OPERATOR'S MANUAL

VERTICAL MILL

MODEL: VM-949-1 / 3

Baileigh Industrial, Inc.
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Rev. 04/2015

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THANK YOU & WARRANTY

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

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

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

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

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

Limitation of Liability. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER OR ANY OTHER PARTY FOR ANY INCIDENTIAL, 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 Majuere. 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@baileighindustrial.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.

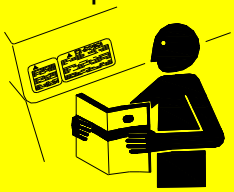
Your machine is designed and manufactured to work smoothly and efficiently. Following proper maintenance instructions will help ensure this. Try and use original spare parts, whenever possible, and most importantly; **DO NOT** overload the machine or make any unauthorized modifications.

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**.

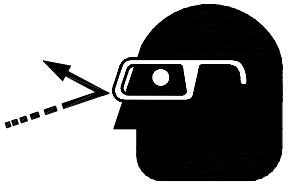
Safety signs with signal word **DANGER** or **WARNING** are typically near specific hazards.

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.

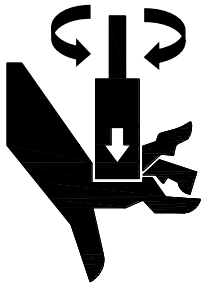
PROTECT EYES

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



BEWARE OF PIERCING POINTS

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

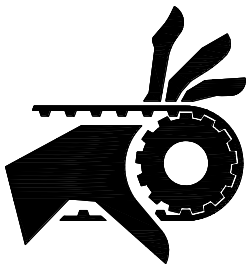


ENTANGLEMENT HAZARD – ROTATING SPINDLE

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

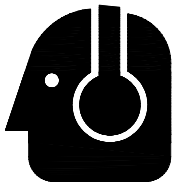
BEWARE OF PINCH POINTS

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

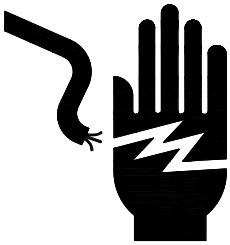


PROTECT AGAINST NOISE

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.



HIGH VOLTAGE



USE CAUTION IN HIGH VOLTAGE AREAS.
DO NOT assume the power to be off.

(MAKE SURE PROPER LOCKOUT PROCEDURES ARE FOLLOWED)

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

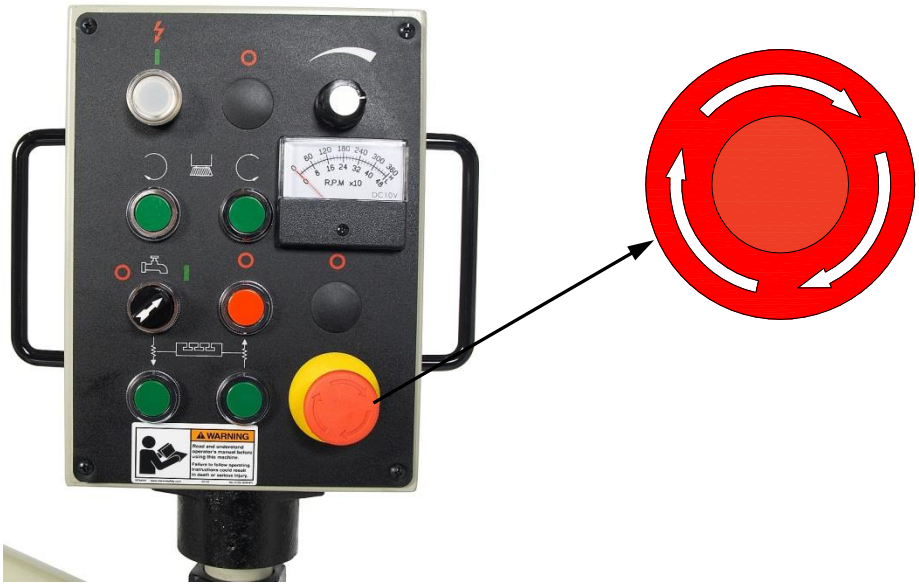
1. **Only trained and qualified personnel can operate this machine.**
2. **Make sure guards are in place and in proper working order before operating machinery.**

3. **Machines can eject** piece parts towards the operator. Know and avoid the conditions which cause the piece part to kickback.
4. **Check** for damaged parts before using machinery. Check for binding or misaligned parts, broken parts, loose bolts, or any other conditions which may impair the machines operation. Repair or replace any damaged parts before operation.
5. **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.
6. **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.
7. **Properly secure** the cutting tool in the spindle before operating the machine.
8. **Do not remove** any warning signs.
9. **Check** safety equipment, such as safety covers, emergency stop buttons, safety mats, railings, light booms, ramps, and warning signs.
10. **Make sure** electrical cables are well protected from damage. Check insulation periodically for wear.
11. Remove any adjusting tools. Before operating the machine, make sure any adjusting tools have been removed.
12. Keep work area clean. Cluttered areas invite injuries.
13. Dressing material edges. Always chamfer and deburr all sharp edges.
14. **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.
15. 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.
16. Dress appropriate. **DO NOT** wear loose fitting clothing or jewelry as they can be 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.
17. Use eye and ear protection. Always wear ISO approved impact safety goggles. Wear a full-face shield if you are producing metal filings.
18. **DO NOT** over reach. Maintain proper footing and balance at all times. **DO NOT** reach over or across a running machine.
19. Stay alert. Watch what you are doing and use common sense. **DO NOT** operate any tool or machine when you are tired.
20. Observe work area conditions. **DO NOT** use machines or power tools in damp or wet locations. **DO NOT** expose to rain. Keep work area well lighted. **DO NOT** use electrically powered tools in the presence of flammable gases or liquids.

21. Keep children away. Children must never be allowed in the work area. **DO NOT** let them handle machines, tools, or extension cords.
22. 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.
23. **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.

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.



***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.*

TECHNICAL SPECIFICATIONS

Table Size	49" x 9" (1245 x 230mm)
Spindle Center To Column Min Max	8.38" – 20.98" (215 – 533mm)
Spindle Diameter	3.37" (85mm)
Spindle Feed Per Rev	.0015"/.003"/.005" (.0381/.0762/.127mm)
Spindle Head Swivel	45° (F&R) 90° (R&L)
Motor Spindle	3hp (2.25kw)
Travel Auto X Axis	25.19" (640mm)
Travel Auto Y Axis	12" (305mm)
Travel Auto Z Axis	16" (406mm)
Travel Manual X Axis	28.5" (725mm)
Travel Manual Y Axis	12" (305mm)
Travel Manual Z Axis	16" (406mm)
Spindle Nose To Table Min Max	2.24" – 18.22" (57 – 463mm)
Spindle Speed	60 – 4200 rpm
Spindle Taper	NST 40
Table Load Capacity	440 lbs. (200kg)
T Slots	.625" (15.8mm)
Motor Coolant	1/8hp (93w)
Cross Travel Of Ram	12.59" (320mm)
Power	220V / Verify Phase. 25A
Shipping Weight	2,200 lbs. (998kg)
Spindle Travel	5" (127mm)
Shipping Dimensions	60" x 60" x 83" (1524 x 1524 x 2109mm)

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@baileighindustrial.com, Phone: 920.684.4990, or Fax: 920.684.3944.

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 in one crate. 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 plug in the power cable, or turn the power switch on until the missing parts are obtained and installed correctly.

Cleaning

Your machine may be shipped with a rustproof waxy oil coating and grease on the exposed unpainted metal surfaces. To remove this protective coating, use a degreaser or solvent cleaner. 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.

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.

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:

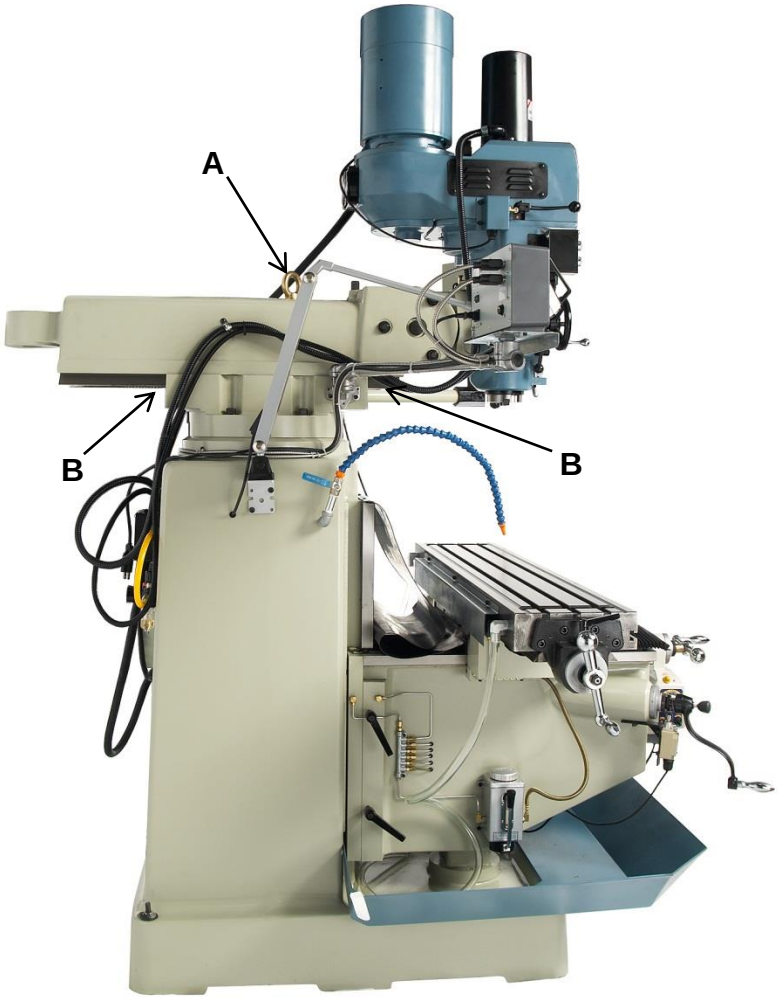
- Always lift and carry the machine with the lifting holes provided at the top of the machine.
- Use lift equipment such as straps, chains, capable of lifting 1.5 to 2 times the weight of the machine.
- Take proper precautions for handling and lifting.
- Check if the load is properly balanced by lifting 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.

- 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.

1. Position the ram head and the table to the back limit against the column.
2. Tighten the (4) ram locking bolts that hold the ram to the column to 47 ft. lbs. of torque.
3. The preferred method for lifting the mill is with the eye-bolt (**A**) installed into the tapped hole on the top of the ram. Be careful to steady the mill to prevent it from spinning.

An alternative method for lifting the mill is with slings.

4. Position the slings around the ram as close to the column as possible (**B**). Verify that the slings do not damage other components such as wires and mounting brackets.
5. Check if the load is properly balanced by lifting it an inch or two.
6. Locate the machine where it is to be installed, and lower slowly until it touches the floor.



INSTALLATION

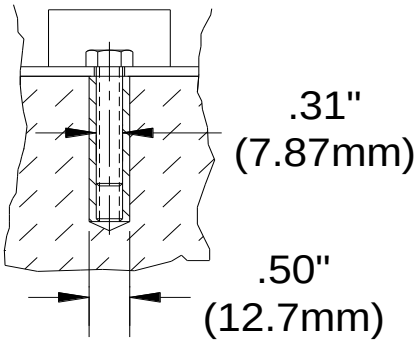
IMPORTANT:

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

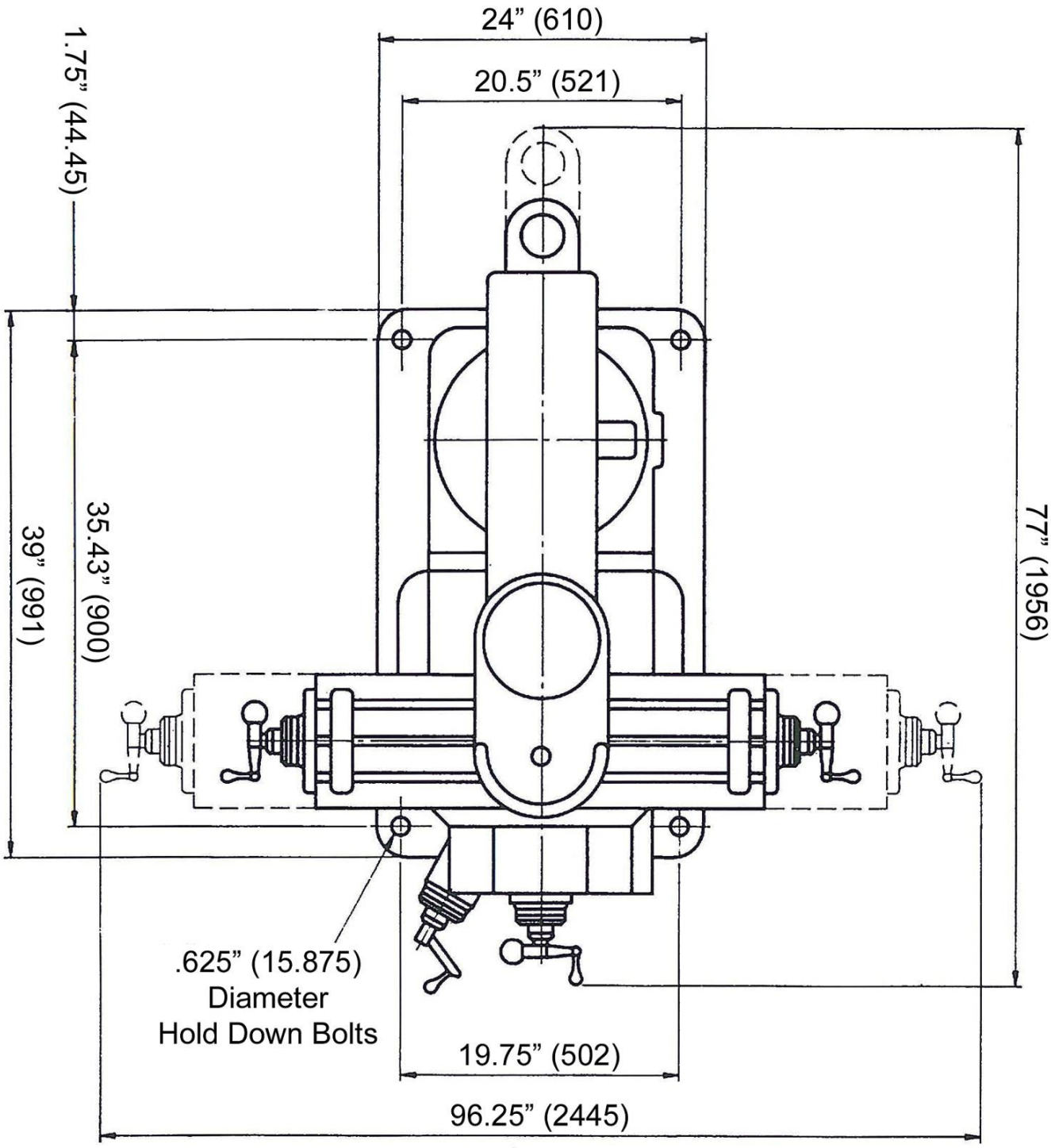
- Overall weight of the machine.
- Weight of material being processed.
- Sizes of material to be processed through the machine.
- Space needed for auxiliary stands, work tables, or other machinery.
- Clearance from walls and other obstacles.
- Maintain an adequate working area around the machine for 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, using bolts and expansion plugs or sunken tie rods that connect through holes in the base of the stand.



OVERALL DIMENSIONS

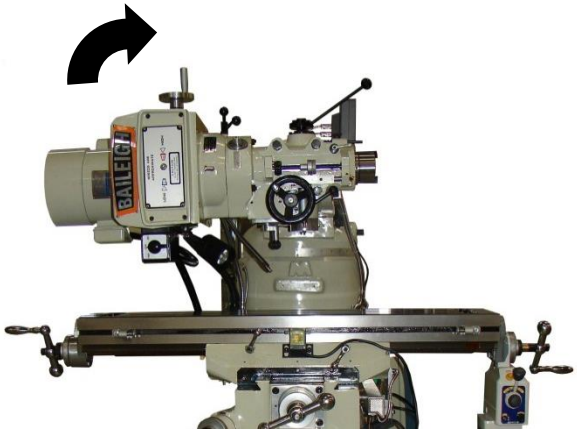


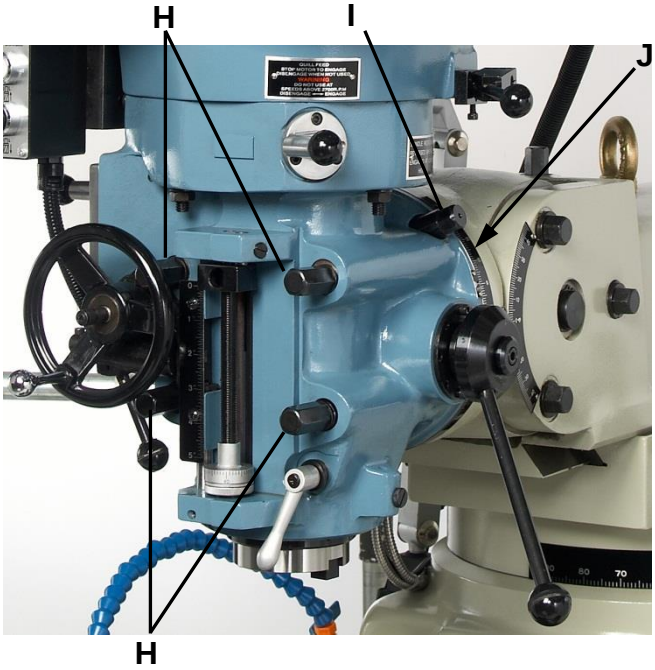
ASSEMBLY AND SET UP

⚠ 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

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





Drip Tray

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

Drain Hose Connection

Install the bayonet fittings (**L**) into each end of the table. Connect a drain hose to the fitting and secure with a hose clamp. Run the other end of the hoses down to the drip tray.

Shipping Container Contents

1 Mill
1 Flat Way Cover (rear)
1 Accordion Way Cover (front)
1 Tool Box:
- 1 Hex Wrench Set (1.5 - 10mm)
- 1 19mm Combination Wrench
- 1 #2 Cross Point Screw Driver
- 1 #2 Flat Blade Screw Driver
- 1 Plastic Oil Cap
- 1 Operator's Manual

ELECTRICAL

***Important**: Verify the electrical phase of your machine before making the electrical connections. This model is sold as single phase or three phase. All other operation is similar.*

WARNING: Baileigh Industrial is not responsible for any damage caused by wiring up to an alternative 3-phase power source other than direct 3-phase. If you are using an alternate power source, consult a certified electrician or contact Baileigh Industrial prior to energizing the machine.

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 machine is wired for 220 volts, 60hz alternating current. Before connecting the machine to the power source, make sure the power source is OFF.
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 ±5%, and for the frequency is ±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

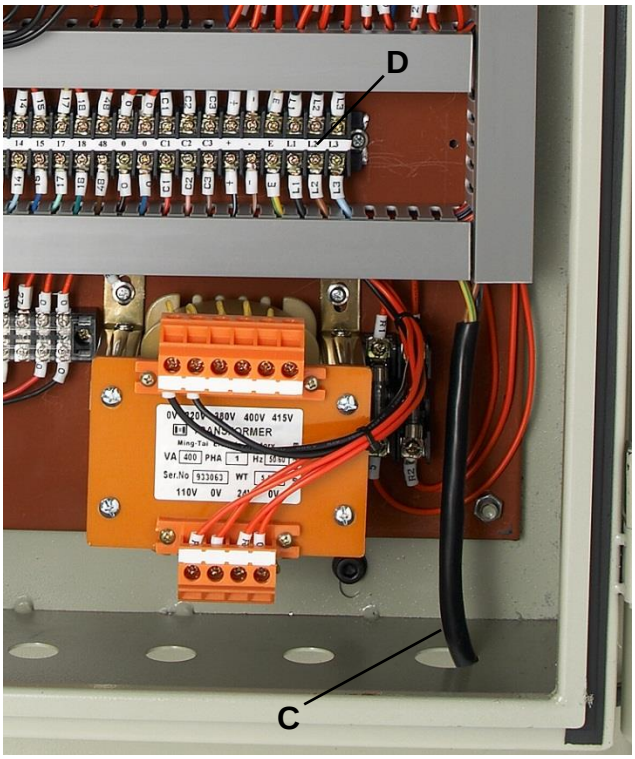
Extension cord should be in good condition and meet the minimum wire gauge requirements listed below:

	LENGTH		
AMP RATING	25ft	50ft	100ft
0-6	16	16	16
7-10	16	16	14
11-12	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:

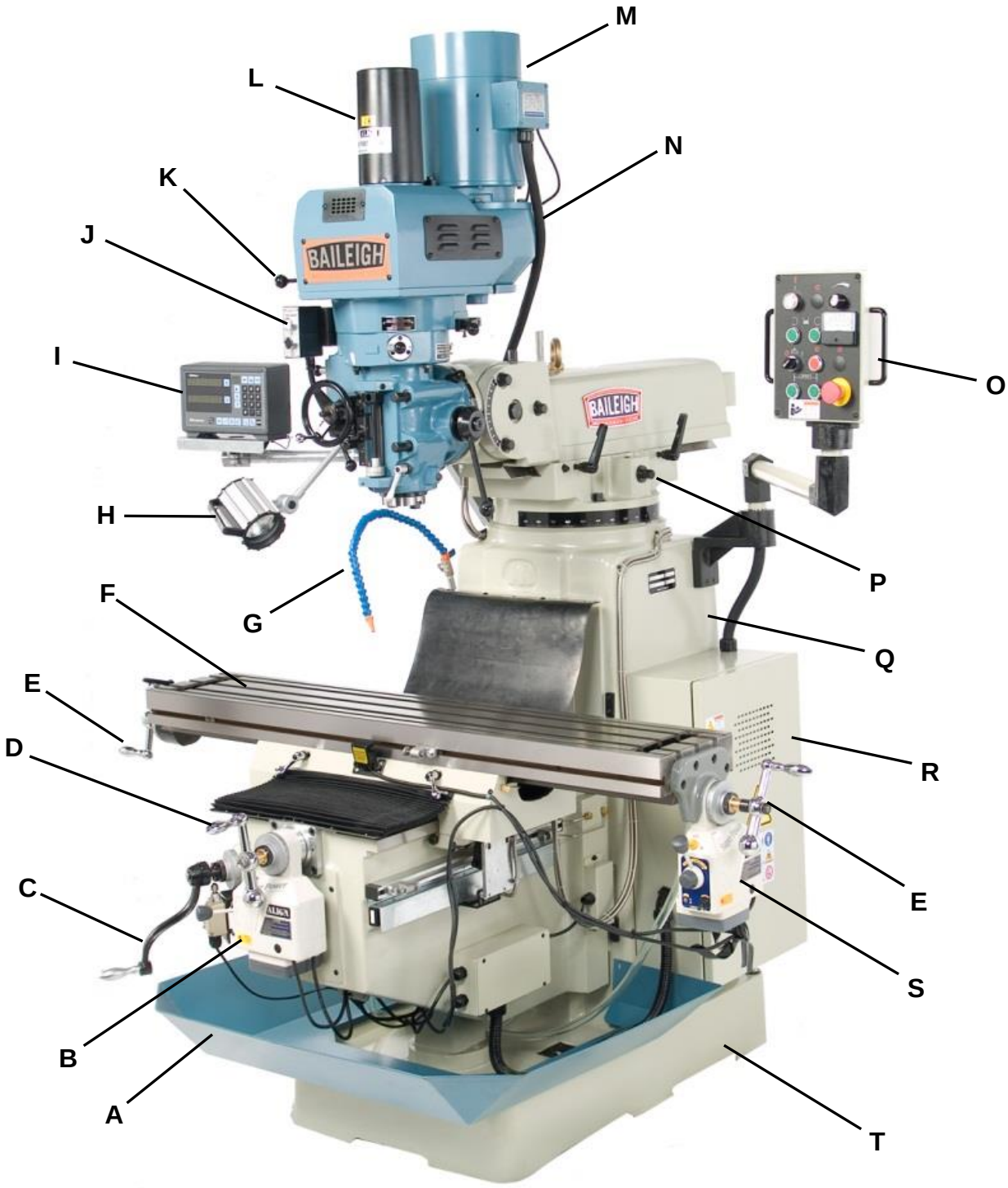
1. Unlock and open the electrical enclosure door.
2. Locate the power cord (C) which connects to the terminal strip at locations E, L1, L2, and L3 (D). Insert a fitting into an open hole to grip the power cord (supplied by customer).
3. Connect the three power wires terminals L1, L2, & L3. Connect the ground wire (typically green) to the E terminal.
4. Check that the power cord has not been damaged during installation.



Check for correct rotation of the motor

1. Close the electrical enclosure door.
2. With power connected and the main disconnect turned ON, the power light (**E**) on the control panel will be lit.
3. Push the spindle forward start button (**F**) to start the spindle. The spindle should rotate in a clockwise direction as looking down on the spindle from and overhead position.
4. If not, disconnect power to the machine, and switch the **L1** and **L3** wires**. DO NOT** move the ground wire.

GETTING TO KNOW YOUR MACHINE



Item	Description	Function
A	Chip and Drip Tray	Collects chips and funnels coolant back to tank
B	“Y” axis Power Feed	Power feed to drive the table forward and back
C	“Z” axis Manual	Turning the handle raises and lowers the knee
D	“Y” axis Manual	Turning the handle moves the table forward and back
E	“X” axis Manual	Turning the handle moves the table left or right
F	Table	Holds the material for machining
G	Flexible Coolant Hose	Directs the flow of coolant to the material
H	Work Lamp	Provides additional light as needed
I	Digital Readout (DRO)	Displays and sets “X” and “Y” axis positions
J	Drawbar Control	Used to install and remove tooling
K	Spindle Brake Lever	Stops and hold the spindle when power is turned off
L	Air Power Drawbar Drive	Electrically controlled air drive to install and remove tooling
M	Drive Motor	Powers the spindle for machining
N	Drive Housing	Houses the drive gears
O	Control Panel	Houses the controls used to operate the mill
P	Ram Crankshaft	Turn the crankshaft to extent or retract the ram
Q	Column	Support for the milling head and houses the coolant pump
R	Electrical Enclosure	Houses electrical components and connections
S	“X” axis Power Feed	Power feed to drive the table left and right
T	Machine Base	Supports the mill and houses the coolant tank

Operator Controls

NOTICE: *When starting the motor, allow the motor to come up to the full set RPM before placing a load on the motor. At the highest frequency setting, this may be as long as 10 seconds. Motor damage will occur if loaded before full rpm is achieved. This is NOT covered by warranty.*

The control panel contains the following control functions:

1. Power Lamp
2. Spindle Reverse
3. Spindle Forward
4. Spindle Stop
5. Coolant Pump
6. Knee Down
7. Knee Up
8. Emergency Stop
9. RPM Indicator for Spindle
10. Spindle Frequency Adjusting

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 easily engaged with the spindle running.

Power Feed Engagement Crank

The power feed crank (**A**) 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: *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.*

QUILL FEED
Stop Motor to Engage
Disengage When Not in Use
DO NOT Use at Speeds
Above 2700 RPM
DISENGAGE ◀ ▶ ENGAGE

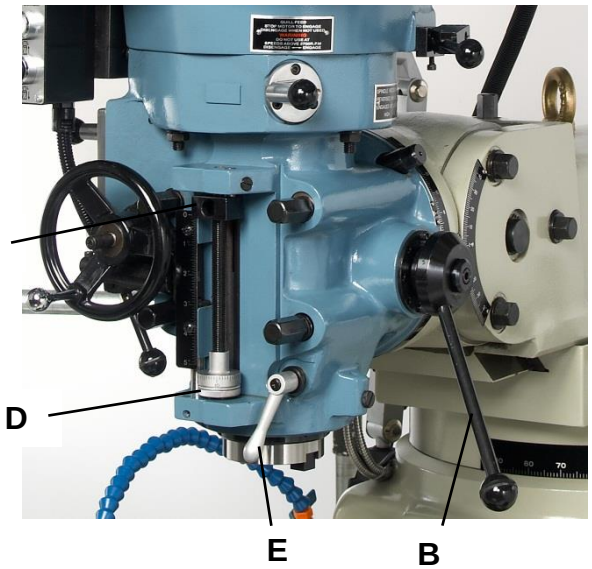
Note: *It is recommended that the power feed worm gear be disengaged whenever the power feed is not required. This will avoid unnecessary wear on power feed worm gear.*

Quill Feed Handle

The quill feed handle (**B**), 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 (**C**) is used to disengage power feed in either direction. It also acts as a depth stop when working to a given depth.



Micrometer Nut

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

Quill Lock

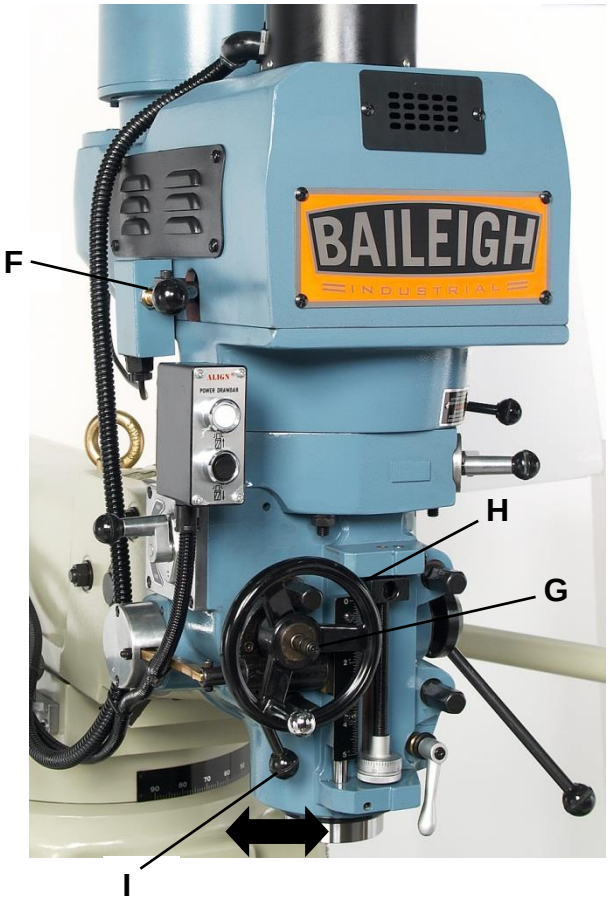
The quill lock (**E**) is used to lock the quill in a stationary up or down position when milling or whenever quill movement is not necessary.

Spindle Brake

The spindle brake handle (**F**) 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.

Feed Reverse Knob

Position of the feed reverse knob (**G**) 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 (**H**) 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.*

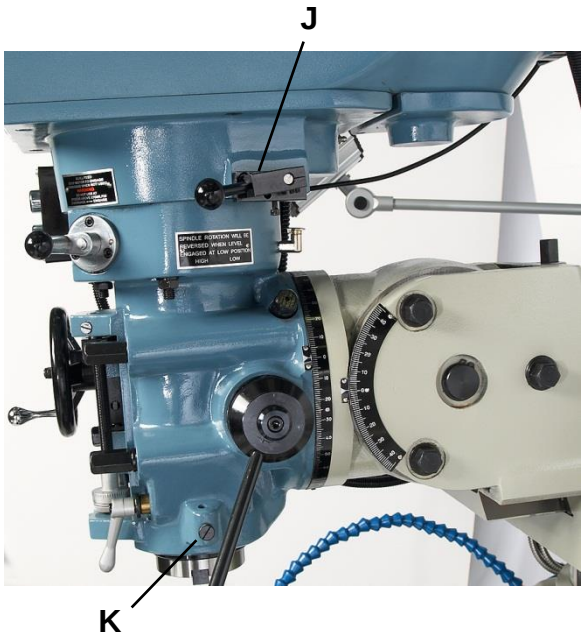
Feed Control Lever

The feed control lever (**I**) 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.*

HI – Neutral – LO Lever

DO NOT shift the Hi – Neutral – Lo lever when the motor is running.
The Hi – Neutral – Lo lever (**J**) 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.



Indicator Mount

Use the indicator mount (**K**) to attach a dial indicator when leveling the tool head to the table.

Using the Drawbar

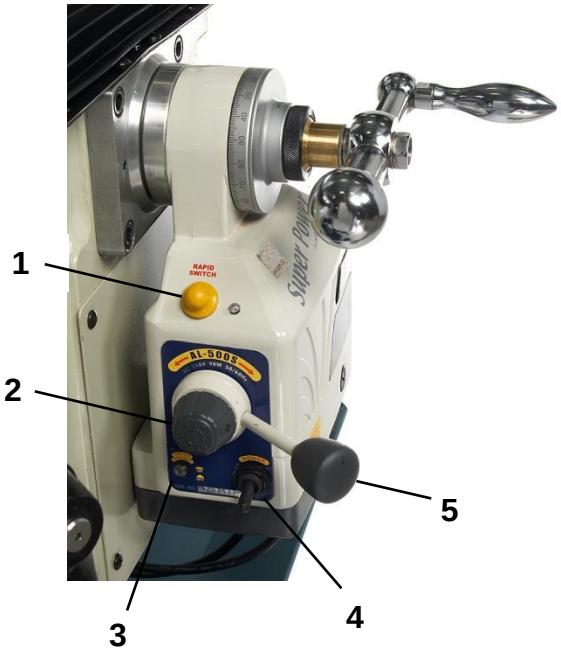
⚠ CAUTION: It will damage the drawbar and possibly the spindle if you engage the power drawbar while the machine running. Ensure the main machine power is "OFF" and the machine has completely stopped.

1. Connect the air supply and set the pressure to 90 psi (6.3kg-cm).
2. Stop the machine.
3. Hold the spindle brake and press the white button to install and tighten the tool.
4. Hold the spindle brake and press the black button to loosen and remove the tool.

Power Table Feed for X and Y Axis

The power table feed may be used to move the table at various speeds on the X and Y axis for automated feed functions.

1. Fast Travel Switch: Press and hold to move the table for repositioning. DO NOT use during milling operation.
2. Speed Control Knob: Use to set the desired speed of the table during a milling operation.
3. Circuit Breaker: Press to reset if tripped.
4. Power Switch: Turns power ON or OFF for the table feed.
5. Directional Control Handle:



⚠ CAUTION: 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 is the KA Counter DRO (Digital Readout). The front has a touch pad for operator input and display areas for that information. The rear of the unit has power cable connector, ground connector, and input connectors for the "X" and "Y" axis. See the separate KA Counter Manual for operation information.

One Shot Oiler

The lines running from the oiler pump supply oil to the ways of the table, saddle, and column (knee) at the same time with single pump stroke when scheduled. See the lubrication and maintenance section.

Coolant Pump

The selector switch on the control panel, 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 metal and debris from the coolant reservoir. Fill with coolant and re-attach access plate.

GENERAL SPEED RECOMMENDATIONS

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

TABLE OF CUTTING SPEEDS AND FEEDS

Feet per Minute	15	20	25	30	40	50	60	70	80	90	100
Diameter Inches	Revolutions per Minute										
1/16"	917	1222	1528	1833	2445	3056	3667	4278	4889	5500	6112
1/8"	458	611	764	917	1222	1528	1833	2139	2445	2750	3056
3/16"	306	407	509	611	815	1019	1222	1426	1630	1833	2037
1/4"	229	306	382	458	611	764	917	1070	1375	1375	1528
5/16"	183	244	306	367	489	611	733	856	978	1100	1222
3/8"	153	204	255	306	407	509	611	713	815	917	1019
7/16"	131	175	318	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

MACHINE ADJUSTMENT

Alignment of head

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 in (fig. 1),
2. Mount a surface indicator as shown.
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 0.0005”*

4. Re-tighten the locking bolts.
5. Loosen the (4) locknuts in (fig. 2) but leave some drag on them for fine adjustment.
6. Mount a surface indicator as shown.
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.

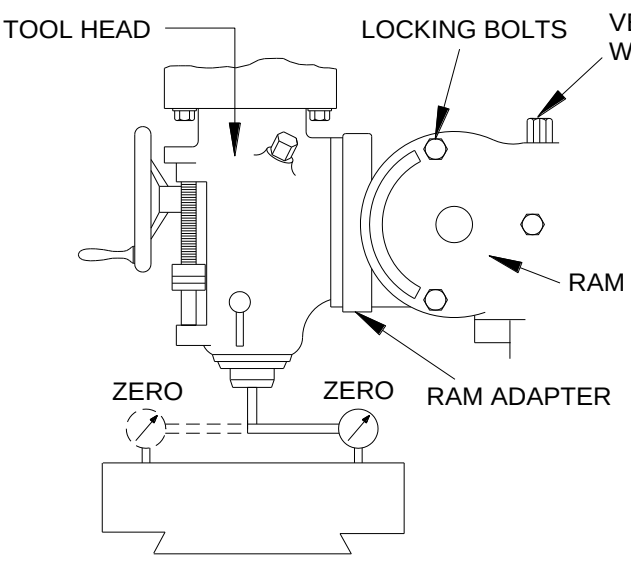


figure 1

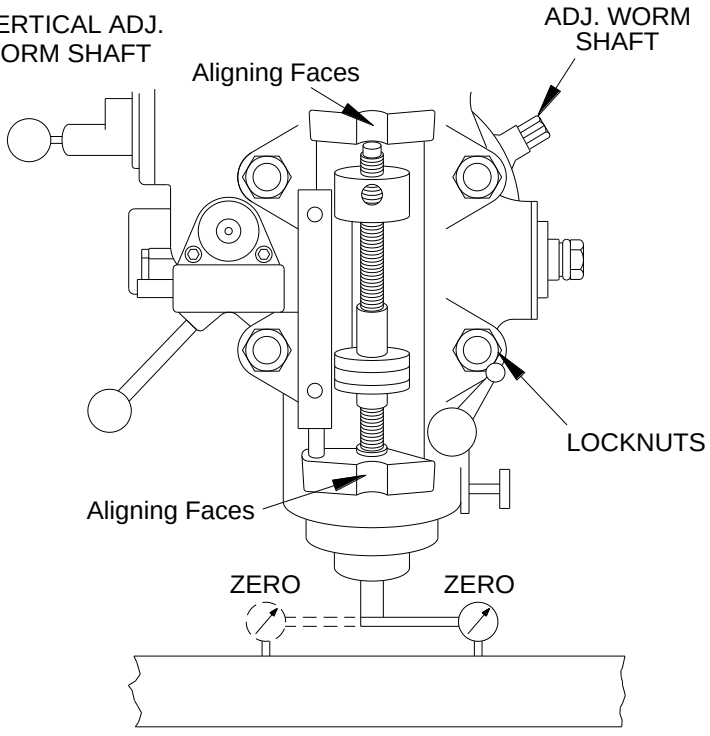
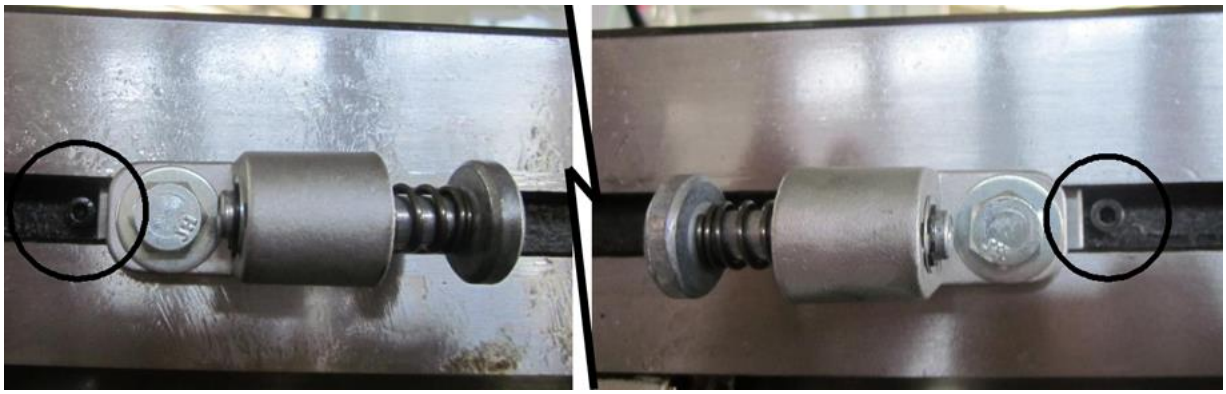


figure 2

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.

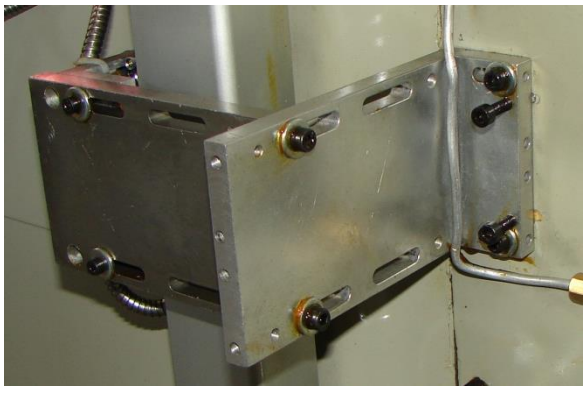
NOTE: *Always be aware of any interference points or cables that may need to be moved.*

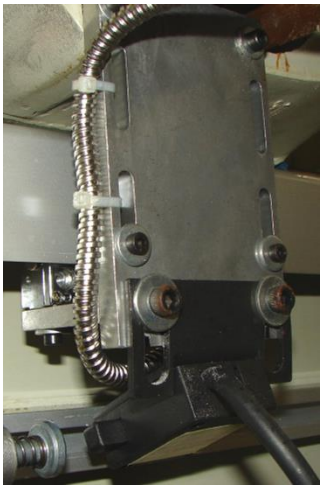


IMPORTANT: ***NEVER*** *move the positive travel stop blocks on the Y axis to allow the table to travel closer to the end of the table. This will damage the table and the DRO reader. This will void the warranty and be determined to be tampering with the limit switches.*

Electronic Ruler Adjustment

The electronic rulers and pickups have been set-up and adjusted at the factory. No further adjustments should be required. If in need of further assistance contact: **Baileigh Industrial service department.**





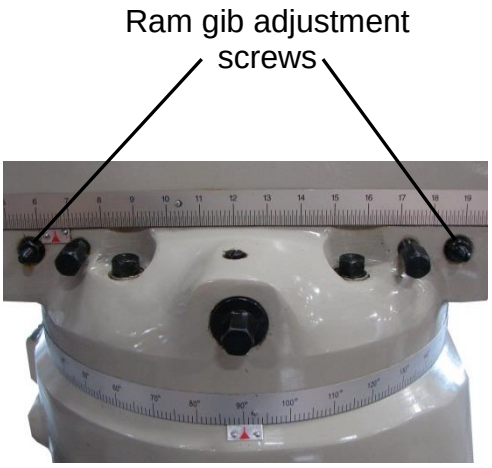
GIB ADJUSTMENT

⚠ CAUTION: DISCONNECT THE MILL FROM POWER SOURCE BEFORE ADJUSTING THE GIBS.

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 Ram Gib

The column swivel has a long tapered gib and two adjustment screws. To tighten gib, turn adjusting screws clockwise (**cw**) until a slight drag is felt when moving the Ram manually. First back off the jam nut, use a flathead screw driver to make the adjustment, and then re-tighten the jam nut.



Adjustment of Knee Gib

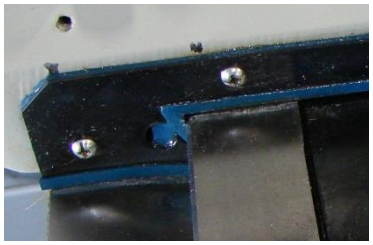
Remove the chip wiper. To tighten gib, turn the adjusting screw clockwise (**cw**) until a slight drag is felt when moving the knee up and down. Replace the chip wiper.

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

Adjustment of Saddle Gib

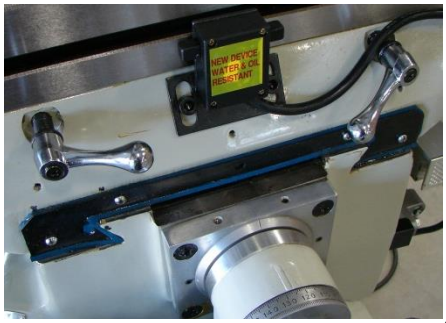
A tapered gib is used for adjusting the saddle bearing on the knee. This forms a guide for the saddle. To tighten the gib, first remove the pleated way cover (**P**). Next remove the (4) screws holding on the chip wiper guard plate and pull it back. The adjustment can be made through the hole as indicated on the wiper. To tighten gib, turn adjusting screw clockwise (**cw**) until a slight drag is felt when moving the saddle manually. Replace the chip wiper guard plate and pleated way cover.



Clamping the Table, Saddle, 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 as shown. 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, along side the column. The knee clamps should only be used when there is no need to change the elevation of the table.

Ram Position

Front to Back

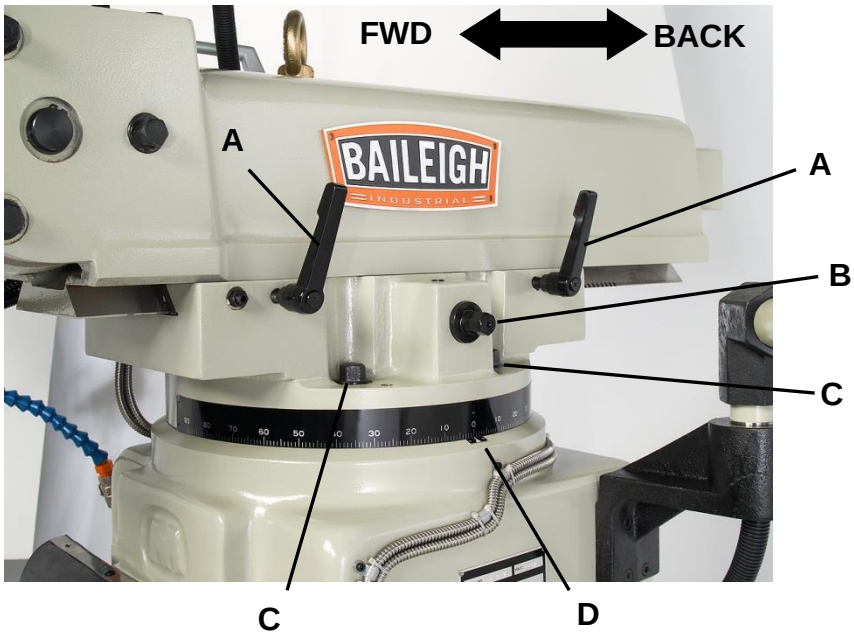
The ram can be moved after loosening the (2) ram lock studs (**A**). Rotating crankshaft (**B**) clockwise (**cw**) will move the ram back. Counterclockwise (**ccw**) rotation will move the ram forward.

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.*

Rotate

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



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

- 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.
- Check and tighten any loose mounting bolts.
- 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.
- Inspect the power plug and cord.
- Keep area around machine clear of debris.
- Check for any unsafe conditions and fix immediately.
- Check that all nuts and bolts are properly tightened.

***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.

Weekly Maintenance

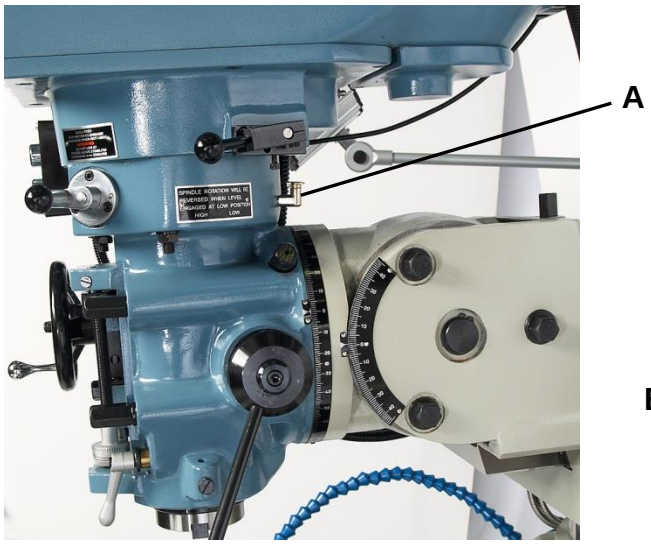
- Thoroughly clean the machine including the coolant reservoir.
- Lubricate the vertical bevel gears.
- Lubricate the 3 leadscrews.

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.

Lubricate the Machine

1. Spindle Bearings - fill oil cup (A) once daily with 10W machine oil.
2. Oil Pump - fill reservoir (B) as needed by removing cap on top of tank and filling with 10W machine oil. Pump oil with release handle once for every hour of operation. Way surfaces and leadscrews are lubricated in this manner.
3. Knee Leadscrew – From under the front of the table, lubricate with #2 tube grease once weekly.



Oil Disposal

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

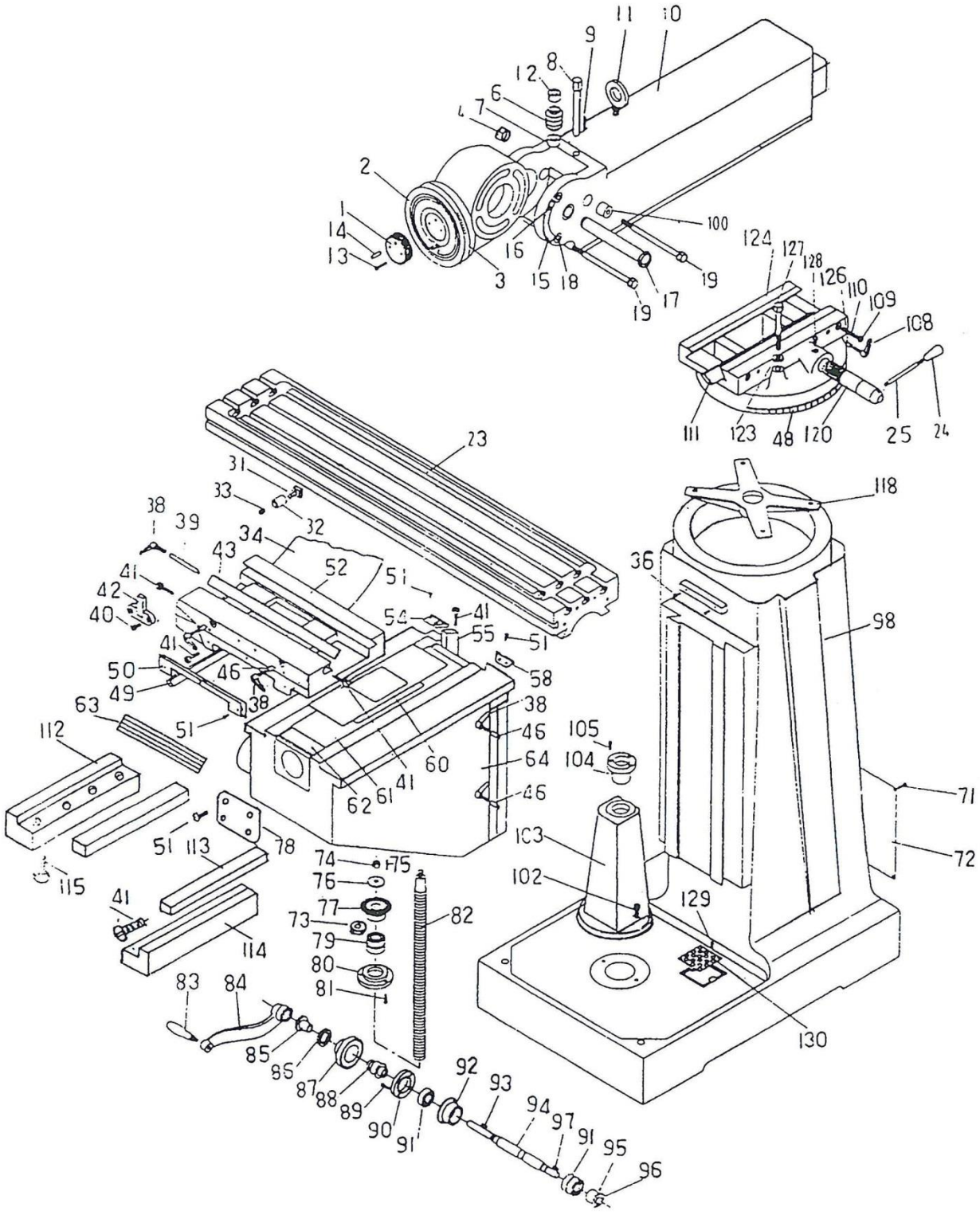
Accessing and Cleaning the Coolant System

- 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.

BASE ASSEMBLY



BASE ASSEMBLY

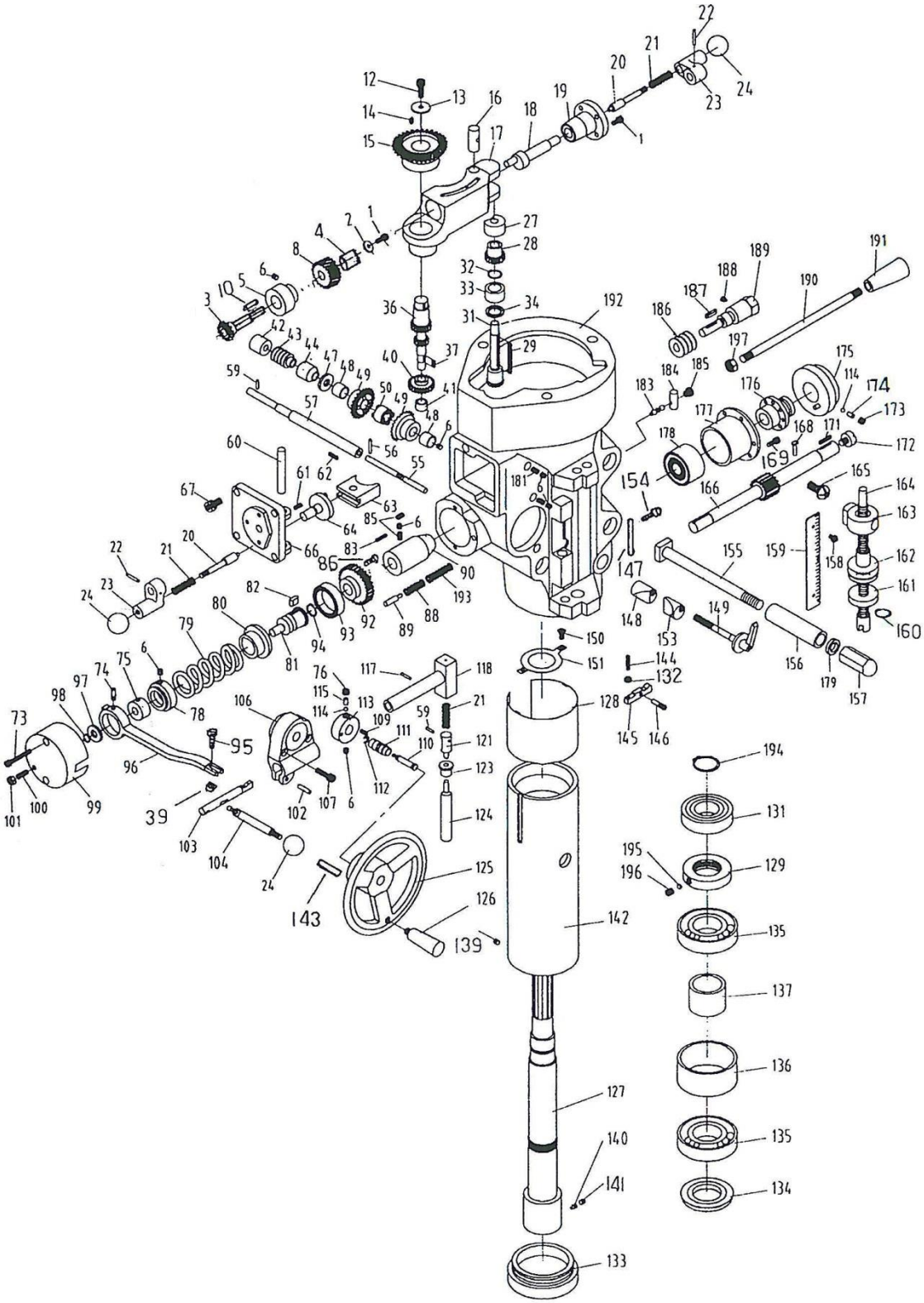
Item	Part No.	Description	Size	Qty.
1	C-1	Worm Washer		1
2	C-2	Ram Adaptor	(#30)	1
2a	C-2	Ram Adaptor	(#40)	1
3	C-3	Adaptor Scale	(#30)	1
3a	C-3	Adaptor Scale	(#40)	1
4	C-4	Lock Nut	(#30)	1
4a	C-4	Lock Nut	(#40)	1
6	C-6	Worm Gear		1
7	C-12	Collar		1
8	C-8	Worm Shaft	(#30)	1
8a	C-8	Worm Shaft	(#40)	1
9	KEY5550	Key	5x5x50	1
10	C-10	Ram	(#30)	1
10a	C-10	Ram	(#40)	1
11	C-11	Hook	3/4"	1
12	C-7-1	Washer		1
13	TS-1504061	Hex Socket Cap Screw	M8x30	2
14	C-14	Spring Pin		1
15	C-15	Angle Plate		1
16	C-16	Rivet		10
17	C-17	Adaptor Pivot Stud	(#30)	1
17a	C-17	Adaptor Pivot Stud	(#40)	1
18	C-18	Washer		3
19	C-9	Locking Bolt	(#30)	3
19a	C-9	Locking Bolt	(#40)	3
23	C-23	Table		1
31	C-31	T-Bolt		2
32	C-32	Table Stop Piece		2
33	C-33	Hex Nut	3/8"-16NC	2
34	C-34	Chip Guard		1
36	C-36	Pan Head Screw	3/16" x 3/8"	4
38	C-38a	Saddle Lock Bolt		5
39	C-39	Saddle Lock Plunger		1

Item	Part No.	Description	Size	Qty.
40	C-40	Hex Socket Cap Screw		2
41	C-41	Adjusting Screw		10
42	C-42	Table Stop Bracket		1
43	C-43	Gib		1
46	C-46	Table Lock Plunger		4
49	C-49	Saddle Knee Gib		1
50	C-50-1	Wiper		2
51	C-51	Pan Head Screw		18
52	C-52	Saddle		1
54	C-54	Knee Wiper Felt		1
55	C-55	Knee Column Gib		1
58	C-58	Knee Wiper Felt		1
60	C-60	Chip Guards		1
61	C-61	Chip Guards		1
62	C-62	Chip Guards		1
63	C-63	Chip Guards		1
64	C-64	Knee		1
71	C-71	Pan Head Screw		8
72	C-72	Cover		1
73	C-23-1	Washer		1
74	C-74	Nut	1/2"-20NF	1
75	KEY5525	KEY	5 x 5 x 25	1
76	C-76	Washer		1
77	C-77	Bevel Gear		1
78	C-78	Front Cover		1
79	BB-5305ZZ	Ball Bearing	5305	1
80	C-80	Bearing Stop		1
81	TS-1503051	Hex Socket Cap Screw	M6 x 20	3
82	C-82	Leadscrew		1
83	C-83	Handle		1
84	C-84	Elevating Crank		1
85	C-85	Gear Shear Clutch		1
86	C-86	Dial Lock Nut		1
87	C-87	Dial		1
88	C-88	Dial Holder		1

Item	Part No.	Description	Size	Qty.
89	TS-1503051	Hex Socket Cap Screw	M6 x 20	3
90	C-90	Bearing Stop		1
91	BB-6204ZZ	Ball Bearing	6204ZZ	2
92	C-92	Bearing Stop		1
93	KEY3318	Key	3 x 3 x 18	1
94	C-94	Shaft		1
95	C-95	Grub Set Screw		1
96	C-96	Bevel Gear		1
97	KEY4418	Key	4 x 4 x 18	1
98	C-98	Column		1
100	C-19-1		(#30)	1
100a	C-19-1		(#40)	1
102	TS-1505051	Hex Socket Cap Screw	M10 x 35	2
103	C-103	Lead Screw Housing		1
104	C-82-1	Lad Screw Nut		1
105	TS-1503051	Hex Socket Cap Screw	M6 x 20	3
108	C-38a	Lock Belt	(#30)	2
108a	C-38a	Lock Belt	(#40)	2
109	C-109	Nut	(#30)	2
109a	C-109	Nut	(#40)	2
110	C-110	Set Screw	(#30)	2
110a	C-110	Set Screw	(#40)	2
111	C-111	Gib	(#30)	1
111a	C-111	Gib	(#40)	1
112	C-112	Gib Holder (L)		1
113	C-113	Gib		1
114	C-114	Gib Holder (R)		1
115	TS-1505051	Hex Socket Cap Screw	M10 x 35	8
118	C-118	Spider	(#30)	1
118a	C-118	Spider	(#40)	1
120	C-120	Ram Pinion		1
123	C-123	Spring Washer		4
124	C-124	Turret	(#30)	1
124a	C-124	Turret	(#40)	1
126	C-126	Ram Lock Plunger		2

Item	Part No.	Description	Size	Qty.
127	C-127	Locking Bolt	(#30)	4
127a	C-127	Locking Bolt	(#40)	4
128	C-128	Ram Pinion Set Screw		1
129	C-129	Rivet		2
130	C-130	Strainer		1

HEAD ASSEMBLY



HEAD ASSEMBLY

Index No.	Part No.	Description	Size	Qty.
1	TS-1503031	Hex Socket Cap Screw	M6 x 12	1
2	B-2	Washer		1
3	B-3	Feed Bevel Pinion	(#30)	1
3a	B-3	Feed Bevel Pinion	(#40)	1
4	B-4	Worm Gear Shaft Sleeve	(#30)	1
4a	B-4	Worm Gear Shaft Sleeve	(#40)	1
5	B-5	Bushing		1
6	TS-1522011	Set Screw	M6 x M6	1
8	B-8	Worm Gear		1
10	KEY3312	Key	3 x 3 x 12	1
12	TS-1504031	Hex Socket Cap Screw	M8 x 16	1
13	B-13	Washer		1
14	KEY3308	Key	3 x 3 x 8	2
15	B-15	Bevel Gear		1
16	B-16	Feed Engage Pin		1
17	B-17	Worm Gear Cradle	(#30)	1
17a	B-17	Worm Gear Cradle	(#40)	1
18	B-18	Worm Gear Cradle Shaft		1
19	B-19	Shaft Sleeve		1
20	B-20	Gear Shaft Plunger		2
21	B-21	Spring		2
22	B-22	Spring Pin	3 x 20	2
23	B-23	Shift Crank		2
24	B-24	Black Plastic Ball		3
25	TS-1503010	Hex Socket Cap Screw	M5 x 12	3
27	B-27	Bushing		1
28	B-28	Gear		1
29	KEY3345	Key	3 x 3 x 45	1
31	B-31	Gear Shaft		1
32	B-32	Snap Ring	S-16	1
33	B-33	Bevel Gear Bushing		1
34	B-34	Spacer		1
36	B-36	Gear		1
39	TS-1540031	Nut	M5	1
40	B-40	Feed Drive Gear		1
41	B-41	Needle Bearing		1
42	B-42	Bushing		1
43	B-43	Worm Gear		1
44	B-44	Bushing	(#30)	1
44a	B-44	Bushing	(#40)	1
47	B-47	Washer		1

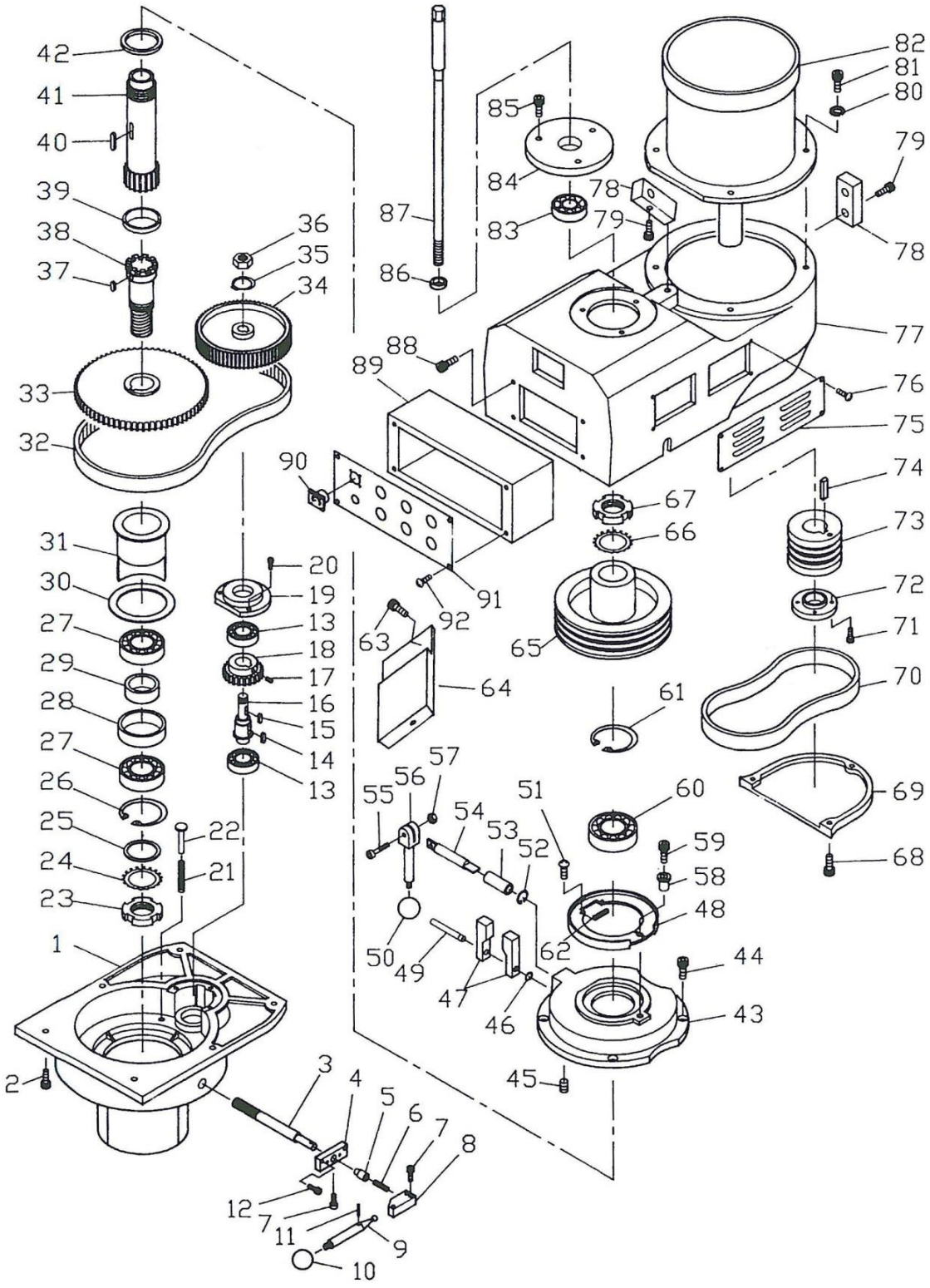
Index No.	Part No.	Description	Size	Qty.
48	B-48	Bushing		2
49	B-49	Bevel Gear		2
50	B-50	Feed Reverse Clutch		1
54	TS-1503061	Hex Socket Cap Screw	M6 x 25	1
55	B-55	Reverse Clutch Rod	(#30)	1
55a	B-55	Reverse Clutch Rod	(#40)	1
56	B-56	Spring Pin	3 x 20	1
57	B-57	Feed Worm Shaft	(#30)	1
57a	B-57	Feed Worm Shaft	(#40)	1
58	TS-1523011	Set Screw	M6 x 6	1
59	B-59	Spring Pin	3 x 12	1
60	B-60	Chip Guard		1
61	TS-1522031	Set Screw	M5 x 10	1
62	KEY3315	Key	3 x 3 x 15	2
63	B-63	Feed Gear Shift Fork		1
64	B-64	Gear Shift Crank	(#30)	1
64a	B-64	Gear Shift Crank	(#40)	1
66	B-66	Cluster Gear Cover	(#30)	1
66a	B-66	Cluster Gear Cover	(#40)	1
67	TS-1502031	Hex Socket Cap Screw	M5 x 12	4
73	TS-1502081	Hex Socket Cap Screw	M5 x 35	2
74	B-74	Clutch Ring Pin		2
75	B-75	Clutch Ring		1
76	TS-1523021	Set Screw	M6 x 8	1
78	B-78	Clutch Locknut		1
79	B-79	Safety Clutch Locknut		1
80	B-80	Overload Clutch		1
81	B-81	Overload Clutch Sleeve	(#30)	1
81a	B-81	Overload Clutch Sleeve	(#40)	1
82	KEY5813	Key	5 x 8 x 13	1
83	B-83	Hex Socket Head Bolt		3
85	TS-1523011	Set Screw	M6 x M6	2
86	B-86	Cross Plate Screw	M4 x 16	4
88	B-88	Spring		1
89	B-89	Spring Plunger		1
90	B-90	Bushing	(#30)	1
90a	B-90	Bushing	(#40)	1
92	B-92	Worm Gear		1
93	B-93	Clutch Ring		1
94	B-94	Snap Ring	S-10	1
95	TS-1502051	Hex Socket Cap Screw	M5 x 20	1
96	B-96	Clutch Trip Lever	(#30)	1
96a	B-96	Clutch Trip Lever	(#40)	1

Index No.	Part No.	Description	Size	Qty.
97	B-97	Clutch Washer		1
98	B-98	Snap Ring	S-10	1
99	B-99	Clutch Arm Cover		1
100	C-19-1	Set Screw	M6 x 16	1
101	TS-1540041	Nut	M6	1
102	B-102	Spring Pin	5 x 18	1
103	B-103	Cam Rod	(#30)	1
103a	B-103	Cam Rod	(#40)	1
104	B-104	Trip Handle		1
106	B-106	Feed Trip Bracket	(#30)	1
106a	B-106	Feed Trip Bracket	(#40)	1
107	TS-1503051	Hex Socket Cap Screw	M6 x 20	1
108	TS-1523031	Set Screw	M6 x 10	1
109	KEY3310	Key	3 x 3 x 10	1
110	B-110	Knob Stud		1
111	B-111	Reverse Knob		1
112	B-112	E-Ring	E-6	1
113	B-113	Handle Wheel Clutch		1
114	B-114	Steel Ball		2
115	B-115	Compression Spring		2
116	B-116	Set Screw	M8 x 6	1
117	B-117	Spring Pin	3 x 15	1
118	B-118	Cam Rod Sleeve	(#30)	1
118a	B-118	Cam Rod Sleeve	(#40)	1
119	B-119	Spring Pin	3 x 12	1
120	B-120	Compression Spring		1
121	B-121	Trip Plunger		1
123	B-123	Bushing		4
124	B-124	Feed Trip Plunger		1
125	B-125	Handle Wheel		1
126	B-126	Handle		1
127	B-127	Spindle	R-8	1
127a	B-127	Spindle	(#30)	1
127b	B-127	Spindle	(#40)	1
128	B-128	Quill Skirt	(#30)	1
128a	B-128	Quill Skirt	(#40)	1
129	B-129	Locknut	(#30)	1
129a	B-129	Locknut	(#40)	1
131	BB-6206ZZ	Ball Bearing	6206ZZ (#30)	1
131a	BB-6008ZZ	Ball Bearing	6008ZZ (#40)	1
132	B-132	Nut	M4	1
133	B-133	Nose Piece	(#30)	1
133a	B-133	Nose Piece	(#40)	1

Index No.	Part No.	Description	Size	Qty.
134	B-134	Spindle Dirt Shield	(#30)	1
134a	B-134	Spindle Dirt Shield	(#40)	1
135	BB-7207C	Angular Bearing	7207 (#30)	1
135a	BB-701OC	Angular Bearing	7010 (#40)	1
136	B-136	Spacer	(#30)	1
136a	B-136	Spacer	(#40)	1
137	B-137	Spacer	(#30)	1
137a	B-137	Spacer	(#40)	1
138	BB-7207C	Angular Bearing	7207	1
139	B-139	Set Screw		1
140	B-140	Set Screw		1
141	TS-1523011	Set Screw	M6 x 6	1
142	B-142	Quill	(#30)	1
142a	B-142	Quill	(#40)	1
143	B-143	Spring Pin	3 x 16	1
144	B-144	Set Screw	M4 x 20	1
145	B-145	Feed Trip Lever		1
146	B-146	Trip Lever Pin		1
147	B-147	Indicator Rod		1
148	B-148	Quill Lock Sleeve	(#30)	1
148a	B-148a	Quill Lock Sleeve	(#40)	1
149	B-149	Lock Handle	(#30)	1
149a	B-149a	Lock Handle	(#40)	1
150	B-150	Round Head Screw	M5 x 8	2
151	B-151	Washer	M5	2
153	B-153	Quill Lock Sleeve	(#30)	4
153a	B-153	Quill Lock Sleeve	(#40)	4
154	B-154	Indicator Rod Screw		4
155	B-155	T-Bolt	(#30)	4
155a	B-155	T-Bolt	(#40)	4
156	B-156	Spacer		4
157	B-157	Adaptor Nut		4
158	B-158	Round Head Screw		2
159	B-159	Micrometer Scale		1
160	B-160	Snap Ring	S-16	1
161	B-161	Quill Micro-Stop Nut		1
162	B-162	Quill Micro-Stop Nut		1
163	B-163	Quill Stop Knob	(#30)	1
163a	B-163	Quill Stop Knob	(#40)	1
164	B-164	Quill Micro-Stop Nut		1
165	B-165	Round Head Screw	M10 x 15	1
166	B-166	Quill Pinion Shaft	(#30)	1
166a	B-166	Quill Pinion Shaft	(#40)	1

Index No.	Part No.	Description	Size	Qty.
168	B-168	Pin		1
169	TS-1503010	Hex Socket Cap Screw	M5 x 12	2
171	KEY3320	Key	3 x 3 x 20	1
172	B-172	Pinion Shaft Hub Screw	(#30)	1
172a	B-172	Pinion Shaft Hub Screw	(#40)	1
173	B-173	Set Screw	5/16" x 1/4"	1
174	B-174	Compression Spring		1
175	B-175	Handle Hub		1
176	B-176	Hub Sleeve		1
177	B-177	Spring Cover	(#30)	1
177a	B-177	Spring Cover	(#40)	1
178	B-178	Clock Spring	(#30)	1
178a	B-178	Clock Spring	(#40)	1
179	B-179	Washer		4
181	TS-1523041	Set Screw	M6 x 12	2
183	B-183	Reverse Trip Ball Lever		1
184	B-184	Reverse Trip Plunger		1
185	B-185	Trip Ball Lever Screw		1
186	B-186v	Worm Gear		1
187	KEY4418	Key	4 x 4 x 18	1
188	B-188	Set Screw		1
189	B-189	Worm Shaft	(#30)	1
189a	B-189	Worm Shaft	(#40)	1
190	B-190	Pinion Shaft Hub Handle		1
191	B-191	Black Plastic Ball		1
192	B-192	Quill Housing	(#30)	1
192a	B-192	Quill Housing	(#40)	1
193	B-193	Compression Spring		1
194	B-194	Snap Ring	(#30)	1
194a	B-194	Snap Ring	(#40)	1
195	B-195	Bush		1
196	TS-1523011	Set Screw	M6 x 6	1
197	B-197	Nut		1

INVERTER SPEED HEAD ASSEMBLY



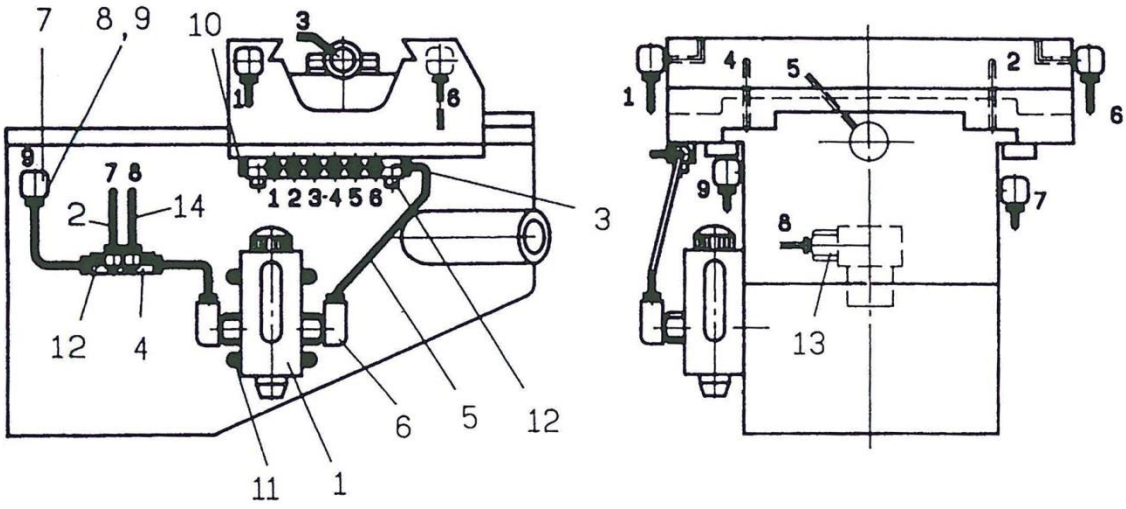
INVERTER SPEED HEAD ASSEMBLY

Index No.	Part No.	Description	Size	Qty.
1	PVS-082	Housing	(#30)	1
1a	PVS-082	Housing	(#40)	1
2	TS-1503051	Hex Socket Cap Screw	M6 x 20	6
3	PVS-087	Gear Shaft Pinion		1
4	PVS-089	Detent Plate		1
5	PVS-090	Bearing Stop		1
6	PVS-091	Spring		1
7	TS-1503011	Hex Socket Cap Screw	M5 x 14	3
8	PVS-092	Pinion Block		1
9	PVS-094	Pinion Crank		1
10	PVS-099	Plastic Ball		1
11	IVS-011	Spring Pin	3 x 20	1
12	TS-1502041	Hex Socket Cap Screw	M5 x 16	3
13	BB-6203ZZ	Ball Bearing	6203ZZ	2
14	KEY5518	Key	5 x 5 x 18	1
15	KEY5515	Key	5 x 5 x 15	1
16	PVS-067	Counter Shaft		1
17	TS-1523011	Set Screw	M6 x 6	1
18	PVS-066	Bull Gear		1
19	PVS-064	Bearing Housing		1
20	TS-1502051	Hex Socket Cap Screw	M5 x 20	3
21	PVS-084	Spring		3
22	PVS-102	Spring Shaft		3
23	PVS-081	Nut	(#30)	1
23a	PVS-081	Nut	(#40)	1
24	PVS-109	Lock Washer	(#30)	1
24a	PVS-109	Lock Washer	(#40)	1
25	PVS-103	Washer	(#30)	1
25a	PVS-103	Washer	(#40)	1
26	PVS-080	Snap Ring	C-62 (#30)	1
26a	PVS-080	Snap Ring	C-72 (#40)	1
27	BB-6908ZZ	Ball Bearing	6908ZZ	2
27a	BB-6910ZZ	Ball Bearing	6910ZZ	2
28	PVS-079	Bearing Washer	(#30)	1
28a	PVS-079	Bearing Washer	(#40)	1
29	PVS-078	Bearing Washer	(#30)	1
29a	PVS-078	Bearing Washer	(#40)	1
30	PVS-076	Washer	(#30)	1
30a	PVS-076	Washer	(#40)	1
31	PVS-075	Rack Cup	(#30)	1
31a	PVS-075	Rack Cup	(#40)	1

Index No.	Part No.	Description	Size	Qty.
32	PVS-063	Timing Belt	225L100 (#30)	1
32a	PVS-063	Timing Belt	8M-560 (#40)	1
33	PVS-074	Gear	(#30)	1
33a	PVS-074	Gear	(#40)	1
34	PVS-062	Timing Belt Pulley	(#30)	1
34a	PVS-062	Timing Belt Pulley	(#40)	1
35	IVS-035	Spring Washer	5/8"	1
36	PVS-061	Nut	5/8"-18NF	1
37	KEY8712	Key	8 x 7 x 12	1
38	PVS-073	Spindle Gear Hub	(#30)	1
38a	PVS-073	Spindle Gear Hub	(#40)	1
39	PVS-100	Collar	(#30)	1
39a	PVS-100	Collar	(#40)	1
40	KEY7740	Key	7 x 7 x 40	1
41	4VS-H003	Spindle Pulley Hub	(#30)	1
41a	4VS-H003	Spindle Pulley Hub	(#40)	1
42	IVS-042	Collar	(#30)	1
42a	IVS-042	Collar	(#40)	1
43	PVS-050	Lower Housing Cover	(#30)	1
43a	PVS-050	Lower Housing Cover	(#40)	1
44	TS-1503051	Hex Socket Cap Screw	M6 x 20	4
45	TS-1523011	Set Screw	M6 x 6	1
46	IVS-046	Snap Ring	S-8	1
47	PVS-059	Brake Stud		2
48	PVS-047	Brake Lining		1
49	PVS-058	Brake Finger Pivot Stud		1
50	PVS-099	Plastic Ball		2
51	IVS-051	Round Head Screw		4
52	IVS-052	Snap Ring	S-12	1
53	PVS-052	Brake Shaft Sleeve		1
54	PVS-053	Brake Lock Shaft		1
55	TS-1503061	Hex Socket Cap Screw	M6 x 25	1
56	PVS-054	Brake Lock Block		1
57	TS-1540041	Nut	M6	1
58	PVS-048	Lock Screw		1
59	TS-1502041	Hex Socket Cap Screw	M5 x 16	1
60	BB-6010ZZ	Ball Bearing	6010ZZ	1
61	PVS-046	Bearing Cover		1
62	PVS-049	Brake Spring		2
63	TS-1502031	Hex Socket Cap Screw	M5 x 12	2
64	IVS-064	Brake Ring		1
65	4VS-002	Pulley	(#40)	1
65a	4VS-002	Pulley	(#30)	1

Index No.	Part No.	Description	Size	Qty.
66	IVS-066	Washer		1
67	IVS-067	Lock Nut		1
68	TS-1502051	Hex Socket Cap Screw	M5 x 20	3
69	PVS-011	Motor Pulley Cover		1
70	IVS-070	Belt		1
71	TS-1502041	Hex Socket Cap Screw	M5 x 16	6
72	1020-H071	Lock Ring		1
73	1020-H070	Motor Pulley		1
74	KEY10830	Key	10 x 8 x 30	1
75	PVS-101	Cover		2
76	IVS-076	Round Head Screw		8
77	PVS-001	Housing		1
78	SP-060	Block		1
79	TS-1504051	Hex Socket Cap Screw	M8 x 25	3
80	IVS-080	Spring Washer	M10	4
81	IVS-081	Hex Socket Cap Screw	M10 x 30	4
82	IVS-082	Inverter Motor	3HP/4P	1
83	BB-6007ZZ	Ball Bearing	6007ZZ (#30)	1
83a	BB-6009ZZ	Ball Bearing	6009ZZ (#40)	1
84	PVS-013	Cover	(#30)	1
84a	PVS-013	Cover	(#40)	1
85	TS-1502041	Hex Socket Cap Screw	M5 x 16	3
86	PVS-115	Draw Bar Washer	(#30)	1
86a	PVS-115	Draw Bar Washer	(#40)	1
87	PVS-114	Draw Bar	(#30)	1
87a	PVS-114	Draw Bar	(#40)	1
88	TS-1503021	Hex Socket Cap Screw	M6 x 10	4
89	4VSE187	Operation Box		1
90	IVS-090	R.P.M. Indicator		1
91	4VSE186	Operation Panel		1
92	IVS-092	Round Head Screw		6

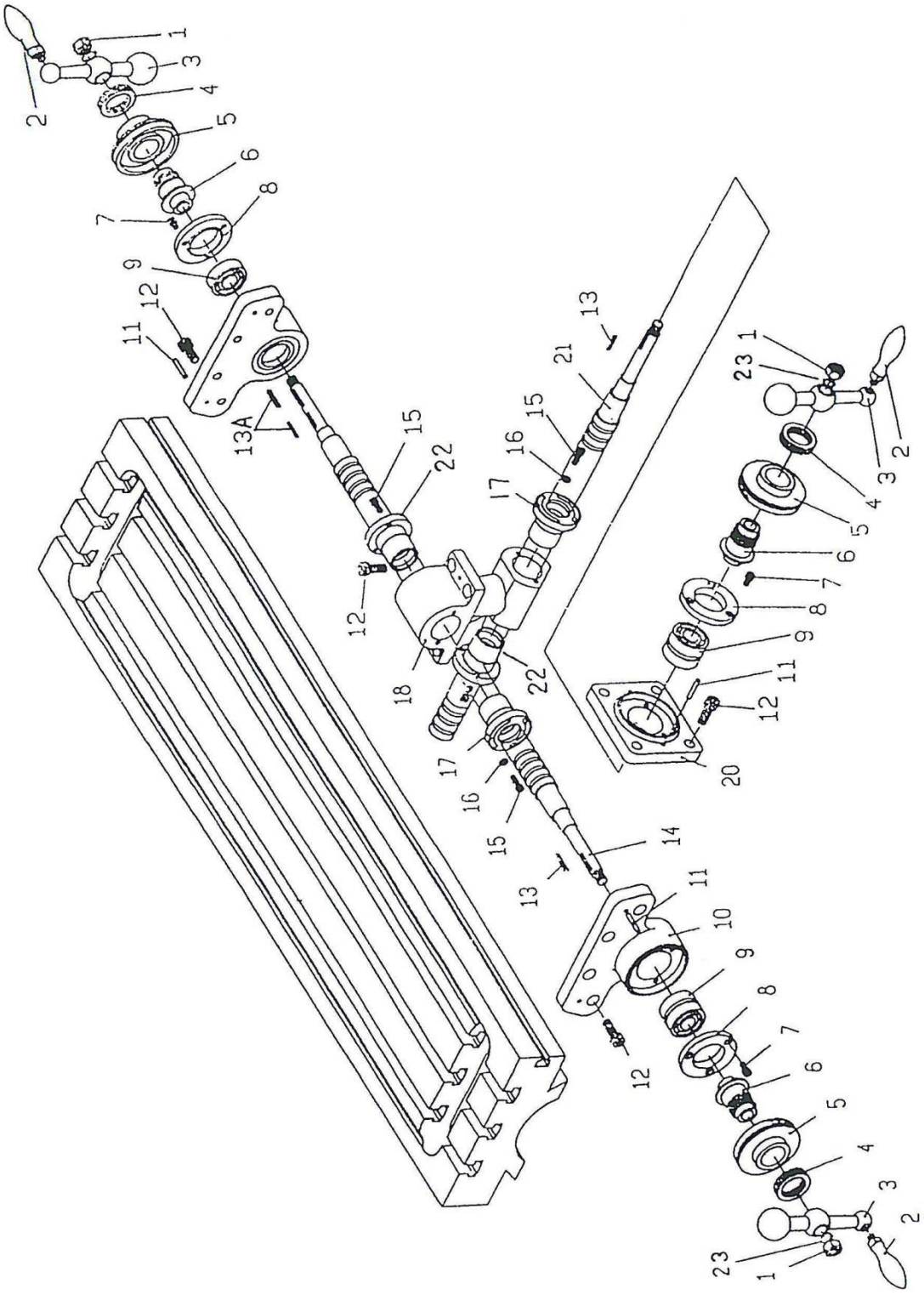
ONE SHOT LUBRICATION SYSTEM



ONE SHOT LUBRICATION SYSTEM

Index No.	Part No.	Description	Size	Qty.
1	CLA-8	Handle Oiler		1
2	ALMP-04	Aluminum Piece	13.5mm	1
3	A-8	Oil Regulation Distributor		1
4	A-4	Oil Regulation Distributor		1
5	A-5	Flexible Steel Tube	4 x 550	1
6	PH-4011	Elbow Joint		2
7	PI-401	Elbow Joint		6
8	PA-4	Thimble Nut		20
9	PB-4	Thimble		20
10	PG-004	Union		1
11		Screw	M6 x 14	4
12	TS-1502061	Hex Socket Cap Screw	M5 x 25	4
13	PD-401	Straight Joint		1
14	A-14	Nylon Piece	4 x 700	1

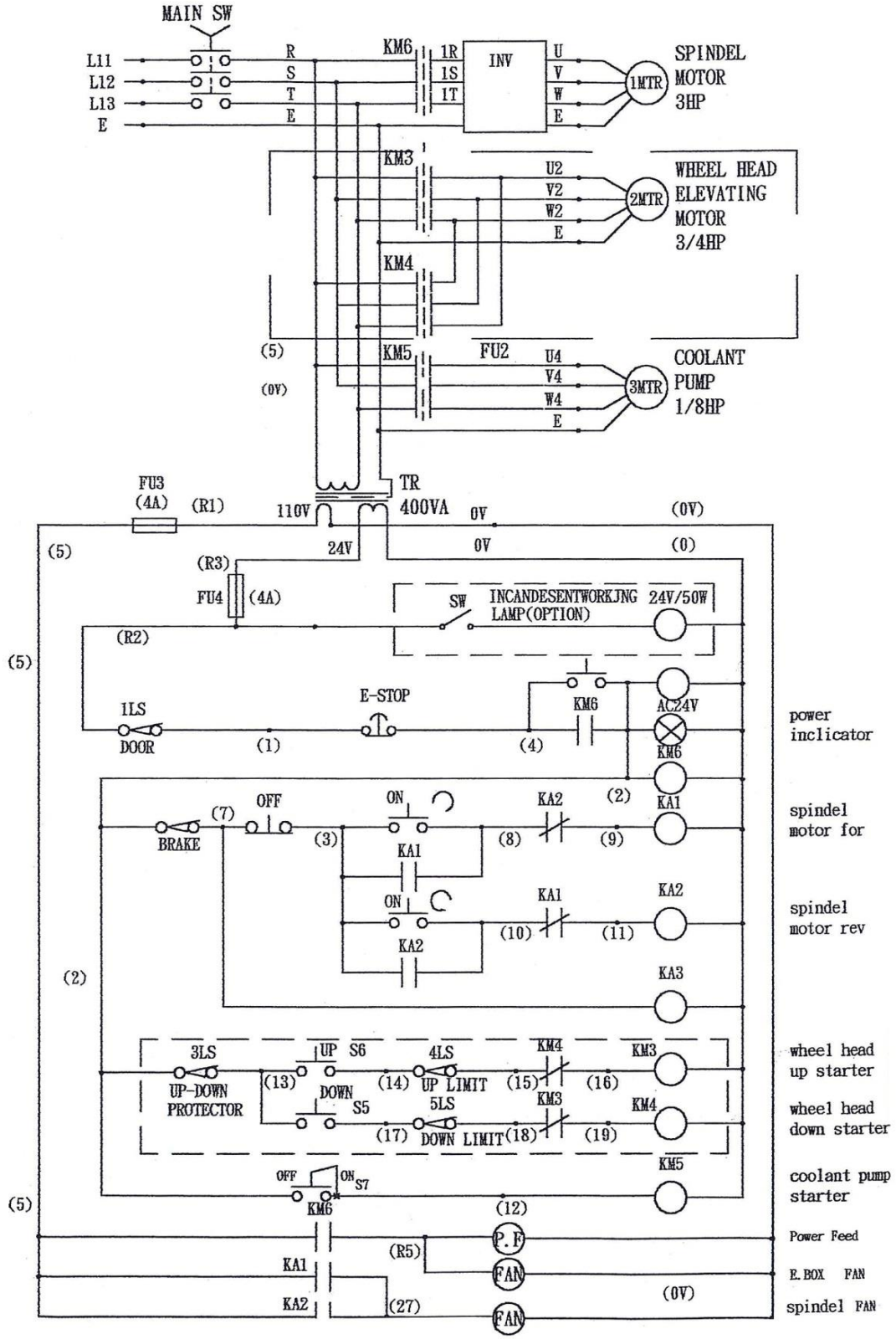
LEADSCREW ASSEMBLY



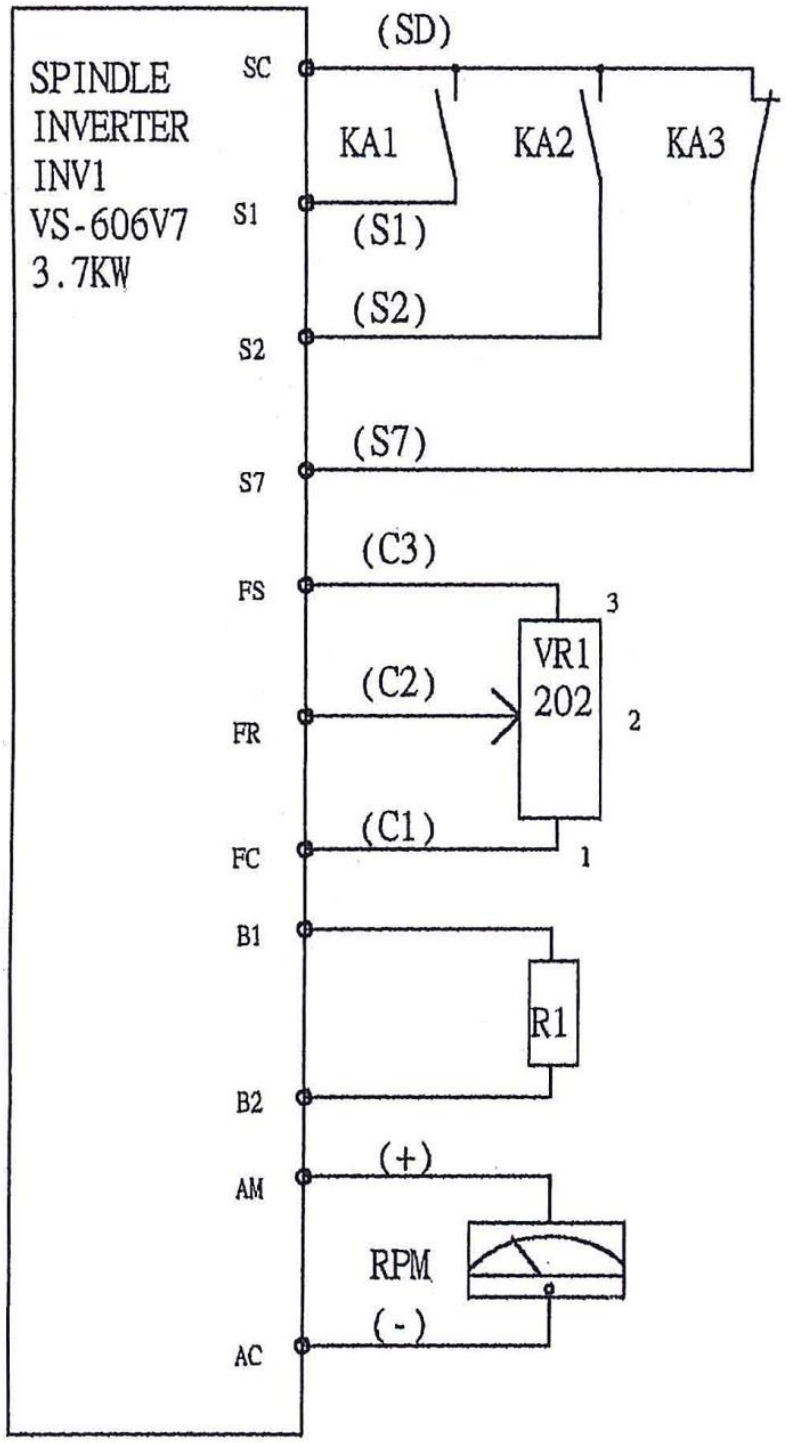
LEADSCREW ASSEMBLY

Index No.	Part No.	Description	Size	Qty.
1	D-1	Nut	1/2"-20NF	3
2	D-2	Handle		3
3	D-3	Ball Crank		3
4	D-4	Dial Lock Nut		3
5	D-5	Dial		3
6	D-6	Dial Holder		3
7	TS-1503031	Hex Socket Cap Screw	M6 x 12	9
8	C-90	Bearing Stop		3
9	BB-6204ZZ	Ball Bearing	6204ZZ	5
10	D-10	Bearing Bracket		2
11	D-11	Spring Pin	5 x 25	6
12	TS-1505031	Hex Socket Cap Screw		16
13	KEY3325	KEY	3 x 3 x 25	2
13a	KEY3325	KEY	3 x 3 x 18	2
14	D-14	Leadscrew		1
15	TS-1503061	Hex Socket Cap Screw		10
16	H-9	Washer		4
17	D-17	Feed Screw Nut		2
18	D-18	Feed Nut Bracket		1
20	D-20	Cross Bearing Bracket		1
21	D-21	Cross Feed Screw		1
22	D-22	Cross Feed Nut		2
23	D-23	Spring Washer		3

ELECTRICAL SCHEMATIC 1



ELECTRICAL SCHEMATIC 2



NOTES

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