F60DM UPGRADE

MULTI-PURPOSE CNC
MACHINING CENTERS

MACHINE SERIAL NUMBER

_____

OPERATIONS AND MAINTENANCE
MANUAL

MANUFACTURED BY:

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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 or intlparts@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

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 F60DM 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 F60DM 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 F60DM 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.

F60 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 form the control panel.

Disclaimer

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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.

Limited Warranty

Rottler Manufacturing Company Model F60DM parts and equipment is warranted as to materials and workmanship. This limited warranty remains in effect for one year from the date of delivery, provided the machine is owned and operated by the original purchaser and is operated and maintained as per the instructions in the manual.

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

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 Parts Department 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 Parts 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 approval from Rottler Corporation Management.

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.

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INSTALLATION

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Description:

The model F65 is a precision, single point, high speed boring machine. The F65 can be equipped with tooling and accessories for re-boring most American passenger car and truck engines, In-lines as well as 60 and 90 degree V-types.

The F65 machines can be easily tooled to machines a wide range of engines, including European and Asian.

The machine is designed to maintain the alignment of cylinder bores 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 the clamping of portable boring bars to the cylinder head surface of the blocks.

Convenient controls, fast block clamping, air floated Spindle Base positioning and clamping, means considerable savings in floor to floor time and operator involvement.

Change over or re-setting 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.

Limited Warranty:

Rottler Manufacturing Company Model F65 parts and equipment is warranted as to materials and workmanship. This limited warranty remains in effect for one year from the date of delivery, provided the machine is owned and operated by the original purchaser and is operated and maintained as per the instructions in the manual.

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.

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

Freight charges after the 60 day period are the customer's responsibility.

Electrical Power:

Make sure all electrical equipment has the proper overload protection. The F65 should have a stable power supply to prevent damage and uncontrolled movement of the machine.

Machine Operator:

The operator of the F65 should be a skilled machinist craftsman who is well versed in the caution, care, and knowledge required to safely operate metal cutting tools. Eye protection must be worn at all times by the operator and all other personnel in the area of the machine.

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.

The F65 machines have the following areas of exposed moving parts that you must train yourself to respect and stay away from when they are in motion:

Tool Sharpening:

Must be done with care and dexterity to get good bore results, be alert to the light pressure required for tool sharpening.

CAUTION: Exposed diamond wheel is a potential hazard to your hands, fingers, and face. Eye protection must be worn when working in this area.

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 of Block Handler Assembly. Lifting Eye can eventually fail if the eye is reset in line with the 502-1-80 lift channel. Eye must be at a right angle.

Machine Maintenance:

Any machine adjustment, maintenance or parts replacement absolutely requires a complete power disconnection from the machine, this is an absolute rule.

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, 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. Make sure the button has been depress for at least 1 ½ minutes or the drive will not have time to reset and they will not function.

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.

Machine Installation:

Location:

The productivity of the F65 will depend a great deal on the proper initial installation. Pay particular attention to the means by which work pieces are lifted into and out of the machine as well as the material handling to and from other operations in your shop. The proper loading arrangements and work location for your F65 is extremely important.

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

For shops where large production runs are anticipated, the work pieces should be loaded and unloaded directly from a conveyer. If this is not the case, we suggest you pay considerable attention to the crane so that it covers an adequate area to allow the operator to back up and remove work pieces without creating a cluttered, dangerous work area.

Remove the Toolbox, Parallels and optional equipment form the machine. Completely clean these articles along with the rest of the machine with solvent, rust inhibitor was applied at the time of shipment. Any of the rust inhibitor left on the machine will allow Cast Iron dust to build up and cause premature wear to the machine.

IMPORTANT:
The ways under the table as well as the ways behind the Vertical gibs were sprayed with rust inhibitor as well. It is extremely important that these surfaces be cleaned thoroughly. Use a cleaner, such as WD-40 to clean the ways where the table and the spindle unit are not sitting. Move the table and spindle unit onto the area that has been cleaned and clean where they were sitting. Spray the ways with WD-40 and move the table and spindle unit over the sprayed area. You must do this several time to get all of the rust inhibitor off of the gib surfaces. If you do not the rust inhibitor will plug up the oiler holes and also cause sticktion when moving in small increments, such as handwheel.

Leveling and Alignment:

Leveling the F65 properly is very important if you are to use the F65 to its full blue printing capabilities as well as maximizing the use of Rottler fixturing.

Use the following instructions to properly level the F65.

Six Hex head bolts, six jam nuts, and six purple leveling pads are provided with the machine for leveling. Refer to the following illustrations for leveling bolt locations. Screw the jam nuts all the way onto the bolts; insert the bolts at the base support points. Screw the bolts in until they are just protruding from the bottom of the base casting. Lower the machine onto the Leveling pads, making sure the bolts seat into the recessed area of the leveling pads.

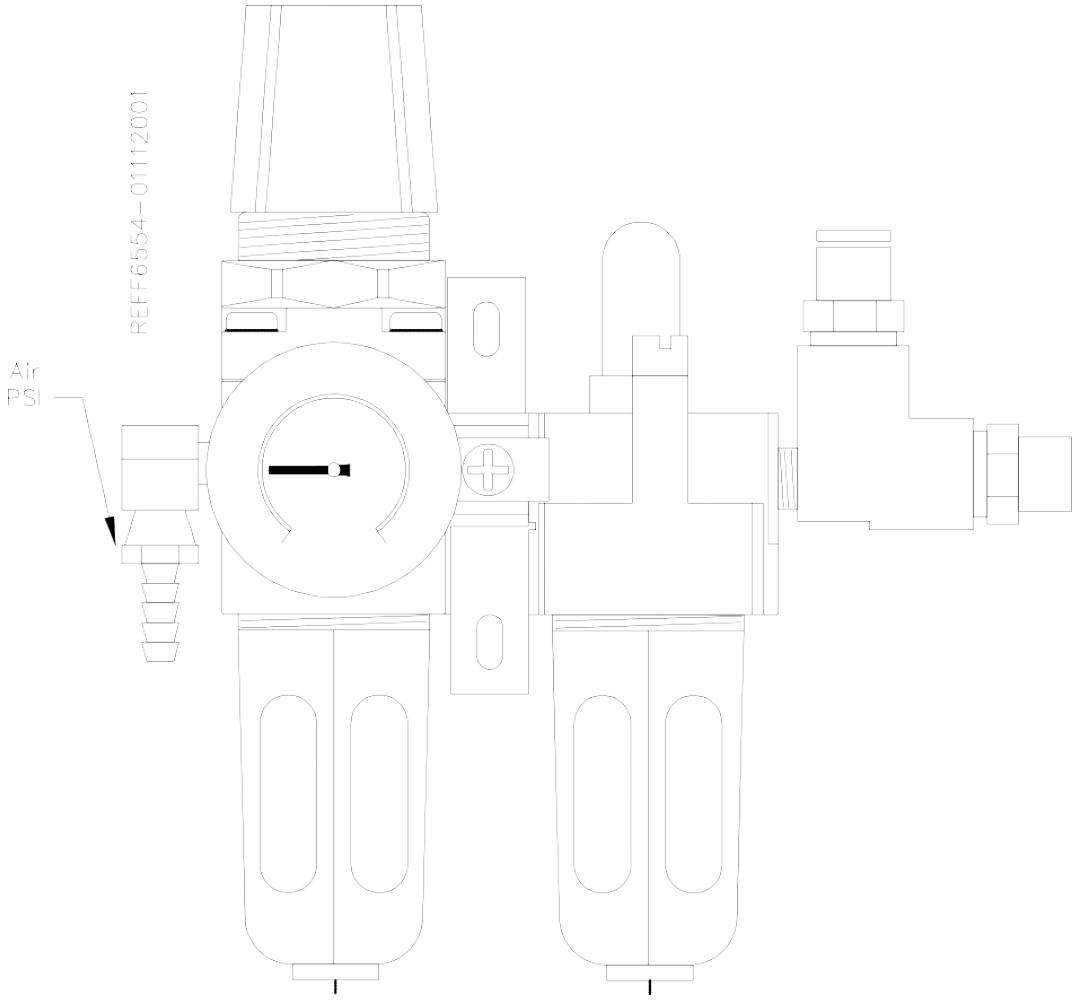
Make sure there is equal pressure on each of the leveling bolts. Remove he protective rubber cover, located behind the table, from the Y-Axis (In/Out). Place the level on the Y-Axis ways, level the ways in both directions (Horizontal / In-Out) within .0005".

Check the level in both directions on the Table. If it does not match the alignment of the Y-Axis ways refer to the Maintenance Chapter of this manual for full alignment procedures.

Air Supply:

It is very important that the air source for the F65 be moisture free. Water and oil in the air lines will result in early cylinder and valve failure as well as introducing moisture into the Inner spindle bearings. The factory recommends installing a water trap at the machine.

Attach a 100 P.S.I. air source to the main air intake located on the right hand side of the main rear enclosure.



Power Supply:

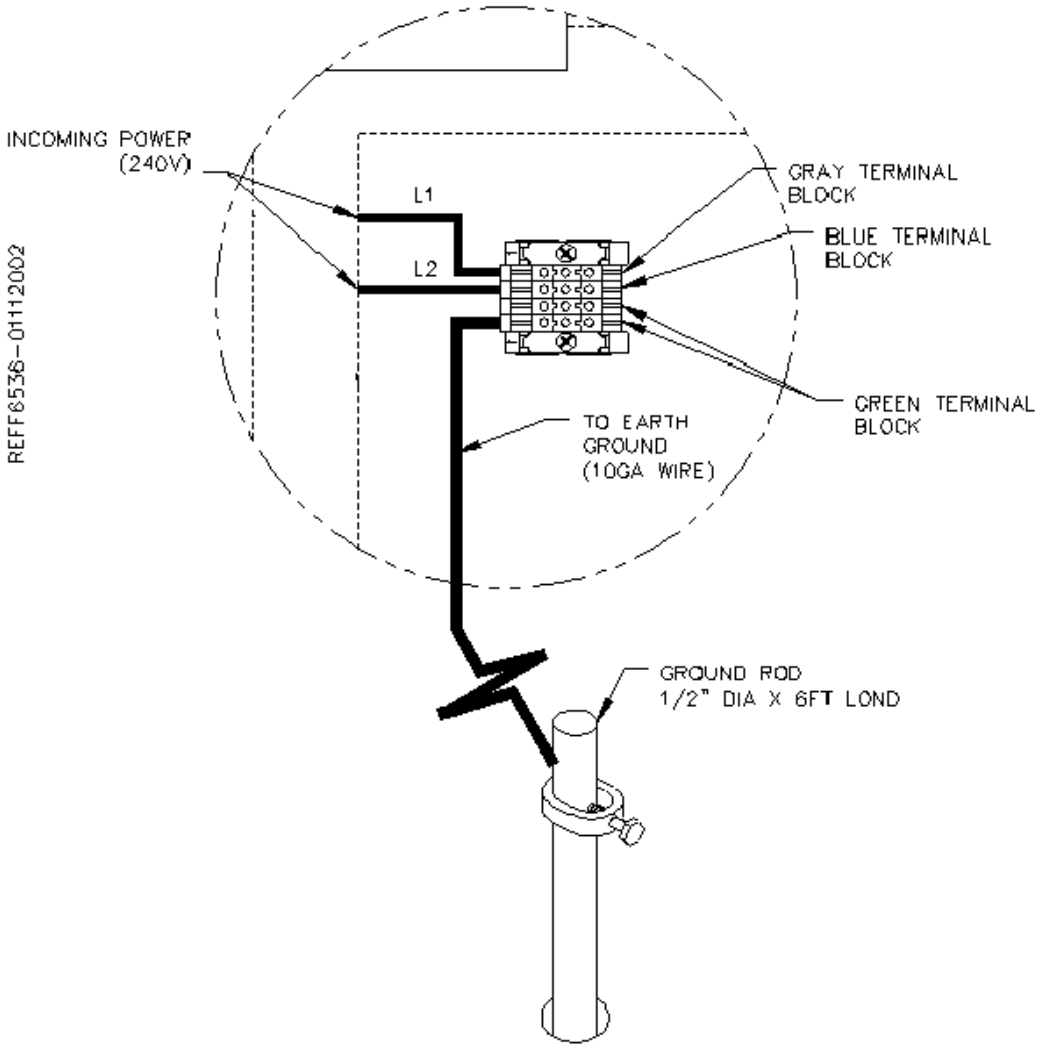
This machine has the following power requirements:

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

See illustration below for correct connection of “measured” incoming power. Connect single phase wiring to the main rear enclosure, located on the right rear of machine base. The connection point for power is located inside the enclosure. The connection termination point is located on the left hand side of the electrical panel about half way up. Connect L1 to the Grey terminal block, L2 (neutral) to the blue terminal block. Attach wire from the grounding rod to the second green and yellow terminal. Important: Electrically connect in accordance with national and local electrical codes.

Grounding:

This machine must be connected to a good earth ground rod. A 6 foot, ½” diameter, 15 OHM, Copper grounding rod driven into the earth next to the machines is preferred. Not providing a grounding rod could void factory warranty.



Getting Started

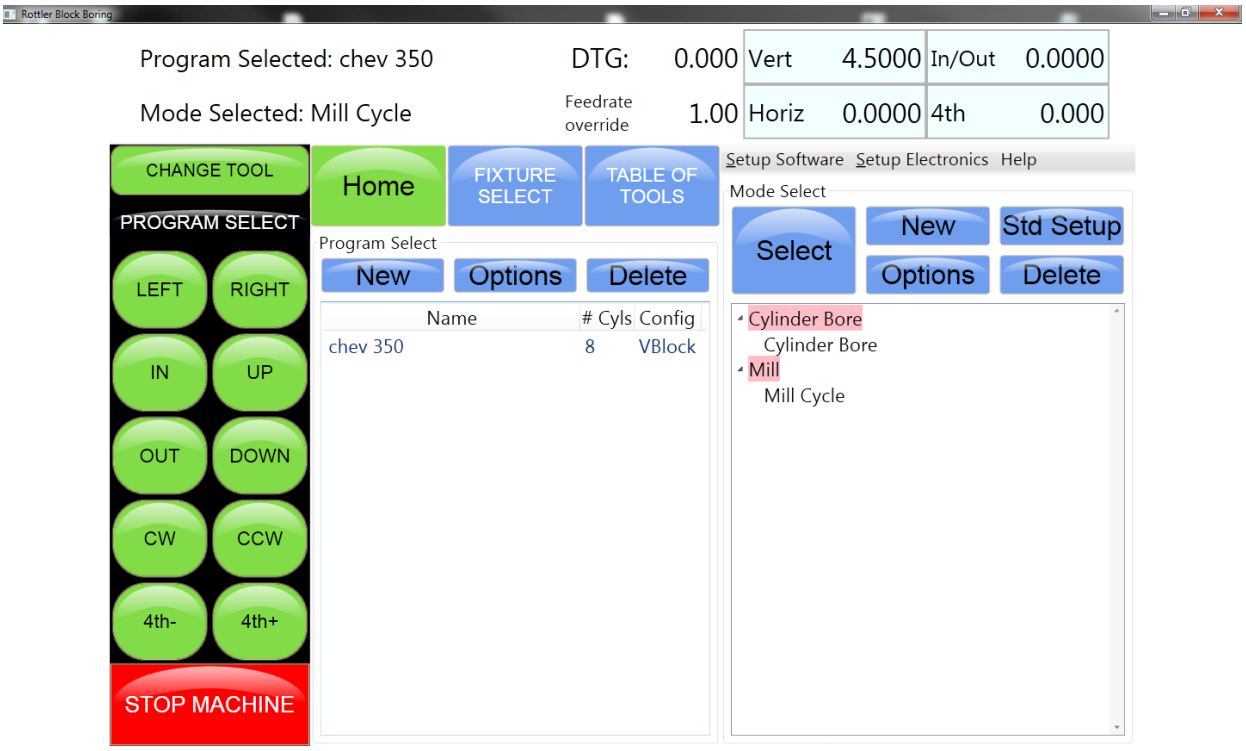
Once power has been supplied to the machine measure the incoming voltage with a meter to verify proper voltages before turning the Main Power switch on. Failure to measure and record proper voltages to the machine could cause damage and will void factory warranty. Measure L1 to L2 and record on the installation report. Record L1 to ground and L2 to ground and record on the installation report.

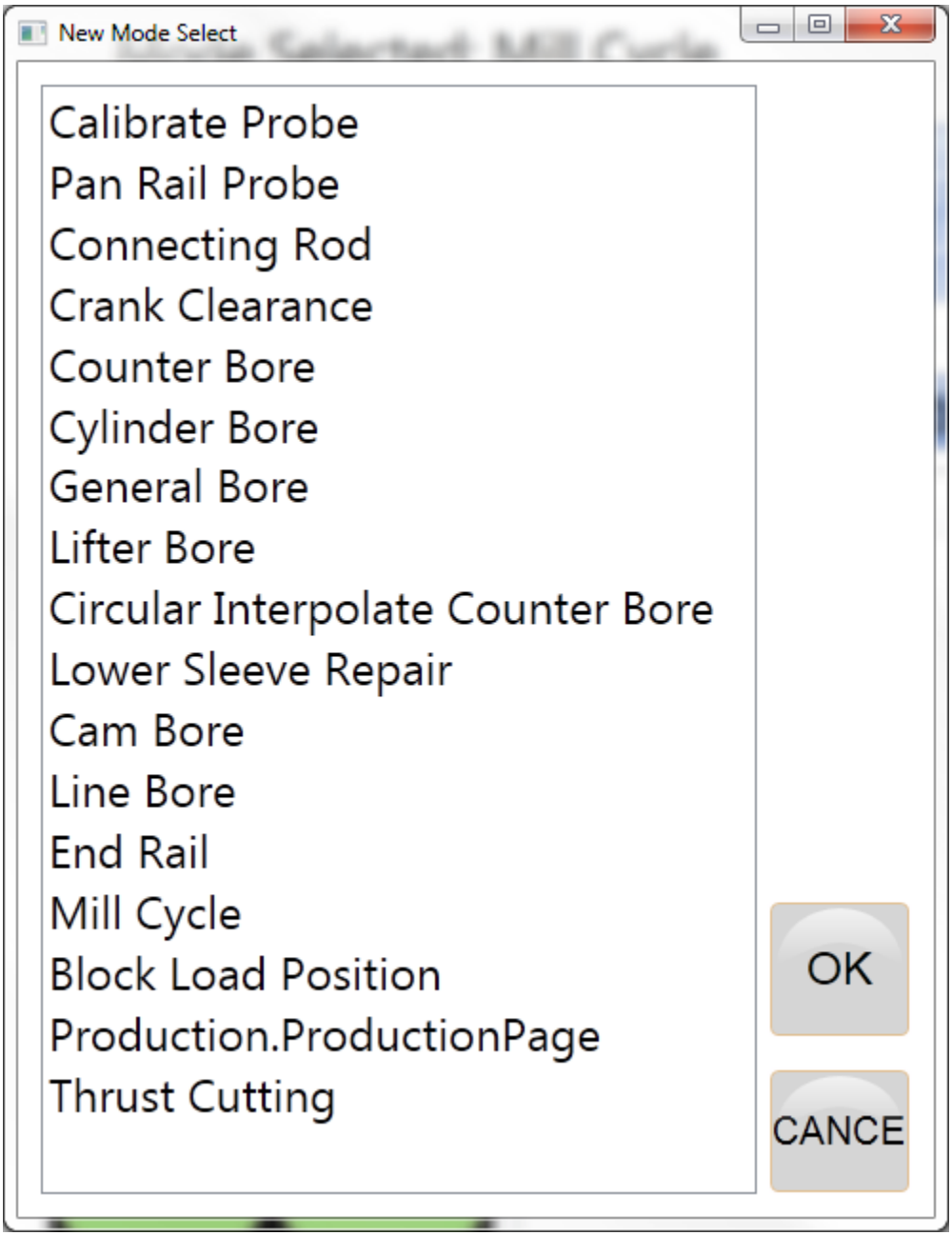
Power Up

Turn the Main Power switch on. Allow a few minutes for the machine to fully boot up.

Note: The Rottler F60DM uses a touch screen for control and data transfer to the computer. Be careful not to touch the screen until the machine has fully booted up and a Rottler screen is showing. If the screen is touched prior to full boot –up it may activate a function or interfere with proper boot-up.

To start the Rottler software simply double click on the Rottler icon as located on your desktop labeled Rottler_WPF. The next screen to appear is the Block Select screen. At this point, select any block and press SELECT. This needs to be done to be able to move the machine so the shipping restraints can be removed.





Click on the New button to view all of the available modes. This will take you to the Rottler program where the handwheel can be used. Highlight the Cylinder Bore mode and touch the OK button. This will bring up the Operation screen.

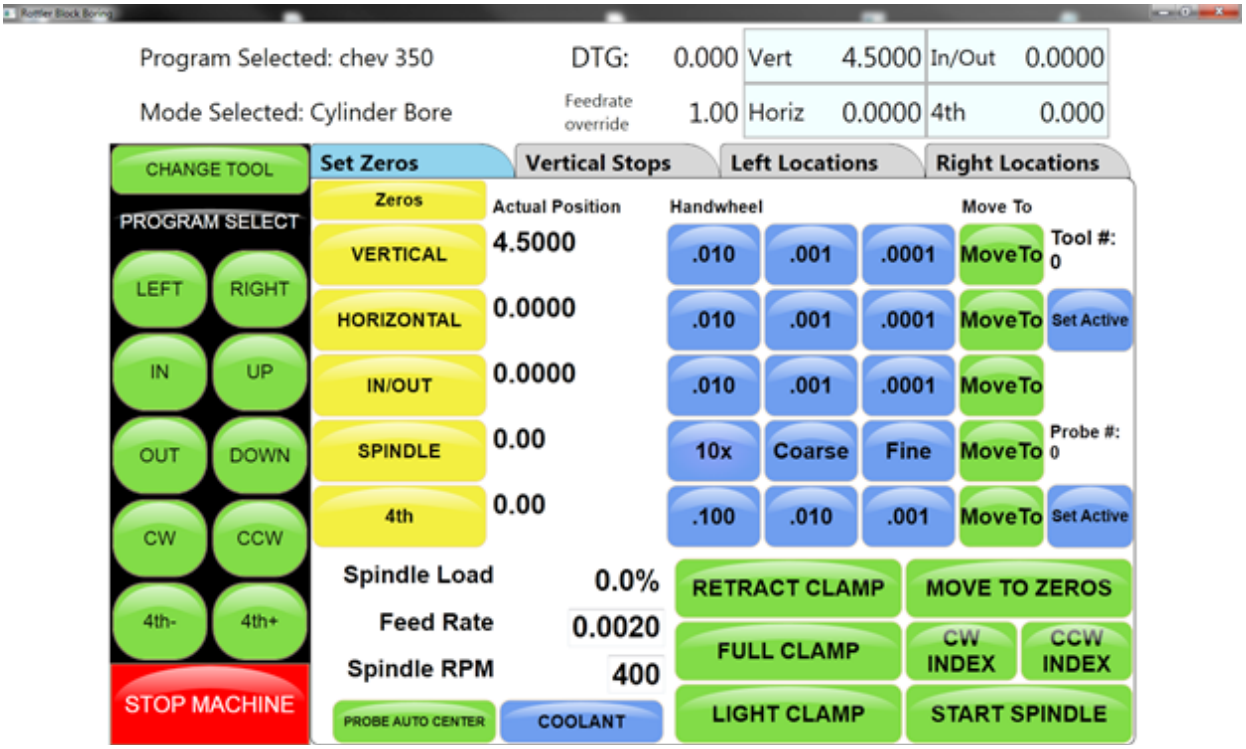
Shipping Restraints

There are three main shipping restraints on the F60DM. A restraint under the spindle, a bar through the counter weight and a Bolt in the top of the counter-weight. The following is the procedure for removing these restraints.

IMPORTANT: Do not ouch any of the rapid travel movements on the machine at this time.

Spindle Support

Once in the Bore Mode (Set Zero Tab) press the VERTICAL .001 Handwheel button. Use the handwheel to move the spindle up until it clears the spindle support. Unbolt and remove the spindle support from the table.



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SAFETY

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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 death or 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 personal 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.

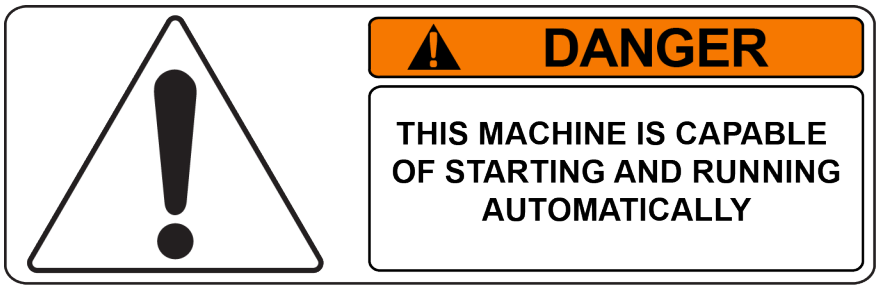
ONLY QUALIFIED PERSONAL should perform service on the electrical and control systems.

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.

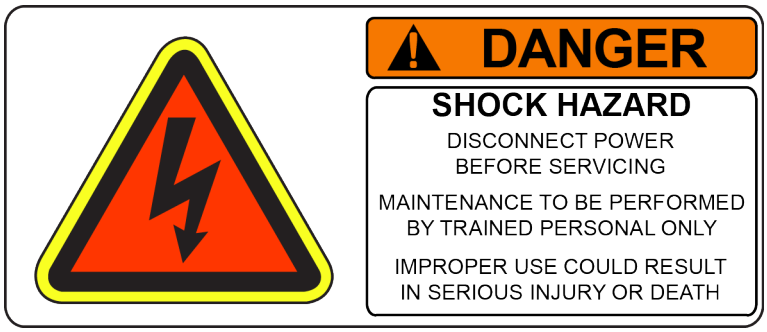
CAUTION No list of safety guidelines can be complete. Every piece of shop environment is different. Always consider safety first, as it applies to your individual working conditions. Use this and other machinery with caution and respect. Failure to follow guidelines could result in serious personal injury,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

Electrical Power

THIS MACHINE IS AUTOMATICALLY CONTROLLED AND MAY START AT ANYTIME



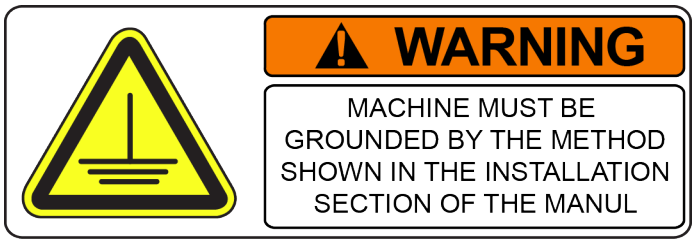
All electrical power should be removed from the machine before opening the rear electrical enclosure. It is recommended that the machine have a electrical LOCK-OUT device installed.



Make sure all electrical equipment has the proper electrical overload protection.

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.

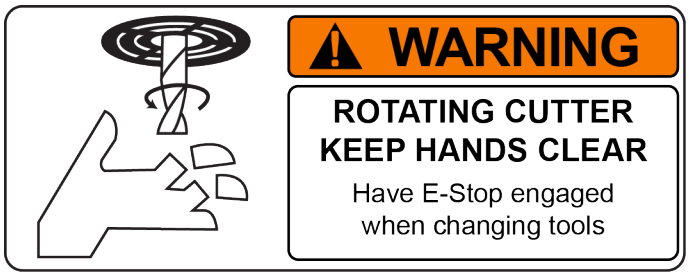
Machine Operator:

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.

CAUTION **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.

CAUTION **Machine Maintenance** – Any machine adjustment, maintenance or parts replacement absolutely requires a complete power disconnection from the machine, ***this is an absolute rule.***

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.

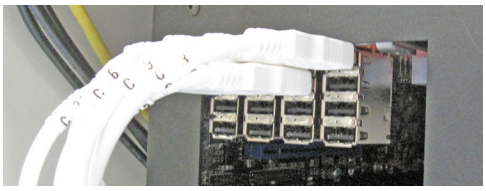
The machine should be hooked up to the internet anytime it is on. The software on the machine will automatically connect to our server to send back useful information on machine status.

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.

⚠ 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 PLC 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.

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. The Rottler program will 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.

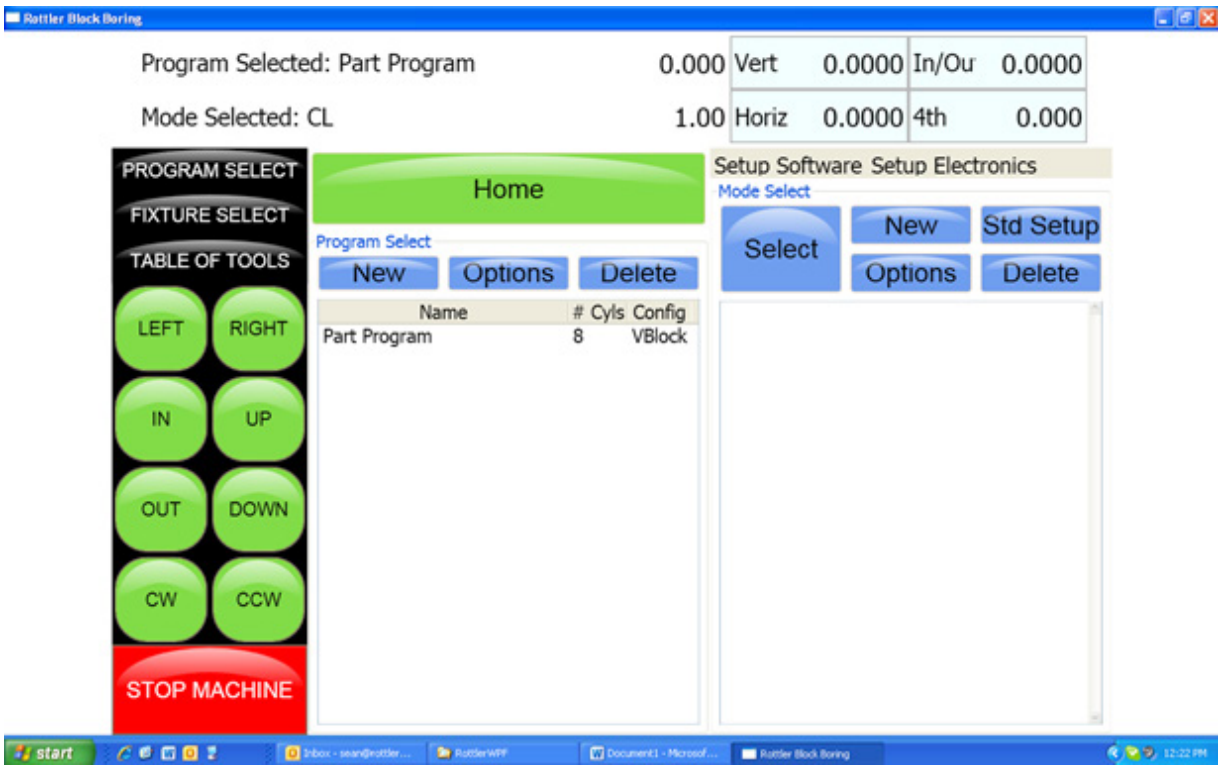
Press the “Start” button in the left-hand side of the Start Bar. This will bring up the “Start Menu”. Press the “Shutdown” line at the bottom of the Start Menu. This will bring up a Pop Up menu, make sure that “shut down computer” is selected and press “OK”.

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

Initialization Screen

When the F90Y is powered up the Rottler program will not automatically start. It may take several minutes for the computer to power. 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

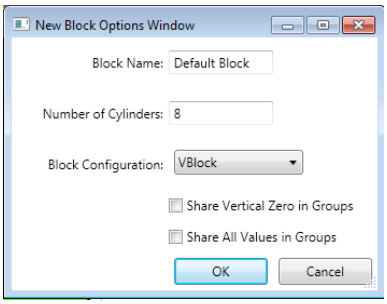
Pressing this button will cause the machine to move all axis to their home (Machine Origin) position. The vertical will home first to be sure it is clear to move the other axis. The machine MUST be homed after it is turned on. This is how the machine gets its reference points to operate.

Program Select

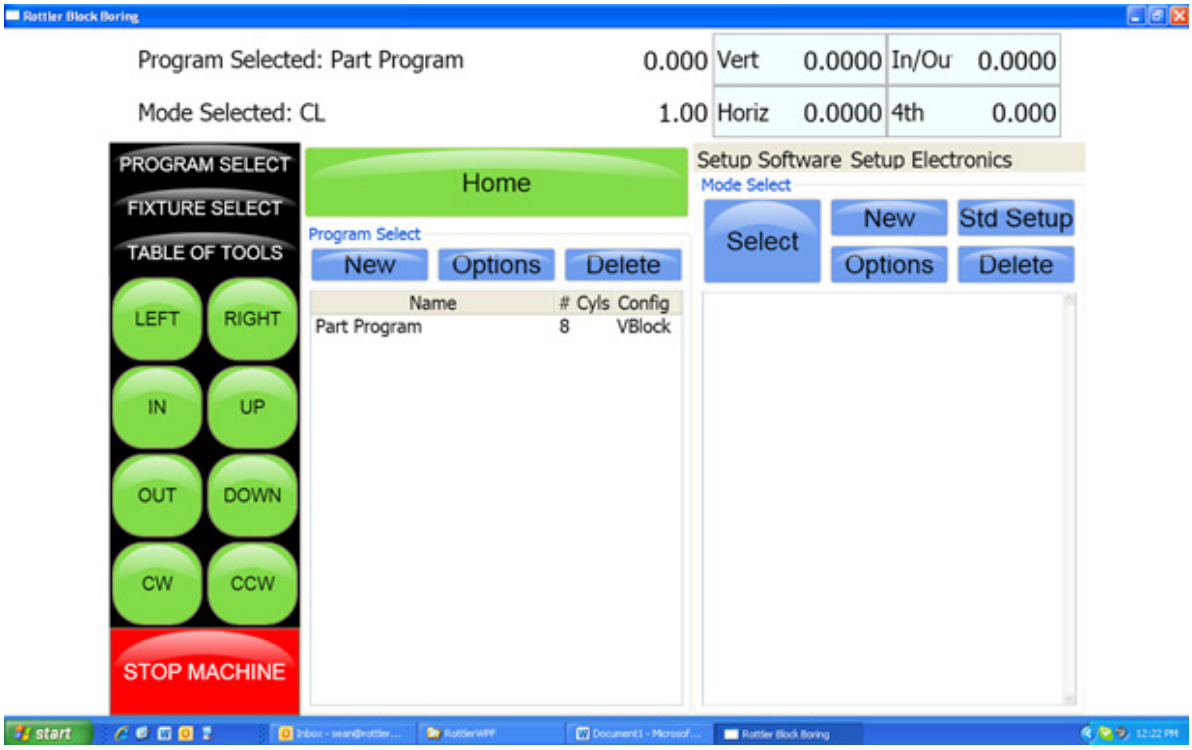
This is the left section of the screen. This is where you create and select blocks you will be working with.

New

Pressing this in the Upper level will cause a dialog box to appear. Here is where you name and configure the block i.e 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.

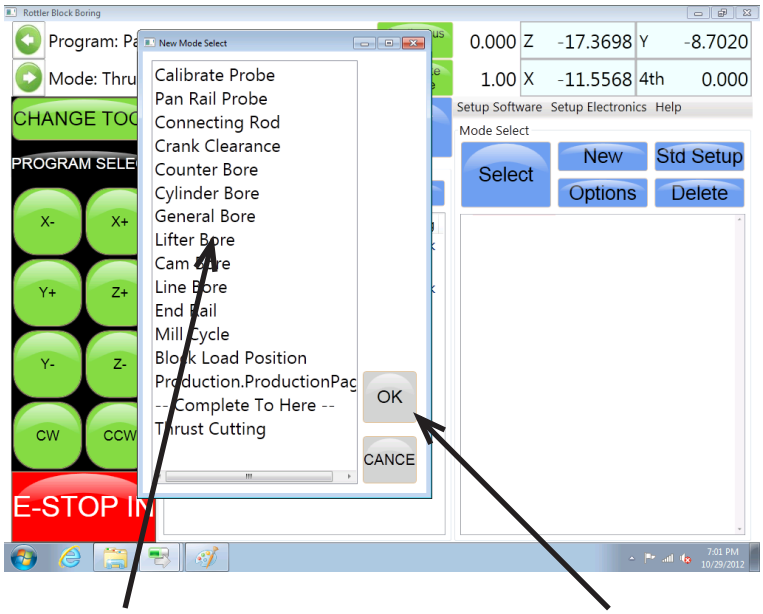
Mode Select

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 left to right, the farther right 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.

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.

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.

IMPORTANT

Setting Spindle Index

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 F90Y machine. When this button is pressed a single Probing routine will be run in the position the machine is currently at.

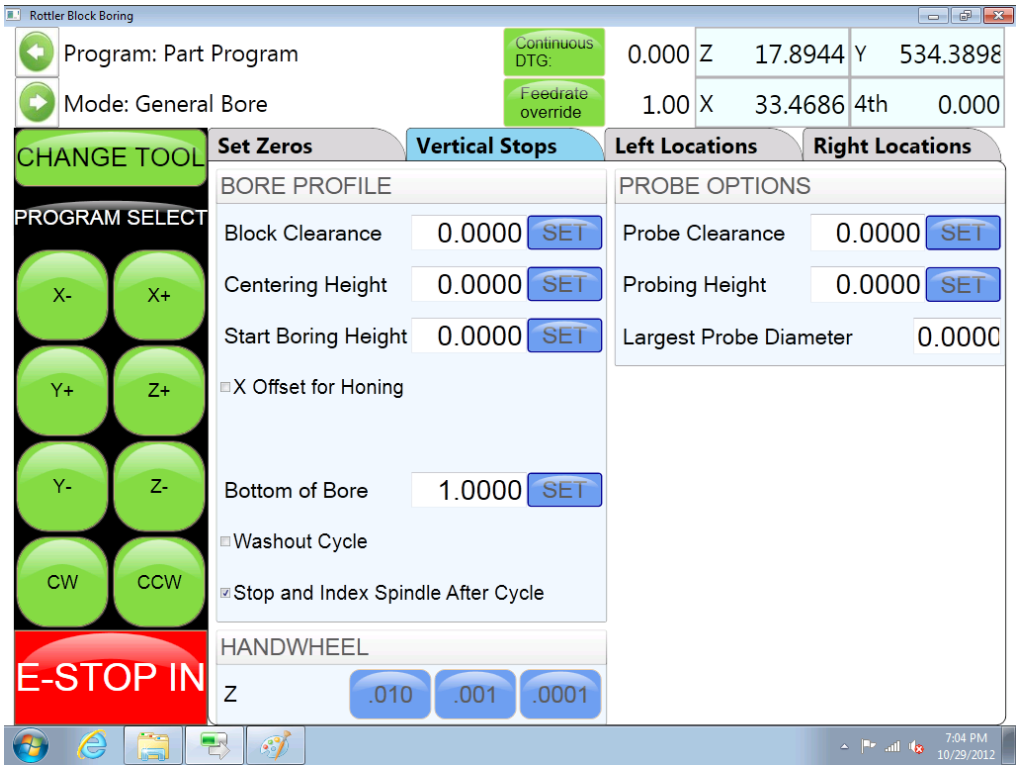
Vertical Stops Tab

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.

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 F90Y 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.

Lifter Bore

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

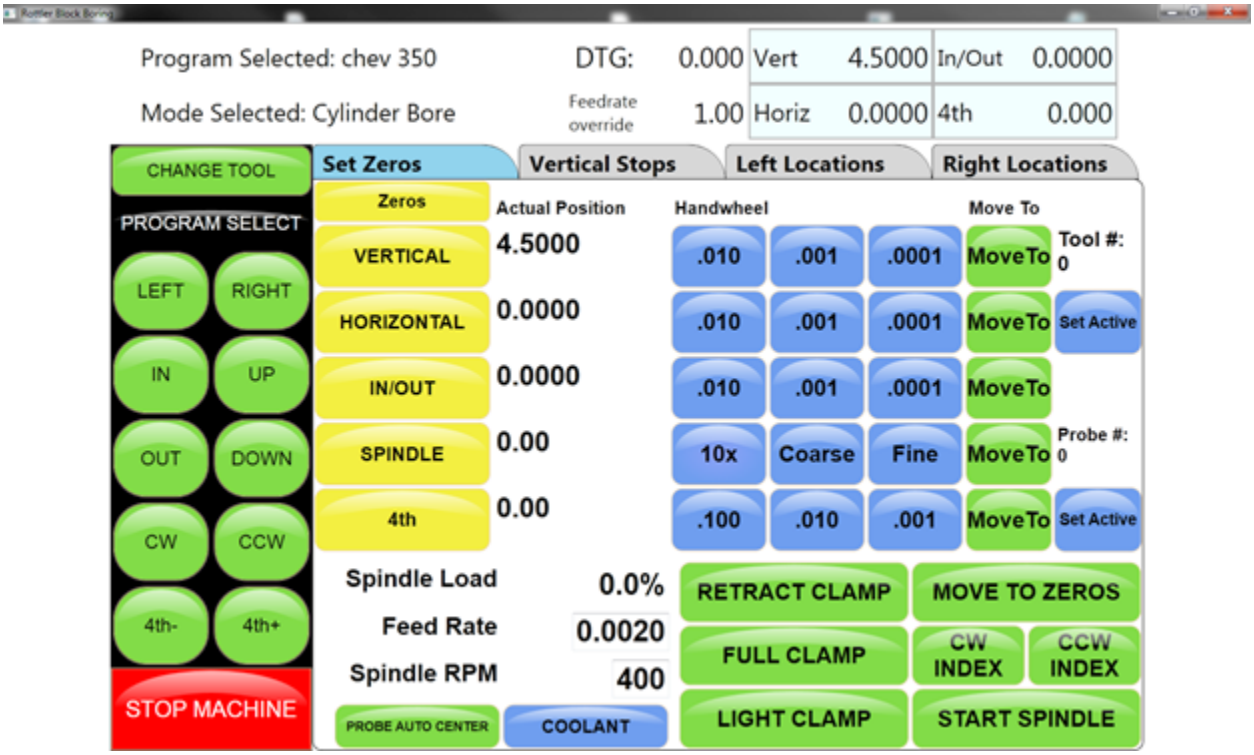
On the Program Vertical Stops screen, lower Clearance Offset is not an option.

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 a 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

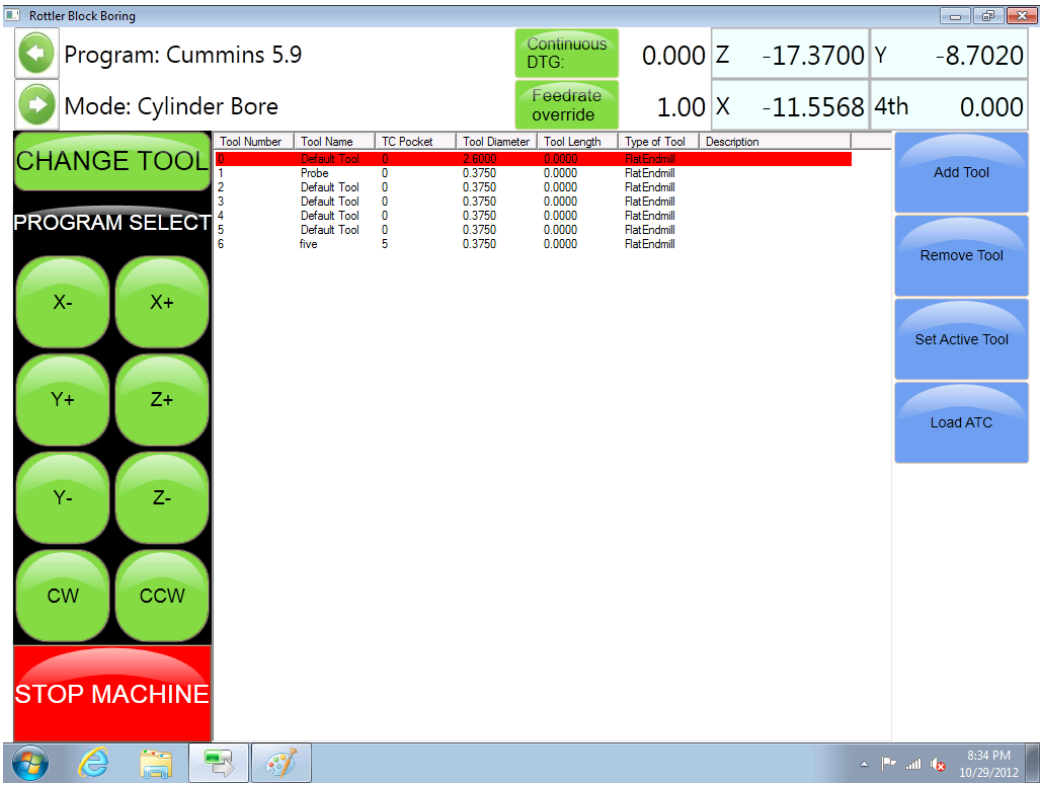
The Table Of Tools is used to set different tool lengths so multiple tools can be used in one program and reference the same vertical zero position.

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.

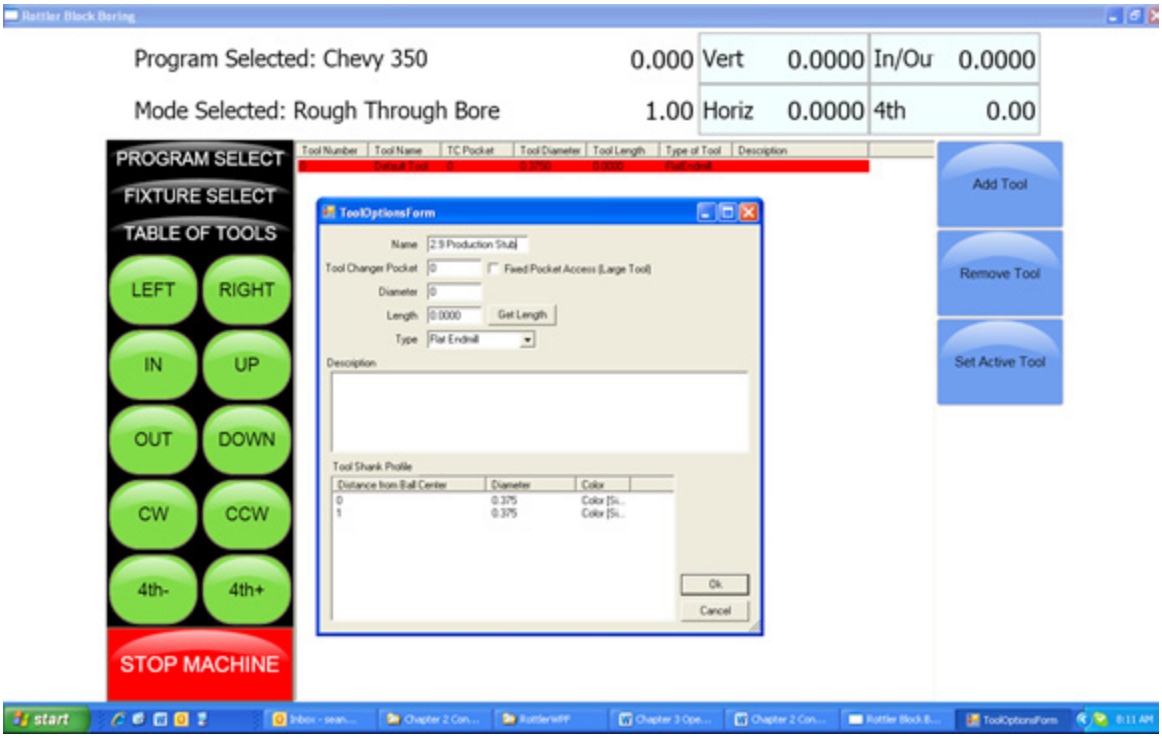
On this screen you will be able to Add, Remove or Set that tool Active (installed in spindle and being used).



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.

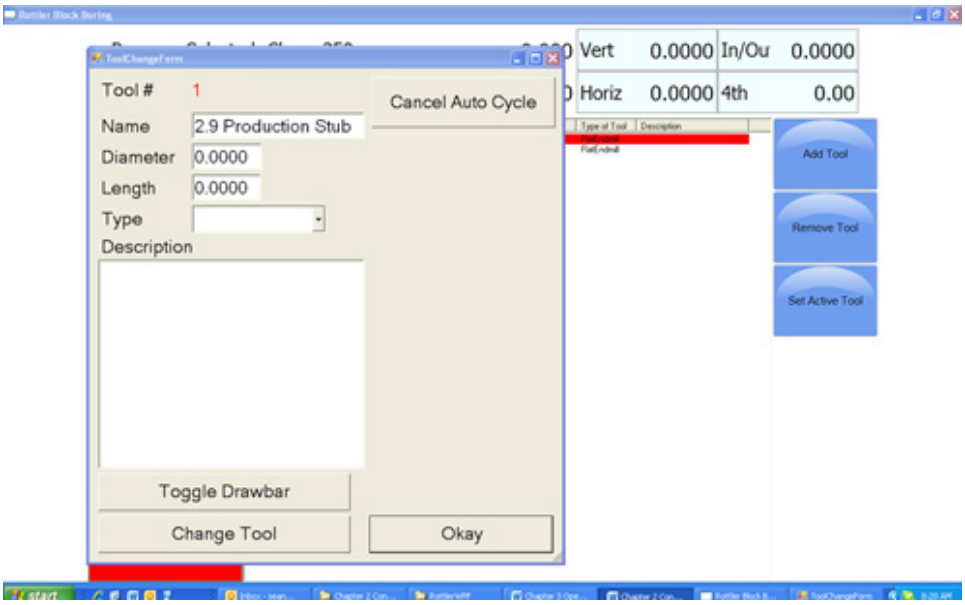
Remove Tool

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.



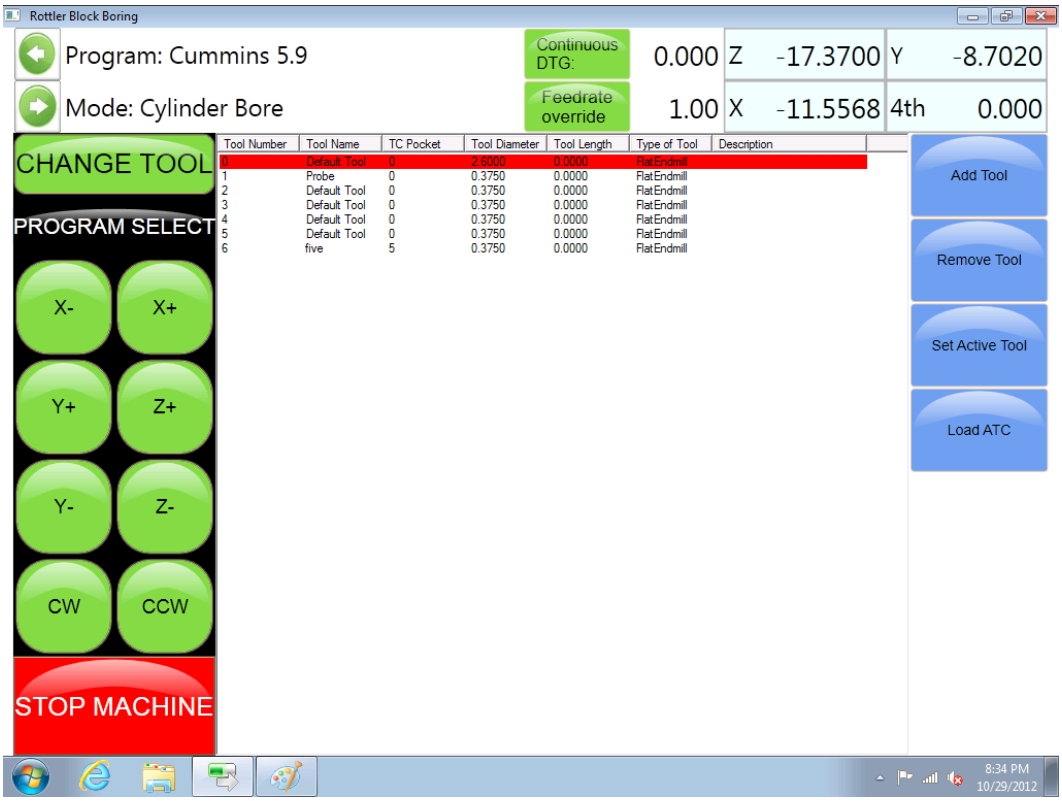
This window will open when the machine does an automatic tool change. This will be discussed in Chapter 3 Operating Instructions. After you press OK another window will open. This is a Warning Dialog box to inform the operator of the possibility of the spindle start if the tool change is done in an automatic 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.

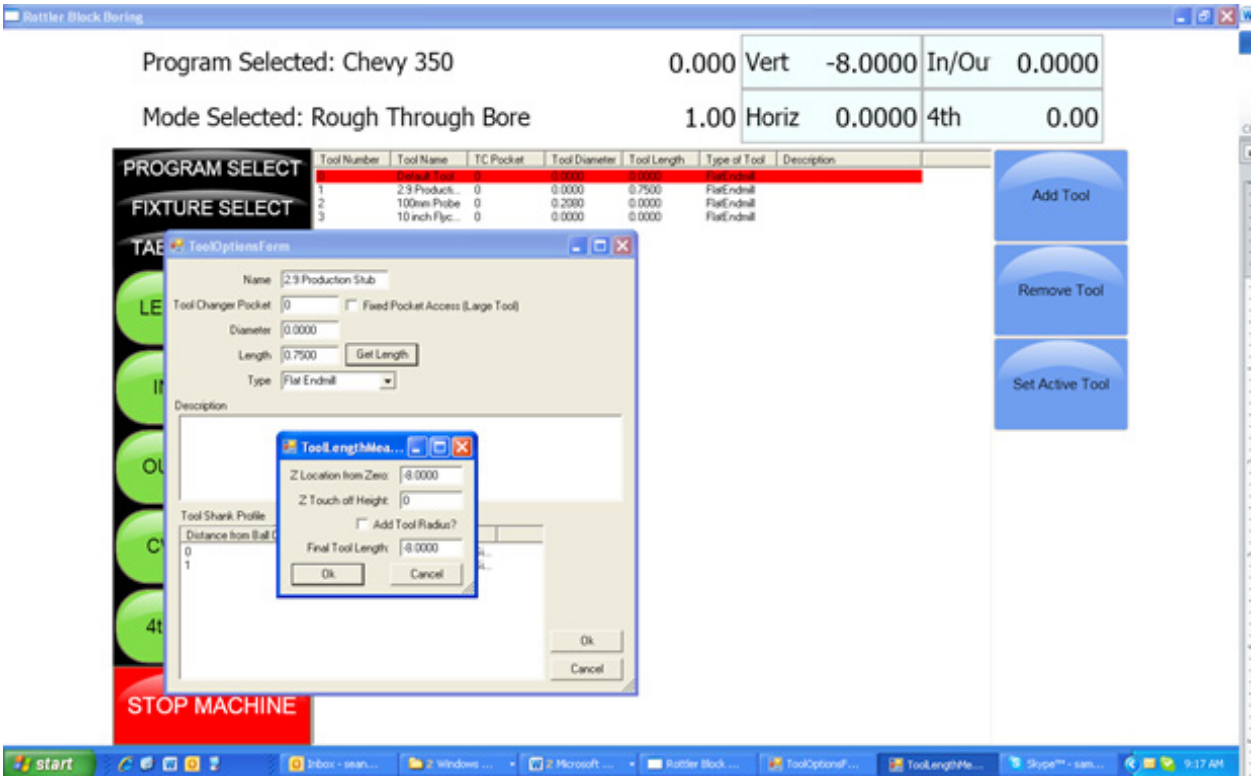
For this example we will be setting offsets for a 2.9 Production Stub, 100mm Probe and a 10 inch Fly cutter. Add these tools to the table of Tools.

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

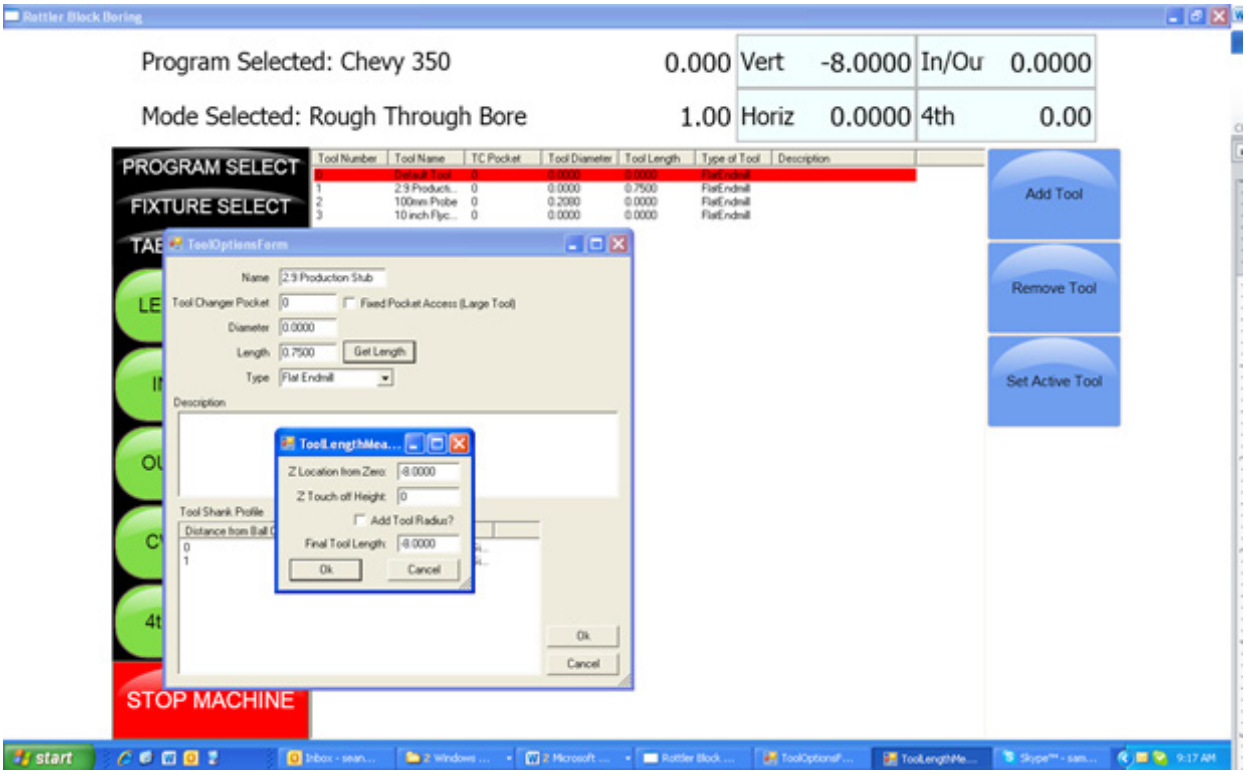
This is the distance the Vertical Axis is from the home position. NOT where the operator has set the Vertical Zero in the program. This value is set by the computer automatically. In this example the tool just touched the flat at 8.0000.

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.

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.

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 3 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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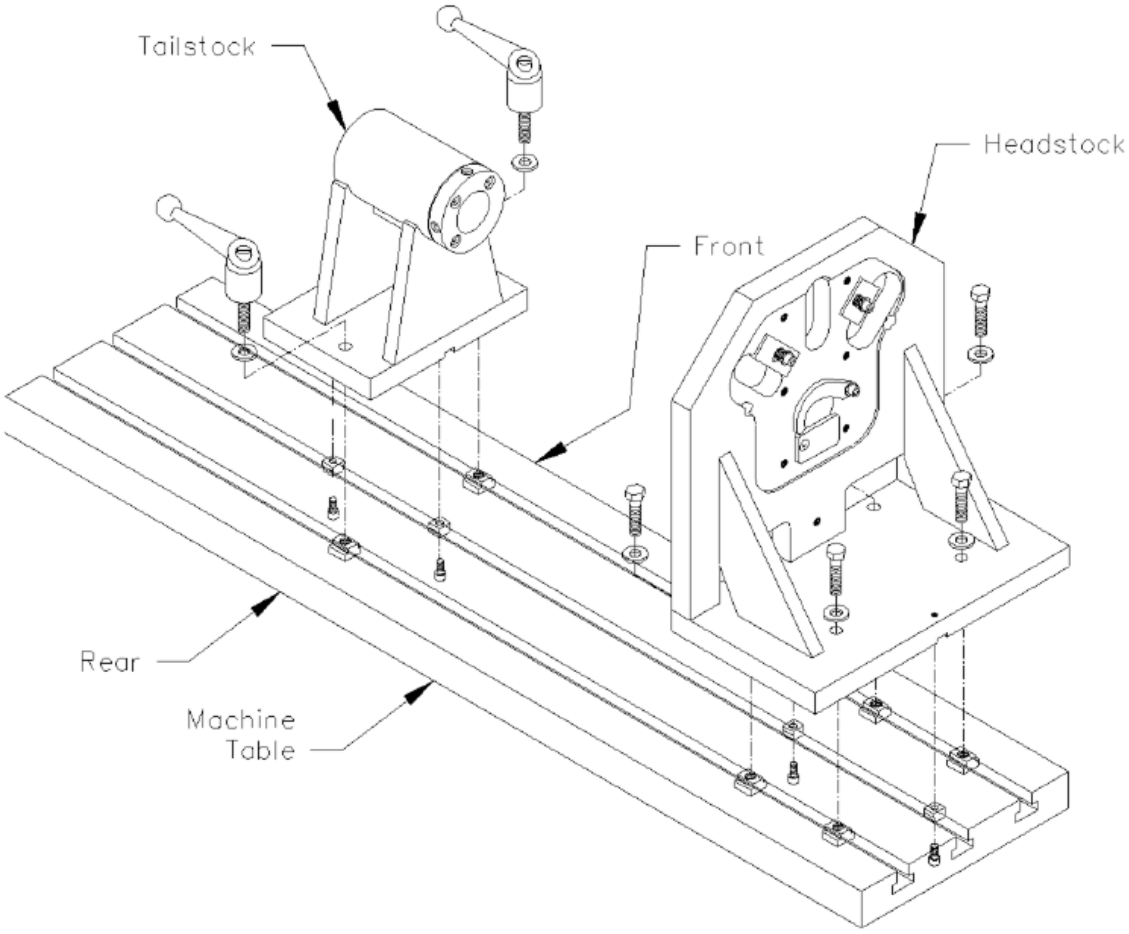
Operating Instructions

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

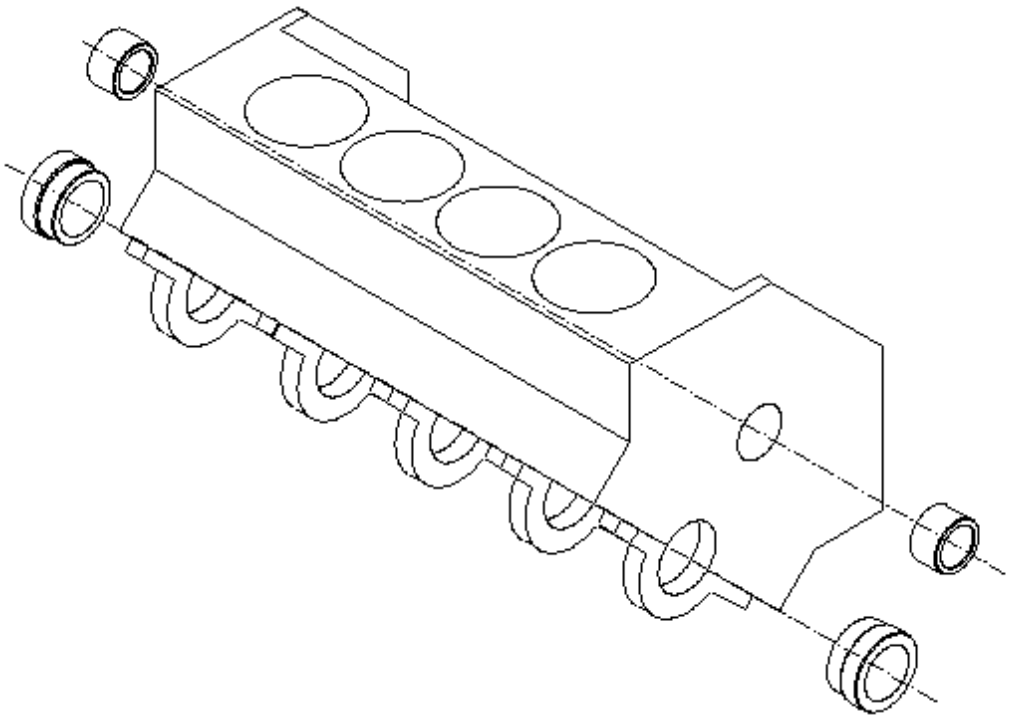
All modes of operation will be discussed in this chapter.

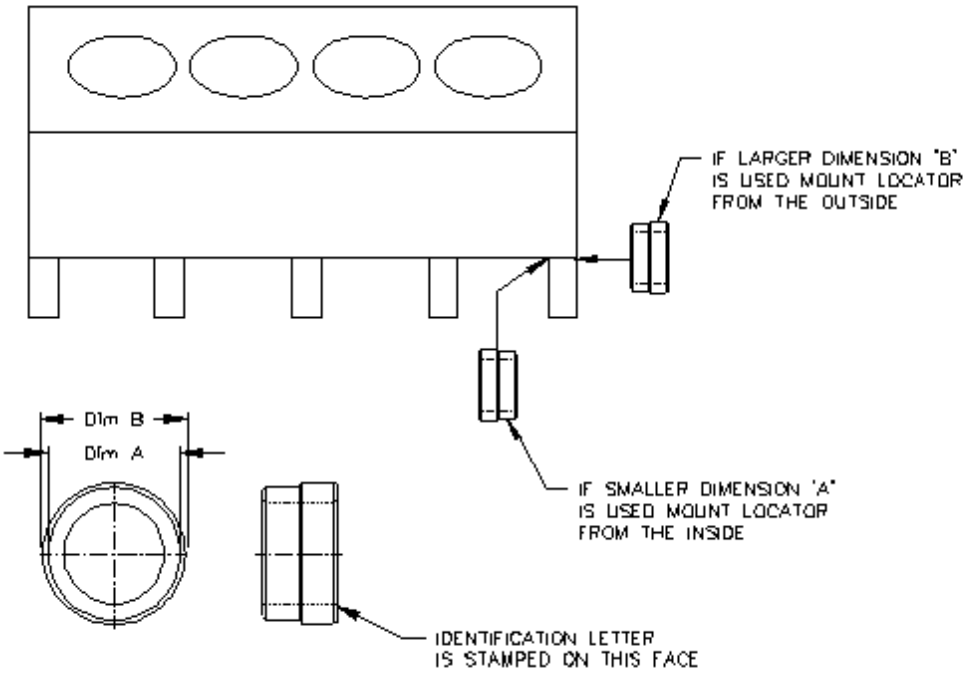
Loading a Block

Performance Fixture 650-3-1 Cylinder Boring
Install and align the performance fixture head stock on the left hand side of the table as shown below.
Follow the alignment procedures for the Performance fixture in the Maintenance section of this manual.
Tighten the Head Stock to the table securely using the four Hex bolts and T-Nuts.
Install the Tail Stock onto the right hand side of the table but do not tighten down.



Select the correct Main and Cam bushing for the block you are going to be using from the tables in the Options section of this manual. Place bushings in block as shown below.

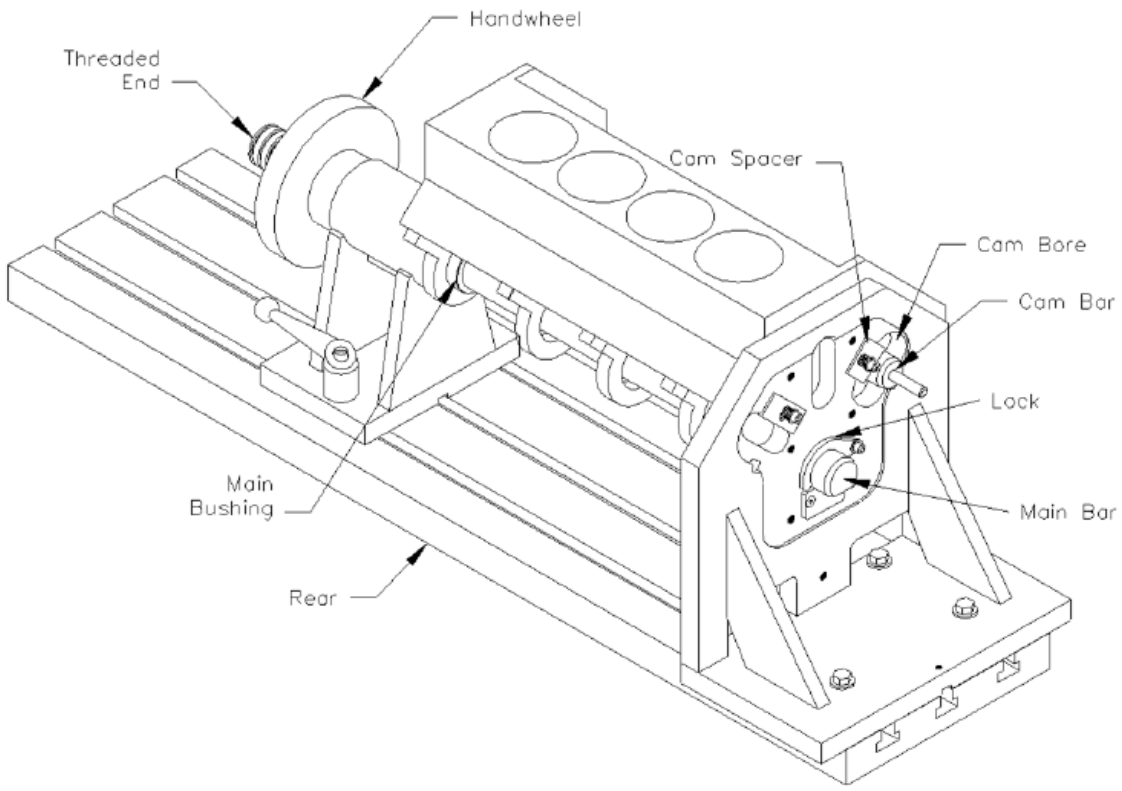




Note: Each locator covers two bearing diameters ('A' and 'B'). The unused diameter MUST be placed INSIDE the block to prevent interference with the Index plates.

1) Using a slow travel hoist, position the block between the Head stock and Tail stock with the Bell housing end of the block towards the Head stock.
2) Slide the unthreaded end of the Main Bar through the Tail stock, both Main bushings and into the Head stock with the flat facing down. The threaded end of the Main Bar should be on the Tail stock side of the table. Slide the Lock into the groove on the Main Bar.
3) Rotate the block until the bank you want to bore is facing up. Make sure the cam spacer is not in the cam Bore area at this time. Slide the Cam Bar through the two Cam bushings and into the Head stock with the reduced diameter at the Head stock.
4) Snap the Cam spacer into place.
5) Push the Tail stock up to the block. Tighten the Handwheel with a quick snapping motion.
6) Tighten the two handles on the Tail stock.

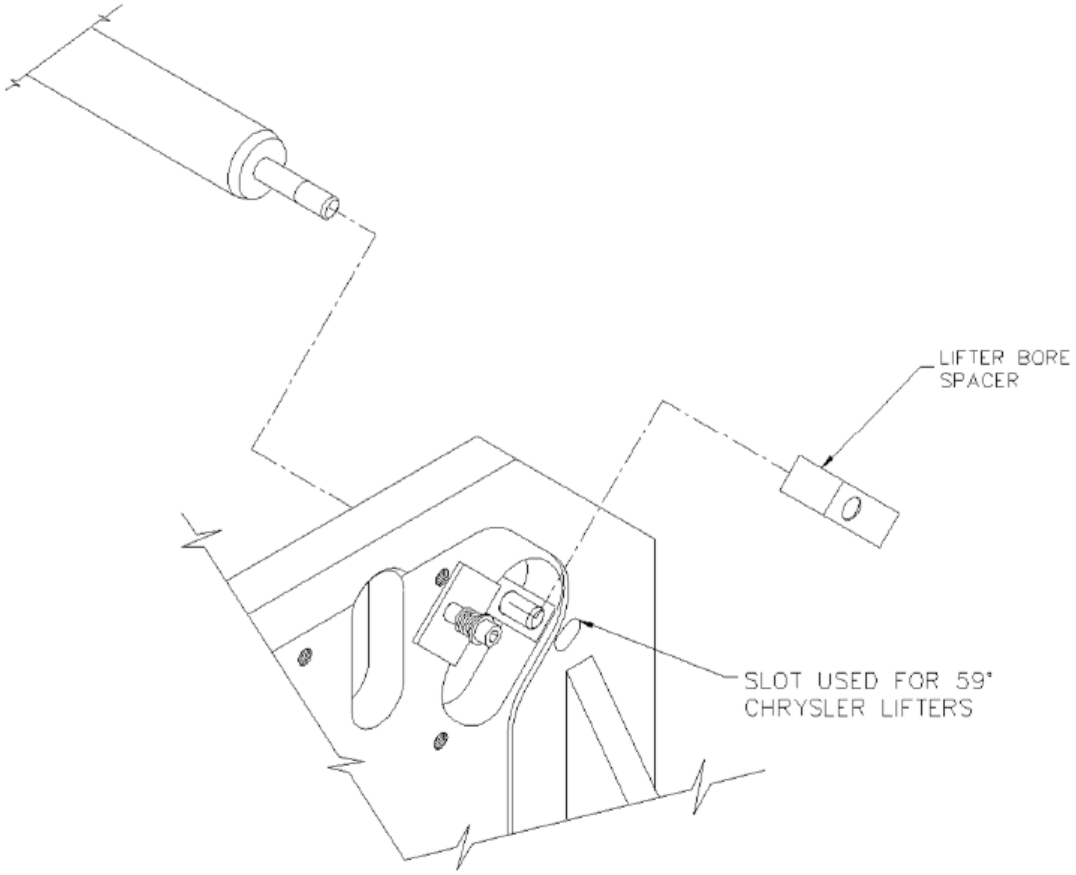
The block and fixture are now locked in place and ready for machining.



Performance Fixture 650-3-1 Lifter Boring

The same procedure for loading a block in Lifter boring as was used in Cylinder Boring with an exception in the Cam Bar area.

1) Instead of the Cam Bar being slid through the Cam Bore to its full Diameter, the small shaft on the end of the Cam Bar is used in conjunction with spacer Blocks.
2) Select the correct Spacer from the Chart in the Options section of this manual for the angle of the Lifter Bores.
3) The Cam Spacer must be out of the Cam Bore.
4) See illustration below for spacer installation.

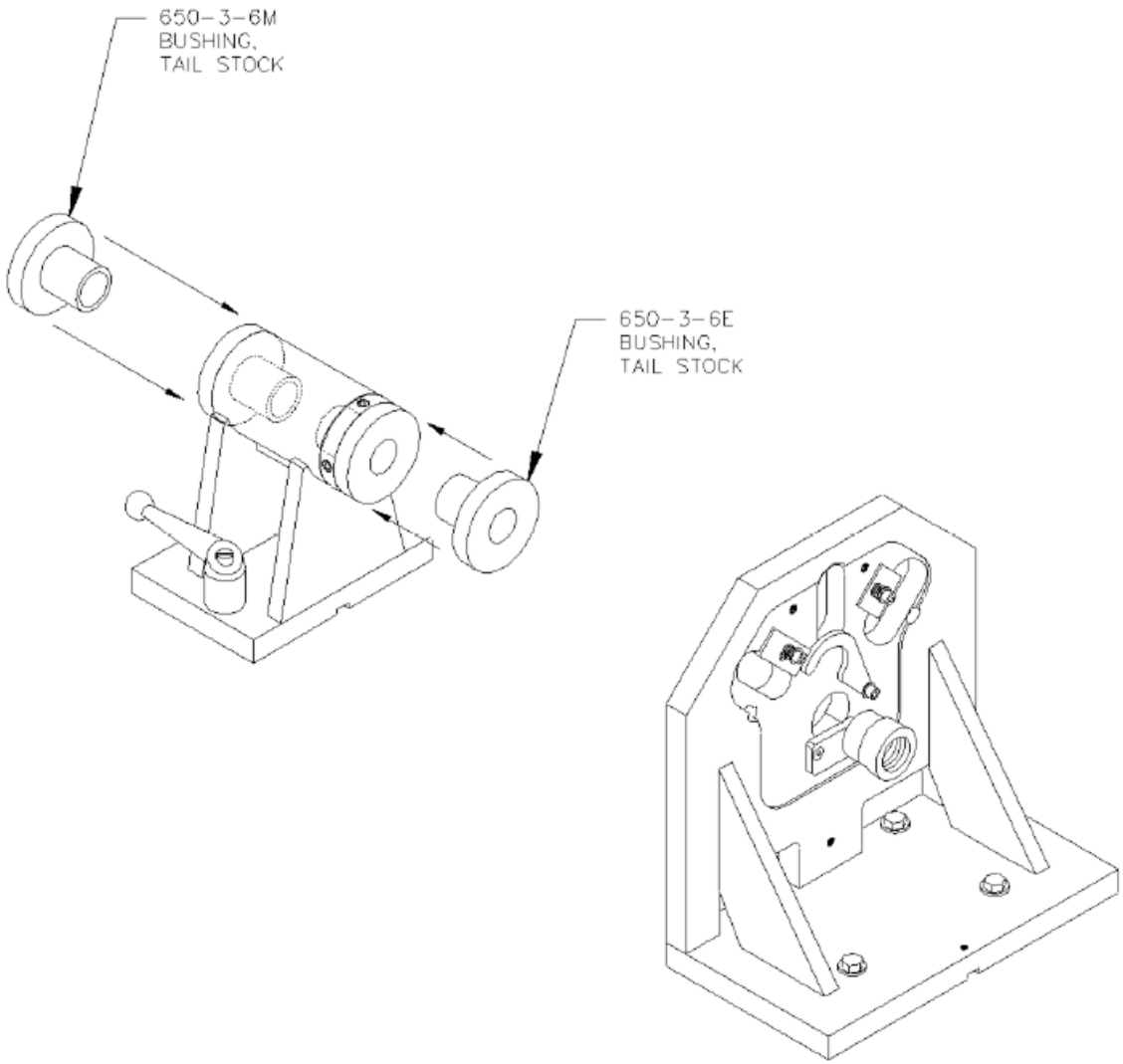


Lower End Machining Package 650-3-1A

1) Install and align the performance fixture head stock on the left hand side of the table as shown in the Performance Fixture section. Follow the alignment procedures for the Performance fixture in the Maintenance section of this manual. Tighten the Head Stock to the table securely using the four Hex bolts and T-Nuts.

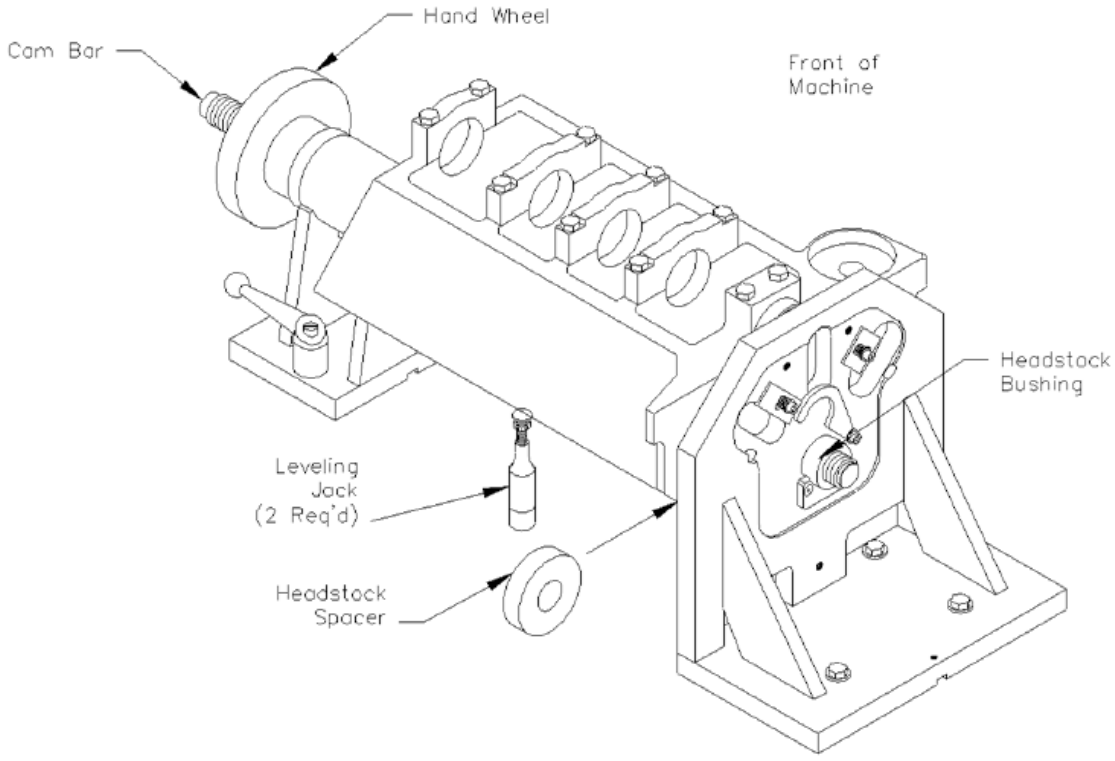
Install the Tail Stock onto the right hand side of the table but do not tighten down.

Install the Tail stock bushings 650-3-6E and 650-3-6M into the Tail stock as shown below.



2) Select the correct size Cam Bushings for the block you are using and install them into the block.
3) Using a slow travel hoist, position the block between the Head stock and Tail stock with the Bell housing end of the block towards the Head stock with the Main Caps facing up.
4) Install Head stock bushing into Head stock with the flat facing down and the smaller diameter into the Main bore of the Head stock.
5) Slide the Cam Bar (short threaded end first) through the Tail stock bushings, Cam bushings (installed in block) and Head stock Spacer.
6) Thread the Cam Bar into the Head stock Bushing until tight.
7) Slide the Tail stock up to the block.
8) Snug the handwheel up to the Tail stock but do not lock in place.
9) Install the Leveling Jacks between the underside of the block and the bed of the machine. One each side.
10) Rotate the block until the Pan Rails are even to each other.
11) Make sure there is even pressure on each of the Leveling Jacks.
12) Tighten the Handwheel into place.
13) Tighten the Tail stock into place using the handles.

The block and fixture are now locked in place and ready for machining.

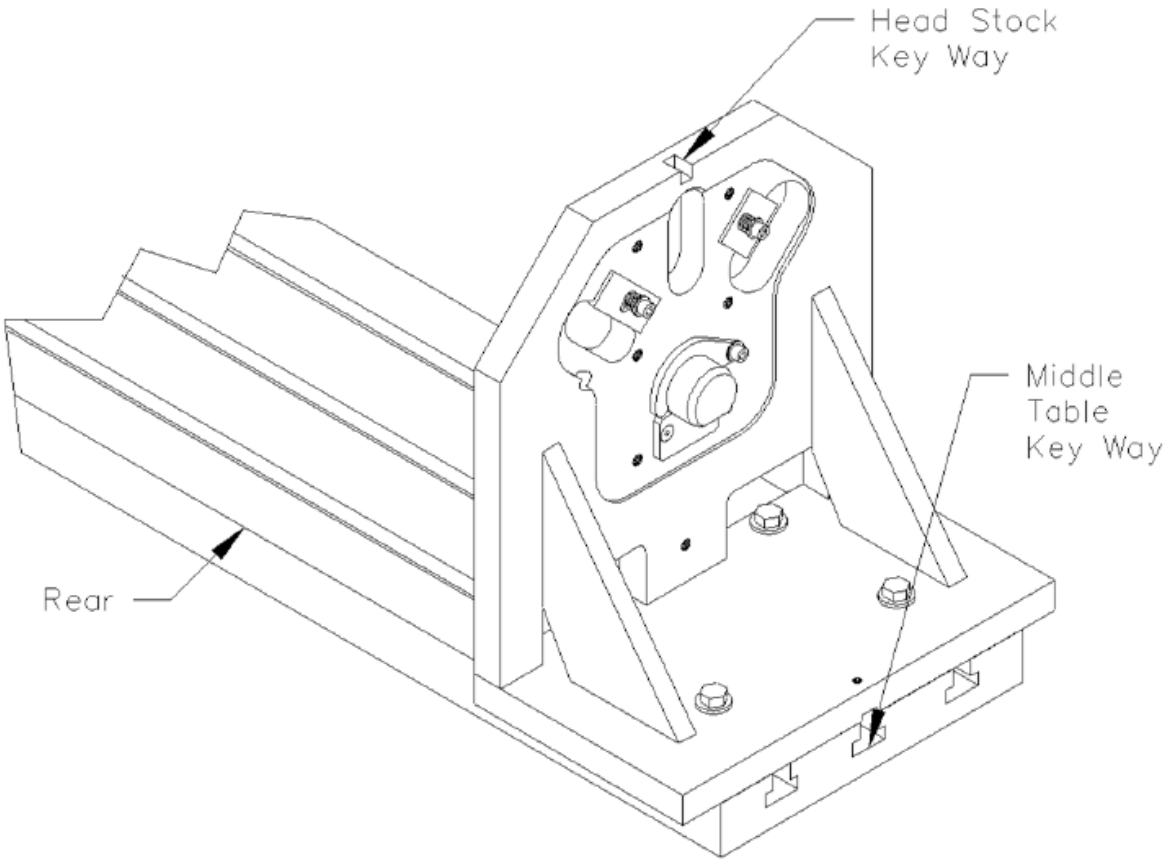


Block End Truing Fixture 650-3-30

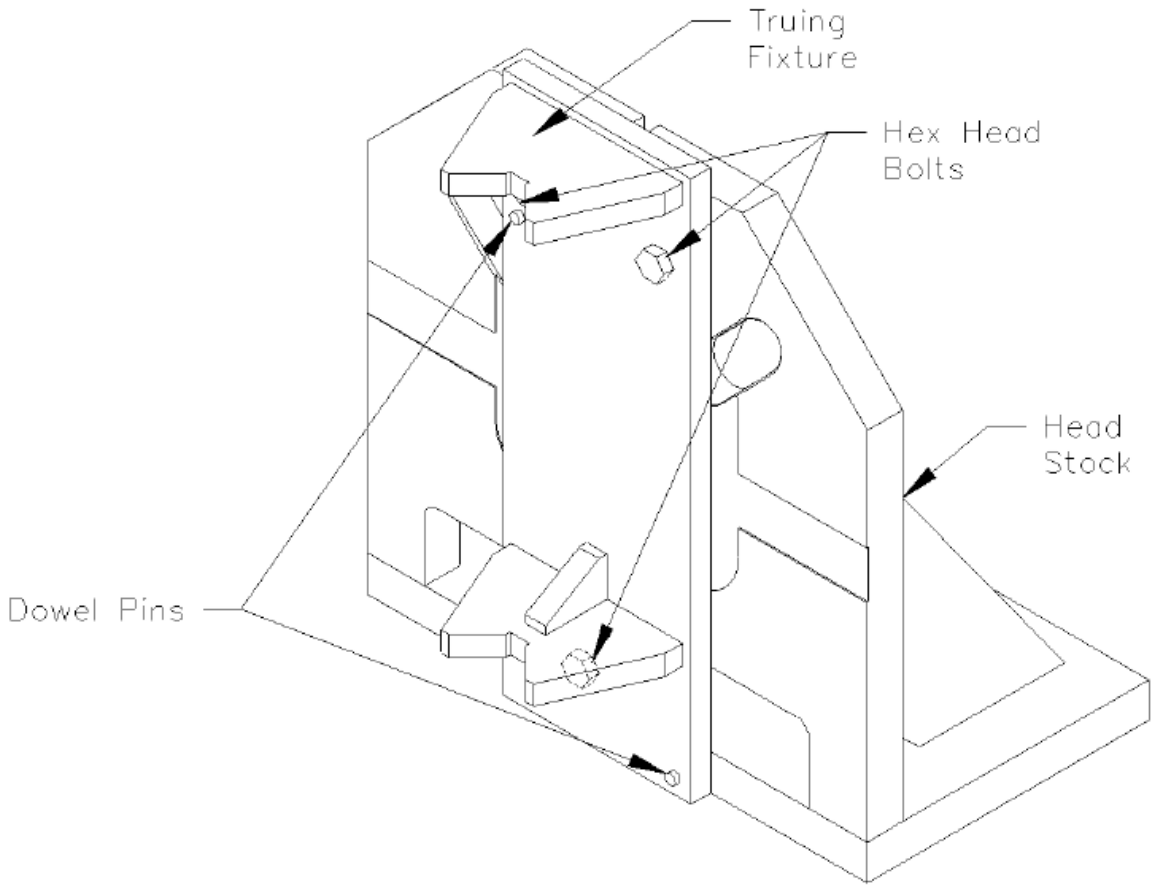
If you are truing the ends of a block use the standard Head stock mentioned in the Maintenance section of this manual.

If you are Boring the Cam Tunnels with this fixture follow the standard Head stock in the Maintenance section of this manual plus the procedure below:

1) Do not have the Head stock hold down bolts all the way tight, the fixture may need to be moved slightly.
2) The center of the Key Way on the Head stock need to be lined up with the center of the middle Key Way on the machine bed. This will place the center of the Main bore directly inline with the center of the Cam bore.
3) Lock the Head stock in place.



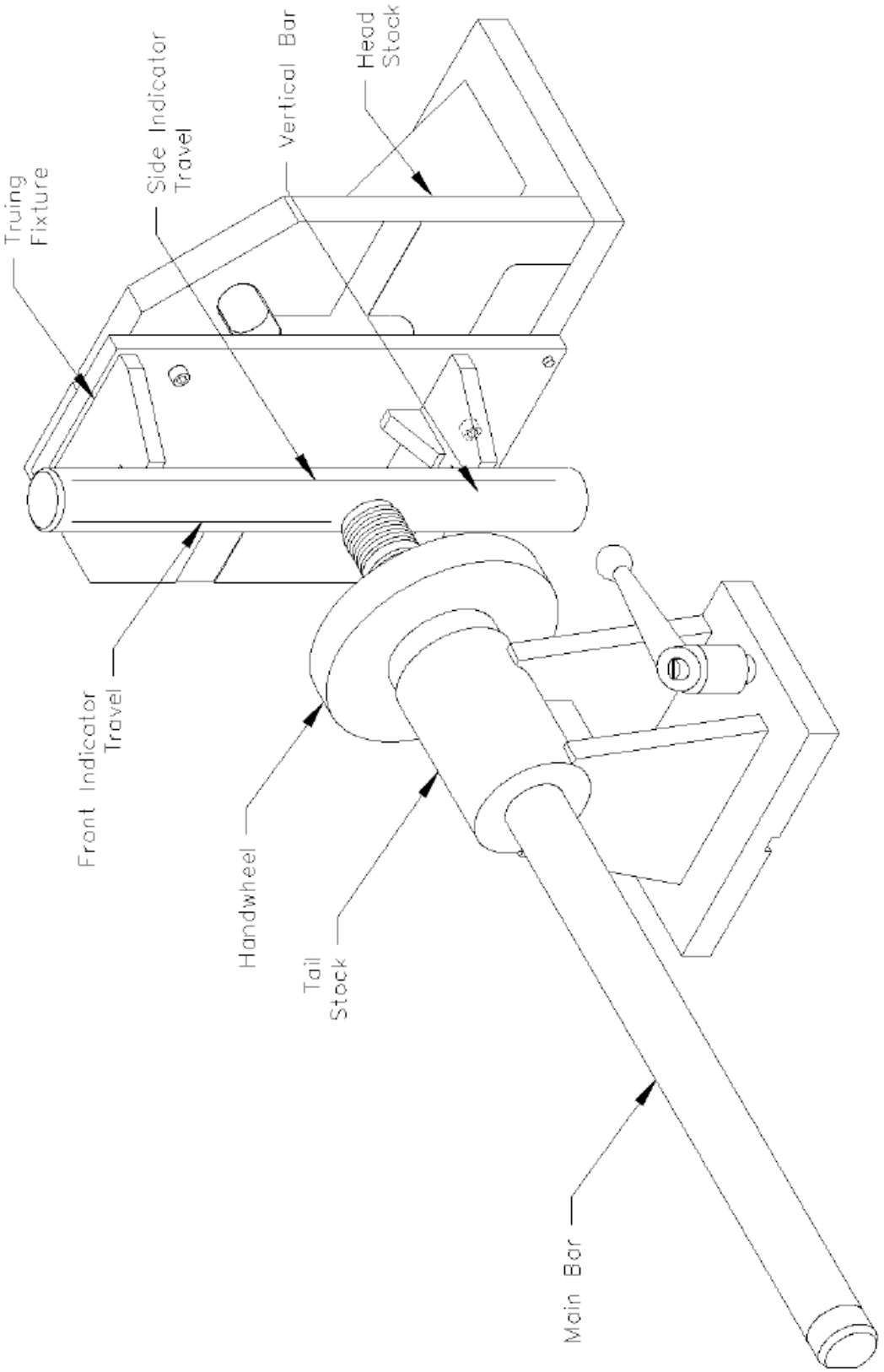
4) Install the Truing Fixture onto the Head stock. Slide the two Dowel pins on the Truing Fixture into the appropriate Dowel holes on the Head stock.
5) Bolt the Truing Fixture to the Head stock using the three supplied Hex Head Bolts.



The following steps are designed to check the Vertical Bar for straightness. This Bar was checked and tested at Rottler Manufacturing. The following steps are to make sure there is not a burr or debris between any of the parts.

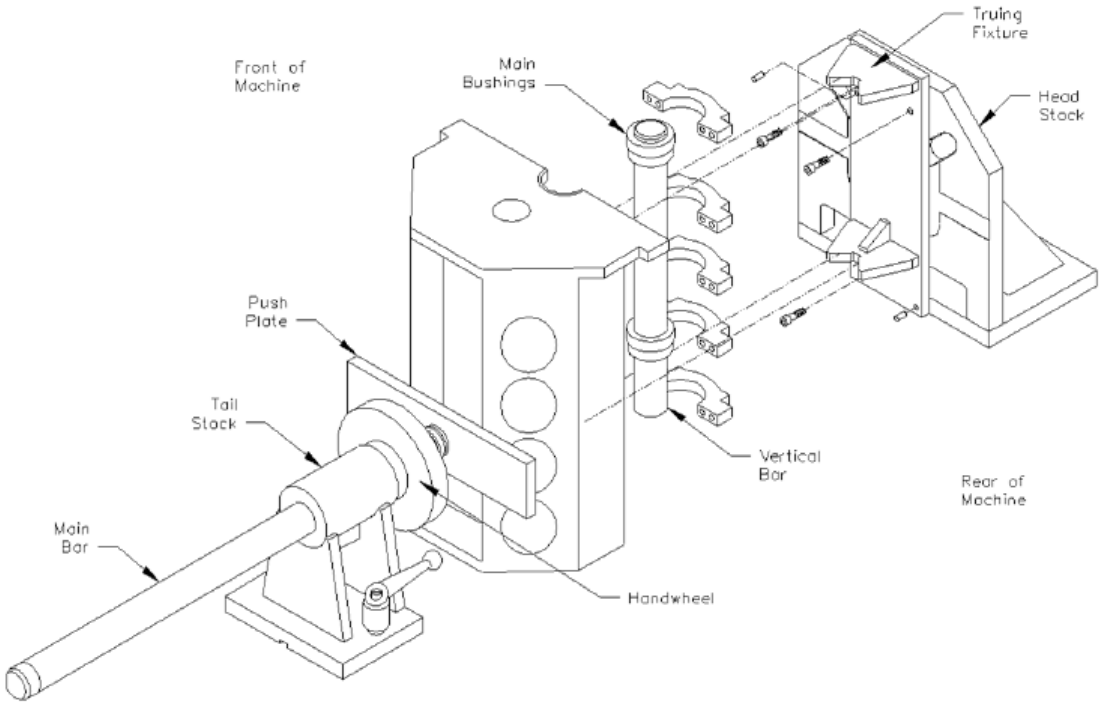
6) Slide the Main Bar though the Tail stock (threaded end first).
7) Thread the Handwheel onto the Main Bar.
8) Place the Vertical Bar into the “V” on the Truing Fixture.
9) Slide the Tail stock towards the Head stock until the Main Bar just touches the vertical Bar.
10) Tighten the Tail stock down.
11) Turn the Handwheel until the Main Bar holds the Vertical Bar securely in place.
12) Attach a indicator to the machine spindle or cutterhead and run it up and down the front and side face of the Vertical Bar. It should be within .0015 variance.

Note: Front face will only have half travel as the Main Bar obstruct full travel..


Truing Fixture
Side Indicator Travel
Vertical Bar
Head Stock
Front Indicator Travel
Handwheel
Tail Stock
Main Bar

13) Loosen the Handwheel and remove the Vertical Bar.
14) Loosen the Tail stock and slide it to the right hand side of the machine table.
15) Select the correct Main Bushing for the block you are machining from the table in the Options section of this manual. Install the Main bushings as shown in the Performance Fixture earlier in this section.
16) Using a slow travel hoist position the block between the Head stock and tail stock with the Main Caps facing the Head stock as shown.
17) Slide the Vertical Bar into the Main bushings from the top. You will want to put a spacer on the table below the Vertical Bar so the bar does not go below the top V on the Truing fixture
18) Slide the towards the Head stock so that the Main Vertical Bar come to rest in the Vs on the truing fixture.
19) Slide the Tail stock up to the block and insert push plate as shown.
20) Tighten down the Tail stock.
21) Turn the Handwheel until the push plate has enough tension on it to keep the block from moving.

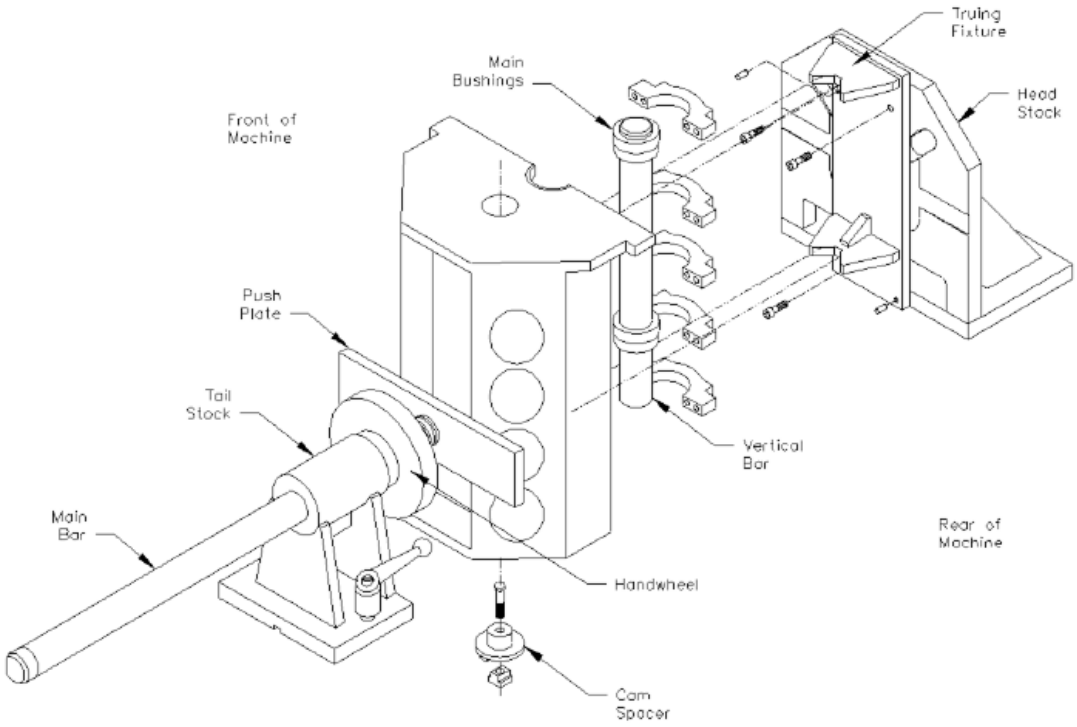
The block and fixture are now locked in place and ready for machining.



Block End Truing Fixture 650-3-30 when used with Cam Boring
When using the End truing Fixture for Cam Boring you will also need tooling package 650-3-43A

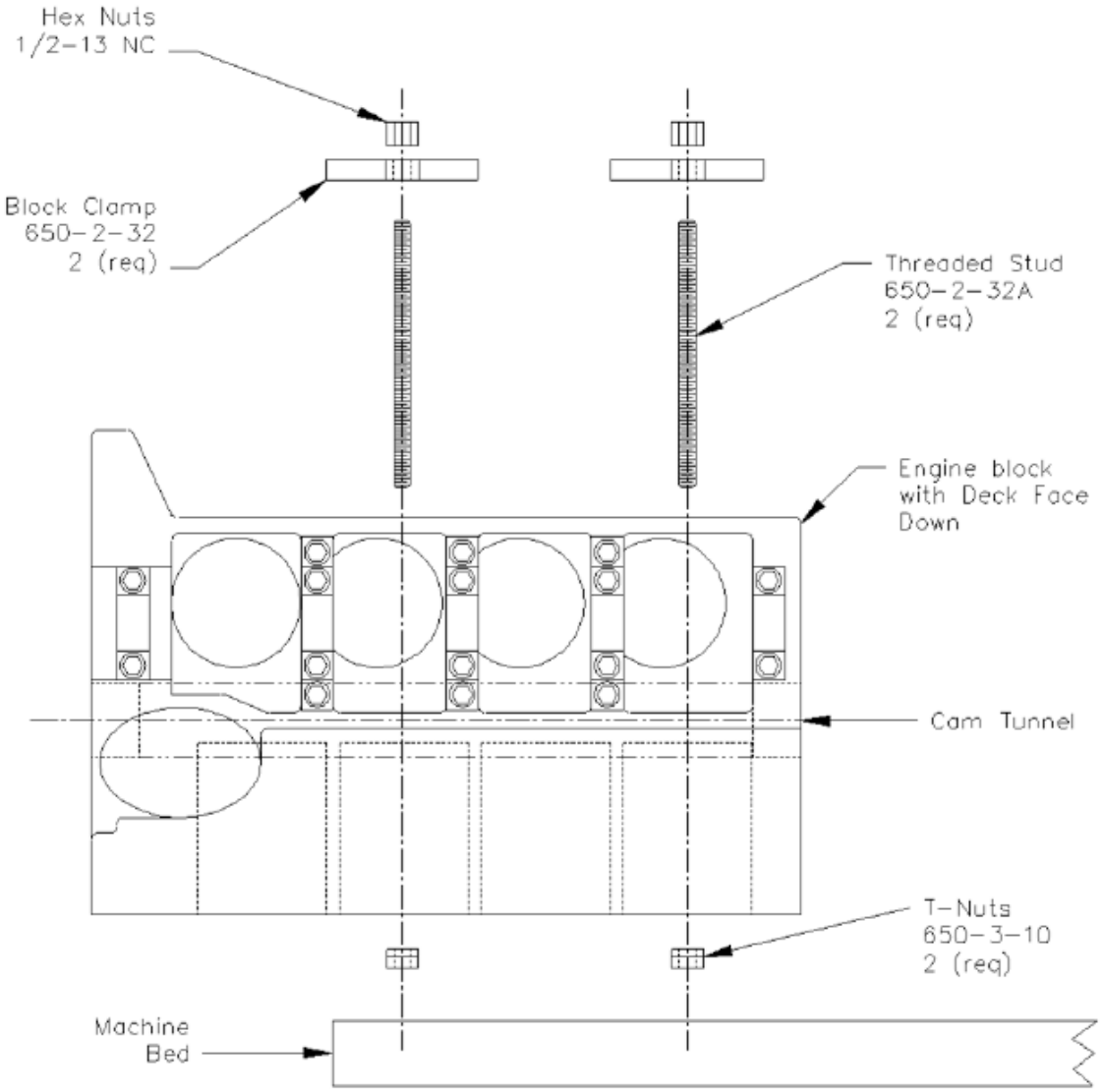
1) Use the same set up and line up procedure as with the standard End Truing Fixture discussed earlier in this section.
2) Place the Cam Spacer in the middle T-slot of the machine bed along with T-Nut and Bolt.
3) Select the correct Cam Bushing for the block you are going to be machining from the table in the Option section of this manual.
4) Place the Cam Bushing over the Cam Spacer. This will put the Cam and Main in-line and on center with the Fixturing.

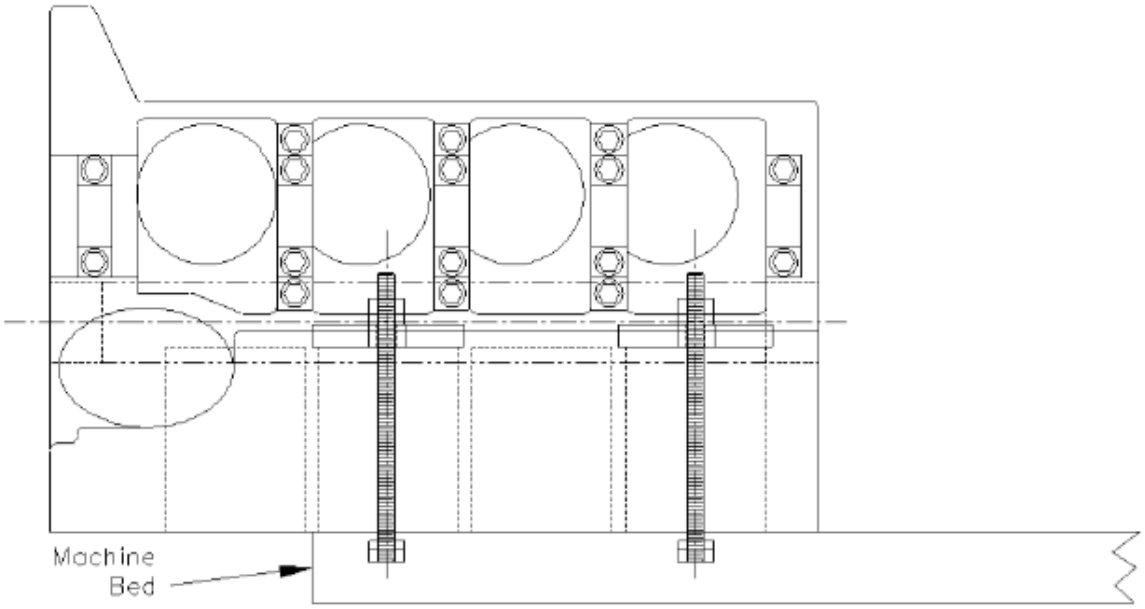
The block and fixture are now locked in place and ready for machining.



Cam Tunnel Boring

Place two T-Nuts in the outside key way (closest to operator).
Mount block onto machine bed, as shown below with the right most cylinder hanging off the machine bed.
Place threaded rod through the first and third bores and thread into T-Nuts.





Screw the supplied 1/2-13 NC nuts on to the threaded rod and snug them up. Do not tighten them all the way at this point.
Attach a magnetic base indicator to the spindle and run it along the upper pan rail to get it relatively straight. It does not need to be perfectly strait because a double flex coupling is used.
Tighten the 1/2-13 nuts down.

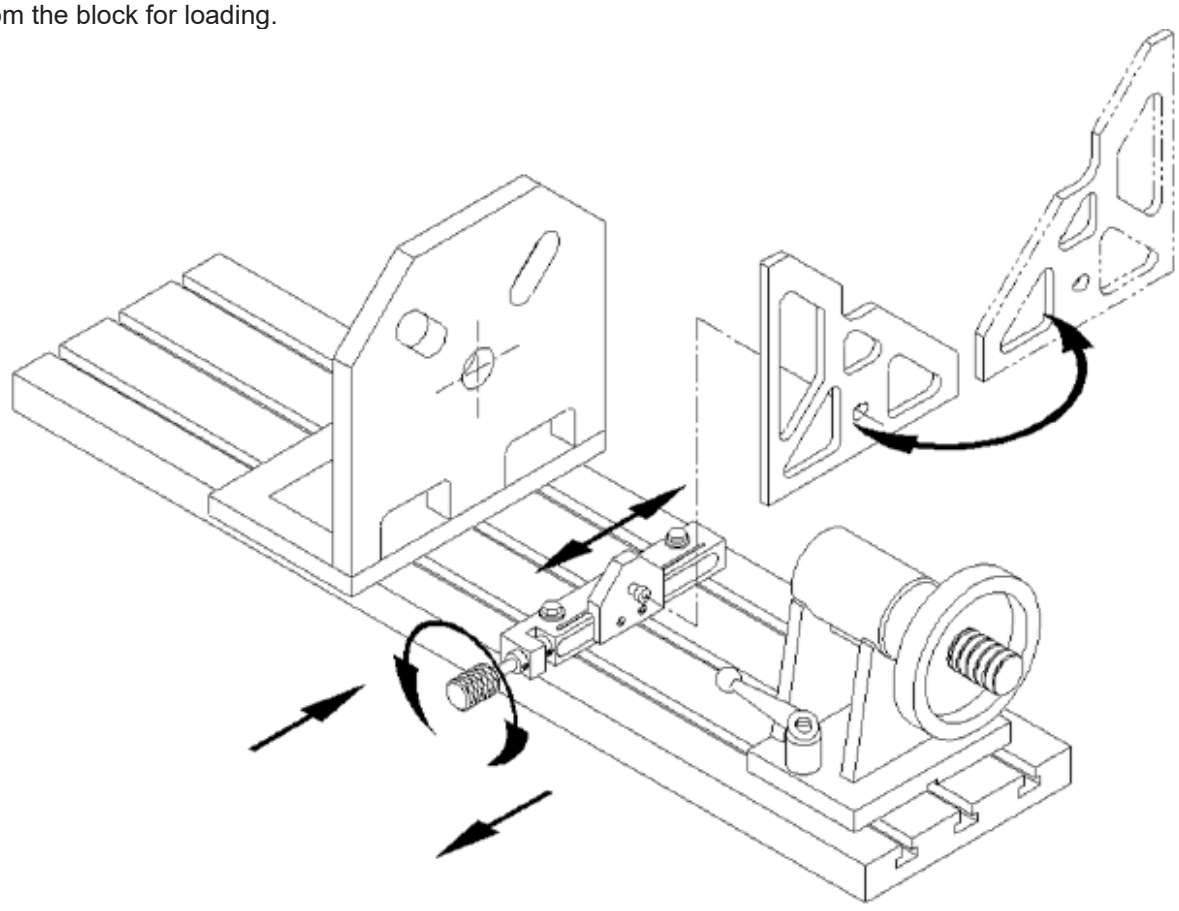
The block and fixture are now locked in place and ready for machining.

650-3-20A Pan Rail Wedge Fixture

Installation and Operation

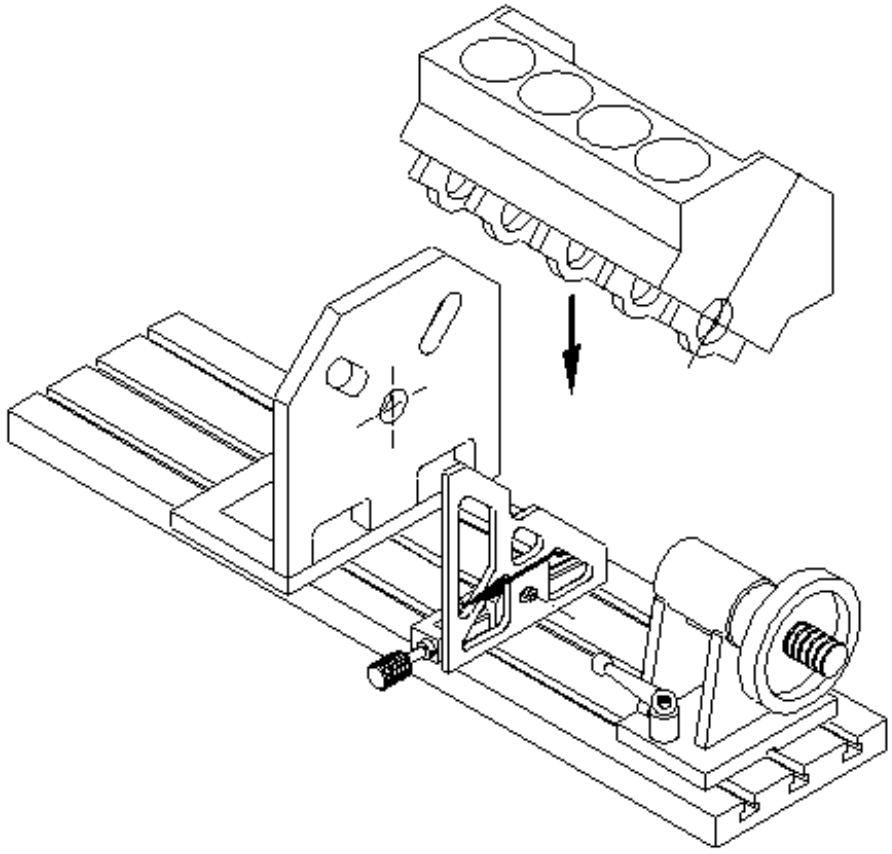
The 650-3-20A Pan Rail Wedge Fixture is used with the Performance fixture to set the correct cylinder bank angle for milling and boring operations. This fixture positions the block using the pan rail to set this angle. Both V-blocks and Y-blocks, as well as overhead cam blocks can all be set using this fixture.

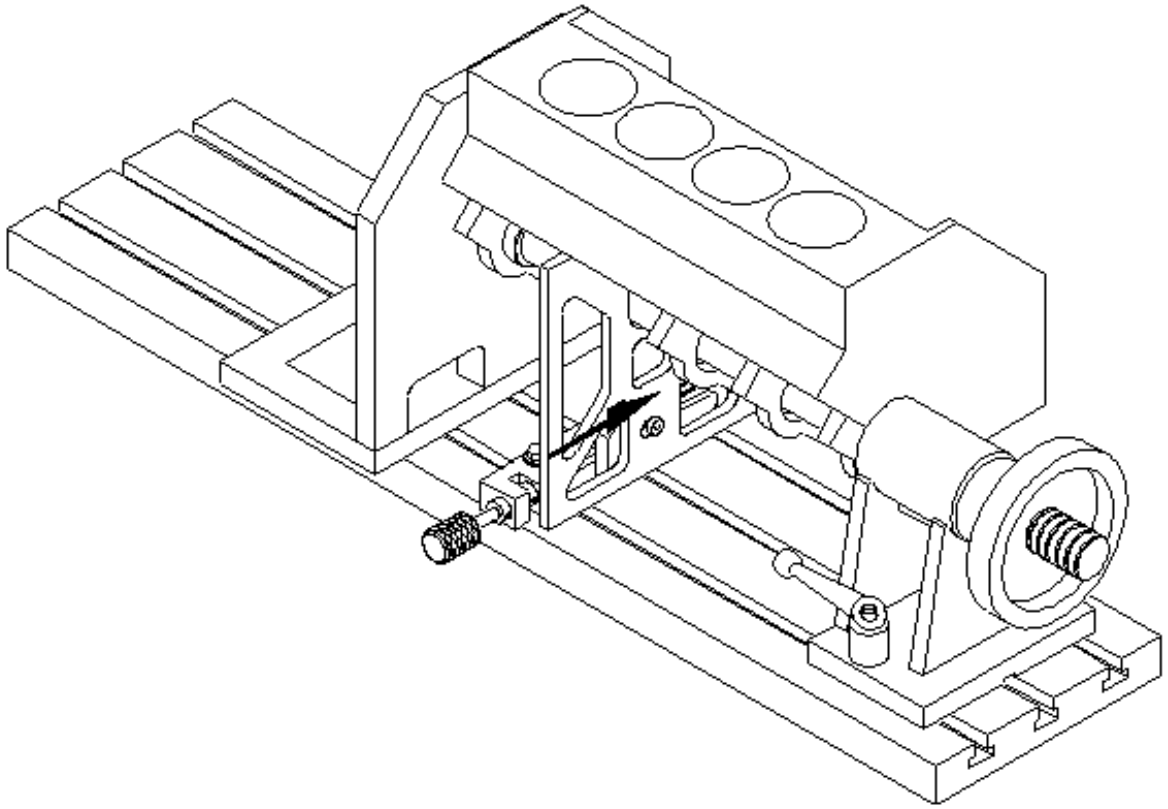
Mounting:
The pan rail fixture is mounted to the machine table between the head stock and tail stock of the performance fixture. Locate the fixture approximately centered between two of the main bearing caps. The key attached to base locates to the center keyway of the table. Once positioned, tighten the (2)(MF-150) hex bolts to secure. Choose the correct wedge for the block being machined from the list below:
650-3-23H Tall 30 deg. Wedge – 60 deg. V-blocks
650-3-23G Tall 45 deg. Wedge – 90 deg. V-blocks
650-3-23B Short 30 deg. Wedge – 60 deg. Y-blocks
650-3-23A Short 45 deg. Wedge – 90 deg. Y-blocks
These wedges can be flipped to face angled surface toward front or rear, depending on which bank of the block will be machined first. Mount the wedge to the fixture by sliding the keyhole over the shoulder screw in the 650-3-24 support plate. Turning the knob clockwise moves the wedge towards the operator, counterclockwise moves the wedge away from the operator. Operate the knob to move the wedge away from the block for loading.



Loading the block

Note: for this fixture to work properly and with accuracy the block pan rails must be clean, smooth, and free of burrs. Burrs, dirt, and gasket material left of the pan rails will not let this fixture perform correctly. Install the wedge on the support plate with the angled surface facing the pan rails. Turn the knob to move support plate and wedge away from the centerline of the fixture to allow room to install the block in the fixture. Load the block with the bank you wish to machine approximately in position. Turn knob to bring wedge up to contact the pan rail. Once contacted, keep turning the knob until the wedge contacts both pan rails. At this point, the wedge should make firm contact with both the pan rails and the table. This contact can be checked with shim at both pan rails and front and rear at bottom of the wedge. Now the operator can tighten the performance fixture and proceed with machining. Note: this fixture is designed to position the block, not hold the block. Failure to tighten the fixture could result in block movement, causing possible block and/or machine damage and operator injury.



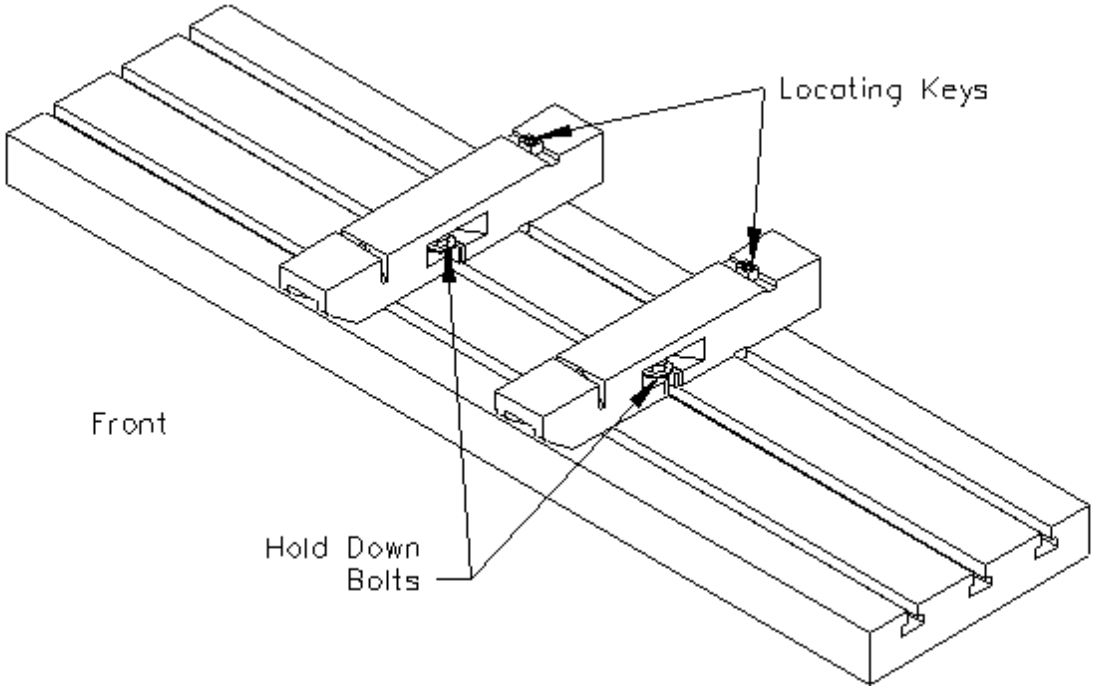


Switching banks

After machining the first bank, clear chips away from the fixtures moving parts, especially around the contact surfaces of the wedge. Turn the knob to move the wedge away from the pan rails. Move the support plate away far enough to disengage the wedge from the shoulder screw. Remove the wedge from the support plate. Loosen the block and rotate to the other bank, again, approximately in the correct position. Turn the knob to position the support plate to install the wedge, turned around to again face the angled surface to the pan rails. Make sure the contact surfaces of the wedge are clean and free of chips. Turn the knob to move the wedge into contact with the pan rails, and continue until full contact with pan rails is made. Full contact can be checked with shim at both pan rails and front and rear at bottom of the wedge. Tighten the performance fixture and proceed with machining.

V6/V8 Manual Fixture Assembly 502-1-72H

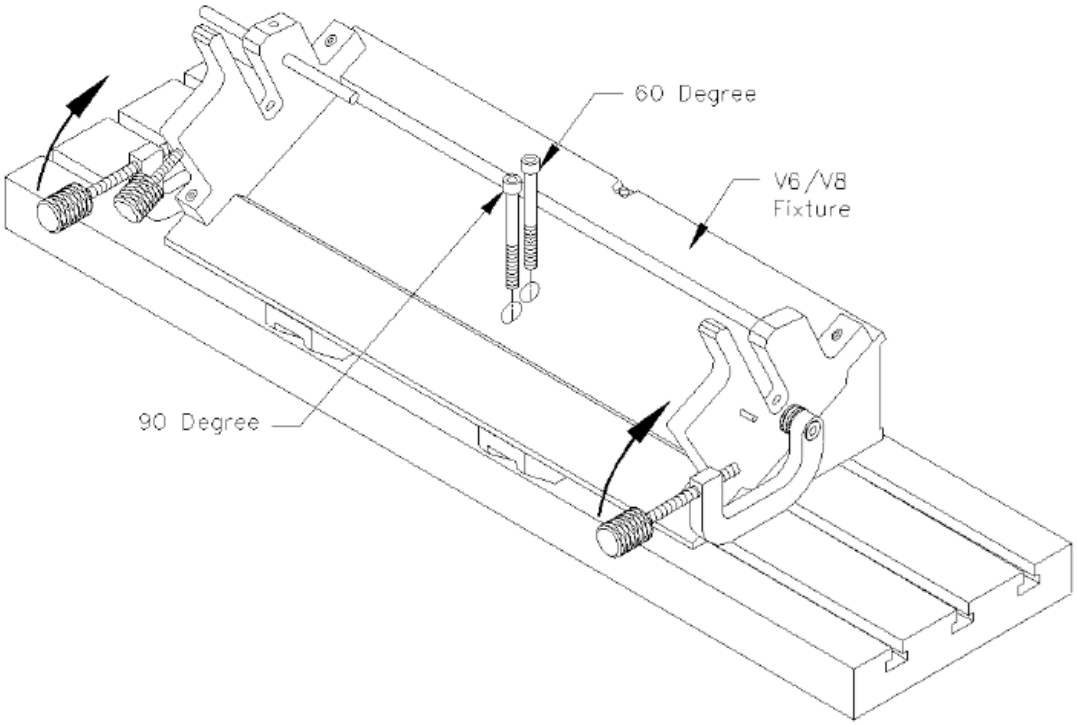
Place parallels 650-3-34 on Machine bed 10 inches apart and secure with T-Nut and Hex bolts that are provided. The keys on the bottom of the parallels go in the back Key Way.



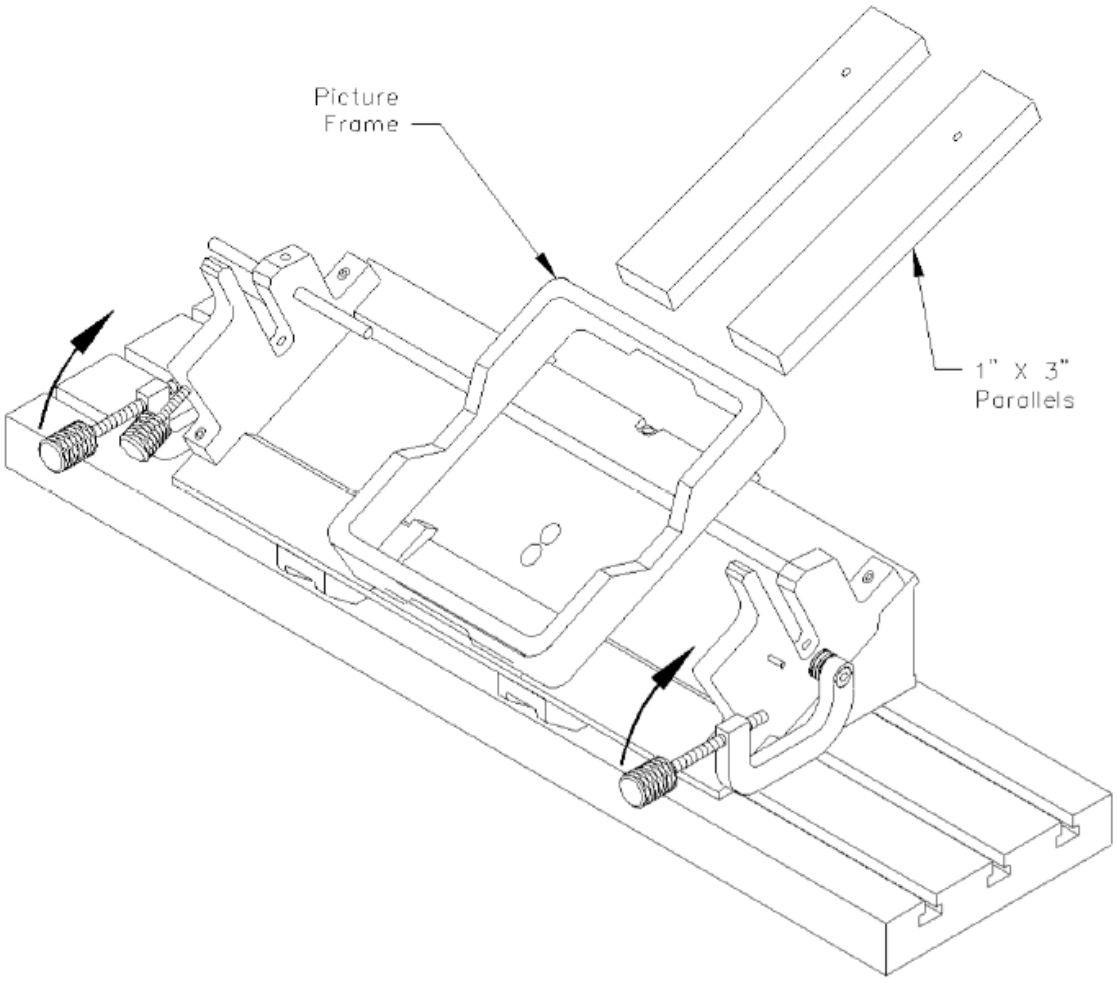
Select the 60 or 90 degree position for the fixture. Using a slow moving hoist, set the V6/V8 fixture onto the parallels.

Push the V6/V8 fixture back on the parallels until the keys in the top of the parallels line up to the machined sections on the rear of the V6/V8 fixture.

Use the supplied Socket Head cap Screw and T-Nut to secure the fixture in place.

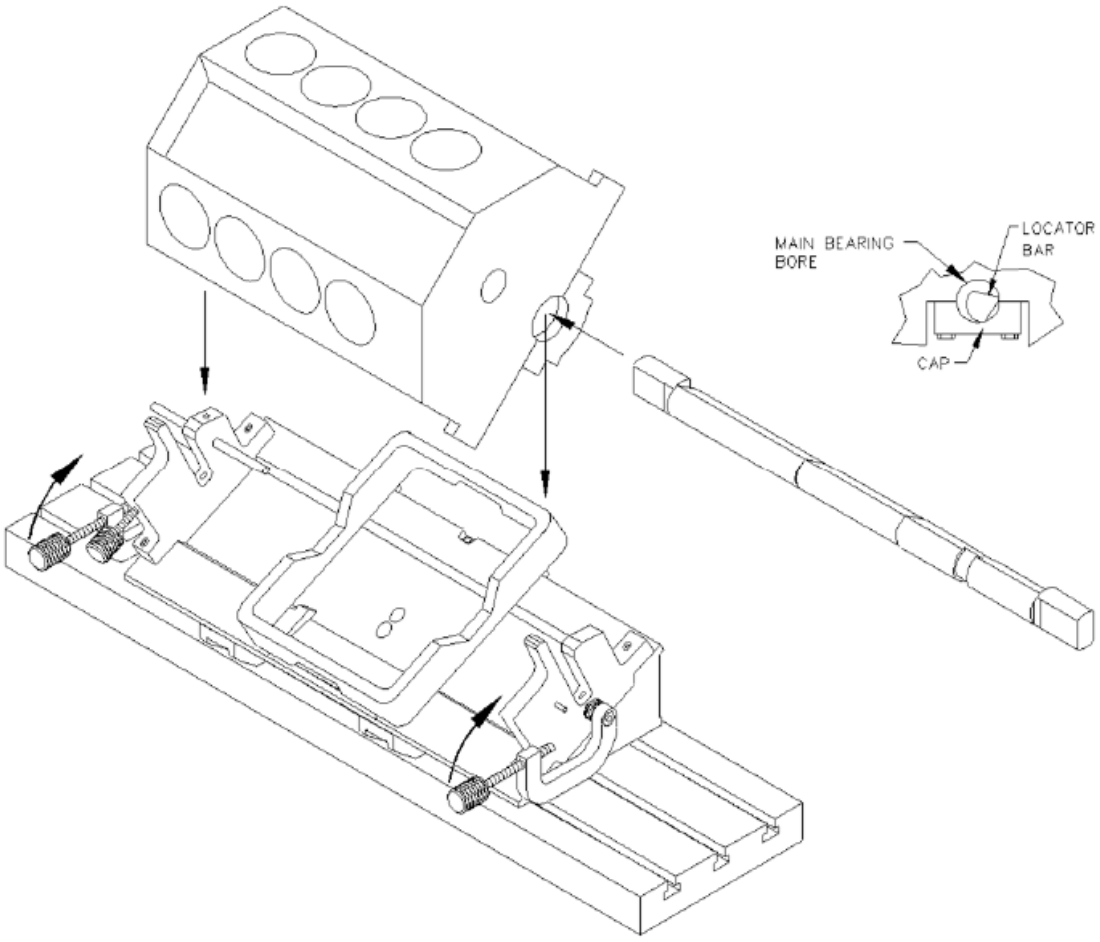


Decide if the Picture Frame or the 1” X 3” will need to be used.



Slide the Locator Bar through the Mains of the block.
Lower the block with the Locator Bar installed into the V6/V8 fixture. Clamp the Locator Bar with the screw in clamps. Shown on next page.

For a more detailed description on properly using and adjusting the V6/V8 fixture refer to the Manual V6/V8 Combination Fixture 502-1-72H in the Options section of this manual.


MAIN BEARING BORE
LOCATOR BAR
CAP

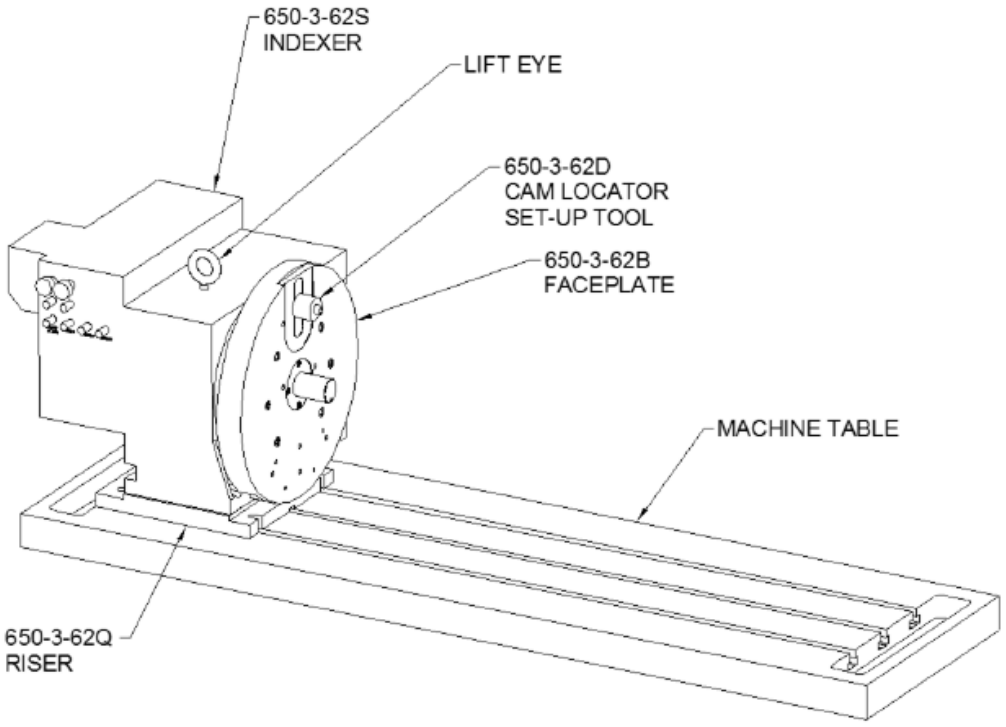
650-3-59 Automatic 4th Axis Fixture

The 650-3-59 Auto performance fixture is designed to quickly and accurately fixture v-style engine blocks for boring, surfacing, and other assorted machining operations. This fixture consists of an indexing headstock and an extending tailstock. This fixture is controlled with on screen commands on the F67 and F68 series machines. Locator sets are available to fit specific blocks and provide quick change over between different block styles. As with any precision tooling, careful machine set up and block preparation are critical to consistent accuracy and quality work.

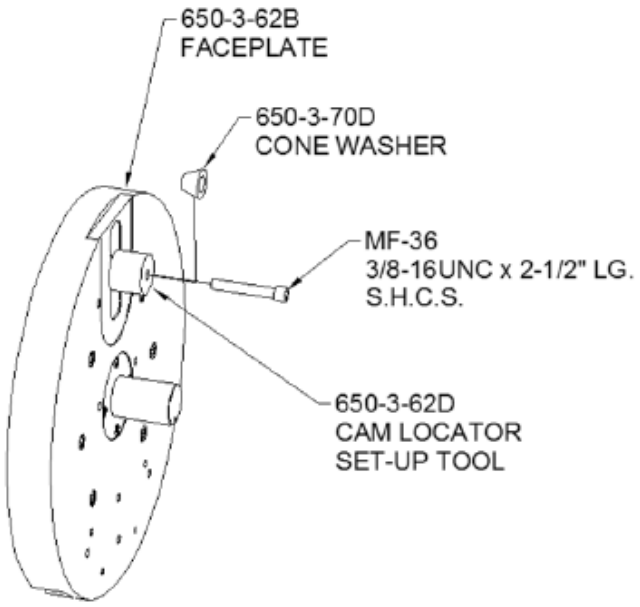
Mount the indexer unit to machine.

The indexer unit for this fixture can be lifted using the supplied lift eye on top of the indexer. This eye can stay on the indexer in use. The indexer should be positioned on the left end of the machine table with the keys on the bottom of the 650-3-62Q riser plate in the center keyway.

Push the indexer back so the keys are against the backside of the center keyway of the machine table and tighten (4) mounting bolts. Use an indicator to check 650-3-62B faceplate for straightness both vertically and horizontally.

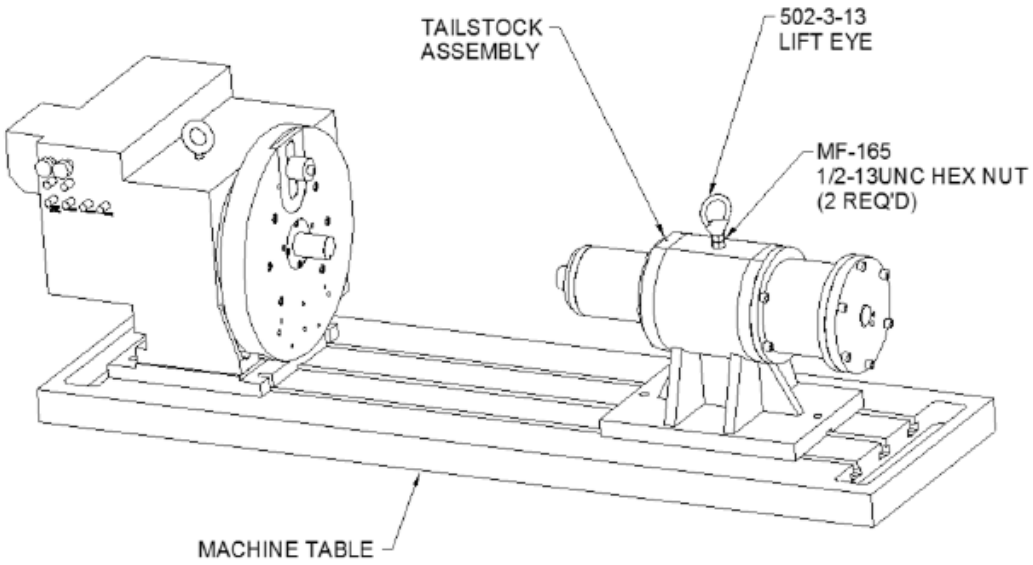


The 650-3-62D cam locator set-up tool should be installed on the indexer from the factory. This tool is used to check the angle ‘0’ of the indexer. The diameter of this tool is the same diameter as the shaft on the 650-3-62H faceplate pinion. With the indexer set to 0 degrees these two shafts should be aligned vertically. An indicator can be used to check this. With the two shafts aligned vertically, the flat machined on the top of the 650-3-62B faceplate should indicate 0. The number stamped on the machined flat is the exact distance from the flat to the headstock centerline. The two flats milled at 45 degrees to each side of this central flat are set to the same distance from centerline.

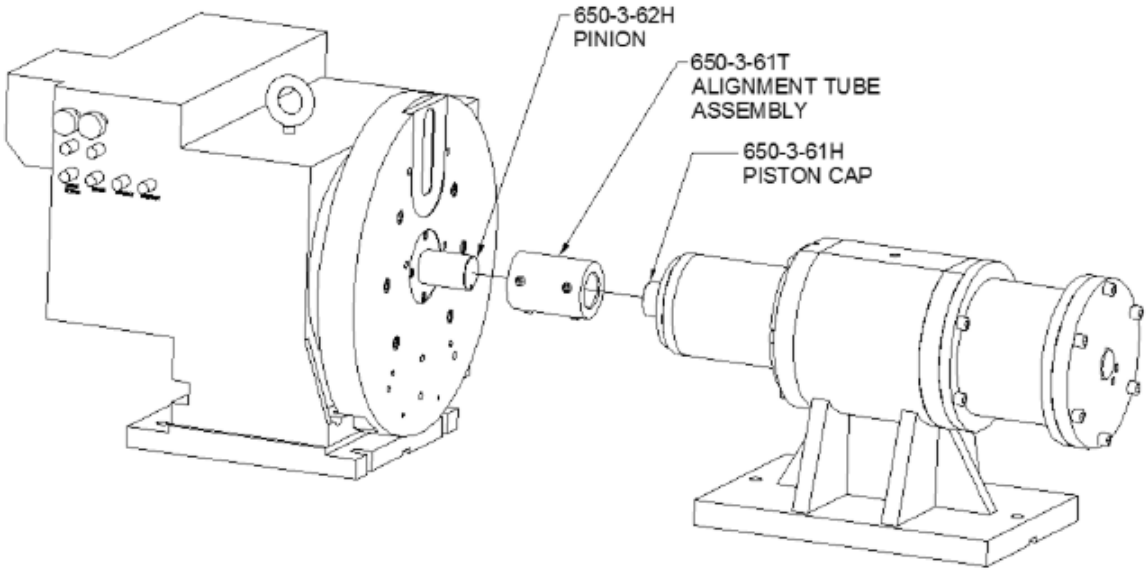


Mount the tailstock unit onto machine.

The tailstock can be lifted using the supplied 502-3-13 lift eye. Note: the lift eye has (2) 1/2-13unc nuts attached to it to prevent threading the lift eye too deep into the housing and contacting the 650-3-61G piston tube. Do not remove these nuts or substitute a longer thread as this will damage precision parts of this assembly. After moving the tailstock into position remove the lift eye and replace it with 650-3-61S 1/2-13 x 5/8" long socket button head screw to keep contamination out of the housing.

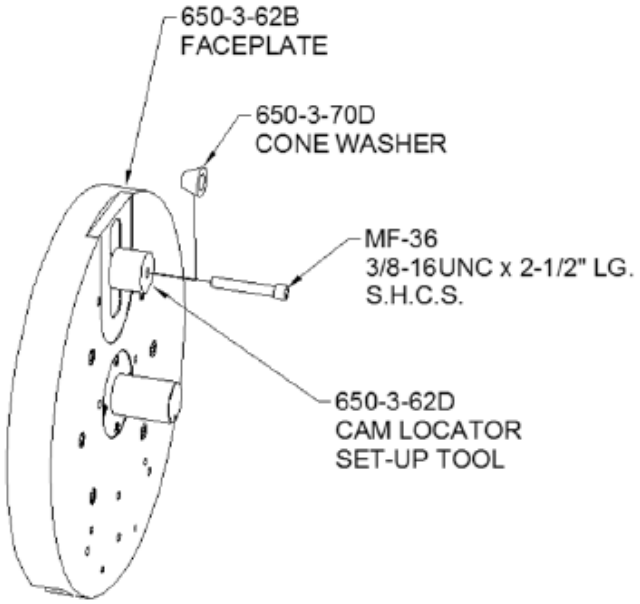


Install 650-3-61T alignment tool assembly to the pinion shaft of the indexer unit. Slide the tailstock up to place the 650-3-61H piston cap nose into the alignment tool. At this point the keys of the tailstock should be against the back of the machine table center keyway. When moving the tailstock to accommodate different block sizes the keys must be pushed against the keyway each time to ensure alignment before tightening the (2) mounting bolts. Remove the alignment tool assembly and place aside for future checking of alignment.



Using the 4th Axis Fixture

The 650-3-62D cam locator set-up tool should be installed on the indexer from the factory. This tool is used to check the angle '0' of the indexer. The diameter of this tool is the same diameter as the shaft on the 650-3-62H faceplate pinion. With the indexer set to 0 degrees these two shafts should be aligned vertically. An indicator can be used to check this. With the two shafts aligned vertically, the flat machined on the top of the 650-3-62B faceplate should indicate 0. The number stamped on the machined flat is the exact distance from the flat to the headstock centerline. The two flats milled at 45 degrees to each side of this central flat are set to the same distance from centerline.

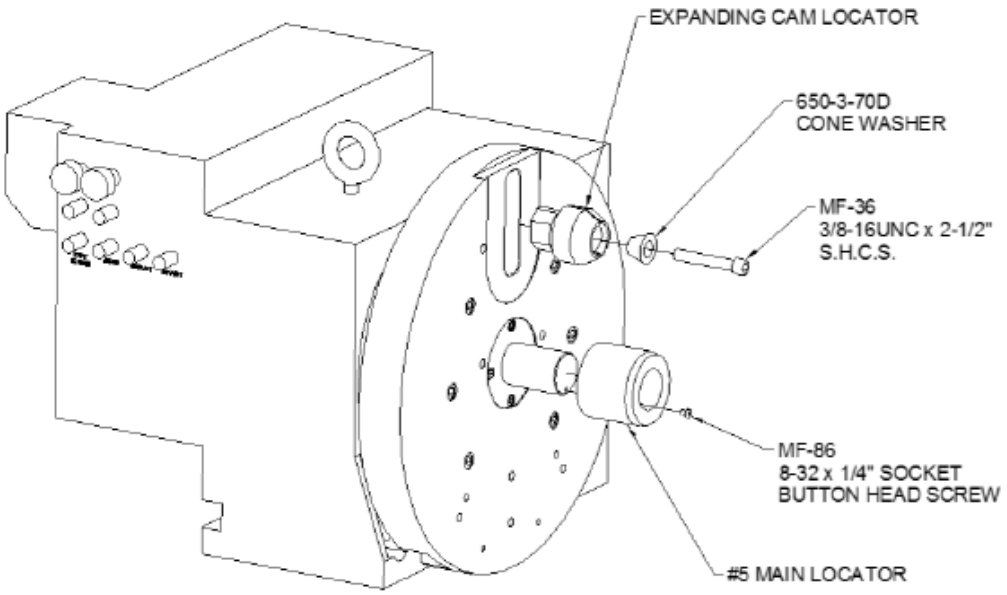


Locators: This fixture requires the use of locator sets, sized to fit individual engine blocks. These sets consist of (1) cam bearing bore locator, (1) #5 main bearing bore locator, and (1) #1 main bearing bore locator.

Main bearing bore locators: The #5 main locator is sized to fit onto the 650-3-62H faceplate pinion with the tapered end facing out. This locator is retained on the pinion by the MF-86 button head screw in the pinion. The #1 main locator is sized to fit onto the 650-3-61H piston cap of the tailstock with the tapered end facing out. This locator is also retained by an MF-86 button head screw.

Expanding cam bore locator: The cam bore locator is sized to fit into the 650-3-62B faceplate. To load the specific locator: remove the MF-36 3/8-16UNC cap screw and the 650-3-62D setup tool from the faceplate. The setup tool should be set aside for checking indexer '0' in the future. Install the cam locator with its socket fitting into the slot in the faceplate. The 650-3-70D cone washer is installed into the mating countersink in the locator, and held in by re-installing the 3/8-16UNC cap screw. This cap screw threads into the 650-3-62V cam locator nut that is trapped in the 650-3-62B faceplate Tighten the cap screw just enough to hold the locator in the desired location in the slot.

CAM AND MAIN LOCATOR INSTALLATION



Loading an engine block

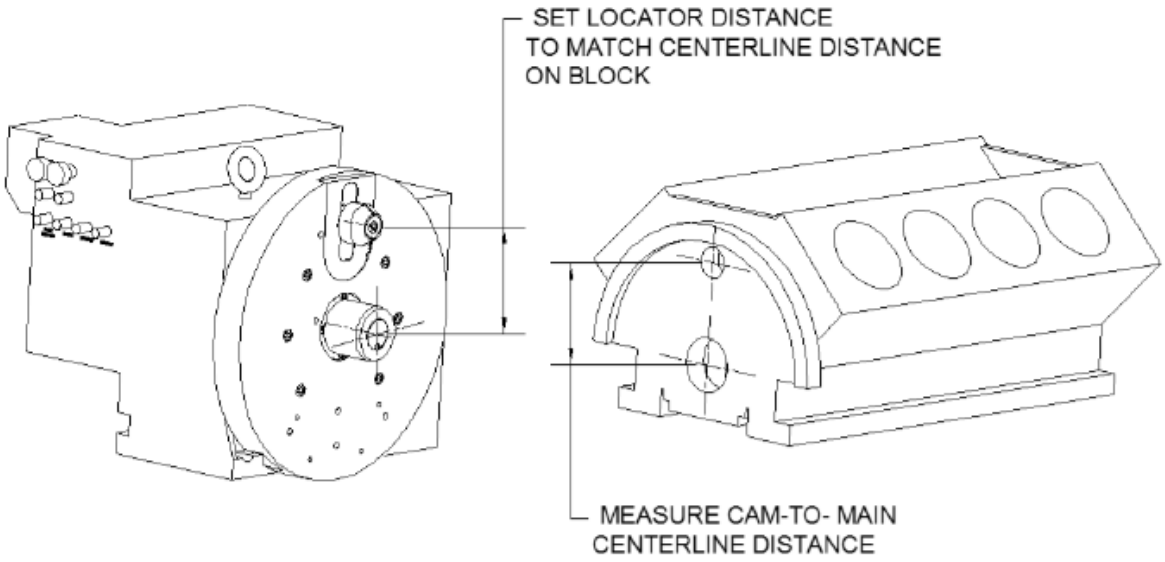
This fixture requires the main bearing bores, the rear cam bearing bore, and the transmission mounting surface of the engine block be clean and free from nicks, dings, and foreign particles. Failing to ensure this will result in poor performance of your fixture.

The tailstock must be positioned to allow space to install the engine block, but still be close enough to clamp the block within the 6” of stroke allowed by the tailstock piston. Approximately 3-1/2” of the stroke will be used to take up the required length of the locators, leaving approximately 2-1/2” of room to position the tailstock.

Generally, measure the overall length of the engine block and add 1”. This will be the space to leave between the pinion noses of the headstock and tailstock with the tailstock piston retracted. Example: a 20” long engine block will require the pinion noses to be 21” apart. This will leave 1/2” of room on each end of the engine block for loading and still be within the stroke length of the tailstock.

After setting the distance between the pinion noses, tighten the tailstock down with its keys pushed back against the center keyway of the table.

Measure the distance between the centerlines of the main and cam bores of the block. Slide the adjustable cam locator to be equal to this distance. Lightly tighten the MF-36 cap screw to keep the cam locator in place.



Using a hoist, load the engine block down between the pinions with the bell housing surface facing the headstock. Slide the blocks main bore over the #5 main locator on the headstock and position the block to slide the cam bore over the cam locator. Tapers on the outside of both locators will aid in positioning. Push the block flush up against the faceplate and activate the 'light extend'. This will extend the tailstock piston with limited pressure to locate the block on the tailstock. CAUTION: keep fingers and all other objects out of the path of the tailstock piston. Even with limited pressure, severe injury could occur if this rule is not followed. If desired, a hex socket and long extension can reach through the cam bores from the front of the block and be used to tighten the cap screw holding the cam locator in place. The 650-3-70D cone washer will expand the cam locator to provide a tighter fit on the cam bore, further centering the block on the indexer '0'. Once the block is located properly, full tailstock pressure can be applied after rotating the indexer to the desired angle.

After machining is complete, unload the block in reverse order. Loosen the cap screw on the cam locator to release pressure on the cam bore of the block. Position the hoist to hold block and retract the tailstock. Slide the block off the faceplate and locators to remove.

Readjusting tailstock piston alignment

Checking for tailstock alignment may be required after heavy use or after a crash has occurred. The first step is to check all possible variables before making adjustments.

Headstock: make sure the headstock is pushed back with the keys against the back of the center keyway of the machine table. Tighten the (4) bolts to secure the headstock to the table and check faceplate for squareness.

Tailstock: the tailstock also must be pushed back with the keys against the back of the center keyway of the machine table.

With both units tightened down as described above, an indicator can be used to check the alignment between the two pinions both vertically and horizontally. If the alignment is out more than .001 in either direction an adjustment must be made.

The headstock pinion should be checked for runout. With an indicator placed on the 650-3-62H pinion, rotate the indexer. The runout here should be no more than .0005. Runout of this pinion can be adjusted by loosening the (6) MF-33A 3/8-16 cap screws holding the faceplate to the indexer and tapping the faceplate until the pinion runs true. Retighten the (6) cap screws. Check both pinions with an indicator again for alignment. If still not aligned within specs the tailstock will need adjustment.

Begin with the tailstock piston retracted. Remove the 650-3-61K cushion from the tailstock piston cap. Note the timing of the 650-3-61H piston cap relative to the piston tube to reassemble in the same configuration. Remove the (4) MF-5 cap screws from the 650-3-61H piston cap. If the cap does not slide out, the MF-5 cap screws can be threaded into the four tapped holes of the cap and evenly tightened to push the cap out of the 650-3-61G piston tube. Beneath the piston cap is the 650-3-61J nose plate which is attached to the piston of the 650-3-61E stroking cylinder with a MF-172 1/2-20 hex nut. Activating the tailstock to light extend should push the nose plate out of the piston tube. Using the flats on the cylinder piston to keep it from turning, removed the 1/2-20 hex nut. Slide the nose plate off of the cylinder piston.

Remove the (4) MF-34 3/8-16 x 2” long cap screws holding the 650-3-61C tailstock extension on. The tailstock extension with the stroking cylinder should slide out through the back of the housing.

Slide the piston tube to be centered in the tailstock housing. Reinstall the 650-3-61H nose plate in the piston tube. Remove 6247A retainer, 6248 wiper, 6249 felt compressor, and 6251 felt oiler from front of 6225A bearing carrier. Loosen 100-82-2B 8-32 brass tipped set screw in bearing carrier. Tighten 6223 spindle nut until piston tube will not slide by hand. Loosen the (6) MF-32 3/8-16 cap screws holding the 6225A carrier on the housing. Loosen the (6) MF-31 3/8-16 cap screws holding the 650-3-61F rear bushing on the housing.

Install the 650-3-61T alignment tube assembly over the pinion of the headstock. Slide the tailstock up to fit the tailstock pinion into the alignment tube. Tighten (4) setscrews on the alignment tube to lock the two pinions in alignment. Push the tailstock housing to the rear to contact the keys with the middle keyway of the machine table and tighten its two mounting bolts. Check the piston tube with an indicator across the top and the back on both ends for straightness. Tap on either the carrier or the rear bushing to adjust alignment. The piston tube should be straight within .0005 in both directions. Retighten the 3/8-16 cap screws holding both the carrier and the rear bushing. Loosen the tailstock mounting bolts. Loosen the (4) set screws of the alignment tube assembly and slide the tailstock back from the headstock. Push the tailstock back on the middle keyway and tighten the mounting bolts. Recheck alignment of the pinions with an indicator in both directions. Recheck the straightness of the piston tube with an indicator. If alignment is within specs, reassemble the tailstock as follows:

Loosen the 6223 spindle nut until the piston tube can be moved by hand applying about 40-50 lbs. of force. Tighten the 100-82-2B set screw to lock the nut in place. Remove the 650-3-61H piston cap. Reinstall the 650-3-61C tailstock extension with the stroking cylinder attached and lightly tighten its (4) mounting cap screws. The stroking piston cylinder should be sticking out the front of the piston tube. Reinstall the 650-3-61J nose plate and tighten the 1/2-20 nut to secure. Release the air pressure from the stroking cylinder and slide its piston back by hand into the piston tube until the nose plate contacts the bottom of the counterbore in the piston tube. Tighten the (4) cap screws holding the 650-3-61C tailstock extension on. Reinstall the 650-3-61H piston cap and 650-3-61K cushion.

Block Blueprint Dimensions

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Block Dimensions: Cylinder Bore Dimensions

Block Make & Model	Cylinder Bore Location Left Bank	Cylinder Bore Location Right Bank	Cylinder Bore Spacing	Cylinder Bank Offset	Cylinder Bore Center from Dowel Pin Location
Dimension From					
Chevy 302, 305, 307 327,350, 400	1. 2.40 front dowel 2. 6.80 3. 11.20 4. 15.60	1. 2.40 front dowel 2. 6.80 3. 11.20 4. 15.60	4.4	.880 offset	1.42
Chevy 396, 427	1. 2.24 front dowel 2. 7.08 3. 11.92 4. 16.76	1. 2.47 front dowel 2. 7.32 3. 12.15 4. 16.99	4.84		1.85
Chevy 454	1. 2.24 front dowel 2. 7.08 3. 11.92 4. 16.76	1. 2.47 front dowel 2. 7.32 3. 12.15 4. 16.99	4.84		1.85
Chevy LS1	1. 2.200 front dowel 2. 6.600 3. 11.00 4. 15.400	1. 2.200 front dowel 2. 6.600 3. 11.00 4. 15.400	4.4		2.2
Chevy SB 2	1. 2.40 front dowel 2. 6.80 3. 11.20 4. 15.60	1. 2.40 front dowel 2. 6.80 3. 11.20 4. 15.60	4.4	.880 offset	1.42
Ford 289,302,351W	1. 2.190 rear dowel 2. 6.570 3. 10.950 4. 15.33	1. 2.190 front dowel 2. 6.570 3. 10.950 4. 15.330	4.38		Left Bank 2.115/2.125 Right Bank 2.118/2.122
Ford 351C, 351M & 400	1. 2.190 rear dowel 2. 6.57 3. 10.950 4. 15.33	1. 2.190 front dowel 2. 6.570 3. 10.950 4. 15.330	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 Make & Model	**Cylinder Bore Location Left Bank**	**Cylinder Bore Location Right Bank**	**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 dowel 2. 7.35 3. 12.25 4. 17.15	1. 2.45 front dowel 2. 7.35 3. 12.25 4. 17.15	4.9		
Ford 4.6 & 5.4			3.937		
Ford V10			3.937		
Chrysler 318,340,360	1. 4.02 rear dowel pan rail 2. 8.48 3. 12.94 4. 17.40	1. 3.14 rear dowel pan rail 2. 7.60 3. 12.06 4. 16.52	4.46	0.88	
Chrysler 383, 426 wedge	2.52 front dowel 7.32 12.120 16.92	2.52 front dowel 7.32 12.120 16.920	4.8		
Chrysler 426 Hemi, 440	2.52 front dowel 7.32 12.120 16.92	2.52 front dowel 7.32 12.120 16.920	4.8	9.5	
Chrysler V10 Iron					

Block Dimensions: Other Dimensions

Block Make & Model	Lifter Angle	Bore	Lifter Location Bank	Bore Left	Lifter Location Bank	Bore Right	Crank Diameter	Bore	Cam Diameter	Bore	Cam Bore to Crank Centerline Bore	Deck Height
Dimensions From												
Chevy 302,305,307 327,350,400	41 degrees Int & Ex	1. 1.58 front dowel 2. 3.14 3. 6.16 4. 7.72 5. 10.38 6. 11.94 7. 14.96 8. 16.52	1. 1.48 front dowel 2. 3.04 3. 6.06 4. 7.62 5. 10.28 6. 11.84 7. 14.86 8. 16.42	small journal 2.4906/2.4916 late model journal 2.6406/2.6416 400 sbc 2.8406/2.8416	1st Journal 2.0190/2.0210 5th Journal 2.009/2.0110	4.521	9.0315	
Chevy 396, 427	45 degrees Int. 38 degrees Ex. Caution Dart & World Blocks are 38.75 degrees	1. 1.34 front dowel 2. 3.14 3. 6.18 4. 7.98 5. 11.02 6. 12.82 7. 15.86 8. 17.66	1. 1.57 front dowel 2. 3.37 3. 6.41 4. 8.21 5. 11.25 6. 13.05 7. 16.09 8. 17.89	2.9365/2.9375	1st Journal 2.1395/2.1405 5th Journal 2.1295/2.1305	5.15	9.8	
Chevy 454	45 degrees Int. 38 degrees Ex. Caution Dart & World Blocks are 38.75 degrees	1. 1.34 front dowel 2. 3.14 3. 6.18 4. 7.98 5. 11.02 6. 12.82 7. 15.86 8. 17.66	1. 1.57 front dowel 2. 3.37 3. 6.41 4. 8.21 5. 11.25 6. 13.05 7. 16.09 8. 17.89	2.9365/2.9375	1st Journal 2.1395/2.1405 5th Journal 2.1295/2.1305	5.15	9.8	
Chevy LS1		1. 1.4004 ft dowel 2. 3.227 3. 5.800 4. 7.627 5. 10.200 6. 12.027 7. 14.600 8. 16.427	1. 1.173 ft dowel 2. 3.00 3. 5.573 4. 7.400 5. 9.973 6. 11.800 7. 14.373 8. 16.200	2.750/2.751	2.3276/2.3295 1st & 5th Journal	4.885	9.235/9.245	

Block Make & Model	Lifter Angle	Lifter Location Bank Bore	Bore Left	Lifter Location Bank Bore	Bore Left	Crank Diameter Bore	Cam Diameter Bore	Cam Bore to Crank Centerline Bore	D e c k Height
Dimension From									
Chevy SB 2	41degrees 15 min. Intake & Exhaust	1. 1.518 front dowel 3.353 2. 5.918 3. 7.753 4. 10.340 5. 12.152 6. 14.740 7. 8. 16.552	1. 2.306 front dowel 4.140 2. 6.706 3. 8.540 4. 11.127 5. 12.940 6. 15.527 7. 8. 17.340	1st Journal	1st Journal 2.0190/2.0210 5th Journal 2.009/2.0110	4.521		
F o r d 289,302,351W	41degrees 15 min. Intake & Exhaust	1. 1.375 Rear dowel 3.105 2. 5.755 3. 7.485 4. 10.135 5. 11.865 6. 14.515 7. 8. 16.245	1. 1.375 front dowel 3.105 2. 5.755 3. 7.485 4. 10.135 5. 11.865 6. 14.515 7. 8. 16.245	2.4412/2.442 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	
F o r d 351C, 351M & 400	41 degrees 15 min Intake & Exhaust	1. 1.375 rear dowel 3.105 2. 5.755 3. 7.485 4. 10.135 5. 11.865 6. 14.515 7. 8. 16.245	1. 1.375 front dowel 3.105 2. 5.755 3. 7.485 4. 10.135 5. 11.865 6. 14.515 7. 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 15 min Intake & Exhaust	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.				

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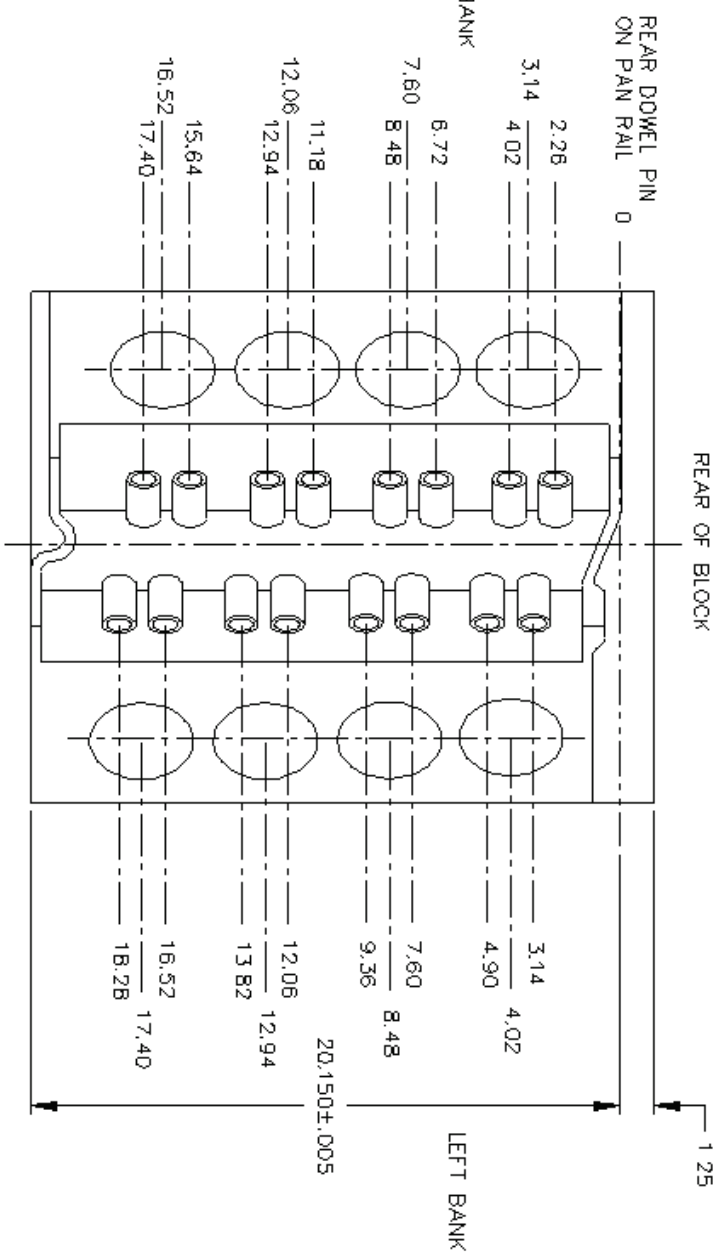

Chevrolet Big Block Dimensions

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

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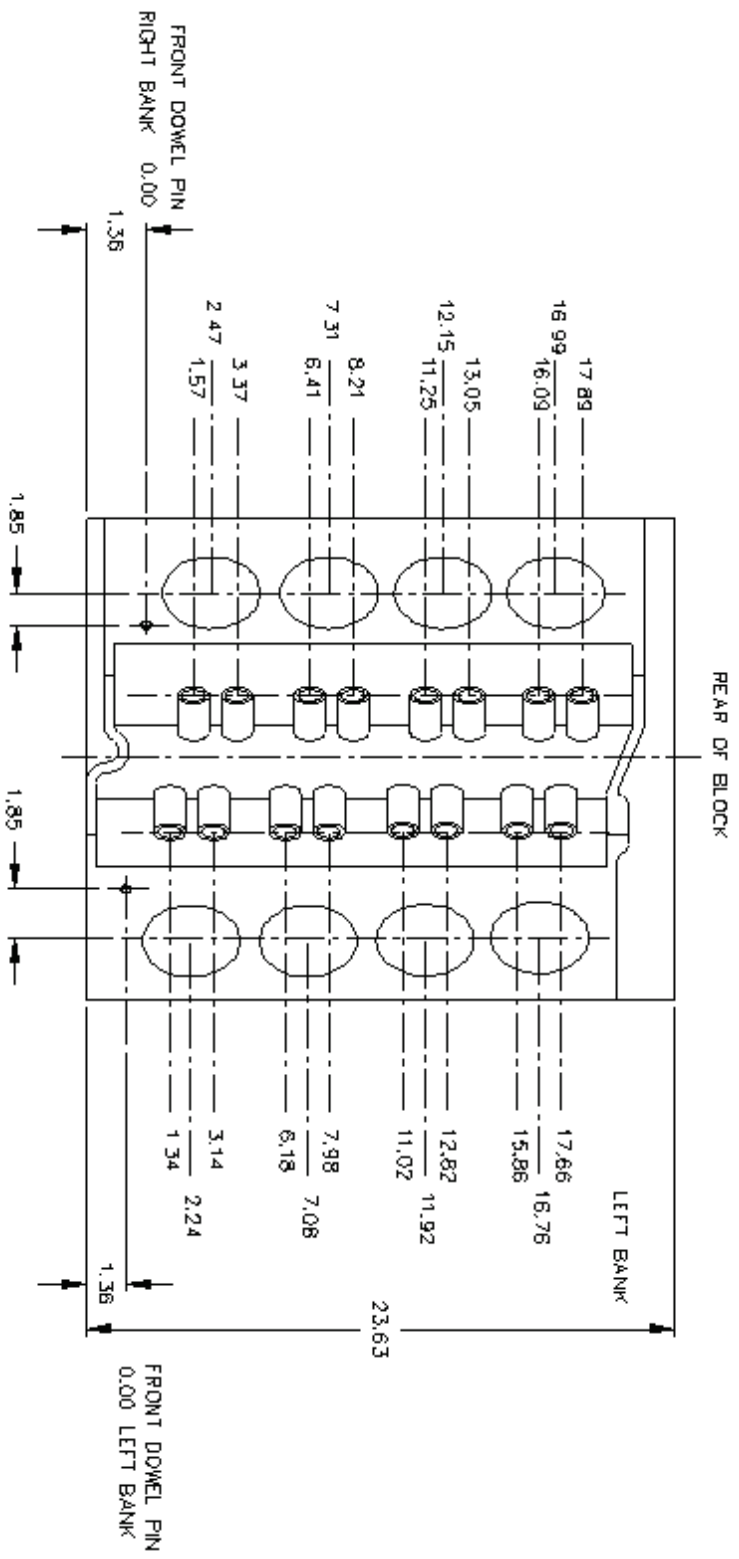

Chevrolet Small Block Dimensions

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	

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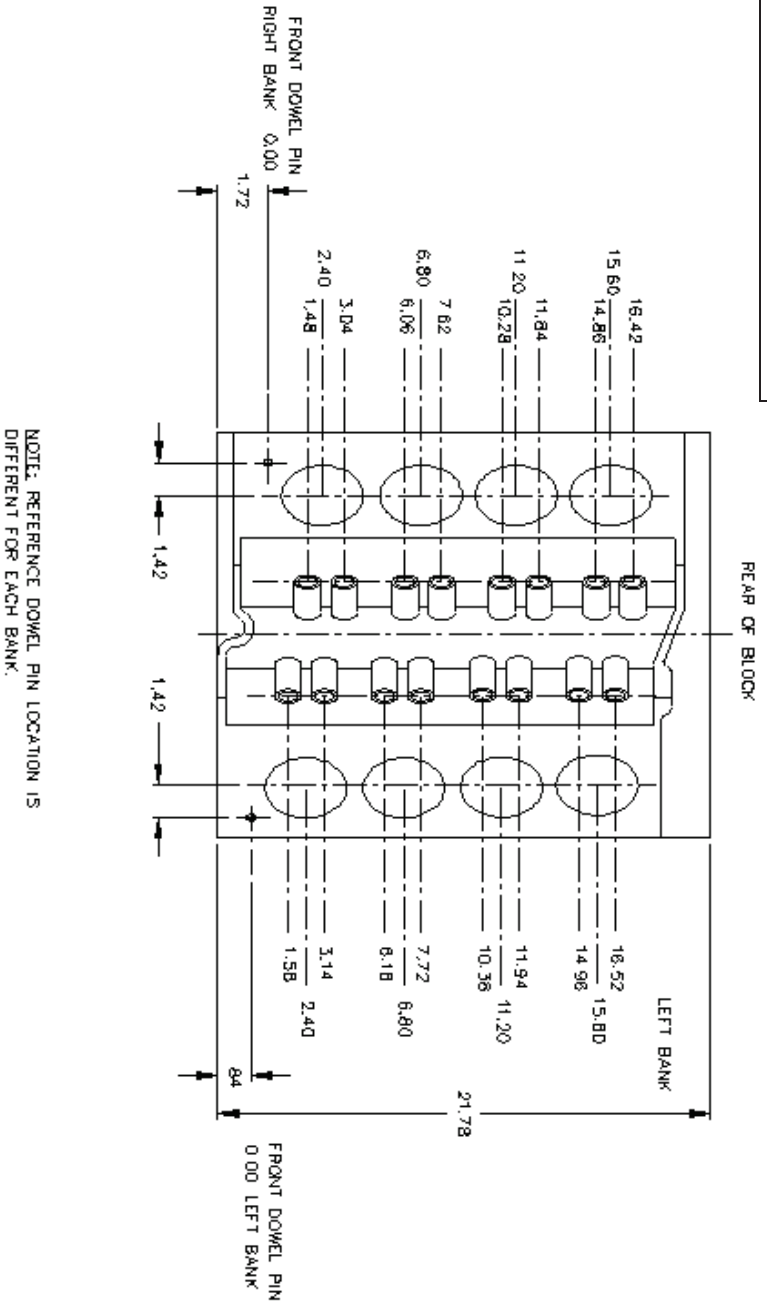

NOTE: REFERENCE DOWEL PIN LOCATION IS DIFFERENT FOR EACH BANK.

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

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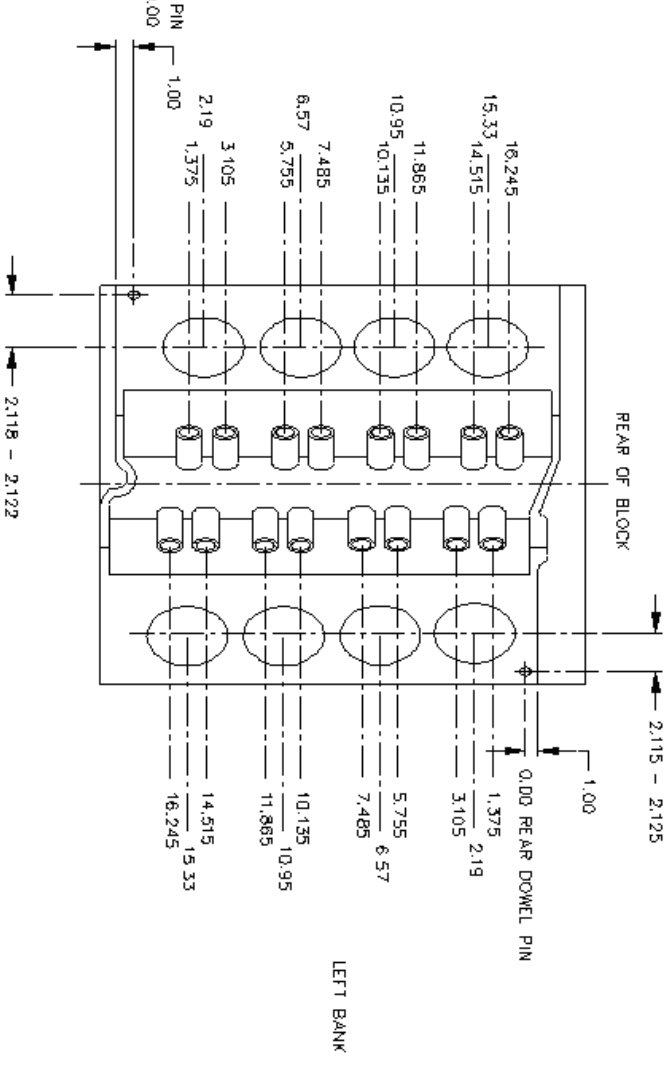

Ford 351C-400 Dimensions

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

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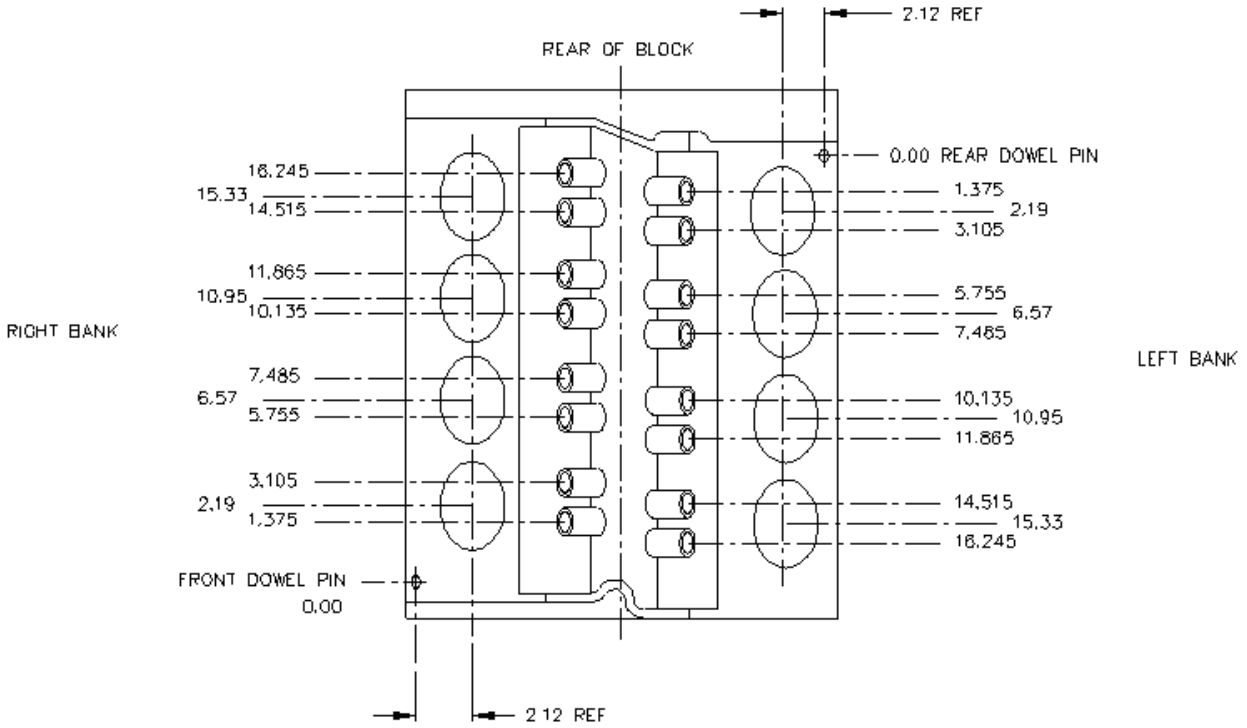
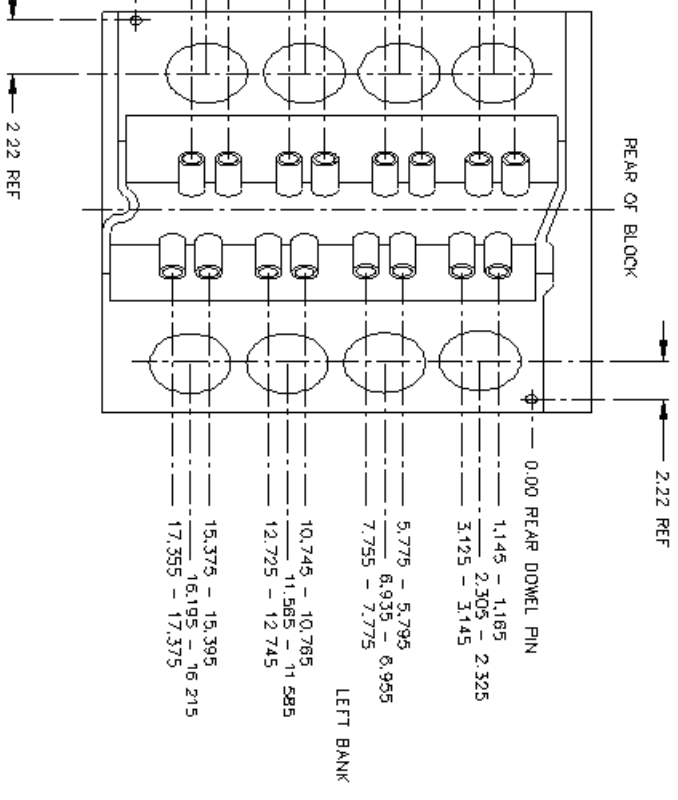


NOTE: REFERENCE DOWEL PIN LOCATION IS DIFFERENT FOR EACH BANK.

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.



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.

This 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

This machine ***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.

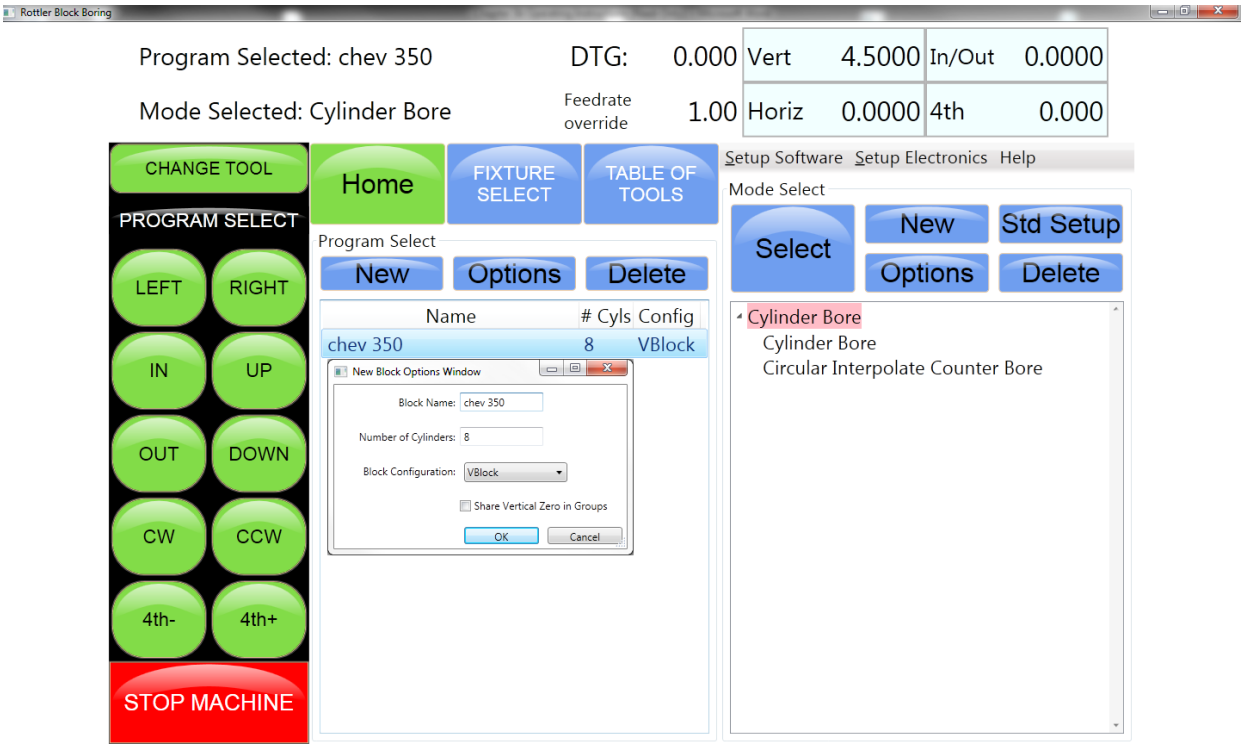
Create a Block Program

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.



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. 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 and then Rough Through Bore on the screen. This will bring up the boring program with the Set Zeros tab shown.

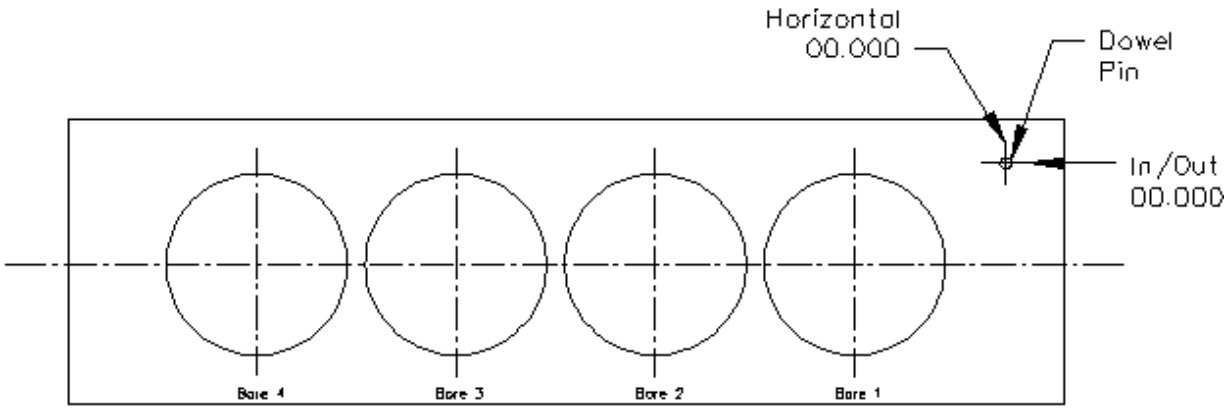
NOTE: Once a certain feature is discussed in a particular mode it will not be discussed again in the following modes.

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 it's 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

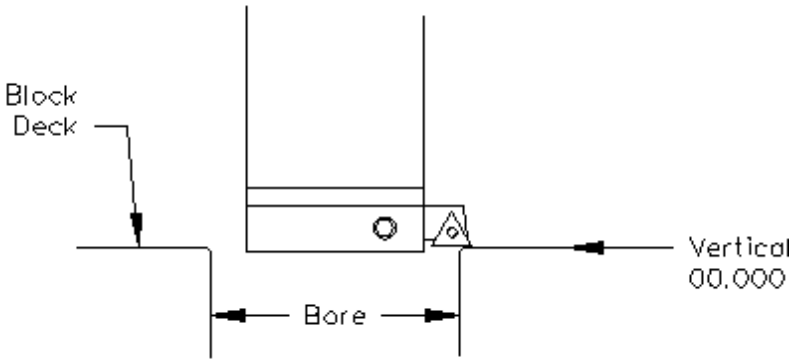
For this example, the Dowel Pin will be our zero point for the Horizontal and In/Out axis. Using an indicator or electronic probe center the spindle on the Dowel Pin then press the Horizontal and In/Out Zero buttons. The display next to these buttons will go to zeros. The Horizontal and In/Out zero positions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

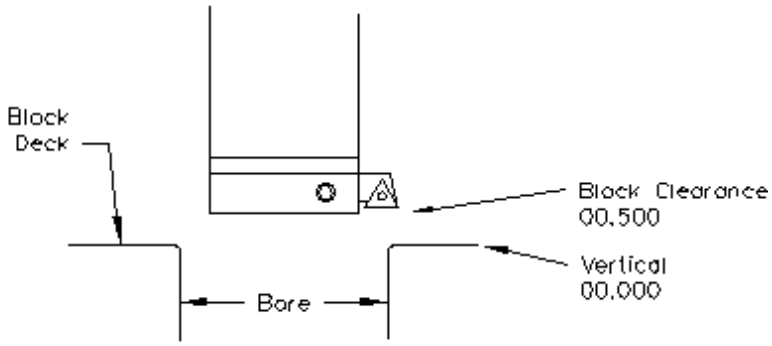
Even if you are not going to be boring a block to the blue print specifications it is recommended to have the Blueprint values entered. It will speed up the process of indicating and probing a block by giving the operator a close estimate of bore location.

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.

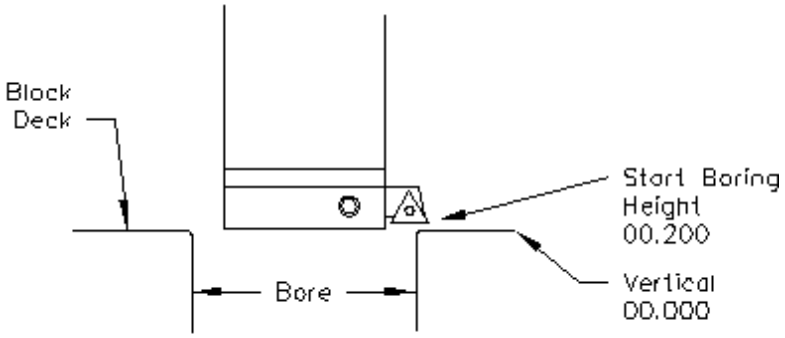


Centering Height

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

Start Boring Height

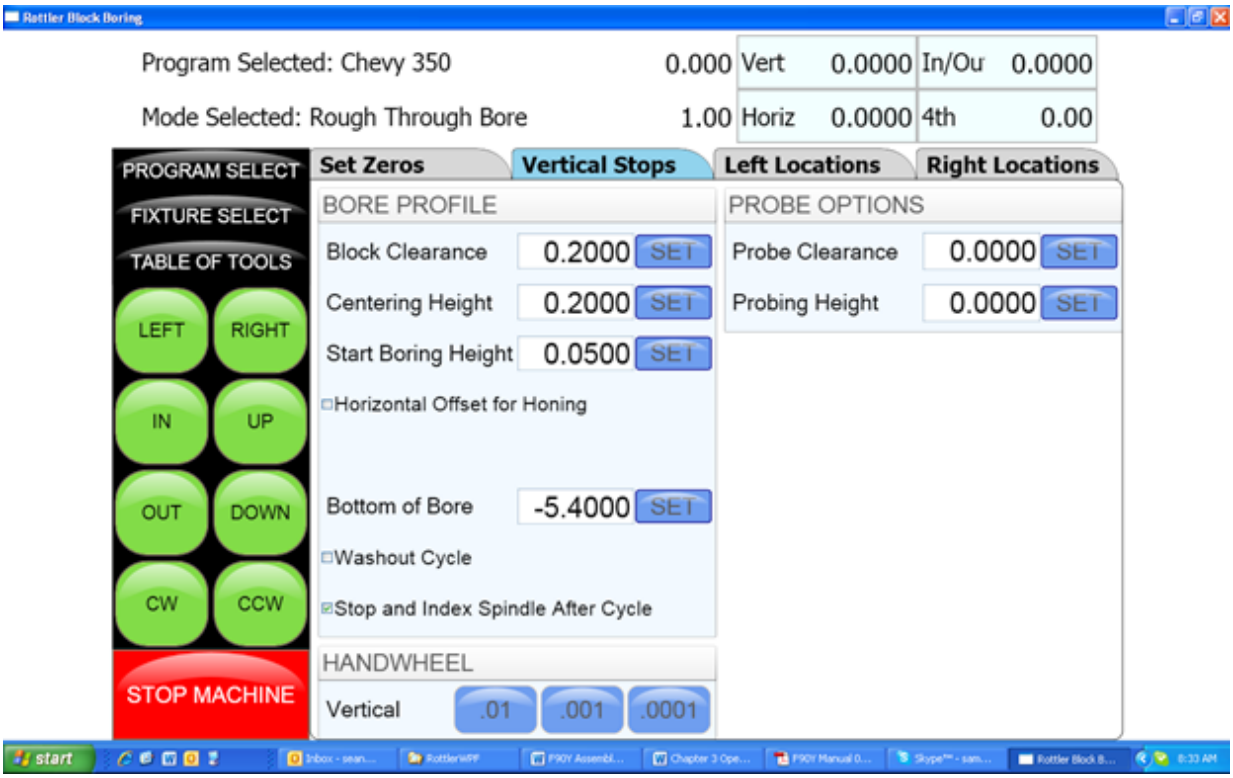
This is the distance above zero or the block deck where you want the cutterhead to start rotating and the downward feed to start. Generally this is just a short distance above the block deck to minimize the amount of time the machine bores through air.



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.

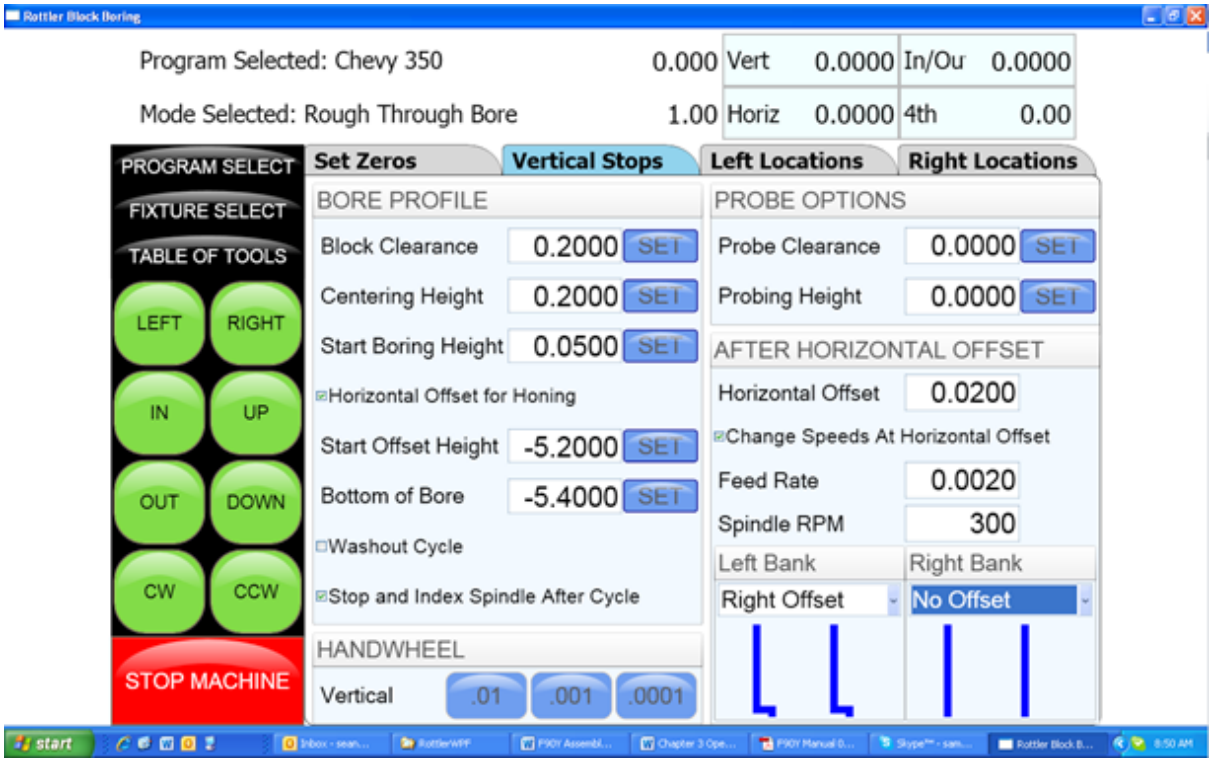


When Blueprinting the Probe is not used. It will be discussed later in this Chapter.

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 that 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 need 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

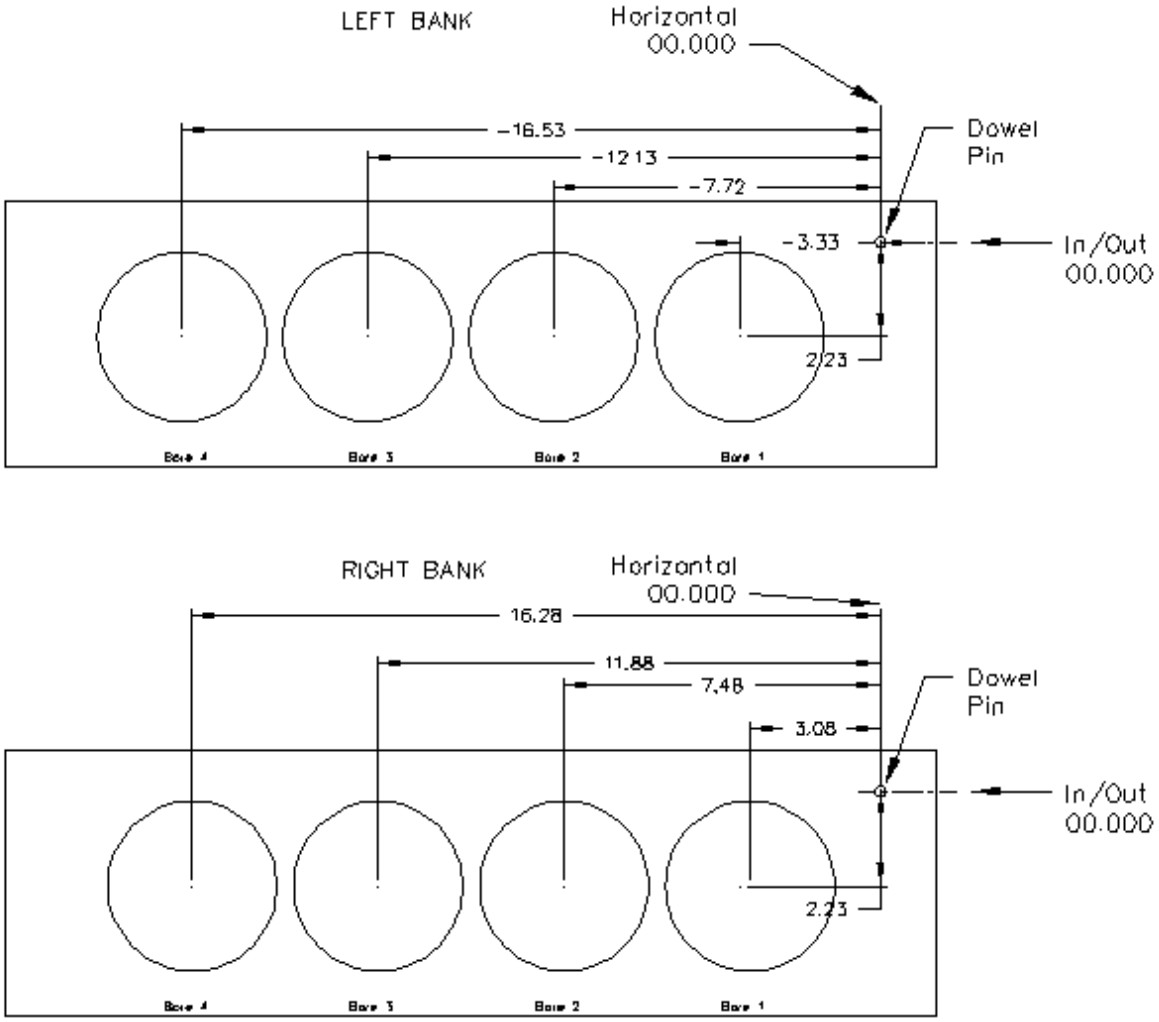
Checking this box will open another window on the right hand side of the screen. Here you can enter the RPM and number of revolutions that will be performed when the cutter reaches the Bottom of Bore position. In Through Boring this is not generally used. This is used when a certain type of finish is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

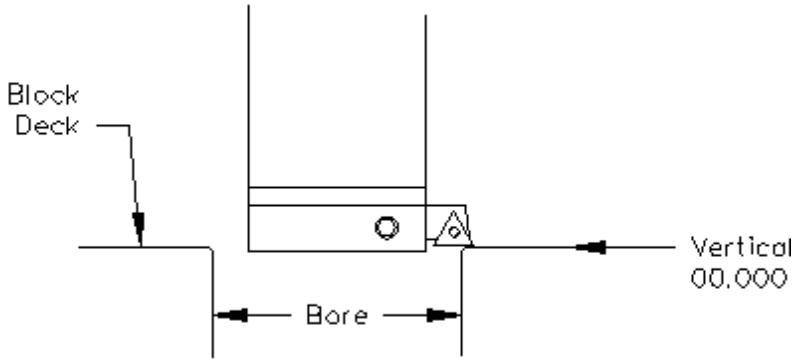
Indicating

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.



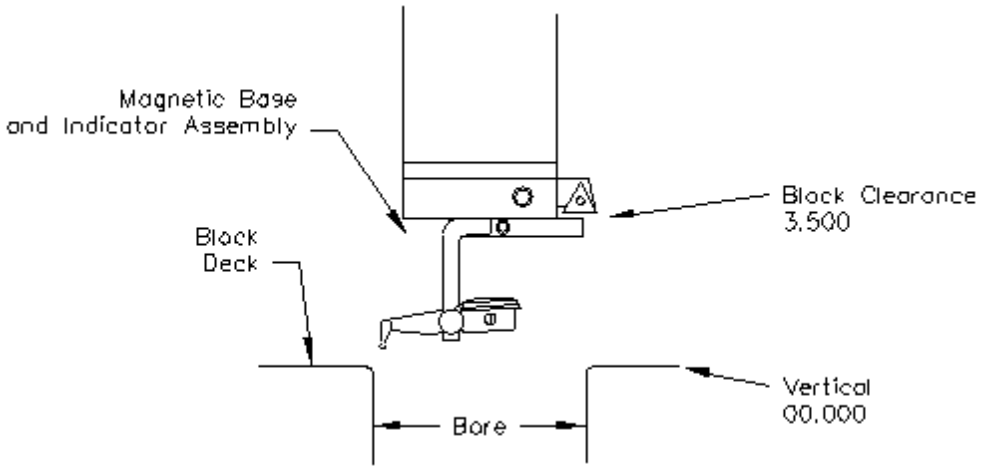
The zeros points for all axis have now been set. All the numbers entered from this point on will reference these zero positions. You are finished with the Set Zeros screen, select the next Tab to the Right.

Programming Vertical Stops

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

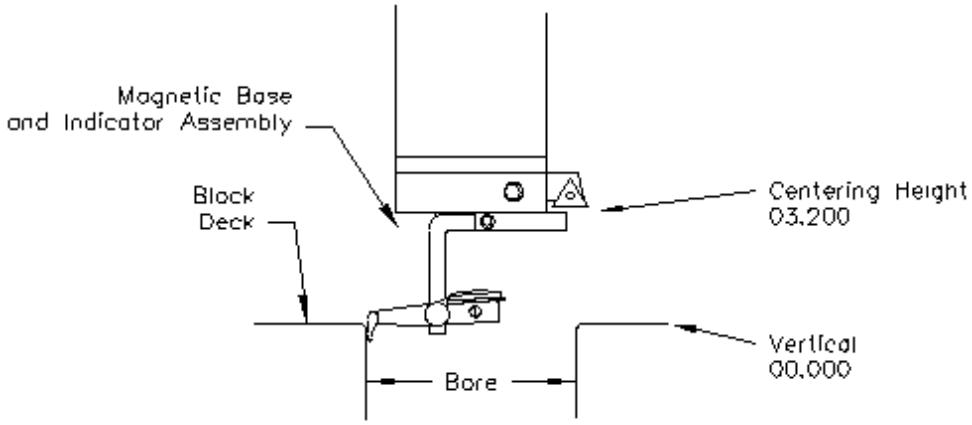
Block Clearance

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.



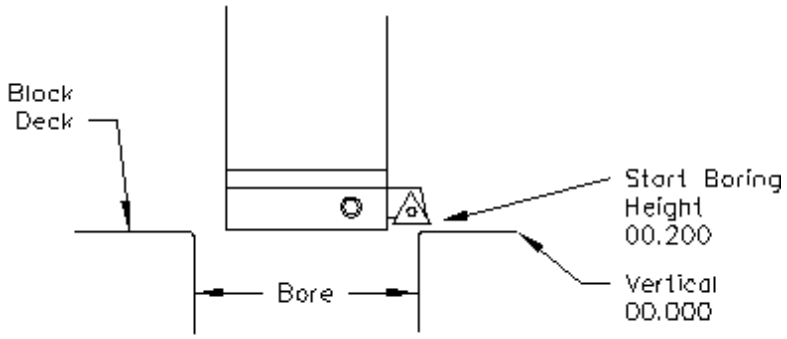
Centering Height

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 indicting 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.

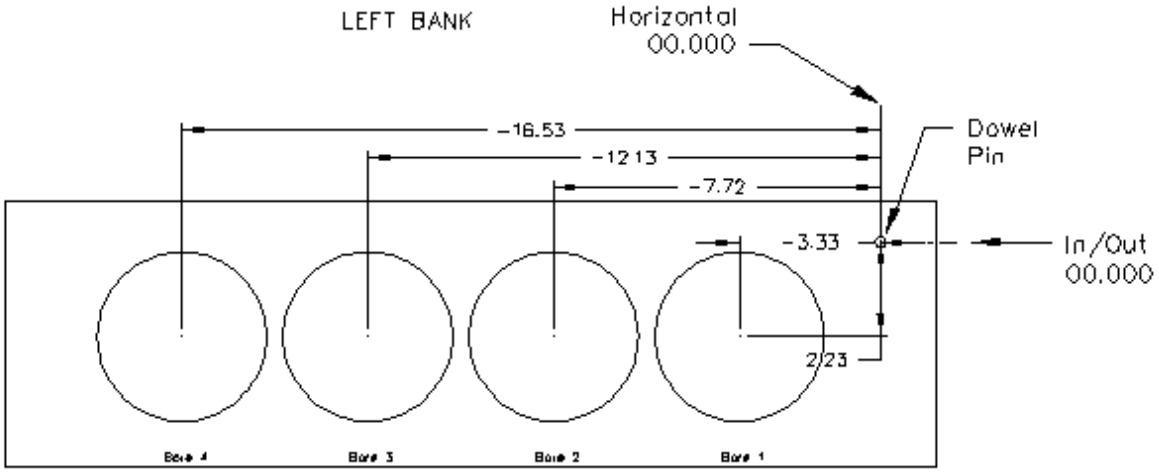
This is an example of what the above program would look like on the vertical stops.

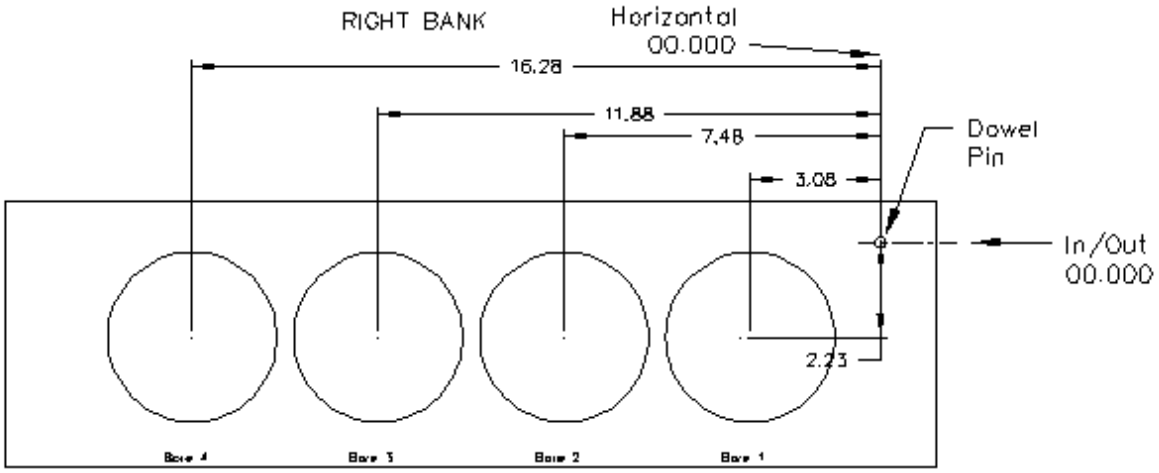
The Vertical stops have now been set. You are finished with the Vertical Stops screen, select Left and/or Right Locations.

Bore Locations

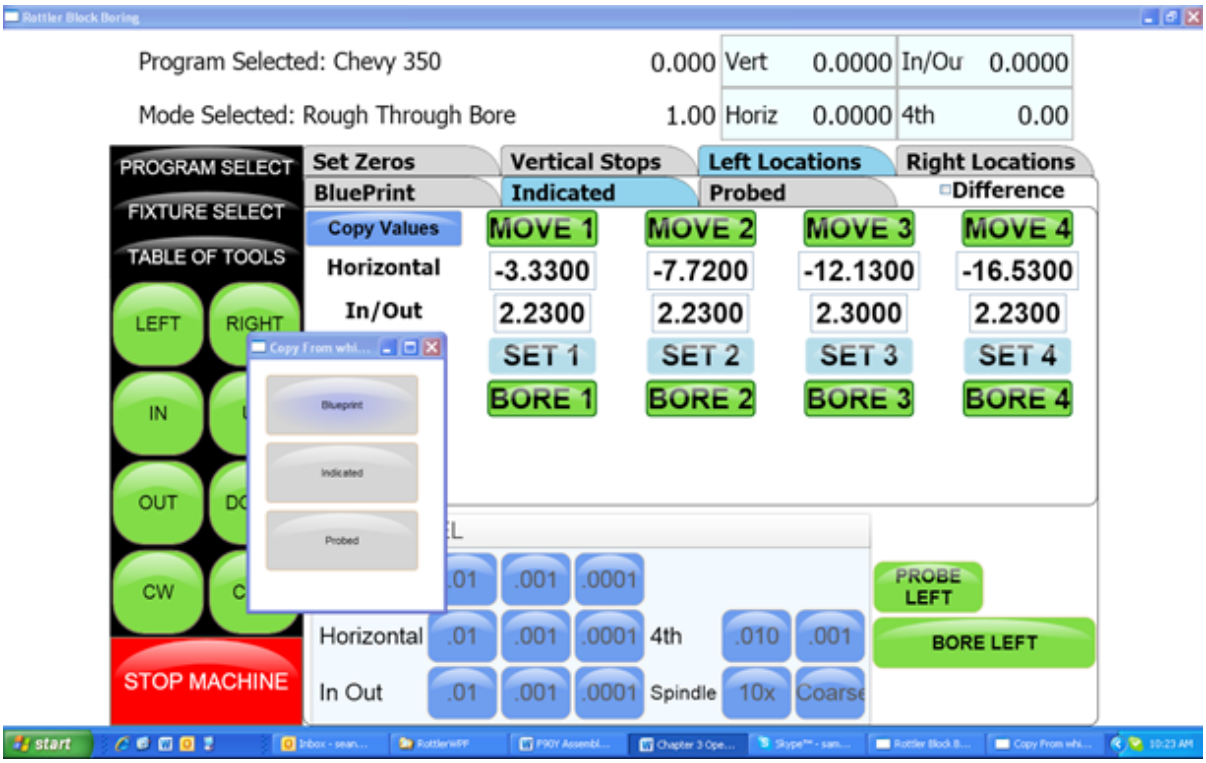
To build a program you must set the Horizontal and In/Out Stops for the program. There are eight (8) Horizontal and In/Out stops used in the boring program. All Horizontal and In/Out stop are based from where their zero positions were set.

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.

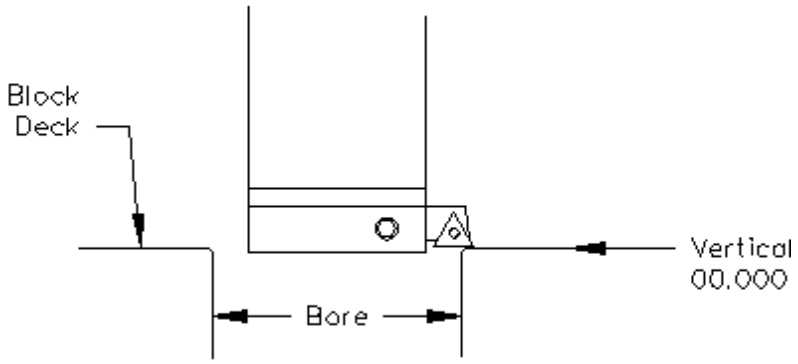
Probing

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

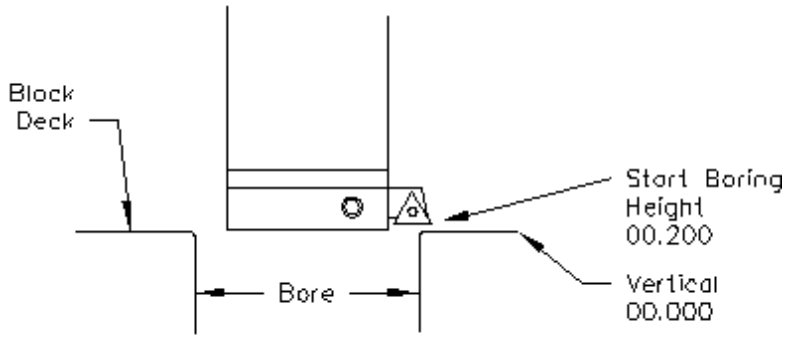
This is the distance above the zero position or block deck allowing the probe to move to the next bore unobstructed.

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

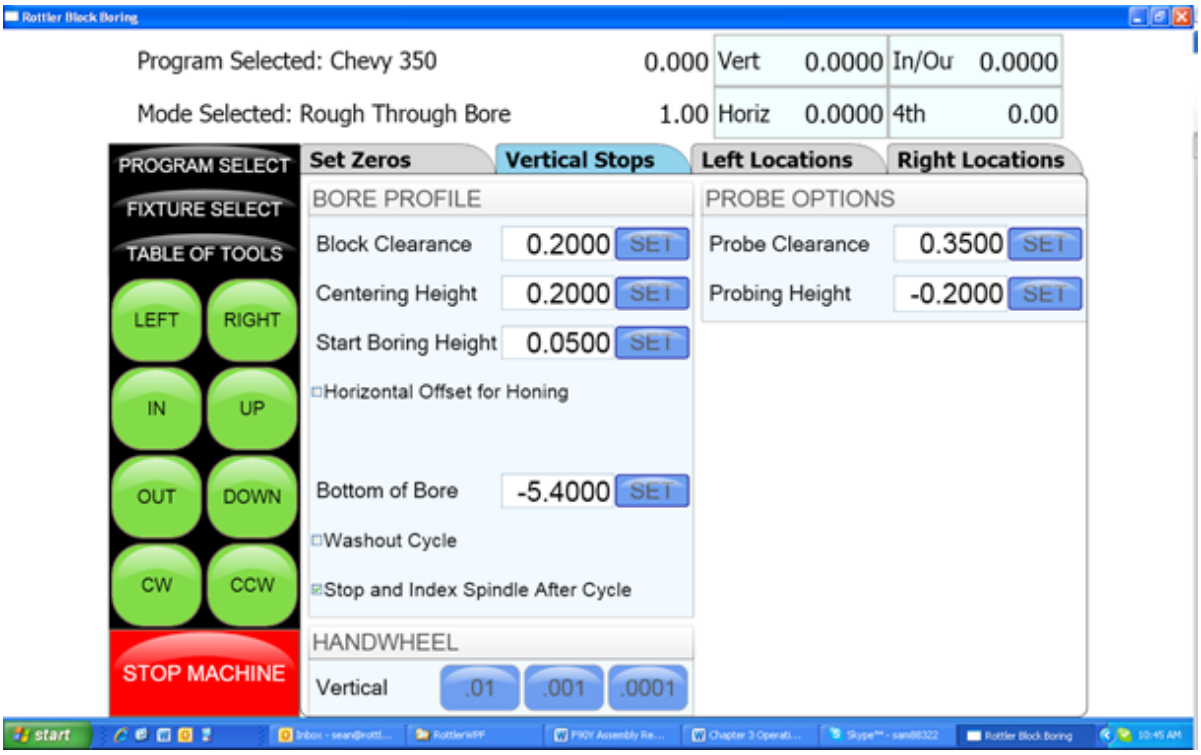
This is the distance above zero or the block deck where you want the cutterhead to start rotating and the downward feed to start. Generally this is just a short distance above the block deck to minimize the amount of time the machine bores through air.



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

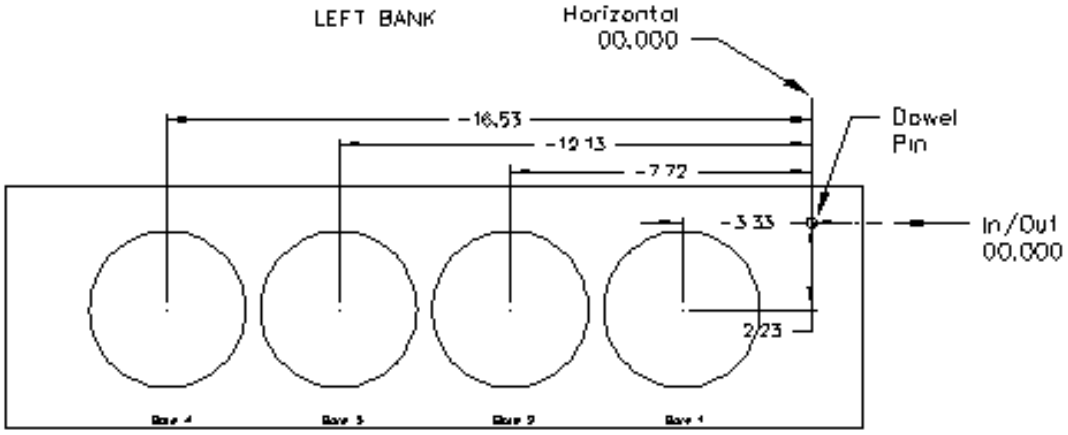
This feature is located on the Set Zero page. This allows easily find the center of a hole or cylinder. Roughly place the probe in the center of a cylinder. Press Probe Auto Center. The cylinder will be probed in 4 places, when finished the probe will move to the center of the probed cylinder. Pressing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

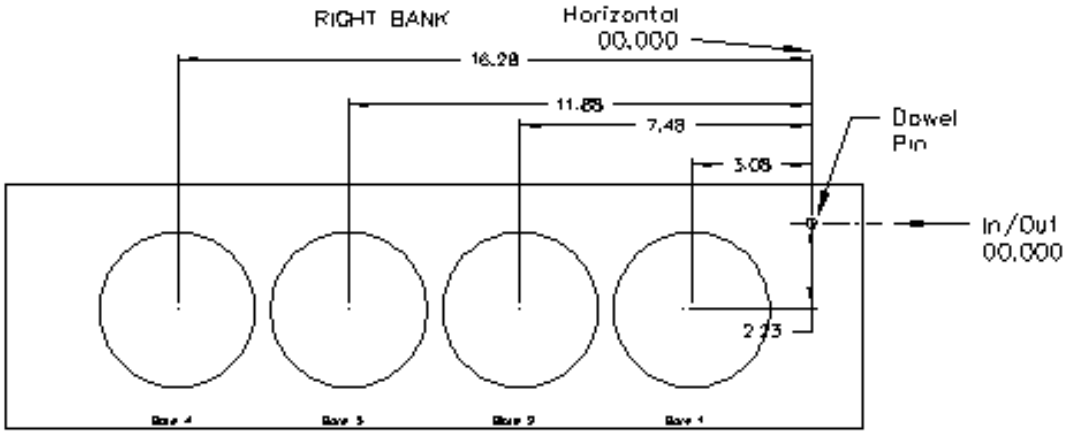
Automatic Probing Procedure

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.





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.

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

Program 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.

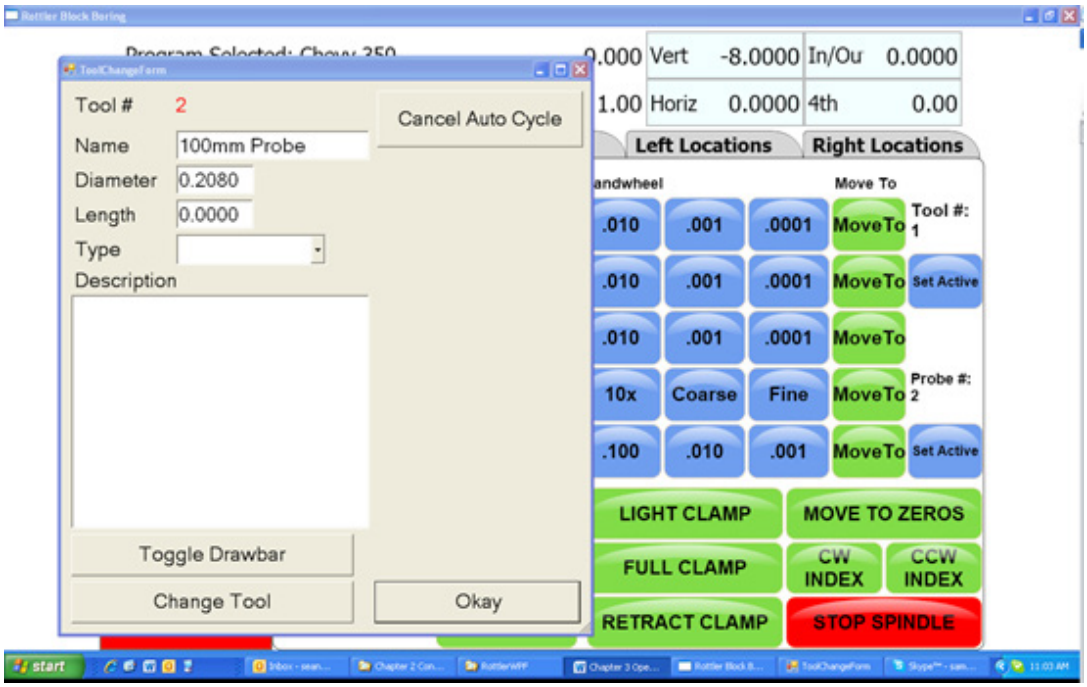
NOTE: The Tool highlighted in red is the currently Active tool.

The following shows what the screen will look like with to 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 very 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.



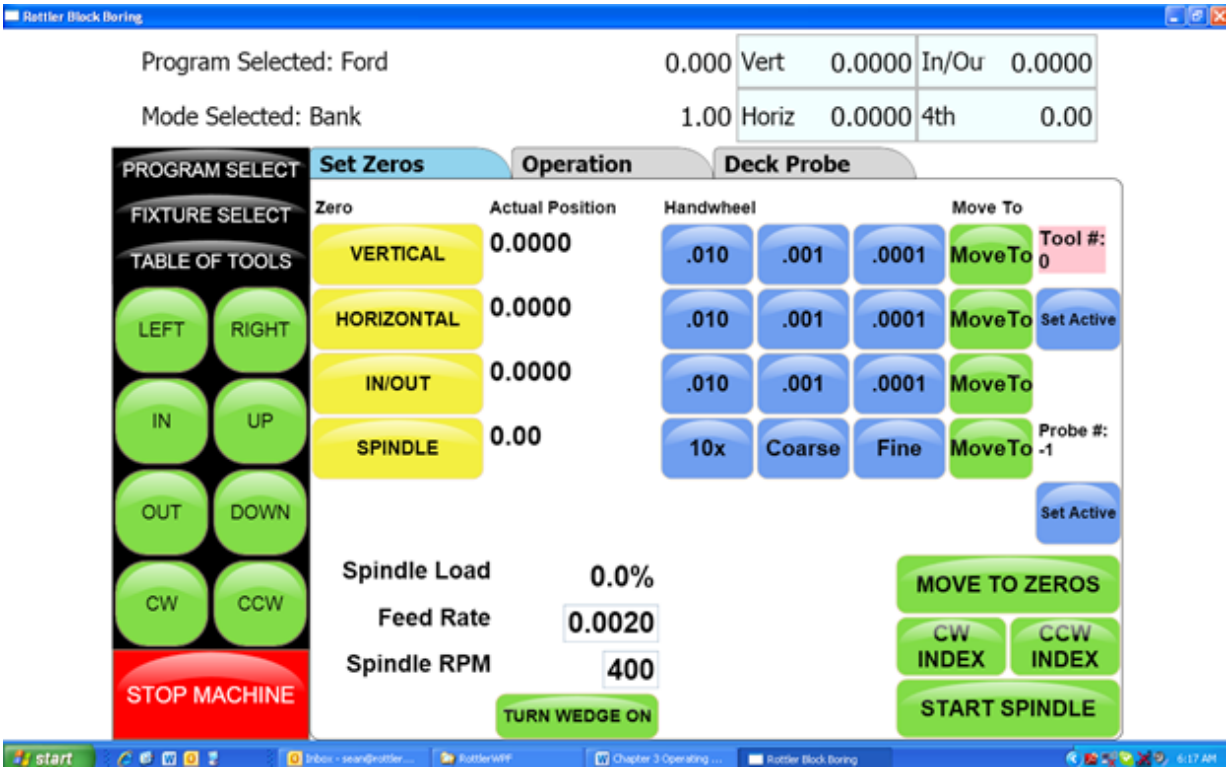
The Currently Active tool in a program will be highlighted in Pink on the Set Zero page.

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

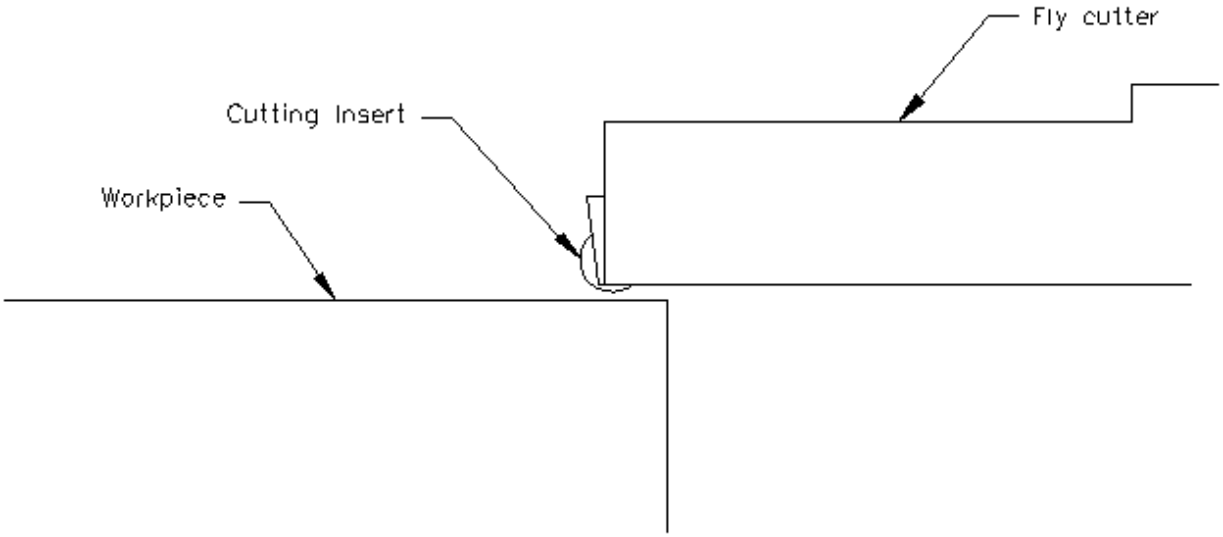
For this example we are going to set the In/Out Zero at the center line of the work piece.

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 ¼". 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

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 wet 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.

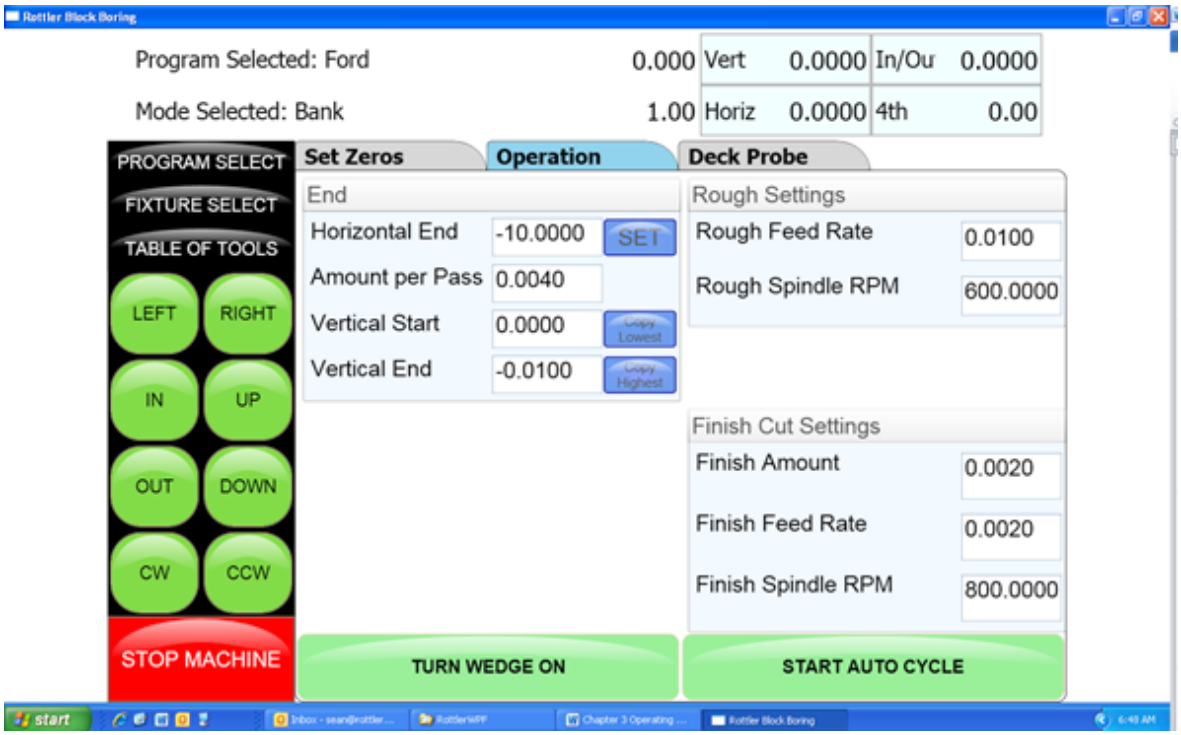
Finish Feed Rate

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 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.

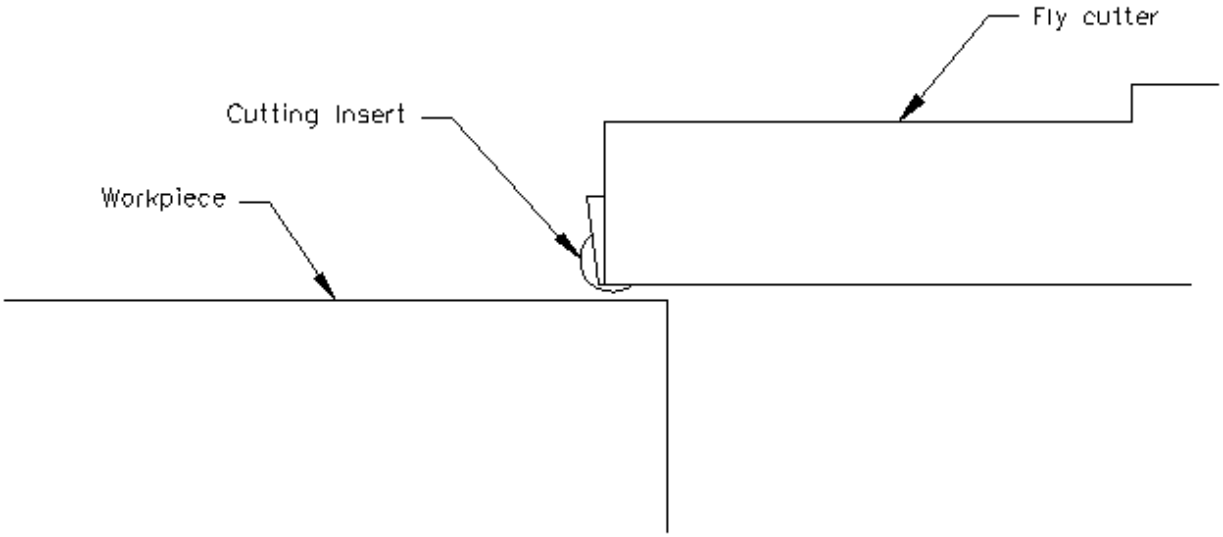
Vertical Zero

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 my 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 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.

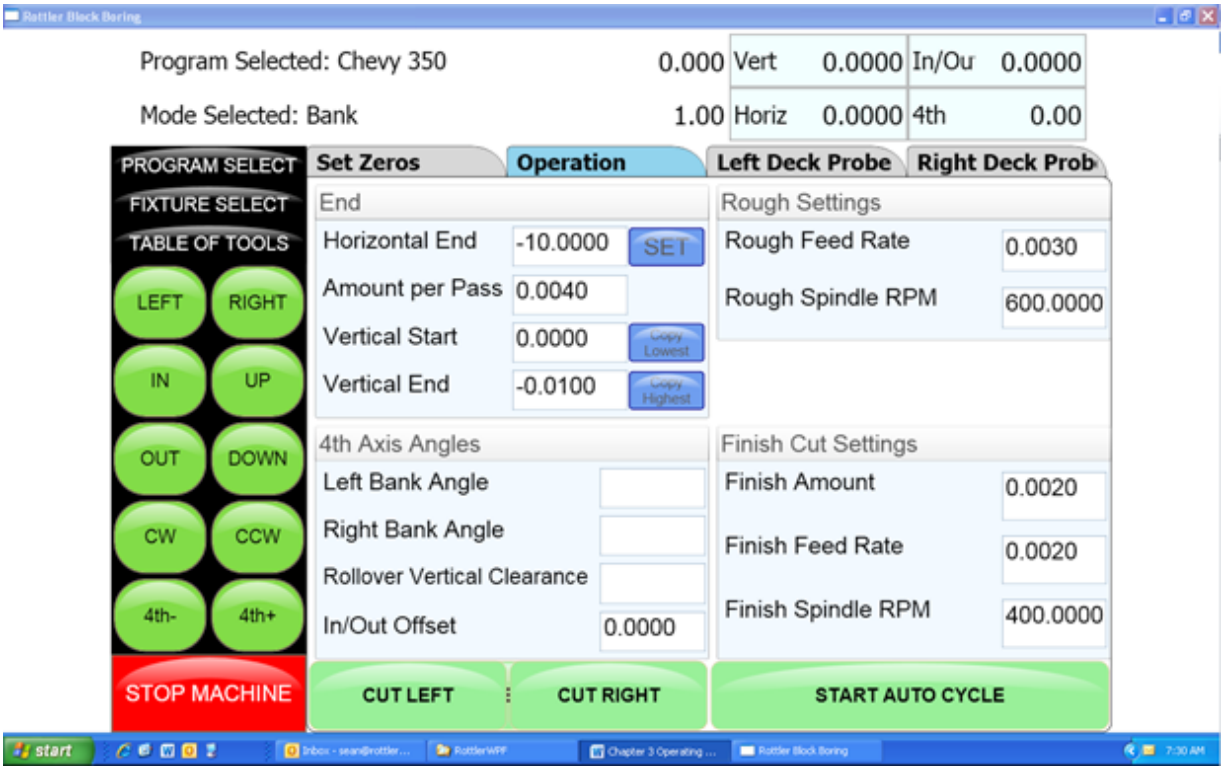
Start the spindle. Press the Vert .001 button to put the handwheel in .001 per detent. Slowly move the spindle downward until you can hear or see the cutter just touch the block. Press your Vertical Zero button here. Press the Right travel button to feed the spindle off of the work piece. When the cutter 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 F90Y 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 wet 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.

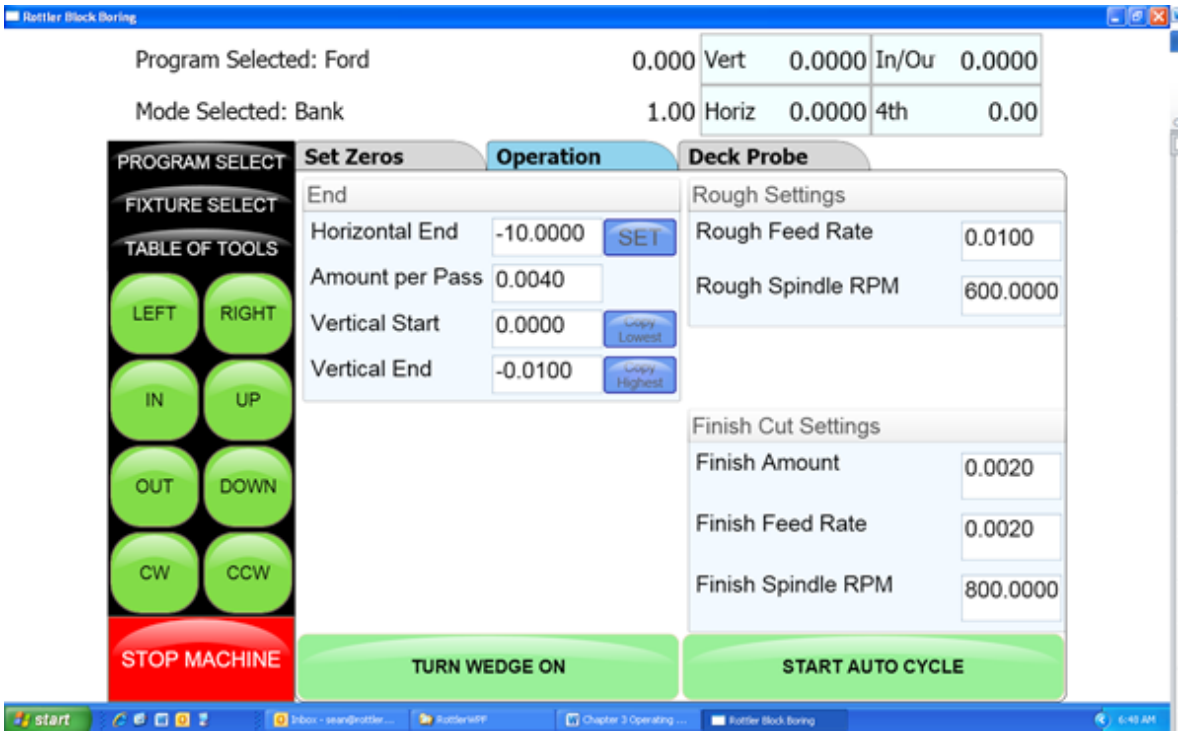
Finish Feed Rate

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.

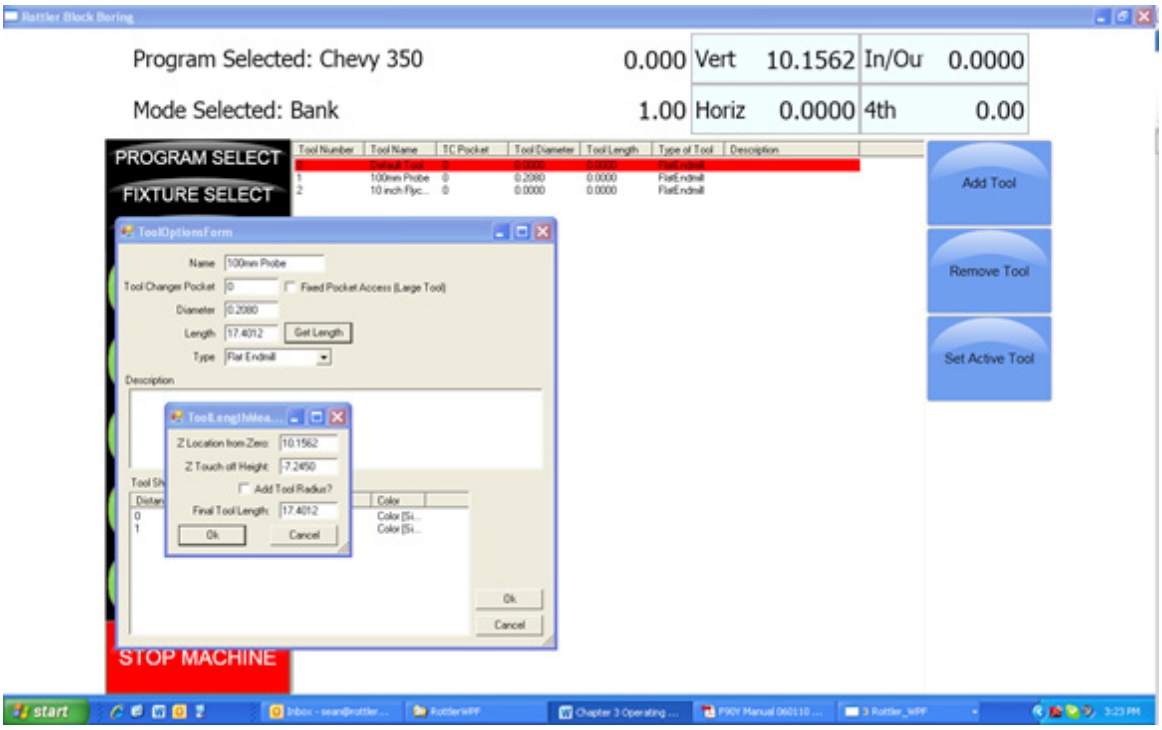
Go to Program Select, then select the block you are working with and then Mill Mode.

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 you r 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 sill 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. Her 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.

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. The block will then roll back over to the Left bank and the spindle will move to the first Left location and stop.

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

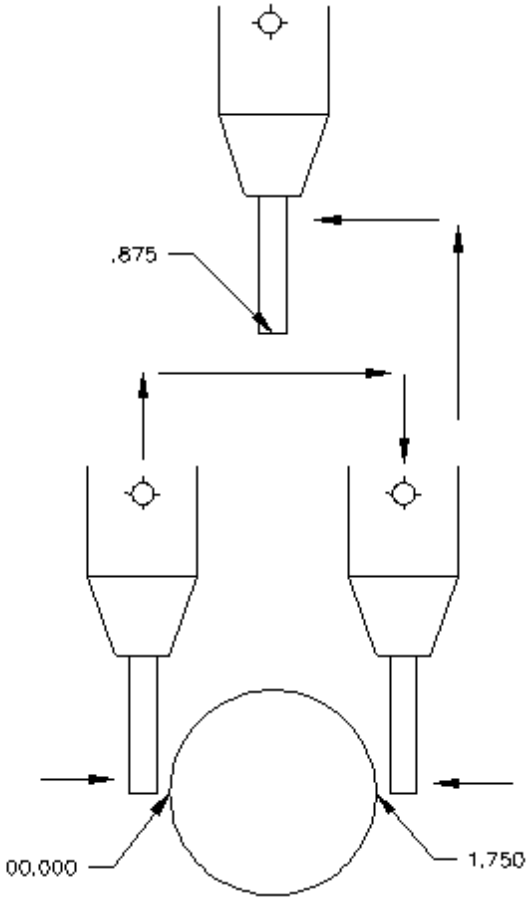
Pressing this button will start the Auto Cycle for Both Banks. First the Left bank will be cut to the set parameters. The spindle will go to the Clearance Height and Roll over to the Right bank and cut it to the set parameters. The Spindle will again go to the Clearance Height and roll over to the Left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

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

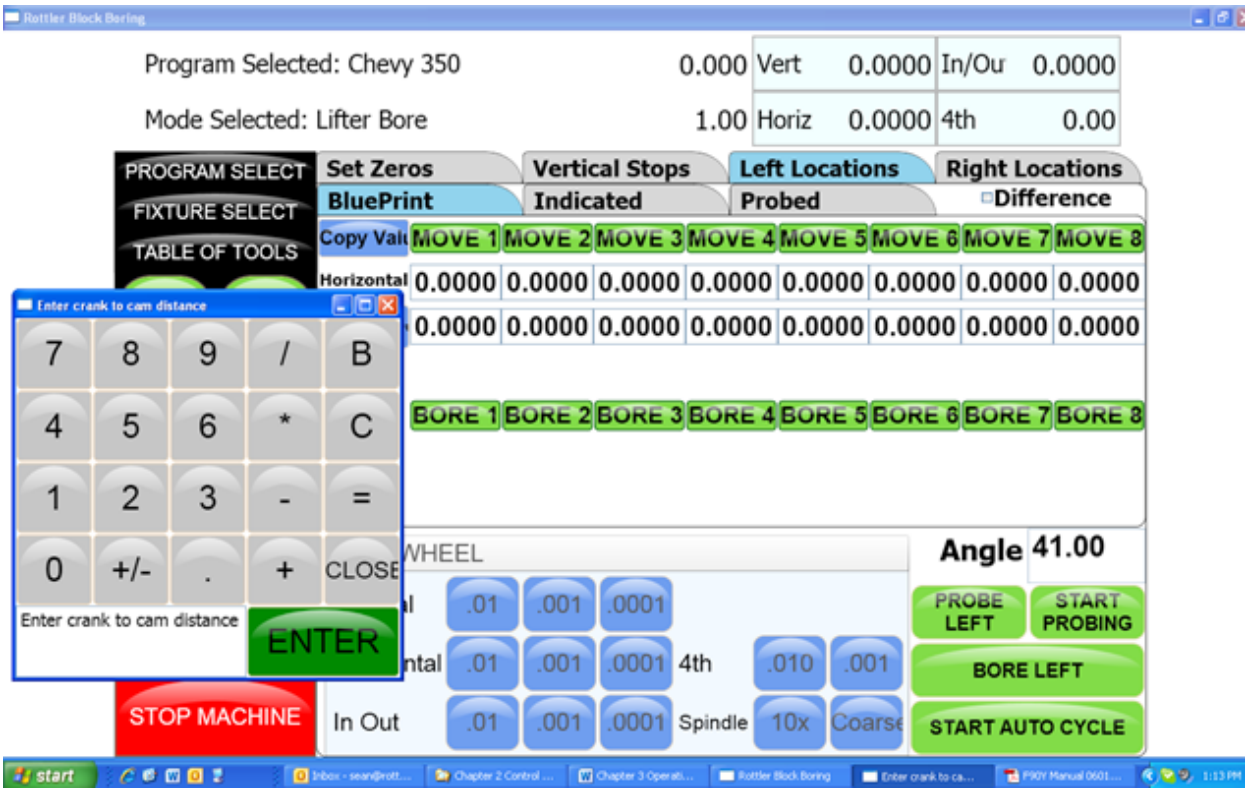
Pay particular attention when setting this height, there are often protrusions in the casting that will not allow the End Mill to travel unobstructed all the way to the start of the lifter bore. It is safest to set the Start Boring Height above the Deck.

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.



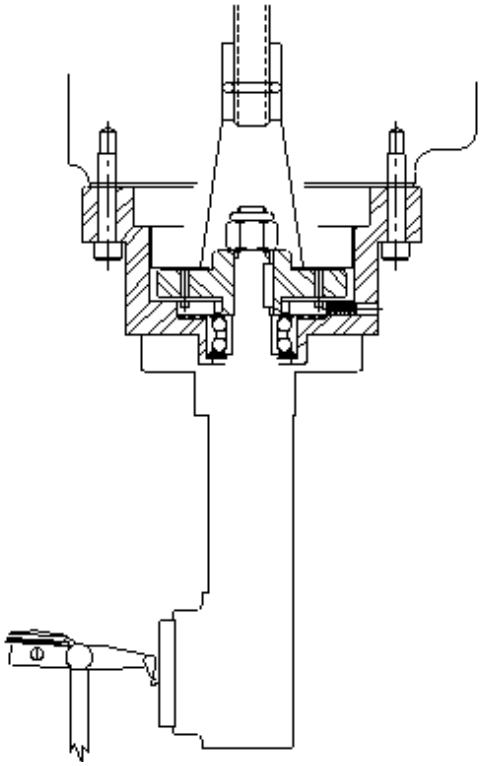
Line Bore Mode

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 form 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

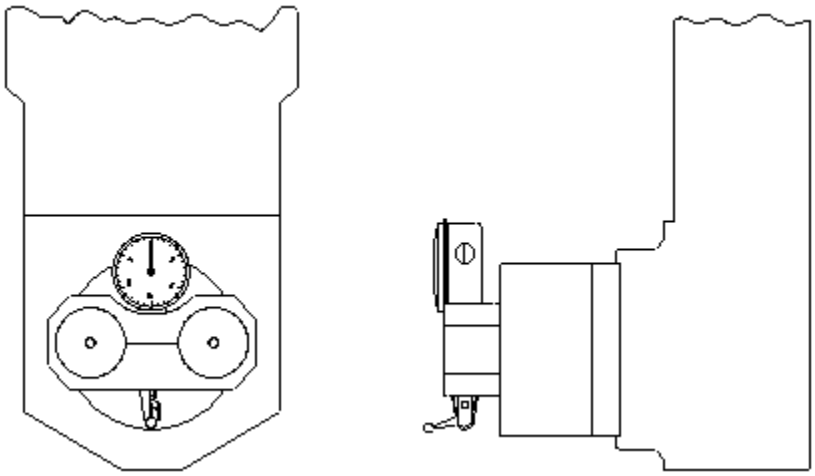
The purpose of setting zero points is to give the operator a specific point to build programs from. The machine also uses these zero points to run the program from. The zero points can be set at any point in the machines’ travel. Each axis (except the Spindle rotation) will need to have a zero point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

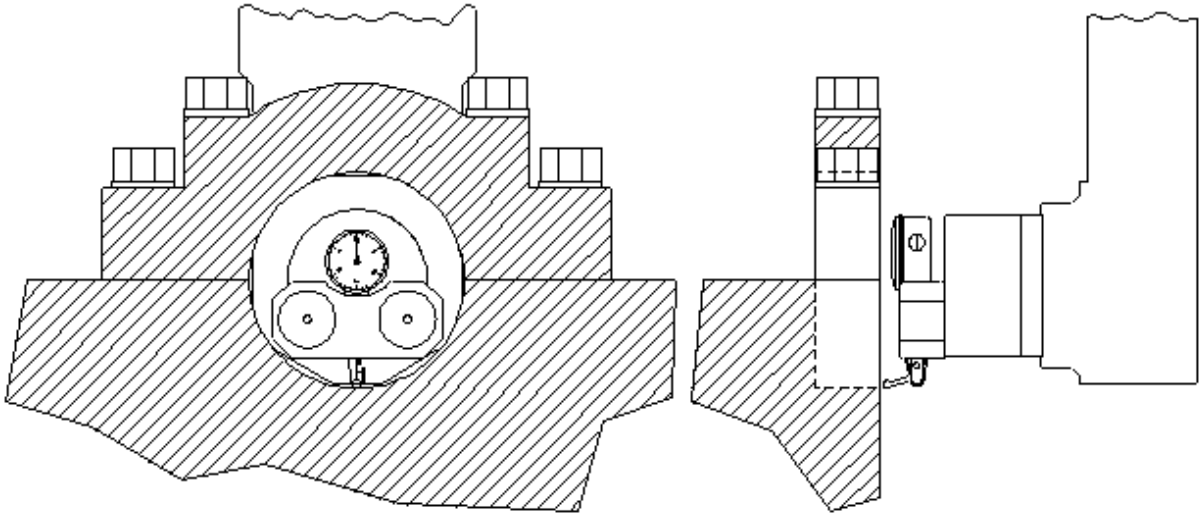
In/Out and Vertical Zero

Locate the supplied 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 he 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 point 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 negative value that will allow the 90 degree head to travel over the cap and bolts to the next main bore unobstructed.

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

Running the Auto Cycle

You will need to set a Feed Rate and Spindle RPM on this screen to run an auto cycle. After this is done press the “Move to Zeros” button. The spindle will move up the Vertical Block Clearance distance if it is not already there. It will then move to the Horizontal and In/Out axis to the zero position. The vertical will then move down to the zero position and stop.

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 radius, 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 the 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.

Cam End Tunnel Boring

To bore the end tunnels on a block refer to Block End Truing Fixture 650-3-30 when used with Cam Boring for set up the block. Select a Cam bushing that will fit the existing Cam bore and place it in the Cam Spacer. Place the distributor end of the block facing up. You will need to be in the Bore Mode on the control panel.

Center the spindle over the Main bore using the electronic probe or magnetic base with indicator. Zero the Horizontal and In/Out axis.

The Cam spacer placed in the center T-Slot should put the Cam tunnel in line with the Main bore.

Move the table the specified distance toward the Cam Tunnel. This distance should in the blue printing specifications for the block you are working with.

Check that you are on center of the cam bore with the electronic probe or indicator. If it is not on center the block may have been previously bored or honed incorrectly.

⚠ CAUTION **Be very careful when correcting the existing Cam bore on the In/Out axis. This could cause the distributor gears to be damaged.**

You can also skip the above procedure and center on the existing Cam bore.

Once centered on the Cam bore or set to correct the Cam bore, zero the Horizontal and In/Out axis.

Install the 650-2-3F cutterhead into the spindle.

Refer the Bore Mode, Programming Vertical Stops earlier in this chapter to set the vertical stops.

Note: It is important to bore the Cam End bores the full length of the cutterhead on both ends. If you do not you may have trouble getting the Cam Bar to bore the full length between Cam End Bores.

Hint: It is helpful and more efficient to have three (3) tool holders set up for this procedure, two (2) of them for large material removal and one for a finish pass of .020” to .030”.

Bore the distributor end Cam bore.

Note: To bore the oil groove in the Cam Bore, refer to the Cam Bore Oil Groove section in this chapter. This is a CNC operation.

Remove the block from the fixture, select a Cam bushing that will fit the bore that was made on the distributor end of the block.

Rotate the block so that the distributor end is now facing down. Tighten the block into the fixture. The Cam spacer will put the end bores in line.

Press the move to zeros button.

Bore this end off the block.

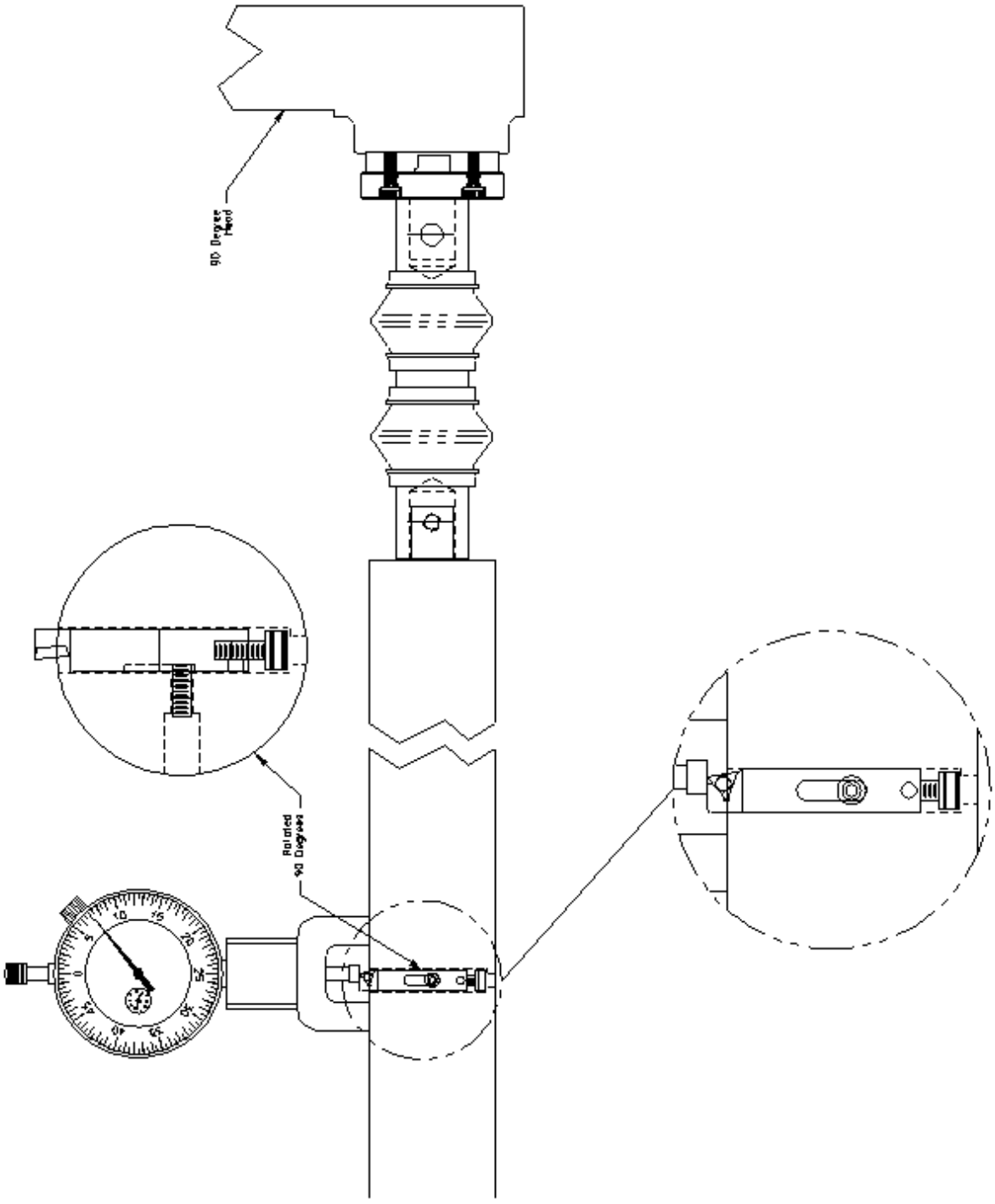
Remove the block and the fixturing from the machine.

Refer to Cam Tunnel Boring in this chapter to bore the center tunnel of the Cam.

Cam Tunnel Boring

To bore the center of the Cam tunnel refer to Cam Tunnel Boring in the Block Mounting section of this chapter. Mount the block as shown.

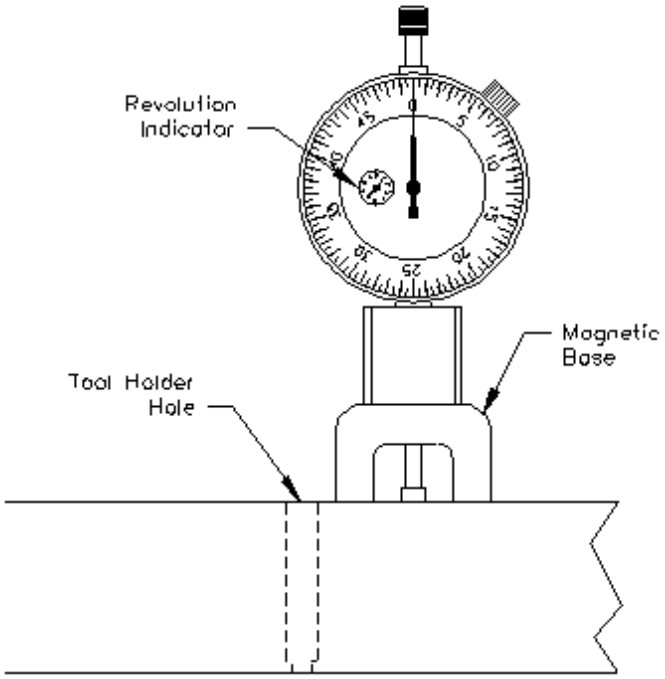
The following illustration shows the cutting tool and holder and how they are set inside the Cam Boring Bar.



Zeroing the Micrometer

Remove the magnet keepers from the bottom of the indicators magnetic base. These should be put back on when the magnet is not in use to keep the magnet strong.

Place the magnet on the smooth portion of the bar next to the tool holder hole. Set the zero on the indicators dial, noting the number of revolutions the dial has made.



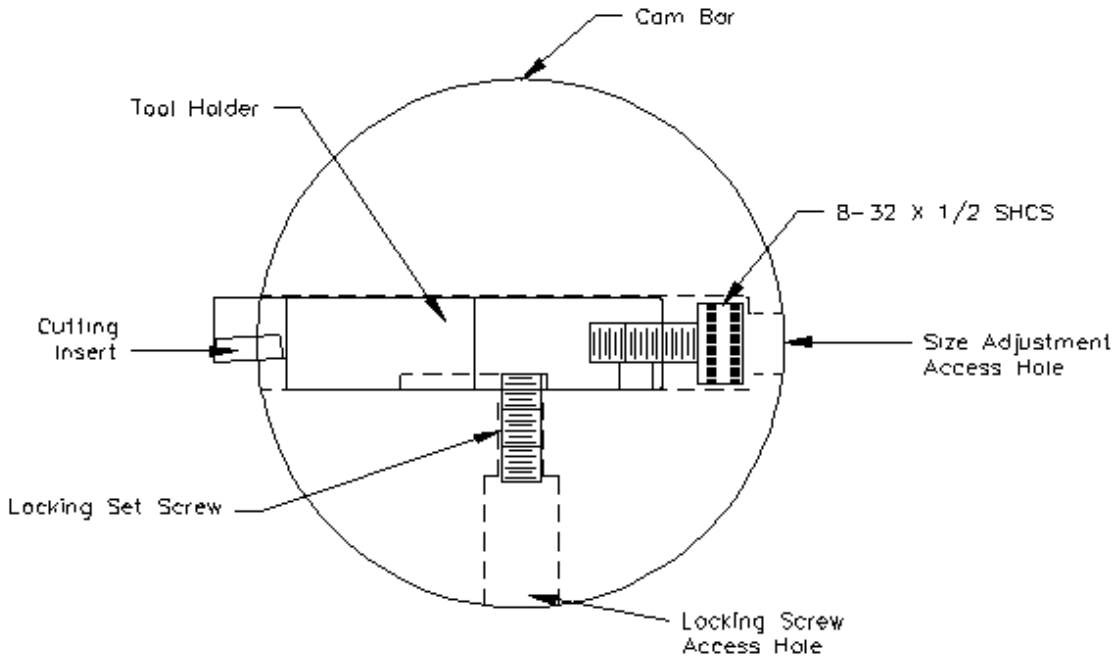
Setting Cutting Size

The diameter of the Cam Bar 650-2-32D is 1.7500". The 8-32 X ½" socket head cap screw on the back of tool holder is used to adjust size. When the tool holder is inserted into the Cam Bar the cap screw goes against a ledge inside the Cam Bar. When the cap screw is turned in the size will get smaller. When the cap screw is turned out the size will get bigger.

⚠ CAUTION **When adjusting the size on the tool holder, you must remember that the amount that will be taken off of the diameter will be twice the reading on the dial indicator.**

When the dial indicator reads zero the bar will cut 1.7500". Double the amount past zero on the dial indicator and add that to 1.7500" to determine the cut diameter.

Once the size has been set, lock the set screw in the Cam Bar to secure the tool.



Refer to the Line boring section of this chapter for mounting and alignment of the 90 degree head.

Select Line Bore Mode of operation.

Mount the dual flex coupling to the 90 degree head with the two (2) supplied socket head cap screws.

Install one Cam Bearing Locator into the left side of the block.

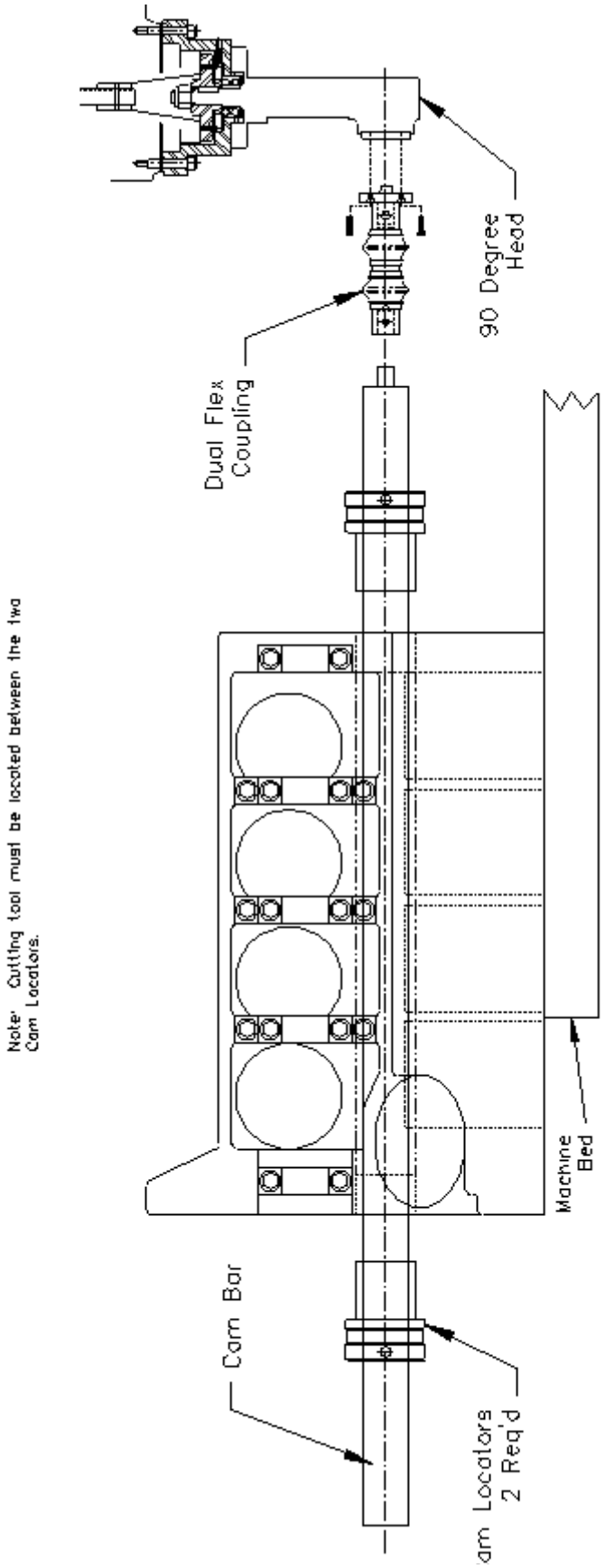
Slide the Cam Bar into the Cam Tunnel and then into the right side locator. Keep the end of the Cam Bar with the adapter on it to the right.

Slide the second locator onto the Cam Bar, then the locator into the Cam Bore. The cutting tool needs to be between the two (2) locators.

Bring the 90 degree head down and line up the end of the dual flex coupling with the adapter on the Cam Bar. This does not have to be a precise line up, the dual flex coupling will take care of any alignment variance. Tighten the socket head cap screw on the dual flex coupling on to the adapter on the Cam Bar.

Press the Vertical, Horizontal and In/Out zero buttons.

Final set up should look line the drawing on the following page. The mounting components are not shown on this drawing. Refer to the block mounting section of this chapter.


90 Degree Head
Dual Flex Coupling
Machine Bed
Cam Bar
am Locators 2 Req'd
Note: Cutting tool must be located between the two Cam Locators.

Setting Vertical Stops

Make sure the machine is at the zero positions as described previously.

When using the Line Bore Mode to do the Cam Tunnel boring the vertical stops described here will never change. They must be used to run an a cycle without damaging parts.

Block Clearance:	-.001
Block Center Line:	00.000

Setting Horizontal Stops

All of the Horizontal stops are to remain at 00.000 when using the Line Bore Mode to do Cam Tunnel boring. The only setting that gets changed on this screen is the Bore Length for Horizontal stop 1. This will be the distance between the two (2) end Cam bores that needs to be bored out.

Auto Cycle

You **DO NOT USE** the Auto Cycle when Cam Tunnel boring. The only items that get used on this screen are the Feed Rate and Spindle RPM.

Recommended feeds and speeds will be discussed later in this chapter.

Manual Bore

This screen is used to bore the Cam Tunnel. With the Horizontal and the In/Out axis at the zero position and the Vertical at or above the Block Clearance Height, Press the BORE1 button.

The spindle will do a rapid move down to the Block Center Line position (this is only .001 so will not notice the move). The spindle and Horizontal feed will start at the programmed speed. The machine will continue boring horizontally until the horizontal position set in the Bore Length is reached. The Vertical will retract .001 and the horizontal will retract back to the zero position.

Recommended Boring Procedure

The three (3) tool holders included in this package should be used as dedicated holders. Two of them set for roughing passes and the third set for a final finish pass.

It is recommended to set the first two tool holders for a .100” pass each, then set the third tool for the finish size.

Size is not critical on the first two passes, these tools can be set and not adjusted for each use. The third tool should be checked with the dial indicator for final size each time you use it.

Recommended Feed Rate:	.001 - .003
Recommended Spindle RPM:	300 – 500

IMPORTANT: You should put a light coating of light weight oil on the Cam Bar to prevent it from seizing up as it goes through the Cam Locators. At higher spindle speeds the bar heats up more.

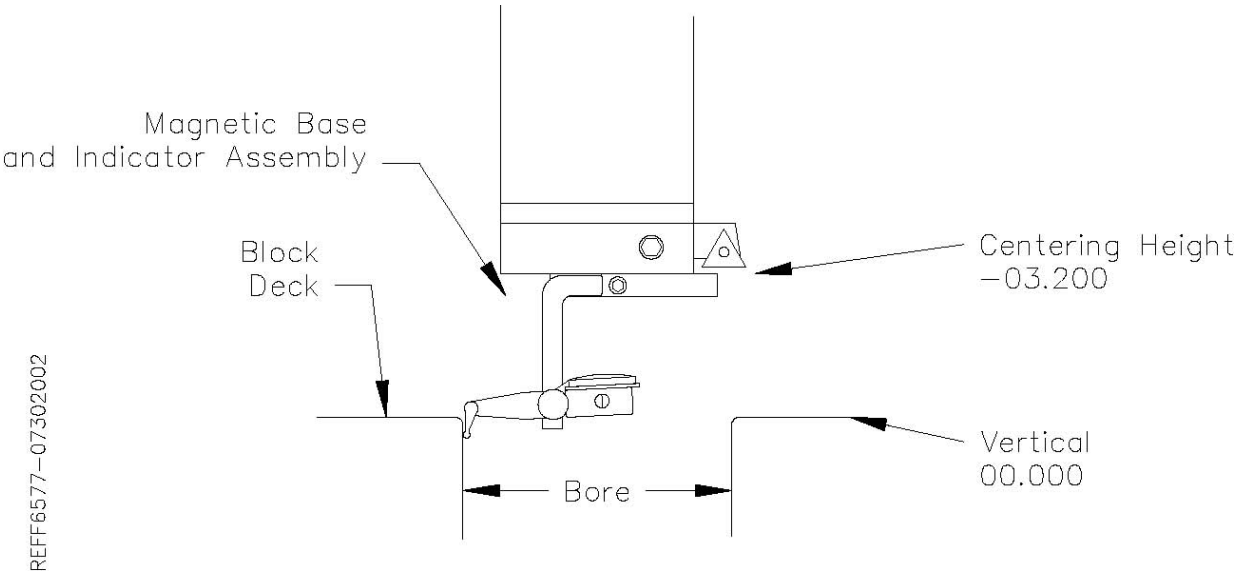
Con Rod

Manual Screen

This screen is used to set the center of the conrod to be bored and a vertical height reference for the cutterhead and boring tool to be used.

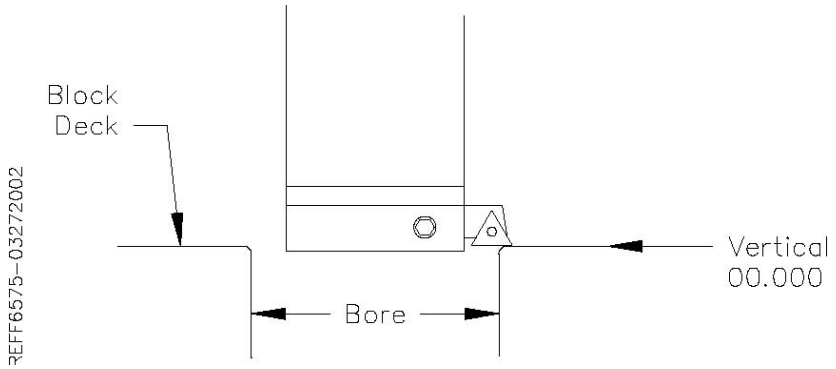
Setting In/Out and Horizontal Zero

Using a suitable Magnetic Base and Indicator assembly as shown below, indicate in the center of the conrod and touch the Yellow Horizontal Zero and In/Out Zero Buttons to set the machine to the center of the conrod. Normally only the conrod half of the big end is used for centering. When setting the In/Out Zero, the last movement of travel when indicating the bore of the conrod, must be in the inwards direction. When setting the Horizontal Zero, the last movement of travel when indicating the bore of the conrod, must be in the leftwards direction. This will eliminate any backlash that may be in the machine.

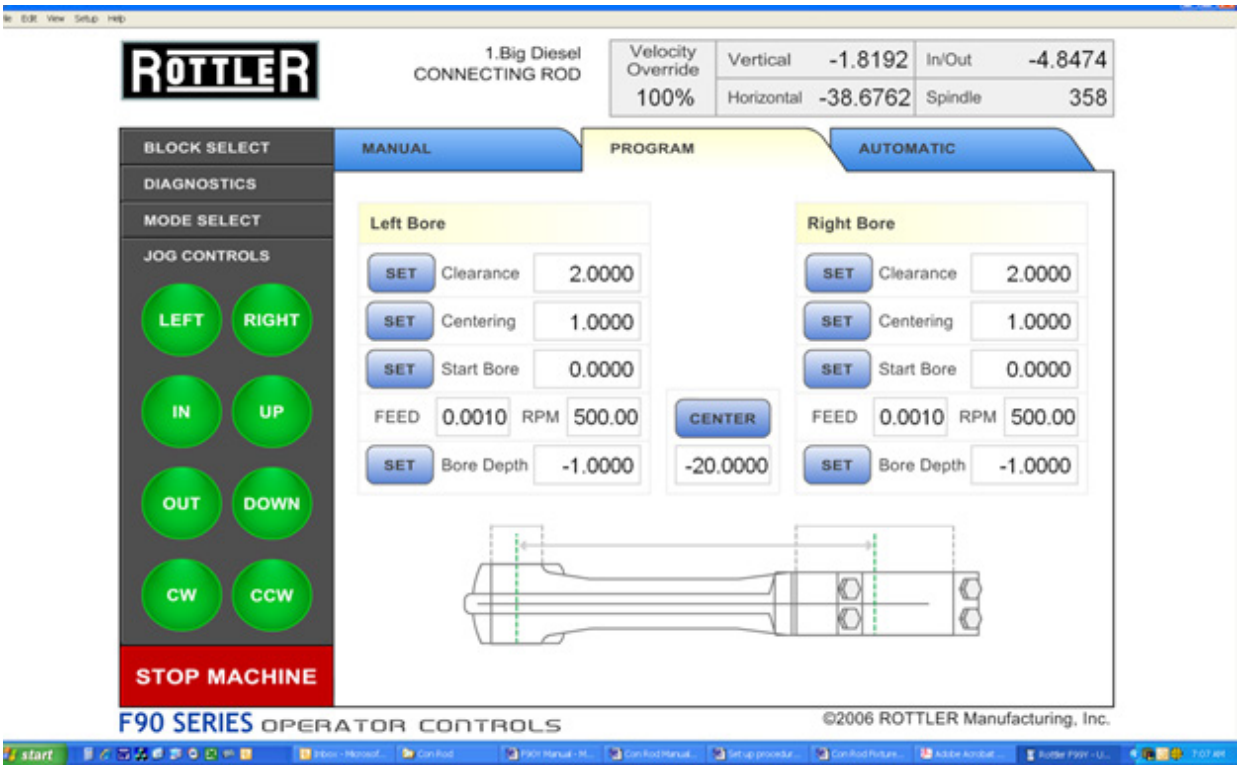


Setting Vertical Zero

Fit the cutterhead and boring tool that is going to be used to bore the big end. Once the Horiz and In/Out center has be established, slowly lower the cutterhead until the boring tool just makes contact with the thrust face of the big end of the conrod. At this point, press the yellow Vert Zero button.



Program Screen



This screen is used to input all the parameters for boring both the big and small end of the rod plus setting positions for centering and measuring.

Measure: This allows a position to be set where the conrod will move to be able to measure a bore easily without interference of the cutterhead, this is normally set to move the conrod away from the machine towards the operator.

Clearance: This is the vertical height of the cutterhead with reference to vertical zero to where the cutterhead will move before any horizontal movements take place.

Centering: This is the vertical height of the cutterhead with reference to vertical zero to where the cutterhead will move in order to center the bore with a dial gauge.

Start Bore: This is the vertical height of the cutterhead with reference to vertical zero to where the cutterhead will move to start boring the conrod. This is set about .040” (1mm) above the side of the conrod bore.

Bore Depth: This is the vertical height of the cutterhead with reference to vertical zero to where the cutterhead will stop boring, index the boring tool to the right, move the conrod to the right for tool clearance then rapid the cutterhead upwards to the clearance position.

Center Set: This is where the center to center distance of the big end and small end of the rod can be programmed.

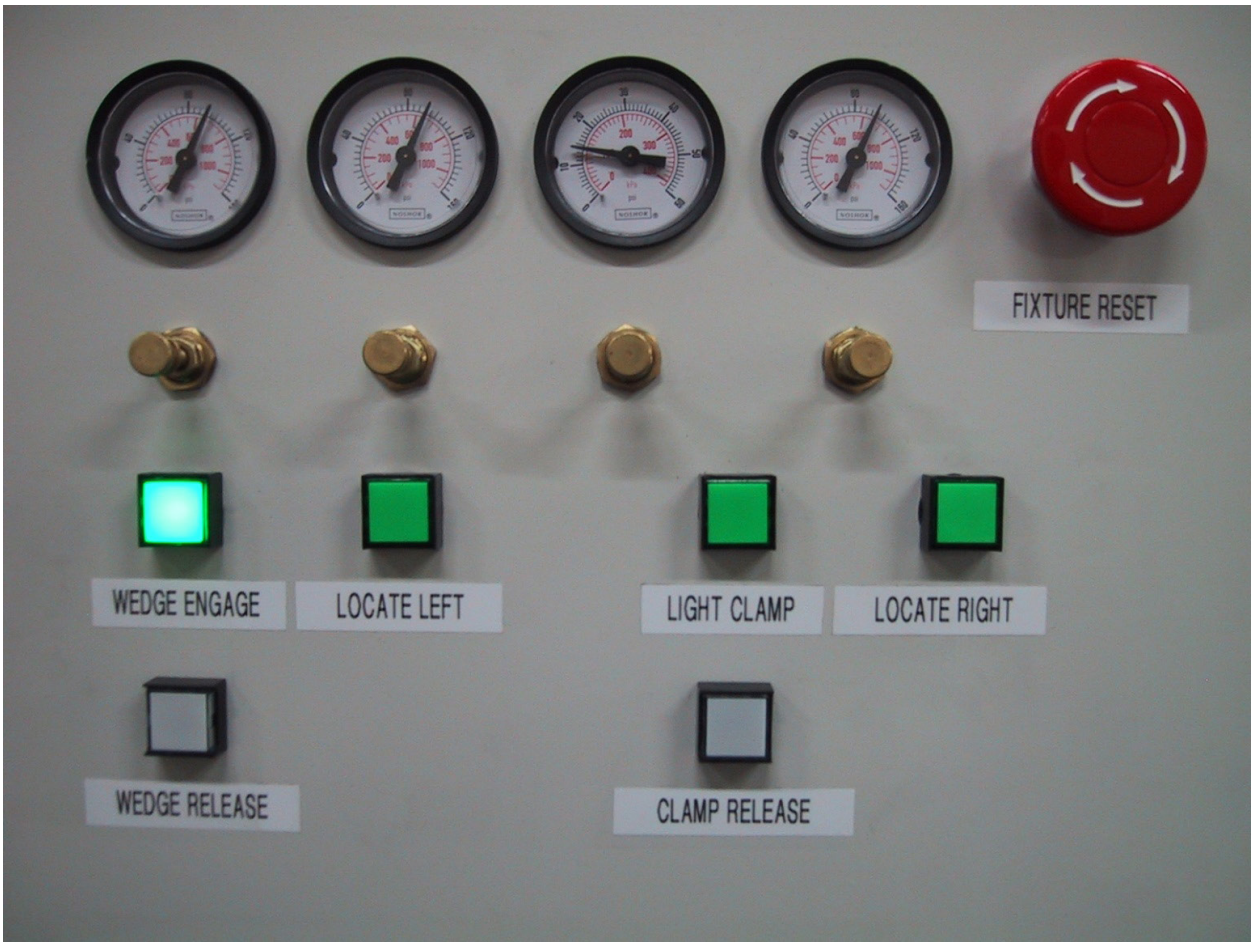
Automatic Screen

This screen is used to run programs such as bore right big end of the conrod. When the green buttons are touched, the machine will move to the position or start an automatic cycle.

Bore Both: If special cutterheads with big and small end tooling in one are being used, the block can be checked so that the machine will bore both big and small end in one cycle. Normally the big and small ends are bored with different cutterheads and this block will be unchecked.

Note: Do not stop an automatic cycle in mid cycle and then try to start it again. The CNC code running behind the Rottler screens use offsets in the controller. If the machine is stopped during an automatic cycle the machine must be shut down and restarted to clear the offsets. Otherwise the displayed position and actual position of the machine will not be correct.

Fixture Control Panel



Set up procedure for conrod fixture

Select the widest big and small end ball locators that will fit inside the conrod 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 conrod 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 conrod support and place across the conrod fixture.

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

Adjust the conrod 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 conrod to be sure the 3 support pads are correctly located and their hold down cap screws are tight.

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

Remove the conrod 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 conrod back in the fixture and adjust the left hand slide assembly so that both the left hand locating balls contact the bore inside the conrod small end.

Remove the conrod 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 conrod 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 hey do nor 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 places light clamping pressure on the clamp arms and lightly hold the conrod down against the 3 support pads under the big end of the conrod.

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

Select a set of wedges that will allow the outside of the small end of the conrod 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 conrod 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)

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MAINTENANCE
Contents

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Quick Reference Preventative Maintenance: F60DM **6-1**

Digital Micrometer setting instructions **6-17**

To Set Or Edit Micrometer **6-18**

Procedure: **6-21**

Maintenance

Quick Reference Lubrication Chart: F60DM

Refer to the maintenance section in the manual for lubrication location points and instruction.

Assembly	Frequency (Hours)	Lube Operation	Recommended Lubricant	Date Serviced
Way Oil Level	40	Fill as needed	Conoco Brand 76 Way Oil HD 68 or ISO VG 68 equivalent	
Drawbar oil level	160	Fill as needed	General Purpose air tool oil	

Quick Reference Preventative Maintenance: F60DM

Refer to the procedures in the maintenance section of the manual 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.

Procedure	Frequency (Hours)	Date Serviced/Comments
Check Way Oil Functionality	160	
Visually Inspect Way Covers	160	
Check Air Pressure Regulators	480	
Check Backlash	960	
Check Gibbs	960	
Check for Loose Bolts	960	
Check Machine Geometry	960	
Check Incoming Voltage	960	

Removable copy

Quick Reference Lubrication Chart: F60DM

Refer to the maintenance section in the manual for lubrication location points and instruction.

Assembly	Frequency (Hours)	Lube Operation	Recommended Lubricant	Date Serviced
Way Oil Level	40	Fill as needed	Conoco Brand 76 Way Oil HD 68 or ISO VG 68 equivalent	
Drawbar oil level	160	Fill as needed	General Purpose air tool oil	

Quick Reference Preventative Maintenance: F60DM

Refer to the procedures in the maintenance section of the manual 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.

Procedure	Frequency (Hours)	Date Serviced/Comments
Check Way Oil Functionality	160	
Visually Inspect Way Covers	160	
Check Air Pressure Regulators	480	
Check Backlash	960	
Check Gibbs	960	
Check for Loose Bolts	960	
Check Machine Geometry	960	
Check Incoming Voltage	960	

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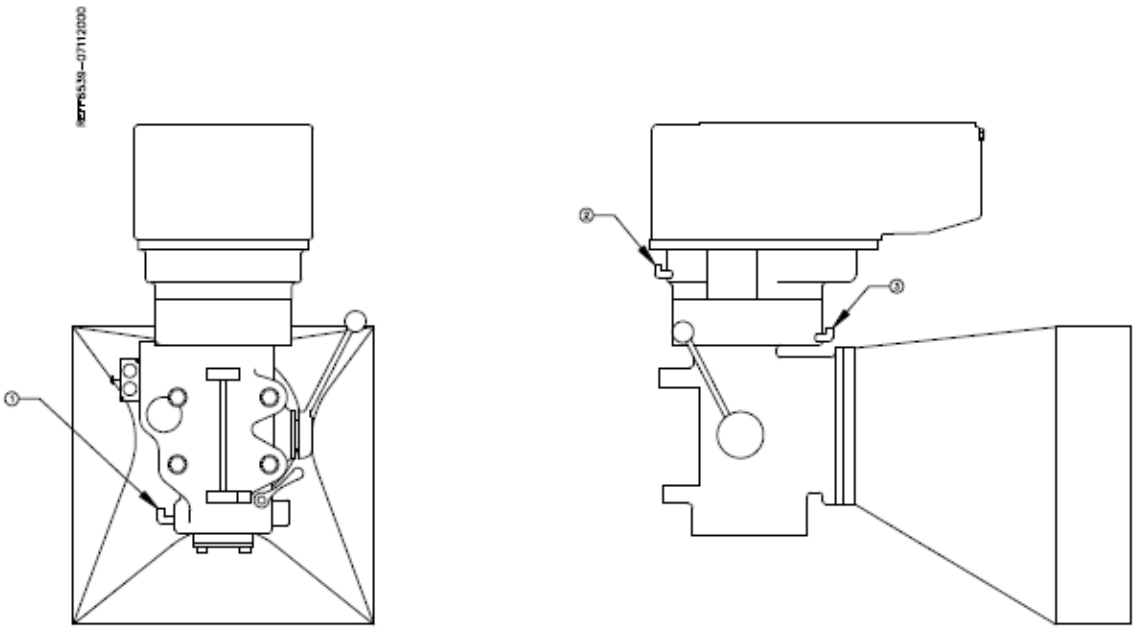
Lubrication

Manual Lubrication

Lubricate, in the places indicated, weekly with 5-6 drops of ***Union 76 Way Oil HD-68*** or equivalent lubricant.

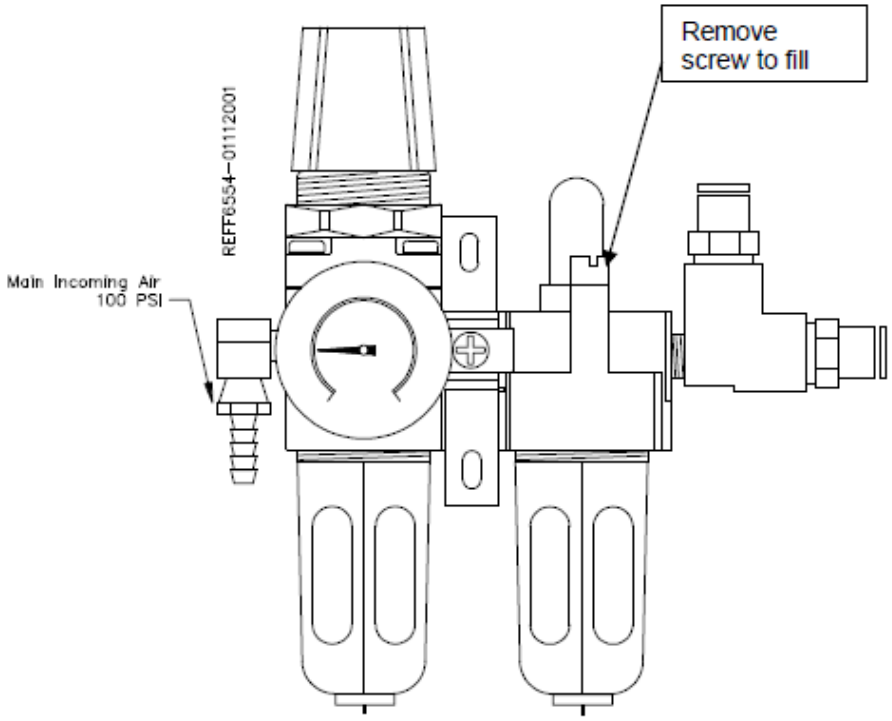


Automatic Lubrication System

The automatic lubrication system includes metering valves for proportional distribution and includes an alarm for low fluid level warning. Still, please check fluid level before operation. Add ***Union 76 Way Oil HD-68,*** or equivalent, as needed in reservoir at rear of machine.

Power Draw Bar Lubrication:

The Power Draw Bar assembly needs to have oil supplied in the air line to it. Use machine tool oil in this reservoir. The reservoir is located on the back of the main column of the machine. Refer to the following illustration for filling location.



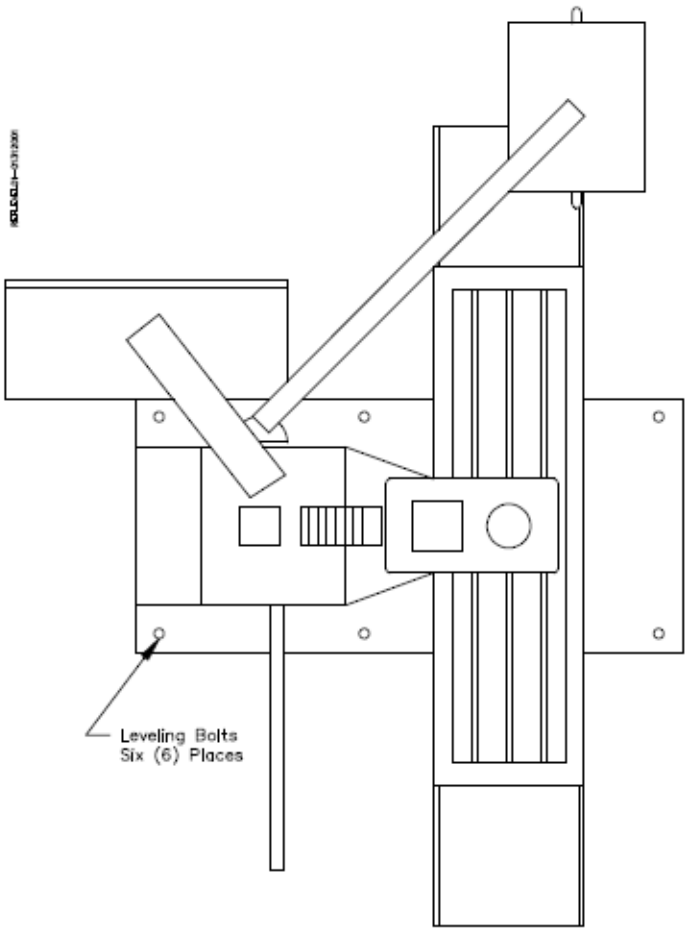
Leveling and Alignment:

The following is a description of how to properly level and align the F65 machine. These procedures should be followed in the order they written to obtain correct machine level and alignment.

Leveling the Machine:

After uncrating the F65 set it down in desired location with leveling bolts and leveling pads installed.

Remove the Y-Axis protective rubber located on the backside of the table. This is where you will position the level to level the machine. A .0005" increment per foot precision level is required.



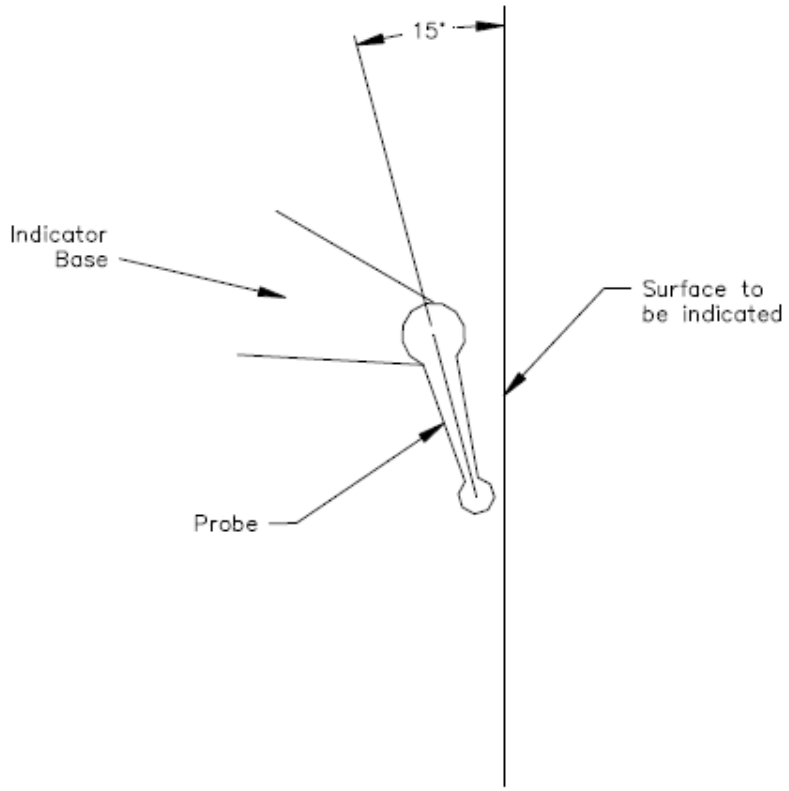
Using the four (4) corner leveling bolt to start with, bring the machine up to level in both directions (front to back and left to right) within .0005" per foot.

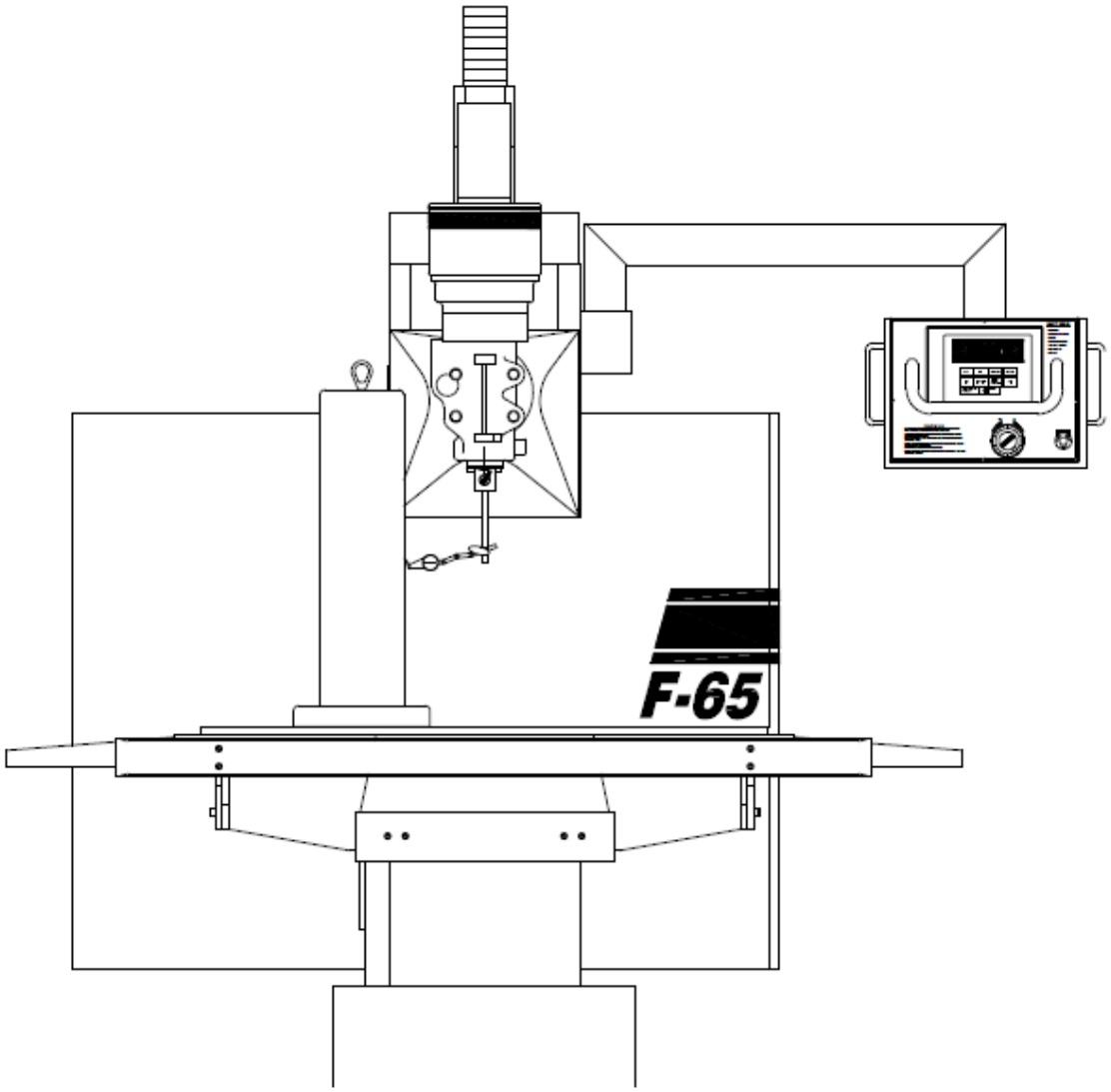
After you have leveled the bed using the four corner bolts, move to the middle leveling bolts. Bring these bolts down until they have approximately the same amount of pressure on them as them as the four corner bolts. Be careful not to throw the level of the machine off while doing this.

This will put the lower casting level.

Alignment:
Place the alignment cylinder on the table in roughly the same position as shown on the following page.

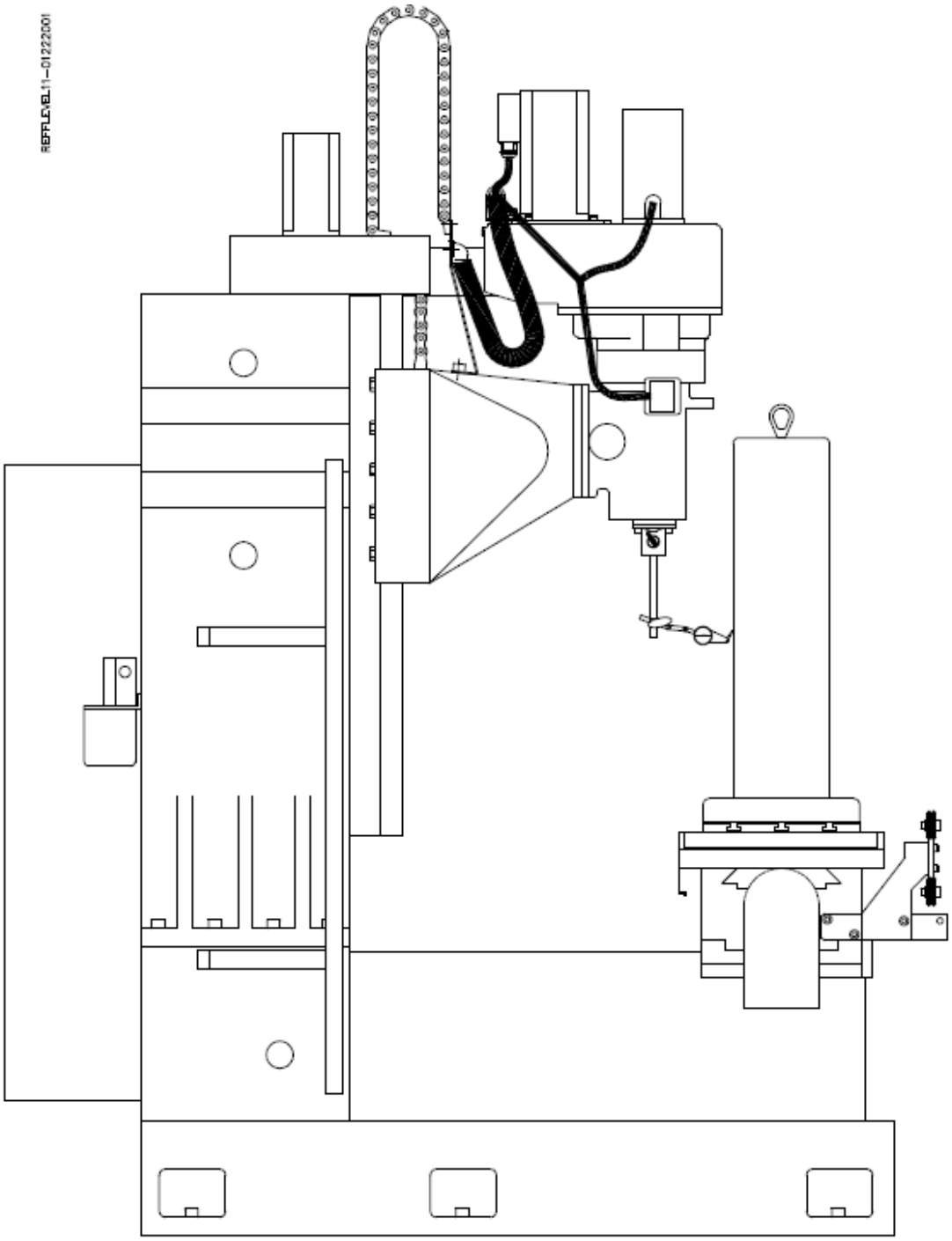
Note: The position (angle) of the probe to the surface you are indicating is critical. Using an incorrect angle on the probe will result in inaccurate readings from the surface being indicated. The angle of the probe should be at about 15 degrees from the surface being indicated (see illustration 2).





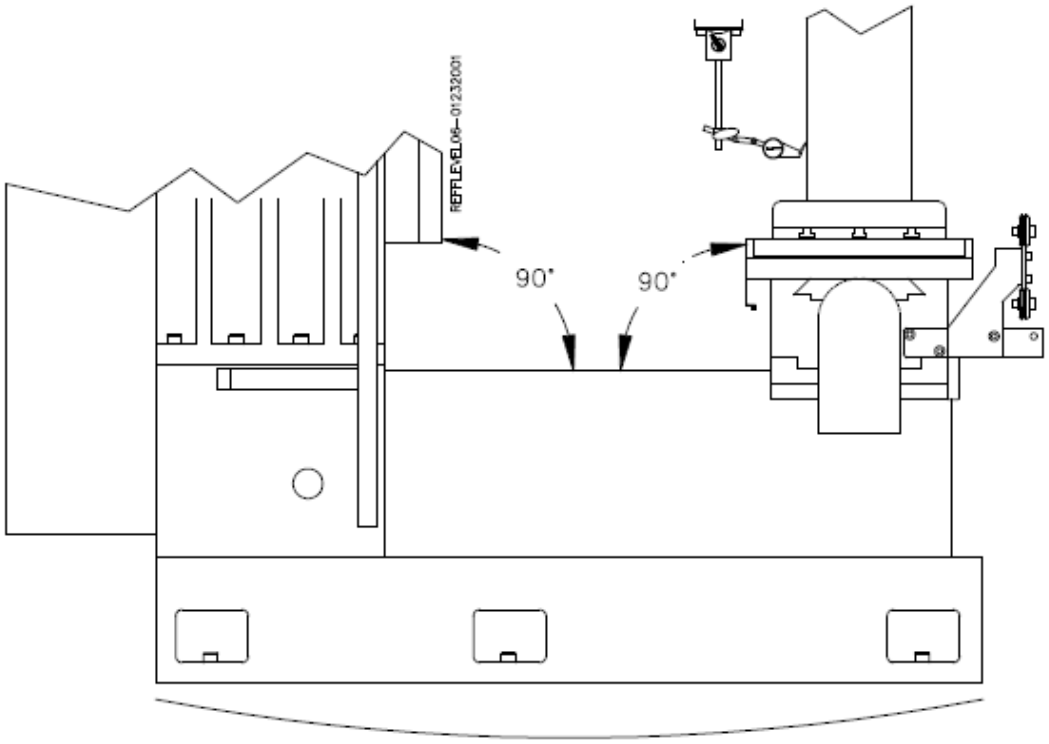
Put about .010" pressure on the indicator. Run the vertical throughout its full travel. The runout should not be more than .0005. If the runout is more than this, check the table top as well as the bottom of the alignment cylinder for burrs or debris.

Move the table out and check the perpendicularity of the vertical ways. This should be within .0005".



If the Vertical perpendicularity is not within tolerance the Middle Leveling Bolts may need to be adjusted.

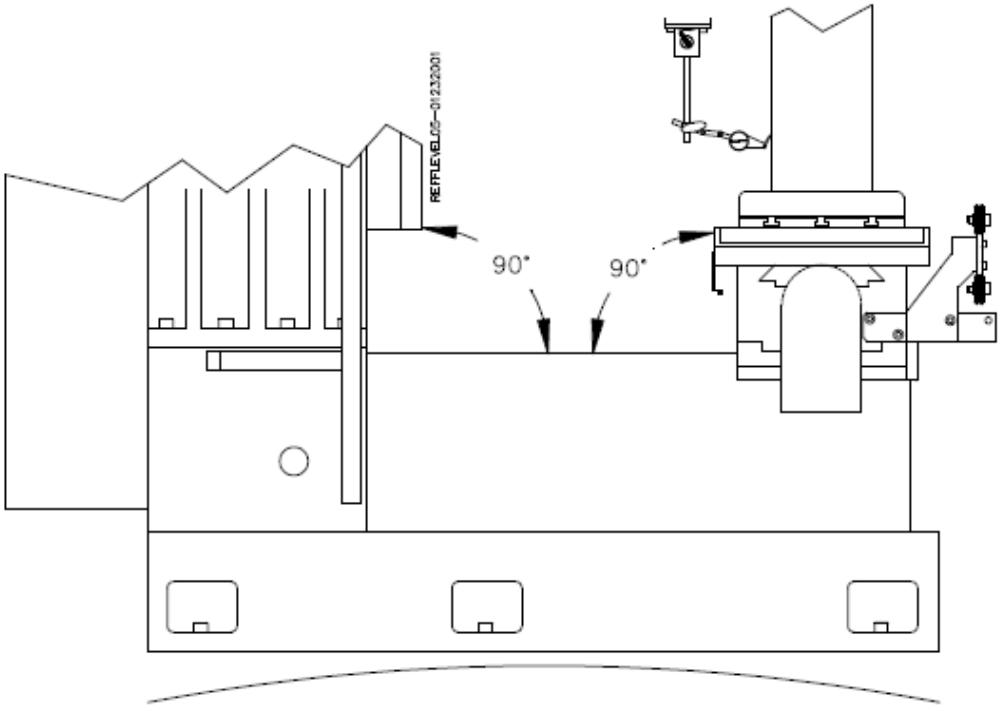
Middle Leveling Bolts:
If the procedures for the Leveling was followed correctly, it is unlikely that the deviance from Front to Back is being caused by the Middle Leveling Bolts. The following are examples of what could be caused by incorrect pressure on the middle leveling bolts.
Example 1: Zero the indicator on the top of the cylinder. When traveling to the bottom of the cylinder, if the reading decreases past -.001" to something such as -.002", then the middle leveling bolts have too little pressure on them and it is bowing the casting slightly in the middle as shown below.



The arched line underneath the picture is illustrating the bow to the casting if the middle leveling bolts have too little pressure on them.

To correct the deviance slowly add pressure to the middle bolts equally. Be sure to watch the level of the machine to be sure not to throw it off. After adding pressure from the middle bolts you can remove pressure from the front and rear corner bolts to bring the deviance within .001".

Example 2: Zero the indicator on the top of the cylinder. When traveling to the bottom of the cylinder, if the reading decreases past +.001" to something such as +.002", then the middle leveling bolts have too much pressure on them and it is bowing the casting slightly in the middle as shown below.



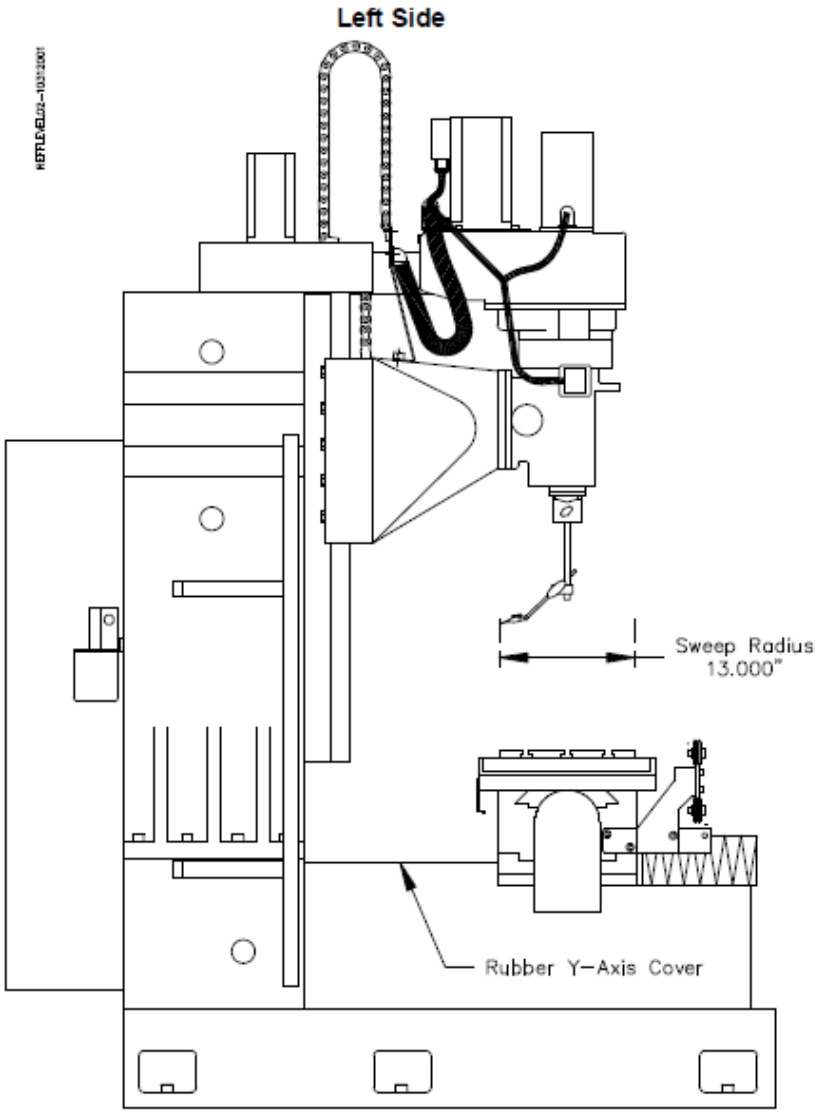
The arched line underneath the picture is illustrating the bow to the casting if the middle leveling bolts have too much pressure on them.

To correct the deviance slowly remove pressure from the middle bolts equally. Be sure to watch the level of the machine to be sure not to throw it off. After relieving pressure from the middle bolts you can apply slightly more pressure to the front corner bolts to bring the deviance within .001".

Sweeping the Spindle:
Remove any fixturing or tooling from the machine table and clean thoroughly.

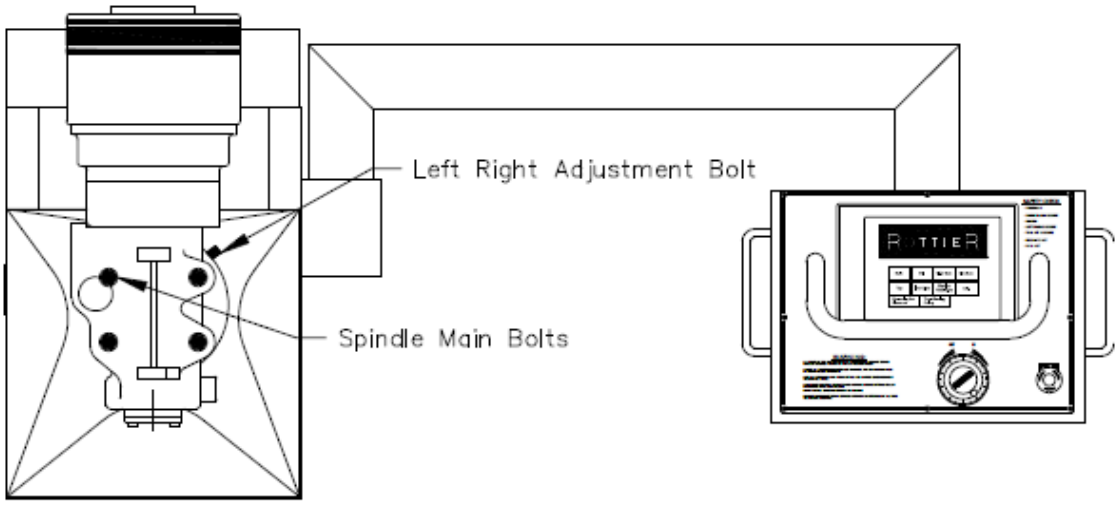
Attach a mag base indicator to the bottom of the spindle. Make sure that the mag base is attached in such a way that the spindle is able to be rotated 360 degrees without interference.

Use the following illustration for a visual reference on installing and using the Mag base indicator correctly.



Loosen the four Spindle Main Bolts slightly. Using the Adjustment bolt on the right hand side of the spindle head, sweep the spindle to within +/- .0002 Left to Right. Do not worry about the Front to Back reading at this time as the Spindle Main bolts are not tight

Once the Left to Right has been aligned, tighten the Spindle Main Bolts to 80-ft. lbs. Verify the Left to Right sweep again to make sure it did not change while tightening the Spindle Main bolts.



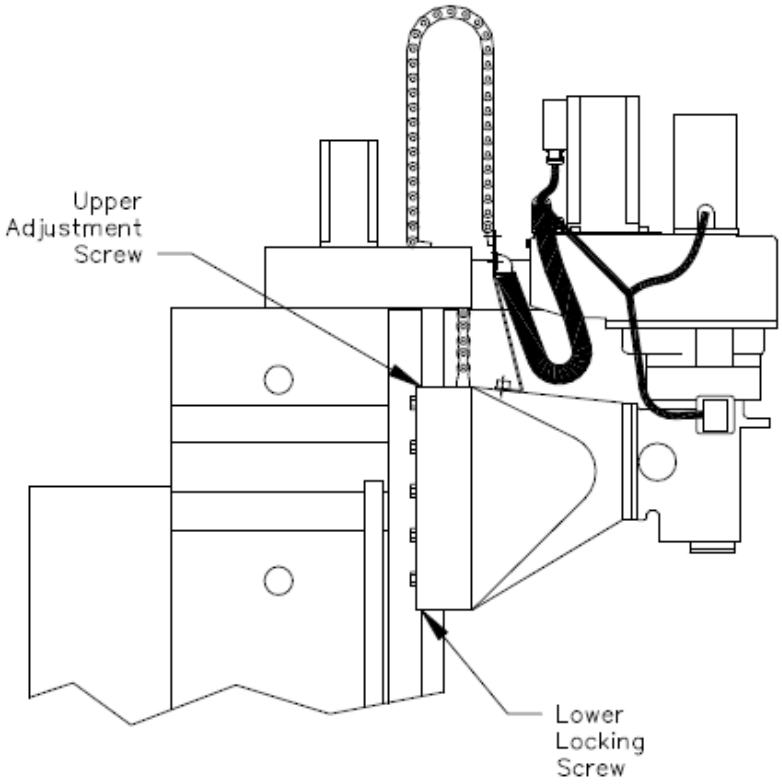
Check the Front to Back sweep it should be within .0005. If it is not, the Vertical gibs may need adjustment.

Vertical Gib Adjustment:

Gib adjustments can affect the sweep of the spindle front to back. With the indicator in the 6 O'clock position (as you face the front of the machine) tightening the vertical gibs will lessen the pressure on the indicator probe. Loosening the gib will increase the amount of pressure on the indicator probe.

Example: If you have a reading of 0.0 on the indicator at the 6 O'clock position and -.002" in the 12 O'clock position, tightening the gibs will bring the front of the spindle up. Adjust the gibs until you are within the factory specified .001" deviance.

To adjust the vertical gibs locate the screw at the top and bottom of the gibs.



Tightening Gibs:
To tighten the gibs, loosen the lower screw. Start tightening the top screw until the correct alignment is achieved. When the correct alignment is achieved, tighten the lower screw to lock the adjustment in place.

Note: Adjusting the gibs too tight will cause sticktion and erratic movement in the vertical travel.

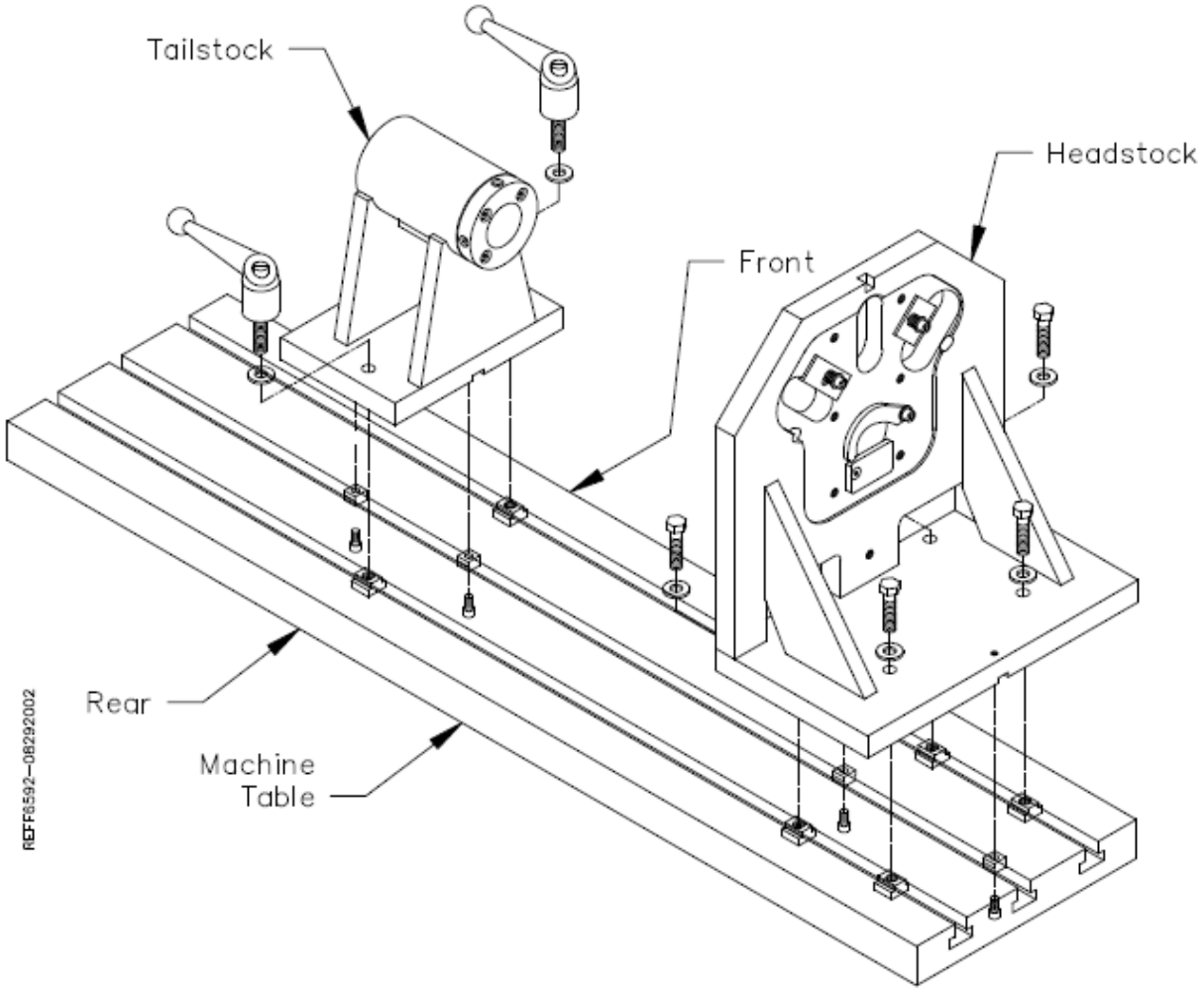
Loosening Gibs:
To loosen the gibs, loosen the top screw. Start tightening the lower screw until the correct alignment is achieved. When the correct alignment is achieved, tighten the upper screw to lock adjustment in place.

Note: Having the gibs too loose will cause erratic bore size and finish.

If you do not know how tight or loose the gibs are adjusted, you can remove the way wipers from the top of the gib. When you look in at the gib you will see a horizontal scribe line on most of the gibs. This can be aligned with the internal casting for a starting point. The gibs may need further adjustment at this point. This is only recommended as a starting point.

If there are any questions on this procedure contact Rottler Manufacturing Service Department.

Performance Fixture Line-Up:
Install the keys for the Head and Tail Stock into the machine bed as shown below. Place the Head and Tail Stock onto the machine table. Install the hold down bolts but do not tighten them down.



Push the head and tail stock toward the rear of the machine until the their keys but up against the table key ways. Snug the hold down bolts and handles. Attach a magnetic base and indicator to the spindle. Run the indicator across the face of the head stock front to back. Adjust the fixture until the indicator runs within .001". Lock the hold down bolts in place. Run the indicator from top to bottom on the head stock. It should be within .001". If it is not, pull the fixture from the table and check for burrs or dings in the head stock and table surface. Be sure there is not debris on the head stock or machine table. Re-install the head stock and follow the previous procedure. Check the face of the head stock again to be sure it did not move while tightening down the bolts.

Install the Main Bar though the tail stock and into the head stock. Run the indicator along the back side of the bar. It should be within .002" through out the travel. Adjust the tail stock in or out as needed to align the bar. Tighten down the locking handles. Run the indicator along the top of the bar. It should be within .002". If it is not, pull the fixture from the table and check for burrs or dings in the tail stock and table surface. Be sure there is not debris on the tail stock or machine table. Re-install the tail stock and follow the previous procedure. Check the bar again to be sure it did not move while tightening down the bolts.

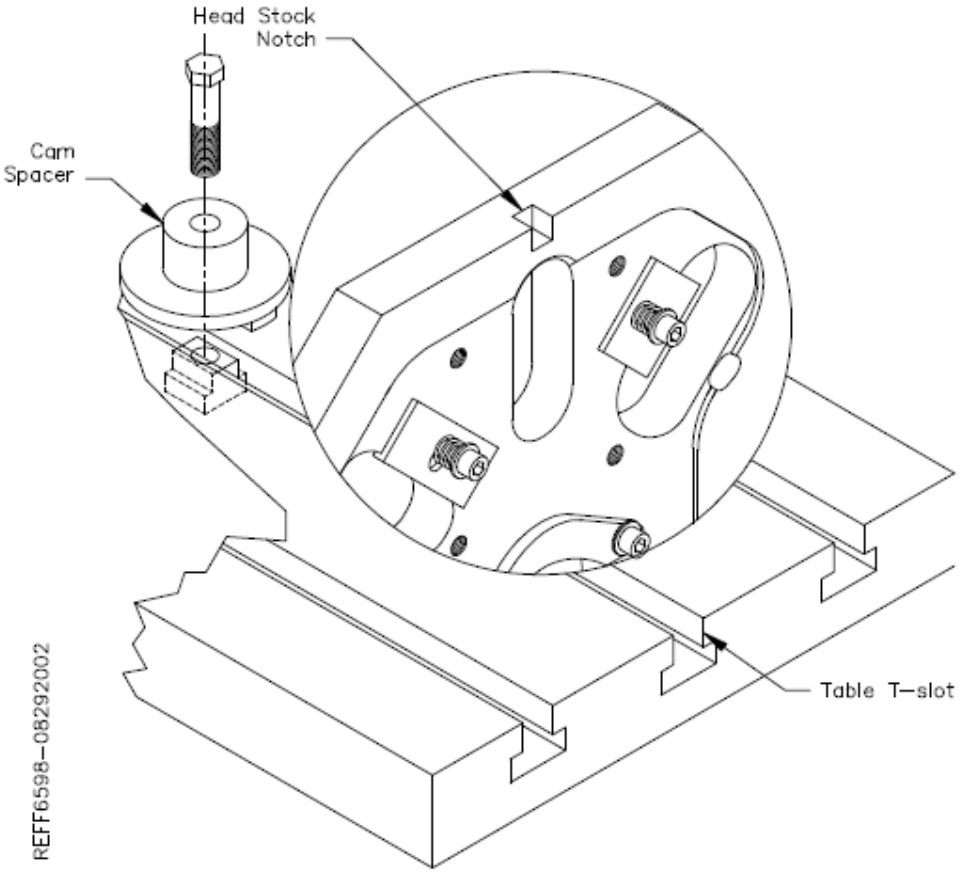
Performance Fixture Line-Up (Cam End Tunnel Boring):
Install the keys for the Head and Tail Stock into the machine bed as shown on previous page. Place the Head and Tail Stock onto the machine table. Install the hold down bolts but do not tighten them down.

The center of the middle table key way needs to be lined up with the center of the Head Stock notch. Using the electronic probe, touch the front side of the middle keyway. Zero the In/Out position. Using the handwheel, move the table out until the probe touches the back side of the key way. Record the numerical reading in the In/Out position box. Divide this number in half, handwheel the In/Out axis until the numerical reading is the same as the halved number. Zero the In/Out axis again. The spindle is now centered over the middle key way. Adjust the head stock In/Out until the center of the Head Stock notch is at the In/Out zero position.

Attach a magnetic base and indicator to the spindle. Run the indicator across the face of the head stock front to back. Adjust the fixture until the indicator runs within .001". Lock the hold down bolts in place. Run the indicator from top to bottom on the head stock. It should be within .001". If it is not, pull the fixture from the table and check for burrs or dings in the head stock and table surface. Be sure there is not debris on the head stock or machine table. Re-install the head stock and follow the previous procedure. Check the face of the head stock again to be sure it did not move while tightening down the bolts.

Mount the End Truing V-End Truing Fixture (650-3-31) to the Head stock. Mount the block to the Truing Fixture. The above procedure has aligned the fixture so the main bore in on the same center line as the middle keyway.

Install the Cam spacer into the middle keyway. Place the bottom Cam Bore on the block over the cam Spacer with the correct bushing installed. This will put the Cam Bore in line with the Main bore.

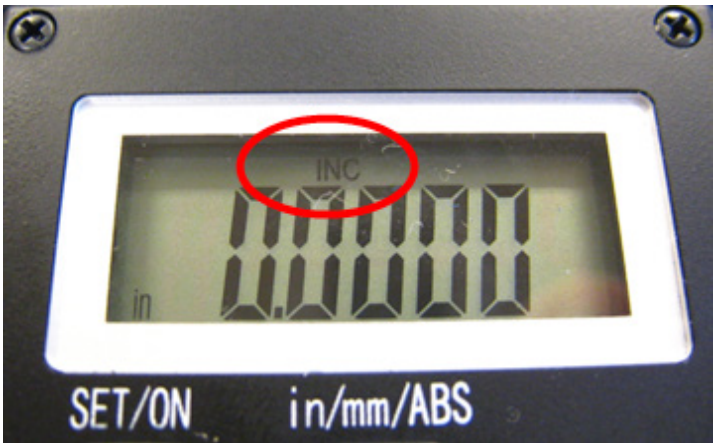


Digital Micrometer setting instructions

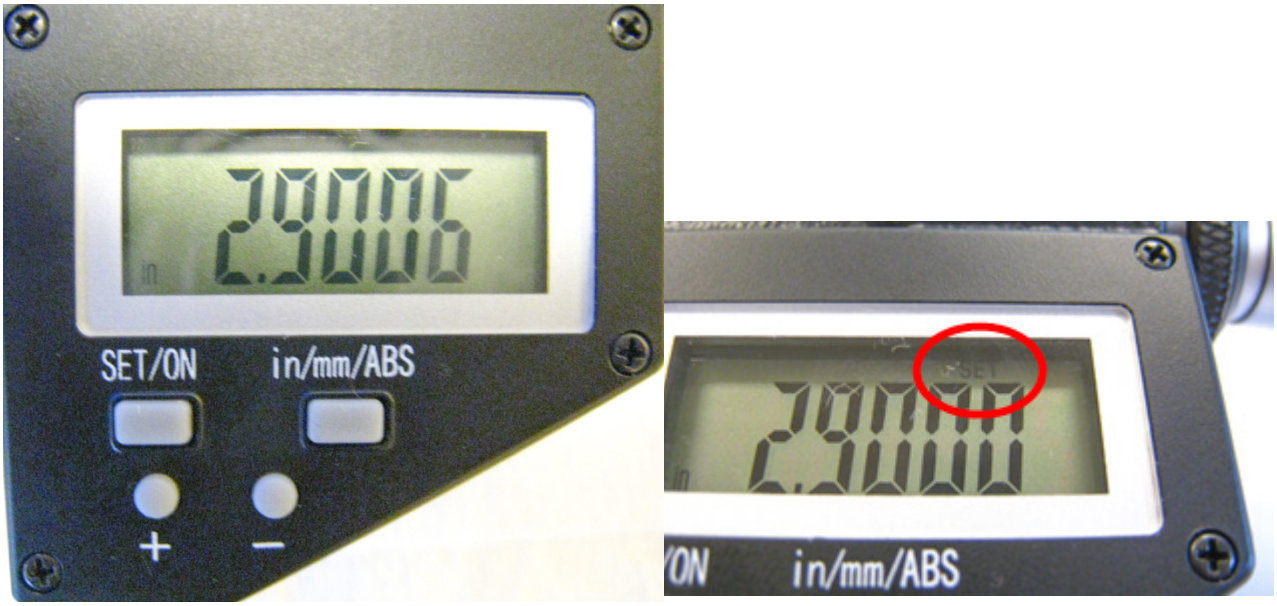
Turn the thimble until the ‘0’ line on the thimble lines up with the vertical line nearest the spindle lock ring.

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.

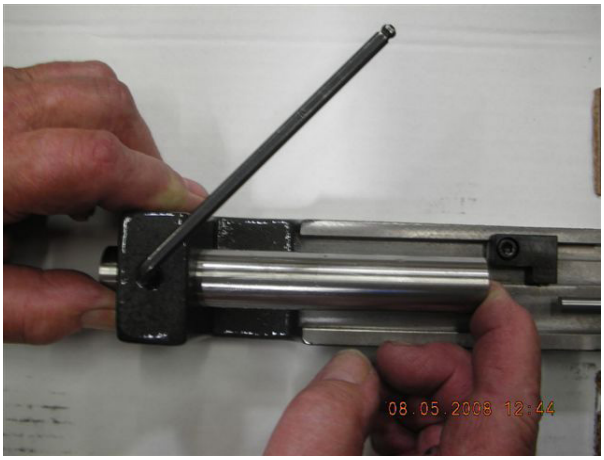
CAUTION: AFTER MICROMETER SET-UP IS COMPLETE, DO NOT PUSH SET/ON BUTTON AGAIN. PUSHING THE SET/ON BUTTON DURING USE WILL RETURN THE DISPLAY TO THE ORIGINAL MINIMUM BORE DIAMETER. THE ONLY TIME YOU SHOULD USE THE SET/ON BUTTON AGAIN IS TO- A. To shut micrometer off at which time you push and hold the 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.

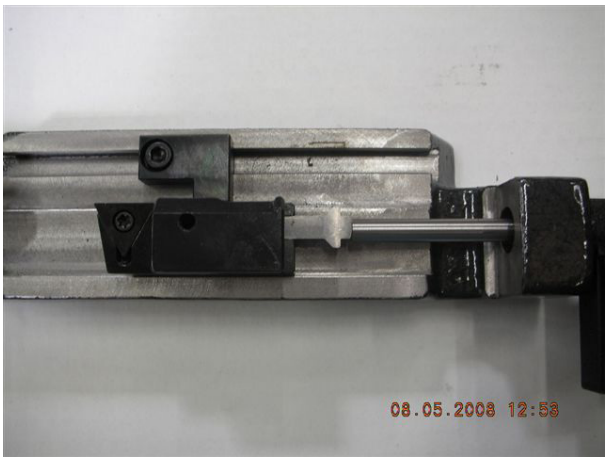
Micrometer is calibrated in inch mode. If metric is desired, press and hold in/mm/ABS button until mode changes to metric (approximately 3-4 seconds). A quick press of the in/mm/ABS button will put micrometer in ABS mode: 0.000, with another quick press returning it to initial setting.

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 -

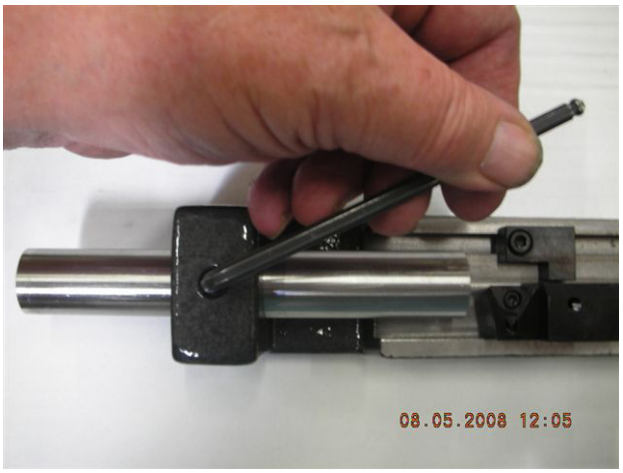
Loosen the set screw holding the large diameter anvil. Slide the anvil back out of the way.



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.

TROUBLESHOOTING

Please visit the service tab of our web page at Send a Service Request www.rottlermfg.com or contact the Rottler Factory Service at service@rottlermfg.com for assistance and your service request.

You may also call Rottler at 1-800-452-0534 or 1-253-872-7050

Please ensure you have the Machine Model and Serial Number available when contacting Rottler for Service

MACHINE PARTS

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Rottler Replacement and Specialty Inserts

Below is a description of the cutting inserts available from Rottler. The inserts have gone through extensive performance testing. To take full advantage of the capabilities of your Rottler machine, we highly recommend Rottler cutting tools be used. Rottler machine performance can be significantly reduced if qualified tooling is not used. Using an incorrect insert can result in bore geometry inconsistency, short tool life, and poor surface finish.

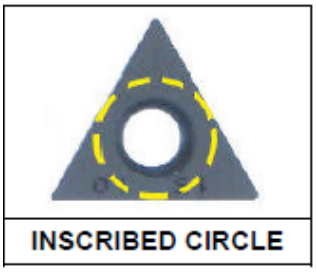
Below are general guidelines. When using these inserts it is best to refer to the operator manual of the particular machine you are using. Rottler Manufacturings latest operator manuals have more detailed information on feeds and speeds for the particular machine and cutterhead that you are using.

GENERAL INFORMATION

Rottler CBN and PCD Inserts are laser marked with our part number on one side. On single sided inserts, the part number is on the back side of the insert.

Rottler surfacing insert toolholders are designed so they can hold square and round inserts that are of the same basic size. For example, a 3/8” (9.52 mm) IC round and 3/8” (9.52 mm) IC square insert will fit into the standard 3/8” (9.52 mm) IC Rottler toolholders. IC refers to inscribed circle.

Rottler SF, F60, F80 and F90 Series surfacing cutterheads are supplied standard with Rottler 3/8” (9.52 mm) IC toolholders fitted to our surfacing heads. Optional 1/2” (12.7 mm) toolholders are interchangeable with 3/8” (9.52 mm) toolholders.



Insert breaking or chipping can be caused by several things. It can be caused by not operating the insert at the correct RPM. It is very typical for an insert to break or chip when cutting too slow. Interrupted cuts can cause an insert to break as well. When making a heavy sleeve cut in a cylinder that has been cracked it is often required to slow the RPM down to ½ the normal operating speed to prevent chipping of the insert.

Tool Nose Radius

The tool nose radius has an important effect on the cutting process. If you use the same feed rate per revolution on two different sized tool nose radius the larger tool radius will give a smoother finish. There are two other important characteristics of the tool radius. The larger the tool radius the stronger the cutting edge. The larger radius will hold up to interrupted cuts better than a smaller radius.

A disadvantage of a larger tool radius is that is creates more tool pressure than a smaller radius. When using long small diameter boring bars or large diameter milling cutterheads the high tool pressure of a large radius can cause chatter in the finish.

Edge Preparation

Rottler inserts have edge preparations specifically designed for proper cutting performance. Some inserts have sharp edges, Some have a few ten thousandths of an inch honed edge. Others have a T land which is actually a beveled edge. Generally the sharp edge will require the minimum amount of cutting pressure but the edge will not be as strong and long lasting. The T land insert is at the opposite end of the spectrum. It generates a lot of cutting force and can create chatter. The advantage of a T land is that is very tough. Most Rottler inserts have a honed edge which gives a good balance between cutting performance and tool life.

Surfacing Inserts Cutting Speed Calculation

Inserts are designed to cut within a speed range – SFPM. In order to convert from cutting speed to RPM, use the following formula:

$$RPM = \frac{SFPM \times 3.82}{DIAMETER}$$

SFPM = Surface Feet per Minute
RPM = Revolutions per Minute
DIAMETER in Inches

The feed rate on most Rottler machines is designated in inches / revolution. The F65M and the SFM have feed rates designated in inches / minute. It is important to adjust the inches / minute rate to obtain the correct load (inches / revolution). Following are the formulas to use. You do not have to perform this calculation with an “A” model machine

If you know the RPM and the Feed Rate per Revolution you want, use the following formula to obtain the correct Feed Rate per minute.

FRM = RPM X FRR
FRM = Feed Rate Inches per Minute
FRR = Feed Rate Inches per Revolution
RPM = Spindle Revolutions per Minute

METRIC CONVERSION
1 inch = 25.4mm = 2.54cm
1mm = .040 inches

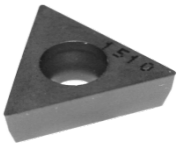
CYLINDER BORING INSERTS

Rottler has just completed the development of group of new triangular inserts for cylinder boring. Extensive trials were made to come up with new inserts that would outperform the older inserts. The result is a group of inserts that are the same unit cost but have 5 – 50% increased tool life. The increased tool life decreases overall operation cost to the end user.

Rottler offers either triangular or square inserts for cylinder boring, sleeving, and counter boring. Triangular inserts are excellent general purpose inserts for doing all boring, sleeving and counterboring operations.. When doing counter boring operations it is important to use a tool nose radius small enough that it will not interfere with the mating corner on the part that is installed in the counterbore.

When removing less than.060” (1.50mm) on the diameter a square insert is the most economical insert to use. The square inserts Rottler offers have 8 cutting edges. A Triangular insert only has 3 cutting edges.

RT321 (General purpose and sleeving)



A 3/8” (9.52 mm) IC triangular insert with a black ceramic coating and 1/64” (.4 mm) cutting radius. This insert is the best to use for counterboring when the small corner radius is required for clearance or when the machine is at its extended travel limits. The 1/64” (.4 mm) radius should be used when machining to a step where the mating part requires a smaller radius to eliminate an interference problem in the radius. If you are machining a long bore where the spindle must be extended towards the limits of its travel or if a long stub bar is being used, the 1/64” (.4 mm) radius will minimize the possibility of chatter. A feed rate of .002” - .005” (.05 mm - .12 mm) per revolution should be used to obtain a typical surface finish. When machining large counter bores typically found in Cummins or Cat Blocks, a feed rate of .002” - .004”/rev (.02 mm-.1 mm/rev) should be used. When cutting gray cast iron use a speed in the 800 – 1200 SFPM area for best productivity and tool life.

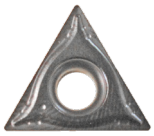
When cutting nodular, ductile, or compacted graphite cast iron the speed should be in the 200 – 400 SFPM area – 300 RPM on a 4” (100 mm) diameter bore. Nodular, ductile, or compacted graphite cast irons, is found most often in high performance engine blocks or sleeves. When cutting these tough cast irons it is best to use a feed rate of between .002 and .005 (.05 mm and .13 mm) per revolution.

RT322 (General purpose and sleeving)

This is the same insert as RT321, except it has a 1/32” (.8 mm) radius. This insert is the best to use for heavy sleeve cutting and can also be used for general machining and counterboring. This larger radius insert will give a smoother finish for a given feed rate when sleeve cutting to allow easier sleeve fitting and closer metal to metal contact for heat transfer. It is possible to use a feed rate that is 30% faster with the RT322 compared with the RT321 and still obtain the same finish. The 1/32” (.8 mm) radius is stronger than the 1/64 (.4mm) radius of the RT321. The RT322 should always be used for heavy sleeve cuts unless the finish part requires the smaller radius for clearance or you are cutting a long bore. The larger radius creates more tool pressure than the small radius. The increased tool pressure may cause chatter in the finish if machining very long bores. A feed rate of .006” - .012” (.15 mm - .3 mm) per revolution should be used to obtain a typical surface finish. When machining large counter bores typically found in Cummins or Cat Blocks, a feed rate of .002” - .004”/rev (.05 mm-.1 mm/rev) should be used. When cutting gray cast iron use a speed in the 800 – 1200 SFPM area for best productivity and tool life.

When cutting nodular, ductile, or compacted graphite cast iron the speed should be in the 200 – 400 SFPM area – 300 RPM on a 4” (100 mm) diameter bore. Nodular, ductile, or compacted graphite cast irons, is found most often in high performance engine blocks or sleeves. When cutting these tough cast irons it is best to use a feed rate of between .006” and .010” (.15 mm and .25 mm) per revolution.

RTS321 (Steel Cutting)



A 3/8” (9.52 mm) IC triangular insert with a grey ceramic coating and 1/64” (.4 mm) cutting radius. This insert is the best to for cutting steel. It has a chip breaker to break steel chips. If you are machining a long bore where the spindle must be extended towards the limits of its travel or if a long stub bar is being used, the 1/64” (.4 mm) radius will minimize the possibility of chatter. A feed rate of .002” - .005” (.05 mm - .12 mm) per revolution should be used to obtain a typical surface finish. When cutting mild steel use a speed in the 400 – 1000 SFPM area for best productivity and tool life. This insert should not be used for cutting cast iron.

Note: When using this insert it is required to use a “0” degree rake cartridge.

RTS322 (Steel Cutting)

A 3/8” (9.52 mm) IC triangular insert with a grey ceramic coating and 1/32” (.8 mm) cutting radius. This insert is the best to for cutting steel. It has a chip breaker to break steel chips. A feed rate of .003” - .008” (.05 mm - .12 mm) per revolution should be used to obtain a typical surface finish. When cutting mild steel use a speed in the 400 – 1000 SFPM area for best productivity and tool life. This insert should not be used for cutting cast iron.

Note: When using this insert it is required to use a “0” degree rake cartridge.

RT211 (General purpose and sleeving)

A 1/4” (6.35 mm) IC triangular insert with a black ceramic coating and 1/64” (.4 mm) cutting radius. The 1/64” (.4 mm) radius should be used when machining to a step where the mating part requires a smaller radius to eliminate an interference problem. If you are machining a long bore where the spindle must be extended towards the limits of its travel or if a long stub bar is being used, the 1/64” (.4 mm) radius will minimize the possibility of chatter. A feed rate of .002” - .005” (.05 mm - .12 mm) should be used to obtain a typical surface finish. When machining large counter bores typically found in Cummins or Cat Blocks, a feed rate of .002” - .004”/rev. (.05 mm - .1 mm/rev) should be used. When cutting gray cast iron use a speed in the 800 – 1200 SFPM area for best productivity and tool life.

When cutting nodular, ductile, or compacted graphite cast iron the speed should be in the 200 – 400 SFPM area – 300 RPM on a 4” (100 mm) diameter bore. Nodular, ductile, or compacted graphite cast irons, is found most often in high performance engine blocks or sleeves. When cutting these tough cast irons it is best to use a feed rate of between .002 and .005 (.05 mm and .13 mm) per revolution.

RT212 (General purpose and sleeving)

This is the same insert as RT212, except it has a 1/32” (1.6 mm) radius. This larger radius insert will give a smoother finish when sleeve cutting to allow easier sleeve fitting and closer metal to metal contact for heat transfer. The 1/32” (1.6 mm) radius is stronger than the 1/64 (.8 mm) radius of the RT321. The RT322 should always be used for sleeve cuts unless the finish part requires the smaller radius for clearance or you are cutting a long bore. The larger radius creates more tool pressure than the small tool radius. The increased tool pressure will create chatter in the finish. A feed rate of .006” - .012” (.15 mm - .3 mm) per revolution should be used to obtain a typical surface finish. When machining large counter bores typically found in Cummins or Cat Blocks, a feed rate of .002” - .004”/rev. (.05 mm -. 1 mm/rev) should be used. When cutting gray cast iron use a speed in the 800 – 1200 SFPM area for best productivity and tool life.When cutting nodular, ductile, or compacted graphite cast iron the speed should be in the 200 – 400 SFPM area – 300 RPM on a 4” (100 mm) diameter bore. Nodular, ductile, or compacted graphite cast iron is found most often in high performance engine blocks or sleeves. When cutting these tuff cast irons it is best to use a feed rate of between .006” and .010” (.15 mm and .25 mm) per revolution.

RT321F (Precision Counterboring and Finishing)

A 3/8” (9.52 mm) IC triangular, uncoated insert with a 1/64” (.8 mm) cutting radius. Gives the best finish results when machining precision counter bores often machined in diesel engine blocks. The 1/64” (.8 mm) radius should be used when machining to a step where the mating part requires a smaller radius to eliminate an interference problem. If you are machining a long bore where the spindle must be extended towards the limits of its travel or if a long stub bar is being used, the 1/64” (.8 mm) radius will minimize the possibility of chatter. A feed rate of .002” - .005” (.05 mm - .12 mm) should be used to obtain a typical surface finish. When machining large counter bores typically found in Cummins or Cat Blocks, a feed rate of .002 - .004/rev. (.05 mm - .1 mm/rev) should be used.

RT322F (Precision Counterboring and Finishing)

A 3/8” (9.52 mm) IC triangular, uncoated insert with a 1/32” (1.6 mm) cutting radius. Gives the best finish results when machining precision counter bores often machined in diesel engine blocks. A feed rate of .004” - .008” (.05 mm - .1 mm) should be used to obtain a typical surface finish. When machining large counter bores typically found in Cummins or Cat Blocks, a feed rate of .002 - .004/rev. (.05 mm - .1 mm/rev) should be used. When cutting gray cast iron use a speed in the 300 - 600 SFPM area for best productivity and tool life. Tool life of this insert is significantly less than the RT322.

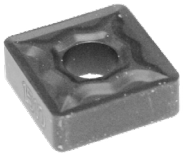
RT211F (Precision Counterboring and Finishing)

A 1/4” (6.35 mm) IC triangular, uncoated insert with a 1/64” (.8 mm) cutting radius. Gives the best finish results when machining precision counter bores often machined in diesel engine blocks. The 1/64” (.8 mm) radius should be used when machining to a step where the mating part requires a smaller radius to eliminate an interference problem. If you are machining a long bore where the spindle must be extended towards the limits of its travel or if a long stub bar is being used, the 1/64” (.8 mm) radius will minimize the possibility of chatter. A feed rate of .002 - .005 (.05 mm - .12 mm) should be used to obtain a typical surface finish. When machining large counter bores typically found in Cummins or Cat Blocks, a feed rate of .002 - .004/rev. (.05 mm - .1 mm) should be used. When cutting gray cast iron use a speed in the 300 - 600 SFPM area for best productivity and tool life. Tool life of this insert is significantly less than the RT211

RT212F (Precision Counterboring and Finishing)

A 1/4” (6.35 mm) IC triangular insert with a gold coating and 1/32” (1.6 mm) cutting radius. The coating gives the best finish results when machining precision counter bores often machined in diesel engine blocks. A feed rate of .002 - .005 (.05 mm - .12 mm) should be used to obtain a typical surface finish. When machining large counter bores typically found in Cummins or Cat Blocks, a feed rate of .002 - .004/rev. (.05 mm - .1 mm/rev.) should be used. When cutting gray cast iron use a speed in the 300 - 800 SFPM area for best productivity and tool life. Tool life of this insert is significantly less than the RT211.RS322 (High speed oversize through boring)

RS322 (High speed oversize through boring)



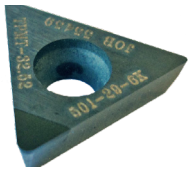
A 3/8” (9.52 mm) IC, square insert with a black ceramic coating. It is used on Rottler boring machines for through boring when removing .010” - .060” (.25 mm - 1.5 mm) on the diameter. A very economical insert as it has 8 cutting edges. On a 4” (100mm) bore use 1000 - 1200 RPM and a feed rate of .008” - .012” (.2 mm - .3 mm) per rev feed rate to obtain the typical surface finish. The insert can also be used for sleeve cuts when a square step is not required. For example, when used on an F80 or F5 machine it can be run at 1000 – 1200 RPM and .005/rev (.12 mm/rev) feed rate to remove up to .200” (5 mm) on the diameter from a 4.200” (106 mm) bore.

When cutting nodular, ductile, or compacted graphite cast iron the speed should be in the 200 – 400 SFPM area – 300 RPM on a 4” (100 mm) diameter bore. Nodular, ductile, or compacted graphite cast iron is found most often in high performance engine blocks or sleeves. When cutting these tuff cast irons it is best to use a feed rate of between .006” and .010” (.15 mm and .25 mm) per revolution.

6301E (High speed oversize through boring)

This is a square 3/8” (9.52 mm) IC, 1/32” (1.6 mm) radius, double sided, CBN Insert. These inserts are intended for use on high speed boring on Rottler F80 and F60 series machines. On common cast iron blocks the RPM should be set to achieve 1000 – 2200 SFPM On harder cast irons the RPM should be reduced to obtain acceptable tool life. A feed rate of .010” - .014” (.25 mm - .36 mm) per revolution. They have exceptional long life when removing up to .040” (1.02 mm) on the diameter. They do not give good tool life on some cast irons with high sulfur content.

501-29-6K (High speed aluminum boring)



This is a 3/8” (9.52 mm) IC, triangle insert with a black diamond tip. It has a 1/32” (1.6 mm) radius. This insert is used to bore aluminum cylinders. It cannot be used to bore any other material. It is the best insert for finishing aluminum. For best tool life and finish the insert can be run from 400 – 4000 SFPM. Feed rates between .004” and .010” (.1 mm and .25 mm) should be used.

511-29-20E (Steel boring)

A 3/8” (9.52 mm) IC triangular insert with a gold coating and 1/32” (1.6 mm) cutting radius. This insert is for boring steel and ductile iron. It features a chip breaker to break-up the “string” of metal that can often form when boring steel.

SURFACING INSERTS

Rottler offers a wide variety of inserts used for surfacing. There are many applications in surfacing that include a variety of materials to be surfaced. Cylinder heads with pre-combustion chambers are particularly challenging because there are such a variety of materials used by the different cylinder head manufactures. One of the latest inserts we have tested for cutting cylinder heads with pre-combustion chambers is the 7202Z. It is probably the best for cutting a wide variety of heads with pre-combustion chambers. The 6303B is our standard for cutting a wide variety of cast iron heads. The 6303B will cut aluminum but is not ideal. The best insert for cutting aluminum is the 6303M which is a diamond insert.

When machining large cylinder blocks with larger precision depth counter bores using a 18” (450mm) or larger diameter fly cutter it is important to use a square 6301J insert. The smaller radius minimizes cutter deflection and will result in more accurate counterbore depths.

Below are the inserts commonly used on Rottler machines in surfacing/milling applications. Please read carefully..

6303B

A round 3/8” (9.52 mm) IC, double sided, CBN Insert. An excellent, long life insert for surfacing cast iron heads and blocks - round shape gives many cutting edges on each side of insert. When using a 14” (355.6 mm) cutterhead (SF, F65, F80) speeds range from 900-1200 RPM. When using an 18” (457 mm) cutterhead speeds range from 600-800 RPM.

6303M

A round 3/8” (9.52 mm) IC, single sided, PCD Insert. For use on aluminum only - heads and blocks without liners. This insert has a thin layer of PCD applied to a carbide disk. The diamond appears to be a shiny black wafer. The hardness of the diamond resists the abrasive nature of the silica in aluminum heads and blocks. RPM speeds with a 14” (355.6 mm) cutter range from 900-2000 RPM.

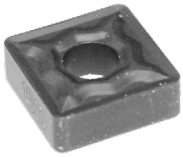
6303U

A round 3/8” (9.52 mm) IC, single sided, CBN Insert. This insert does an excellent job when cutting hard cast iron blocks and heads of a single material or bi-metal. This insert is the best to use when machining compacted graphite cast iron heads and blocks often found in the performance industry. RPM speeds with a 14” (355.6 mm) cutter range from 650-750 RPM.

6303K

A round, gold-colored, 3/8” (9.52 mm) IC, single sided, coated carbide insert. This is a very economical, general purpose insert for surfacing aluminum. It is advisable to use this insert for rough cutting to remove welding or contaminants before. A PCD insert should be used for the final cut to give the super fine finish required for MLS (multi layer steel) head gaskets. RPM speeds with a 14” (355.6 mm) cutterhead range from 600-1000 RPM.

RS322



A square 3/8” (9.52 mm) IC carbide insert with a very dark purple ceramic coating. This carbide insert is normally used for high speed boring. It works well as an economical insert for rough surfacing or heavy stock removal of cast iron. A CBN insert should be used for the final finish cut.

6301J

A square 3/8” (9.52 mm) IC, 1/16” (.0039 mm) radius, double sided, CBN Insert. The 1/16” (.0039 mm) radius of this insert will produce a more accurate (flatter) finish than a round insert typically used for surfacing on F80/F90 Series machines when surfacing large diesel blocks and heads which are high in nickel. The square surfacing insert is intended for F80/F90 applications where it may encounter heavier cuts and greater interrupted cuts. When using an 18” (457 mm) cutter speeds range from 600-800 RPM, and with a 14” (355.6 mm) cutter speeds range from 900-1200 RPM.

6303V

An octagonal 3/8” (9.52 mm) IC, .094” (2.4 mm) corner radius, double sided, solid CBN Insert with 16 cutting corners. The .094” (2.4mm) corner radius of this insert will produce a more accurate (flatter) finish than a round 3/8” (.52mm) or square 1/16” (1.6mm) corner radius insert typically used for surfacing on F70/F80/F90/F100 Series machines when surfacing large diesel blocks and heads which are high in nickel. The octagonal surfacing insert is intended for applications where it may encounter interrupted cuts. When using an 18” (457 mm) cutterhead, speeds range from 600-800 RPM, and with a 14” (355.6 mm) cutter speeds range from 900-1200 RPM. The .094” (2.4mm) corner radius will allow faster feed rates compared to the 6301J square insert.

1/2” (12.70mm) SURFACING INSERTS

6303P

A round 1/2” (12.7 mm) IC, single sided, PCD Insert. For use on aluminum only - heads and blocks without liners. This insert has a thin layer of PCD applied to the top of a carbide disk. The diamond appears to be a shiny black wafer. The hardness of the diamond resists the abrasive nature of the silica in aluminum heads and blocks. RPM speeds with a 14” (355.6 mm) cutter range from 1000-2000 RPM. Requires the purchase of 1/2” (12.7 mm) negative rake tool holders. The standard Rottler 3/8” (9.52 mm) IC tool holders will not hold this insert.

6303Q

A round 1/2” (12.7 mm) IC double sided, CBN Insert. An excellent insert for machining cast iron heads and blocks. Round shape gives many cutting edges on each side of insert. Requires the purchase of 1/2” (12.7 mm) negative rake tool holders. The standard Rottler 3/8” (9.52 mm) IC tool holders will not hold this insert.

6864E

A five sided / five cornered insert coated carbide insert. There are a total of ten cutting corners on this inserts. This is the best insert for roughing and finishing spray weld. This is used in Rottler milling heads that are designed specifically for cutting spray weld. Currently they cannot be used in Rottler's common "flycutter" style surfacing cutterheads.

Bi-metal Surfacing

Cylinder Heads with Pre-combustion Chambers and Aluminum Blocks with Hard Sleeves
Cylinder heads with pre-combustion chambers or aluminum engine blocks with cast iron or steel cylinder sleeves are a challenge to cut and most often require a special cutting insert and special cutting technique. There are many different material combinations so there is not one insert that works the best on all applications. Below is information to use as a guide to the best insert to use and some of the required cutting parameters.

Generally the tool life when using any of these inserts in the cutting of bi-metal surfaces will be short when compared to cutting a single material. The cost of the insert per surfacing job will be higher compared with cutting single materials. The customer must incorporate the higher insert cost into the price charged for the surfacing job.

Another excellent alternative to cutting cylinder heads with pre-combustion chambers is to remove the combustion chamber from the head, surface the cylinder head, then use the Rottler Pre-combustion Chamber Re-seating Tool to machine the combustion chamber counterbore back to OEM specification depth. It is fast and economical to use. See Bulletin C49.

Cylinder Heads with Protruding Valve Seats
Some cylinder heads have valve seats that protrude into the head gasket surface. Valve seats are made out of a wide variety of material. Some are very hard or difficult to cut when compared with the aluminum or cast iron head surface. In many cases it is best to cut the valve seat down below the head surface in a seat and guide machine. This takes a few more minutes when cutting the valve seats but it can save a lot of time and minimize tooling cost when surfacing the head.

The following inserts use Rottler 3/8" (9.52mm) Toolholders supplied with Rottler Surfacing Cutterheads;

6303S

A round 3/8" (9.52 mm) IC, single sided, CBN Insert. For use on aluminum blocks with iron liners and aluminum heads with steel pre-combustion chambers. RPM speeds with a 14" (355.6 mm) cutter range from 650-750 RPM.

6303U

A round 3/8" (9.52 mm) IC, single sided, CBN Insert. This insert does an excellent job when cutting hard cast iron blocks and heads of a single material or bi-metal. This insert is the best to use when machining compacted graphite cast iron heads and blocks often found in the performance industry. RPM speeds with a 14" (355.6 mm) cutter range from 650-750 RPM.

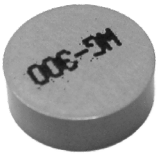
6303R

A round 3/8” (9.52 mm) IC, single sided, CBN Insert. For use on cast iron heads with steel pre-combustion chambers. RPM speed with a 14” (355.6 mm) cutter range from 600-700 RPM and with an 18” (457 mm) cutter range from 500-600 RPM.

6301I

A square 3/8” (9.52 mm) IC, double sided, ceramic insert. For use on cast iron heads with pre-combustion chambers. You can make one finish cut and two rough cuts with each new cutting edge. Always use a new edge when making a finish cut. Use 350-500 RPM on a 14” (355.6 mm) diameter cutterhead. See Bulletin C49.

6301V



A round 3/8” (9.52 mm) IC, double sided, ceramic insert. For use on cast iron heads with pre-combustion chambers. You can make one finish cut and two rough cuts with each new cutting edge. Always use a new edge when making a finish cut. Use 350-500 RPM on a 14” (355.6 mm) diameter cutterhead. See Bulletin C49.

SPECIAL TOOLHOLDER AND INSERT FOR SURFACING DIESEL ALUMINUM HEADS WITH STEEL PRE-CHAMBERS

7202X

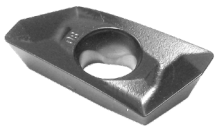
Fly Cutter Tool Holder Assembly uses special 7202Z insert for surfacing aluminum cylinder heads with steel pre-combustion chambers.

7202Z

Round Insert, 3/8” (9.52 mm) IC gold coated for aluminum cylinder heads with steel pre-combustion chamber. For use with 7202X tool holder only. RPM speeds with 14” (355.6 mm) cutter range from 450-550 RPM and with a 16” (406.4 mm) cutter, 400-500 RPM. Requires very slow feed rate. Surfacing these heads is a difficult operation and only the minimum amount of material can be removed per pass. For best results, rotating the insert so that a new ‘corner’ is used for the final pass should give good results.

INSERTS FOR SHELL MILLING CUTTERHEADS

6514T



Parallelogram configuration, carbide material. Special insert used with the Rottler 650-2-44P 4” (101.6 mm) shell mills only. Designed for general purpose applications.

MAIN LINE BORING INSERTS

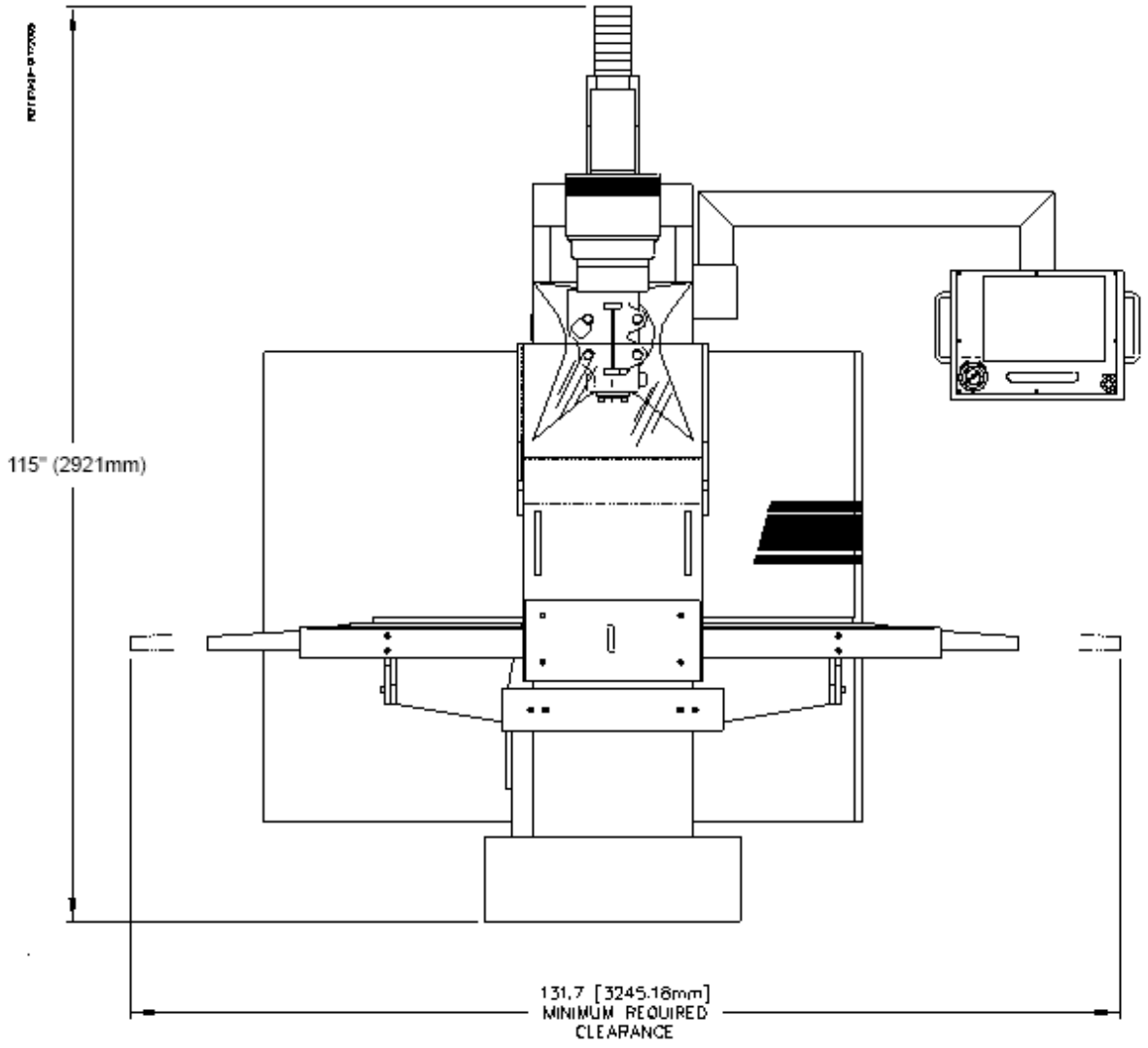
Use the same RT series inserts as defined under cylinder boring. Depending on type of toolholder, either 1/4” (6.35 mm) IC or 3/8” (9.52 mm) IC inserts will be required. Commonly 1/64” (.8 mm) radius inserts are used for rough or heavy cutting, and 1/32” (.4 mm) radius inserts are used for finish boring for a smooth surface finish. In extreme conditions were the material is hard or the tool is extended and prone to chatter, use the 1/64” (.8 mm) inserts.

CONNECTING ROD INSERTS

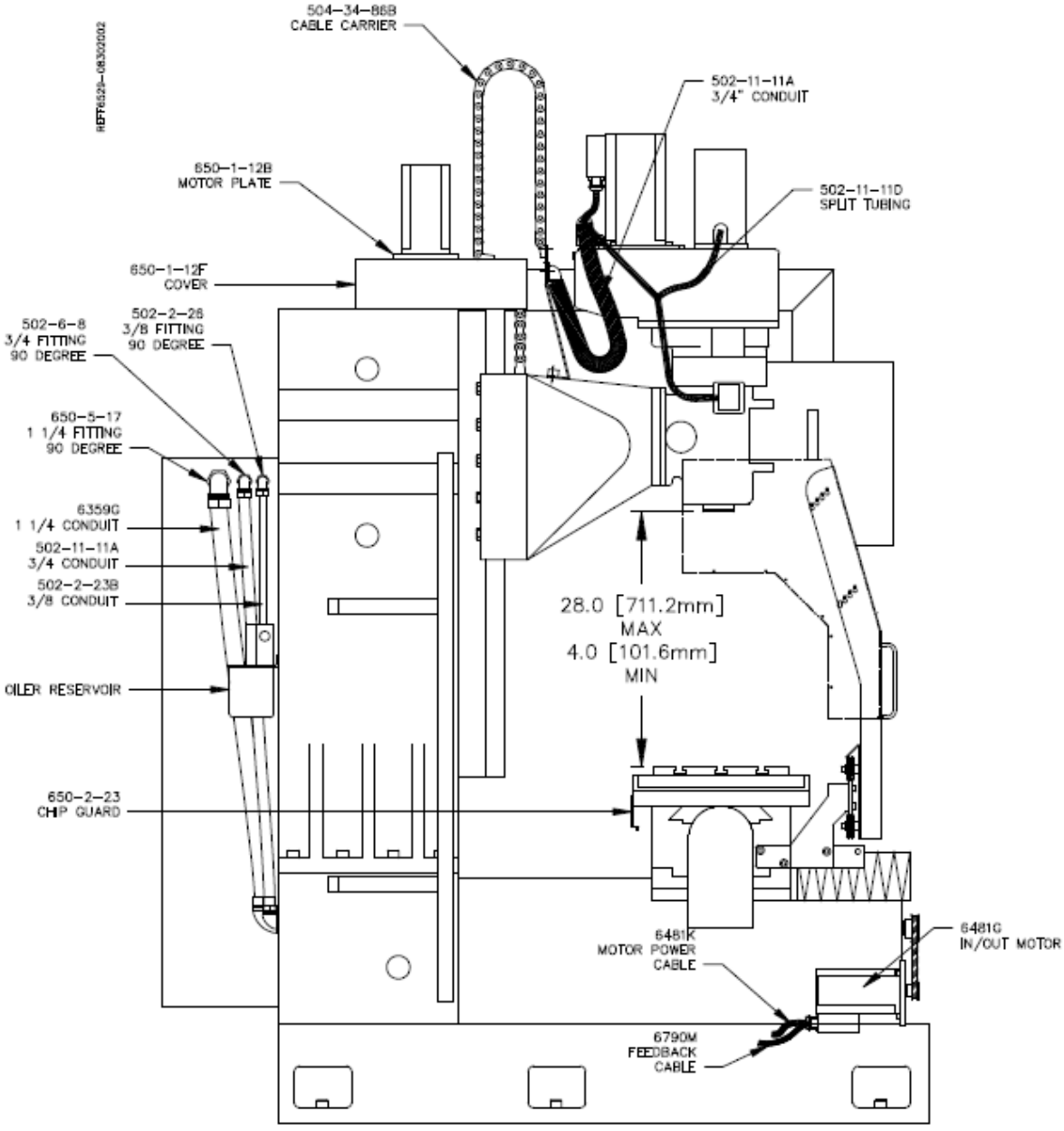
Many customers have reported good results boring connecting rods with Rottler RT inserts. When boring small end bearings made of bronze, the RTF series of inserts should be used.

Machine Parts

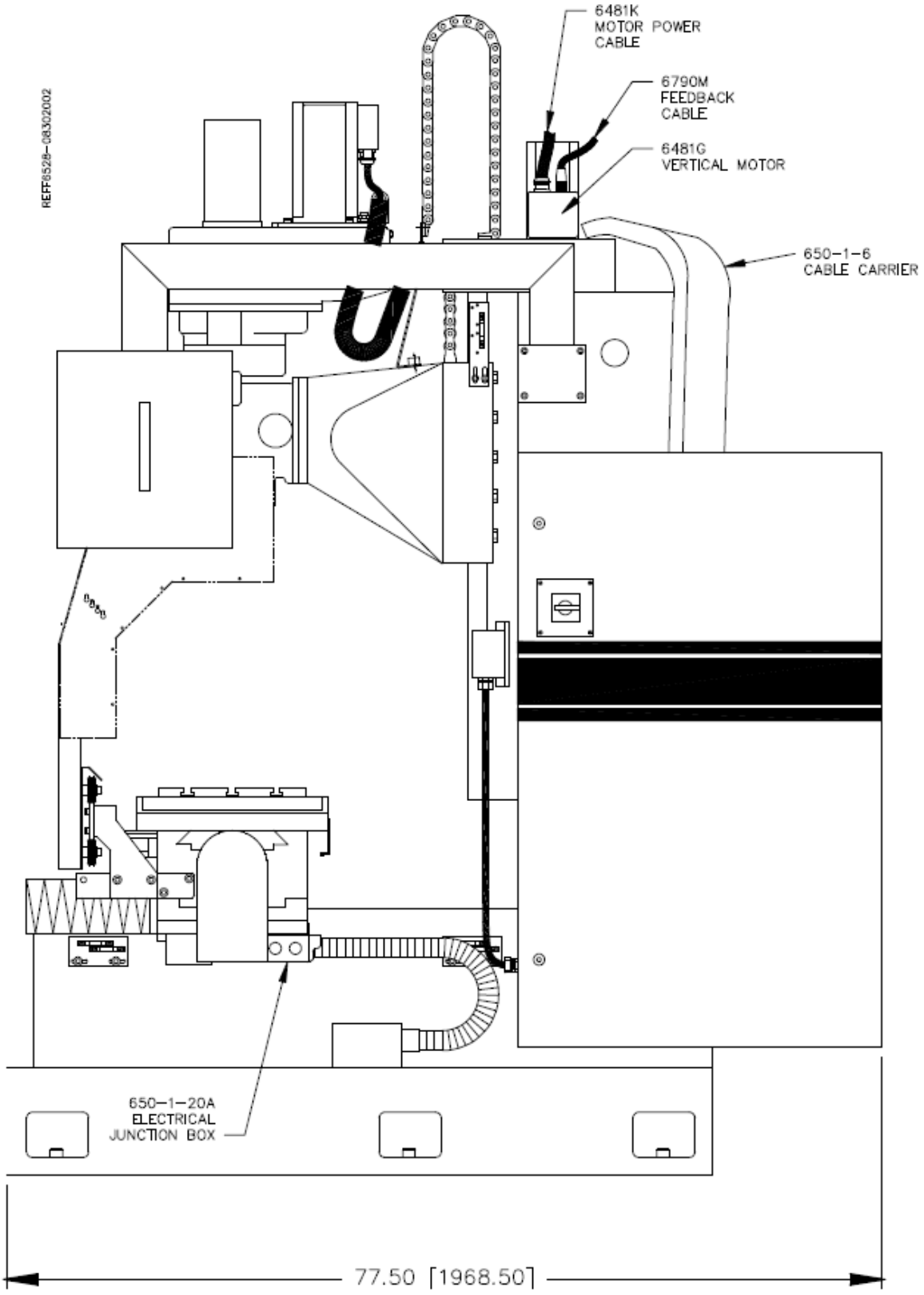
F60DM Front View



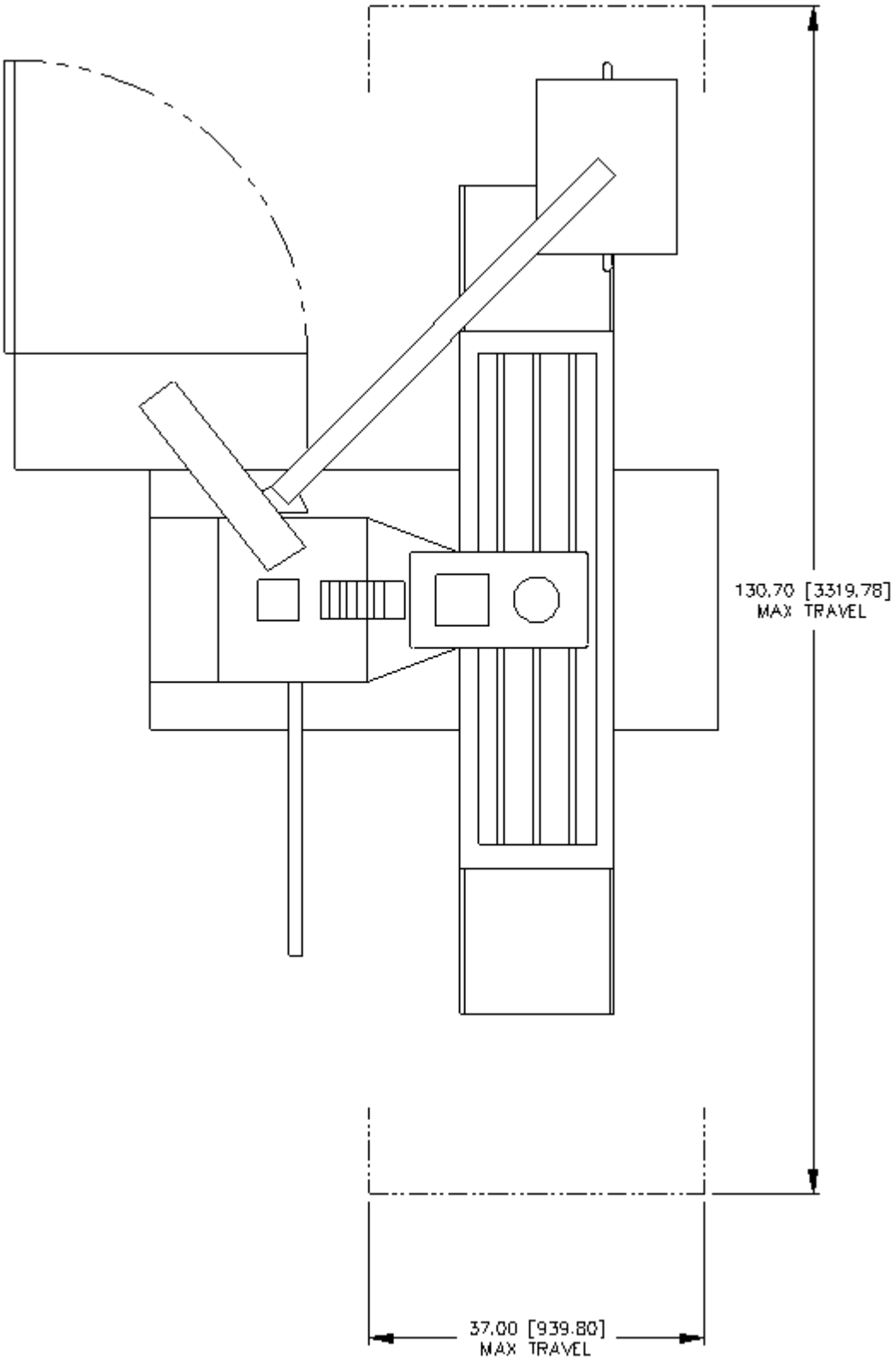
F60DM left Side View



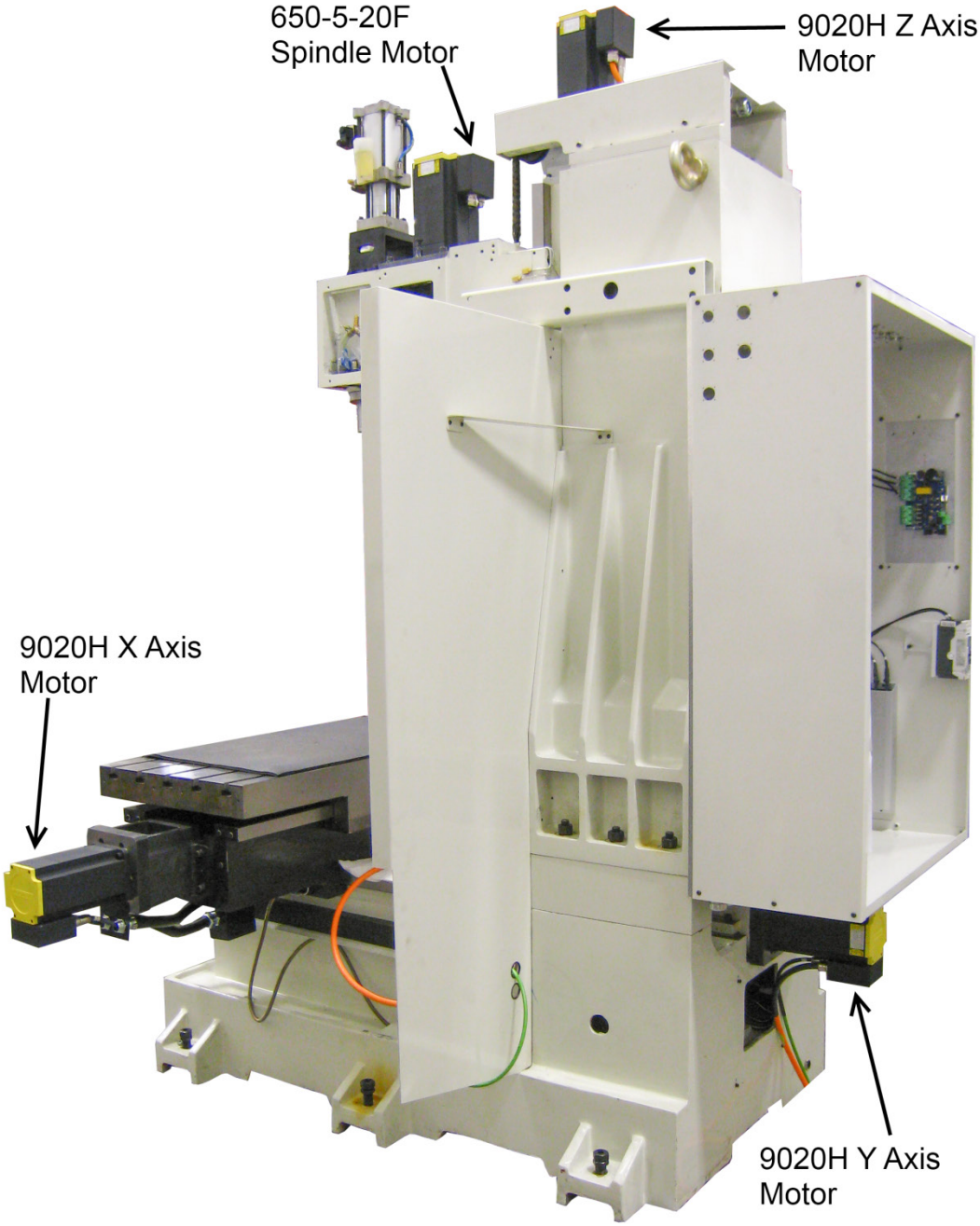
F60DM Right Side View



F60DM Top View

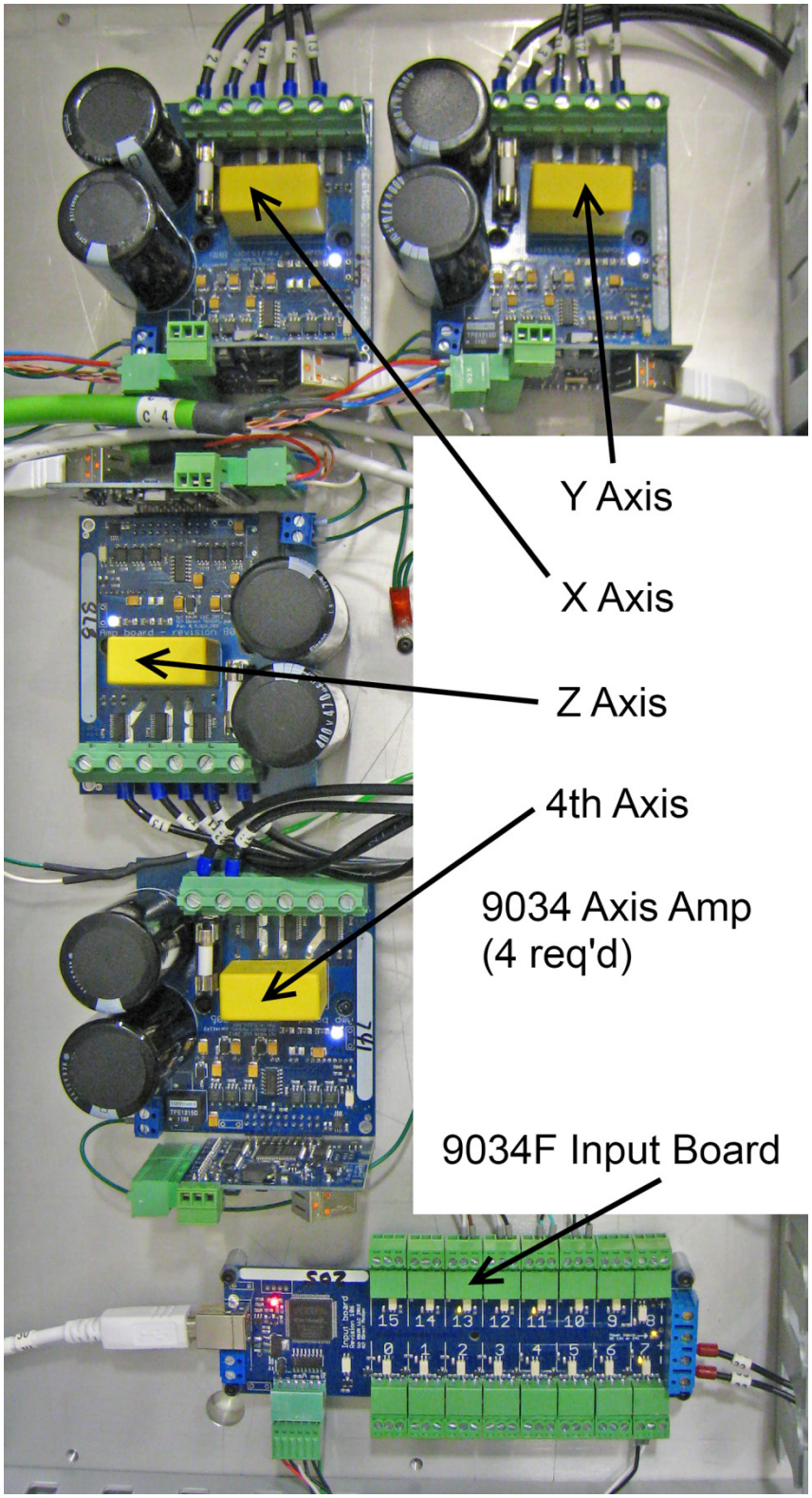


Motor Locations

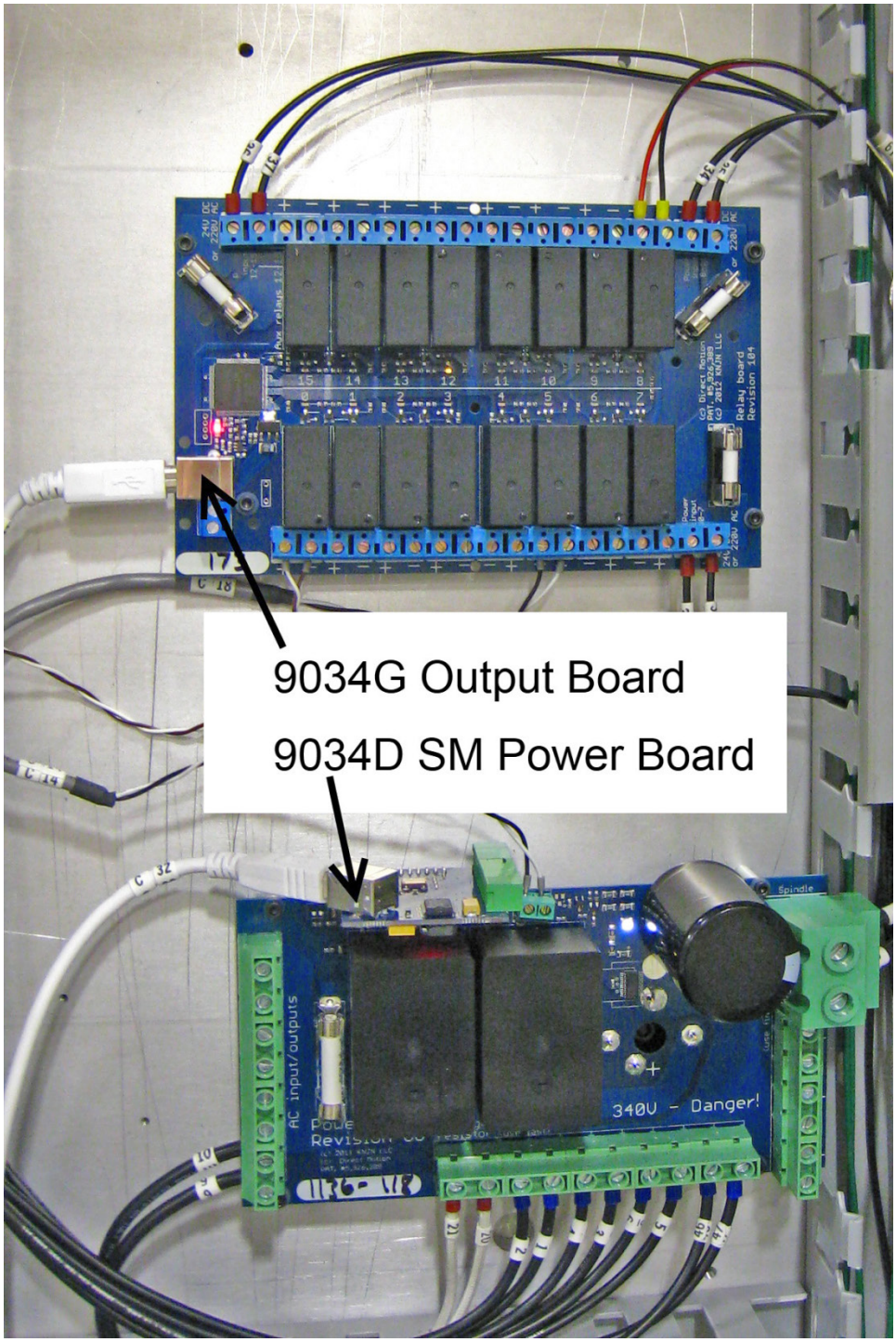


Electrical Panel

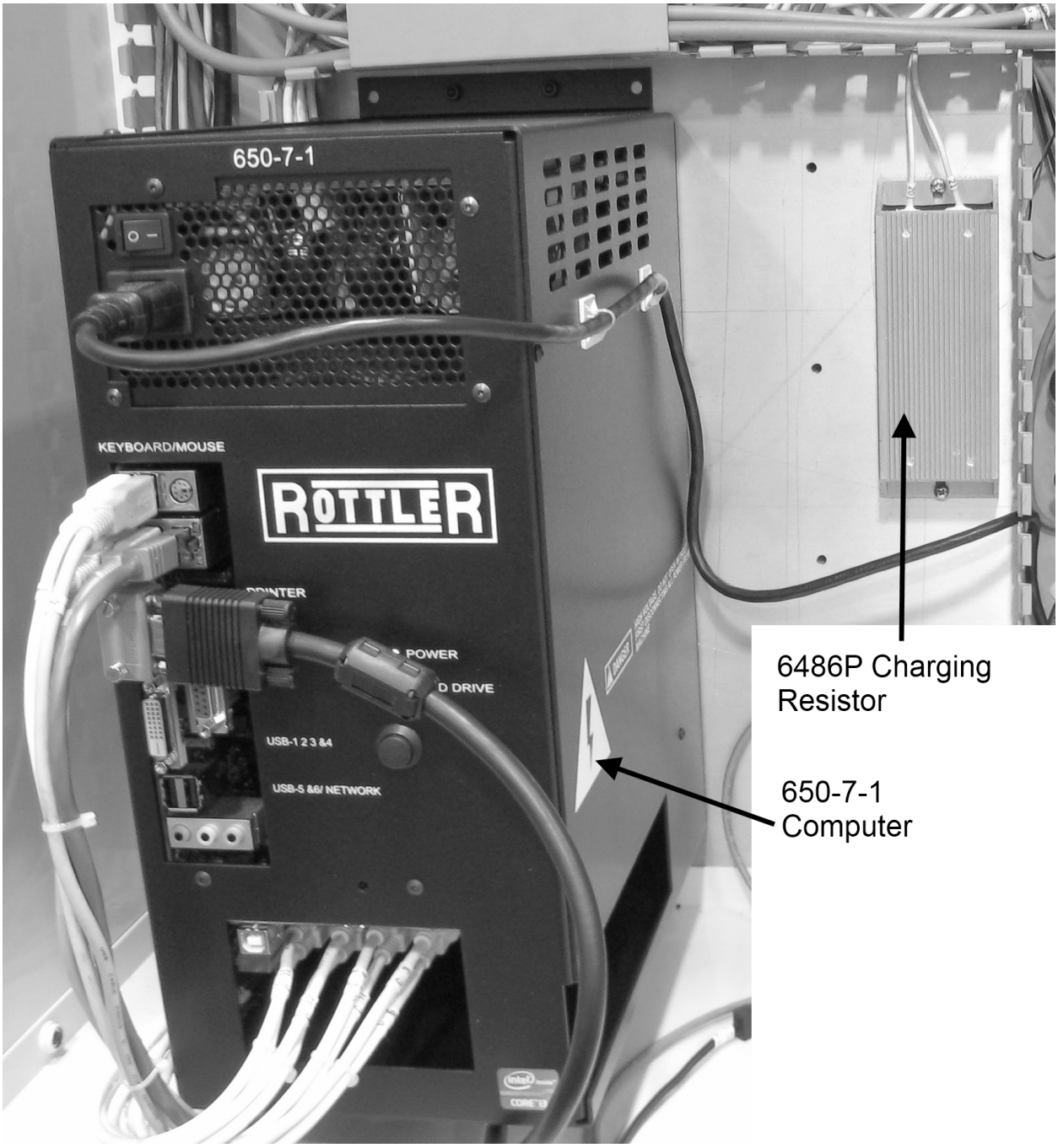
Axis Amps & Input Board



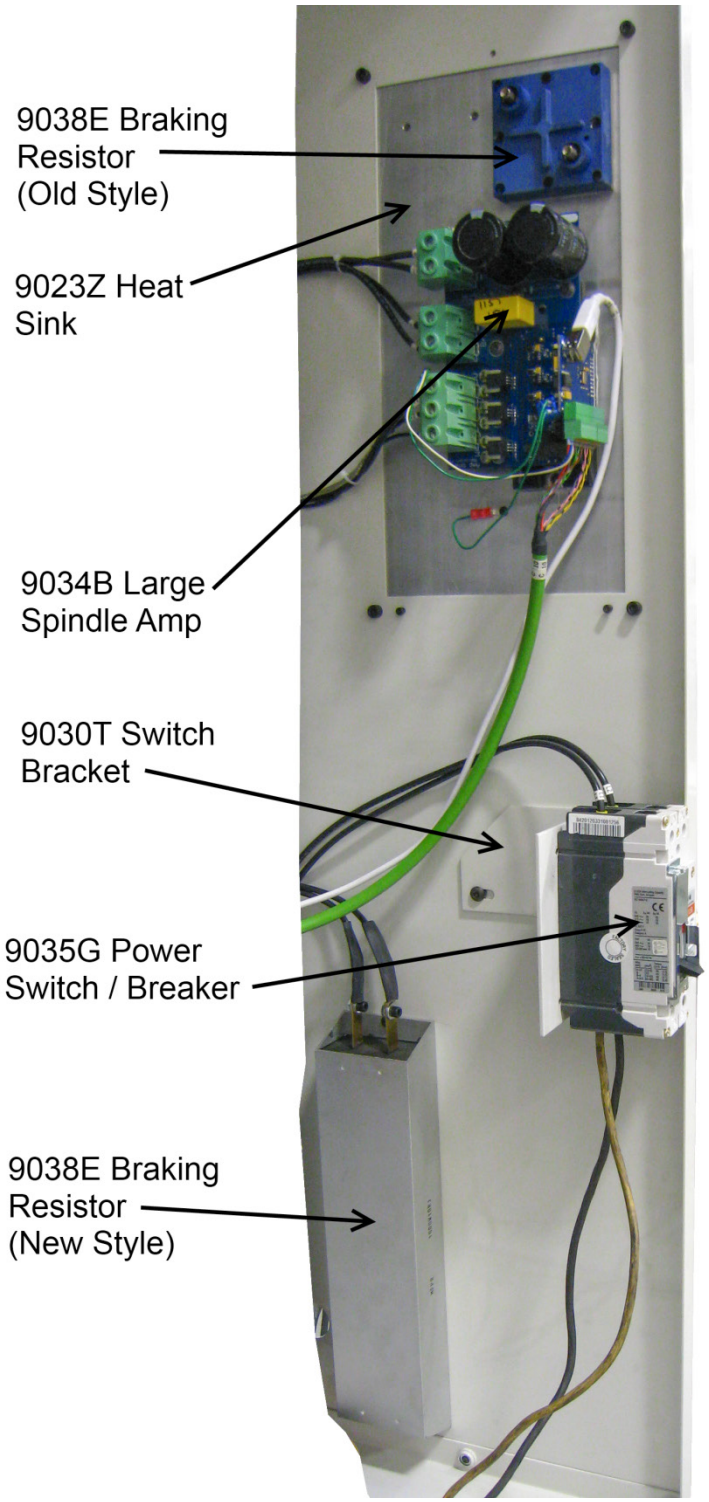
Output & SM Power Boards



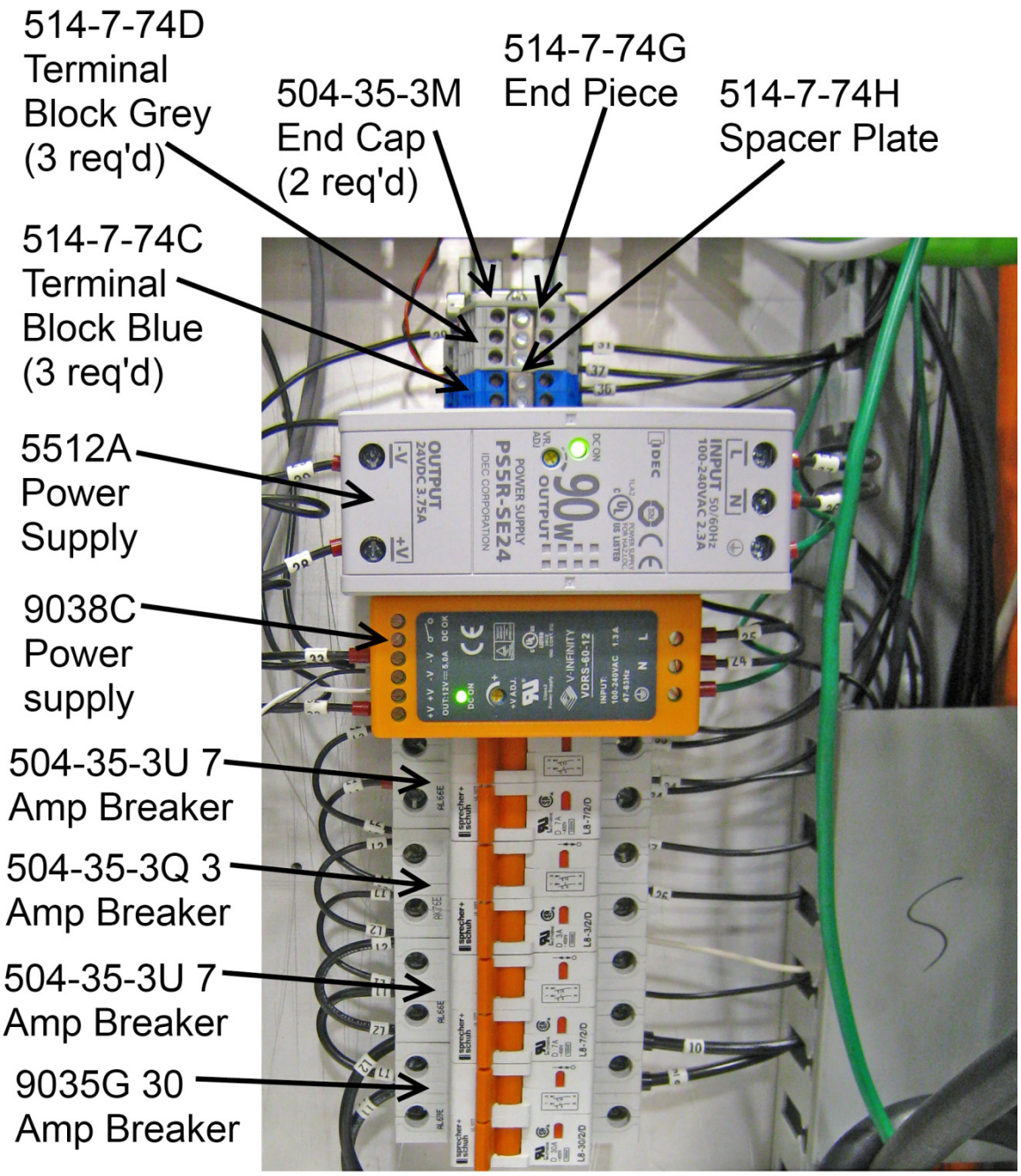
Computer Assembly



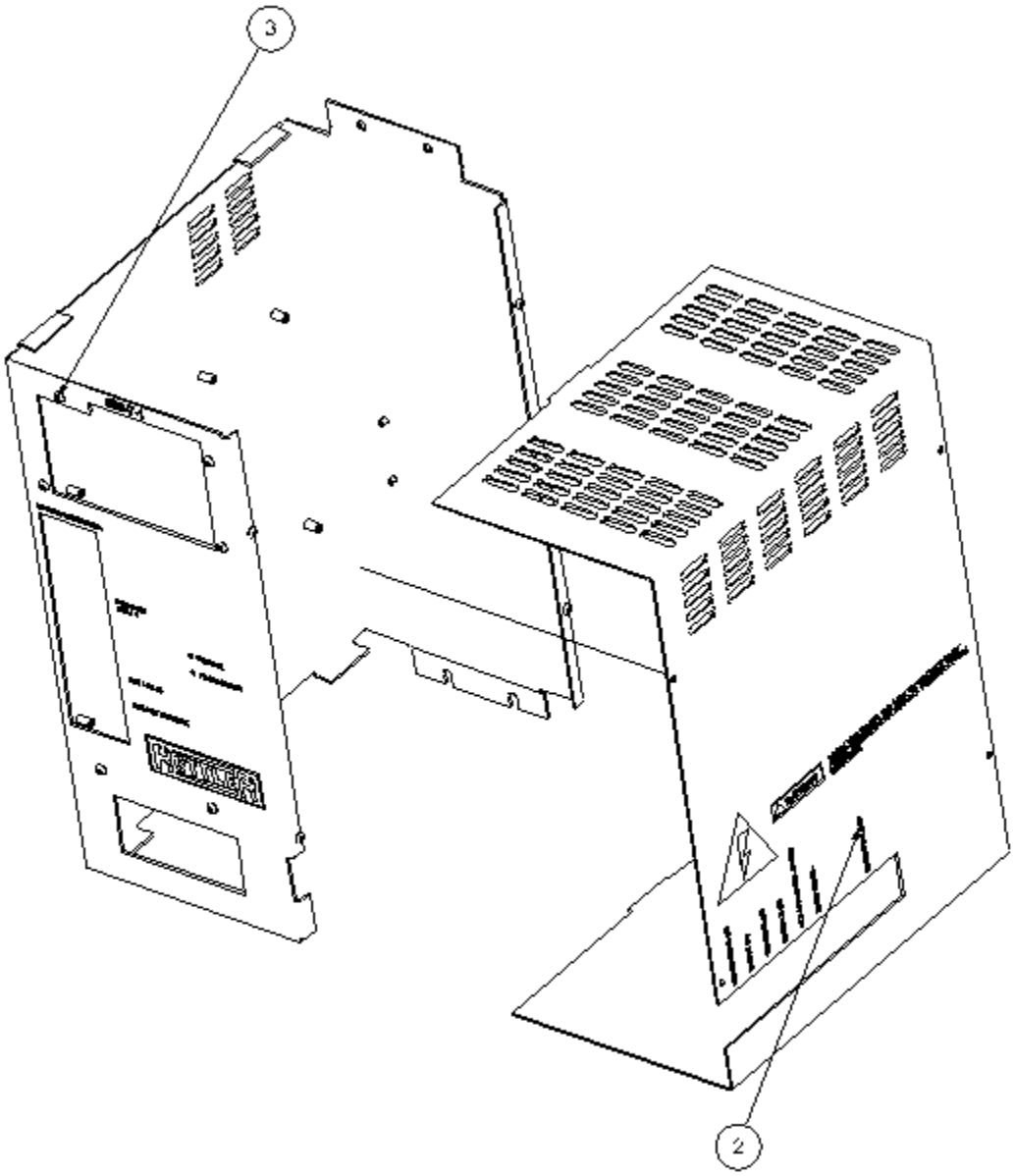
Enclosure Side Components



DIN Rail Components

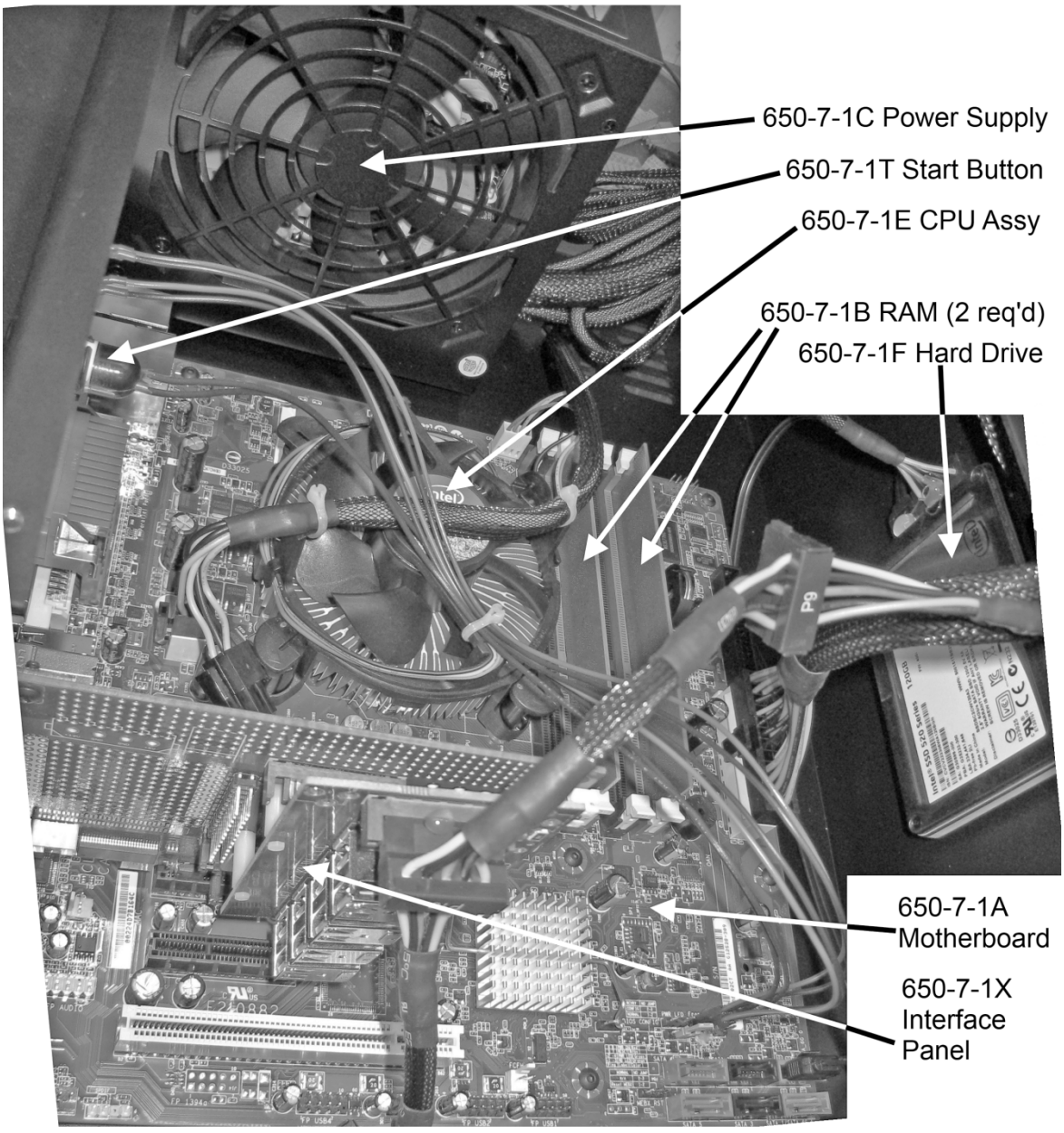


Computer Enclosure 650-1-27X



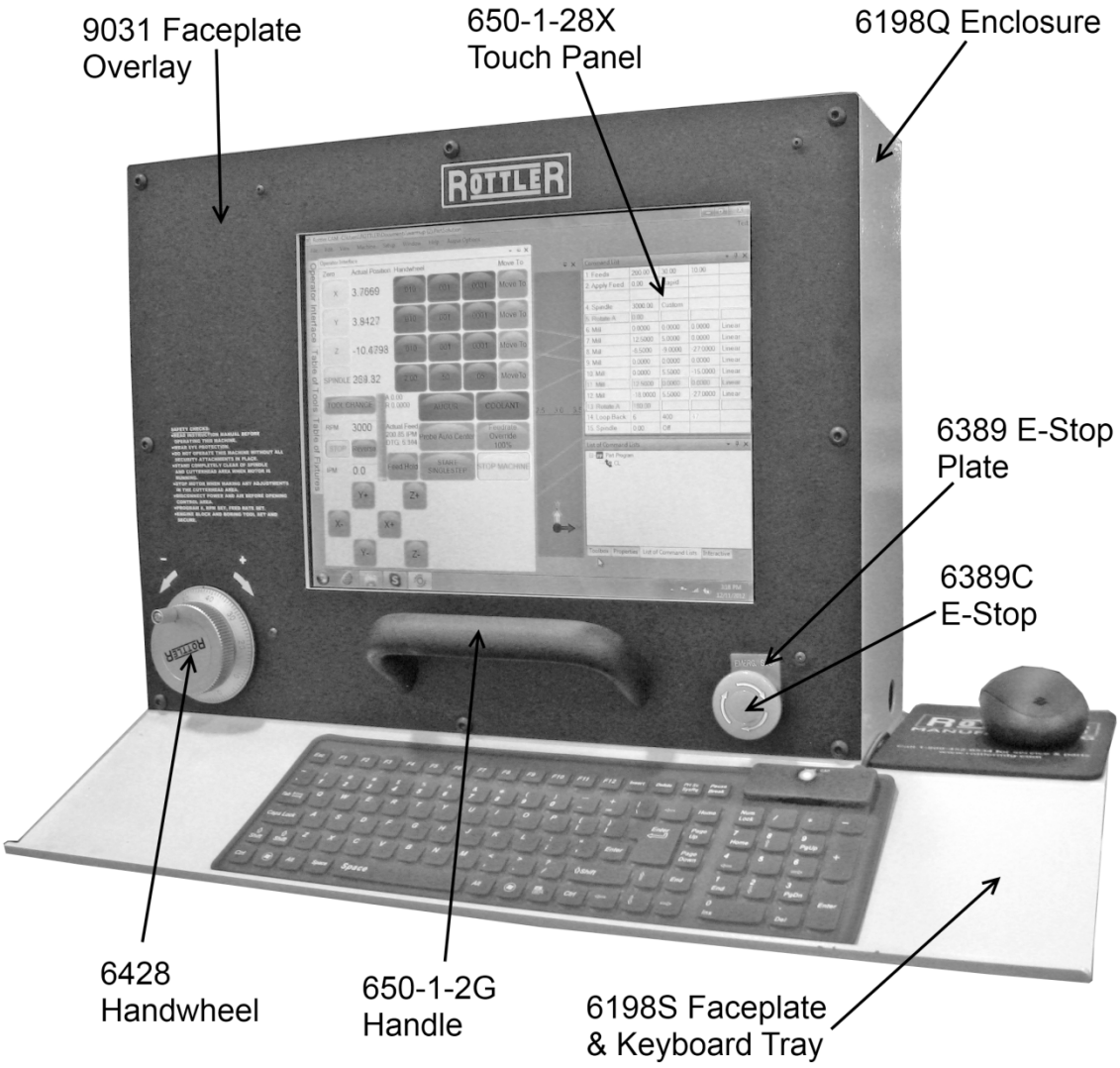
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	650-1-27Y	Computer Case, Front
2	1	650-1-27Z	Case, Computer, Side

Computer Parts

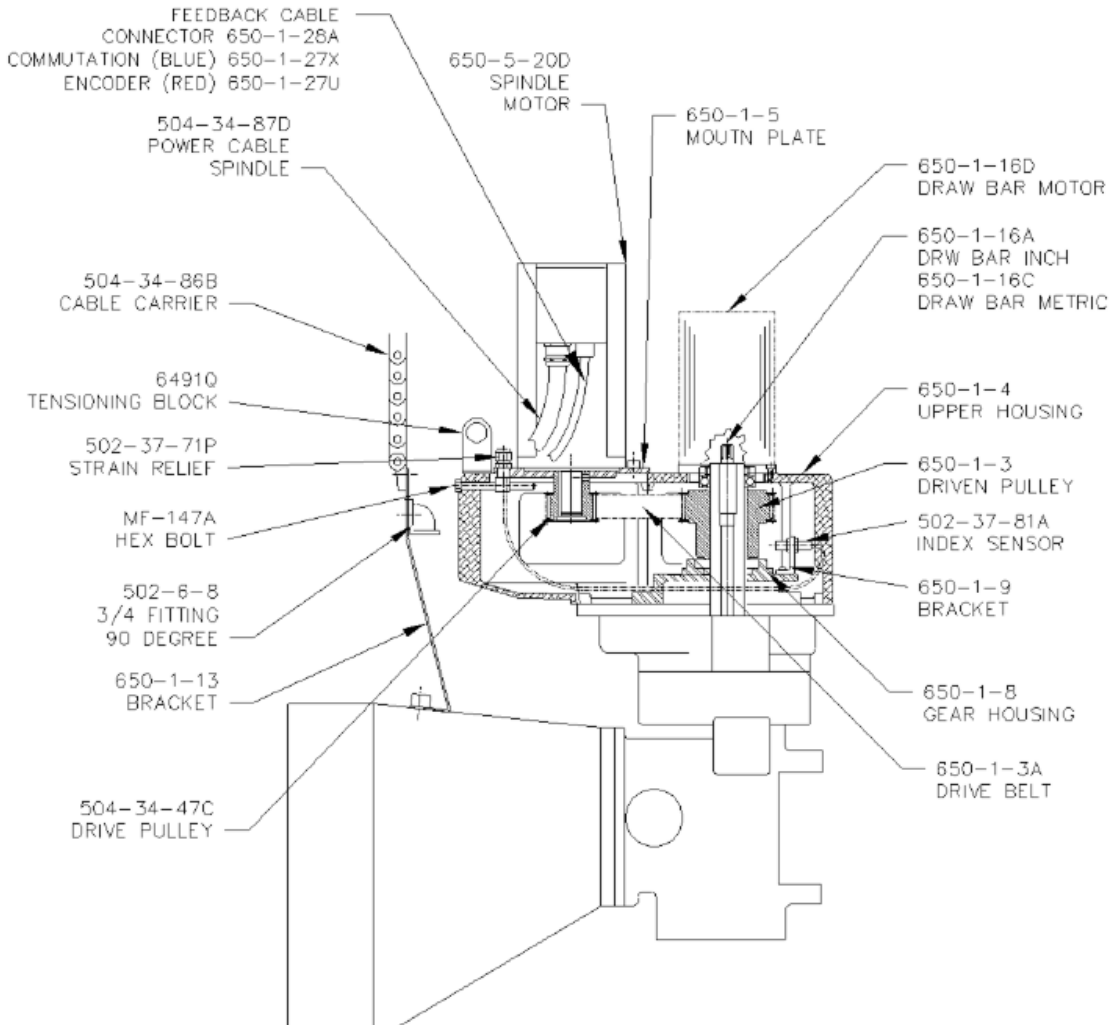


Enclosure Door Components

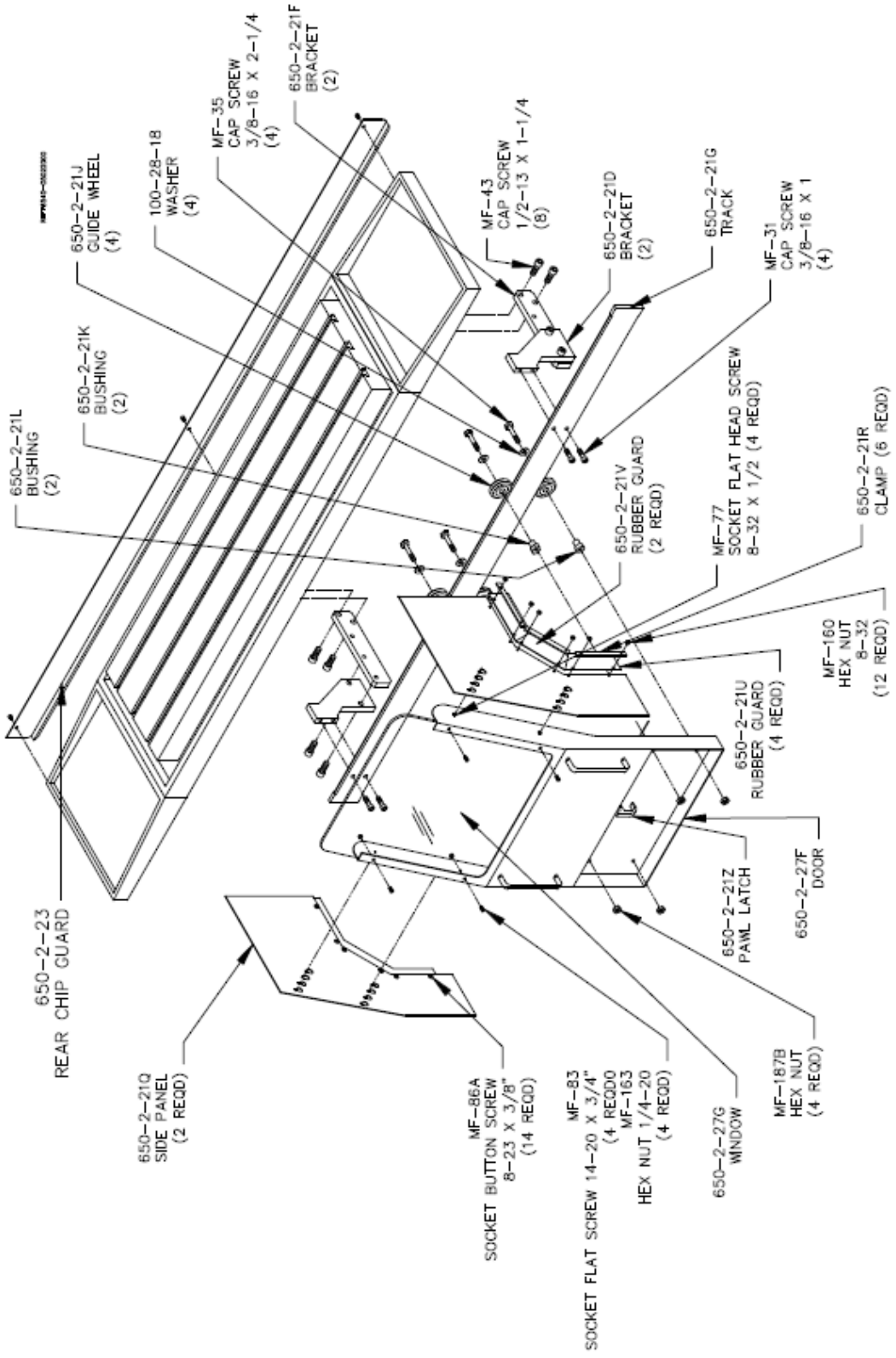
Control Panel



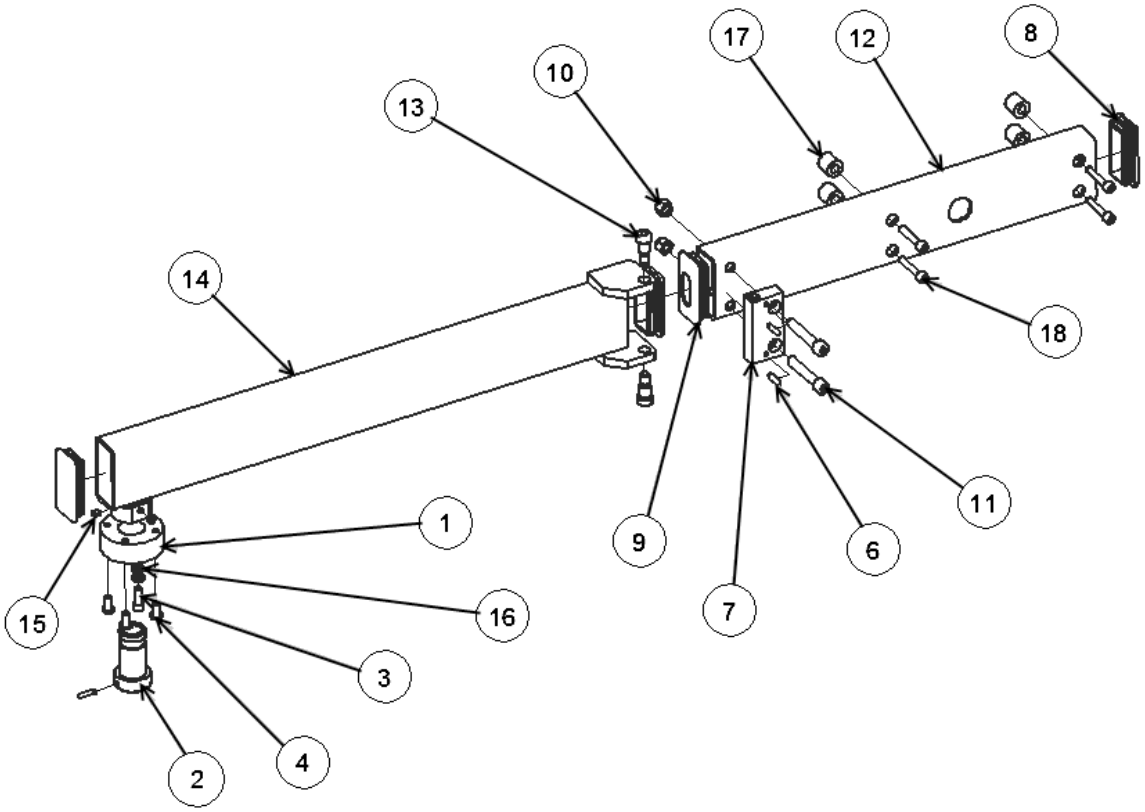
Upper Belt Housing



Chip Shield Assembly

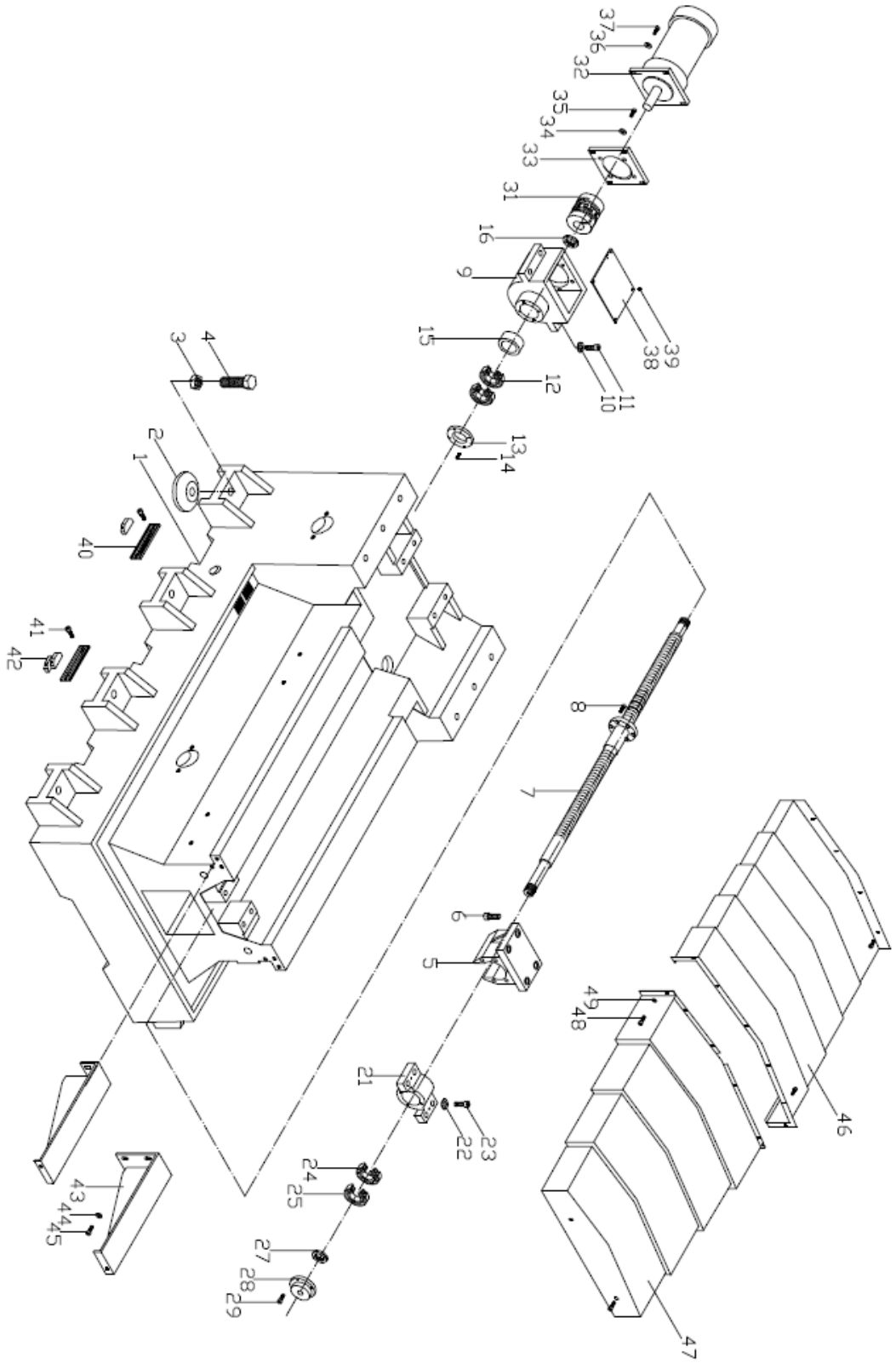


Pendent Swing Arm Assembly



650-1-33A PENDANT SWING ARM ASSEMBLY F60			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	6196B	Swivel Housing
2	1	6197B	Swivel
3	1	MF-31	S.H.C.S. 3/8 - 16 UNC - 1
4	3	MF-96	3/8-16UNC x 3/8" LG. Socket Button Head Cap Screw
6	3	MF-204	1/4 x 1 Dowel Pin
7	1	6201H	HINGE BLOCK - PENDANT F8
8	2	6200J	Plug
9	2	6200L	Tubing Plug, Slotted
10	2	MF-186	1/2-13 Nylock Nut
11	2	MF-45C	S.H.C.S. 1/2 - 13 UNC - 3
12	1	650-1-33	SWING ARM SUPPORT - F60 PENDANT
13	2	6201J	BOLT, PIVOT- PENDANT F80
14	1	6200B	Swing arm
15	2	MF-71	Cup Point Set Screw 3/8 - 16 x 3/8
16	2	MF-184A	3/8" LOCK WASHER
17	4	650-1-33B	SPACER, SWING ARM SUPPORT - F69
18	4	MF-34	3/8-16UNC x 2" LG. S.H.C.S.

Base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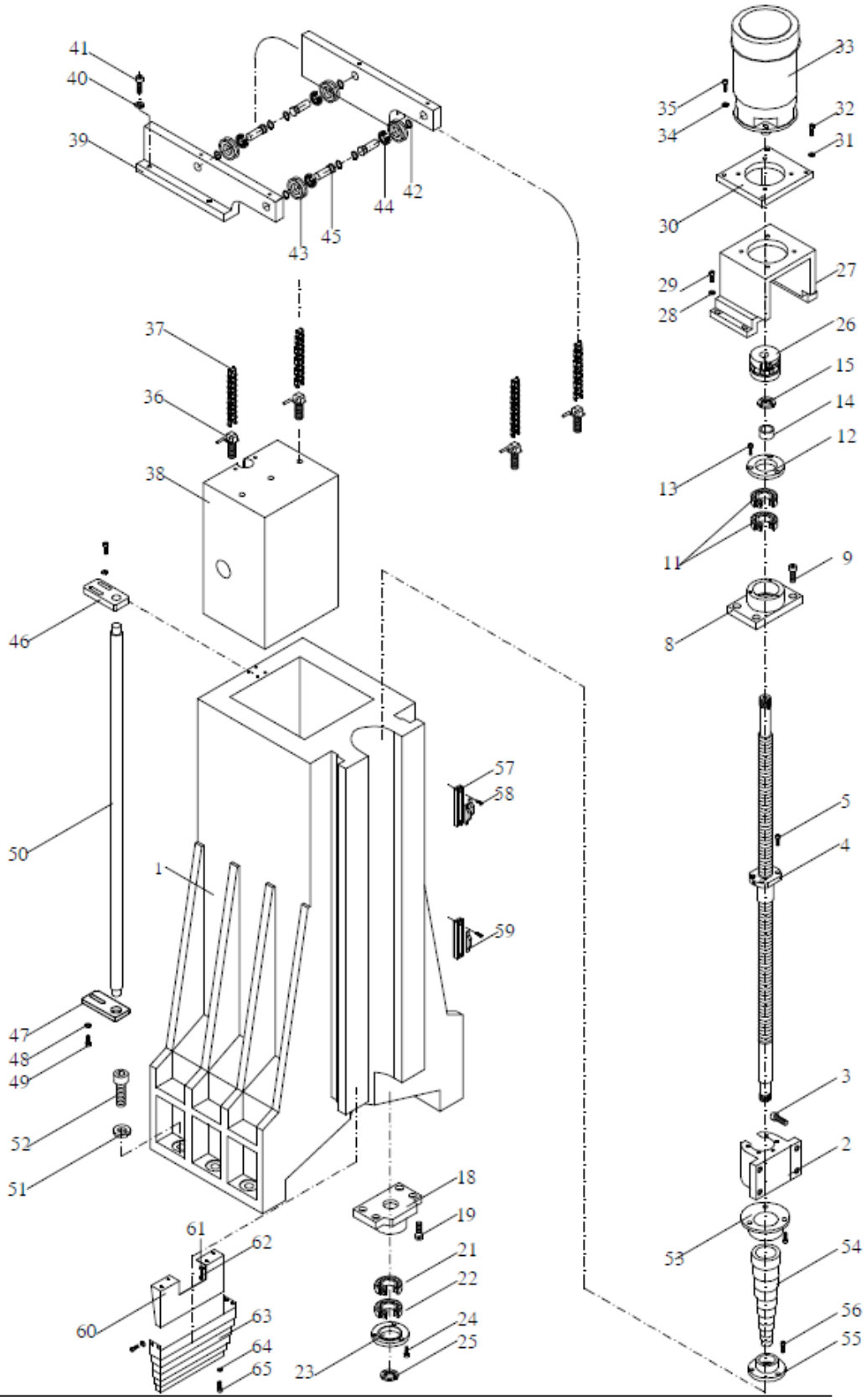
Base Parts List

ITEM	PART	Description	Q'TY	ITEM	PART	Description	Q'TY
1		Base	1	40		Seat	2
2		Leveling pad	8	41		Screw (M6*12)	4
3		Nut	8	42		Dog	3
4		Screw (M24*70)	8	43		Cover Brace	2
5		Nut Bracket	1	44		Washer (M6)	6
6		Screw(M12*40)	4	45		Screw (M6*20)	6
7		Ballscrew	1	46		Rear Way Cover	1
8		Screw (M10*25)	5	47		Front Way Cover	1
9		Bearing Bracket	1	48		Screw (M6*12)	18
10		Washer (M12)	4	49		Washer (M6)	18
11		Screw (M12*60)	4				
12		Bearing (25T AC62B)	2				
13		Bearing Cover	1				
14		Screw (M6*20)	4				
15		Spacer	1				
16		Nut (YSF M25*1.5P)	1				
21		Bearing Bracket	1				
22		Washer (M12)	4				
23		Screw (M12*70)	4				
24		Bearing (6305)	1				
25		Bearing (25T AC62B)	1				
27		Nut(YSF M25*1.5P)	1				
28		Cover	1				
29		Screw(M6*12)	4				
31		Coupling	1				
32		Motor	1				
33		Motor Plate	1				
34		Washer (M10)	4				
35		Screw (M10*35)	4				
36		Washer (M10)	4				
37		Screw (M10*35)	4				
38		Cover	1				
39		Screw (M5*8)	4				

Column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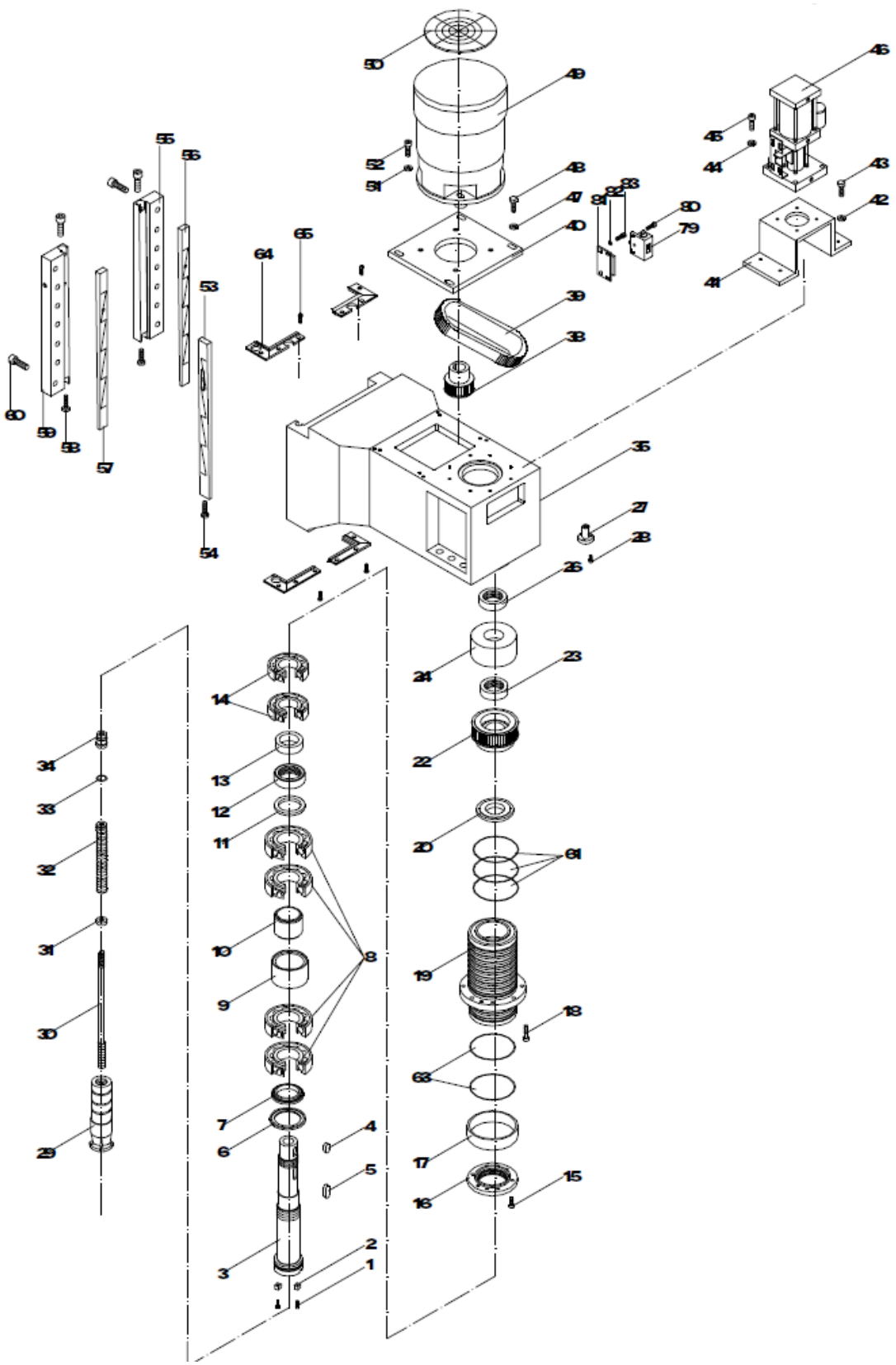
Column Parts List

ITEM	PART	Description	Q'TY	ITEM	PART	Description	Q'TY
1		Frame	1	39		Chain Supporter	2
2		Nut Bracket	1	40		Washer (M8)	4
3		Screw (M12*40)	4	41		Screw (M8*40)	4
4		Ballscrew	1	42		C Type Ring	8
5		Screw (M10*25)	5	43		Wheel	4
8		Bracket	1	44		Bearing(6205)	4
9		Screw (M10*35)	4	45		Shaft	4
11		Bearing(7205)	2	46		Guide Pad	1
12		Bracket Cover	1	47		Guide Pad	1
13		Screw (M6*20)	3	48		Washer (M10)	4
14		Space	1	49		Screw (M10*35)	2
15		Nut(M25*1.5P)	1	50		Guide Shaft	1
18		Bracket	1	51		Washer (3/4")	6
19		Screw (M10*30)	4	52		Screw(3/4"*2")	6
21		Bearing(6205)	1	53		Upper Stay	1
22		Bearing(7205)	1	54		Ballscrew Chip Cover	1
23		Cover	1	55		Lower Stay	1
24		Screw (M6*16)	3	56		Screw(M5*8)	5
25		Nut(M25*1.5P)	1	57		Seat	2
26		Coupling	1	58		Screw (M6*12)	4
27		Motor Seat	1	59		Dog	3
28		Washer (M10)	4	60		Cover Brace	1
29		Screw (M10*40)	4	61		Washer (M6)	4
30		Motor Plate	1	62		Screw (M6*16)	4
31		Washer (M10)	4	63		Lower Way Cover	1
32		Screw(M10*35)	4	64		Washer (M6)	6
33		Motor	1	65		Screw (M6*12)	6
34		Washer (M10)	4				
35		Screw(M10*35)	4				
36		Chain Screw(M16)	2				
37		Chain	2				
38		Count Blance	1				

Headstock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Headstock Parts List

ITEM	PART	Description	Q'TY	ITEM	PART	Description	Q'TY
1		Screw (M6*20)	2	39	D10-E039	Belt	1
2		Key (6*6*16)	2	40	D10-E040	Motor Plate	1
3		Spindle	1	41	D10-E041	Cylinder Seat	1
4		Key (5*5*25)	1	42		Washer	4
5		Key (12*8*50)	1	43		Screw (M12*40)	4
6		Seal	1	44		Washer	4
7		Seal	1	45		Screw (M8*45)	4
8		Bearing (7014)	4	46	D10-E046	Power Draw Bar	1
9		Spacer	1	47		Washer	4
10		Spacer	1	48		Screw (M12*45)	4
11		Nut	1	49		Motor	1
12		Collar	1	50	9	Fan	1
13		Collar	1	51		Washer	4
14		Bearing (7012)	2	52		Screw (M12*45)	4
15		Screw (M8*25)	8	53	D10-E053	Gib	1
16		Cover	1	54		Gib Screw (5/16"*24)	2
17		Collar	1	55	D10-E055	Bracket	1
18		Screw (M10*30)	8	56	D10-E056	Gib	1
19		Quill	1	57	D10-E057	Gib	1
20		Chip Cover	1	58		Gib Screw (5/16"*24)	2
22		Spindle Pulley	1	59	D10-E059	Bracket	1
23		Balancing Ring	1	60		Screw (M12*40)	14
26		Timming Belt	1	61		O Type Ring(G145)	3
27		Coolant Nozzle	3	63		O Type Ring(G145)	2
28		Screw(M6*16)	6	64	D10-E064	Wiper	4
29		4 Jaws	1	65		Screw (M5*12)	16
30		Draw Bar	1	79	D10-E079	Z Limit Switch	1
31		Collar	1	80		Screw (M6*20)	2
32		Disc Spring § 40* § 20	99	81	D10-E081	Seat	1
33		Collar(P36)	1	82		Washer	2
34		Nut	1	83		Screw (M6*16)	2
35	D10-E035	Headstock	1				
38	D10-E038	Motor pulley	1				

Table

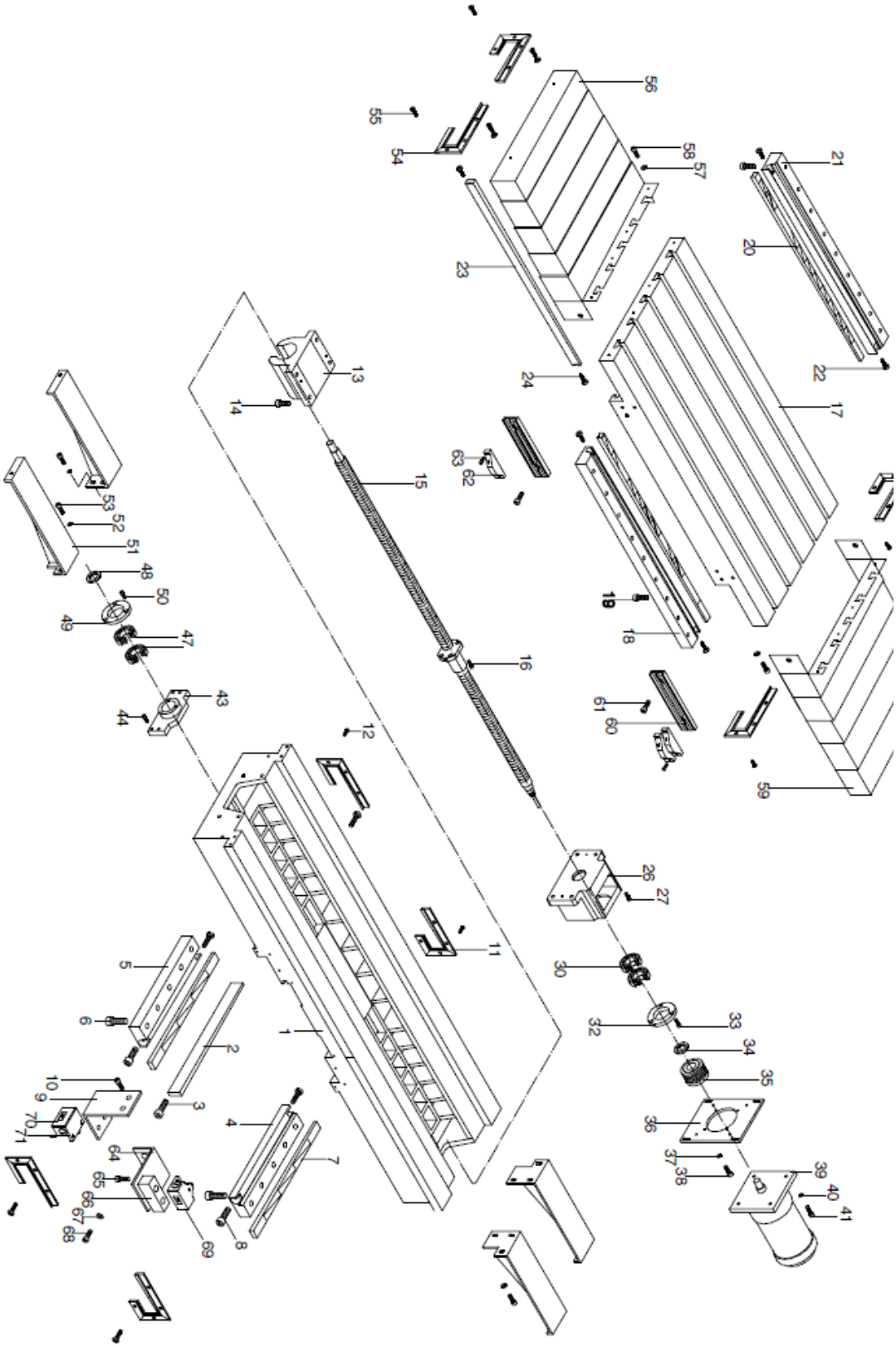
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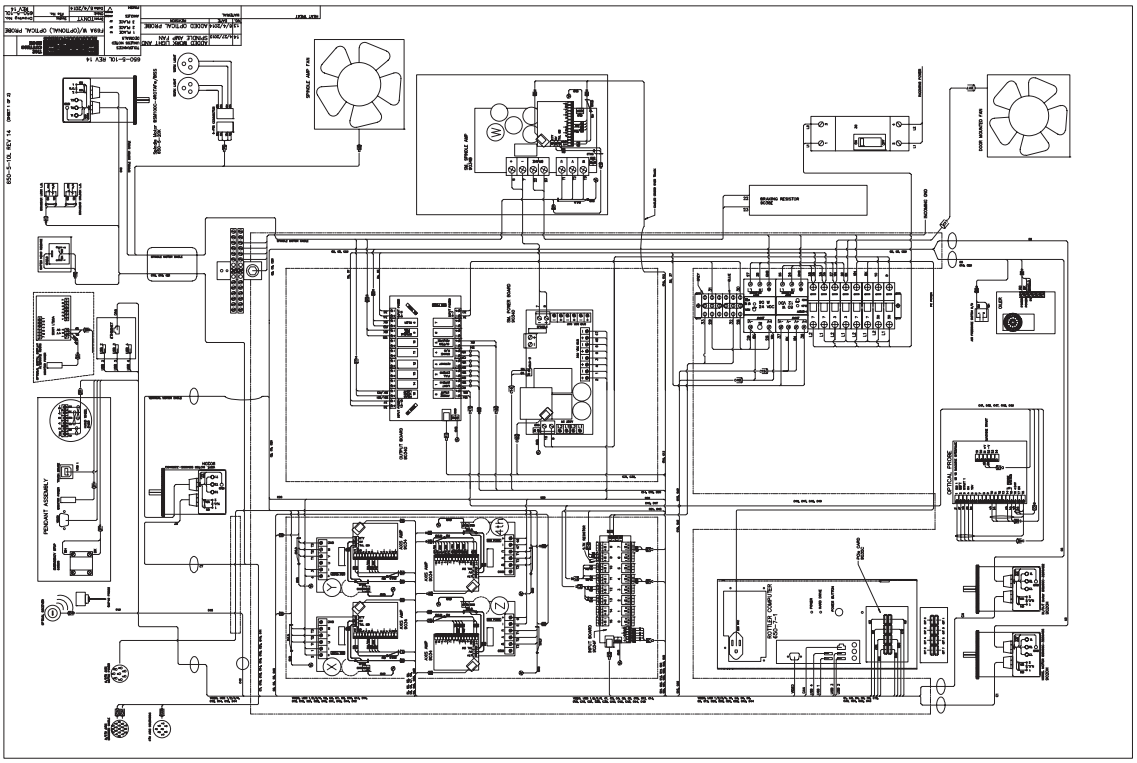
Table Parts List

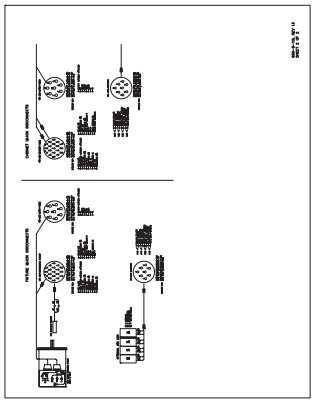
ITEM	PART	Description	Q'TY	ITEM	PART	Description	Q'TY
1		Saddle	1	44		Screw (M8*30)	4
2		Gib	1	47		Bearing(6205)	2
3		Gib Screw(5/16"*30)	2	48		Nut(YSR M25*1.5P)	1
4		Bracket	1	49		Cover	1
5		Bracket	1	50		Screw (M6*12)	4
6		Screw (M12*40)	10	51		Cover Brace	4
7		Gib	2	52		Washer (M6)	12
8		Gib Screw (5/16"*30)	4	53		Screw (M6*20)	12
9		Seat	1	54		Wiper	4
10		Screw (6*16)	2	55		Screw (M5*12)	16
11		Wiper	4	56		Left Way Cover	1
12		Screw(M5*12)	16	57		Washer (M6)	4
13		Nut Bracket	1	58		Screw (M6*12)	12
14		Screw (M12*40)	4	59		Right Way Cover	1
15		Ballscrew	1	60		Seat	2
16		Screw (M10*25)	5	61		Screw(M6*16)	4
17		Table	1	62		Dog	3
18		Bracket	1	63		Screw(M5-12)	6
19		Screw (M12*40)	18	64		Seat	1
20		Gib	2	65		Screw(M6*16)	2
21		Bracket	1	66		Block	1
22		Gib Screw (5/16"*30)	4	67		Washer (M6)	2
23		Gib	1	68		Screw (M6*16)	2
24		Gib Screw (5/16"*30)	2	69		X Limit Switch	1
26		Bearing Bracket	1	70		Y Limit Switch	1
27		Screw (M10*45)	4	71		Screw(M6*20)	2
30		Bearing(25T AC62)	2				
32		Bearing Cover	1				
33		Screw (M6*20)	3				
34		Nut(YSF M25*1.5P)	1				
35		Coupling	1				
36		Motor Plate	1				
37		Washer (M10)	4				
38		Screw(M10*35)	4				
39		Motor	1				
40		Washer (M10)	4				
41		Screw(M10*35)	4				
43		Bearing Bracket	1				

Wiring Diagram Optical Probe version without Charge Resistor

Scalable PDF version of this diagram located on the manual CD that shipped with this machine.

OPTICAL PROBE
WITHOUT CHARGE RESISTOR



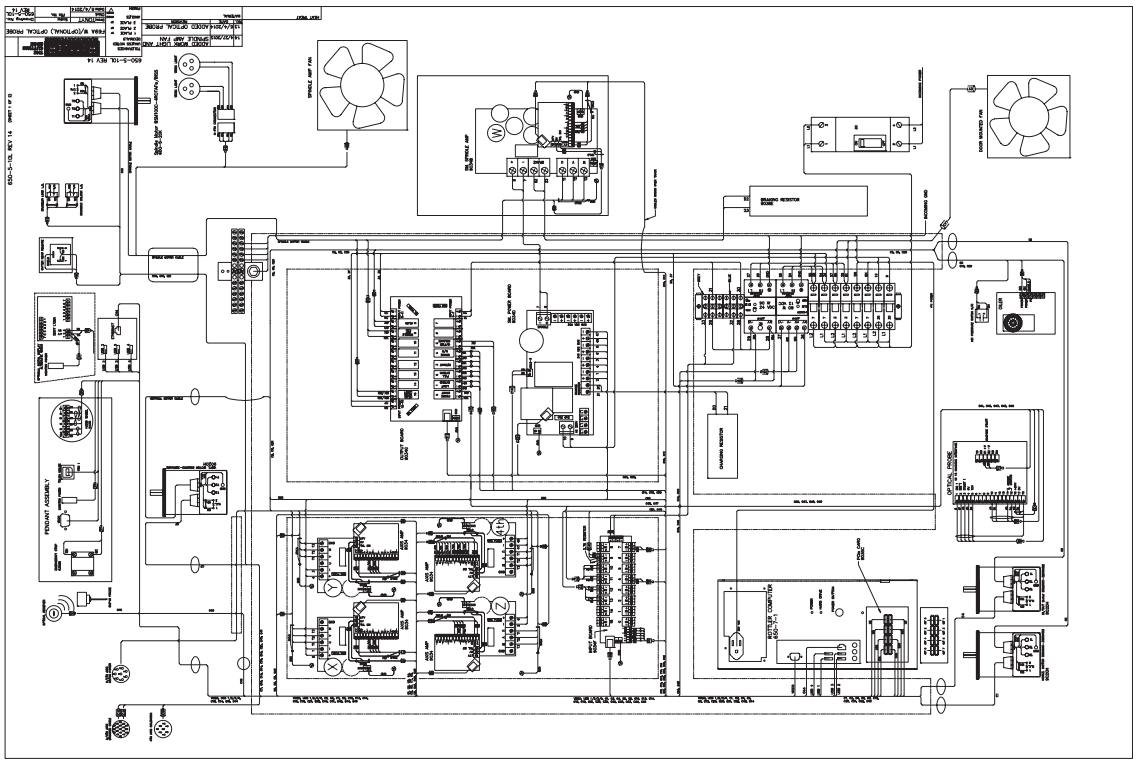


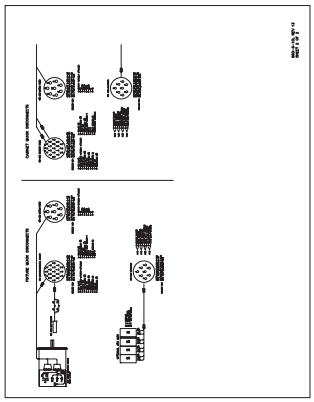
Wiring Diagram Optical Probe version with Charge Resistor

Scalable PDF version of this diagram located on the manual CD that shipped with this machine.

OPTICAL PROBE

WITH CHARGE RESISTOR



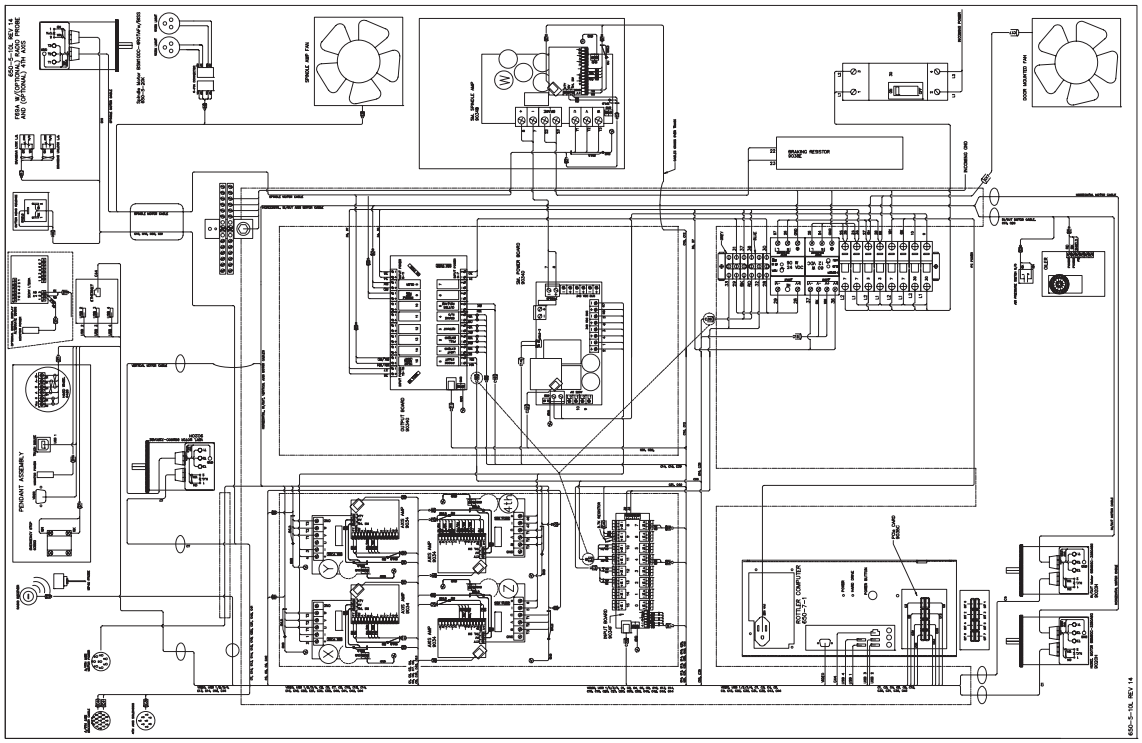


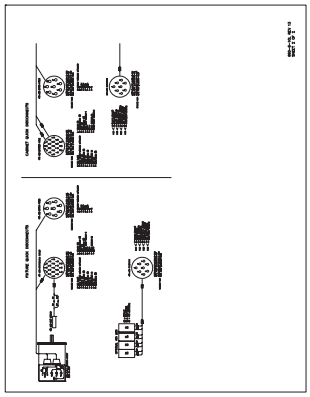
Wiring Diagram Radio Probe version without Charge Resistor

Scalable PDF version of this diagram located on manual CD that shipped with the machine.

RADIO PROBE

WITHOUT CHARGE RESISTOR



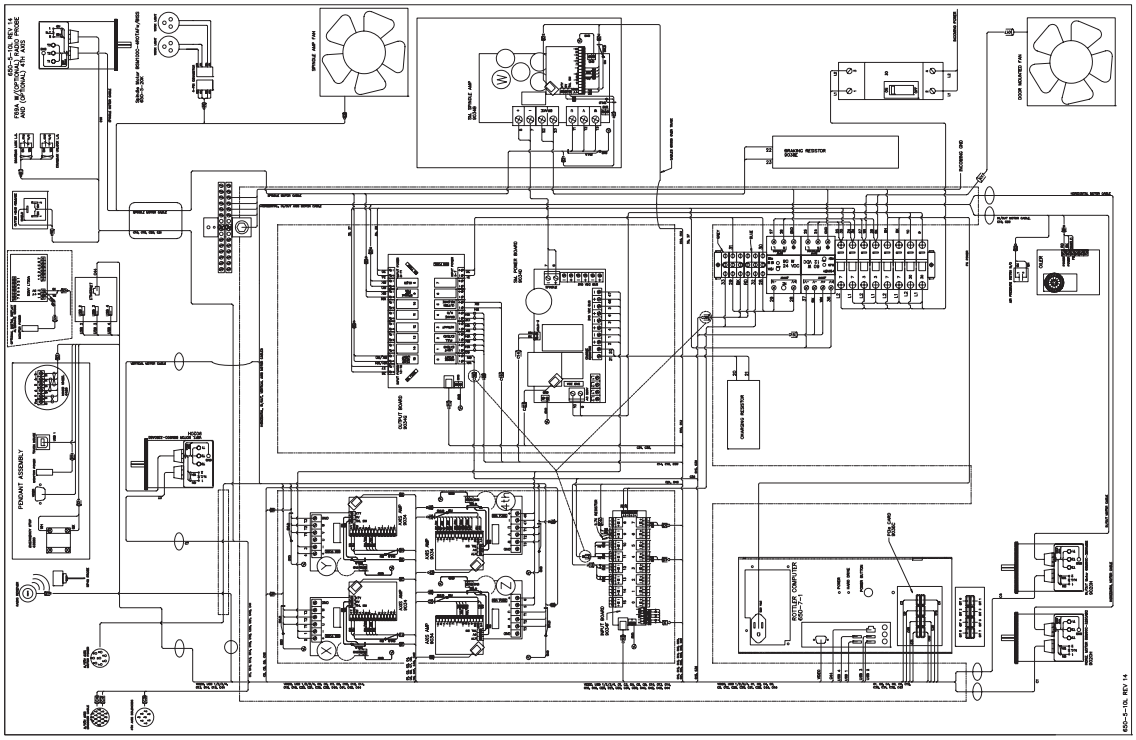


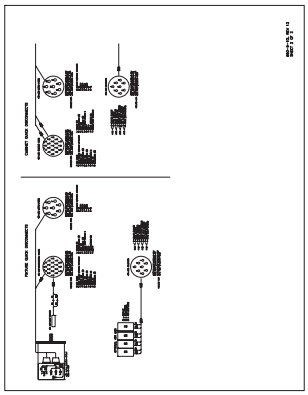
Wiring Diagram Radio Probe version with Charge Resistor

Scalable PDF version of this diagram located on manual CD that shipped with the machine.

RADIO PROBE

WITH CHARGE RESISTOR





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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) Union 76 CP Oil

2) Dyna Cool K-2002

3) Mobil Vactra Oil #2

4) Valvoline High Performance Gear Oil

5) Valvoline Synpower Synthetic Oil

6) Molywhite #00 Grease

Safety Data Sheet

According to OSHA HCS 2012 (29 CFR 1910.1200), Health Canada HPR (SOR/2015-17), and Mexico NOM-018-STPS-2015

SECTION 1: Identification

Product Identifier	**CP Oil**
Other means of identification	Phillips 66 CP Oil 22 Phillips 66 CP Oil 32
Code	**LBPH817726**
Relevant identified uses	Industrial Oil
Uses advised against	All others
24 Hour Emergency Phone Number	CHEMTREC: 1-800-424-9300 CHEMTREC México 01-800-681-9531

Manufacturer/Supplier
Phillips 66 Lubricants
P.O. Box 4428
Houston, TX 77210

SDS Information
URL: www.phillips66.com/SDS
Phone: 800-762-0942
Email: SDS@P66.com

Customer Service
U.S.: 800-368-7128 or International: 1-832-765-2500
Technical Information
1-877-445-9198

SECTION 2: Hazard identification

Classified Hazards

No classified hazards

Hazards Not Otherwise Classified (HNOC)

PHNOC: None known

HHNOC: None known

Label elements

No classified hazards

SECTION 3: Composition/information on ingredients

Chemical Name	CASRN	Concentration
Distillates, petroleum, hydrotreated heavy paraffinic	64742-54-7	>95

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4: First aid measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: Remove contaminated shoes and clothing and cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops and persists, seek medical attention.

Inhalation: First aid is not normally required. If breathing difficulties develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. Seek immediate medical attention.

Ingestion: First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Most important symptoms and effects, both acute and delayed: Inhalation of oil mists or vapors generated at elevated temperatures may cause respiratory irritation. Accidental ingestion can result in minor irritation of the digestive tract, nausea and diarrhea. Prolonged or repeated contact may dry skin and cause irritation.

Notes to Physician: Acute aspirations of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities.

SECTION 5: Firefighting measures

NFPA 704: National Fire Protection Association

Health: 0 **Flammability:** 1 **Instability:** 0

0 = minimal hazard
1 = slight hazard
2 = moderate hazard
3 = severe hazard
4 = extreme hazard

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Specific hazards arising from the chemical

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of sulfur, nitrogen or phosphorus may also be formed.

Special protective actions for fire-fighters: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8). Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop and contain spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

Methods and material for containment and cleaning up: Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

SECTION 7: Handling and storage

Precautions for safe handling: Keep away from flames and hot surfaces. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8). Spills will produce very slippery surfaces. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

SECTION 8: Exposure controls/personal protection

Occupational exposure limits
The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

Chemical Name	ACGIH	OSHA	Mexico	Phillips 66
Distillates, petroleum, hydrotreated heavy paraffinic	TWA: 5mg/m³ STEL: 10 mg/m³ as Oil Mist, if Generated	---	---	---

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Biological occupational exposure limits
Note: This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye/Face Protection: The use of eye/face protection is not normally required; however, good industrial hygiene practice suggests the use of eye protection that meets or exceeds ANSI Z.87.1 whenever working with chemicals.

Skin/Hand Protection: The use of skin protection is not normally required; however, good industrial hygiene practice suggests the use of gloves or other appropriate skin protection whenever working with chemicals. Suggested protective materials: Nitrile rubber

Respiratory Protection: Where there is potential for airborne exposure above the exposure limit a NIOSH certified air purifying respirator equipped with R or P95 filters may be used.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use. Air purifying respirators provide limited protection and cannot be used in atmospheres that exceed the maximum use concentration (as directed by regulation or the manufacturer's instructions), in oxygen deficient (less than 19.5 percent oxygen) situations, or under conditions that are immediately dangerous to life and health (IDLH).

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

SECTION 9: Physical and chemical properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended

to be specifications.

Appearance: Amber, Transparent
Physical Form: Liquid
Odor: Petroleum
Odor Threshold: No data
pH: Not applicable
Vapor Density (air=1): >1
Upper Explosive Limits (vol % in air): No data
Lower Explosive Limits (vol % in air): No data
Evaporation Rate (nBuAc=1): No data
Particle Size: Not applicable
Percent Volatile: No data
Flammability (solid, gas): Not applicable
Solubility in Water: Negligible

Flash Point: > 302 °F / > 150 °C
Test Method: Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
Initial Boiling Point/Range: No data
Vapor Pressure: <1 mm Hg
Partition Coefficient (n-octanol/water) (Kow): No data
Melting/Freezing Point: < -11 °F / < -24 °C
Auto-ignition Temperature: No data
Decomposition Temperature: No data
Specific Gravity (water=1): 0.86 @ 60ºF (15.6ºC)
Bulk Density: 7.1-7.2 lbs/gal
Viscosity: 4.0 - 6 cSt @ 100°C; 20.5 - 35 cSt @ 40°C
Pour Point: < -11 °F / < -24 °C

SECTION 10: Stability and reactivity

Reactivity: Not chemically reactive.

Chemical stability: Stable under normal ambient and anticipated conditions of use.

Possibility of hazardous reactions: Hazardous reactions not anticipated.

Conditions to avoid: Extended exposure to high temperatures can cause decomposition. Avoid all possible sources of ignition.

Incompatible materials: Avoid contact with strong oxidizing agents and strong reducing agents.

Hazardous decomposition products: Not anticipated under normal conditions of use.

SECTION 11: Toxicological information

Information on Toxicological Effects

Substance / Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful		>5 mg/L (mist, estimated)
Dermal	Unlikely to be harmful		> 2 g/kg (estimated)
Oral	Unlikely to be harmful		> 5 g/kg (estimated)

Likely Routes of Exposure: Inhalation, eye contact, skin contact

Aspiration Hazard: Not expected to be an aspiration hazard

Skin Corrosion/Irritation: Not expected to be irritating. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Not expected to be irritating.

Skin Sensitization: No information available on the mixture, however none of the components have been classified for skin sensitization (or are below the concentration threshold for classification).

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): Not expected to cause organ effects from single exposure.

Specific Target Organ Toxicity (Repeated Exposure): Not expected to cause organ effects from repeated exposure.

Carcinogenicity: No information available on the mixture, however none of the components have been classified for carcinogenicity (or are below the concentration threshold for classification).

Germ Cell Mutagenicity: No information available on the mixture, however none of the components have been classified for

germ cell mutagenicity (or are below the concentration threshold for classification).

Reproductive Toxicity: No information available on the mixture, however none of the components have been classified for reproductive toxicity (or are below the concentration threshold for classification).

Information on Toxicological Effects of Components

Distillates, petroleum, hydrotreated heavy paraffinic

Carcinogenicity: This oil has been highly refined by a variety of processes to reduce aromatics and improve performance characteristics. It meets the IP-346 criteria of less than 3 percent PAH's and is not considered a carcinogen by the International Agency for Research on Cancer.

SECTION 12: Ecological information

GHS Classification:
No classified hazards

Toxicity: All acute aquatic toxicity studies on samples of lubricant base oils show acute toxicity values greater than 100 mg/L for invertebrates, algae and fish. These tests were carried out on water accommodated fractions and the results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon compositions.

Persistence and Degradability: The hydrocarbons in this material are not readily biodegradable, but since they can be degraded by microorganisms, they are regarded as inherently biodegradable.

Bioaccumulative Potential: Log Kow values measured for the hydrocarbon components of this material are greater than 5.3, and therefore regarded as having the potential to bioaccumulate. In practice, metabolic processes may reduce bioconcentration.

Mobility in Soil: Volatilization to air is not expected to be a significant fate process due to the low vapor pressure of this material. In water, base oils will float and spread over the surface at a rate dependent upon viscosity. There will be significant removal of hydrocarbons from the water by sediment adsorption. In soil and sediment, hydrocarbon components will show low mobility with adsorption to sediments being the predominant physical process. The main fate process is expected to be slow biodegradation of the hydrocarbon constituents in soil and sediment.

Other adverse effects: None anticipated.

SECTION 13: Disposal considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations. This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the SDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.This material under most intended uses would become "Used Oil" due to contamination by physical or chemical impurities. Whenever possible, Recycle used oil in accordance with applicable federal and state or local regulations. Container contents should be completely used and containers should be emptied prior to discard.

SECTION 14: Transport information

U.S. Department of Transportation (DOT)
UN Number: Not regulated
UN proper shipping name: None
Transport hazard class(es): None
Packing Group: None
Environmental Hazards: This product does not meet the DOT/UN/IMDG/IMO criteria of a marine pollutant
Special precautions for user: If shipped by land in a packaging having a capacity of 3,500 gallons or more, the provisions of 49 CFR, Part 130 apply. (Contains oil)
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable

SECTION 15: Regulatory information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds)

This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)
Should this product meet EPCRA 311/312 Tier reporting criteria at 40 CFR 370, refer to Section 2 of this SDS for appropriate classifications.

CERCLA/SARA - Section 313 and 40 CFR 372
This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

EPA (CERCLA) Reportable Quantity (in pounds)
This material does not contain any chemicals with CERCLA Reportable Quantities.

California Proposition 65
This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

International Inventories
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.
All components are either on the DSL, or are exempt from DSL listing requirements.

SECTION 16: Other information

Issue Date:	Previous Issue Date:	SDS Number	Status:
17-Apr-2018	23-Jun-2016	LBPH817726	FINAL

Revised Sections or Basis for Revision:
Exposure limits (Section 8); Regulatory information (Section 15)

Legend (pursuant to NOM-018-STPS-2015):
The information within is considered correct but is not exhaustive and will be used for guidance only, which is based on the current knowledge of the substance or mixture and is applicable to the appropriate safety precautions for the product.

Guide to Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; HPR = Hazardous Products Regulations; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:
The information presented in this Safety Data Sheet is based on data believed to be accurate as of the date this Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

SAFETY DATA SHEET
DYNA COOL K-2002

Issue Date: 13-May-2015 **Revision Date:** 25-January-2018 **Version** 1

1. IDENTIFICATION

Product Identifier

Product Name DYNA COOL K-2002

Other means of identification

SDS # DYNA-004

Product Code 5428

Recommended use of the chemical and restrictions on use

Recommended use Metalworking fluid

Restrictions on use Industrial use only

Details of the supplier of the safety data sheet

Manufacturer Address

Company Name: DYNA TECH Chemical Specialties, Inc.
Address: P. O. Box 34
Colgate, WI 53017
Telephone: 262-646-7600
Fax: 262-820-9176

Emergency Telephone Number (24 hours/day): **INFOTRAC 1-352-323-3500 (International)**
1-800-535-5053 (North America)

2. HAZARDS IDENTIFICATION

Hazard Classification Not classified as hazardous under 29CFR 1910.1200 (HazCom 2012)

Label Elements

Hazard Symbol: No symbol.

Signal Word: No signal word.

Hazard Statement: Not applicable.

Precautionary Statement: Not applicable.

Other hazards which do not result in GHS classification: None.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Component(s):

CHEMICAL NAME	CAS-NO.	CONCENTRATION
Mineral oil	Confidential	20 – 50%
Triethanolamine	102-71-6	5 – 10%
Ethoxylated alcohol	Confidential	1 – 5%
Biocide	Confidential	1 - 5%
Sodium hydroxide	1310-73-2	10 – 20%

Specific chemical identities and/or exact percentages have been withheld as trade secrets.

4. FIRST-AID MEASURES

Ingestion: Rinse mouth thoroughly. Call a POISON CENTER/doctor/…/ if you feel unwell. Do NOT induce vomiting.

Inhalation: Move to fresh air. Call a POISON CENTER/doctor/…/ if you feel unwell.

Skin Contact: Remove contaminated/saturated clothing and shoes. Wash contact areas with soap and water. If skin irritation occurs: Get medical advice/attention.

Eye Contact: Flush thoroughly with water. If irritation occurs, get medical assistance. Continue to rinse for at least 15 minutes.

Most important symptoms/effects, acute and delayed

Symptoms: No data available.

Indication of immediate medical attention and special treatment needed

Treatment: Get medical attention as appropriate or if symptoms persist.

5. FIRE-FIGHTING MEASURES

General Fire Hazards: No unusual fire or explosion hazards noted.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: Water spray, fog, CO_2, dry chemical or regular foam. Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media: Do not use water jet as an extinguisher, as this will spread the fire.

Specific hazards arising from the chemical: Heat may cause the containers to explode. During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters

Special firefighting procedures: No data available.

Special protective equipment for firefighters: Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: See Section 8 of the SDS for Personal Protective Equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Keep unauthorized personnel away. Ensure adequate ventilation.

Methods and material for containment and cleaning up: Absorb with sand or other inert absorbent. Stop the flow of material, if this is without risk.

Environmental Precautions: Avoid release to the environment. Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so.

7. HANDLING AND STORAGE

Precautions for safe handling:

End-users should follow industry best practices for handling and using this product.

Guidance may be found using the current version of ASTM Standard E1497-05: Standard Practice for Selection and Safe Use of Water-Miscible and Straight Oil Metal Removal Fluids. Contains amines. Do not add sodium nitrite or other nitrosating agents which may form cancer causing nitrosamines. Contains a component that when heated at or above 300F (150C) may generate Formaldehyde vapors. Observe good industrial hygiene practices. Wear appropriate personal protective equipment. Do not expose to intense heat as product may expand and pressurize container.

Conditions for safe storage, including any incompatibilities:

Store in original tightly closed container. Avoid contact with oxidizing agents. Store away from incompatible materials.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Limits

CHEMICAL NAME	TYPE	EXPOSURE LIMIT VALUES	SOURCE
Mineral oil - Mist.	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)
Mineral oil – Mist.	STEL	10 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)
Triethanolamine	TWA	5 mg/m3	US. ACGIH Threshold Limit Values (03 2012)
Sodium hydroxide	PEL	2 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminate (29 CFR 1910-1000) (02 2006)
Sodium hydroxide	Ceiling	2 mf/m3	US. ACGIH Threshold Limit Values (03-2012)

Protective Measures: Use personal protective equipment as required.

Respiratory Protection: In case of inadequate ventilation, use suitable respirator. Seek advice from supervisor on the company's respiratory protection standards.

Eye Protection: Wear safety glasses with side shields (or goggles).

Skin and Body Protection: Wear chemical-resistant gloves, footwear, and protective clothing appropriate for the risk of exposure. Contact health and safety professional or manufacturer for specific information.

Hygiene measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Contaminated work clothing should be laundered prior to re-use. Discard contaminated footwear that cannot be cleaned. Avoid contact with skin, eyes, and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state:	Liquid
Form:	No data available.
Color:	Blue
Odor:	Mild
Odor threshold:	No data available.
pH:	No data available.
Melting point/freezing point:	No data available.
Initial boiling point and boiling range:	No data available.
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Relative density:	1.07
Solubility(ies)	
Solubility in water:	Soluble.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	> 20.5 mm2/s (40 °C)
Other Information	
VOC:	10.18 g/l (ASTM E 1868-10)

10. STABILITY AND REACTIVITY

Reactivity:	Not reactive during normal use.
Chemical Stability:	Material is stable under normal conditions.
Possibility of Hazardous Reactions:	None under normal conditions.
Conditions to Avoid:	Avoid heat or contamination.
Incompatible Materials:	No data available.
Hazardous Decomposition Products:	Formaldehyde

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Ingestion:	May be ingested by accident. Ingestion may cause irritation and malaise.
Inhalation:	Inhalation is the primary route of exposure. In high concentrations, vapors, fumes or mists may irritate nose, throat and mucus membranes.
Skin Contact:	Prolonged skin contact may cause redness and irritation.
Eye Contact:	Eye contact is possible and should be avoided.

Symptoms related to the physical, chemical and toxicological characteristics

Ingestion:	No data available.
Inhalation:	No data available.
Skin Contact:	No data available.
Eye Contact:	No data available.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral Product:	ATEmix (): > 5000 mg/kg
Dermal Product:	ATEmix (): 2000-5000 mg/kg
Inhalation Product:	Not classified for acute toxicity based on available data.
Repeated Dose Toxicity Product:	No data available.
Skin Corrosion/Irritation Product:	No data available.
Serious Eye Damage/Eye Irritation Product:	No data available.
Respiratory or Skin Sensitization Product:	May cause an allergic skin reaction.
Carcinogenicity Product:	No data available.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified.

U.S. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified.

U.S. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified.

Germ Cell Mutagenicity

In Vitro Product:	No data available.
In Vivo Product:	No data available.
Reproductive Toxicity Product:	No data available
Specific Target Organ Toxicity – Single Exposure Product:	No data available
Specific Target Organ Toxicity – Repeated Exposure Product:	No data available
Aspiration Hazard Product:	No data available.
Other effects:	No data available.

12. ECOLOGICAL INFORMATION

General information: This product has not been evaluated for ecological toxicity or other environmental effects.

13. DISPOSAL CONSIDERATIONS

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws. Dispose of waste at an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal. It is the responsibility of the product user or owner to determine at the time of disposal, which waste regulations, must be applied.

Contaminated Packaging: Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. TRANSPORT INFORMATION

DOT Not regulated

IMDG Not regulated.

IATA Not regulated

15. REGULATORY INFORMATION

US Federal Regulations

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)
None present or none present in regulated quantities.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard Categories
Not listed.

SARA 313 (TRI Reporting)
None present or none present in regulated quantities.

US State Regulations

US. California Proposition 65
This product contains chemical(s) known to the State of California to cause cancer and/or to cause birth defects or other reproductive harm.

16. OTHER INFORMATION

Issue Date: 13-May-2015
Revision Date: 25-January-2018
Revision Note: Updated information.
Version #: 1
Further Information: No data available.

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. This information should be used to make an independent determination of the methods to safeguard workers and the environment. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

END OF SAFETY DATA SHEET

Product Name: MOBIL VACTRA OIL NO. 2
Revision Date: 30 Aug 2018

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: 201560901015, 600494-85
Intended Use: Lubricant

COMPANY IDENTIFICATION

Supplier: **East Coast Lubes Pty Ltd (Queensland and Northern Territory)**
A.B.N. 37 117 203 611
Cnr North and Mort Streets
Toowoomba, Queensland 4350 Australia

24 Hour Emergency Telephone 1300 131 001
Supplier General Contact 1800 069 019

Supplier: **Southern Cross Lubes (Victoria and Tasmania, New South Wales and Australian Capital Territory)**
58-66 Ajax Road
Altona, Victoria 3018, Australia

24 Hour Emergency Telephone 1300 131 001
Product Technical Information
Supplier General Contact 1300 466 245
1300 552 861

Supplier: **Perkal Pty Ltd Trading as Statewide Oil (Western Australia)**
A.B.N. 43 009 283 363
14 Beete Street
Welshpool, Western Australia 6106 Australia

24 Hour Emergency Telephone (8:00am to 4:30pm Mon to Fri) 1300 919 904
Product Technical Information
Supplier General Contact (08) 9350 6777
(08) 9350 6777

Supplier: **Perkal Pty Ltd Trading as Statewide Oil (South Australia)**
A.B.N. 43 009 283 363
6-10 Streiff Rd
Wingfield, South Australia 5013 Australia

24 Hour Emergency Telephone (8:00am to 4:30pm Mon to Fri) 1300 919 904
Product Technical Information
Supplier General Contact (08) 8359 8995
(08) 8359 8995

SECTION 2 HAZARDS IDENTIFICATION

This material is not hazardous according to regulatory guidelines (see (M)SDS Section 15).

Contains: PHOSPHORIC ACID ESTERS, AMINE SALT May produce an allergic reaction.

Other hazard information:

Physical / Chemical Hazards:
No significant hazards.

Health Hazards:
High-pressure injection under skin may cause serious damage. Excessive exposure may result in eye, skin, or respiratory irritation.

Environmental Hazards:
No significant hazards.

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 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

Reportable Hazardous Substance(s) or Complex Substance(s)

Name	CAS#	Concentration*	GHS Hazard Codes
2,6-DI-TERT-BUTYL-P-CRESOL	128-37-0	0.1 - < 1%	H400(M factor 1), H410(M factor 1)
PHOSPHORIC ACID ESTERS, AMINE SALT	Confidential	0.1 - < 1%	H227, H302, H317, H318, H401, H411

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume. Other ingredients determined not to be hazardous up to 100%.

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 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.

NOTE TO PHYSICIAN

None

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight streams of water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Fire-fighters 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: Aldehydes, Incomplete combustion products, Oxides of carbon, Smoke, Fume, Sulphur oxides

FLAMMABILITY PROPERTIES

Flash Point [Method]: >205°C (401°F) [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.

PROTECTIVE MEASURES

Avoid contact with spilled material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

For emergency responders: Respiratory protection: respiratory protection will be necessary only in special cases, e.g., formation of mists. Half-face or full-face respirator with filter(s) for dust/organic vapor or Self

Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Work gloves that are resistant to hydrocarbons are recommended. Gloves made of polyvinyl acetate (PVA) are not water-resistant and are not suitable for emergency use. Chemical goggles are recommended if splashes or contact with eyes is possible. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic material is recommended.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do so without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do so 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: Dyke 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. Material can accumulate static charges which may cause an electrical spark (ignition source). When the material is handled in bulk, an electrical spark could ignite any flammable vapors from liquids or residues that may be present (e.g., during switch-loading operations). Use proper bonding and/or earthing procedures. However, bonding and earthing may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator.

STORAGE

The type of container used to store the material may affect static accumulation and dissipation. Do not store in open or unlabelled containers. Keep away from incompatible materials.

Material is defined under the National Standard [NOHSC:1015] Storage and Handling of Workplace Dangerous Goods.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Substance Name	Form	Limit/Standard			Note	Source
2,6-DI-TERT-BUTYL-P-CRESOL		TWA	10 mg/m3			Australia OELs

2,6-DI-TERT-BUTYL-P-CRESOL	Inhalable fraction and vapour	TWA	2 mg/m3			ACGIH

Exposure limits/standards for materials that can be formed when handling this product:

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

Biological limits

No biological limits allocated.

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 selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:
Particulate
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/vapour 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:
Nitrile,Viton
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. Practise good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Colour: Amber
Odour: Characteristic
Odour Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.883
Flammability (Solid, Gas): N/A
Flash Point [Method]: >205°C (401°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D
Boiling Point / Range: > 316°C (600°F)
Decomposition Temperature: N/D
Vapour Density (Air = 1): > 2 at 101 kPa
Vapour Pressure: < 0.013 kPa (0.1 mm Hg) at 20 ºC
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3.5
Solubility in Water: Negligible
Viscosity: 68 cSt (68 mm2/sec) at 40 ºC | 8.6 cSt (8.6 mm2/sec) at 100°C
Oxidizing Properties: See Hazards Identification Section.

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.

INCOMPATIBLE MATERIALS: Strong oxidisers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data for material.	Negligible hazard at ambient/normal handling temperatures.
Ingestion	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin Corrosion/Irritation: No end point data for material.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	
Serious Eye Damage/Irritation: No end point data for material.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.
Sensitisation	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: No end point data for material.	Not expected to be a skin sensitizer. Based on assessment of the components.
Aspiration: Data available.	Not expected to be an aspiration hazard. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: No end point data for material.	Not expected to be a germ cell mutagen. Based on assessment of the components.
Carcinogenicity: No end point data for material.	Not expected to cause cancer. Based on assessment of the components.
Reproductive Toxicity: No end point data for material.	Not expected to be a reproductive toxicant. Based on assessment of the components.
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: No end point data for material.	Not expected to cause organ damage from prolonged or repeated exposure. Based on assessment of the components.

OTHER INFORMATION

For the product itself:

Component concentrations in this formulation would not be expected to cause skin sensitization, based on tests of the components, this formulation, or similar formulations.

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 sensitising in test animals.

IARC Classification:
The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--
1 = IARC 1 2 = IARC 2A 3 = IARC 2B

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

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. Protect the environment. Dispose of used oil at designated sites. Minimize skin contact. Do not mix used oils with solvents, brake fluids or coolants.

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 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 (ADG) : Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

This material is not considered hazardous according to Australia Model Work Health and Safety Regulations.

Product is not regulated according to Australian Dangerous Goods Code.

No Poison Schedule number allocated by the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) established under the Therapeutic Goods Act.

AS1940 COMBUSTIBLE CLASS: C2

REGULATORY STATUS AND APPLICABLE LAWS AND REGULATIONS

Listed or exempt from listing/notification on the following chemical inventories (May contain substance(s) subject to notification to the EPA Active TSCA inventory prior to import to USA): AICS, DSL, ENCS, IECSC, KECI, PICCS, TCSI, TSCA

SECTION 16 OTHER INFORMATION

KEY TO ABBREVIATIONS AND ACRONYMS:

N/D = Not determined, N/A = Not applicable, STEL = Short-Term Exposure Limit, TWA = Time-Weighted Average

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H227: Combustible liquid; Flammable Liquid, Cat 4
H302: Harmful if swallowed; Acute Tox Oral, Cat 4
H317: May cause allergic skin reaction; Skin Sensitization, Cat 1

H318: Causes serious eye damage; Serious Eye Damage/Irr, Cat 1
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H401: Toxic to aquatic life; Acute Env Tox, Cat 2
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1
H411: Toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 2

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Southern Cross Lubes (Victoria and Tasmania): Section 01: Supplier Mailing Address information was deleted.
Southern Cross Lubes (Victoria and Tasmania, New South Wales and Australian Capital Territory): Section 01: Supplier Mailing Address information was added.
Section 11 Acute Toxicity data - Header information was deleted.
Section 11 Substance Name - Header information was deleted.
Section 11 Substance Toxicity table - Header information was deleted.
Section 11 Substance Toxicology table information was deleted.
Section 12: information was modified.

DGN: 7053124DAU (1014681)

Prepared by: Exxon Mobil Corporation
EMBSI, Clinton NJ USA
Contact Point: See Section 1 for Local Contact number

End of (M)SDS

Valvoline		Page: 1
SAFETY DATA SHEET		Revision Date: 09/28/2016
		Print Date: 11/1/2016
		SDS Number: R0091437
Valvoline™ High Performance SAE 80W-90 Gear Oil ™ Trademark, Valvoline or its subsidiaries, regisred in various countries VV838		Version: 1.4

29 CFR 1910.1200 (OSHA HazCom 2012)

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product identifier

Trade name : Valvoline™ High Performance SAE 80W-90 Gear Oil

™ Trademark, Valvoline or its subsidiaries, regisred in various countries

Relevant identified uses of the substance or mixture and uses advised against

Details of the supplier of the safety data sheet Valvoline LLC 3499 Blazer Parkway Lexington, KY 40509 United States of America (USA) 1-800-TEAMVAL	**Emergency telephone number** 1-800-VALVOLINE **Regulatory Information Number** 1-800-TEAMVAL **Product Information** 1-800-TEAMVAL

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Skin sensitization : Category 1

GHS label elements

Hazard pictograms :

Signal Word : Warning

Hazard Statements : May cause an allergic skin reaction.

Precautionary Statements : **Prevention:**
Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
Contaminated work clothing must not be allowed out of the workplace.
Wear protective gloves.
Response:
IF ON SKIN: Wash with plenty of soap and water.
If skin irritation or rash occurs: Get medical advice/ attention.
Wash contaminated clothing before reuse.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Chemical nature : Defatter

Hazardous components

Chemical name	CAS-No.	Classification	Concentration (%)
RESIDUAL OILS (PETROLEUM), SOLVENT-DEWAXED	64742-62-7	This material is not considered hazardous under the OSHA Hazard Communication Standard (HazCom 2012).	21.105
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT	64742-47-8	Asp. Tox. 1; H304	1.393
AMINES, C12-14-TERT-ALKYL	68955-53-3	Flam. Liq. 4; H227 Acute Tox. 4; H302 Acute Tox. 2; H330 Acute Tox. 3; H311 Skin Corr. 1B; H314 Eye Dam. 1; H318 Skin Sens. 1A; H317	0.343

SECTION 4. FIRST AID MEASURES

General advice : Move out of dangerous area.
Show this safety data sheet to the doctor in attendance.
Do not leave the victim unattended.

If inhaled : If breathed in, move person into fresh air.
If unconscious, place in recovery position and seek medical advice.

If symptoms persist, call a physician.

In case of skin contact	:	Remove contaminated clothing. If irritation develops, get medical attention. If on skin, rinse well with water. First aid is not normally required. However, it is recommended that exposed areas be cleaned by washing with soap and water. Wash contaminated clothing before re-use.
In case of eye contact	:	Flush eyes with water as a precaution. Remove contact lenses. Protect unharmed eye. If eye irritation persists, consult a specialist.
If swallowed	:	Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person. If symptoms persist, call a physician.
Most important symptoms and effects, both acute and delayed	:	Acute aspiration of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Repeated aspiration of small quantities of mineral oil can produce chronic inflammation of the lungs (i.e. lipoid pneumonia) that may progress to pulmonary fibrosis. Symptoms are often subtle and radiological changes appear worse than clinical abnormalities. Occasionally, persistent cough, irritation of the upper respiratory tract, shortness of breath with exertion, fever, and bloody sputum occur. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities. Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include: stomach or intestinal upset (nausea, vomiting, diarrhea) irritation (nose, throat, airways) Headache Dizziness May cause an allergic skin reaction.
Notes to physician	:	No hazards which require special first aid measures.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Water spray Foam

		Carbon dioxide (CO2) Dry chemical
Unsuitable extinguishing media	:	High volume water jet
Specific hazards during firefighting	:	Do not allow run-off from fire fighting to enter drains or water courses.
Hazardous combustion products	:	carbon dioxide and carbon monoxide Hydrocarbons
Specific extinguishing methods	:	
		Product is compatible with standard fire-fighting agents.
Further information	:	Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Special protective equipment for firefighters	:	In the event of fire, wear self-contained breathing apparatus.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed.
Environmental precautions	:	Prevent product from entering drains. Prevent further leakage or spillage if safe to do so. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal.
Other information	:	Comply with all applicable federal, state, and local regulations.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	Do not breathe vapours/dust. Do not smoke. Persons susceptible to skin sensitisation problems or asthma, allergies, chronic or recurrent respiratory disease should not be employed in any process in which this mixture is being used.

Container hazardous when empty.
Avoid exposure - obtain special instructions before use.
Avoid contact with skin and eyes.
Smoking, eating and drinking should be prohibited in the application area.
For personal protection see section 8.
Dispose of rinse water in accordance with local and national regulations.

Conditions for safe storage : Keep container tightly closed in a dry and well-ventilated place.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
DISTILLATES (PETROLEUM), HYDROTREATED LIGHT	64742-47-8	TWA	5 mg/m3 Mist	OSHA Z-1
		TWA	200 mg/m3 (total hydrocarbon vapor)	ACGIH
		TWA	5 mg/m3 Mist	OSHA P0
		TWA	5 mg/m3 Mist	NIOSH REL
		ST	10 mg/m3 Mist	NIOSH REL
		PEL	5 mg/m3 particulate	CAL PEL

Hazardous components without workplace control parameters

Components	CAS-No.
AMINES, C12-14-TERT-ALKYL	68955-53-3

Engineering measures : Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below exposure guidelines (if applicable) or below levels that cause known, suspected or apparent adverse effects.

Personal protective equipment

Respiratory protection : Respiratory protection is not required under normal conditions of use.

Hand protection

Remarks	:	The suitability for a specific workplace should be discussed with the producers of the protective gloves.
Eye protection	:	Not required under normal conditions of use. Wear splash-proof safety goggles if material could be misted or splashed into eyes.
Skin and body protection	:	Wear as appropriate: Impervious clothing Safety shoes Choose body protection according to the amount and concentration of the dangerous substance at the work place. Discard gloves that show tears, pinholes, or signs of wear. Wear resistant gloves (consult your safety equipment supplier).
Hygiene measures	:	Wash hands before breaks and at the end of workday.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	:	liquid
Colour	:	amber
Odour	:	No data available
Odour Threshold	:	No data available
pH	:	No data available
Melting point/freezing point	:	No data available
Boiling point/boiling range	:	> 424.9 °F / 218.3 °C (1013.333 hPa)
Flash point	:	> 222 °C Method: Cleveland open cup
Evaporation rate	:	> 1 Ethyl Ether
Flammability (solid, gas)	:	No data available
Upper explosion limit	:	No data available
Lower explosion limit	:	No data available
Vapour pressure	:	< 0.1000000 mmHg
Relative vapour density	:	> 1AIR=1

Relative density	:	0.89 (60.00 °F)
Density	:	0.8916 g/cm3 (15.56 °C)
Solubility(ies)		
Water solubility	:	No data available
Solubility in other solvents	:	No data available
Partition coefficient: n-octanol/water	:	No data available
Thermal decomposition	:	No data available
Viscosity		
Viscosity, dynamic	:	No data available
Viscosity, kinematic	:	146 mm2/s (40 °C)
Oxidizing properties	:	No data available

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	No decomposition if stored and applied as directed.
Chemical stability	:	Stable under recommended storage conditions.
Possibility of hazardous reactions	:	Product will not undergo hazardous polymerization.
Incompatible materials	:	Strong oxidizing agents
Hazardous decomposition products		Aldehydes carbon dioxide and carbon monoxide Carbon monoxide

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	:	Inhalation Skin contact Eye Contact Ingestion

Acute toxicity
Not classified based on available information.
Components:
RESIDUAL OILS (PETROLEUM), SOLVENT-DEWAXED:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg
Acute inhalation toxicity	:	LC50 (Rat): > 5.58 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: Not classified as acutely toxic by inhalation under GHS. Remarks: No mortality observed at this dose.
Acute dermal toxicity	:	LD50 (Rabbit): > 5,000 mg/kg Remarks: No mortality observed at this dose. LD50 (Rabbit): > 2,000 mg/kg Assessment: Not classified as acutely toxic by dermal absorption under GHS.

DISTILLATES (PETROLEUM), HYDROTREATED LIGHT:

Acute oral toxicity	:	LD50 (Rat): > 5,000 mg/kg
Acute dermal toxicity	:	LD50 (Rabbit): > 3,160 mg/kg Assessment: No adverse effect has been observed in acute dermal toxicity tests.

AMINES, C12-14-TERT-ALKYL:

Acute oral toxicity	:	LD50 (Rat): 612 mg/kg Method: OECD Test Guideline 401
Acute inhalation toxicity	:	LC50 (Rat, female): 1.19 mg/l Exposure time: 4 h Test atmosphere: vapour Method: OECD Test Guideline 403
Acute dermal toxicity	:	LD50 (Rat): 251 mg/kg Method: OECD Test Guideline 402

Skin corrosion/irritation
Not classified based on available information.
Product:
Remarks: May cause skin irritation in susceptible persons.

Components:
RESIDUAL OILS (PETROLEUM), SOLVENT-DEWAXED:
Species: Rabbit
Result: No skin irritation

DISTILLATES (PETROLEUM), HYDROTREATED LIGHT:

Result: Slight, transient irritation

AMINES, C12-14-TERT-ALKYL:
Species: Rabbit
Result: Corrosive after 3 minutes to 1 hour of exposure

Serious eye damage/eye irritation
Not classified based on available information.
Product:
Remarks: Vapours may cause irritation to the eyes, respiratory system and the skin.

Remarks: Unlikely to cause eye irritation or injury.

Components:
RESIDUAL OILS (PETROLEUM), SOLVENT-DEWAXED:
Species: Rabbit
Result: No eye irritation

DISTILLATES (PETROLEUM), HYDROTREATED LIGHT:
Result: Slight, transient irritation

AMINES, C12-14-TERT-ALKYL:
Species: Rabbit
Result: Corrosive

Respiratory or skin sensitisation
Skin sensitisation: May cause an allergic skin reaction.
Respiratory sensitisation: Not classified based on available information.
Components:
RESIDUAL OILS (PETROLEUM), SOLVENT-DEWAXED:
Test Type: Buehler Test
Species: Guinea pig
Assessment: Does not cause skin sensitisation.

AMINES, C12-14-TERT-ALKYL:
Test Type: Buehler Test
Species: Guinea pig
Assessment: The product is a skin sensitiser, sub-category 1A.

Germ cell mutagenicity
Not classified based on available information.
Components:
AMINES, C12-14-TERT-ALKYL:

Genotoxicity in vitro	:	Test Type: Ames test Test species: Salmonella typhimurium Metabolic activation: with and without metabolic activation Method: OECD Test Guideline 471 Result: negative
Genotoxicity in vivo	:	Test Type: Micronucleus test Test species: Mouse

Cell type: Bone marrow
Method: OECD Test Guideline 474
Result: negative

Carcinogenicity
Not classified based on available information.
Reproductive toxicity
Not classified based on available information.
STOT - single exposure
Not classified based on available information.
STOT - repeated exposure
Not classified based on available information.
Aspiration toxicity
Not classified based on available information.
Product:
No aspiration toxicity classification

Components:
RESIDUAL OILS (PETROLEUM), SOLVENT-DEWAXED:
No aspiration toxicity classification

DISTILLATES (PETROLEUM), HYDROTREATED LIGHT:
May be fatal if swallowed and enters airways.

Further information
Product:
Remarks: No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity
Product:
Ecotoxicology Assessment

Acute aquatic toxicity	:	Acute aquatic toxicity Category 3; Harmful to aquatic life.
Chronic aquatic toxicity	:	Chronic aquatic toxicity Category 3; Harmful to aquatic life with long lasting effects.

Components:
RESIDUAL OILS (PETROLEUM), SOLVENT-DEWAXED:

Toxicity to fish	:	LL50 (Pimephales promelas (fathead minnow)): > 100 mg/l Exposure time: 96 h Test Type: static test Test substance: WAF Method: OECD Test Guideline 203 Remarks: No toxicity at the limit of solubility
Toxicity to daphnia and other aquatic invertebrates	:	EL50 (Daphnia magna (Water flea)): > 10,000 mg/l Exposure time: 48 h Test Type: static test Test substance: WAF

Method: OECD Test Guideline 202

Toxicity to algae : NOEL (Pseudokirchneriella subcapitata (green algae)): >= 100 mg/l
End point: Growth inhibition
Exposure time: 72 h
Test Type: static test
Test substance: WAF
Method: OECD Test Guideline 201

Toxicity to fish (Chronic toxicity) : NOELR (Oncorhynchus mykiss (rainbow trout)): Calculated >= 1,000 mg/l
Exposure time: 14 d

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : NOEL (Daphnia (water flea)): 10 mg/l
Exposure time: 21 d
Test substance: WAF
Method: OECD Test Guideline 211

DISTILLATES (PETROLEUM), HYDROTREATED LIGHT:

Toxicity to fish : LC50 (Oncorhynchus mykiss (rainbow trout)): 2 - 5 mg/l
Exposure time: 96 h
Test Type: semi-static test
Test substance: WAF
Method: OECD Test Guideline 203
Remarks: Information given is based on data obtained from similar substances.

Toxicity to daphnia and other aquatic invertebrates : EL50 (Water flea (Daphnia magna)): 1.4 mg/l
Exposure time: 48 h
Test Type: static test
Test substance: WAF
Method: OECD Test Guideline 202
Remarks: Information given is based on data obtained from similar substances.

Toxicity to algae : EL50 (Pseudokirchneriella subcapitata (green algae)): > 1 - 3 mg/l
Exposure time: 72 h
Test Type: static test
Test substance: WAF
Method: OECD Test Guideline 201
Remarks: Information given is based on data obtained from similar substances.

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : NOEL (Water flea (Daphnia magna)): 0.48 mg/l
Exposure time: 21 d
Test Type: semi-static test
Test substance: WAF
Method: OECD Test Guideline 211
Remarks: Information given is based on data obtained from similar substances.

AMINES, C12-14-TERT-ALKYL:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 1.3 mg/l Exposure time: 96 h Test Type: static test Method: OECD Test Guideline 203
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Water flea (Daphnia magna)): 2.5 mg/l Exposure time: 48 h Test Type: static test
Toxicity to algae	:	ErC50 (Pseudokirchneriella subcapitata (microalgae)): 0.44 mg/l End point: Growth inhibition Exposure time: 72 h Test Type: static test Method: OECD Test Guideline 201 NOEC (Pseudokirchneriella subcapitata (microalgae)): 0.05 mg/l End point: Growth inhibition Exposure time: 72 h Test Type: static test Method: OECD Test Guideline 201
M-Factor (Acute aquatic toxicity)	:	1
Toxicity to fish (Chronic toxicity)	:	NOEC (Oncorhynchus mykiss (rainbow trout)): 0.078 mg/l Exposure time: 96 d Test Type: flow-through test Method: OECD Test Guideline 210
M-Factor (Chronic aquatic toxicity)	:	1

Persistence and degradability

Components:

RESIDUAL OILS (PETROLEUM), SOLVENT-DEWAXED:

Biodegradability	:	Result: Not readily biodegradable. Biodegradation: 2 - 4 % Exposure time: 28 d Method: OECD Test Guideline 301B

DISTILLATES (PETROLEUM), HYDROTREATED LIGHT:

Biodegradability	:	Result: Inherently biodegradable Biodegradation: 58.6 % Exposure time: 28 d Method: OECD Test Guideline 301F Remarks: Expected to be biodegradable

AMINES, C12-14-TERT-ALKYL:
Biodegradability : Result: Not readily biodegradable.
Biodegradation: 22 %
Exposure time: 28 d
Method: OECD Test Guideline 301D

No data available

Bioaccumulative potential

Components:

AMINES, C12-14-TERT-ALKYL:
Partition coefficient: n-octanol/water : log Pow: 2.9

No data available

Mobility in soil

Components:

No data available

Other adverse effects

No data available

Product:

Additional ecological information : An environmental hazard cannot be excluded in the event of unprofessional handling or disposal., Harmful to aquatic life with long lasting effects.

Components:

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

General advice : The product should not be allowed to enter drains, water courses or the soil.
Do not contaminate ponds, waterways or ditches with chemical or used container.
Send to a licensed waste management company.

Dispose of in accordance with all applicable local, state and federal regulations.

Contaminated packaging : Empty remaining contents.
Dispose of as unused product.
Empty containers should be taken to an approved waste handling site for recycling or disposal.
Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International transport regulations

REGULATION

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ID NUMBER	PROPER SHIPPING NAME	*HAZARD CLASS	SUBSIDIARY HAZARDS	PACKING GROUP	MARINE POLLUTANT / LTD. QTY.

U.S. DOT - ROAD

Not dangerous goods

CFR_RAIL_C

Not dangerous goods

U.S. DOT - INLAND WATERWAYS

Not dangerous goods

TDG_ROAD_C

Not dangerous goods

TDG_RAIL_C

Not dangerous goods

TDG_INWT_C

Not dangerous goods

INTERNATIONAL MARITIME DANGEROUS GOODS

Not dangerous goods

INTERNATIONAL AIR TRANSPORT ASSOCIATION - CARGO

Not dangerous goods

INTERNATIONAL AIR TRANSPORT ASSOCIATION - PASSENGER

Not dangerous goods

MX_DG

Not dangerous goods

***ORM = ORM-D, CBL = COMBUSTIBLE LIQUID**

Marine pollutant		no

Dangerous goods descriptions (if indicated above) may not reflect quantity, end-use or region-specific exceptions that can be applied. Consult shipping documents for descriptions that are specific to the shipment.

SECTION 15. REGULATORY INFORMATION

SARA 311/312 Hazards : Acute Health Hazard

SARA 313 This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop 65 This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

The components of this product are reported in the following inventories:

TSCA : On TSCA Inventory

DSL : All components of this product are on the Canadian DSL

AICS : On the inventory, or in compliance with the inventory

ENCS : On the inventory, or in compliance with the inventory

KECI : On the inventory, or in compliance with the inventory

PICCS : On the inventory, or in compliance with the inventory

IECSC : On the inventory, or in compliance with the inventory

Inventories
AICS (Australia), DSL (Canada), IECSC (China), REACH (European Union), ENCS (Japan), ISHL (Japan), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TCSI (Taiwan), TSCA (USA)

SECTION 16. OTHER INFORMATION

Further information
Revision Date: 09/28/2016

NFPA:	HMIS III:

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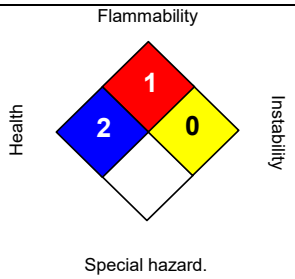

HEALTH	2
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

NFPA Flammable and Combustible Liquids Classification
Combustible Liquid Class IIIB

Full text of H-Statements

H227	Combustible liquid.
H302	Harmful if swallowed.
H304	May be fatal if swallowed and enters airways.
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.
H317	May cause an allergic skin reaction.
H318	Causes serious eye damage.
H330	Fatal if inhaled.

Sources of key data used to compile the Safety Data Sheet
Valvoline internal data including own and sponsored test reports
The UNECE administers regional agreements implementing harmonised classification for labelling (GHS) and transport.

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances. This SDS has been prepared by Valvoline's Environmental Health and Safety Department (1-800-VALVOLINE).

List of abbreviations and acronyms that could be, but not necessarily are, used in this safety data sheet :
ACGIH : American Conference of Industrial Hygienists
BEI : Biological Exposure Index
CAS : Chemical Abstracts Service (Division of the American Chemical Society).
CMR : Carcinogenic, Mutagenic or Toxic for Reproduction
FG : Food grade

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GHS : Globally Harmonized System of Classification and Labeling of Chemicals.
H-statement : Hazard Statement
IATA : International Air Transport Association.
IATA-DGR : Dangerous Goods Regulation by the “International Air Transport Association” (IATA).

ICAO : International Civil Aviation Organization
ICAO-TI (ICAO) : Technical Instructions by the “International Civil Aviation Organization”
IMDG : International Maritime Code for Dangerous Goods
ISO : International Organization for Standardization
logPow : octanol-water partition coefficient
LCxx : Lethal Concentration, for xx percent of test population
LDxx : Lethal Dose, for xx percent of test population.
ICxx : Inhibitory Concentration for xx of a substance
Ecxx : Effective Concentration of xx
N.O.S.: Not Otherwise Specified
OECD : Organization for Economic Co-operation and Development
OEL : Occupational Exposure Limit
P-Statement : Precautionary Statement
PBT : Persistent , Bioaccumulative and Toxic
PPE : Personal Protective Equipment
STEL : Short-term exposure limit
STOT : Specific Target Organ Toxicity
TLV : Threshold Limit Value
TWA : Time-weighted average
vPvB : Very Persistent and Very Bioaccumulative
WEL : Workplace Exposure Level

CERCLA : Comprehensive Environmental Response, Compensation, and Liability Act
DOT : Department of Transportation
FIFRA : Federal Insecticide, Fungicide, and Rodenticide Act
HMIRC : Hazardous Materials Information Review Commission
HMIS : Hazardous Materials Identification System
NFPA : National Fire Protection Association
NIOSH : National Institute for Occupational Safety and Health
OSHA : Occupational Safety and Health Administration
PMRA : Health Canada Pest Management Regulatory Agency
RTK : Right to Know
WHMIS : Workplace Hazardous Materials Information System

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		Print Date: 11/1/2016
		SDS Number: R0300933
Synpower™ 75W-90 SYNTHETIC GEAR OIL VV975		Version: 1.1

29 CFR 1910.1200 (OSHA HazCom 2012)

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product identifier

Trade name : Synpower™ 75W-90
SYNTHETIC GEAR OIL

Recommended use of the chemical and restrictions on use

Details of the supplier of the safety data sheet	**Emergency telephone number** 1-800-VALVOLINE **Regulatory Information Number** 1-800-TEAMVAL **Product Information** 1-800-TEAMVAL
Valvoline LLC 3499 Blazer Parkway Lexington, KY 40509 United States of America SDS@valvoline.com	

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Eye irritation : Category 2A

Skin sensitization : Category 1

GHS Label element

Hazard pictograms :

Signal Word : Warning

Hazard Statements : May cause an allergic skin reaction.
Causes serious eye irritation.

Precautionary Statements : **Prevention:**
Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
Wash skin thoroughly after handling.
Contaminated work clothing must not be allowed out of the workplace.
Wear eye protection/ face protection.
Wear protective gloves.
Response:

IF ON SKIN: Wash with plenty of soap and water.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If skin irritation or rash occurs: Get medical advice/ attention.
If eye irritation persists: Get medical advice/ attention.
Wash contaminated clothing before reuse.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Other hazards
None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Chemical nature : Defatter

Hazardous components

Chemical Name	CAS-No.	Classification	Concentration (%)
HEAVY PARAFFINIC DISTILLATE	64742-54-7	Asp. Tox. 1; H304	61.42
DI-TERT-BUTYL POLYSULFIDE	68937-96-2	Flam. Liq. 4; H227 Skin Sens. 1B; H317	4.99
WHITE MINERAL OIL	8042-47-5	Not a hazardous substance or mixture.	2.90
Phosphoric acid esters, amine salt	91745-46-9	Acute Tox. 4; H302 Eye Dam. 1; H318 Skin Sens. 1; H317 Aquatic Acute 2; H401 Aquatic Chronic 2; H411	1.99

SECTION 4. FIRST AID MEASURES

General advice	:	Move out of dangerous area. Show this safety data sheet to the doctor in attendance. Do not leave the victim unattended.
If inhaled	:	If breathed in, move person into fresh air. If unconscious place in recovery position and seek medical advice. If symptoms persist, call a physician.
In case of skin contact	:	Remove contaminated clothing. If irritation develops, get medical attention. If on skin, rinse well with water. First aid is not normally required. However, it is recommended that exposed areas be cleaned by washing with soap and water. Wash contaminated clothing before re-use.
In case of eye contact	:	Immediately flush eye(s) with plenty of water. Remove contact lenses. Protect unharmed eye.
If swallowed	:	Do not give milk or alcoholic beverages. Never give anything by mouth to an unconscious person. If symptoms persist, call a physician.
Most important symptoms and effects, both acute and delayed	:	Acute aspiration of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Repeated aspiration of small quantities of mineral oil can produce chronic inflammation of the lungs (i.e. lipoid pneumonia) that may progress to pulmonary fibrosis. Symptoms are often subtle and radiological changes appear worse than clinical abnormalities. Occasionally, persistent cough, irritation of the upper respiratory tract, shortness of breath with exertion, fever, and bloody sputum occur. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities. Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include: acne stomach or intestinal upset (nausea, vomiting, diarrhea) irritation (nose, throat, airways) May cause an allergic skin reaction. Causes serious eye irritation.
Notes to physician	:	No hazards which require special first aid measures.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Water spray Foam Carbon dioxide (CO2) Dry chemical
Unsuitable extinguishing media	:	High volume water jet
Specific hazards during firefighting	:	Do not allow run-off from fire fighting to enter drains or water courses.
Hazardous combustion products	:	carbon dioxide and carbon monoxide Hydrocarbons Aldehydes Sulphur oxides Hydrogen chloride gas Nitrogen oxides (NOx) Oxides of phosphorus
Specific extinguishing methods	:	Product is compatible with standard fire-fighting agents.
Further information	:	Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.
Special protective equipment for firefighters	:	In the event of fire, wear self-contained breathing apparatus.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed.
Environmental precautions	:	Prevent product from entering drains. Prevent further leakage or spillage if safe to do so. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal.

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Other information : Comply with all applicable federal, state, and local regulations.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling : Do not breathe vapours/dust.
Do not smoke.
Persons susceptible to skin sensitisation problems or asthma, allergies, chronic or recurrent respiratory disease should not be employed in any process in which this mixture is being used.
Container hazardous when empty.
Avoid exposure - obtain special instructions before use.
Avoid contact with skin and eyes.
Smoking, eating and drinking should be prohibited in the application area.
For personal protection see section 8.
Dispose of rinse water in accordance with local and national regulations.

Conditions for safe storage : Keep container tightly closed in a dry and well-ventilated place.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Electrical installations / working materials must comply with the technological safety standards.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
WHITE MINERAL OIL	8042-47-5	REL	5 mg/m3 Mist.	NIOSH/GUIDE
		STEL	10 mg/m3 Mist.	NIOSH/GUIDE
		PEL	5 mg/m3 Mist.	OSHA_TRANS
		TWA	5 mg/m3 Mist.	TN OEL
		TWA	5 mg/m3 Inhalable fraction.	ACGIH

Engineering measures : Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below exposure guidelines (if applicable) or below levels that cause known, suspected or apparent adverse effects.

Personal protective equipment

Hand protection

Remarks	:	The suitability for a specific workplace should be discussed with the producers of the protective gloves.
Eye protection	:	Wear chemical splash goggles when there is the potential for exposure of the eyes to liquid, vapor or mist.
Skin and body protection	:	Wear as appropriate: impervious clothing Safety shoes Choose body protection according to the amount and concentration of the dangerous substance at the work place. Discard gloves that show tears, pinholes, or signs of wear. Wear resistant gloves (consult your safety equipment supplier).
Hygiene measures	:	Wash hands before breaks and at the end of workday. When using do not eat or drink. When using do not smoke.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	:	liquid
Odour	:	mild
Odour Threshold	:	No data available
pH	:	No data available
Melting point/freezing point	:	No data available
Boiling point/boiling range	:	No data available
Flash point	:	> 390 °F / > 199 °C Method: Cleveland open cup
Evaporation rate	:	No data available
Flammability (solid, gas)	:	No data available
Upper explosion limit	:	6 %(V) Calculated Explosive Limit
Lower explosion limit	:	1 %(V) Calculated Explosive Limit
Vapour pressure	:	1.3333333 hPa (20 °C) Calculated Vapor Pressure

Relative vapour density	:	No data available
Relative density	:	No data available
Density	:	0.86 g/cm3 (15.56 °C)
Solubility(ies)		
Water solubility	:	No data available
Solubility in other solvents	:	No data available
Partition coefficient: n-octanol/water	:	No data available
Thermal decomposition	:	No data available
Viscosity		
Viscosity, dynamic	:	No data available
Viscosity, kinematic	:	100 mm2/s (40 °C)
Oxidizing properties	:	No data available

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	No decomposition if stored and applied as directed.
Chemical stability	:	Stable under recommended storage conditions.
Possibility of hazardous reactions	:	Product will not undergo hazardous polymerization.
Conditions to avoid	:	excessive heat Exposure to sunlight.
Incompatible materials	:	Iron steel Strong acids Strong oxidizing agents
Hazardous decomposition products		carbon dioxide and carbon monoxide Hydrocarbons Hydrogen chloride gas Nitrogen oxides (NOx) Oxides of phosphorus Sulphur oxides

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure : Inhalation
Skin contact
Eye Contact
Ingestion

Acute toxicity
Not classified based on available information.
Components:
HEAVY PARAFFINIC DISTILLATE:
Acute oral toxicity : LD 50 (Rat): > 15 g/kg

Acute dermal toxicity : LD 50 (Rabbit): > 5 g/kg

DI-TERT-BUTYL POLYSULFIDE:
Acute oral toxicity : LD50 (Rat): > 2,000 mg/kg
Method: OECD Test Guideline 401

Acute dermal toxicity : LD50 (Rat): > 2,000 mg/kg
Method: OECD Test Guideline 402

WHITE MINERAL OIL:
Acute oral toxicity : LD 50 (Rat): 50,000 mg/kg

Acute dermal toxicity : LD 50 (Rabbit): > 2,000 mg/kg
Assessment: Not classified as acutely toxic by dermal absorption under GHS.

Phosphoric acid esters, amine salt:
Acute oral toxicity : LD 50 (Rat): 2,000 mg/kg

Skin corrosion/irritation
Not classified based on available information.
Product:
Remarks: May cause skin irritation in susceptible persons.

Components:
HEAVY PARAFFINIC DISTILLATE:
Result: Mildly irritating to skin

DI-TERT-BUTYL POLYSULFIDE:
Result: Slightly to moderately irritating to skin

WHITE MINERAL OIL:
Result: Not irritating to skin

Phosphoric acid esters, amine salt:
Result: Mildly irritating to skin

Serious eye damage/eye irritation
Causes serious eye irritation.

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Product:
Remarks: Vapours may cause irritation to the eyes, respiratory system and the skin., Causes serious eye irritation.

Components:
HEAVY PARAFFINIC DISTILLATE:
Result: Not irritating to eyes

DI-TERT-BUTYL POLYSULFIDE:
Result: Slightly irritating to eyes

WHITE MINERAL OIL:
Result: Not irritating to eyes

Phosphoric acid esters, amine salt:
Result: Severely irritating to eyes

Respiratory or skin sensitisation
Skin sensitisation: May cause an allergic skin reaction.
Respiratory sensitisation: Not classified based on available information.
Components:
DI-TERT-BUTYL POLYSULFIDE:
Test Type: Maximisation Test (GPMT)
Species: Guinea pig
Assessment: The product is a skin sensitiser, sub-category 1B.
Method: OECD Test Guideline 406

Phosphoric acid esters, amine salt:
Assessment: May cause sensitisation by skin contact.

Germ cell mutagenicity
Not classified based on available information.
Components:
DI-TERT-BUTYL POLYSULFIDE:
Genotoxicity in vitro : Test Type: in vitro assay
Result: Positive results were obtained in some in vitro tests.

Genotoxicity in vivo : Test Type: Micronucleus test
Test species: Mouse
Cell type: Bone marrow
Method: OECD Test Guideline 474
Result: negative

Carcinogenicity
Not classified based on available information.
Reproductive toxicity
Not classified based on available information.
STOT - single exposure
Not classified based on available information.
STOT - repeated exposure
Not classified based on available information.
Aspiration toxicity
Not classified based on available information.

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Components:
HEAVY PARAFFINIC DISTILLATE:
May be fatal if swallowed and enters airways.

Further information
Product:
Remarks: No data available

Carcinogenicity:

IARC	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
NTP	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Components:
HEAVY PARAFFINIC DISTILLATE:

Toxicity to fish	:	LL50 (Fish): > 100 mg/l
Toxicity to daphnia and other aquatic invertebrates	:	EL50 (Aquatic invertebrates): > 10,000 mg/l
Toxicity to algae	:	EL50 (Algae, algal mat (Algae)): > 100 mg/l
Toxicity to fish (Chronic toxicity)	:	NOEC (Fish): 10 mg/l
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Aquatic invertebrates): 10 mg/l

DI-TERT-BUTYL POLYSULFIDE:

Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Water flea (Daphnia magna)): 0.24 mg/l Exposure time: 48 h Test Type: static test Method: OECD Test Guideline 202
Toxicity to algae	:	EC50 (Pseudokirchneriella subcapitata (microalgae)): 2.45 mg/l End point: Growth inhibition

Exposure time: 72 h
Test Type: static test
Method: OECD Test Guideline 201

NOEC (Pseudokirchneriella subcapitata (microalgae)): 0.1 mg/l
End point: Growth inhibition
Exposure time: 72 h
Test Type: static test
Method: OECD Test Guideline 201

Phosphoric acid esters, amine salt:
Ecotoxicology Assessment
Acute aquatic toxicity : Toxic to aquatic life.

Chronic aquatic toxicity : Toxic to aquatic life with long lasting effects.

Persistence and degradability

Components:

DI-TERT-BUTYL POLYSULFIDE:

Biodegradability : Result: Not readily biodegradable.
Biodegradation: 13 %
Exposure time: 28 d
Method: OECD Test Guideline 301B

Bioaccumulative potential

Components:

DI-TERT-BUTYL POLYSULFIDE:

Partition coefficient: n-octanol/water : log Pow: 5.6 (20 °C)
pH: 7

Mobility in soil

Components:

No data available

Other adverse effects

No data available

Product:

Additional ecological information : An environmental hazard cannot be excluded in the event of unprofessional handling or disposal., Toxic to aquatic life with long lasting effects.

Components:

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

General advice : The product should not be allowed to enter drains, water

courses or the soil.
Do not contaminate ponds, waterways or ditches with chemical or used container.
Send to a licensed waste management company.

Dispose of in accordance with all applicable local, state and federal regulations.

Contaminated packaging : Empty remaining contents.
Dispose of as unused product.
Empty containers should be taken to an approved waste handling site for recycling or disposal.
Do not re-use empty containers.

SECTION 14. TRANSPORT INFORMATION

International transport regulations

REGULATION

ID NUMBER	PROPER SHIPPING NAME	*HAZARD CLASS	SUBSIDIARY HAZARDS	PACKING GROUP	MARINE POLLUTANT / LTD. QTY.

U.S. DOT - ROAD

Not dangerous goods

CFR_RAIL_C

Not dangerous goods

U.S. DOT - INLAND WATERWAYS

Not dangerous goods

TDG_ROAD_C

Not dangerous goods

TDG_RAIL_C

Not dangerous goods

TDG_INWT_C

Not dangerous goods

INTERNATIONAL MARITIME DANGEROUS GOODS

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Not dangerous goods	MARINE POLLUTANT:(DI-TERT-BUTYL POLYSULFIDE)

INTERNATIONAL AIR TRANSPORT ASSOCIATION - CARGO

Not dangerous goods

INTERNATIONAL AIR TRANSPORT ASSOCIATION - PASSENGER

Not dangerous goods

MX_DG

Not dangerous goods

***ORM = ORM-D, CBL = COMBUSTIBLE LIQUID**

Marine pollutant		yes

Dangerous goods descriptions (if indicated above) may not reflect quantity, end-use or region-specific exceptions that can be applied. Consult shipping documents for descriptions that are specific to the shipment.

SECTION 15. REGULATORY INFORMATION

SARA 311/312 Hazards : Acute Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.
Component(s)SARA 313

Pennsylvania Right To Know

HEAVY PARAFFINIC DISTILLATE	64742-54-7	50.00 - 70.00 %
VISCOSITY MODIFIER	Not Assigned	20.00 - 30.00 %
DI-TERT-BUTYL POLYSULFIDE	68937-96-2	1.00 - 5.00 %
WHITE MINERAL OIL	8042-47-5	1.00 - 5.00 %

New Jersey Right To Know

HEAVY PARAFFINIC DISTILLATE	64742-54-7	50.00 - 70.00 %

VISCOSITY MODIFIER	Not Assigned	20.00 - 30.00 %
DI-TERT-BUTYL POLYSULFIDE	68937-96-2	1.00 - 5.00 %
WHITE MINERAL OIL	8042-47-5	1.00 - 5.00 %
LUBRICANT ADDITIVE	Not Assigned	1.00 - 5.00 %

California Prop 65 Proposition 65 warnings are not required for this product based on the results of a risk assessment.

The components of this product are reported in the following inventories:

TSCA	:	On TSCA Inventory
DSL	:	All components of this product are on the Canadian DSL.
AUSTR	:	On the inventory, or in compliance with the inventory
NZIOC	:	Not in compliance with the inventory
ENCS	:	On the inventory, or in compliance with the inventory
KECL	:	On the inventory, or in compliance with the inventory
PICCS	:	On the inventory, or in compliance with the inventory
IECSC	:	On the inventory, or in compliance with the inventory

Inventories
AICS (Australia), DSL (Canada), IECSC (China), REACH (European Union), ENCS (Japan), ISHL (Japan), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TSCA (USA)

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SECTION 16. OTHER INFORMATION

Further information
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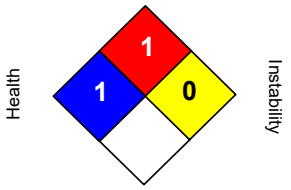
NFPA:	HMIS III:
Flammability  Special hazard.	HEALTH 2 FLAMMABILITY 1 PHYSICAL HAZARD 0 = not significant, 1 =Slight, 2 = Moderate, 3 = High 4 = Extreme, * = Chronic

NFPA Flammable and Combustible Liquids Classification
Combustible Liquid Class IIIB

Full text of H-Statements referred to under sections 2 and 3.

H227	Combustible liquid.
H302	Harmful if swallowed.
H304	May be fatal if swallowed and enters airways.
H317	May cause an allergic skin reaction.
H318	Causes serious eye damage.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

Sources of key data used to compile the Safety Data Sheet
Valvoline internal data including own and sponsored test reports
The UNECE administers regional agreements implementing harmonised classification for labelling (GHS) and transport.

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances. This SDS has been prepared by Valvoline's Environmental Health and Safety Department (1-800-825-8654).

List of abbreviations and acronyms that could be, but not necessarily are, used in this safety data sheet :
ACGIH : American Conference of Industrial Hygienists
BEI : Biological Exposure Index

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CAS : Chemical Abstracts Service (Division of the American Chemical Society).
CMR : Carcinogenic, Mutagenic or Toxic for Reproduction
FG : Food grade
GHS : Globally Harmonized System of Classification and Labeling of Chemicals.
H-statement : Hazard Statement
IATA : International Air Transport Association.
IATA-DGR : Dangerous Goods Regulation by the “International Air Transport Association” (IATA).

ICAO : International Civil Aviation Organization
ICAO-TI (ICAO) : Technical Instructions by the “International Civil Aviation Organization”
IMDG : International Maritime Code for Dangerous Goods
ISO : International Organization for Standardization
logPow : octanol-water partition coefficient
LCxx : Lethal Concentration, for xx percent of test population
LDxx : Lethal Dose, for xx percent of test population.
ICxx : Inhibitory Concentration for xx of a substance
Ecxx : Effective Concentration of xx
N.O.S.: Not Otherwise Specified
OECD : Organization for Economic Co-operation and Development
OEL : Occupational Exposure Limit
P-Statement : Precautionary Statement
PBT : Persistent , Bioaccumulative and Toxic
PPE : Personal Protective Equipment
STEL : Short-term exposure limit
STOT : Specific Target Organ Toxicity
TLV : Threshold Limit Value
TWA : Time-weighted average
vPvB : Very Persistent and Very Bioaccumulative
WEL : Workplace Exposure Level

CERCLA : Comprehensive Environmental Response, Compensation, and Liability Act
DOT : Department of Transportation
FIFRA : Federal Insecticide, Fungicide, and Rodenticide Act
HMIRC : Hazardous Materials Information Review Commission
HMIS : Hazardous Materials Identification System
NFPA : National Fire Protection Association
NIOSH : National Institute for Occupational Safety and Health
OSHA : Occupational Safety and Health Administration
PMRA : Health Canada Pest Management Regulatory Agency
RTK : Right to Know
WHMIS : Workplace Hazardous Materials Information System

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[MOLYWHITE RE No.00][KYODO YUSHI CO., LTD.][07-543]

SAFETY DATA SHEET

1. Identification

Product identifier: **MOLYWHITE RE No.00**
Recommended use of the chemical and restrictions on use:
Lubricating grease
Manufacturer
Name: KYODO YUSHI CO., LTD.
Address: 2-2-30, Tsujido Kandai, Fujisawa-Shi, Kanagawa, Japan
TEL: +81-466-33-3157
Emergency phone number: +81-466-33-3157

2. Hazards identification

GHS Classification
Physical Hazards
Flammable liquids : Not classified
Health Hazards
Acute toxicity - Oral : Not classified
Acute toxicity - Dermal : Not classified
Environment Hazards
Hazardous to the aquatic environment (Long-term hazard)
: Category Chronic 3
OSHA Defined Hazards: (Pyrophoric gas, Simple asphyxiant, Combustible dust)
: Classification not possible

GHS Labeling Elements
Symbol: Not applicable.
Signal Word: Not applicable.
Hazard Statements:
(H412) Harmful to aquatic life with long lasting effects
Precautionary Statements
Prevention:
(P273) Avoid release to the environment.
Response:
Not applicable.
Storage:
Not applicable.
Disposal:
(P501) Disposal should be in accordance with applicable regional, national and local laws and regulations.
Hazards Not Otherwise Classified(HNOC)
・Not applicable.

3. Composition/ information on ingredients

Formula: Not applicable.

Components:

Component	Contents(%)
Base oil(Synthetic hydrocarbon oil, refined mineral oil)	85-95
Thickener(Lithium soap)	< 10
EP additive(Containing molybdenum compounds,	< 5
Oxidation inhibitor(Butylated hydroxytoluene (BHT))	< 5
Additive(s)(Containing barium compounds)	< 5

Hazardous Ingredients:

Component	CAS No.	Contents(%)
Molybdenum compounds	Confidential	1-3

See Section 8 for exposure limits (if applicable).
See Section 15 for legal controlled substance (if applicable).

4. First-aid measures

Eye Contact:
- Immediately flush with water for at least 15 minutes. Get medical attention.

Skin Contact:
- Thoroughly remove with cloth or paper and wash carefully with soap and water.

Inhalation:
- Remove the victim from the contamination to fresh air. Cover the victim in a blanket to keep warm and quiet. Consult a physician.

Ingestion:
- Do not induce vomiting. Immediate consult a physician.

Notes to Physicians:
- Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. Fire-fighting measures

Flammable Limits: No data available.
Autoignition Temperature: No data available.
Extinguishing Media:
- Foam, dry chemical, CO2, dry sand.

Unsuitable Extinguishing Media:
- Do not use water. Water can be dangerous possibly leading to fire spread.

Specific Hazards with Regard to Fire-fighting:
- Thermal decomposition and combustion may produce carbon monoxide and/or carbon dioxide.

Specific Methods of Fire-fighting:
- In the early stages of fire, use dry chemical, CO2, dry sand, etc. fire-extinguisher.
- In case of massive fire, use foam fire-extinguisher to shut off the air supply.
- Get all persons to safety. Authorized personnel only at the fire site.

Protection of Firefighters:
- Fire-fighters should wear protective equipment.
- Start fire fighting from the windward side.

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6. Accidental release measures

Personal Precautions:
- Wear protective equipment during cleanup work.

Environmental Precautions:
- Prevent spills from entering sewers or waterway.

Methods for Clean-Up:
- For small spills, absorb with inert material (e.g., dry sand, sawdust or waste cloth), then place in a chemical waste container with a cover for disposal.
- For large spills, dike to keep spillage in a safe place for later disposal.

Prevention of Secondary Hazards:
- Immediately shut off all sources of ignition.

7. Handling and storage

Handling

Technical Measures:
- Handle the product in a well-ventilated place. Do not leak, flood or scatter the product to prevent unwanted evaporation.

Precautions:
- Contact with eye may cause irritation. Use protective glasses to avoid contact with eyes.
- Contact with skin may cause irritation. Use protective gloves to avoid skin contact.
- Do not swallow. (Drinking the product may cause diarrhea and vomiting.)
- Close container after each use.

Precautions for Safe Handling:
- Wear gloves to avoid injury on hands at opening the container.

Storage

Appropriate Storage Conditions:
- Keep container closed to protect from dust/water ingress after use.
- Store in a cool, dry place, away from direct sunlight, heat source and fire.
- Keep out of reach of children.

Safe Packaging Materials:
- Do not expose empty container to pressure.
- Do not weld, heat, drill or cut container. Residue ignition and explosion hazards.

8. Exposure controls/personal protection

Exposure Guidelines

ACGIH
- Butylated hydroxytoluene (BHT): TWA 2mg/m3
- Mineral oil: TWA 5mg/m3

Engineering Controls:
- When vapor or mist exhales, install an apparatus to close the vapor/mist source or ventilation equipment.

Protective Equipment

Respiratory Protection:
- Wear a gas mask for organic gas when needed (not necessary under normal conditions).

Hand Protection:
- Wear oil-resistant protective gloves in case of prolonged and/or repeated skin contact.

Eye Protection:
- Wear chemical safety goggles whenever the product splashes.

Skin and Body Protection:
- Wear long-sleeved oil-resistant working clothes whenever handling for many hours and/or getting wet. Immediately take off the wet clothes and thoroughly wash them before reusing.

9. Physical and chemical properties

Appearance	
Form	: Semi-fluid
Color	: Yellow
Odor	: Slight odor
pH	: No data available.
Melting point	: No data available.
Flash point	: 190°C(Seta)
Vapor pressure	: No data available.
Solubility in water	: Insoluble in water
Vapor density	: No data available.
Density	: 0.87(25°C)g/cm3
Partition coefficient: n-octanol/water	: No data available.
Viscosity	: No data available.
Dropping point	: 193°C

10. Stability and reactivity

Reactivity, Conditions to avoid:
- Avoid contact with strong oxidant.

Chemical Stability:
- Product is stable under normal conditions.

Possibility of Hazardous Reactions:
- Not available.

Materials to avoid:
- Strong oxidizers.

Hazardous Decomposition Products:
- This material is expected to be stable under normal conditions of use.

11. Toxicological information

Information on the likely routes of exposure: Not applicable.
Delayed and immediate effects and also chronic effects from short- and long-term exposure

Acute toxicity - Oral:
- Not classified based on the category of each ingredient or the product properties.
- Refined mineral oil LD50 Acute oral >5 g/kg (rat)

Acute toxicity - Dermal:
- Not classified based on the category of each ingredient or the product properties.

Acute toxicity - Inhalation (Gases): No data available.
Acute toxicity - Inhalation (Vapors): No data available.
Acute toxicity - Inhalation (Dusts and mists): No data available.
Skin corrosion/irritation: No data available.

Eye damage/irritation: No data available.
Sensitization - Respiratory: No data available.
Sensitization - Skin: No data available.
Germ cell mutagenicity: No data available.
Carcinogenicity: No data available.
Toxic to reproduction: No data available.
Effects on or via lactation: No data available.
Specific target organ toxicity (Single exposure):
No data available.
Specific target organ toxicity (Repeated exposure):
No data available.
Aspiration hazard: No data available.
Other Toxicity Information
NTP Report on Carcinogens: Not listed.
IARC Monographs: Not listed.

12. Ecological information

Ecotoxicity
Hazardous to the aquatic environment (Acute hazard):
No data available.
Hazardous to the aquatic environment (Long-term hazard):
・Classified under Category Chronic 3 based on the category of each ingredient or the product properties.
Persistence and Degradability: No data available.
Bioaccumulative potential: No data available.
Mobility in soil: No data available.
Hazardous to the ozone layer: No data available.

13. Disposal considerations

Waste Residues:
・Properly dispose of in accordance with any relevant regulations.
・Properly dispose of by a licensed waste disposer.
・For in-house incineration disposal, ensure exhaust gas treatment (washing treatment, etc.) to prevent air pollution from sulfur oxides.
・No dumping.
・When burning, be sure to do so on someone’s watch in a safe place and in the way that burning and/or explosion will never pose a potential hazard.
Contaminated Packaging:
・Dispose of container after completely removing the contents.

14. Transport information

DOT Hazardous Materials: Not applicable.
UN Transport of Dangerous Goods
UN Number: Not applicable.
UN Proper Shipping Name: Not applicable.
Transport Hazard Class: Not applicable.
Packing Group: Not applicable.
Land(RID/ADR): Not applicable.
Sea(IMO/IMDG): Not applicable.
Air(ICAO/IATA): Not applicable.
Specific Precautionary Transport Measures and Conditions:
・Contains combustible liquid. Keep fire away.
・Handle with care to prevent container damage.

・Ensure proper packaging before shipping to avoid load shifting and falling accident.

15. Regulatory information

Regulatory information with regard to this product in your country or your region should be examined by your own responsibility.

US TSCA (Toxic Substances Control Act)
All components of this product are listed on the TSCA inventory of Chemical Substances.

US OSHA (Occupational Safety and Health Act):
This product is hazardous according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200, since this product contains OSHA Hazardous Substances;

Name	CAS No.	Contents(%)
Molybdenum compounds	Confidential	1-3

US CERCLA
(Comprehensive Environmental Release, Compensation & Liability Act):
CERCLA Hazardous Substances:

Name	CAS No.	Contents(%)
Zinc compounds	Confidential	0.1-0.5

US SARA (Superfund Amendment & Reauthorization Act) Title III:
SARA Extremely Hazardous Substances (302): None

SARA Hazard Categories (311/312): None

SARA Toxic Release Inventory (TRI) (313):

Name	CAS No.	Contents(%)
Barium compounds	Confidential	0.3-0.7
Zinc compounds	Confidential	0.1-0.5

16. Other Information

NFPA
Health hazards: 1
Flammability: 1
Instability: 0
Special Hazard: -

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Original date: Oct/31/2014
Revision date: / /

References

1. OSHA Hazard Communication Standard 29 CFR 1910.1200
2. Thresholds limit values for chemical substances and physical agents and biological exposure indices, ACGIH(2012)
3. IARC MONOGRAPHS ON THE EVALUATION OF THE CARCINOGENIC RISK OF CHEMICALS TO HUMANS VOLUME 33
4. Report on Carcinogens Twelfth Edition 2011, NTP
5. EU CLP Regulation (EC No 1272/2008 ANNEX VI Harmonised classification and labelling for certain hazardous substances)
6. Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Third revised edition.

Disclaimer

This SDS is an addition and complementary document beside the technical data sheet.The information is based upon our knowledge about the product at the date of edition.

Since we cannot anticipate or control the different conditions under which these information or our product may be used, we make no guarantee that recommendations will be adequate for all individuals and situations.