HAFCO METALMASTER

Edition : 2.0
Date: (01/26)

Instruction Manual

INDUSTRIAL MILLING MACHINE

BM-90HV

Order Code: (M633D)

MACHINE DETAILS

MACHINE.	INDUSTRIAL MILLING MACHINE
MODEL NO.	BM-90HV
SERIAL NO.	
DATE OF MANF.	

Imported by

Australia

HARE&FORBES MACHINERYHOUSE

www.machineryhouse.com.au

New Zealand

MACHINERYHOUSE

www.machineryhouse.co.nz

NOTE:
This manual is only for your reference. At the time of the compiling of this manual every effort to be exact with the instructions, specifications, drawings, and photographs of the machine was taken. Owing to the continuous improvement of the HAFCO METALMASTER machine, 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 any electric machine.

SAFETY SYMBOLS:
The purpose of safety symbols is to attract your attention to possible hazardous conditions

⚠ WARNING ***Indicates a potentially hazardous situation causing injury or death***

⚠ CAUTION ***Indicates an alert against unsafe practices.***

Note: Used to alert the user to useful information

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)

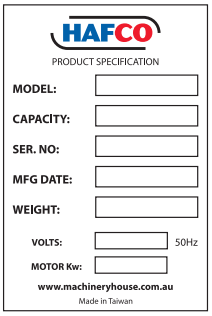

FIG. 1

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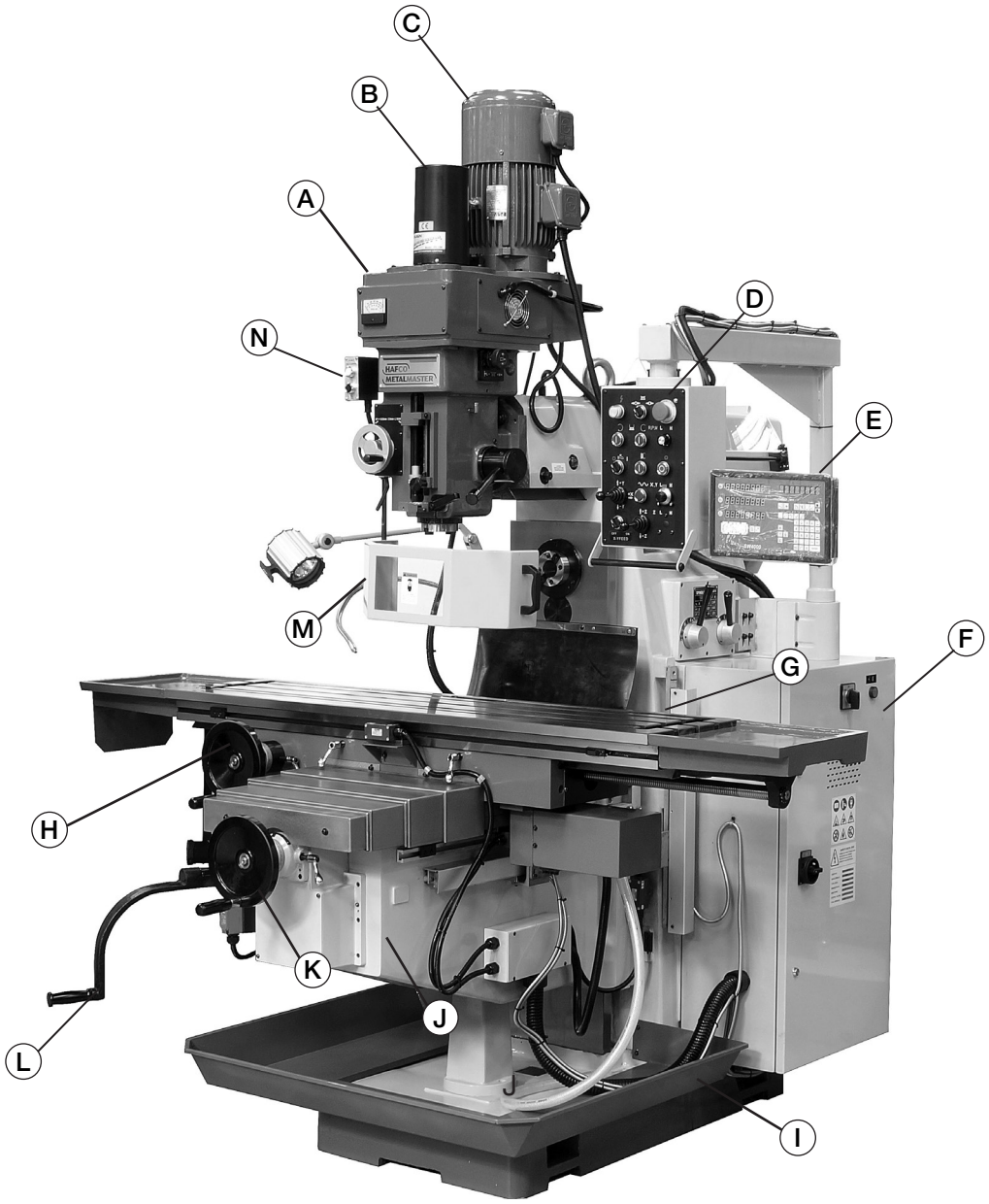
1.1 SPECIFICATIONS

Order Code	M633D
MODEL	**BM-90HV**
Digital Readout	3 Axis
Type	Vertical & Horizontal
Table Size (mm)	1470 x 370
Spindle Taper - Vertical	NT-40
Spindle Taper - Horizontal	NT-40
Longitudinal Travel (X-Axis) (mm)	1120
Cross Travel (Y-Axis) (mm)	520
Vertical Travel (Z-Axis) (mm)	440
Types of Slide	Dovetail (X), Square (Y,Z)
Ram Travel (mm)	600
Spindle to Table - Vertical (mm)	505
Spindle Travel / Diameter (mm)	140/110
Throat Depth Max. (mm)	785
Spindle Centre to Table - Horizontal (mm)	25 ~ 395
Tilting Head (Left - Right)	±45 °
Tilting Head (Forward ~ Back)	Fixed
Power Feed - Quill (mm/rev)	0.035 / 0.07 / 0.14
Power Feed - Longitudinal (X-Axis) (mm/min)	30 -3000
Power Feed - Cross (Y-Axis) (mm/min)	30 - 3000
Power Feed - Vertical (Z-Axis) (mm/min)	Rapid
Table T-Slot size (mm)	18
Work Table Capacity (kg)	600
Spindle Speeds Vertical (No. /rpm)	Inverter (60 - 3600)
Spindle Speeds Horizontal (No. /rpm)	9 (65 - 1500)
Motor Power - Vertical Spindle (kW / hp)	3.75 / 5
Motor Power - Horizontal Spindle (kW / hp)	3.75 / 5
Voltage / Amperage (V / amp)	415
Dimensions (L x W x H) (cm)	2070 x 1900 x 2495
Weight (kg)	2725

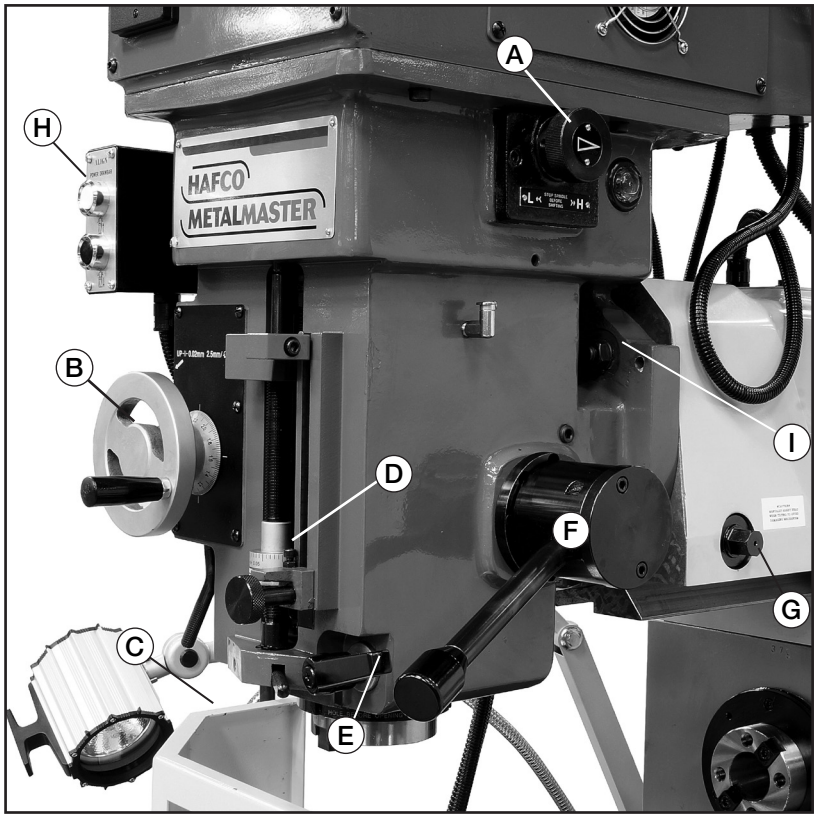
1.2 IDENTIFICATION

Become familiar with the names and locations of the controls and features shown below to better understand the instructions when mentioned later in this manual.



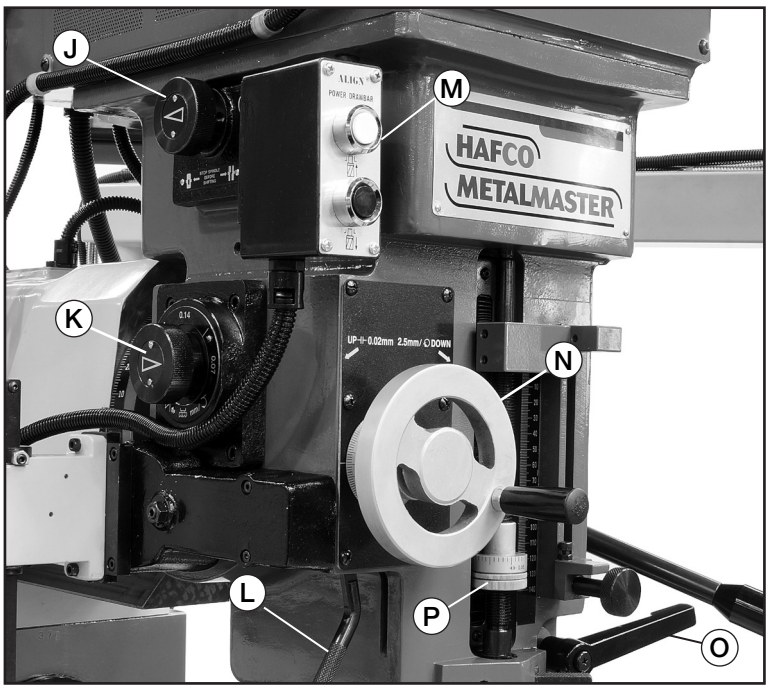
A	Headstock & Drive System	H	X-Axis Hand wheel
B	Air Powered Draw bar	I	Splash Tray
C	Motor	J	Knee
D	Control Panel	K	Y-Axis Hand wheel
E	Digital Readout Display	L	Z-Axis Crank
F	Electrical Cabinet	M	Cutter Safety Guard
G	Work Table	N	Air Powered Draw bar Controls

1.3 HEAD IDENTIFICATION



Head Right Hand Side	
A	High / Low Speed Lever
B	Quill Down Feed Handle
C	Cutter Safety Guard
D	Depth Stop
E	Spindle Lock
F	Manual Spindle Handle
G	Rack for Side Tilt
H	Power Draw bar Controls
I	Lock Nuts for Side Tilt

Head Left Hand Side	
J	Engage - Disengage Quill Feed
K	Feed Selector
L	Feed Control Lever
M	Power Draw bar Control
N	Quill Manual Feed Handle
O	Spindle Lock
P	Depth Stop



2. SAFETY

2.1 GENERAL METALWORKING MACHINE SAFETY

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 work piece.
- ✓ 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.
- ✓ DISCONNECT 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.

2.1 GENERAL SAFETY REQUIREMENTS 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, neckties, rings, bracelets or other jewellery that can become 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.

CAUTION!

It is impossible to cover all possible hazards Every workshop environment is different. These are designed as a guide to be used to compliment training and as a reminder to users prior to equipment use. Always consider safety first, as it applies to the individual working conditions.

2.1 GENERAL SAFETY REQUIREMENTS Cont.

HAZARDS ASSOCIATED WITH MACHINES include, but are not limited to:

- Being struck by ejected parts of the machinery.
- Being struck by material ejected from the machinery.
- Contact or entanglement with the machinery.
- Contact or entanglement with any material in motion.

Health Hazards (other than physical injury caused by moving parts)

- Chemicals hazards that can irritate, burn, or pass through the skin.
- Airborne items that can be inhaled, such as oil mist, metal fumes, solvents, and dust.
- Heat, noise, and vibration.
- Ionizing or non-ionizing radiation. (X-ray, lasers, etc.)
- Biological contamination and waste.
- Soft tissue injuries (for example, to the hands, arms, shoulders, back or neck) resulting from repetitive motion, awkward posture, extended lifting, and pressure grip.

Other Hazards

- Slips and falls from and around machinery during maintenance.
- Unstable equipment that is not secured against falling over.
- Safe access to/from machines. (access, egress)
- Fire or explosion.
- Pressure injection injuries from the release of fluids and gases under high pressure.
- Electrical Hazards, such as electrocution from faulty or ungrounded electrical components.
- Environment in which the machine is used. (in a machine shop, or on a work site)

WARNING!

The machine is the sole responsibility of the owner for its safe use. This responsibility includes but is not limited to proper installation in a safe environment, personnel training, proper inspection and maintenance, manual availability and comprehension. The manufacturer will not be held liable for injury or property damage from negligence, improper training, machine modifications or misuse.

WARNING!

Machines are safeguarded to protect the operator from injury or death with the placement of guards. Machines must not be operated with the guards removed or damaged.

2.2 ADDITIONAL SAFETY FOR MILLING MACHINES

DO NOT use this machine unless you have read the manual or have been trained and assessed to a competent level in its safe use and operation.

Safety glasses must be worn at all times in work areas

Long and loose hair must be contained

Gloves must not be worn when using this machine

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 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.

ENDING OPERATIONS AND CLEANING UP

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

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.

POTENTIAL HAZARDS AND INJURIES

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

3. POWER SUPPLY

3.1 ELECTRICAL REQUIREMENTS

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 415V. To minimize the risk of electrocution, fire, or equipment damage, these machines should be hard wired with installation work and electrical wiring 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.....415V
Cycle.....50 Hz
Phase.....Three Phase
Power Supply Circuit.....15 Amps
Full Load Current..... 7.6 Amps

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

3.2 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 machine at 415V is 7.6 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.

4 SETUP

4.1 UNPACKING

This machine was carefully packaged for safe transport. When unpacking, separate all enclosed items from packaging materials and inspect them for shipping damage. If items are damaged, please contact your distributor.

NOTE: Save all the packaging materials until you are completely satisfied with the machine and have resolved any issues with the distributor, or the shipping agent.

When unpacking, check the packing list to make sure that all parts shown are included. If any parts are missing or broken, please contact your distributor.

4.2 INCLUDED ITEMS

- 3 Axis digital readout fitted
- Automatic oil lubrication pump and reservoir
- Pneumatic drawbar system M16 thread
- Coolant system
- Slideway covers
- Z-Axis powered elevating motor
- X & Y-Axis inverter controlled power-feed
- Halogen light
- Safety cutter guard
- Swarf tray
- Drawbar M16 thread

4.3 CLEAN - UP

The unpainted surfaces of the machine have been coated with a waxy oil to protect them from corrosion during shipment. Remove the protective coating with a solvent cleaner or a citrus based degreaser.

Optimum performance from your machine will be achieved when you clean all moving parts or sliding contact surfaces that are coated with rust prevented products.

It is advised to avoid chlorine based solvents, such as acetone or brake parts cleaner, as they will damage painted surfaces and strip metal should they come in contact. Always follow the manufacturer's instructions when using any type of cleaning product.

4.4 SITE PREPARATION

When selecting the site for the machine, consider the largest size of workpiece that will be processed through the machine and provide enough space around the machine for operating the machine safely. Consideration should be given to the installation of auxiliary equipment. Leave enough space around the machine to open or remove doors/covers as required for the maintenance and service as described in this manual.

It is recommended that the machine is anchored to the floor to prevent tipping or shifting. It also reduces vibration that may occur during operation.

4.5 LIFTING INSTRUCTIONS

On the day that the machine arrives, make sure that a crane or forklift 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

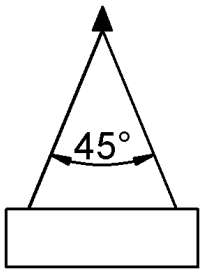


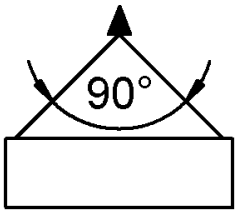
Fig 4.1.

When the slings are at a 45° angle then each sling is carrying the equivalent of 50% of load weight. (Fig.4.1).

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 4.2)

NOTE: THE MANUFACTURER RECOMMENDS NOT TO EXCEED 90° ANGLE

Fig 4.2



Lifting Point

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.

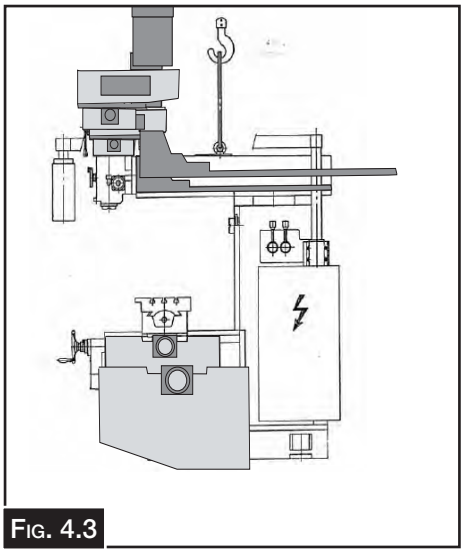


FIG. 4.3

WARNING!

Make sure everyone is away from the load before hoisting. The load must be under control when lowering loads suspended. Rigging and crane operation must be carried out by persons with approved qualifications.

4.6 ANCHORING TO THE FLOOR

The machine is best mounted on a concrete slab.

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. 4.4)

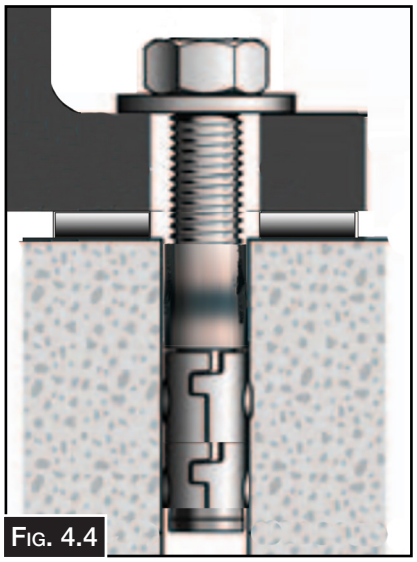


Fig. 4.4

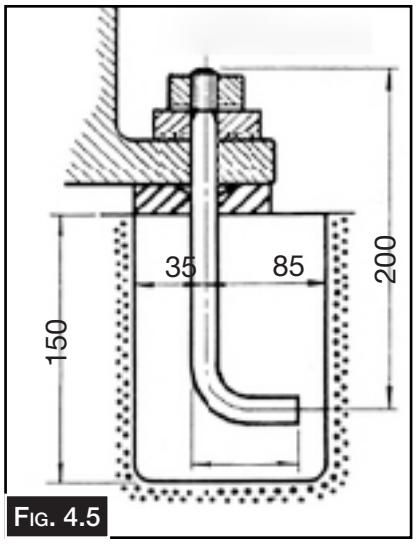


Fig. 4.5

In some case a suitable foundation may not be available and a new one may need to be prepared.

The foundation should be concrete approximately 150mm thick with pockets left clear for the hold down bolts. The hold down bolts can be “L” shape as per the example in Fig. 4.5

4.7 MACHINE LEVELLING

To set your machine up so that it operates to optimum performance, apply the following procedure

After your machine has been anchored to a concrete slab floor, it then needs to be levelled. Loosen the hold down bolts and place a level on the surface of the working table. Metal shims need to be placed under corner of the base of the machine until level. Once level then tighten the hold down bolts. (Fig. 4.6).

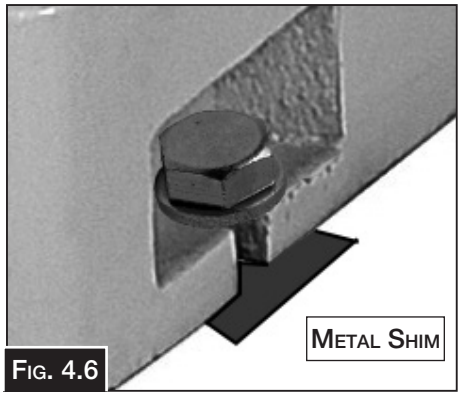


Fig. 4.6

CAUTION!

The machine must not rest on supports other than those defined in Fig. 4.6.

4.8 ASSEMBLY

The machine must be fully assembled before it can be operated. First clean any parts that are coated in rust preventative to ensure the assembly process can proceed smoothly.

VERTICAL HEAD

Some machines when they leave the factory may have been supplied with the head spindle up and the motor down. On the receipt of the machine in this condition the head needs to be returned to the correct position.

Any time the head has been rotated, you must square the spindle with the table when setting the headstock back to the 0° position. This is the only way to ensure precision milling results later. (See Page 26)

NOTE: The lock bolts shown in Fig. 4.7 are threaded into T-nuts that travel in a circular slot during head rotation. When rotating the head, it is possible for these T-nuts to jam in the slot preventing movement of head. If this happens, gently rotate each lock bolt, starting with the lower right, until you free up the jammed T-nut. Then continue to rotate head to desired position.

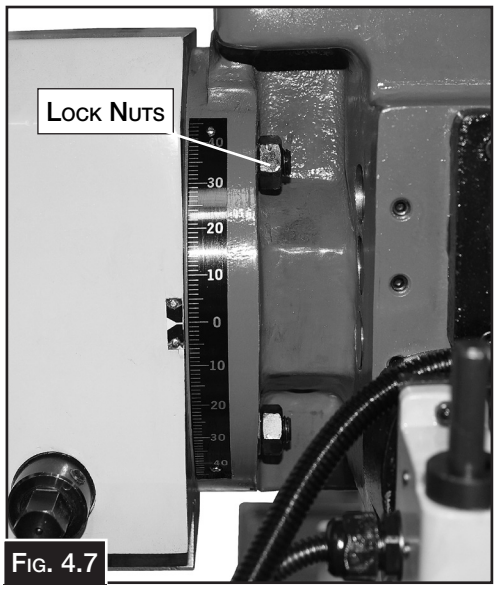


Fig. 4.7

HANDLES

To avoid damage to the lead screws, handles and the crank during shipping, they may be supplied facing in towards the machine or be removed. These will need to be inverted or attached.

X and Y Axis Handles

Remove the hex nut from the X and the Y-axis lead screw. Align the handle keyway with the lead screw key, slide the X and Y-axis handles onto the lead screw, then secure them in place with the removed hex nut. (Fig. 4.8)

Thread the handles into the tapped hole in the handles and tighten them with a wrench.

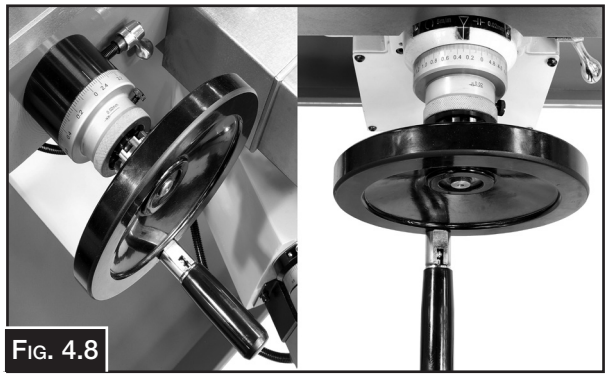


Fig. 4.8

Z Axis Crank Handle

The Z-Axis handle is supplied loose and requires no installation. (Fig. 4.9)

Note: The Z-axis crank is not spring-loaded so that the teeth of the crank and the lead screw can remain engaged. A micro switch prevents the power feed from operating. The crank must be removed when the Z-axis power feed is used.


Fig. 4.9

4.9 TEST RUN

After all the assembly steps have been completed, the machine and its safety features must be tested to ensure its correct operation.

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. The Troubleshooting table in the Maintenance section of this manual may be able to help. If the problem persists then contact your dealers service technician.

During the test run, the proper operation of the following needs to be verified:

1. Spindle Motor and Coolant Pump direction
2. Emergency Stop Button operation
3. Z-Axis Power Feed
4. X-Axis Power Feed.

To Test The Mill

1. Inspect all lubrication points and top up if necessary. Refer to Lubrication on Page 46 for specific details.
2. Clean out the coolant reservoir in the base of the mill, then fill it with coolant.
3. Clear away all tools and objects used during assembly and preparation.
4. Set the spindle speed to the low range (refer to the Setting Spindle Speed Range section beginning on Page 37 for detailed instructions).
5. Press the spindle ON button, then turn the spindle direction switch to the forward (right) position to start spindle rotation. Listen for abnormal noises and watch for unexpected actions or operation. The mill should run smoothly and without excessive vibration or rubbing noises. If the direction is incorrect, isolate the machine and have the electrician make changes to the wiring. Repeat step 5 with the reverse switch.

Testing The Emergency Stop Button

Make sure that the emergency button has been reset.

Start the machine and then press the emergency stop button. The machine should stop and the power should be cut off. If the machine cannot be started then the emergency stop is working correctly. To reset the emergency stop twist the red top until it pops up.

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.

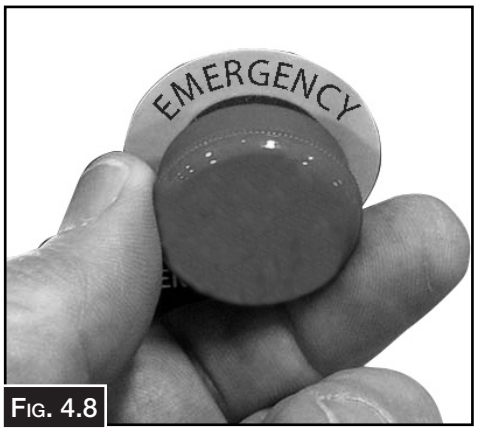


FIG. 4.8

Test Run Z-Axis Power Feed

The mill comes with a power feed unit for X-axis table travel. Proper operation of the limit switch attached to the side of the knee is critical for the safe use of this power feed unit.

Test Run X-Axis Power Feed

The mill comes with a power feed unit for X-axis table travel. Proper operation of the limit switch attached to the front of the table is critical for the safe use of this power feed unit.

4.10 INTERLOCKED MOVABLE CHUCK GUARD - USE & OPERATION.

Function.

The intended design and use of the interlocked movable chuck guard is to prevent access to rotating spindles or tools.

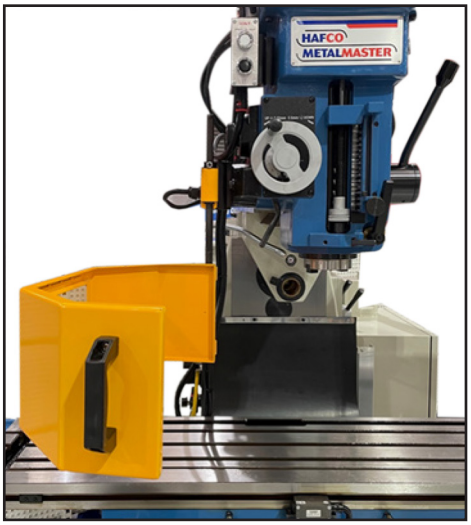
Accidental contact with moving parts during operation may cause severe entanglement, impact, cutting, or crushing injuries. Reduce this risk by keeping any included guards/covers/doors installed, fully functional, and positioned correctly for maximum protection. It is important to always ensure they are properly installed and working correctly while machine is running.

Testing Interlocked moveable Chuck Guard:

Test the chuck guard safety switch by moving guard to open position and try to start Mill. The Mill should not start.

If the mill starts, check guard is properly installed and check for physical damage to the safety switch. If you are unsure, contact your local distributor to arrange a service.

Open Position



Closed Position

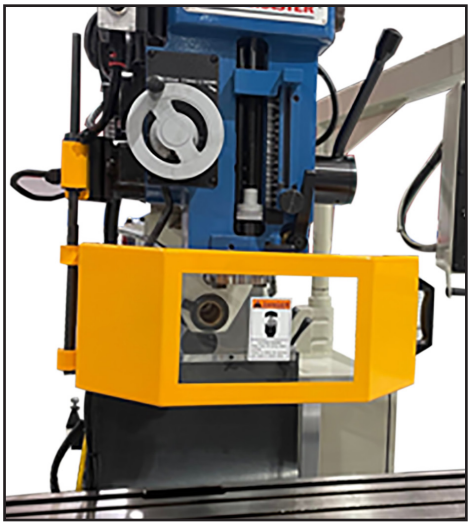
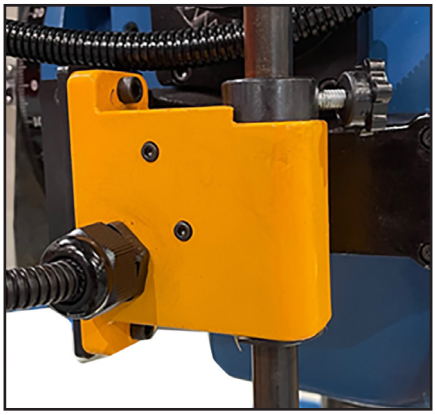


Image Shows – Internal Safety switch & Height Adjustment knob for chuck guard.



4.10 INTERLOCKED MOVABLE CHUCK GUARD - USE & OPERATION. Cont

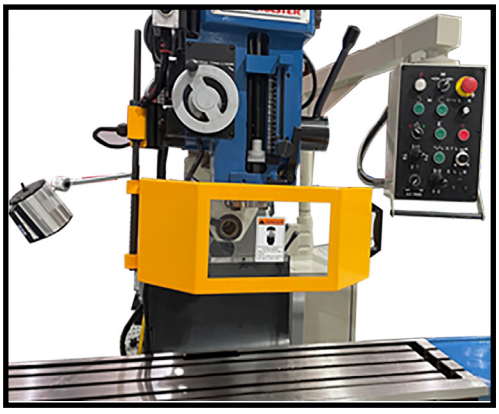
Height Adjustment of Chuck Guard.

By loosening and tightening the height Adjustment Knob, ensure the chuck guard is positioned to the required height, so to best protect both the rotating spindle or tools.

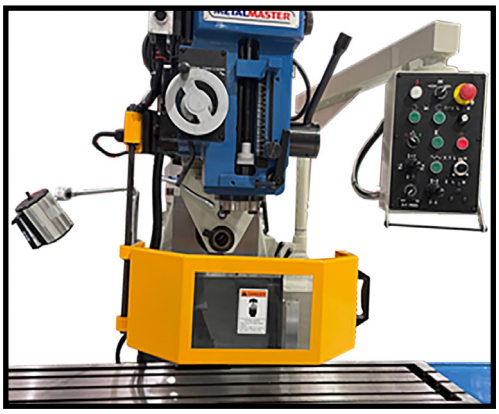
Below images show the maximum range of mill chuck guard height adjustment in the Closed Position.

Upper Position

Middle Position



Lower Position



5. OPERATION

5.1 OPERATION OVERVIEW

This machine may perform many types of operations that are beyond the scope of this manual. Many of these operations may be dangerous or deadly if performed incorrectly.

The instructions in this section are written with the understanding that the operator has the necessary knowledge and skills to operate this machine. If at any time you are experiencing difficulties performing any operation, stop using the machine!

If you are an inexperienced operator, we strongly recommend that you read books, trade articles, or seek training from an experienced operator before performing any unfamiliar operations. Above all, your safety should come first!

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 they can more easily understand the controls discussed later in this manual.

Typical Operation

1. Examine the work piece to make sure it is suitable for milling and meets the capacity of the machine.
2. Firmly clamp the work piece to the table making sure that the work piece is supported under the clamps
3. Install the correct cutting tool and holder for the operation.
4. Use the manual down feed and table controls to confirm the correct positioning of the cutting tool and work piece for the operation. If the X-axis or Z-axis power feed will be used during the operation, the operator confirms the speed and length of table movement required.
5. Configure the mill for the correct spindle speed and feed for the operation.
6. Put on personal protective gear and makes sure the work piece and table are clear of all tools, cords, and other items.
7. Start the spindle rotation and perform the operation.
8. Turn the mill OFF.

WARNING!

Read and understand the instructions in this manual before operating this machine to reduce the risk of serious injury or even death. Save all warnings and instructions for future reference.

WARNING!

Before operating any machine, take time to read and understand all safety signs and symbols. If not understood seek explanation from your supervisor or an experienced operator.

5.2 CONTROLS

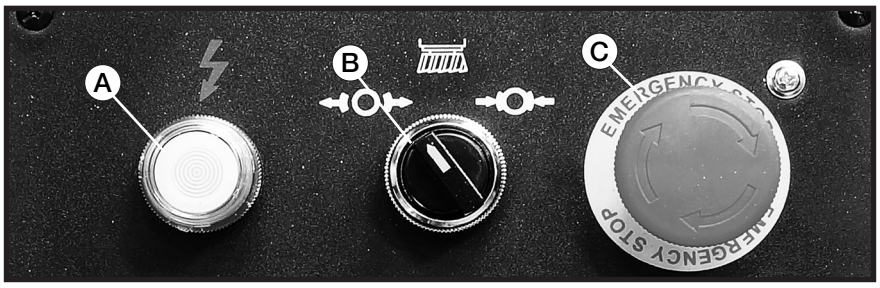
The purpose of this control overview is to provide the novice machine operator with a basic understanding of how the machine is used during operation, and the machine controls and what they do. It also helps the operator to understand if they are discussed later in this manual.

NOTE: DO NOT start the machine until all of the setup instructions have been performed.

Operating a machine that is not setup correctly may result in malfunction or unexpected results that can lead to serious injury, death or damage to the machine or property.

Control Panel

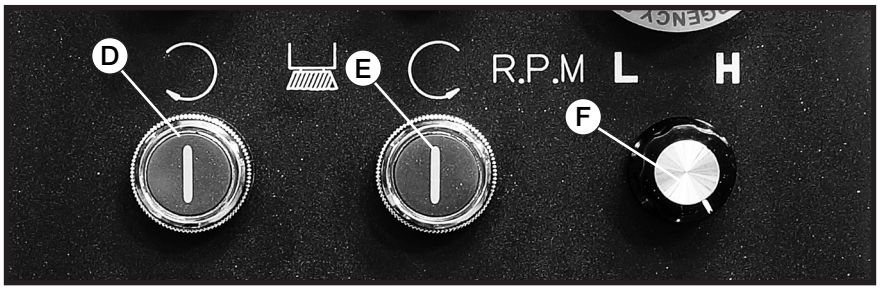
5.2 CONTROLS Cont.



A **Power Light :** This light is illuminated when power is switched on to the control panel and the machine.

B **Spindle Forward Button.** When looking from the top of the machine rotates the spindle clockwise.

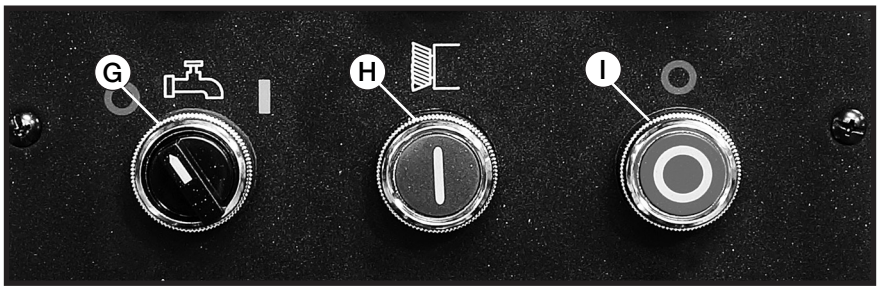
C **Emergency Stop Button :** When pressed disconnects power from the control panel, stops the spindle and the feed motor.



D **Vertical Spindle Forward :** When pressed starts the vertical spindle in a clockwise motion as viewed from the top of the machine.

E **Vertical Spindle Reverse :** When pressed starts the vertical spindle in an anti clockwise motion as viewed from the top of the machine.

F **High Low Speed Control :** This switches the vertical spindle speed between High and Low range speed.

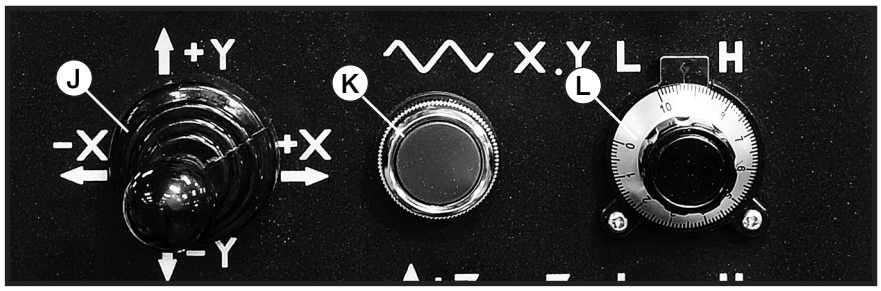


G **Coolant Pump :** When pressed starts the coolant pump.

H **Horizontal Spindle Forward :** When pressed starts the horizontal spindle in a clockwise motion as viewed from the front of the machine.

I **Horizontal Spindle Stop :** When pressed stops the horizontal spindle.

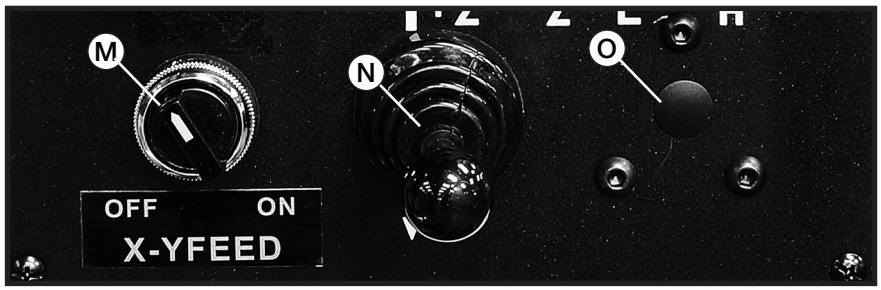
5.2 CONTROLS Cont.



J **X or Y Selection Lever :** The joystick selects either “X” or “Y” axis for the feed or rapid traverse direction

K **Rapid Travers Button :** When pressed applies rapid traverse to the direction selected by the joystick.

L **Feed Dial :** Adjusts the speed of the feed to the “X” and “Y” axis.



M **X or Y Feed ON/OFF Switch :** Switches on the power feed for the “X” and “Y” axis.

N **Z-Axis Elevation Lever :** When selected raises or lowers the table.

O **Spare :** .

WARNING!

Before using the feed or rapid travel operations on the mill, make sure that the Table locks or Knee locks have been released. Failure to do so may cause damage to the feed system

WARNING!

Machines are safeguarded to protect the operator from injury or death with the placement of guards. Machines must not be operated with the guards removed or damaged.

5.3 HEADSTOCK CONTROLS

A. **Quill Fine Feed Hand Wheel:** The hand wheel is used to fine feed the quill Down or Up manually. Each graduation is 0.02mm(Fig 5.3)

B. **Quill Feed Engaging Lever:** When this is switched to the left engages the drive to the quill feed.

NOTE: The spindle must be stopped before the lever is engaged. (Fig 5.3)

C. **Feed Selection Lever.** Selects the rate of quill feed. Selects one of the three feed rates available, 0.035, 0.07, 0.14mm(Fig 5.3)

D. **Depth Stop:** Can be set to trip out the feed at the end of the feed processed. (Fig.5.4)

E. **Manual Quill Quick Stop:** Used to set a dead stop when using the manual down handle. (Fig. 5.4)

F. **Spindle Lock:** Locks the spindle when not being fed to enhance rigidity. (Fig.5.4)

NOTE: The spindle lock must be released before moving the spindle up or down.

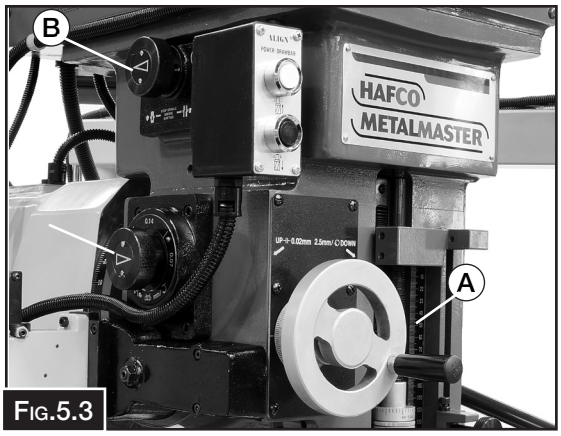


FIG.5.3

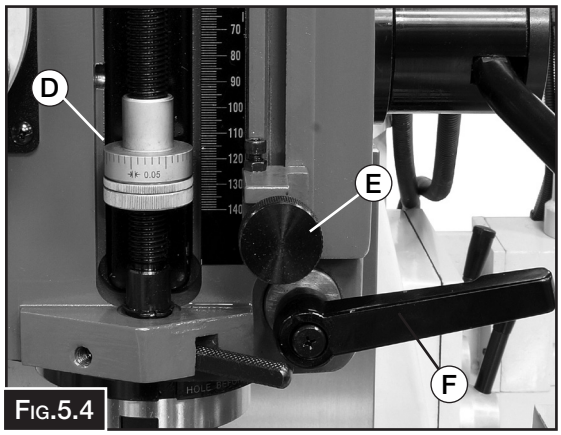


FIG.5.4

5.4 TABLE TRAVEL

The milling table moves in 3 directions, (Fig.5.5) which are known as

X-Axis or Longitudinal movement
Y-Axis or Cross travel movement
Z-Axis or Vertical travel movement

The table movements of X and Y are controlled by not only the hand wheels but also with power feed. The Z-Axis has only a powered elevating motor

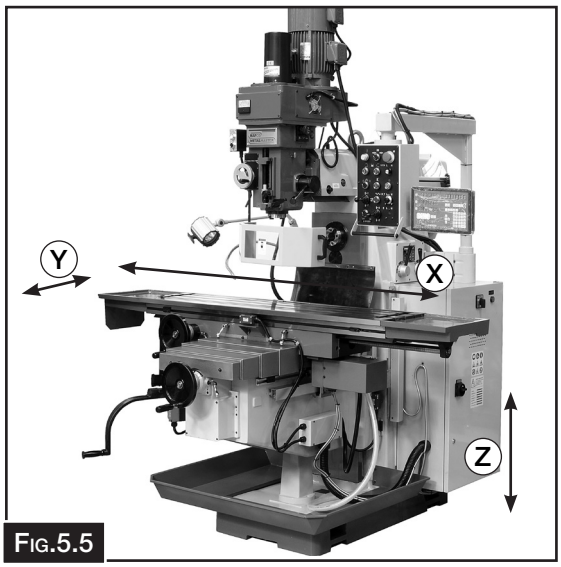


FIG.5.5

Graduated Dials

The table handles and Z-axis crank (Fig. 5.6) have graduated dials attached that display the table movement in the increments, as shown in the table below.

Axis	Increments
X	0.02
Y	0.02
Z	0.02

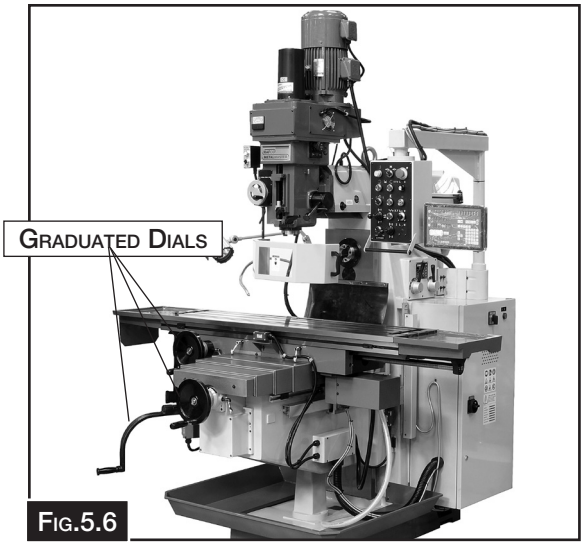


FIG.5.6

OPERATING X & Y-AXIS POWER FEED

Before beginning the cutting action, raise the cutter above the work piece, then use the power feed to move the table through the cutting path before starting the spindle and taking the cut.

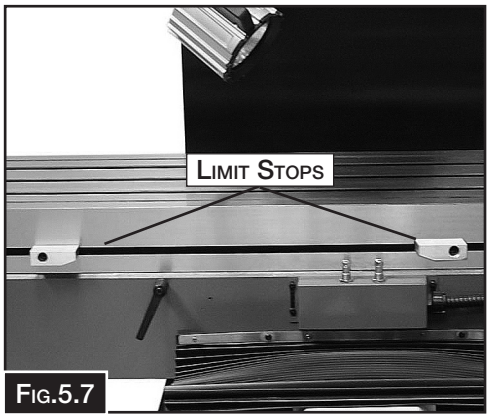


FIG.5.7

To Operate X-Axis Power Feed.

1. Release the X-axis table locks (See Page 22)
2. Move the limit stops along the front table slot to the position to cover the amount of table travel required. (Fig. 5.7)
3. Make sure the feed dial (D in Fig. 5.8)is turned all the way to the way down, then move the direction lever left or right (B in Fig.5.8) to the direction required, switch the feed ON, (A in (Fig.5.8) and gradually turn the feed dial clockwise until the feed rate is correct.
4. When you are finished using the power feed, then rotate the speed dial all the way counter clockwise and move the directional lever to the neutral (middle) position.
5. For rapid traverse press “E” in Fig. 5.8.

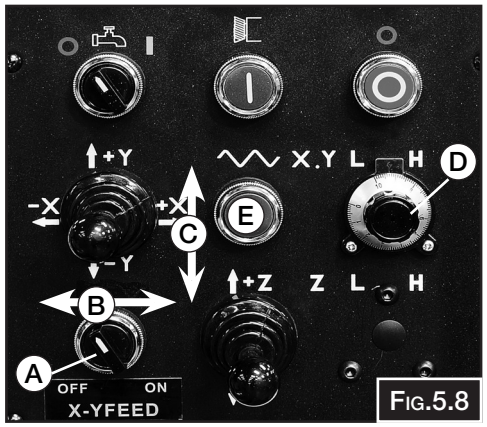


FIG.5.8

To Operate Y-Axis Power Feed.

1. Release the Y-axis table locks (See Page 22)
2. Make sure the feed dial (D in Fig. 5.8) is turned all the way to the way down, switch the feed ON, (A in Fig.5.8) then move the direction lever up or down (C in Fig.5.8) to the direction required and gradually turn the feed dial clockwise until the feed rate is correct.
3. When you are finished using the power feed, then rotate the speed dial all the way counter clockwise and move the directional lever to the neutral (middle) position.
4. For rapid traverse press “E” in Fig. 5.8.

5.5 TABLE LOCKS

Milling cutters apply a lot of pressure to the work piece. To insure that precision is maintained, it is important that there is no movement of the work piece and the slides. To achieve this the slides not being used must be locked so that they cannot move. Below are the positions of the lock handles.

X - Axis see Fig. 5.9

Y - Axis see Fig. 5.10

Z - Axis see Fig. 5.11

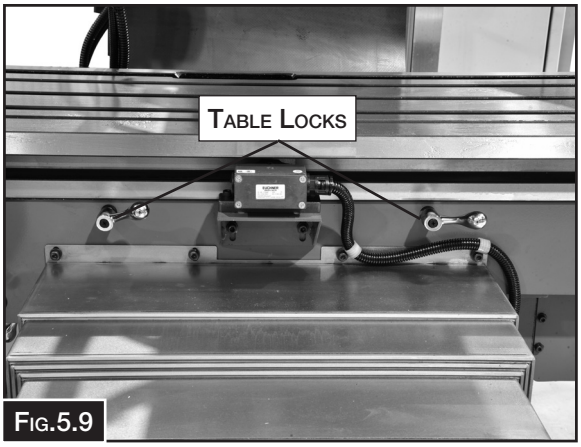


Fig.5.9

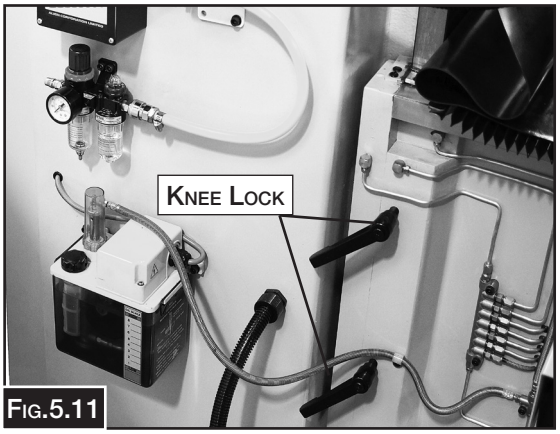


Fig.5.11

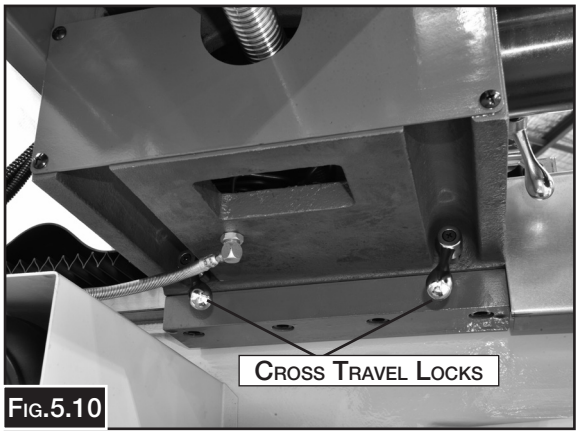


Fig.5.10

5.6 HEAD MOVEMENT

The milling head rotates 45° side to side.

Rotating The Head (Fig.5.12)

1. DISCONNECT THE MACHINE FROM THE POWER!
2. Loosen the four rotating lock bolts (two on each side of the ram.) (Fig. 5.13)

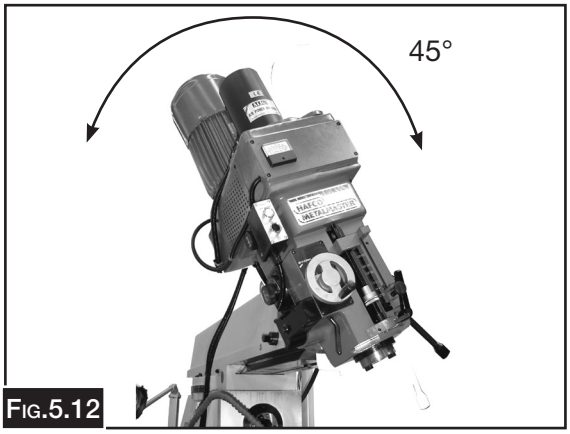


Fig.5.12

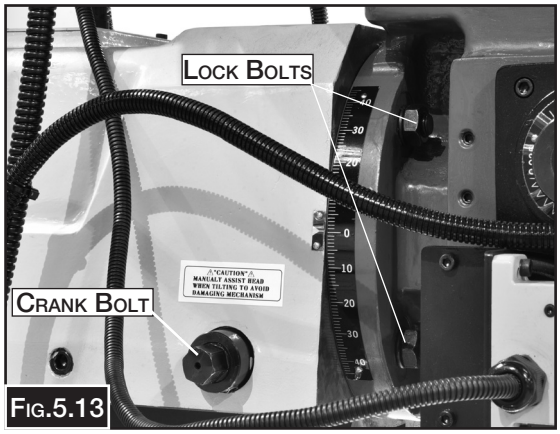


Fig.5.13

3. Use one hand to apply pressure to the head in the direction of tilt, then slowly rotate the crank bolt. Rotating this crank bolt will rotate the head to the side. (Fig. 5.13)
4. Once the head is in the desired position for the operation, re-tighten all four lock bolts.

5.7 ALIGNING THE SPINDLE

After the head has been moved it will require the spindle axis to be precisely perpendicular to the table. The spindle needs to be aligned with the table to ensure the spindle is exactly 90° to the table.

This procedure involves mounting a dial test indicator to the quill or spindle, rotating it around the table, and adjusting the head position so that the spindle axis is 90° to the table X - and Y axes. (Fig. 5.14)

The goal is to get the difference of the indicator readings between the ends of the table down to 0.0127mm. However, the acceptable variance will depend on the requirements of the operation.

Rotate the spindle by hand so that the indicator point rests on each end of the table. (Fig.5. 14)

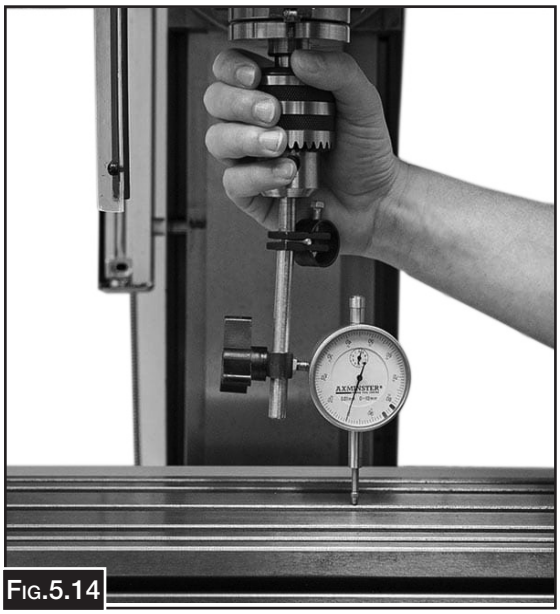


FIG.5.14

NOTE: Make sure that the machine has been disconnected from the power supply to avoid any unexpected start up, which could cause injury.

5.8 RAM MOVEMENT

The milling machine ram travels forward and backward 600 mm and rotates horizontally 360° in either direction around the turret.

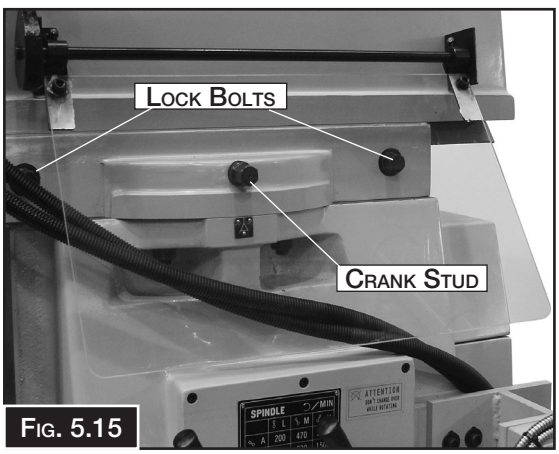


FIG. 5.15

Moving The Ram Back and Forth

1. DISCONNECT THE MACHINE FROM THE POWER!
2. Loosen the two lock nuts shown (Fig. 5.15) on the right side of the ram.
3. Before moving the ram, make sure there are no obstructions, especially with the spindle or the tool with the work piece. Once clear, then slowly turn the crank stud to move the ram.
4. Re-tighten the lock bolts after the ram has been placed in the desired position.

CAUTION!

Check the oil levels and lubrication points before running the machine for the first time. Lack of lubrication can cause damage to the machine and may void the warranty.

ROTATING THE RAM

1. DISCONNECT THE MACHINE FROM POWER!
2. Loosen the four lock bolts on the top of the turret. (There are two lock bolts on either side of the ram.) (Fig. 5.16)
3. Remove the location dowel pin. (The pin locates the ram so it is square to the table.)

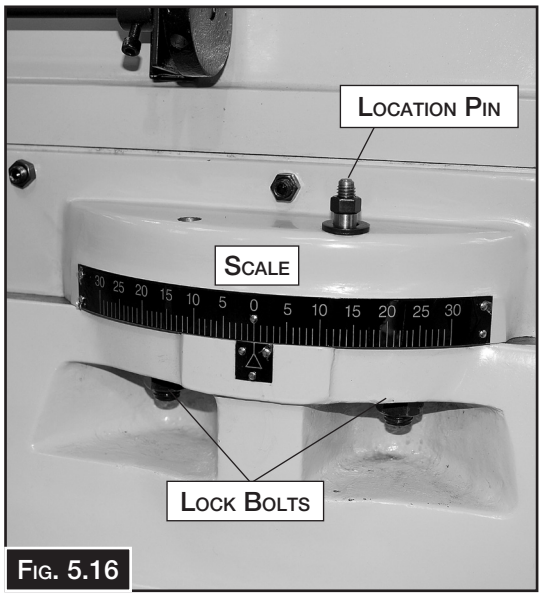


FIG. 5.16

⚠WARNING ***When rotating the ram take care not to entangle or stretch the electrical cabling.***

4. Push on the head to manually rotate the ram on the turret. Use the scale to determine the desired position. (Fig. 5.16)
5. Re-tighten the four lock bolts to secure the ram in place.

⚠WARNING ***BEFORE OPERATING THE MILL MAKE SURE THAT THE RAM HAS BEEN LOCKED FIRMLY IN PLACE. UNEXPECTED MOVEMENT OF THE RAM AND HEAD DURING OPERATIONS COULD CAUSE DAMAGE TO THE CUTTER, WORK PIECE, OR INJURY TO THE OPERATOR***

⚠ *WARNING!*

The machine is the sole responsibility of the owner for its safe use. This responsibility includes but is not limited to proper installation in a safe environment, personnel training, proper inspection and maintenance, manual availability and comprehension. The manufacturer will not be held liable for injury or property damage from negligence, improper training, machine modifications or misuse.

⚠ *WARNING!*

Always check the capacity of the machine. Exceeding the capacity of the machine may result in sudden breakage that ejects dangerous metal debris at the operator or bystanders.

5.9 SETTING THE SPINDLE SPEED

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 controls 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 work piece material and the diameter of the cutting tool, as noted in the formula. (Fig.4.17)

The 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.

$$(RPM) = \frac{\text{Cutting Speed m/min} \times 1000}{\text{Cutter Diameter} \times 3.14}$$

Fig. 5.17

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 VERTICAL Spindle Speed Range

Setting the spindle speed involves firstly setting the spindle speed range lever to engage or disengage the spindle spline with the back gear. (Fig.5.19)

NOTE: The BM-90HV is designed to operate only with the spindle High/Low speed range lever in either the high or low position. To avoid damaging the head stocks moving parts do not start the spindle without the HIGH/LOW range lever firmly in either the high or low position

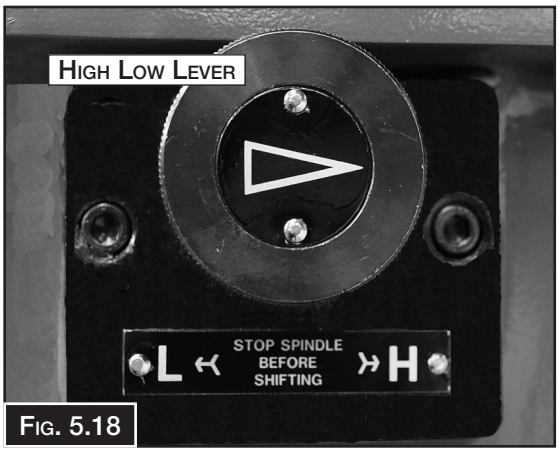


Fig. 5.18

WARNING!

To avoid damaging gears, ALWAYS make sure the spindle is completely stopped BEFORE moving the spindle speed levers.

Setting VERTICAL Spindle Speed

Once the speed range has been selected, and the speed required has been determined, then use the spindle speed control dial and RPM Meter to set the required spindle speed.

NOTE: Before setting the spindle speed turn the spindle speed dial (F) to the lowest position to eliminate any surprise, and to make sure that the cutter is clear of the work piece.

FIG. 5.19

To set the spindle speed, first start the spindle rotation (D) then slowly rotate the speed dial (F) until the display shows the speed required. (Fig. 5.19)

The RPM Meter will show the speed in R.P.M

Setting HORIZONTAL Spindle Speed

Use the chart below or the one on the side of the machine when setting the spindle speed. With the spindle completely stopped, position the range lever and the spindle speed lever (Fig. 5.20), as indicated by the spindle speed chart, to set the desired spindle RPM.

Note: If necessary, rotate the spindle a little by hand to mesh the gears when changing speeds.

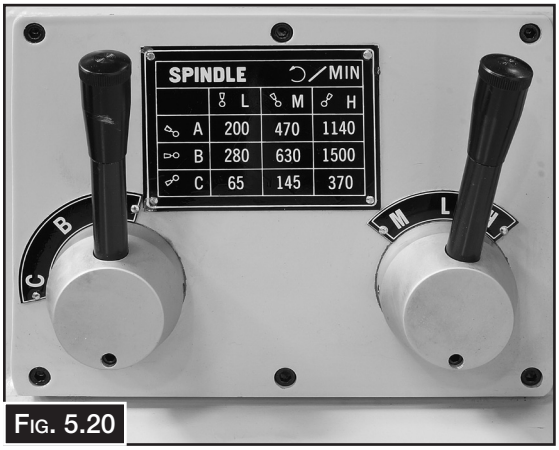


FIG. 5.20

SPINDLE			R.P.M
	L	**M**	**H**
A	200	470	1140
B	280	630	1500
C	65	145	370

⚠ *WARNING!*

To avoid damaging gears, ALWAYS make sure the spindle is completely stopped BEFORE moving the spindle speed levers.

5.10 SPINDLE DOWN FEED CONTROLS

Spindle down feed movement are controlled by three mechanisms

1. The auto-down feed.
2. The fine down feed hand wheel.
3. The coarse down feed handle.

Auto Down Feed,

To set the down feed for auto feed control,

1. Make sure that the spindle is stationary, then turn the down feed selector knob to engage the quill down feed.(Fig. 5.20)

NOTE: It may be necessary to rotate the spindle by hand to move the gears to allow the feed mechanism to engage or dis-engage.

2. Once the feed is engaged then select the down feed rate from the feed dial. (Fig. 5.21)
3. Make sure that the quill lock lever is released before operating the quill down feed.
4. Engage the feed by moving the feed lever to the left (A in Fig. 5.22). To disengage the feed, pull down on the release lever. (B in Fig. 5.22)
5. The feed will automatically trip out if the depth stop has been set.(X in Fig. 5.22)

Fine Down Feed Handle

To use the fine feed handle the following procedure is required.

1. Move the feed dial to one of the two neutral positions. (D in Fig. 5.23)
2. Engage the feed by moving the feed engage lever to the left.(A in Fig. 5.11)
3. The fine feed handle can now be manually moved to lower the spindle in a controlled manner. (C in Fig. 5.22)
4. When finished then release the fine feed by pressing the feed release lever. (B in Fig. 5.22)

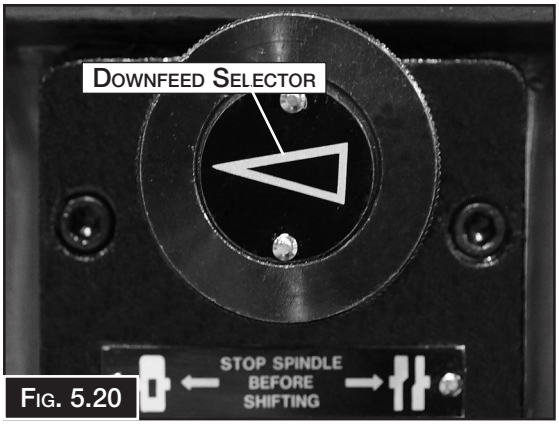


FIG. 5.20

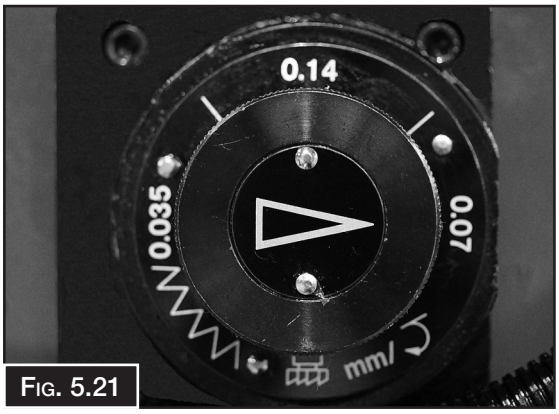


FIG. 5.21

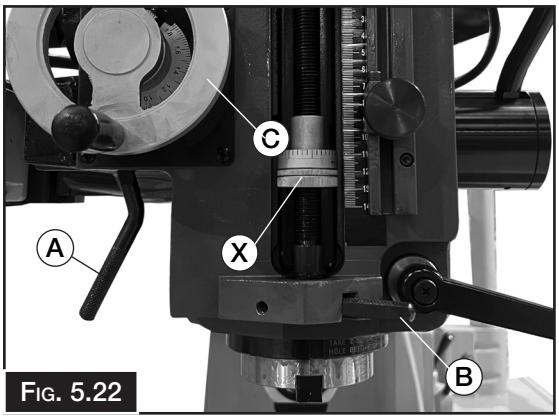


FIG. 5.22

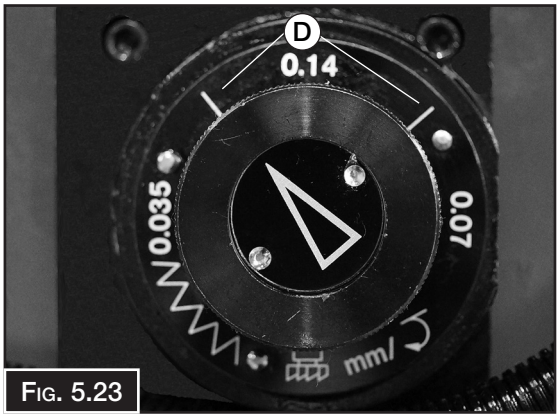


FIG. 5.23

Coarse Down-feed Handle

The coarse down feed handle is usually used for drilling operations. To operate see the following

1. Make sure that the quill fine down feed has been released by pressing the Feed Release Lever. (B in Fig. 5.22)
2. Move the Course Down Feed Handle (E in Fig. 5.24) to the left to engage the handle and then the spindle can be moved up or down.
3. The quick action dead stop can be set by loosening the dead stop knob (F in Fig. 5.24) and sliding the dead stop up or down as required.

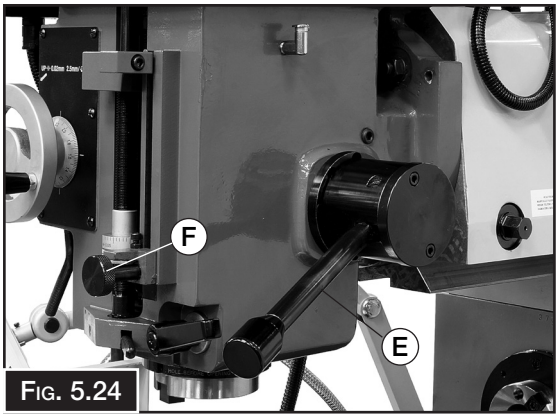


FIG. 5.24

5.11 HORIZONTAL SPINDLE

The horizontal spindle is designed for the use of horizontal arbours that can be used with single or multiple cutters (gang milling) arranged anywhere along the length of the arbour, for simple to very complex cutting operations. (Fig. 5.25)

The **BM-90HV** is supplied with :

1 x 1” Dia. Horizontal Arbour.

To Install The Horizontal Spindle:

1. DISCONNECT MACHINE FROM POWER SUPPLY
2. Loosen the locking nuts on the side of the arbour supports, and slide the supports off the ram dovetail.
3. Loosen the four ram rotation hex nuts. (Two on each side of the ram) (Fig. 5.26)
4. Align the “0” mark on the ram base with the “0” on the angle scale then re-tighten the four ram rotation hex nuts.
5. Clean the two mating parts in the spindle and on the arbour, and then place the arbour in the spindle and secure with the M16 draw bar.

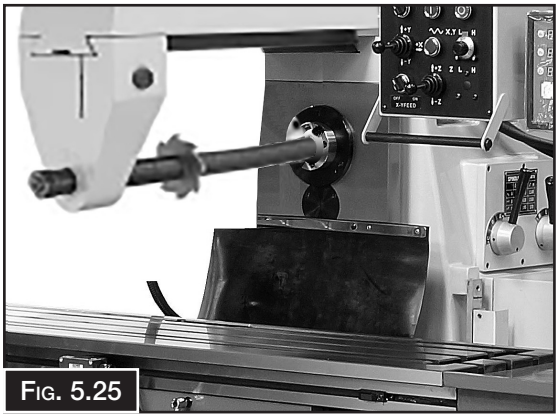


FIG. 5.25

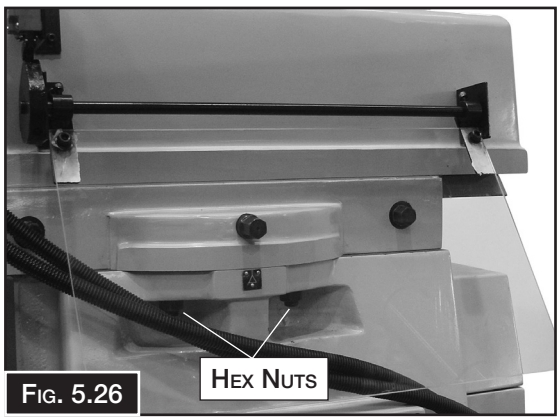


FIG. 5.26

6. Install the cutters required and position them along the arbour using the spacers as required. Decide where the arbour support is to be placed and ensure that the arbour support bush is in the corresponding place. Slide on the arbour support and secure with the clamp nut. (Fig. 5.25)

5.12 LOADING & UNLOADING TOOLING

This milling machine is equipped with NT-40 spindle tapers with a M16 air operated spindle draw bar on the vertical spindle and a manual draw bar on the horizontal spindle. To use the vertical spindle air operated draw bar, first set the air pressure regulator at 90 P.S.I. (Fig. 5.27)

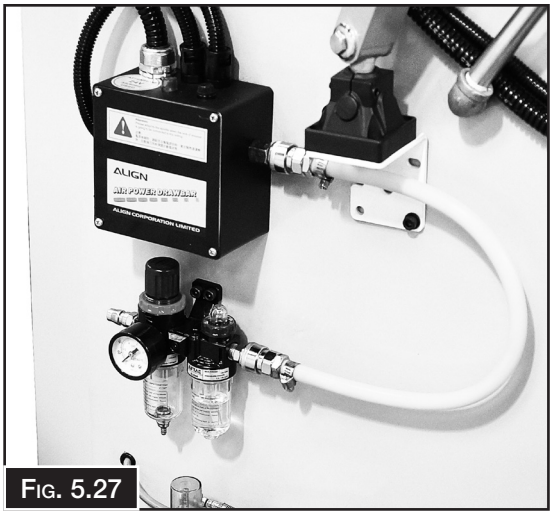


Fig. 5.27

VERTICAL SPINDLE

Loading Tooling.

1. Make sure that the spindle has come to a complete stop.
2. Clean any debris or surface substances from inside the spindle taper and the mating surface of the tooling.

NOTE: Debris or oily substances can prevent the tooling and spindle from properly mating. This condition can cause excessive vibration, poor cutting results, or tool/work piece damage.

3. With one hand holding the tool in place, insert the tool holder into the spindle making sure that the driving lugs are aligned with the slots in the tool holder and with the other hand press the up button to activate the air draw bar. (Fig. 5.28)

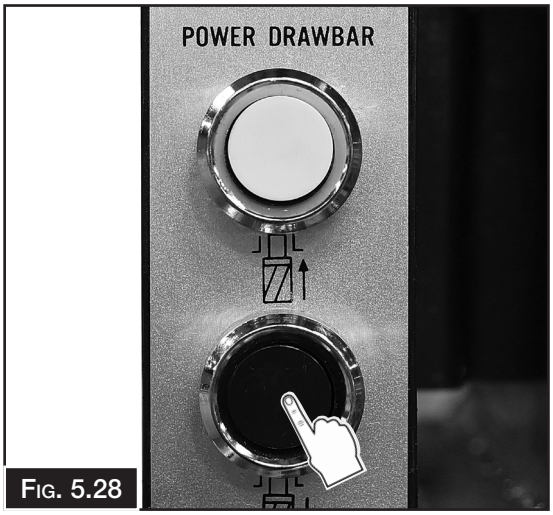


Fig. 5.28

Unloading Tooling

1. Make sure that the spindle has come to a complete stop.
2. With one hand holding the tool in place, press and hold the down button until the tool holder has disengaged from the draw bar. (Fig. 5.29)

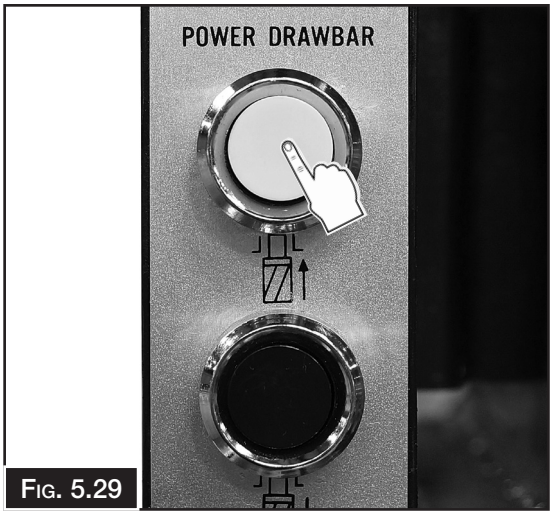
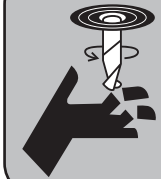


Fig. 5.29



CAUTION!

ROTATING CUTTER HAZARD
Always keep hands clear of the cutter. Disconnect the power before installing or removing the cutter.

5.12 LOADING & UNLOADING TOOLING CONT.

HORIZONTAL SPINDLE

Loading Tooling.

1. Make sure that the spindle has come to a complete stop.
2. DISCONNECT THE MACHINE FROM THE POWER!
3. Loosen the locking bolt on the side of the arbour support, and slide the support off the ram dovetail slide. (Fig. 5.30)
4. Clean any debris or surface substances from inside the spindle taper and the mating surface of the arbour.
3. Slide the tool arbour into the spindle making sure that the driving lugs are aligned with the slots in the arbour. Remove the top half of the back cover of the machine to gain access to the horizontal draw bar. (Fig. 5.31)
4. Screw the draw bar into the arbour and tighten. (Fig. 5.32)

FIG. 5.30


FIG. 5.31

Unloading Tooling

1. Make sure that the spindle has come to a complete stop.
2. DISCONNECT THE MACHINE FROM THE POWER!
3. Loosen the locking bolt on the side of the arbour support, and slide the support off the ram dovetail slide. (Fig. 5.30)
4. Remove the top half of the back cover at the back of the machine to gain access to the horizontal draw bar and loosen the draw bar one turn. (Fig. 5.32)
5. With a soft face hammer tap the end of the draw bar to release the arbour from the spindle taper.
6. Unscrew the draw bar from the arbour.

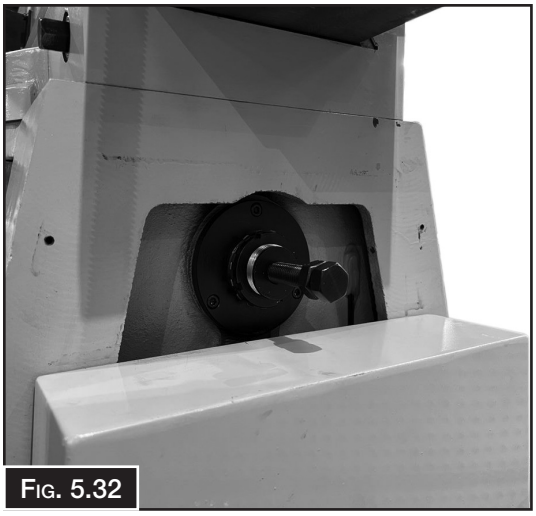


FIG. 5.32

WARNING!

Cutting tools are sharp. Take care when handling them. Failure could cause a deep cut injury.

6. MAINTENANCE

It is very important that regular maintenance of the equipment is carried out. The operators need to follow the daily maintenance procedures.

For optimum performance from this machine, the maintenance schedule listed below and procedures in this section must be followed.

To reduce the risk of injury and for proper machine operation, if any of the items below are observed then, switch the machine OFF and immediately disconnect it from power, and fix the problem before continuing operations.

- ❑ Loose mounting bolts or fasteners.
- ❑ Check/adjust lubrication.
- ❑ Worn, frayed, cracked, or damaged wires.
- ❑ Emergency STOP button not correctly working.
- ❑ Missing belt guards.
- ❑ Reduction in braking speed or efficiency.
- ❑ Coolant not flowing or flowing incorrectly.
- ❑ Any other unsafe condition.

6.1 LUBRICATION

Lubrication is very important to maintain accuracy and avoid machine troubles. Be sure to appropriately lubricate the machine according to the Lubrication chart below and also found on the side of the machine.

⚠WARNING ***Before maintaining or cleaning the machine, turn off the circuit breaker, or disconnect the machine from the power supply. Post a sign to inform other workers that the machine is under maintenance.***

Automatic Oil Lubricator

The Automatic Oil Lubricator is connected to a series of aluminium tubes that carry the lubricant to the wear points that are along the table, saddle, knee ways, and the lead screws. (Fig. 6.1)

Check the sight glass daily on the side of the oiler to know when to re-fill the reservoir.

Re-fill the reservoir with oil that is equivalent to ISO 68 oil.

FIG. 6.1

6.1 LUBRICATION CONT.

The mill head has many moving metal-to-metal contacts that require regular and proper lubrication to ensure a precise and long-lasting operation.

Lubrication oil cups are supplied on the head which are required to be replenished daily with SAE -10 Light Oil. (Fig. 6.2)

NOTE: Clean any dirt and grime from the oil cup or grease fitting and the immediate area before adding the lubrication. This will prevent any contamination of the new lubricant.

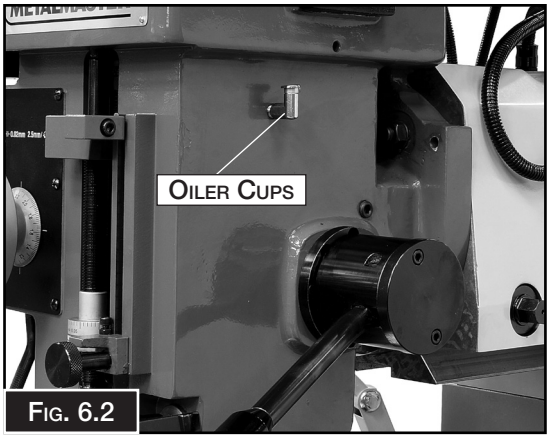


FIG. 6.2

Headstock Gearbox

The headstock Gearbox lubricates the gears with ISO 32 machine oil. The site glass on the headstock of the mill is just an inspection window to ensure oil is pumping correctly.

The reservoir is on the ram located under the access plate (4 socket head cap screws) with the oil level site glass beneath. The headstock oil should be checked before each operation to ensure it doesn't drop below sight glass visibility. Headstock oil must be changed on an annual basis.

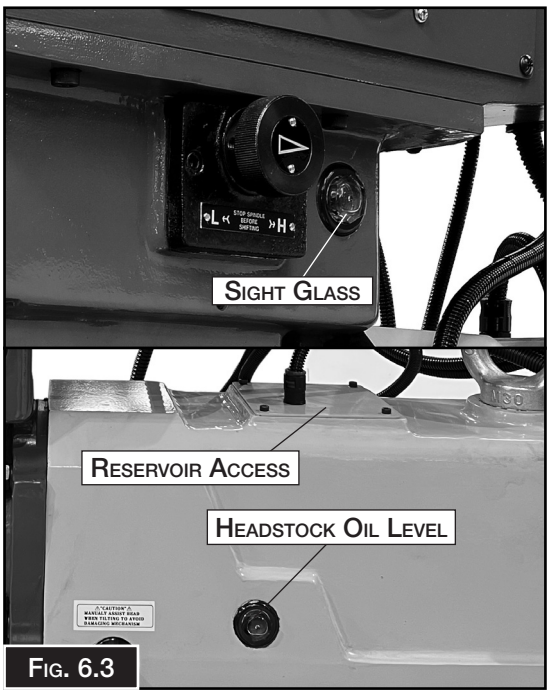


FIG. 6.3

Horizontal Gearbox

The horizontal gearbox uses ISO 32 machine oil to lubricate the gears, and is equipped with an oil-level sight glass to gauge when the proper amount of oil is in the gearbox. (Fig 6.4)

The amount of oil in the horizontal gearbox must be regularly checked before each operation to ensure it doesn't drop below sight glass visibility. The oil must be changed on an annual basis to ensure proper lubricity of oil.

NOTE: Failure to follow reasonable lubrication procedures as instructed in this manual could lead to premature failure of the milling machine components, and could cause the warranty to be void. The recommended lubrication schedule in this section, is based on light to medium usage.

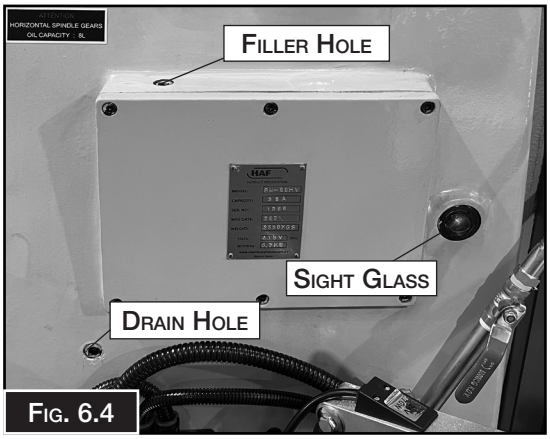


FIG. 6.4

6.2 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.

X- Axis Longitudinal Fig. 6.4

Y- Axis Cross Fig. 6.5

Z- Axis Vertical Fig. 6.6

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/knee 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/knee until you feel a slight drag in the path of movement. Repeat Steps 3–4 as necessary.

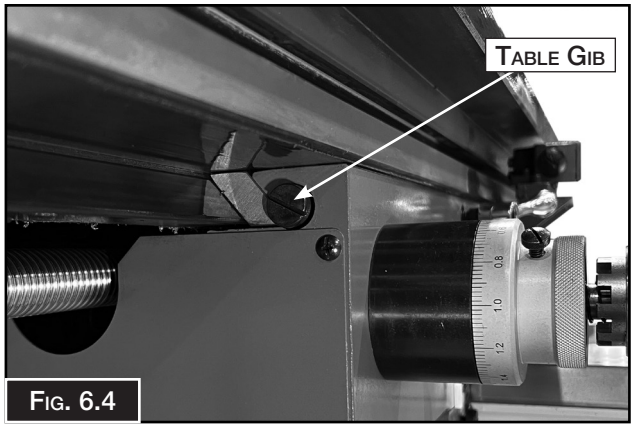


FIG. 6.4

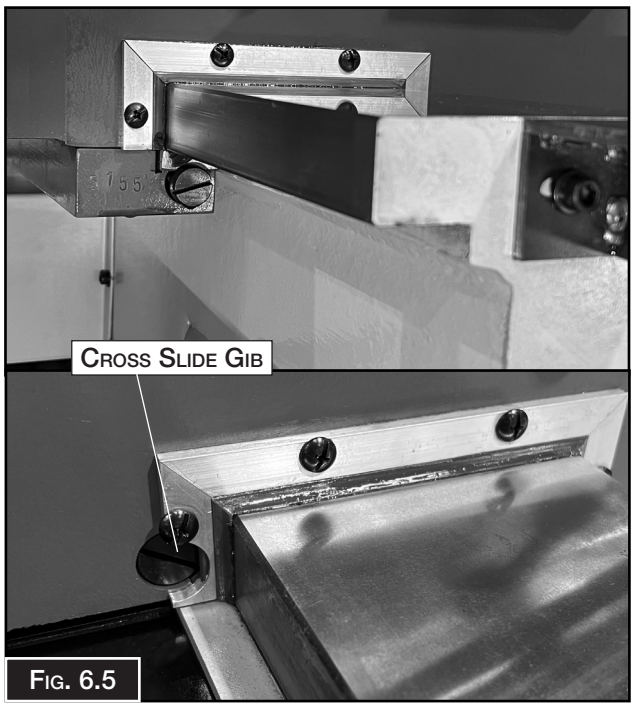


FIG. 6.5

FIG. 6.6

6.3 TROUBLESHOOTING

Read the troubleshooting section if a problem develops with your machine. If you need any assistance or additional help with a problem, call the Technical Support Department. For spare parts go to www.machineryhouse.com.au/contactus and fill out the enquiry form attaching a copy of scanned parts list.

Symptom	Possible Cause	Possible Solution
Machine does not start or a breaker trips.	1. Plug/receptacle at fault/wired wrong. 2. Incorrect power supply voltage/circuit size. 3. Power supply circuit breaker tripped or fuse blown. 4. Motor wires connected incorrectly. 5. Wiring open/has high resistance. 6. Spindle rotation switch at fault. 7. Start capacitor at fault . 8. Centrifugal switch at fault . 9. Motor at fault.	1. Test for good contacts; correct the wiring. 2. Ensure correct power supply voltage/circuit size. 3. Ensure circuit is sized correctly and free of shorts. Reset circuit breaker or replace fuse. 4. Correct motor wiring connections. 5. Check/fix broken, disconnected, or corroded wires. 6. Replace switch. 7. Test/replace. 8. Adjust/replace centrifugal switch if available. 9. Test/repair/replace.
Machine stalls or is underpowered	1. Machine undersized for task. 2. Feed rate/cutting speed too fast. 3. Wrong work piece material. 4. Belt(s) slipping. 5. Oil/grease on belt(s). 6. Motor wired incorrectly. 7. Spindle rotation switch at fault. 8. Gearbox at fault. 9. Motor overheated. 10. Pulley/sprocket slipping on shaft. 11. Centrifugal switch at fault. 12. Motor bearings at fault.	1. Use correct cutter/bit; reduce feed rate; reduce spindle RPM; use coolant if possible. 2. Decrease feed rate/cutting speed. 3. Use correct type/size of metal. 4. Tension/replace belt(s); ensure pulleys are aligned. 5. Clean belt(s). 6. Wire motor correctly. 7. Test/replace switch. 8. Select appropriate gear ratio; replace broken or slipping gears. 9. Clean motor, let cool, and reduce workload. 10. Replace loose pulley/shaft. 11. Adjust/replace centrifugal switch if available. 12. Test/repair/replace.
Machine has vibration or noisy operation.	1. Work piece loose. 2. Belt(s) worn or loose. 3. Motor or component loose. 4. Chuck or cutter at fault. 5. Belt(s) slapping headstock casting/guard. 6. Motor fan rubbing on fan cover. 7. Pulley loose. 8. Machine incorrectly mounted. 9. Motor bearings at fault. 10. Centrifugal switch is at fault .	1. Use the correct holding fixture/re-clamp work piece. 2. Inspect/replace belts with a new matched set. 3. Inspect/replace damaged bolts/nuts, and re-tighten with thread locking fluid. 4. Replace unbalanced chuck; replace/resharpen cutter; use correct feed rate. 5. Replace/realign belts with a matched set. 6. Fix/replace fan cover; replace loose/damaged fan. 7. Re-align/replace shaft, pulley set screw, and key. 8. Tighten mounting bolts; relocate/shim machine. 9. Test by rotating shaft; rotational grinding/loose shaft requires bearing replacement. 10. Replace.
Tool loose in spindle.	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.	1. Tighten draw bar. 2. Clean tool and spindle taper. 3. Lessen depth of cut and allow chips to clear.
Breaking tools or cutters.	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.	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.	1. Table locks not tight. 2. Work piece 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.	1. Tighten table locks (Page 10). 2. Properly clamp workpiece on table or in vise. 3. Set spindle speed correctly or use slower feed rate (Page 15,16). 4. Fully retract spindle and raise table This increases rigidity. 5. Tighten quill lock lever (Page 8.9). 6. Tighten gibs (Page 26).

6.3 TROUBLESHOOTING

Symptom	Possible Cause	Possible Solution
Table is hard to move.	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.	1. Fully release table locks (Page 10). 2. Frequently clean away chips or debris. 3. Lubricate ways (Page 25). 4. Make sure that table limit stops are not in the way. 5. Adjust gibs (Page 26).
Headstock is hard to raise.	1. Headstock lock(s) or gib is at fault. 2. Headstock lead screw is binding. 3. Gib is too tight.	1. Loosen/replace lock lever and adjust gib. 2. Clean and lubricate headstock leads crew and gears. 3. Adjust gib (Page 26).
Bad surface finish	1. Spindle speed/feed rate is too fast. 2. Dull or incorrect cutting tool. 3. Wrong rotation of cutting tool. 4. Work piece not secure. 5. Spindle extended too far down.	1. Set spindle speed correctly or use slower feed rate (Page 16). 2. Sharpen cutting tool or select one that better suits the operation. 3. Check for proper cutting tool rotation. 4. Properly clamp work piece on table or in vice. 5. Fully retract spindle and raise table. This increases rigidity.
Cutting results not square.	1. Table and spindle are not at 90° to each other. 2. Table travel is inconsistent.	1. Square the spindle (Page 23). 2. Adjust gibs (Page 26).
Spindle overheats.	1. Poor spindle bearing lubrication. 2. Spindle bearings too tight. 3. Mill operated at high speeds for extended period.	1. Replace spindle bearings. 2. Properly adjust spindle bearing preload. 3. Allow mill to cool.
Lack of power at the spindle.	1. Belts are loose. 2. Wrong voltage.	1. Properly tension belts. 2. Correct voltage.
Spindle does not fully retract.	1. Poorly adjusted return spring. 2. Worn return spring.	1. Increase return spring tension. 2. Replace return spring.
Spindle switch does not work.	1. Shorted/disconnected wiring..	1. Inspect wiring connections. Replace/repair as necessary.
Power feed does not move table or is slipping.	1. Table locked. 2. Drive selector not engaged. 3. Sheared pin. 4. Gears not meshing or teeth missing. 5. Motor shaft and gear shaft not engaged.	1. Unlock table locks. 2. Select speed, engage drive selector. 3. Replace pin. 4. Check gears and adjust/replace. 5. Replace clutch.
Operates at high speed only or is inconsistent.	1. Rapid micro switch is stuck. 2. V.R. does not work properly. 3. Wiring harness unplugged from circuit board .	1. Lightly tap on it to lower it. 2. Test/repair/replace. 3. Reconnect wiring harness.
DRO does not give reading.	1. DRO is not turned on/plugged in. 2. Shorted/disconnected wiring/plugs..	1. Press DRO ON/Power button/plug in. 2. Inspect circuit boards, sensors, plugs, and wiring connections. Replace/repair as necessary.
DRO reading is incorrect.	1. Initial reading is incorrect. 2. Sensor has gone bad. 3. Spacing between sensor & scale is incorrect.	1. Tare/zero/reset DRO at beginning point. 2. Test/replace sensor as necessary. 3. Adjust spacing between sensor and scale.
Lamp will not light	1. Power not turned on. 2. Bulb is burned out. 3. Short in wiring or wired incorrectly.	1. Press switch/button on lamp or control panel. 2. Replace bulb. 3. Trace and test wiring. Fix any errors.

WARNING!

Disconnect all power from the machine before servicing. There may be multiple power sources present. Remove the plug from the power point or remove the fuse if hard wired. Failure to do may cause death or injury.

INDUSTRIAL MILLING MACHINE
BM-90HV

Order Code: (M633D)

Edition : 2.0
Date: (01/26)

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 anytime 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.

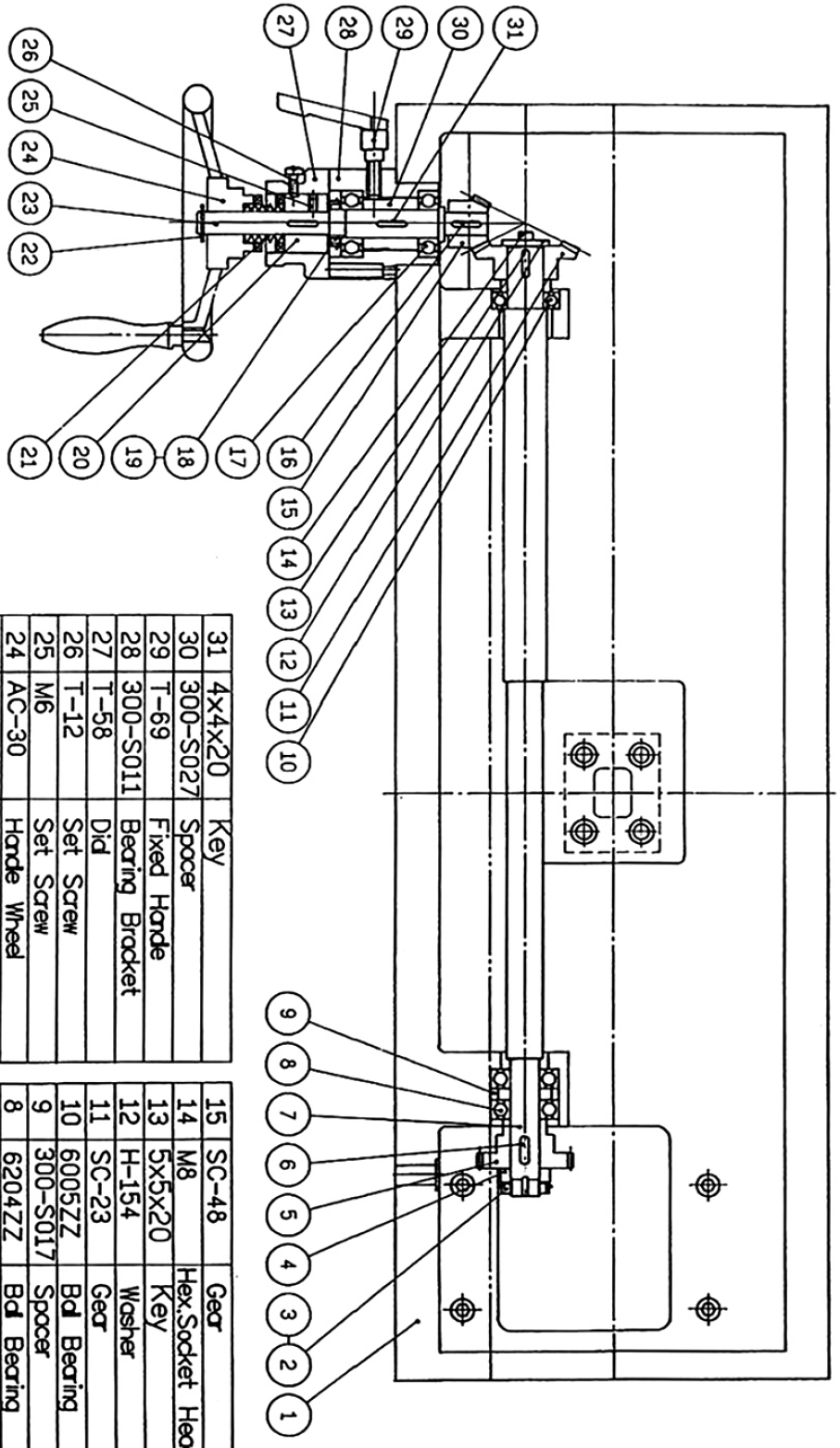
NOTE: SOME PARTS MAY ONLY BE AVAILABLE AS AN ASSEMBLY

3. Go to **www.machineryhouse.com.au/contactus** and fill out the inquiry form attaching a copy of scanned parts list.

WARNING!
Electricity is dangerous and could cause death
All electrical work must be carried out by a qualified electrician.

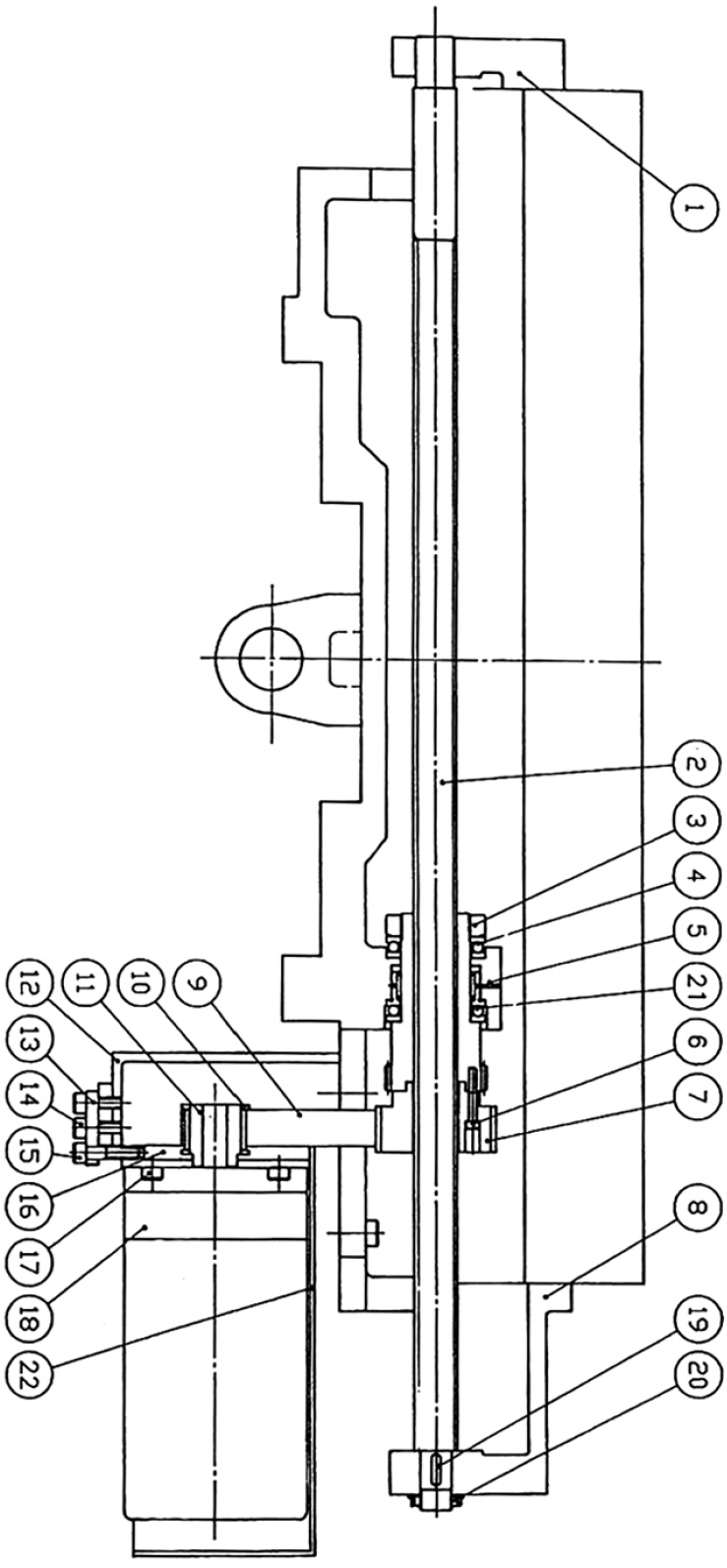
CAUTION!
It is impossible to cover all possible hazards Every workshop environment is different. These are designed as a guide to be used to compliment training and as a reminder to users prior to equipment use. Always consider safety first, as it applies to the individual working conditions.

LONGITUDINAL FEED



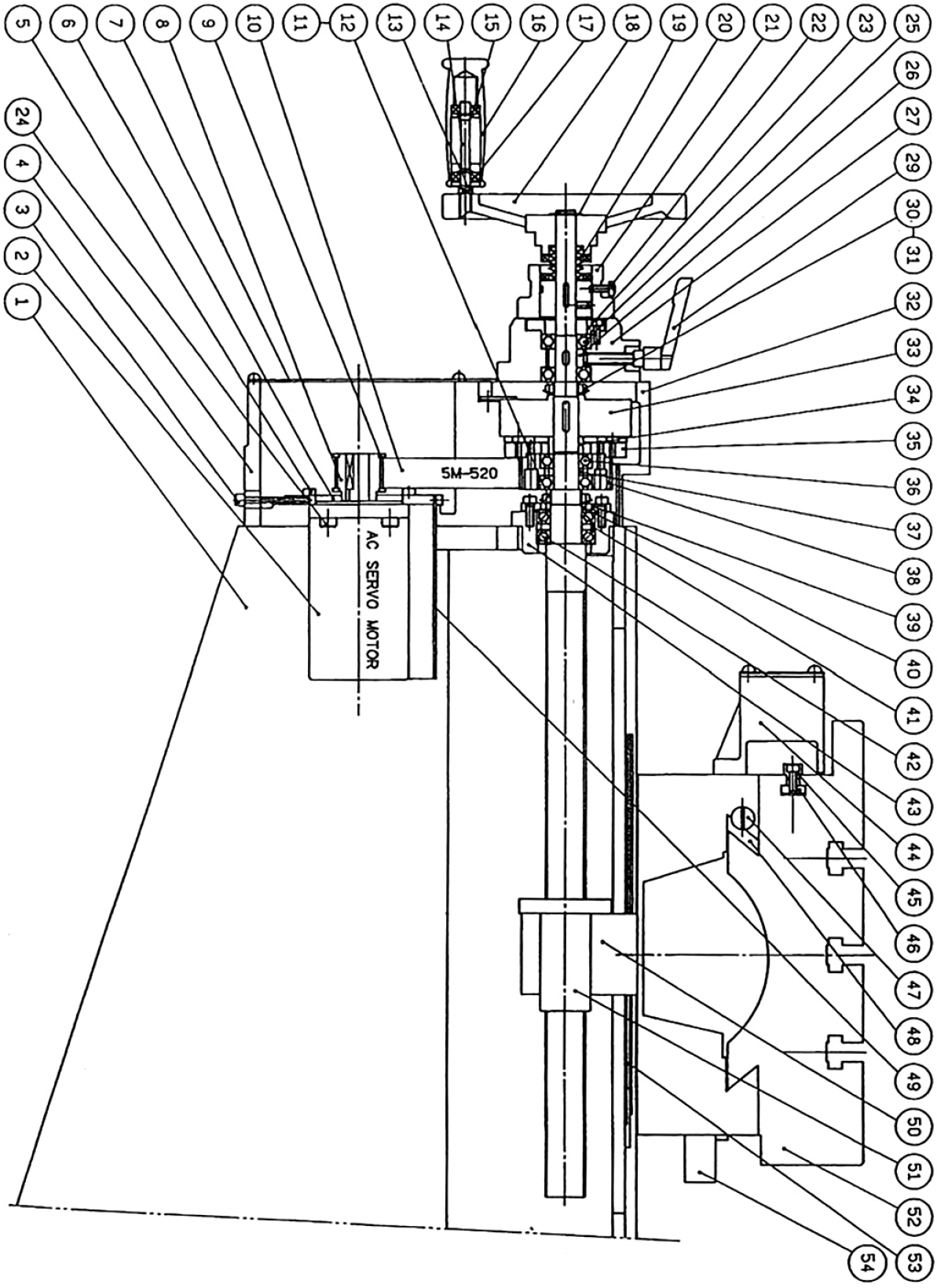
ITEM	PART No.	NAME
1	300-S054	Saddle
2	AN-04	Lock Nut
3	AW-04	Washer
4	300-S018	Spacer
5	300-S015	Gear
6	4x4x20	Key
7	300-S012	Shaft
8	6204ZZ	Bd Bearing
9	300-S017	Spacer
10	6005ZZ	Bd Bearing
11	SC-23	Gear
12	H-154	Washer
13	5x5x20	Key
14	M8	Hex.Socket Head Bolt
15	SC-48	Gear
16	5x5x20	Key
17	6204ZZ	Bd Bearing
18	AN-04	Lock Nut
19	AW-04	Washer
20	AC-31	Did Holder
21	T-42-1	Spring
22	S-16	Snap Ring
23	300-S010	Shaft
24	AC-30	Handle Wheel
25	M6	Set Screw
26	T-12	Set Screw
27	T-58	Did
28	300-S011	Bearing Bracket
29	T-69	Fixed Handle
30	300-S027	Spacer
31	4x4x20	Key

LONGITUDINAL FEED



ITEM	PART No.	NAME
1	300-T002	Bearing Sets
2	300-T006	Ball Screw
3	MR45	Lock Nut
4	51109	Thrust Bearing
5	300-S001	Saddle
6	M5	Hex.Socket Head Bolt
7	300-S023	Time Pully
8	300-T003	Bearing Sets
9	5M-475-25W	Time Belt
10	SP-025	Flang
11	SP-047	Time Pully
12	300-S030	Feed Box
13	SP-060	Fixed Plate
14	M8	Hex.Socket Head Bolt
15	M8	Hex.Socket Head Bolt
16	300-S032	Motor Plate
17	M8	Hex.Socket Head Bolt
18		AC Servo Motor
19	4x4x20	Key
20	AN-04	Lock Nut
21	NAX4532Z	Needdle Bearing
22	300-S31A	Motor Cover

CROSS FEED



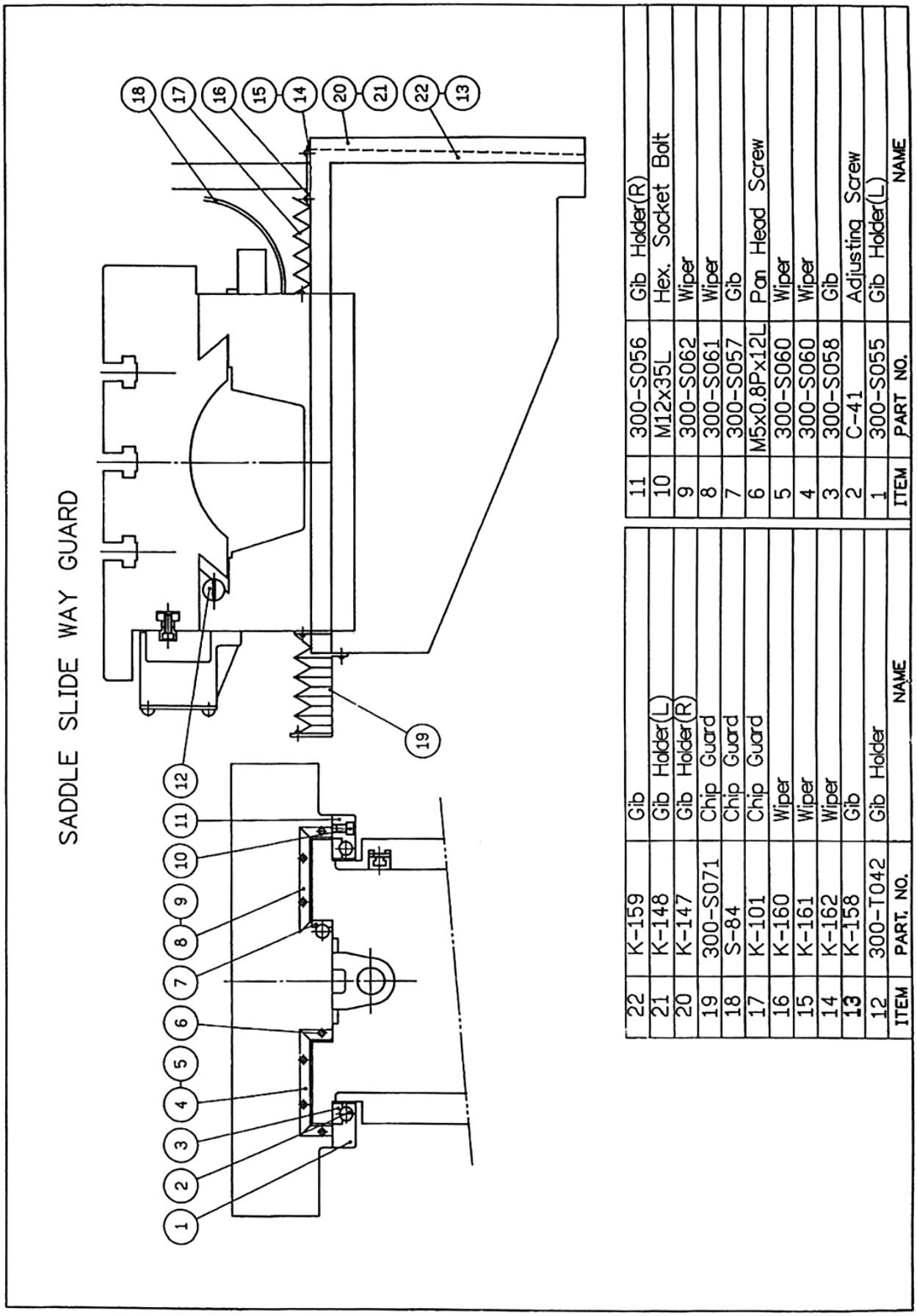
CROSS FEED

	DESCRIPTION
1	Knee
2	AC Servo Motor
3	Hex. Socket Head Bolt
4	Feed Box
5	Hex. Socket Head Bolt
6	Motor Bracket
7	Cover
8	Belt Wheel
9	Flange
10	Belt
11	Lock Nut
12	Lock Washer
13	Nut
14	Shaft
15	Snap Ring
16	Handle
17	Ball Bearing
18	Handle Wheel
19	Snap Ring
20	Spring
21	Dial
22	Set Screw
23	Bearing Stop
24	Hex. Socket Head Bolt
25	Ball Bearing
26	Spacer
27	Bearing Bracket 28
29	Handle Screw
30	Lock Nut
31	Lock Washer
32	Feed Box
33	Magnetic Clutch
34	Spacer
35	Spacer
36	Ball Bearing
37	Spacer
38	Belt Wheel
39	Bearing Stop
40	Spacer
41	Spacer

	DESCRIPTION
42	Ball Bearing Bearing Bracket
43	Limit Close
44	Dog Nut
45	Adjusting Screw
46	Gib Cover Bracket
47	Ball Screw Table
48	Chip Guard
49	Table Rear Cover

NOTE: SOME INDIVIDUAL PARTS MAY ONLY BE AVAILABLE AS AN ASSEMBLY

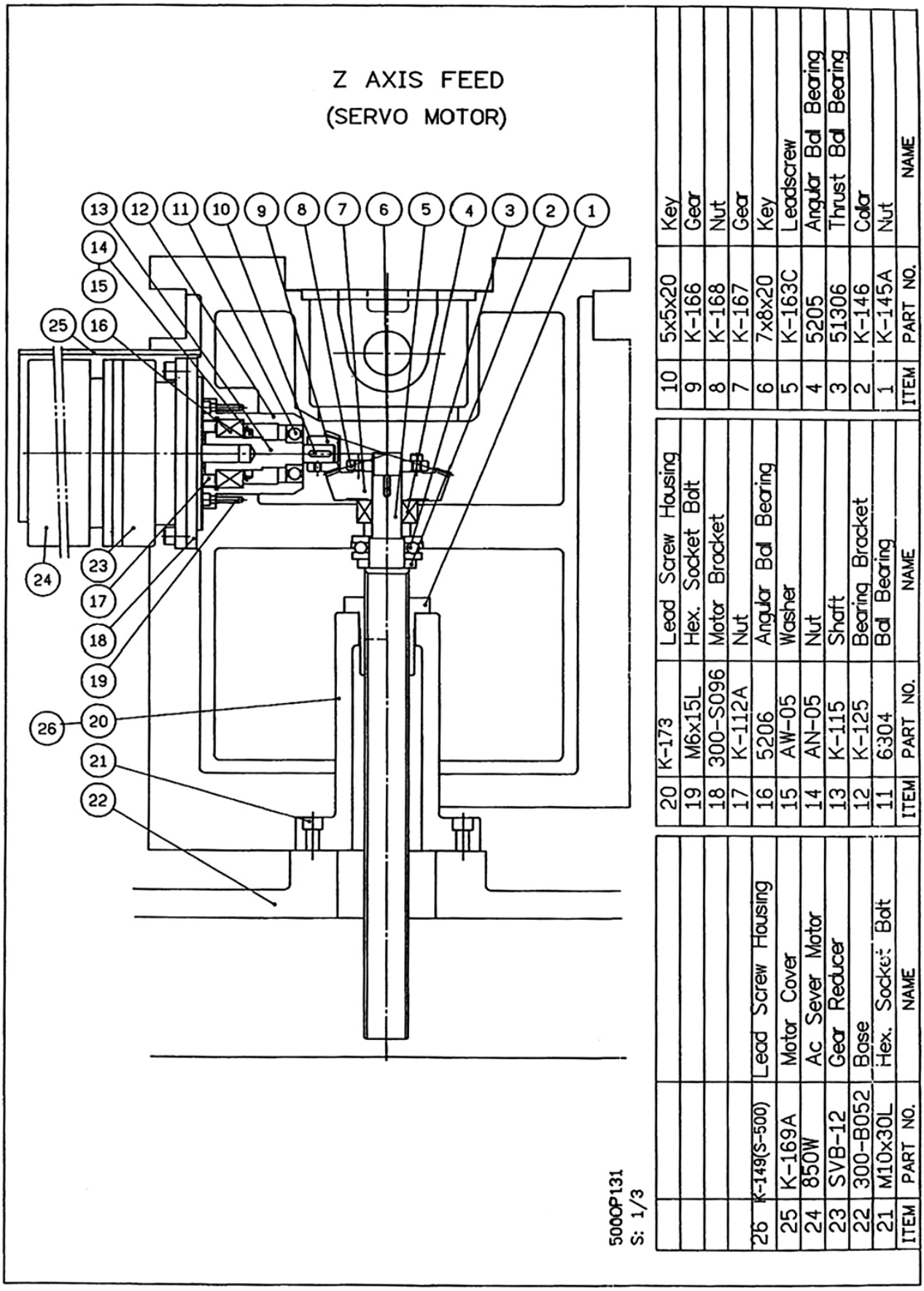
SADDLE SLIDE WAY GUARD



ITEM	PART. NO.	NAME
22	K-159	Gib
21	K-148	Gib Holder(L)
20	K-147	Gib Holder(R)
19	300-S071	Chip Guard
18	S-84	Chip Guard
17	K-101	Chip Guard
16	K-160	Wiper
15	K-161	Wiper
14	K-162	Wiper
13	K-158	Gib
12	300-T042	Gib Holder

ITEM	PART NO.	NAME
11	300-S056	Gib Holder(R)
10	M12x35L	Hex. Socket Bolt
9	300-S062	Wiper
8	300-S061	Wiper
7	300-S057	Gib
6	M5x0.8Px12L	Pan Head Screw
5	300-S060	Wiper
4	300-S060	Wiper
3	300-S058	Gib
2	C-41	Adjusting Screw
1	300-S055	Gib Holder(L)

Z AXIS FEED - SERVO MOTOR

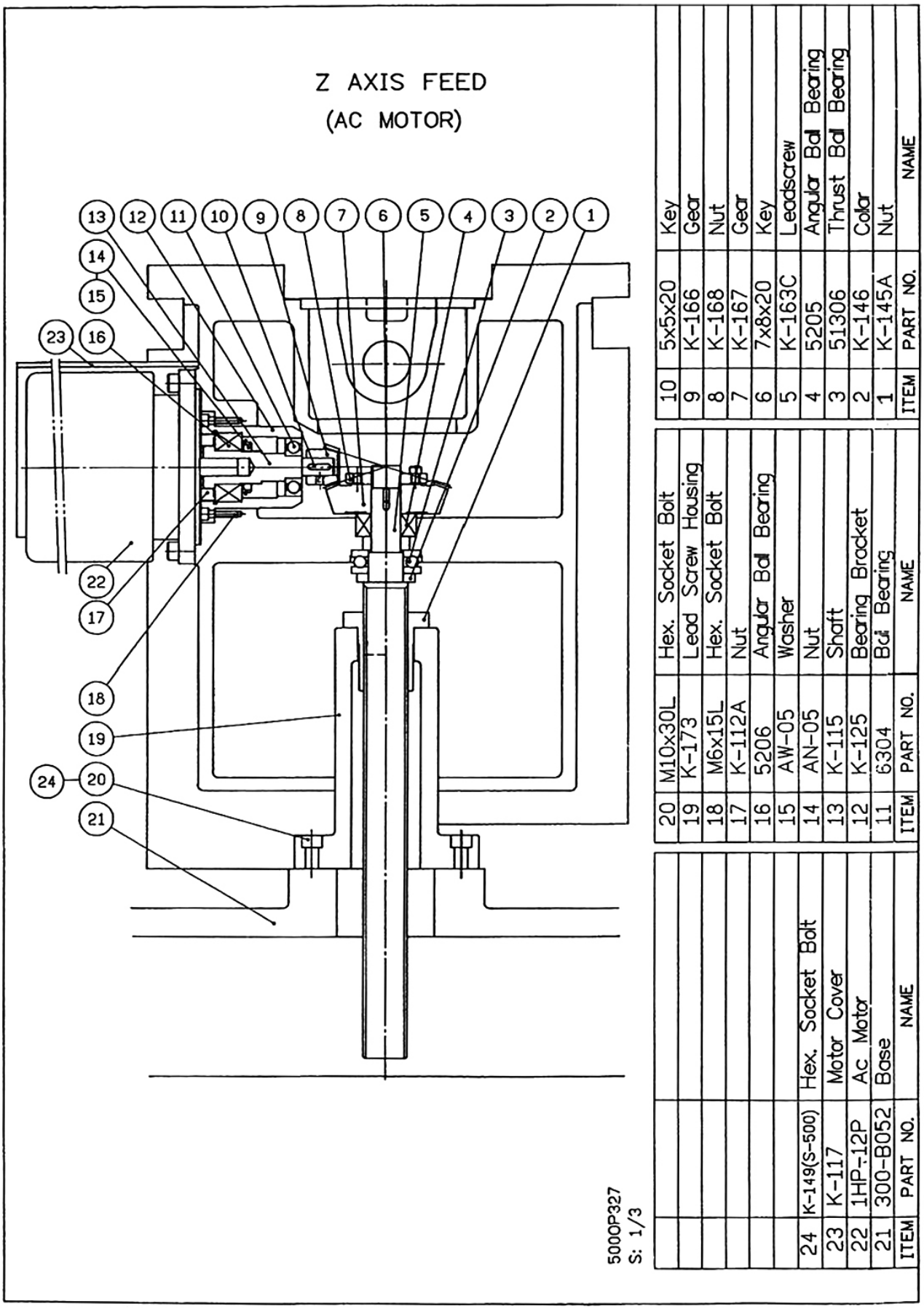


ITEM	PART NO.	NAME
26	K-149(S-500)	Lead Screw Housing
25	K-169A	Motor Cover
24	850W	Ac Sever Motor
23	SVB-12	Gear Reducer
22	300-B052	Base
21	M10x30L	Hex. Socket Bolt

ITEM	PART NO.	NAME
20	K-173	Lead Screw Housing
19	M6x15L	Hex. Socket Bolt
18	300-S096	Motor Bracket
17	K-112A	Nut
16	5206	Angular Bal Bearing
15	AW-05	Washer
14	AN-05	Nut
13	K-115	Shaft
12	K-125	Bearing Bracket
11	6304	Bal Bearing

ITEM	PART NO.	NAME
10	5x5x20	Key
9	K-166	Gear
8	K-168	Nut
7	K-167	Gear
6	7x8x20	Key
5	K-163C	Leadscrew
4	5205	Angular Bal Bearing
3	51306	Thrust Bal Bearing
2	K-146	Collar
1	K-145A	Nut

Z AXIS FEED - AC MOTOR

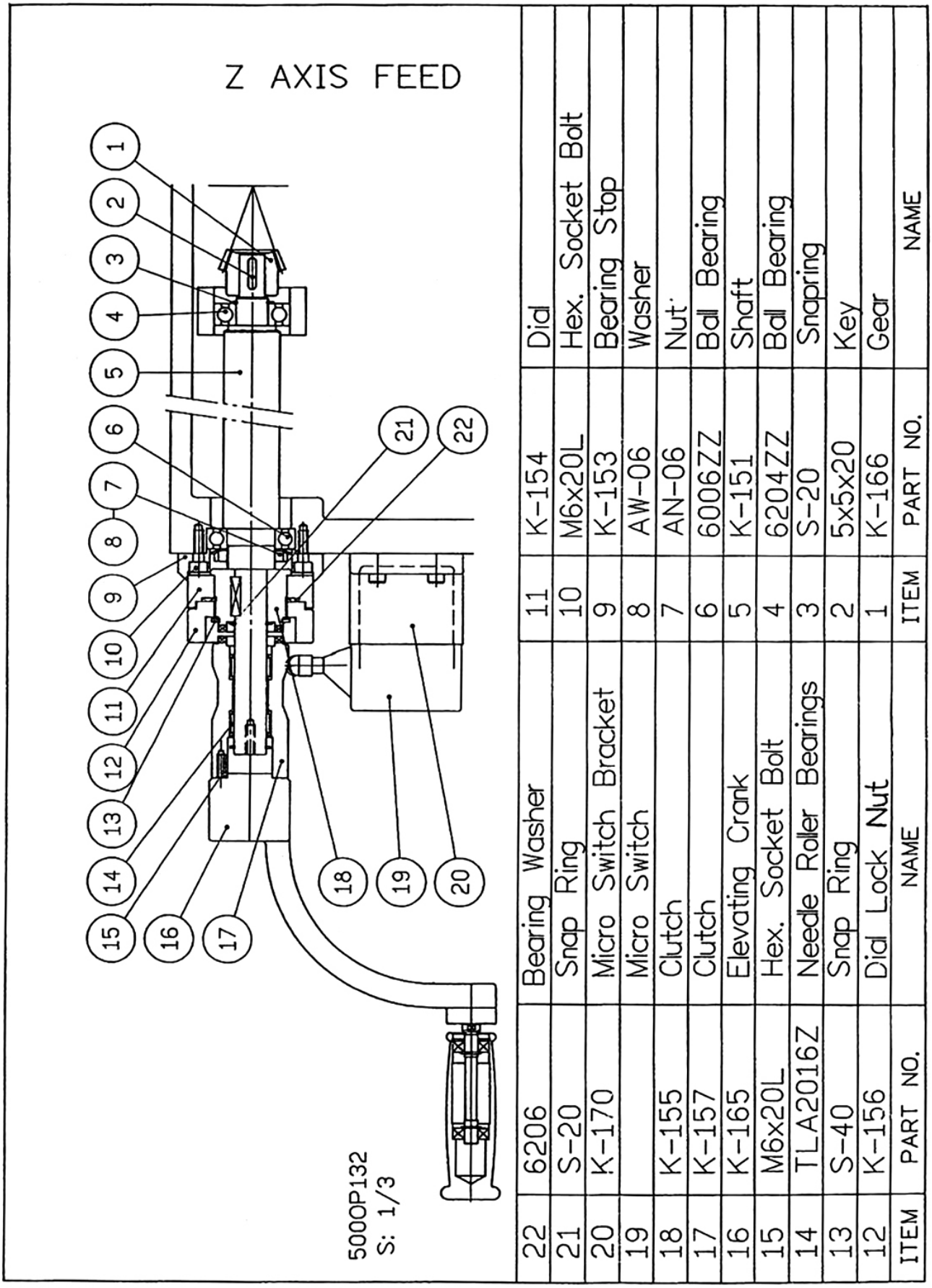


ITEM	PART NO.	NAME
24	K-149(S-500)	Hex. Socket Bolt
23	K-117	Motor Cover
22	1HP-12P	Ac Motor
21	300-B052	Base

ITEM	PART NO.	NAME
20	M10x30L	Hex. Socket Bolt
19	K-173	Lead Screw Housing
18	M6x15L	Hex. Socket Bolt
17	K-112A	Nut
16	5206	Angular Bal Bearing
15	AW-05	Washer
14	AN-05	Nut
13	K-115	Shaft
12	K-125	Bearing Bracket
11	6304	Bal Bearing

ITEM	PART NO.	NAME
10	5x5x20	Key
9	K-166	Gear
8	K-168	Nut
7	K-167	Gear
6	7x8x20	Key
5	K-163C	Leadscrew
4	5205	Angular Bal Bearing
3	51306	Thrust Bal Bearing
2	K-146	Collar
1	K-145A	Nut

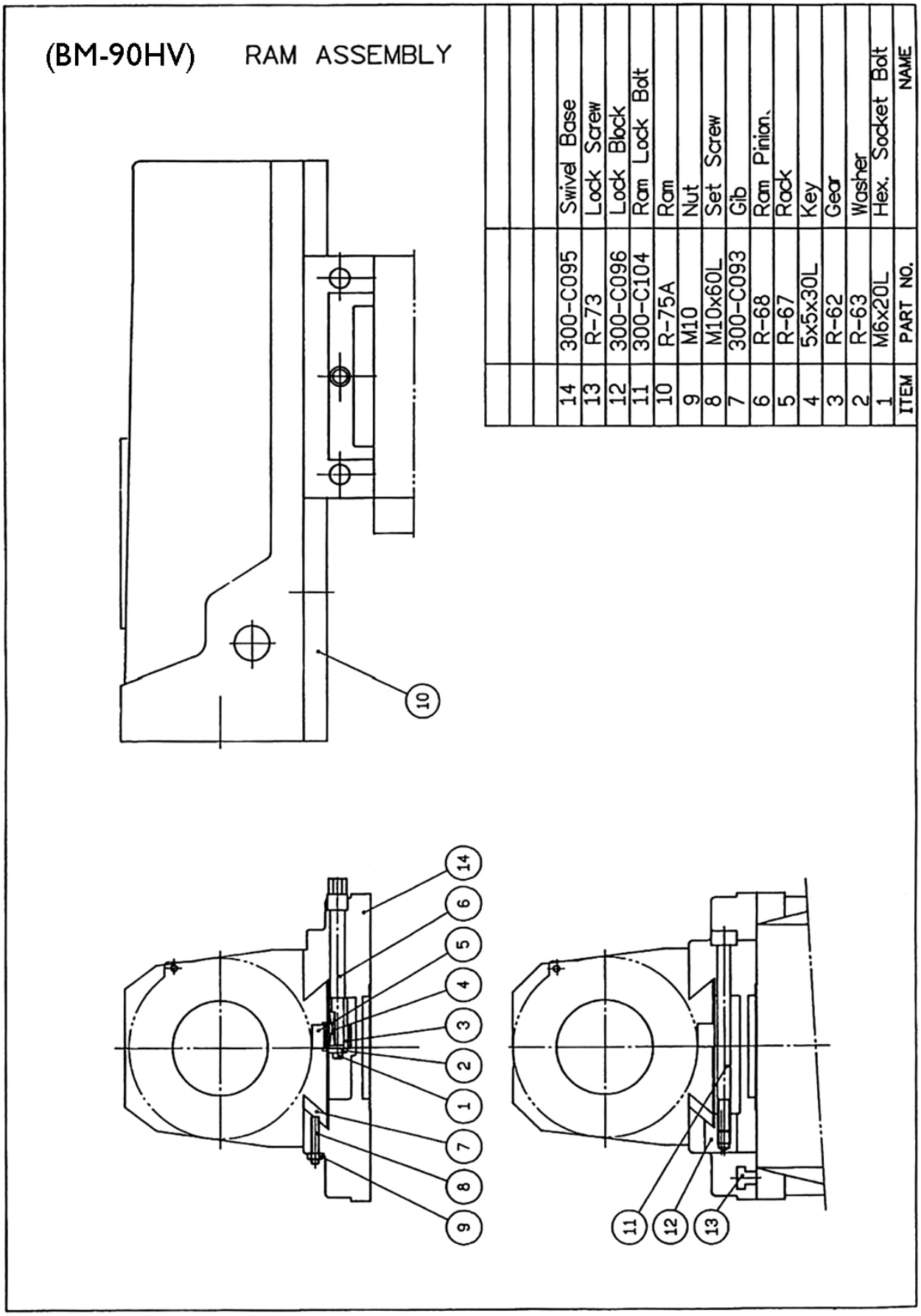
Z AXIS FEED



ITEM	PART NO.	NAME
22	6206	Bearing Washer
21	S-20	Snap Ring
20	K-170	Micro Switch Bracket
19		Micro Switch
18	K-155	Clutch
17	K-157	Clutch
16	K-165	Elevating Crank
15	M6x20L	Hex. Socket Bolt
14	TLA2016Z	Needle Roller Bearings
13	S-40	Snap Ring
12	K-156	Dial Lock Nut

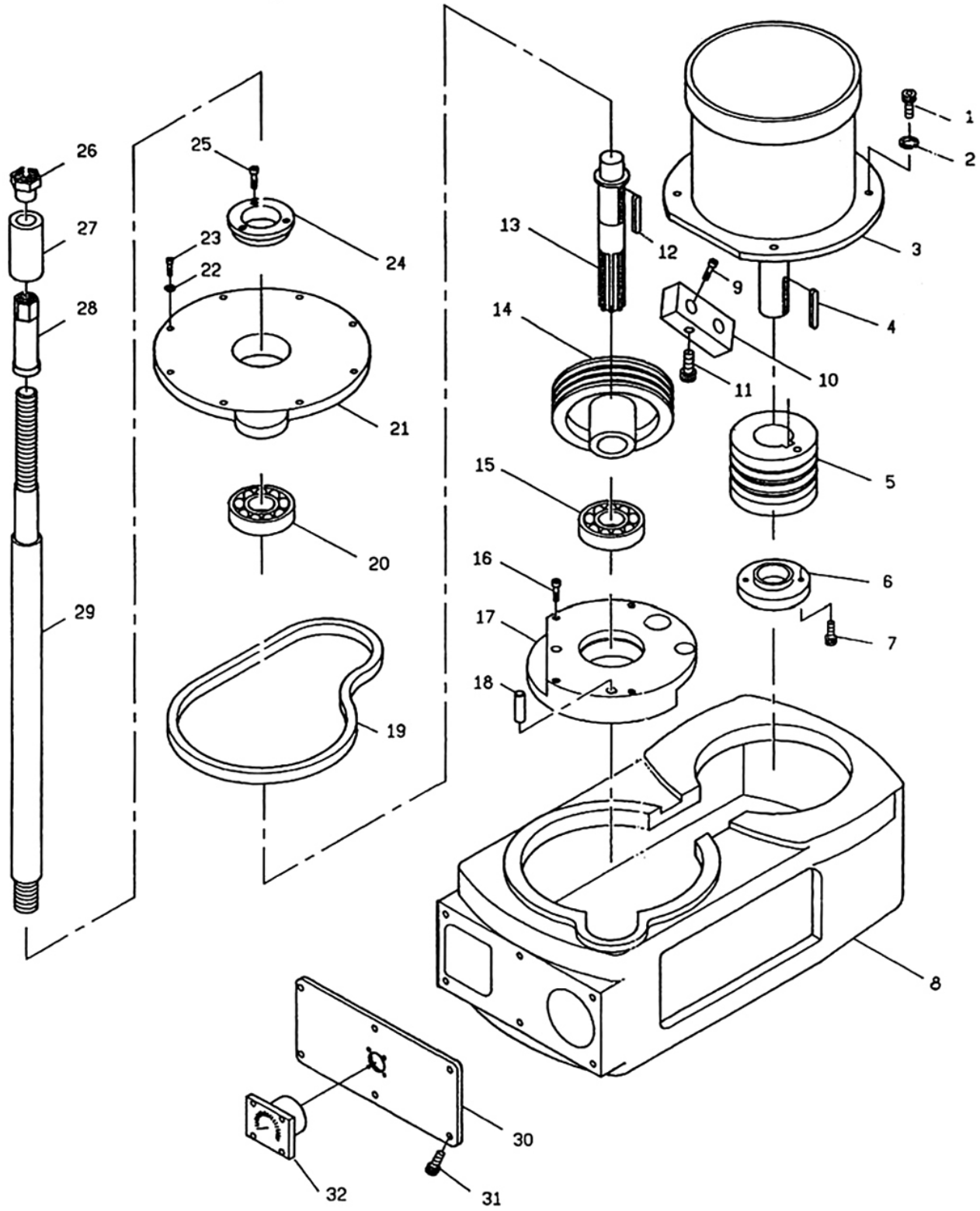
ITEM	PART NO.	NAME
11	K-154	Dial
10	M6x20L	Hex. Socket Bolt
9	K-153	Bearing Stop
8	AW-06	Washer
7	AN-06	Nut
6	6006ZZ	Ball Bearing
5	K-151	Shaft
4	6204ZZ	Ball Bearing
3	S-20	Snapring
2	5x5x20	Key
1	K-166	Gear

RAM ASSEMBLY



ITEM	PART NO.	NAME
14	300-C095	Swivel Base
13	R-73	Lock Screw
12	300-C096	Lock Block
11	300-C104	Ram Lock Bolt
10	R-75A	Ram
9	M10	Nut
8	M10x60L	Set Screw
7	300-C093	Gib
6	R-68	Ram Pinion.
5	R-67	Rack
4	5x5x30L	Key
3	R-62	Gear
2	R-63	Washer
1	M6x20L	Hex. Socket Bolt

INVERTER TOP HOUSING

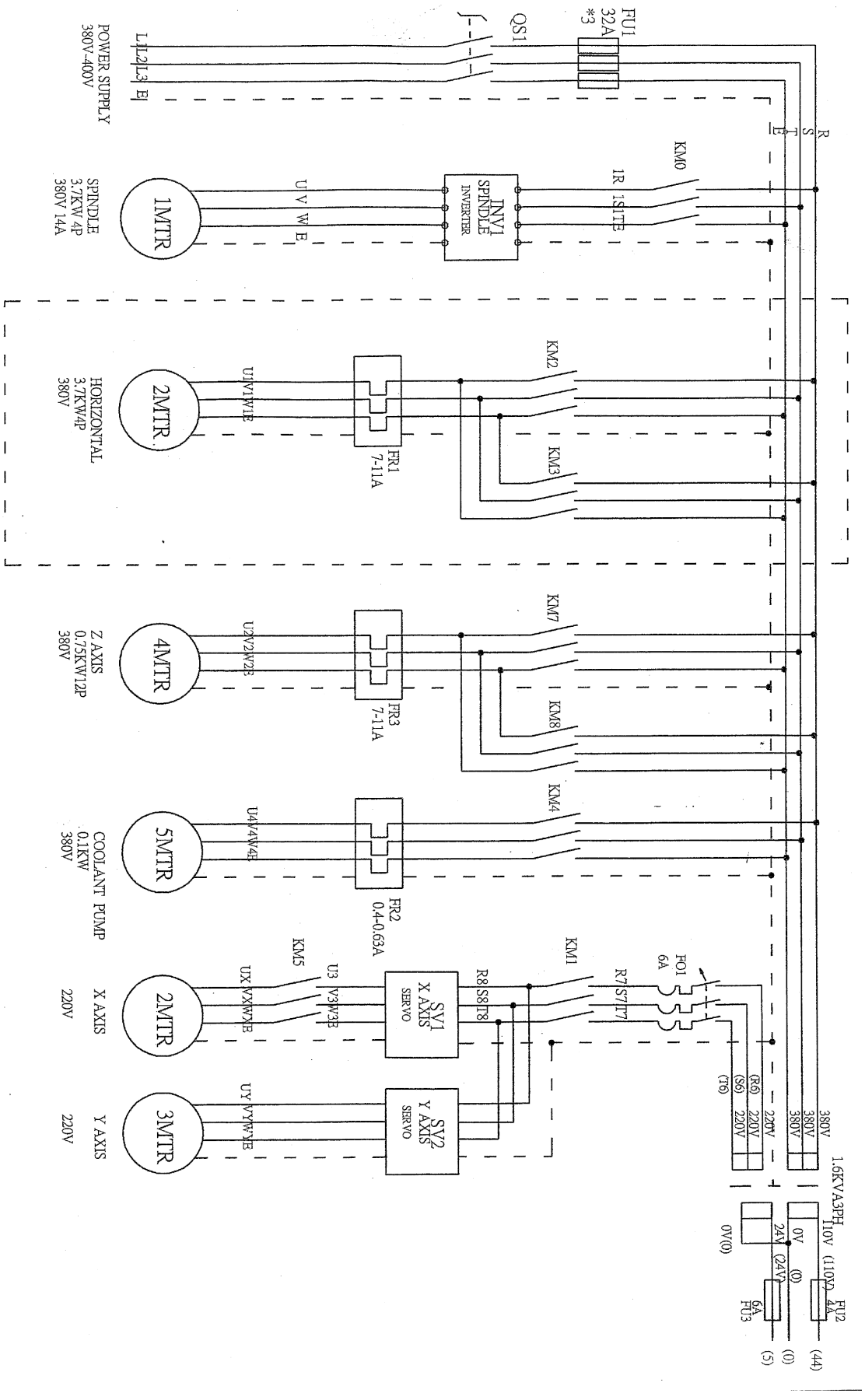


INVERTER TOP HOUSING PARTS LIST

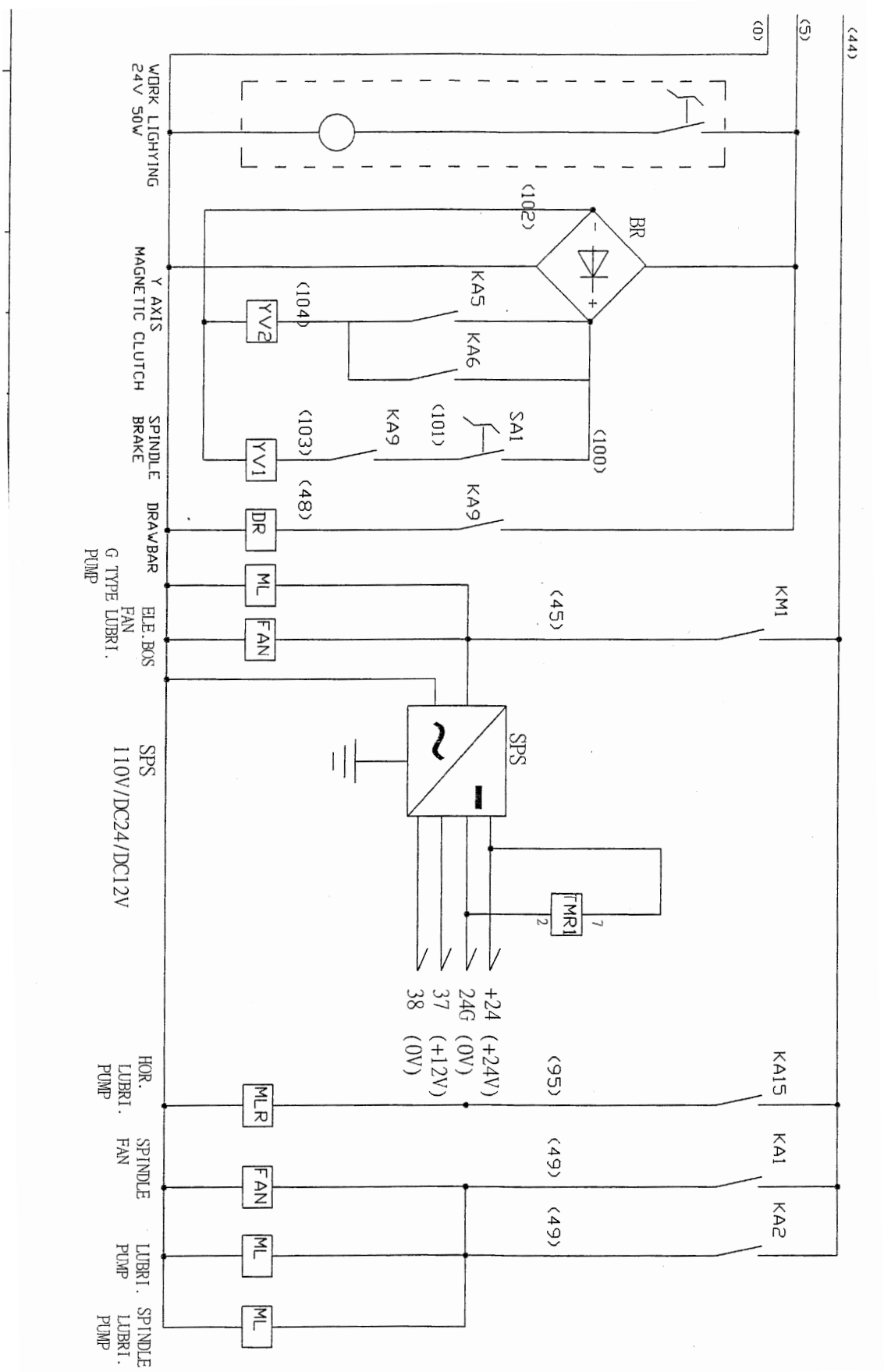
	DESCRIPTION		DESCRIPTION
1	Hex.Socket Head Bolt		
2	Washer		
3	Motor		
4	Key		
5	Pulley		
6	Pulley Stop Ring		
7	Hex. Socket Head Bolt		
8	Head Body		
9	Hex. Socket Head Bolt		
10	Bracket		
11	Hex. Socket Head Bolt		
12	Key		
13	Gear Shaft		
14	Pulley		
15	Ball Bearing		
16	Hex. Socket Head Bolt		
17	Bearing Supporter		
18	Pin		
19	Belt		
20	Ball Bearing		
21	Bearing Supporter		
22	Washer		
23	Hex. Socket Head Bolt		
24	Bearing Stop Ring		
25	Hex. Socket Head Bolt		
26	Nut		
27	Outer Sleeve		
28	Inner Sleeve		
29	Draw Bar		
30	Brake Seat		
31	Hex. Socket Head Bolt		
32	R.p.m Indicator		

NOTE: SOME INDIVIDUAL PARTS MAY ONLY BE AVAILABLE AS AN ASSEMBLY

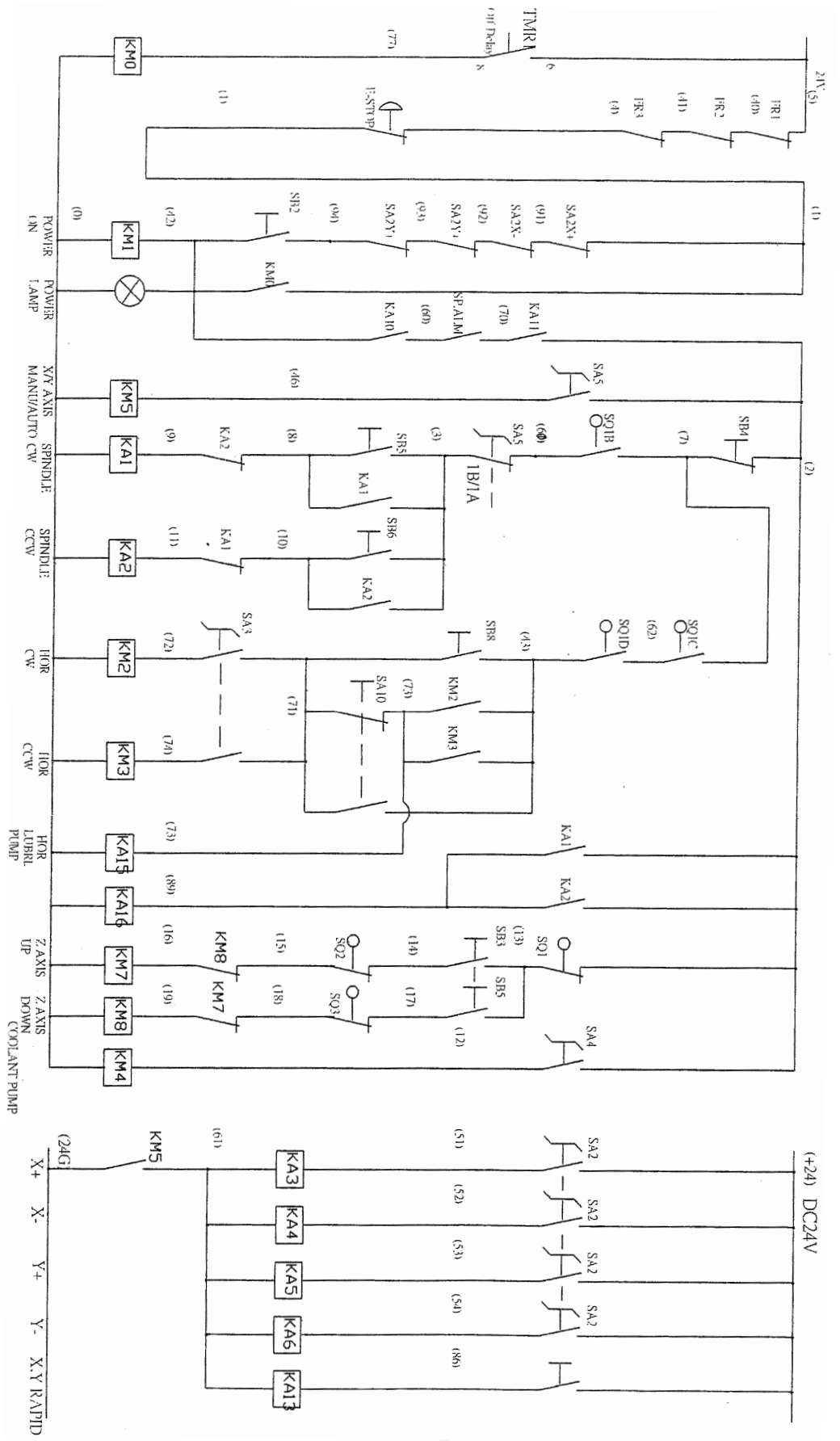
WIRING DIAGRAM 1



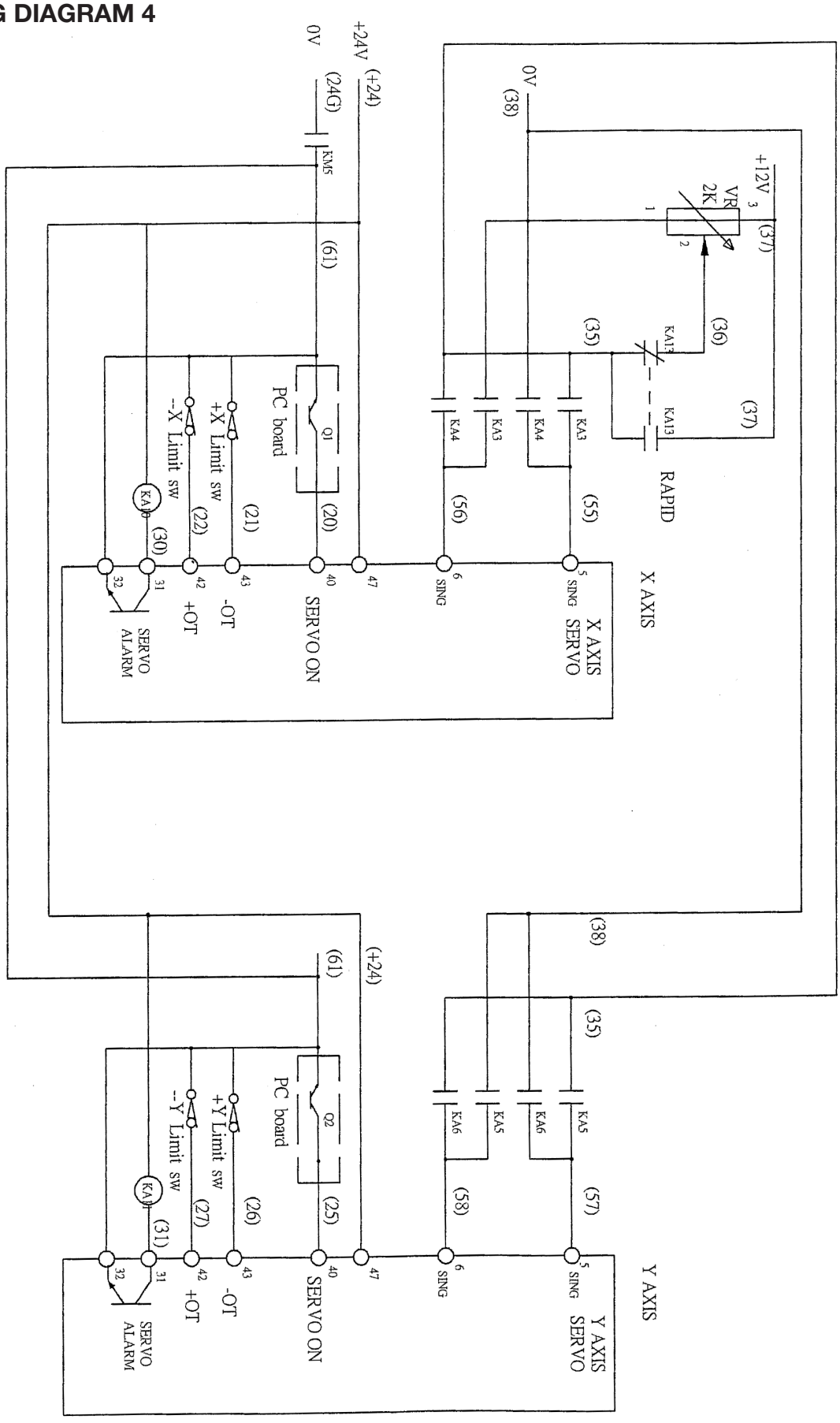
WIRING DIAGRAM 2



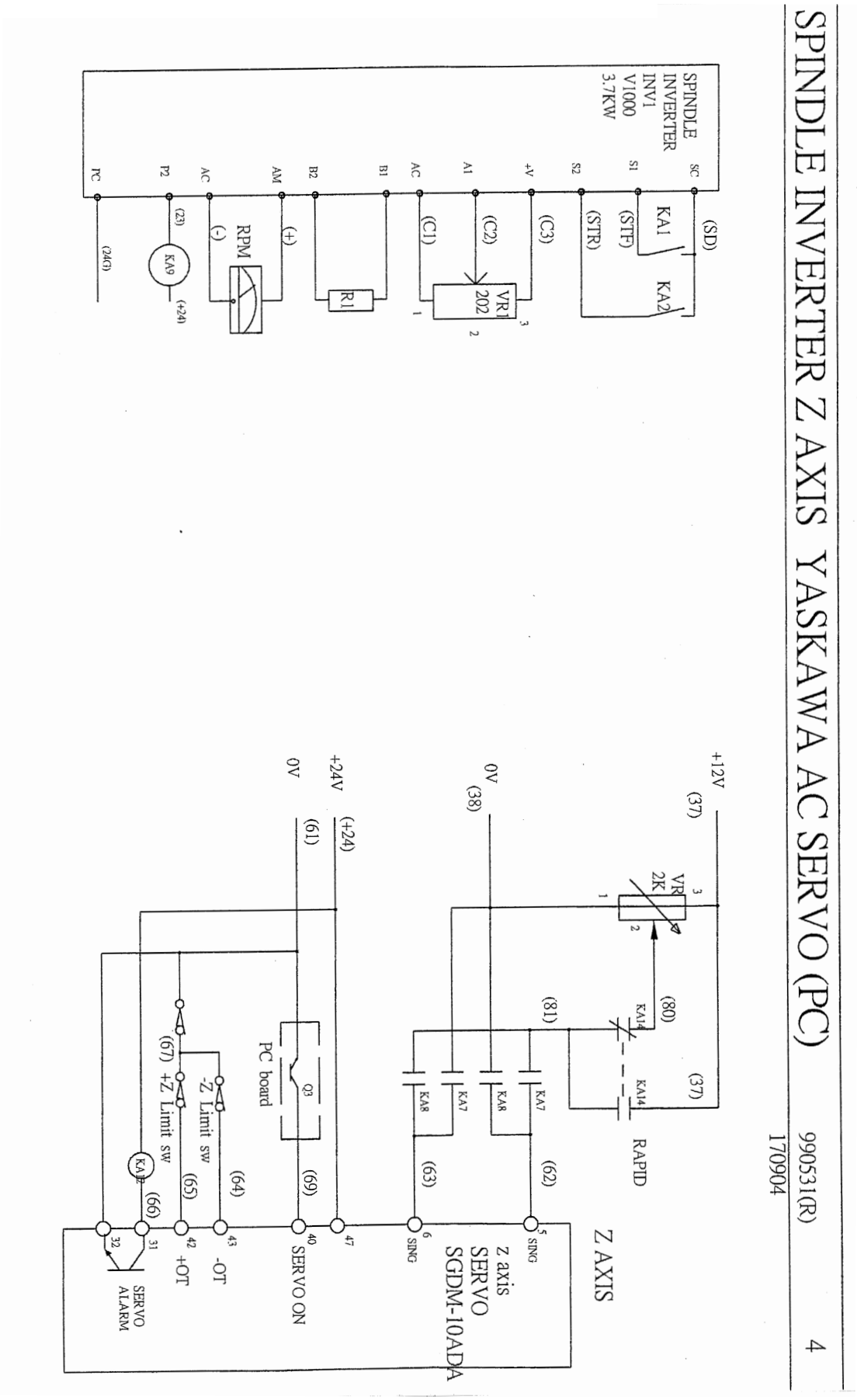
WIRING DIAGRAM 3



WIRING DIAGRAM 4



WIRING DIAGRAM 5



ENVIRONMENT PROTECTION

Recycle unwanted materials instead of disposing of them as waste. All tools, accessories and packaging should be sorted, taken to a recycling centre and disposed of in a manner which is compatible with the environment. When the product becomes completely unserviceable and requires disposal, drain any fluids (if applicable) into approved containers and dispose of the product and fluids according to local regulations.

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