

HAFCO METALMASTER

DRILL MILL OPERATION MANUAL



**Model.
HM-46B**

Order Code M138, M138D

Edition No : HM-046-1

Date of Issue : 10/2019

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OPERATION MANUAL

MACHINE DETAILS

MACHINE	<input type="text" value="DRILL MILL"/>
MODEL NO.	<input type="text" value="HM-46B"/>
SERIAL NO.	<input type="text"/>
DATE OF MANF.	<input type="text"/>

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NOTE:

This manual is only for your reference. Owing to the continuous improvement of the HAFCO METALMASTER machines, changes may be made at any time without obligation or notice. Please ensure the local voltage is the same as listed on the specification plate before operating this electric machine.



NOTE:

In order to see the type and model of the machine, please see the specification plate. Usually found on the back of the machine. See example (Fig.1)

PRODUCT SPECIFICATION

MODEL:	<input type="text"/>
CAPACITY:	<input type="text"/>
SER. NO.:	<input type="text"/>
MFG DATE:	<input type="text"/>
WEIGHT:	<input type="text"/>
VOLTS:	<input type="text"/>
MOTOR Kw:	<input type="text"/>

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Made in China

FIG.1



OPERATION MANUAL

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OPERATION MANUAL

1.1 SPECIFICATIONS

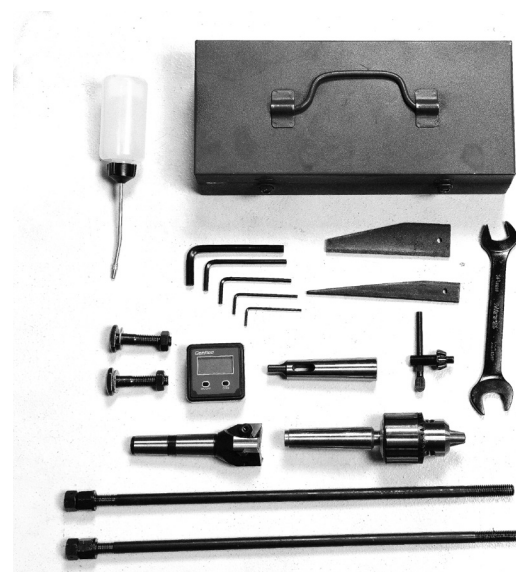
Order Code	M138	M138D
Model	HM-46B	HM-46B(DRO)
Capacity Steel (mm)	32	32
Table Size (mm)	730 x 210	730 x 210
X Axis Travel (mm)	485	485
Y Axis Travel (mm)	190	190
Z Axis Travel (mm)	425	425
Head Tilt Left-Right	90°	90°
Throat Depth Max (mm)	265	265
Spindle To Table (mm)	485	485
Spindle Travel (mm)	120	120
Spindle Diameter (mm)	75	75
Spindle Taper	3mt	3mt
Spindle Speeds	6(95 - 1650)	6(95 - 1650)
Motor (kW/HP)	1.5 / 2	1.5 / 2
Voltage / Amperage	240 / 10	140 . 10
Dimensions (L x W x H) (cm)	84 x 77 x115	84 x 77 x115
Weight (kg)	293	293
Digital Readout	-	3 Axis Counter X,Y Scales only
X. Axis Power Feed	Optional	Optional
Draw Bar Size	1 off 1/2 x 12 TPI 1off M12 x 1.75mm	1/2 x 12 TPI 1off M12 x 1.75mm

1.2 ACCESSORIES

1. Bevel angle box
2. Drill Chuck and Arbour
3. Mt3 x MT2 Drill sleeve
4. Mt3 x 45mm Face Mill
5. 3 x TPMN16 inserts
6. Instruction Manual
7. Hex keys and Spanner
8. Drawbars (2)
9. Toolbox and Oiler
10. Drill Drifts

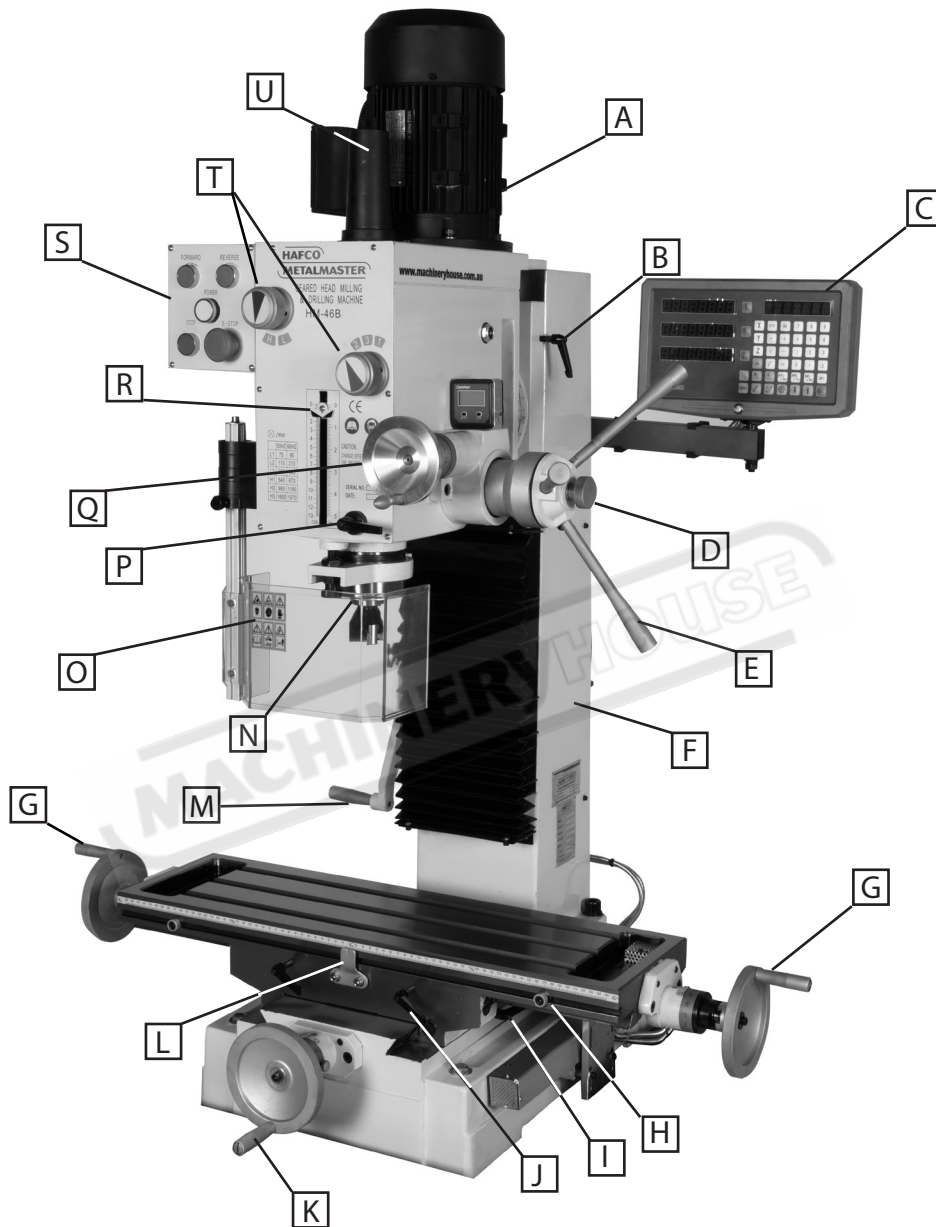
OPTIONAL ACCESSORIES

- Mill Drill Stand (Order Code M135A)
- X Axis Power Feed (Order Code M230)
- 240 -110volt Transformer (M240)



OPERATION MANUAL

1.3 IDENTIFICATIONS



A	Motor	H	Table Travel Stop	O	Spindle Guard
B	Z Axis Lock	I	Y Axis Table Lock	P	Spindle Lock
C	Digital Readout	J	X Axis Table Lock	Q	Fine Down-feed Handle
D	Down-feed Selector Knob	K	Y Axis Handle	R	Depth Stop Scale
E	Course Down-feed Handle	L	Table Travel Stop	S	Control Panel
F	Dovetail Column	M	Vertical Handle	T	Speed Selectors
G	X Axis Handles	N	Spindle	U	Drawbar Cover

OPERATION MANUAL

2.1 GENERAL METALWORKING SAFE PRACTICES

DO NOT use this machine unless you have read this manual or have been instructed in the use of this machine in its safe use and operation



WARNING

This manual provides safety instructions on the proper setup, operation, maintenance, and service of this machine. Save this manual, refer to it often, and use it to instruct other operators. Failure to read, understand and follow the instructions in this manual may result in fire or serious personal injury—including amputation, electrocution, or death.

The owner of this machine is solely responsible for its safe use. This responsibility includes, but is not limited to proper installation in a safe environment, personnel training and authorization to use, proper inspection and maintenance, manual availability and comprehension, of the application of the safety devices, integrity, and the use of personal protective equipment.

The manufacturer will not be held liable for injury or property damage from negligence, improper training, machine modifications or misuse.



- ✓ Always wear safety glasses or goggles.
- ✓ Wear appropriate safety footwear.
- ✓ Wear respiratory protection where required.
- ✓ Gloves should never be worn while operating the machine, and only worn when handling the workpiece.
- ✓ Wear hearing protection in areas > 85 dBA. If you have trouble hearing someone speak from one metre (three feet) away, the noise level from the machine may be hazardous.
- ✓ DISCONNECTION THE MACHINE FROM POWER when making adjustments or servicing.
- ✓ Check and adjust all safety devices before each job.
- ✓ Ensure that guards are in position and in good working condition before operating.
- ✓ Ensure that all stationary equipment is anchored securely to the floor.
- ✓ Ensure all machines have a start/stop button within easy reach of the operator.
- ✓ Each machine should have only one operator at a time. However, everyone should know how to stop the machine in an emergency.

OPERATION MANUAL**2.1 GENERAL METALWORKING SAFE PRACTICE Cont.**

- ✓ Ensure that keys and adjusting wrenches have been removed from the machine before turning on the power. Appropriate storage for tooling should be provided.
- ✓ Ensure that all cutting tools and blades are clean and sharp. They should be able to cut freely without being forced.
- ✓ Stop the machine before measuring, cleaning or making any adjustments.
- ✓ Wait until the machine has stopped running to clear cuttings with a vacuum, brush or rake.
- ✓ Keep hands away from the cutting head and all moving parts.
- ✓ Avoid awkward operations and hand positions. A sudden slip could cause the hand to move into the cutting tool or blade.
- ✓ Return all portable tooling to their proper storage place after use.
- ✓ Clean all tools after use.
- ✓ Keep work area clean. Floors should be level and have a non-slip surface.
- ✓ Use good lighting so that the work piece, cutting blades, and machine controls can be seen clearly. Position any shade lighting sources so that they do not cause any glare or reflections.
- ✓ Ensure there is enough room around the machine to do the job safely.
- ✓ Obtain first aid immediately for all injuries.
- ✓ Understand that the health and fire hazards can vary from material to material. Make sure all appropriate precautions are taken.
- ✓ Clean machines and the surrounding area when the operation is finished.
- ✓ Use proper lock out procedures when servicing or cleaning the machines or power tools.

DO NOT

- × Do not distract an operator. Horseplay can lead to injuries and should be strictly prohibited.
- × Do not wear loose clothing, gloves, necktie's, rings, bracelets or other jewellery that can be come entangled in moving parts. Confine long hair.
- × Do not handle cuttings by hand because they are very sharp. Do not free a stalled cutter without turning the power off first. Do not clean hands with cutting fluids.
- × Do not use rags or wear gloves near moving parts of machines.
- × Do not use compressed air to blow debris from machines or to clean dirt from clothes.
- × Do not force the machine. It will do the job safer and better at the rate for which it was designed.



BEFORE OPERATING ANY MACHINE, TAKE TIME TO READ AND UNDERSTAND ALL SAFETY SIGNS AND SYMBOLS. IF NOT UNDERSTOOD SEEK EXPLANATION FROM YOUR SUPERVISOR.

OPERATION MANUAL

2.2 MILL DRILL SAFETY

DO NOT use this machine unless you have been instructed in its safe use and operation and have read and understood this manual



Safety glasses must be worn at all times in work areas



Long and loose hair must be contained



Gloves must not be worn



Sturdy footwear must be worn at all times in work areas



Close fitting/protective clothing must be worn



Rings and jewellery must not be worn.

PRE-OPERATIONAL SAFETY CHECKS

- ✓ Locate and ensure you are familiar with all machine operations and controls.
- ✓ Ensure all guards are fitted, secure and functional. Do not operate if guards are missing or faulty.
- ✓ Check workspaces and walkways to ensure no slip/trip hazards are present
- ✓ Ensure cutter is in good condition and securely mounted.
- ✓ Check coolant delivery system (if used) to allow for sufficient flow of coolant.

OPERATIONAL SAFETY CHECKS

- ✓ Keep clear of moving machine parts.
- ✓ Follow correct clamping procedures. Keep overhangs as small as possible and check work piece is secure.
- ✓ Set the correct speed to suit the cutter diameter, the depth of cut and the material.
- ✓ Feed the workpiece against the milling cutter.

ENDING OPERATIONS AND CLEANING UP

- ✓ Switch off the machine when work completed.
- ✓ Remove milling cutters and store them safely.
- ✓ Before making adjustments and measurements or cleaning swarf accumulations, switch off and bring the machine to a complete standstill.
- ✓ Leave the machine and work area in a safe, clean and tidy state.

POTENTIAL HAZARDS AND INJURIES

- Sharp cutters.
- Hair/clothing getting caught in moving machine parts.
- Eye injuries.
- Metal splinters and burrs.
- Flying debris.

DON'T

- × Do not use faulty equipment. Immediately report suspect machinery.
- × Never leave the machine running unattended.
- × Do not leave equipment on top of the machine.

2.3 LIFTING INSTRUCTIONS

On the day that the machine arrives, make sure that a crane with sufficient capacity is available to unload the machine from the vehicle. Ensure access to the chosen site is clear and that doors and ceilings are sufficiently high and wide enough to receive the machine.

To handle the machine, the slings should be positioned so the machine is level when lifted.

When using slings please take note of the sling angle and the loads that apply

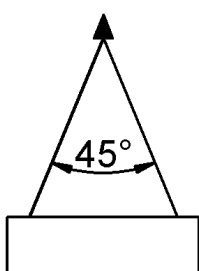


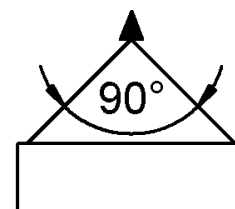
FIG 2.1.

When the slings are at a 45° angle then each sling is carrying the equivalent of 50% of load weight. (Fig.2.1).

When the slings are at a 90° angle then each sling will have a weight equal to 75% of the load on each sling. (Fig 2.2)

Note! The manufacturer recommends not to exceed 90° angle

FIG 2.2



LIFTING POINTS

When lifting the machine only certified lifting slings should be used.

Ensure that when lifting, the machine does not tip over. Check that the lifting slings do not interfere with the hydraulic pipes or electrical conduits.

Failure to follow these instructions could cause damage to the machine.

1. Move the shipping crate next to the workbench or optional stand, then unbolt machine from pallet.
2. Move table as close to column as possible, and raise headstock to its highest position. This will help balance machine when moving.
3. Tighten Z-axis locks to avoid sudden shifts when lifting.
4. Place a lifting strap under headstock, as shown in Fig. 2.3, connect strap ends to a forklift or hook, then lift and place machine on the workbench or on the optional stand.

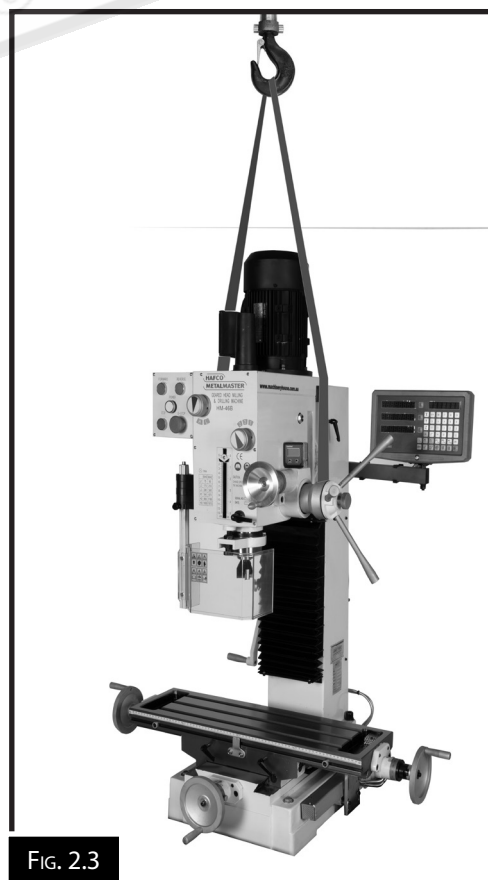


FIG. 2.3

MOUNTING METHODS

If the machine is mounted on the optional stand, it should be bolted to the floor or concrete slab (Fig. 2.5)

Masonry anchors with bolts are the best way to anchor machinery, because the anchors sit flush with the floor surface, making it easy to unbolt and move the machine later, if needed. (Fig. 2.4)



FIG. 2.4

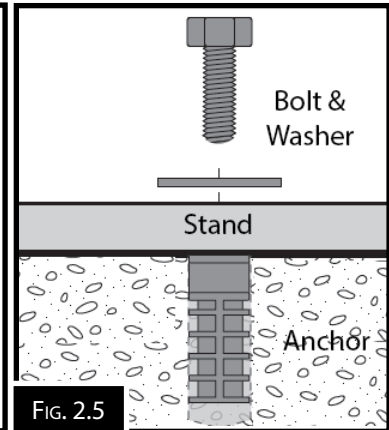


FIG. 2.5

3. SETUP

3.1 BOLTING THE MILL DRILL ON THE STAND

Before you place the stand on the floor, it is recommended that you consider the following options.

When bolting down the stand, consider using Hafco M0015 machine mounts to make it easy for leveling and eliminate vibration.

Bolting the stand to the floor prevents tipping or shifting and reduces vibration that may occur during operation, resulting in a machine that runs slightly quieter and feels more solid.

If the machine is to be installed in a commercial or workplace setting, or if it is permanently connected (hardwired) to the power supply, then the stand should be anchored to the floor.

Order Code M0015



M0015

3.2 ASSEMBLY

Except for the hand-wheel handles, the mill/drill was fully assembled at the factory. Use a slotted screwdriver to attach the hand-wheel handles, to the "X" and "Y" axis handles.

3.3 LEVELING

Whether you mount your machine to the cabinet stand or to an existing workbench, it must be leveled. If you mounted your machine to an existing workbench, use a precision level and metal shims as needed under the machine base to make sure the machine table is level from side-to-side and from front-to-back. If you mounted your machine to the cabinet, use a precision level on the table and adjust the machine mounts or place shims under the corners of the cabinet to make sure the machine table is level from side-to-side and from front-to-back.

(Fig. 3.1)



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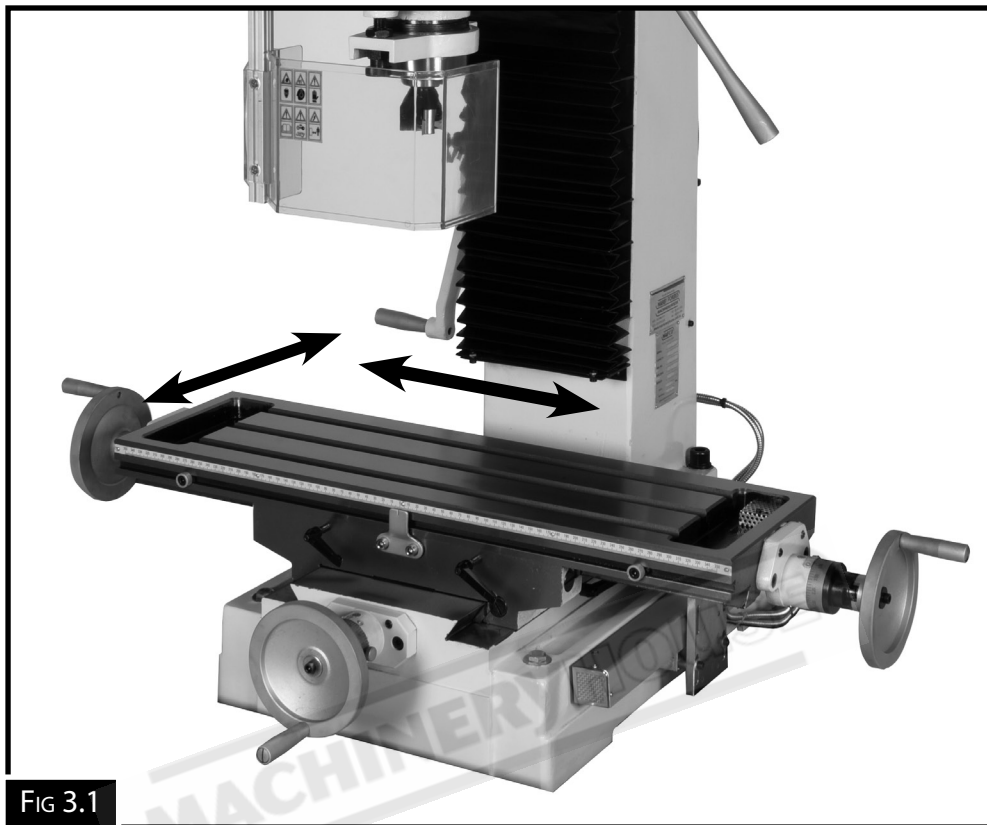


FIG 3.1

3.4 ELECTRICAL INSTALLATION

Place the machine near an existing power source. Make sure all power cords are protected from traffic, material handling, moisture, chemicals, or other hazards. Make sure there is access to a means of disconnecting the power source. The electrical circuit must meet the requirements for 240V. If the machine is to be hard wired, to minimize the risk of electrocution, fire, or equipment damage, the installation and electrical wiring must be done by a qualified electrician.

NOTE : The use of an extension cord is not recommended as it may decrease the life of electrical components on your machine.

ELECTRICAL REQUIREMENTS

Nominal Voltage.....240V
Cycle.....50 Hz
Phase.....Single Phase
Power Supply Circuit.....10 Amps
Full Load Current.....7.1 Amps

(Full load current rating is also on the specification plate on the motor.)

3.5 FULL-LOAD CURRENT RATING

The full-load current rating is the amperage a machine draws when running at 100% of the output power. Where machines have more than one motor, the full load current is the amperage drawn by the largest motor or a total of all the motors and electrical devices that might operate at one time during normal operations.

Full-Load Current Rating for these machines at 240V is 7.1 Amps

It should be noted that the full-load current is not the maximum amount of amps that the machine will draw. If the machine is overloaded, it will draw additional amps beyond the full-load rating and if the machine is overloaded for a long period of time, damage, overheating, or fire may be caused to the motor and circuitry.

This is especially true if connected to an undersized circuit or a long extension lead. To reduce the risk of these hazards, avoid overloading the machine during operation and make sure it is connected to a power supply circuit that meets the requirements.



3.6 BASIC CONTROLS

The descriptions below can be used to gain a basic understanding of the control panel. Knowing this information is required to safely complete the Test Run.

FORWARD Button: Starts clockwise spindle rotation (as viewed from above). The spindle must be completely stopped before this button is pushed.

REVERSE Button: Starts counterclockwise spindle rotation (as viewed from above). The spindle must be completely stopped before this button is pushed.

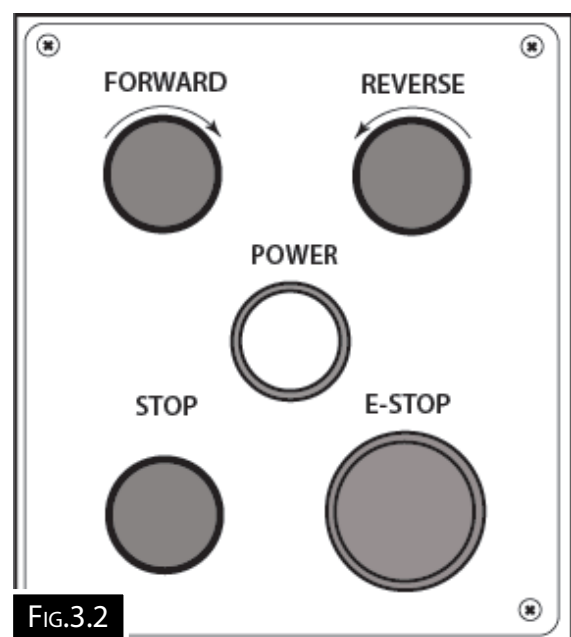


FIG.3.2

POWER Lamp: Illuminates when the machine is connected to power.

STOP Button: Stops spindle rotation.

EMERGENCY STOP Button: Cuts power to the spindle motor and remains depressed until reset. Twist clockwise until it pops out to reset. (Fig.3.3)

HIGH/LOW RANGE LEVER: Selects either high or low spindle speed range. (A in Fig3.4)

SPINDLE SPEED LEVER: Selects one of three spindle speeds in the selected speed range. (B in Fig.3.4)

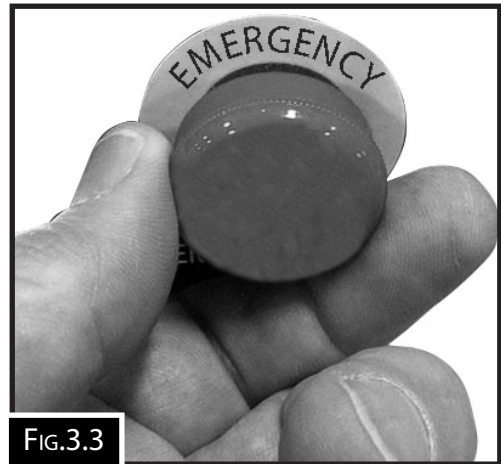


FIG.3.3

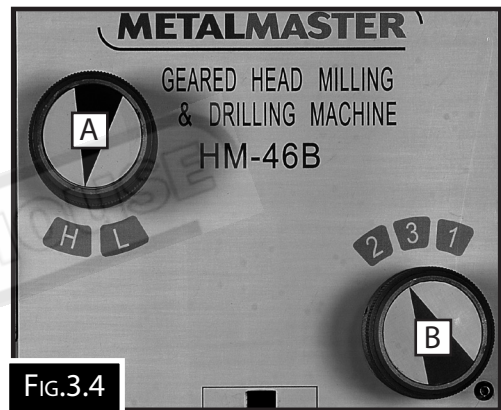


FIG.3.4

3.7 TEST RUN

NOTE: The headstock oil reservoir must have the proper amount of oil in it before the mill/drill can be operated for the first time. Damage caused by running the mill/drill without oil in the reservoir will not be covered under warranty.

Test run the machine to ensure it is properly connected to power and safety components are functioning correctly. If you find an unusual problem during the test run, immediately stop the machine, disconnect it from power, and fix the problem BEFORE operating the machine again. Consult The Troubleshooting table in the maintenance section of this manual for possible solution.

The Test Run consists of verifying the following:

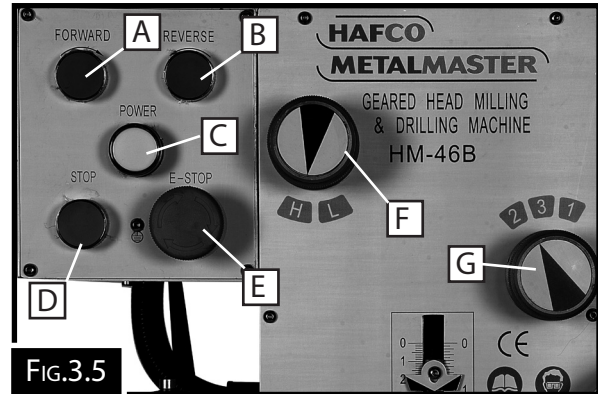
- 1) The motor powers up and runs correctly, and
- 2) the safety disabling mechanism on the emergency stop button works correctly.

To test run the mill/drill:

1. Clear all setup tools away from machine.
2. Connect machine to power supply. Power lamp should light.

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3. Press EMERGENCY STOP button (E in Fig3.5)
This will help prevent unexpected startup when machine is connected to power
4. Shift high/low range lever (F) right to "L" and spindle speed lever (G) left to "2". This selects a spindle speed of 170 RPM (refer to spindle speed chart on headstock).



Note: You may need to rotate spindle back and forth by hand while putting pressure on the shift lever to allow gears to mesh.

5. Twist EMERGENCY STOP button (E in Fig 3.5) clockwise until it pops out - this resets the button and enables the power to control panel and motor.
6. Press the SPINDLE FORWARD button (A in Fig 3.5). Spindle should rotate clockwise (as viewed from top) and machine should run smoothly with little to no vibration or rubbing noises.
7. Press STOP button (D in Fig.3.5) and wait for spindle to completely stop.
8. Press SPINDLE REVERSE button.(B in Fig.3.5) Spindle should rotate counterclockwise (as viewed from top).
10. Press EMERGENCY STOP button (E in Fig.3.5) and wait for spindle to completely stop.
11. Without resetting EMERGENCY STOP button, press SPINDLE FORWARD button. Machine should not start.

NOTE: If the machine does start (with EMERGENCY STOP button pushed in), immediately disconnect the power to machine. EMERGENCY STOP safety feature is not working correctly. This safety feature must work properly before proceeding with regular operations. Refer to Troubleshooting on Page 24 for possible solution.

12. Twist EMERGENCY STOP button clockwise to reset it.

Once everything is working as it should then the Test Run is complete and the machine can be used for normal operation.

4. OPERATION.

4.1 OPERATION OVERVIEW

The purpose of this overview is to provide the novice machine operator with a basic understanding of how the machine is used during operation, so the machine controls/components discussed later in this manual are easier to understand.

Due to the generic nature of this overview, it is not intended to be an instructional guide. To learn more about specific operations, read this entire manual and seek additional training from experienced machine operators, and do additional research outside of this manual by reading "how-to" books, trade magazines, or visiting websites.

When undergoing a typical operation, the operator needs to do the following:

1. Examines the workpiece to make sure it is suitable for the machining operation.
2. Check the machine to ensure that it is safe to use and put on protective clothing and safety equipment.
3. Place the workpiece on the table and securely clamp it to the table.
4. Select the correct cutting tool for the job and with the machine disconnected from power, install the cutting tool using the correct holder.
5. Lower the headstock so the cutting tool is just above the workpiece.
6. Select the correct spindle speed for the cutter and the workpiece.
7. Connect the machine to the power supply and turn it ON.
8. Uses the down feed, or table controls to perform the cutting operation.
9. Turn the machine OFF and wait for the spindle to completely stop before removing the workpiece, changing tooling, or changing spindle speeds.

4.2 DOWN- FEED CONTROLS

These machines are equipped with a course down-feed control mainly used for drilling or quick adjustment and a fine down-feed control used mainly when milling or where controlled down-feed is required. (Fig.4.1)

- A. Depth Stop and Scale
- B. Quill Lock Lever
- C. Depth Stop Adjustment Knob
- D. Fine Down-feed Hand-wheel
- E. Down-feed Selector Knob
- F. Coarse Down-feed Handle

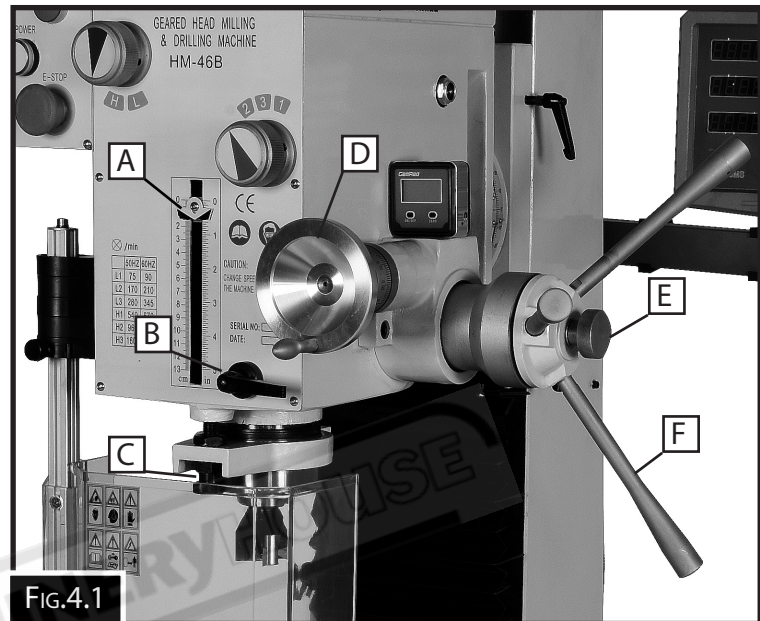


FIG.4.1

To Use The Coarse Down-feed

1. Loosen quill lock lever.
2. Loosen down-feed selector knob to engage coarse down-feed handles.
3. Position depth stop with adjustment knob.
4. Use coarse down-feed handles to raise and lower the spindle.

Depth Stop

The depth stop limits the downward movement of the cutting tool. With the use of the depth stop adjustment knob (see "C" in Fig.4.2), it can be positioned anywhere within 0–125mm. This is useful when performing the same operation multiple times.

To Use The Fine Down-feed

1. Loosen quill lock lever.
2. Tighten down-feed selector knob to engage fine down-feed hand wheel.
3. Position depth stop with adjustment knob.
4. Rotate fine down-feed hand wheel to raise and lower spindle.



FIG.4.2

4.3 HEADSTOCK MOVEMENT

The headstock is designed to move up and down along the Z axis and tilt 90 degrees side to side.



WARNING

The head is heavy and will require support when tilting. Arrange for some help to support the head when tilting.

To Raise or Lower the Headstock

1. DISCONNECT THE MACHINE FROM POWER!
2. Loosen both Z-axis lock levers shown in Fig.4.3

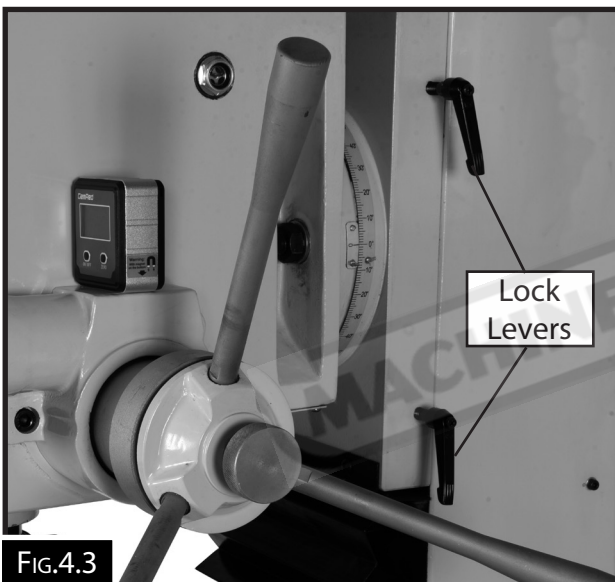


FIG.4.3

3. Use Z-axis crank shown in Fig.4.4 to adjust the headstock height.
4. Tighten Z-axis lock levers to secure the head



FIG.4.4

To Tilt The Headstock

1. DISCONNECT THE MACHINE FROM POWER!
2. Loosen the three locking hex nuts a 1/4 to 1/2 a turn. There is one on either side of the head (Fig.4.5) and one under the bottom of the head (see Fig.4.6).

NOTE: The 3 nuts must only be loosened a quarter to a half a turn maximum to avoid the head disengaging from the tilting mechanism and the head dropping under its own weight.

3. Using the scale shown as a guide, swivel the headstock and re-tighten the three hex nuts to secure it

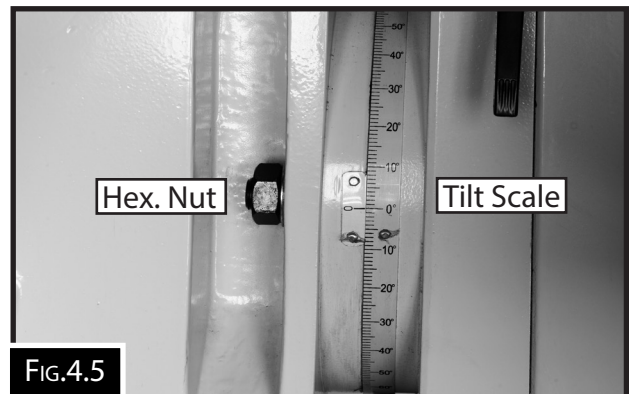


FIG.4.5

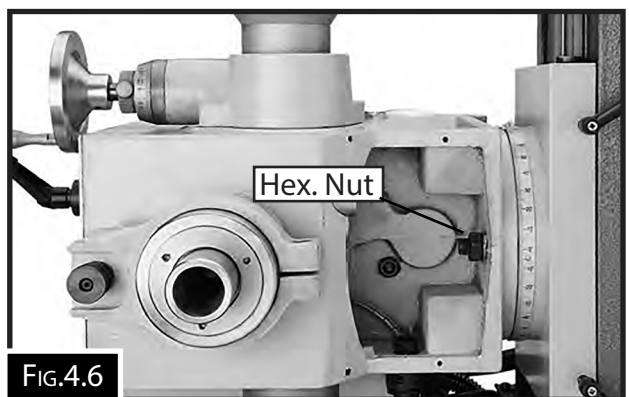


FIG.4.6

4.4 TABLE MOVEMENT

The table has travel in two directions called "X" and "Y" axis

X Axis is the Longitudinal Travel

Y Axis is the Cross Travel

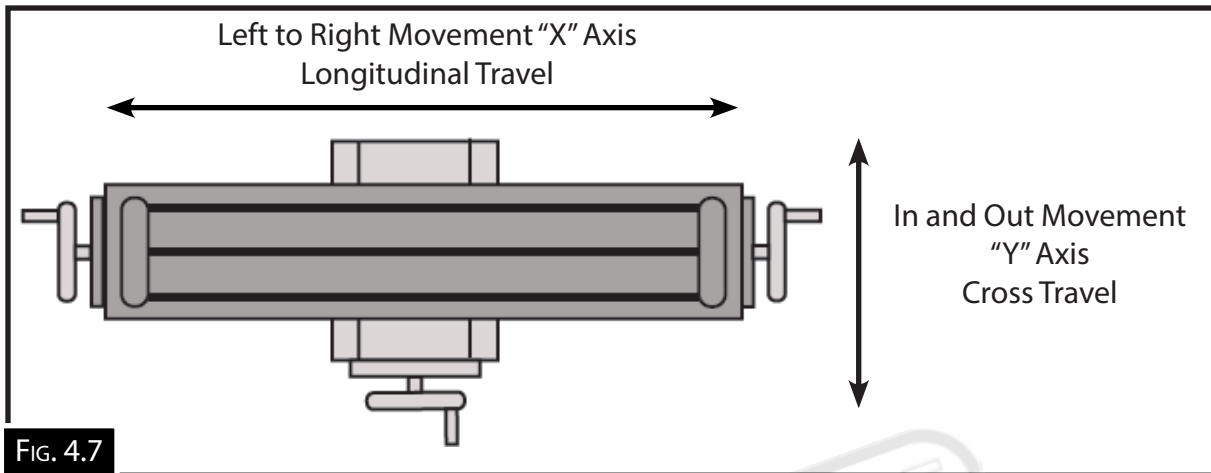


FIG. 4.7

GRADUATION DIALS

The hand-wheels have graduated dials that are used to determine table movement in 0.05mm increments, with one full revolution equaling 0.30mm

A thumb screw is provided so the graduated dial can be adjusted to a relative starting point. (Fig.4.8 & 9)

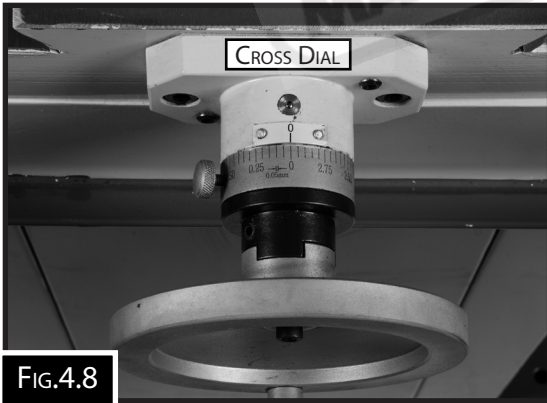


FIG.4.8

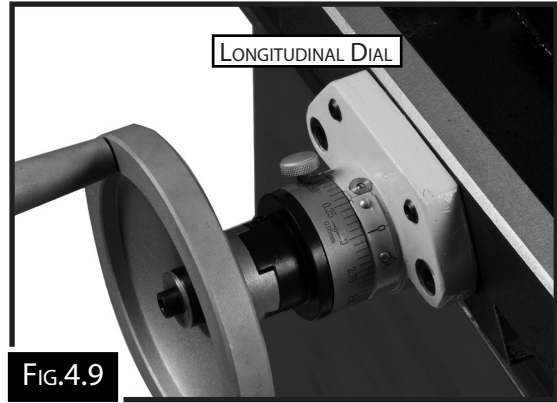


FIG.4.9

Before moving the table make sure that the table lock for that movement has been unlocked. Always lock the table if not using the movement in that direction. (Fig.4.10)

NOTE: When tightened, table locks provide table rigidity in that path of table travel for increased precision.

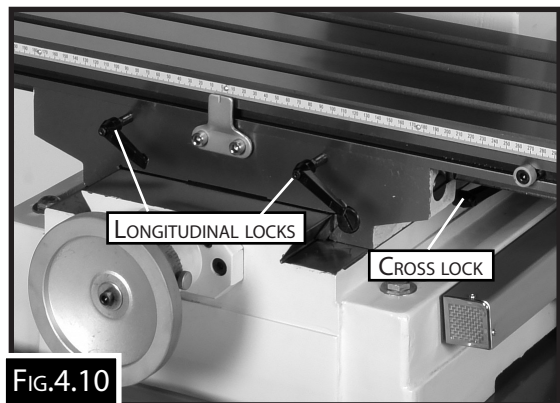


FIG.4.10

4.5 INSTALLING & REMOVING THE TOOLING

The machine is fitted with a 3MT spindle to hold the tooling. While the taper will hold drills where pressure is applied to the end of the drill, with milling cutters pressure is applied to the side of the cutter, therefore the cutter arbour needs to be held also with a drawbar.

To install the tooling:

1. DISCONNECT THE MACHINE FROM POWER!
2. Remove the drawbar cap, so the drawbar is exposed. (Fig.4.11)
3. Clean the mating surfaces then insert the tooling in the spindle with force so that the taper holds the arbour..
4. Working from the top, thread the drawbar by hand into the tooling until it is snug, then use a spanner to tighten it.
5. Replace the drawbar cap



FIG.4.11

NOTE: Height of drawbar inside spindle can be changed by rotating adjustment nut. Do not overtighten the drawbar. Overtightening makes the tool removal difficult and may cause damage to the arbor and threads.

To remove the tooling:

1. DISCONNECT THE MACHINE FROM POWER!
2. Remove the drawbar cap.
3. Un-thread the drawbar from tooling one full rotation.

NOTE: Do not fully un-thread the tooling from the drawbar, or the drawbar and tool threads could be damaged in the next step.

4. Tap the top of drawbar with hammer to unseat the taper.
5. Hold onto the tooling with one hand and fully un-thread the drawbar.



FIG.4.12

4.6 DIGITAL ANGLE GAUGE

The digital angle gauge is easily installed against the machined surfaces on the mill head, and held in place by the magnetic surfaces on the edges of the angle gauge. The digital angle gauge allows for easy angle setting of the head. (Fig.4.13)

Features and Functions

1. Automatic LCD Backlight
2. Can measure in absolute or relative measurement
3. The angle will be displayed in degrees
4. The working range of the angle measurement is $4 \times 90^\circ$
5. Automatic digit inversion for overhead measurements
6. Magnetic base.

Battery Installation (Battery 1 x AAA):

1. Make sure the digital angle gauge is switched OFF
2. Remove the battery compartment cover.
3. Install the new battery, following the polarity indicator.
4. Replace the battery cover.

NOTE: Always remove the battery before storing the digital angle gauge.

Operation

The operation of the digital angle gauge is very simple. Press the ON/OFF button to switch on the gauge and press the "ZERO" button at anytime to zero the gauge. (Fig.4.14)

To set true Zero find a level surface and place the angle gauge on the surface, switch on the digital angle gauge and press zero. It will remember zero until the "ZERO" button is pressed again.

4.7 CHANGING THE SPEEDS

Selecting the correct spindle speed is important for safe and satisfactory results, as well as maximizing tool life.

To set the spindle speed for your operation, you will need to:

1. Determine the best spindle speed for the cutting task,
2. Configure the spindle speed levers to produce the required spindle speed.

Determining Spindle Speed

Many variables affect the optimum spindle speed to use for any given operation, but the two most important are the recommended cutting speed for the workpiece material and the diameter of the cutting tool, as noted in the formula. (Fig.4.15)



FIG.4.13

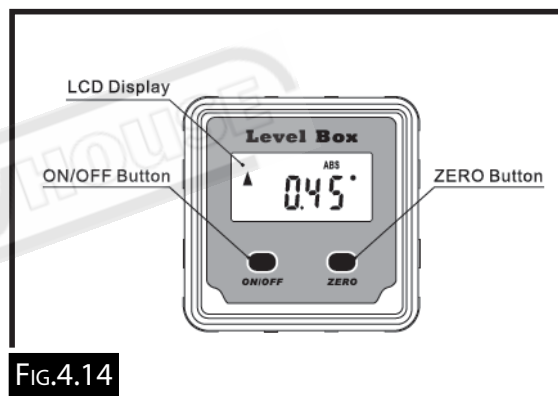


FIG.4.14



OPERATION MANUAL

Cutting speed, typically is defined in meters per minute (M/Min), is the speed at which the edge of a cutting tool moves across the material surface.

A recommended cutting speed is an ideal speed for cutting a type of material in order to produce the desired finish and optimize tool life.

$$RPM) = \frac{CUTTING\ SPEED\ M/MIN \times 1000}{CUTTER\ DIAMETER \times 3.14}$$

FIG. 4.15

Books such as Fitting and Machinery Technical Manual (L341) or Machine Shop Practice, and some internet sites, provide excellent recommendations for which cutting speeds to use when calculating the spindle speed. These sources also provide a wealth of additional information about the variables that affect cutting speed and they are a good educational resource. Also, there are a large number of easy-to-use spindle speed calculators that can be found on the internet. These sources will help you take into account the applicable variables in order to determine the best spindle speed for the operation.

SETTING THE SPINDLE SPEED

Use the chart or the one on the headstock when setting the spindle speed. The spindle must be stopped before the change gears can be moved. With the spindle completely stopped, position the high/low range and spindle speed levers according to the chart. (Fig.4.16)

	1	2	3
L	95	180	300
H	570	1000	1650



FIG.4.16

5. MAINTENANCE

5.1 LUBRICATION:

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

Points requiring lubrication are:

1. Internal spline drive assembly. Keep this area well lubricated with a good grade grease, insert grease in the hole at the top of spindle pulley spline driver, lube **TWICE YEARLY**.
2. A light film of oil applied to the quill, table and column will reduce wear, prevent rust, and assure ease of operation. **EVERY 30 DAYS**. Fluid Film (O040 or O043)
3. Quill return spring should receive oil (SAE 20) **ONCE YEARLY**. Remove cover plate and apply oil with oil can or small brush.
4. **IMPORTANT:** The gear box should be filled with oil such as SAE 68 to the level in the sight glass. **CHANGE OIL EVERY 12 MONTHS**.
5. Apply oil to quill pinion **EVERY 90 DAYS**.

NOTE: Use extreme care when performing these operations and keep hands clear of pinch points. Do not apply with motor running.

5.2 CHANGING THE GEAR BOX OIL

The headstock oil should be changed every 12 months.

To Change The Oil.

1. Run the spindle for 5 or 10 minutes at 570rpm to warm the oil
2. **DISCONNECT THE MACHINE FROM THE POWER**
3. Open the drain plug to allow the oil to drain from the opening completely.
4. Replace the oil drain plug and remove the oil filler plug, and fill the gearbox with oil until the oil level reaches the middle of the oil fluid lever indicator. (Fig. 5.2)
5. Then replace the oil filler plug.

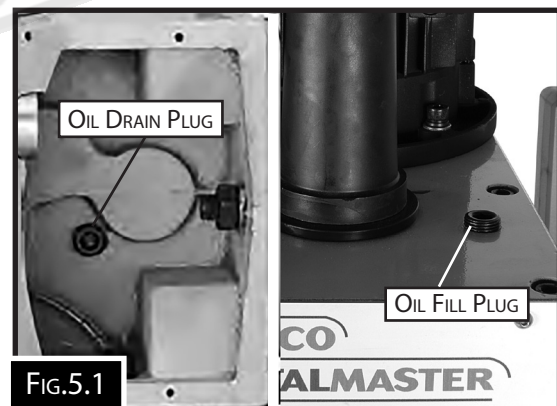


Fig.5.1



Fig.5.2

5.3 GIB ADJUSTMENT

Gibs are tapered lengths of metal that are sandwiched between two moving surfaces. Gibs control the gap between these surfaces and how they slide past one another. Correctly adjusting the gibs is critical to producing good milling results.

Tight gibs make table movement more accurate but stiff. Loose gibs make moving the table sloppy but easier to do. The goal of gib adjustment is to remove unnecessary sloppiness without causing the ways to bind.

Gibs are adjusted with a screw on each end of the gib, that move the tapered gib back-and-forth to increase or decrease the friction pressure between the sliding surfaces. The process of properly adjusting the gibs requires trial-and-error and patience.

Refer to Fig. 5.2-5.4 to identify the locations of the table, saddle, and column gibs, and one of the two adjustment screws for each.

NOTE: It will be necessary to remove small parts, such as way wipers and covers, to access the gib adjustment screws.

The following is the method used to adjust the gibs.

1. DISCONNECT MACHINE FROM POWER!
2. Make sure all table/column locks are loose.
3. Loosen one gib adjustment screw, then `` tighten the other the same amount to move the gib.
4. Use the handles/crank to move table/head until you feel a slight drag in the path of movement. Repeat Steps 3–4 as necessary.

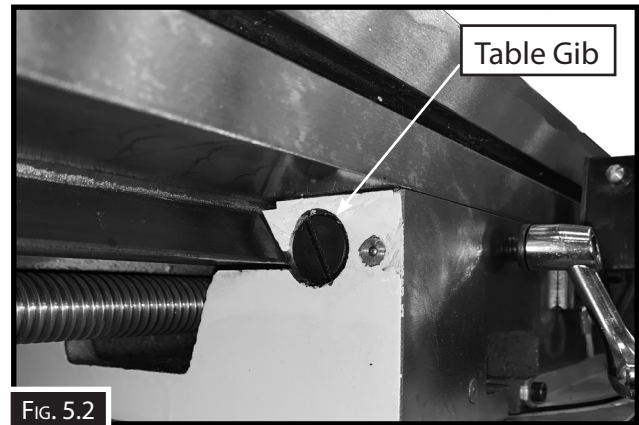


FIG. 5.2

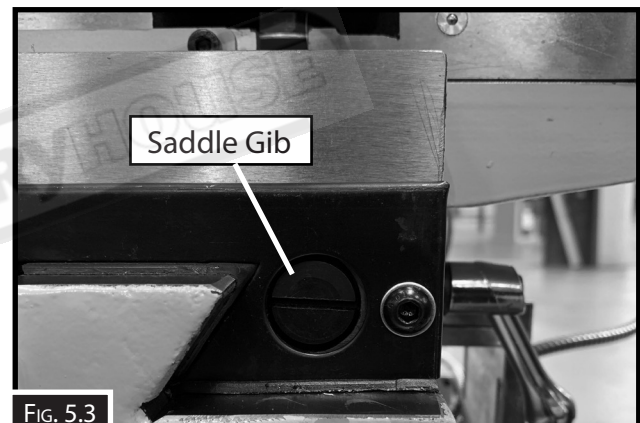


FIG. 5.3

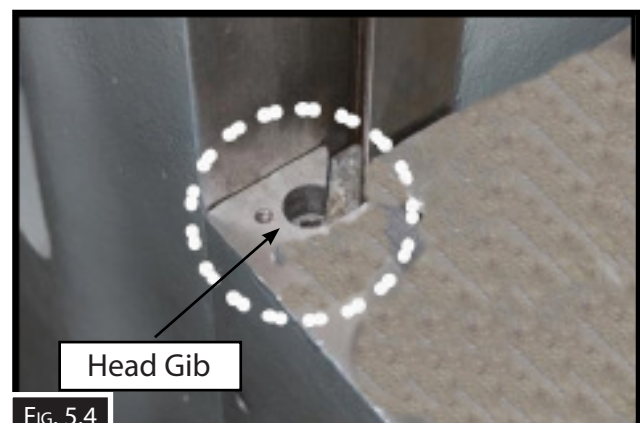


FIG. 5.4



OPERATION MANUAL

5.4 TROUBLESHOOTING

Symptom	Possible Cause	Possible Solution
Tool loose in spindle.	<ol style="list-style-type: none"> 1. Tool is not fully drawn up into spindle taper. 2. Debris on tool or in spindle taper 3. Taking too big of a cut. 	<ol style="list-style-type: none"> 1. Tighten drawbar. 2. Clean tool and spindle taper. 3. Lessen depth of cut and allow chips to clear.
Breaking tools or cutters.	<ol style="list-style-type: none"> 1. Spindle speed/feed rate is too fast. 2. Cutting tool is too small. 3. Cutting tool getting too hot. 4. Taking too big of a cut. 5. Spindle extended too far down. 	<ol style="list-style-type: none"> 1. Set spindle speed correctly or use slower feed rate 2. Use larger cutting tool and slower feed rate. 3. Use coolant or oil for appropriate application. 4. Lessen depth of cut and allow chips to clear. 5. Fully retract spindle and raise table. This increases rigidity.
Workpiece or tool vibrates or chatters during operation.	<ol style="list-style-type: none"> 1. Table locks not tight. 2. Workpiece not secure. 3. Spindle speed/feed rate is too fast. 4. Spindle extended too far down 5. Quill lock lever not tight. 6. Gibs too loose in table. 	<ol style="list-style-type: none"> 1. Tighten table locks. 2. Properly clamp workpiece on table or in vise. 3. Set spindle speed correctly or use slower feed rate (Page 20,21). 4. Fully retract spindle and raise table This increases rigidity. 5. Tighten quill lock lever. 6. Tighten gibs.
Table is hard to move.	<ol style="list-style-type: none"> 1. Table locks are tightened down. 2. Chips have loaded up on ways. 3. Ways are dry and need lubrication. 4. Table limit stops are interfering. 5. Gibs are too tight. 	<ol style="list-style-type: none"> 1. Fully release table locks . 2. Frequently clean away chips or debris. 3. Lubricate ways. 4. Make sure that table limit stops are not in the way 5. Adjust gibs .
Headstock is hard to raise.	<ol style="list-style-type: none"> 1. Headstock lock(s) or gib is at fault. 2. Headstock leadscrew is binding. 3. Gib is too tight. 	<ol style="list-style-type: none"> 1. Loosen/replace lock lever and adjust gib 2. Clean and relubricate headstock leadscrew and gears 3. Adjust gib.
Bad surface finish	<ol style="list-style-type: none"> 1. Spindle speed/feed rate is too fast. 2. Dull or incorrect cutting tool. 3. Wrong rotation of cutting tool 4. Workpiece not secure. 5. Spindle extended too far down. 	<ol style="list-style-type: none"> 1. Set spindle speed correctly or use slower feed rate (Page 20,21). 2. Sharpen cutting tool or select one that better suits the operation. 3. Check for proper cutting tool rotation. 4. Properly clamp workpiece on table or in vise. 5. Fully retract spindle and raise table. This increases rigidity.
Cutting results not square.	<ol style="list-style-type: none"> 1. Table and spindle are not at 90° to each other. 2. Table travel is inconsistent 	<ol style="list-style-type: none"> 1. Square the spindle. 2. Adjust gibs .
Spindle overheats.	<ol style="list-style-type: none"> 1. Poor spindle bearing lubrication. 2. Spindle bearings too tight. 3. Mill operated at high speeds for extended period. 	<ol style="list-style-type: none"> 1. Replace spindle bearings. 2. Properly adjust spindle bearing preload. 3. Allow mill to cool.
Noisy Operation	<ol style="list-style-type: none"> 1. Faulty Motot 2. Faulty Bearings 	<ol style="list-style-type: none"> 1. Replace or repair motor 2. Replace bearings.

SPARE PARTS SECTION

The following section covers the spare parts diagrams and lists that were current at the time this manual was originally printed. Due to continuous improvements of the machine, changes may be made at any time without notification.

HOW TO ORDER SPARE PARTS

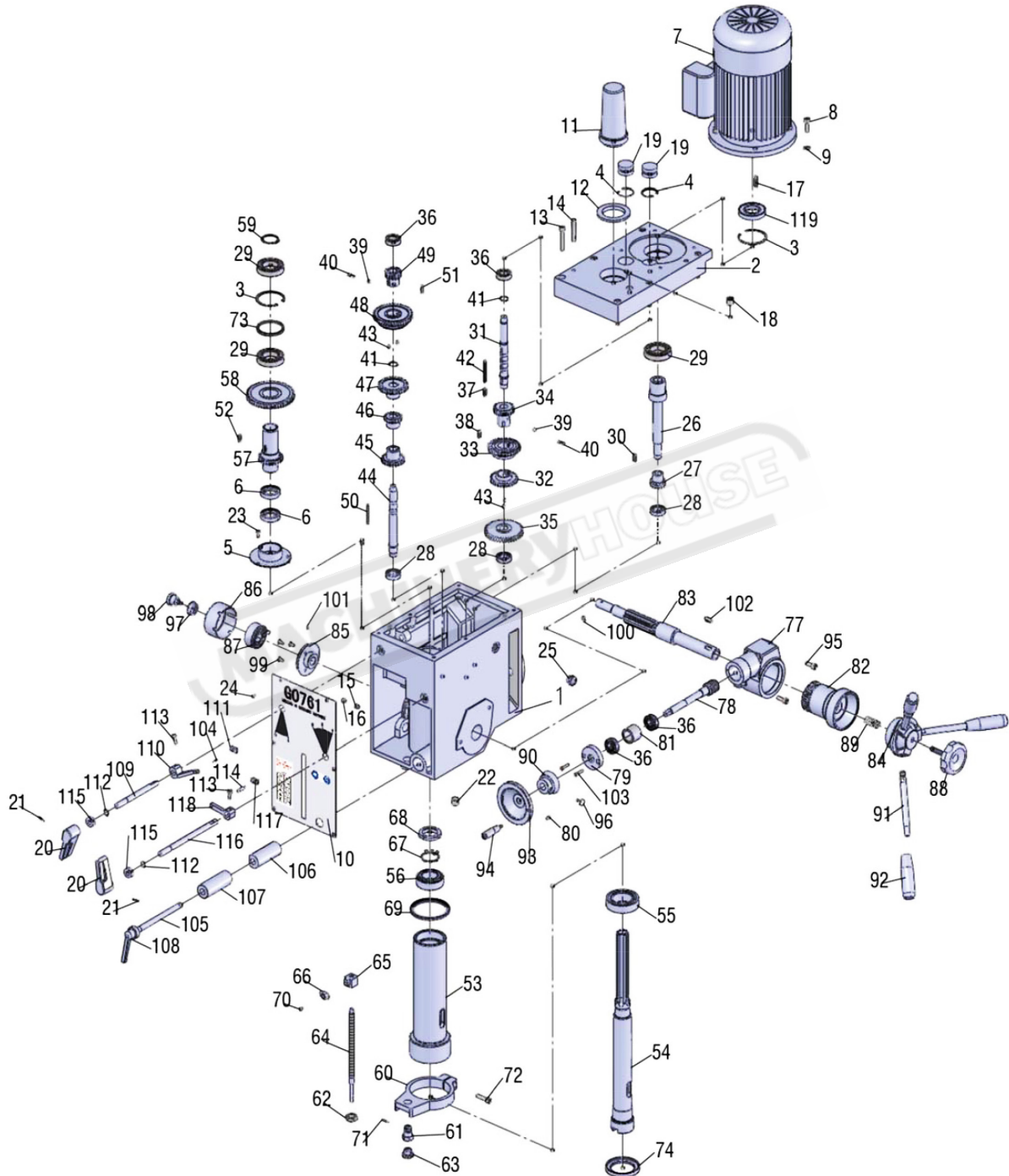
1. Have your machines **model number, serial number & date of manufacture** on hand, these can be found on the specification plate mounted on the machine
2. A scanned copy of your parts list/diagram with required spare part/s identified
3. Go to www.machineryhouse.com.au/contactus and fill out the enquiry form attaching a copy of scanned parts list.

MACHINERYHOUSE



OPERATION MANUAL

HEAD PARTS DIAGRAM





OPERATION MANUAL

HEAD PARTS LIST

No.	Qty.	Code.	Name	No.	Qty.	Code.	Name
1	1	20010B	Head Body	37	1	6X14	Key
2	1	20011B	Head Body Cover	38	1	6X28	Key
3	2	φ62	Int Retaining Ring	39	2	φ8	Ball
4	2	φ35	Int Retaining Ring	40	2		Spring
5	1	20018B	Airtight Base	41	2	φ18	Ext Retaining Ring
6	2	45×35X10	Airtight Ring	42	1	5X50	Key
7	1	1.5KW	Motor	43	4	M6X12	Screw
8	1	M8X25	Screw	44	1	20107B	lii Shaft
9	1	8	Washer	45	1	20109-B	Gear Z25
10	1	20201	Plate	46	1	20110-2-B	Gear Z18
11	1	20304-1B	Arbor Bolt Cover	47	1	20112-B	Gear Z32
12	1	20304-2B	Arbor Bolt Cover Base	48	1	20113-B	Gear Z43
13	6	M8X45	Screw	49	1	20115-B	Gear Z16
14	2	8×40	Pin	50	1	5X50	Key
15	1	M10×10	Screw	51	1	6X18	Key
16	1	M10×8	Screw	52	1	6X18	Key
17	1	6X28	Key	53	1	20019	Spindle Sleeve
18	1	ZG3/8"	Bolt	54	1	20104B	Spindle
19	2	20020B	Cap	55	1	30207 /P5	Bearing
20	2	20307B	Speed Lever	56	1	30206 /P5	Bearing
21	2	3X18	Pin	57	1	20114-B	Splined Sleeve Z25
22	1	ZG3/8"	Oil Plug	58	1	20116-B	Gear Z53
23	3	M5x10	Screw	59	1	φ35	Ext Retaining Ring
24	6	M4X8	Screw	60	1	20012	Feed Base
25	1	M18X1.5	Oil Pointer	61	1	20128	Support Base
26	1	20105B	I Shaft	62	1	20129	Nut
27	1	20105-1-B	Gear Z14	63	1	20130	Knob
28	3	6003 / P5	Bearing	64	1	20131	Graduated Rod
29	3	6007 / P5	Bearing	65	1	20021	Fixed Bolt
30	1	5X25	Key	66	1	20132	Scale Board
31	1	20106B	li Shaft	67	1	φ30	Lock Washer
32	1	20108-B	Gear Z29	68	1	M30X1.5	Lock Nut
33	1	20110-1-B	Gear Z35	69	1	20308	Rubber Washer
34	1	20111-B	Gear Z21	70	1	M4X8	Screw
35	1	20106-1-B	Gear Z41	71	1	3X18	Split Pin
36	4	6202 / P5	Bearing	72	1	M8X30	Bolt



OPERATION MANUAL

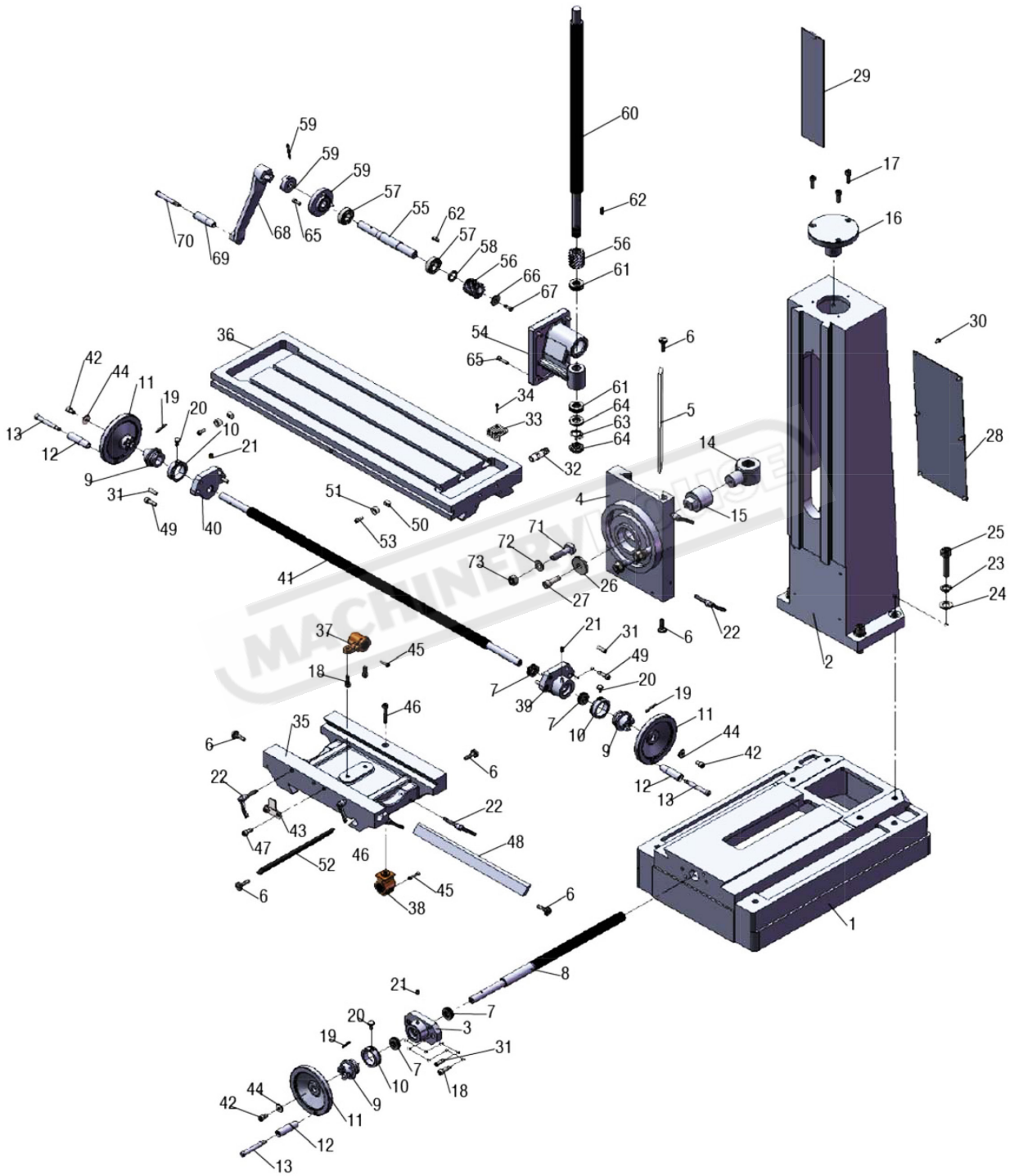
HEAD PARTS LIST

No.	Qty.	Code.	Name	No.	Qty.	Code.	Name
73	1	20024B	Separating Ring	108	1		Adjust Handle
74	1	20133B	Bearing Cover	109	1	20125B	Lever Shaft
75	1	M5 x 6	Screw (R8)	110	1	20022-1B	Lever
76	1	M5 x 4	Pin (R8)	111	1	20204-2B	Lever Bracket
77	1	20015	Worm Wheel Box	112	2	12	Ext Retaining Ring
78	1	20119	Worm Shaft	113	2	M6X16	Screw
79	1	20302	Worm Cover	114	1	20204-3B	Lever Rod
80	1	M6X12	Screw	115	2	12X22X8	Oil Seal
81	1	20120	Separating Ring	116	1	20126B	Long Lever Shaft
82	1	20016	Worm Wheel	117	1	20204-1B	Lever Bracket
83	1	20117	Pinion Shaft	118	1	20022-2B	Lever
84	1	20013	Handle Body	119	1	35x62x10	Oil Seal
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				
104	1	3X15	Pin				
105	1	20124B	Fixed Bolt				
106	1	20203B	Fixed Tight Block				
107	1	20202B	Fixed Tight Block				



OPERATION MANUAL

COLUMN AND TABLE PARTS





OPERATION MANUAL

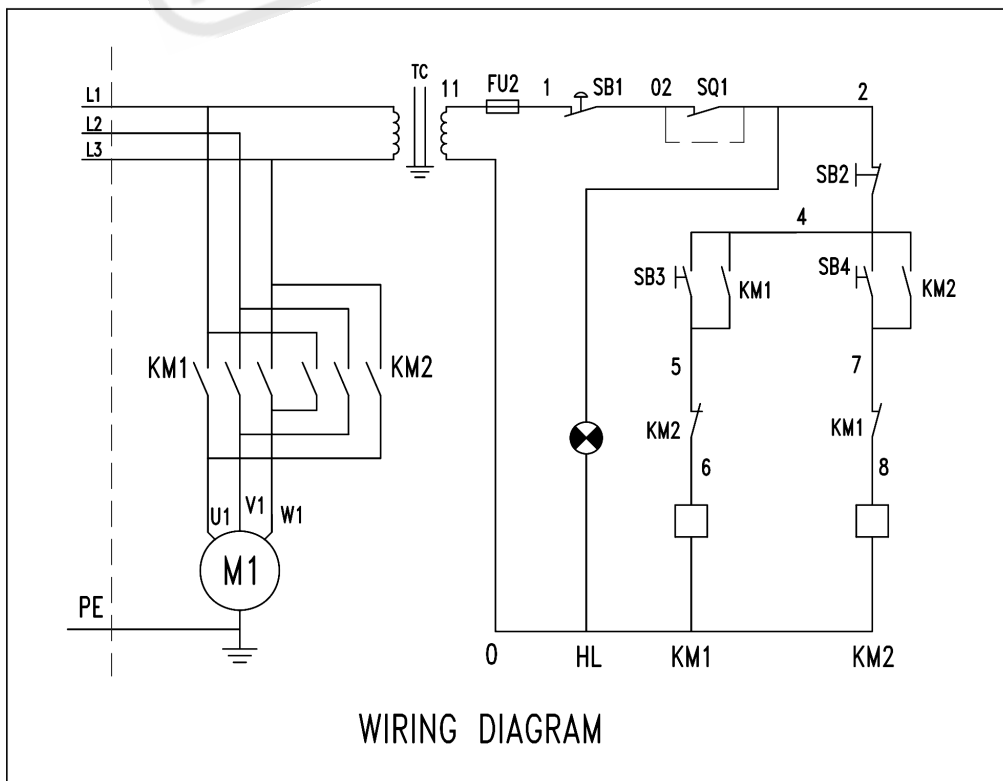
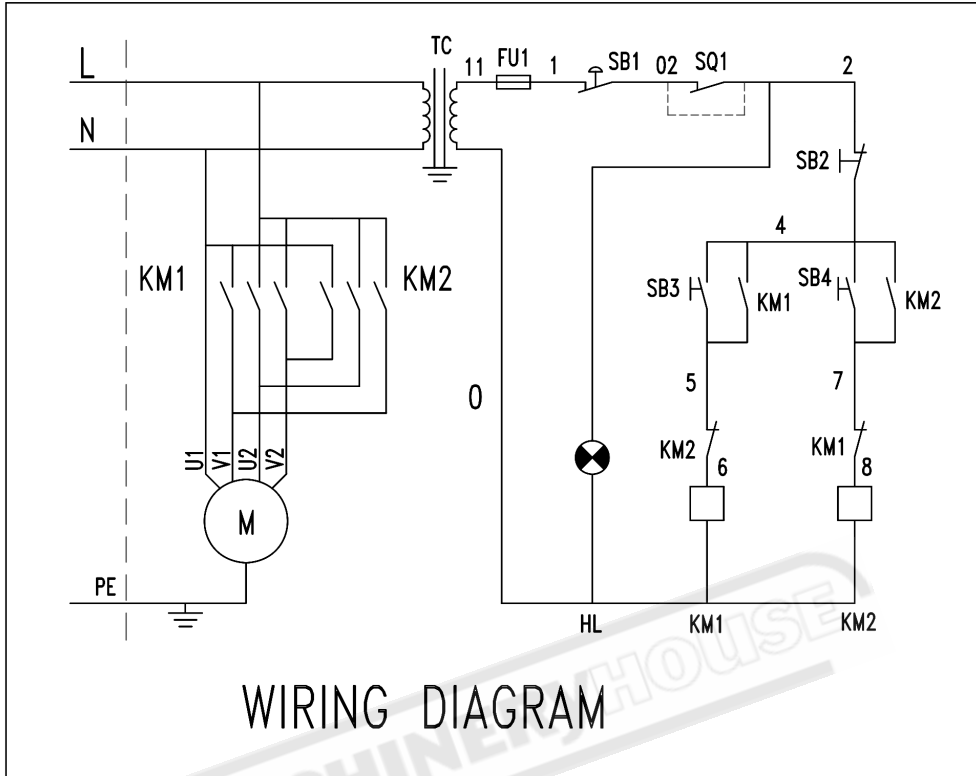
COLUMN AND TABLE PARTS LIST

No.	Qty.	Code.	Name	No.	Qty.	Code.	Name
1	1	10010	Base	42	3	M6x16	Screw
2	1	10013	Column	43	1	10105	Dial Clutch
3	1	10021	Square Flange	44	3	6	Washer
4	1	10016	Raise And Lower Base	45	2	M5X20	Screw
5	1	10025	Gib Strip	46	1	M8X45	Screw
6	6	10106	Screw	47	2	M8X15	Screw
7	4	51103	Bearing	48	1	10022	Gib Strip
8	1	10104	Table Screw	49	4	M8X25	Screw
9	3	10102	Dial Clutch	50	2	10108	Movable Fixed Block
10	3	10111	Graduated Plate	51	2	10109	Fixed Block Support
11	3	10301	Wheel	52	1	10023	Gib Strip
12	3	20305-1B	Turn Handle	53	2	M6 X 16	Screw
13	3	20305-1B	Screw	54	1	10017	Raise And Lower Base
14	1	10024	Nut	55	1	10113	Shaft
15	1	10117	Nut Bracket	56	2	20109	Gear
16	1	10014	Cover	57	2	6004	Bearing
17	3	M8x20	Screw	58	1	100218	Washer
18	4	M8X25	Screw	59	1	10015	Flange
19	3	5X35	Pin	60	1	10016	Raise And Lower Screw
20	2	10107	Screw	61	2	51104	Bearing
21	5	8	Oil Cup	62	2	6 X 20	Key
22	6	M8	Fixed Handle	63	1	20	Lock Washer
23	4	16	Washer	64	2	M20X1.5	Lock Nut
24	4	16	Washer	65	7	M6 X 20	Screw
25	4	M16X60	Bolt	66	1	20109.1	Washer
26	1	10120	Washer	67	1	M8x16	Screw
27	1	M12X35	Screw	68	1	10018	Handle
28	1	10119	Plate	69	1	10018.1	Turn Handle
29	1	10124	Protecting Cover	70	1	10018.2	Screw
30	6	M6X12	Screw	71	3	M14x55	Bolt
31	6	8X30	Pin	72	3	14	Washer
32	1		Pipe Joint	73	3	M14	Nut
33	1		Filter Screen				
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				



OPERATION MANUAL

WIRING DIAGRAM





WARNING

General Machinery Safety Instructions

Machinery House
requires you to read this entire Manual before using this machine.

- 1. Read the entire Manual before starting machinery.** Machinery may cause serious injury if not correctly used.
- 2. Always use correct hearing protection when operating machinery.** Machinery noise may cause permanent hearing damage.
- 3. Machinery must never be used when tired, or under the influence of drugs or alcohol.** When running machinery you must be alert at all times.
- 4. Wear correct Clothing.** At all times remove all loose clothing, necklaces, rings, jewelry, etc. Long hair must be contained in a hair net. Non-slip protective footwear must be worn.
- 5. Always wear correct respirators around fumes or dust when operating machinery.** Machinery fumes & dust can cause serious respiratory illness. Dust extractors must be used where applicable.
- 6. Always wear correct safety glasses.** When machining you must use the correct eye protection to prevent injuring your eyes.
- 7. Keep work clean and make sure you have good lighting.** Cluttered and dark shadows may cause accidents.
- 8. Personnel must be properly trained or well supervised when operating machinery.** Make sure you have clear and safe understanding of the machine you are operating.
- 9. Keep children and visitors away.** Make sure children and visitors are at a safe distance for you work area.
- 10. Keep your workshop childproof.** Use padlocks, Turn off master power switches and remove start switch keys.
- 11. Never leave machine unattended.** Turn power off and wait till machine has come to a complete stop before leaving the machine unattended.
- 12. Make a safe working environment.** Do not use machine in a damp, wet area, or where flammable or noxious fumes may exist.
- 13. Disconnect main power before service machine.** Make sure power switch is in the off position before re-connecting.
- 14. Use correct amperage extension cords.** Undersized extension cords overheat and lose power. Replace extension cords if they become damaged.
- 15. Keep machine well maintained.** Keep blades sharp and clean for best and safest performance. Follow instructions when lubricating and changing accessories.
- 16. Keep machine well guarded.** Make sure guards on machine are in place and are all working correctly.
- 17. Do not overreach.** Keep proper footing and balance at all times.
- 18. Secure workpiece.** Use clamps or a vice to hold the workpiece where practical. Keeping the workpiece secure will free up your hand to operate the machine and will protect hand from injury.
- 19. Check machine over before operating.** Check machine for damaged parts, loose bolts, Keys and wrenches left on machine and any other conditions that may effect the machines operation. Repair and replace damaged parts.
- 20. Use recommended accessories.** Refer to instruction manual or ask correct service officer when using accessories. The use of improper accessories may cause the risk of injury.
- 21. Do not force machinery.** Work at the speed and capacity at which the machine or accessory was designed.
- 22. Use correct lifting practice.** Always use the correct lifting methods when using machinery. Incorrect lifting methods can cause serious injury.
- 23. Lock mobile bases.** Make sure any mobile bases are locked before using machine.
- 24. Allergic reactions.** Certain metal shavings and cutting fluids may cause an allergic reaction in people and animals, especially when cutting as the fumes can be inhaled. Make sure you know what type of metal and cutting fluid you will be exposed to and how to avoid contamination.
- 25. Call for help.** If at any time you experience difficulties, stop the machine and call you nearest branch service department for help.



Milling Machine Safety Instructions

Machinery House
requires you to read this entire Manual before using this machine.

- 1. Maintenance.** Make sure the mill is turned off and disconnect from the main power supply and make sure all moving parts have come to a complete stop before any inspection, adjustment or maintenance is carried out.
- 2. Mill Condition.** Mill must be maintained for a proper working condition. Never operate a mill that has damaged or worn parts. Scheduled routine maintenance should be performed on a scheduled basis.
- 3. Leaving a Mill Unattended.** Always turn the mill off and make sure all moving parts have come to a complete stop before leaving the mill. Do not leave mill running unattended for any reason.
- 4. Avoiding Entanglement.** Remove loose clothing, belts, or jewelry items. Never wear gloves while machine is in operation. Tie up long hair and use the correct hair nets to avoid any entanglement with the mill spindle or moving parts.
- 5. Chuck key safety.** Always remove your chuck key, draw bar wrench, and any service tools immediately after use. Chuck keys left in the chuck can cause serious injury.
- 6. Understand the machines controls.** Make sure you understand the use and operation of all controls.
- 7. Tooling selection & holding.** Always use the correct cutting tool for the job you are milling. Make sure it is sharp and held firmly in place.
- 8. Cutting Tool inspection.** Inspect Drill and end mills for sharpness, chips, or cracks before use. Replace any cutting tools immediately if dull, chipped or cracked. Handle new cutting tools with care. Cutting edges are very sharp and can cause lacerations.
- 9. Reversing the spindle.** Make sure the spindle has come to a complete stop before changing the direction of the spindle. Do not slow or stop the spindle by using your hand.
- 10. Stopping the spindle.** Do not slow or stop the spindle by using your hand.
- 11. Speed selection.** Select the appropriate speed for the type of work, material, and tool bit. Allow the mill to reach full speed before beginning a cut.
- 12. Clearing chips.** Always use a brush to clear chips. Never clear chips when the mill is running.
- 13. Power outage.** In the event of a power failure during use of the mill, turn off all switches to avoid possible sudden start up once power is restored.
- 14. Clean work area.** Keep the area around the mill clean from oil, tools and chips.
- 15. Tilting head.** Use an assistant to help support the head correctly. Make sure bolts that secure the head for tilting are not loosened to much as head can slip and cause serious injury. Please refer to Mill head Tilting Instructions for correct procedure.
- 16. Call for help.** If at any time you experience difficulties, stop the machine and call your nearest branch service department for help.

PLANT SAFETY PROGRAM

NEW MACHINERY HAZARD IDENTIFICATION, ASSESSMENT & CONTROL

Milling Machine

Developed in Co-operation Between A.W.I.S.A and Australia Chamber of Manufactures
This program is based upon the Safe Work Australia, Code of Practice - Managing Risks of Plant in the Workplace (WHSA 2011 No10)

Item No.	Hazard Identification	Hazard Assessment	Risk Control Strategies <small>(Recommended for Purchase / Buyer / User)</small>
A	ENTANGLEMENT	HIGH	Eliminate, avoid loose clothing / Long hair etc.
B	CRUSHING	LOW	Secure & support workpiece on mill table.
B	CRUSHING	HIGH	Mill head tilting adjustment - please refer to mill head tilting instruction sheet for correct procedure.
C	CUTTING, STABBING, PUNCTURING	MEDIUM	Incorrect adjustment may result in the head becoming detached and a crushing hazard Isolate power to machine prior to any checks or maintenance being carried out. Do not adjust or clean machine until the machine has fully stopped.
D	SHEARING	MEDIUM	Make sure all guards are secured shut when machine is on. Isolate power to machine prior to any checks or maintenance.
F	STRIKING	MEDIUM	Ensure tooling is secure in chuck. Wear safety glasses. Stand clear of moving parts on machine. Remove all loose objects around moving parts. Ensure correct spindle direction when milling.
H	ELECTRICAL	MEDIUM	All electrical enclosures should only be opened with a tool that is not to be kept with the machine. Machine should be installed & checked by a Licensed Electrician.
M	HIGH TEMPERATURE	LOW	Wear appropriate protective clothing to prevent hot swarf.
O	OTHER HAZARDS, NOISE.	LOW	Wear hearing protection as required.
Plant Safety Program to be read in conjunction with manufactures instructions			



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Authorised and signed by:
Safety officer:



Manager:



Revised Date: 12th March 2012