F69A CNC
MACHINING CENTER
MACHINE MAINTENANCE AND PARTS MANUAL

8029 S 200th Street, Kent, WA 98032 USA | www.rottlermfg.com | Ph: (253) 872-7050 | Fax: (253) 393-0230
Rev 062022

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MANUAL SECTIONS

INTRODUCTION
MAINTENANCE
TROUBLESHOOTING
MACHINE PARTS
MSDS

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INTRODUCTION

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

ATTENTION OWNER/BUSINESS MANAGER

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

We suggest that the new user of the F69A 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 F69A 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 F69A 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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Limited Warranty

Rottler Manufacturing Company Model F69A parts and equipment is warranted as to materials and workmanship. This limited warranty remains in effect for one year from the date of installation or two years from the date of the original shipment from Rottler or whichever date occurs first. This only applies is the machine is owned and operated by the original purchaser and is operated and maintained as per the instructions in the manual. A machine is warranted only if the Installation Report has been properly executed by a certified installation person and received by Rottler at the time of actual installation.

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

injury or loss. Buyer waives any right, beyond the foregoing warranty, to make a claim against Rottler. No warranty is provided for any Products not paid in full.

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

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

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

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MAINTENANCE

Contents

Maintenance

Quick Reference Lubrication Chart: F69A

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: F69A

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: F69A

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Check Gibbs	960	
Check for Loose Bolts	960	

Check Machine Geometry	960	
Check Incoming Voltage	960	

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Lubrication

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 has a gravity feed oiling system. Use machine tool oil in this reservoir. The reservoir is located on the side of the Draw Bar Assembly cylinder. There is a window on the side of the headstock cover to observe the oil level in the reservoir. Refer to the following illustration for filling location.

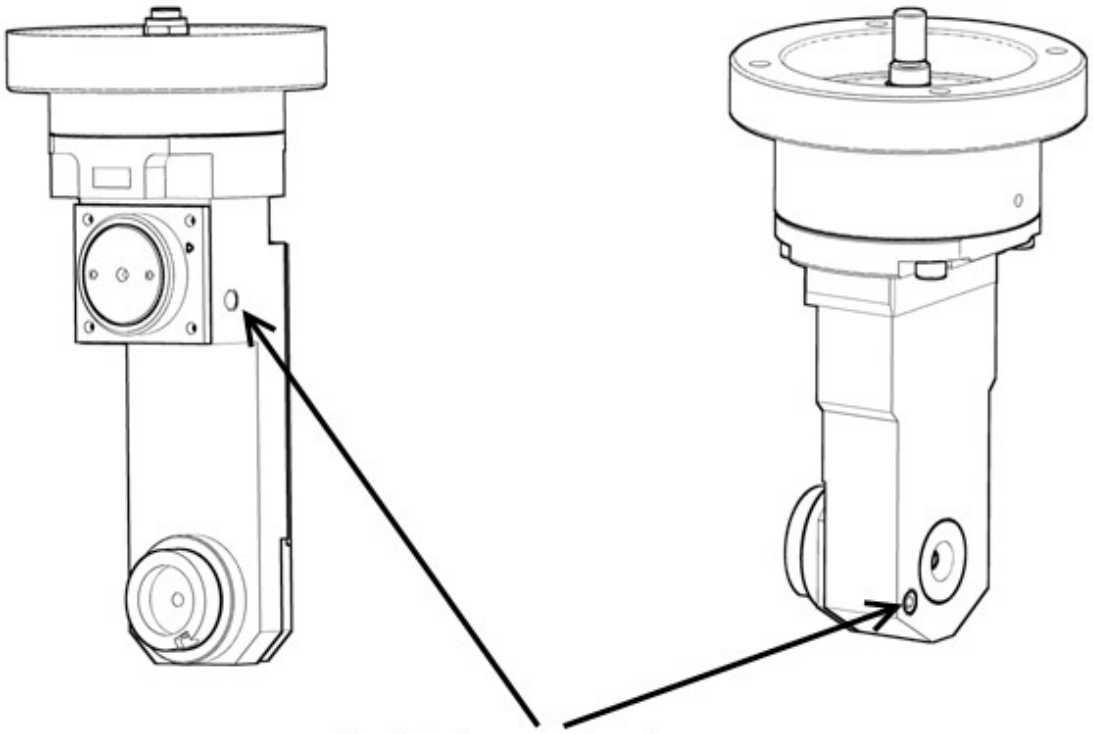
Right Angle Drive Lubrication Information.

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

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

All Rottler Right Angle Drives are filled with Union 76 Turbine Oil 68 prior to shipment. Use this or an equivalent ISO VG68 oil if the need to add or change oil arises.

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



Typical pipe plug locations

Probe “On-Center” Adjustment

This covers setup and calibration of the probe, so it will accurately position your machine.

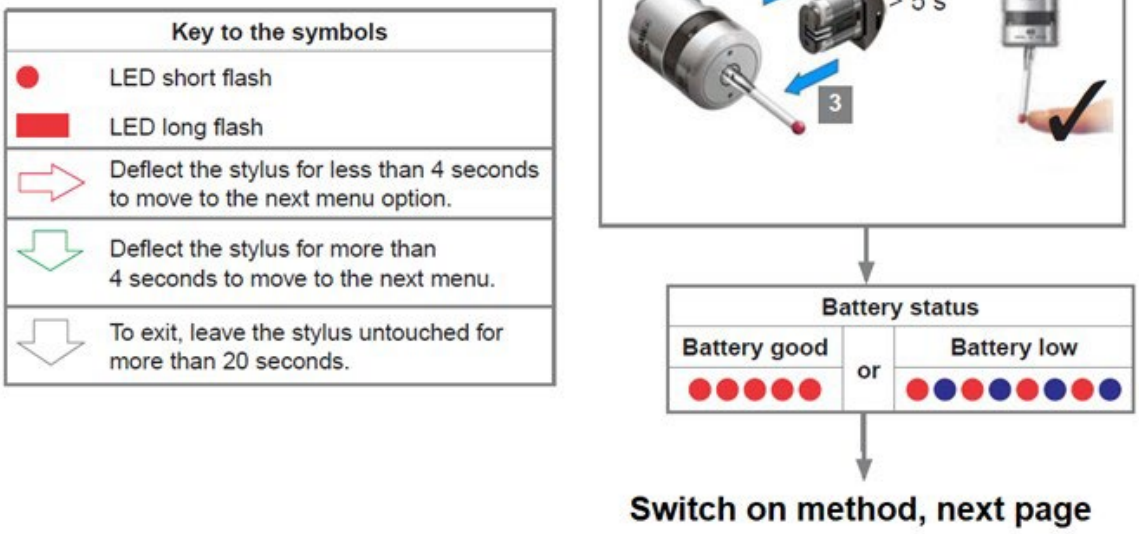
- Verify that the four adjusting screws and two locking screws are installed in the probe tool holder.
- Assemble probe on either CAT 40 Shank or Rottler Taper
- With the machine breaker that supplies power to the probe receiver turned off;
- Install batteries in the probe WITH stylus deflected.

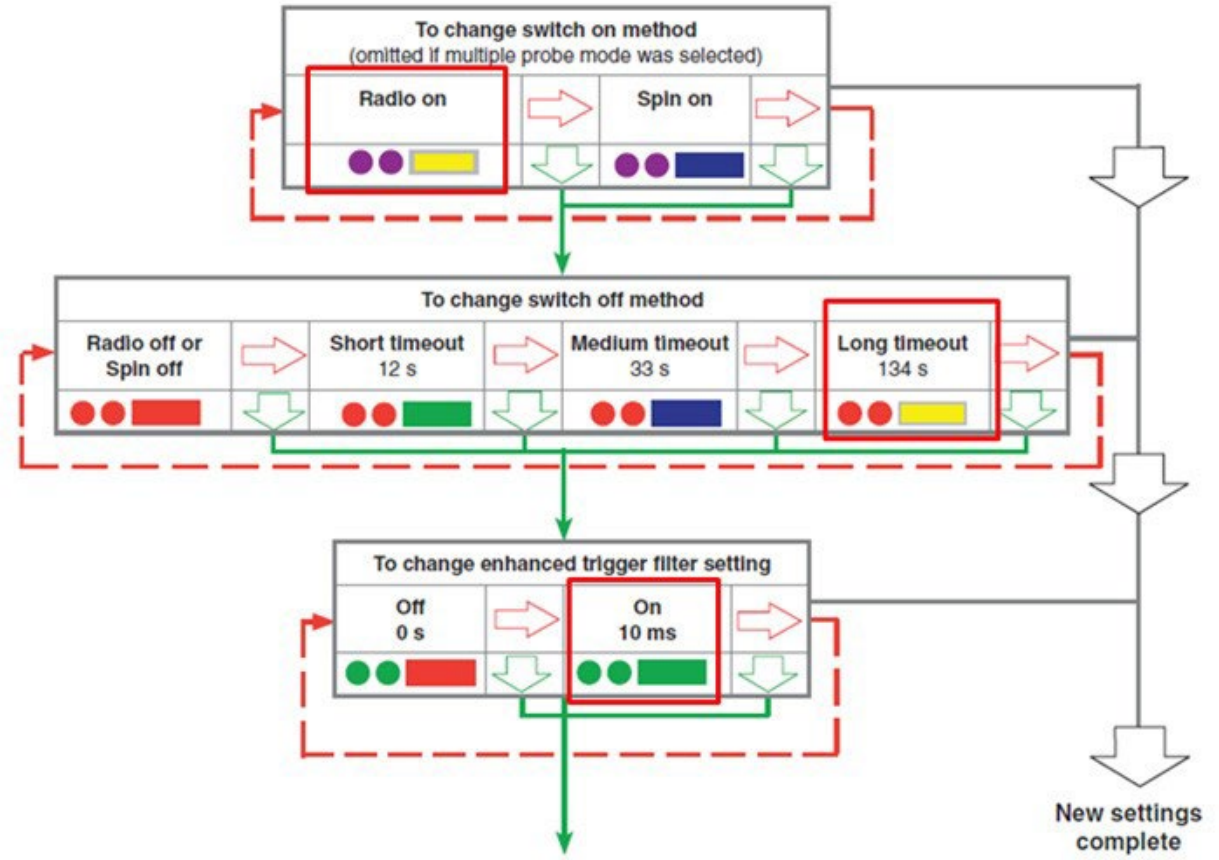
Probe LED check will run.

- Release stylus after battery check this will put you in edit mode.
- First will be Switch off method, you want this at purple, purple, yellow (Radio On). If it is not, deflect and release stylus quickly to change the mode.
- Hold the stylus deflected until the colors change to move to the next setting.
- You should be at Switch Off method; it should be red, red, yellow (134 seconds). If it is not, deflect and release stylus quickly to change the mode.
- Hold the stylus deflected until the colors change to move to the next setting.
- You should be at Enhanced trigger filter; it should be green, green, green (on). If it is not, deflect and release stylus quickly to change the mode.
- Hold the stylus deflected until the colors change again to move to the next setting.
- You should be at Acquisition mode, light blue, light blue, light blue.
- Turn on machine and quickly deflect and release the stylus. This must be done within 10 seconds of turning on the power breaker to the probe. If you are watching the RMI-Q (located ON the machine)

you will see the right light turn red, yellow, red, yellow, red, yellow is shows the partnership has been acquired.

- Go into the software and do a probe auto center and hit start probe to verify that it works correctly.

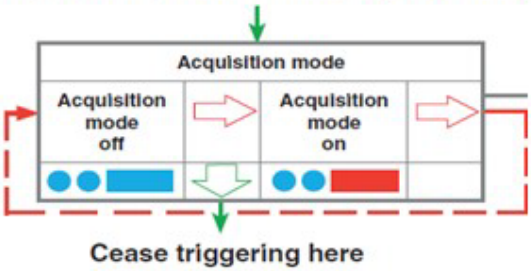




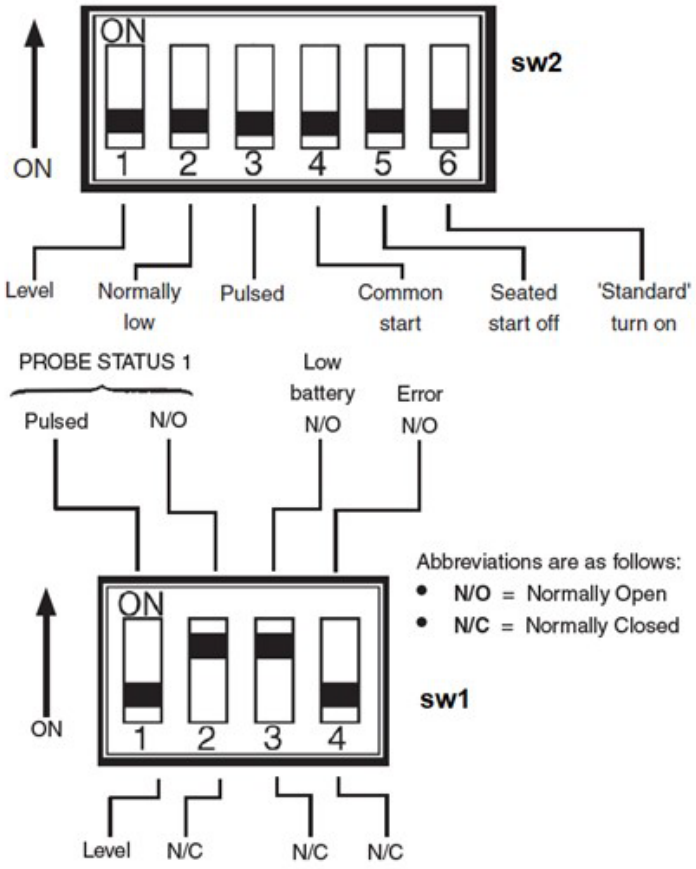
Changing the probe settings (continued)

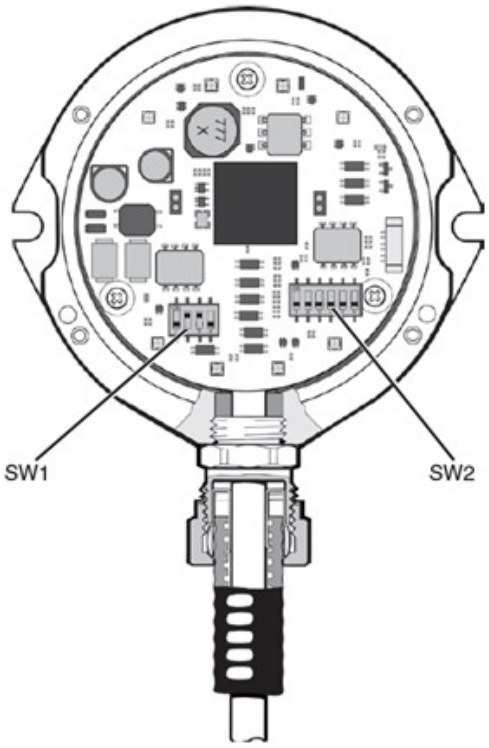
Note: After the RMI has been acquired, the RMP40 will only show Acquisition mode off.

See RMP40 - RMI partnership.



If the Probe does not turn off after 137 seconds you will need to make sure that the RMI-Q switches are shown in the following positions:





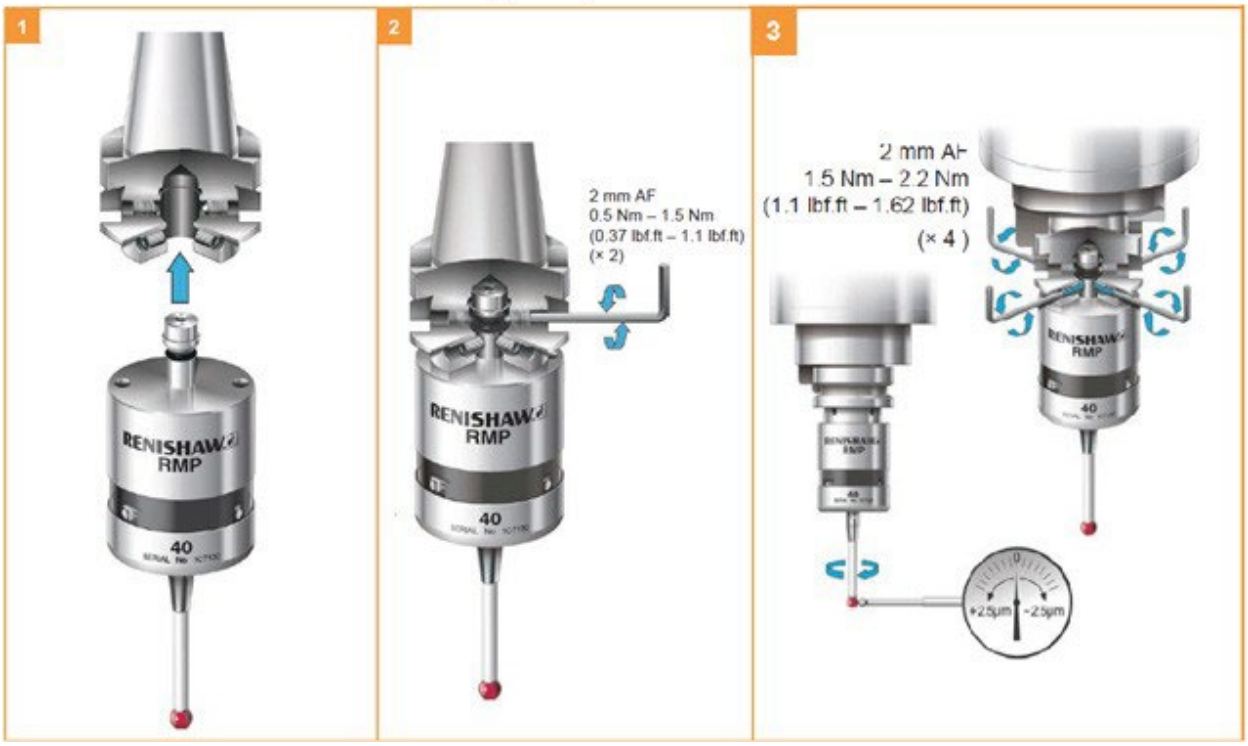
During normal use, the difference between the touch position and the reported position does not change, but it is important that the probe is calibrated in the following circumstances:

- when a probe system is to be used for the first time;
- when a new stylus is fitted to the probe;
- when it is suspected that the stylus has become distorted or that the probe has crashed;
- at regular intervals to compensate for mechanical changes of your machine tool;
- if repeatability of relocation of the probe shank is poor. In this case, the probe may need to be recalibrated each time it is selected.

It is good practice to set the tip of the stylus on center, because this reduces the effect of any variation in spindle and tool orientation. A small amount of run-out is acceptable, and can be compensated for as part of the normal calibration process.

- calibrating either in a bored hole of know size, a ring gauge, or on a datum sphere.

Mounting the probe on a shank



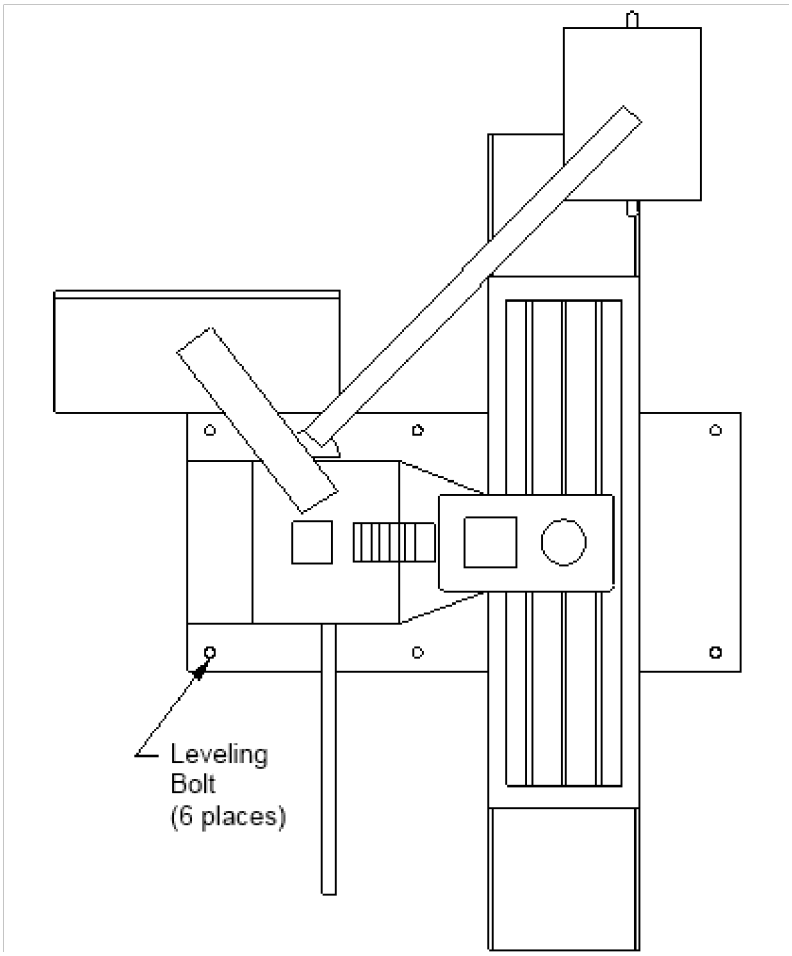
- Dial the probe stylus into center using a .0001” indicator to within .0005” the tighter tolerance you hold the more accurate the machine will be. You must use an indicator that takes very little pressure to get a reading. Excessive pressure on the stylus will deflect the probe and you will not be able to dial it in correctly.
- Go to the Main/Block Model screen and select the Table of Tools. You may only have a Default Tool #0 listed.
- Press Add Tool. This will bring up a dialog box. Change the name from default tool to probe style that you are installing i.e. 50mm stylus, 100mm stylus. Set the diameter to .2360” this is default probe tip on a 50mm,100mm, and 17.5mm.
- Install a block, or parallels onto the machine and secure it solidly to the machine table.
- Place the Ring Gauge onto the top of the block, use Probe Auto Center to find center zero your X and Y axis here. Make sure you use a ring gauge or a hole of a known diameter. This will set the correct probe timing.
- Adjust the probed diameter by going to the IO under Setup Electronics and changing the Probe MS. You will need to increase or decrease the MS of the probe to achieve correct Probe Diameter.
- Repeat until the correct diameter is displayed.
- Probe Auto Center the ring gauge, without moving X or Y, remove the probe up in Z and Install the cutter head. Put a magnet base with the Last Word indicator on the cutter head and sweep the cylinder/ring gauge.
- The variation in X and Y Should be less than .0005.
- If not add compensation to ProbeOffSet under > Setup Eletronics-Addins-ProbeSetup

Leveling and Alignment:

The following is a description of how to properly level and align the F69A machine. These procedures should be followed in the order they written to obtain correct machine level and alignment.

Leveling the Machine:
After uncrating the F69A 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.



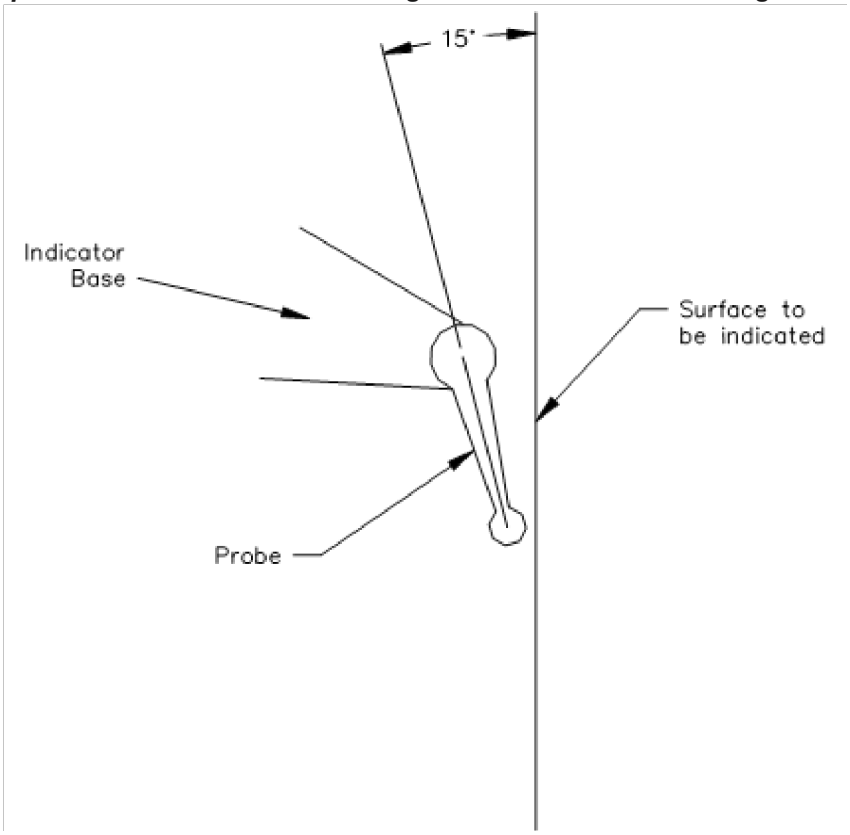
Using the four (4) corner leveling bolt to start with, bring the machine up to level in both directions (front to back and left to right) within .0005” per foot.

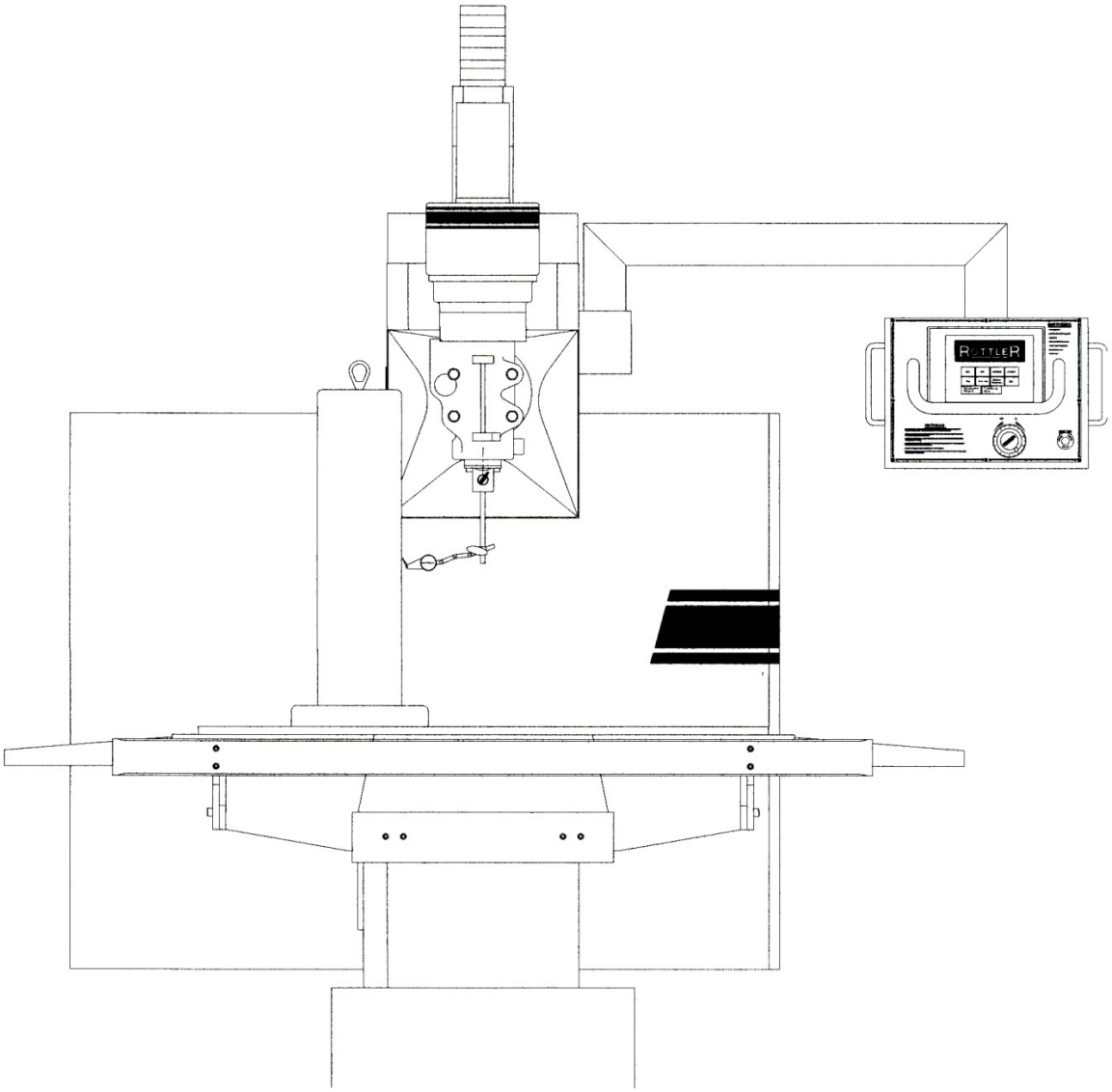
After you have leveled the bed using the four corner bolts, move to the middle leveling bolts. Bring these bolts down until they have approximately the same amount of pressure on them as them as the four corner bolts. Be careful not to throw the level of the machine off while doing this.

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.

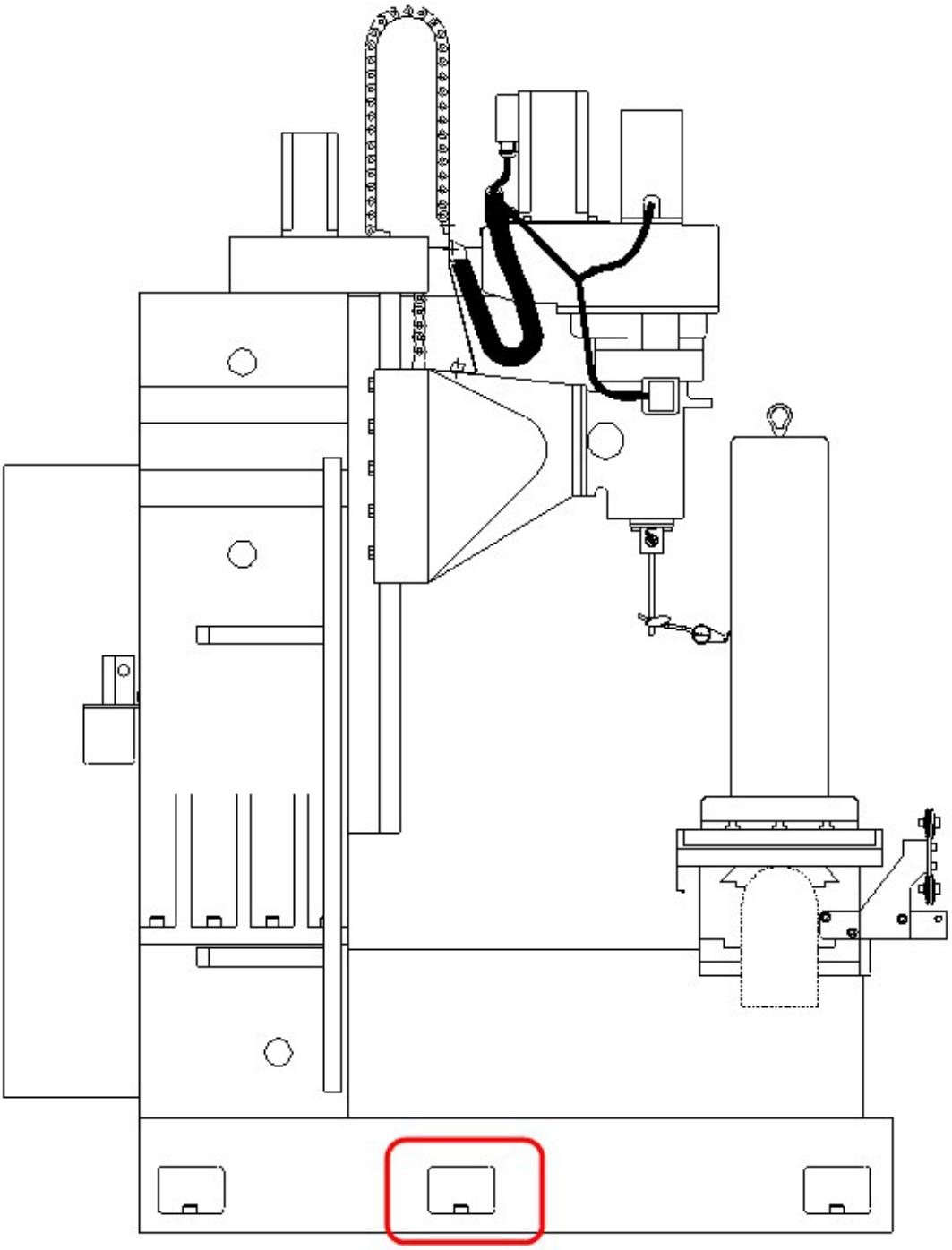
Note: The position (angle) of the probe to the surface you are indicating is critical. Using an incorrect angle on the probe will result in inaccurate readings from the surface being indicated. The angle of the probe should be at about 15 degrees from the surface being indicated.





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”.

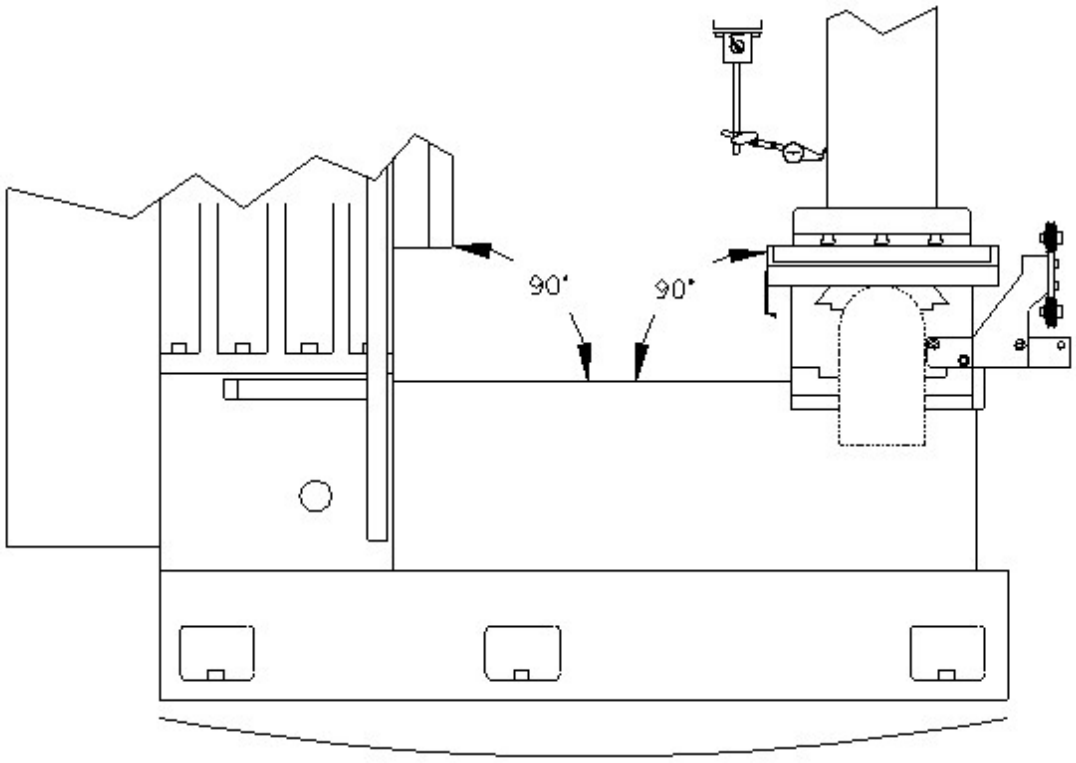


If the Vertical perpendicularity is not within tolerance the Middle Leveling Bolts may need to be adjusted.

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.

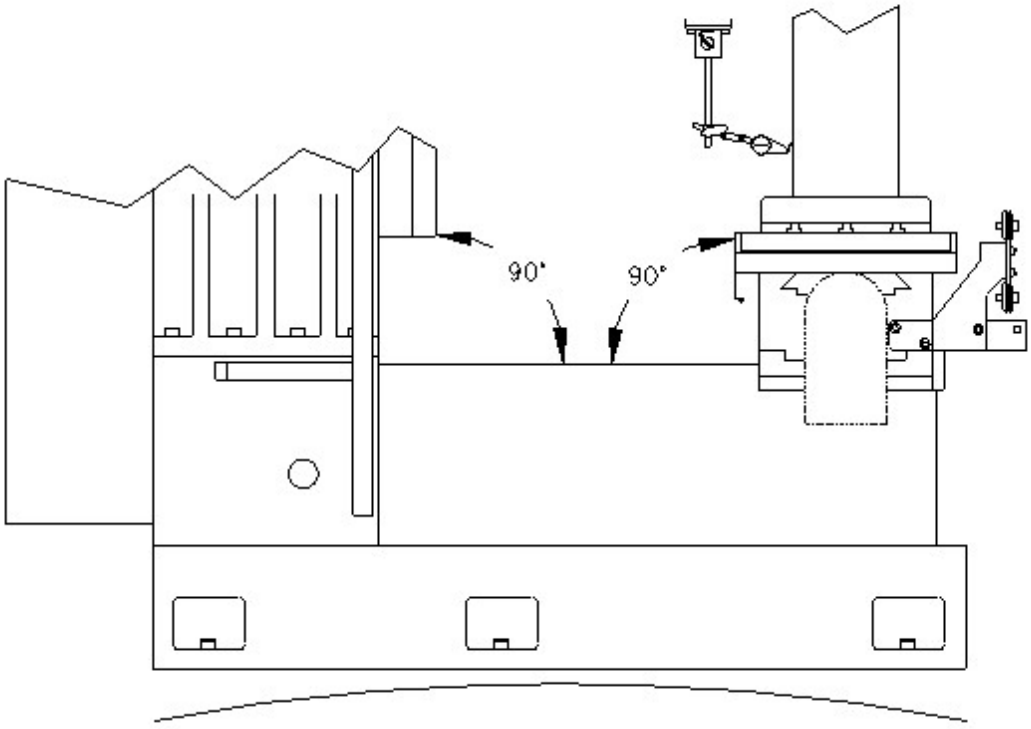
Example 1: Zero the indicator on the top of the cylinder. When traveling to the bottom of the cylinder, if the reading decreases past -.001” to something such as -.002”, then the middle leveling bolts have too little pressure on them and it is bowing the casting slightly in the middle as shown below.



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.

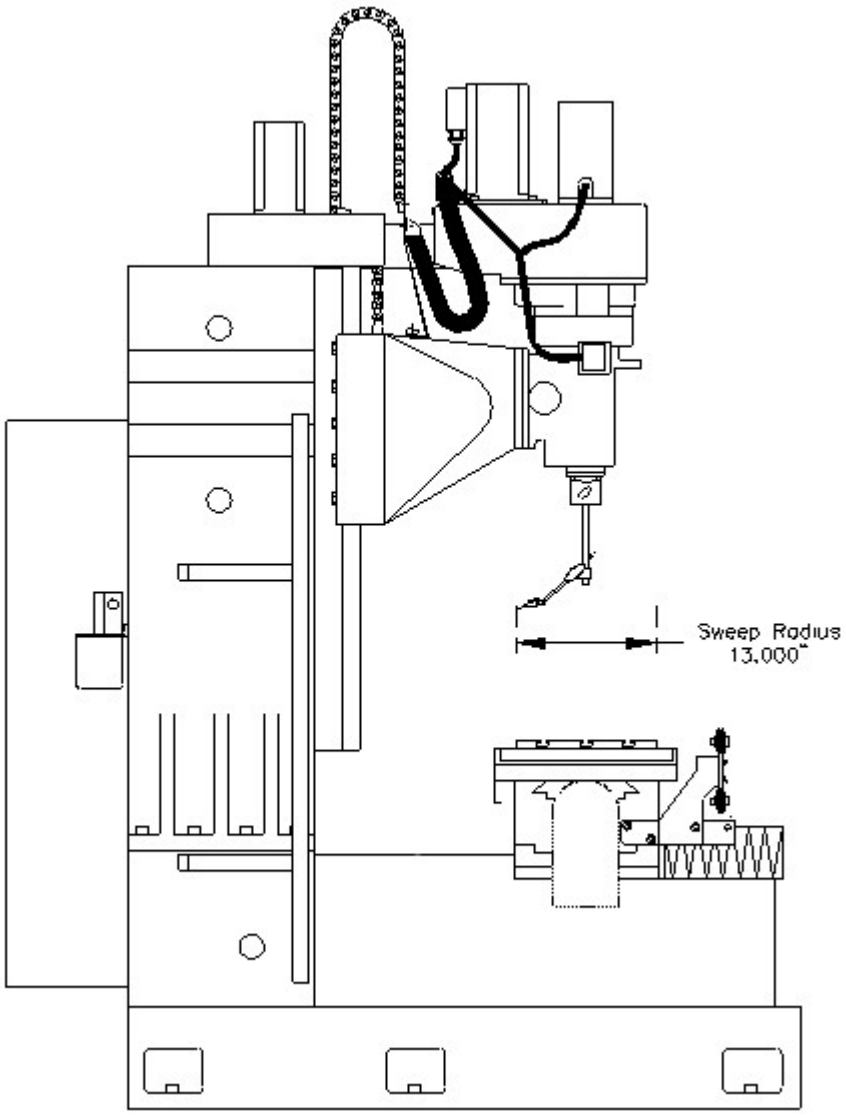
To correct the deviance slowly remove pressure from the middle bolts equally. Be sure to watch the level of the machine to be sure not to throw it off. After relieving pressure from the middle bolts you can apply slightly more pressure to the front corner bolts to bring the deviance within .001”.

Sweeping the Spindle

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

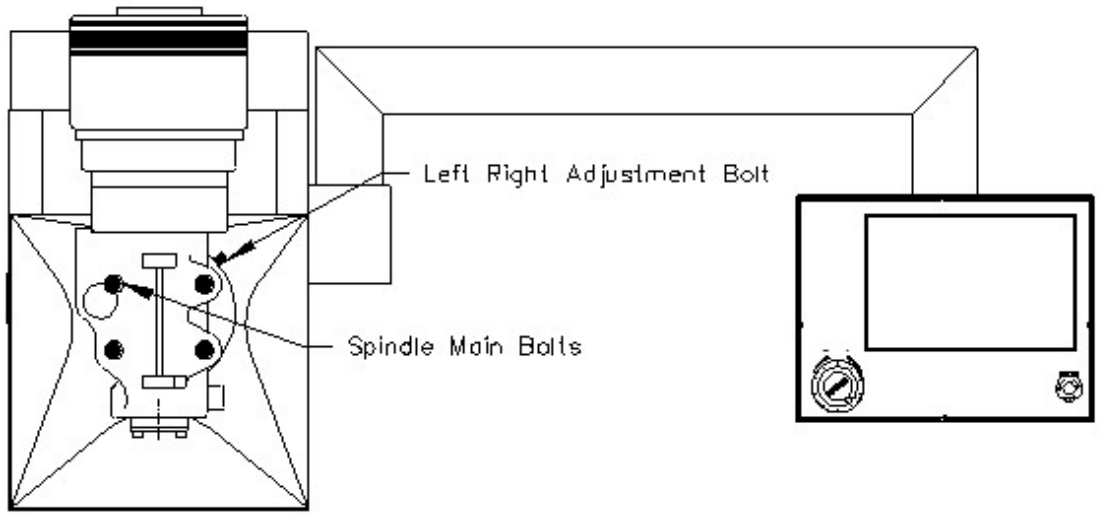
Attach a magnetic base indicator to the bottom of the spindle. Make sure that the magnetic base is attached in such a way that the spindle is able to be rotated 360 degrees without interference.

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



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.



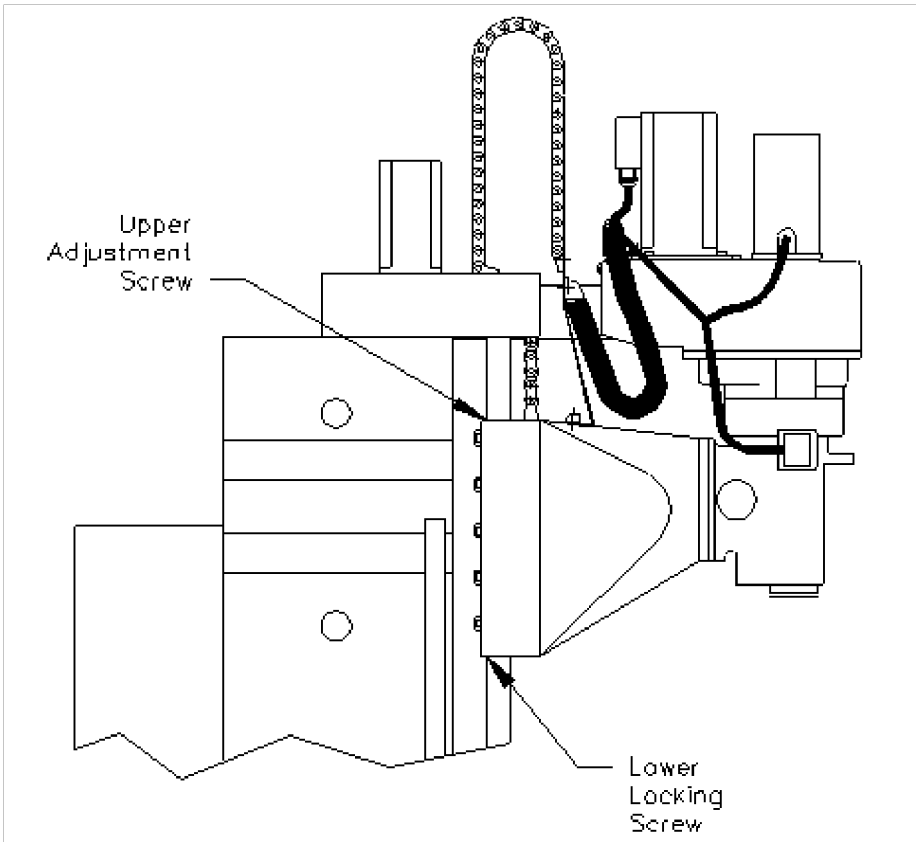
Check the Front to Back sweep it should be within .0005. If it is not, the Vertical gibs may need adjustment.

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.

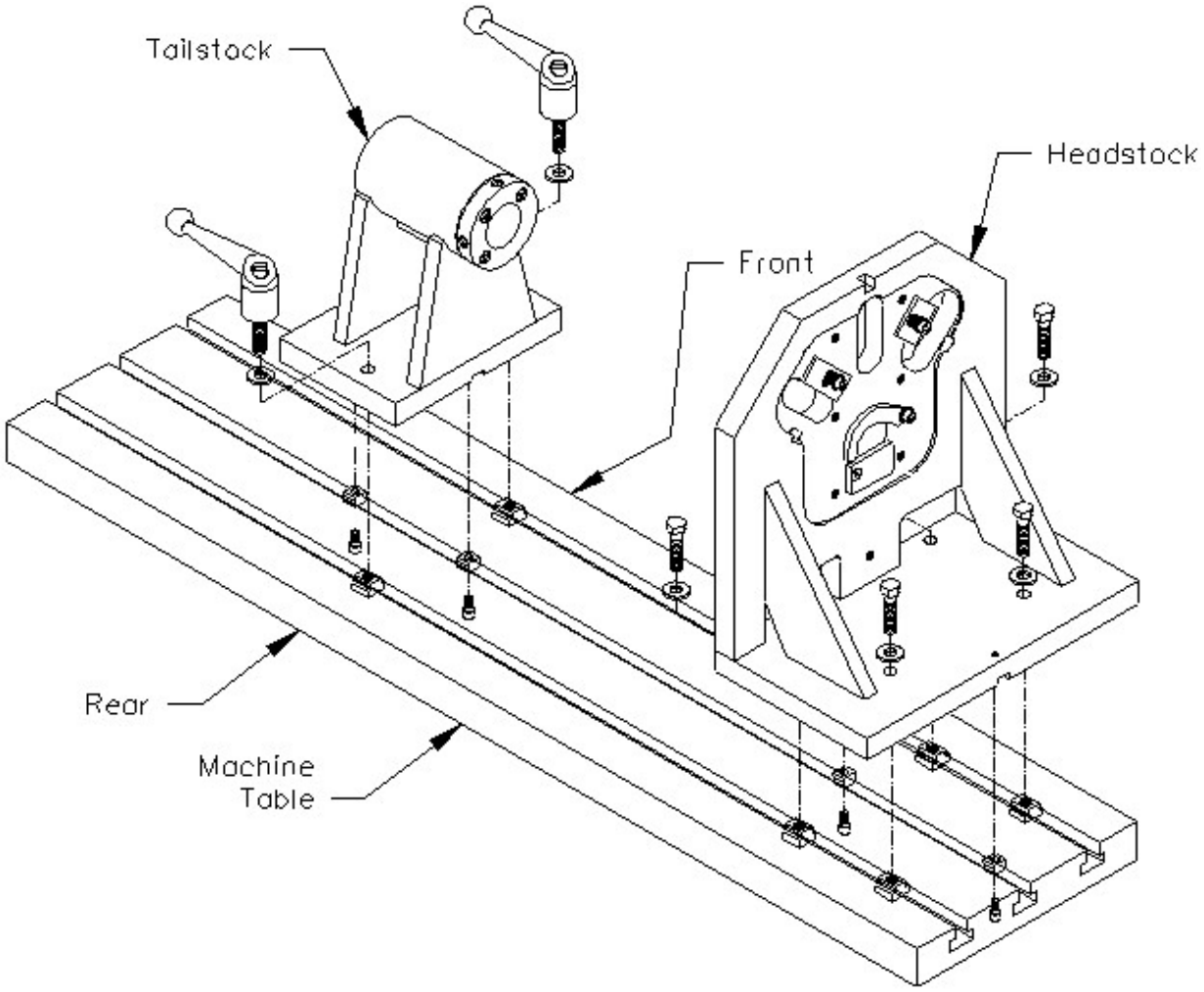
Loosening Gibs
To loosen the gibs, loosen the top screw. Start tightening the lower screw until the correct alignment is achieved. When the correct alignment is achieved, tighten the upper screw to lock adjustment in place.

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)

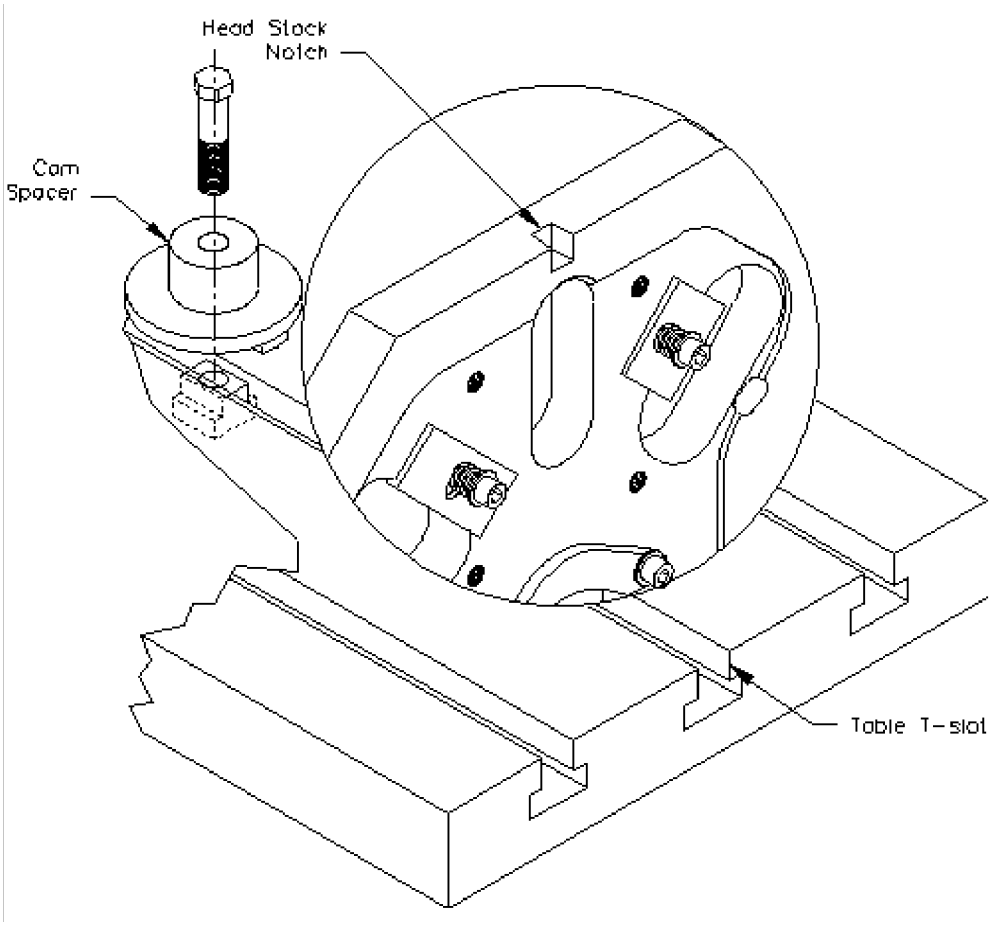
Install the keys for the Head and Tail Stock into the machine bed as shown on previous page. Place the Head and Tail Stock onto the machine table. Install the hold down bolts but do not tighten them down.

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.



To Copy Block Info From Your Machine

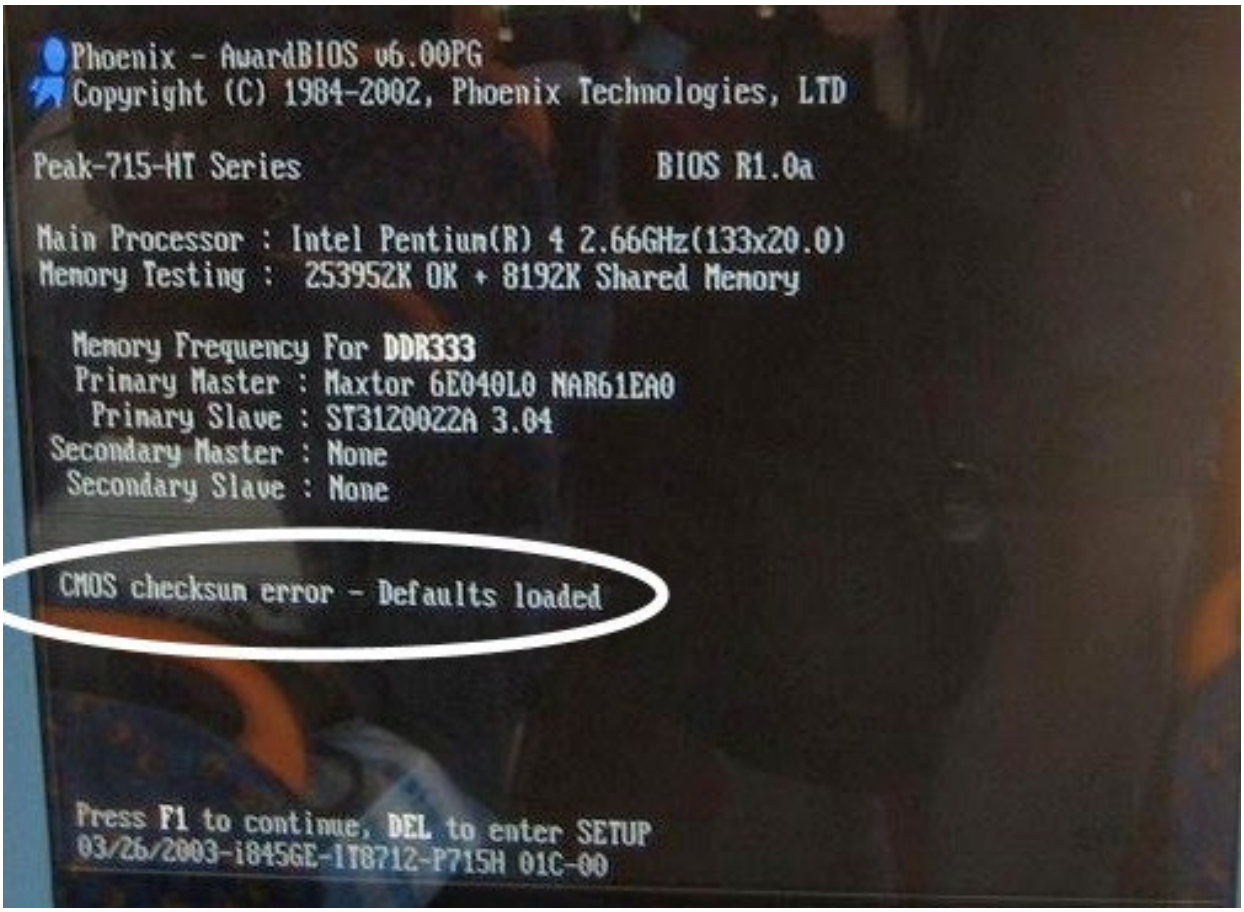
On the machine that has the info to be copied from, with the Rottler program up, go to file, click open, with the new window open scroll to local disk C:, open rottler, open backup 3 axis (if you have an F90 or a F60 with only 3 axis software) or backup 4 axis (if it is newer F60 software or has 4thaxis), open 2008 (or the latest year), open 08 (or the latest month), then pick a date in the following list that comes up (these are constantly added to, they are current dates: 2008 = year, 08 = month), copy it to thumb drive.

To Install Block Info Onto Your Machine

On the machine to copy this to, with the Rottler program up, go to file, click
open, when the new window opens up scroll to USB memory stick and find the copied file, and then open. You will need to select a block and mode, re-input the spindle speed, choose a different mode, so it will ask you if you want to save changes, that is the key.

Replacing the Motherboard Battery

If computer fails to boot up and you get a CMOS error message on the screen, then the battery on the computer motherboard has failed and needs to be replaced.



The following is the procedure for replacing the motherboard battery.

Turn off the power on the electrical enclosure and remove the enclosure cover.

Locate the computer and check to see that the power light is not on. If it is on turn off the power switch.
Note: On some machines it may be necessary to unbolt the computer from the enclosure in order to gain access to the cover screws.

Remove the 6 screws indicated by the arrows from the cover.

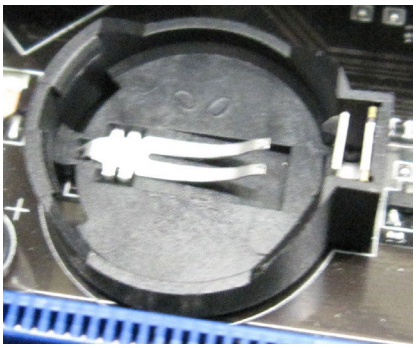
Remove the cover.


650-7-1
RM650
KEYBOARD/MOUSE
ROTTLER
PRINTER
COM 1
ATC
PUMP
DANGER

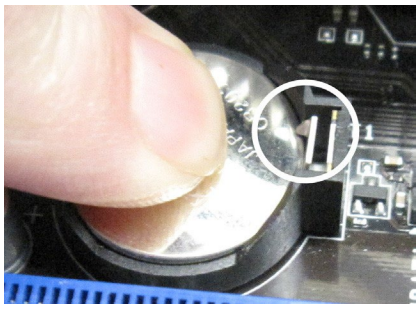
Locate the battery on the motherboard. will pop up.

Push the battery retention clip away from the battery. When the clip is released the battery

Remove the battery and place new battery in the battery holder.



Using your finger tip push down on the battery until the retention clip is in its lock position.



Replace computer cover and make sure that power switch on the computer is on.

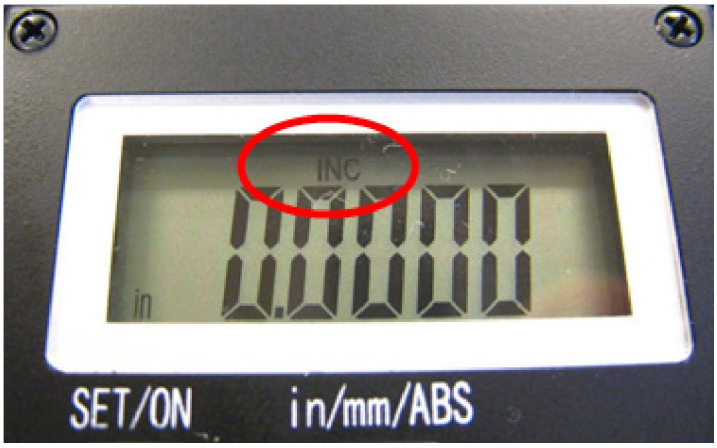
Replace the enclosure cover and switch power back on.

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.

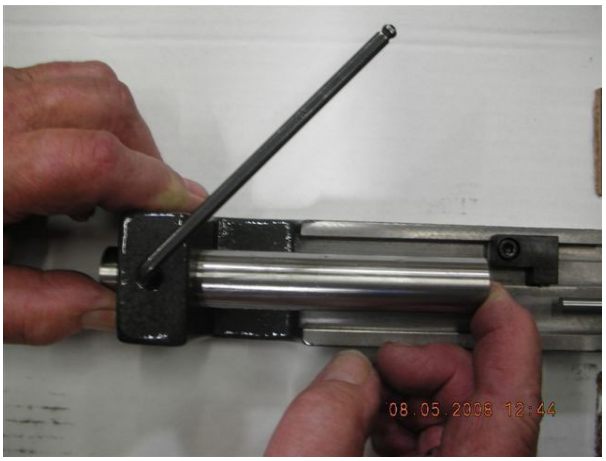
CAUTION: AFTER MICROMETER SET-UP IS COMPLETE, DO NOT PUSH SET/ON BUTTON AGAIN. PUSHING THE SET/ON BUTTON DURING USE WILL RETURN THE DISPLAY TO THE ORIGINAL MINIMUM BORE DIAMETER. THE ONLY TIME YOU SHOULD USE THE SET/ON BUTTON AGAIN IS TO- A. To shut micrometer off at which time you push and hold the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

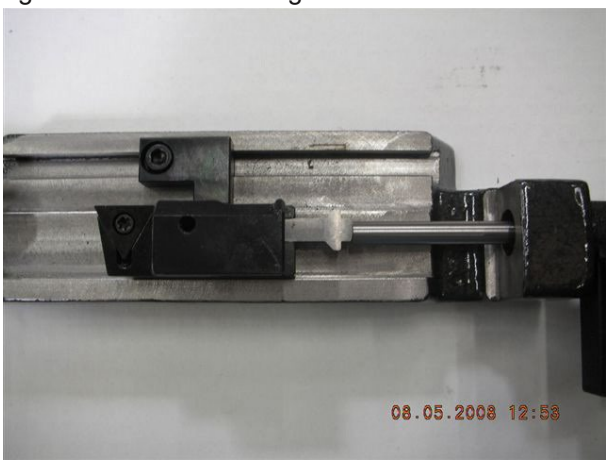
Micrometer is calibrated in inch mode. If metric is desired, press and hold in/mm/ABS button until mode changes to metric (approximately 3-4 seconds). A quick press of the in/mm/ABS button will put micrometer in ABS mode: 0.000, with another quick press returning it to initial setting.

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 -

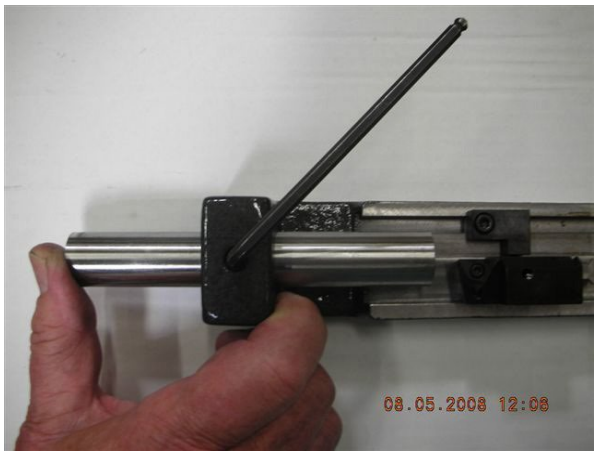
Loosen the set screw holding the large diameter anvil. Slide the anvil back out of the way.

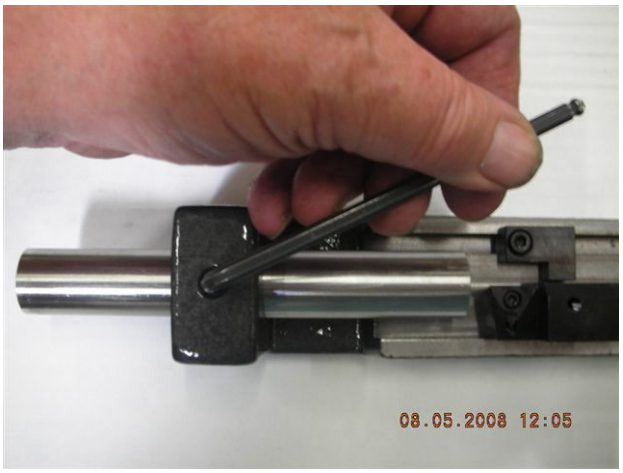


Place the tool holder used to bore the hole into the micrometer frame. Slide the location nub on the back of the tool holder gently up against the end of the digital micrometer shaft.

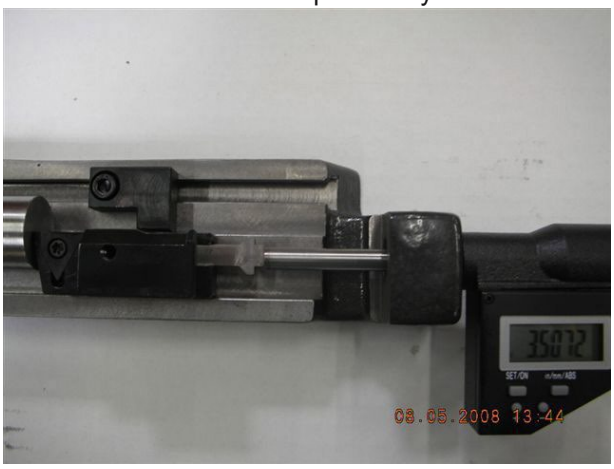


Slide the large diameter anvil up until it touches the end of the cutting tip of the tool holder. Tighten the set screw.





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.

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Section 7 Troubleshooting I

TROUBLESHOOTING

Problem:

Icon on screen does not move to area touched.

Solution:

Follow the procedure below to recalibrate the touchscreen.

1. Get to the Alignment screen.
    1. If an Elo icon is available in the tool tray at the lower right side of the desktop, click it, then click Align.
    2. Otherwise, go to the Windows Control Panel, double-click Elo Touchscreen and click the Align button on the General tab.
        1. If Windows XP and no Elo icon, click the “Switch to Classic View” button on the left
        2. If Windows 7 and no Elo icon, look for “View by: Category” text toward the upper right; click it and select “Small icons”
2. Touch and release the upper left target; the target should jump to the lower right.
3. Touch and release the lower right target; the target should jump to the upper right.
4. Touch and release the upper right target; a check screen should appear.
5. Touch and release the green check mark; the check screen should disappear.
6. The cursor should now jump to the point of touch.
7. If the Elo Control Panel is open, close it and the Windows Control Panel.

For further assistance in 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

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MACHINE PARTS

Contents

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.

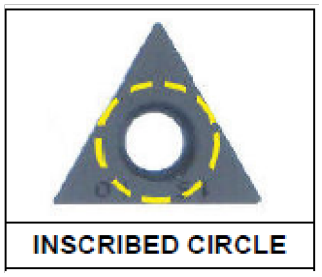
Below are general guidelines. When using these inserts it is best to refer to the operator manual of the particular machine you are using. Rottler Manufacturings latest operator manuals have more detailed information on feeds and speeds for the particular machine and cutterhead that you are using.

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.


INSCRIBED CIRCLE

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

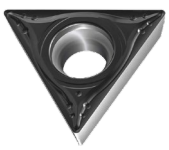
CYLINDER BORING INSERTS

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.

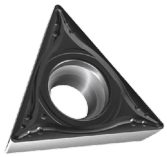
RT321 (General purpose and sleeving)



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.

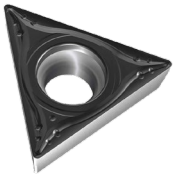
Note: When using this insert it is required to use a “0” degree rake cartridge.

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)



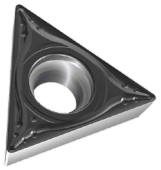
A 1/4” (6.35 mm) IC triangular insert with a black ceramic coating and 1/64” (.4 mm) cutting radius. The 1/64” (.4 mm) radius should be used when machining to a step where the mating part requires a smaller radius to eliminate an interference problem. If you are machining a long bore where the spindle 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)

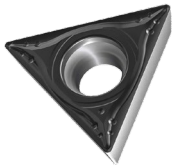
This is the same insert as RT212, except it has a 1/32” (.8 mm) radius. This larger radius insert will give a smoother finish when sleeve cutting to allow easier sleeve fitting and closer metal to metal contact for heat transfer. The 1/32” (.8 mm) radius is stronger than the 1/64 (.4 mm) radius of the 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” (.4 mm) cutting radius. Gives the best finish results when machining precision counter bores often machined in diesel engine blocks. 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.

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.

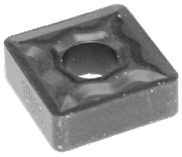
RT211F (Precision Counterboring and Finishing)

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)



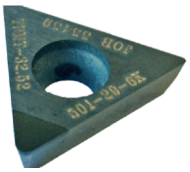
A 3/8” (9.52 mm) IC, square insert with a black ceramic coating. It is used on Rottler boring machines for through boring when removing .010” - .060” (.25 mm - 1.5 mm) on the diameter. A very economical insert as it has 8 cutting edges. On a 4” (100mm) bore use 1000 - 1200 RPM and a feed rate of .008” - .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 breakup 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.

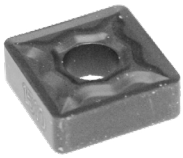
6303U

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.

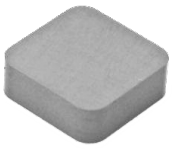
6303U

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

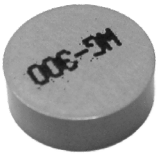
A round 3/8” (9.52 mm) IC, single sided, CBN Insert. For use on cast iron heads with steel pre-combustion chambers. RPM speed with a 14” (355.6 mm) cutter range from 600-700 RPM and with an 18” (457 mm) cutter range from 500-600 RPM.

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.

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.

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 precombustion 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

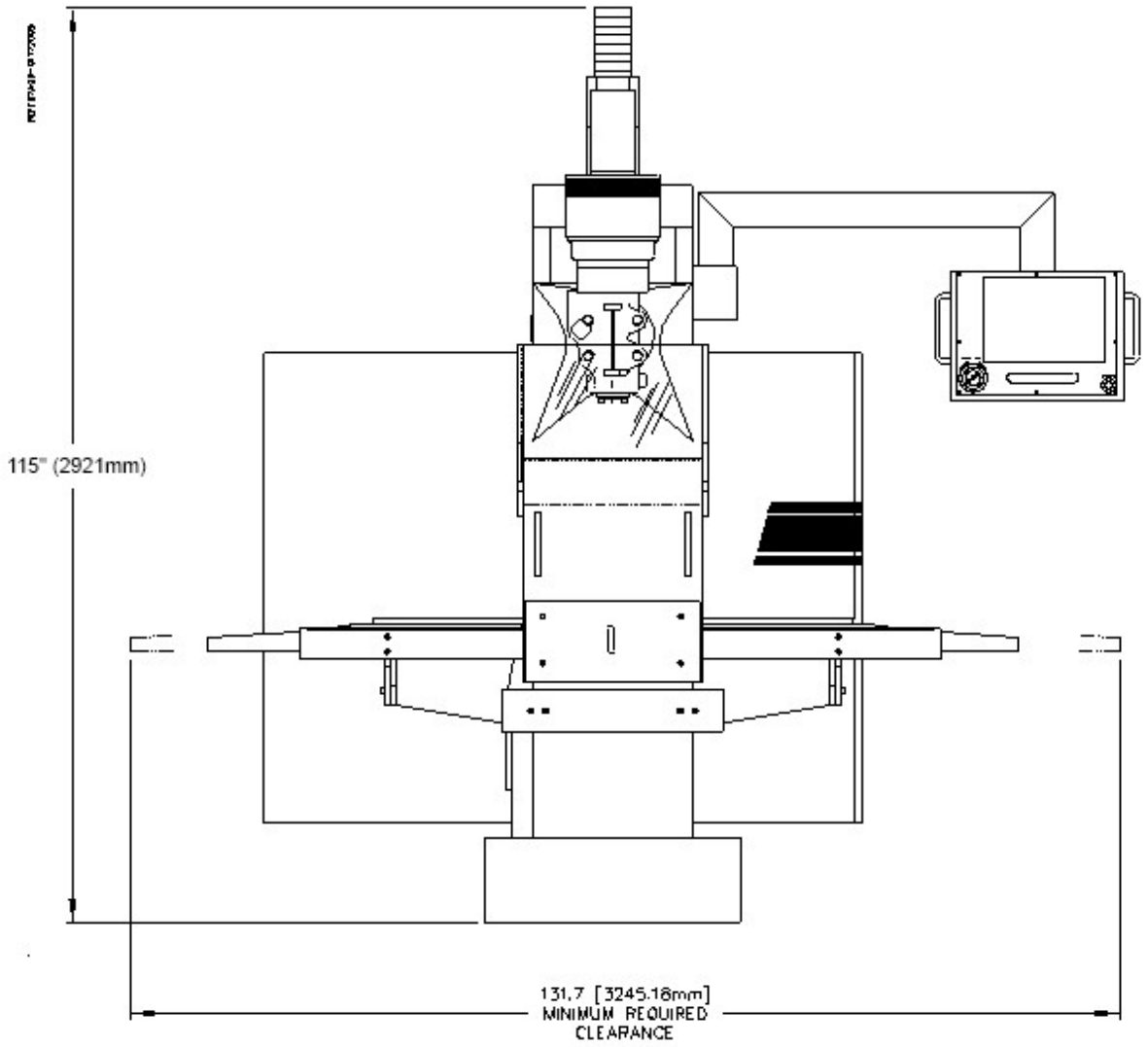
Use the same RT series inserts as defined under cylinder boring. Depending on type of toolholder, either 1/4” (6.35 mm) IC or 3/8” (9.52 mm) IC inserts will be required. Commonly 1/64” (.8 mm) radius inserts are used for rough or heavy cutting, and 1/32” (.4 mm) radius inserts are used for finish boring 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

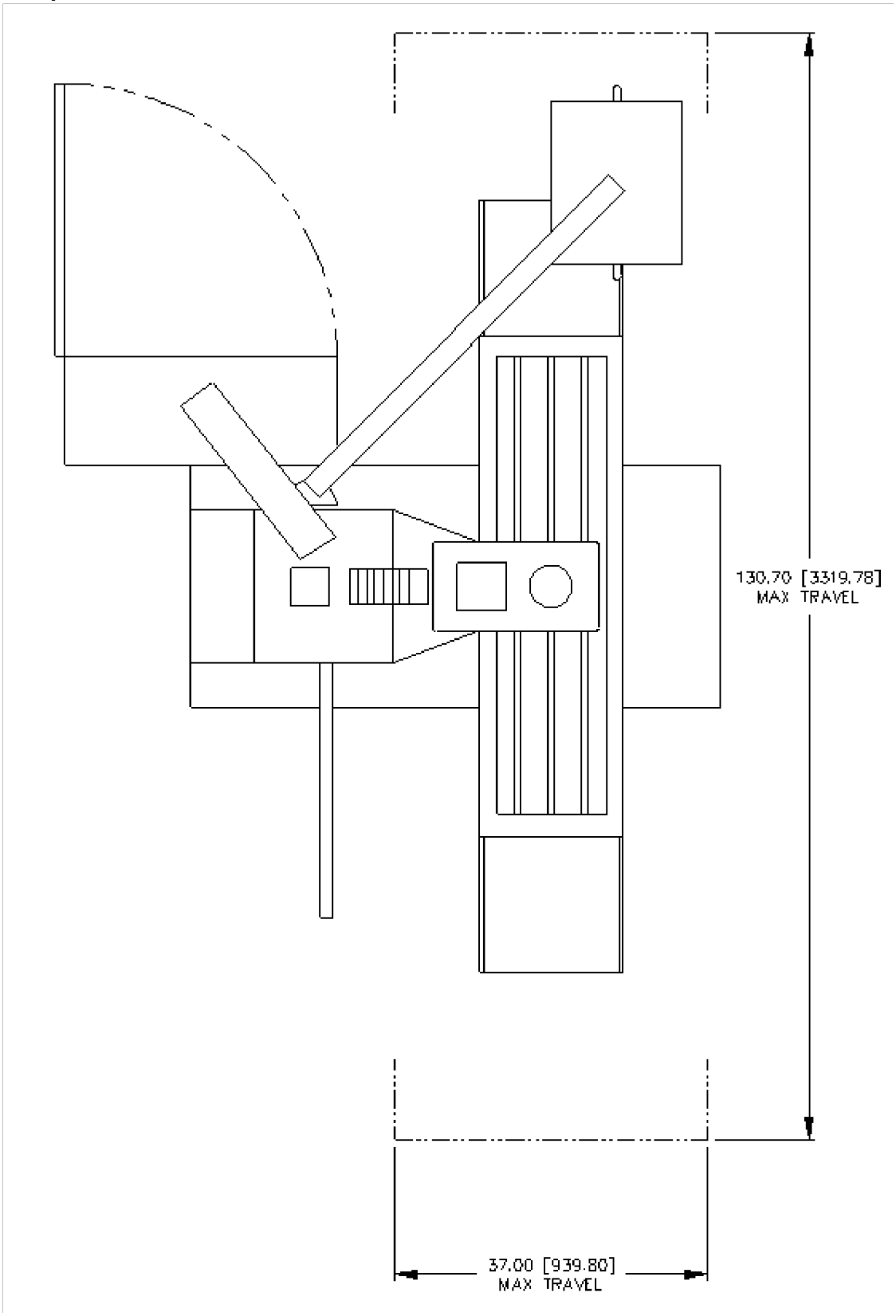
F69A Front View



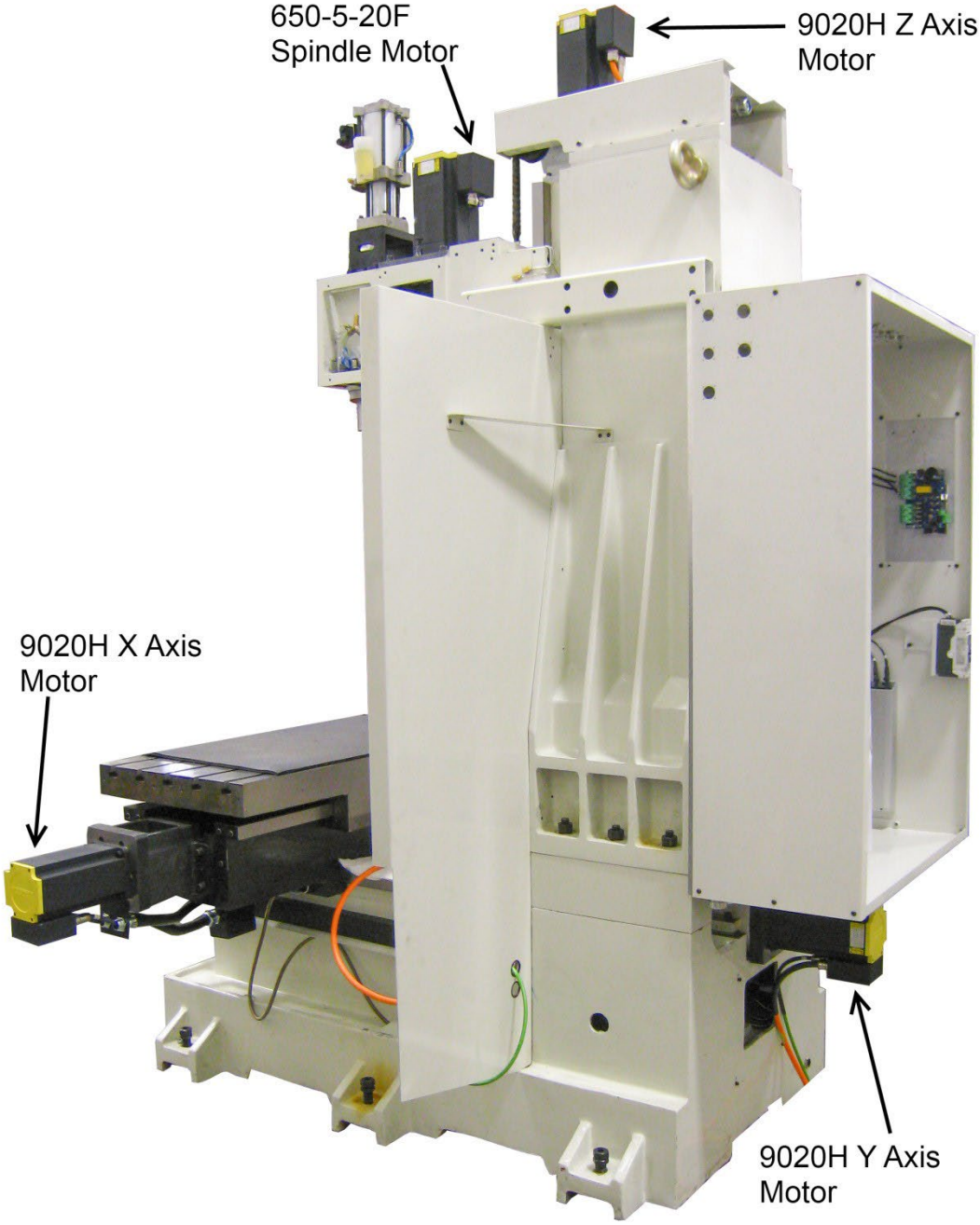
F69A left Side View

F69A Right Side View

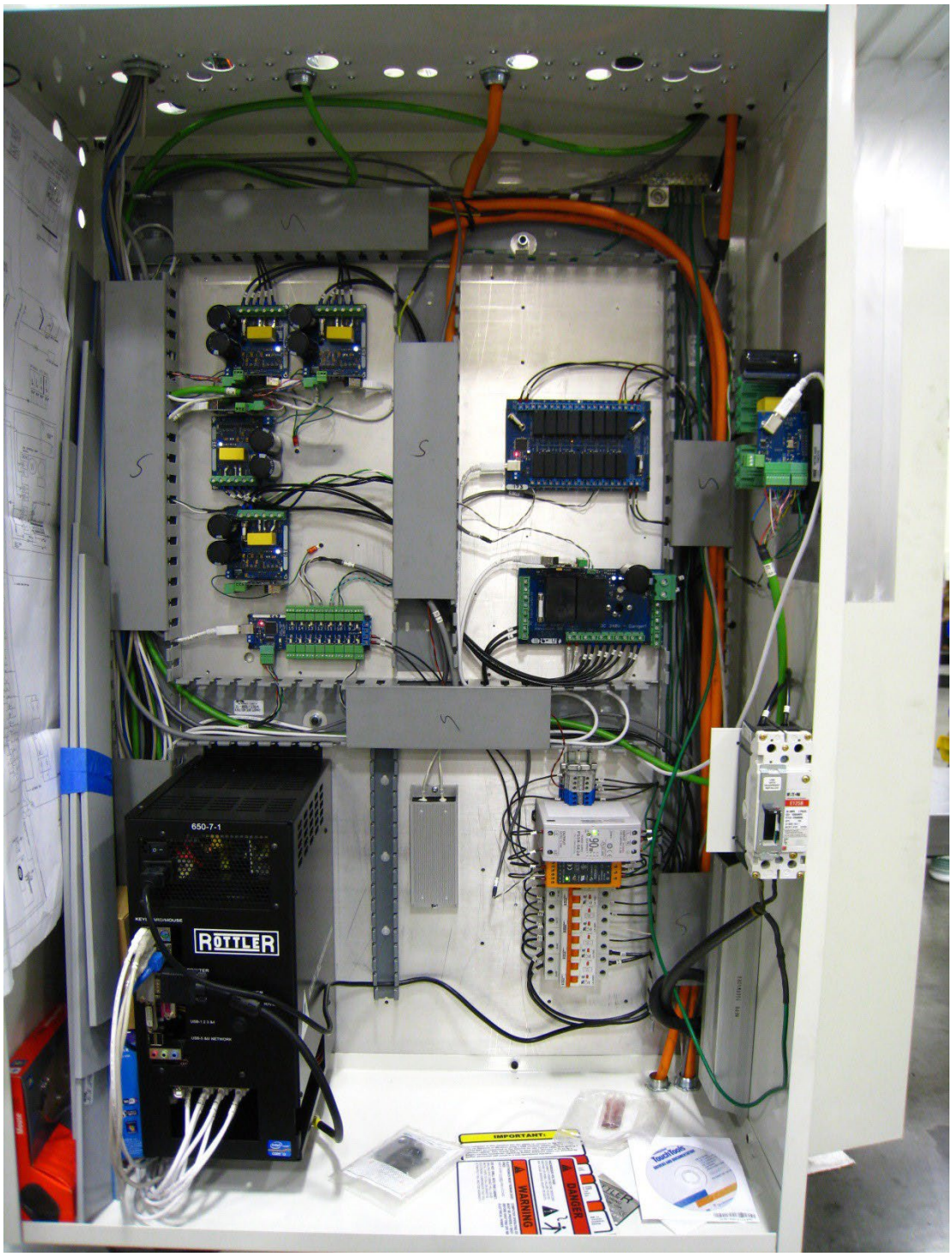
F69A Top View



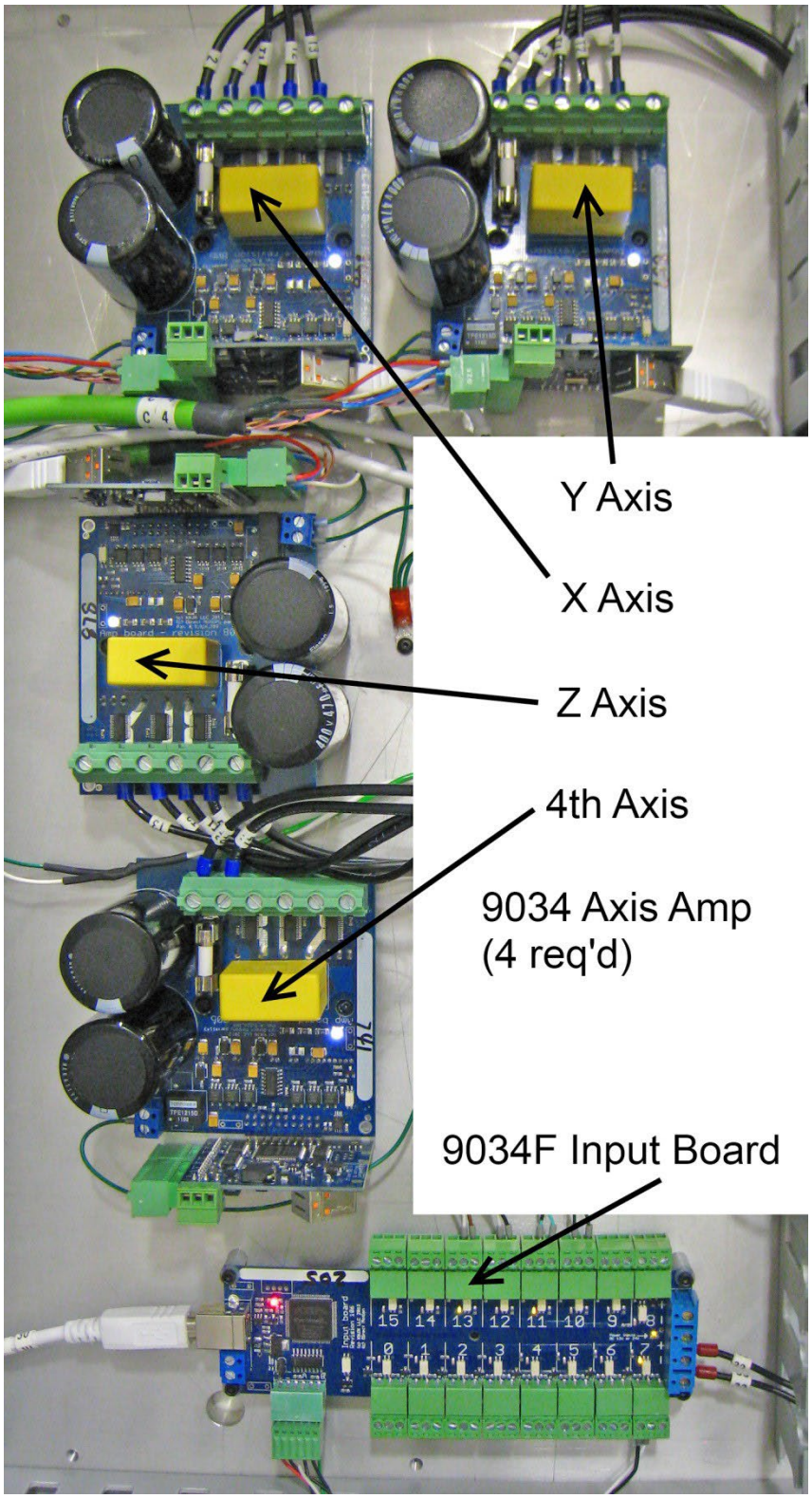
Motor Locations



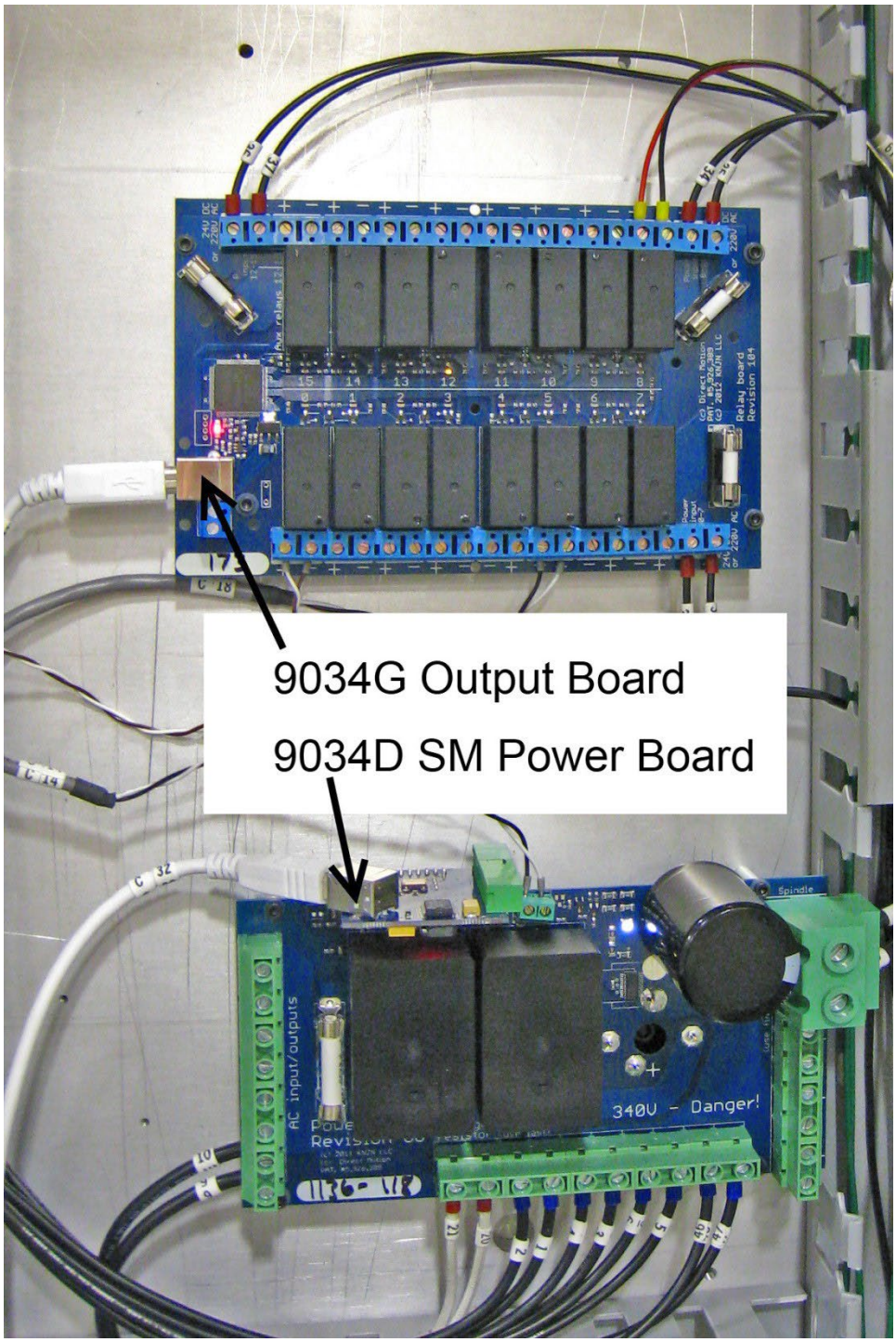
Electrical Panel



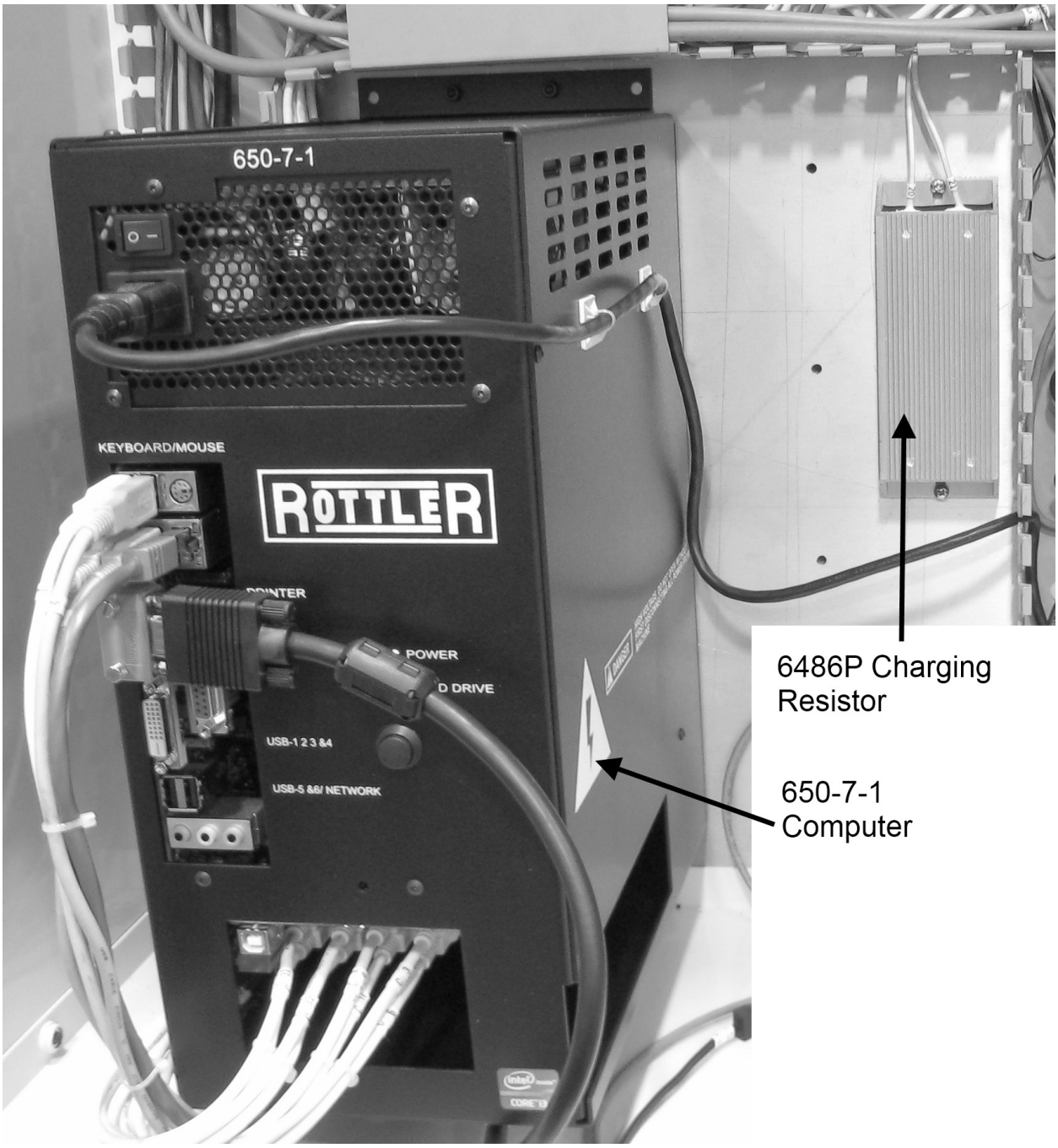
Axis Amps & Input Board



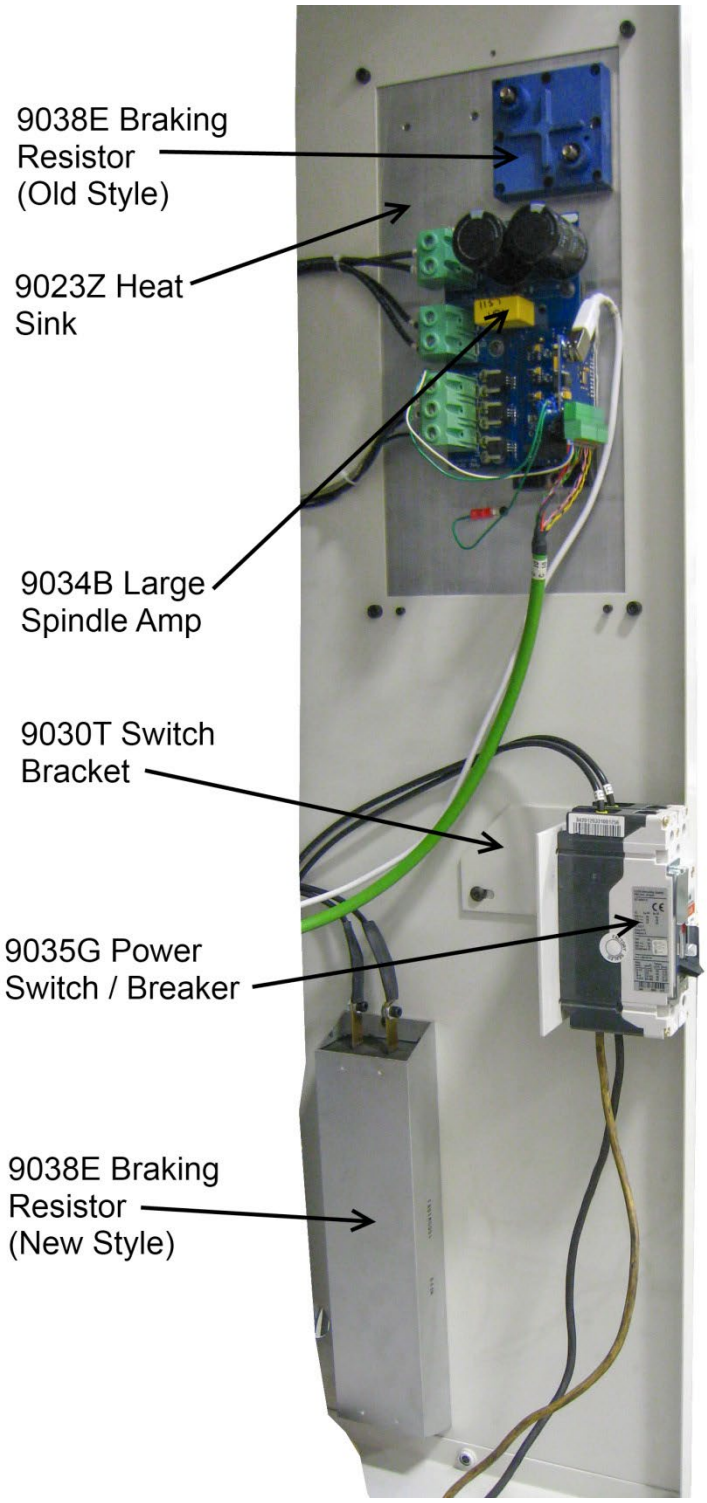
Output & SM Power Boards



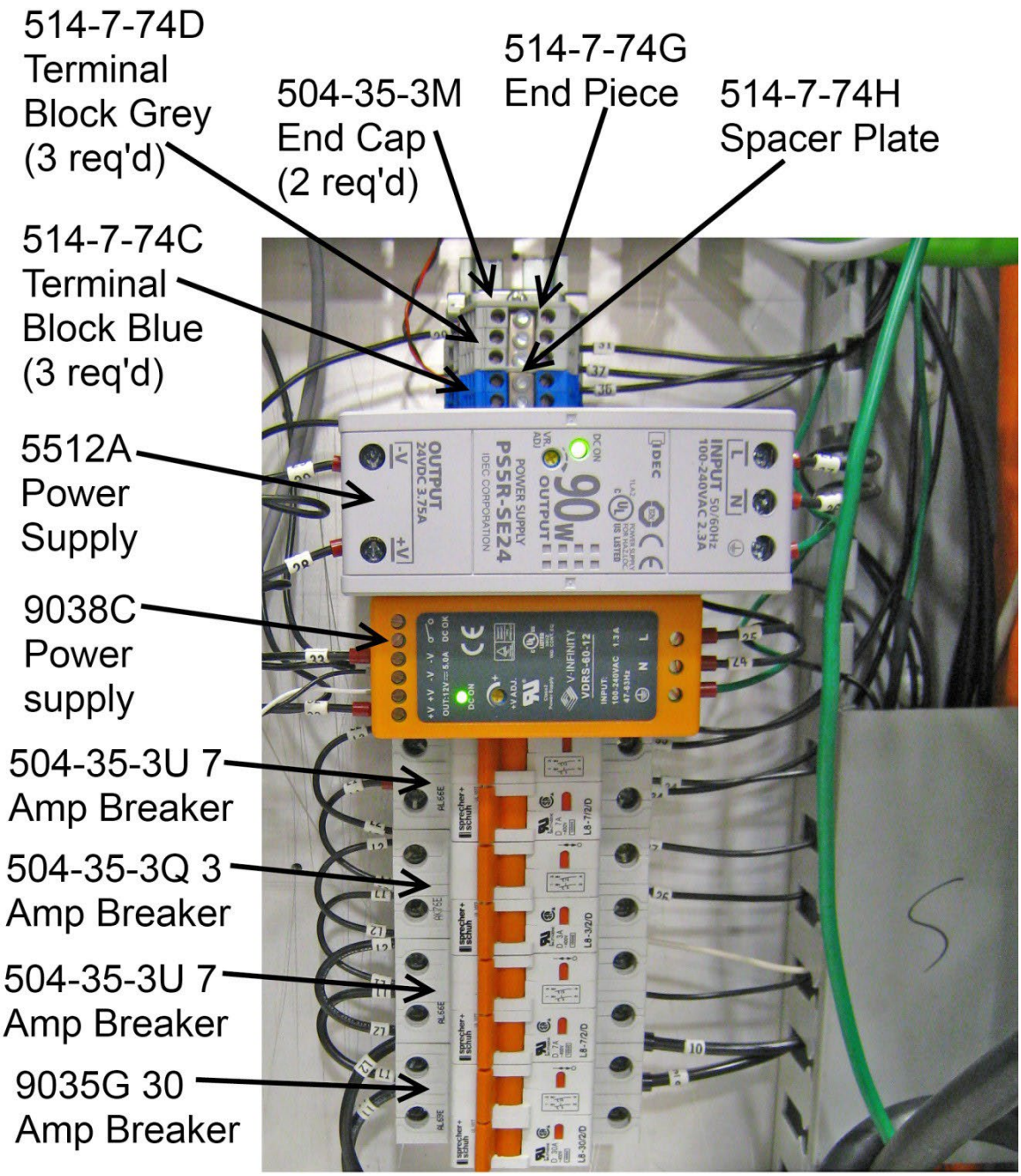
Computer Assembly



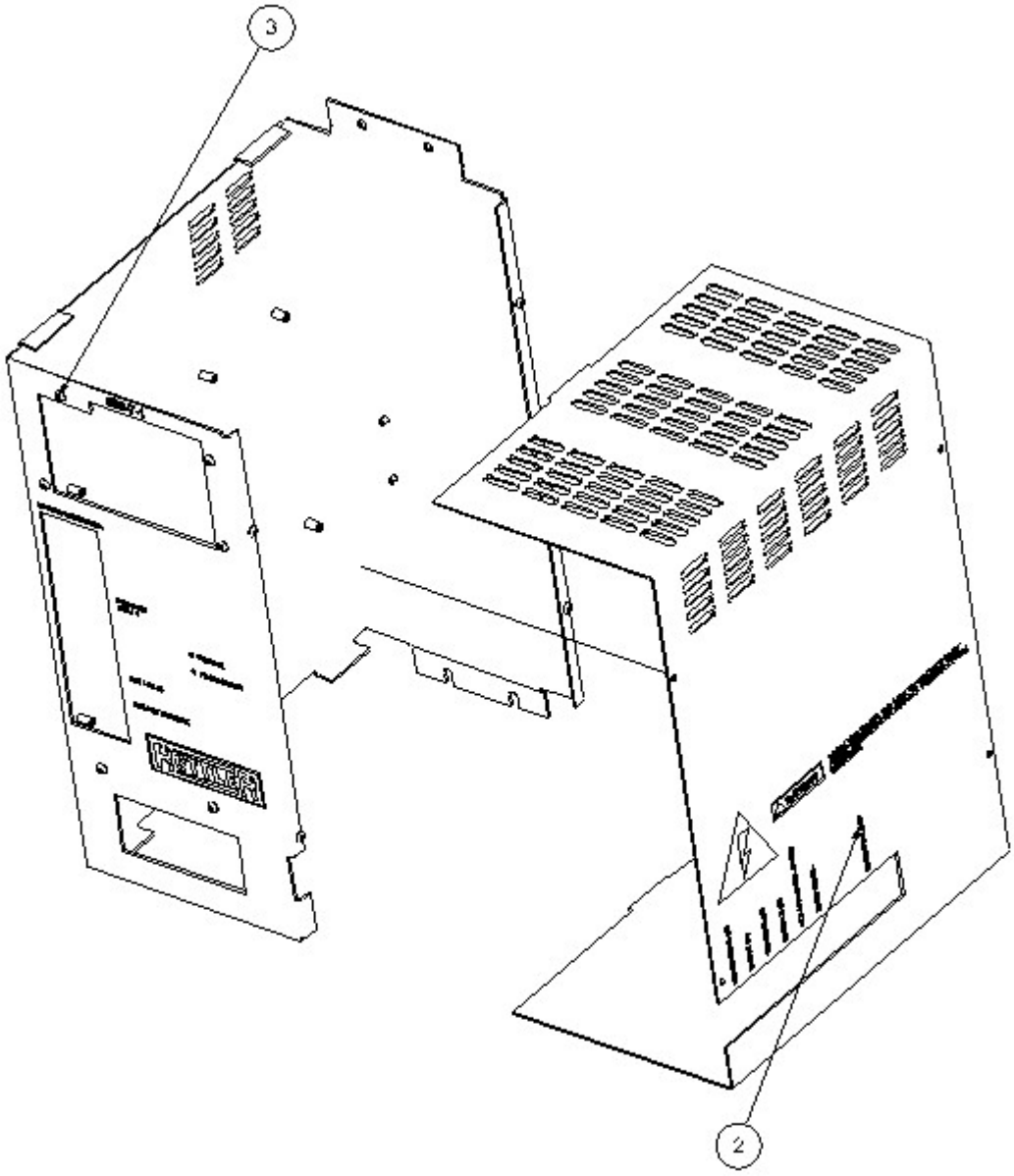
Enclosure Side Components



DIN Rail Components

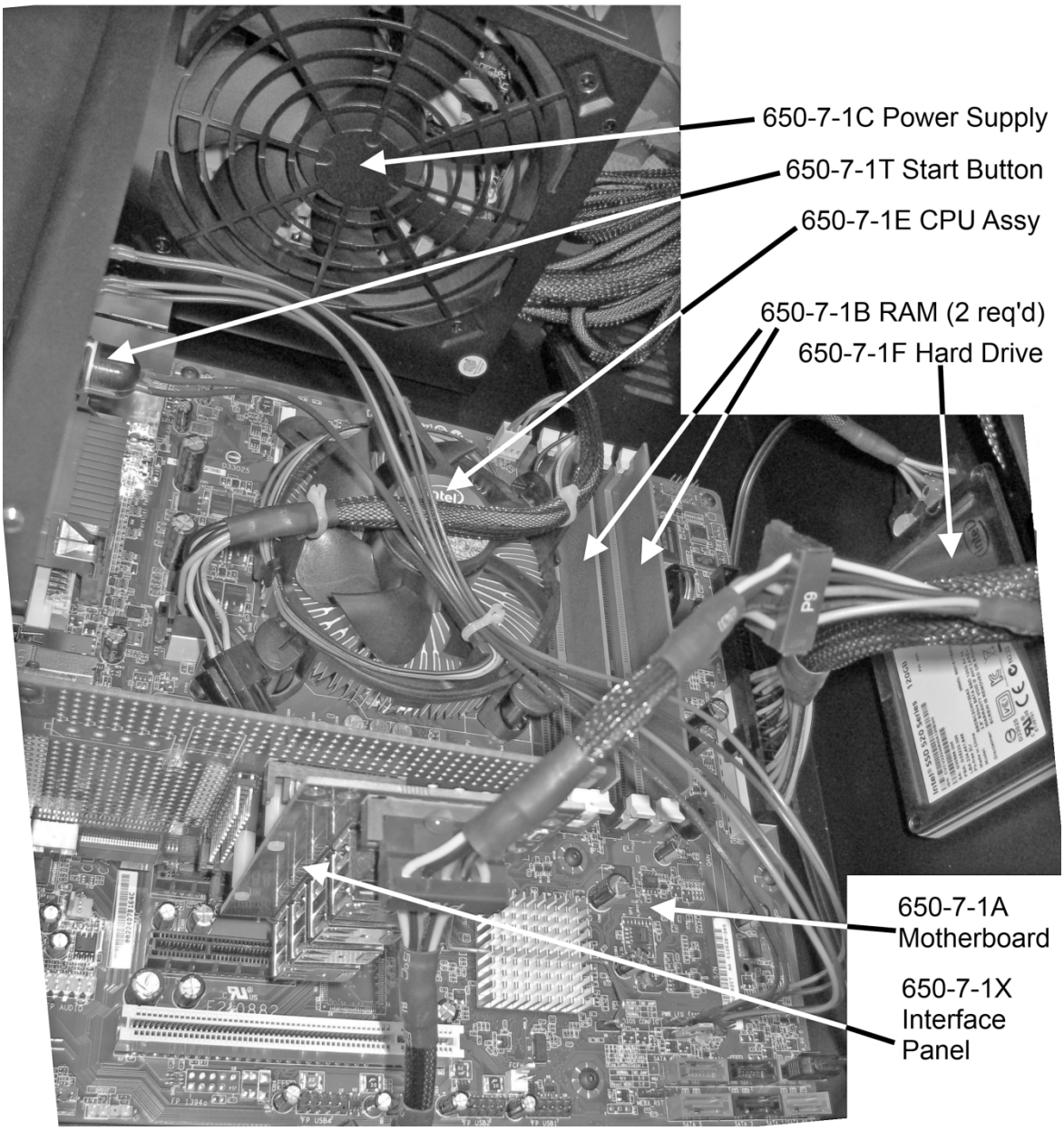


Computer Enclosure 650-1-27X

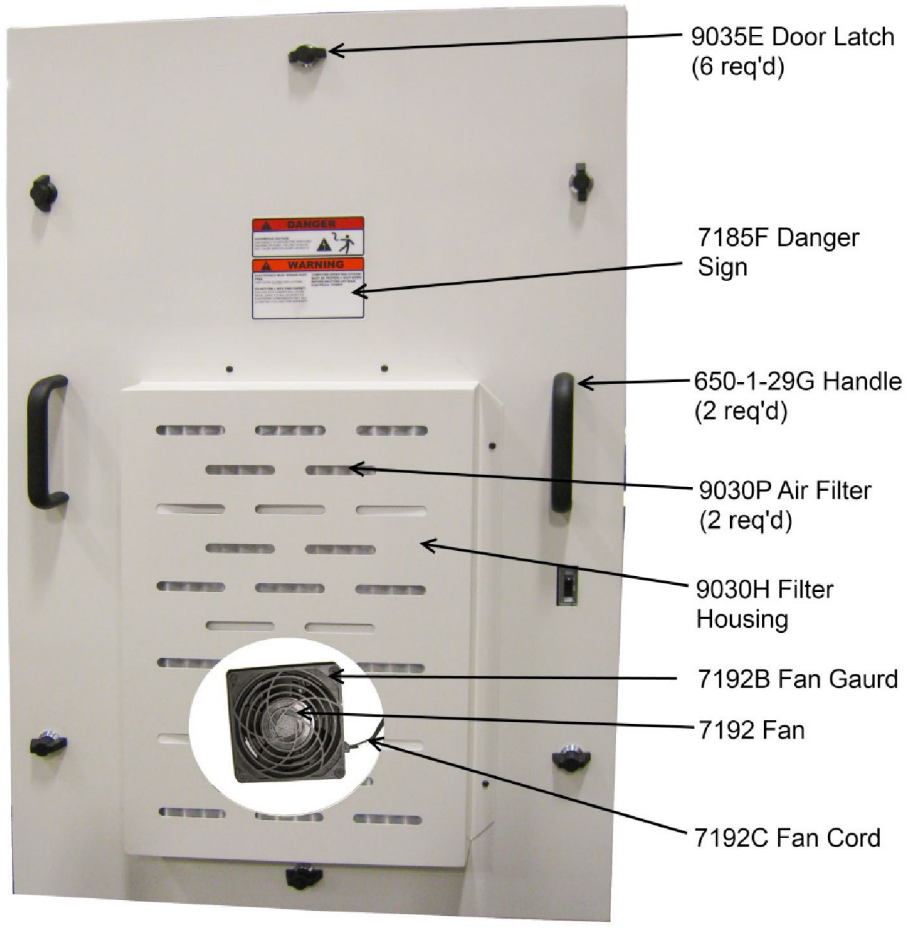


Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	650-1-27Y	Computer Case, Front
2	1	650-1-27Z	Case, Computer, Side

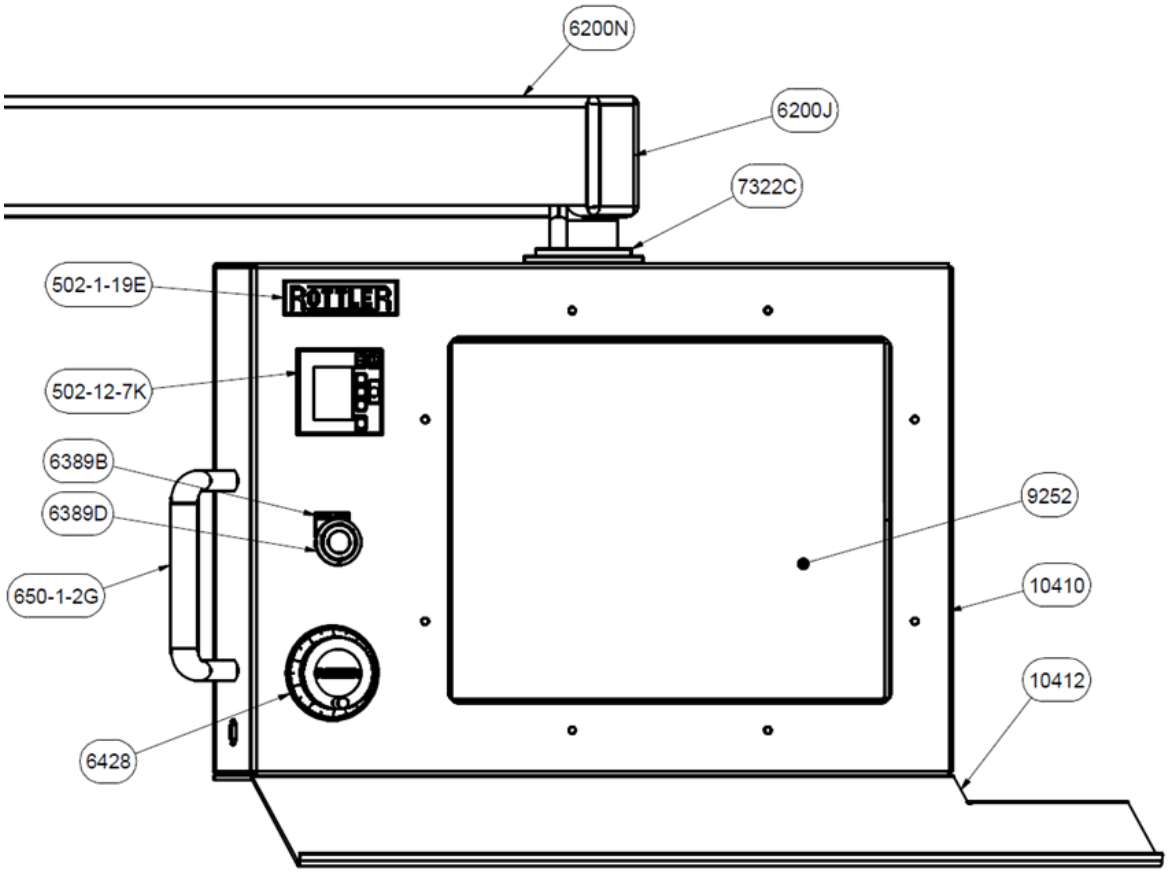
Computer Parts



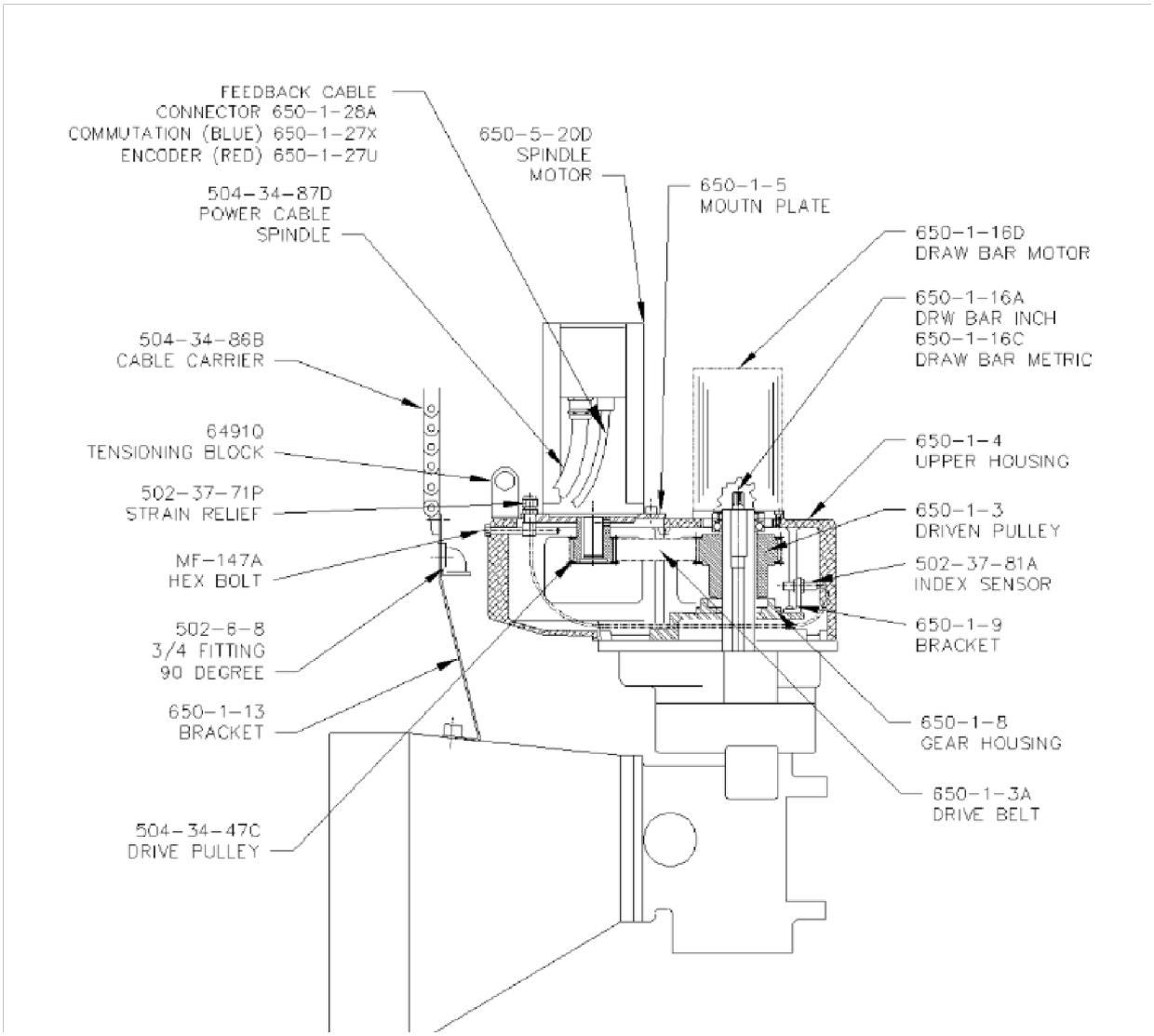
Enclosure Door Components


9035E Door Latch
(6 req'd)
7185F Danger
Sign
650-1-29G Handle
(2 req'd)
9030P Air Filter
(2 req'd)
9030H Filter
Housing
7192B Fan Gaurd
7192 Fan
7192C Fan Cord
DANGER
WARNING

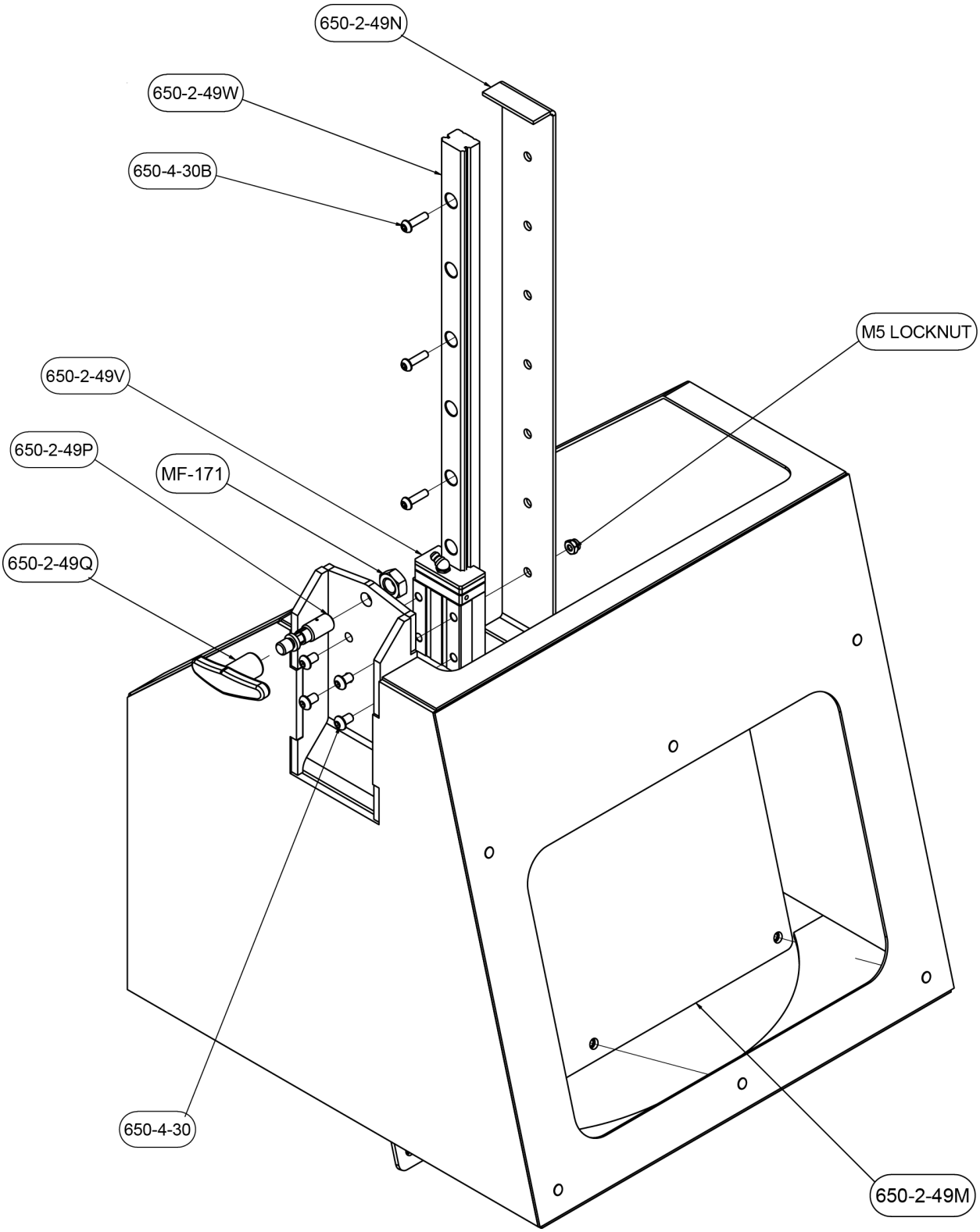
Control Panel



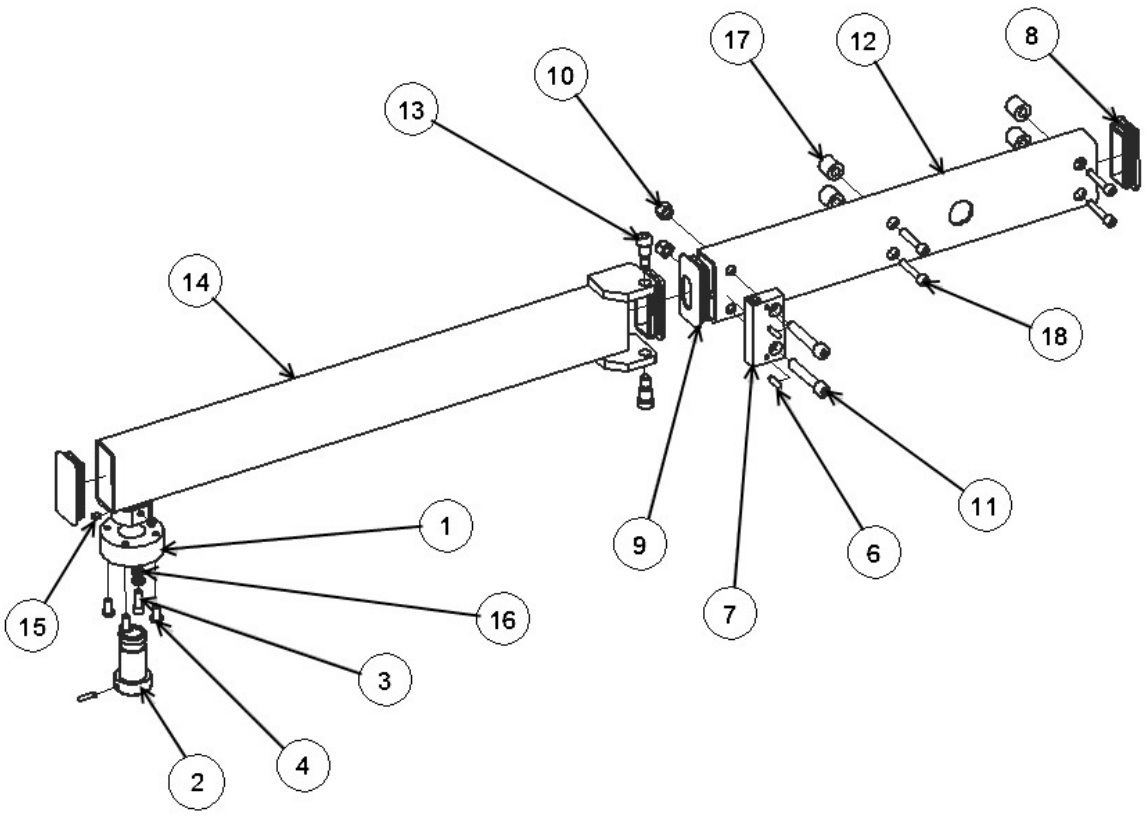
Upper Belt Housing



Chip Shield Assembly

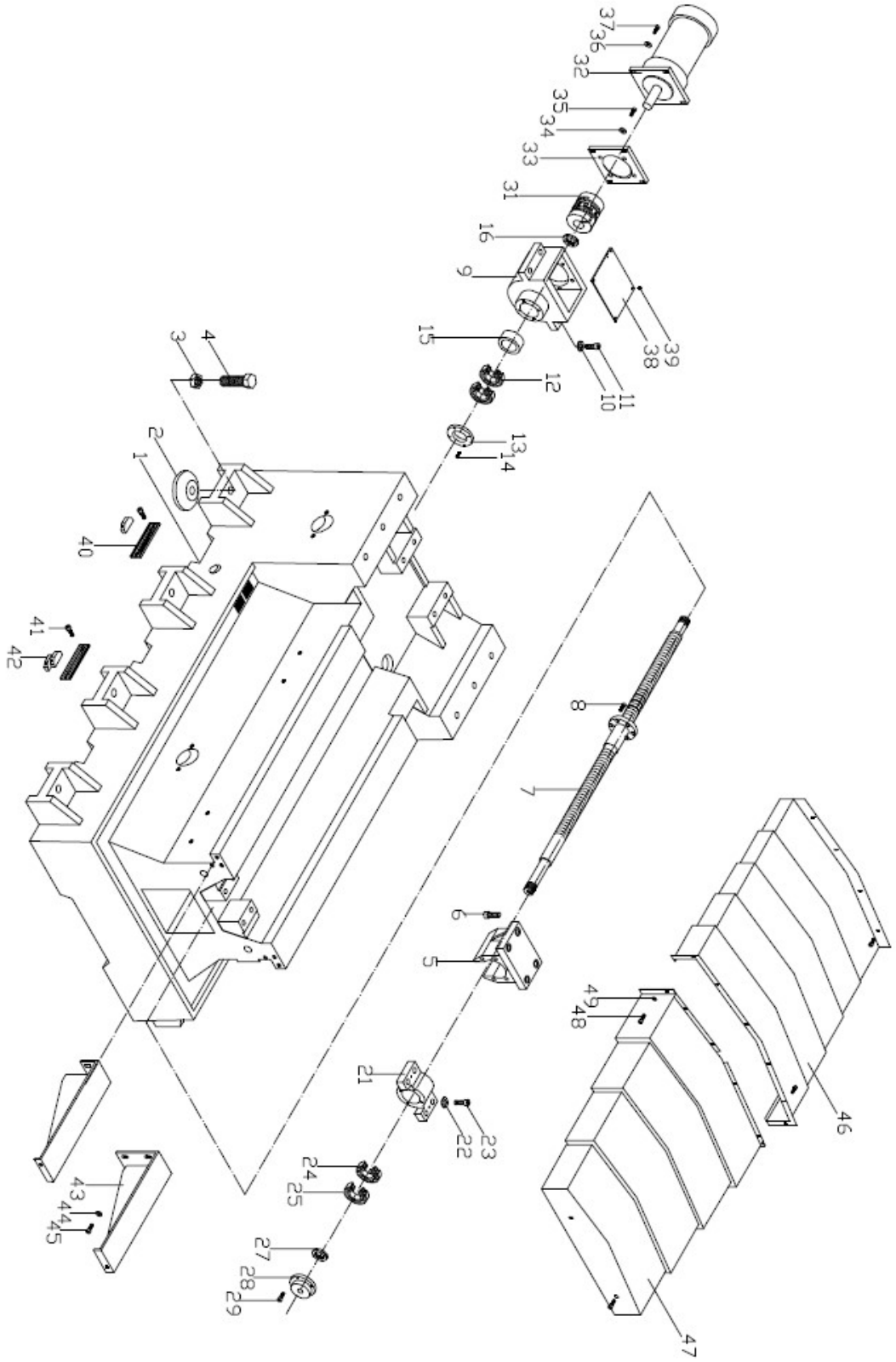


Pendent Swing Arm Assembly



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.

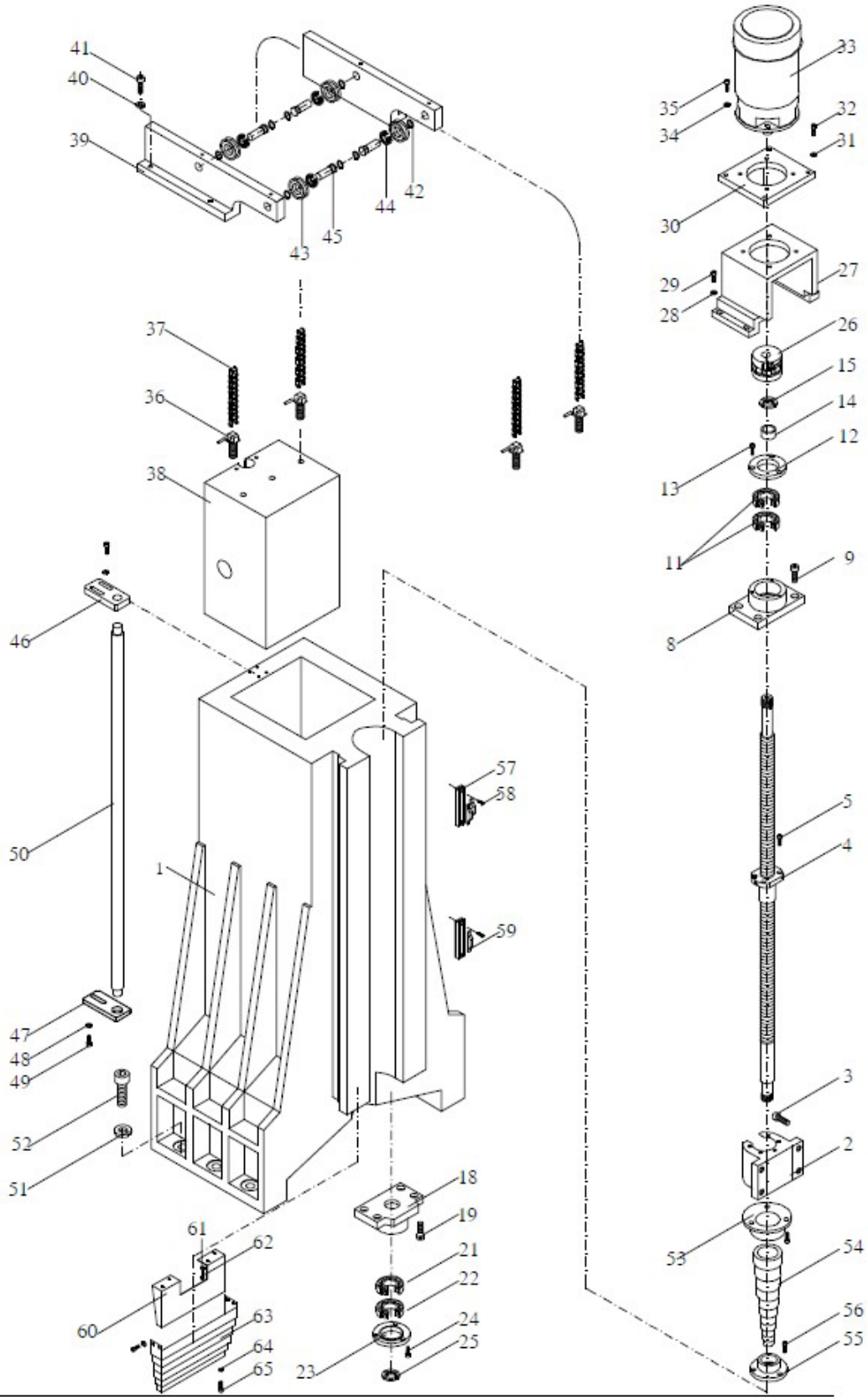
Base



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	650-6-6A	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	650-6-6	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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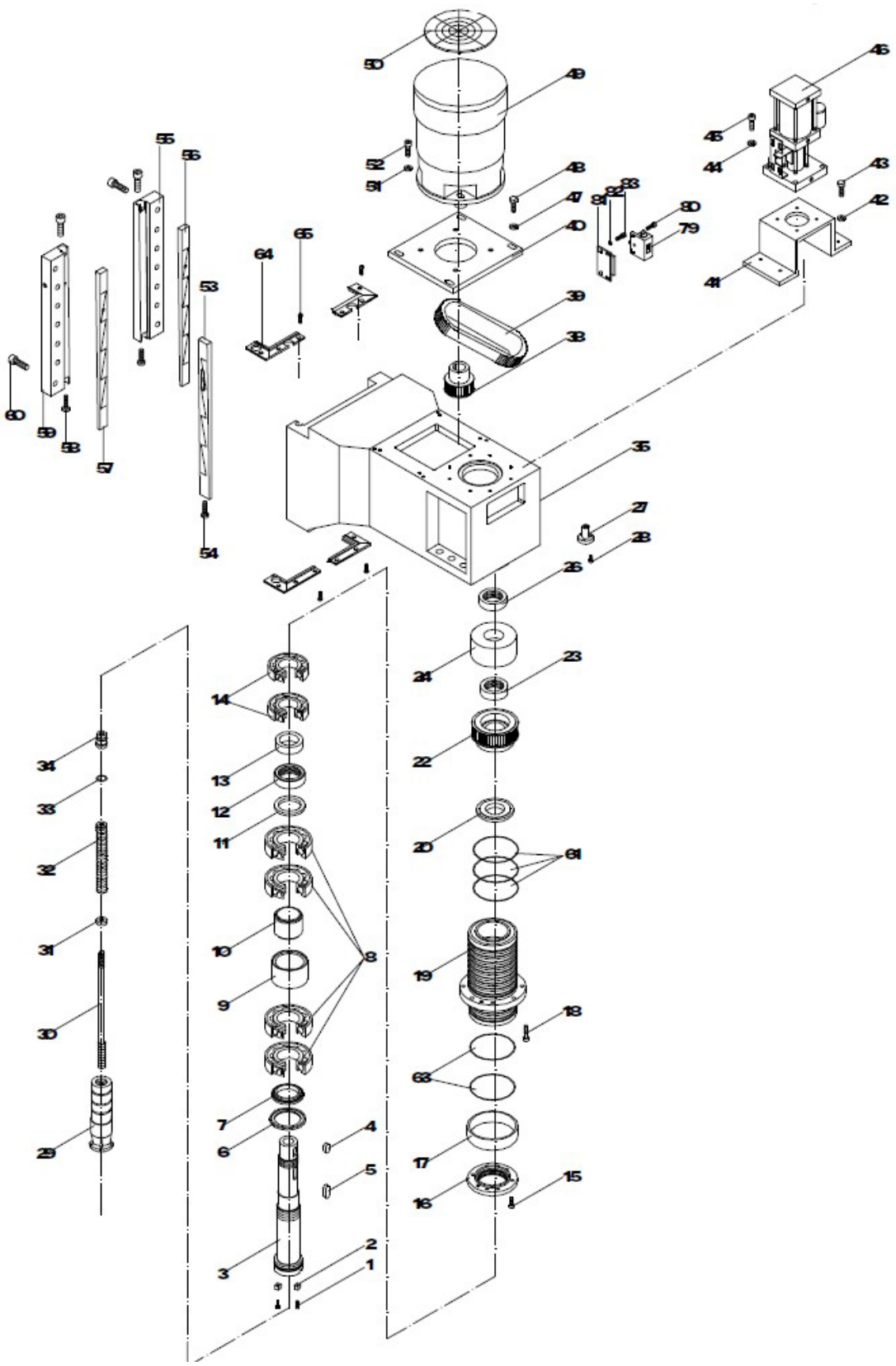
Column Parts List

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	650-6-7A	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	650-6-7	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



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

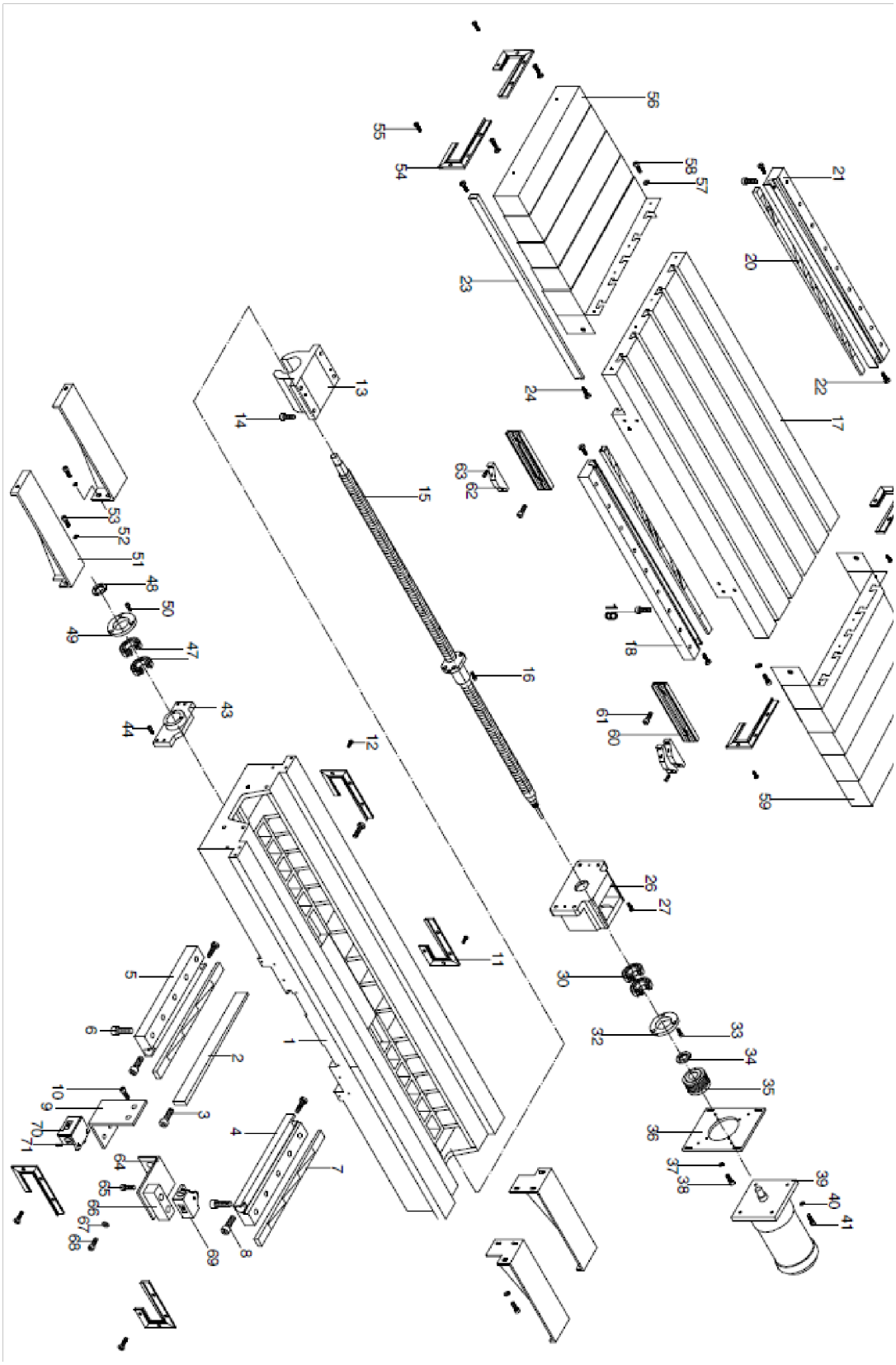
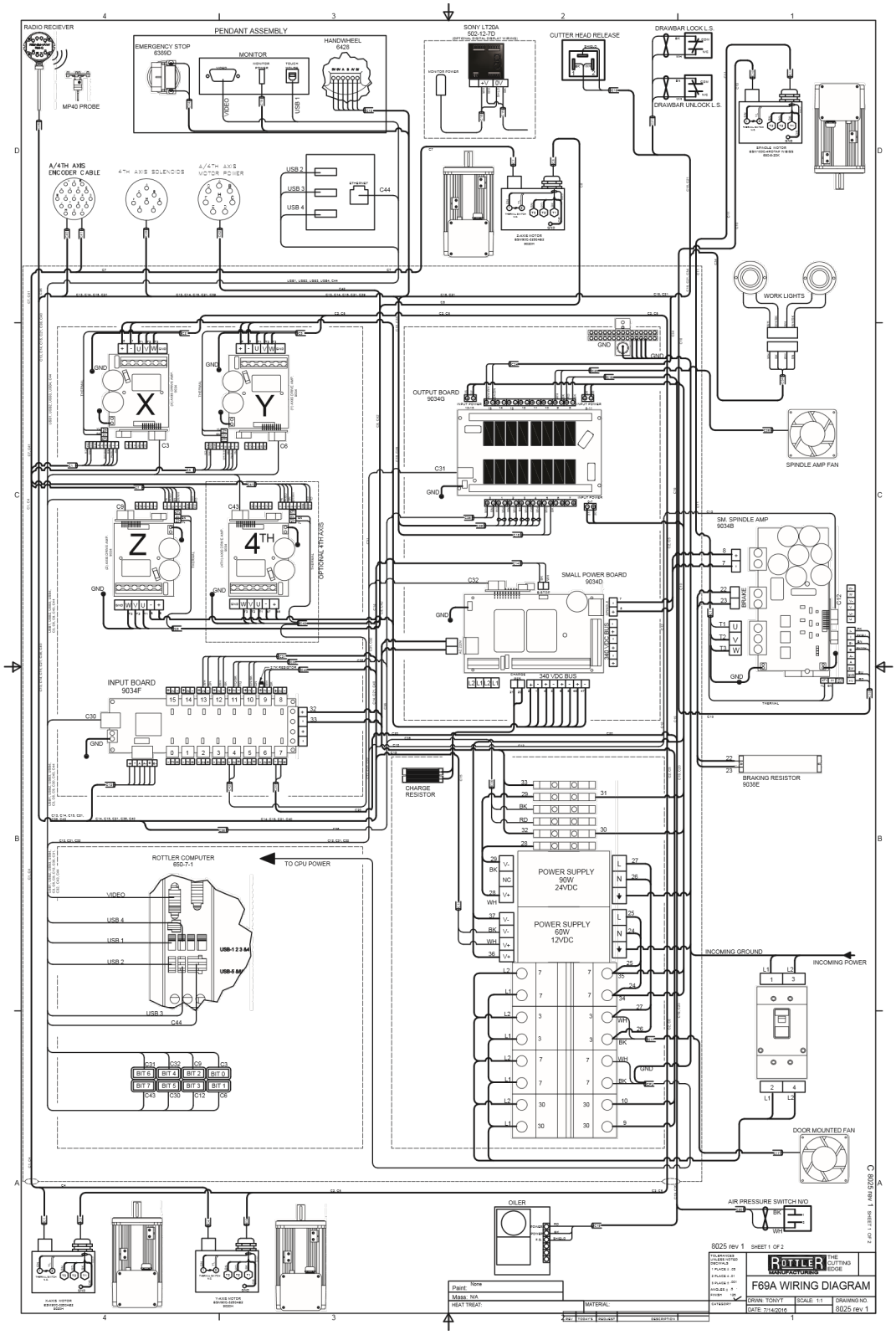


Table Parts List

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	650-6-5A	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	650-6-5	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

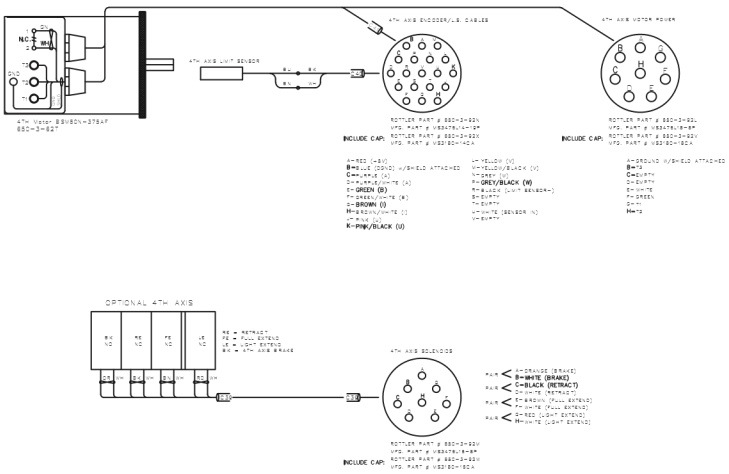
Scalable PDF version of this diagram located on the manual CD that shipped with this machine.



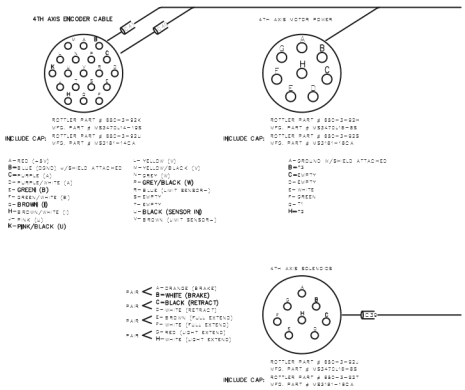
Connector Pin Out Diagram

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

FIXTURE QUICK DISCONNECTS



CABINET QUICK DISCONNECTS



SDS

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

CP Oil (All Grades)

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name:	CP Oil (All Grades)
MSDS Number:	720810
Synonyms:	76 CP Oil 22 76 CP Oil 32
Intended Use:	Industrial Oil
Manufacturer/Supplier:	ConocoPhillips 600 N. Dairy Ashford Houston, Texas 77079-1175
Emergency Health and Safety Number:	Chemtrec: 800-424-9300 (24 Hours)
MSDS Information:	Phone: 800-762-0942 Email: MSDS@conocophillips.com Internet: http://w3.conocophillips.com/NetMSDS/

2. HAZARDS IDENTIFICATION

Emergency Overview

This material is not considered hazardous according to OSHA criteria.

NFPA

Appearance: Clear and bright
Physical Form: Liquid
Odor: Petroleum

Potential Health Effects

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Contact may cause mild skin irritation including redness and a burning sensation. Prolonged or repeated contact can defat the skin, causing drying and cracking of the skin, and possibly dermatitis (inflammation). No harmful effects from skin absorption are expected.

Inhalation (Breathing): No information available on acute toxicity.

Ingestion (Swallowing): Low degree of toxicity by ingestion.

Signs and Symptoms: Effects of overexposure may include irritation of the digestive tract, nausea and diarrhea. Inhalation of oil mist or vapors at elevated temperatures may cause respiratory irritation.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders.

See Section 11 for additional Toxicity Information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CASRN	Concentration*
Lubricant Base Oil (Petroleum)	VARIOUS	>99
Additives	PROPRIETARY	<1

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

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 (Breathing): If respiratory symptoms develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. If symptoms persist, seek medical attention.

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

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.

5. FIRE-FIGHTING MEASURES

NFPA 704 Hazard Class

Health: 0 **Flammability:** 1 **Instability:** 0 (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

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.

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces.

Fire Fighting Instructions: For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. 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 immediate hazard area and keep unauthorized personnel out. 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.

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.

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

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. The use of explosion-proof electrical equipment is recommended. Stay upwind and away from spill/release. 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 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. 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 for Containment and Clean-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.

7. HANDLING AND STORAGE

Precautions for safe handling: Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment.

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.

"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.

Conditions for safe storage: Keep container(s) tightly closed. 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.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Component	US-ACGIH	OSHA	Other
Lubricant Base Oil (Petroleum)	TWA: 5mg/m^3 STEL: 10 mg/m^3 as Oil Mist, if generated	TWA: 5 mg/m^3 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.

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 protection that meets or exceeds ANSI Z.87.1 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, a face shield may be necessary.

Skin/Hand Protection: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Suggested protective materials: Nitrile.

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.

9. PHYSICAL AND CHEMICAL PROPERTIES

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:	Clear and bright
Physical Form:	Liquid
Odor:	Petroleum
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure:	<1 mm Hg
Vapor Density (air=1):	>1
Boiling Point/Range:	No data
Melting/Freezing Point:	<-11.2°F / <-24°C
Pour Point:	<-11.2°F / <-24°C
Solubility in Water:	Negligible
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity:	0.86 @ 60ºF (15.6ºC)
Bulk Density:	7.1 lbs/gal
Viscosity:	4 - 6 cSt @ 100°C; 20 - 35 cSt @ 40°C
Percent Volatile:	Negligible
Evaporation Rate (nBuAc=1):	<1
Flash Point:	>302°F / >150°C
Test Method:	Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
LEL (vol % in air):	No data
UEL (vol % in air):	No data
Autoignition Temperature:	No data

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated conditions of storage and handling.

Conditions to Avoid: Extended exposure to high temperatures can cause decomposition.

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidizing agents and strong reducing agents.

Hazardous Decomposition Products: Not anticipated under normal conditions of use.

Hazardous Polymerization: Not known to occur.

11. TOXICOLOGICAL INFORMATION

Chronic Data:

Lubricant Base Oil (Petroleum)

Carcinogenicity: The petroleum base oils contained in this product have been highly refined by a variety of processes including severe hydrocracking/hydroprocessing to reduce aromatics and improve performance characteristics. All of the oils meet the IP-346 criteria of less than 3 percent PAH's and are not considered carcinogens by NTP, IARC, or OSHA.

Acute Data:

Component	Oral LD50	Dermal LD50	Inhalation LC50
Lubricant Base Oil (Petroleum)	>5 g/kg	>2 g/kg	No data

12. ECOLOGICAL INFORMATION

12. ECOLOGICAL INFORMATION

Ecological Information: Lubricant oil basestocks are complex mixtures of hydrocarbons (primarily branched chain alkanes and cycloalkanes) ranging in carbon number from C15 to C50. The aromatic hydrocarbon content of these mixtures varies with the severity of the refining process. White oils have negligible levels of aromatic hydrocarbons, whereas significant proportions are found in unrefined basestocks. Olefins are found only at very low concentrations. Volatilization is not significant after release of lubricating oil basestocks to the environment due to the very low vapor pressure of the hydrocarbon constituents. In water, lubricating oil basestocks will float and will spread at a rate that is viscosity dependent. Water solubilities are very low and dispersion occurs mainly from water movement with adsorption by sediment being the major fate process. In soil, lubricating oil basestocks show little mobility and adsorption is the predominant physical process.

Both acute and chronic ecotoxicity studies have been conducted on lubricant base oils. Results indicate that the acute aquatic toxicities to fish, Daphnia, Ceriodaphnia and algal species are above 1000 mg/l using either water accommodated fractions or oil in water dispersions. Since lubricant base oils mainly contain hydrocarbons having carbon numbers in the range C15 to C50, it is predicted that acute toxicity would not be observed with these substances due to low water solubility. Results from chronic toxicity tests show that the no observed effect level (NOEL) usually exceeds 1000 mg/l for lubricant base oils with the overall weight of experimental evidence leading to the conclusion that lubricant base oils do not cause chronic toxicity to fish and invertebrates.

Large volumes spills of lubricant base oils into water will produce a layer of undissolved oil on the water surface that will cause direct physical fouling of organisms and may interfere with surface air exchange resulting in lower levels of dissolved oxygen. Petroleum products have also been associated with causing taint in fish even when the latter are caught in lightly contaminated environments. Highly refined base oils sprayed onto the surface of eggs will result in a failure to hatch.

Extensive experience from laboratory and field trials in a wide range of crops has confirmed that little or no damage is produced as a result of either aerosol exposure or direct application of oil emulsion to the leaves of crop plants. Base oils incorporated into soil have resulted in little or no adverse effects on seed germination and plant growth at contamination rates up to 4%.

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 MSDS 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.

14. TRANSPORTATION INFORMATION

U.S. Department of Transportation (DOT)

Shipping Description:	***Not regulated***
Note:	***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)***

International Maritime Dangerous Goods (IMDG)

Shipping Description:	***Not regulated***
Note:	***U.S. DOT compliance requirements may apply. See 49 CFR 171.22, 23 & 25.***

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #:	***Not regulated***

14. TRANSPORTATION INFORMATION

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	---	---	---
Max. Net Qty. Per Package:	---	---	---

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)

Acute Health:	No
Chronic Health:	No
Fire Hazard:	No
Pressure Hazard:	No
Reactive Hazard:	No

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.

Canadian Regulations:
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class
None

National Chemical 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.

U.S. Export Control Classification Number: EAR99

16. OTHER INFORMATION

Issue Date:	15-Jul-2008
Status:	Final
Previous Issue Date:	15-Aug-2005
Revised Sections or Basis for Revision:	NFPA ratings (Sections 2&5) Physical Properties (Section 9) Environmental hazards (Section 12)
MSDS Number:	720810

MSDS Legend:
ACGIH = American Conference of Governmental Industrial Hygienists; ADR = Agreement on Dangerous Goods by Road; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); EINECS - European Inventory of Existing Commercial Chemical Substances; EPA = [US] Environmental Protection Agency; Germany-TRGS = Technical Rules for Dangerous Substances; IARC = International Agency for Research on Cancer; ICAO/IATA = International Civil Aviation Organization / International Air Transport Association; IMDG = International Maritime Dangerous Goods; Ireland-HSA = Ireland's National Health and Safety Authority; LEL = Lower Explosive Limit; N/A = Not Applicable; N/D = Not Determined; NIOSH = National Institute for Occupational Safety and Health; NTP = [US] National Toxicology Program; OSHA = [US] Occupational Safety and Health Administration; PEL = Permissible Exposure Limit; RID = Regulations Concerning the International Transport of Dangerous Goods by Rail; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value; TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; UK-EH40 = United Kingdom EH40/2005 Workplace Exposure Limits

Disclaimer of Expressed and implied Warranties:
The information presented in this Material Safety Data Sheet is based on data believed to be accurate as of the date this Material 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.

Material Safety Data Sheet

DYNA COOL K-2002 **MSDS No. 5428**

Date of Preparation: 6/19/2001 Revision: 8/5/02

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: DYNA COOL K-2002
Chemical Formula: 5428
General Use: CUTTING FLUID
Manufacturer: DYNA TECH CHEMICAL CORPORATION
P.O. BOX 71 **PHONE: 262-646-7600**
PEWAUKEE, WI 53072 **EMERGENCY: 800-535-5053**

HMIS	
H	1
F	0
R	0
PPE	X

☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆

Section 2 - Composition / Information on Ingredients

Ingredient Name	CAS Number	% wt *or* % vol
MINERAL OIL	PROPRIETARY	<20%
TRIETHANOLAMINE	102-71-6	<10%

Trace Impurities:

Ingredient	OSHA PEL	ACGIH TLV	NIOSH REL
MINERAL OIL	5 MG/M3 (AS MIST)	5 MG/M3 (AS MIST)	
TRIETHANOLAMINE	5 MG/M3	5 MG/M3	

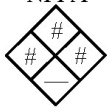
Toxicity Data:

Section 3 - Physical and Chemical Properties

Physical State: LIQUID
Appearance and Odor: CLEAR BLUE COLOR , CHARACTERISTIC
Vapor Pressure: N/A
Specific Gravity (H_2O=1, at 4 °C): 1.020
pH: N/A
Water Solubility: EMULSIFIES
Boiling Point: 212 + DEG F
Vapor Density (Air=1): N/A
% Volatile: N/A
Evaporation Rate: N/A

Section 4 - Fire-Fighting Measures

NFPA



Flash Point: NONE
Flash Point Method: N/A
LEL: NONE
UEL: NONE
Flammability Classification: NONE
Extinguishing Media: WATER FOG, DRY CHEMICAL, FOAM, AND CO2
Unusual Fire or Explosion Hazards: NONE KNOWN
Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 5 - Stability and Reactivity

Stability: DYNA COOL K-2002 is stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization cannot occur.

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Chemical Incompatibilities: STRONG OXIDIZING AGENTS
Conditions to Avoid: AVOID CONTACT WITH INCOMPATIBLE MATERIALS AND EXPOSURE TO EXTREME TEMPERATURES
Hazardous Decomposition Products: Thermal oxidative decomposition of DYNA COOL K-2002 can produce OXIDES OF CARBON, TRACES OF FORMALDEHYDE, AMMONIA AND OXIDES OF NITROGEN

Section 6 - Health Hazard Information

Potential Health Effects

Primary Entry Routes: INHALATION - SKIN CONTACT - EYE - INGESTION
Acute Effects
Inhalation: LOW VOLATILITY, IS NOT EXPECTED TO CAUSE IRRITATION WHILE USED UNDER NORMAL CONDITIONS, EXPOSURE TO HIGH MIST LEVELS IN POORLY VENTILATED AREAS MAY IRRITATE THE UPPER RESPIRATORY TRACT WITH SYMPTOMS OF ITCHING EYES AND NASAL PASSAGES.
Eye: MILD IRRITATION AND REDNESS MAY RESULT UPON DIRECT CONTACT OR WHEN EXPOSED TO HIGH MIST LEVELS IN POORLY VENTILATED AREAS.
Skin: SKIN CONTACT MAY RESULT IN SLIGHT TEMPORARY IRRITATION
Ingestion: THIS PRODUCT IS NOT EXPECTED TO CAUSE IRRITATION WHILE USED UNDER NORMAL CONDITIONS.
Carcinogenicity: IARC, NTP, and OSHA do not list DYNA COOL K-2002 as a carcinogen.
Medical Conditions Aggravated by Long-Term Exposure:
Chronic Effects:

Emergency and First Aid Procedures

Inhalation: REMOVE VICTIM TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL A PHYSICIAN.
Eye Contact: IMMEDIATELY FLUSH EYE WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. HOLD EYELIDS OPEN DURING THIS FLUSHING WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
Skin Contact: FLUSH AREA WITH WATER WHILE REMOVING CONTAMINATED CLOTHES AND SHOES. FOLLOW BY WASHING WITH SOAP AND WATER. DO NOT REUSE CLOTHING OR SHOES UNTIL CLEANED. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION. DO NOT APPLY OILS OR OINTMENTS, UNLESS ORDERED BY PHYSICIAN.
Ingestion: IF CONSCIOUS, DRINK A QUART OF WATER. DO NOT INDUCE VOMITING. CALL A PHYSICIAN IMMEDIATELY. IF UNCONSCIOUS OR IF IN CONVULSIONS, TAKE IMMEDIATELY TO A HOSPITAL OR PHYSICIAN. NEVER INDUCE VOMITING OR GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS VICTIM. AFTER DILUTION WITH WATER, FRUIT JUICE MAY BE ADMINISTRATED TO ACCOMPLISH NEUTRALIZATION. SEVERAL GLASSES OF MILK OR SEVERAL OUNCES MILK OF MAGNESIA MAY BE GIVEN FOR THEIR SOOTHING EFFECT. GET MEDICAL ATTENTION.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: NONE
Special Precautions/Procedures: NONE

Section 7 - Spill, Leak, and Disposal Procedures

Spill /Leak Procedures: EVACUATE UNPROTECTED PERSONNEL FROM AREA. MAINTAIN ADEQUATE VENTILATION. USE PROPER SAFETY EQUIPMENT. SWEEP UP MATERIAL INTO CONTAINERS AND DISPOSE OF PROPERLY. AVOID DIRECT DISCHARGE TO SEWERS AND SURFACE WATERS. NOTIFY AUTHORITIES IF ENTRY OCCURS.
Spills
Containment: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
Disposal Regulatory Requirements: OBSERVE ALL LOCAL, STATE, AND FEDERAL REGULATIONS.
Container Cleaning and Disposal: OBSERVE ALL LOCAL, STATE, AND FEDERAL REGULATIONS. DISPOSE OF AT APPROVED WASTE TREATMENT FACILITY. IF APPROVED NEUTRALIZE MATERIAL AND FLUSH TO SEWER. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOIDER, DRILL, GRIND, OR EXPOSE EMPTY CONTAINERS TO HEAT, FLAME, SPARKS OR OTHER SOURCES OF IGNITION.
Ecological Information:

EPA Regulations:

Revision: 8/5/02 **DYNA COOL K-2002** **MSDS No. 5428**

This information may be subject to the provision reporting requirements of Section 313 of the Superfund Amendment and Reauthorization Act of 1986 (SARA). All sections - CERCLA, RCRA, and OSHA.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls:
Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.
Administrative Controls:
Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or non routine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.
*Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.
Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.
Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.
Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Special Precautions and Comments

Handling Precautions: WEAR CHEMICAL SAFETY GOGGLES OR FACE SHIELD WITH SAFETY GOGGLES, AND PROTECTIVE CLOTHING. USE SELF-CONTAINED BREATHING APPARATUS IF NECESSARY. DO NOT USE IN POORLY VENTILATED OR CONFINED SPACES. WHEN MAKING SOLUTIONS, HEAT MAY BE GENERATED. ADD SLOWLY TO SURFACES OF SOLUTION WHILE STIRRING TO AVOID SPLATTERING. NEVER USE PRESSURE TO EMPTY CONTAINERS. EMPTY CONTAINERS MAY CONTAIN EXPLOSIVE VAPORS OR DANGEROUS RESIDUES. DO NOT CUT, PUNCTURE, OR WELD ON OR NEAR CONTAINER. ALL LABELLED HAZARDOUS PRECAUTIONS MUST BE OBSERVED. DO NOT REUSE EMPTY CONTAINER WITHOUT COMMERCIAL CLEANING OR RECONDITIONING.
Storage Requirements: STORE IN COOL, WELL-VENTILATED AREA AWAY FROM HEAT AND OUT OF DIRECT SUNLIGHT. DO NOT STORE OPEN, UNLABELLED, MISLABELLED, OR EMPTY CONTAINERS. KEEP CONTAINERS TIGHTLY CLOSED. STORE AWAY FROM INCOMPATIBLE MATERIALS. DO NOT EAT, DRINK, OR SMOKE IN WORK AREA.

DOT Transportation Data (49 CFR 172.101):

Shipping Name: NOT DOT HAZARDOUS AS PACKAGED
Hazard Class: NONE
Packing Group: III
Label: NONE

Prepared By: SLW
Revision Notes:

Disclaimer: THE DATA IN THIS MATERIAL SAFETY DATA SHEET IS BELIEVED TO BE CORRECT. HOWEVER, SINCE CONDITIONS OF USE ARE OUTSIDE OUR CONTROL IT SHOULD NOT BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH WE ASSUME LEGAL RESPONSIBILITY. THIS INFORMATION IS PROVIDED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION.

ExxonMobil

Product Name: MOBIL VACTRA OIL NO. 2
Revision Date: 17Oct2008
Page 1 of 8

MATERIAL SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: MOBIL VACTRA OIL NO. 2
Product Description: Base Oil and Additives
Product Code: 600494-00, 970716
Intended Use: Lubricant

COMPANY IDENTIFICATION

Supplier: **EXXON MOBIL CORPORATION**
3225 GALLOWS RD.
FAIRFAX, VA. 22037 USA

24 Hour Health Emergency	609-737-4411
Transportation Emergency Phone	800-424-9300
ExxonMobil Transportation No.	281-834-3296
Product Technical Information	800-662-4525, 800-947-9147
MSDS Internet Address	http://www.exxon.com, http://www.mobil.com

SECTION 2 COMPOSITION / INFORMATION ON INGREDIENTS

No Reportable Hazardous Substance(s) or Complex Substance(s).

SECTION 3 HAZARDS IDENTIFICATION

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

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

NFPA Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0
HMIS Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4 FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use

mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

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

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Hazardous Combustion Products: Smoke, Fume, Aldehydes, Sulfur oxides, Incomplete combustion products, Oxides of carbon

FLAMMABILITY PROPERTIES

Flash Point [Method]: >205C (401F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

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

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is a static accumulator.

STORAGE

Do not store in open or unlabelled containers. Keep away from incompatible materials.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists / aerosols can occur, the following are recommended: 5 mg/m³ - ACGIH TLV, 10 mg/m³ - ACGIH STEL, 5 mg/m³ - OSHA PEL.

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

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator

selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid
Color: Brown
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.883
Flash Point [Method]: >205C (401F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Autoignition Temperature: N/D
Boiling Point / Range: N/D
Vapor Density (Air = 1): > 2 at 101 kPa
Vapor Pressure: < 0.013 kPa (0.1 mm Hg) at 20 C
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A

Log Pow (n-Octanol/Water Partition Coefficient): > 3.5
Solubility in Water: Negligible
Viscosity: 68 cSt (68 mm2/sec) at 40 C | 8.6 cSt (8.6 mm2/sec) at 100C
Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -6°C (21°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

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

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m3	Minimally Toxic. Based on test data for structurally similar materials.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on test data for structurally similar materials.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials.

CHRONIC/OTHER EFFECTS

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

Additional information is available by request.

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

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be

completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

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

AIR (IATA) : Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: AICS, IECSC, DSL, EINECS, ENCS, KECI, PICCS, TSCA

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below: None.

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

No revision information is available.

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Internal Use Only
MHC: 0B,0B,0,0,0,0 PPEC: A

DGN: 2007221XUS (1014962)

Product Information

A PRODUCT OF THE VALVOLINE COMPANY A DIVISION OF ASHLAND INC.

VALVOLINE HIGH PERFORMANCE GEAR OIL

Valvoline High Performance Gear Oils are superior sulfur-phosphorus, extreme pressure gear lubricants formulated with premium quality base stocks to meet the demands for excellent performance. It is designed to provide excellent load carrying capacity, extreme pressure properties, anti-foam performance, demulsibility, corrosion protection, thermal stability protection, and service fill limited slip capability. These products are recommended for conventional rear axles, limited slip rear axles, and transmissions requiring EP gear lubes under high speed, high load, high torque, and high horsepower conditions. **Valvoline High Performance Gear Oils** meet or exceed API Services GL-5 and GL-4*. The inclusion of Limited Slip Friction Modifier in this product makes it unnecessary to add additional friction modifier (Ford M2C118A, Chrysler MS-5630, or GM1052358) in most vehicles.

The Valvoline High Performance Gear Oils Advantages:

- **Thermal Protection:** Provides outstanding thermal stability for cleanliness and longer service life.
- **Wear Protection:** Contains additives to assist in protecting gear teeth against pitting, spalling, and scouring.
- **Reduces Chattering:** Contains special additives to reduce chattering in limited-slip differentials.
- **Corrosion Protection:** Protects parts from rust and corrosion.

Approvals/Performance Levels			
API GL-4 *	75W-90	80W-90	85W-140
API GL-5	75W-90	80W-90	85W-140

Test	75W-90	80W-90	85W-140
Vis @ 100°C (cSt)	15.47	14.4	28.1
Vis @ 40°C (cSt)	99.0	145.9	394
Viscosity Index	166	96	98
Spec Gravity @ 60F	0.862	0.895	0.904
Density (lbs/gal)	7.19	7.47	7.53
Brookfield Vis., cP	106,000(-40C)	108,000(-26C)	120,000(-12C)
Pour Point, C	-45	-30	-15
Phosphorus, wt%	0.066	0.066	0.066

*In synchronized manual transmission applications use:

- Valvoline Professional Series Manual Transmission Fluid or
- Valvoline Synchromesh Manual Transmission Fluid (available September 2012)

Effective Date: 05/21/2012 Replaces: 01/27/2012 ZGZ Doc #-Rev 5

Product Information

A PRODUCT OF THE VALVOLINE COMPANY A DIVISION OF ASHLAND INC.

VALVOLINE SYNPOWER FULL SYNTHETIC GEAR OIL W/LIMITED SLIP

Valvoline SynPower Gear Oil is a superior sulfur-phosphorus extreme pressure gear lubricant formulated with synthetic basestocks and additives to provide excellent performance. It is designed to provide excellent extreme pressure protection, load carrying capacity, anti-foam performance, corrosion protection, and thermal stability protection. It is recommended for conventional and high performance applications. **Valvoline SynPower Gear Oil** is recommended for use in axle applications requiring factory-fill or drain-and-fill levels of limited slip performance.

Valvoline SynPower Gear Oil is recommended for use in axle applications requiring factory-fill or drain-and-fill levels of limited slip performance. Valvoline SynPower 75W-140 is also recommended for use where Ford **M2C-192A, GM 12346140, Chrysler MS-8985 , or GL-5** SAE 75W-140 gear oil is specified. The addition of a supplemental friction modifier(Ford M2C-118-A, Chrysler MS-5630, or GM 1052358) **is not** required.

Valvoline SynPower Gear Oil Advantages:

- **Thermal Protection:** Provides outstanding thermal stability for cleanliness and longer service life.
- **Corrosion Protection:** Protects parts from rust and corrosion.
- **Reduces Chattering:** Contains special additives to reduce chattering in limited-slip differentials.
- **Wear Protection:** Contains additives to assist in protecting gear teeth.
- **Flow Properties:** Provides excellent low temperature protection.

Approvals/Performance Levels	Viscosity Grade/Other	
API MT-1	75W-90	
API GL-5	75W-90	75W-140
API GL-4*	75W-90	75W-140
MIL-PRF-2105E	75W-90	
SAE J2360	75W-90	
Mack GO-J	75W-90	

Test	75W-90	75W-140
Vis @ 100°C (cSt)	15.6	25.8
Vis @ 40°C (cSt)	100	171
Viscosity Index	150	183
Spec Gravity @ 60°F	0.865	0.861
Density (lbs/gal)	7.22	7.18
Flash COC (°C)	231	173
Pour Point (°C)	-48	-48
Phosphorus, wt.%	0.21	0.19
Sulfur, wt.%	2.3	2.3
Boron, wt.%	0.03	0.03

*In synchronized manual transmission applications use:

- Valvoline Professional Series Manual Transmission Fluid or
- Valvoline Synchromesh Manual Transmission Fluid (available September 2012)

This information only applies to products manufactured in the following location(s):

Effective Date:	Replaces:	Author's Initials:	Pages	Code
05-21-12	01-23-12	ZGZ		Rev 005

KYODO YUSHI
MATERIAL SAFETY DATA SHEET

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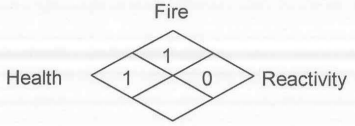
MSDS No. : 07-543 DATE PREPARED:2009/ 4 / 1
PRODUCT NAME : MOLYWHITE RE No.00



NFPA HAZARD RATING
4 -- Extreme
3 -- Height
2 -- Moderate
1 -- Slight
0 – Insignificant

1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : MOLYWHITE RE No.00
PRODUCT CODE : 07543

COMPANY NAME : KYODO YUSHI CO., LTD.
2-2-30, TSUJIDO KANDAI, FUJISAWA-SHI, KANAGAWA, JAPAN

EMERGENCY TELEPHONE NUMBER : +81 – 466 – 33 – 3157

2 COMPOSITION /INFORMATION ON INGREDIENTS

CHEMICAL FAMILY : Lubricating Grease.
FORMULA : not applicable
COMPONENTS :

NAME	CONTENTS (%)
Base oil (Refined mineral oil, synthetic hydrocarbon oil)	85 – 95
Thickener (Lithium soap)	<10
EP additives (Containing molybdenum, zinc compound)	<5
Oxidation inhibitor (2,6-di-t-buthyl-p-cresol)	<5
Additives (Containing barium compound)	<5

HAZARDOUS INGREDIENTS

NAME	CAS No.	CONTENTS (%)
Molybdenum compound	68412-26-0	1 – 3
2,6-di-t-buthyl-p-cresol	128-37-0	1 – 3

See Section 8 for exposure limits (if applicable)

3 HAZARDOUS IDENTIFICATION

CLASS NAME OF HAZARDOUS CHEMICALS FOR SDS IN JAPAN Not applicable

- PHYSICAL AND CHEMICAL HAZARDS : Not applicable
- ADVERSE HUMAN HEALTH EFFECTS :Prolonged and repeated contact may cause skin irritation.
- ENVIRONMENTAL EFFECTS : No data available.

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4 FIRST AID MEASURES

EYES : Immediately flush with water for at least 15 minutes. Get medical attention.

SKIN : Remove excess with cloth or paper and wash area thoroughly with soap and water.

INGESTION : Consult a physician. Do not induce vomiting.

INHALATION : Keep the victim warm and quiet. Remove the victim from the contamination Immediately to fresh air.

NOTE TO PHYSICIANS : Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5 FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES :

- FLASH POINT : 190 ℃ METHOD : Seta Flash Method
- FLAMMABLE LIMITS : LFL : N/A UFL : N/A
- AUTOIGNITION TEMPERATURE : no data available
- HAZARDOUS DECOMPOSITION PRODUCTS : Thermal decomposition and combustion may produce carbon monoxide and/or carbon dioxide.

* N/A : Not applicable.

EXTINGUISH MEDIA : Dry chemical, Water fog, CO_2, Foam, Sand/Earth

FIRE FIGHTING INSTRUCTIONS : Dense smoke. Fire fighter wear an approved self-contained breathing apparatus. Do not use water except fog.

6 ACCIDENTAL RELEASE MEASURES

PROCEDURE FOR CLEAN-UP : Transfer bulk of mixture into another container. Absorb residue with an inert material such as earth, sand and vermiculite.
Sweep up and dispose solid waste in accordance with local, state and federal regulations.

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

7 HANDLING AND STORAGE

HANDLING : Contact with eye may cause irritation. Use protective glasses or other devices to avoid contact with eyes. Contact with skin may cause irritation. Use protective gloves to avoid skin contact.
Do not swallow. (Eating product cause diarrhea and vomiting.)
Wear gloves to avoid injury on hands at opening the container.
Keep out reach of children.

STORAGE : Keep container closed until ready for use. Storage away from fire source or sunlight and in cool dry area.

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8 EXPOSURE CONTROLS/PERSONAL PROTECTION

CONTROL PARAMETERS :
Oil mist, mineral: ACGIH TLV (2007): TWA 5mg/m^3
Molybdenum compound: ACGIH TLV (2007): TWA as Mo 10mg/m^3
2,6-di-t-buthyl-p-cresol ACGIH TLV (2007): TWA 2mg/m^3

ENGINEERING MEASURES : none

PERSONAL PROTECTIVE EQUIPMENT :
- RESPIRATORY PROTECTION : Wear a gas mask (for organic gas), if necessary.
- EYE PROTECTION : Chemical safety goggles and if handled hot, full face shield.
- HAND AND BODY PROTECTION : Protective gloves, rubber or plastic oil resistant.
- OTHER PROTECTIVE EQUIPMENT : none

9 PHYSICAL AND CHEMICAL PROPERTIES

· APPEARANCE :	Yellow paste	· ODOR :	Slight odor.
· VAPOR PRESSURE	N/A	· VAPOR DENSITY(AIR=1) :	N/A
· SPECIFIC GRAVITY(H_2O=1):	0.87		
· SOLUBILITY IN WATER	Negligible	· EVAPORATION RATE (n-Butyl Acetate=1)	Slower
· SOLUBILITY IN ----- :	N/A		
· PH :	N/A	· FREEZING POINT :	N/A
· BOILING POINT :	N/A	· VISCOSITY :	N/A
· MELTING POINT(Dropping Point) :	193 ℃		

* N/A : Not applicable.

10 STABILITY AND REACTIVITY

- STABILITY : (CONDITION TO AVOID) Product is stable under normal condition. Avoid over heating.
- INCOMPATIBILITY : (SPECIFIC MATERIALS TO AVOID) Strong oxidizers such as hydrogen peroxide, bromine, and chromic acid.
- HAZARDOUS DECOMPOSITION PRODUCTS : Oxides of lithium, nitrogen, sulfur, zinc, phosphorus, barium and molybdenum.
- HAZARDOUS POLYMERIZATION : none
- REACTIVTY WITH WATER : none

11 TOXICOLOGICAL INFORMATION

- CORROSIVE AND IRRITANT PROPERTIES : No data available
- ALLERGENIC AND SENSITIZING EFFECTS :No data available
- ACUTE TOXICITY : Refined mineral oil LD50 Acute oral 5<g/kg(rat)
- SUB-CHRONIC TOXICITY : No data available
- CHRONIC TOXICITY : Prolonged and repeated skin contact may cause irritation.
- CARCINOGENIC EFFECT : Not listed IARC,NTP,ACGIH.
- MUTAGENIC EFFECTS : No data available
- EFFECTS ON THE REPRODUCTIVE SYSTEM : No data available
- TERATOGENIC EFFECTS : No data available

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12 ECOLOGICAL INFORMATION

- BIODEGRABILITY : No data available
- BIOACCUMULATION : No data available
- FISH TOXICITY : No data available

13 DISPOSAL CONSIDERATION

WASTE DISPOSAL METHOD : Incinerate in accordance with applicable regulation.

ATTENTION : Do not use pressure to empty this container. When empty, container may have vapor or product residue. Do not cut, puncture or weld on near the drum.

14 TRANSPORT INFORMATION

DOT : Not applicable
UN No. : Not applicable
FIRE SERVICE LAW (JAPAN) : Not applicable
LAND(RID/ADR): Not regulated for rail/road transport
SEA(IMO/IMDG): Not regulated for sea transport
AIR(ICAO/IATA): Not regulated for air transport

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; Molybdenum compound, 2,6-di-t-buthyl-p-cresol.

US CERCLA (Comprehensive Environmental Release, Compensation & Liability Act):
Zinc compounds (0.1 – 0.5%) no RQ is assigned to this generic or broad class.

US SARA (Superfund Amendment & Reauthorization Act) Title Ⅲ:
This product contains no Extremely Hazardous Substances.
SARA Hazard Categories (311/312): None
SARA Toxic Release Inventory (TRI) (313): Zinc compounds (0.1 – 0.5%)
Barium compounds (0.3 – 0.7%)

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16 OTHER INFORMATION

INFORMATION CONTACT : KYODO YUSHI CO., LTD.
International Business Dept.
2-2-30, TSUJIDO KANDAI, FUJISAWA-SHI, KANAGAWA, JAPAN
Tel +81 – 466 – 33 – 3157

REFERENCE : CMA Interim Guideline for the Preparation of MSDS.
Chapter 7 : MSDS Examples.
ACGIH Threshold Limit Values for Chemical Substances in the Work Environment. (2007)

ORIGINAL DATE : 98/ 1 / 26,
REVISION DATE : 2009/ 4 / 1,

This MSDS 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.