



OPERATOR'S MANUAL

Metal Working



VARIABLE SPEED VERTICAL MILL MODEL: VM-942-1

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THANK YOU & WARRANTY

Thank you for your purchase of a machine from Baileigh Industrial. We hope that you find it productive and useful to you for a long time to come.

Inspection & Acceptance. Buyer shall inspect all Goods within ten (10) days after receipt thereof. Buyer's payment shall constitute final acceptance of the Goods and shall act as a waiver of the Buyer's rights to inspect or reject the goods unless otherwise agreed. If Buyer rejects any merchandise, Buyer must first obtain a Returned Goods Authorization ("RGA") number before returning any goods to Seller. Goods returned without a RGA will be refused. Seller will not be responsible for any freight costs, damages to goods, or any other costs or liabilities pertaining to goods returned without a RGA. Seller shall have the right to substitute a conforming tender. Buyer will be responsible for all freight costs to and from Buyer and repackaging costs, if any, if Buyer refuses to accept shipment. If Goods are returned in unsalable condition, Buyer shall be responsible for full value of the Goods. Buyer may not return any special-order Goods. Any Goods returned hereunder shall be subject to a restocking fee equal to 30% of the invoice price.

Specifications. Seller may, at its option, make changes in the designs, specifications or components of the Goods to improve the safety of such Goods, or if in Seller's judgment, such changes will be beneficial to their operation or use. Buyer may not make any changes in the specifications for the Goods unless Seller approves of such changes in writing, in which event Seller may impose additional charges to implement such changes.

Limited Warranty. Seller warrants to the original end-user that the Goods manufactured or provided by Seller under this Agreement shall be free of defects in material or workmanship for a period of twelve (12) months from the date of purchase, provided that the Goods are installed, used, and maintained in accordance with any instruction manual or technical guidelines provided by the Seller or supplied with the Goods, if applicable. The original end-user must give written notice to Seller of any suspected defect in the Goods prior to the expiration of the warranty period. The original end-user must also obtain a RGA from Seller prior to returning any Goods to Seller for warranty service under this paragraph. Seller will not accept any responsibility for Goods returned without a RGA. The original end-user shall be responsible for all costs and expenses associated with returning the Goods to Seller for warranty service. In the event of a defect, Seller, at its sole option, shall repair or replace the defective Goods or refund to the original end-user the purchase price for such defective Goods. Goods are not eligible for replacement or return after a period of 30 days from date of receipt. The foregoing warranty is Seller's sole obligation, and the original end-user's exclusive remedy, with regard to any defective Goods. This limited warranty does not apply to: (a) die sets, tooling, and saw blades; (b) periodic or routine maintenance and setup, (c) repair or replacement of the Goods due to normal wear and tear, (d) defects or damage to the Goods resulting from misuse, abuse, neglect, or accidents, (f) defects or damage to the Goods resulting from improper or unauthorized alterations, modifications, or changes; and (f) any Goods that has not been installed and/or maintained in accordance with the instruction manual or technical guidelines provided by Seller.

EXCLUSION OF OTHER WARRANTIES. THE FOREGOING LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. ANY AND ALL OTHER EXPRESS, STATUTORY OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. NO WARRANTY IS MADE WHICH EXTENDS BEYOND THAT WHICH IS EXPRESSLY CONTAINED HEREIN.

Limitation of Liability. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER OR ANY OTHER PARTY FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR DOWN TIME) ARISING FROM OR IN MANNER CONNECTED WITH THE GOODS, ANY BREACH BY SELLER OR ITS AGENTS OF THIS AGREEMENT, OR ANY OTHER CAUSE WHATSOEVER, WHETHER BASED ON CONTRACT, TORT OR ANY OTHER THEORY OF LIABILITY. BUYER'S REMEDY WITH RESPECT TO ANY CLAIM ARISING UNDER THIS AGREEMENT IS STRICTLY LIMITED TO NO MORE THAN THE AMOUNT PAID BY THE BUYER FOR THE GOODS.



Force Majeure. Seller shall not be responsible for any delay in the delivery of, or failure to deliver, Goods due to causes beyond Seller's reasonable control including, without limitation, acts of God, acts of war or terrorism, enemy actions, hostilities, strikes, labor difficulties, embargoes, non-delivery or late delivery of materials, parts and equipment or transportation delays not caused by the fault of Seller, delays caused by civil authorities, governmental regulations or orders, fire, lightening, natural disasters or any other cause beyond Seller's reasonable control. In the event of any such delay, performance will be postponed by such length of time as may be reasonably necessary to compensate for the delay.

Installation. If Buyer purchases any Goods that require installation, Buyer shall, at its expense, make all arrangements and connections necessary to install and operate the Goods. Buyer shall install the Goods in accordance with any Seller instructions and shall indemnify Seller against any and all damages, demands, suits, causes of action, claims and expenses (including actual attorneys' fees and costs) arising directly or indirectly out of Buyer's failure to properly install the Goods.

Work By Others; Safety Devices. Unless agreed to in writing by Seller, Seller has no responsibility for labor or work performed by Buyer or others, of any nature, relating to design, manufacture, fabrication, use, installation or provision of Goods. Buyer is solely responsible for furnishing, and requiring its employees and customers to use all safety devices, guards and safe operating procedures required by law and/or as set forth in manuals and instruction sheets furnished by Seller. Buyer is responsible for consulting all operator's manuals, ANSI or comparable safety standards, OSHA regulations and other sources of safety standards and regulations applicable to the use and operation of the Goods.

Remedies. Each of the rights and remedies of Seller under this Agreement is cumulative and in addition to any other or further remedies provided under this Agreement or at law or equity.

Attorney's Fees. In the event legal action is necessary to recover monies due from Buyer or to enforce any provision of this Agreement, Buyer shall be liable to Seller for all costs and expenses associated therewith, including Seller's actual attorneys' fees and costs.

Governing Law/Venue. This Agreement shall be construed and governed under the laws of the State of Wisconsin, without application of conflict of law principles. Each party agrees that all actions or proceedings arising out of or in connection with this Agreement shall be commenced, tried, and litigated only in the state courts sitting in Manitowoc County, Wisconsin or the U.S. Federal Court for the Eastern District of Wisconsin. Each party waives any right it may have to assert the doctrine of "forum non conveniens" or to object to venue to the extent that any proceeding is brought in accordance with this section. Each party consents to and waives any objection to the exercise of personal jurisdiction over it by courts described in this section. Each party waives to the fullest extent permitted by applicable law the right to a trial by jury.

Summary of Return Policy.

- 10 Day acceptance period from date of delivery. Damage claims and order discrepancies will not be accepted after this time.
- You must obtain a Baileigh issued RGA number PRIOR to returning any materials.
- Returned materials must be received at Baileigh in new condition and in original packaging.
- Altered items are not eligible for return.
- Buyer is responsible for all shipping charges.
- A 30% re-stocking fee applies to all returns.

Baileigh Industrial makes every effort to ensure that our posted specifications, images, pricing and product availability are as correct and timely as possible. We apologize for any discrepancies that may occur. Baileigh Industrial reserves the right to make any and all changes deemed necessary in the course of business including but not limited to pricing, product specifications, quantities, and product availability.

For Customer Service & Technical Support:

Please contact one of our knowledgeable Sales and Service team members at:
(920) 684-4990 or e-mail us at sales@baileigh.com



INTRODUCTION

The quality and reliability of the components assembled on a Baileigh Industrial machine guarantee near perfect functioning, free from problems, even under the most demanding working conditions. However if a situation arises, refer to the manual first. If a solution cannot be found, contact the distributor where you purchased our product. Make sure you have the serial number and production year of the machine (stamped on the nameplate). For replacement parts refer to the assembly numbers on the parts list drawings.

Our technical staff will do their best to help you get your machine back in working order.

In this manual you will find: (when applicable)

- Safety procedures
- Correct installation guidelines
- Description of the functional parts of the machine
- Capacity charts
- Set-up and start-up instructions
- Machine operation
- Scheduled maintenance
- Parts lists

GENERAL NOTES

After receiving your equipment remove the protective container. Do a complete visual inspection, and if damage is noted, **photograph it for insurance claims** and contact your carrier at once, requesting inspection. Also contact Baileigh Industrial and inform them of the unexpected occurrence. Temporarily suspend installation.

Take necessary precautions while loading / unloading or moving the machine to avoid any injuries.

Your machine is designed and manufactured to work smoothly and efficiently. Following proper maintenance instructions will help ensure this. Try and use original spare parts, whenever possible, and most importantly; **DO NOT** overload the machine or make any modifications.



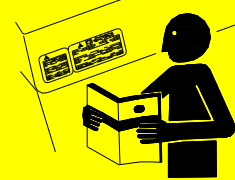
Note: *This symbol refers to useful information throughout the manual.*



IMPORTANT

PLEASE READ THIS OPERATORS MANUAL CAREFULLY

It contains important safety information, instructions, and necessary operating procedures. The continual observance of these procedures will help increase your production and extend the life of the equipment.



SAFETY INSTRUCTIONS

LEARN TO RECOGNIZE SAFETY INFORMATION

This is the safety alert symbol. When you see this symbol on your machine or in this manual, **BE ALERT TO THE POTENTIAL FOR PERSONAL INJURY!**

Follow recommended precautions and safe operating practices.

UNDERSTAND SIGNAL WORDS

A signal word – **DANGER**, **WARNING**, or **CAUTION** is used with the safety alert symbol. **DANGER** identifies a hazard or unsafe practice that will result in severe **Injury or Death.**

Safety signs with signal word **DANGER** or **WARNING** are typically near specific hazards.

General precautions are listed on **CAUTION** safety signs. **CAUTION** also calls attention to safety messages in this manual.



DANGER



WARNING



CAUTION

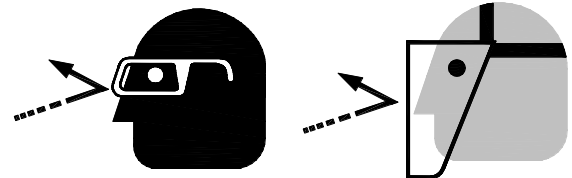


SAVE THESE INSTRUCTIONS.
Refer to them often and use them to instruct others.



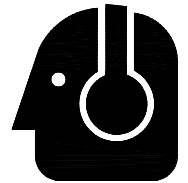
PROTECT EYES

Wear safety glasses or suitable eye protection when working on or around machinery.



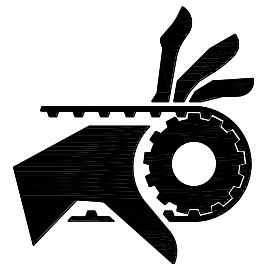
PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear suitable hearing protective devices such as ear muffs or earplugs to protect against objectionable or uncomfortable loud noises.



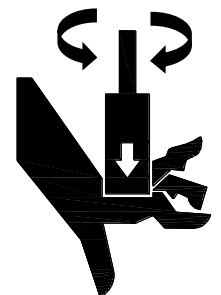
BEWARE OF PINCH POINTS

Keep hands and fingers away from the servo motors drive belt and pulleys during operation. Keep motor guards in place at all times while the machine is running.



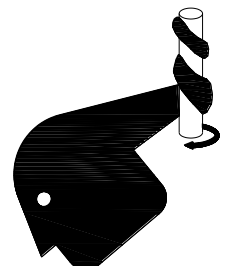
BEWARE OF PIERCING POINTS

NEVER place Keep hands, fingers, or any part of your body away from rotating tooling bit.



ENTANGLEMENT HAZARD – ROTATING SPINDLE

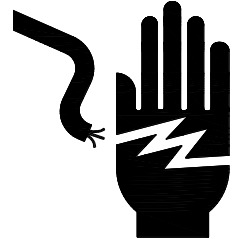
Contain long hair, **DO NOT** wear jewelry or loose fitting clothing.





HIGH VOLTAGE

USE CAUTION IN HIGH VOLTAGE AREAS. DO NOT assume the power to be off.
FOLLOW PROPER LOCKOUT PROCEDURES.



EMERGENCY STOP BUTTON

In the event of incorrect operation or dangerous conditions, the machine can be stopped immediately by pressing the **E-STOP** button. Twist the emergency stop button clockwise (cw) to reset. Note: Resetting the E-Stop will not start the machine.



SAFETY PRECAUTIONS



Metal working can be dangerous if safe and proper operating procedures are not followed. As with all machinery, there are certain hazards involved with the operation of the product. Using the machine with respect and caution will considerably lessen the possibility of personal injury. However, if normal safety precautions are overlooked or ignored, personal injury to the operator may result.

Safety equipment such as guards, hold-downs, safety glasses, dust masks and hearing protection can reduce your potential for injury. But even the best guard won't make up for poor judgment, carelessness or inattention. **Always use common sense** and exercise **caution** in the workshop. If a procedure feels dangerous, don't try it.

REMEMBER: Your personal safety is your responsibility.



WARNING: FAILURE TO FOLLOW THESE RULES MAY RESULT IN SERIOUS PERSONAL INJURY

Dear Valued Customer:

- All Baileigh machines should be used only for their intended use.
- Baileigh does not recommend or endorse making any modifications or alterations to a Baileigh machine. Modifications or alterations to a machine may pose a substantial risk of injury to the operator or others and may do substantial damage to the machine.
- Any modifications or alterations to a Baileigh machine will invalidate the machine's warranty.



PLEASE ENJOY YOUR BAILEIGH MACHINE!PLEASE ENJOY IT SAFELY!

1. **FOR YOUR OWN SAFETY, READ INSTRUCTION MANUAL BEFORE OPERATING THE MACHINE.** Learn the machine's application and limitations as well as the specific hazards.
2. **Only trained and qualified personnel can operate this machine.**
3. **Make sure guards are in place and in proper working order before operating machinery.**
4. **Remove any adjusting tools.** Before operating the machine, make sure any adjusting tools have been removed.
5. **Keep work area clean.** Cluttered areas invite injuries.
6. **Overloading machine.** By overloading the machine you may cause injury from flying parts. **DO NOT** exceed the specified machine capacities.
7. **Dressing material edges.** Always chamfer and deburr all sharp edges.
8. **Do not force tool.** Your machine will do a better and safer job if used as intended. **DO NOT** use inappropriate attachments in an attempt to exceed the machines rated capacity.
9. **Use the right tool for the job. DO NOT** attempt to force a small tool or attachment to do the work of a large industrial tool. **DO NOT** use a tool for a purpose for which it was not intended.
10. **Turn off** main power to the machine and wait for the cutting tool to stop turning before removing debris, removing or securing the piece part, or changing the position of the work table.
11. **Never** expose your hands or limbs to the cutting area while the machine is operating.
12. **Make Sure** drawbar has been tightened before turning vertical mill on.
13. **Never** leave the machine running while unattended. Turn the power OFF. Do not leave the machine until the spindle comes to a complete stop.
14. **Hold** the piece part firmly against the table. **DO NOT** attempt to mill a piece part that does not have a flat surface against the table, or that is not secured by a vise. Prevent the piece part from rotating by clamping it to the table or by securing it against the column of the mill.
15. **Never** start the machine before clearing the table of all objects (tools, scrap pieces, etc.)
16. **Machines can eject** piece parts towards the operator. Know and avoid the conditions which cause the piece part to kickback.
17. **Do not stop** the spindle using your hand. Allow the spindle to stop on its own, or in the case of an emergency, use the spindle brake.
18. **Disconnect power** and make sure all moving parts have come to a complete stop before changing cutting tools, starting any inspection, adjustment, or maintenance procedure.
19. **Properly secure** the cutting tool in the spindle before operating the machine.



20. **Do not remove** any safety equipment, such as safety covers, emergency stop buttons, safety mats, railings, light booms, ramps, and warning signs.
21. **Make sure** electrical cables are well protected from damage. Check insulation periodically for wear.
22. **Dress appropriate. DO NOT** wear loose fitting garments, jewelry, neckties, or gloves which may get caught in moving machine parts. Protective clothing and steel toe shoes are recommended when using machinery. Wear a restrictive hair covering to contain long hair.
23. **Use eye and ear protection.** Always wear ISO approved impact safety goggles. Wear a full-face shield if you are producing metal filings.
24. **Stay alert.** Watch what you are doing and use common sense. **DO NOT** operate any tool or machine when you are tired.
25. **Check for damaged parts.** Before using any tool or machine, carefully check any part that appears damaged. Check for alignment and binding of moving parts that may affect proper machine operation.
26. **Do not overreach.** Maintain proper footing and balance at all times. **DO NOT** reach over or across a running machine. **Make sure** it is possible to move freely around the machine and associated equipment. The floor should be kept clean and dry, and the surrounding area well illuminated, so that work can be performed safely.
27. **Observe work area conditions. DO NOT** use machines or power tools in damp or wet locations. Do not expose to rain. **DO NOT** use electrically powered tools in the presence of flammable gases or liquids.
28. **Keep children away.** Children must never be allowed in the work area. **DO NOT** let them handle machines, tools, or extension cords.
29. **Store idle equipment.** When not in use, tools must be stored in a dry location to inhibit rust. Always lock up tools and keep them out of reach of children.
30. **DO NOT operate machine if under the influence of alcohol or drugs.** Read warning labels on prescriptions. If there is any doubt, **DO NOT** operate the machine.
31. **Turn off** power before checking, cleaning, or replacing any parts.
32. Be sure **all** equipment is properly installed and grounded according to national, state, and local codes.
33. Keep **all** cords dry, free from grease and oil, and protected from sparks and hot metal.
34. Inspect power and control cables periodically. Replace if damaged or bare wires are exposed. **Bare wiring can kill!** **DO NOT** touch live electrical components or parts.
35. **DO NOT** bypass or defeat any safety interlock systems.
36. Keep visitors a safe distance from the work area.



TECHNICAL SPECIFICATIONS

Table Size	42" x 9" (1067 x 230mm)
T Slots	3 @ .625" x .125" x 2.5" (16 x 3 x 64mm)
Travel Manual X Axis	30" (762mm)
Travel Manual Y Axis	12" (305mm)
Travel Manual Z Axis	16" (406mm)
Travel Auto X Axis	28.5" (724mm)
Travel Auto Y Axis	12" (305mm)
Travel Auto Z Axis	16" (406mm)
Table Load Capacity	770 lbs. (350kg)
Spindle Speed Range	60 to 4200 RPM
Spindle Travel	5" (127mm)
Spindle Center To Column Min Max	0 – 12" (0 – 305m)
Spindle Nose To Table Min Max	0 – 16" (0 – 406mm)
Spindle Diameter	3.37" (85.6mm)
Spindle Taper	NST 40
Spindle Feed Per Rev	.0015"/.003"/.006" (.04/.08/.15mm)
Spindle Head Swivel	45° (F&R) 90° (R&L)
Cross Travel Of Ram	12" (305mm)
Power	220V / 1-phase
Motor Spindle	3hp
Motor Coolant	1/8hp
Shipping Weight	2,200 lbs.
Shipping Dimensions	60" x 60" x 83"

TECHNICAL SUPPORT

Our technical support department can be reached at 920.684.4990, and asking for the support desk for purchased machines. Tech Support handles questions on machine setup, schematics, warranty issues, and individual parts needs: (other than die sets and blades).

For specific application needs or future machine purchases contact the Sales Department at: sales@baileigh.com, Phone: 920.684.4990, or Fax: 920.684.3944.



Note: The photos and illustrations used in this manual are representative only and may not depict the actual color, labeling or accessories and may be intended to illustrate technique only.

Note: The specifications and dimensions presented here are subject to change without prior notice due to improvements of our products.



UNPACKING AND CHECKING CONTENTS

Your Baileigh machine is shipped complete. Separate all parts from the packing material and check each item carefully. Make certain all items are accounted for before discarding any packing material.



WARNING: SUFFOCATION HAZARD! Immediately discard any plastic bags and packing materials to eliminate choking and suffocation hazards to children and animals.

If any parts are missing, **DO NOT** place the machine into service until the missing parts are obtained and installed correctly.

Cleaning



WARNING: DO NOT USE gasoline or other petroleum products to clean the machine. They have low flash points and can explode or cause fire.



CAUTION: When using cleaning solvents work in a well-ventilated area. Many cleaning solvents are toxic if inhaled.

Your machine may be shipped with a rustproof waxy coating and/or grease on the exposed unpainted metal surfaces. Fully and completely remove this protective coating using a degreaser or solvent cleaner. Moving items will need to be moved along their travel path to allow for cleaning the entire surface. For a more thorough cleaning, some parts will occasionally have to be removed. **DO NOT USE** acetone or brake cleaner as they may damage painted surfaces.

Follow manufacturer's label instructions when using any type of cleaning product. After cleaning, wipe unpainted metal surfaces with a light coating of quality oil or grease for protection.



Important: This waxy coating is **NOT** a lubricant and will cause the machine to stick and lose performance as the coating continues to dry.





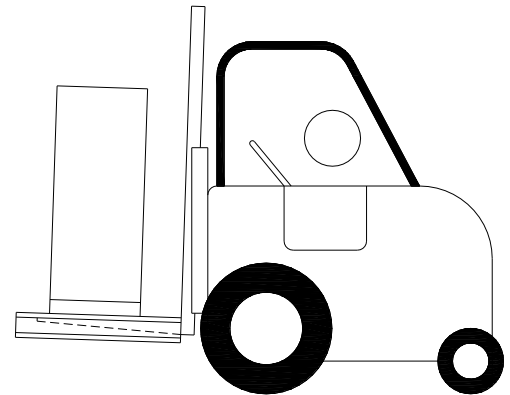
TRANSPORTING AND LIFTING



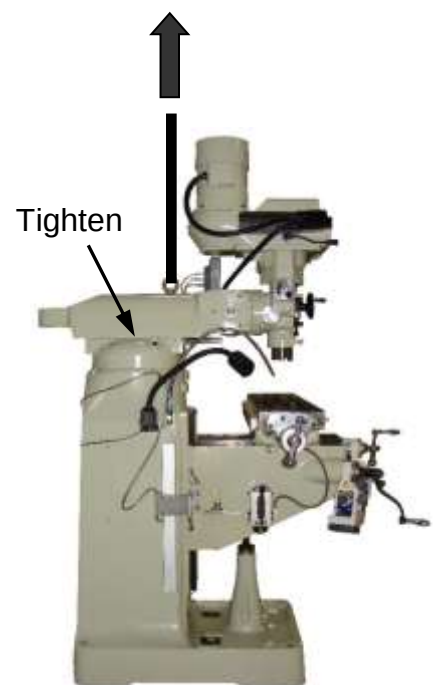
CAUTION: Lifting and carrying operations should be carried out by skilled workers, such as a truck operator, crane operator, etc. If a crane is used to lift the machine, attach the lifting chain carefully, making sure the machine is well balanced. Choose a location that will keep the machine free from vibration and dust from other machinery. Keep in mind that having a large clearance area around the machine is important for safe and efficient working conditions.

Follow these guidelines when lifting:

- The lift truck must be able to lift at least 1.5 – 2 times the machines gross weight.
- Make sure the machine is balanced. While transporting, avoid rough or jerky motion, and maintain a safe clearance zone around the transport area.
- Use a fork lift with sufficient lifting capacity and forks that are long enough to reach the complete width of the machine.
- Remove the securing bolts that attach the machine to the pallet.
- Approaching the machine from the side, lift the machine on the frame taking care that there are no cables or pipes in the area of the forks.
- Move the machine to the required position and lower gently to the floor.
- Level the machine so that all the supporting feet are taking the weight of the machine and no rocking is taking place.
- Always lift and carry the machine with the lifting holes provided at the top of the machine.
- Use lift equipment such as straps, chains, capable of lifting 1.5 to 2 times the weight of the machine.
- Take proper precautions for handling and lifting.
- Tighten ram locking bolts. Tighten (4) bolts that hold the ram to the column to 47 ft. lbs. of torque.



2200 lbs.





- Check if the load is properly balanced by lifting it an inch or two.
- Lift the machine, avoiding sudden accelerations or quick changes of direction.
- Locate the machine where it is to be installed, and lower slowly until it touches the floor.

INSTALLATION

IMPORTANT:

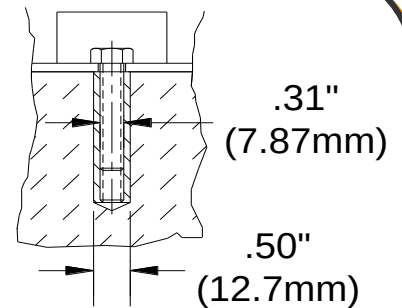
Consider the following when looking for a suitable location to place the machine:

- Overall weight of the machine.
- Weight of material being processed.
- Sizes of material to be processed through the machine.
- Space needed for auxiliary stands, work tables, or other machinery.
- Clearance from walls and other obstacles.
- Maintain an adequate working area around the machine for safety.
- Have the work area well illuminated with proper lighting.
- Keep the floor free of oil and make sure it is not slippery.
- Remove scrap and waste materials regularly, and make sure the work area is free from obstructing objects.
- If long lengths of material are to be fed into the machine, make sure that they will not extend into any aisles.
- **LEVELING:** The machine should be sited on a level, concrete floor. Provisions for securing it should be in position prior to placing the machine. The accuracy of any machine depends on the precise placement of it to the mounting surface.
- **FLOOR:** This tool distributes a large amount of weight over a small area. Make certain that the floor is capable of supporting the weight of the machine, work stock, and the operator. The floor should also be a level surface. If the unit wobbles or rocks once in place, be sure to eliminate by using shims.
- **WORKING CLEARANCES:** Take into consideration the size of the material to be processed. Make sure that you allow enough space for you to operate the machine freely.
- **POWER SUPPLY PLACEMENT:** The power supply should be located close enough to the machine so that the power cord is not in an area where it would cause a tripping hazard. Be sure to observe all electrical codes if installing new circuits and/or outlets.

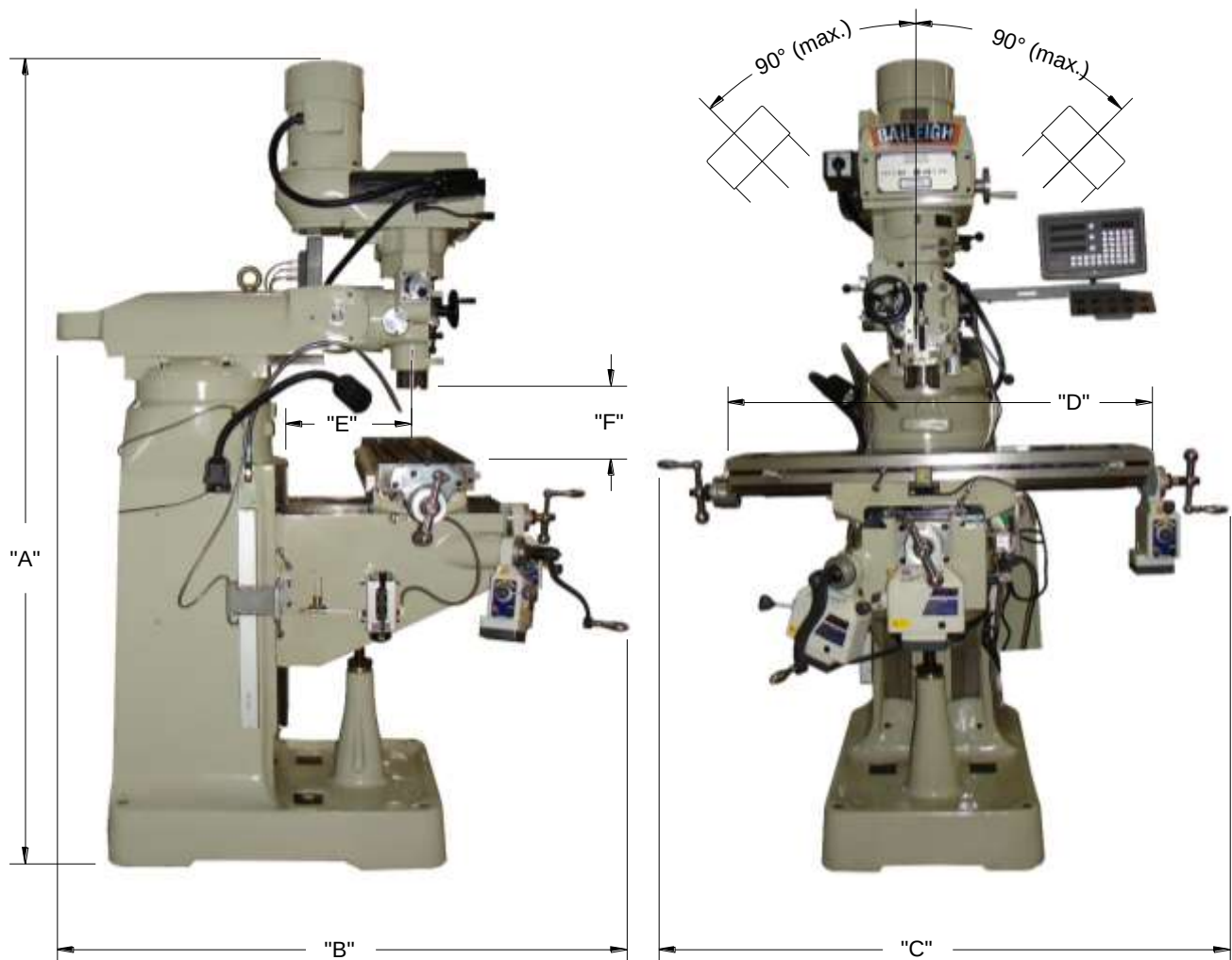


Anchoring the Machine

- Once positioned, anchor the machine to the floor, as shown in the diagram. Use bolts and expansion plugs or sunken tie rods that connect through and are sized for the holes in the base of the stand.
- This machine requires a solid floor such as concrete at a minimum of 4" (102mm) thick. 6" (153mm) minimum is preferred.



OVERALL DIMENSIONS





A	83.00" (2108mm)
B	63.00" (1600mm)
C	57.00" (1448mm)
D	0 – 16.00" (0 – 406mm) (X) axis
E	0 – 12.00" (0 – 305mm) (Y) axis
F	0 – 28.50" (0 – 724mm) (Z) axis

Contents of Tool Box

Machine Components

- A – (1) Manual feed wheel
- B – (1) Feed wheel handle
- C – (1) Feed reversing knob
- D – (1) Quill feed handle
- E – (1) Elevating crank – "Z" axis
- F – (4) Ball crank handles
- G – (1) Eye bolt



Tools

- H – (1) Box wrench 19mm, 21mm
- I – (1) Flat head screw driver 150x6mm
- J – (1) Phillips head screw driver 150x8mm
- K – (1 set) Metric allen wrenches



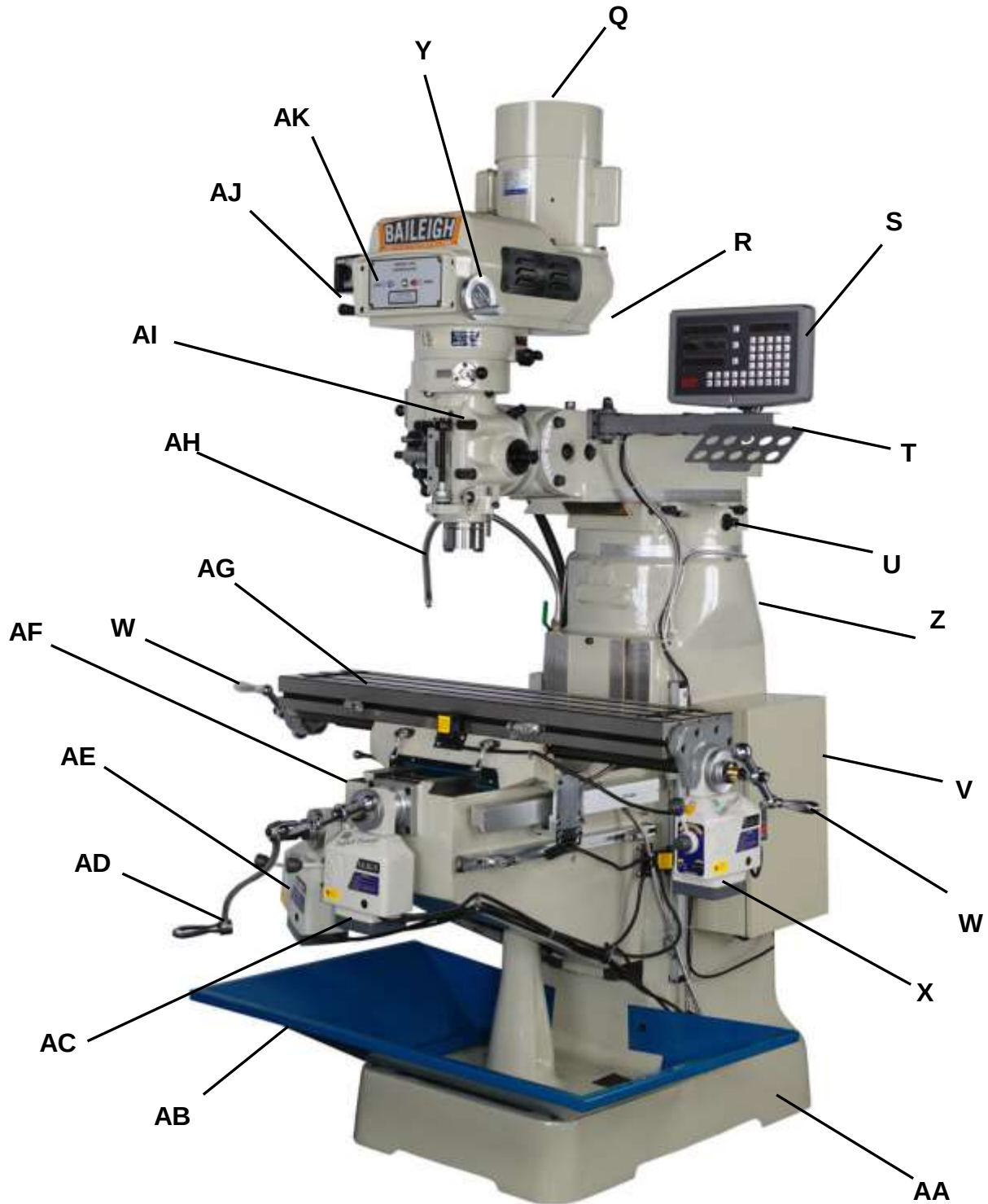
Items Packaged Separately

- L – (1) Drip tray
- M – (1) Coolant hose w/clamps
- N – (1) Way cover (sheet) w/screws
- O – (1) Draw bar (12 x 1.75tpi) w/threaded adapter (10 x 11 tpi)
- P – (1) Way cover (pleated) w/screws





GETTING TO KNOW YOUR MACHINE





Q	Drive Motor	Provides power to the spindle
R`	Drive Belt Housing	Houses the belt, variable pulley,
S	Digital Display Meter	Positioning functions for machine tool processing
T	Tool Holder	Used to display a selection of often used tools
U	Ram Crankshaft	Turn crankshaft to extend or retract ram
V	Electrical Enclosure	Houses electrical components and wire terminal strips
W	"X" Axis (Manual)	Turning the handle controls the tables left-right "X" axis
X	"X" Axis (Power Feed)	Power feed motor drives the tables left-right "X" axis
Y	Speed Change Handwheel	Turning the wheel changes the spindle speed
Z	Column	Support for the milling machine head
AA	Machine Base	Supports milling machine and houses coolant tank
AB	Chip And Drip Tray	Collects chips and coolant which goes bank to tank
AC	"Y" Axis (Power Feed)	Power feed motor drives the tables Fwd-Back "Y" axis
AD	"Z" Axis (Manual)	Turning the handle raises and lowers the knee "Z" axis
AE	"Z" Axis (Power Feed)	Power feed motor drives the knee Up-Down "Z" axis
AF	"Y" Axis (Manual)	Turning the handle controls the tables Fwd-Back "Y" axis
AG	Table	Hold the piece part for machining
AH	Flexible Coolant Hose	Directs the flow of coolant to the piece part
AI	Power Feed Engage - Disengage	Rotate and engage handle to use power feed
AJ	Fwd - Stop - Rev Switch	3 position switch to control rotation of spindle
AK	High - Low Speed Indicator	Shows speed set with the speed change handwheel



Power Table Feed for X, Y, & Z axis

A parts list, parts breakdown, and electrical schematic of the AL-500S power feed is at the back of this manual.

⚠ IMPORTANT: *It will damage the power feed gear if you suddenly change direction with the control handle, while the machine is under high speed operation. If you intend to change direction, push the handle to the "OFF" position. Wait until the machine has completely stopped and then push the handle in the intended direction.*



Operator Interface

Shown below are the front and rear views of the 3-axis DRO (Digital Readout). The front has a touch pad for operator input and display areas for that information. The rear of the unit has an ON-OFF switch, power cable connector, ground connector, and input connectors for the "X", "Y", and "Z" axis.



One Shot Oiler

The lines running from the oiler pump supply oil to the ways of the table, saddle, and column (knee). (See the lubrication and maintenance section)





Quill Feed Selector

This crank is used to select the feed rate of the quill. It is shifted to different positions by pulling out the knob and turning from one position to another. The feed rates are stamped on the cover below each hole. They are .003, .0015, and .006 inch / rev. The feed changes are more readily engaged with the spindle running.



Coolant Pump

The selector switch turns the pump ON and OFF. Access to the coolant pump is on the back of the column. Remove the (4) screws to allow removal of the access plate. Vacuum out any loose sand and debris from the coolant reservoir. Fill with coolant and re-attach access plate.

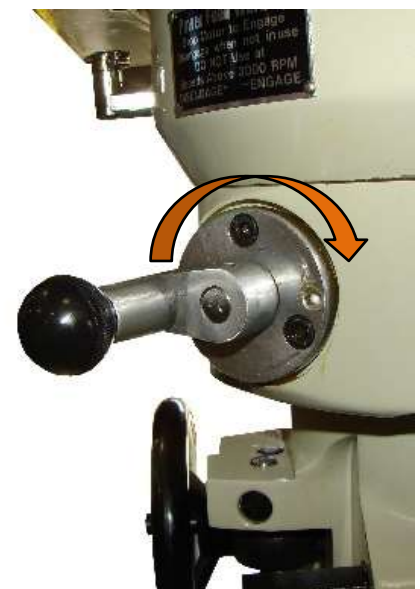


Power Feed Engagement Crank

The power feed crank engages the power feed worm gear when the lever is in the right-hand hole. To disengage, pull the knob out and turn crank in a clockwise (cw) direction and move to opposite position.



Note: The handle must be moved in clockwise (cw) direction to engage or disengage power feed. If handle is moved counterclockwise (ccw), no damage will occur, but nothing will happen.



POWER FEED WARNING
Stop Motor to Engage
Disengage When Not in Use
DO NOT Use at Speeds
Above 3000 RPM
DISENGAGE ← → **ENGAGE**



Note: It is recommended that the power feed worm gear be disengaged whenever the power feed is not required. This will avoid unnecessary wear on power feed worm gear.



Feed Reverse Knob

Position of the feed reverse knob (C) depends upon direction of spindle rotation. If boring with right hand cutting tools, pull feed handle towards operator until the clutch engages. Neutral position is between forward and reverse. It is recommended that the handle be left in neutral position when not in use.



Manual Feed Handwheel

The feed reversing knob should be in neutral position and the feed control lever engaged. Clockwise (cw) rotation of the handwheel (A) moves the quill down. Manual feed handwheel and quill feed handle may be disengaged by pulling them out approximately 1/8".



Note: The feed control lever must be engaged in order to use manual feed controls.

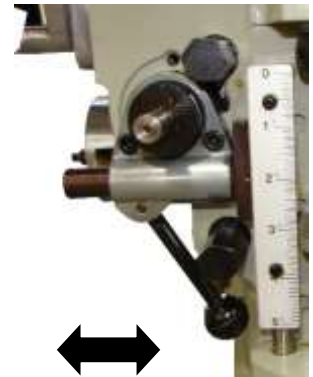


Feed Control Lever

The feed control lever engages the overload clutch on the pinion shaft when moved left. It will stay engaged until either the quill stop comes in contact with the micrometer adjusting nut, forcing the feed control lever to disengage automatically, or released manually by moving the lever to the right.



Note: The feed control lever is set at the factory to disengage automatically. If it should go out of adjustment turn the socket setscrew located at the bottom of the tripping rod. When adjusting the socket setscrew, check the automatic disengagement in both directions. The quill stop nut should be against the feed trip lever for the down position and against the reverse trip ball lever for the up position.



Quill Feed Handle

The quill feed handle (D), when turned, either raises or lowers the quill. It can be made freewheeling by pulling the handle out, which disengages the drive pin.





Quill Stop Knob

The quill stop knob is used to disengage power feed in either direction. It also acts as a depth stop when working to a given depth.



Micrometer Nut

This nut is used for the setting of depths. Each graduation on the nut indicates .001" of depth. It reads directly to the scale mounted next of it. Depths may be obtained by setting micrometer nut in conjunction with the quill stop.



Quill Lock

The quill lock is used to lock the quill in a stationary up or down position when milling or whenever quill movement is not necessary.



Spindle Brake

The spindle brake handle can be moved up or down to stop the spindle rotation. There are no adjustments on the brake so it must be replaced when worn out.





Forward – Reverse Switch

This is the motor reversing switch. When the head is in direct drive (High Range), the motor and spindle are turning in the same direction. When the head is in “Back Gear” (Low Range), the spindle runs backwards unless the motor direction is reversed. In the stop position the motor will not be running.



HI – Neutral – LO Lever

This lever is used to put the head into either direct drive or backgear. Rotate the spindle to facilitate meshing of clutch or gears. Neutral can be found at the mid-way position and is provided to permit free spindle rotation for indicating and set-up. In high speed (Direct Drive), the spindle is driven by tapered clutch teeth. If the clutch is not meshed tightly, clutch rattle will be heard. This can be corrected by moving the detent plate upwards as the clutch wears. This is also the reason for possible loss of neutral, requiring the reversal of the detent plate.



IMPORTANT: DO NOT shift **HI – LO** lever while motor is running.

Indicator Mounting Rod

Use this rod to mount a dial indicator when leveling the tool head to the table.



Speed Change Handwheel



IMPORTANT: DO NOT attempt to change spindle RPM unless the motor is running.

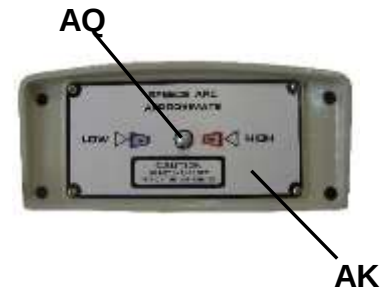
Spindle speeds are adjusted by turning the speed change handwheel (Y) on the right front of the belt housing. There are two speed ranges shown on the indicator (AK). LO – (70 – 500 rpm) and HI – (600 – 4200 rpm).

The Low gears are obtained by using the back gear drive. To engage the back gears, shift lever (AO) to the LO position. **DO NOT FORCE THE LEVER!** If the back gears do not mesh, turn off the power, rotate the spindle nose by hand until the gears line up, and move the lever to LO.



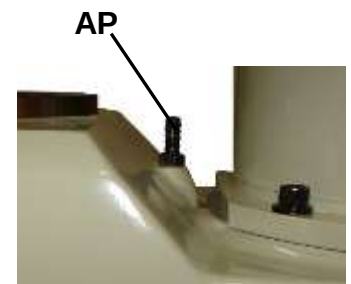


The High gears are obtained by using the direct drive. To engage the direct drive gears, shift lever (AO) to the HI position. **DO NOT FORCE THE LEVER!** If the direct drive gears do not mesh, turn off the power, rotate the spindle nose by hand until the gears line up, and move the lever to HI.



Wear on the vari-drive belt will cause a slight change in the speeds as shown on the indicator (AK). This can be corrected as follows.

1. Crank the speed change handwheel snugly against the high-speed stop. This will be near the 4200 reading on the dial.
2. Use a tachometer to determine the actual spindle speed.
3. Loosen the jam nut, then turn the pivot stud (AP) until the spindle speed registers 4200 on the tachometer.
4. Tighten the jam nut.
5. Now recalibrate the speed dial plate to match the tachometer reading. This is done by loosening the hex nut (AQ) until the spindle speed registers 4200 on the tachometer.
6. Tighten the hex nut (AQ).



Using the Drawbar

The drawbar (O) has an M12x1.75 right hand thread which attaches to the adapter having a 5/8-11 thread. The drawbar should be tightened with normal pressure using the wrench furnished with the machine. To loosen the collet, back off the drawbar, and if the collet does not open, give the top of the drawbar a slight tap. The spindle has a non-sticking taper and the collet should release readily. When tightening or loosening the drawbar, it is necessary to lock the spindle. To do this, use the spindle brake which is located on the left side of the belt housing, either pushing it up, or pulling it down. Make sure the quill is raised all the way.





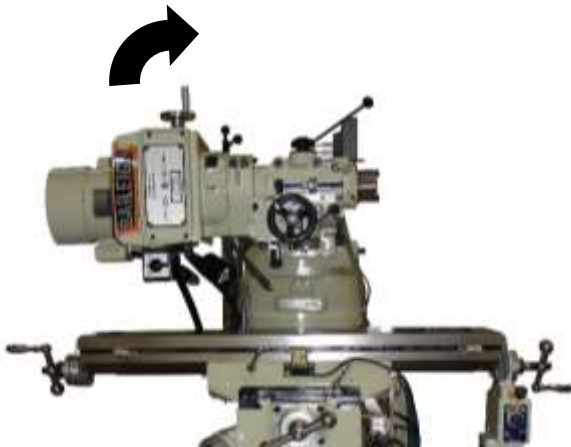
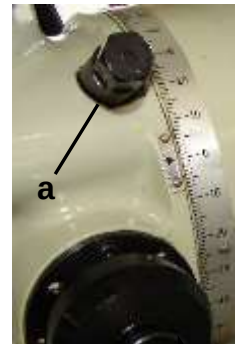
ASSEMBLY AND SET UP



WARNING: For your own safety, DO NOT connect the machine to the power source until the machine is completely assembled and you read and understand the entire instruction manual.

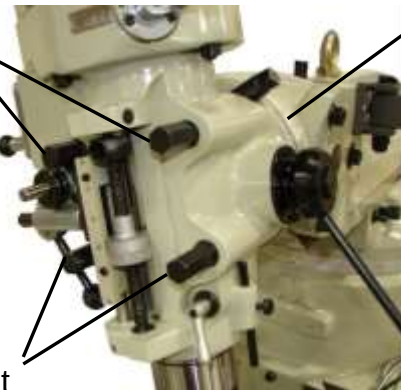
Positioning the Head Upright

1. Loosen (4) locknuts counterclockwise (ccw).
2. To raise the head from a horizontal position, turn crankshaft (a) counterclockwise (ccw). Degrees of rotation can be read on the scale.
3. After setting angle, re-tighten locknuts to 25 ft. lbs. of torque. Overtightening will cause distortion in the quill.



Locknut

Locknut



Feed Reverse Knob

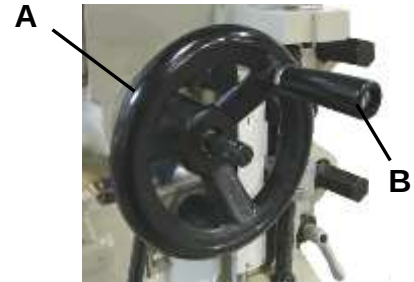
1. Attach the feed reverse knob (C) to the end of the shaft.
2. Use a screwdriver to tighten.





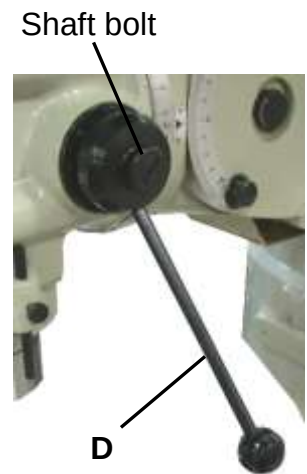
Manual Feed Handwheel

1. Screw the handle (B) onto the handwheel (A).
2. Then slide the handwheel onto the shaft and over the feed reverse knob.
3. To use the handwheel, rotate until the roll pin engages the pilot hole.



Quill Feed Handle

1. Remove the shaft bolt, slide on quill feed handle (D) and re-attach the shaft bolt.
2. By sliding the hub of the handle in or out you can engage or dis-engage the handle.



Elevating Crank

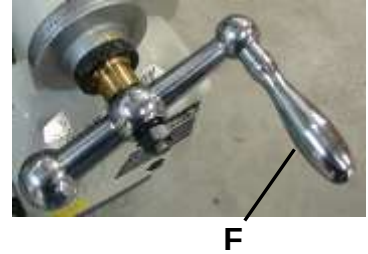
1. Remove the capscrew and washer.
2. Slide the elevating crank handle (E) over the spring and reattach the washer and capscrew.
3. To use the handle, engage the teeth and turn.
4. The spring should always return the handle to a freewheeling state. If not inspect the shaft and bore for smooth operation. Clean and lubricate with a general-purpose oil to help the crank handle move free and easy. Check for scratches or burrs. Remove with a light emery cloth. Verify that the return spring is not broken, replace if it is.





Ball Crank Handles

1. Secure the 4 handles (F) to the 4 cranks as shown.
2. Repeat this for the remaining 3 cranks.



Eye Bolt

If not already installed, secure eye bolt (G) to the tapped hole on top of the ram.

This is the lift point it the mill is to lifted via craning type operation.



Drip Tray

Set drip tray (L) into position on base and secure with (2) capscrews.



Drain Hose Connection

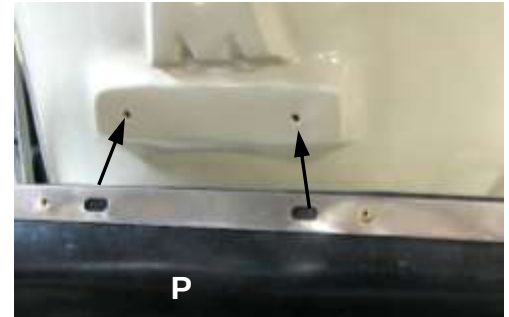
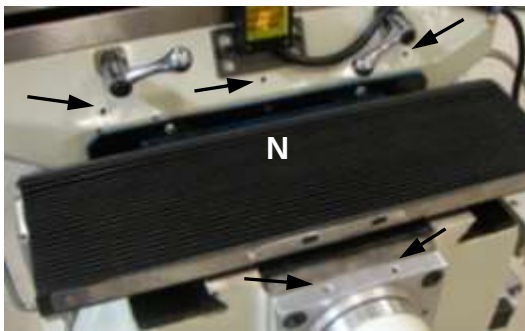
Connect a drain hose (M) to the press-on fitting and secure with a hose clamp. There is a fitting located on each end of the table. Run the other end of the hoses down to the drip tray.





Installing Way Covers

1. Punch holes in way covers to line up with tapped holes in machine.
2. Attach way covers as shown, using the supplied screws through the metal stiffeners.





ELECTRICAL



CAUTION: HAVE ELECTRICAL UTILITIES CONNECTED TO MACHINE BY A CERTIFIED ELECTRICIAN!

Check if the available power supply is the same as listed on the machine nameplate.



WARNING: Make sure the grounding wire (green) is properly connected to avoid electric shock. DO NOT switch the position of the green grounding wire if any electrical plug wires are switched during hookup.

Power Specifications

Your tool is wired for 220 volts, 60Hz alternating current. Before connecting the tool to the power source, make sure the machine is cut off from power source.

Before switching on the power, you must check the voltage and frequency of the power to see if they meet with the requirement, the allowed range for the voltage is $\pm 5\%$, and for the frequency is $\pm 1\%$.

Considerations

- Observe local electrical codes when connecting the machine.
- The circuit should be protected with a time delay fuse or circuit breaker with a amperage rating slightly higher than the full load current of machine.
- A separate electrical circuit should be used for your tools. Before connecting the motor to the power line, make sure the switch is in the "OFF" position and be sure that the electric current is of the same characteristics as indicated on the tool.
- All line connections should make good contact. Running on low voltage will damage the motor.
- In the event of a malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This tool is equipped with an electric cord having an equipment-grounding conductor and a grounding plug. The plug must be plugged into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances.



WARNING: In all cases, make certain the receptacle in question is properly grounded. If you are not sure, have a qualified electrician check the receptacle.



- Improper connection of the equipment-grounding conductor can result in risk of electric shock. The conductor with insulation having an outer surface that is green with or without yellow stripes is the equipment-grounding conductor. If repair or replacement of the electric cord or plug is necessary, do not connect the equipment-grounding conductor to a live terminal.
- Check with a qualified electrician or service personnel if the grounding instructions are not completely understood, or if in doubt as to whether the tool is properly grounded.
- Repair or replace damaged or worn cord immediately.

Extension Cord Safety

Extension cord should be in good condition and meet the minimum wire gauge requirements listed below:

AMP RATING	LENGTH		
	25ft	50ft	100ft
1-12	16	16	14
13-16	14	12	12
17-20	12	12	10
21-30	10	10	No
WIRE GAUGE			

An undersized cord decreases line voltage, causing loss of power and overheating. All cords should use a ground wire and plug pin. Replace any damaged cords immediately.

Power cord connection:

1. Turn the main disconnect switch on the control panel to the OFF position.
2. Unwrap the power cord and route the cord away from the machine toward the power supply.
 - a. Route the power cord so that it will NOT become entangled in the machine in any way.
 - b. Route the cord to the power supply in a way that does NOT create a trip hazard.
3. Connect the power cord to the power supply and check that the power cord has not been damaged during installation.
4. When the machine is clear of any obstruction. The main power switch may be turn ON to test the operation. Turn the switch OFF when the machine is not in operation.
5. Connect the power feeds and the Digital Readout to the plug receptacles at the back of the electrical enclosure. Unwrap the power cord for each item and route the cord to the power receptacle.



- a. Route the power cord so that it will NOT become entangled in the machine in any way.
- b. Route the cord to the power supply in a way that does NOT create a trip hazard.
- c. **CONNECT THE POWER CORD TO THE MATCHING VOLTAGE RECEPTACLE. ONLY THE DRO WILL CONNECT TO THE 220 VOLT RECEPTACLE.**

⚠ IMPORTANT: The lower outlet is wired for **220** Volts. **DO NOT** plug in a 110V piece of equipment or you **WILL PERMANENTLY DAMAGE IT!**



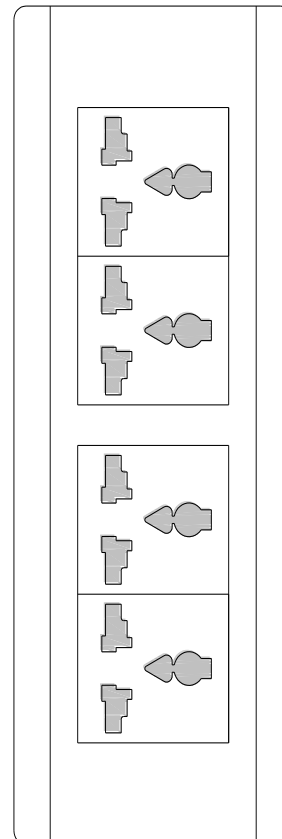
110V →

110V →

110V →

220V →

Use for the digital readout
which uses a variable
voltage of 80~260 Volts.





MACHINE ADJUSTMENTS AND OPERATION

⚠ CAUTION: Always wear proper eye protection with side shields, safety footwear, and leather gloves to protect from burrs and sharp edges.

Travel Stops

Each machine axis has two adjustable travel stops. They determine how much travel is available for each axis. Slide the travel stop in the track and secure with the 12mm hex bolt. When using the "X", "Y", or "Z" axis power feed, the shut-off switch will be actuated when the plunger is contacted with the travel stop. CAUTION: Always be aware of any interference points or cables that may need to be moved.



Electronic Ruler Adjustment

The electronic rulers and pickups have been set-up and adjusted at the factory. No further adjustments should be required.





Head Alignment

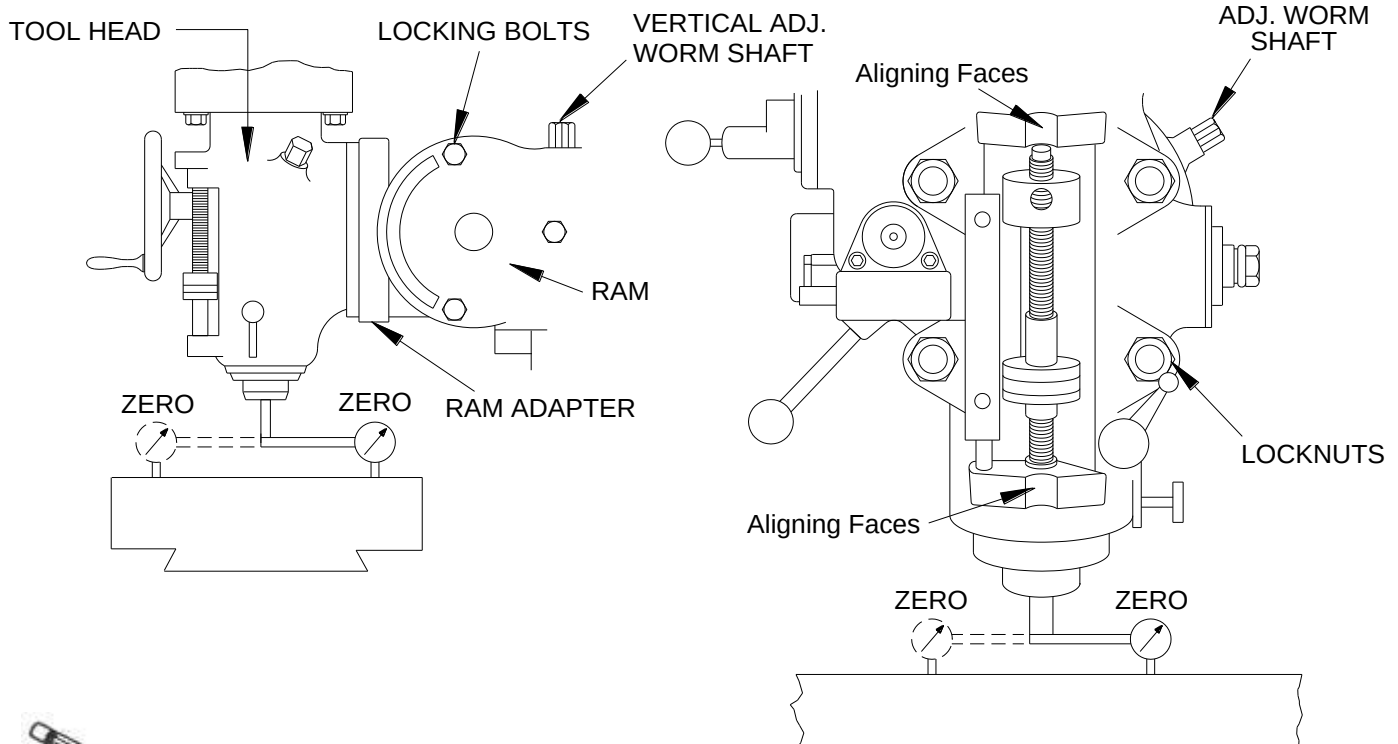
When doing precision work where it is necessary to have the head perfectly square with the table, follow the procedure below:

1. Loosen the (3) locking bolts.
2. Mount a surface indicator as shown in left image.
3. Turn the vertical adjustment wormshaft to raise or lower the tool head until the needle on the indicator shows "0" in both directions.



Note: The table is fitted to be slightly higher in the front, usually about .0005".

4. Re-tighten the locking bolts.
5. Loosen the (4) locknuts but leave some drag on them for fine adjustment.
6. Mount a surface indicator as shown in right image.
7. Turn the adjustment wormshaft to rotate the tool head until the needle on the indicator shows "0" in both directions.
8. Re-tighten the locknuts.



Note: The various gibs on your vertical mill help control the accuracy of the table movements along the ways. Tight gibs allow for more accuracy but harder movement. Loose gibs mean less accuracy but easier movement. Proper gib adjustment removes unnecessary sloppiness without causing the ways to bind.



Adjustment of Table Gib

The table is provided with a full length tapered gib in the saddle and an adjusting screw on the left side as indicated.

1. To tighten the gib, turn adjusting screw clockwise (cw) until a slight drag is felt when moving the table manually.



Adjustment of Saddle Gib

A tapered gib is used for adjusting the saddle bearing on the knee. This forms a guide for the saddle.

1. To tighten the gib, first remove the pleated way cover.
2. Remove the (4) screws holding on the chip wiper guard plate and pull it back.
3. The adjustment can be made through the hole as indicated on the wiper.
4. Turn adjusting screw clockwise (cw) until a slight drag is felt when moving the saddle manually.
5. Replace the chip wiper guard plate and pleated way cover.



Adjustment of Knee Gib

1. Remove the chip wiper.
2. To tighten gib, turn the adjusting screw clockwise (cw) until a slight drag is felt when moving the knee up and down.
3. Replace the chip wiper.





Adjustment of Ram Gib

The column swivel has a long tapered gib and two adjustment screws as shown.

1. First back off the jam nut, and then use a flathead screw driver to make the adjustment.
2. Turn the adjusting screws clockwise (cw) until a slight drag is felt when moving the Ram manually.
3. Hold the screws in position and tighten the jam nut.

Ram gib adjustment screws



Clamping the Saddle, Table, and Knee

When milling with longitudinal table feed only, it is advisable to clamp the knee to the column and the saddle to the knee to add rigidity. This will provide for heavier cuts with a minimum of vibration.

The saddle locking clamp is located on the left-hand side of the saddle. Using moderate clamping pressure will hold the saddle sufficiently. Excessive pressure can cause slight table binding.



The table locking clamps are located on the front of the saddle, and should always be clamped when NOT using longitudinal movement.



The knee locking clamps are on the left side of the knee, alongside the column. The knee clamps should only be used when there is no need to change the elevation of the table.



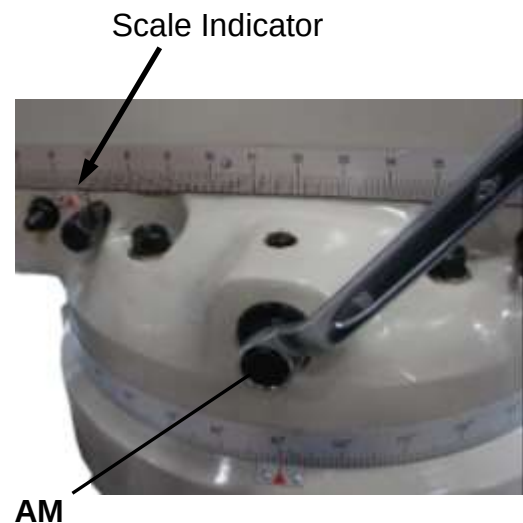
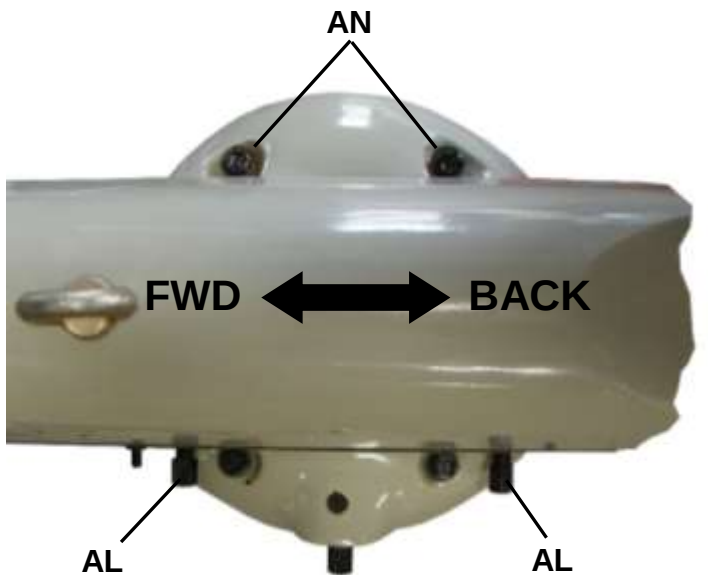


Ram Position

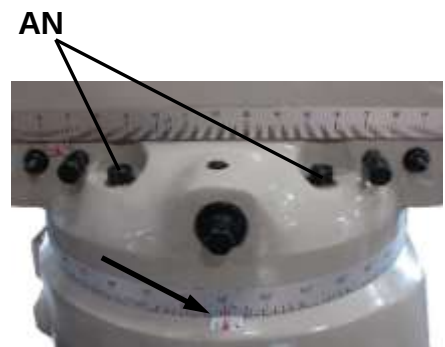
The ram can be moved after loosening the (2) ram lock studs (AL).
Rotating crankshaft (AM) clockwise (cw) will move the ram back. Counterclockwise (ccw) rotation will move the ram forward.
Use the scale indicator to keep track of movement.
LOCK THE RAM SECURELY AFTER MOVING.



Note: It is recommended that on heavy milling work, the head should be kept as close as possible to the column for maximum rigidity.



To rotate the ram, unlock the (4) head bolts (AN). Manually turn the ram to the desired angle as shown on the degree scale indicator. Re-tighten the head bolts.





Motor / Vari-Belt Removal

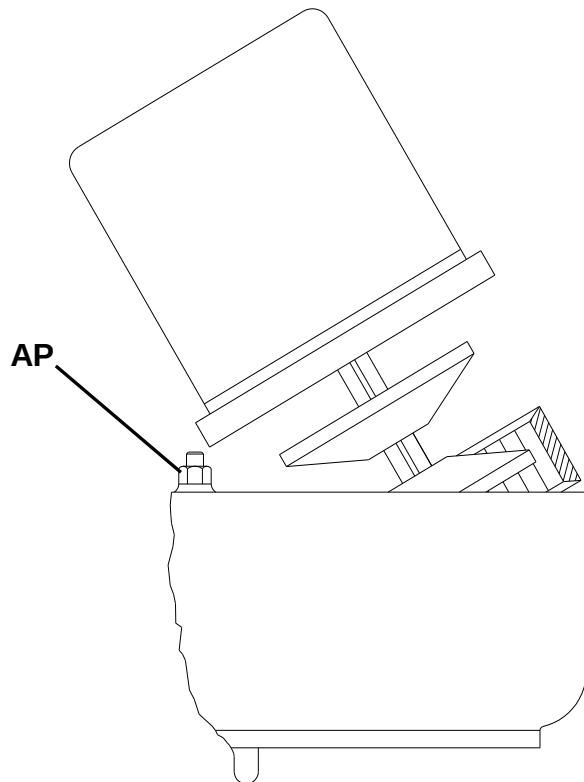
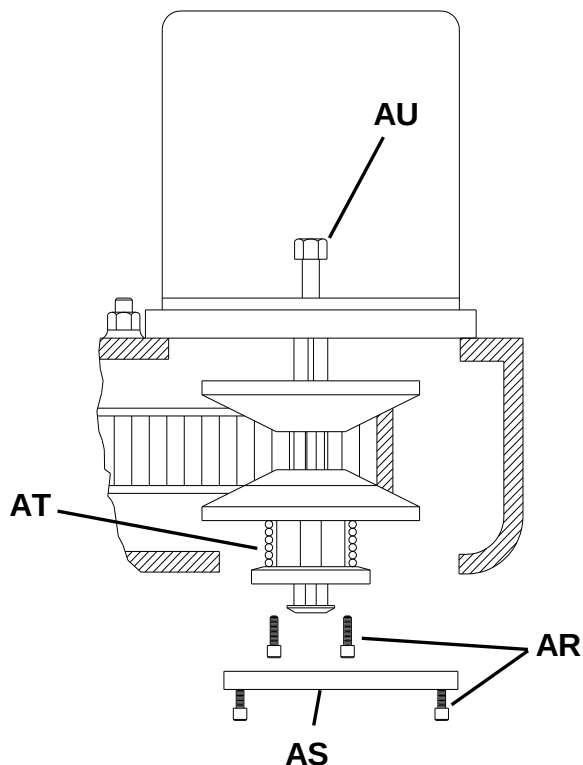
Run the head to the lowest speed of either range and shut off the motor. This puts the Vari-Drive belt and pulley in the best position for disassembly.

1. Disconnect the power to the machine.
2. Remove the FWD./REV. switch from the side of the belt housing.
3. Remove the cover (AS) at the lower end of the motor shaft.
4. Use (2) of the cover screws (AR) just removed and insert them into the bottom of the Vari-Drive pulley. When secure, they will make the pulley, spring, and spring retainer as a single unit.



CAUTION: There is always a potential for personal injury when a heavy spring is under compression.

Removing the Motor (Side View)



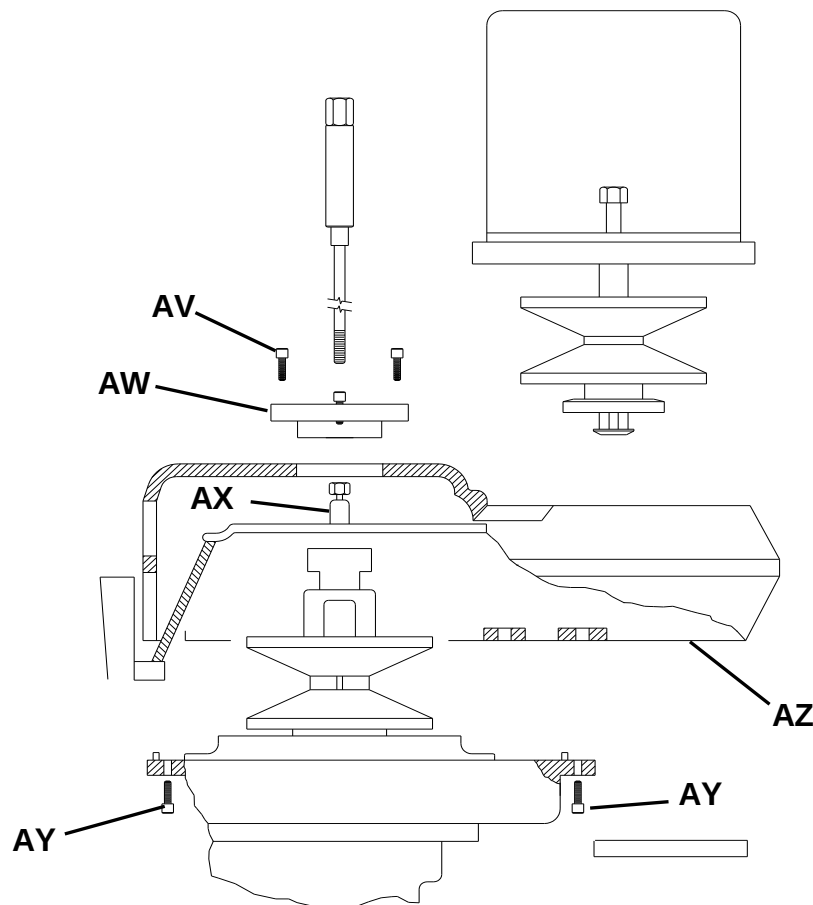
5. Without starting the motor, crank the speed change handwheel to the top speed position.



6. Now remove the (4) socket cap screws (AU) and flat washers that fasten the motor to the belt housing.
7. The motor should be lifted slightly and pulled firmly away from the spindle toward the rear of the belt housing. This will pull the Vari-Drive belt deeply into the spindle pulley, providing the slack needed to slip the belt over the motor pulley.
8. Lift the motor high enough to rest the motor base GENTLY on the adjusting screw (AP) seen directly in front of the motor flange.
9. The belt can now be slipped over the lower pulley and the motor removed from the housing.

Changing the Vari-Drive Belt

10. Complete the previous procedure for removing the motor.
11. Remove the (3) screws (AV) and lift out the top bearing cap (AW).
12. Looking down inside of the housing, locate and remove (2) socket head cap screws and sleeves (AX).
13. Next remove the (6) screws (AY) holding the belt housing (AZ) to the base.
14. Remove the old belt and replace it with a new one. Do Not substitute with another brand as this may cause unwanted vibration and noise.





Removing the Table

To remove the table, you must first remove the ball crank, handles, dial holders, and bearing brackets.

Turn the lead screw all the way out and slide the table from the saddle.

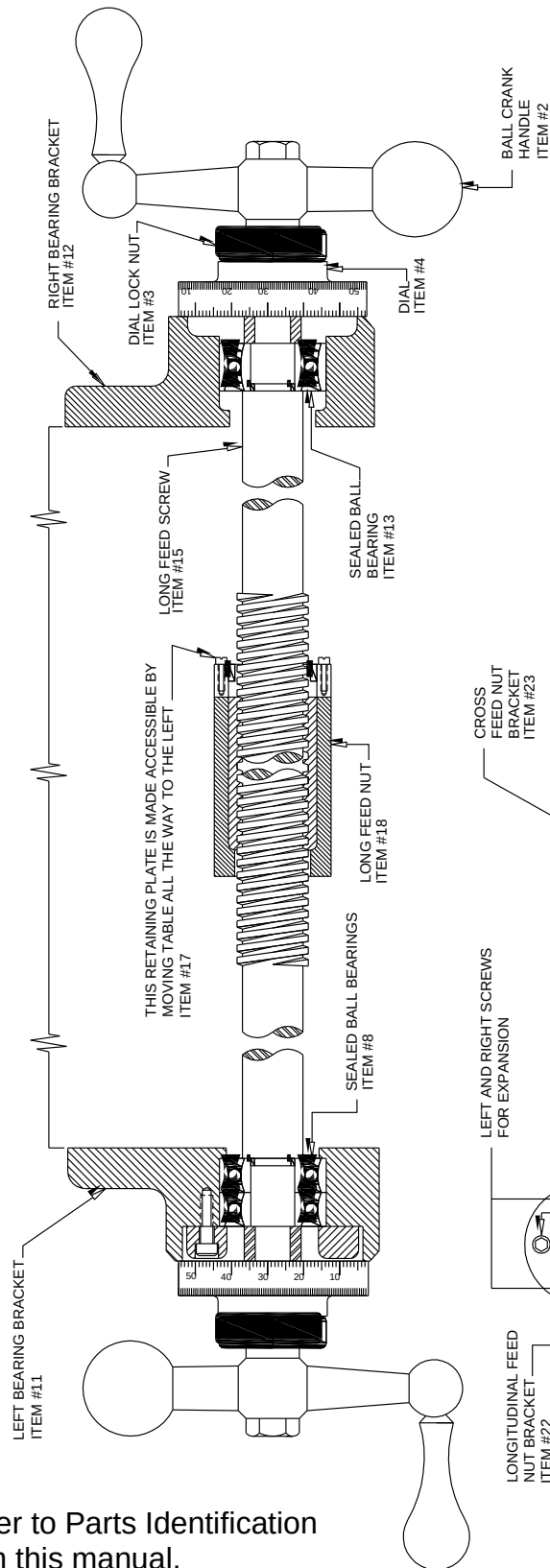
Removing the Saddle

Follow the same procedure as removing the table, however, it is necessary to remove the entire front bracket assembly.

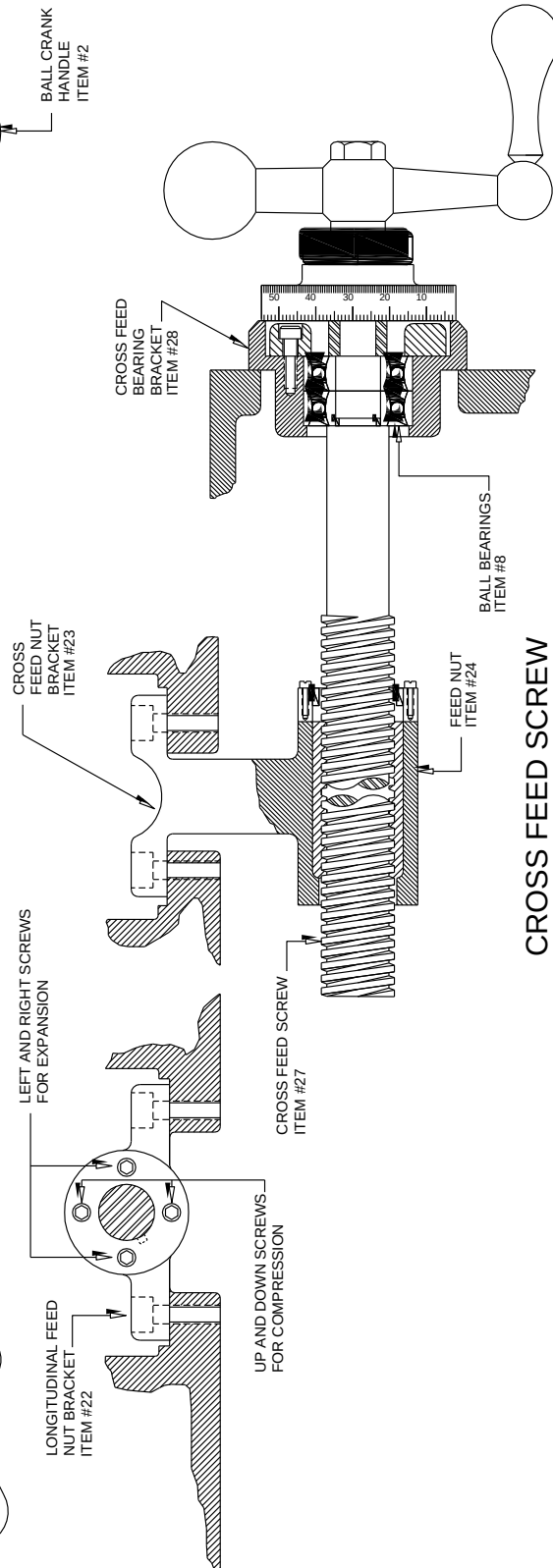
Next remove the cross-feed nut bracket which can only be done by removing the table.



LONGITUDINAL FEED SCREW



CROSS FEED SCREW



Also refer to Parts Identification pages in this manual.



GENERAL SPEED RECOMMENDATIONS

Material to be Cut	Feet Per Minute		
	Rough Cut	Rough and Finish	Light and Finish Cut
Cast Iron - Soft (Under 200 Brinnell)	70	80-90	120
Cast Iron - Med. (200-300 Brinnell)	55	60-70	90
Cast Iron - Hard (Over 200) Brinnell)	40	50-60	70
Steel (Chrome Nickel 40-45 Shore	30	40	50
Steel (Stainless)	60	80	90
Steel (Low Carbon)	80	90	140
Steel (High Carbon)	40	50	70
Bronze (Medium)	90	120	150
Bronze (Hard)	65	90	130
Brass (Hard)	100	150	200
Copper	150	200	300
Duraluminum	400	-----	600
Aluminum	600	-----	1000

TABLE OF CUTTING SPEEDS AND FEEDS

Feet Per Minute	15	20	25	30	40	50	60	70	80	90	100
Diameter Inches	Revolutions Per Minute										
1/16"	917	1222	1528	1833	2445	3056	3667	4278	4889	5500	6112
1/8"	458	611	764	917	1222	1528	1833	2139	2445	2750	3056
3/16"	306	407	509	611	815	1019	1222	1426	1630	1833	2037
1/4"	229	306	382	458	611	764	917	1070	1375	1375	1528
5/16"	183	244	306	367	489	611	733	856	978	1100	1222
3/8"	153	204	255	306	407	509	611	713	815	917	1019
7/16"	131	175	218	262	349	437	524	611	698	786	873
1/2"	115	153	191	229	306	382	458	535	611	688	764
5/8"	91	122	153	183	244	306	367	428	489	550	611
3/4"	76	102	127	153	204	255	306	357	407	458	509
7/8"	65	87	109	131	175	218	262	306	349	393	437
1"	57	76	95	115	153	191	229	267	306	344	382
1 1/8"	50	67	84	102	136	170	204	238	272	306	340
1 1/4"	45	61	76	91	122	153	183	214	244	275	306
1 3/8"	41	55	69	83	111	139	167	194	222	250	278
1 1/2"	38	50	63	76	102	127	153	178	204	229	255
1 5/8"	35	47	58	70	94	118	141	165	188	212	235
1 3/4"	32	43	54	65	87	109	131	153	175	196	218
1 7/8"	30	40	50	61	81	105	122	143	163	183	204
2"	28	38	47	57	76	95	115	134	153	172	199



LUBRICATION AND MAINTENANCE



WARNING: Make sure the electrical disconnect is OFF before working on the machine.

Maintenance should be performed on a regular basis by qualified personnel.

Always follow proper safety precautions when working on or around any machinery.

Daily Maintenance

- Check daily for any unsafe conditions and fix immediately.
- Check that all nuts and bolts are properly tightened.
- Do a general cleaning by removing dust and metal chips from the machine.
- Top off the coolant reservoir. (80% of full tank capacity)
- Clean filter screens located on the machine base.
- Sharpen or replace any worn or damaged tooling.
- Check the sight glass of the one-shot oiler to make sure it is full, and pull once to send lubricant through the lines.
- Lubricate the quill gearing.

Weekly Maintenance

- On a weekly basis clean the machine and the area around it.
- Lubricate threaded components and sliding devices.
- Apply rust inhibitive lubricant to all non-painted surfaces.
- Thoroughly clean the machine including the coolant reservoir.
- Lubricate the vertical bevel gears.
- Lubricate the 3 leadscrews.

Monthly Maintenance

- Check that all screws and bolts are tight and secure.
- Wipe built up grime from the vertical mill with a rag and a mild solvent.
- Check for worn or damaged electrical cables.



Note: When cleaning chips and debris from the machine, use a brush and a shop vacuum. **DO NOT** blow off the machine with compressed air. The force of the compressed air may force chips into critical mechanisms or may inflict injury to yourself or others.



Greasing the Machine

1. Lubricate the bull gear with a #2 grease through the grease fitting shown.



2. Lift the caps of the two quill gearing oil cups shown and lubricate with 5 drops each of an ISO 68 lubricant or equivalent (daily).



Oil Disposal

Used oil products must be disposed of in a proper manner following your local regulations.

Accessing and Cleaning the Coolant System

- Clean the drain screens on the machine base and the drains on the ends of the table.
- Drain and wash out the dirt and debris from the reservoir
- Thoroughly clean the pump and pump inlet
- Re-fill tank with coolant solution.

Oils for Lubricating Coolant

Any 10:1 (water to coolant) solution will work, however we recommend Baileigh B-Cool 20:1 (water to coolant) biodegradable metal cutting fluid. It has excellent cooling and heat transfer characteristics, is non-flammable, and extends tool and machine life. Each gallon of concentrate makes 21 gallons of coolant.

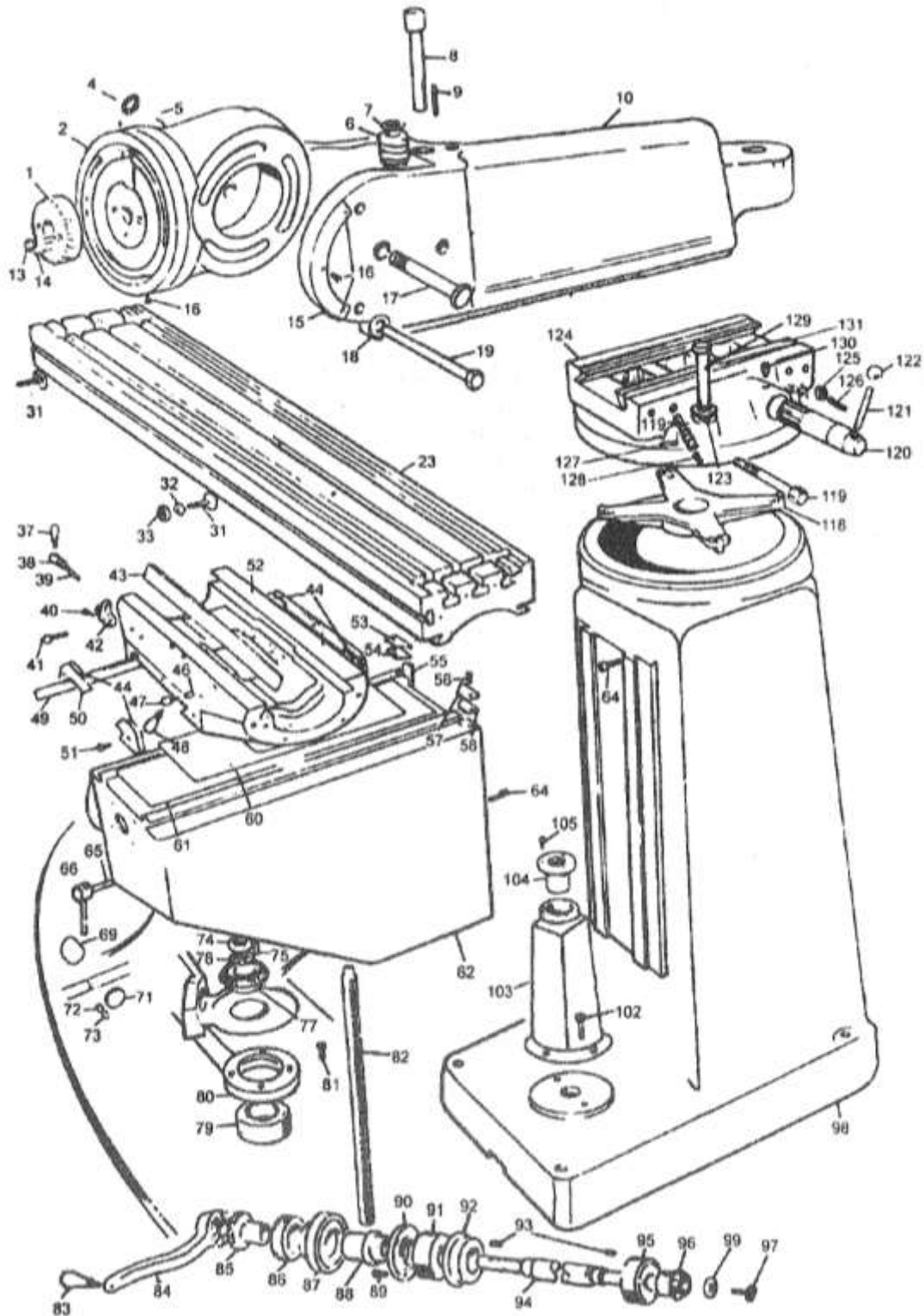
Storing Machine for Extended Period of Time

If this machine is to be inactive for a long period of time, prepare the machine as follows:

- Disconnect the electrical supply from the power panel.
- Empty and clean the coolant reservoir.
- Clean and grease the machine.
- Cover the machine.



PARTS IDENTIFICATION DRAWING A



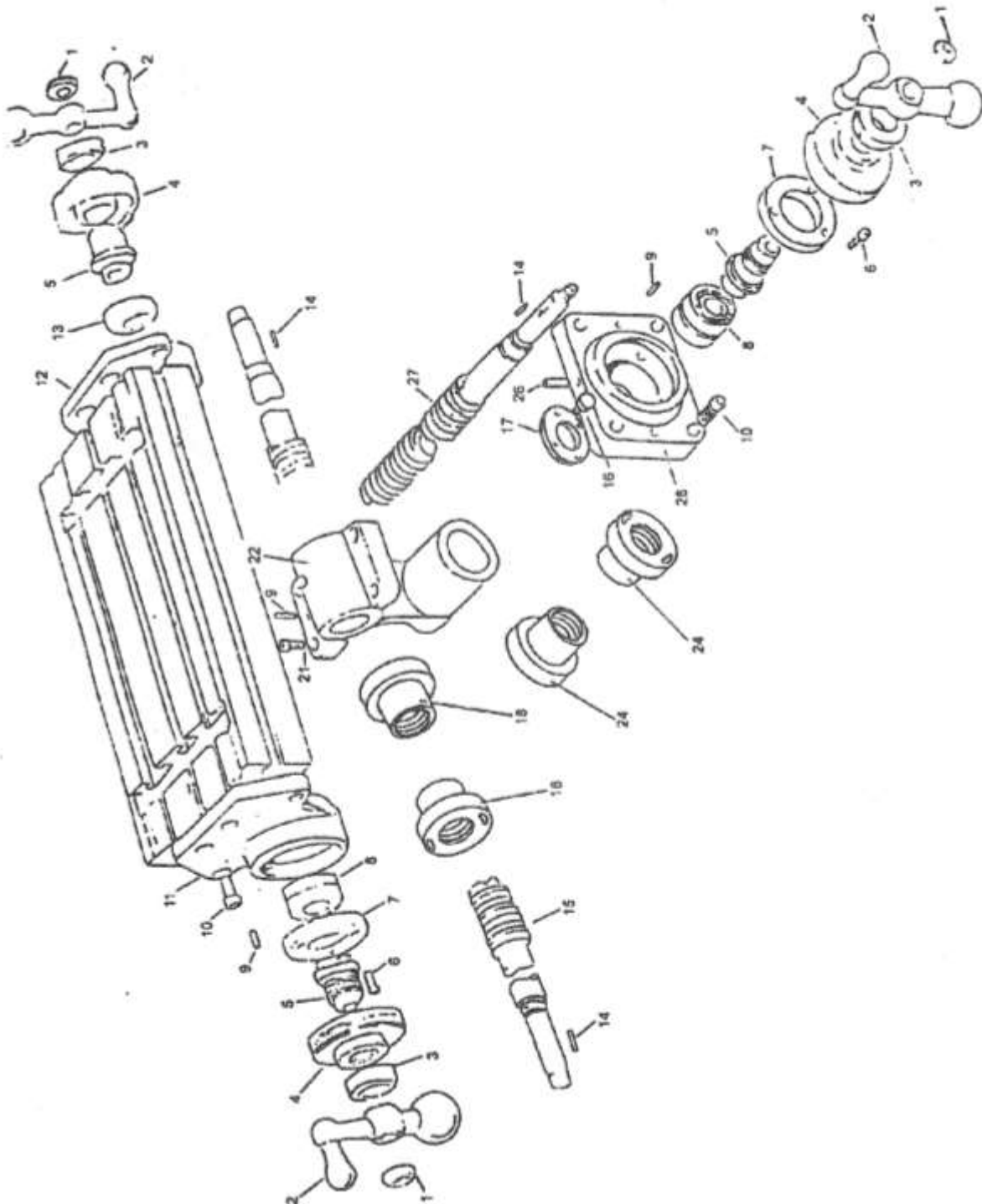


Parts List Sheet A

ITEM No:	PARTS No:	DESCRIPTION	ITEM No:	PARTS No:	DESCRIPTION
1	5033	Quill Housing Adjusting Gear	69	4001-1	Knee Lock Plunger
2	5019	Ram Adapter	71	4045	Knee Binder Plug(Plastic)
4	5027	Nut	72	4049	Dog Point Set Screw
6	5020	Vertical Adjusting Worm	73	4049	Set Screw
7	5022	Worm Thrust Washer(2 Req.)	74	4023	Jam Nut
8	5021	Vertical Adjusting Worm Shaft	75	4020	Key
9	5023	Worm Key	76	4022	Washer
10	5018	Ram	77	4019	Bevel Gear
13	5035	Socket Cap Screw(2 Req.)	79	4040	Sealed Ball Bearing
14	5034	Roll Dowel Pin	80	4039	Bearing Retainer Ring
15	5043	Angle Plate	81	4041	Socket Head Cap Screw
16	5032	Round HD Drive Screw(5 Req.)	82	4021	Elevating Screw Assembly
17	5026	Adapter Pivot Pin	83	4003	Handle
18	5029	Chamfered & Hardened Washer (7 Req.)	84	4002	Elevating Crank
19	5028	Adapter Locking Bolt(3 Req.)	85	4013	Gearshaft Clutch Insert
23	2001	Table 42" or 48"	86	2016	Dial Lock Nut
31	2031	Stop Piece T-Bolt(3 Req.)	87	4010	Dial with 100 Graduations
32	2030	Table Stop Piece(2 Req.)	88	4011	Dial Holder
33	2032	Hex Nut(3 Req.)	89	4009	Socket Head Cap Screw
37	3031	Table Lock Bolt Handle	90	2011	Bearing Retaining Ring
38	3030	Saddle Lock Bolt	91	2008	Grease Sealed Bearing
39	3032	Saddle Lock Plunger	92	4006	Bearing Cap
40	3036	Socket HD Cap Screw(2 Req.)	93	4015	Key
41	3028	Gib Adjusting Screw(3 Req.)	94	4017	Elevating Shaft for 12" Knee
42	3035	Table Stop Bracket	95	2008	Grease Sealed Bearing
43	3026	Saddle/Table Gib	96	4014	Bevel Pinion
44	3037	Felt Wipers(4 Req.)	97	4042	Set Screw
46	3029	Table Lock Plunger	98	1001	Column
47	3030	Table Lock Bolt	99	4017-1	Washer
48	3031	Table Lock Bolt Handle	102	4027	Socket Head Cap Screw
49	3027	Saddle/Knee Gib	103	4026	Pedestal
50	3027-2	Saddle Knee Wiper Plate(4 Req.)	104	4024	Elevating Screw Nut
51	3038	Oval Head Screw(8 Req.)	105	4025	Socket Head Cap Screw
52	3001	Saddle	118	5003	Spider
53	4028-2	Left Hand Column Wiper Holder	119	2010	Ram Lock Stud
54	4028-1	Knee Wiper Felt	120	5012	Ram Pinion
55	4038	Knee/Column Gib	121	5013	Ram Pinion Handle
56	4029	Allen Cap Screw(2 Req.)	122	5014	Plastic Ball
57	4028-3	Right Hand Column Wiper Holder	123	5005	Chamfered Hardened Washer
58	4028	Knee Wiper Felt	124	5001	Turret
60	3040	Chip Guards-Upper	125	5007-1	Gib Screw Nut
61	3039	Chip Guards-Lower	126	5007	Gib Screw
62	4001	Knee 12"	127	5009	Lock Bar
64	1001-1	Stop Screw	128	5009-1	Screw
65	4048	Knee Lock Shaft Assembly	129	5004	Locking Bolt
			130	5015	Ram Pinion Screw
			131	5002	Ram/Turret Gib



PARTS IDENTIFICATION DRAWING B





Parts List Sheet B

ITEM NO:	PARTS NO:	DESCRIPTION
1	2004	Jam Nut(3 Req.)
2	2018	Ball Crank Handle(3 Req.)
3	2016	Dial Lock Nut(3 Req.)
4	2012	Dial with 2000 Graduations(3 Req.)
5	2014	Dial Holder(3 Req.)
6	2036	Socket Cap Screw(6 Req.)
7	2011	Bearing Retainer Ring(2 Req.)
8	2008	Grease Sealed Ball Bearings(2 Req.)
9	2027	Roll Pin(10 Req.)
10	2026	Socket Cap Screw(12 Req.)
11	2006	Left Bearing Bracket
12	2006	Right Bearing Bracket
13	2008	Grease Seal Ball Bearing
14	2003	Key(3 Req.)
15	2002	Longitudinal Feed Screw 42" - 49" - 50"
16	3021	Socket Cap Screw(8 Req.)
17	3019	Cross Feed Nut Retaining Plate(2 Req.)
18	3020	Longitudinal Feed Nut
20	3041	Key(2 Req.)
21	3024	Socket Cap Screw(8 Req.)
22	3023	Longitudinal Feed Nut Bracket
23	3022	Cross Feed Nut Bracket
24	3020	Cross Feed Nut
26	3005-1	Stop Screw
27	3002	Gross Feed Screw for 12" Knee
28	3005	Cross Feed Bearing Bracket





Parts List Sheet C

ITEM NO:	PARTS NO:	DESCRIPTION
1	6141	RD.HD.Screw
2	6140	Bevel Pinion Washer
3	6139	Feed Bevel Pinion
4	6138	Feed Worm Gear Shaft Sleeve
5	6137	Worm Cradle Bushing
6	6123	Setscrew
7	6136	Worm Gear Spacer(4Req.)
8	6134	Feed Drive Worm Gear
9	6133	Feed Drive Worm Gear Shaft
10	6142	Worm Shaft Key
11	6135	Key
12	6150	Locknut
13	6149	Washer
14	6147	Cluster Gear Key
15	6148	Feed Reverse Bevel Gear
16	6122	Feed Engage Pin
17	6121	Worm Gear Cradle
18	6126	Worm Gear Cradle Throw-out
19	6125	Shift Sleeve
20	6169	Gearshift Plunger
21	6170	Compression Spring
22	6128	Roll Pin
23	6168	Shift Crank
24	6131	Black Plastic Ball
25	6132	Cap Screw(3Req.)
27	6157	Cluster Gear Shaft Upper Bearing
28	6153	Cluster Gears Assembly
29	6160	Cluster Gear Key
31	6151	Cluster Gear Shaft
32	6158	Snap Ring
33	6156	Bevel Gear Bearing
34	6159	Bevel Gear Thrust Spacer
36	6143	Feed Driving Gear
37	6145	Key
40	6144	Feed Drive Gear
41	6252	Needle Bearing
42	6227	Bushing
43	6225	Worm
44	6224	Feed Worm Shaft Bushing
47	6223	Feed Worm Shaft Thrust Washer
48	6221	Bushing
49	6220	Feed Reverse Bevel Gear
50	6222	Feed Reverse Clutch
51	6220	Feed Reverse Bevel Gear
52	6221	Bushing
55	6216	Reverse Clutch Rod
56	6217	Roll Pin
57	6209	Feed Worm Shaft
59	6226	Pin
60	6163	Feed Shift Rod

ITEM NO:	PARTS NO:	DESCRIPTION
63	6162	Feed Gear Shift Fork
64	6166	Cluster Gear Shift Crank
66	6161	Cluster Gear Cover
67	6165	Cap Screw(4Req.)
68	6169	Gear Shift Plunger
69	6170	Compression Spring
70	6168	Shift Crank
71	6167	Roll Pin
72	6171	Black Plastic Ball
73	6206	Cap Screw(2Req.)
74	6202	Clutch Ring Pin(2Req.)
75	6200	Clutch Ring
76	6199	Socket Set Screw
77	6199-1	Brass Plug
78	6198	Overload Clutch Locknut
79	6167	Safety Clutch Spring
80	6194	Overload Clutch
81	6195	Overload Clutch Sleeve
83	6189	Round Head Screw(3Req.)
84	6228	Mock-it Lockscrew
85	6228	Socket Set Screw
86	6246	Lockscrew
87	6246-1	Socket Set Screw
88	6191	Compression Spring
89	6193	Overload Clutch Lever Spring Plunger
90	6186	Quill Pinion Shaft Bushing
91	6190	Pinion Shaft Worm Gear Spacer
92	6187	Overload Clutch Worm Gear
93	6188	Overload Clutch Ring
94	6188-1	Snap Ring
95	6236-1	Dowel Pin
96	6203	Overload Clutch Trip Lever
97	6201	Overload Clutch Washer
98	6195-1	Snap Ring
99	6205	Clutch Arm Cover
100	6207	Socket Set Screw
101	6208	Chem Blacked Locknut
103	6239	Cam Rod
104	6234	Trip Handle
105	6233	Black Plastic Ball
106	6231	Feed Trip Bracket
107	6232	Cap Screw(2Req.)
108	6219	Socket Set Screw
109	6229	Key
110	6214	Feed Reverse Knob Stud
111	6213	Reverse Knob
112	6215	Snap Ring
113	6218	Hand wheel Clutch
114	6225	Steel Ball

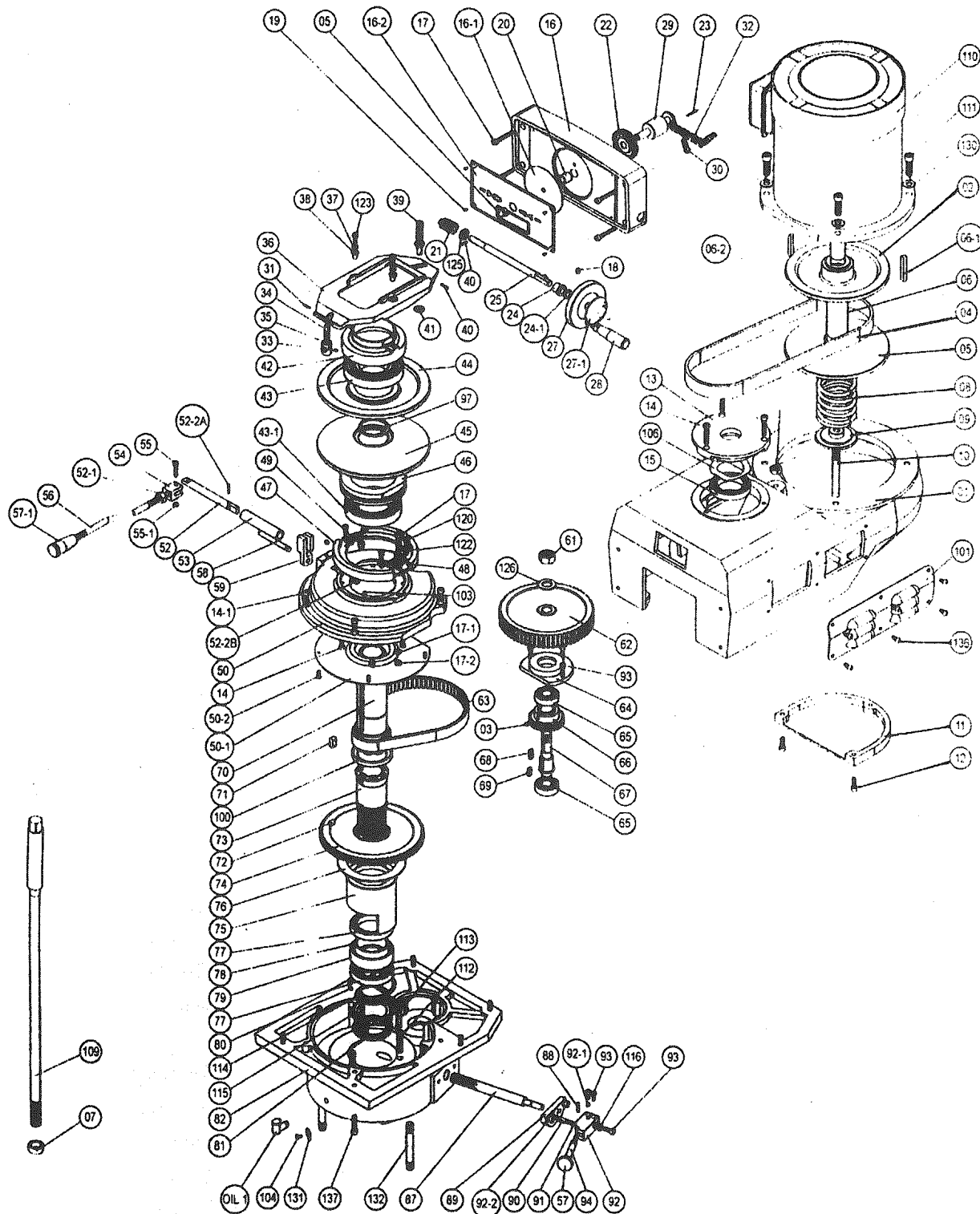


ITEM NO:	PARTS NO:	DESCRIPTION
115	6219-2	Compression Spring
116	6219-1	Handwheel Clutch Spring Screw
117	6237	Roll Pin
118	6236	Cam Rod Sleeve Assy.
119	6241	Roll Pin
120	6242	Compression Spring
121	6240	Trip Plunger
123	6118-1	Trip Plunger Bushing
124	6118	Feed Trip Plunger
125	6210	Handwheel
127	6084	Spindle
128	6086	Quill Skirt
129	6090	Locknut
130	6091	Lockwasher
131	6092	Bearing
132	6094	Sleeve
133	6098	Nose-Piece
134	6097	Spindle Dirt Shield
135	6093	Bearing
136	6095	(Bearing Spacer-Large)
137	6096	(Bearing Spacer-Small)
138	6093	Bearing
139		Screw
140	6253	Special Socket Set Screw
141	6254	Collet Alignment Screw
142	6085	Quill
144	6113	Socket Set Screw
145	6111	Feed Trip Lever
146	6112	Trip Lever Pin
148	6116-1	Quill Lock Sleeve
149	6119	Lock Handle
151	6088	Felt Washer
152	6117	Quill Lock Bolt
153	6116	Quill Lock Sleeve Tapped
155	5036	T-Bolt Assy.
156	6120	Lower Clamping Bolt Spacer (2 Req.)

ITEM NO:	PARTS NO:	DESCRIPTION
157	5038	Locknut
158	6244	Chem Blacked RD. HD. Screws(2 Req.)
159	6243	Micrometer Scale
160	6115	Snap Ring
161	6108	Quill Micro-stop Nut
162	6107	Micrometer Nut
163	6105	Quill Stop Knob
164	6104	Quill Stop Micro-screw
165	6106	Screw
166	6172	Quill Pinion Shaft
168	6185	Screw Pin
169	6180-1	RD. Head Screw(2 Req.)
170	6179	Roll Pin
171	6184	Key
172	6183	Pinion Shaft Hub Screw
173	6176	Steel Ball
174	6175	Compression Spring
175	6178	Rack Feed Handle Hub
176	6182	Pinion Shaft Hub Sleeve
177	6180	Spring Cover
178	6181	Clock Spring(Clock Spring Assy.)
181	6246-1	Socket Set Screw
182	6246	Lockscrew
183	6110	Reverse Trip Ball Lever
184	6109	Feed Reverse Trip Plunger
185	6114	Reverse Trip Ball Lever Screw
186	5039	Worm Gear
187	5041	Key
188	5042	Socket Set Screw
189	5040	Addition Worm Shaft
190	6174	Pinion Shaft Hub Handle
191	6173	Black Plastic Ball Handles
192	6101	Quill Housing



PARTS IDENTIFICATION DRAWING D





Parts List Sheet D

ITEM NO: DESCRIPTION

1	Belt Housing
2	Stationary Motor Varidisc
3	Socket Set Screw
4	Belt
5	Adjustable Motor Varidisc Assembly
6	Bushing
6-2	Key
06-1	Key
7	Snap Ring
8	Spring for Varidisc Motor Shaft
9	Adjustable Varidisc Spring Collar
10	Socket Cap Screw
11	Motor Pulley Cover
12	Socket Cap Screw(2 Req.)
13	Top Bearing Cap
13-1	Waves Washer
14	Socket Cap Screw(3 Req.)
14-1	Socket Cap Screw(3 Req.)
15	Ball Bearing
16	Speed Change Housing
16-1	Vari-Speed Dial
16-2	Face Plate
17	Socket Cap Screw(4 Req.)
17-1	Washer
17-2	Nut
18	Full Dog Socket Set Screw
19	Copper Bushing
20	Bushing
21	Worm Gear
22	Speed Changer Spur Gear
23	Pin
24	Copper Bushing
24-1	Washer
25	Speed Change Shaft
26	Fix Pin
27	Speed Change Handwheel
28	Handle
29	Speed Change Chain Drum
30	Set Screw
31	Pin
32	Chain
33	Chain front Screw
34	Nut
35	Chain end Screw
36	Speed Change Plate
37	Washer(2 Req.)
38	Pivot Sleeve(2 Req.)
39	Speed Change Plate Pivot Stud
40	Cotter Pin

ITEM NO: DESCRIPTION

41	Washer
42	Spindle Pulley Bearing Sliding Housing
43	Ball Bearing
43-1	Ball Bearing
44	Adjustable-Driven Varidisc
45	Stationary Driven Varidisc
46	Brake Bearing Cap
47	Brake Sheo Assembly
48	Brake Sheo Pivot Sleeve
49	Brake Spring(2 Req.)
50	Belt Housing Base
50-1	Gear Cover
50-2	Cap Screw(3 Req.)
51	Set Screw(2 Req.)
52	Brake Lock Bushing
52-2	Spring Pin
53	Brake Lock Shaft
54	Handle fix Block
55	Spring Pin
56	Brake Lock Handle
57	Bakelite Ball Handle
57-1	Plastic Handle
58	Turning Block Shaft
59	Finger Pivot Stud(2 Req.)
60	Set Screw
61	Jam Nut
62	Timing Belt Pulley
63	Belt
64	Bull Gear Pinion Bearing Cap
65	Ball Bearing(2 Req.)
66	Bull Gear Pinion
67	Bull Gear Pinion Counter Shaft
68	Key
69	Key
70	Timing Pulley Clutch
71	Key
72	Key
73	Splined Gear Hub
74	Spindle Bull Gear Assembly
75	Bearing Sleeve
76	Ball Bearing Gear Sleeve Washer
77	Ball Bearing(2 Req.)
78	Bearing Spacer
79	Bearing Spacer
80	Snap Ring
81	Bearing Locknut
82	Gear Housing
83	Fixed Clutch Bracket

**ITEM NO: DESCRIPTION**

84	Spring
85	Studs(3 Req.)
86	Set Screw
87	Clutch Gear Shaft
88	Pin(2 Req.)
89	Hi-Low Detent Plate
90	Hi-Low Detent Punger
91	Spring
92	Hi-Low Pinion Block
92-1	Socket Cap Screw
92-2	Washer
93	Locket Cap Screw(3 Req.)
94	Hi-Low Shift Crank
95	Hex Cap Nut
96	Jam Nut
97	Snap Ring
98	Timing Pulley Clutch Washer
99	Socket Set Screw
100	Timing Pulley Clutch Snap Ring
101	Ventilator(2 Req.)
102	Set Bolt
103	Washer
104	Copper Chip(2 Req.)

ITEM NO: DESCRIPTION

105	Washer
108	Drawbar Washer
109	Drawbar
110	Motor
111	Hex HD Screw(4 Req.)
112	Compression Spring(3 Req.)
113	Adjust Pin(3 Req.)
114	Washer
115	Lock Washer
116	Washer
120	See Screw(4 Req.)
122	Washer(4 Req.)
123	Socket Cap Screw(2 Req.)
125	Worm Gear Washer
126	Washer
129	Socket Cap Screw(6 Req.)
130	Washer(4 Req.)
131	Flat HD Socket Cap Screw(2 Req.)
132	Set Screw(3 Req.)
135	Oblong Key
136	Socket Cap Screw(12 Req.)
137	Socket Cap Screw(6 Req.)





ELECTRICAL ENCLOSURE COMPONENTS





TROUBLESHOOTING

WARNING Disconnect the machine from power source before troubleshooting.

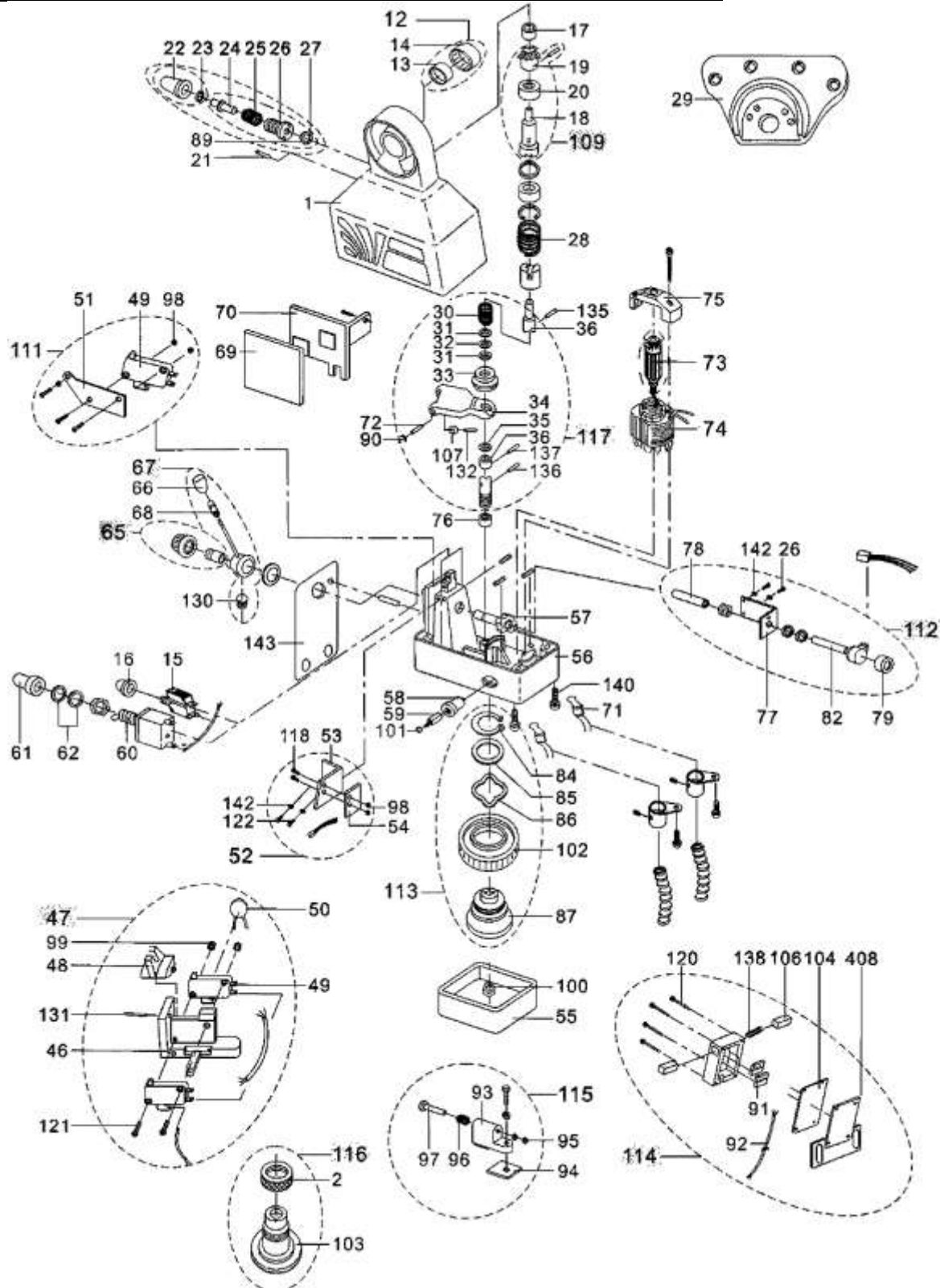
FAULT	PROBABLE CAUSE	REMEDY
Vertical Mill Does Not Run	1. Wrong voltage 2. The plug or receptacle is wired incorrectly 3. Power supply is switched OFF or is faulty 4. Motor is faulty	1. Make sure the machine voltage matches the nameplate. 2. Test the contacts and correct the wiring. 3. Check for correct voltage on all legs and that main power supply is on. 4. Replace motor
Excessive Vibration	1. Improper belt tension. 2. Uneven belt wear. (hard spots) 3. Motor or spindle pulley out of balance. 4. Bad motor.	1. Adjust belt tension. 2. Replace belt. 3. Balance or replace problem pulley. 4. Replace motor.
Motor Stalls	1. Over feeding. 2. Dull tooling. 3. Motor not building up to running speed. 4. Bad motor	1. Reduce feed rate. 2. Sharpen tooling & keep sharp. 3. Replace or repair motor. 4. Replace motor.
Noisy Operation	1. Piece part alignment is poor. 2. Noisy motor	1. Use vise or clamps to control alignment. 2. Check motor bearings
Tool Heats up or Burns Work	1. Excessive speed. 2. Dull tool. 3. Feed rate too slow. 4. Failure to use cutting oil or coolant. (on steel.)	1. Reduce speed. 2 Sharpen tool or replace. 3. Increase feed enough to clear chips. 4. Use cutting oil or coolant on steel.
Tool Slips in Collet	1. Collet is not fully seated into spindle Taper. 2. Collet sized incorrectly. 3. Debris on collet or mating surfaces of spindle.	1. Snug up using drawbar. 2. Size collet to tool shank. 3. Clean oil and debris from collet and spindle.



FAULT	PROBABLE CAUSE	REMEDY
Breaking Tooling	1. Excessive cut depth 2. Spindle speed/feed rate too fast.	1. Decrease cut depth 2. Use correct feed rate and spindle speed.
Table is Hard to Move	1. Locks are tightened down. 2. Chips have plugged up the ways 3. Ways need lubrication.	1. Loosen locks for proper movement. 2. Clean away chips frequently. 3. Use one-shot oiler to lubricate ways.
Poor Surface Finish on Piece Parts	1. Wrong feed rate/spindle speed. 2. Damaged or incorrect tooling. 3. Wrong spindle rotation for tooling. 4. Piece part is not securely clamped to table. 5. Gibs are loose.	1. Use correct feed rate and spindle rpm. 2. Replace and use correct tooling. 3. Correct tool rotation. 4. Make piece part or vise is firmly clamped to table. 5. Tighten as necessary.



ALIGN POWER FEED SCHEMATIC DIAGRAM OF PARTS





Align Power Feed Parts List

Item	Parts Number	Description	Specification	Remarks
1	P01807	Top Housing		AL-500S
2	A0100-01	Bevel Gear Nut		
3	A0100-02A	Washer		
4	A0100-02B	Washer		
5	A0100-02C	Washer		
6	A-0100-02D	Washer		
7	A0100-04A	Washer		
8	A0100-04B	Washer		
9	A0100-04C	Washer		
10	A0100-04E	Washer		
11	A0100-07A	Washer		
12	A0101A	Needle Bearing		
13	A0101B	Inner Ring		
14	A0101C	Needle Bearing		
15	A0102	Circuit Breaker		
16	A0102-01	Cap of Circuit Breaker		
17	A0103	Bushing Bearing		
18	P01022	Drive Gear Shaft		AL-500S
19	P01021	Drive Gear		AL-500S
20	A0109	Spacer		
21	A0110	Light Transmitter		
22	A0111-01	Hex-Seal Boot		
23	A0111-01A	Nut for Rapid Switch		
24	A0111-02	Rapid Switch plunger		
25	A0111-03	Spring for Rapid Switch		
26	A0111-04	Rapid Switch Housing		
27	A0111-1-5	Rapid Switch Assembly		
28	A0112	Spring For Top Housing		
29	P01808	Adaptor		
30	A0301-05	Spring For Clutch		
31	A0301-06	Washer TRA	512	
32	A0301-07	Washer Bearing NTA	512	
33	A0301-08	Bearing Cup		



Item	Parts Number	Description	Specification	Remarks
34	A03011-9	Lift Fork		
35	A0301-10	Washer	1x8x18mm	
36	A0301-12A	Shaft Mount		
37	ALW-25-1	Wire	24AWG x L59mm	
38	ALW-26	Wire	18AWG x L50mm	
39	ALW-3	Wire	22AWG	
40	ALW-6	Wire	22AWG x L116mm	
41	ALW-7	Wire	22AWG x L160mm	
42	ALW-8	Wire	22AWG x L100mm	
43	ALW-9	Wire	22AWG x L100mm	
44	B00001	Bearing	627ZZ	
45	B00006	Bearing	608ZZ	
46	C0501	Micro Switch Holder		
47	C0501-6V	Micro Switch Assembly		
48	C0502	Switch Actuator		
49	C0504	Micro Switch		
50	C0506	Capacitor		
51	C0507	Micro Switch Holder		
52	C0508	Micro Switch Assembly		
53	C0508-01	Mounting Plate		
54	C0508-02	Micro Switch		
55	P01809	Bottom Cover		AL-500S
56	P01806	Bottom Housing		
57	E0902V	250 Cam Assembly		
57	E0902P	235 Cam Assembly		
58	P01004	Carbon Brush Holder		
59	E0905	Brush		
60	E-0907	On-Off Switch		
61	E0907-01	Cap of On-Off Switch		
62	E0907-02	Washer		
63	E0910	Spring Washer	627	
64	E0911	Set Screw	1/4" x 1/4"	
65	P01928	Speed Control Knob		
66	P01927	Handle Knob		
67	P01810	180' Control Handle		



Item	Parts Number	Description	Specification	Remarks
67	P01811	90' Control Handle		
68	E0913A	Inner Ring		
69	E0915V	Circuit Board Insulator		
70	E0916V	400S/500S Circuit Board Assembly		AL-500S/400S
71	E0917	Strain Relief		
72	E0922	Lift Fork Shaft		
73	P01907	SP Armature Assembly		AL-500S
74	E0926V	400S/500S Motor Field		AL-400S/500S
75	E0927A	Bearing Mount		
76	E0928	Bushing	8x14.8x20	
77	E0929-01	Strain of Potentiometer		
78	E0929-02	Ring of Potentiometer		
79	E0929-03	Cap of Potentiometer		
80	E0929-04	Washer of Potentiometer		
81	E0929-05	Nut of Potentiometer		
82	E0929V	400S/500S Potentiometer	10K Ohm	AL-500S/400S
83	E0930	Power Cord	0.75x 3Cx 2.7M	
84	E0934-01	Crescent ring	S38	
85	E0934-02	Washer	1.5x 38x 54	
86	E0934-03	Spring Washer	6205	
87	E0934-04	Hub of Zytel Gear		
88	F01001	Crescent Ring	IR24	
89	F10040	E-Ring	E4	
90	F10050	E-Ring	E5	
91	F1104	Micro Switch		
92	F1106A-2	Control Cord	0.75x 4Cx1.7M	AL-500S/400S
93	G0100-011	Travel Stop		
94	G0103	Nut		
95	G0106	Crescent Ring		
96	G0107	Spring		
97	G0108	Travel Stop Shaft		
98	N10020	Nut	M 2	
99	N10030	Nut	M 3	
100	N22001	Nut	5/16"	



Item	Parts Number	Description	Specification	Remarks
101	E0906	Carbon Brush Cap		
102	P01007	Plastic Gear		
103	P01016	AL-500S Bevel Gear	16x 4	For AL Ser.
104	P01015	Limit Switch Cover		
105	P01018	Limit Switch Holder		
106	P01019	Actuator		
107	P01028	Lift Fork Ring		
108	P01040	Hold Plate	30 Deg.	
109	P01901	Drive Gear Assembly		
110	P01903	Lift Fork Assembly		
111	P01904	Micro Switch Assembly		
112	P01905	250/500S Potentiometer Assembly		
113	P01909	Zytel Gear Assembly		
114	P01910	Limit Switch Assembly		AL-400S/500S
115	P01916	Travel Stop Set (2 Pcs Set)		
116	P01917	Bevel Gear Set	5/8"	AL-400S/300S
117	P01923	Lift Fork Assembly		
118	T12010	Screw	2x 10 mm	
119	T13015	Screw	3x 15 mm	
120	T13020	Screw	3x 20 mm	
121	T13030	Screw	3x 30 mm	
122	T14006	Screw	4x 6 mm	
123	T14010	Screw	4x 10 mm	
124	T15010-1	Screw	4x 10 mm	
125	T14070	Screw	4x 70 mm	
126	T20001	Set Screw	3/16" x 3/8"	
127	T20003	Set Screw	5/16" x 1"	
128	T55035	Set Screw	5 x 35 mm	
129	T60001	Set Screw	1/4 x 1"	
130	T74004	Set Screw	4 x 4 mm	
131	U33025	Pin	Ø 2 x 24.8 mm	
132	U35016	Pin	Ø 2.5 x 16 mm	
133	U33015	Pin	Ø 3 x 15mm	
134	U35014	Pin	Ø 5 x 14 mm	



Item	Parts Number	Description	Specification	Remarks
135	U42515	Pin	Ø 2.5 x 15 mm	
136	U43014	Pin	Ø 3 x 13.7 mm	
137	U43017	Pin	Ø3 x 17.5 mm	
138	W04001	Spring		
139	W10050	Washer	1 x Ø 5 x Ø 12 mm	
140	W10080	Washer	1 x Ø 8 x Ø 18 mm	
141	W10080-1	Washer	0.6 x Ø 8 x Ø 12 mm	
142	W20040	Spring Washer	Ø 4 mm	
143	D20283	On-Off Brand		
144	P01919	Limit Switch Fixture		



POWER FEED TROUBLESHOOTING

WARNING **Disconnect the machine from power source before troubleshooting.**

THE POWER FEED DOES NOT WORK AND THE POWER INDICATOR DOES NOT GLOW:

1. Ensure there is no problem with the power supply.
2. Check if the circuit breaker on the power feed unit kicked out.
3. Check for proper contact at the ON-OFF switch.

THE MOTOR DOES NOT WORK WHEN PUSHING THE DIRECTION LEVER EITHER LEFT OR RIGHT:

1. Open power feed unit by loosening (4) bottom hex screws.
2. Check if the carbon brush is making proper contact with the armature or if carbon brush is used up already.
3. Check that internal wiring to the printed circuit board is all connected.
4. Check that the potentiometer connections are intact and that it is functioning properly.

SPEED CONTROL IS ERRATIC OR ALWAYS AT HIGH SPEED:

1. Check rapid micro-switch. Make sure it is not stuck. If its position is too high, lightly tap on it to lower.
2. Check that V.R. is in good condition and functioning properly.

BREAKER ALWAYS KICKS OUT ON POWER FEED UNIT DURING NORMAL USAGE:

1. Short circuit in the armature, need to replace with a new armature.

CURRENT LEAKAGE:

1. Check limit switch assembly for possible short.
2. Check armature by first removing the dust cap.
3. Measure for short with an ohmmeter across the carbon brush and the outer cover of the power feed unit.



NOTES



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