



OPERATOR'S MANUAL

Metal Working



VARIABLE SPEED VERTICAL MILL MODEL: VM-942-1

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Table of Contents

| | |
|---|----|
| THANK YOU & WARRANTY | 1 |
| INTRODUCTION..... | 3 |
| GENERAL NOTES..... | 3 |
| SAFETY INSTRUCTIONS | 4 |
| SAFETY PRECAUTIONS | 6 |
| Dear Valued Customer:..... | 6 |
| TECHNICAL SPECIFICATIONS..... | 9 |
| TECHNICAL SUPPORT | 9 |
| UNPACKING AND CHECKING CONTENTS..... | 10 |
| Cleaning | 10 |
| TRANSPORTING AND LIFTING | 11 |
| INSTALLATION..... | 12 |
| Anchoring the Machine..... | 13 |
| OVERALL DIMENSIONS..... | 13 |
| Contents of Tool Box..... | 14 |
| GETTING TO KNOW YOUR MACHINE | 15 |
| ASSEMBLY AND SET UP | 23 |
| ELECTRICAL..... | 27 |
| MACHINE ADJUSTMENTS AND OPERATION..... | 30 |
| Travel Stops | 30 |
| Electronic Ruler Adjustment | 30 |
| Head Alignment..... | 31 |
| Adjustment of Table Gib..... | 32 |
| Adjustment of Saddle Gib..... | 32 |
| Adjustment of Knee Gib..... | 32 |
| Adjustment of Ram Gib | 33 |
| Clamping the Saddle, Table, and Knee..... | 33 |
| Ram Position | 34 |
| Motor / Vari-Belt Removal | 35 |
| Removing the Table | 37 |
| Removing the Saddle | 37 |
| LUBRICATION AND MAINTENANCE | 40 |
| Greasing the Machine | 41 |
| Accessing and Cleaning the Coolant System..... | 41 |
| Oils for Lubricating Coolant | 41 |
| Storing Machine for Extended Period of Time | 41 |
| PARTS IDENTIFICATION DRAWING A..... | 42 |
| Parts List Sheet A..... | 43 |
| PARTS IDENTIFICATION DRAWING B..... | 44 |
| Parts List Sheet B..... | 45 |
| PARTS IDENTIFICATION DRAWING C..... | 46 |
| Parts List Sheet C..... | 47 |



| | |
|--|----|
| PARTS IDENTIFICATION DRAWING D..... | 49 |
| Parts List Sheet D..... | 50 |
| ELECTRICAL SCHEMATIC..... | 52 |
| ELECTRICAL ENCLOSURE COMPONENTS..... | 53 |
| TROUBLESHOOTING..... | 54 |
| ALIGN POWER FEED SCHEMATIC DIAGRAM OF PARTS..... | 56 |
| Align Power Feed Parts List..... | 57 |
| ELECTRICAL CIRCUIT DIAGRAM..... | 62 |
| POWER FEED TROUBLESHOOTING..... | 63 |



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, (e) 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.



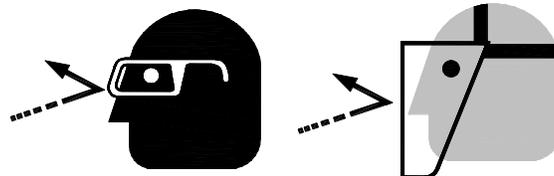


SAVE THESE INSTRUCTIONS.
Refer to them often and use them to instruct others.



PROTECT EYES

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



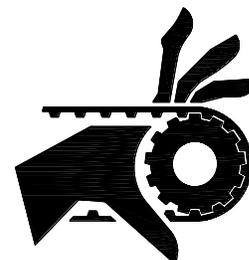
PROTECT AGAINST NOISE

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.



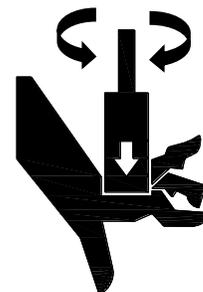
BEWARE OF PINCH POINTS

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 hands, fingers, or any part of your body away from rotating tooling bit.



ENTANGLEMENT HAZARD – ROTATING SPINDLE

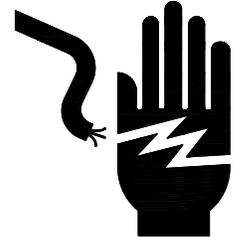
Contain long hair, **DO NOT** wear jewelry or loose fitting clothing.





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.



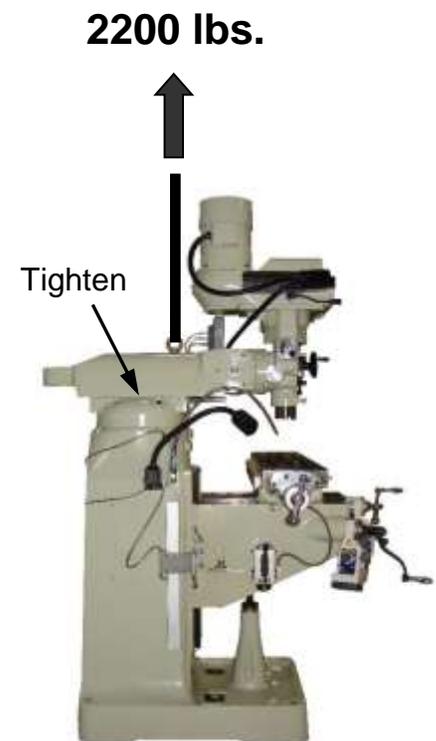
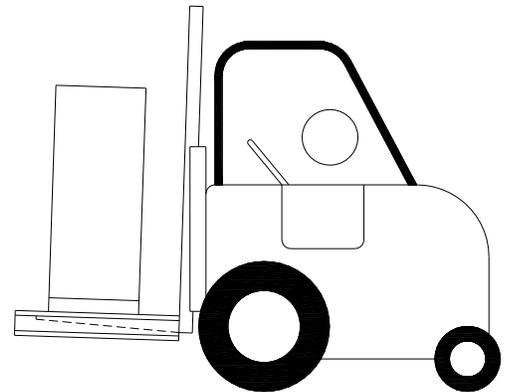


TRANSPORTING AND LIFTING

⚠ 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.





- 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:

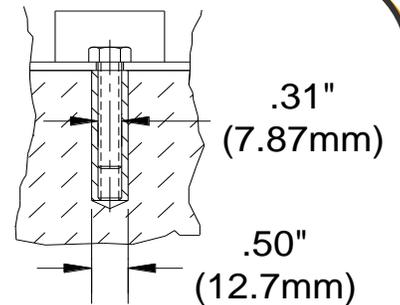
Consider the following when looking for a suitable location to place the machine:

- 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.

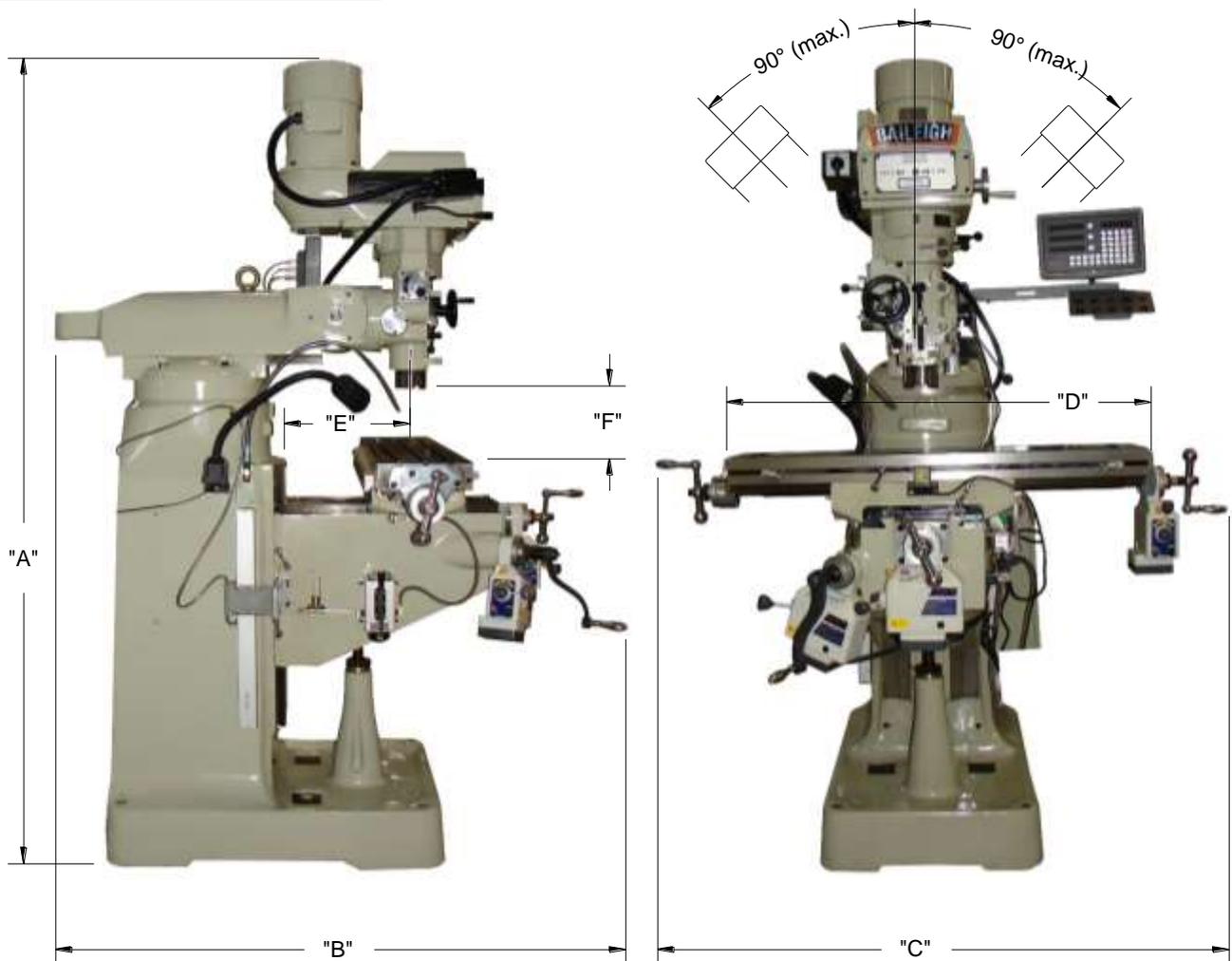


Anchoring the Machine

- 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



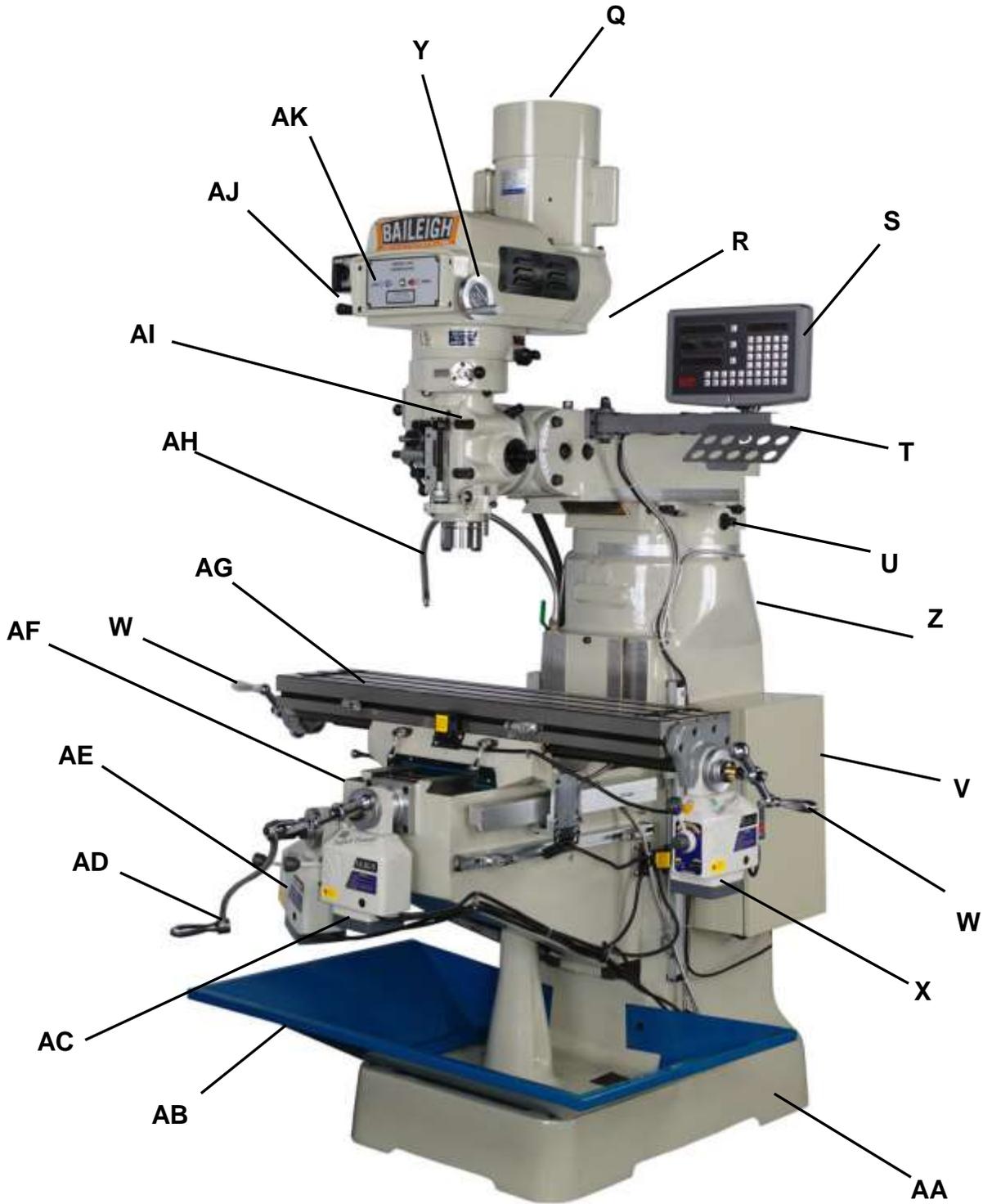
Items Packaged Separately

- 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.

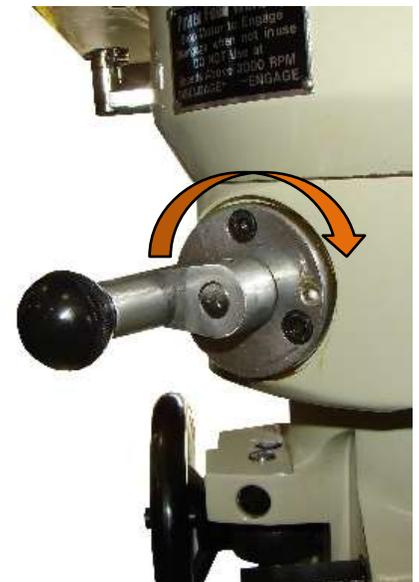


Power Feed Engagement Crank

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

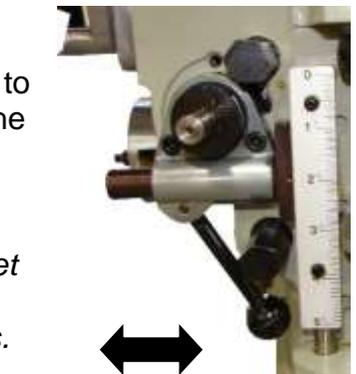
The feed reversing knob should be in neutral position and the feed control lever engaged. Clockwise (cw) rotation of the handwheel (A) moves the quill down. Manual feed handwheel and quill feed handle may be disengaged by pulling them out approximately 1/8".



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.





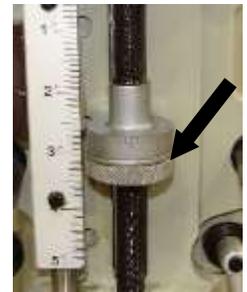
Quill Stop Knob

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 to 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.

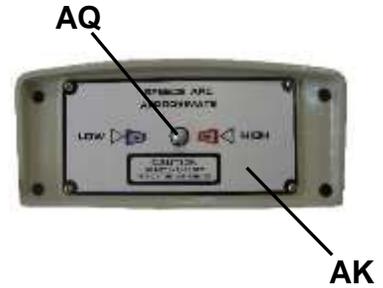
Spindle speeds are adjusted by turning the speed change handwheel (Y) on the right front of the belt housing. There are two speed ranges shown on the indicator (AK). LO – (70 – 500 rpm) and HI – (600 – 4200 rpm).

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.





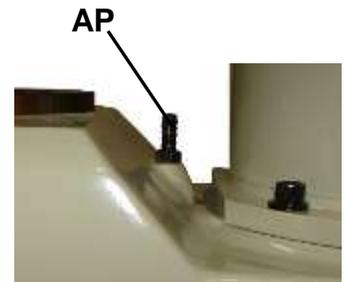
The High gears are obtained by using the direct drive. To engage the direct drive gears, shift lever (AO) to the HI position. **DO NOT FORCE THE LEVER!** If the direct drive gears do not mesh, turn off the power, rotate the spindle nose by hand until the gears line up, and move the lever to HI.



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.



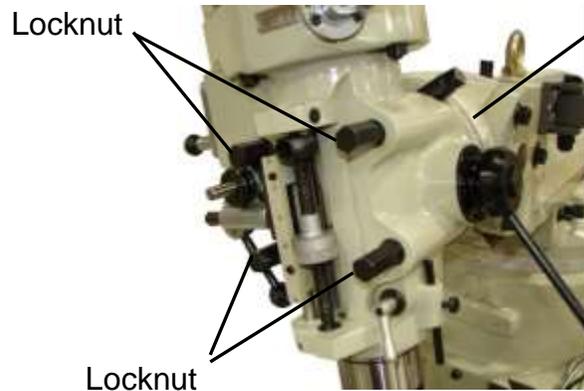
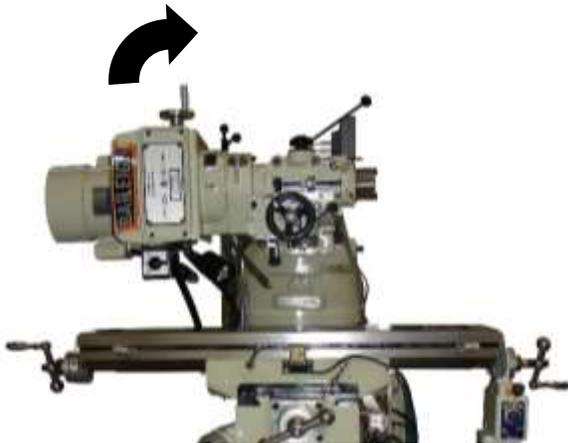
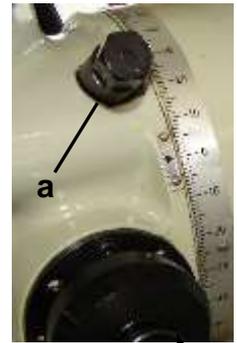


ASSEMBLY AND SET UP

⚠ 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.



Feed Reverse Knob

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





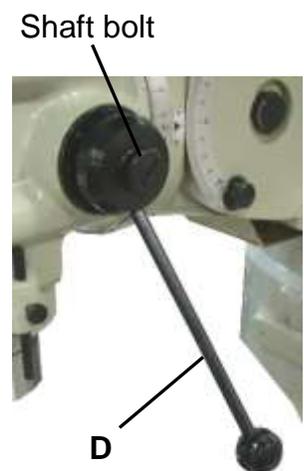
Manual Feed Handwheel

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 disengage 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.



F

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.



G

Drip Tray

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



L

Drain Hose Connection

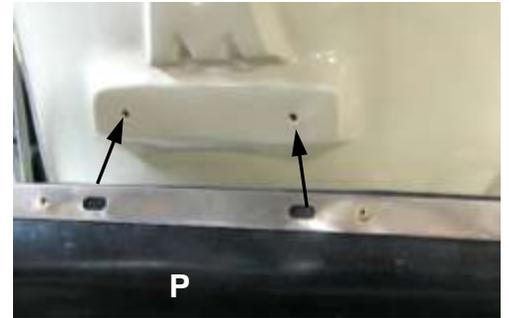
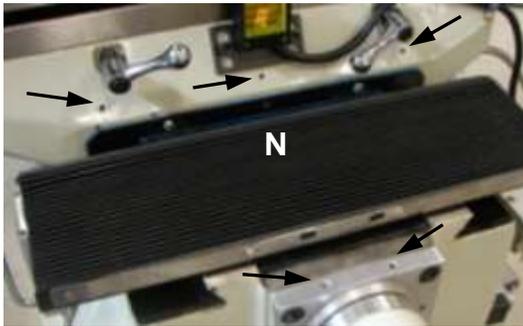
Connect a drain hose (M) to the press-on fitting and secure with a hose clamp. There is a fitting located on each end of the table. Run the other end of the hoses down to the drip tray.





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!**



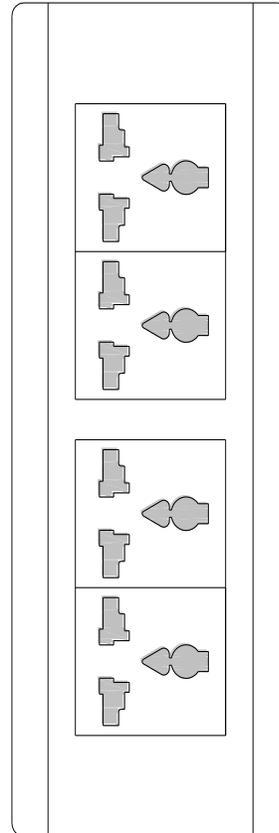
110V →

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

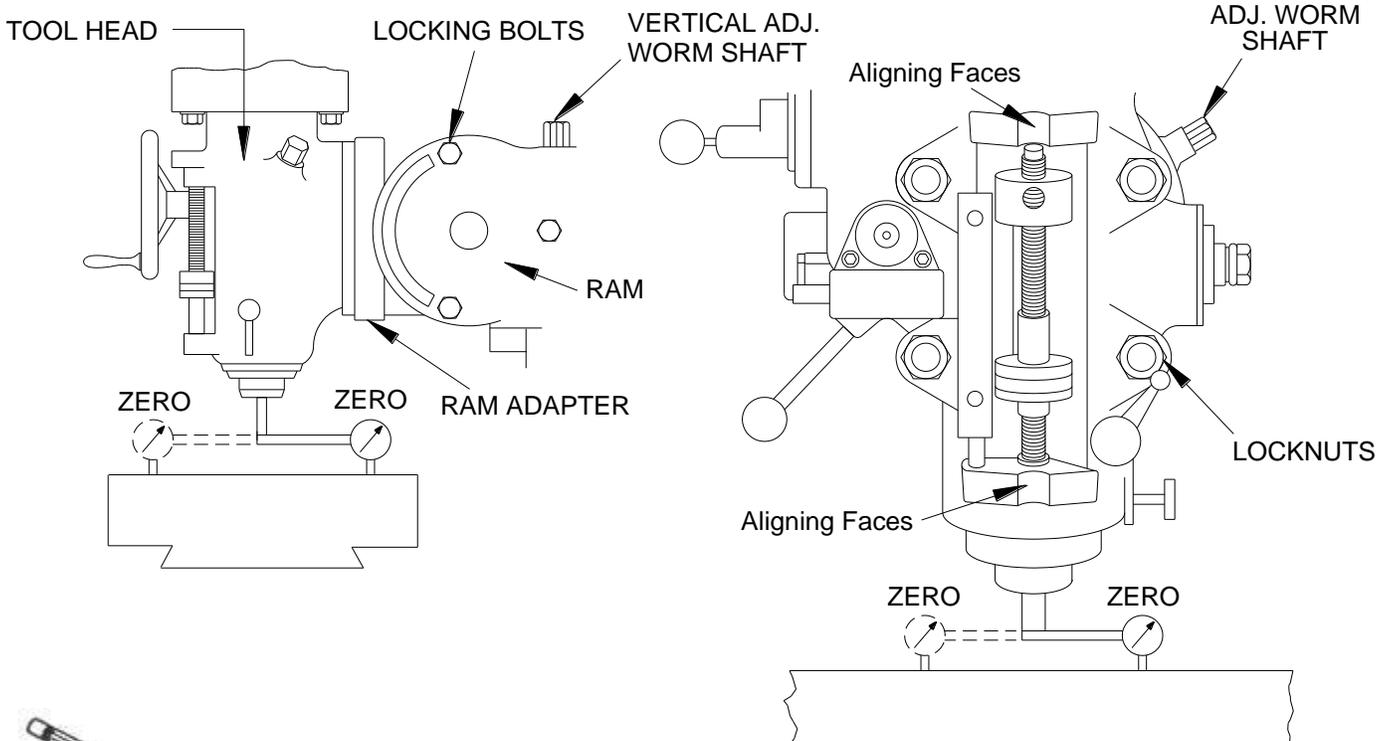
When doing precision work where it is necessary to have the head perfectly square with the table, follow the procedure below:

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.



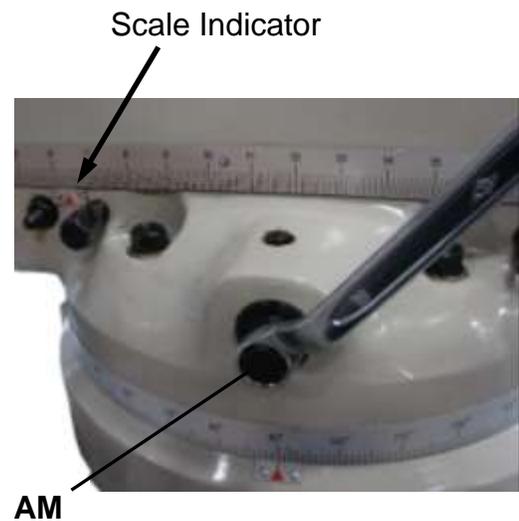
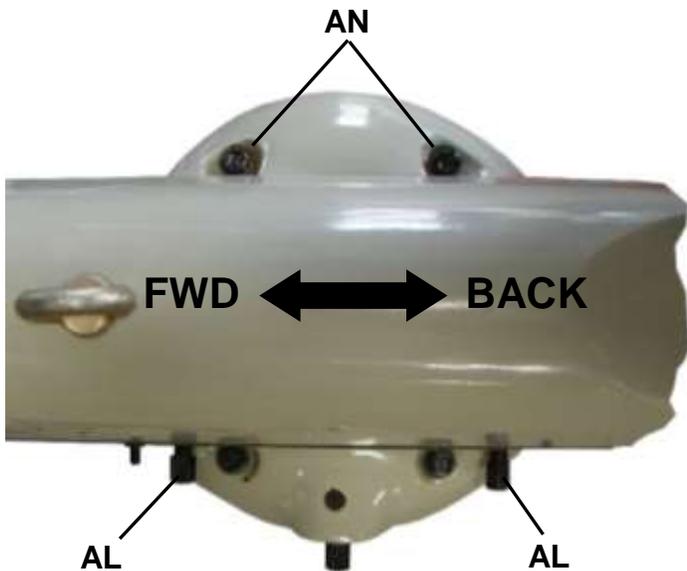


Ram Position

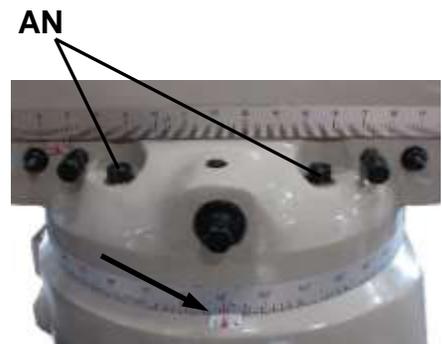
The ram can be moved after loosening the (2) ram lock studs (AL). Rotating crankshaft (AM) clockwise (cw) will move the ram back. Counterclockwise (ccw) rotation will move the ram forward. Use the scale indicator to keep track of movement. **LOCK THE RAM SECURELY AFTER MOVING.**



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.





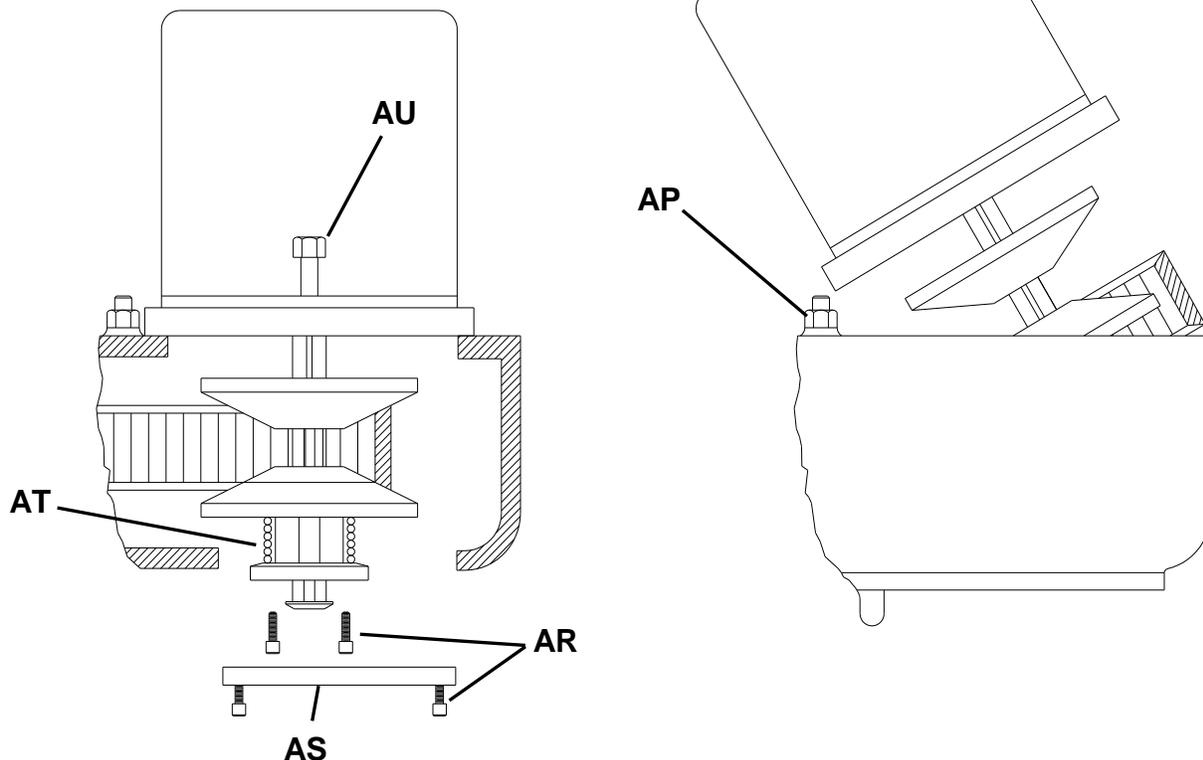
Motor / Vari-Belt Removal

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)



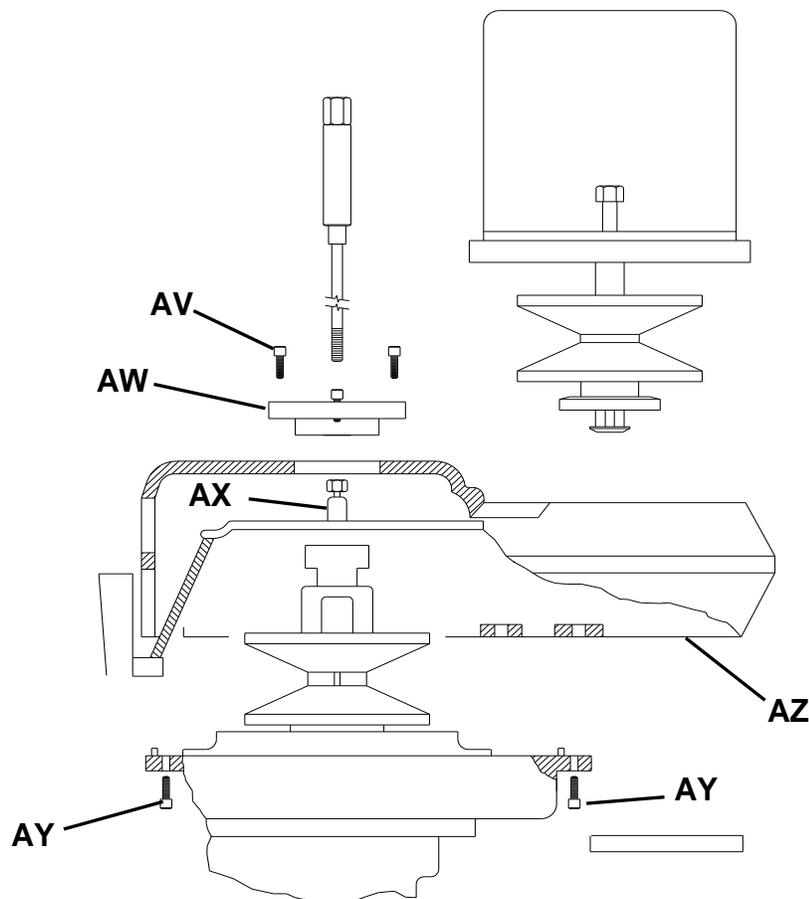
5. Without starting the motor, crank the speed change handwheel to the top speed position.



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.

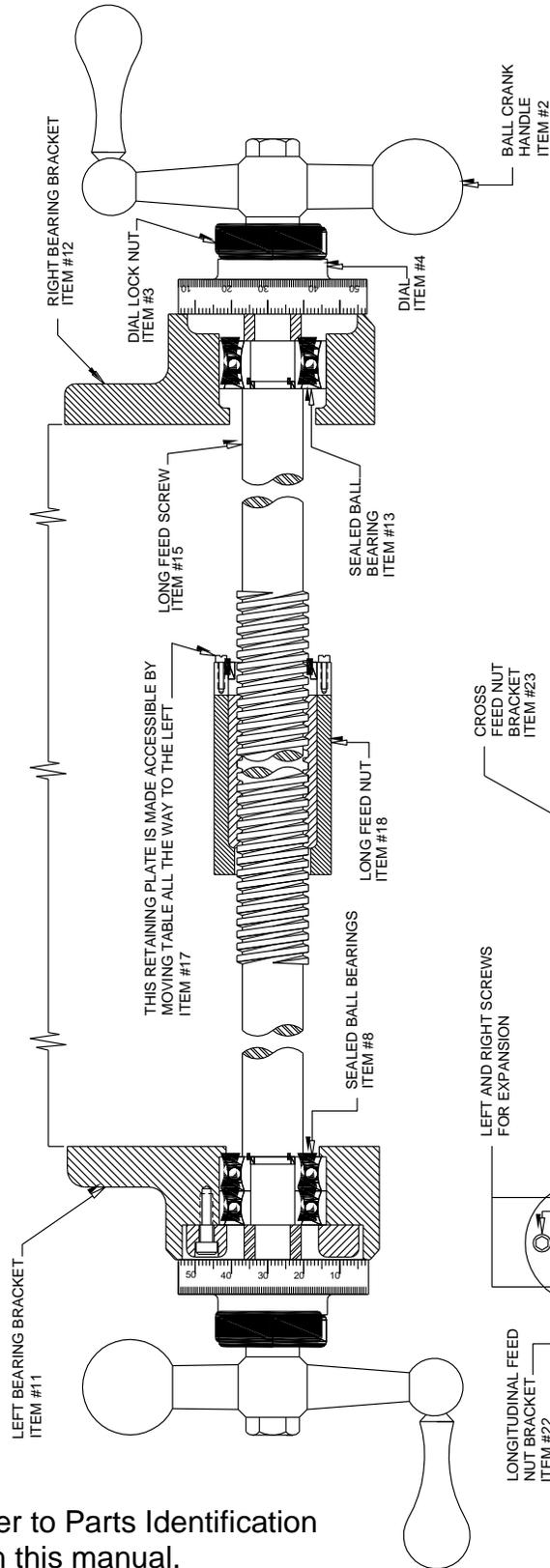
Removing the Saddle

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

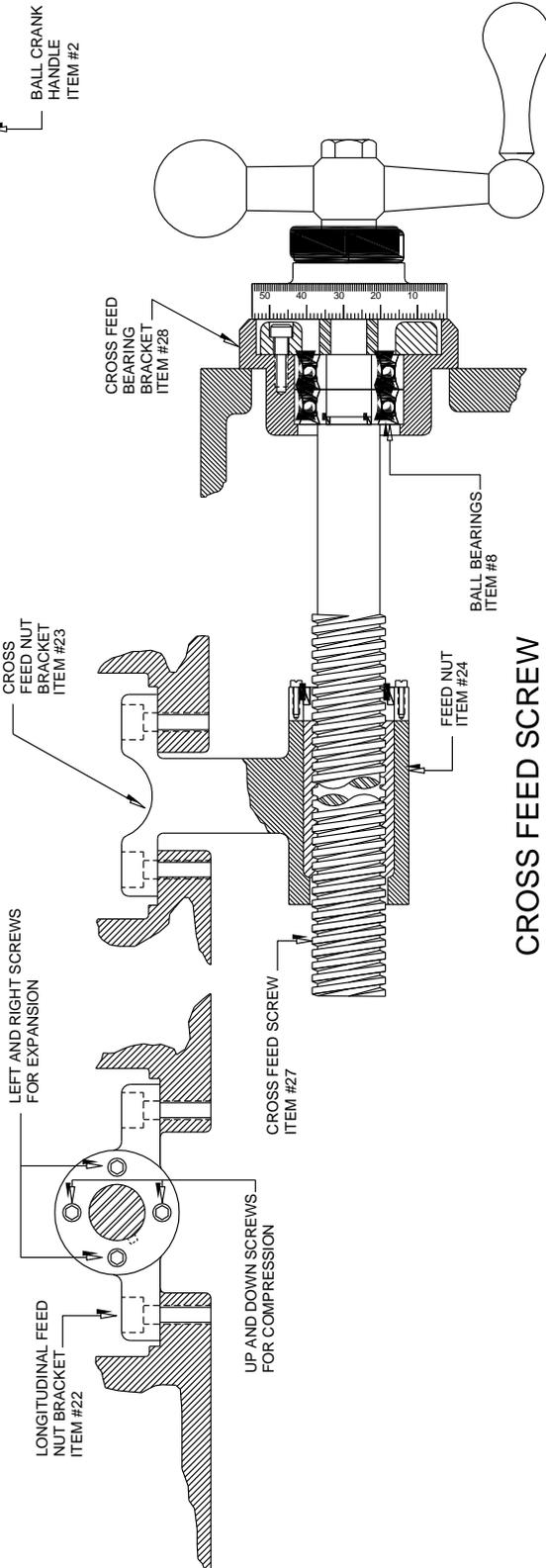
Next remove the cross-feed nut bracket which can only be done by removing the table.



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

| Diameter Inches | Revolutions Per Minute | | | | | | | | | | |
|-----------------|------------------------|------|------|------|------|------|------|------|------|------|------|
| | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 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.

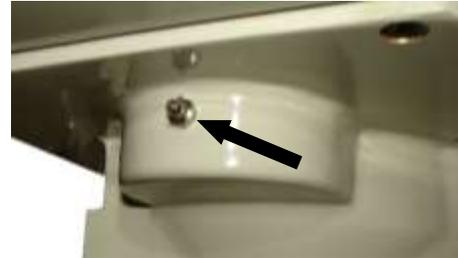


Note: When cleaning chips and debris from the machine, use a brush and a shop vacuum. **DO NOT** blow off the machine with compressed air. The force of the compressed air may force chips into critical mechanisms or may inflict injury to yourself or others.



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.

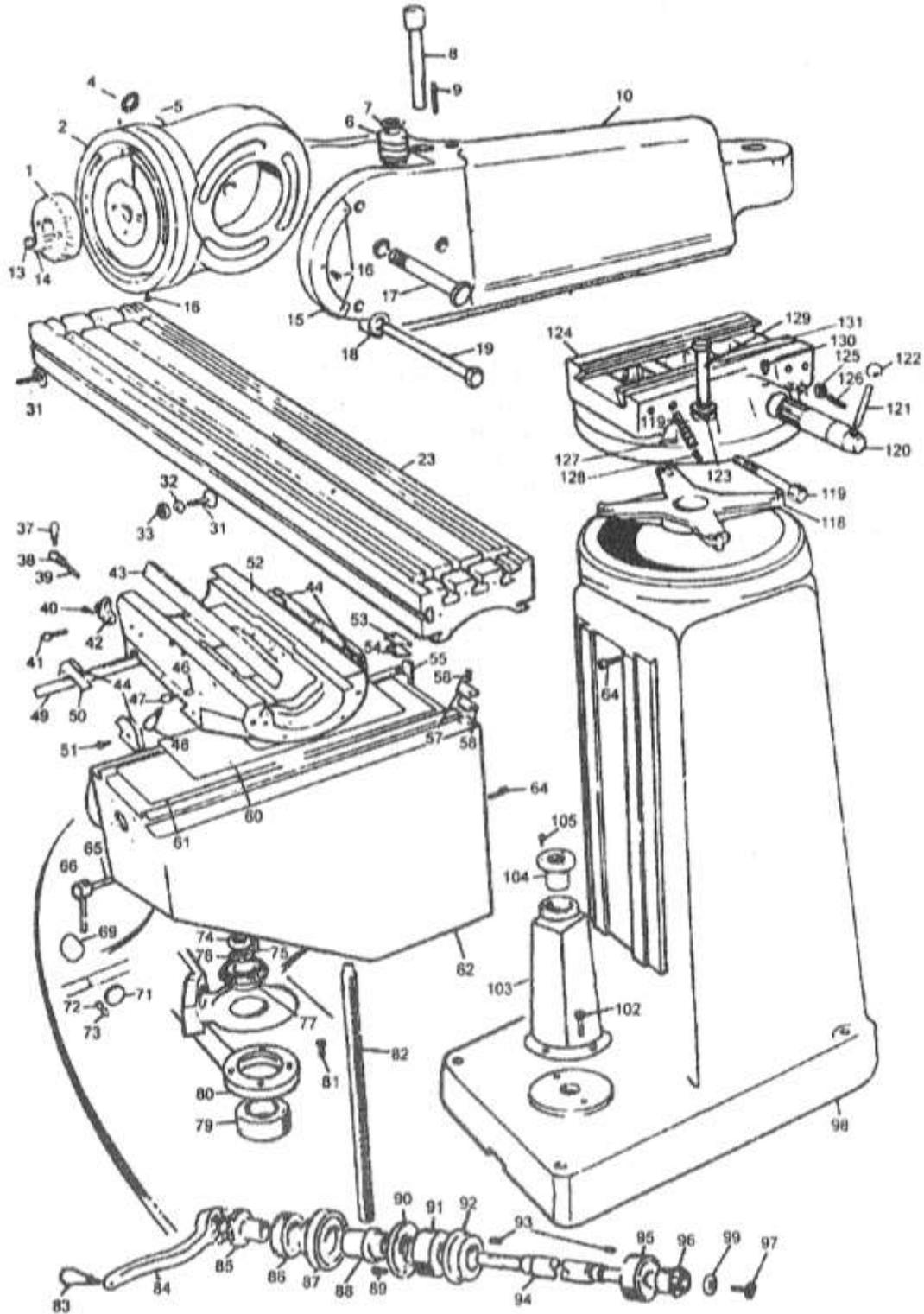
Storing Machine for Extended Period of Time

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



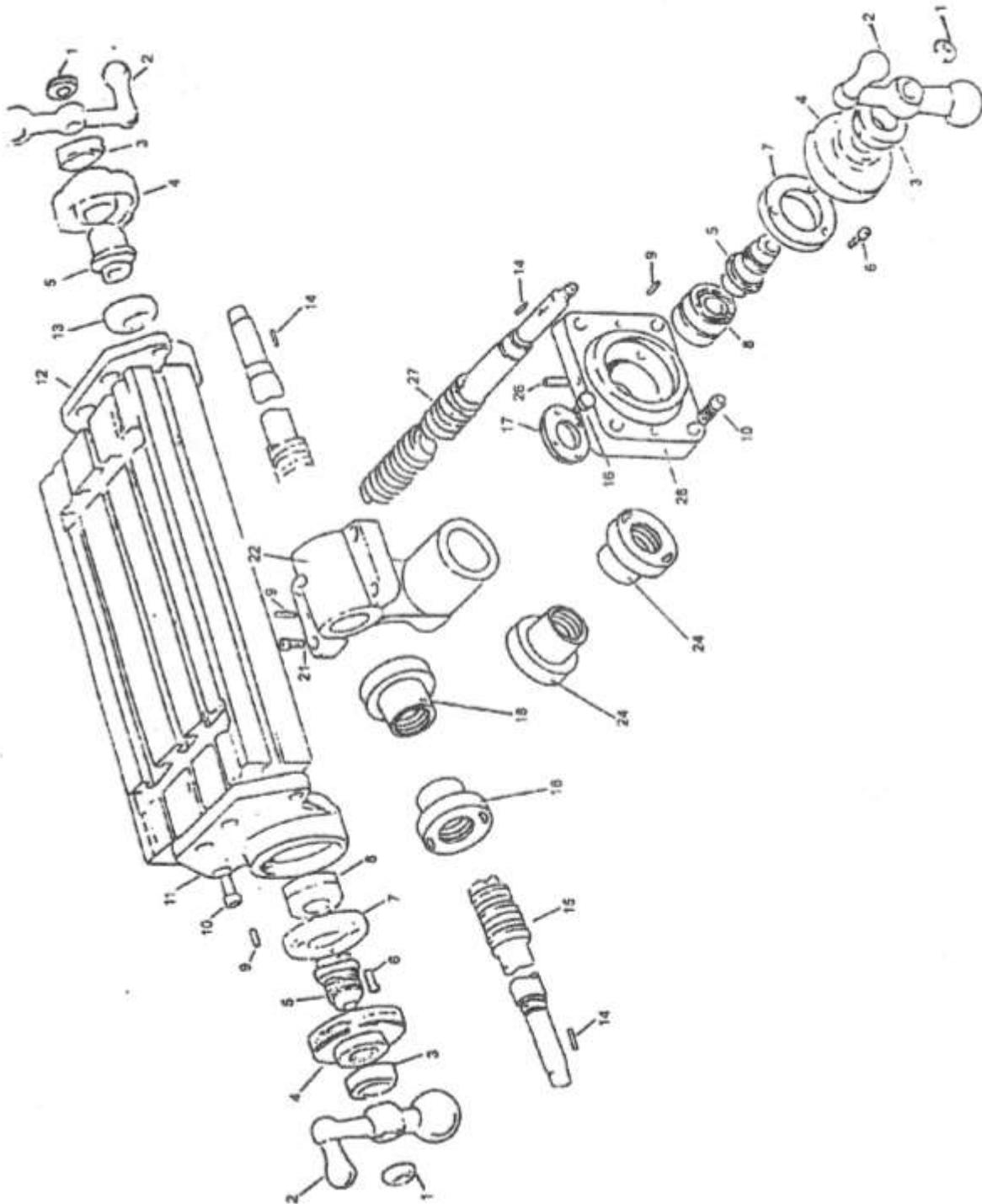


Parts List Sheet A

| 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 |
| | | | 87 | 4010 | Dial with 100 Garduations |
| | | | 88 | 4011 | Dial Holder |
| 31 | 2031 | Stop Piece T-Bolt(3 Req.) | 89 | 4009 | Socket Head Cap Screw |
| 32 | 2030 | Table Stop Piece(2 Req.) | 90 | 2011 | Bearing Retaining Ring |
| 33 | 2032 | Hex Nut(3 Req.) | 91 | 2008 | Grease Sealed Bearing |
| 37 | 3031 | Table Lock Bolt Handle | 92 | 4006 | Bearing Cap |
| 38 | 3030 | Saddle Lock Bolt | 93 | 4015 | Key |
| 39 | 3032 | Saddle Lock Plunger | 94 | 4017 | Elevating Shaft for 12" Knee |
| 40 | 3036 | Socket HD Cap Screw(2 Req.) | 95 | 2008 | Grease Sealed Bearing |
| 41 | 3028 | Gib Adjusting Screw(3 Req.) | 96 | 4014 | Bevel Pinion |
| 42 | 3035 | Table Stop Bracket | 97 | 4042 | Set Screw |
| 43 | 3026 | Saddle/Table Gib | 98 | 1001 | Column |
| 44 | 3037 | Felt Wipers(4 Req.) | 99 | 4017-1 | Washer |
| 46 | 3029 | Table Lock Plunger | 102 | 4027 | Socket Head Cap Screw |
| 47 | 3030 | Table Lock Bolt | 103 | 4026 | Pedestal |
| 48 | 3031 | Table Lock Bolt Handle | 104 | 4024 | Elevating Screw Nut |
| 49 | 3027 | Saddle/Knee Gib | 105 | 4025 | Socket Head Cap Screw |
| 50 | 3027-2 | Saddle Knee Wiper Plate(4 Req.) | 118 | 5003 | Spider |
| 51 | 3038 | Oval Head Screw(8 Req.) | 119 | 2010 | Ram Lock Stud |
| 52 | 3001 | Saddle | 120 | 5012 | Ram Pinion |
| 53 | 4028-2 | Left Hand Column Wiper Holder | 121 | 5013 | Ram Pinion Handle |
| 54 | 4028-1 | Knee Wiper Felt | 122 | 5014 | Plastic Ball |
| 55 | 4038 | Knee/Column Gib | 123 | 5005 | Chamfered Hardened Washer |
| 56 | 4029 | Allen Cap Screw(2 Req.) | 124 | 5001 | Turret |
| 57 | 4028-3 | Right Hand Column Wiper Holder | 125 | 5007-1 | Gib Screw Nut |
| 58 | 4028 | Knee Wiper Felt | 126 | 5007 | Gib Screw |
| 60 | 3040 | Chip Guards-Upper | 127 | 5009 | Lock Bar |
| 61 | 3039 | Chip Guards-Lower | 128 | 5009-1 | Screw |
| 62 | 4001 | Knee 12" | 129 | 5004 | Locking Bolt |
| 64 | 1001-1 | Stop Screw | 130 | 5015 | Ram Pinion Screw |
| 65 | 4048 | Knee Lock Shaft Assembly | 131 | 5002 | Ram/Turret Gib |



PARTS IDENTIFICATION DRAWING B



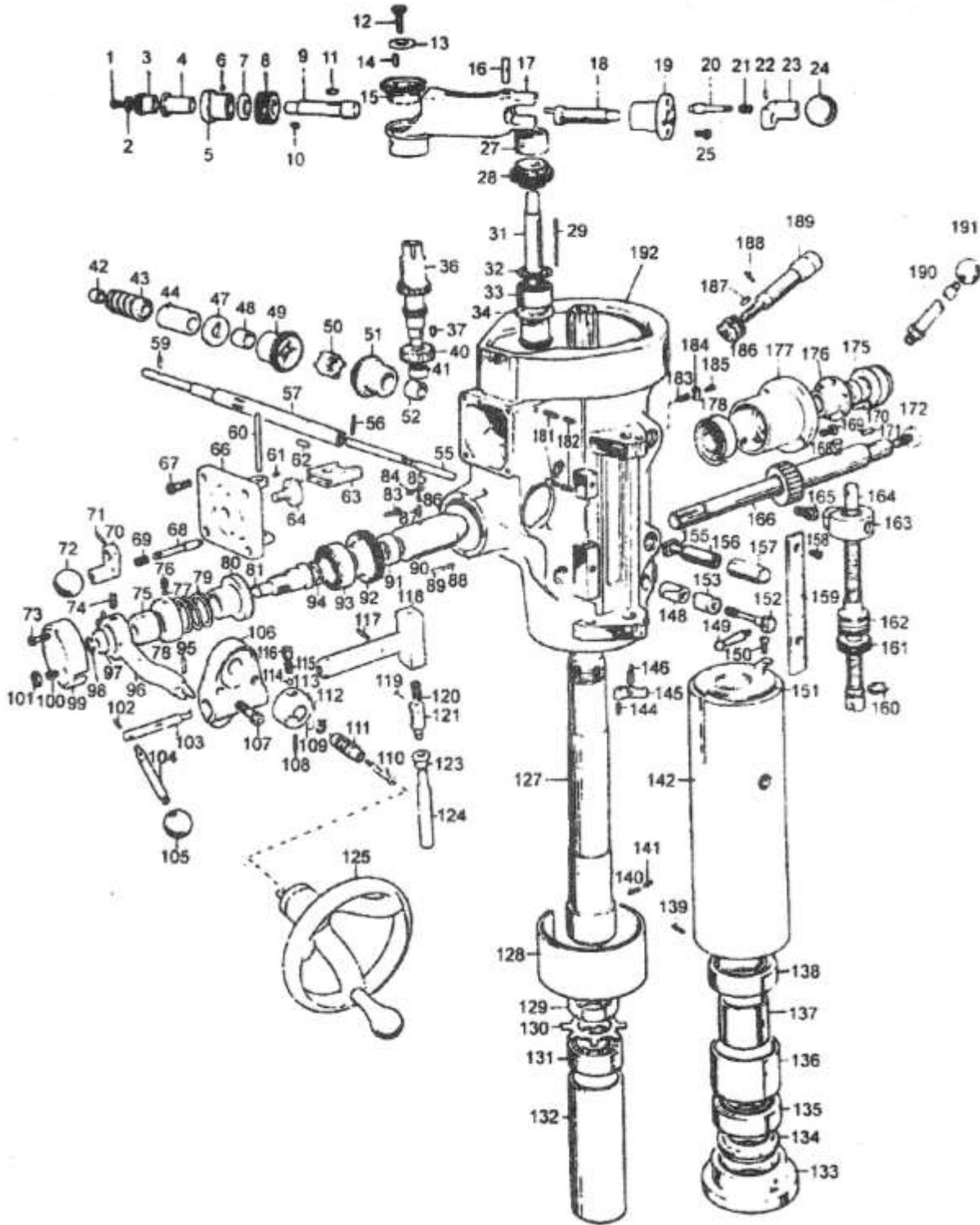


Parts List Sheet B

| 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 IDENTIFICATION DRAWING C





Parts List Sheet C

| ITEM NO: | PARTS NO: | DESCRIPTION | ITEM NO: | PARTS NO: | DESCRIPTION |
|----------|-----------|----------------------------------|----------|-----------|---|
| 1 | 6141 | RD.HD.Screw | 63 | 6162 | Feed Gear Shift Fork |
| 2 | 6140 | Bevel Pinion Washer | 64 | 6166 | Cluster Gear Shift Crank |
| 3 | 6139 | Feed Bevel Pinion | 66 | 6161 | Cluster Gear Cover |
| 4 | 6138 | Feed Worm Gear Shaft Sleeve | 67 | 6165 | Cap Screw(4Req.) |
| 5 | 6137 | Worm Cradle Bushing | 68 | 6169 | Cear Shift Plunger |
| 6 | 6123 | Setscrew | 69 | 6170 | Compression Spring |
| 7 | 6136 | Worm Gear Spacer(4Req.) | 70 | 6168 | Shift Crank |
| 8 | 6134 | Feed Drive Worm Gear | 71 | 6167 | Roll Pin |
| 9 | 6133 | Feed Drive Worm Gear Shaft | 72 | 6171 | Black Plastic Ball |
| 10 | 6142 | Worm Shaft Key | 73 | 6206 | Cap Screw(2Req.) |
| 11 | 6135 | Key | 74 | 6202 | Clutch Ring Pin(2Req.) |
| 12 | 6150 | Locknut | 75 | 6200 | Clutch Ring |
| 13 | 6149 | Washer | 76 | 6199 | Socket Set Screw |
| 14 | 6147 | Cluster Gear Key | 77 | 6199-1 | Brass Plug |
| 15 | 6148 | Feed Reverse Bevel Gear | 78 | 6198 | Overload Clutch Locknut |
| 16 | 6122 | Feed Engage Pin | 79 | 6167 | Safety Clutch Spring |
| 17 | 6121 | Worm Gear Cradle | 80 | 6194 | Overload Clutch |
| 18 | 6126 | Worm Gear Cradle Throw-out | 81 | 6195 | Overload Clutch Sleeve |
| 19 | 6125 | Shift Sleeve | 83 | 6189 | Round Head Screw(3Req.) |
| 20 | 6169 | Gearshift Plunger | 84 | 6228 | Mock-it Lockscrew |
| 21 | 6170 | Compression Spring | 85 | 6228 | Socket Set Screw |
| 22 | 6128 | Roll Pin | 86 | 6246 | Lockscrew |
| 23 | 6168 | Shift Crank | 87 | 6246-1 | Socket Set Screw |
| 24 | 6131 | Black Plastic Ball | 88 | 6191 | Compression Spring |
| 25 | 6132 | Cap Screw(3Req.) | 89 | 6193 | Overload Clutch Lever Spring Plunger |
| 27 | 6157 | Cluster Gear Shaft Upper Bearing | 90 | 6186 | Quill Pinion Shaft Bushing |
| 28 | 6153 | Cluster Gears Assembly | 91 | 6190 | Pinion Shaft Worm Gear Spacer |
| 29 | 6160 | Cluster Gear Key | 92 | 6187 | Overload Clutch Worm Gear |
| 31 | 6151 | Cluster Gear Shaft | 93 | 6188 | Overload Clutch Ring |
| 32 | 6158 | Snap Ring | 94 | 6188-1 | Snap Ring |
| 33 | 6156 | Bevel Gear Bearing | 95 | 6236-1 | Dowel Pin |
| 34 | 6159 | Bevel Gear Thrust Spacer | 96 | 6203 | Overload Clutch Trip Lever |
| 36 | 6143 | Feed Driving Gear | 97 | 6201 | Overload Clutch Washer |
| 37 | 6145 | Key | 98 | 6195-1 | Snap Ring |
| 40 | 6144 | Feed Drive Gear | 99 | 6205 | Clutch Arm Cover |
| 41 | 6252 | Needle Bearing | 100 | 6207 | Socket Set Screw |
| 42 | 6227 | Bushing | 101 | 6208 | Chem Blacked Locknut |
| 43 | 6225 | Worm | 103 | 6239 | Cam Rod |
| 44 | 6224 | Feed Worm Shaft Bushing | 104 | 6234 | Trip Handle |
| 47 | 6223 | Feed Worm Shaft Thrust Washer | 105 | 6233 | Black Plastic Ball |
| 48 | 6221 | Bushing | 106 | 6231 | Feed Trip Bracket |
| 49 | 6220 | Feed Reverse Bevel Gear | 107 | 6232 | Cap Screw(2Req.) |
| 50 | 6222 | Feed Reverse Clutch | 108 | 6219 | Socket Set Screw |
| 51 | 6220 | Feed Reverse Bevel Gear | 109 | 6229 | Key |
| 52 | 6221 | Bushing | 110 | 6214 | Feed Reverse Knob Stud |
| 55 | 6216 | Reverse Clutch Rod | 111 | 6213 | Reverse Knob |
| 56 | 6217 | Roll Pin | 112 | 6215 | Snap Ring |
| 57 | 6209 | Feed Worm Shaft | 113 | 6218 | Hand wheel Clutch |
| 59 | 6226 | Pin | 114 | 6225 | Steel Ball |
| 60 | 6163 | Feed Shift Rod | | | |

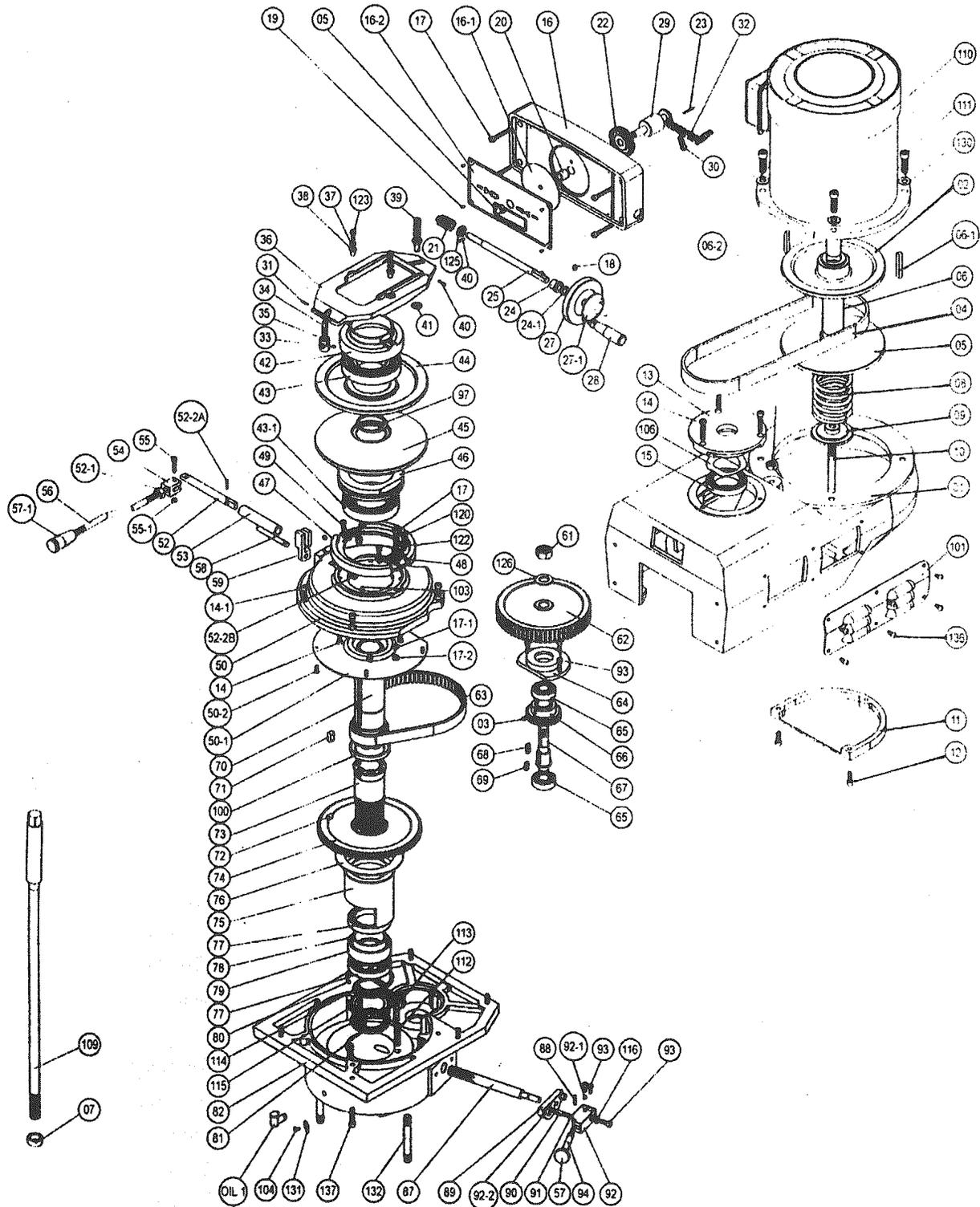


| ITEM NO: | PARTS NO: | DESCRIPTION |
|----------|-----------|--|
| 115 | 6219-2 | Compression Spring |
| 116 | 6219-1 | Handwheel Clutch Spring Screw |
| 117 | 6237 | Roll Pin |
| 118 | 6236 | Cam Rod Sleeve Assy. |
| 119 | 6241 | Roll Pin |
| 120 | 6242 | Compression Spring |
| 121 | 6240 | Trip Plunger |
| 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

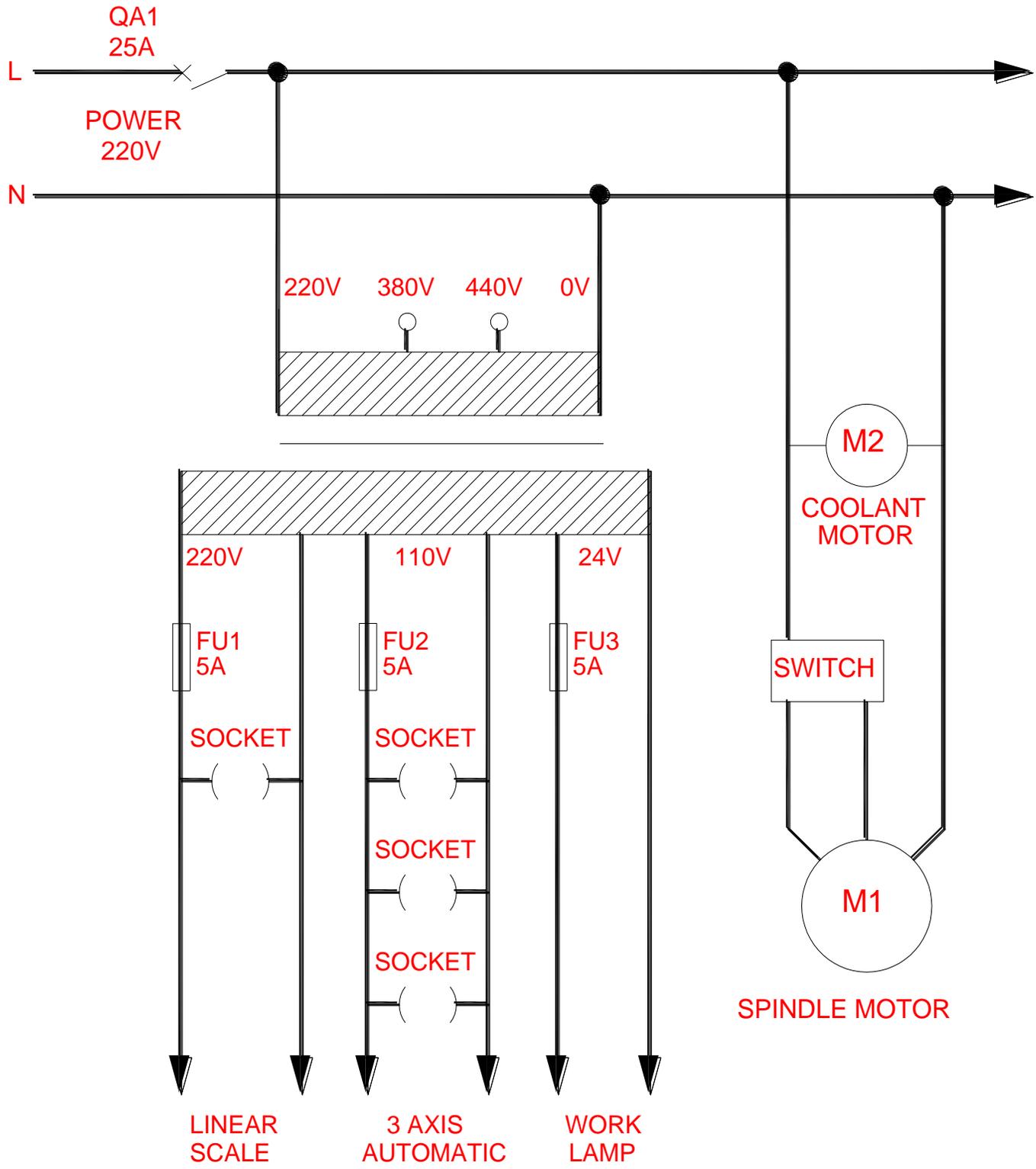
| | |
|------|--------------------------------|
| 84 | Spring |
| 85 | Studs(3 Req.) |
| 86 | Set Screw |
| 87 | Clutch Gear Shaft |
| 88 | Pin(2 Req.) |
| 89 | Hi-Low Detent Plate |
| 90 | Hi-Low Detent Punger |
| 91 | Spring |
| 92 | Hi-Low Pinion Block |
| 92-1 | Socket Cap Screw |
| 92-2 | Washer |
| 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 SCHEMATIC





ELECTRICAL ENCLOSURE COMPONENTS





TROUBLESHOOTING

WARNING Disconnect the machine from power source before troubleshooting.

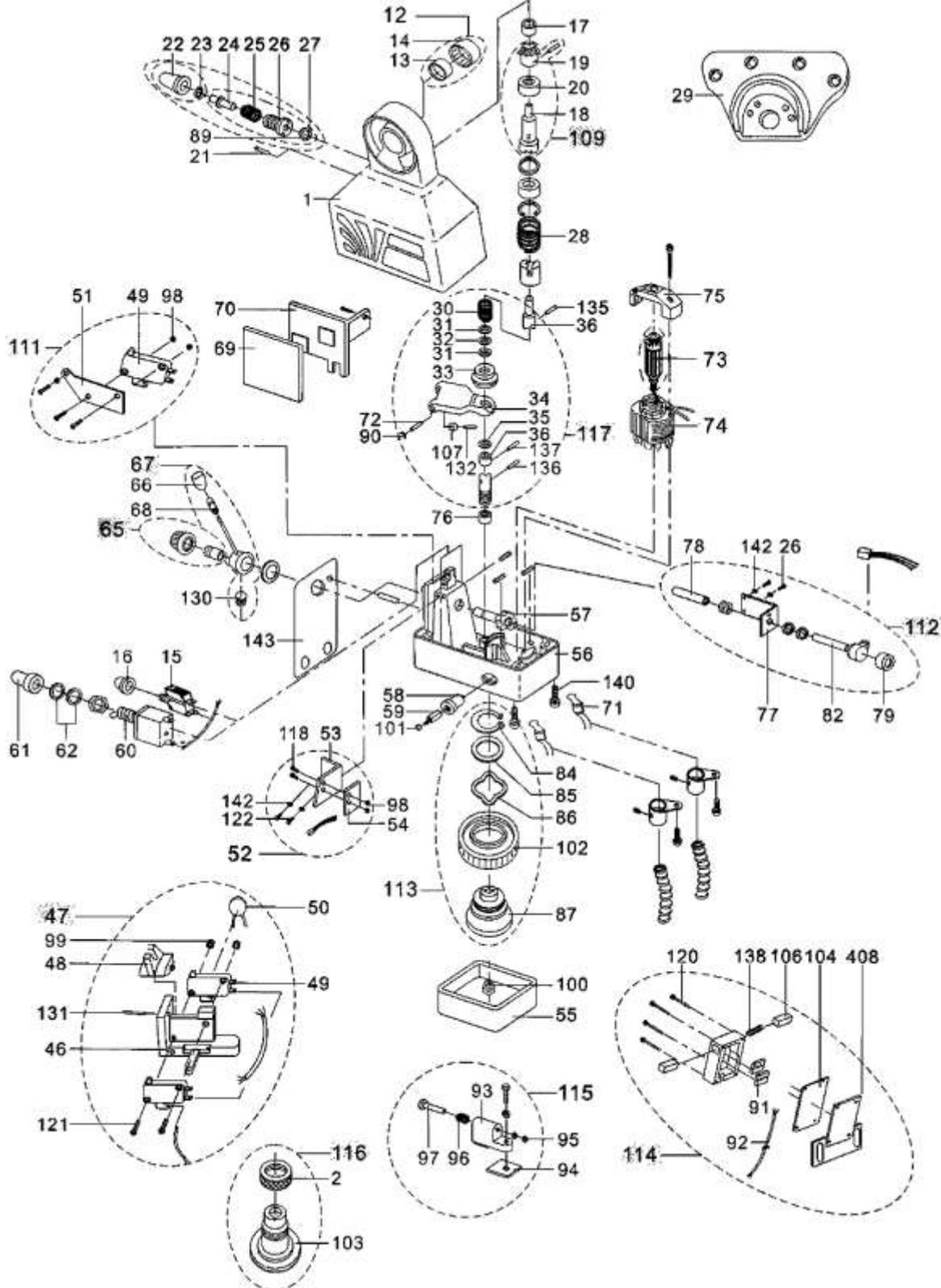
| FAULT | PROBABLE CAUSE | REMEDY |
|-----------------------------|--|---|
| Vertical Mill Does Not Run | <ol style="list-style-type: none"> 1. Wrong voltage 2. The plug or receptacle is wired incorrectly 3. Power supply is switched OFF or is faulty 4. Motor is faulty | <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 1. Improper belt tension. 2. Uneven belt wear. (hard spots) 3. Motor or spindle pulley out of balance. 4. Bad motor. | <ol style="list-style-type: none"> 1. Adjust belt tension. 2. Replace belt. 3. Balance or replace problem pulley. 4. Replace motor. |
| Motor Stalls | <ol style="list-style-type: none"> 1. Over feeding. 2. Dull tooling. 3. Motor not building up to running speed. 4. Bad motor | <ol style="list-style-type: none"> 1. Reduce feed rate. 2. Sharpen tooling & keep sharp. 3. Replace or repair motor. 4. Replace motor. |
| Noisy Operation | <ol style="list-style-type: none"> 1. Piece part alignment is poor. 2. Noisy motor | <ol style="list-style-type: none"> 1. Use vise or clamps to control alignment. 2. Check motor bearings |
| Tool Heats up or Burns Work | <ol style="list-style-type: none"> 1. Excessive speed. 2. Dull tool. 3. Feed rate too slow. 4. Failure to use cutting oil or coolant. (on steel.) | <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 1. Collet is not fully seated into spindle Taper. 2. Collet sized incorrectly. 3. Debris on collet or mating surfaces of spindle. | <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 1. Excessive cut depth 2. Spindle speed/feed rate too fast. | <ol style="list-style-type: none"> 1. Decrease cut depth 2. Use correct feed rate and spindle speed. |
| Table is Hard to Move | <ol style="list-style-type: none"> 1. Locks are tightened down. 2. Chips have plugged up the ways 3. Ways need lubrication. | <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 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. | <ol style="list-style-type: none"> 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" | |



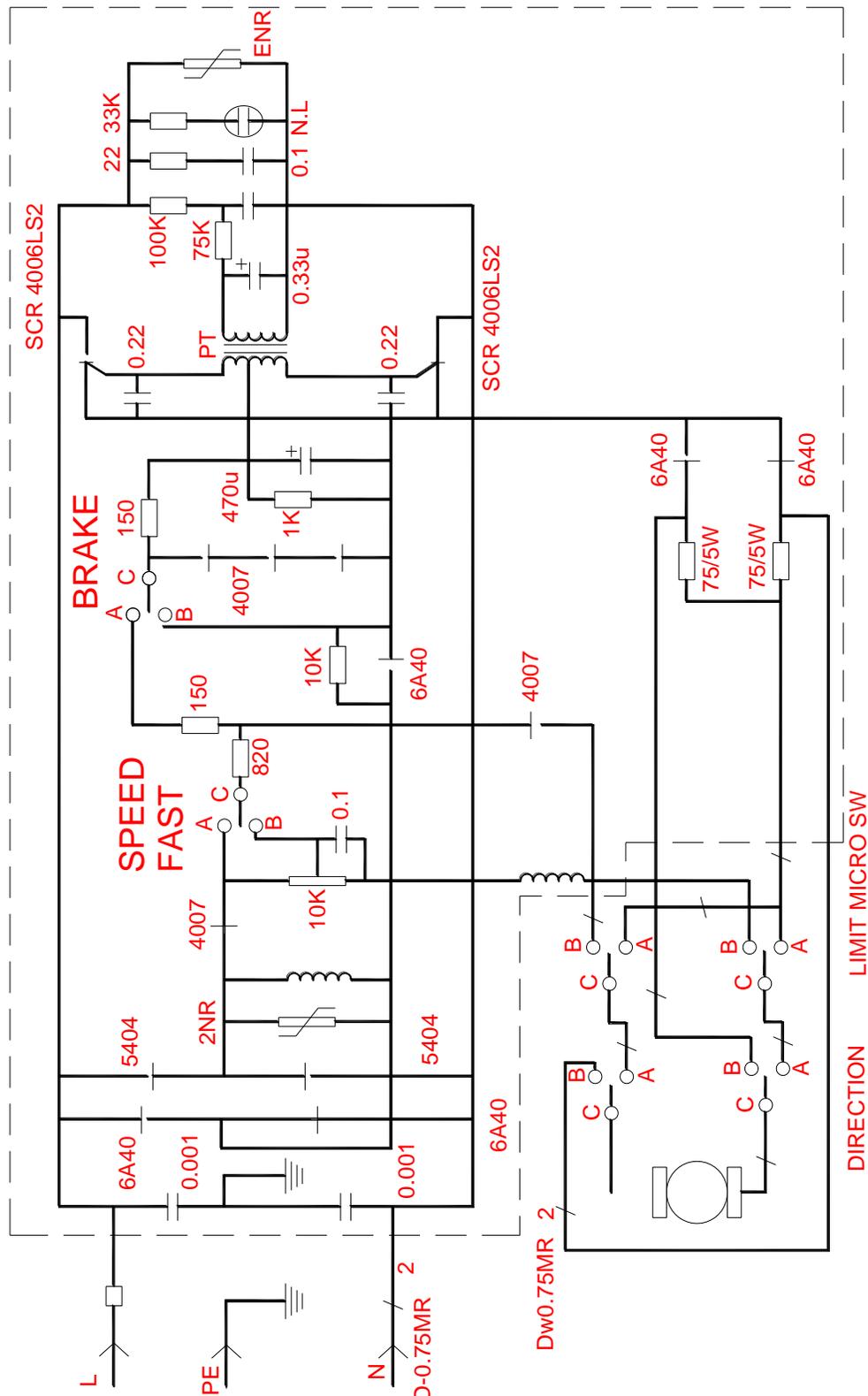
| Item | Parts Number | Description | Specification | Remarks |
|------|--------------|---------------------------------|---------------|--------------|
| 101 | E0906 | Carbon Brush Cap | | |
| 102 | P01007 | Plastic Gear | | |
| 103 | P01016 | AL-500S Bevel Gear | 16x 4 | For AL Ser. |
| 104 | P01015 | 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 | | |



ELECTRICAL CIRCUIT DIAGRAM





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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