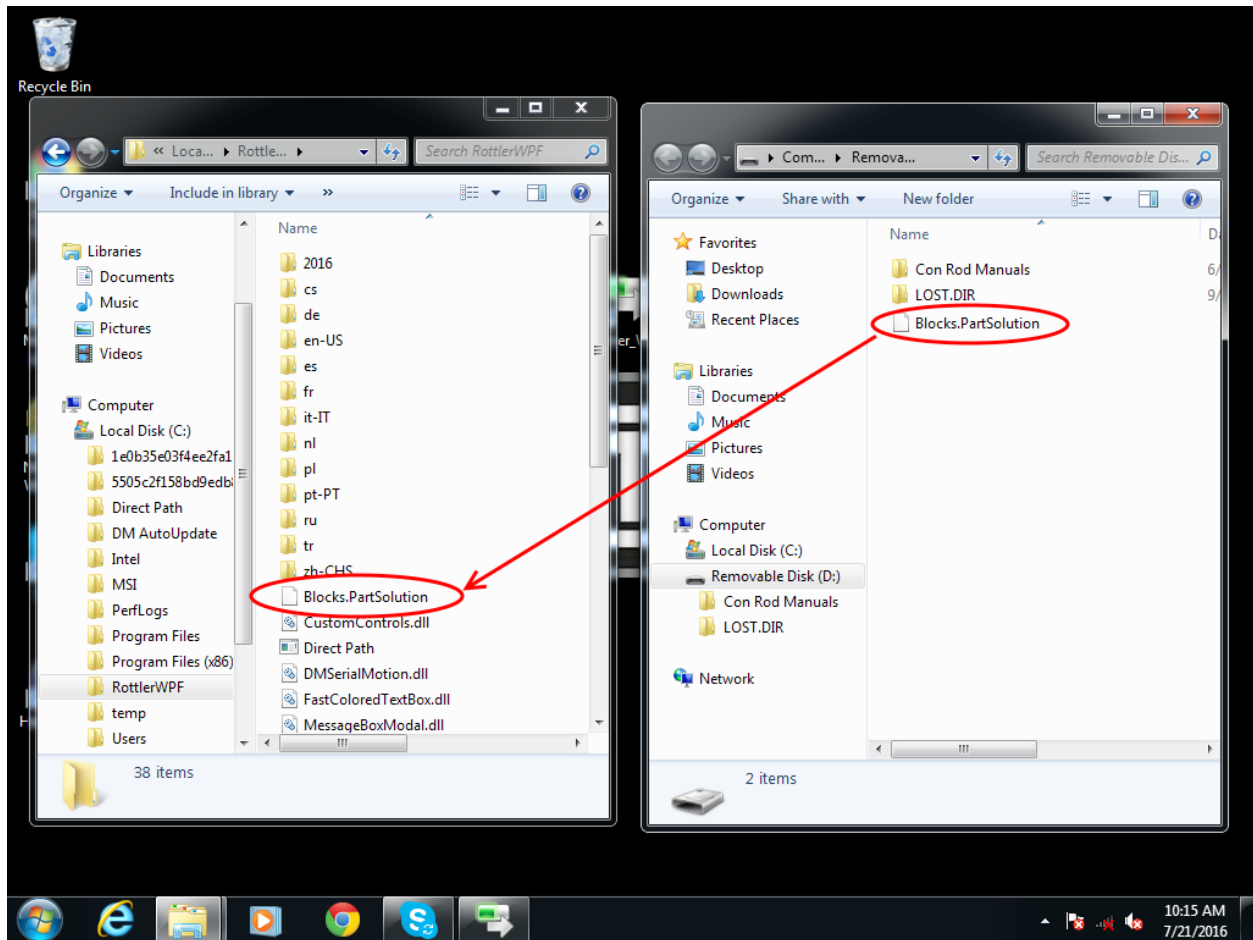


Backup is now complete. Close both file browser windows and remove the flash drive.

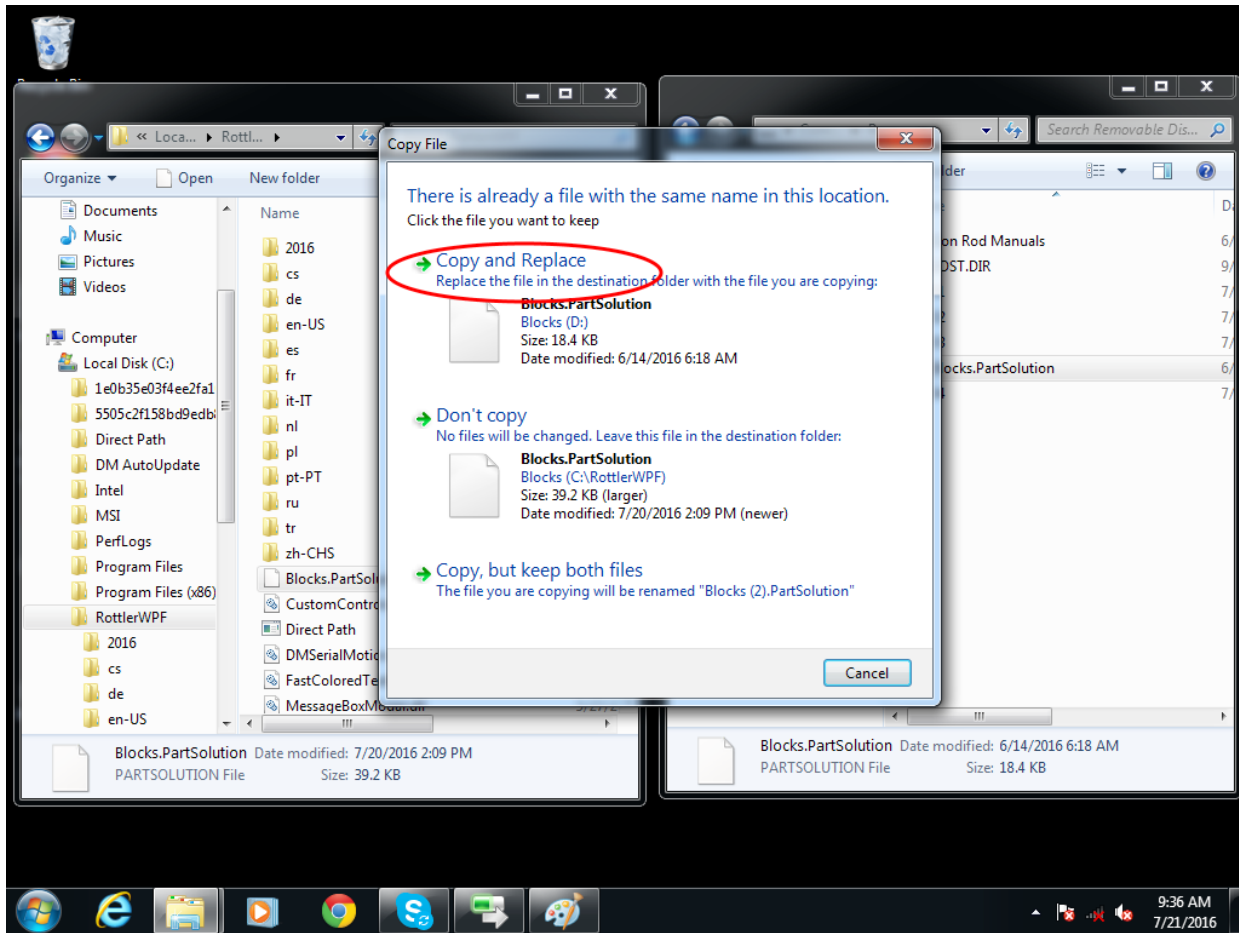


To restore or add block profiles go through the first 5 steps explained previously.

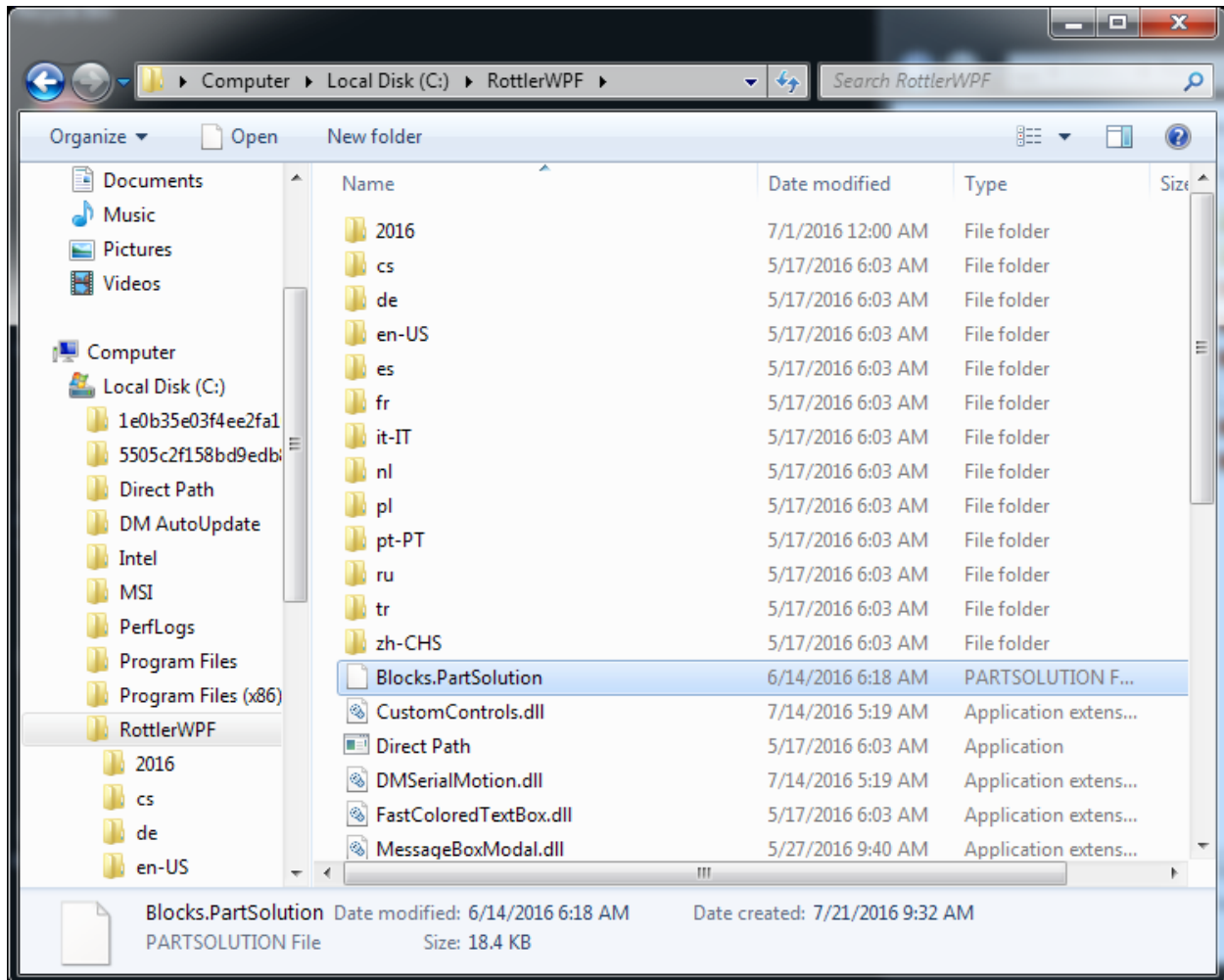
Highlight the block profiles file in the flash drive and drag it into the RottlerWPF folder on the local hard drive.



You will get a pop up window about there being a file of the same name in the destination folder. Click on the Copy and Replace option.



The archived block profiles will now be installed.



Close both browser windows and remove the flash drive. The restore process is now complete.

### Using 3rd Party Tooling in Rottler Machines with CAT 40 Tooling.

When it is not convenient for the customer to order CAT 40 tooling from the factory or if the customer needs tooling that we don't stock, they may purchase tooling from 3rd party vendors such as MSC Metalworking.

Rottler uses a Parlec - A Style, CAT40 Taper, 5/8-11 Thread, 45 Degree Angle Radius, Standard Retention Knob with the following specifications: 1.68 Inch Overall Length, 0.281 Inch Coolant Hole Diameter, 0.74 Inch Knob Diameter, 0.12 Inch Flange Thickness, 0.64 Inch Knob to Flange Length, 0.635 Inch Pilot Diameter, Through Coolant.

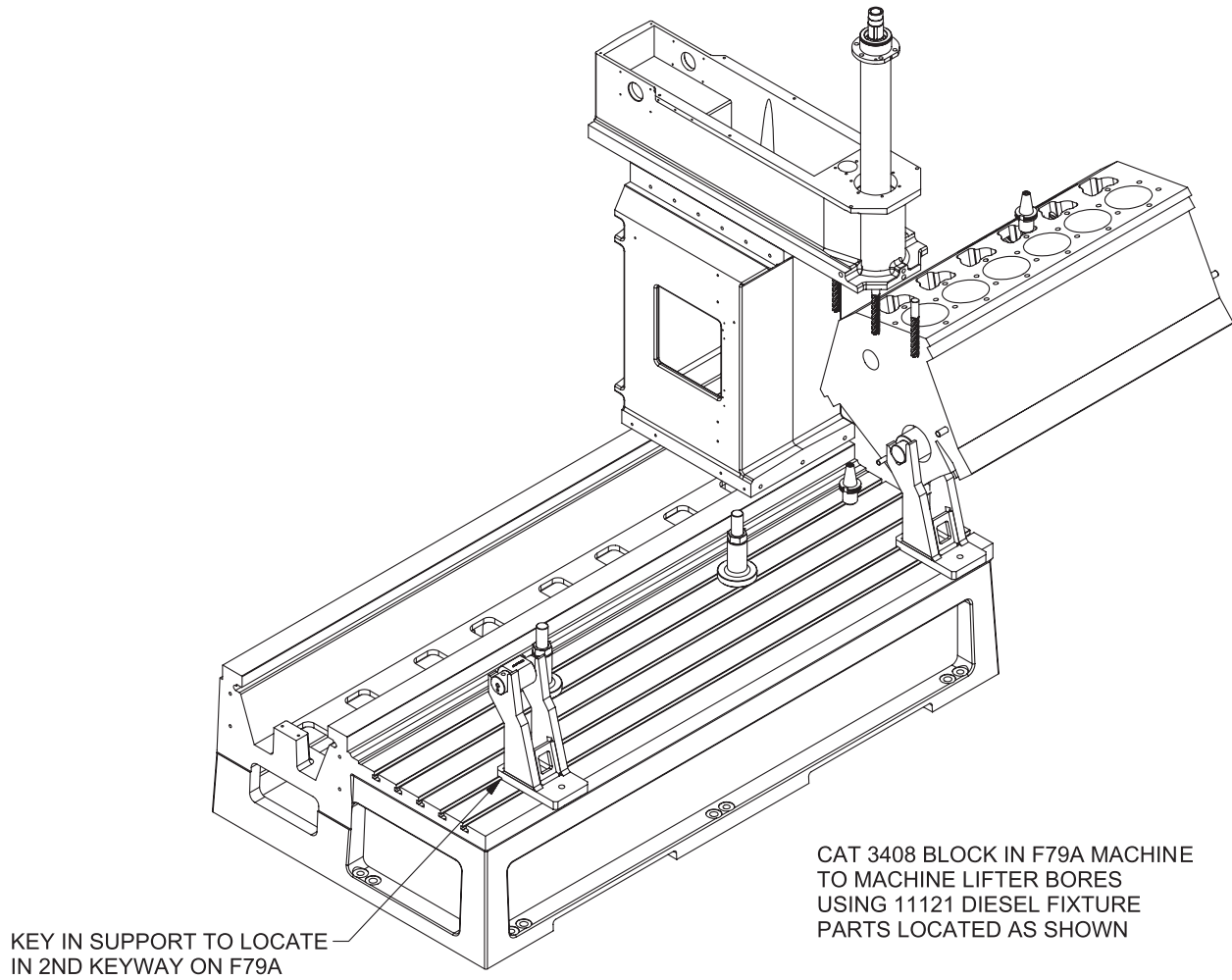


The metric equivalent is a Parlec - A Style, BT40 Taper, M16 x 2 Thread, 45° Angle Radius, Standard Retention Knob 1.65 Inch Overall Length, 0.281 Inch Coolant Hole Diameter, 0.74 Inch Knob Diameter, 0.12 Inch Flange Thickness, 0.64 Inch Knob to Flange Length, 0.669 Inch Pilot Diameter, Through Coolant.



## Set Up of 11121 Fixture for CAT 3408/3412 Blocks

Illustration shows an alternate use of the 11121 diesel fixture to machine the lifter bores of the CAT 3408/3412 block. The supports get mounted as shown (backwards) with the keys located in the 2nd keyway from the front. The jacks are positioned closer to the column.



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# MAINTENANCE

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## Maintenance

### Lubrication

Refer to illustration following these written instructions:

Below are the directions that explain how and where to add oil to the different systems:

**⚠ CAUTION** Do not overfill any of the lubrication points, serious electrical damage may result.

### Outer Spindle

The Outer Spindle is hard chromed and is supported in tapered, cast iron spindle bushings. The Outer Spindle supports the Inner Spindle, bearings, seals etc... and maintains the boring rigidity.

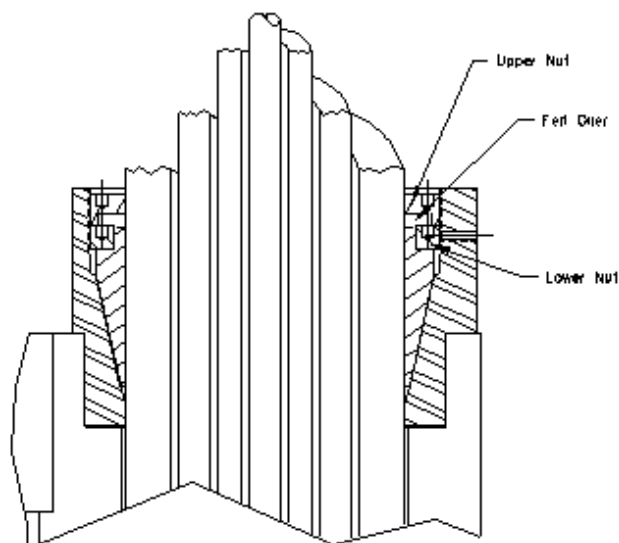
#### Every 8 hours:

The Outer Spindle needs to be moved down to the lower limit, wiped clean, and then lightly coated with ISO VG 68 Way Oil. This is very important, if the spindle is allowed to operate dirty the cast iron dust will act as an abrasive on the spindle chrome. This will cause the spindle to wear prematurely. The outer spindle is a very expensive item to replace.

#### Every 1000 Hours:

Open the sheet metal cover from the front of the spindle unit. There is a large nut where the outer spindle passes through the top of the spindle base. Using a spanner wrench or punch carefully remove the upper nut.

**Note: Do not adjust the nut below the felt wiper. (see the mechanical section for correct adjustment of this nut)**



Slide the felt wiper back into place and tighten the Upper Nut back down.

### Upper Belt Housing

No lubrication is necessary in the Upper Belt Housing.Oil Reservoir System

**IMPORTANT!!** – Every 8 hours check the oil supply lines to the upper spindle to be sure they are full of oil.

The oil reservoir system is located inside the lower portion of the column. This system lubricates the following:

Ways

Inner Spindle Bearings (Upper and Lower)

Horizontal Ballscrew

Outer Spindle

### Every 175 Hours:

The oil level of the reservoir should be checked, and filled with **ISO VG 68 WAY OIL**.

When the oil reservoir is low or empty on the F79A machine, the control will “LOW OIL” and will not run until the reservoir has been filled.

The oil system may require priming if the reservoir has been run empty. You can do this manually or automatically. To prime automatically, change the oiler machine parameter #123 to a value of 10. This will turn the oiler solenoid on every ten seconds as long as the spindle is running. Take note when the oil lines are full, reset the oiler parameter and operate the machine normally. To prime manually, open the air door on the lower left hand side of the column, locate the blue solenoid, press the manual override button on the solenoid repeatedly until the oil lines are full. You need to pause for a second between button presses to allow the valve to reset. Pressing the button too fast will not pump oil through the system.

### Inner Spindle Bearings

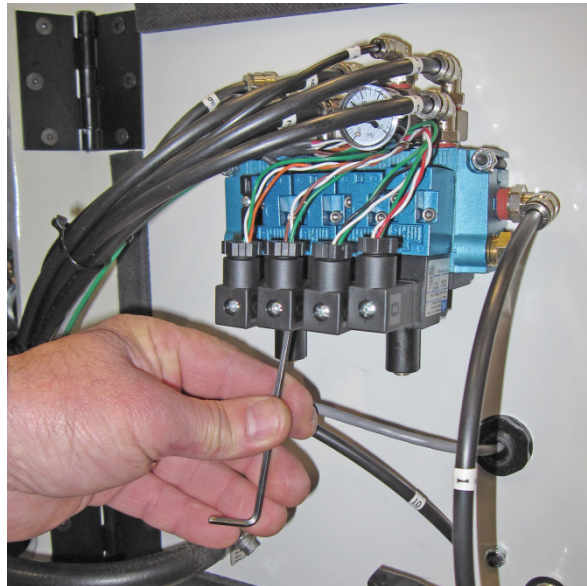
The Inner Spindle Bearings are lubricated from the oil reservoir system. It is normal for a small amount of this oil to seep through the spindle bearings and onto the cutterhead.

### Priming Spindle Base Oil Lines

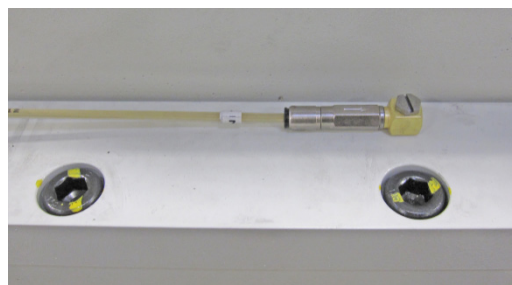
1. After the spindle base has been placed on the column the oil lines must be purged of air.
2. Remove the oil lines located on the spindle base guide rails.



3. Open the door where the regulator is located.
4. Find the solenoid that has the #8 airline attached to it.
5. Manually activate the solenoid until oil flows out of the oil lines.



6. Reattach oil lines.

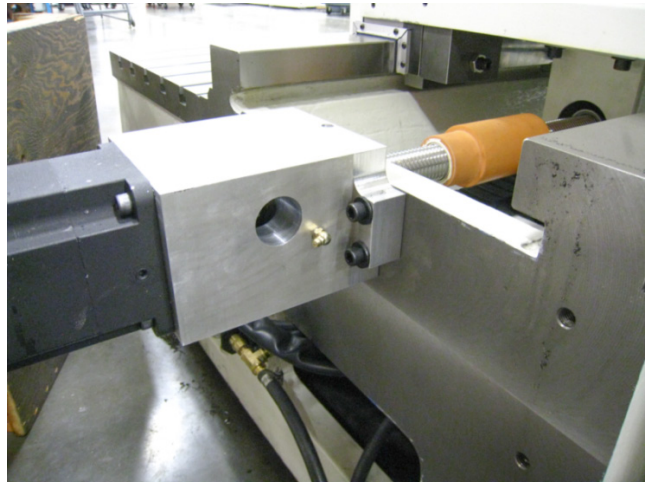


### Quick Reference Lubrication Chart

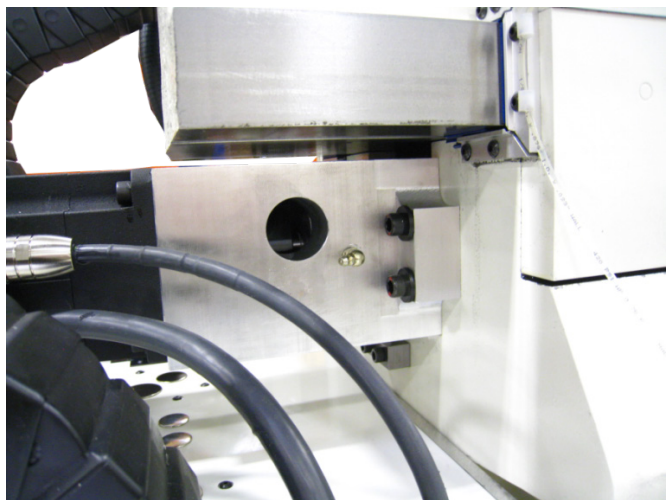
Assembly	Frequency	Lube Operation
Outer Spindle	8 Hours 1000 Hours	Wipe with ISO VG 68 Way Oil Soak felt wiper with ISO VG 68 Way Oil
Oil Reservoir System	8 Hours 175 Hours	Check upper oil lines are full Fill reservoir with ISO VG 68 Way Oil if needed
Ballscrew Bearings	175 Hours	Grease with NLGI #2 Lithium Grease
Swing Arm Hinge	1000 Hours	Grease with NLGI #2 Lithium Grease

### Lubrication Locations

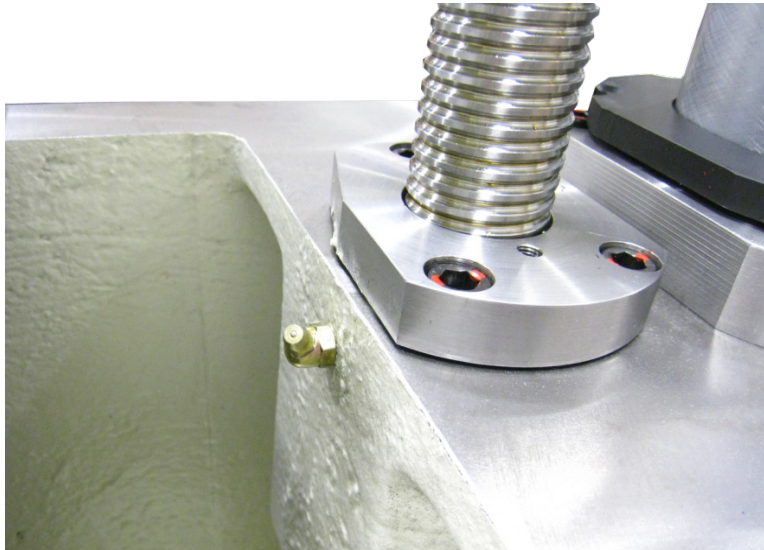
X-Axis Grease Fitting is located under the right side way cover.



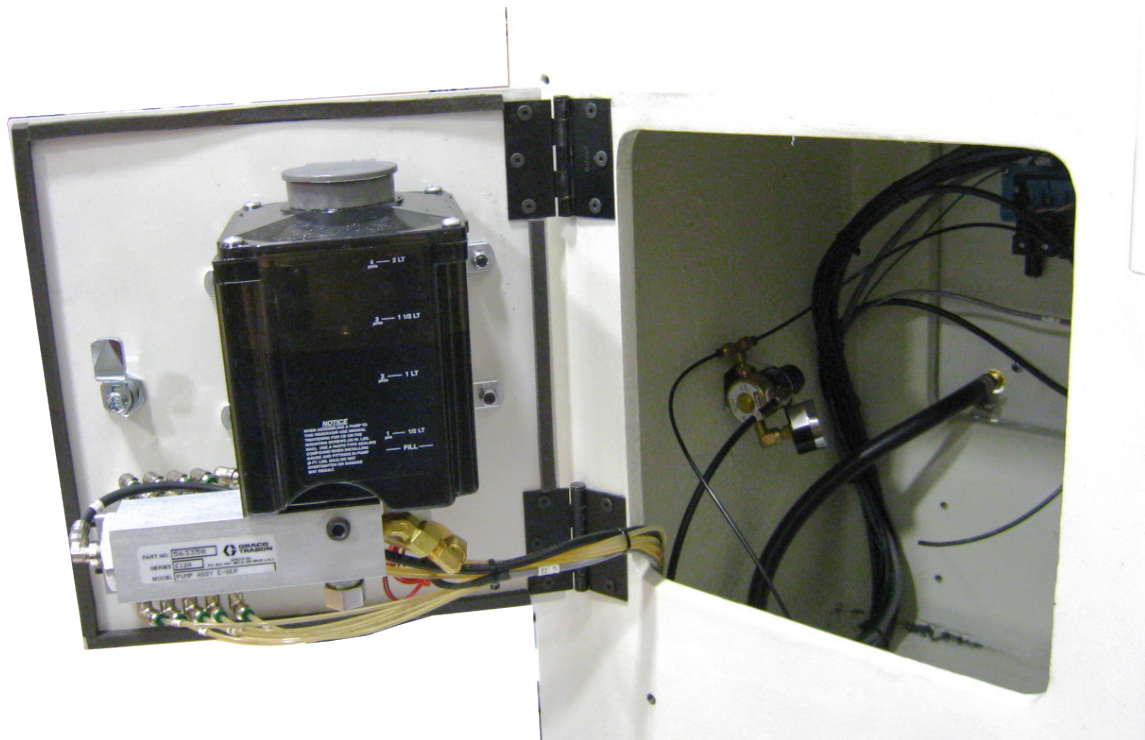
Y-Axis Grease Fitting is located on the back of the spindle above the electrical enclosure.



Z-Axis Grease Fitting is located at bottom of Ballscrew in spindle housing. Open cover to gain access.



Oiler Reservoir is located inside the oiler door on the right side of the spindle column.



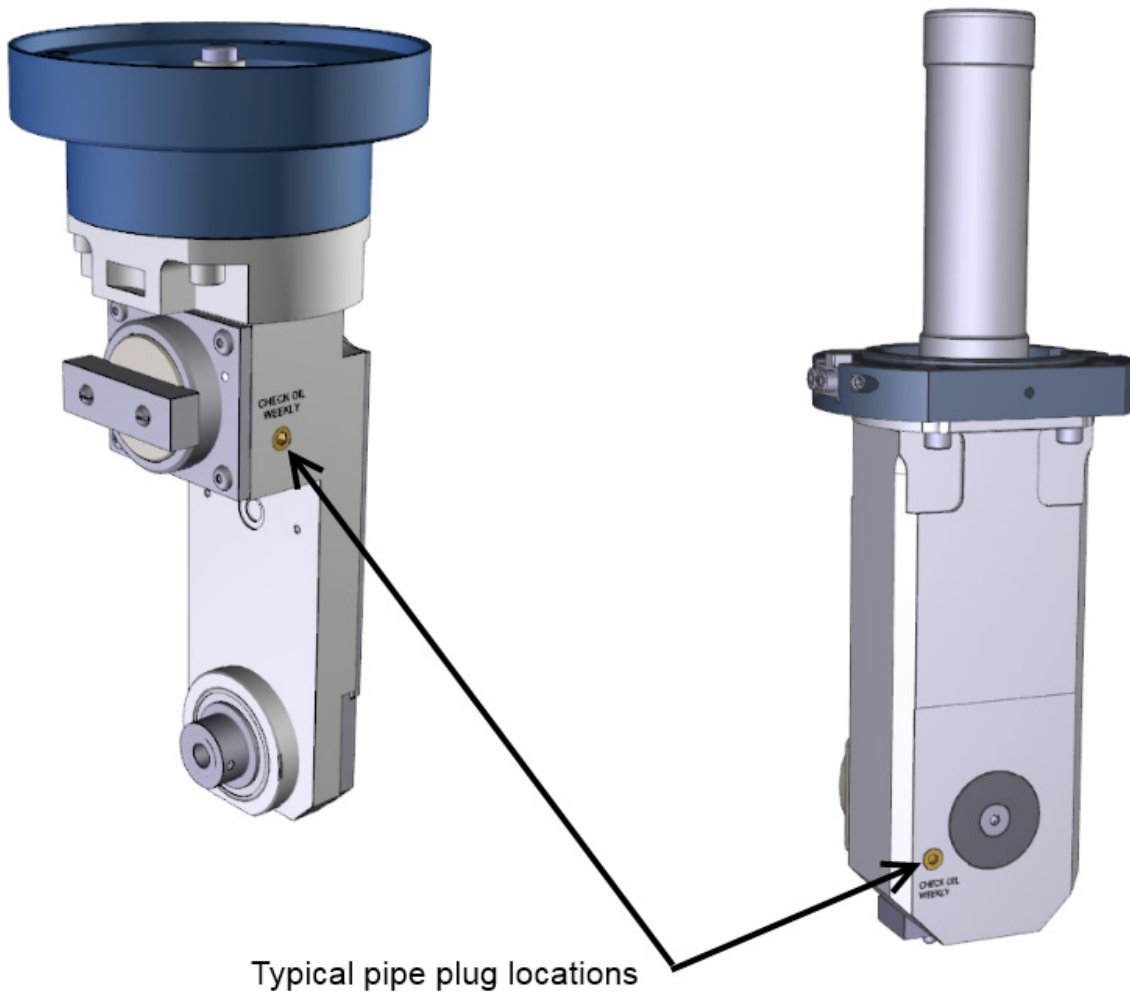
### Right Angle Drive Lubrication Information

All right angle drives require lubrication at the point where the pinion drive intersects with the drive gear. This is generally in the area where the cutterhead is attached, except for the units that have belt drive. There will be a small pipe plug that is removed to check oil level and add oil if needed. See illustration below for general locations.

With the drive mounted on the machine spindle the oil level should be even with the bottom of the pipe plug threads.

All Rottler Right Angle Drives are filled with **GL-4 or GL-5 Gear Oil** prior to shipment. Use this oil if the need to add or change oil arises.

When adding oil, fill until oil starts to run out of fill hole. Allow excess oil to drain, then coat pipe plug threads with anti-seize compound and replace it



## Preventative Maintenance Quick Reference Chart

Refer to the procedures above to make or check these adjustments. Not all of the items listed in the table below have adjustment. The information should be recorded and the amount of wear tracked so the part can be replaced before down time on the machine occurs.

<b>Procedure</b>	<b>Frequency</b>
Inner Spindle	1000 Hours
Outer Spindle	500 Hours
Horizontal Gib	2000 Hours
Spindle Belt	1000 Hours
Spindle Sweep	150 Hours
Horizontal Ballscrew	2000 Hours
Horizontal Backlash	1000 Hours
Vertical Backlash	1000 Hours
In/Out Backlash	1000 Hours
Spindle Tilt	500 Hours
Machine Level	1000 Hours
Spindle Wear	2000 Hours
Horizontal Way Wear	2000 Hours

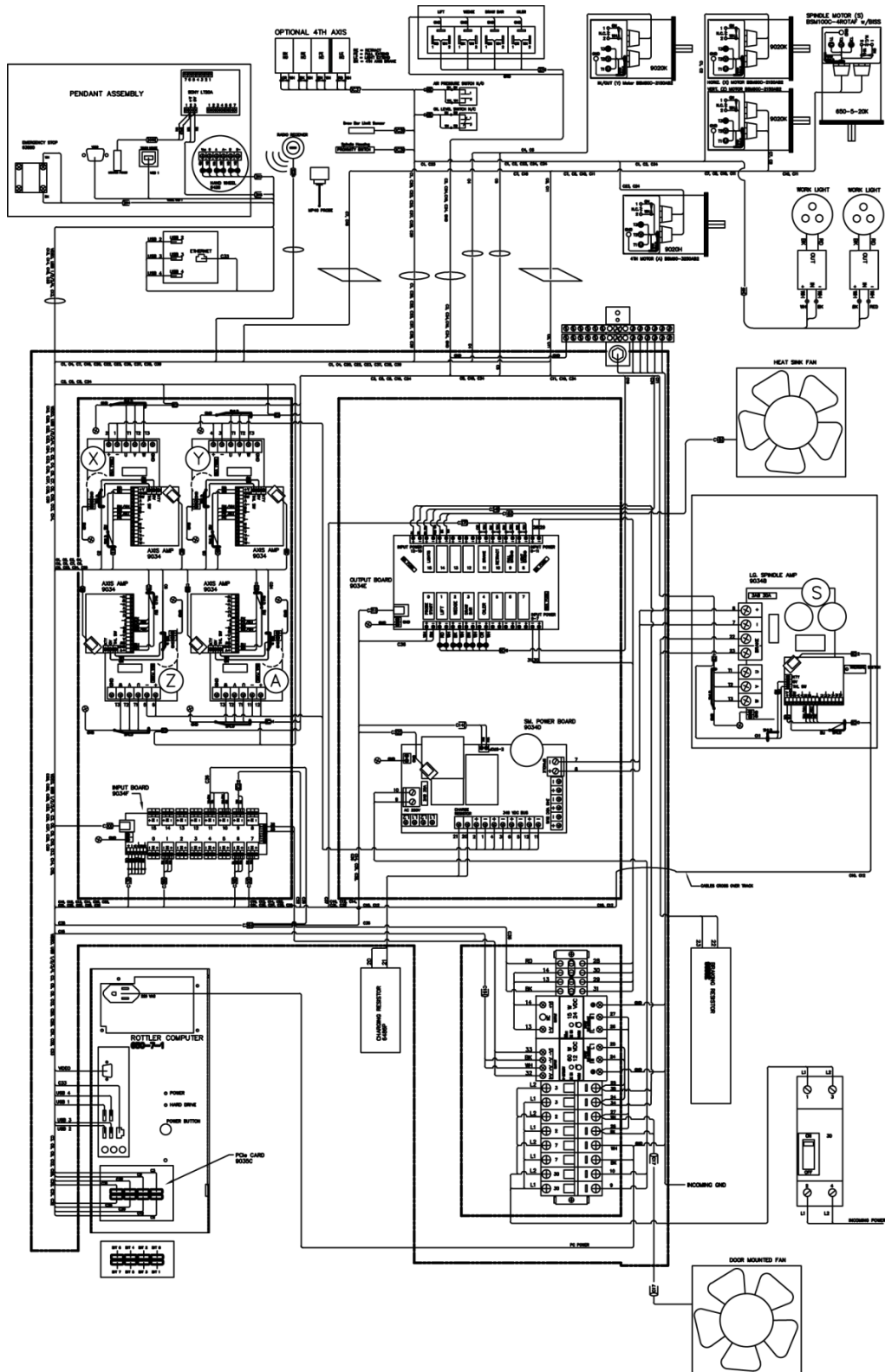
**Air Logic**

**Image Currently Unavailable**



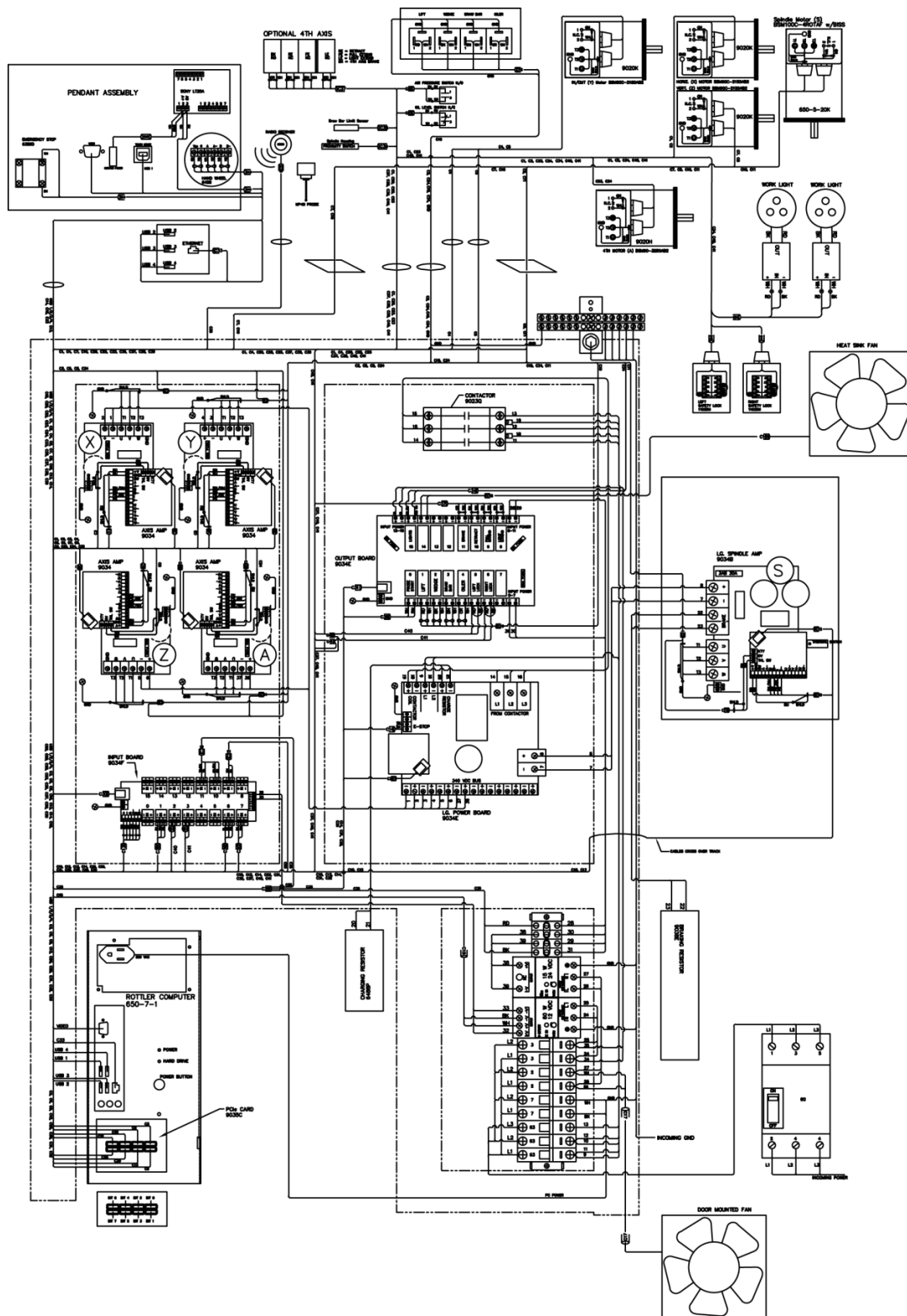
### F79A Wiring Diagram Single Phase

A scalable version of this wiring diagram is located on the manual CD.

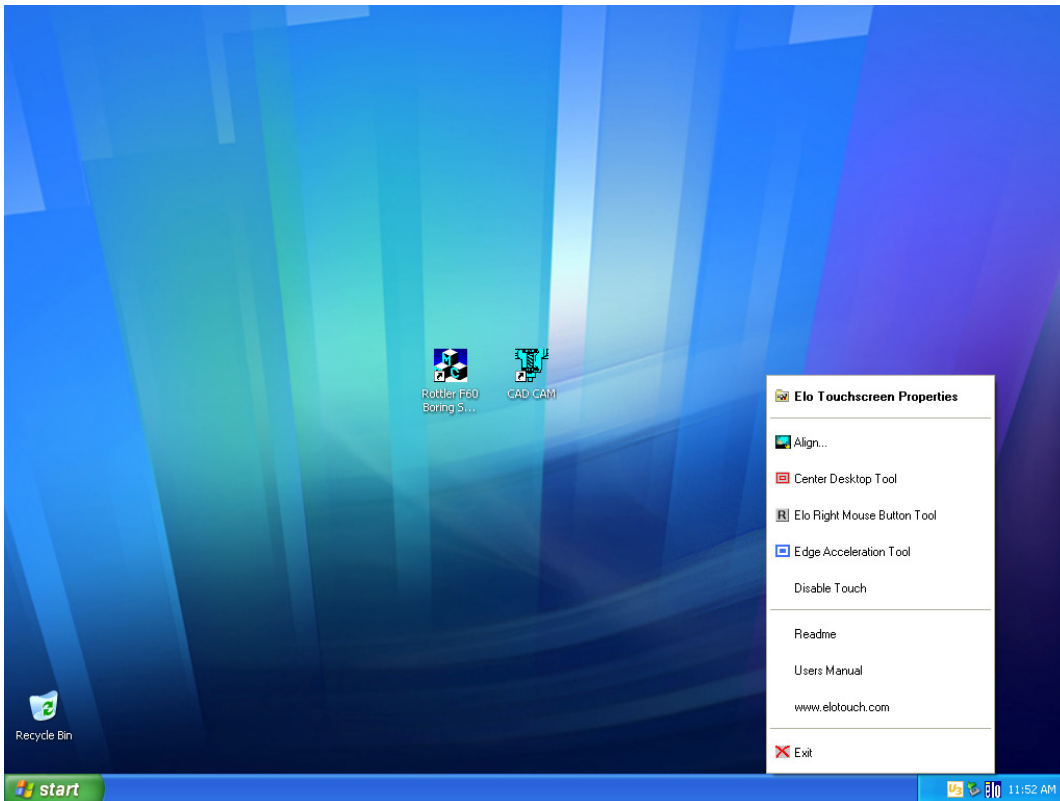


### Wiring Diagram F79A 3 Phase

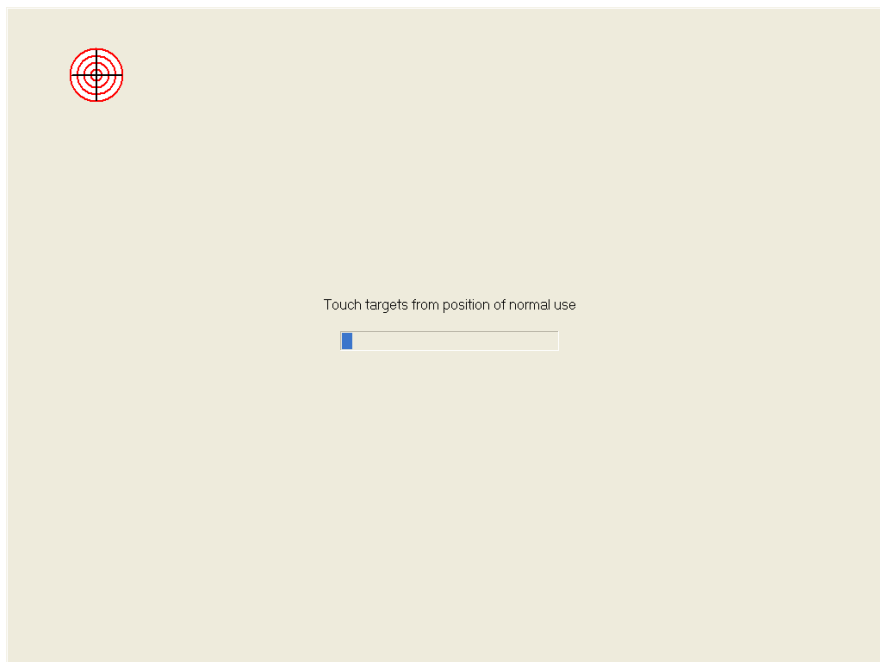
A scalable version of this wiring diagram is located on the manual CD.



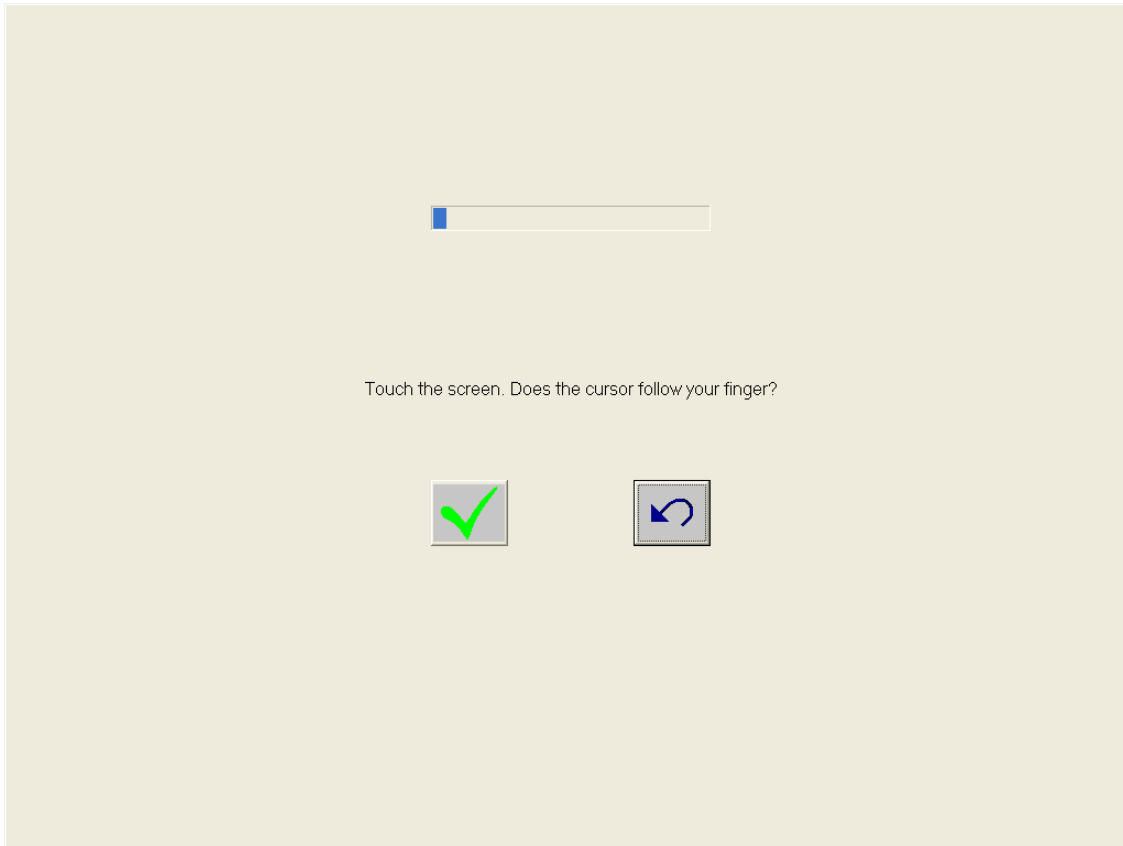
## ELO Alignment



Find the small arrow in the lower right hand side of your screen.  
Click on the ELO icon in the lower right, by the clock. Then click on Align.



Touch the center on each of the targets.



When this screen appears touch around the screen to make sure the arrow follows your finger. If it is good click the green check mark. If not click the blue arrow to do the alignment again.

## 502-12-7B Sony LT20 Set Up Instructions

A standard initialization is carried out at the time of shipment, however it is possible to make the following selections depending on the intended use. Details of the settings at the time of shipment are given in each section.

### Changing between Inches and mm

Turn on the power while holding down the “RESET A” button and press the “MODE” key/ Press the Up arrow to change between inches/mm. Press the “SET” button to set and return to the measuring state.

This device was set to mm at the time of shipment from Sony.

To change the initial settings... Press and hold the “SET” key and “MODE” key for approximately 2 seconds.

Basic Operation:

“MODE” – To the next item.

“UP ARROW” – Select the item.

“SET” – Set Item.

**Note:** *Even if you select an item with the “UP ARROW” key, no changes will be made until you press the “SET” key.*

**Note:** *Once the initial setting modes had been entered it is not possible to return to the measuring state partway through. Press the “MODE” key repeatedly to skip items.*

### Basic Settings

Setting the display (2 channel Models).

One of the following may be chosen: A and B or Only A+B.

A	disp
B	

Setting the input signal resolution (channel A)

One of 0.0005, 0.001, 0.005 or 0.01 mm can be chosen.

Set the resolution to match the resolution of the connected measuring probe.

	rSLP
A	0.0005P

## Outer Spindle Bushing Adjustment

The Lower Spindle Bushing will be adjusted in this demonstration.

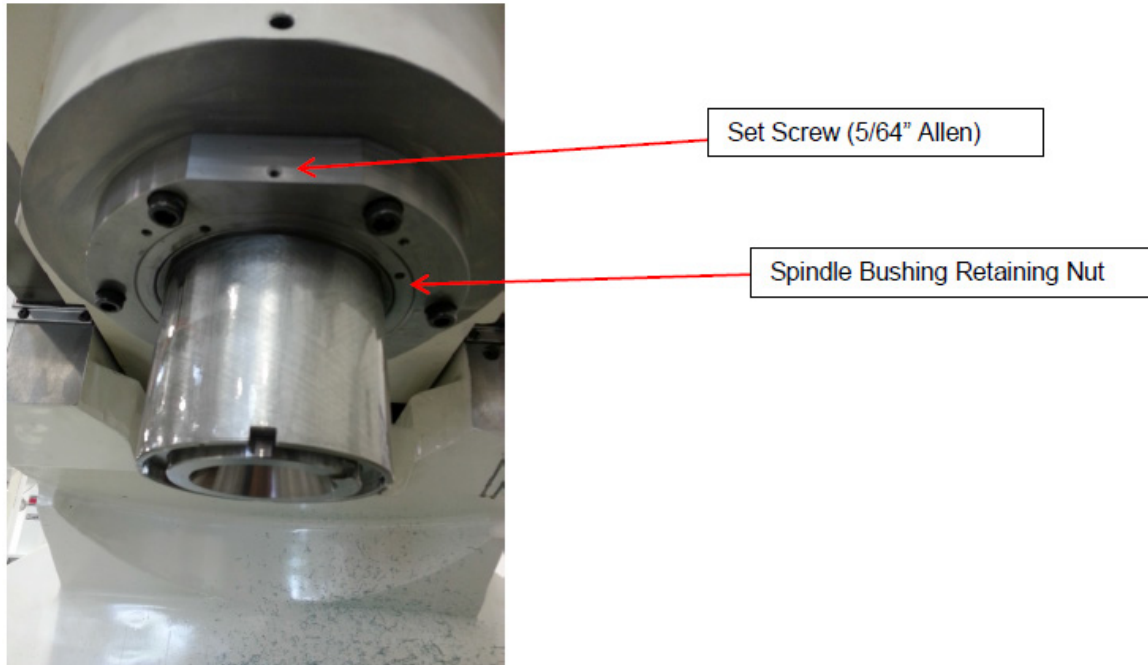
1. Start the Rottler Software.
2. Move the spindle to its full downward position.



Retainer – O-Ring and felt are underneath

3. Loosen the four 10-24 bolts in the Retainer and pull out the O-Ring and Felt.
4. Loosen set screw at top of Bushing Carrier.
5. Take a punch and tighten Lower Bushing Nut with palm of hand. Raise spindle 5" and repeat. This helps set the bushing in the bushing carrier.

(WARNING: Do not tighten Spindle bushing retaining nut when spindle is at the top 3" of travel. Excessive wear and premature failure could result.)



6. Once the Retaining Nut will not tighten any more, a couple soft taps with a punch and a hammer to tighten it is all that is necessary to finish procedure.
7. Re-Install Felt, O-Ring, then Retainer in that order. Tighten down (4) 10-24 bolts.
8. Tighten Set Screw in Bushing Carrier.

### Upper Bushing Adjustment

9. Be sure Spindle is at its home position (full upward position).
10. Repeat steps 3 and 4.
11. Take a punch and tighten Lower Bushing Nut with palm of hand. This time Lower spindle 5" and repeat.

(WARNING: Do not tighten Spindle bushing retaining nut when spindle is at the top 3" of travel. Excessive wear and premature failure could result.)

Once the Retaining Nut will not tighten any more, a couple soft taps with a punch and a hammer to tighten it is all that is necessary to finish procedure.

Re-Install Felt, O-Ring, then Retainer in that order. Tighten down (4) 10-24 bolts.

Tighten Set Screw in Bushing Carrier.

Note: It is recommended to sweep in your spindle after this maintenance procedure.

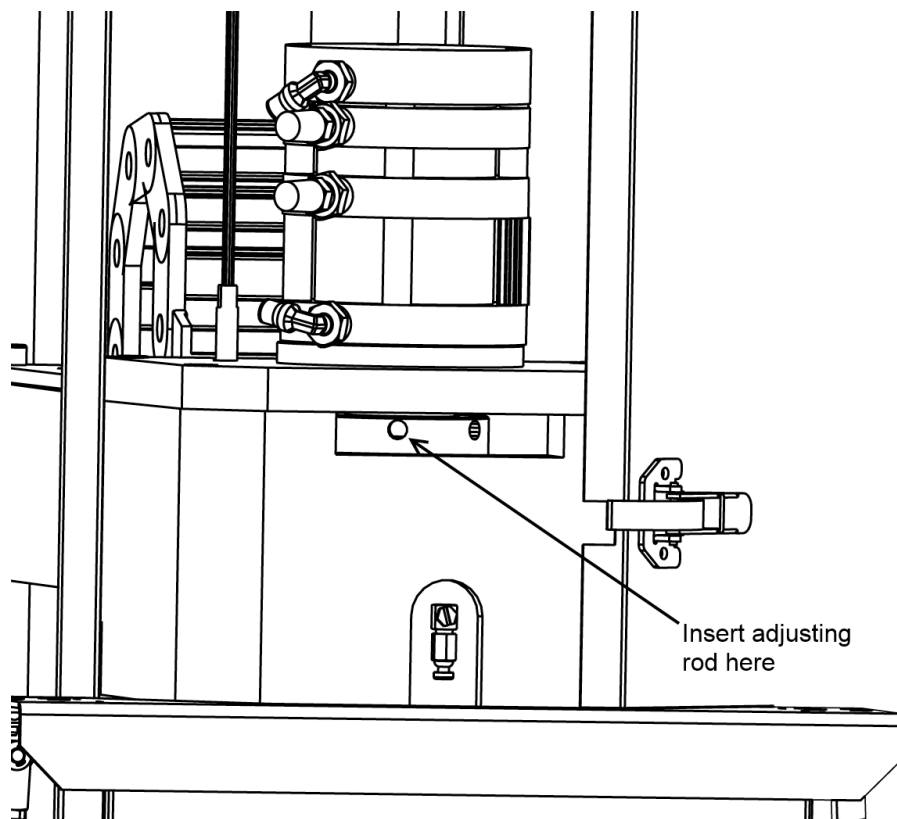
## Inner Spindle Adjustment

This adjustment should be made if you getting chatter or out of round bores.

1. Open the main spindle base door.
2. Install a surfacing cutterhead or a boring cutterhead with a long tool holder installed into the machine.
3. Locate the opening on the belt housing. This is located at the top of the outer spindle. Inside is the inner spindle adjustment nut (6091A). The adjustment nut has holes drilled in it along it's perimeter to allow for use of an adjustment rod.
4. Insert the adjustment rod into one of the holes in the adjustment nut.
5. Rotate the cutterhead 1 turn Clockwise looking from the top, letting the adjustment rod brace against the end of the slot in the belt housing. This will loosen the inner spindle adjustment.
6. Now carefully turn the cutterhead Counter Clockwise looking from the top. The cutterhead will turn easily and you should be able to feel the spring loaded ball detent in the nut. At some point the torque required to turn the cutterhead will sharply increase, immediately stop turning the cutterhead. This indicates that the Belleville washers have collapsed and the bearing is bottomed out.

**IMPORTANT: DO NOT OVER TIGHTEN, SEVERE BEARING DAMAGE WILL OCCUR AND REPLACEMENT WILL BE NECESSARY.**

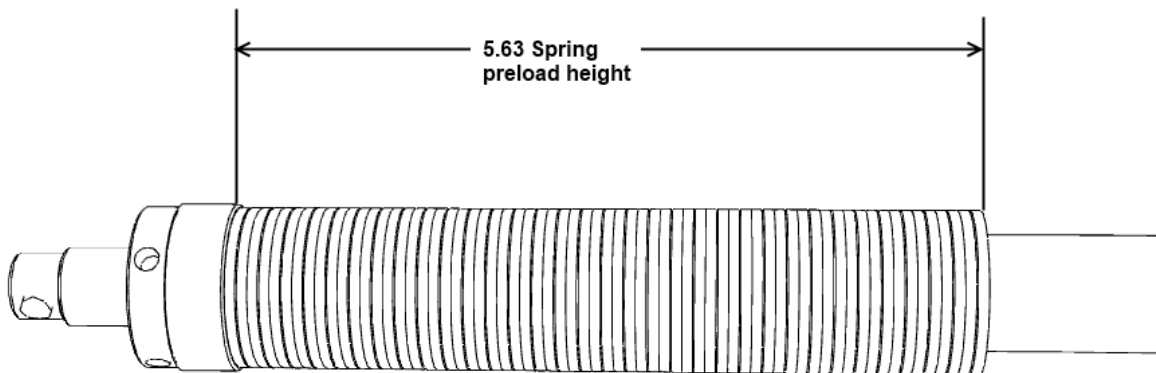
7. Now turn the cutterhead Clockwise until detent notch is felt.
8. Remove the adjustment rod, the inner spindle is now properly adjusted.





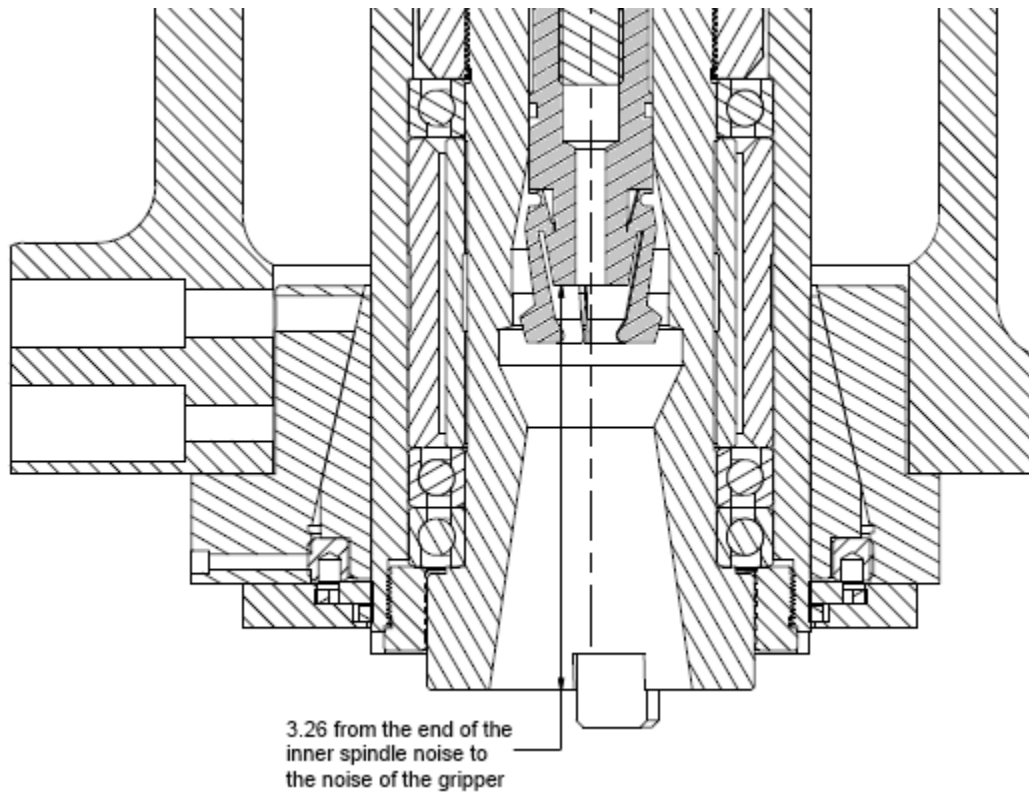
## Adjusting Drawbar

1. Remove the upper housing cover 11006G (Ref manual chapter machine parts, pg. 28).
2. Use a 7/16 combination wrench to hold the hex portion of the top of the draw bar. (page 30 p/n 11021)
3. Through the bottom of the spindle, reach up with a 5/16" Allen, turning counter clockwise, and loosen the jam nut inside the draw bar gripper. (pg. 26, p/n 11021F)
4. Use a Large Flat head screw driver to unscrew the gripper from the draw bar. (You are ensuring that the gripper jam nut is free from the gripper, and that the gripper is free from the drawbar. This is how to adjust the drawbar).
5. You can now pull out the draw bar from the top of the spindle and disassemble. We are going to take the retaining nut off the top and the bellevilles. Reinstall the bellevilles in this order. 42 total bellevilles with the first and last Belleville cupped side facing outwards like such... )()(...)(()
6. Reinstall the retaining nut and torque down until the bellevilles are compressed to a measurement of 5.63. (See picture below for reference.)



7. Install draw bar into spindle and use the flat head screw driver to reinstall the gripper onto the drawbar. (Might want to use that 7/16 combination wrench on the hex portion again for stability).
8. Re-install the upper housing cover and tighten bolts.

- Engage Drawbar and measure from the nose of the inner spindle, to the nose of the draw bar gripper. Adjust accordingly to achieve a 3.26 inch reading. (see drawing below for measurement and clarification).




- Once measurement has been made, tighten jam nut in gripper.

## F79A Upper Housing Disassembly

Travel the machine to the right Home position.

Remove the spindle base door and right side cover.

Place a board across the spindle base directly below the spindle motor (6790K or 6790U). Lower the spindle until the motor just touches the board.

 **CAUTION** Disconnect all power and air to the machine before continuing, severe bodily injury may occur.

Remove the four (4) bolts securing the motor the belt housing. Remove the two (2) bolts that secure the cable carrier (6314K) to the upper housing. Remove the oil and air lines from the upper housing.

**Note: It is not necessary to disconnect the spindle motor wiring.**

Rotate the vertical ballscrew by hand until it is about eight (8) inches from the top plate.

Place a board, of proper length, between the bottom of the upper housing and the top of the spindle base to prevent it from falling.

Remove the two bolts that secure the centering gear housing (6168H) to the belt housing. Work the **centering housing up off the centering shaft. Tie it up to the top plate.**

**IMPORTANT!!: Do not attempt to move the vertical under power when the centering housing is not bolted to the belt housing or the upper plate. Severe damage will result to the centering shaft!!**

Remove the Clevis Pin (7210B) from the draw bar actuator bracket (6174B). Lift the actuator arm (6173B), move the arm and cylinder off to the side. Remove the air cylinder (6204A), clevis pin (6189A) and mount bracket (6188C) from the side of the belt housing. Remove the two (2) bolts that attach the draw bar actuator bracket (6174B) to the to belt housing cover.

Remove the counter weight cable (6453 F or 6453G) from the upper housing by loosening the lock nut and unscrewing the cable nut.

**Note: When reassembling, be sure not to thread the cable nut in too far as it may come in contact with the driven pulley.**

Remove the eight (8) screws holding the inner spindle end cap (6180A). Unscrew these bolts slowly around the diameter of the end cap as they are under spring pressure from the draw bar. Remove the cap by pulling straight up.

Note: When reinstalling, the end cap must be aligned concentric to the draw bar.

Remove the three (3) screws that secure the vertical ballscrew nut to the belt housing. Holding the nut with one hand, turn the ballscrew with the other to move it up and out of the way so the belt housing lid can be removed.

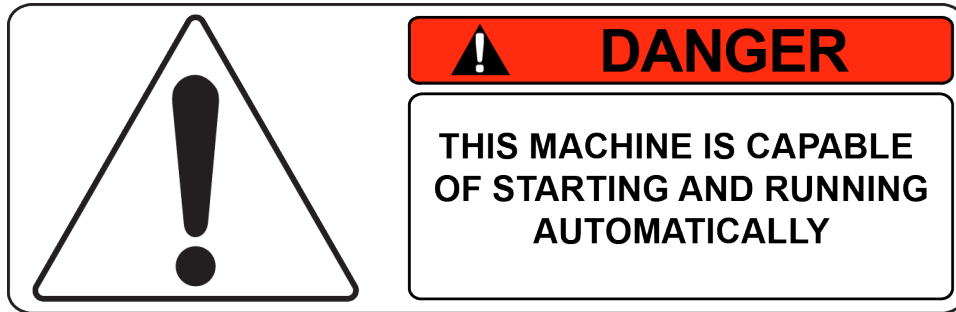
Remove the bolts securing the belt housing covers. The covers are pinned to the belt housing. Use a soft face mallet to carefully remove the covers.

From this position you can remove and/or replace pulleys and belts.

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**Image Currently Unavailable**

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**F79A Inner Spindle Removal and Installation****IMPORTANT**

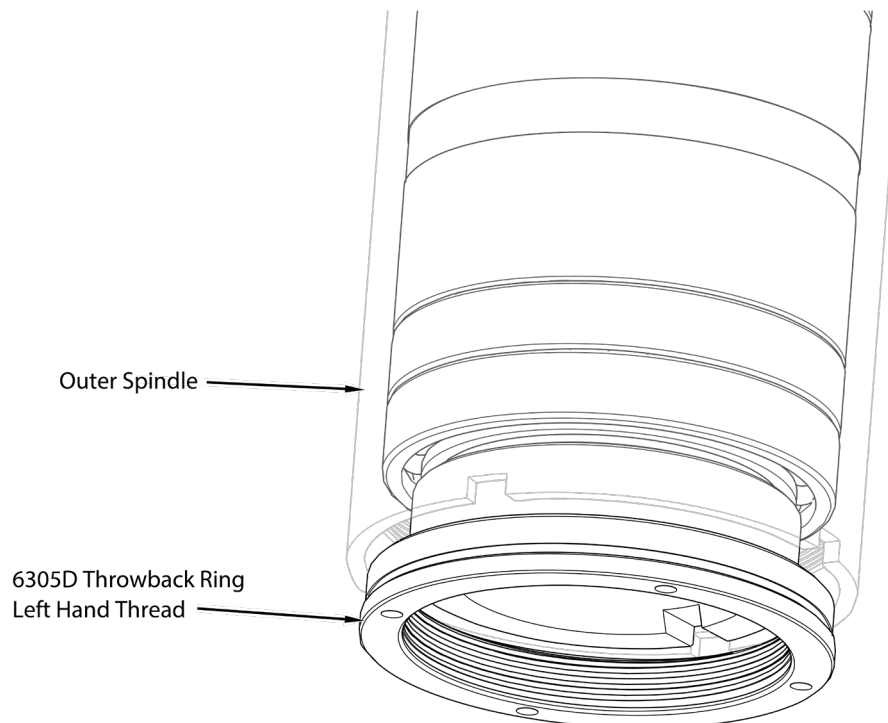
*Be sure to follow all safety procedures as described in Chapter 3 of this manual*

**IMPORTANT**

*When removing bearings, bellevilles and spacers, make a note of the direction they come off. This will aid in correct reassembly, Failure to do so will result in failure of the spindle bearings.*

Move the spindle to the very bottom of travel. Put an 18" parallel onto the bed and stack wood scraps until it touches the bottom of the spindle.

*The driven pulley and inner spindle adjustment nut must be in place before continuing. Remove the LEFT HAND THREAD throwback ring from the bottom of the outer spindle.*



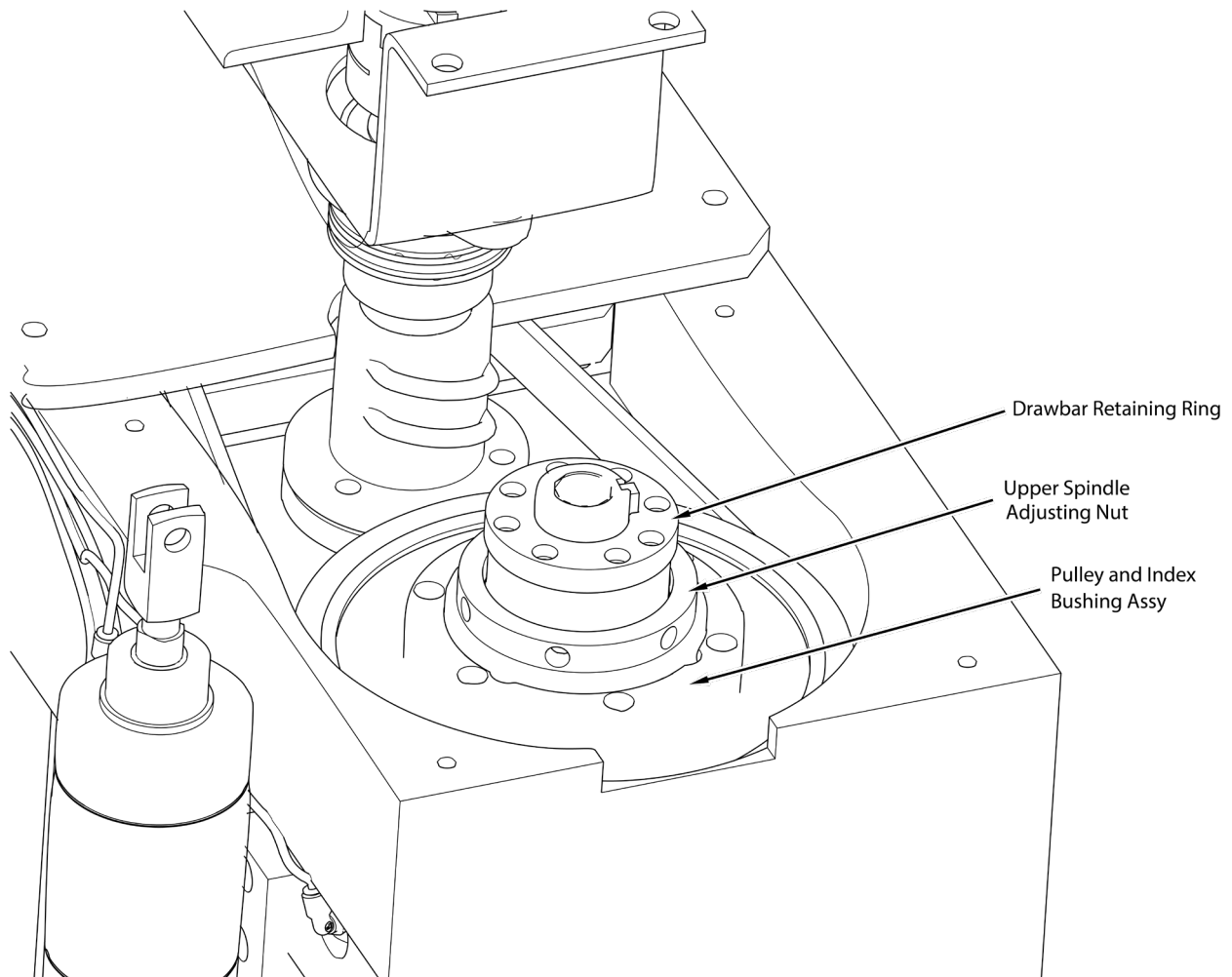
**Note: If the lower throwback ring, the driven pulley, and inner spindle adjustment nut, are not in place the inner spindle will be able to fall out of the outer spindle.**

While keeping the bottom of the inner spindle supported, remove the drawbar retainer ring, inner spindle adjustment nut, driven pulley/ index bushing, and the key from the top.

**The inner spindle is now free to be removed by moving the z-axis up**, the spindle is precision fit to the outer so may require light tapping with a soft plastic hammer to drop it out..

**Note: Be sure of the thrust direction of the bearings on reassembly.**

Reassemble in the reverse order.



### Inner Spindle Angular Contact Bearing Replacement

**Prior to following these instructions, perform the steps in Upper Housing Disassembly and Inner Spindle Removal.**

Loosen the three (3) Allen head set screws on the shoelock nut . Loosen the shoelock nut and slide off of the top of the spindle.

***Note: Be very careful not to damage the threads when sliding nuts, bearings and sleeves off the top of the inner spindle. These are very fine threads used for inner spindle adjustment nut.***

Remove the top bearing by tapping lightly and evenly on both sides of the bearing. After the bearing is moved slightly off of the spacer set, tap the inner race.

***Note: Tapping on the outer race can cause it to roll off of the bearings. Generally after removing the bearings from the inner spindle they are not suitable for re-use.***

Remove the spacer set.

Remove the two lower bearings set of three bearings the same way as the top bearing. The inner spindle should be stripped and ready to be replaced or serviced.

### Assembly Of the Inner Spindle

Make sure inner spindle is free of all dirt and debris, **any debris will cause premature failure of the bearings.**

Lightly coat the lower bearing pack area with ISO68 Way oil.

If you have a bearing heater available to you, it is the recommended method of bearing installation. If not, follow the instructions below.

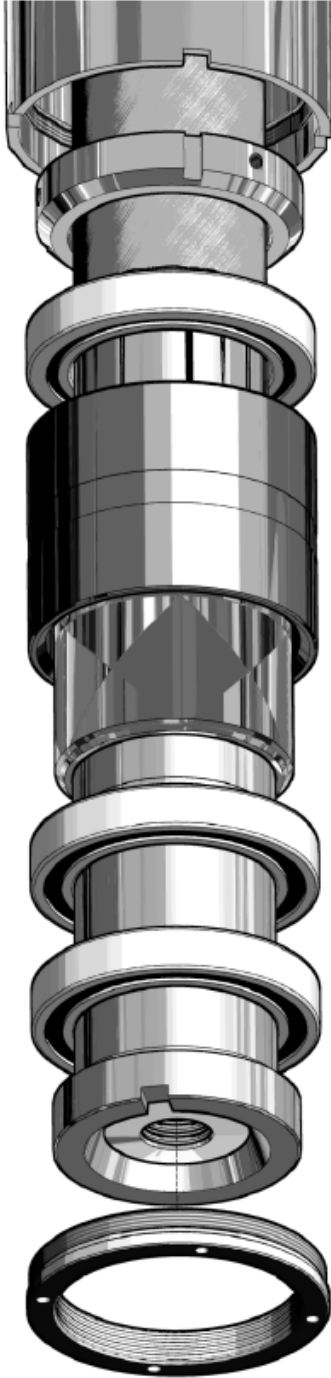
Slide the two (2) lower bearings onto the inner spindle with the correct bearing thrust direction(open side down) until they stop. Use a small brass punch to **lightly tap** each side of the bearing **on only the inner race** until both bearings are seated at the bottom of the spindle.

Install the spacer set.

Install the top bearing until it is seated against the spacer set. Using a small brass punch to **lightly tap** each side of the bearing **on only the inner race** until the top bearing is seated against the spacer set.

Install the shoelock nut and tighten with a spanner wrench until the inner races of the bearings and spacer set are fully seated together. Tighten the three (3) set screws on the shoelock nut. Place the inner spindle in a vise clamping on the tube of the of the spindle and not the nose and lock the vise.

Indicate the bearing set to within .0005" all the way around. Adjust the spacer set by tapping the high side lightly with a brass drift.



Install 3<sup>rd</sup> bearing with the closed side down.

Install inner and outer spacer assembly with beveled end facing up.

Install 2<sup>nd</sup> bearing with the open side down.

Install 1<sup>st</sup> bearing with the open side down.



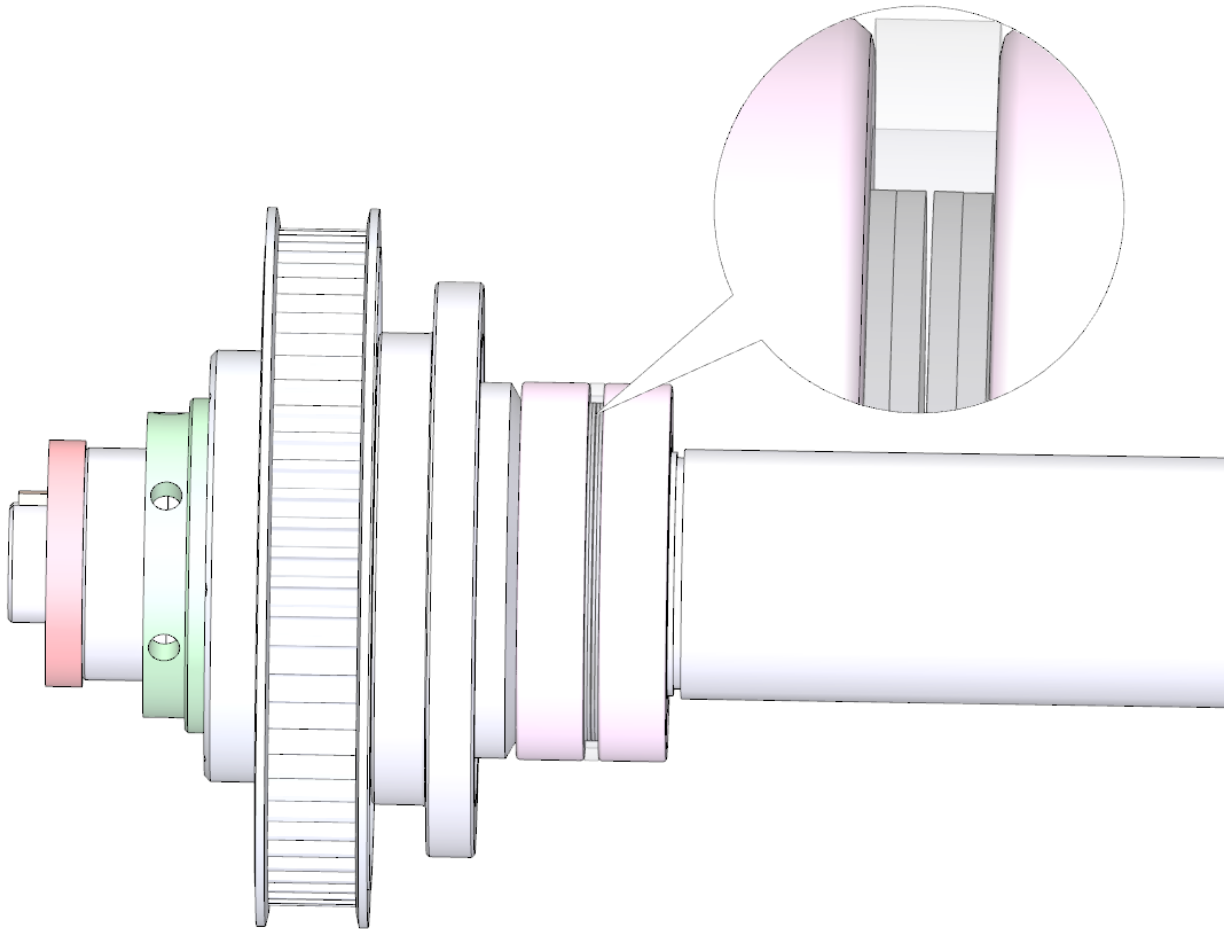
**Installing The Inner Spindle Into The Machine.**

Heat the lower part of the outer spindle with a heat gun before you reinstall the spindle into the outer.

Slide the Inner spindle into the bottom outer spindle.

While keeping the bottom of the inner spindle supported, install upper bearing, non-directional.

Install the four Bellevilles cupping them like so ( )()

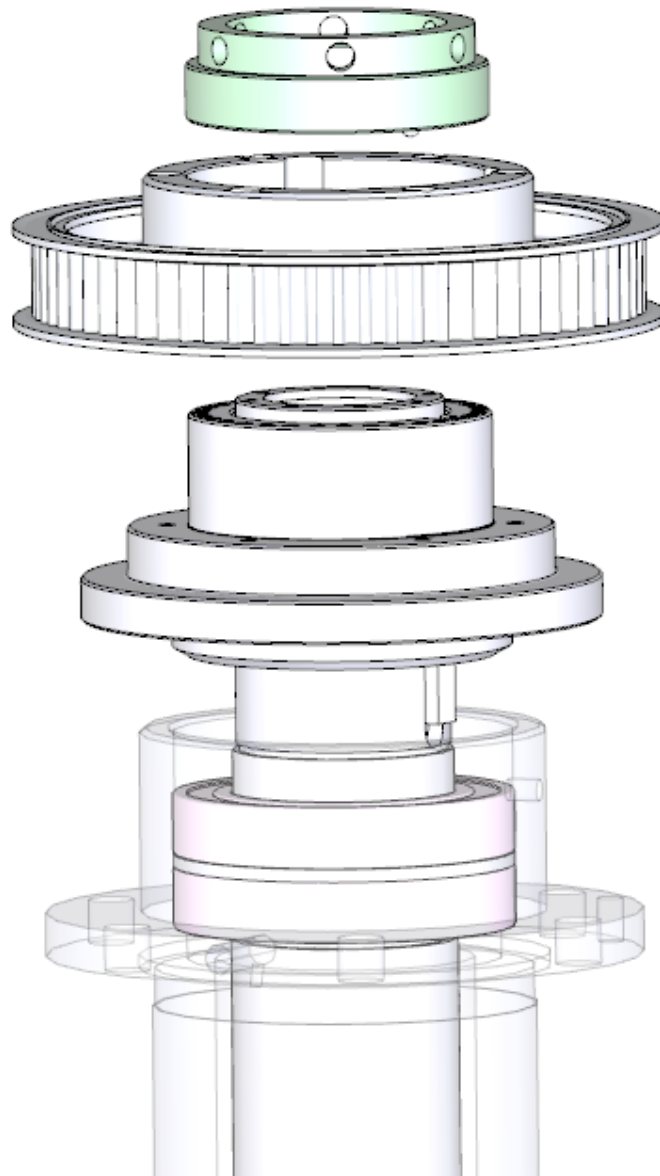


Install the drive key.

Install the driven pulley with the index bushing/driven pulley.

Install the inner spindle adjustment nut, and tighten by hand.

Install the LEFT HAND THREAD throwback ring onto the bottom of the outer spindle. Tighten to metal to metal contact, make a mark with a felt marker marking the position then tighten additional 1/16 of an inch.



### Adjusting The Inner Spindle

Open the main spindle base door.

Install a surfacing cutter head or a boring cutter head with a long tool holder installed into the machine.

Open the spindle base door and locate the opening on the belt housing. This is located at the top of the outer spindle. Inside is the inner spindle adjustment nut.

**The adjustment nut has holes drilled in it along it's perimeter to allow for use of an adjustment rod.**

Insert the adjustment rod into one of the holes in the adjustment nut.

Rotate the cutter head 1 turn Clockwise looking from the top, letting the adjustment rod brace against the end of the slot in the belt housing. This will loosen the inner spindle adjustment.

Now carefully turn the cutter head Counter Clockwise looking from the top. The cutter head will turn easily

and you should be able to feel the spring loaded ball detent in the nut. At some point the torque required to turn the cutter head will sharply increase, immediately stop turning the cutter head. This indicates that the Belleville washers have collapsed and the bearing is bottomed out.

**IMPORTANT**

***DO NOT OVER TIGHTEN, SEVERE BEARING DAMAGE WILL OCCUR AND REPLACEMENT WILL BE NECESSARY.***

***NOTE: A video of this procedure being done is available online at [www.rottlertube.com](http://www.rottlertube.com) search for; F79-F100 machines inner spindle adjustment.***

**IMPORTANT**

***Spindle sweep should be done after you have adjusted the inner spindle.***

***NOTE: A video of this procedure being done is available online at [www.rottlertube.com](http://www.rottlertube.com) search for; F79-F100 machines sweep.***

## Spindle Sweep

The outer spindle must be swept into the main bed of the machine to achieve accurate bores.

Remove all fixturing from the machine bed, clean and stone if needed.

Install a boring cutterhead into the machine.

Install the sweep are into the cutterhead.

Bring the machine down until you have about .005" pressure on the indicator.

**CAUTION** Disconnect all power and air to the machine before continuing, severe bodily injury may occur.

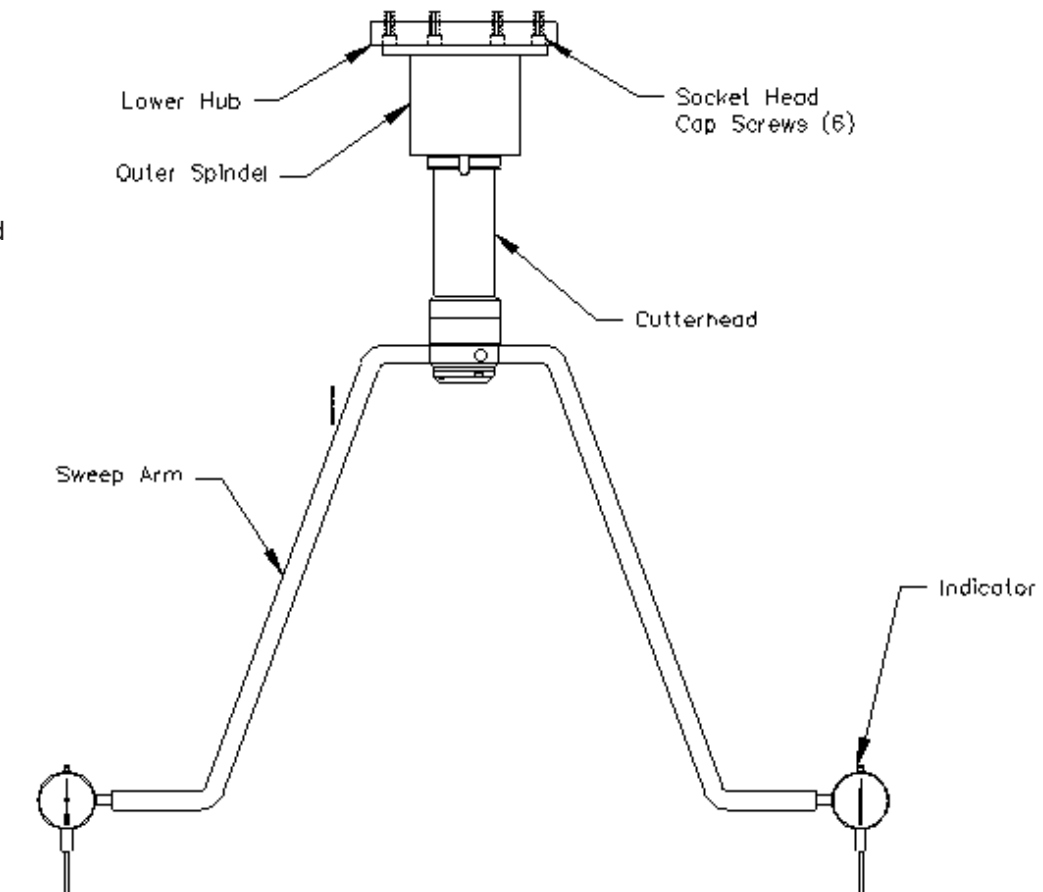
Turn the sweep arm to the 9 O'clock position. Zero the indicator here.

Loosen the 6 socket head cap screws on the lower spindle hub. You do not want them all the way loose, just snug.

Use the three (3) set screws and front pull bolt in the spindle base to move the spindle until the indicator reads within .0005" with a full 360 degree sweep of the indicator.

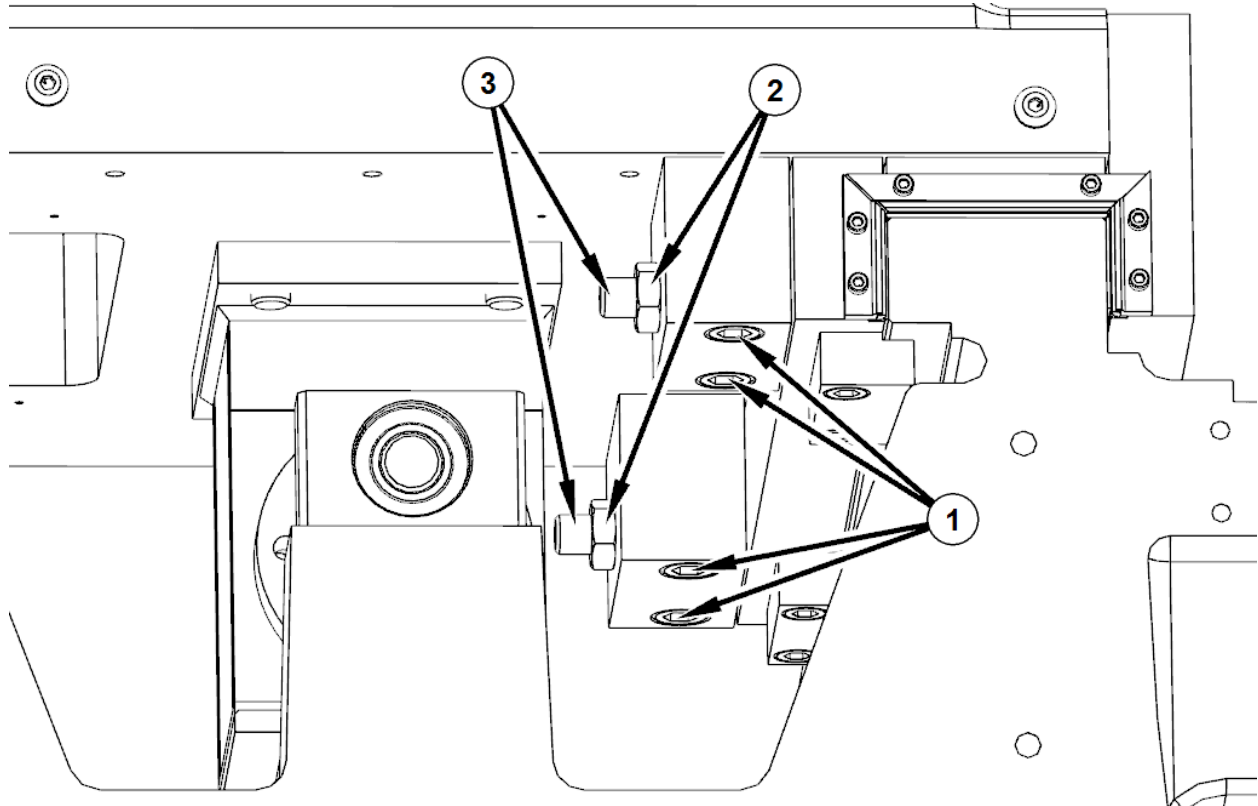
**Note:** You do not want the right hand side of the spindle to be more positive than the left, it will interfere with the automatic tilt of the machine when in Mill mode.

Once the spindle is swept in tighten the six (6) socket head cap screws and double check that the sweep did not move.



## Horizontal Gibs

The Horizontal gibs are located under the main column, on the back side of the front way. These gibs keep the column from “cocking” when the direction of travel is changed. This adjustment becomes more critical when line boring. If the gibs are too loose the column will turn slightly side ways when traveling. This will cause the alignment of the right angle drive to be off. The cutterhead will then cut heavier on one side of the bore.



To adjust:

Loosen the Gib bolts (1)(two on each side)

Loosen the Lock Nut(2) on the set screw.

Tighten the set screw(3) to 35 ft. lbs. using a correct size Allen socket. This will pull the Front Way bearing up against the front way while pressing the Gib up against the back of the Front Way.

Loosen the Set Screw.(3)

Tighten the set screw(3) to 1 ft. lbs..(12 in. lbs.)

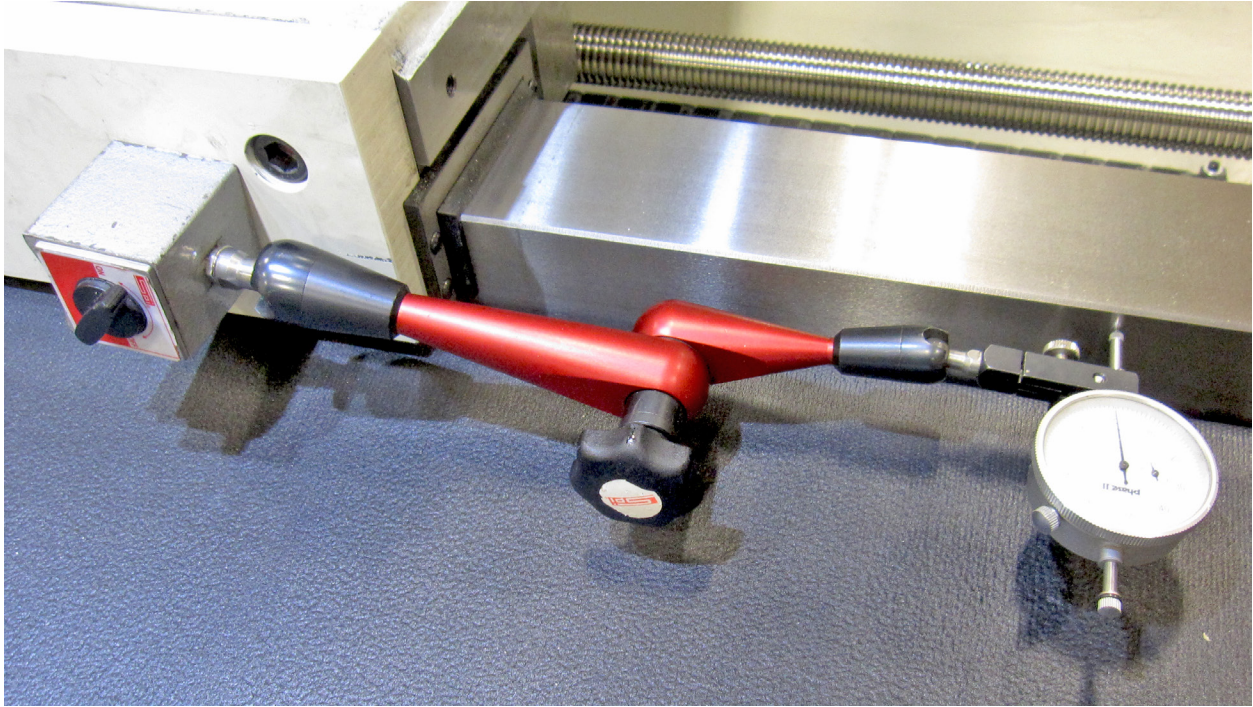
Lock the Lock nut.(2)

Run the machine back and forth to let the gibs adjust to adjust in.

Tighten the Gib bolts.(1)

If the machine will not travel full speed or the handwheel movement is erratic the gibs may be too tight. Re-adjust leaving the Set Screw(3) a little bit looser than the previous adjustment.

Another way to check for correct adjustment is to attach a magnetic base dial indicator (.0001 resolution) to the column with the indicator tip contacting the machine way surface.



Now using the handwheel in .010" per click mode, move the column back and forth, about two turns on the handwheel in each direction at a rapid rate.

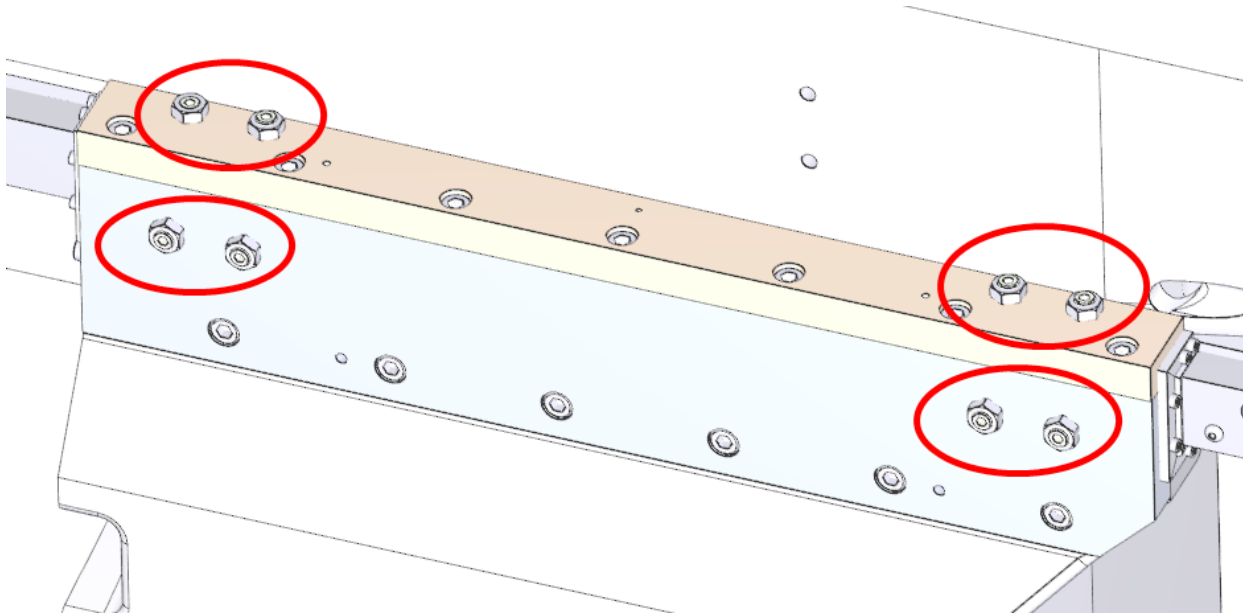
Note the amount of movement on the dial indicator.

The acceptable amount of movement on the dial indicator is between .0002"-.0005".

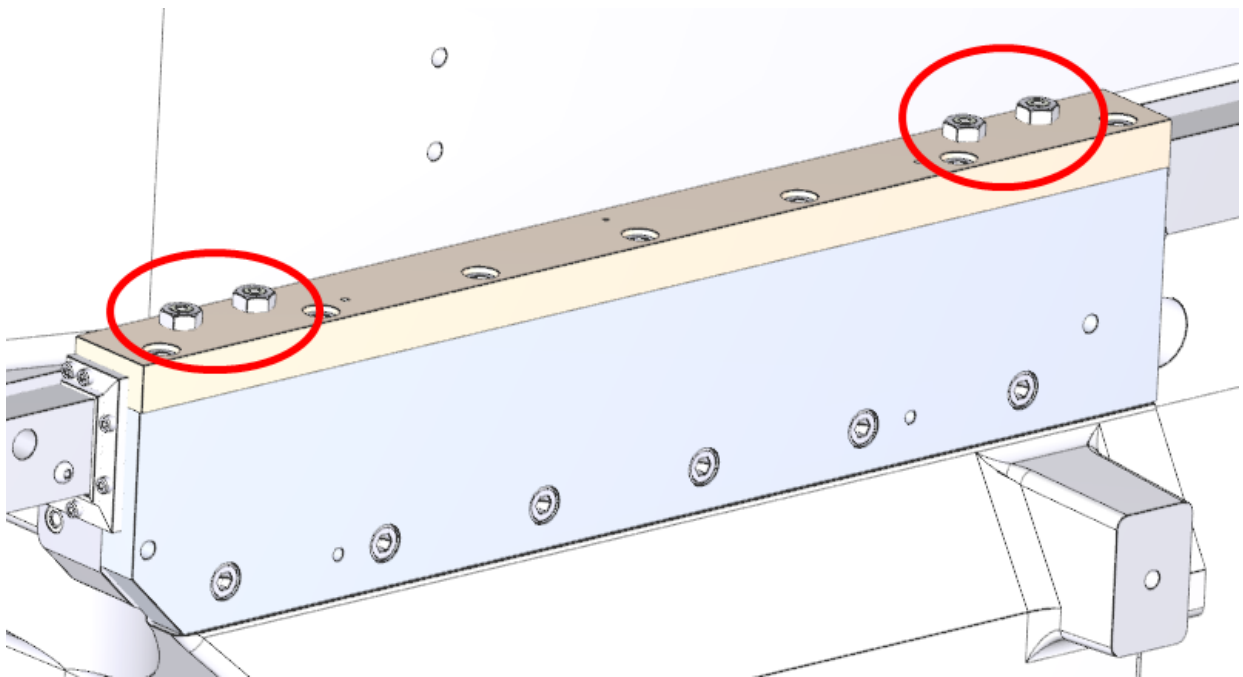
Adjust as necessary. This procedure must be performed at both, the right, and left, sides of the column.

## Adjusting Y-Axis Gibs

The Y-Axis adjusting gibs are located at the top of the machine column that the spindle base is mounted on. There are gibs located on the top and side rails on the left side of the column. Two are located on the top rail and two are located on the side rail.



On the right side of the column there are gibs located on the top rail.



**Adjustment Procedure**

1. On the left side rail loosen the jam nuts.
2. Tighten the set screws until they bottom out and can't be turned further.
3. Loosen each set screw 1/8 turn.
4. Tighten jam nuts.
5. On both top rails loosen jam nuts.
6. Tighten the set screws until they bottom out and can't be turned further.
7. Loosen each set screw 3/4 turn.
8. Tighten jam nuts.



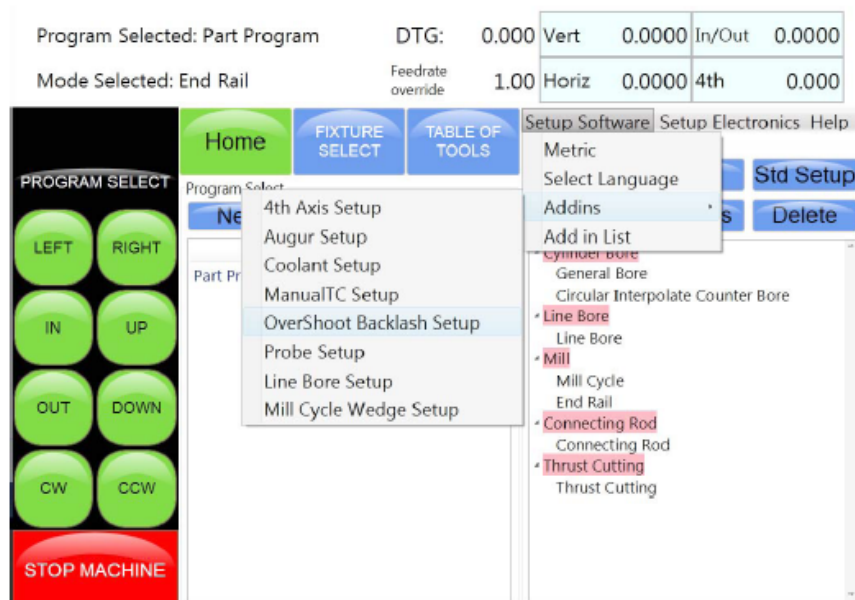
## Backlash Setting .NET Software

The Screens depicted below are for setting Backlash compensation values only. **DO NOT** use any other information on these screens to change information on the machine.

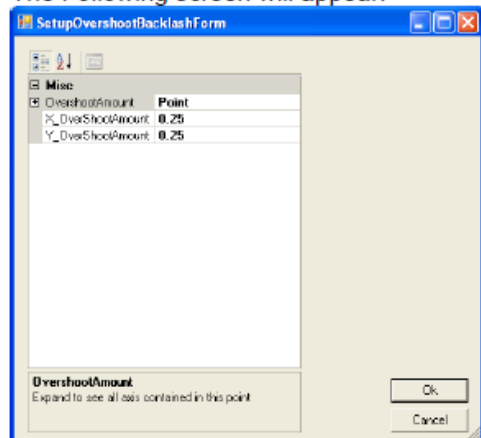
1. Turn off "Overshoot Backlash Setup"

**Note:** Only the F70-90 and 100 machines use the overshoot feature.

Go to Setup Software>Addins>Overshoot Backlash Setup



The Following screen will appear.



1. Record the existing X and Y "Overshoot Amount". Generally .250
2. Use the "On Screen Keyboard", or plug in the full size keyboard, and change the amounts to 0.00, and click on OK. Close the "Setup" screen.

3. Go to Setup Electronics>Control

Program Selected: Part Program      DTG: 0.000

Mode Selected: End Rail      Feedrate override 1.00

Vert	0.0000	In/Out	0.0000
Horiz	0.0000	4th	0.000

The screenshot shows the CNC control interface. On the left is a 'PROGRAM SELECT' panel with buttons for LEFT, RIGHT, IN, UP, OUT, DOWN, CW, and CCW, and a red 'STOP MACHINE' button. The main display area shows a 'Control Options' dialog box with a table of links:

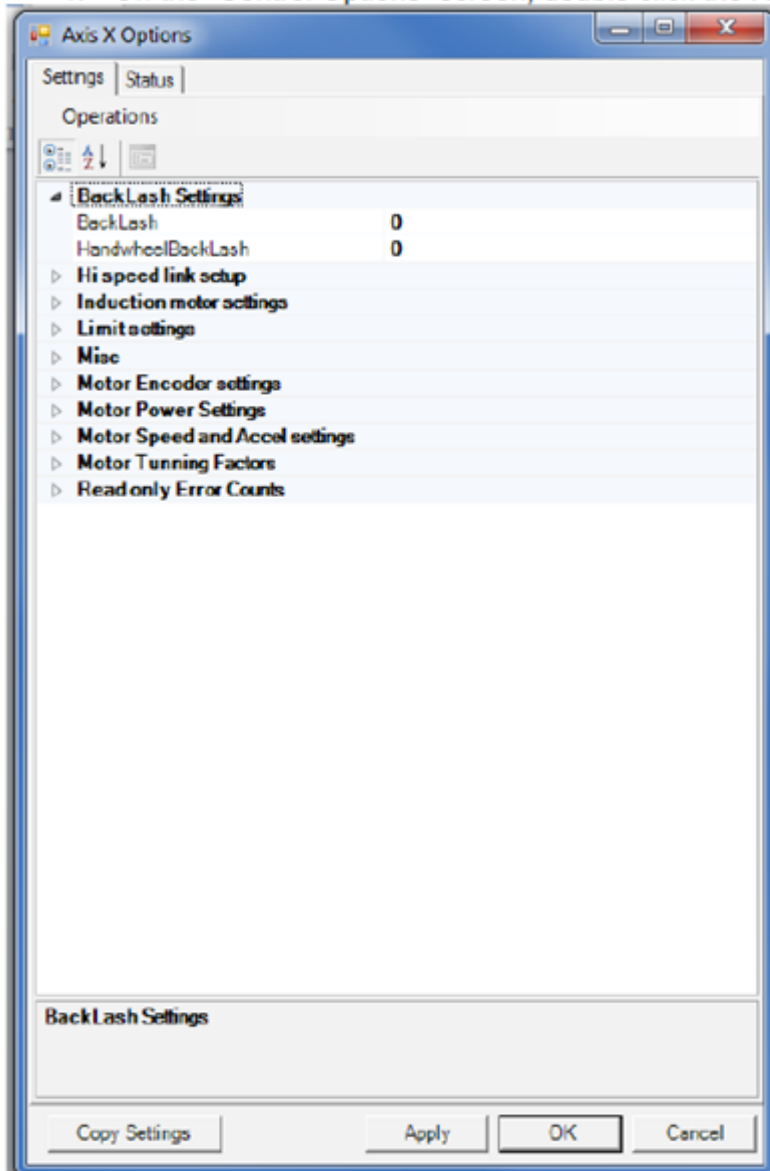
ControlOptionsForm	LinkNumber
X	0
Y	1
Z	2
Handhead	-1
S	3
A	-1
Outputs	6
Inputs	5

Below the table are checkboxes for 'Debug Programming Links', 'InqTiming', 'Run 0 Trace', and 'Status', along with 'Load Settings', 'OK', and 'Cancel' buttons.

On the right, the 'Setup Electronics' menu is open, showing a 'Select' button and a list of options: Control, Coordinated Motion, and IO. Below this, a list of tool types is displayed:

- Cylinder Bore
  - General Bore
  - Circular Interpolate Counter Bore
- Line Bore
  - Line Bore
- Mill
  - Mill Cycle
  - End Rail
- Connecting Rod
  - Connecting Rod
- Thrust Cutting
  - Thrust Cutting

4. On the "Control Options" screen, double click the X to bring up the "X Options" screen.



Now minimize the screen.

5. Repeat step 4 for the Y and Z axis.
6. Close the "Control Options" screen.

7. Select a program (block), then select any cylinder bore mode.

The screenshot displays the control interface for a Rottler Black Boring machine. At the top, it shows the program selected as 'test' and the mode as 'General Bore'. The DTG (Dial Indicator) is set to 0.000, and the feedrate override is 1.00. The interface is divided into several sections:

- Program Select:** A vertical column of buttons labeled LEFT, RIGHT, IN, UP, OUT, DOWN, CW, and CCW. A red STOP MACHINE button is at the bottom of this column.
- Set Zeros:** A section with four yellow buttons: Zeros, VERTICAL, HORIZONTAL, and SPINDLE. Each button is associated with an 'Actual Position' value: Zeros (0.0000), VERTICAL (0.0000), HORIZONTAL (0.0000), and SPINDLE (0.00).
- Vertical Stops:** A section with three yellow buttons: VERTICAL, HORIZONTAL, and SPINDLE. Each button is associated with a 'Handwheel' value: VERTICAL (.010), HORIZONTAL (.010), and SPINDLE (10x).
- Locations:** A section with three yellow buttons: VERTICAL, HORIZONTAL, and SPINDLE. Each button is associated with a 'Move To' value: VERTICAL (.001), HORIZONTAL (.001), and SPINDLE (Coarse).
- Probe #:** A section with a 'Probe #' value of -1 and a 'Set Active' button.
- Spindle Load:** A section showing a Spindle Load of 0.0%.
- Feed Rate:** A section showing a Feed Rate of 0.0020.
- Spindle RPM:** A section showing a Spindle RPM of 400.
- Buttons:** A section with several green buttons: MOVE TO ZEROS, CW INDEX, CCW INDEX, and START SPINDLE.

### Notes:

\*\*\*The photos shown are demonstrating the X axis (horizontal) backlash adjustment. The Y and Z axis are adjusted following the same steps.

\*\*\*The direction of machine travel to put the initial load on the dial indicator, are as follows:

X (horizontal), from the right toward the left.

Y (in/out), from back toward the front.

Z (vertical) from top toward the bottom.

A Dial Indicator with 1.0" to 1.5" of travel should be used for several reasons.



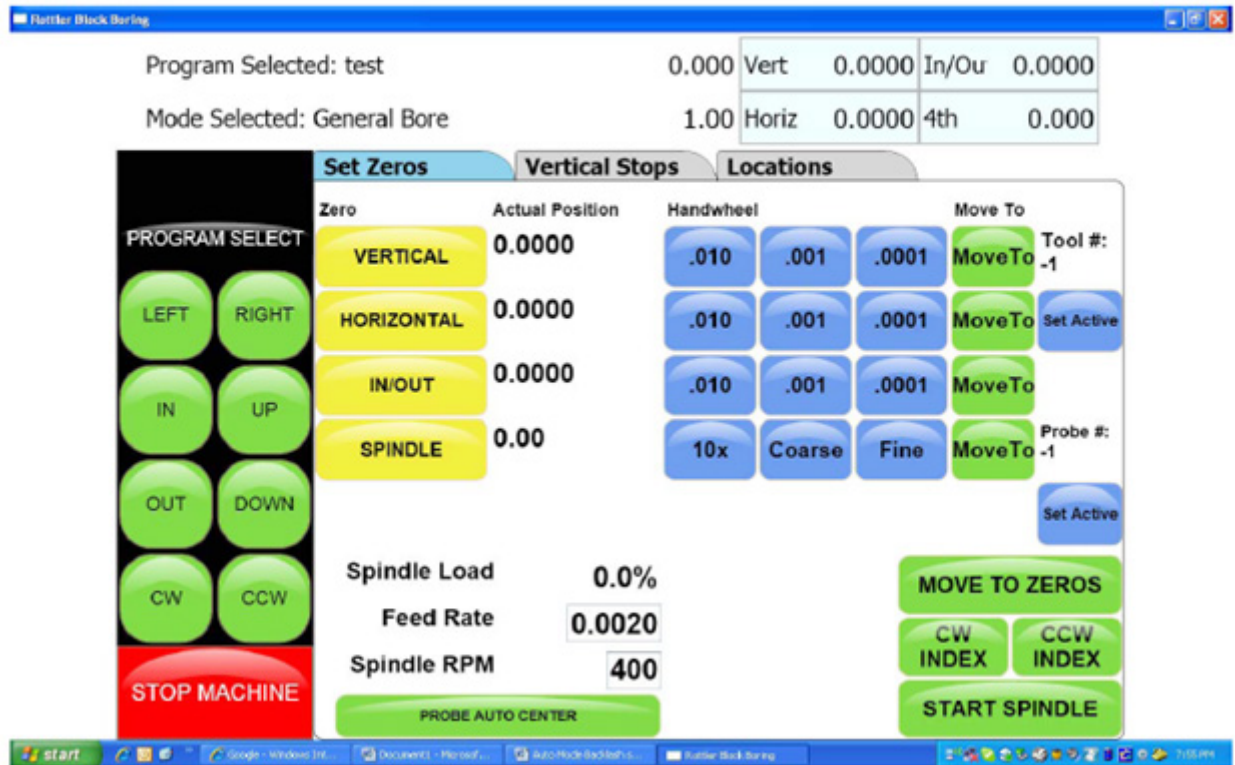
If the axis is overshooting or coming to position slowly you will be able to see it with a dial indicator. With Digital indicator you will only see the end position. The Magnascale indicator should be used to dial or tram in. The automatic moves of the machine can "Shock" the sensitive plunger of the Magnascale.

8. Attach the magnetic base and dial indicator to a stationary stand, parallel, or engine block fixed to the machine bed.

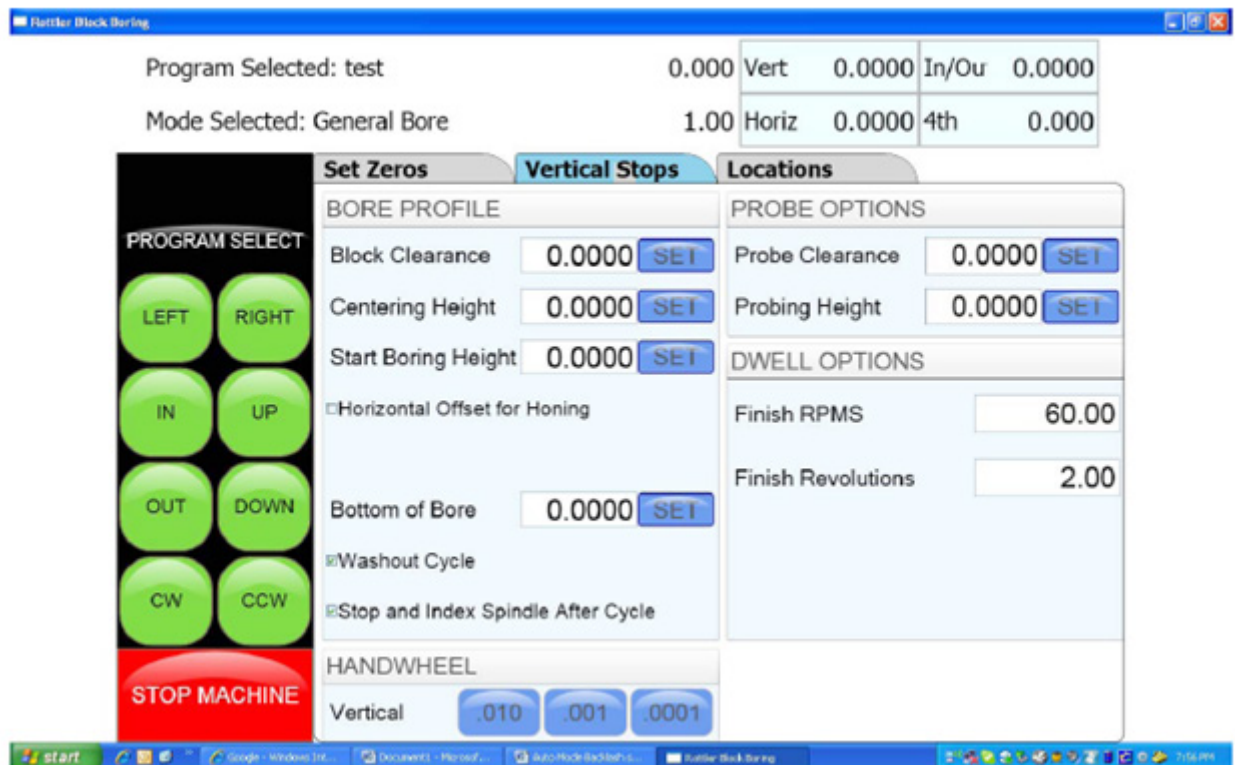


9. Bring the spindle of the machine in position to put a slight load on the Plunger, about .020".

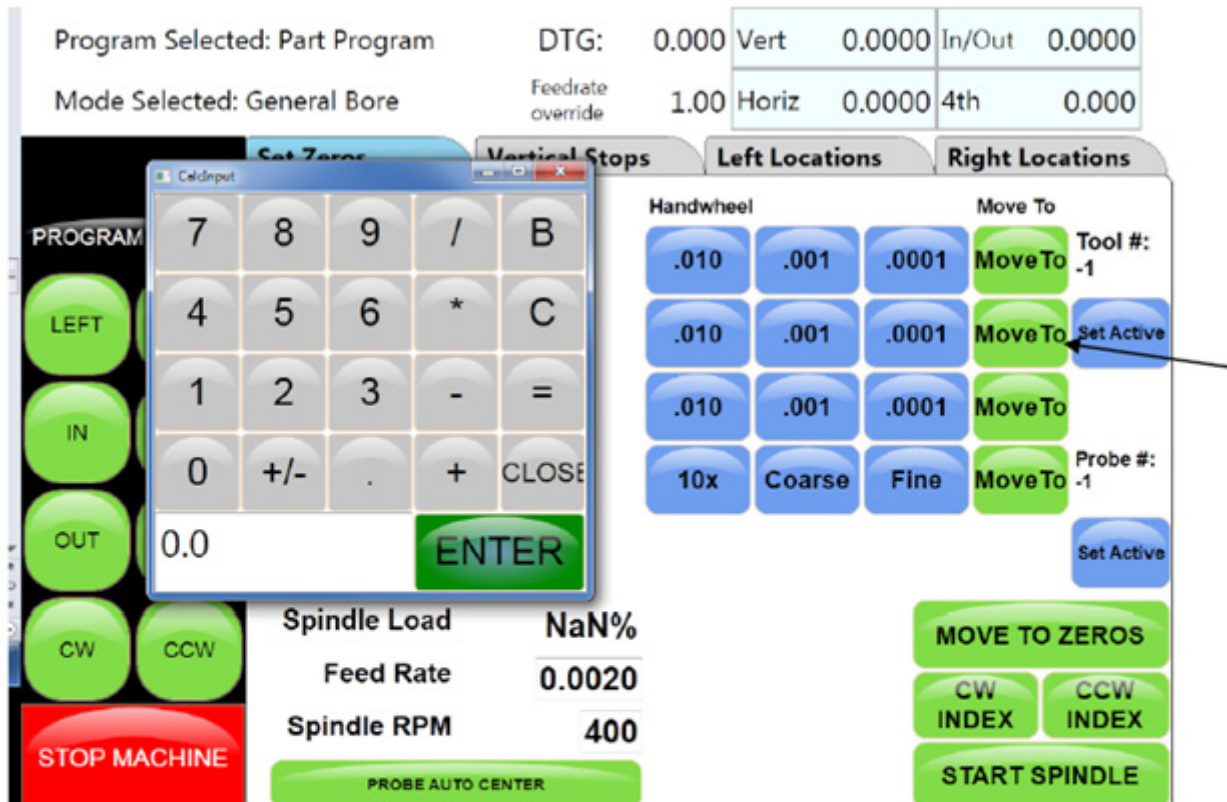
10. Set "Vertical, Horizontal, In/Out" zero.



11. Set all vertical stops to "zero".



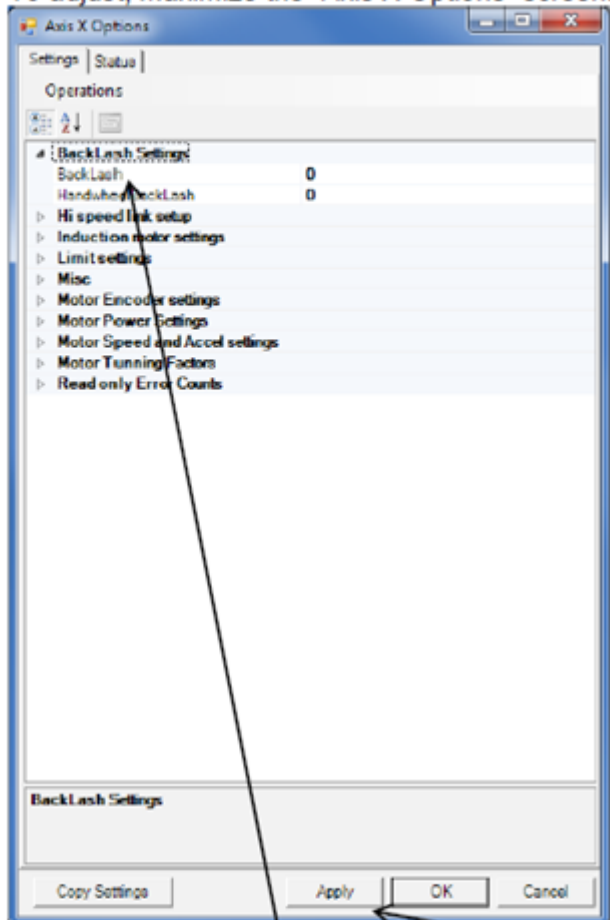
12. Move the machine spindle away from the Plunger a few inches, and press "Move to" and then 0 and Enter from the pop up keypad for the axis that is being measured..



13. Repeat the movement to verify the machine will repeatedly position itself at zero.  
 14. Now, use the "Move To" button and then -.200 to move the spindle -.200" in the opposite direction.  
 15. Press "Move to" and then 0 and Enter from the pop up keypad for the axis that is being measured..

If the machine did not position itself to bring the digital readout to zero, a backlash compensation adjustment is needed.

16. To adjust, maximize the "Axis X Options" screen. Go to Backlash Setting>Backlash.



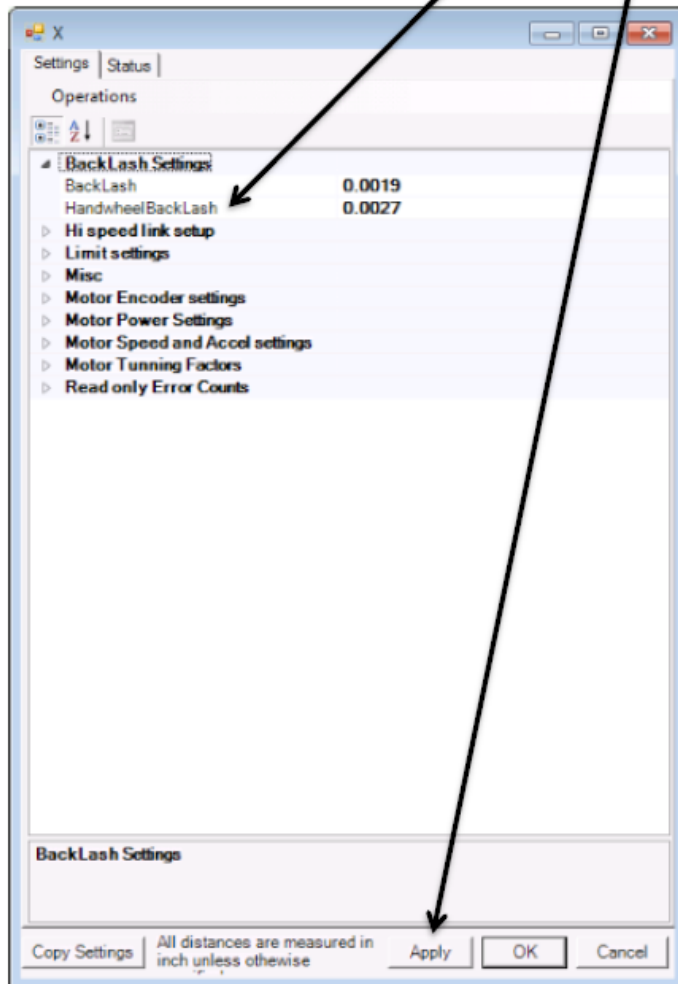
17. Use the "On Screen Keyboard", or plug in the full size keyboard to enter the amount of correction in the Backlash area. After entering a value, click "Apply", for the new setting to take effect.
18. Repeat steps 13 through 17 and adjust as necessary until the machine positions itself to "Zero" on the digital readout from both directions.

Handwheel Backlash is measured in a similar way to Backlash but the axes is moved by the Handwheel – the Move To buttons are NOT used.

19. Set up the Dial Indicator as described in #8 and #9.
20. Touch the .001" Handwheel button and move the axis to away. Turn the handwheel at a **constant speed** and move the axis back until the control panel displays zero. If the axis travels past zero, start again - move back again and turn the Handwheel at **constant speed** until the axis stops on zero on the machine display. Check that the Dial Indicator is zero, if not, move away and back again until both the machine control and Dial Indicator both read zero.



21. Now move the axis in the opposite direction and be sure to stop about .020" less that total plunger travel before compressing the plunger all the way. Now move the axis back by turning the Handwheel at a **constant speed** until the machine display reads zero. Check the reading on the Dial Indicator.
22. Use the "On Screen Keyboard", or plug in the full size keyboard to enter the amount of correction into Handwheel Backlash. Press Apply when you are done.



23. Follow steps 9 through 22 for the Y and Z axis.
24. When finished, re-enter the "Overshoot Backlash Amounts", as recorded in step 2 and click OK and close the window.

## Spindle Belt Adjustment

The spindle belt should not require adjustment very often, but if required use the following instructions.

Open the Spindle Base shroud.

Loosen the four Motor mounting bolts on the spindle motor.

Tighten or loosen the Tension adjustment bolt on the rear of the belt housing until 5 pounds of pressure causes the spindle belt to deflect 1/4".

If the spindle motor is run at high speed and a high pitched whining is heard from the belt housing area the belt adjustment is probably too tight.

If you can visually see the belt jumping around while running the belt is too loose.



**Image Currently Unavailable**

### Mill Tilt Adjustment Procedure

1. Position the Y axis in the middle of its travel. Using a 5/32" hex key, loosen the locking set screw through the access hole in the right side guide rail



2. Put the machine in "Mill Cycle" mode, with the wedge turned off. Attach an indicator as shown in the following photo, and set to zero position.



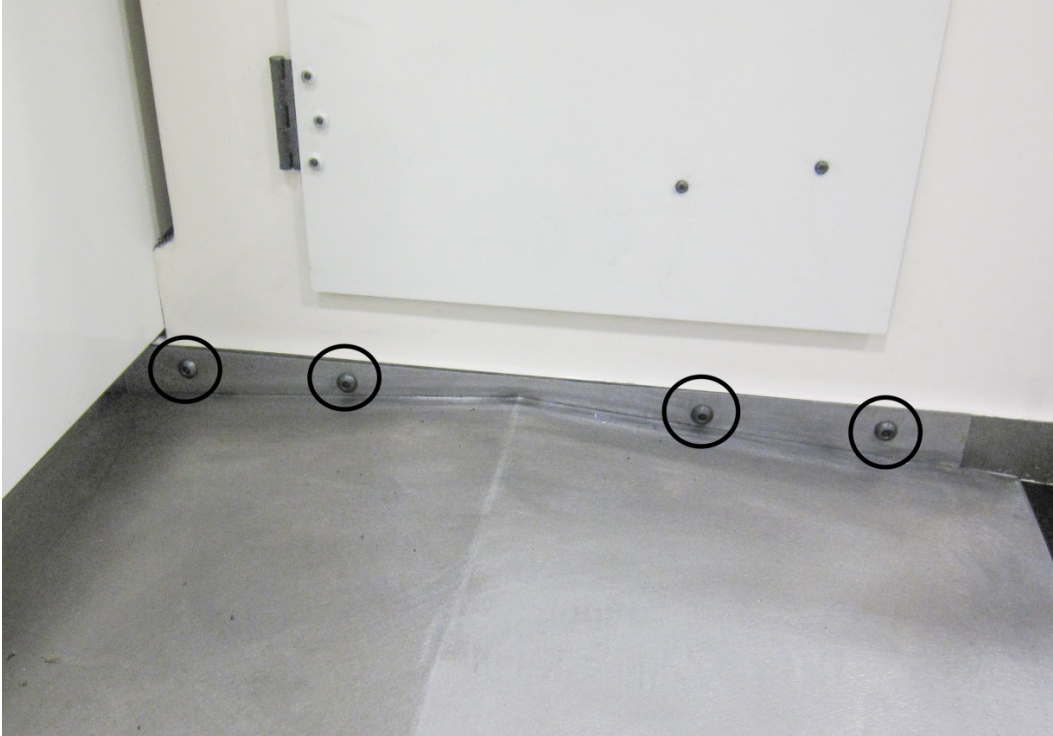
3. Using a 3/16" hex key, turn the adjustment screw in or out to increase, or decrease, the amount of mill tilt. Turn the screw CCW to increase, or turn CW to decrease the amount as shown in the photo at step #2. After each adjustment, turn the "Wedge On", to check the amount. Set to .002"- .004" (.05mm - .1mm) of lift with the wedge turned on. Turn the wedge off to readjust, and then turn the wedge on to check the amount.
4. When finished, tighten the locking set screw as shown in the photo in step #1.
5. Repeat the procedure for the rear wedge.



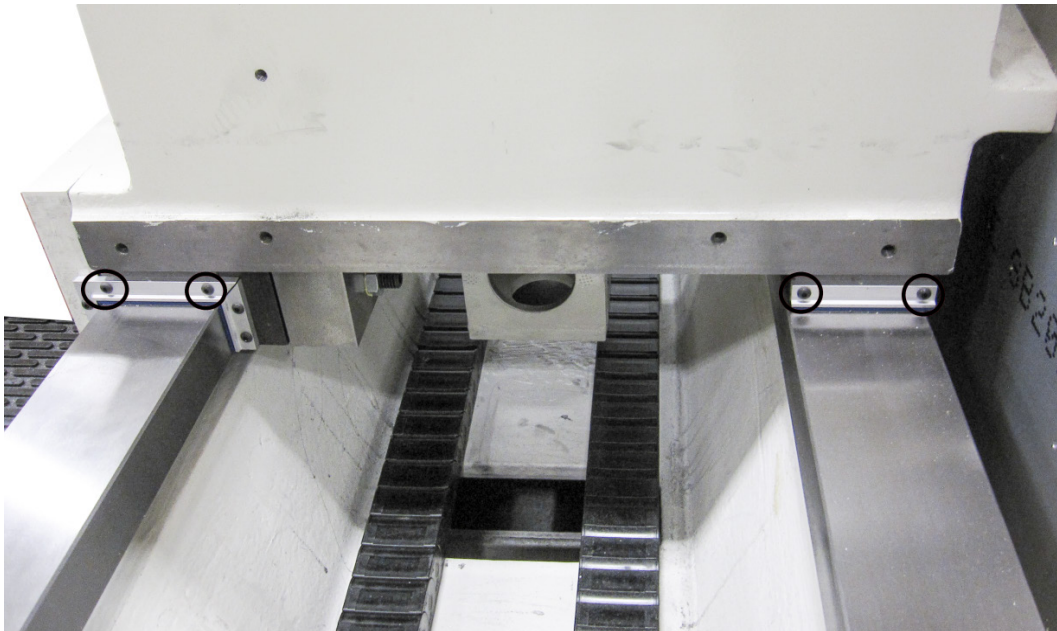
6. After adjusting the rear wedge, re-check the front, to make sure it did not change.

### Checking Wear on Column Turcite Pads

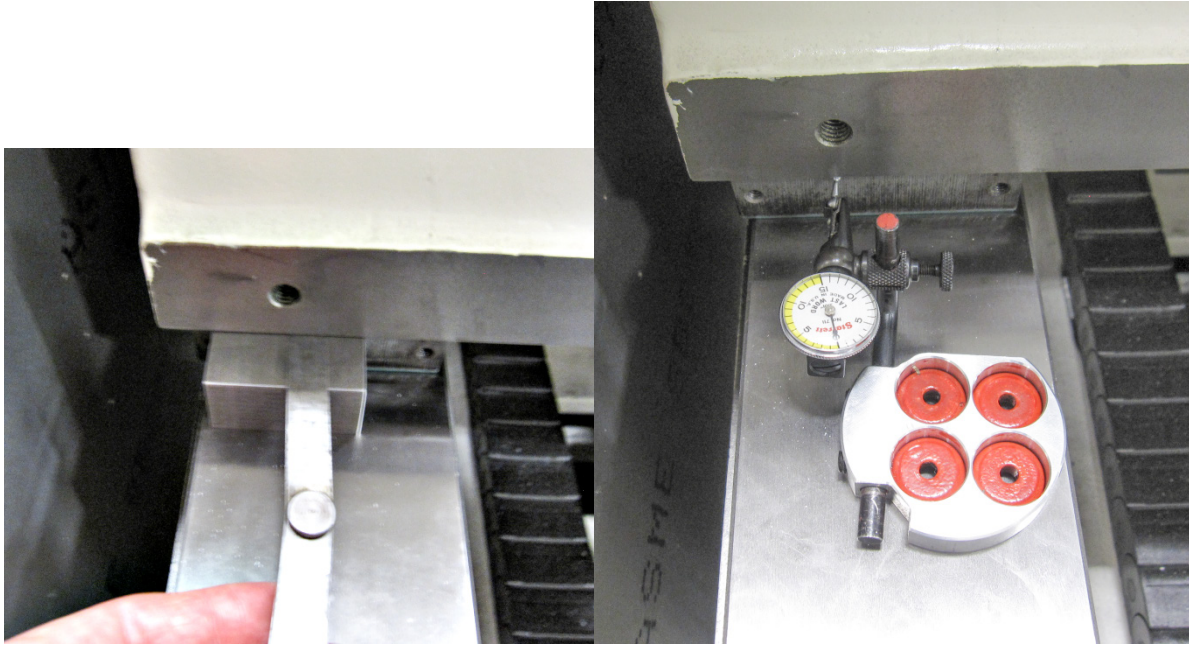
1. Remove bolts holding way covers to column.



2. Slide way covers away from column to gain access to column way.
3. Remove wipers from Turcite pads.



4. Measure height of Turcite pads using either feeler gauge or dial indicator method.



5. Pads will have to be replaced or shimmed if height difference between the 4 pads exceeds .005".

## Digital Micrometer Setting Instructions

Turn the thimble until the '0' line on the thimble lines up with the vertical line nearest the spindle lock ring.



Determine which cutter head bore range the micrometer is going to be used on. ( example; 2.9 – 6.0 )  
We want to initially set the micrometer to the minimum bore diameter of this cutterhead.

**NOTE: MICROMETER CAN NOT BE PROGRAMMED IF THE LETTERS INC APPEAR IN THE DISPLAY.** To get rid of INC, quickly press the in/mm/ABS button.



### To Set Or Edit Micrometer



Press and hold the set/on button and the + or – button at the same time. “Set” will flash in the display. This places the micrometer in edit mode. (CAUTION: use a pencil tip or something similar to gently push the small round buttons - they are quite small and a bit delicate.)

Press and hold the + or – buttons to change the display number to the minimum bore diameter determined earlier (example; 2.9). Caution: Pushing the + or – buttons and holding in place will cause the numbers to scroll automatically. The numbers will count slowly at first and once 0.010” has been counted off the scrolling speed will pick dramatically.

After you have reached the desired number in the display, press the set/on button twice quickly to exit the edit mode. “Set” should no longer be flashing in the display. The micrometer is now ready for use.

CAUTION: AFTER MICROMETER SET-UP IS COMPLETE, DO NOT PUSH SET/ON BUTTON AGAIN. PUSHING THE SET/ON BUTTON DURING USE WILL RETURN THE DISPLAY TO THE ORIGINAL MINIMUM BORE DIAMETER. THE ONLY TIME YOU SHOULD USE THE SET/ON BUTTON AGAIN IS TO- A. To shut micrometer off at which time you push and hold the button or B. to turn micrometer display back on at which time you push button one time. The display will then show the last reading before micrometer was shut off.

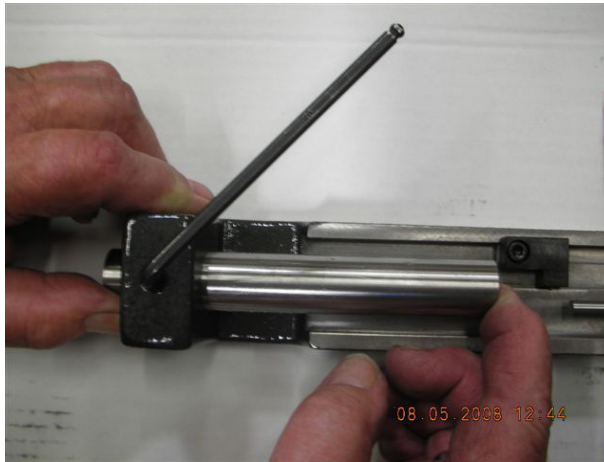
CAUTION: DO NOT BACK THE THIMBLE ALL THE WAY OUT TO THE END OF IT’S TRAVEL. ONCE THE THIMBLE IS BACKED ALL THE WAY OUT, IT WILL NO LONGER ROTATE PROPERLY AND THE DIGITAL HEAD WILL NEED TO BE REPLACED.

Micrometer is calibrated in inch mode. If metric is desired, press and hold in/mm/ABS button until mode changes to metric (approximately 3-4 seconds). A quick press of the in/mm/ABS button will put micrometer in ABS mode: 0.000, with another quick press returning it to initial setting.

Set up the cutter head and bore a set up hole. Measure the bore accurately. Set the digital display to this bore dimension and then -



Loosen the set screw holding the large diameter anvil. Slide the anvil back out of the way.



Place the tool holder used to bore the hole into the micrometer frame. Slide the location nub on the back of the tool holder gently up against the end of the digital micrometer shaft.



Slide the large diameter anvil up until it touches the end of the cutting tip of the tool holder. Tighten the set screw.



Back the digital micrometer shaft off, then bring it up to touch the tool holder and recheck that the numbers in the display are the same as the numbers previously shown.



The micrometer is now set up for use with this cutter head.

**Note:** this procedure must be repeated to set the micrometer to a different cutter head. The micrometer can only be set to one cutter head at a time.

To shut off micrometer press and hold set/on button until screen goes blank or let micrometer set until display disappears.

With initial setting of micrometer it is recommended that you use the procedure detailed below in the event you think you have size problems.



**Procedure:**

The short vertical lines that cross the horizontal scale on the micrometer sleeve are reference marks. Set the zero on the micrometer thimble even with the first vertical line and note the size shown in the digital display. Record this size for future reference. Now follow the same procedure for each line and record the sizes. At any time you feel your micrometer is reading incorrectly, you can quickly refer to the recorded size of the line closest to the range you are using and check that the micrometer is still accurate.






## Probe “On-Center” Adjustment

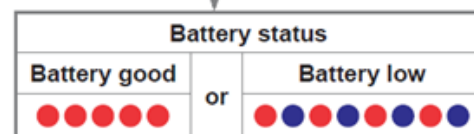
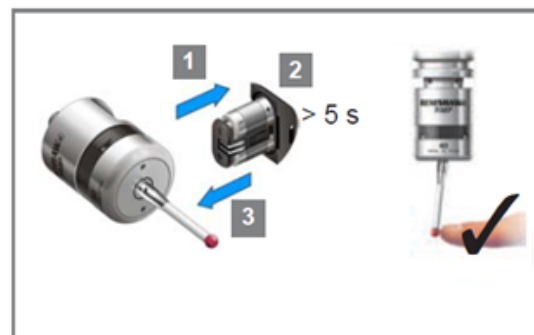
This covers setup and calibration of the probe, so it will accurately position your machine.

- Verify that the four adjusting screws and two locking screws are installed in the probe tool holder.
- Assemble probe on either CAT 40 Shank or Rottler Taper
- With the machine breaker that supplies power to the probe receiver turned off;
- Install batteries in the probe WITH stylus deflected.

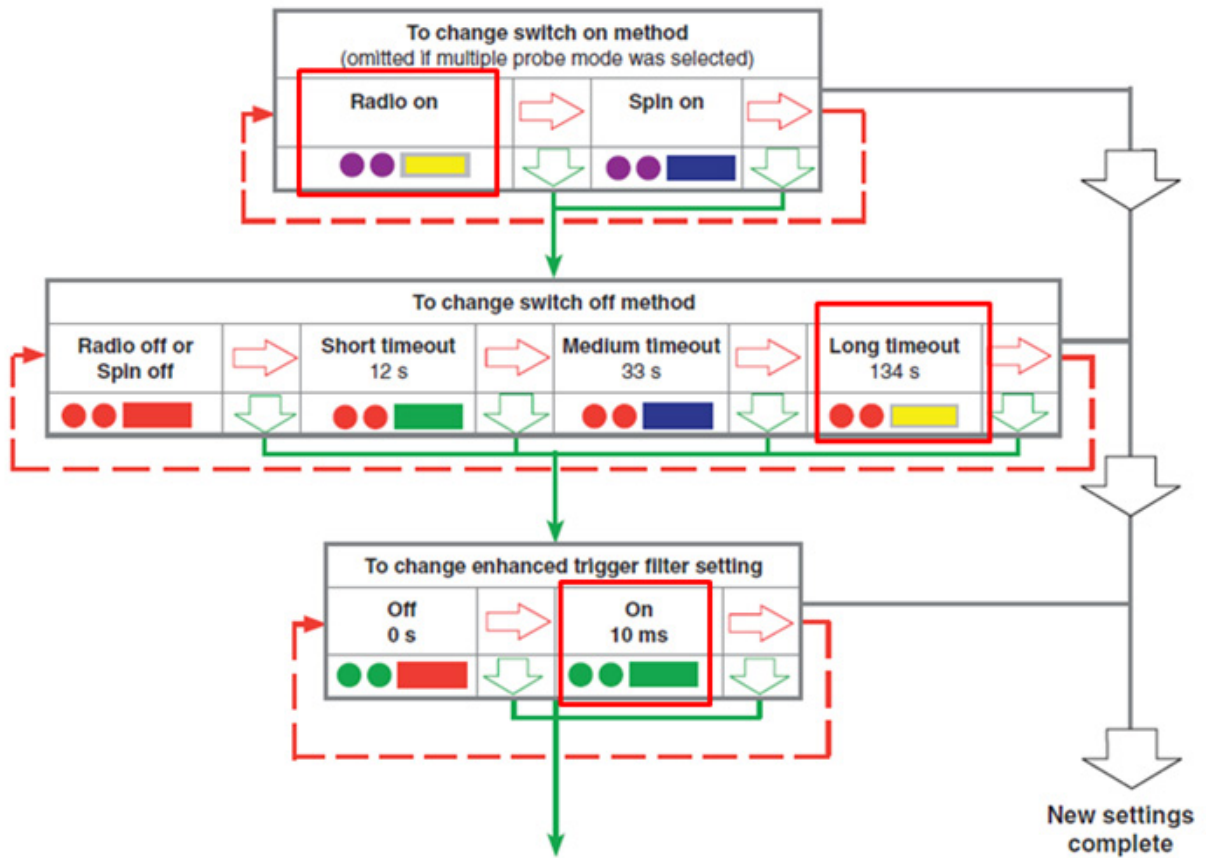
Probe LED check will run.

- Release stylus after battery check this will put you in edit mode.
- First will be Switch off method, you want this at **purple, purple, yellow** (Radio On). If it is not, deflect and release stylus quickly to change the mode.
- Hold the stylus deflected until the colors change to move to the next setting.
- You should be at Switch Off method; it should be **red, red, yellow** (134 seconds). If it is not, deflect and release stylus quickly to change the mode.
- Hold the stylus deflected until the colors change to move to the next setting.
- You should be at Enhanced trigger filter; it should be **green, green, green** (on). If it is not, deflect and release stylus quickly to change the mode.
- Hold the stylus deflected until the colors change again to move to the next setting.
- You should be at Acquisition mode, **light blue, light blue, light blue**.
- Turn on machine and quickly deflect and release the stylus. This must be done within 10 seconds of turning on the power breaker to the probe. If you are watching the RMI-Q (located ON the machine) you will see the right light turn **red, yellow, red, yellow, red, yellow** is shows the partnership has been acquired.
- Go into the software and do a probe auto center and hit start probe to verify that it works correctly.

Key to the symbols	
	LED short flash
	LED long flash
	Deflect the stylus for less than 4 seconds to move to the next menu option.
	Deflect the stylus for more than 4 seconds to move to the next menu.
	To exit, leave the stylus untouched for more than 20 seconds.



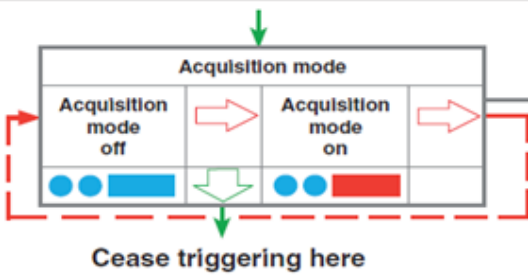
Switch on method, next page



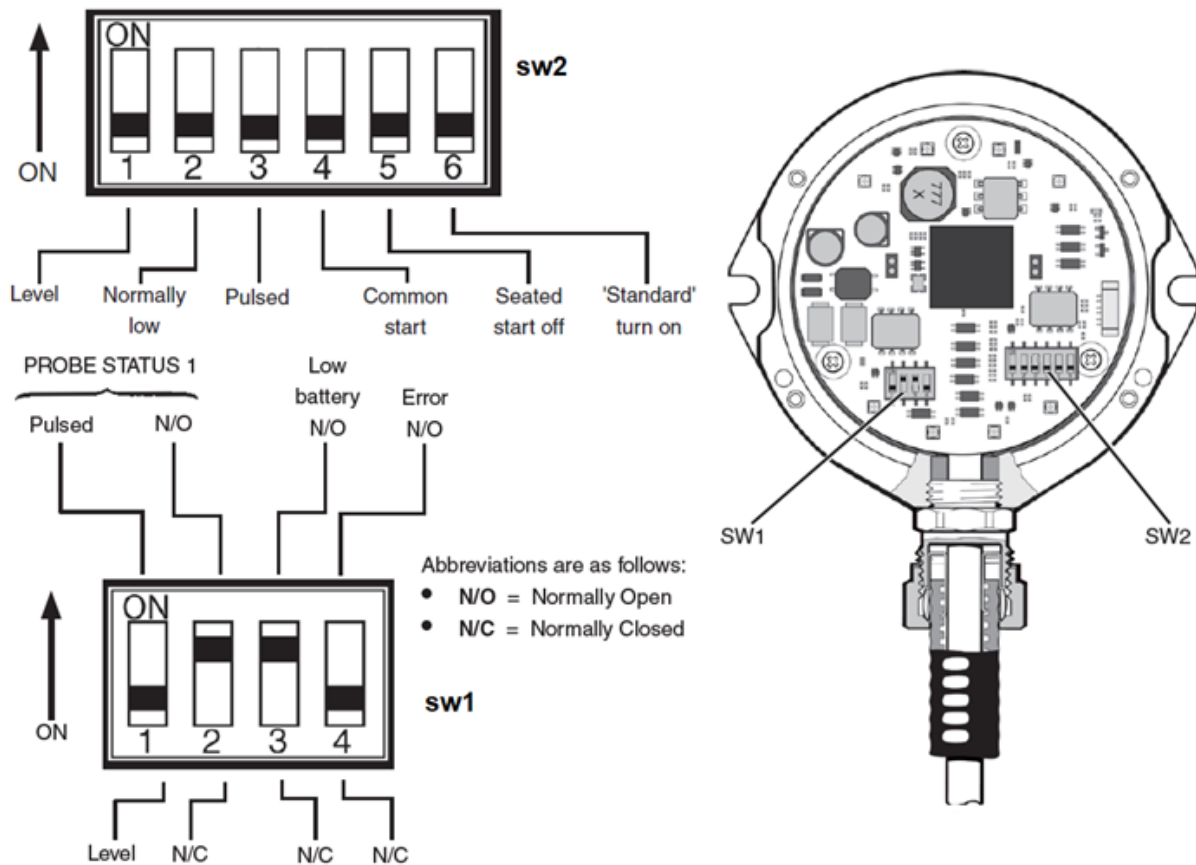
**Changing the probe settings (continued)**

**Note:** After the RMI has been acquired, the RMP40 will only show Acquisition mode off.

See RMP40 - RMI partnership.



If the Probe does not turn off after 137 seconds you will need to make sure that the RMI-Q switches are shown in the following positions:



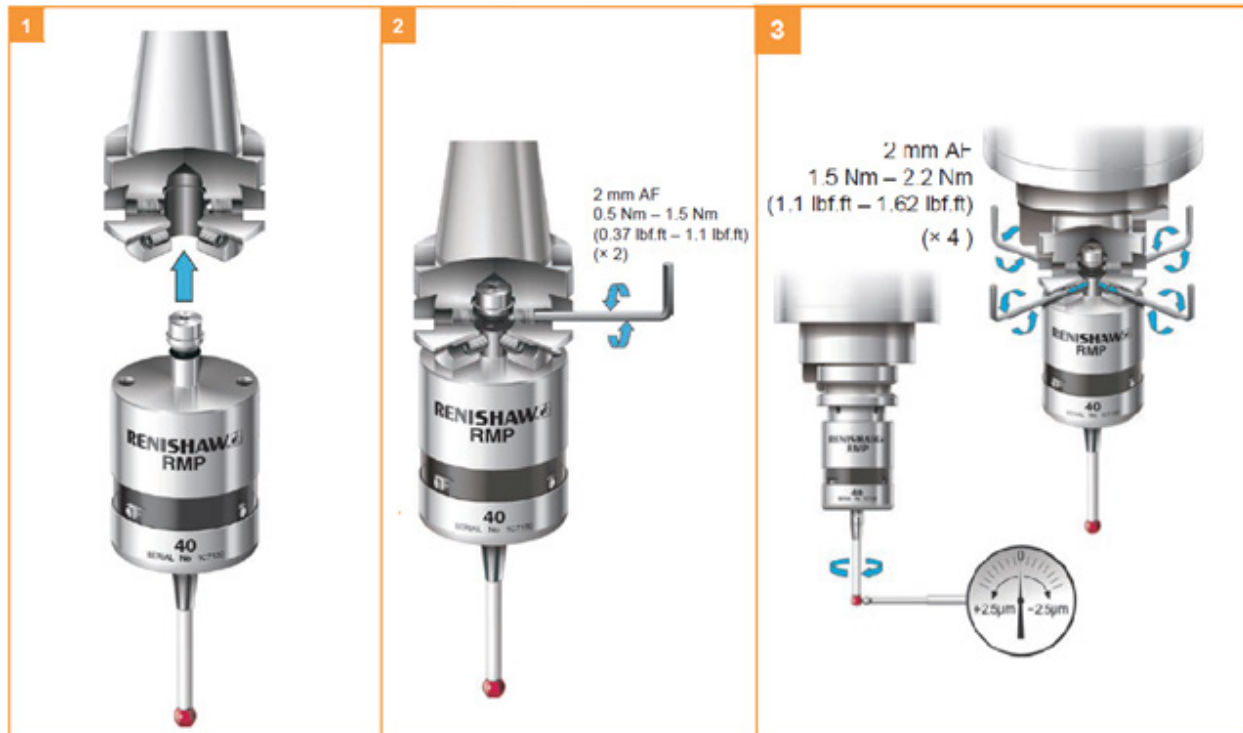
During normal use, the difference between the touch position and the reported position does not change, but it is important that the probe is calibrated in the following circumstances:

- when a probe system is to be used for the first time;
- when a new stylus is fitted to the probe;
- when it is suspected that the stylus has become distorted or that the probe has crashed;
- at regular intervals to compensate for mechanical changes of your machine tool;
- if repeatability of relocation of the probe shank is poor. In this case, the probe may need to be recalibrated each time it is selected.

It is good practice to set the tip of the stylus on center, because this reduces the effect of any variation in spindle and tool orientation. A small amount of run-out is acceptable, and can be compensated for as part of the normal calibration process.

- calibrating either in a bored hole of known size, a ring gauge, or on a datum sphere.

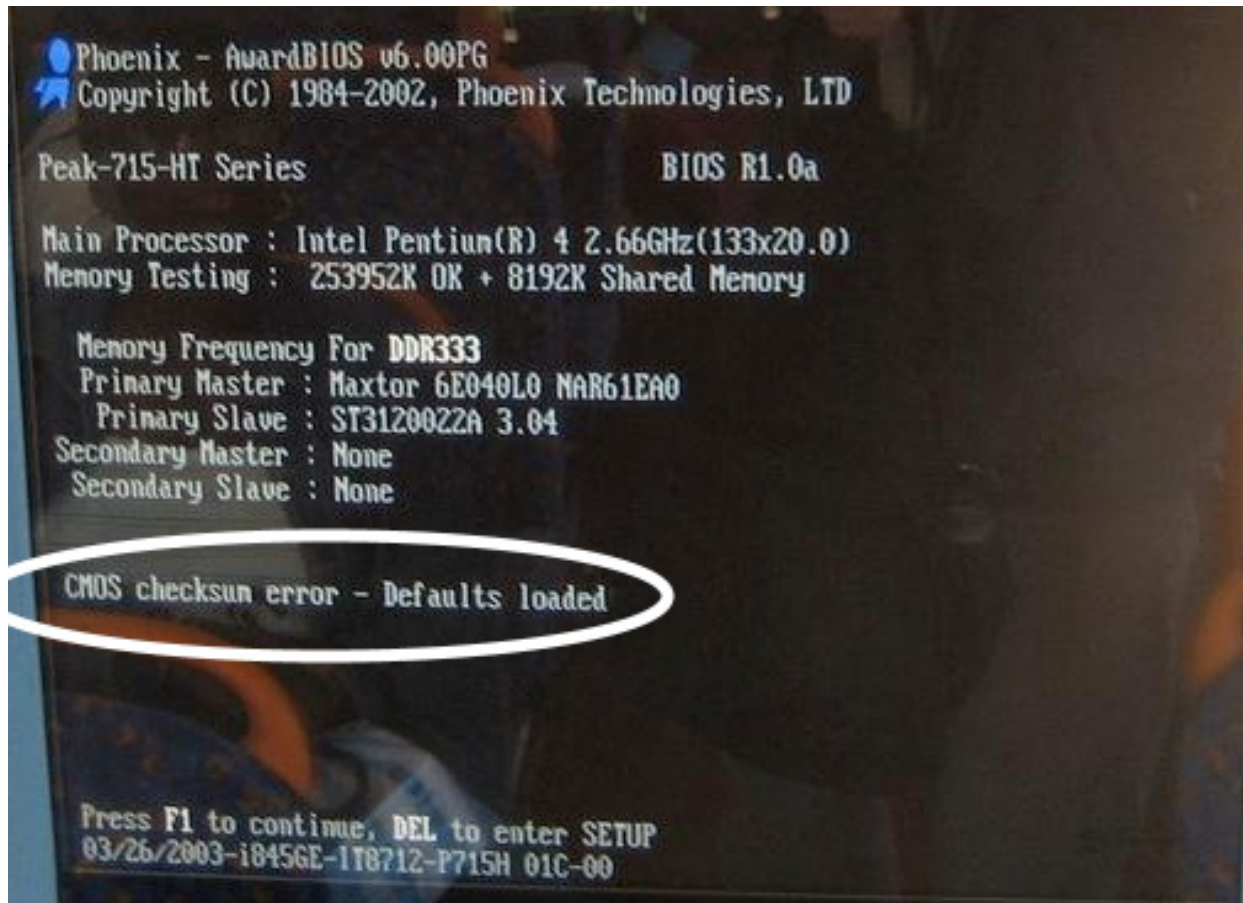
## Mounting the probe on a shank



- Dial the probe stylus into center using a .0001" indicator to within .0005" the tighter tolerance you hold the more accurate the machine will be. You must use an indicator that takes very little pressure to get a reading. Excessive pressure on the stylus will deflect the probe and you will not be able to dial it in correctly.
- Go to the Main/Block Model screen and select the Table of Tools. You may only have a Default Tool #0 listed.
- Press Add Tool. This will bring up a dialog box. Change the name from default tool to probe style that you are installing i.e. 50mm stylus, 100mm stylus. Set the diameter to .2360" this is default probe tip on a 50mm, 100mm, and 17.5mm.
- Install a block, or parallels onto the machine and secure it solidly to the machine table.
- Place the Ring Gauge onto the top of the block, use Probe Auto Center to find center zero your X and Y axis here. Make sure you use a ring gauge or a hole of a known diameter. This will set the correct probe timing.
- Adjust the probed diameter by going to the IO under Setup Electronics and changing the Probe MS. You will need to increase or decrease the MS of the probe to achieve correct Probe Diameter.
- Repeat until the correct diameter is displayed.
- Probe Auto Center the ring gauge, without moving X or Y, remove the probe up in Z and Install the cutter head. Put a magnet base with the Last Word indicator on the cutter head and sweep the cylinder/ring gauge.
- The variation in X and Y Should be less than .0005.
- If not add compensation to ProbeOffset under > Setup Eletronics-Addins-ProbeSetup

## Replacing the Motherboard Battery

If computer fails to boot up and you get a CMOS error message on the screen, then the battery on the computer motherboard has failed and needs to be replaced.



The following is the procedure for replacing the motherboard battery.

Turn off the power on the electrical enclosure and remove the enclosure cover.





Locate the computer and check to see that the power light is not on. If it is on turn off the power switch.  
*Note: On some machines it may be necessary to unbolt the computer from the enclosure in order to gain access to the cover screws.*

Remove the 6 screws indicated by the arrows from the cover.

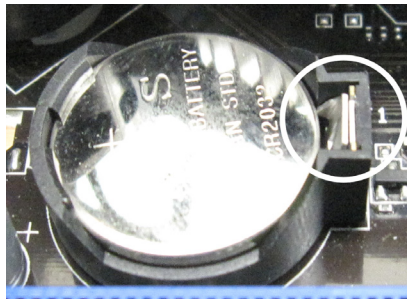
Remove the cover.



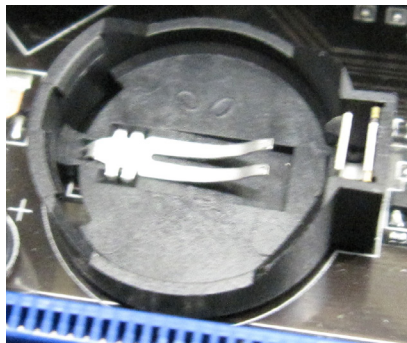
Locate the battery on the motherboard.



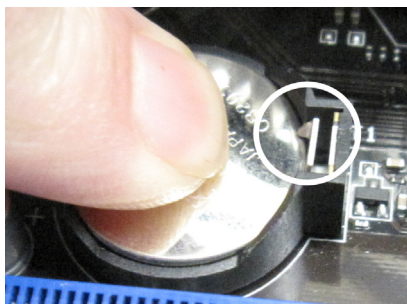
Push the battery retention clip away from the battery. When the clip is released the battery will pop up.



Remove the battery and place new battery in the battery holder.



Using your finger tip push down on the battery until the retention clip is in its lock position.

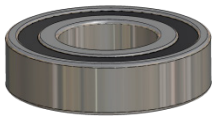


Replace computer cover and make sure that power switch on the computer is on.  
Replace the enclosure cover and switch power back on.

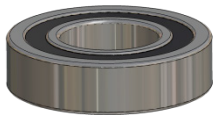
## Ballscrew Assemblies Reference

### Alignment Definitions for Angular Bearings and Belleville Washers

#### Bearing Alignment



VIEW OPEN END UP



VIEW CLOSED END UP

#### Belleville Washer Alignment

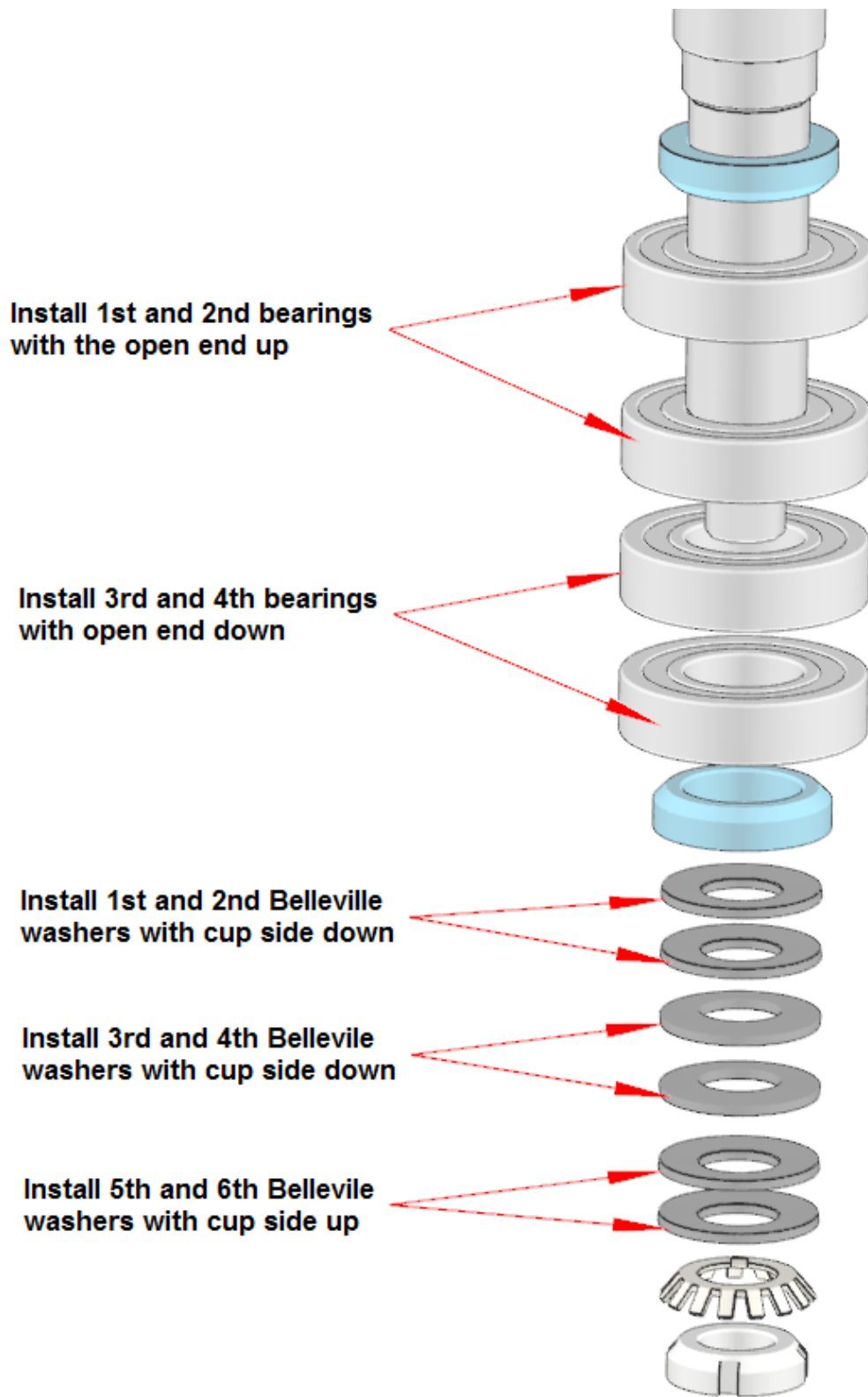


VIEW CUP UP

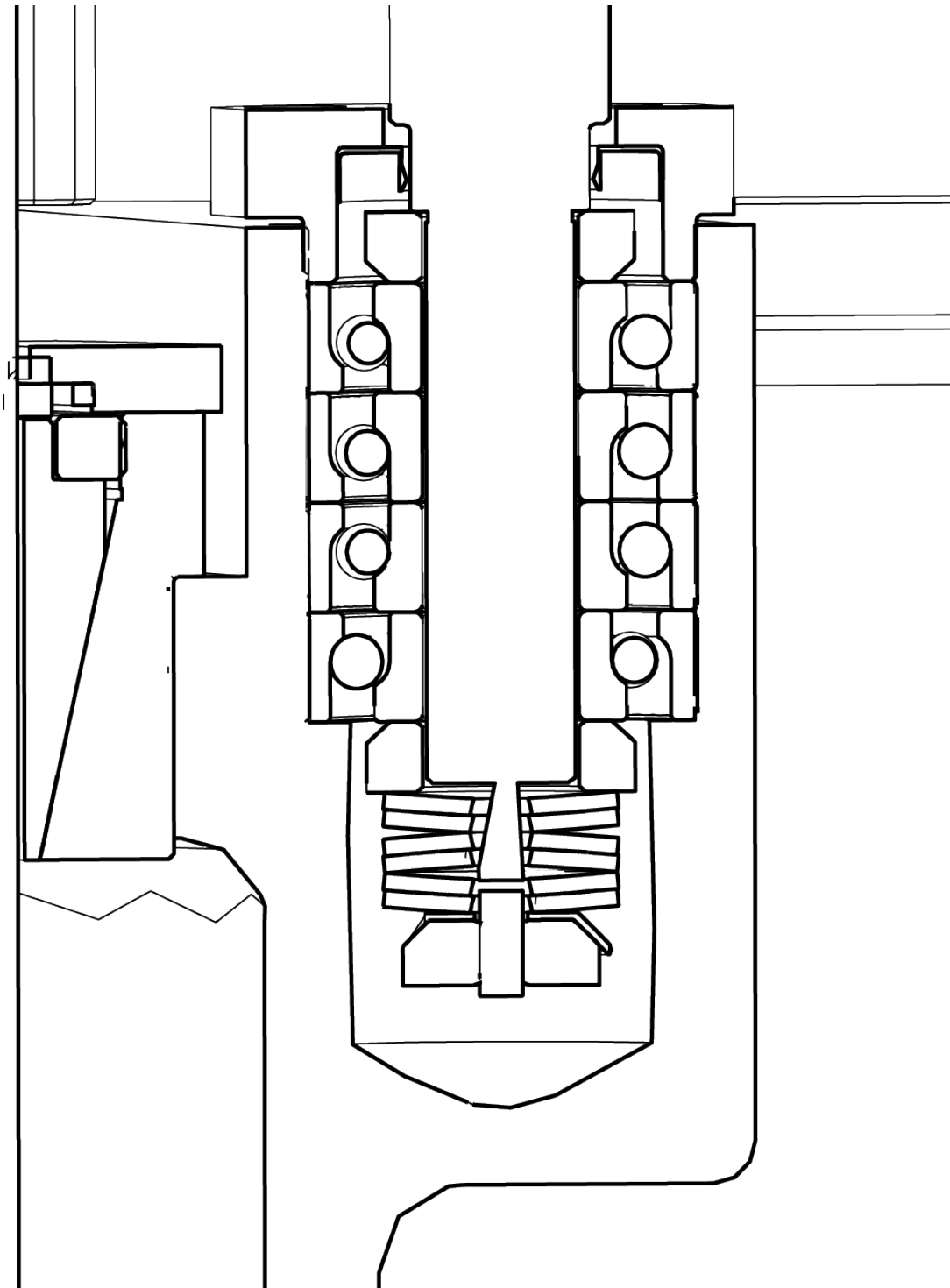


VIEW CUP DOWN

### Z-Axis Lower Bearing and Belleville Washer Stacking Order

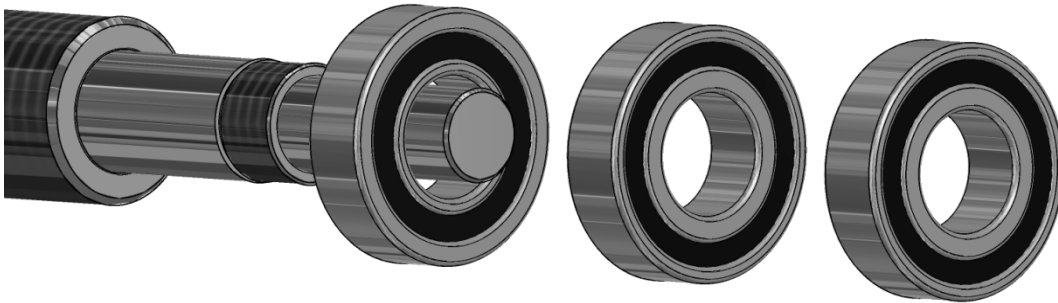


**Z-Axis Lower Bearing and Belleville Washer Section View**



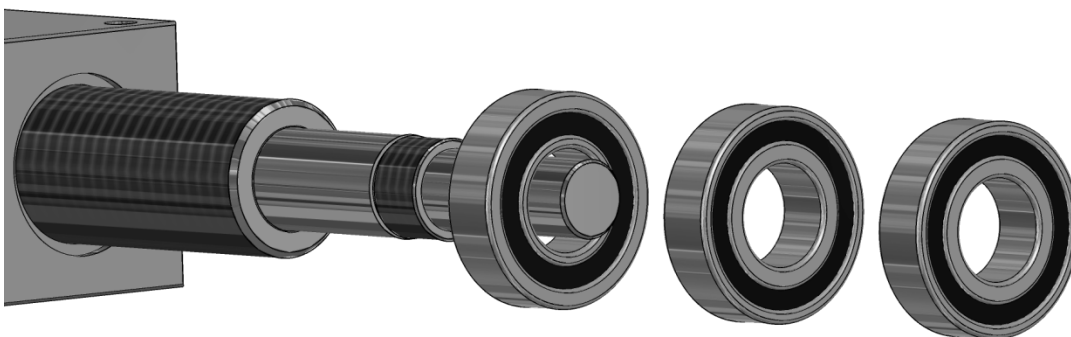
### X-Axis Bearing Stacking Order

Install 1st bearing with open end toward ballscrew shoulder. Install 2nd and 3rd bearings with closed end toward 1st bearing.

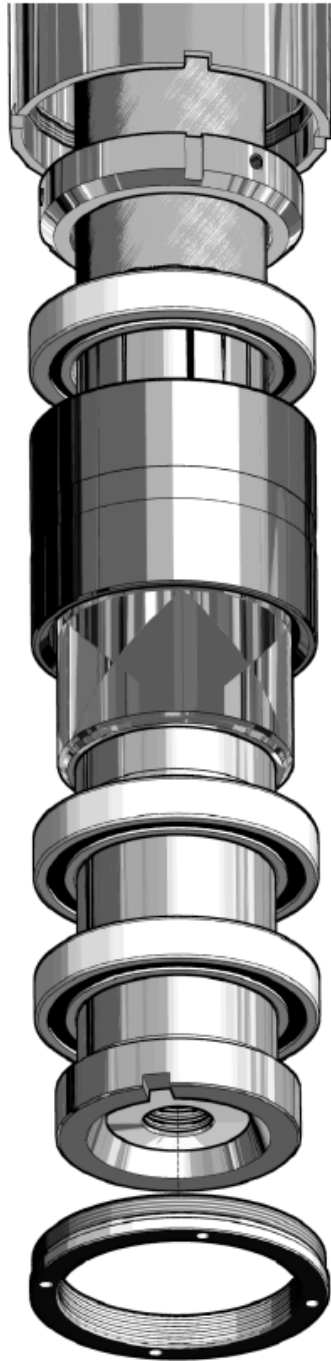


### Y-Axis Bearing Stacking Order

Install 1st bearing with open end toward ballscrew shoulder. Install 2nd and 3rd bearings with closed end toward 1st bearing.



### Inner Spindle Lower Section Bearing Stacking Order



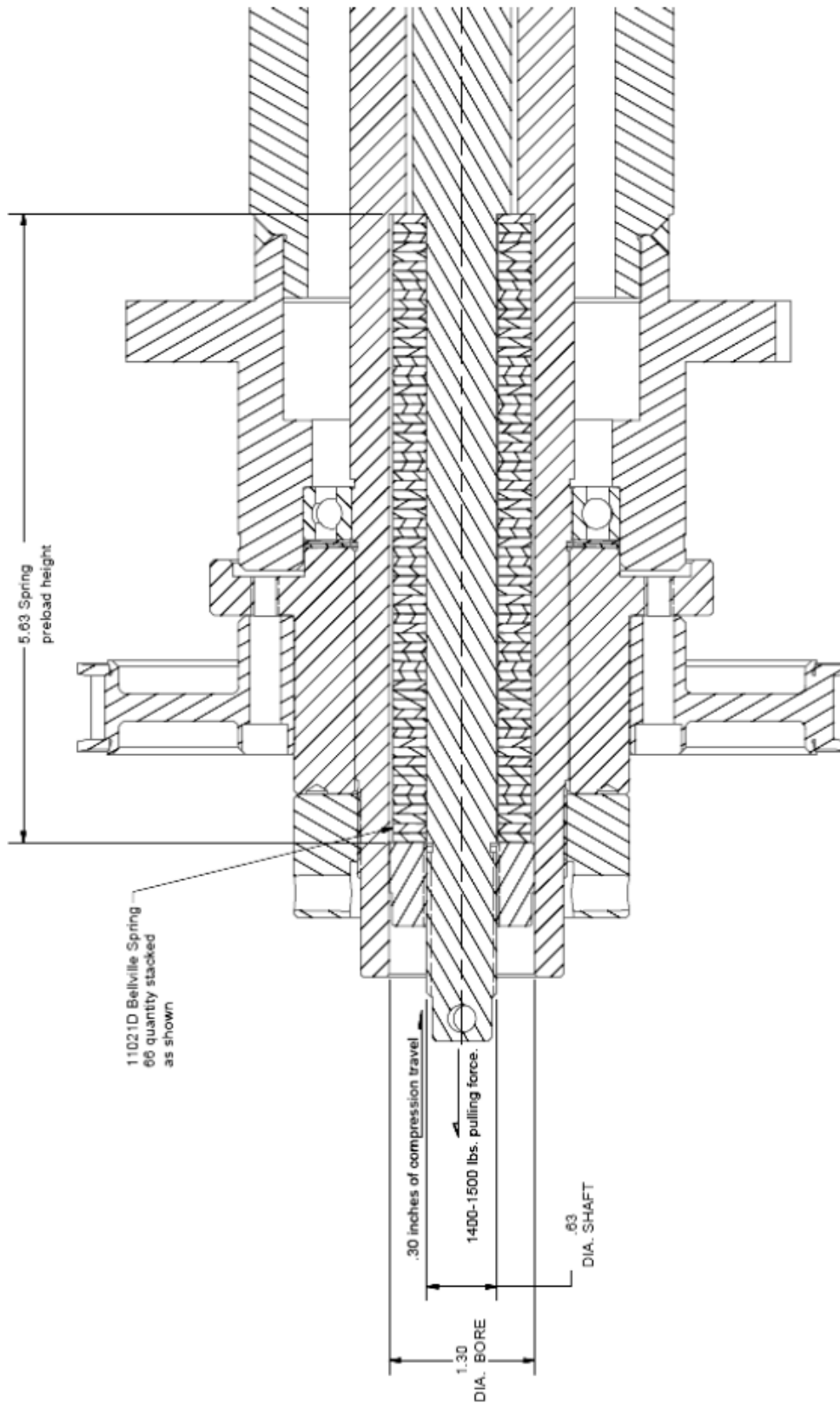
Install 3<sup>rd</sup> bearing with the closed side down.

Install inner and outer spacer assembly with beveled end facing up.

Install 2<sup>nd</sup> bearing with the open side down.

Install 1<sup>st</sup> bearing with the open side down.

### Drawbar Belleville Stack





# TROUBLESHOOTING

**Problem:**

Icon on screen does not move to area touched.

**Solution:**

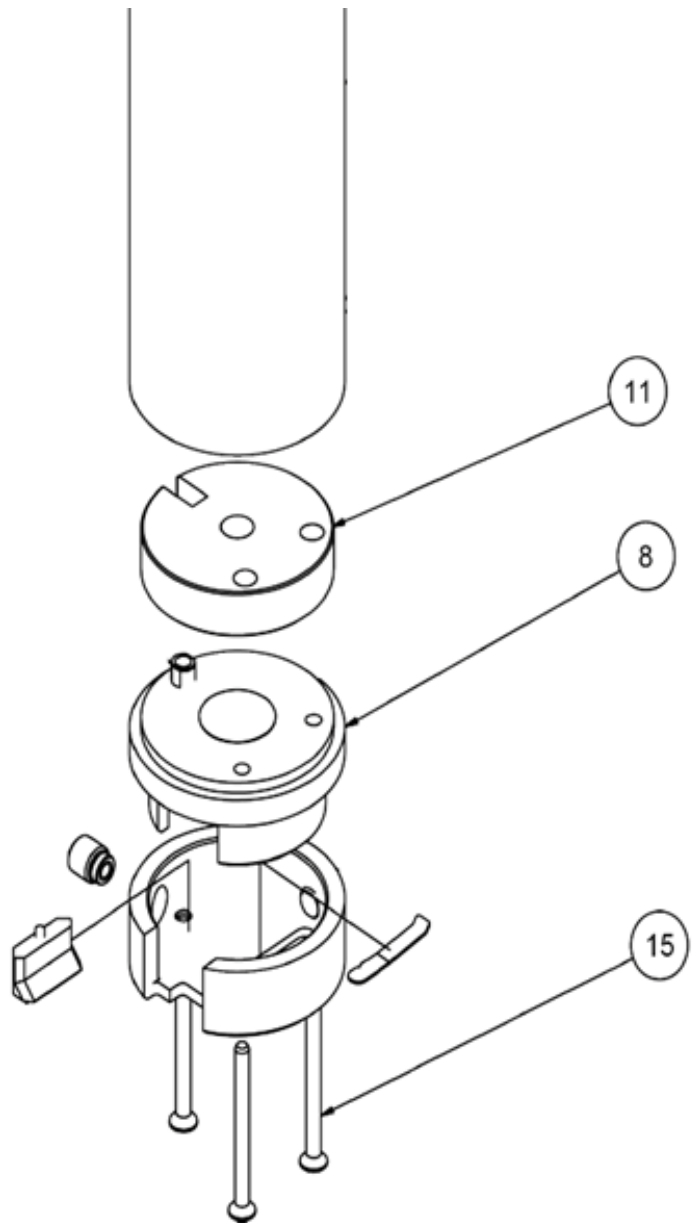
Follow the procedure below to recalibrate the touchscreen.

1. Get to the Alignment screen.
  1. If an Elo icon is available in the tool tray at the lower right side of the desktop, click it, then click Align.
  2. Otherwise, go to the Windows Control Panel, double-click Elo Touchscreen and click the Align button on the General tab.
    1. If Windows XP and no Elo icon, click the "Switch to Classic View" button on the left
    2. If Windows 7 and no Elo icon, look for "View by: Category" text toward the upper right; click it and select "Small icons"
2. Touch and release the upper left target; the target should jump to the lower right.
3. Touch and release the lower right target; the target should jump to the upper right.
4. Touch and release the upper right target; a check screen should appear.
5. Touch and release the green check mark; the check screen should disappear.
6. The cursor should now jump to the point of touch.
7. If the Elo Control Panel is open, close it and the Windows Control Panel.

## Chatter Problems

If you are having chatter problems when you are boring you should do the following steps;

1. Replace the insert, Make sure you use Rottler RT321 inserts it is strongly advised.
2. Clean the inside of the bore head. Oil will build up if you leave the boring head in the machine overnight or have the oiler turned up. You will need to clean any oil off of the counterweight (11), also clean the cavity that the counterweight sits in. This is done by removing the bolts (15). This procedure is the same with other Rottler cutter heads. See the optional equipment parts catalogue for breakdowns of the cutter heads.
3. Check Inner Spindle Adjustment, see maintenance section.
4. Check outer spindle adjustment/bushings, see maintenance section.
5. Newer models we recommend the use of the SSV system, if you are having chatter issues.
6. Counter balance cable pressure; verify that it is in service and unbroken. See maintenance section.



# MACHINE PARTS

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**Machine Parts F79A**



## Specifications

CNC (Computer Numerical Control) Machine using Windows Operating System and Industrial PC with Intel Processor. Precision Programming and Control thru a 15" (400mm) Computerized Touch Screen.

Software options available for Programmable & Automated Cycles such as Boring, Surfacing, Lower Sleeve Offset Boring, Water Hole Repairs, Main & Cam Line Boring, General CNC Machine Work

USB flash drive for file transfer to and from computer

Internet connection to the machine computer must be provided for training support and service.

Machine/Computer can operate in either inch or metric system

3 Axis movement by Direct Drive Precision Ball Screws

All motors - AC Servo Motors - Infinitely Variable

Horizontal Movement (X Axis) - Left and Right Direction – 72" (1830mm)

Horizontal Movement (Y Axis) - In and Out Direction – 12" (305mm)

Vertical Movement (Z Axis) - Up and Down – 18" (457mm)

Vertical, Horizontal and Spindle Load Monitoring for Fast Overload Shut Down

Precision Position Display in .0001" (.002mm) Resolution.

Electronic Handwheel for manual movement - per click: Coarse Mode .01" (.25mm) Medium Mode .001" (.01mm) Fine Mode .0001" (.002mm)

Infinitely Variable Feed rates adjustable by handwheel during automatic cycles

High Performance Spindle Rotation AC Brushless Servo Motor and Drive System

Hard Chromed Precision Spindle with High Speed Angular Contact Bearings

CAT 40 Spindle Taper with Pneumatic Quick Change Tool System

Fast Rapid and Jog Speeds for Reduced Cycle Time

Automatic Workhead Tilt System for Back Clearance during Surfacing

One Piece Heat Treated Mehanite Cast Iron Machine Castings

Turcite Coated Slideways for Low Friction and Extended Life

Automatic Central Lubrication System monitored by computer

Halogen Work Light (mounted)

Chip Guard with Adjustable Pivot Arm

Operation, Programming and Spare Parts Manual - Digital

Paint Color Code: RAL9002 (Grey White)

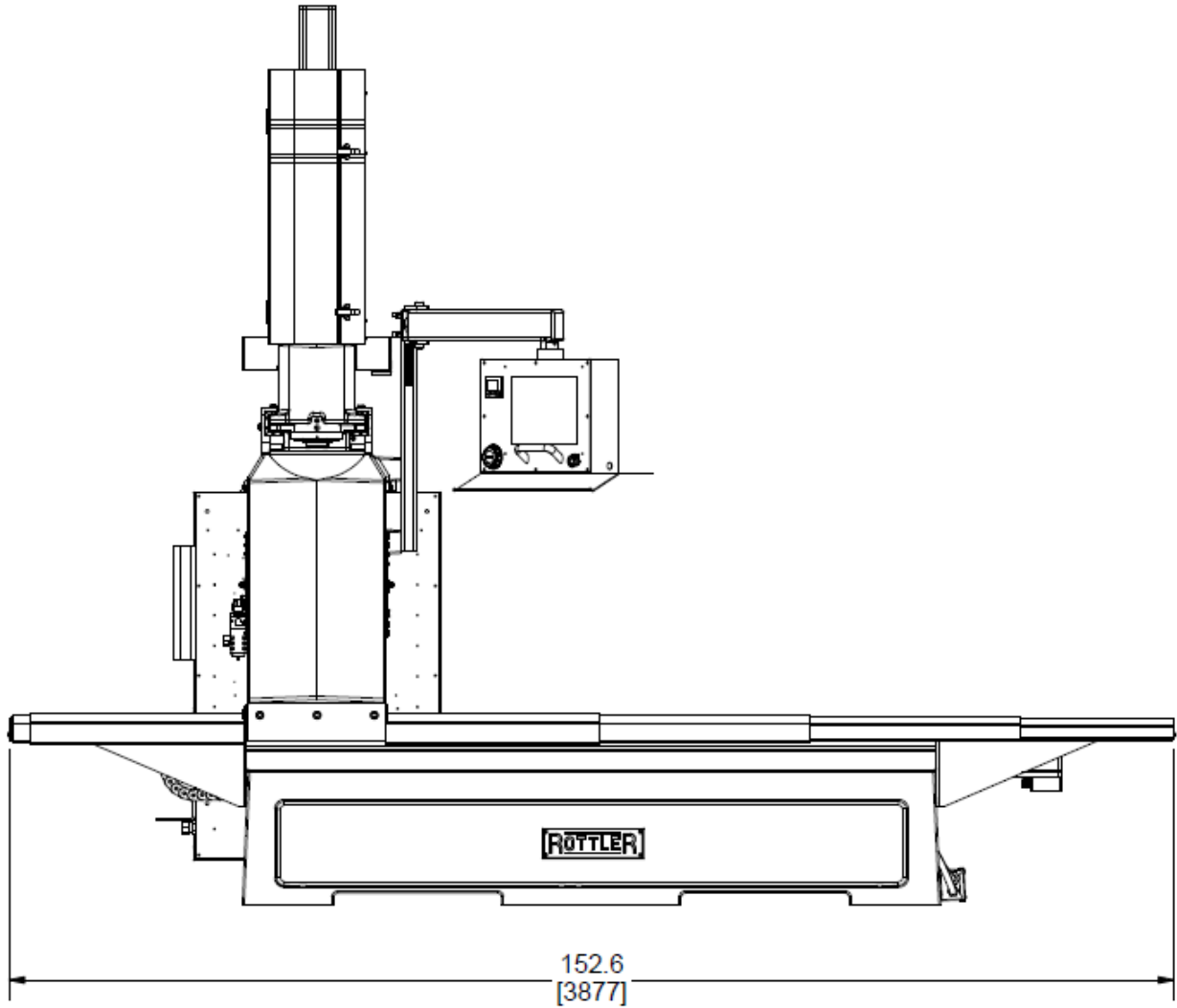
Electrical requirements: 208/240V, 40A, 50/60Hz, 1Ph

Shipping weight: 10,000lbs (4545 kg)

Shipping dimensions: 115" X 75" X 85" H (2,8m X 1.9m X 2.2m H)

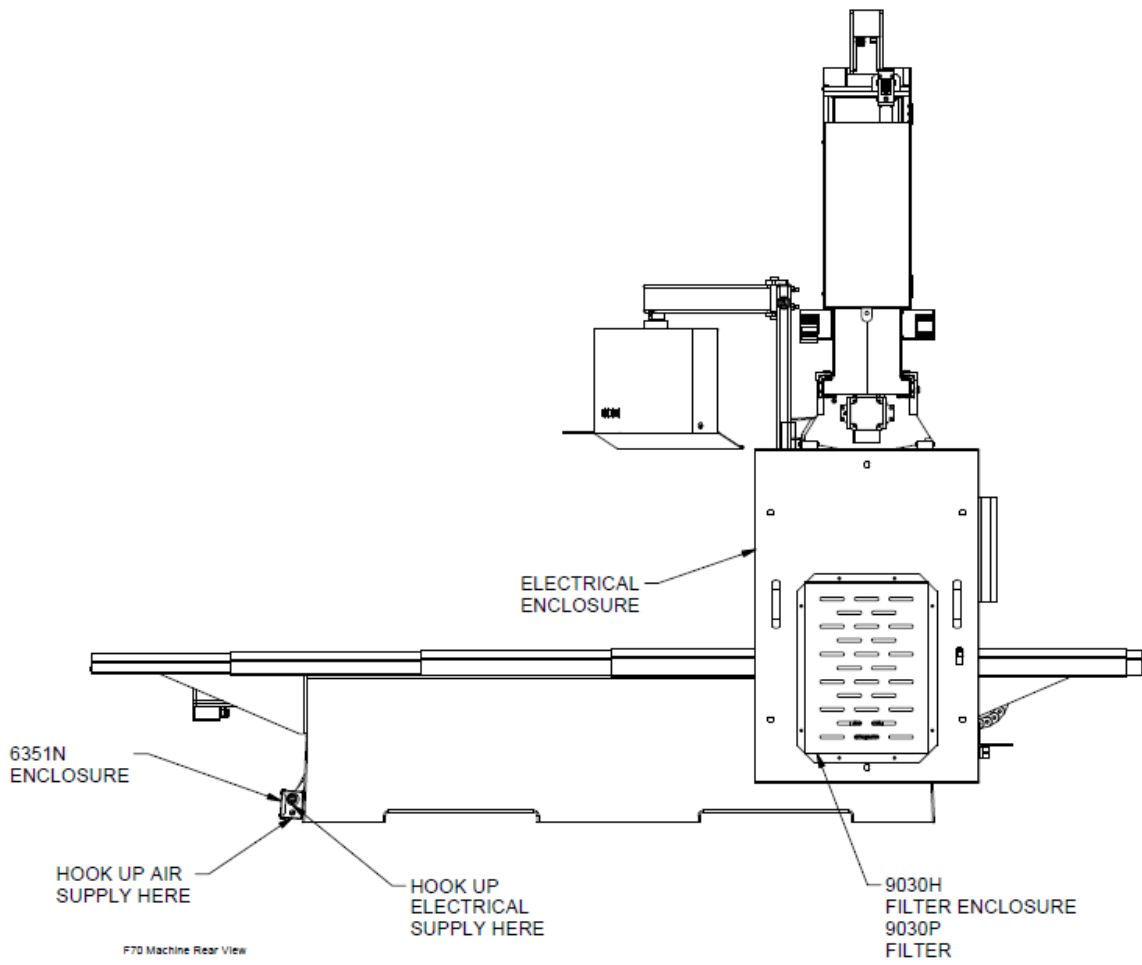
### Dimensions

#### Front View



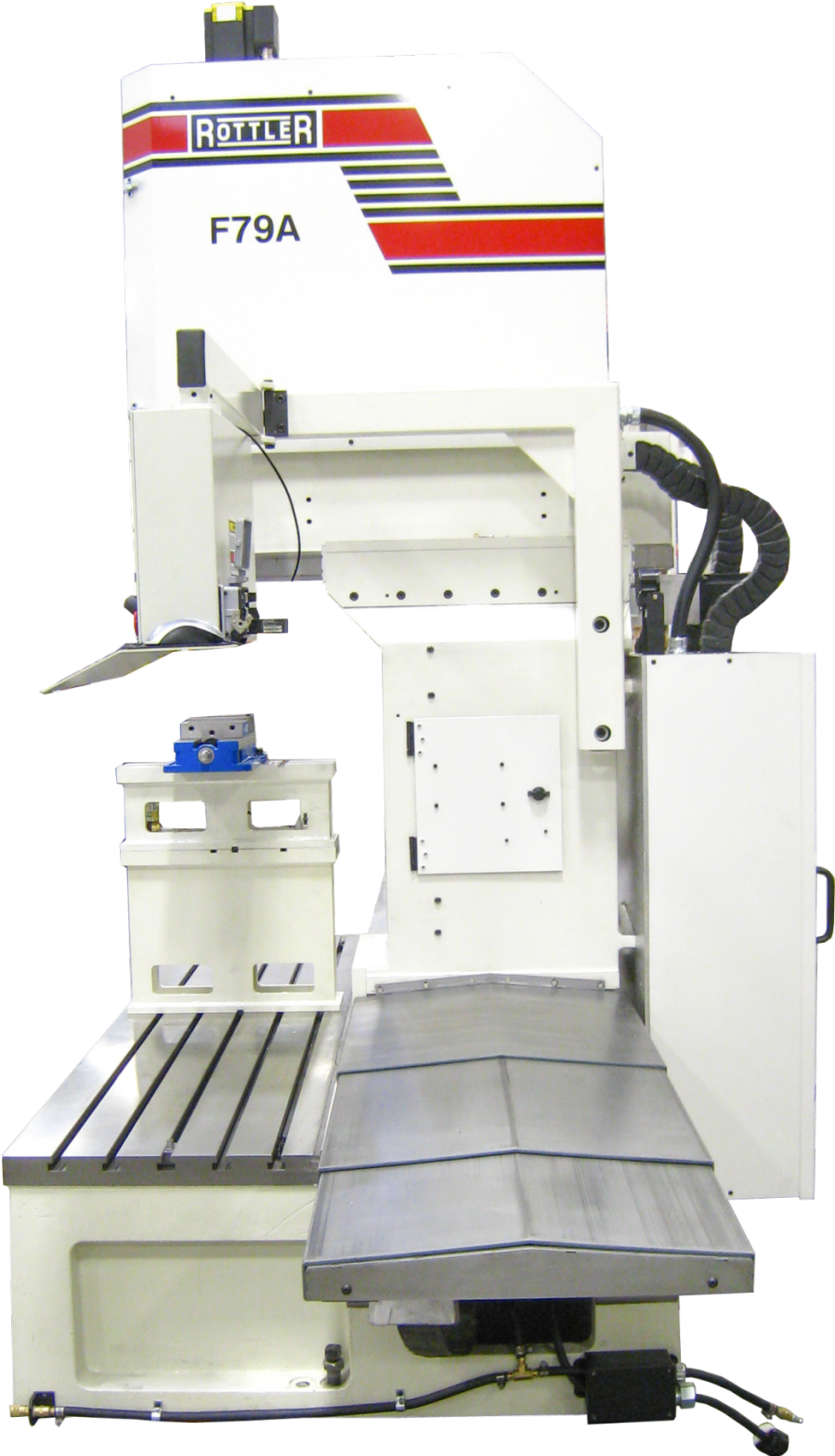
F70 Machine Front View

**Rear View**

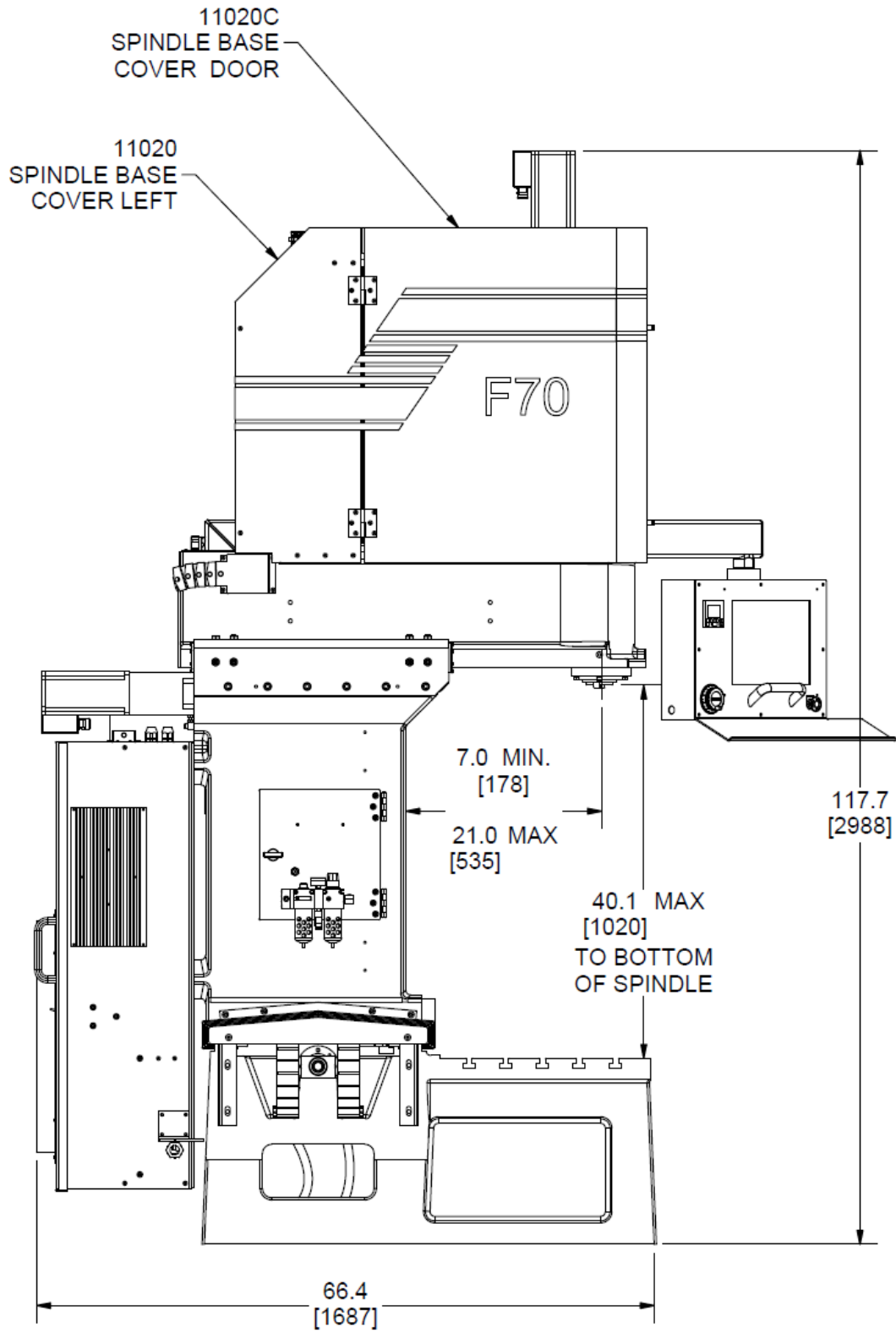




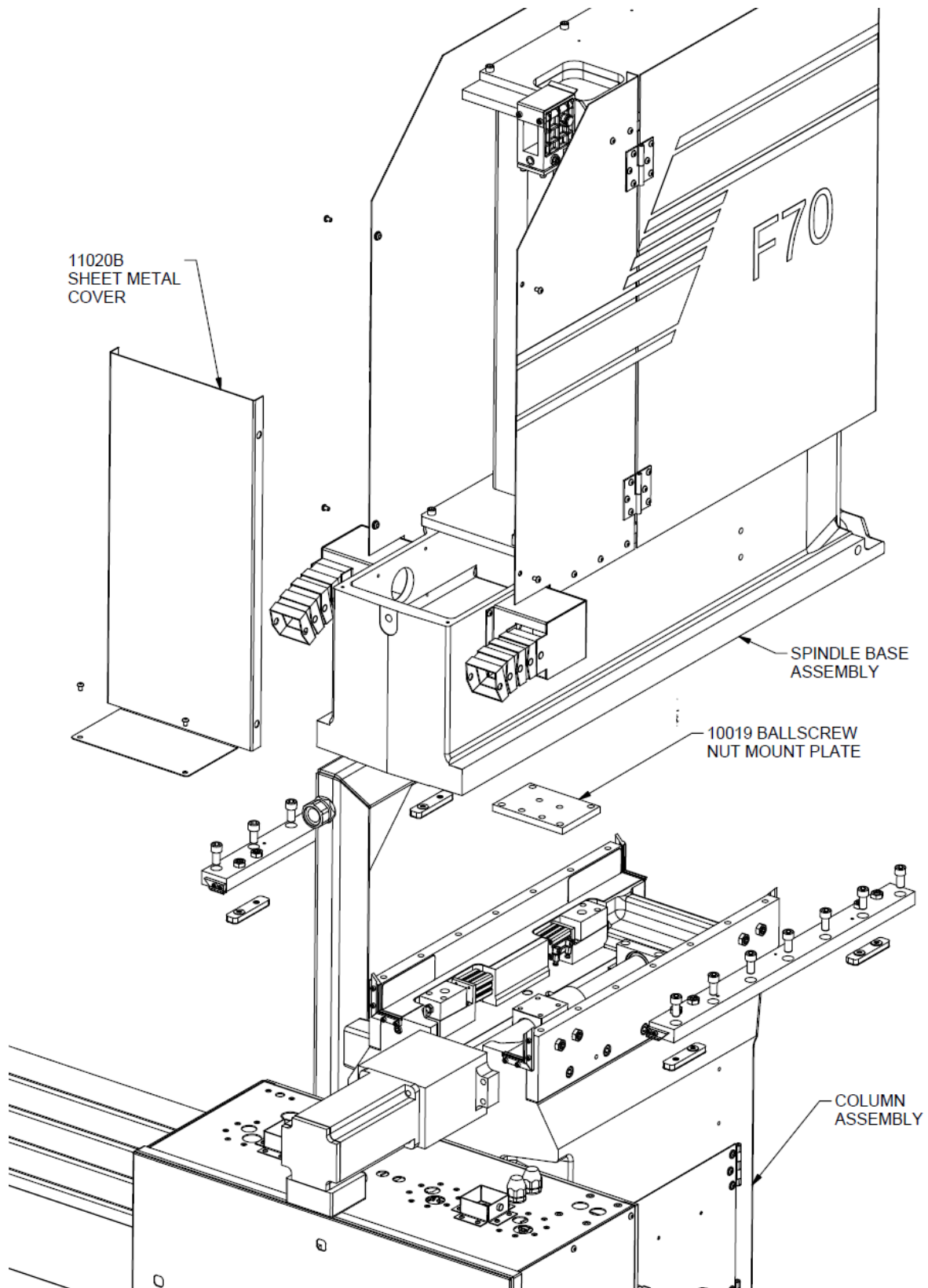
Right Side View



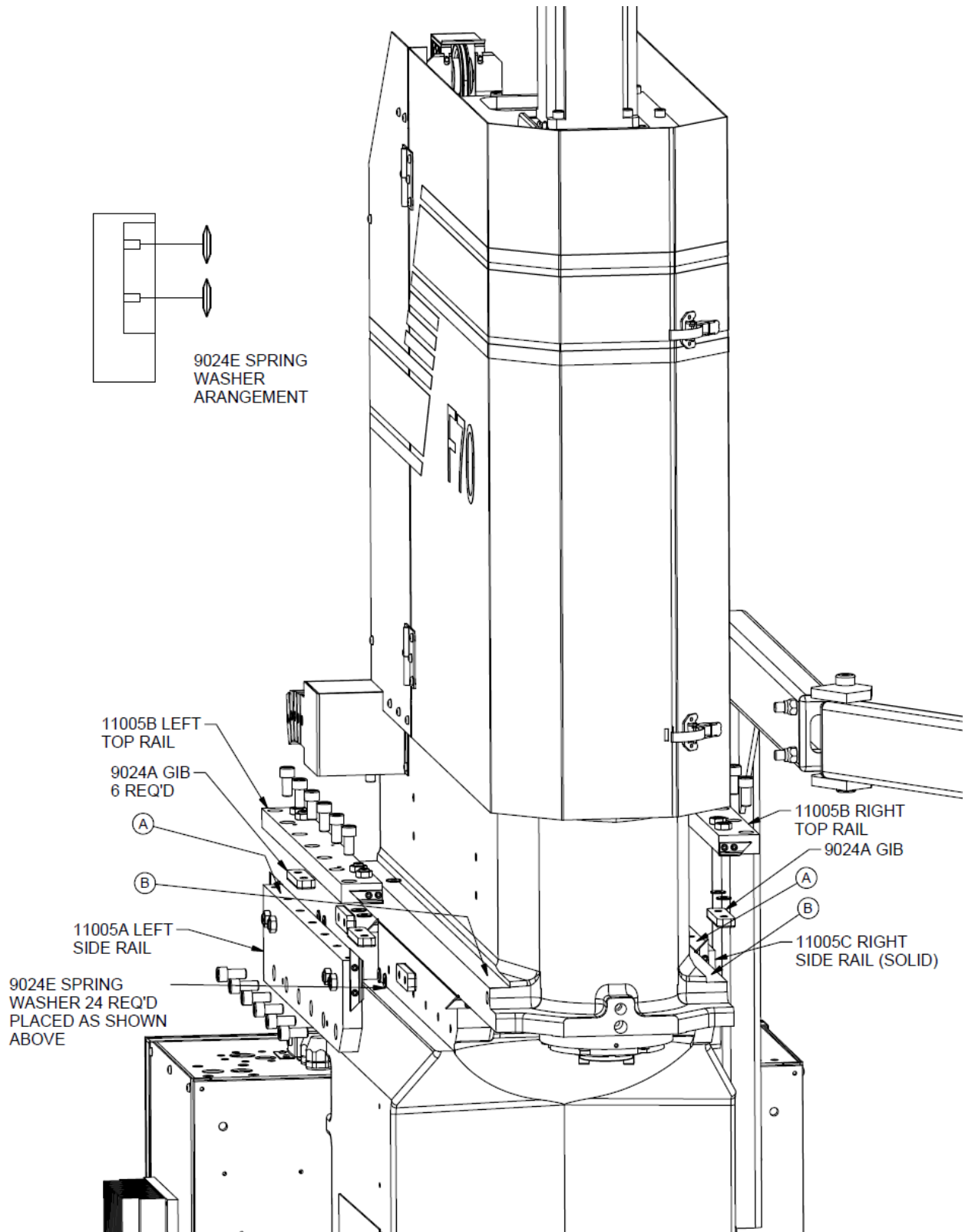
Left Side View



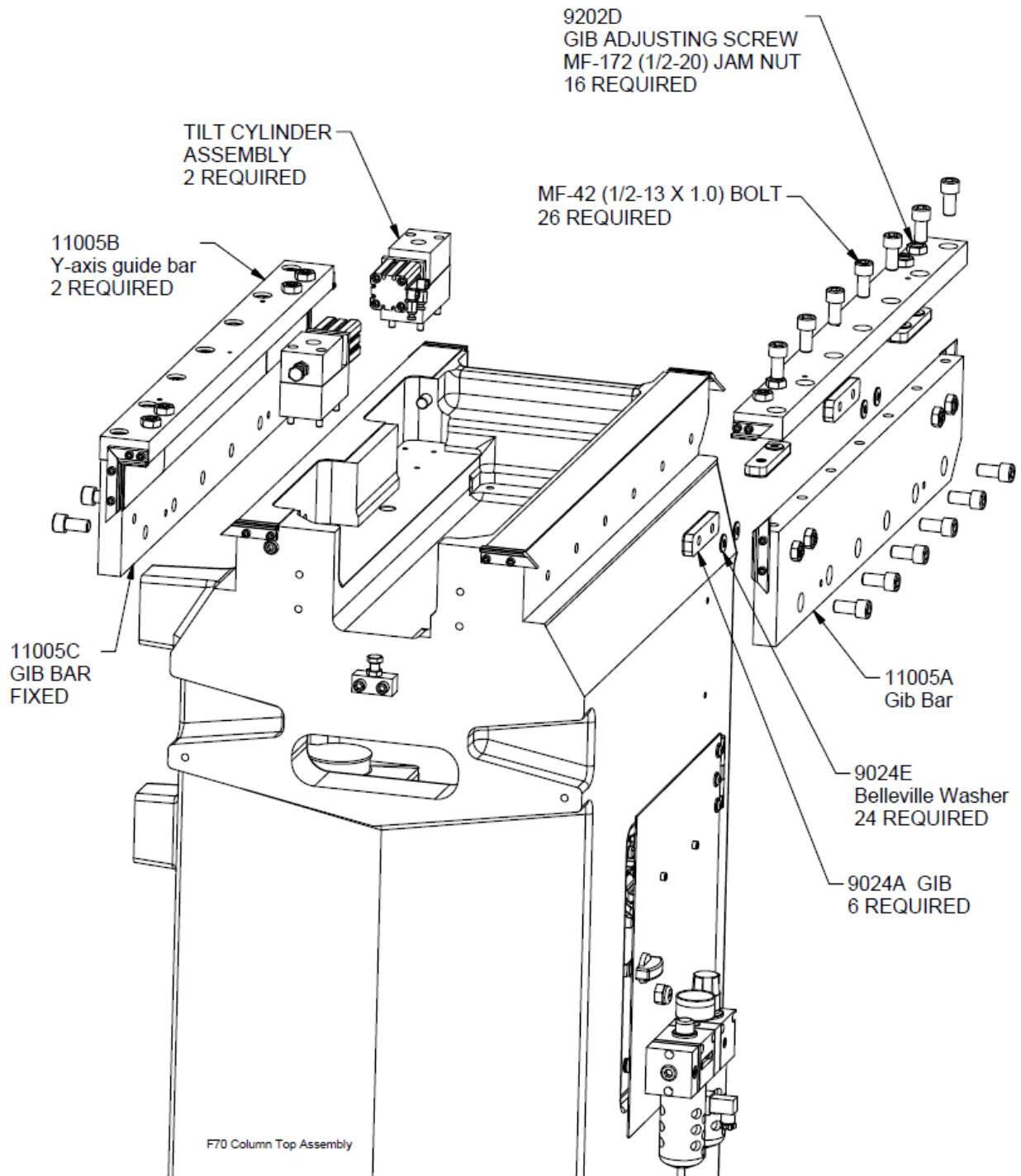
### Column Assembly



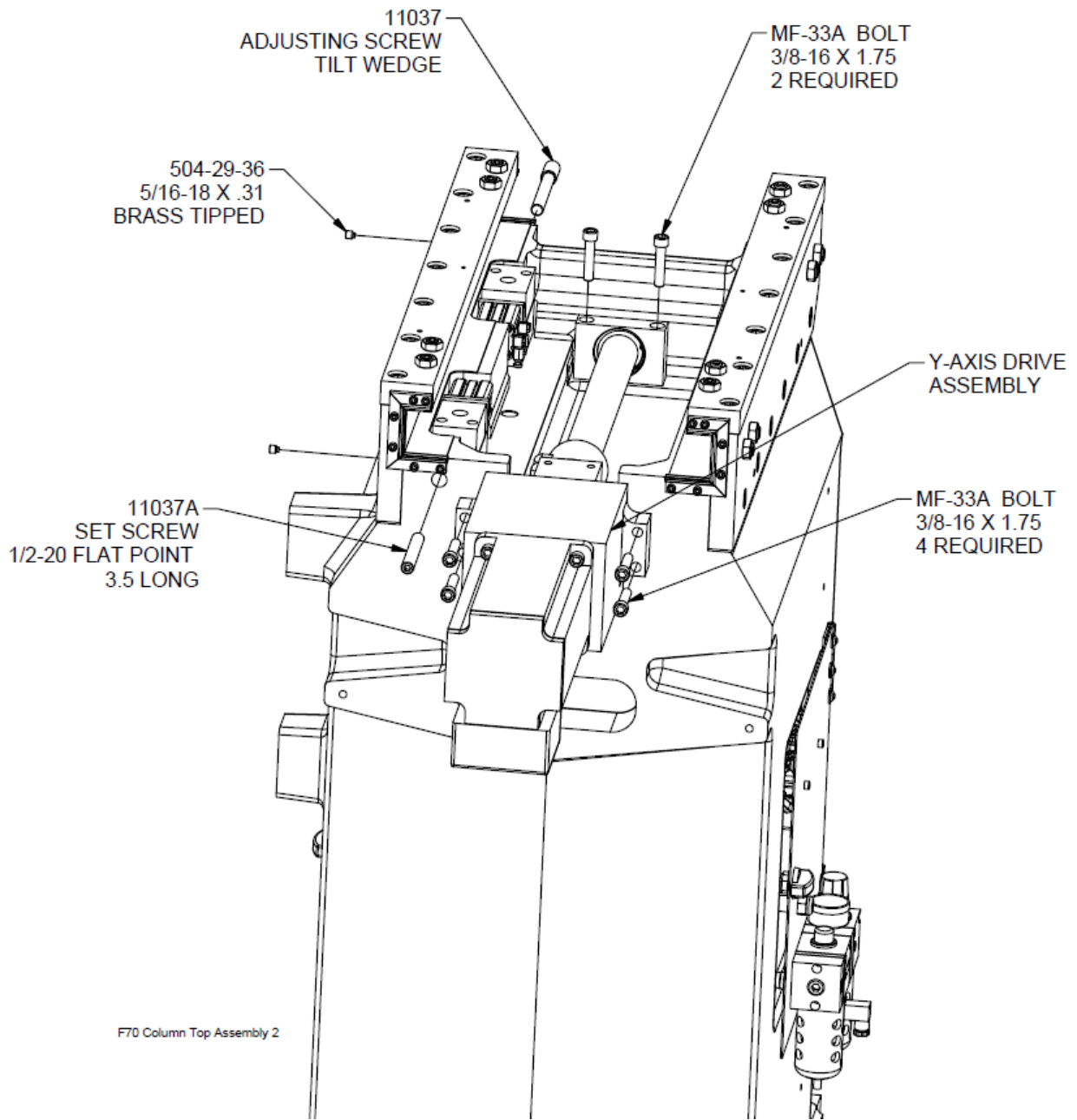
### Column Gib Assembly part 1



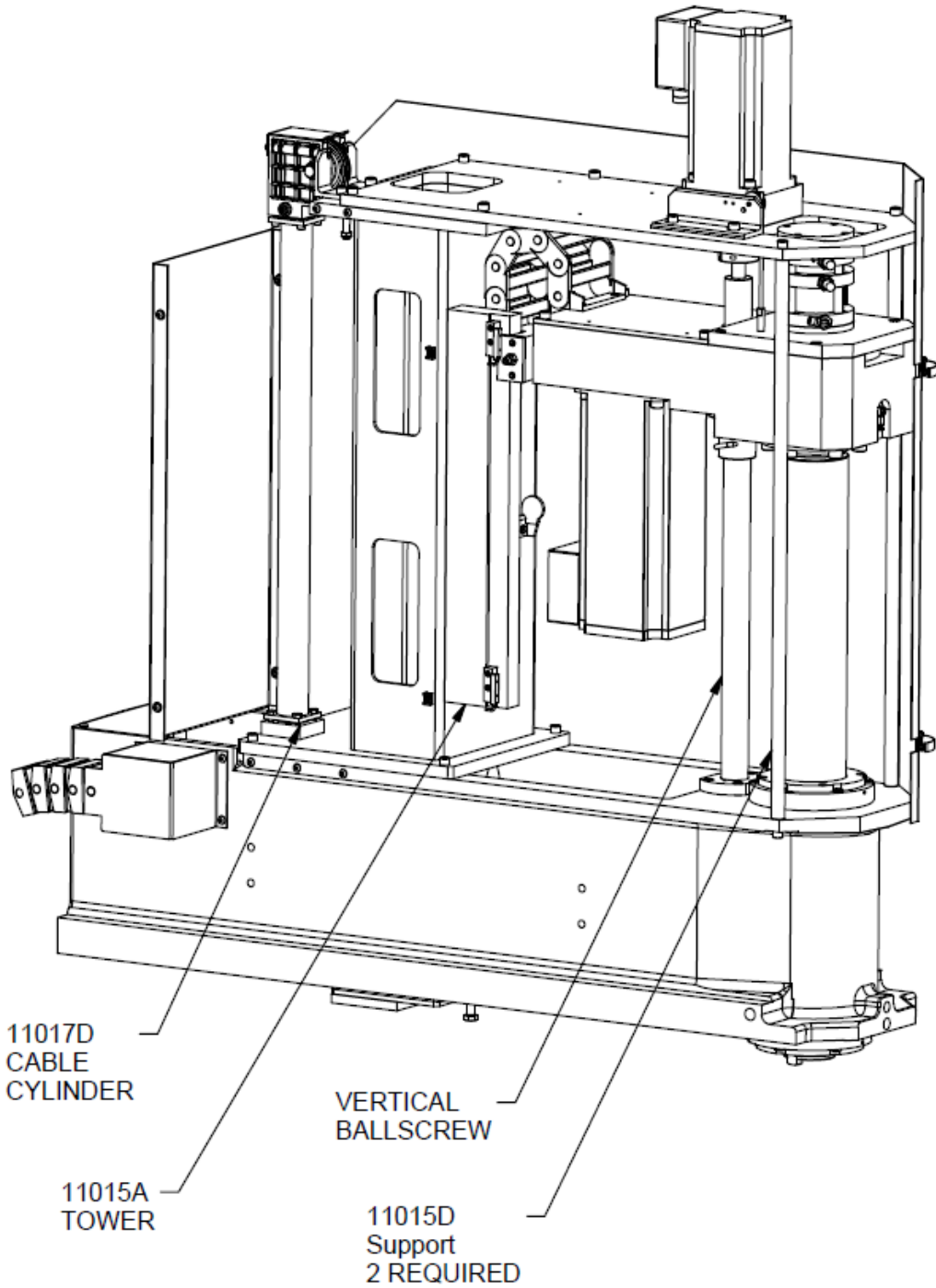
### Column Gib Assembly part 2



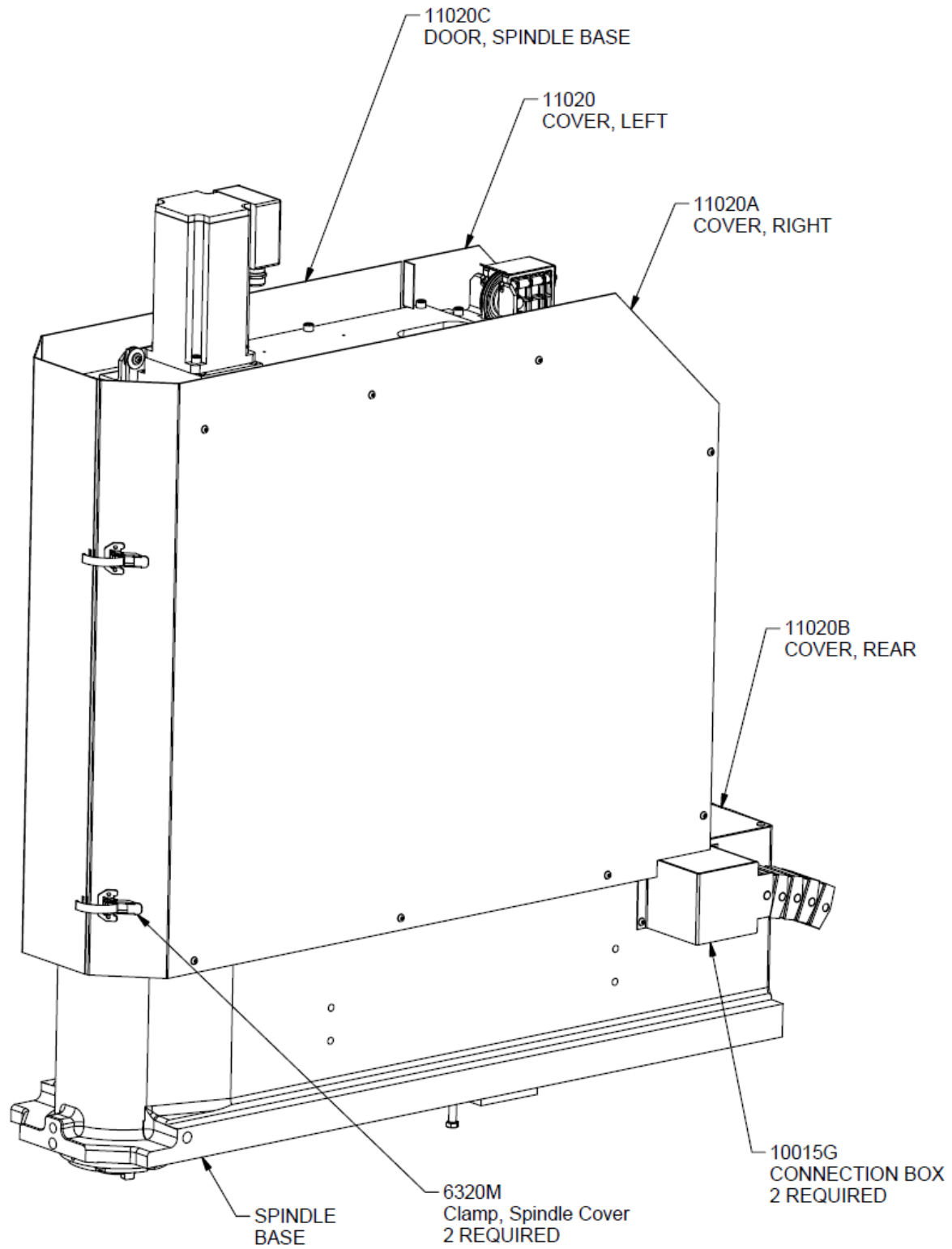
### Column Gib Assembly part 3



### Spindle Assembly Left Side

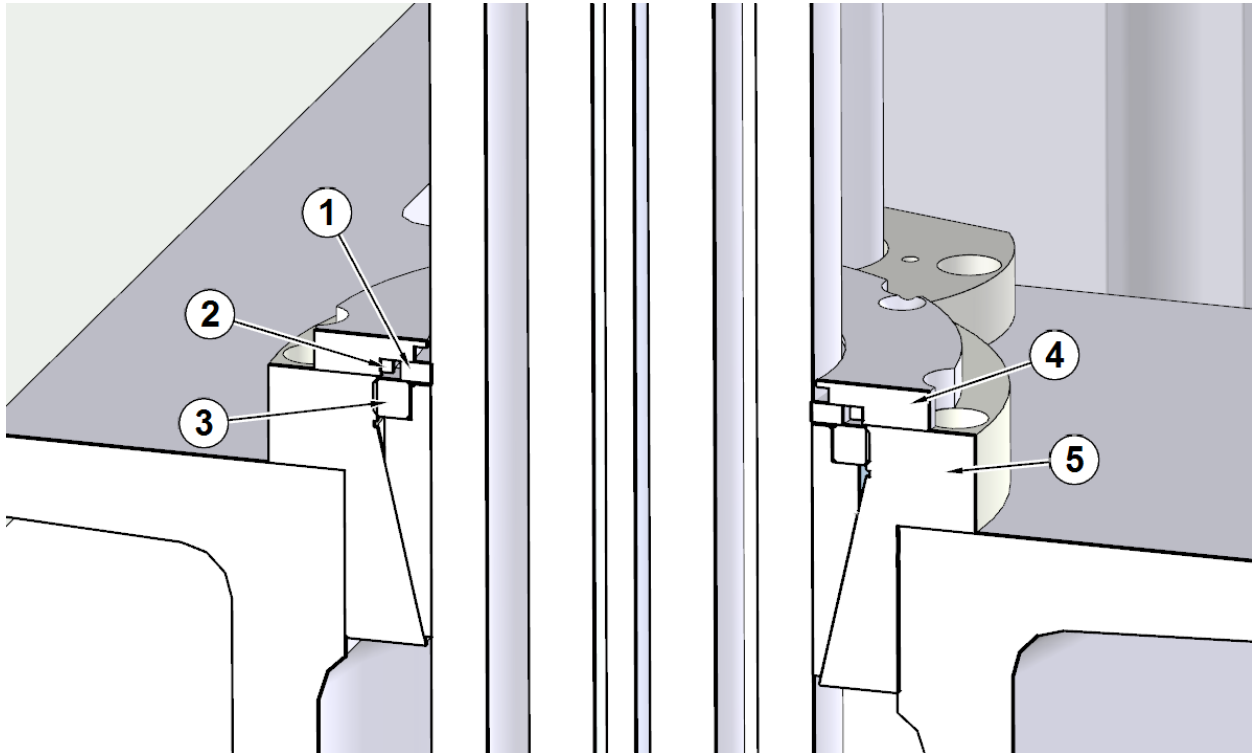


### Spindle Assembly Right Side



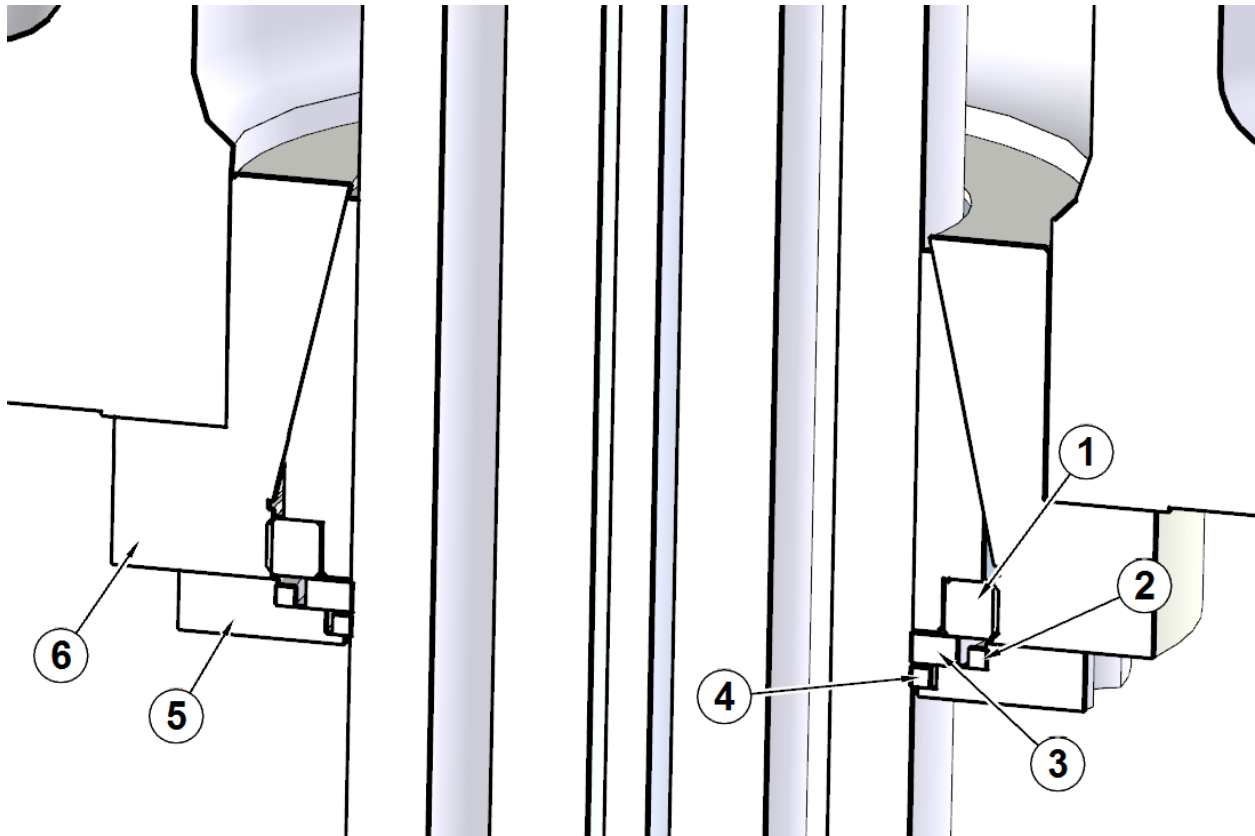


### Upper Spindle Bushing Components



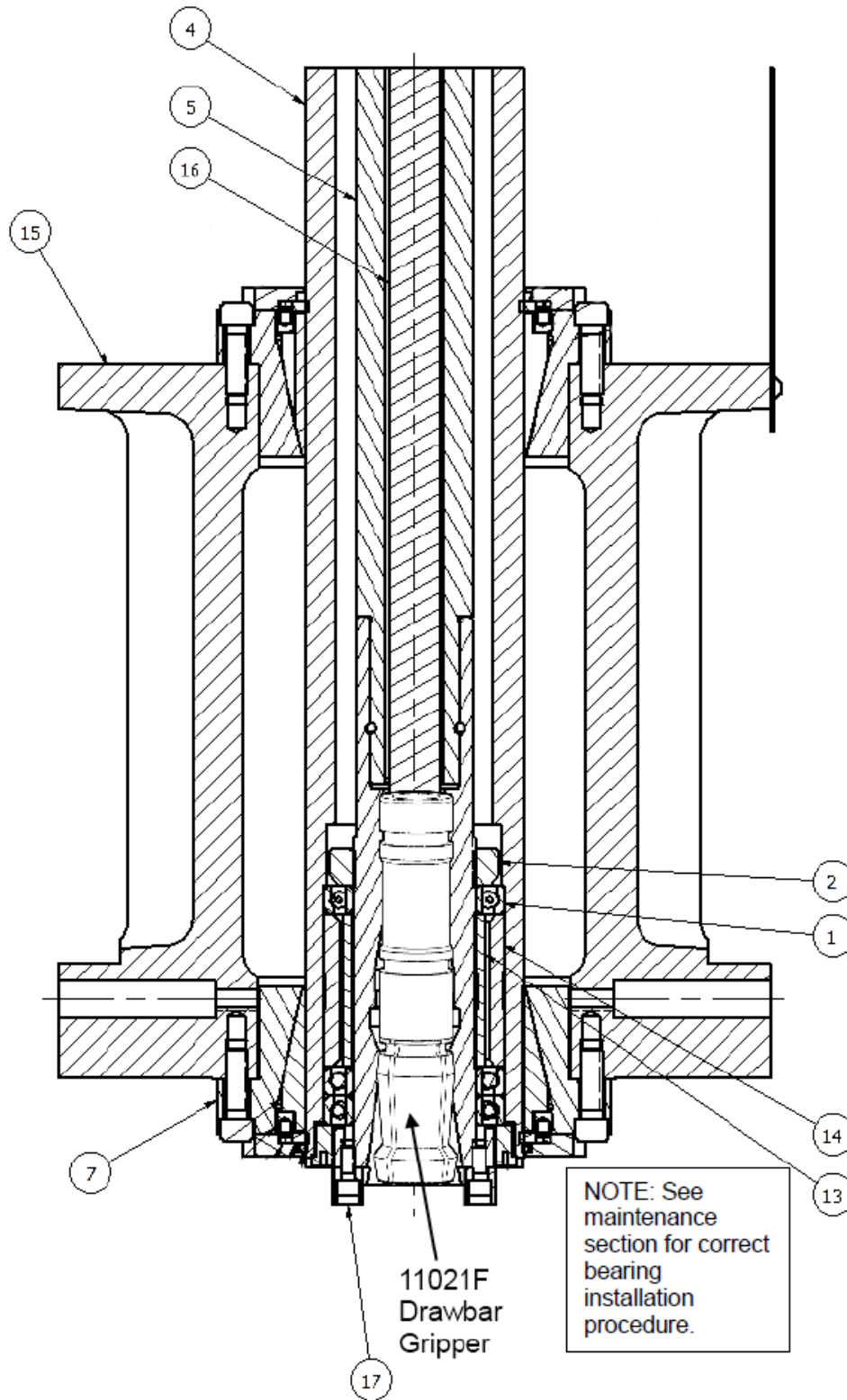
ITEM	PART #	DESCRIPTION
1	11004F	OILER, FELT-LOWER
2	11004E	SQUARE O-RING
3	11004C	NUT, OUTER SPINDLE
4	11004B	RETAINER, WIPER
5	11004A	CARRIER, BEARING

### Lower Spindle Bushing Components



ITEM	PART #	DESCRIPTION
1	11004C	NUT, OUTER SPINDLE
2	11004E	SQUARE O-RING
3	11004F	OILER, FELT-LOWER
4	11004D	SQUARE O-RING
5	11004B	RETAINER, WIPER
6	11004A	CARRIER, BEARING

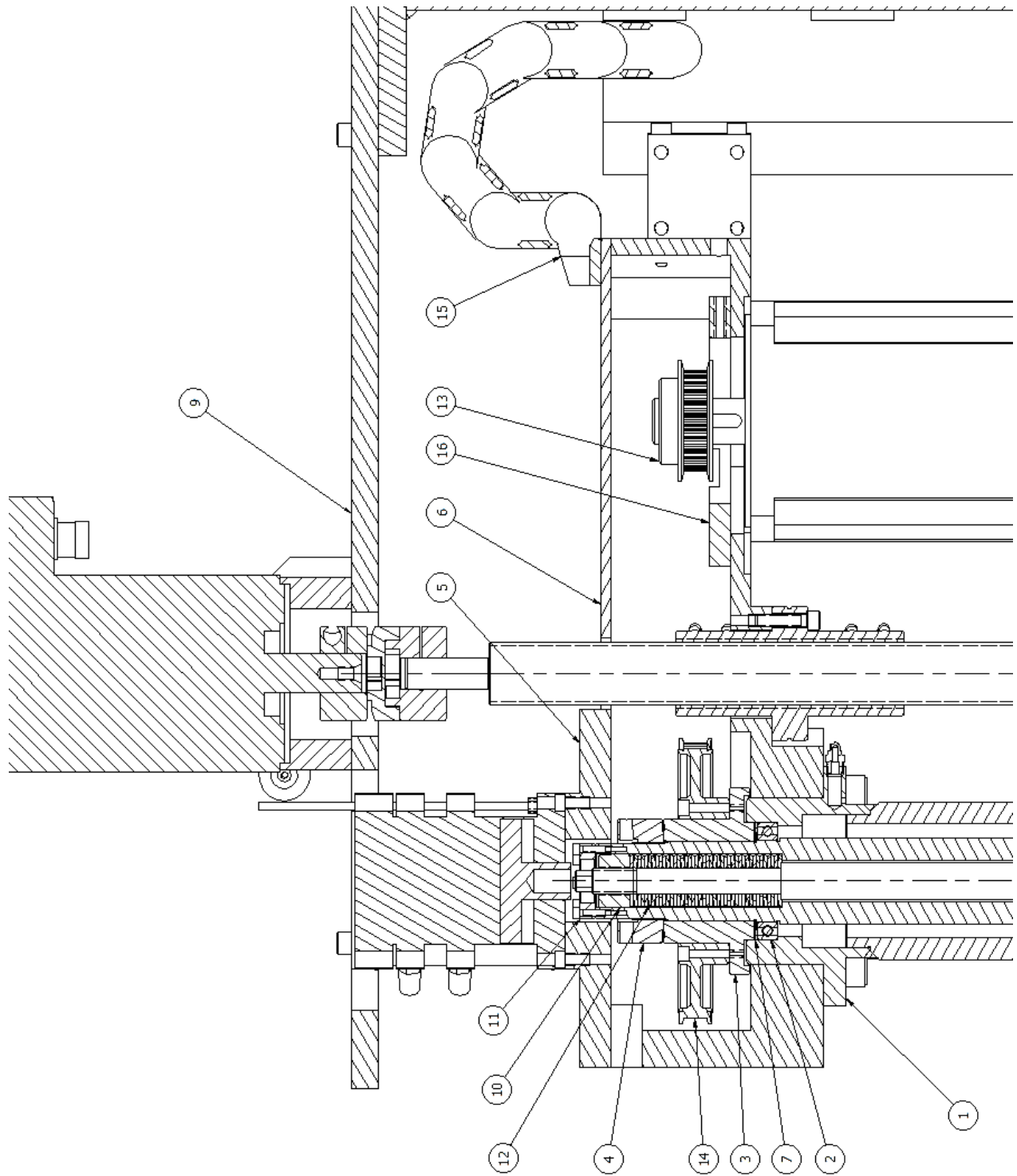
### Spindle Lower Section



**Spindle Lower Section Parts List**

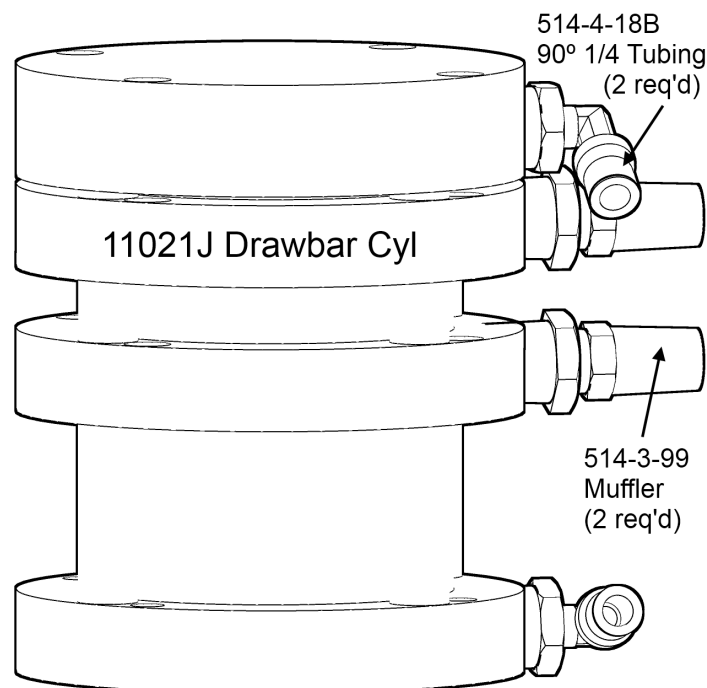
ITEM	QTY	PART NUMBER	DESCRIPTION
1	3	11001B	Spindle Bearings Lower
2	1	11001C	Bearing Nut
4	1	11002D	Outer Spindle
5	1	11003B	Inner Spindle
13	1	11004G	Spindle Spacer, Inner
14	1	11004H	Spindle Spacer, Outer
15	1	11014B	Spindle Base
16	1	11021	Draw Bar
17	2	6170H	Drive Key

### Spindle Upper Section

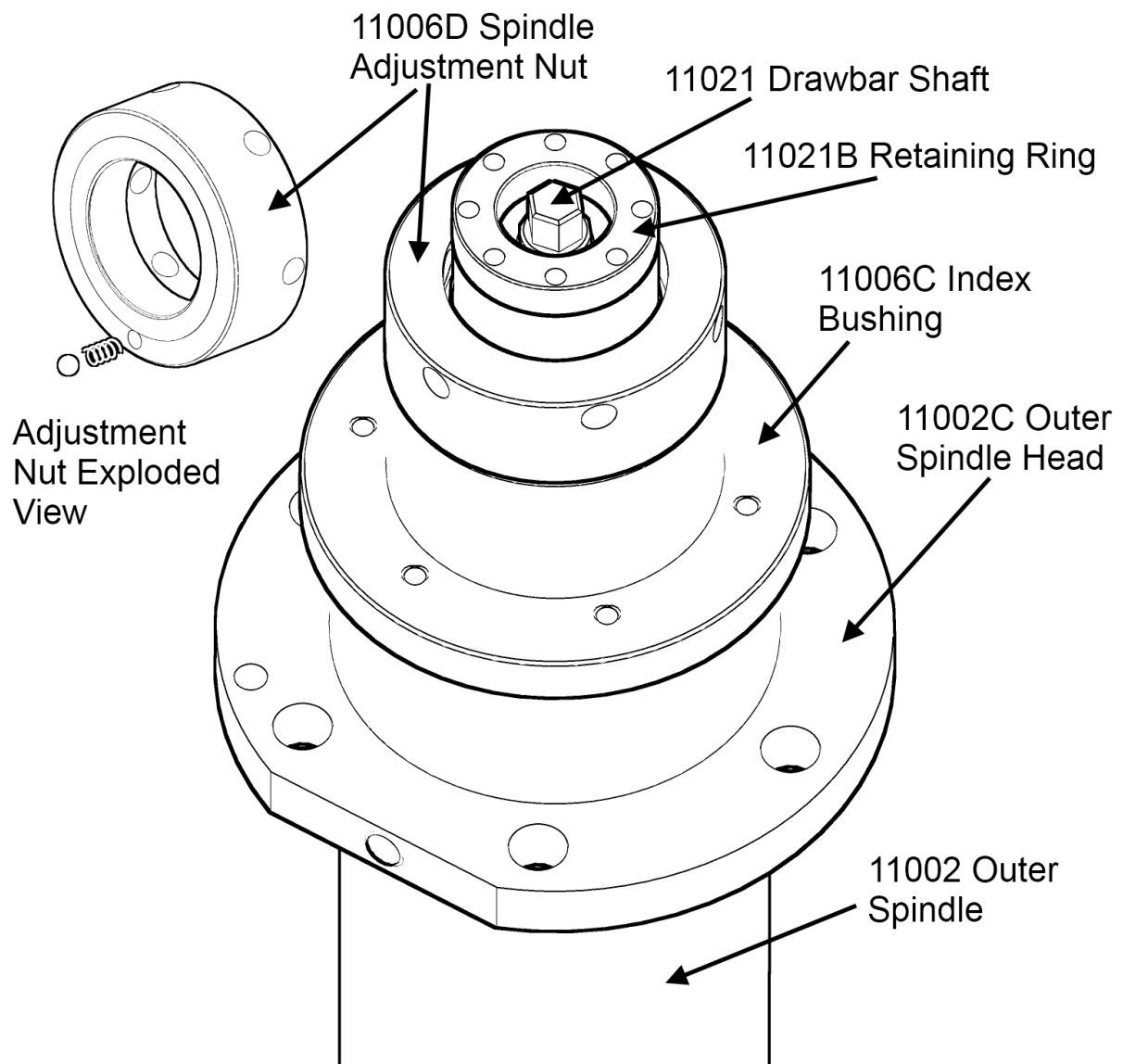


**Spindle Upper Section Parts List**

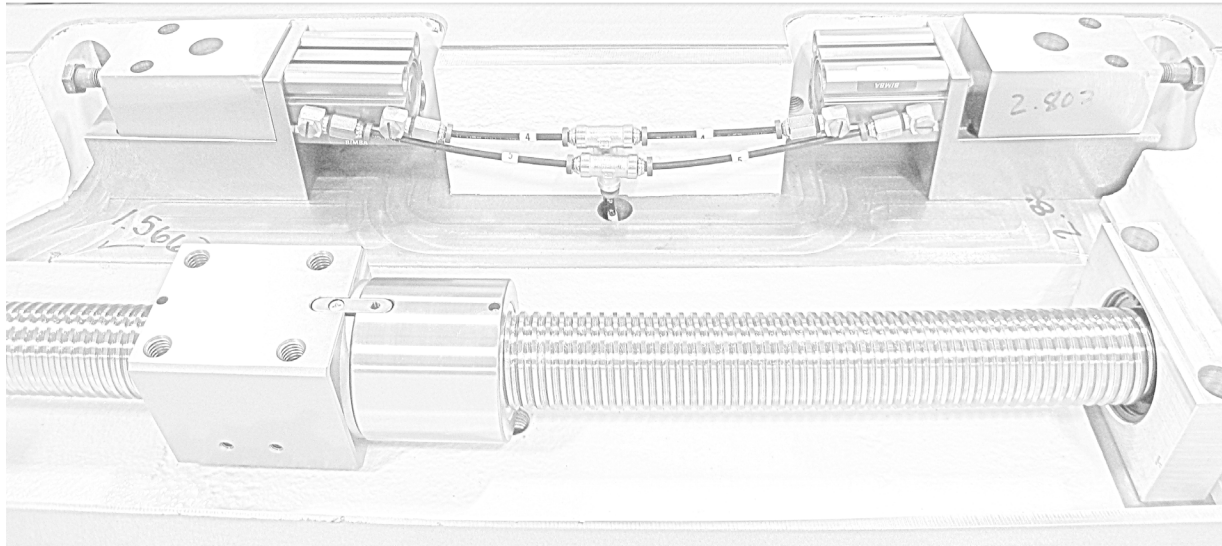
Upper Spindle Section			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	11002D	Outer Spindle
2	1	11006A	Upper spindle bearing
3	1	11006C	Index Bushing
4	1	11006D	Spindle nut
5	1	11006G	Upper Housing Cover
6	1	11006H	Upper Housing Cover
7	2	11006J	Bellville Spring
9	1	11015B	Top Plate
10	1	11021A	Nut
11	1	11021B	Retainer
12	66	11021D	Bellville Spring
13	1	11009M	25 Tooth Sprocket
14	1	11009K	Driven Sprocket 67 Tooth
15	2	11011C	Cable Carrier
16	1	6790S	Motor Mount Plate

**Drawbar Cylinder**

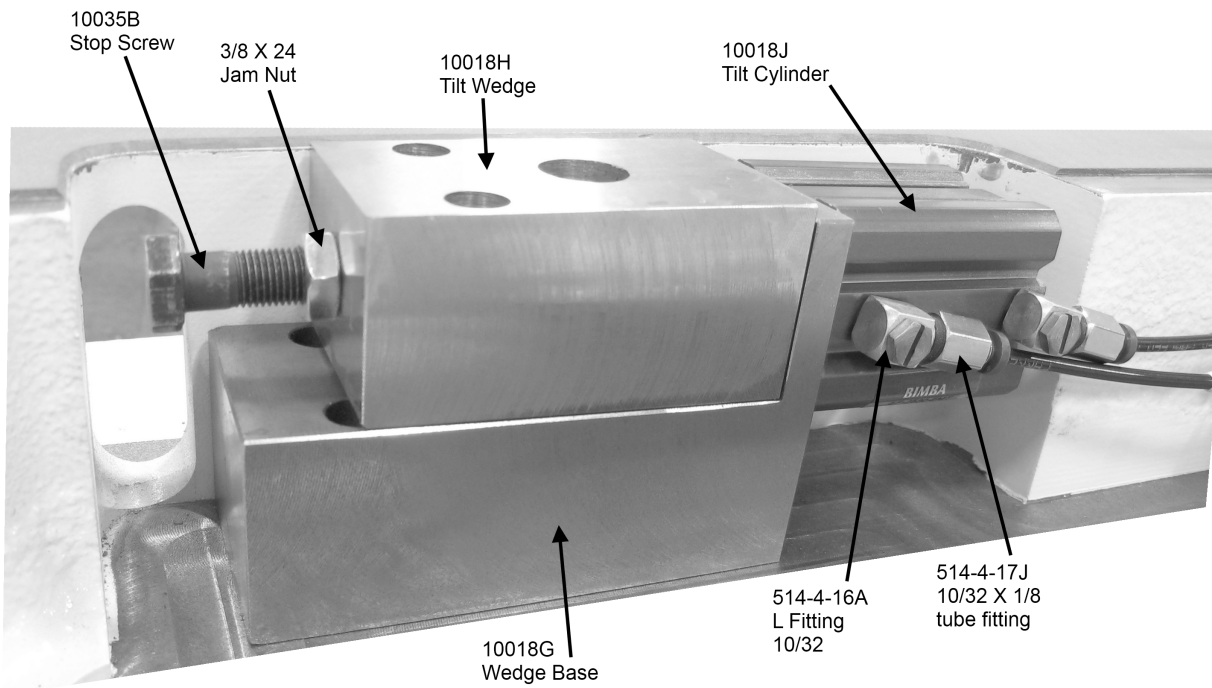
**Upper Spindle Assembly Section**



### Tilt Cylinders

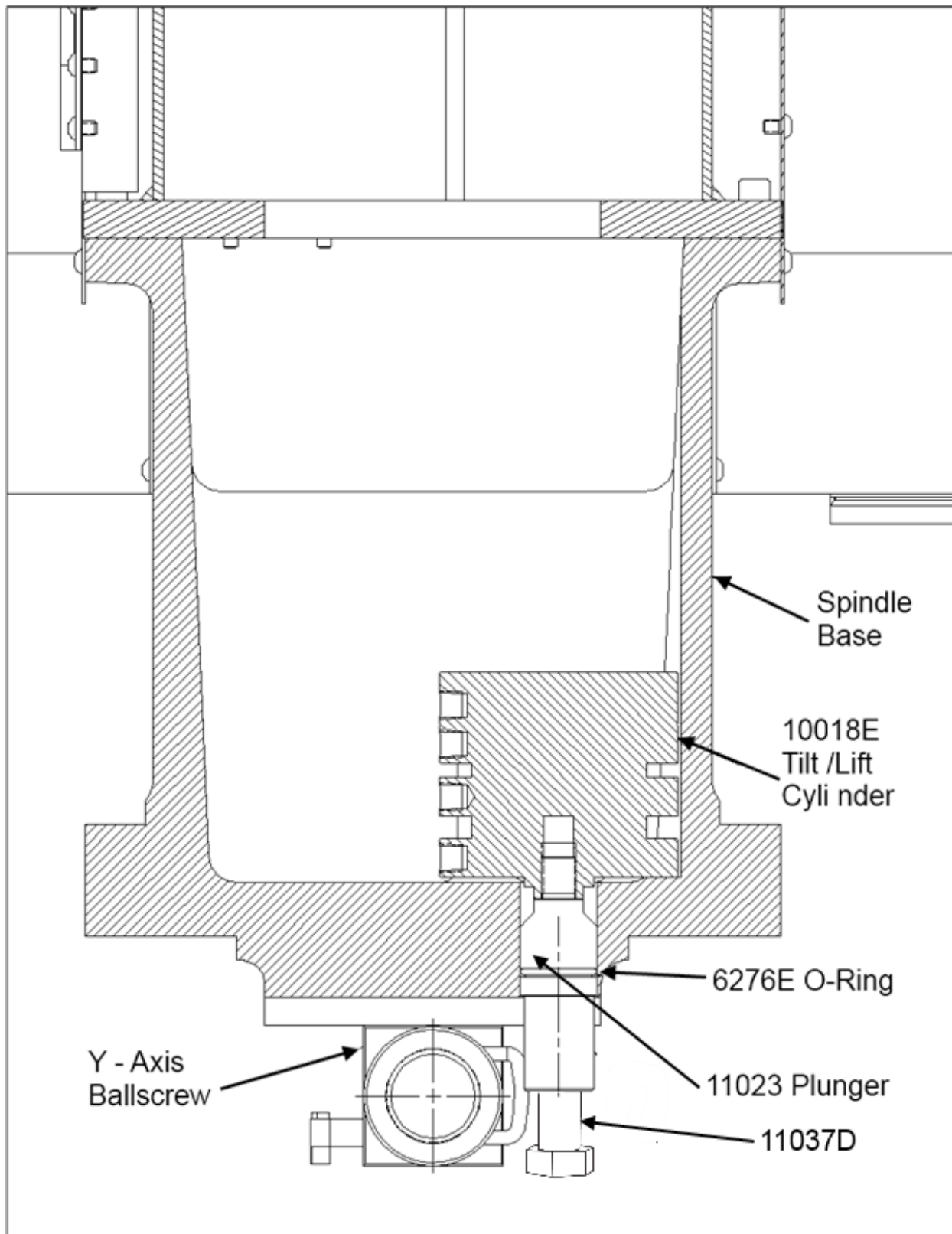


### Tilt Cylinder Parts

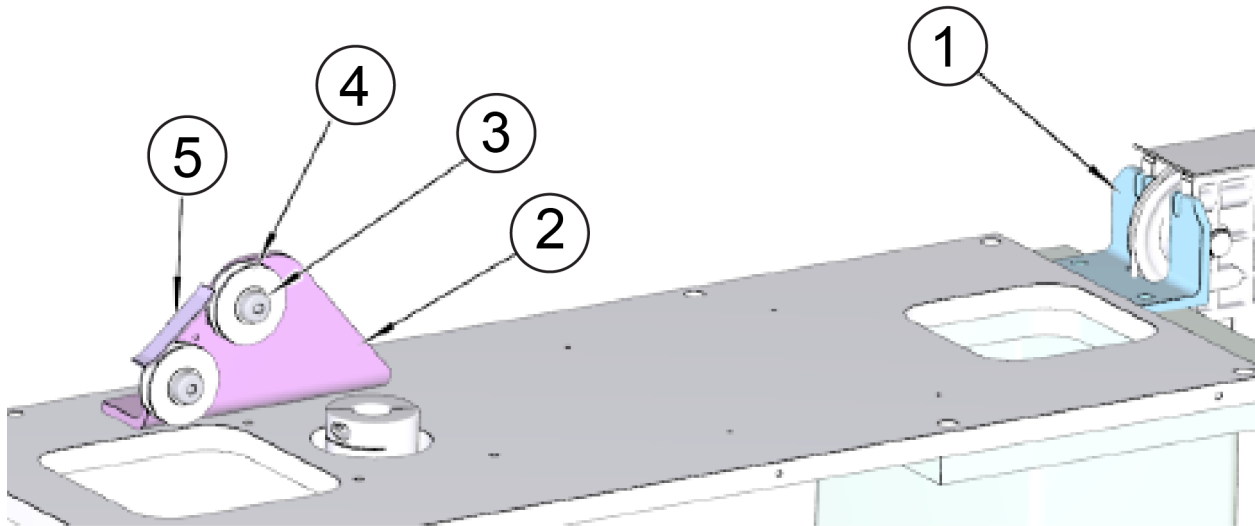




### Tilt Lift Cylinder



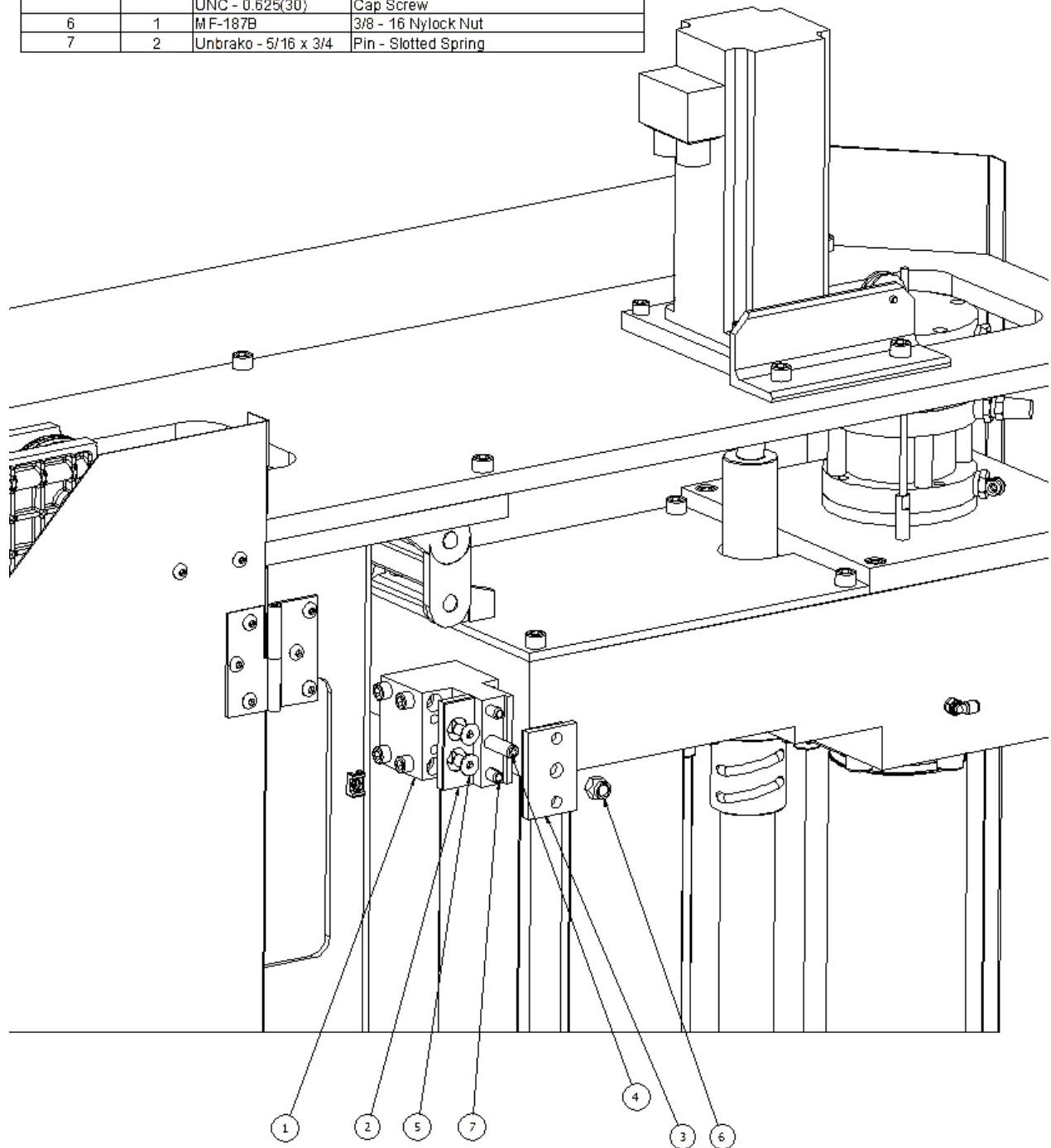
### Counter Balance Cylinder Cable Guide Components



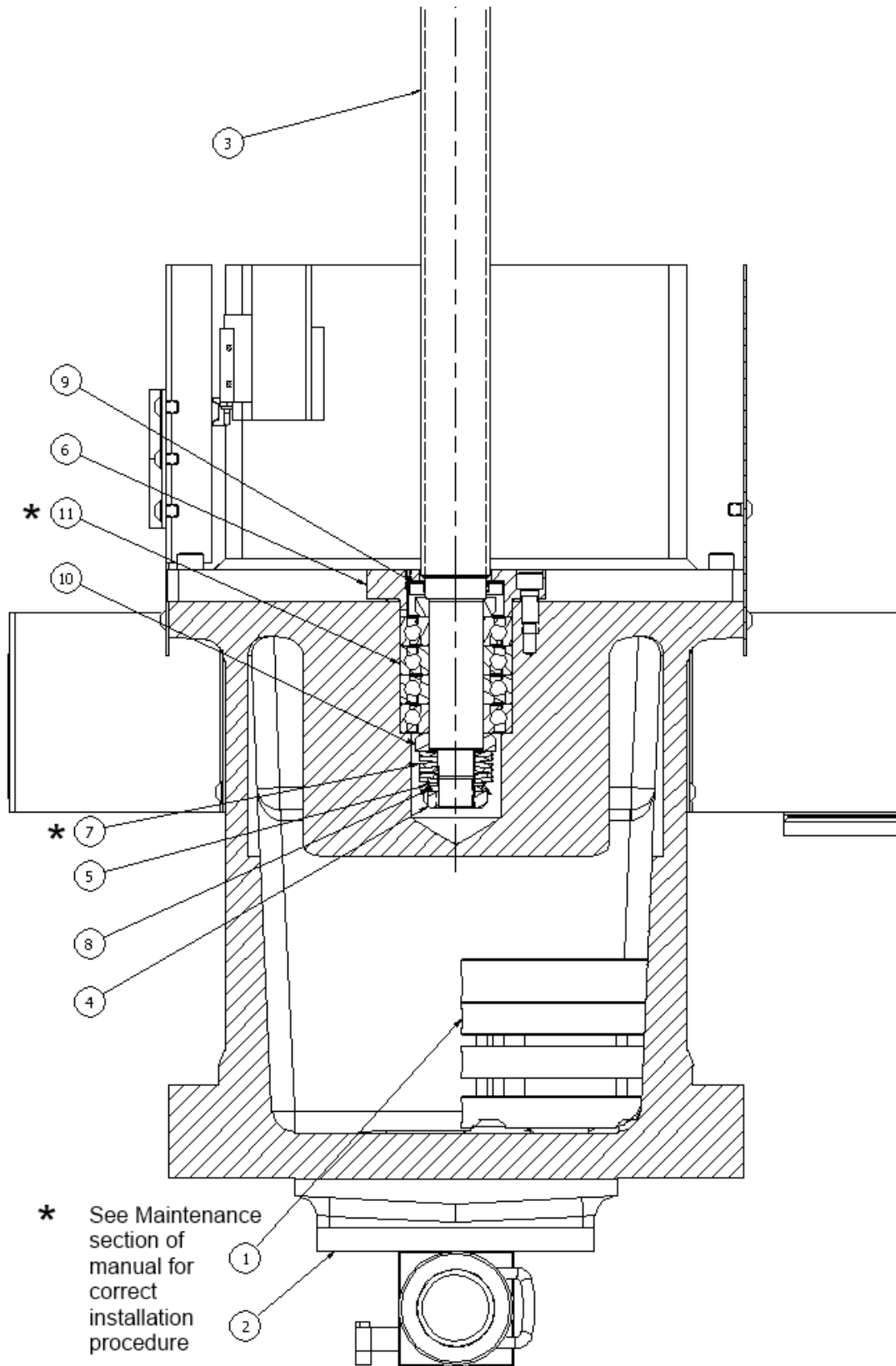
ITEM	PART #	DESCRIPTION
1	11017C	SUPPORT BRACKET, UPPER CABLE CYLINDER
2	11017G	BRACKET, DUAL PULLEY COUNTER BALANCE
3	650-3-66R	SHOULDER SCREW
4	9230	PULLEY, CABLE CYLINDER
5	9217C	CABLE GUIDE, COUNTERWEIGHT CABLE

### Upper Housing Guide

Upper Housing Guide			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	6760J	Bracket
2	1	6760K	Inner Bearing
3	1	6760L	Outer Bearing
4	1	ANSI B18.3 - 3/8-16 UNC x 2	Hexagon Socket Set Screw - Cup Point
5	2	ANSI B18.3 - 5/16-18 UNC - 0.625(30)	Hexagon Socket Flat Countersunk Head Cap Screw
6	1	M F-187B	3/8 - 16 Nylock Nut
7	2	Unbrako - 5/16 x 3/4	Pin - Slotted Spring



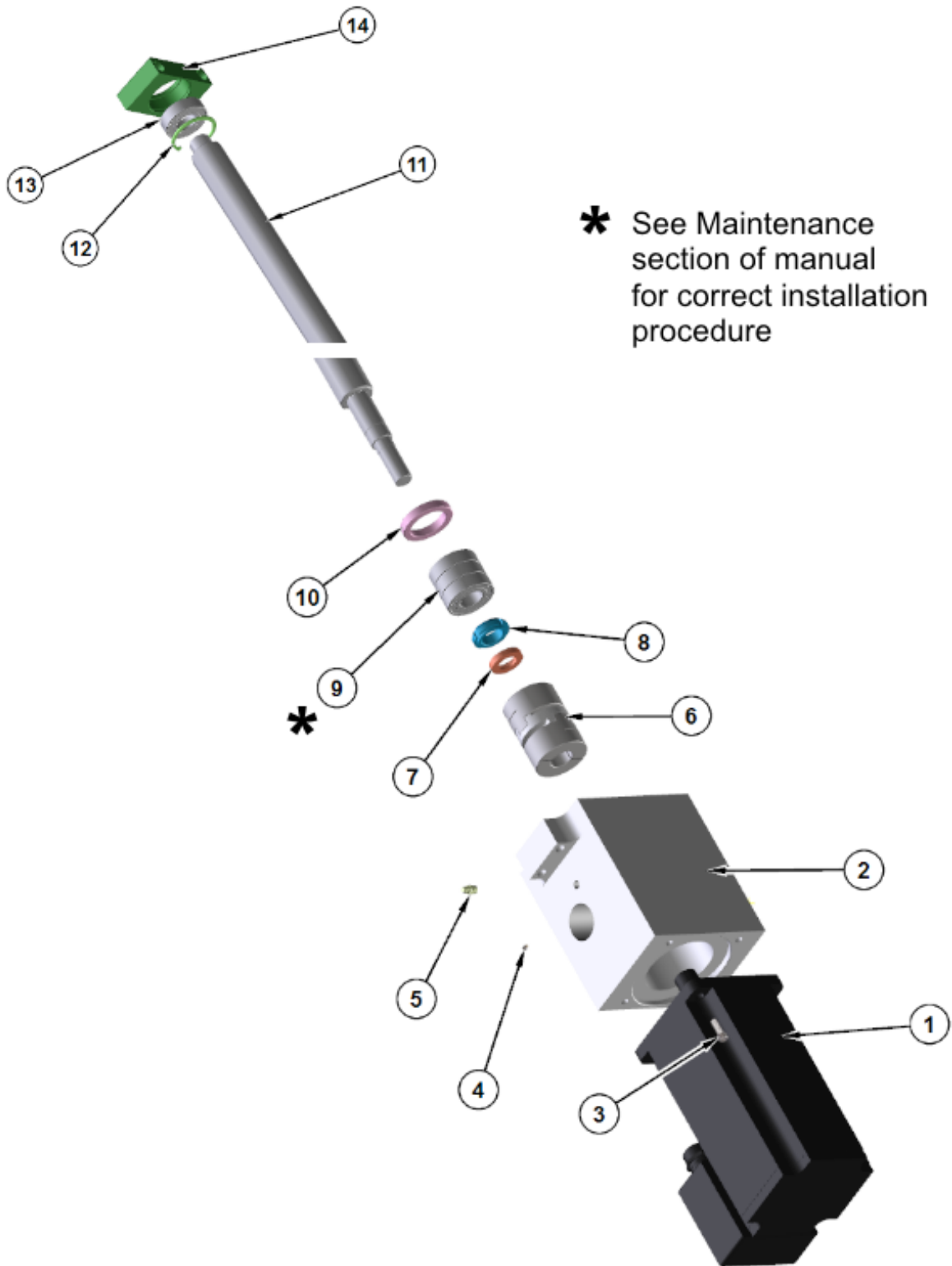
### Vertical Ballscrew Assembly



**Vertical Ballscrew Assembly Parts List**

Vertical Ballscrew Section			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	10018E	Tilt / Lift Cylinder
2	1	10019	Spindle base nut plate
3	1	11016	Vertical Ballscrew
4	1	502-10-17	Lock nut
5	1	502-10-18	Tongued Washer
6	1	6032E	Retainer
7	6	6037A	Bellville Spring
8	1	6049C	Keyed Washer
9	1	6052	Seal
10	2	6107	Shoulder Ring
11	4	6063	Spindle Bearing

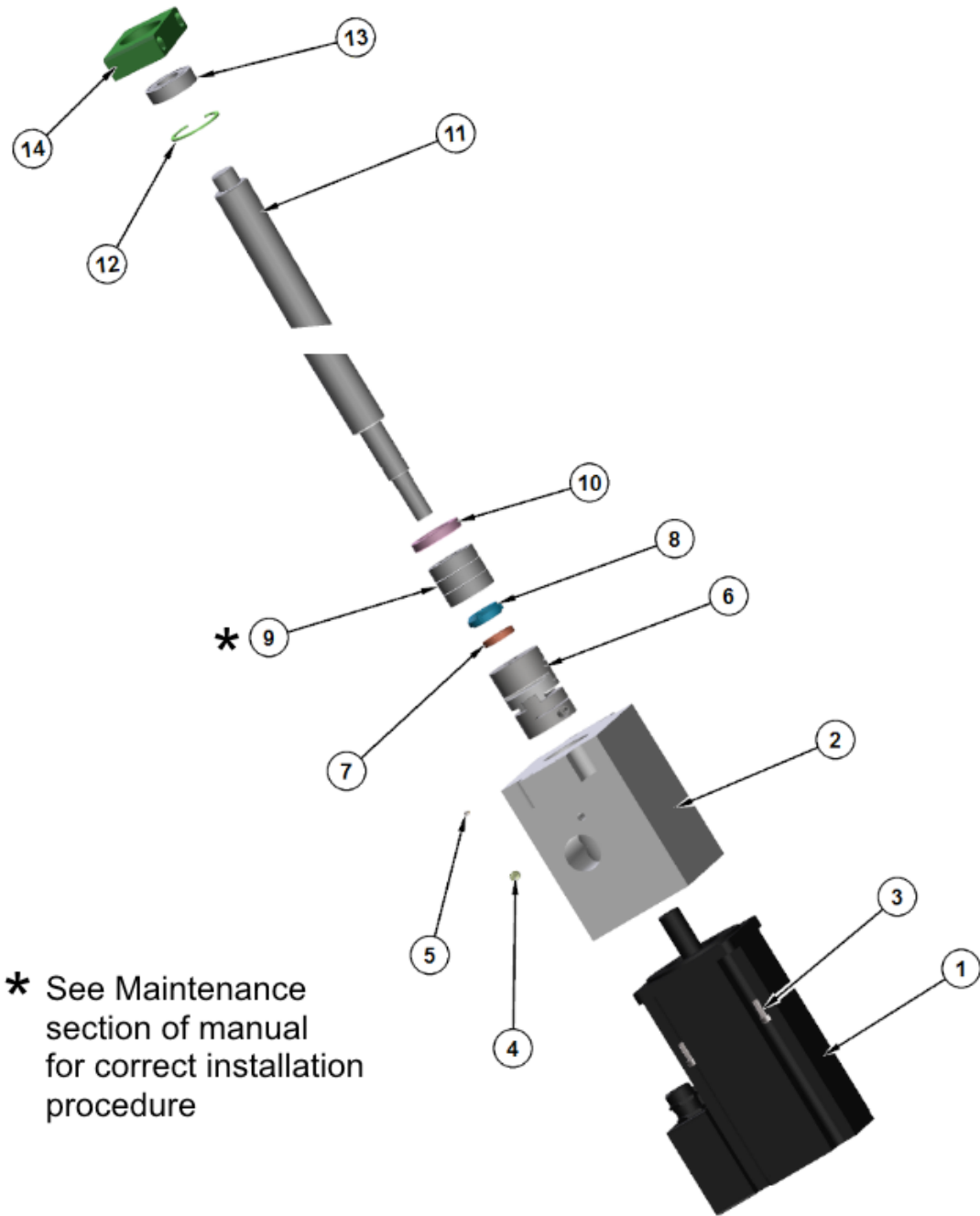
### X – Axis Drive Assembly



**X – Axis Ballscrew Assembly Parts List**

<b>F-79A X-Axis Parts</b>			
<b>Item #</b>	<b>QTY</b>	<b>Part Number</b>	<b>Description</b>
1	1	650-3-62T	Motor
2	1	11008A	Housing
3	4	MF-14	Hexagon Socket Head Cap Screw
4	1	100-82-2	Brass Tipped Set Screw
5	1	MF-191A	Grease Fitting
6	1	9001L	Motor Coupling
7	1	504-34-53	Seal
8	1	504-34-54	Bearing Nut
9	3	6778D	Bearing
10	1	504-34-15A	Bearing Retaining Nut
11	1	11008	Ball Screw
12	1	7245E	Retaining Ring
13	1	6778D	Bearing
14	1	9001A	Bearing Housing

### Y – Axis Ballscrew Assembly

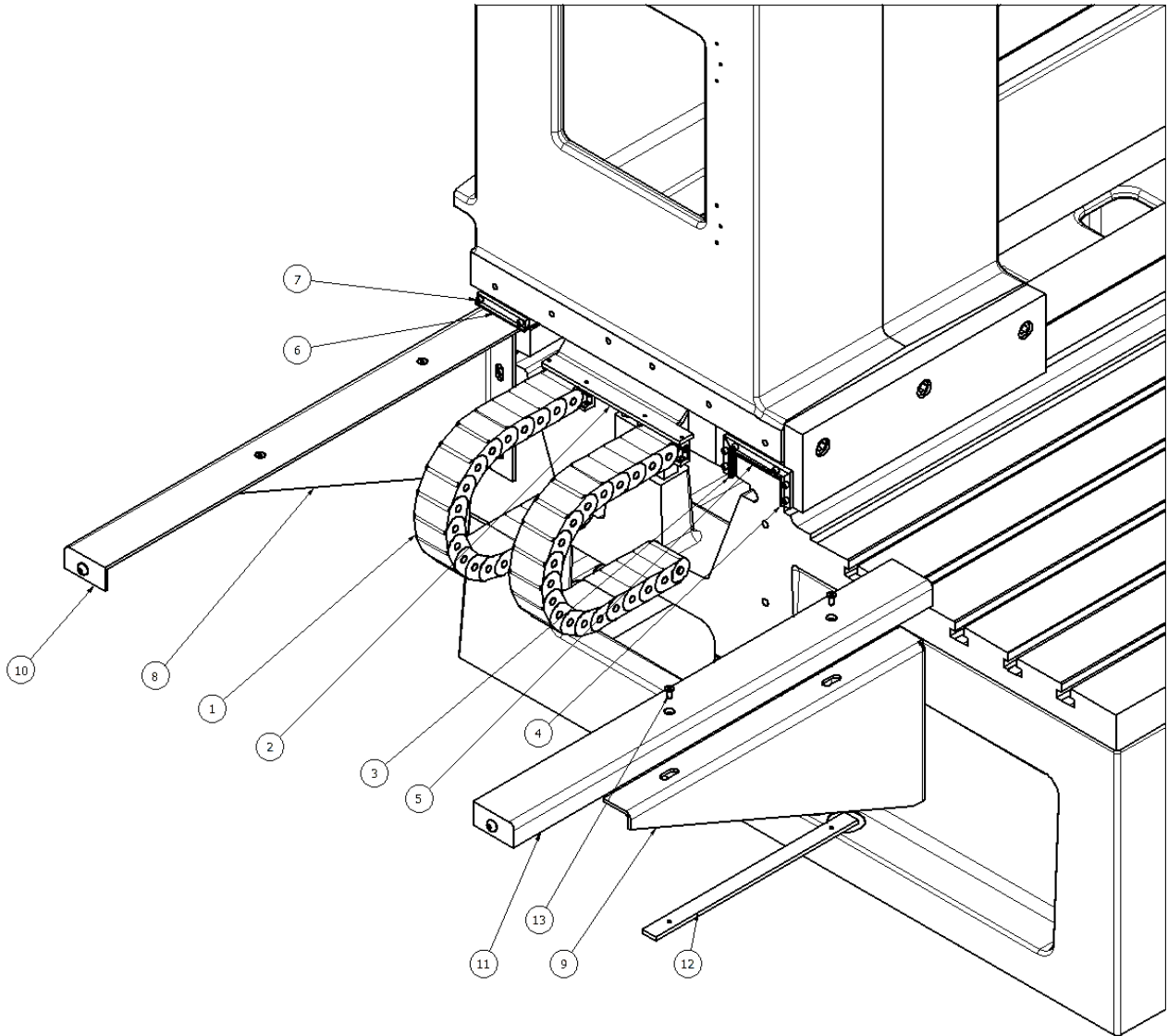




**Y – Axis Ballscrew Assembly Parts List**

<b>F-79A Y-Axis Parts</b>			
<b>Item #</b>	<b>QTY</b>	<b>Part Number</b>	<b>Description</b>
1	1	650-3-62T	Motor
2	1	11008A	Housing
3	4	MF-14	Hexagon Socket Head Cap Screw
4	1	MF-191A	Grease Fitting
5	1	100-82-2	Brass Tipped Set Screw
6	1	9001L	Motor Coupling
7	1	504-34-53	Seal
8	1	504-34-54	Bearing Nut
9	3	6778D	Bearing
10	1	504-34-15A	Bearing Retaining Nut
11	1	11008D	Ball Screw
12	1	7245E	Retaining Ring
13	1	6778D	Bearing
14	1	9001A	Bearing Housing

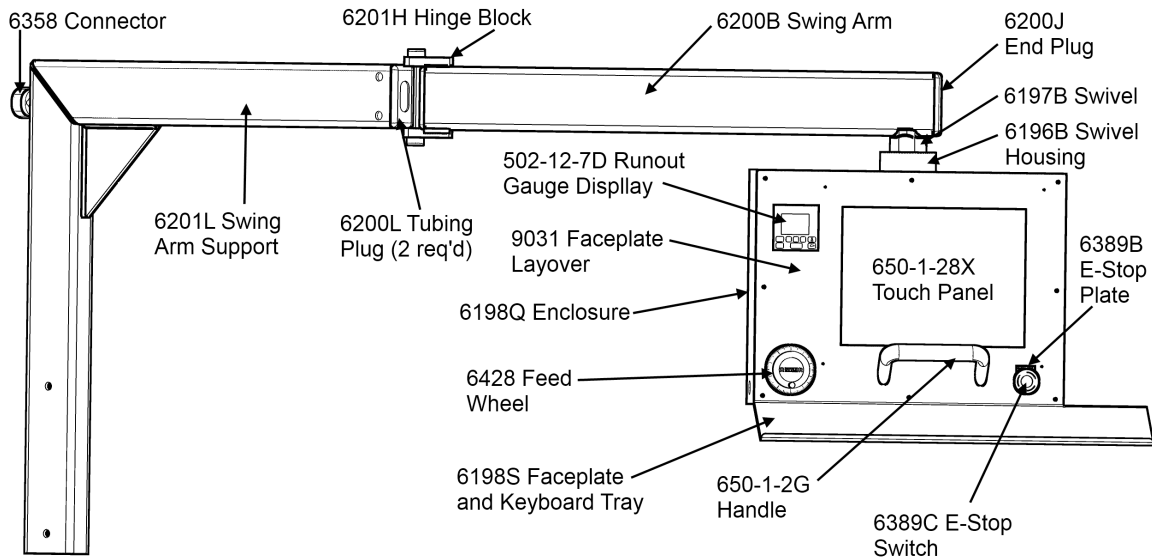
### Way Cover Support



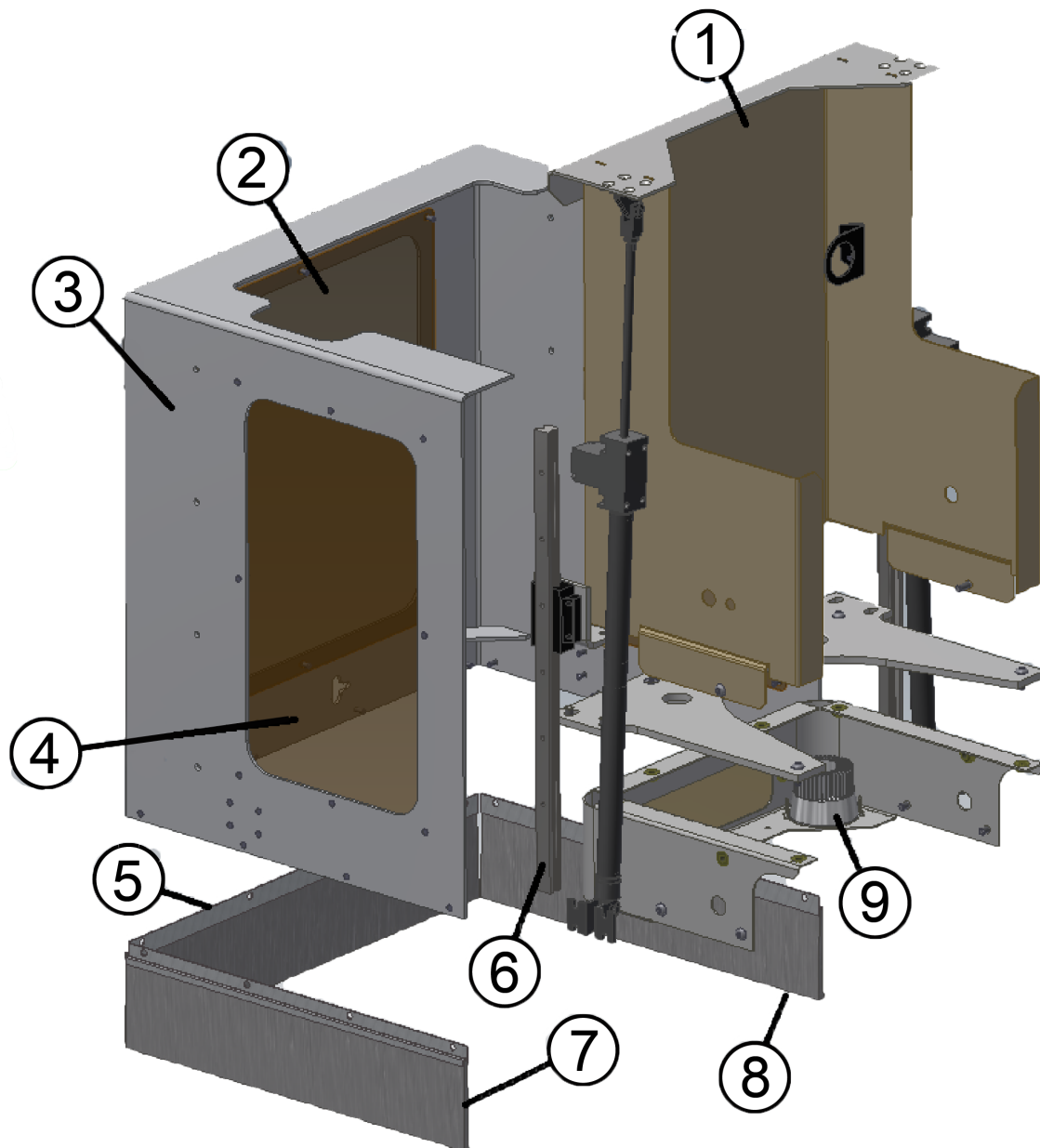
**Way Cover Support Parts List**

Way Cover Support			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	11011	Cable Carrier
2	1	11011B	Cable Carrier Support
3	2	6136B	Wiper, Left
4	2	6137B	Wiper, Right
5	2	6138B	Wiper, Middle
6	2	6139B	Wiper, Top Rear
7	20	MF-5A	S.H.C.S. 10 - 24 UNC - 1/2
8	2	9011A	way cover support left
9	2	9011B	way cover support right
10	2	9011C	way cover support extension left
11	2	9011D	way cover support extension right
12	4	9011E	Clamp Bar - Way Cover Support Assy.
13	8	ANSI B18.3 - 1/4-20 UNC - 0.625(30)	Hexagon Socket Flat Countersunk Head Cap Screw

**Pendent Swing Arm Assembly**

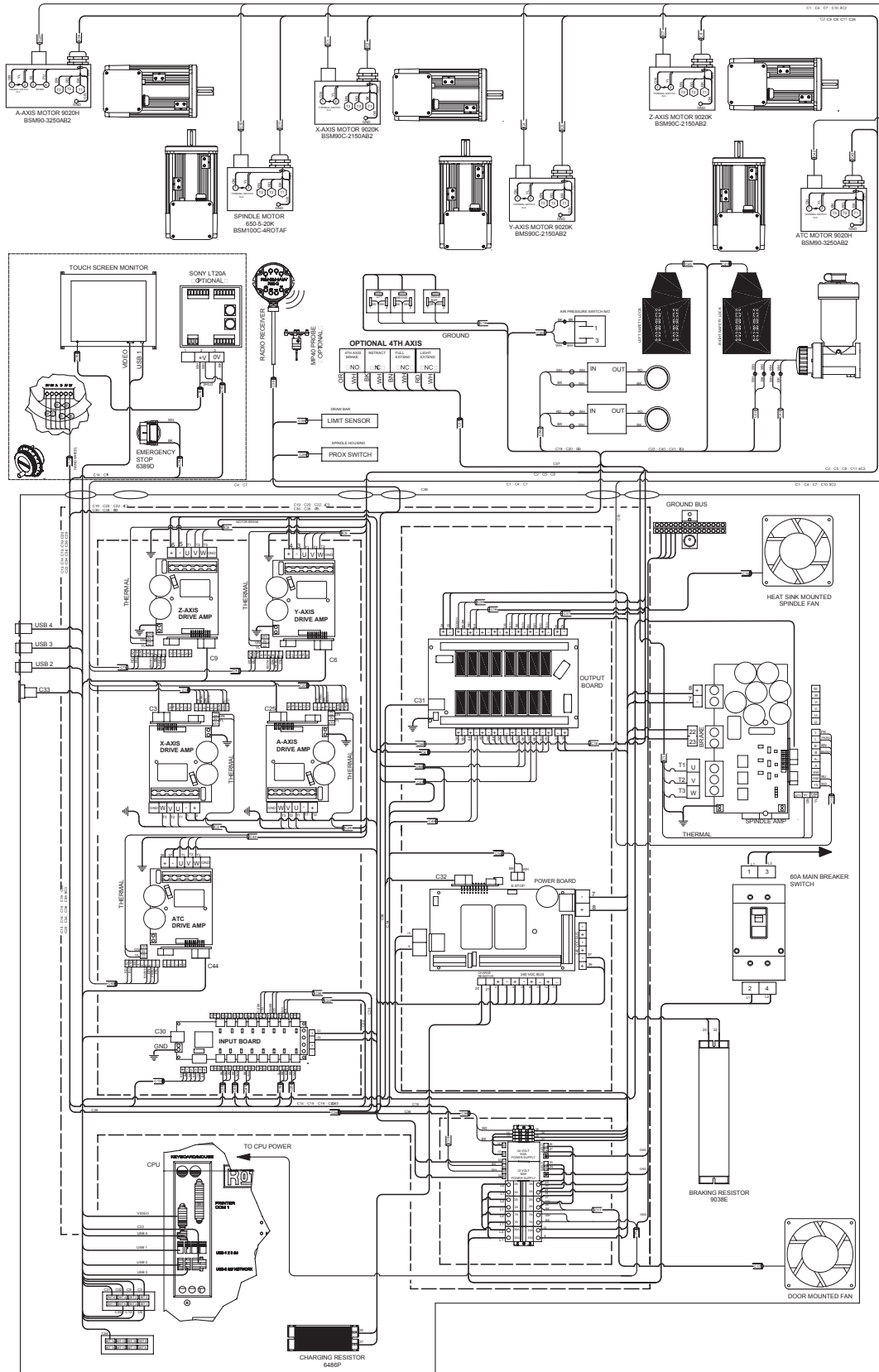


## Chip Shield Assembly



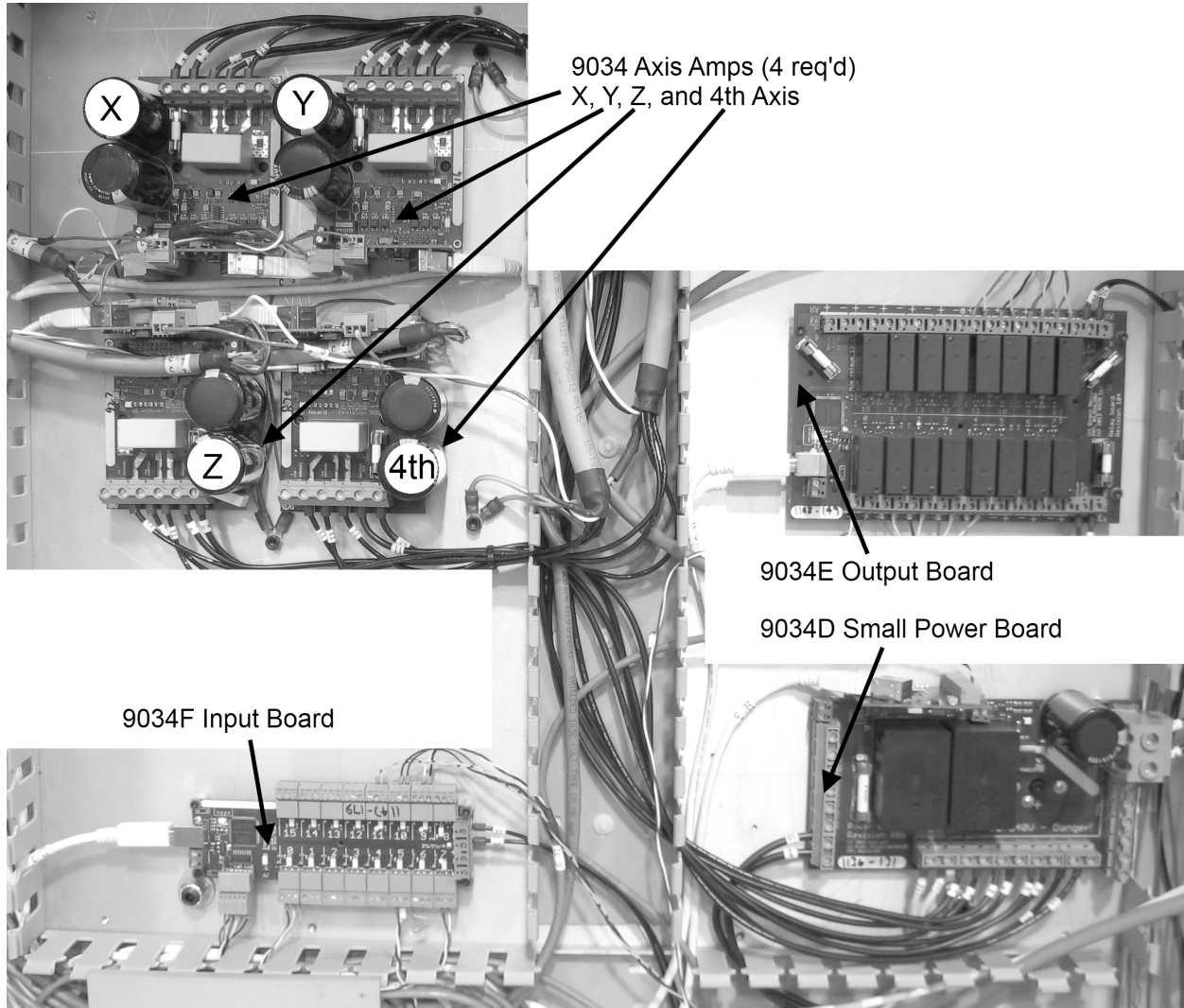
ITEM	PART #	DESCRIPTION
1	11039H	SUPPORT, CHIP SHIELD FRONT
2	11031L	FRONT, CHIP SHIELD LEXAN
3	11031J	SHIELD, CHIP
4	11031K	SIDE, CHIP SHIELD LEXAN
5	11040	BRUSH, FRONT CHIP SHIELD
6	11033B	RAIL, LINEAR
7	11040A	BRUSH, SIDE CHIP SHIELD
8	11040A	BRUSH, SIDE CHIP SHIELD
9	6457H	LED WORKLITE

### Electrical Wiring Diagram

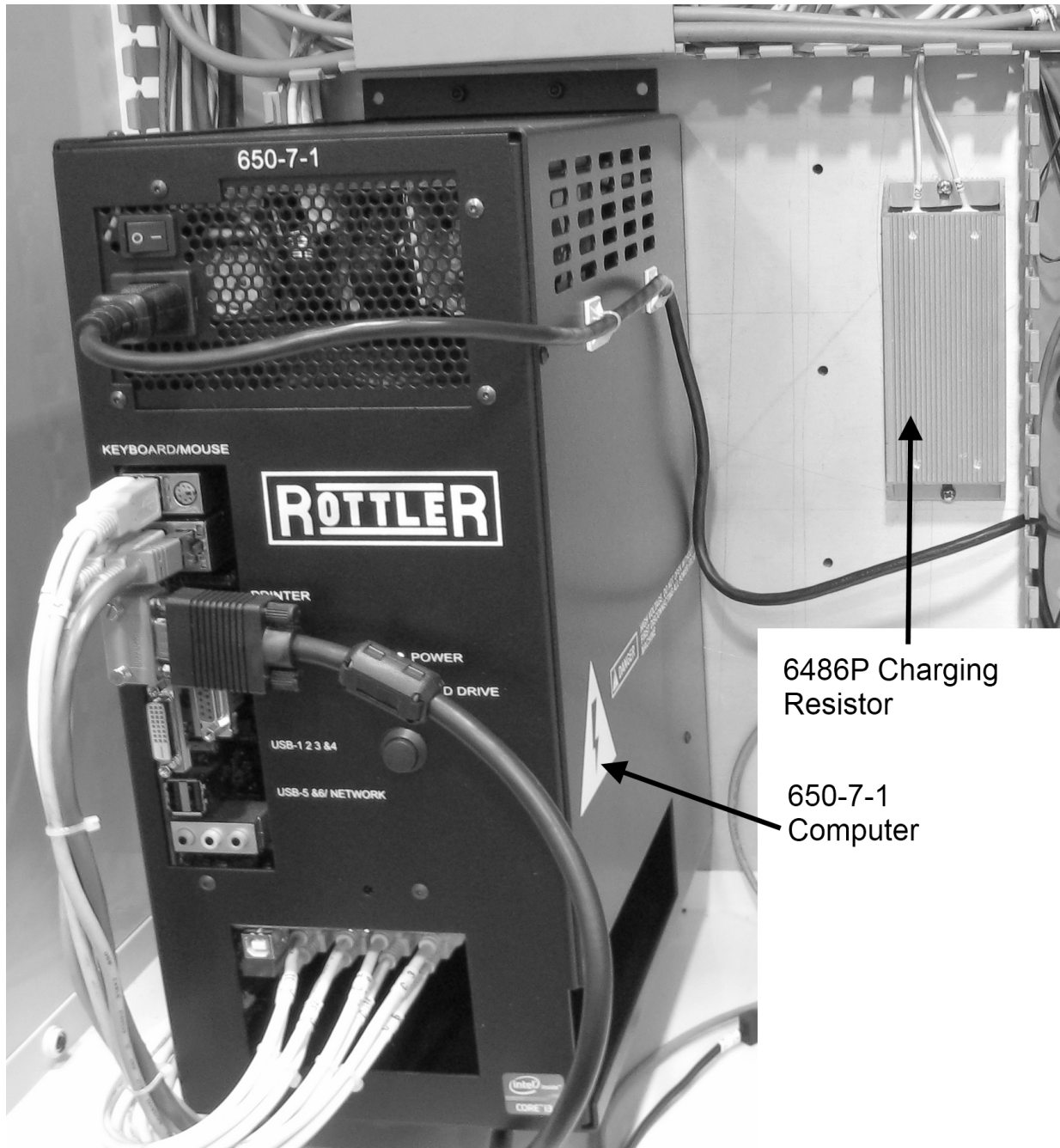


### Electrical Enclosure Components

#### Enclosure Parts Top Half



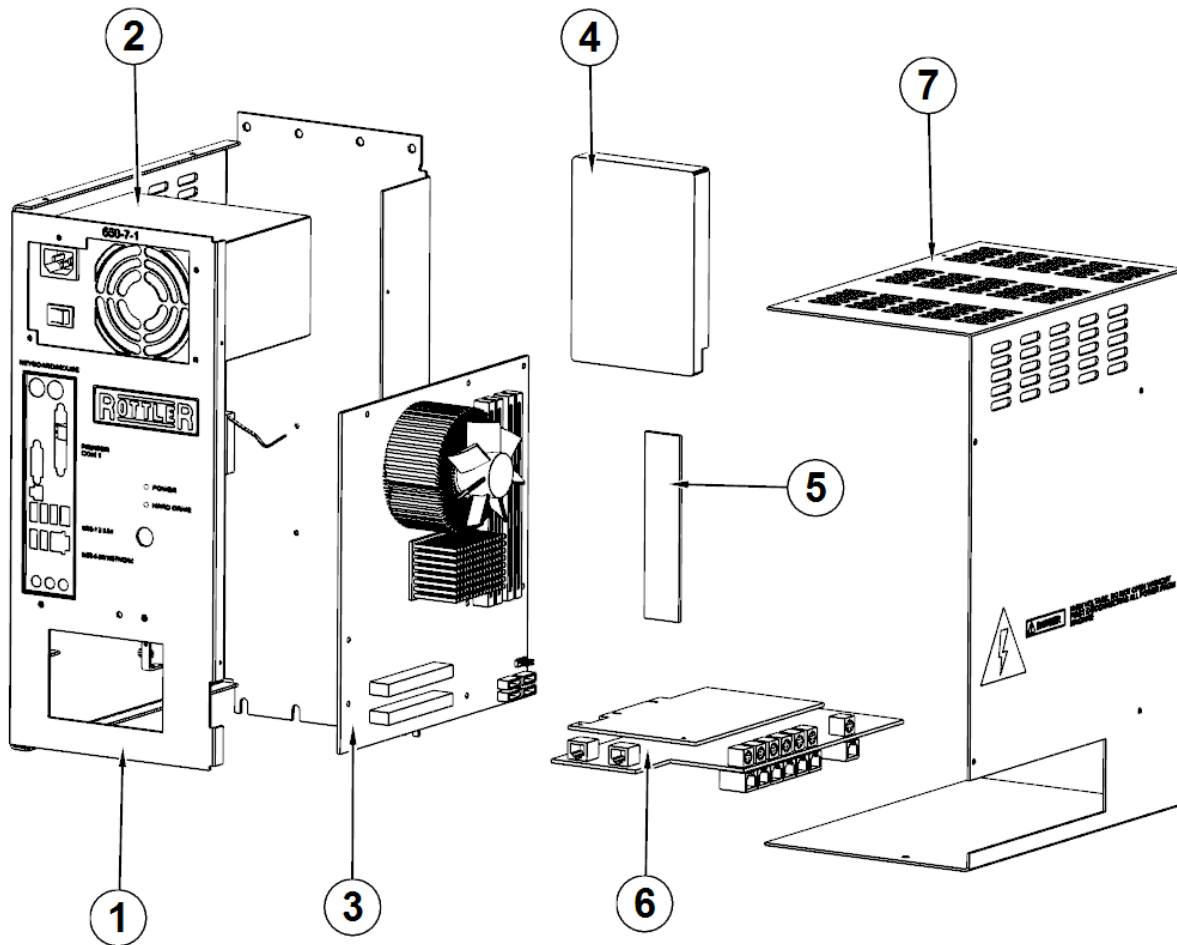
Enclosure Parts Bottom Half



6486P Charging Resistor

650-7-1 Computer

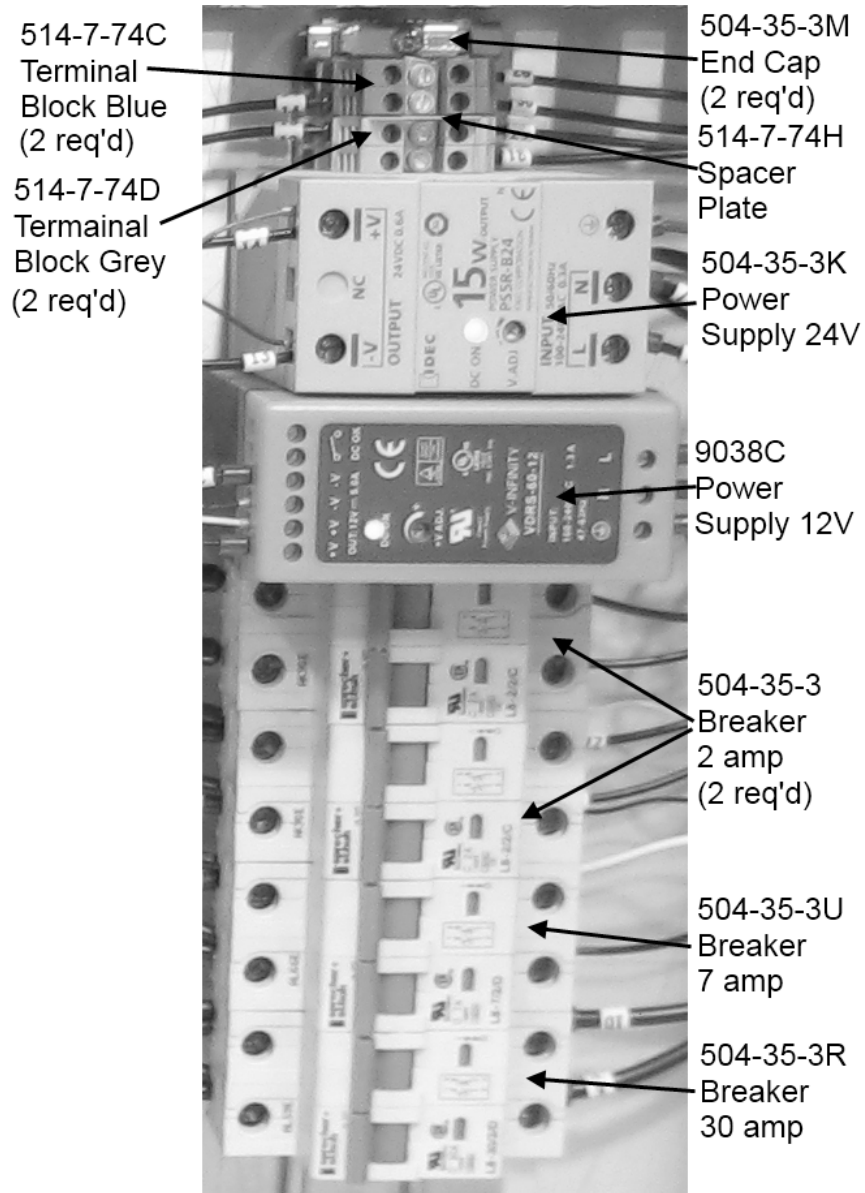
**Computer Components**



ITEM	PART #	DESCRIPTION
1	650-1-27Y	FRAME,COMPUTER CASE--SOLD IN ASSY #650-1-27X
2	650-7-1C	400W POWER SUPPLY
3	650-7-1A	MOTHER BOARD
4	650-7-1F	HARD DRIVE
5	650-7-2F	8GB DDR4 RAM
6	9035D	PCI E CARD - 16 LINK
7	650-1-27Z	COVER,COMPUTER CASE-SOLD IN ASSY #650-1-27X

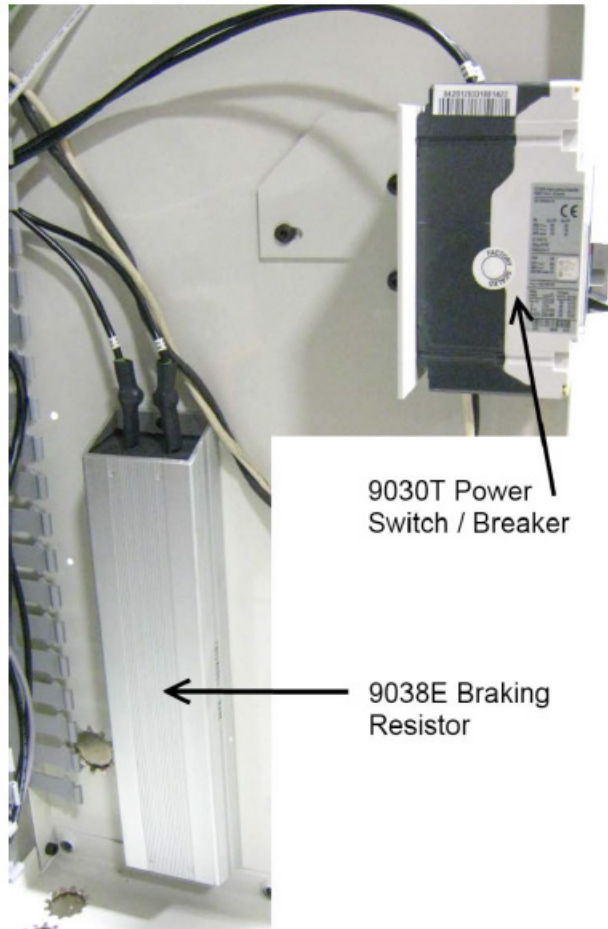
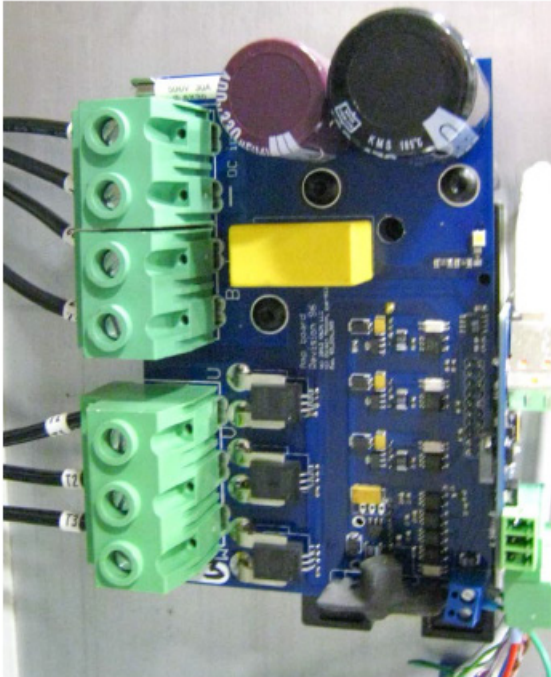


**Enclosure Parts DIN Rail**

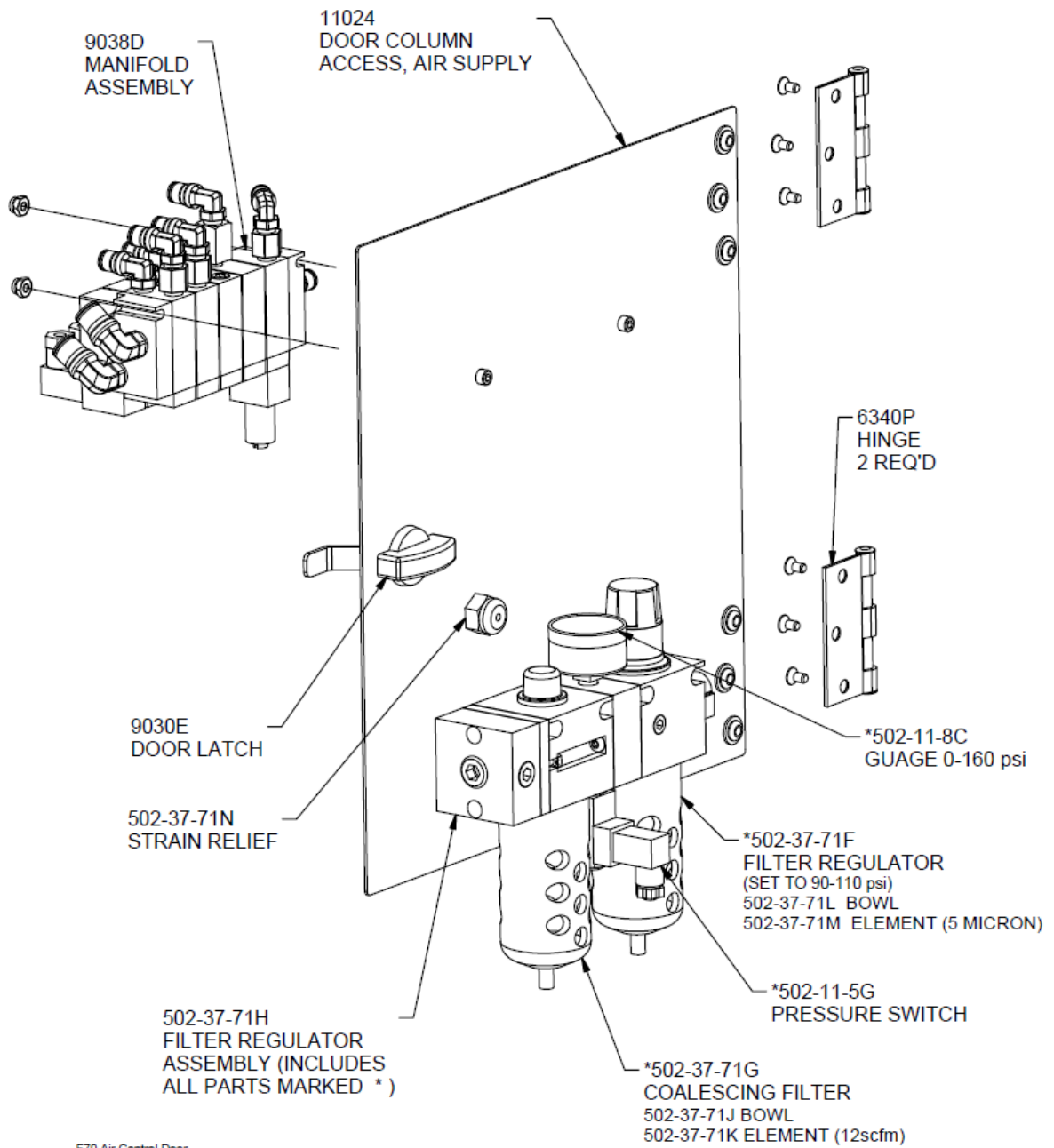


**Enclosure Parts Side Panel**

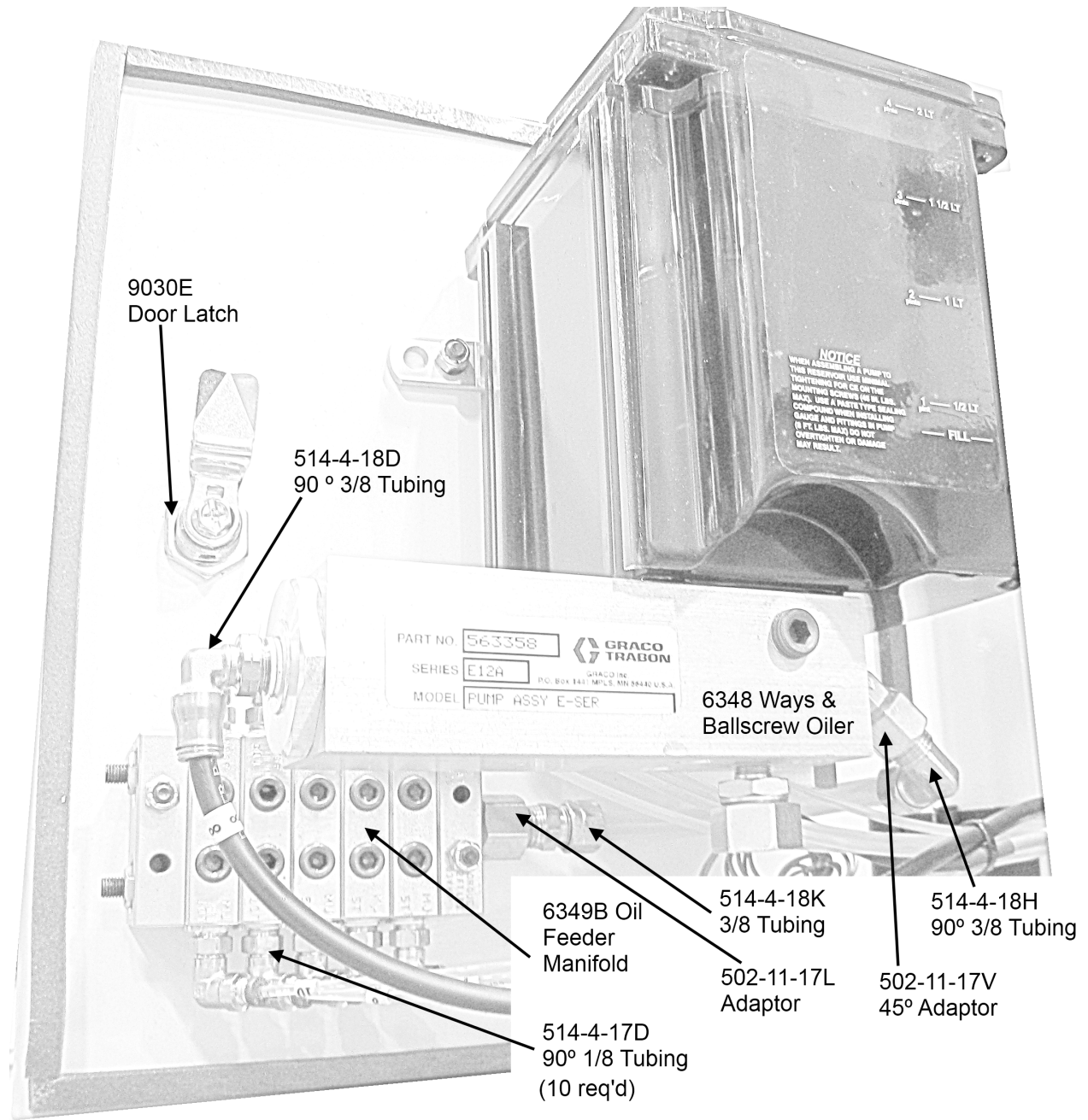
9034B Large Spindle Amp



### Air Control Door Parts



### Oiler Control Door



# OPTIONS

## Optional Equipment

Optional Equipment Catalog and Parts Manual are located on the Manual CD shipped with machine.



# MSDS

The Material Data Safety Sheets list shown in this section are the substances and materials that an operator is most likely to come in contact with while using this machine.

Other substances and materials are used in the manufacture, testing, and shipping of this machine. A complete list of the Material Data Safety Sheets of substances and materials used by Rottler Manufacturing during manufacturing, testing, and shipping is located on the Manual CD shipped with the machine. Material Data Safety Sheets are also located on the company web site: <http://www.rottlermfg.com/documentation.php>

## 1) Mobil Vactra Oil #2



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## MATERIAL SAFETY DATA SHEET

### SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

#### PRODUCT

**Product Name:** MOBIL VACTRA OIL NO. 2  
**Product Description:** Base Oil and Additives  
**Product Code:** 600494-00, 970716  
**Intended Use:** Lubricant

#### COMPANY IDENTIFICATION

**Supplier:** EXXON MOBIL CORPORATION  
 3225 GALLOWES RD.  
 FAIRFAX, VA. 22037 USA

<b>24 Hour Health Emergency</b>	609-737-4411
<b>Transportation Emergency Phone</b>	800-424-9300
<b>ExxonMobil Transportation No.</b>	281-834-3296
<b>Product Technical Information</b>	800-662-4525, 800-947-9147
<b>MSDS Internet Address</b>	<a href="http://www.exxon.com">http://www.exxon.com</a> , <a href="http://www.mobil.com">http://www.mobil.com</a>

### SECTION 2 COMPOSITION / INFORMATION ON INGREDIENTS

No Reportable Hazardous Substance(s) or Complex Substance(s).

### SECTION 3 HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

#### POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

<b>NFPA Hazard ID:</b>	Health: 0	Flammability: 1	Reactivity: 0
<b>HMIS Hazard ID:</b>	Health: 0	Flammability: 1	Reactivity: 0

**NOTE:** This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

### SECTION 4 FIRST AID MEASURES

#### INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use





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mouth-to-mouth resuscitation.

#### SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

#### EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

#### INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

### SECTION 5 FIRE FIGHTING MEASURES

#### EXTINGUISHING MEDIA

**Appropriate Extinguishing Media:** Use water fog, foam, dry chemical or carbon dioxide (CO<sub>2</sub>) to extinguish flames.

**Inappropriate Extinguishing Media:** Straight Streams of Water

#### FIRE FIGHTING

**Fire Fighting Instructions:** Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

**Hazardous Combustion Products:** Smoke, Fume, Aldehydes, Sulfur oxides, Incomplete combustion products, Oxides of carbon

#### FLAMMABILITY PROPERTIES

**Flash Point [Method]:** >205C (401F) [ASTM D-92]

**Flammable Limits (Approximate volume % in air):** LEL: 0.9 UEL: 7.0

**Autoignition Temperature:** N/D

### SECTION 6 ACCIDENTAL RELEASE MEASURES

#### NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

#### SPILL MANAGEMENT



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**Land Spill:** Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

**Water Spill:** Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

#### ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

### SECTION 7 HANDLING AND STORAGE

#### HANDLING

Prevent small spills and leakage to avoid slip hazard.

**Static Accumulator:** This material is a static accumulator.

#### STORAGE

Do not store in open or unlabelled containers. Keep away from incompatible materials.

### SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

**Exposure limits/standards for materials that can be formed when handling this product:** When mists / aerosols can occur, the following are recommended: 5 mg/m<sup>3</sup> - ACGIH TLV, 10 mg/m<sup>3</sup> - ACGIH STEL, 5 mg/m<sup>3</sup> - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

#### ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:  
No special requirements under ordinary conditions of use and with adequate ventilation.

#### PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

**Respiratory Protection:** If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator



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selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

**Hand Protection:** Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

**Eye Protection:** If contact is likely, safety glasses with side shields are recommended.

**Skin and Body Protection:** Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

**Specific Hygiene Measures:** Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

#### ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

### SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

#### GENERAL INFORMATION

**Physical State:** Liquid  
**Color:** Brown  
**Odor:** Characteristic  
**Odor Threshold:** N/D

#### IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

**Relative Density (at 15 C):** 0.883  
**Flash Point [Method]:** >205C (401F) [ASTM D-92]  
**Flammable Limits (Approximate volume % in air):** LEL: 0.9 UEL: 7.0  
**Autoignition Temperature:** N/D  
**Boiling Point / Range:** N/D  
**Vapor Density (Air = 1):** >2 at 101 kPa  
**Vapor Pressure:** <0.013 kPa (0.1 mm Hg) at 20 C  
**Evaporation Rate (n-butyl acetate = 1):** N/D  
**pH:** N/A



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**Log Pow (n-Octanol/Water Partition Coefficient):** > 3.5  
**Solubility in Water:** Negligible  
**Viscosity:** 68 cSt (68 mm<sup>2</sup>/sec) at 40 C | 8.6 cSt (8.6 mm<sup>2</sup>/sec) at 100C  
**Oxidizing Properties:** See Sections 3, 15, 16.

#### OTHER INFORMATION

**Freezing Point:** N/D  
**Melting Point:** N/A  
**Pour Point:** -6°C (21°F)  
**DMSO Extract (mineral oil only), IP-346:** < 3 %wt

### SECTION 10 STABILITY AND REACTIVITY

**STABILITY:** Material is stable under normal conditions.

**CONDITIONS TO AVOID:** Excessive heat. High energy sources of ignition.

**MATERIALS TO AVOID:** Strong oxidizers

**HAZARDOUS DECOMPOSITION PRODUCTS:** Material does not decompose at ambient temperatures.

**HAZARDOUS POLYMERIZATION:** Will not occur.

### SECTION 11 TOXICOLOGICAL INFORMATION

#### ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
<b>Inhalation</b>	
Toxicity (Rat): LC50 > 5000 mg/m <sup>3</sup>	Minimally Toxic. Based on test data for structurally similar materials.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
<b>Ingestion</b>	
Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
<b>Skin</b>	
Toxicity (Rabbit): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on test data for structurally similar materials.
<b>Eye</b>	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials.

#### CHRONIC/OTHER EFFECTS

##### Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.



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Additional information is available by request.

**The following ingredients are cited on the lists below:** None.

--REGULATORY LISTS SEARCHED--  
 1 = NTP CARC                      3 = IARC 1                      5 = IARC 2B  
 2 = NTP SUS                      4 = IARC 2A                      6 = OSHA CARC

## SECTION 12                      ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

### ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

### MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

### PERSISTENCE AND DEGRADABILITY

#### Biodegradation:

Base oil component -- Expected to be inherently biodegradable

### BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

## SECTION 13                      DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

### DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

### REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

**Empty Container Warning** Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be



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completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

#### SECTION 14 TRANSPORT INFORMATION

**LAND (DOT)** : Not Regulated for Land Transport

**LAND (TDG)** : Not Regulated for Land Transport

**SEA (IMDG)** : Not Regulated for Sea Transport according to IMDG-Code

**AIR (IATA)** : Not Regulated for Air Transport

#### SECTION 15 REGULATORY INFORMATION

**OSHA HAZARD COMMUNICATION STANDARD:** When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

**NATIONAL CHEMICAL INVENTORY LISTING:** AICS, IECSC, DSL, EINECS, ENCS, KECI, PICCS, TSCA

**EPCRA:** This material contains no extremely hazardous substances.

**SARA (311/312) REPORTABLE HAZARD CATEGORIES:** None.

**SARA (313) TOXIC RELEASE INVENTORY:** This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

**The Following Ingredients are Cited on the Lists Below:** None.

#### --REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

#### SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

**THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:**



Product Name: MOBIL VACTRA OIL NO. 2  
Revision Date: 17 Oct 2008  
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No revision information is available.

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PPEC: A

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