OPERATOR'S MANUAL

Metal Working

VERTICAL MILL DRILL

MODEL: VMD-931G

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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 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 attorney 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
- Setup 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. **NOTICE**, which is not related to personal injury, is used without a symbol.

DANGER: Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING: Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

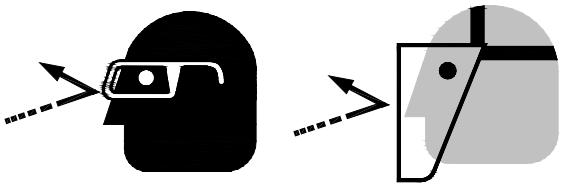
CAUTION: Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE: Indicates a situation which, if not avoided, could result in property damage.

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

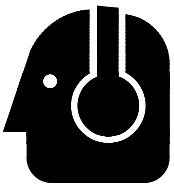
PROTECT EYES

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



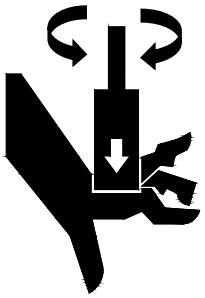
PROTECT AGAINST NOISE

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.



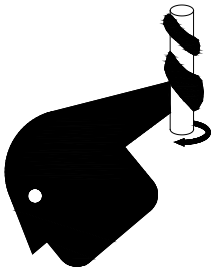
BEWARE OF PIERCING POINTS AND CUTTING HAZARD

NEVER place hands, fingers, or any part of your body on or near rotating tooling. This tooling can be extremely dangerous if you do not follow proper safety procedures. **Keep hand at least 6 inches (150mm) from the tooling while operating.**



ENTANGLEMENT HAZARD – ROTATING SPINDLE

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



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 will not 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 machine's 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. **Dress appropriately. 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.
11. **Use eye and ear protection**. Always wear ISO approved impact safety goggles. Wear a full-face shield if you are producing metal filings.
12. **Do not overreach**. Maintain proper footing and balance at all times. **DO NOT** reach over or across a running machine.
13. **Stay alert**. Watch what you are doing and use common sense. **DO NOT** operate any tool or machine when you are tired.
14. **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.
15. **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.
16. **Keep children away**. Children must never be allowed in the work area. **DO NOT** let them handle machines, tools, or extension cords.
17. Keep visitors a safe distance from the work area.
18. **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.
19. **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.
20. **Turn off** power before checking, cleaning, or replacing any parts.
21. Be sure **all** equipment is properly installed and grounded according to national, state, and local codes.
22. Keep **all** cords dry, free from grease and oil, and protected from sparks and hot metal.
23. 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.
24. **DO NOT** bypass or defeat any safety interlock systems.

TECHNICAL SPECIFICATIONS

Drilling Capacity Cast Iron	1.75” (45mm)
Drilling Capacity Mild Steel	1.25” (32mm)
Face Mill Capacity	3.15” (80mm)
End Mill Capacity	1.25” (32mm)
Working Table Size	31.5" x 9.45" (800 x 240mm)
Working Table Cross Travel	7.48” (190mm)
Working Table Longitudinal Travel	22" (560mm)
Maximum Distance Spindle To Base	17.32” (440mm)
Spindle Stroke	4.75” (120mm)
T-Slot Size	.55" (14mm)
Head Tilt Left Right	90º
Spindle Taper	R8
Draw Bar	7/16”-20 UNF
Spindle Speed	90, 210, 345, 670, 1180, 1970 RPM
Power Supply	115V, 60hz, 20A
Main Motor	2hp, (1.5kw) 115V, 60hz, 17.8A
Coolant Pump	1/16hp, (40w) 115V, 60hz, 0.25A
Coolant Capacity	2.4gal (9L)
Overall Dimension	1075mm*1090mm*800mm
Shipping Dimension (L x W x H)	69” x 44” 70” (1753 x 1118 x 1778mm)
Net Weight	595lbs (270Kg)
Gross Weight	710lbs (322Kg)

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.

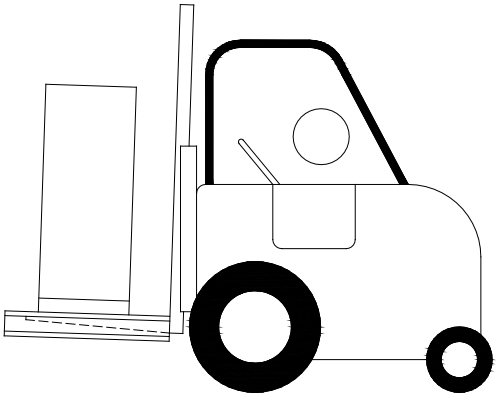
Your machine may be shipped with a rustproof waxy coating and/or grease on the exposed unpainted metal surfaces. Fully and completely remove this protective coating using a degreaser or solvent cleaner. Moving items will need to be moved along their travel path to allow for cleaning the entire surface. 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

NOTICE: *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.*

Follow these guidelines when lifting with truck or trolley:



- 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 with no rocking.

Follow these guidelines when lifting crane or hoist:

- Use lift equipment such as straps capable of lifting 1.5 to 2 times the weight of the machine.
- Lift and carry the machine with the strap around the neck between the column case and the gear case.
- 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, then lower slowly until it touches the surface.

INSTALLATION

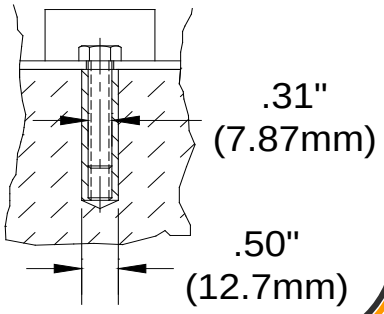
IMPORTANT:

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 machine 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

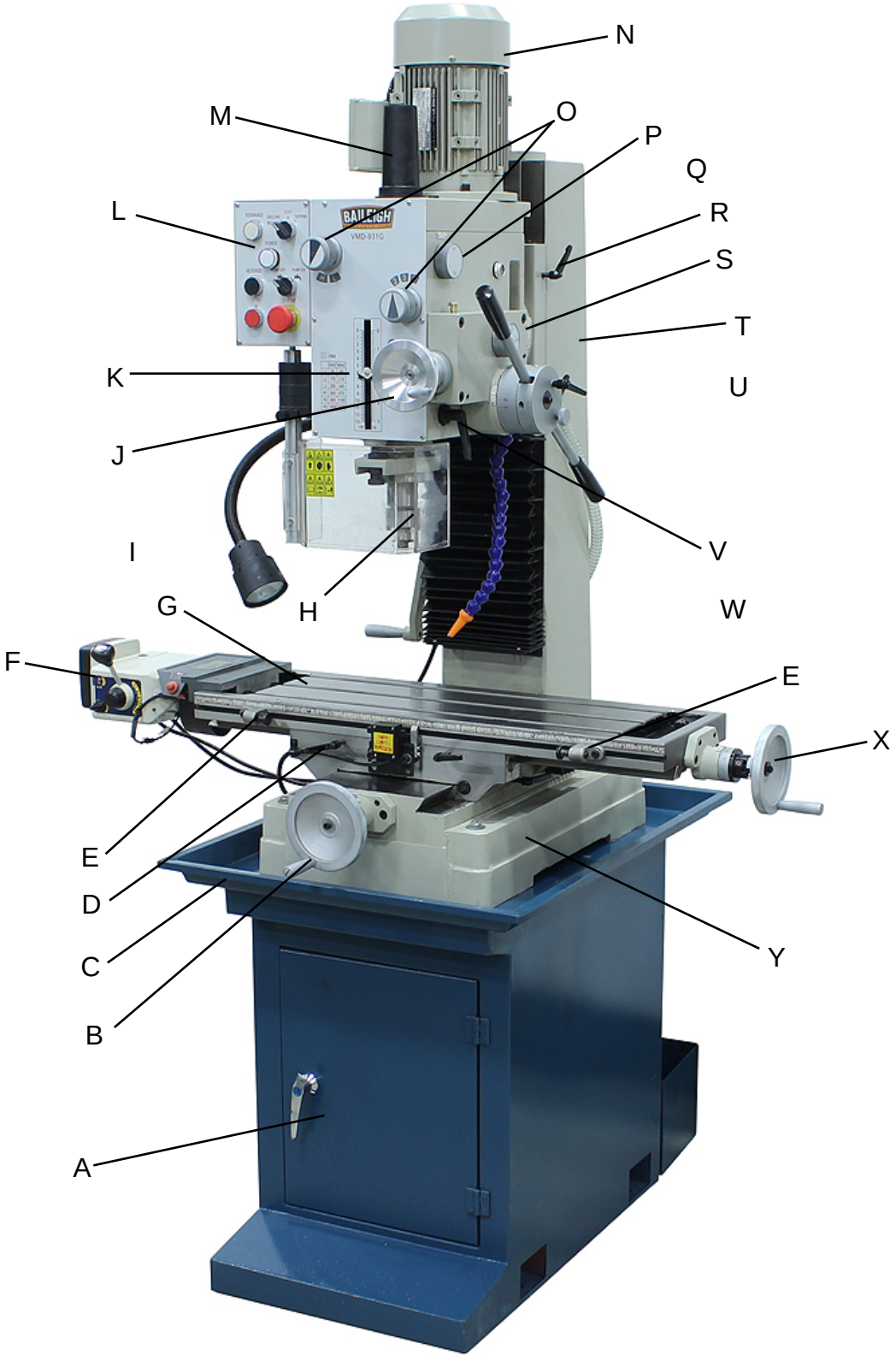
- Once positioned, anchor the machine to the floor, as shown in the diagram. Use bolts and expansion plugs or sunken tie rods that connect through and are sized for the holes in the base of the stand.
- This machine requires a solid floor such as concrete at a minimum of 4” (102mm) thick. 6” (153mm)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



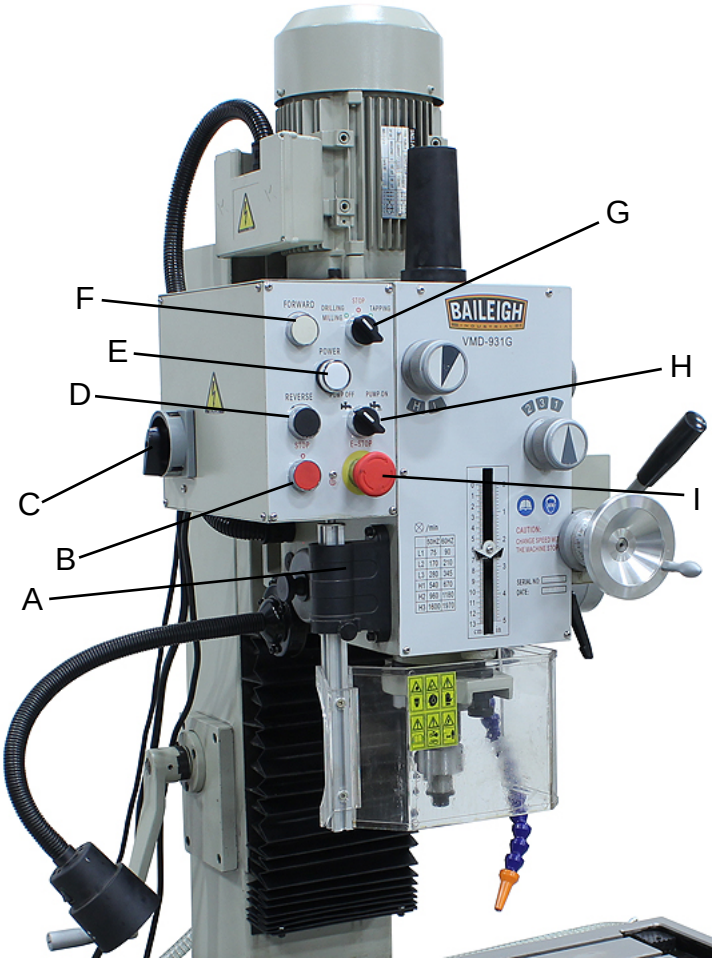
PACKING LIST

Name	Spec	Qty.
Milling & Drilling Machine		1
Stand for Milling & Drilling Machine		1
Draw Bar	7/16''-20UNF	1
Adapter	R8/MT3	1
Taper Shank for Drilling Chuck	R8/B16	1
Drilling Chuck	Ø1 ~ Ø13	1
T Slot Bolt	M12 x 55	2
Washer	M12	2
Nut	M12	2
Tilted Wedge		1
Spanner	19 – 22	1
Hex Wrench Set	3, 4, and 5mm	1
Oil Gun		1

GETTING TO KNOW YOUR MACHINE



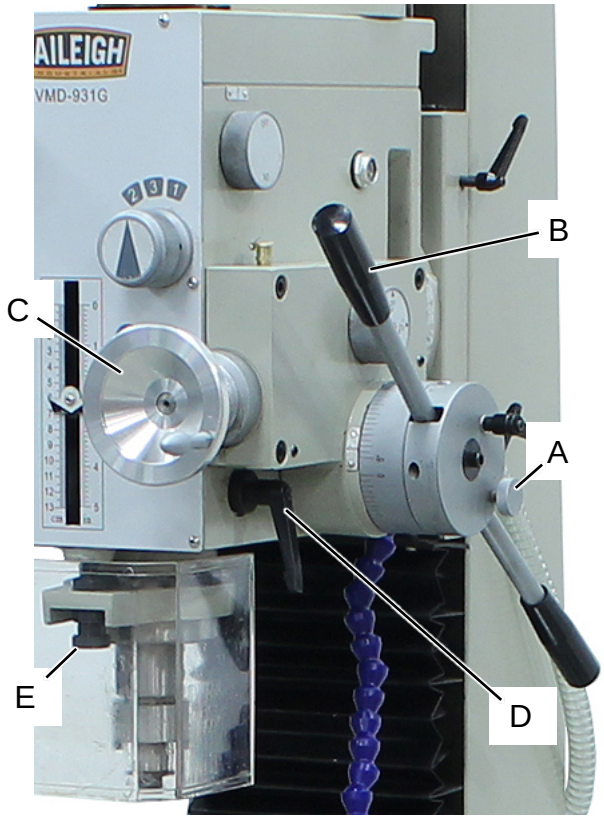
Item	Description	Function
A	Storage Cabinet	To store tools and tooling
B	Cross (Y axis) Handle	Turning the handle moves the table in or out.
C	Coolant Drip Tray	Contains used coolant and machining chips.
D	X Axis Locking Handles	Turning the handles clockwise (cw) locks the (X axis) table
E	Stop Pads, (X Axis)	Stops the travel of the table to the left and right.
F	Longitudinal (X Axis) Power Feed	Power feed to drive the table left and right
G	Table	Used to attach piece part for machining.
H	Spindle	Mounts drilling chuck or milling tooling.
I	Work Light	Illuminates the work point.
J	Fine Down Feed Handwheel	Fine down feed/adjustment of spindle.
K	Depth Gauge Indicator	Displays the quill travel setting.
L	Operation Control Box	Houses the operational switches
M	Drawbar Cover	Access the drawbar.
N	Motor	2hp (1.5kw) to power the vertical mill.
O	Spindle Speed Selectors	Used in combination to change the spindle rotational speed.
P	Power Feed Engagement	Engages the power feed worm gear when the knob is in the On position.
Q	Sight Glass	Displays the oil lever within the gear case.
R	Z Axis Locking Handles	Turning the handles clockwise (cw) locks the (Z axis).
	Head Crank (Z Axis)	Opposite side of lock handles. Use to raise or lower the head.
S	Power Down Feed Selector	Four position shifter to select from neutral to one of three feed rates.
T	Head Support Column	Supports the head and allows raising and lowering.
U	Down Feed Handle	Coarse down feed/adjustment of spindle
V	Quill Travel Lock	Locks the quill up and down travel.
W	Coolant Nozzle	Directs flow of coolant toward the work point.
X	Longitudinal (X Axis) Handle	Turning the handle moves the table left or right.
Y	Base	Support structure for the Mill/Drill and housed a cabinet for the coolant pump and tools and tooling.



Item	Description	Function
A	Chuck Guard Limit Switch	Insures that the chuck guard is closed during operation.
B	Stop Push Button	Stops the spindle motor.
C	Main Disconnect	Turns power On and Off to the electrical system.
D	Reverse Push Button	Starts and runs the spindle in the reverse, (counterclockwise) direction.
E	Power Lamp	Illuminates when power is On (Main Disconnect On) to the electrical system.
F	Forward Push Button	Starts and runs the spindle in the forward, (clockwise) direction.
G	Operation Selector Switch	Selects between the Drilling/Milling operation, Off for no operation, or Tapping operation.
H	Coolant On/Off Switch	Turns the coolant pump On and Off as desired.
I	Emergency Stop Switch	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.

Fine Feed Handwheel

To use the Fine Feed Handwheel, turn the lock knob (A) counter-clockwise (ccw) until loose enough to allow the feed handle (B) to be pulled outward to the locked position.
Turn the handwheel (C) clockwise to move the quill down. The manual feed handle will also rotate forward with the fine feed handwheel.
Turn the engagement knob (A) clockwise until the feed handles release the fine feed handwheel and return the quill feed handle to operation.



Quill Feed Handle

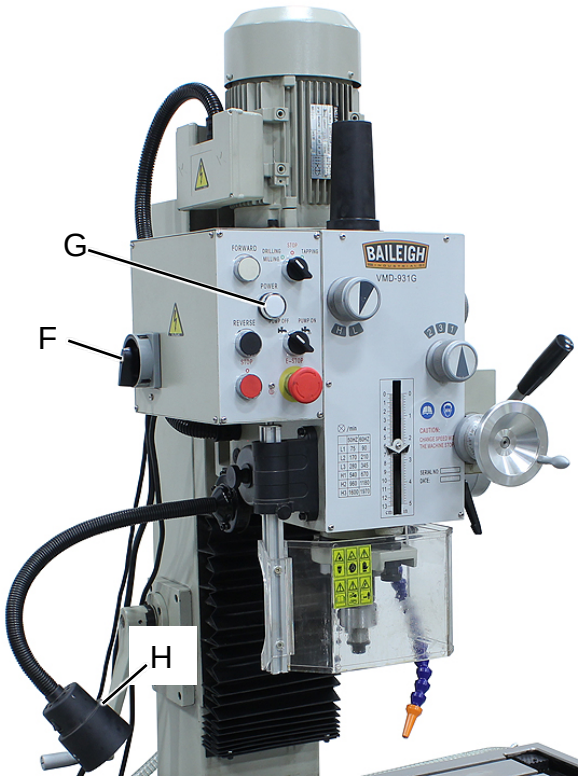
The quill feed handle (B), when turned, either lowers or raises the quill.

Quill Lock

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

Depth Stop

The depth stop adjustment thumb screw (E) is used for the setting/limiting the depth pf quill travel. As shown, the depth stop is set for full quill travel. Adjusting the thumb screw to lower the indicator will limit the quill travel to the desired depth. The stop block travel down and up with the quill. Using the scale and indicator on the stop block, to set the approximate depth. This depth will then be repeatable.
If desired, when the quill is lowered to a desired stop depth, use the quill lock to lock and hold the quill at that depth.



Main Disconnect

The main disconnect (F) enables or disables the mills electrical system. The power lamp (G) will be illuminated when power is ON to the mill.

Work Lamp

The work lamp (H) is independent of the mill operation to provide additional lighting to the work area.

Drilling / Milling – Stop – Tapping

This selector switch controls which type of operation the spindle motor will operate under.
The stop position will not provide power to any other switches.
The Drilling/Milling position will provide power to the Forward and Reverse switches.
The Tapping position will provide tapping activation limit switches and timer.

Forward – Reverse / Run Switches

These switches control the motor operation when drilling or milling.
Press the Forward push button to run the spindle rotation clockwise.
Press the Reverse push button to run the spindle rotation counter-clockwise.
Press the Stop push button to stop the motor and spindle.

Coolant Switch

When power is On to the mill, the coolant pump may be turned on or off.

E-Stop

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.

Table Travel Locks

Always keep the table locked in place unless controlled movement is required for the specific operation. Unexpected table movement during operations could cause the cutter to bind with the workpiece resulting in damage to the cutter and workpiece.

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.

1. Remove the base from the package and place in the desired location.
2. Level and anchor the base providing proper clearance and access around the machine.
3. Install the column cap onto the column. Lightly grease the lift rack retaining beveled edge of the cap.
4. Tighten the cap.
5. Place the drip tray on top of the base and align the bolt holes.
6. Safely lift the mill onto the drip tray and stand.

Important: *Support the coolant pump and tank assembly during the lifting process. Do not pinch the wiring or hoses.*

7. Align the bolt holes and install the four bolts and flat washer through the mill base and drip tray and into the tapped holes on the base.
8. Tighten the bolts to secure the mill to the base.
9. Place the coolant tank behind the base and route the power harness and hoses to prevent pinching, twisting or other interference with the mills operation.
10. Install the three handwheels onto each end of the X axis lead screws and the Y axis lead screw.
11. Secure the handwheels to the shafts with a flat washer and socket head cap screw.

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 machine is wired for 115 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 an amperage rating slightly higher than the full load current of machine.
- A separate electrical circuit should be used for your machines. 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 machine.
- 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 machine 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 machine 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
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.

MACHINE ADJUSTMENTS AND OPERATION

WARNING: Like all machinery there is a potential for danger when operating the machine. Accidents are frequently caused by lack of familiarity with the machine. To decrease the risk of operator injury, use the machine with respect and caution. If normal safety precautions are overlooked or ignored, serious personal injury may occur.

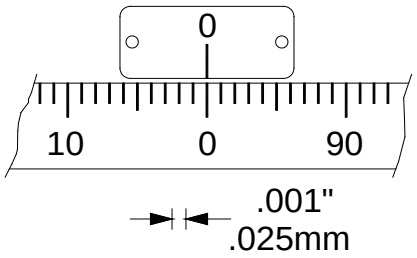
Table Limit Stops

Position the limit stops along the limit stop tracks to confine the travel distance of the table along the X axis.

Loosen the stop caps crew, slide the stop to the required location, and retighten the cap screw.

Table Movements

Axis: Each increment of rotation on the dial equals .001" (.025mm) so one complete rotation of the dial will give 0.10" (2.5mm) of linear table travel on the axis.



Tool Loading into Spindle

1. DISCONNECT POWER TO THE MILL.
2. Shift the gears into the lowest rpm setting.
3. Locate the drawbar and clean any debris from the mating surfaces of the spindle and the collet. (Small chips can throw off the accuracy of the tool while cutting).
4. Align the keyway of the collet with the protruding setscrew inside the spindle and push the collet up into the spindle.
5. While holding the collet, hand tighten the threaded end of the drawbar into the collet.
6. Slide the chosen tool into the collet. Tighten the collet into the spindle. (Make snug but do no over-tighten which could make the tool difficult to remove).

Tool Unloading from Spindle

1. DISCONNECT POWER TO THE MILL.
2. Shift the gears into the lowest rpm setting.
3. Keeping one hand on the tool, use a wrench to loosen the drawbar several turns. If the collet does not loosen from the spindle, give the top of the drawbar a slight tap with a soft mallet.
4. When the collet is loose from the spindle, completely unthread the drawbar from the collet.

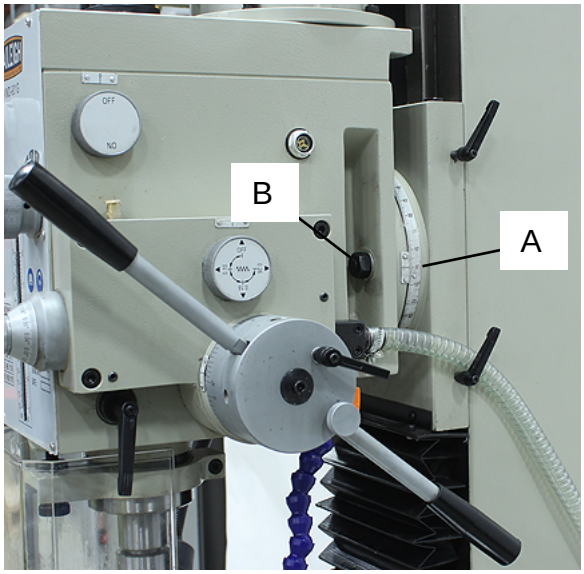
Removing Taper Drills

1. Turn down the arbor bolt and insert the taper drill into the spindle shaft.
1. Turn the quill feed handle until the spindle is lowered and the oblong hole in the rack sleeve appears.
2. Line up this hole with the hole in the spindle. Insert key punch key through holes and strike lightly with a mallet. This will force the taper drill out.

Head Rotation

⚠ CAUTION: Always lock the head firmly in place after making an adjustment. Unexpected movement of the head during machining operations could cause the tool to bind with the piece part, resulting in damage to the tool and piece part, or serious personal injury.

The head can rotate 90° counterclockwise and 90° clockwise from the center “0” position as indicated on the scale (A).



To rotate the head:

1. DISCONNECT POWER TO THE MILL/DRILL.
2. Loosen (2) nuts (B), one on each side of the head, just enough to allow the head to pivot.
3. Manually rotate the head to the desired angle as indicated on the scale to determine the amount of rotation.
4. Once the location has been set, tighten the two nuts to secure the head before beginning operations.

Head Positioning

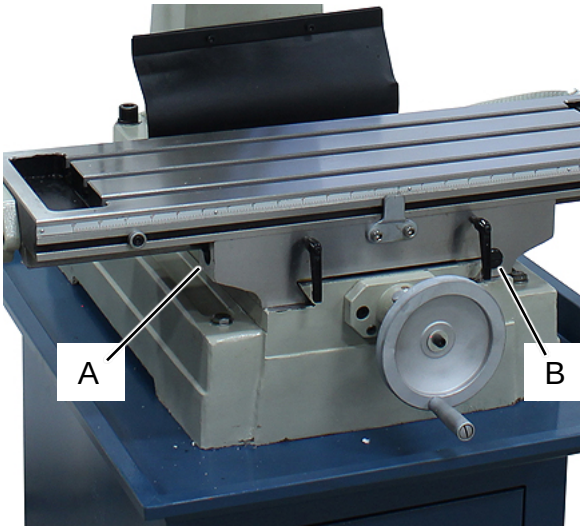
The head may be moved up and down as needed to reduce the amount that the quill needs to be extended. This is especially helpful during milling operations.
The head may also be rotated around the column if needed.

1. Loosen the two clamping nuts (A) located on the opposite side of the hand crank.
2. Use the hand crank to raise or lower the head assembly to the desired height.
3. If desired, rotated the head around the column to the desired position.
4. When the head is in the desired position, securely tighten the two clamping nuts (A). Do not operated this machine with the head loose on the column.

Gib Adjustments

Table Gib Adjustment:

The table is provided with a full length tapered gib and an adjusting screw on the left side (A) just under the table.
To tighten gib, turn adjusting screw clockwise (**cw**) until a slight drag is felt when moving the table manually.



Saddle Gib Adjustment:

The table is provided with a full length tapered gib and an adjusting screw on the right front side (B) of the saddle.
To tighten gib, turn adjusting screw clockwise (**cw**) until a slight drag is felt when moving the table manually.

Calculating Spindle Speed

1. To select the correct spindle speed (RPM) needed for a particular milling operation, first select the type material you will be using from the chart.
2. Then using the formula located below the chart you will be able to calculate what RPM to set the gear configuration at.
3. Measure the diameter of your cutting tool (in inches).

Cutting Speeds for High Speed Steel (HSS) Cutting Tools	
Piece Part Material	Cutting Speed (SFM)
Aluminum and Alloys	300
Bronze and Brass	150
Copper	100
Soft Cast Iron	80
Hard Cast Iron	50
Mild Steel	90
Cast Steel	80
Hard Alloy Steel	40
Tool Steel	50
Stainless Steel	60
Titanium	50
Plastics	300-800
Wood	300-500
Note: For carbide cutting tools, double the cutting speed. These values serve only as a guideline.	

Spindle Speed Example:

For making a surface cut on a piece of mild steel using a 3/8” (0.375”) HSS cutter, do the following:

a. From the chart, the recommended cutting speed for mild steel is 90 (SFM).

b. Using the formula, 90 (SFM) x 4 = 360.

c. 360 / 0.375” (diameter of cutter) = **960** RPM. Because this rpm value is between the settings of 670 and 1180rpm, it is expected that the operator test the cut to determine which speed setting provides the best result.

$$\frac{\text{Cutting Speed (SFM) x 4}}{\text{Tool Diameter (in inches)}} = \text{RPM}$$

d. From the speed chart you would then set the gear selections knobs to the H1 position for 670 rpm, or to the H2 position for 1180 rpm.

Speed Range and Speed Change

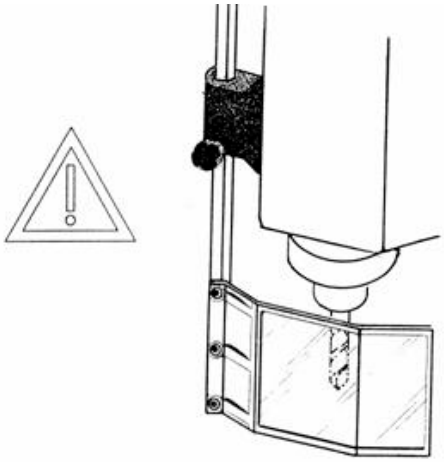
By means of knobs, the spindle speeds are selected. In various combinations, a total of 6 different spindle speeds (rpm) may be selected. Follow the chart on the face of the mill/drill head to set the shift knobs to the desired speed.

Important: **DO NOT** change spindle RPM until the spindle has stopped completely.

- Disconnect the machine from the power supply.
- Match the shift knob position to the chart. The left shift lever is for High (H) and Low (L) range. The right shift knob is for the gear (1, 2, or 3) selection within the gear range.
- The chart is also divided into additional columns to show the rpm if the machine is wired to 50hz or 60hz power supply. Stop the machine when changing the speed gears.
- If spindle speed change is difficult, grasp the spindle and wiggle it rotationally to align the gears for engagement.

Drill Protection Guard

The machine is provided with a security drill guard. Before pressing the starting push button, set the drill guard in the working position, otherwise the machine controls will not start.



Important: *If the guard is opened when operating the machine, the machine will stop.* ***DO NOT*** *REMOVE THE GUARD UNDER ANY CIRCUMSTANCES.*

Piece Clamping

Tangential cutting forces and axial forces in the feed direction of the tool are mainly produced during the milling/drilling process. The tangential forces produce a moment of forces which make the piece being machined want to turn. Therefore, the pieces to be machined (or tapped) must be clamped in an appropriate device such as a machine vise and the vise must be securely clamped to the machine table.

It is the operator's responsibility to obtain and use proper vise and mounting hardware to secure the vise to the work table and the work piece into the vise.

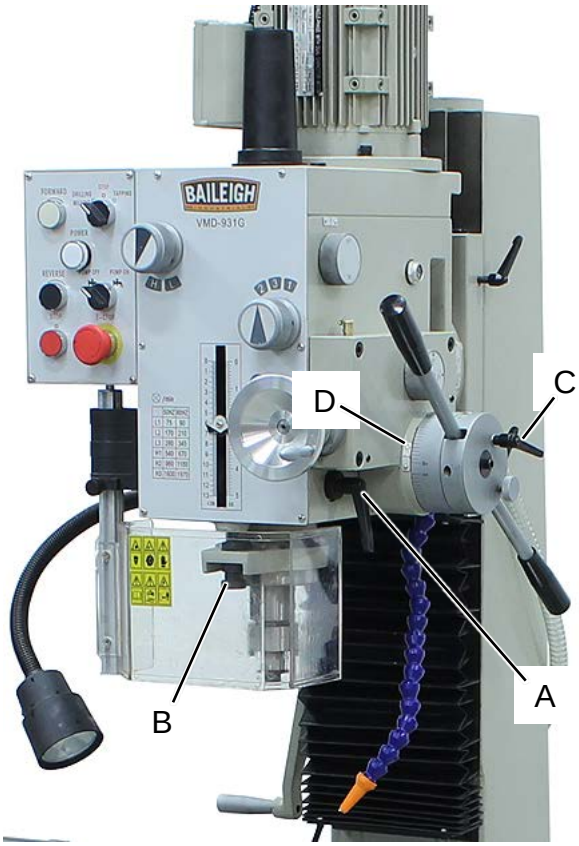
Setting the Depth Stop

This machine has some built-in control stops that activate when either the front depth scale or side depth scale ring reaches zero. Their functions include stop drilling, reverse tapping, or return the drill bit to the start height.

1. Start in manual down-feed mode.
2. Set the tool depth to zero position by lowering a drill bit or tapping tool to the surface of the piece part.
3. Hold in position. Manually hold the down feed handles or tighten the quill feed lock knob (A) to hold the quill in the down position.
4. Set the depth scale stop.

Tapping and Manual Operations use the front depth scale

NOTICE: *DO NOT use the power down feed when tapping. This will damage the tap, the work piece and the machine gears.*



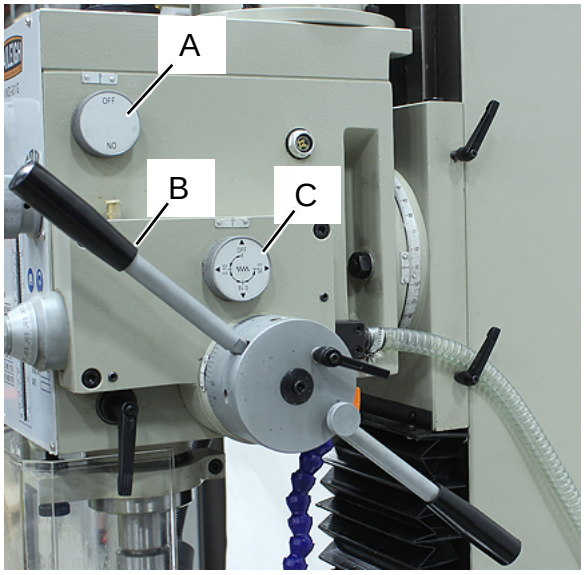
1. Turn the adjustment knob (B) to set the top edge of the indicator to the dimension shown on the scale.
2. Release quill feed lock to allow the quill to raise to the full up position.

Drilling in auto mode use the depth scale ring

1. Loosen the depth scale ring lock knob (C).
2. Adjust the depth scale ring to set the depth of travel measurement at the zero point on the stationary indicator (D).
3. Lock the depth scale ring lock knob (C) to set the depth stop.
4. Release quill feed lock to allow the quill to raise to the full up position.

Manual Down-feed

The down-feed rate changes can only be made while the motor is OFF.



1. Set the front depth stop.
2. Set the down-feed selector (A) to the Off position.
3. Place the selector switch on the control panel to either the Drill/Milling position or the Tapping position.
4. Start machine by pressing either the Forward or Reverse Start button. This will depend upon your specific application and tooling.
5. Use the down-feed handles (B) to lower the spindle for operation.

Automatic Down-feed

Automatic down-feed is a feature to use only when drilling. DO NOT use for tapping. The down-feed rate changes can only be made while the motor is OFF.

1. Set the depth stop using the depth scale ring.
2. Set the down-feed selector (A) to the On position.
3. Set the down-feed rate. Use the knob (C) to change the rates.
4. Place the selector switch on the control panel to the Drill/Milling position.
5. Start machine by pressing either the Forward or Reverse Start button. This will depend upon your specific application and tooling.
6. Pull outward on the down-feed handles (B) to engage the feed gears. The Micro Feed and the Down feed handles will rotate as the quill is moving down. When the depth stop is reached, the down feed handles (B) will snap inward and disengage the down feed and return to the up position. If the quill does not raise up, check for binding on the ooling.

***Note**: If the bit has difficulty drilling or the spindle bounces during the drilling process, stop drilling immediately. Check to see that the drill bit is sharp and that the material is not too hard. Do not use this machine for heavy drilling over a long period of time. This will damage the drive system.*

Operation

⚠ CAUTION: Always wear proper eye protection with side shields, safety footwear, and leather gloves to protect from burrs and sharp edges. Loose hair, jewelry, or clothing could get caught in machinery causing serious personal injury or death.

1. Complete any needed machine adjustments and determine and set the gears to the desired speed setting.
2. Raise or lower the head to the desired height and secure the locking handles.
3. Install the desired tooling for the operation to be performed.
4. Positions and secure the material onto the table so that the material does not come loose or move during operation.
5. If using the quill feed, determine if the feed will be a coarse or fine feed. Tighten the hand knob on the center of the coarse feed hand to engage the fine feed handwheel. Loosen the knob to disengage.
6. Set the depth stop if needed to limit the quill down travel for control and repeatability.
7. Direct the coolant nozzle toward the cutting point of the cutting tool to provide cooling and to flush chips away from the cut.
8. Set the travel stops on the X axis if desired.
9. Loosen the lock handle on the axis(s) that will be moved during the operation. Tighten the lock handles for any axis that should not move during the operation.
10. Use the handwheels to feed the X and/or Y axis as needed to perform the operation.
11. Verify that any tools or loose material is removed from the machine and that the cutting tool is NOT in contact with anything.
12. Determine the direction of rotation needed for the operation and press either the forward or reverse button to start the tool for the correct rotation for the operation.
13. Start the cutter to feed into the material watching for any obstructions.

Metal Chip Indicators

Chips are the best indicator of correct material feed force. Monitor chip information and adjust feed accordingly.

- Thin or Powdered Chips – increase feed rate or reduce spindle speed
- Burned Chips – reduce feed rate and / or spindle speed
- Curly Silvery and Warm Chips – optimum feed rate and spindle speed.

Cutting and advance speed

The cutting speed (m/min) and the advance speed (cm2/min = area traveled by the cutter when removing shavings) are limited by the development of heat close to the tips of the cutter.

- The cutting speed is subordinate to the resistance of the material (R = N/mm^2), to its hardness (HRC) and to the dimensions of the widest section.
- Too high an advance speed (X, Y or Z axis) tends to cause the cutter to deviate from the ideal cutting path, producing non rectilinear cuts on both the vertical and the horizontal plane.

The best combination of these two parameters can be seen directly examining the chips.
Long spiral-shaped chips indicate ideal cutting.
Very fine or pulverized chips indicate lack of feed and/or cutting pressure.
Thick and/or blue chips indicate overload of the blade.

Tapping

NOTICE: *This is a conventional mill/drill, not a special purpose machine, therefore frequent tapping jobs will wear the motor and gears.* Temperature of motor will be increased quickly when tapping due to low motor RPM and frequently motor direction be changed. Therefore, rapid and continuous tapping shall be avoided. Maximum of eight times per minutes of tapping is recommended. The machine shall be stopped for cooling if the motor is too hot.

In general, speeds for tapping require low transmission mode with speeds lower than 150 RPM.

Important: *Chamfer the holes before tapping. A tapping rate of eight times per minute or less is recommended. All tapping must be done while in manual mode.*

The tapping function works with the front depth stop and is manually controlled by the operator. In the tapping mode, the operator pulls on the quill feed handle to engage the tap into the material. The operator will continue to lower the quill to engage the tap into the material. While tapping, the operator shall maintain enough control of the quill feed handle to allowing the tap to pull the quill down. When the quill reaches the bottom of the travel based upon the front depth stop, the motor will stop, there will be a momentary time delay and then the motor will start in the reverse direction to extract the tap.

1. Install the desired tap into chuck or collet to be used.
2. Set the height of the head to minimize quill travel. Provide at least 1/4" (6mm) of travel before the tap will contact the material.
3. Set the front depth stop as needed to ensure that the threads are the correct depth for the operation, but no further.
4. Set the gear knobs to operate the spindle at the desired rpm. Generally, this will be the L1 position for 90 rpm.
5. Set the selector switch on the electrical cabinet to tapping mode.
6. Position the material with the properly sized hole to be tapped under the tape tip. Secure the material in this location.
7. Turn on the coolant selector switch.
8. Start the motor and allow the motor to start and come to full speed before the tap enters the material.
9. Pull the feed handle and continue to apply control down force to the quill handle. Allow the tap to cut the threads and balance the operators pull force to the taps pull force.
10. When the quill reaches the depth stop, work with the tap movement to pause the quill travel and then reverse the travel extracting the tap from the material.
11. Position the material for the next tapping operation and repeat the steps.

SPINDLE BREAK-IN

After successfully completing the test run of this mill, it is recommended to break-in the spindle using the following procedure, to avoid rapid wear of the spindle when placed into operation.

1. Make sure the mill has been properly lubricated.
2. DISCONNECT POWER TO THE MACHINE.
3. Set the gear configuration for a speed of 210 RPM (refer to the section on changing spindle speed).
4. Make sure there are no obstructions or tools around or underneath the spindle.
5. Connect power to the machine.
6. Start the spindle in the forward direction and let it run for a minimum of ten minutes.
7. Turn the machine OFF and wait for the spindle to stop.
8. Start the spindle in the reverse direction and let it run for a minimum of ten minutes.
9. Turn the machine OFF, disconnect it from the power, and then configure the gears for a speed of 1970 RPM.

10. Repeat steps 5 thru 8 for this speed.
11. Turn the mill OFF. This completes the spindle break-in procedure. This mill is now ready for operation.

MATERIAL SELECTION

⚠ CAUTION: It must be determined by the customer that materials being processed through the machine are NOT potentially hazardous to operator or personnel working nearby.

When selecting materials keep these instructions in mind:

- Material must be clean and dry. (without oil)
- Material should have a smooth surface so it processes easily.
- Dimensional properties of material must be consistent and not exceed the machine capacity values.
- Chemical structure of material must be consistent.
- Buy certificated steel from the same vendor when possible.

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.

- Check daily for any unsafe conditions and fix immediately.
- Check that all nuts and bolts are properly tightened.
- 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.
- Check the gear box oil level in the sight glass before operation each day or each shift. The level should be to the midpoint of the glass. If needed, add an SAE 68 oil.

***Note**: Proper maintenance can increase the life expectancy of your machine.*

All ball bearings in your mill/drill are sealed for life requiring no lubrication.

Weekly:
Clean and apply a light film of oil to the quill and column will reduce wear, prevent rust, and assure ease of operation.

Semi-annually:
Internal spline drive assembly. Keep this area well lubricated with a good grade multi-purpose grease. Insert grease in the hole at the top of spindle pulley spline drive.

Annually:
The quill return spring should receive oil (SAE 20). Remove cover plate and apply oil with squirt can or small brush.

Accessing and Cleaning the Coolant System

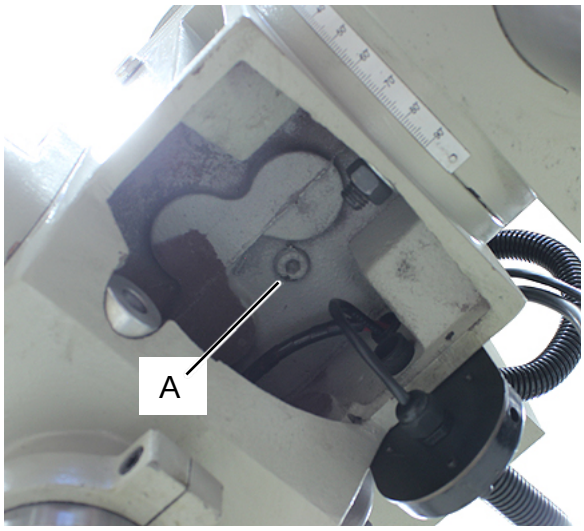
- Clean the drain screens on the end of the table.
- Drain and wash out the dirt and debris from the reservoir.
- Thoroughly clean the pump and pump inlet.
- Fill the tank with coolant solution.

Oils for Lubricating Coolant

Any 10:1 (water to coolant) solution will work, however we recommend Baileigh Coolant 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.

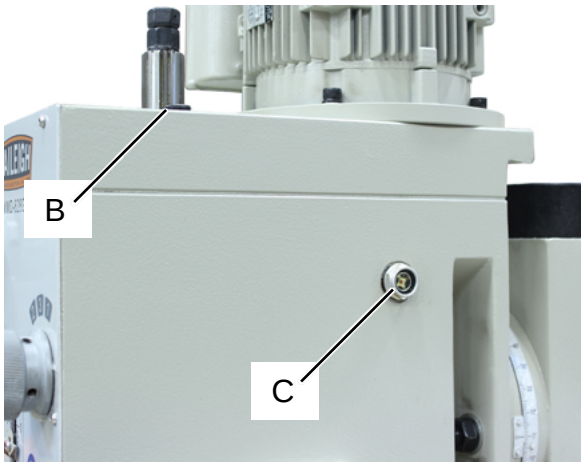
CHANGING THE GEAR BOX OIL

1. Disconnect the mill/drill from the power supply.
2. Place a suitable container under the head.
3. Reach up into the gear case opening and remove the drain plug (A) and allow the oil to fully drain from the gear case.
4. Install the oil drain plug.
5. Remove the oil filler plug (B) and fill the oil to the gearbox with SAE68 oil until the oil lever reach the middle of oil fluid lever indicator (C).
6. Install the fill plug.



Oil Disposal

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



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:

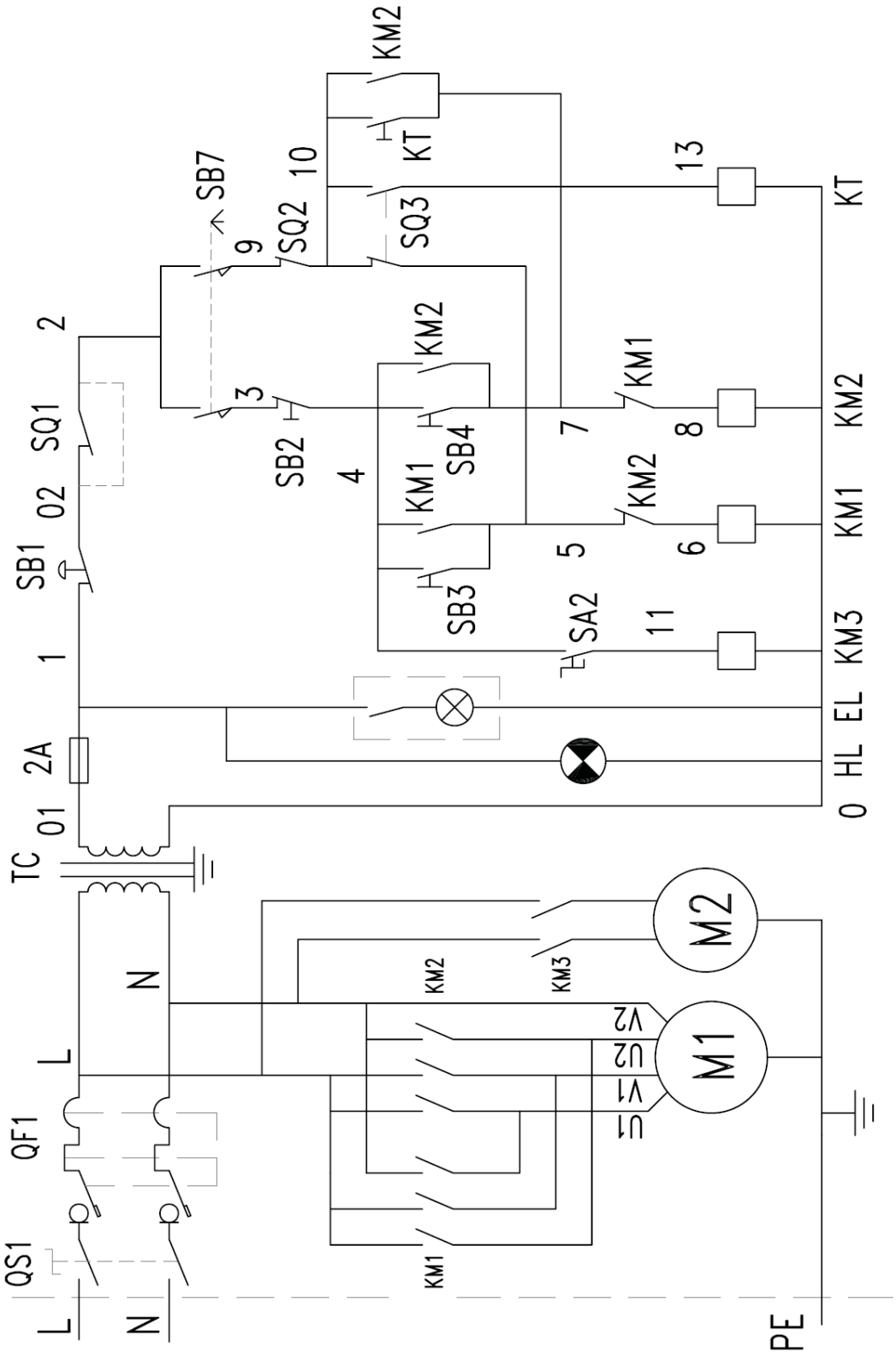
- Disconnect the electrical supply from the power panel.
- Empty and clean the coolant reservoir.
- Clean and grease the machine.
- Cover the machine.

TROUBLESHOOTING

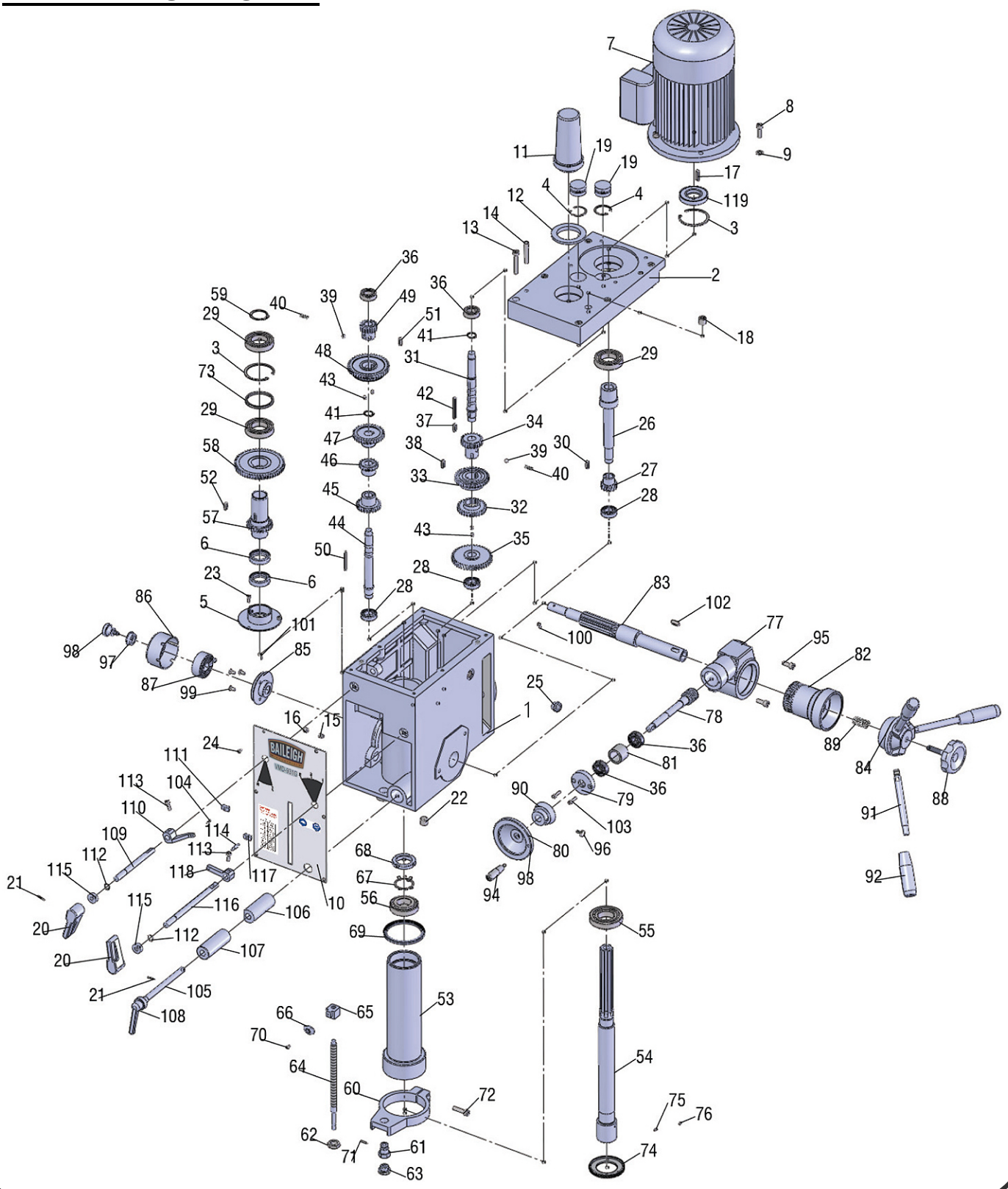
⚠ WARNING: Make sure the electrical disconnect is OFF before working on the machine.

Trouble	Probable Cause	Remedy
Excessive Vibration	1.Motor out of balance 2.Bad motor	1.Balance or replace problem motor. 2.Replace motor
Motor stalls	1.Over feeding. 2.Dull drill. 3.Motor not building up to running speed. 4.Bad motor	1.Replacefeed rate. 2.Sharpen drill and keep sharp. 3.Replace or repair motor. Check fuses in all three legs on three phase motors and replace if necessary. 4.Replace motor
Noisy Operation	1.Excessive vibration 2.Improper quill adjustment. 3.Nosiy spline. 4.Noisy motor	1.Check remedy under excessive vibration. 2.Adjust quill. 3.Lubricate spline. 4.Check motor bearing or for loose motor fan.
Drill or Tool heats up or burns work	1.Excessive speed. 2.Chips not clearing. 3.Dull tool. 4.Feedreate too slow. 5.Rotation of drill incorrect. 6.Failure to use cutting oil or coolant (on steel)	1.Readuce speed. 2.Use pecking operation to clear chips. 3.Sharpen tool or replace. 4.Increase feed enough to clear chips. 5.Reverse motor rotation. 6.Use cutting oil or coolant on steel
Drill leads off	1.No drill spot. 2.Cutting lips on drill off center. 3.Quill loose in head. 4.Bearing play.	1.Center punch or center drill workpiece. 2.Regrind drill. 3.Tighten quill. 4.Check bearings and reseat or replace if necessary.
Excessive drill runout or wobble	1.Bent drill. 2.Bearing play. 3.Drill not seated properly in chucks.	1.Replacedrill.Do not attempt to straighten. 2.Replace or reseat bearings. 3.Loosen, reseat and tighten chuck.
Work or fixture comes loose or spins	1.Failure to clamp workpiece or work holding device to table.	1.Clampworkpiece or work holding device to table surface.

ELECTRICAL DIAGRAM



HEAD PARTS DIAGRAM



Head Parts List

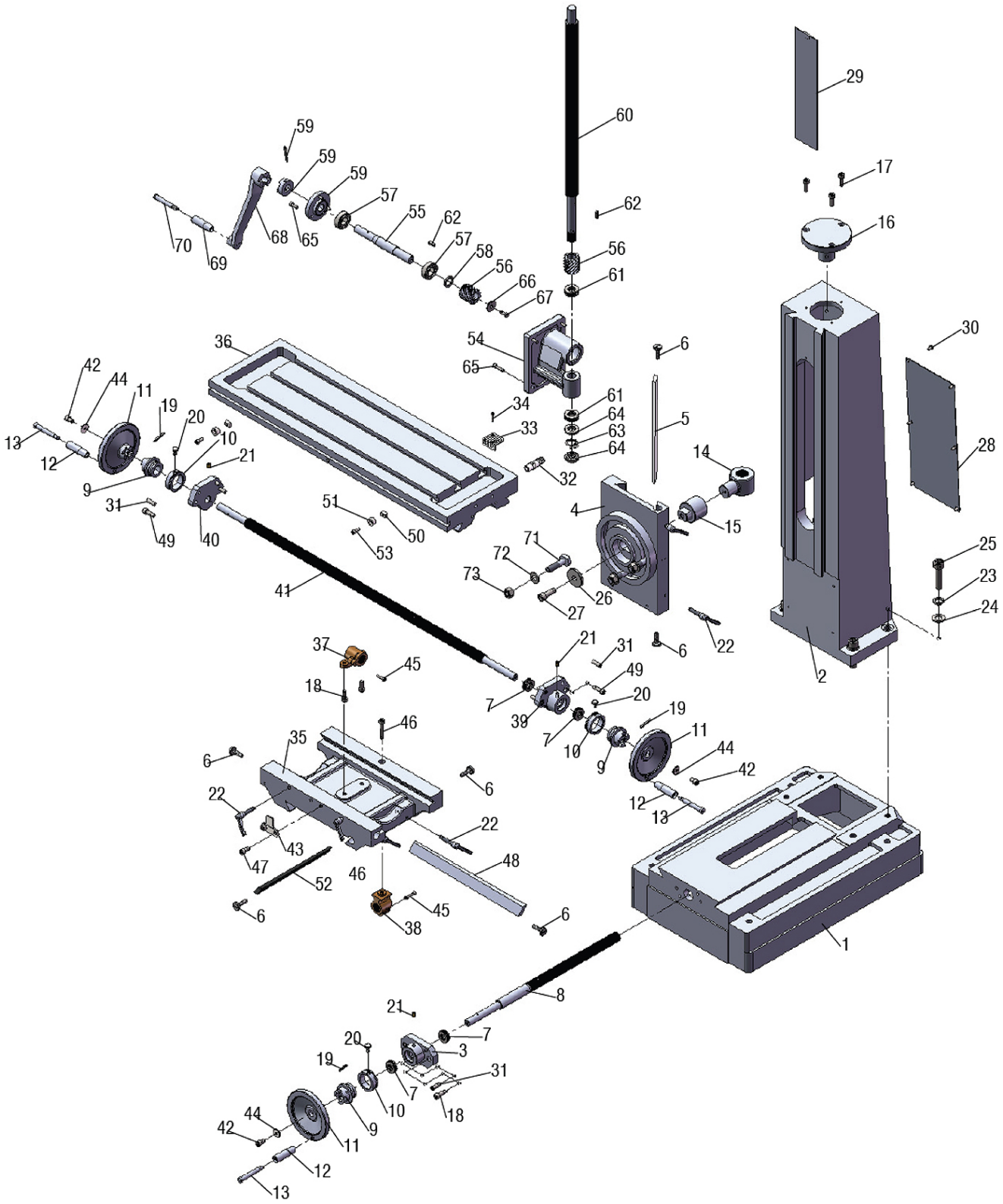
Item	Qty.	Code	Name
1	1	20010B	head body
2	1	20011B	head body cover
3	2	φ62	Int retaining ring
4	2	φ35	Int retaining ring
5	1	20018B	airtight base
6	2	45×35X10	airtight ring
7	1	1.5KW	motor
8	1	M8X25	screw
9	1	8	washer
10	1	20201	plate
11	1	20304-1B	arbor bolt cover
12	1	20304-2B	arbor bolt cover base
13	6	M8X45	screw
14	2	8×40	pin
15	1	M10×10	screw
16	1	M10×8	screw
17	1	6X28	key
18	1	ZG3/8”	bolt
19	2	20020B	cap
20	2	20307B	speed lever
21	2	3X18	pin
22	1	ZG3/8”	oil plug
23	3	M5x10	screw
24	6	M4X8	screw
25	1	M18X1.5	oil pointer
26	1	20105B	I shaft
27	1	20105-1-B	Gear Z14
28	3	6003 / P5	bearing
29	3	6007 / P5	bearing
30	1	5X25	key
31	1	20106B	II shaft
32	1	20108-B	Gear Z29
33	1	20110-1-B	Gear Z35

Item	Qty.	Code	Name
34	1	20111-B	Gear Z21
35	1	20106-1-B	Gear Z41
36	4	6202 / P5	bearing
37	1	6X14	key
38	1	6X28	key
39	2	φ8	ball
40	2		spring
41	2	φ18	Ext retaining ring
42	1	5X50	key
43	4	M6X12	screw
44	1	20107B	III shaft
45	1	20109-B	Gear Z25
46	1	20110-2-B	Gear Z18
47	1	20112-B	Gear Z32
48	1	20113-B	Gear Z43
49	1	20115-B	Gear Z16
50	1	5X50	key
51	1	6X18	key
52	1	6X18	key
53	1	20019	spindle sleeve
54	1	20104B	spindle
55	1	30207 /P5	bearing
56	1	30206 /P5	bearing
57	1	20114-B	splined sleeve Z25
58	1	20116-B	Gear Z53
59	1	φ35	Ext retaining ring
60	1	20012	feed base
61	1	20128	support base
62	1	20129	nut
63	1	20130	knob
64	1	20131	graduated rod
65	1	20021	fixed bolt
66	1	20132	scale board
67	1	φ30	lock washer
68	1	M30X1.5	lock nut

Item	Qty.	Code	Name
69	1	20308	rubber washer
70	1	M4X8	screw
71	1	3X18	split pin
72	1	M8X30	bolt
73	1	20024B	separating ring
74	1	20133B	Bearing cover
75	1	M5X6	Screw
76	1	M5X4	Pin
77	1	20015	worm wheel box
78	1	20119	worm shaft
79	1	20302	worm cover
80	1	M6X12	screw
81	1	20120	separating ring
82	1	20016	worm wheel
83	1	20117	pinion shaft
84	1	20013	handle body
85	1	20118	spring base
86	1	20123	spring cap
87	1	20122	spring plate
88	1	20303	big ripple handle
89	1		compression spring
90	1	20017	graduated plate
91	1	20121B	handle rod
92	1	20301B	handle ball
93	1	20306B	handle wheel
94	1	20305-B	handle rod
95	2	M8X25	screw
96	1	10107	screw
97	1	203063	washer
98	1	203066	screw
99	3	M6X12	screw
100	1	M5X12	screw
101	2	3X12	pin
102	1	8X20	key
103	2	M5X20	screw

Item	Qty.	Code	Name
104	1	3X15	pin
105	1	20124B	fixed bolt
106	1	20203B	fixed tight block
107	1	20202B	fixed tight block
108	1	adjust handle	adjust handle
109	1	20125B	lever shaft
110	1	20022-1B	lever
111	1	20204-2B	lever bracket
112	2	12	Ext retaining ring
113	2	M6X16	screw
114	1	20204-3B	lever rod
115	2	12X22X8	oil seal
116	1	20126B	long lever shaft
117	1	20204-1B	lever bracket
118	1	20022-2B	lever
119	1	12X22X8	oil seal

BASE PARTS DIAGRAM



Base Parts List

Item	Qty.	Code	Name
1	1	10010	base
2	1	10013	column
3	1	10021	square flange
4	1	10016	raise and lower base
5	1	10025	gib strip
6	6	10106	screw
7	4	51103	bearing
8	1	10104	table screw
9	3	10102	dial clutch
10	3	10111	graduated plate
11	3	10301	wheel
12	3	20305-1B	turn handle
13	3	20305-1B	screw
14	1	10024	nut
15	1	10117	nut bracket
16	1	10014	cover
17	3	M8x20	screw
18	4	M8X25	screw
19	3	5X35	pin
20	2	10107	screw
21	5	8	oil cup
22	6	M8	fixed handle
23	4	16	washer
24	4	16	washer
25	4	M16X60	bolt
26	1	10120	washer
27	1	M12X35	screw
28	1	10119	plate
29	1	10124	protecting cover
30	6	M6X12	screw
31	6	8X30	pin
32	1		Pipe joint
33	1		filter screen

Item	Qty.	Code	Name
34	2	M3x25	screw
35	1	10011	center base
36	1	10012	table
37	1	10202	table nut
38	1	10203	table base nut
39	1	10020	right flange
40	1	10019	left flange
41	1	10103	table screw
42	3	M6x16	screw
43	1	10105	Dial clutch
44	3	6	washer
45	2	M5X20	screw
46	1	M8X45	screw
47	2	M8X15	screw
48	1	10022	gib strip
49	4	M8X25	screw
50	2	10108	movable fixed block
51	2	10109	fixed block support
52	1	10023	gib strip
53	2	M6 X 16	screw
54	1	10017	raise and lower base
55	1	10113	shaft
56	2	20109	gear
57	2	6004	bearing
58	1	100218	washer
59	1	10015	flange
60	1	10016	raise and lower screw
61	2	51104	bearing
62	2	6 X 20	key
63	1	20	lock washer
64	2	M20X1.5	lock nut
65	7	M6 X 20	screw
66	1	20109.1	washer
67	1	M8x16	screw
68	1	10018	handle

Item	Qty.	Code	Name
69	1	10018.1	turn handle
70	1	10018.2	screw
71	3	M14x55	bolt
72	3	14	washer
73	3	M14	nut

NOTES

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