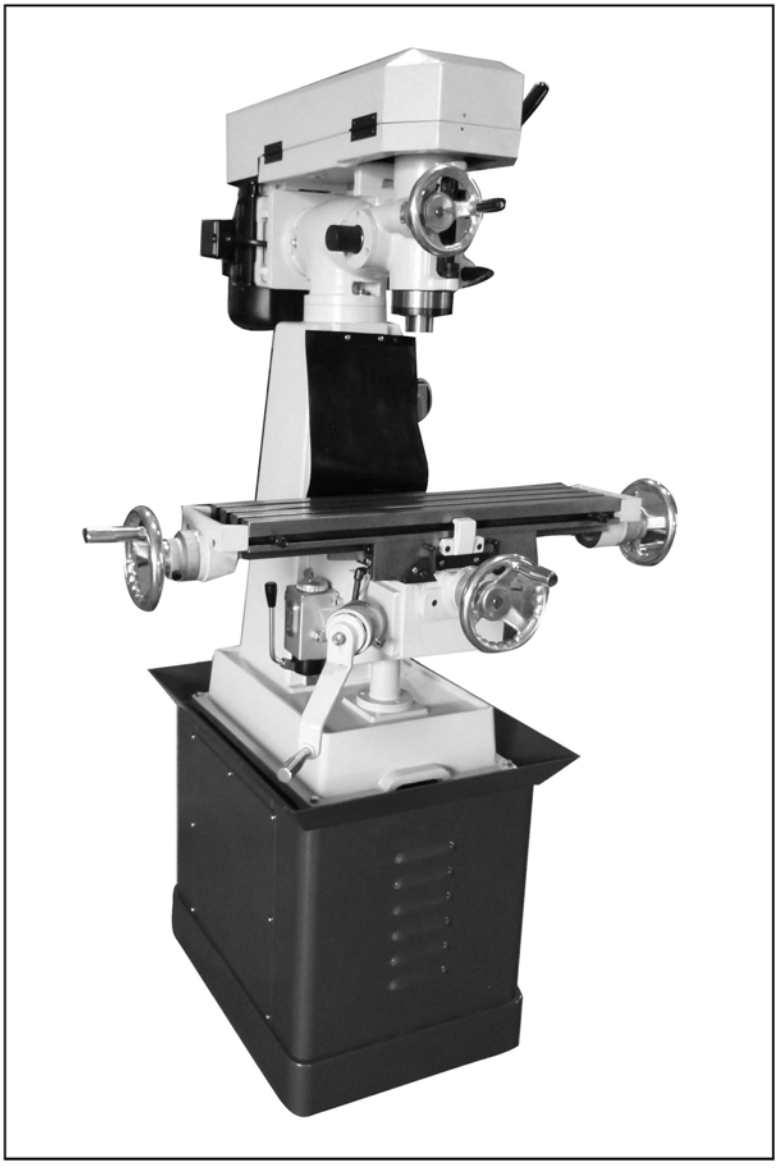
MODEL CX602

MILLING MACHINE

OWNER'S MANUAL



⚠ WARNING

Read all instructions carefully before operation.

PREFACE

We appreciate your purchase of our machine. This machine is designed and manufactured for efficient, heavy-duty operations. This manual concerns the operation, safety and maintenance of the machine. This manual should be kept readily available to the operator for reference. The operator should read this manual carefully before operation to ensure safe, smooth operation of the machine. Our warranty will not apply if there is any improper operation or maintenance of the machine.

When you receive the machine, please check the model, all accessories listed on the packing list and check if there are any parts damaged during transportation. If any part is missing or parts are found to be damaged, please immediately contact your local distributor or machine manufacturer. Again, we would like to thank you for your purchase.

WARRANTY

If any part is proved to is defective within ONE YEAR from the date of purchase then the manufacturer or distributor shall repair or replace the part provided the defective part is returned immediately to the manufacturer or distributor. The manufacturer or distributor shall have no obligation to repair or replace those parts failing due to operator carelessness, misuse or due to any cause such as parts failing due to poor lubrication, inadequate cleaning, improper operating environment, improper utilities or operator error

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1. SAFETY REGULATIONS

1.1 SAFETY REGULATIONS

WARNING: FAILURE TO FOLLOW THESE RULES MAY RESULT IN SERIOUS PERSONAL INJURY.

1. **FOR YOUR OWN SAFETY, READ INSTRUCTION MANUAL BEFORE OPERATING THE TOOL.** Learn the tool's application and limitations as well as the specific hazards peculiar to it.
2. **KEEP GUARDS IN PLACE** and in working order.
3. **ALWAYS WEAR EYE PROTECTION.** Wear safety glasses. Everyday eyeglasses only have impact resistant lenses; they are not safety glasses. Also use face or dust mask if cutting operation is dusty. These safety glasses must conform to ANSI Z87.1 requirements.
   Note: Approved glasses have Z87 printed or stamped on them.
4. **REMOVE ADJUSTING KEYS AND WRENCHES.** Form habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
5. **KEEP WORK AREA CLEAN.** Cluttered areas and benches invite accidents.
6. **DON'T USE IN DANGEROUS ENVIRONMENT.** Don't use power tools in damp or wet locations, or expose them to rain. Keep work area well lighted.
7. **KEEP CHILDERN AWAY.** All visitors should be kept safe distance from work area.
8. **MAKE WORKSHOP KID PROOF** with padlocks, master switches, or by removing starter keys.
9. **DON'T FORCE TOOL** it will do the job better and safer at the rate for which it was not designed.
10. **USE RIGHT TOOL.** Don't force tool or attachment to do a job for which it was not designed.
11. **USE PROPER EXTENSION CORD**. Make sure your extension cord is in good condition. When using an extension cord, be sure to use one heavy enough to carry the current your product will draw. An undersized cord will cause a drop in line voltage resulting in loss of power and overheating. Table 1 shows the correct size to use depending on cord length and nameplate ampere rating. If in doubt, use the next heavier gage. The smaller the gage number, the heavier the cord.
12. **WEAR PROPER APPAREL** Do not wear loose clothing, gloves, neckties, rings, bracelets, or other jewelry which may get caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.

13. **ALWAYS USE SAFETY GLASSES.** Also use face or dust mask if cutting operation is dusty. Everyday eyeglasses only have impact resistant lenses, they are NOT safety glasses.
14. **SECURE WORK.** Use clamps or a vise to hold work when practical. It's safer than using your hand and it frees both hands to operate tool.
15. **DON'T OVERREACH.** Keep proper footing and balance at all times.
16. **MAINTAIN TOOLS WITH CARE.** Keep tools sharp and clean for best and safest performance. Follow instructions for lubricating and changing accessories.
17. **DISCONNECT TOOLS** before servicing; when changing accessories, such as blades, bits, cutters, and the like.
18. **REDUCE THE RISK OF UNINTENTIONAL STARTING.** Make sure switch is in off position before plugging in.
19. **USE RECONNENDED ACCESSORIES.** Consult the owner's manual for recommended accessories. The use of improper accessories may cause risk of injury or persons.
20. **NEVER STAND ON TOOL** Serious injury could occur if the tool is tipped or if the cutting tool is unintentionally contacted.
21. **CHECK DAMAGED PARTS.** Before further use of the tool, a guard or other part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function-check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.
22. **DIRECTION OF FEED.** Feed work into a blade or cutter against the direction of rotation of the blade or cutter only.
23. **NEVER LEAVE TOOL RUNNING UNATTENDED. TURN POWER OFF.** Don't leave tool until it comes to a complete stop.
24. **MAME SURE TOOL IS DISCONNECTED** from power supply while motor is being mounted, connected or reconnected.

1.1.1. GENERAL SAFETY RULES

⚠WARNING Do not attempt to operate until you have read thoroughly and understand completely all instructions, rules, etc. contained in this manual. Failure to comply can result in accidents involving fire, electric shock, or serious personal injury. Keep owners manual and review frequently for continuous safe operation.

1. KNOW YOUR MACHINE.
   For your own safety, read the owner's manual carefully. Learn its application and limitations as well as specific potential hazards pertinent to this machine.

2. KEEP GUARDS IN PLACE AND IN WORKING ORDER.

3. REMOVE ADJUSTING KEYS AND WRENCHES.
   For habit of checking to see that keys and adjusting wrenches are remove from the machine before turning it on.

4. KEEP WORK AREA CLEAN.
   Cluttered areas and benches invite accidents.

5. DO NOT USE IN DANGEROUS ENVIRONMENTS.
   Do not use power tools in damp or we locations, or expose them to rain. Keeps work area well illuminated.

6. KEEP CHILDREN AWAY.
   All visitors should be kept at a safe distance from work area.

7. MAKE WORKSHOP CHILDPROOF.
   With padlocks, master switches, or by removing starter keys.

8. DO NOT FORCE THE MACHINE.
   It will do the job better and be safer at the rate for which it was designed.

9. USE THE RIGHT TOOLS.
   Do not force the machine or attachments to do a job for which they were not designed.

10. WEAR PROPER APPAREL.
    Avoid loose clothing, gloves, neckties, rings, bracelets, or jewelry, which could be caught in moving parts. Nonslip footwear is recommended. Wear protective hair covering to contain long hair.

11. SECURE WORK.
    Use clamps or a vice to hold work when practical. It is safer than using your hand and frees both hands to operate the machine.

12. **DO NOT OVERREACH.**
    Keep proper footing and balance at all times.

13. **MAINTAIN MACHINE IN TOP CONDITION.**
    Keep machine clean for best and safest performance. Follow instructions for lubricating and changing accessories.

14. **DISCONNECT MACHINE FROM POWER SOURCE.**
    Before servicing and when changing accessories, or when mounting and remounting motor.

15. **USE RECOMMENDED ACCESSORIES.**
    Consult the owner's manual for recommended accessories.

16. **NEVER LEAVE MACHINE RUNNING UNATTENDED.** When the power is turned off, do not leave the machine until it comes to a complete stop.

17. **AVOID ACCIDENTAL STARTING.** Make sure switch is in " OFF " position before plugging in cord. Never clean or remove chips while the machine is running.

18. **WARNING LABELS.** Do not remove or alter warning labels and replace any that become obscured.

1.2 WARNING PLATES

This machine has warning symbols attached on it as shown below to ensure proper and safe operation.

These symbols are used on the machine to indicate points or instances of specific danger to operating personnel.

Make sure to memorize these symbols and bring them to the attention of others as and when necessary. **Do not remove safety symbols from the machine.**

2. SPECIFICATIONS

2.1 SPECIFICATIONS

Vertical spindle nose taper	MT3 or R-8 or NT30
Vertical spindle travel	3 1/8" (80mm)
Vertical spindle speed	(9 speeds) 230-2500RPM
Vertical spindle to table surface	0"-13 3/4" (0-345mm)
Working table surface	6"*26" (152*600mm)
T-slots size (Number)	1/2"*3
Maximum longitudinal travel	14 1/2" (370mm)
Maximum cross travel	6" (150mm)
Vertical travel	14 3/4" (345mm)
Lead screw	1"*8 TPI or 3MM PITCH
Vertical head tilting angle (R&L)	90°
Ram swiveling angle	360°
Motor	1.5HP
Net weight (approx)	260kgs

All specifications, dimensions and design characteristics shown in this manual are subject to change without notice.

2.2. MACHINE NOISE

DECLARED NOISE EMISSION VALUES in accordance with ISO 7960.

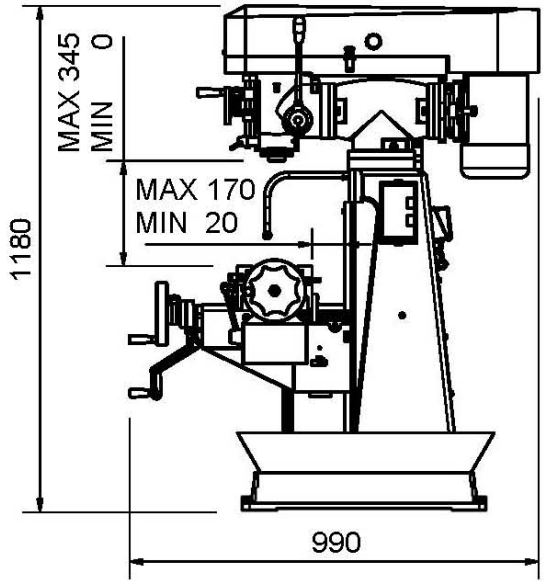
	Idling	Operating
Declared A-weighted Sound Power Level, Lward , in dB re 1 pW .	**A**	**C**
Declared A-Weighted Emission Sound Pressure Level , lpAd , in dB re 20 μ Pa , at the operator's position.	**B**	**D**

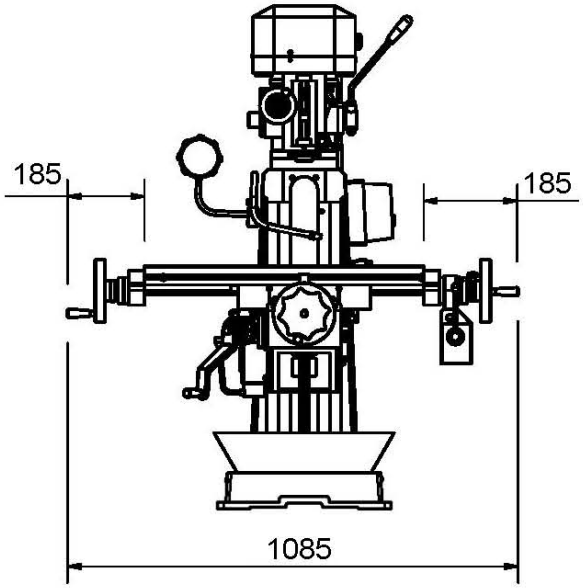
Values determined according to specific test code ISO 3746.

2.3. FUNCTION OF THE MACHINE

1. Model is a compact vertical milling machine . It is easy to set up . The controls are designed for operator convenience with dual table hand wheels .
2. It is very practical for technical schools , small parts production , tool rooms , R&D work , maintenance shops and even hobby use.
3. The machine is ideally suited for many operations , including : conventional milling , compound angle milling , engraving , drilling and jig boring .
4. All "ways" are hand scraped for perfect bearing and alignment . The table is ground for perfect squareness .
5. Castings are high strength material . They are aged for several months , before normalizing and tempering , to minimize deformation .
6. Anti friction bearings are procured from famous manufacturers such as **SKF** , **FAC** , **NSK** , etc … completely interchangeable world wide .

2.4 MACHINE DIMENSIONS





3. INSTALLAITON

3.1. SAFETY RULES FOR MACHINE LIFTING

1. Pay special attention to the balance of the machine while lifting.
2. Use a forklift with sufficient loading capacity to lift the machine.
3. Have another person help guide the way when lifting the machine.
4. The forks of forklift must protrude from under the machine underside.
5. The forklift must only be driven by an experienced forklift driver.

This is a heavy machine. Serious personal injury may occur if safe moving ethods are not used. To be safe, get assistance and use power equipment to move the shipping crate and remove the machine from the crate.

Although not required, we recommend that you mount your new machine to the floor. Because this is an optional step and floor materials may vary, floor mounting hardware is not included. Generally, you can either bolt your machine to the floor or mount it on machine mounts. Both options are described below. Whichever option you choose, it is necessary to level your machine with a precision level.

3.2. SELECTION OF LOCATION

Requirement of operating environment the operating temperature for this machine should be between +5℃ and +40℃ ,while the relative humidity should not exceed 50% at a maximum temperature of +40℃.

Improper environment will affect the machine's safe operation, avoid the following working area:

Avoid placing in area where the machine will rock or be uneven, thus preventing the machine from falling or turning over. This will prevent injuries and undue wear on the machine.

Avoid placing in places where vibration may occur. Install the machine at the anticipated place.

Whether there is any dust on the sliding surface or any defect. Clean it first to avoid setting off sparks or causing an electrical shock.

Space allocation

Consider the largest size of workpiece that will be processed through this machine and provide enough space around the machine for adequate operator material handing or the installation of auxiliary equipment. With permanent installations, leave enough space around the machine to open or remove doors/covers as required by the maintenance and service described in this manual.

Electrical Installation

Place this machine near an existing power source. Make sure all power cords are protected from traffic, material handling, moisture, chemicals, or other hazards. Make sure to leave assess to a means of disconnection the power source or engaging a lockout/tagout device.

Lighting

Lighting around the machine must be adequate enough that operations can be performed safely. Shadows, glare, or strobe effects that may distract or impede the operator must be eliminated.

3.3. TRANSPORTATION

Carefully check over the machine whether it is damaged during transportation.

While moving the machine, be sure to note its weight distribution as well as its balance.

If the machine is damaged while being moved, please contact the manufacturer immediately.

The lifting of the machine is as easy as follows:

The machine can be lifted by a forklift.

Their forks should insert through the machine bottom.

Attention should be paid to the balance of the machine while lifting.

3.4. POWER SUPPLY REQUIREMENT

Insufficient voltage from factory power source may affect the power output of the motor and the function of the controller.

It is important to connect this machine to the correct voltage in the factory power source. Use only an independent power source.

3.7 CONNECT POWER SOURCE WIRES

1. Before connecting the power wires make sure the voltage between the machine and your factory power source is the same.
2. Take out the electrical cover at the electrical control box outside.
3. Connect the power wires to the plug.
4. The machine must be properly grounded to prevent possible injury from electrical shock.
5. Connect the power wires from machine bed to the electrical control box according connecter type.
6. **Qualified electrical personnel should perform all electrical connections.**

⚠ WARNING

Grounding should be based on the local regulations.

4. OPERATION

Operation Overview

This overview gives you the basic process that happens during an operation with this mill. Familiarize yourself with this process to better understand the remaining parts of the Operation section.

To complete a typical operation, the operator does the following:

1. Loosens the knee lock, and adjusts the table height to ensure there is sufficient room to install the tooling in the quill and the workpiece on the table.

2. Installs correct tooling for the task.

3. Mounts the workpiece securely to the table using a vise or clamps.

4. Selects the appropriate spindle speed for the workpiece and tooling.

5. Selects the direction the spindle will turn, based on the type of cut needed, using the direction switch.

6. Unlocks the X- and Y-axis table locks, then secures the Z-axis lock.

7. Wears safety glasses or a face shield.

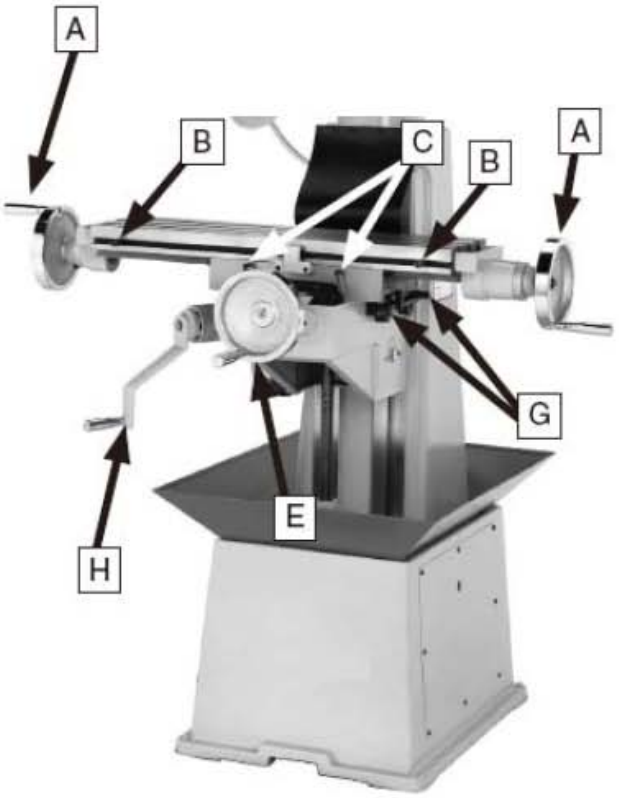
8. Starts the machine.

9. Adjusts the spindle height.

10. For milling operations, uses the X-axis handwheel to move the table left-and-right and uses the Y-axis handwheel to move the table in-or-out, so the cutter removes material evenly from the workpiece. For drilling operations, uses the coarse downfeed lever or fine downfeed handle to lower the tooling into the workpiece, then raises the tooling out of the workpiece.

11. Presses the STOP button to stop the spindle.

4.1 OPERATION INSTRUCTION



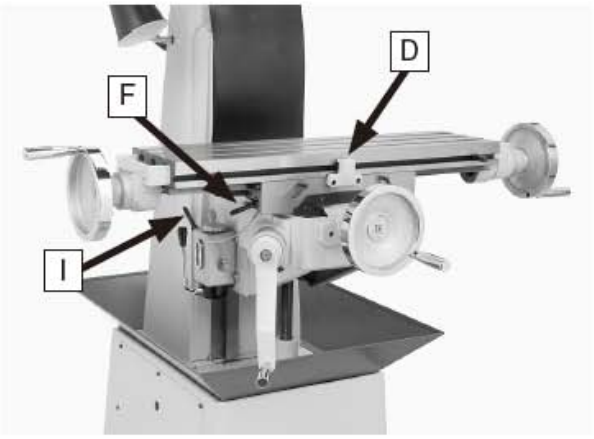


Table Controls

A. X-Axis Handwheels: Controls left-right (X-axis) travel of the table.

B. X-Axis Limit Stops: Limits X-axis table travel.

C. X-Axis Table Locks: Locks the table, preventing table travel in the X-axis.

D. Limit Block: Stops X-axis table movement when the limit stops contact the block.

E. Y -Axis Handwheel: Controls in-out (Y-axis) travel of the table.

F. Y -Axis Lock: Locks the saddle, preventing the table from moving in the Y-axis.

G. Y-Axis Limit Stops: Limit Y-axis table travel.

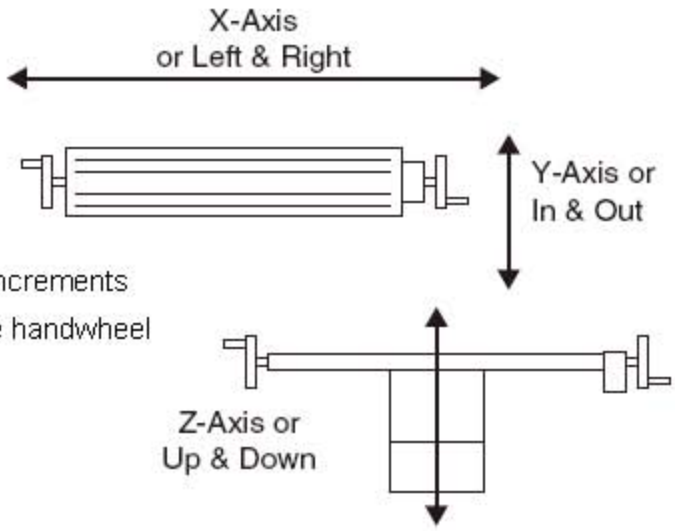
H. Z -Axis Crank Handle: Controls up-down (Z-axis) travel of the table.

I. Z -Axis Lock: Locks the knee, preventing knee or table travel in the Z-axis.

Table Movement

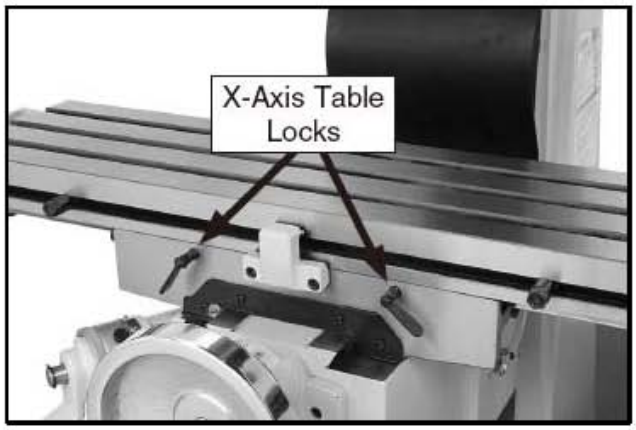
This mill table has three paths of movement controlled by the corresponding handwheels or crank

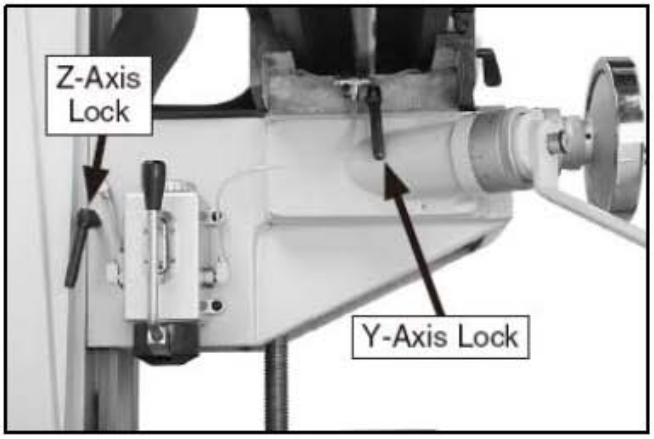
1. Left–right (X-axis)
2. I n–out (Y-axis)
3. Up–down (Z-axis)

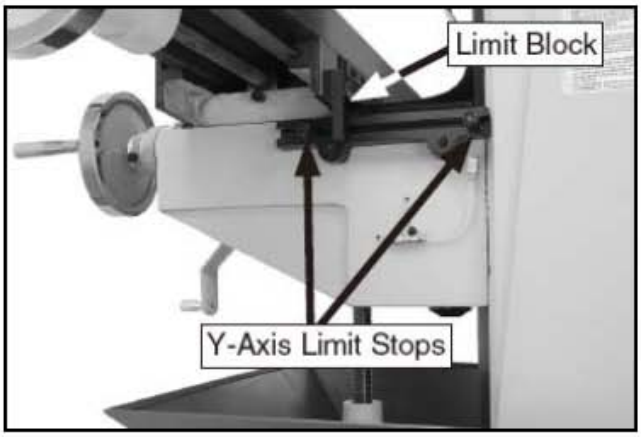


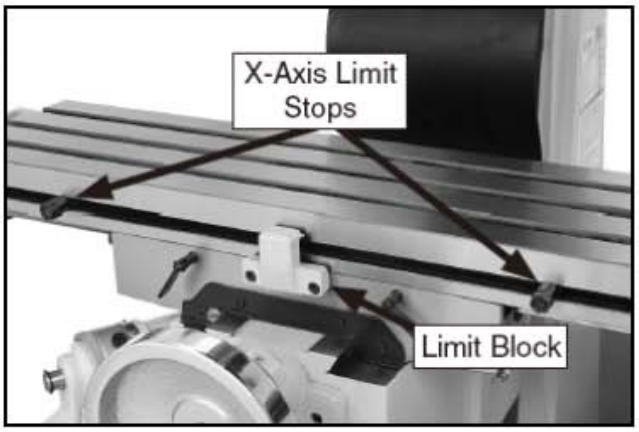
The graduated dials are marked in increments of 0.001", with a full revolution of the handwheel moving the table 0.125".

Locks









Always keep the table locked in place unless controlled movement is required you're your operation. Unexpected table movement during operations could cause the cutter to bind with the workpiece resulting in damage to the cutter and workpiece, and possible personal injury.

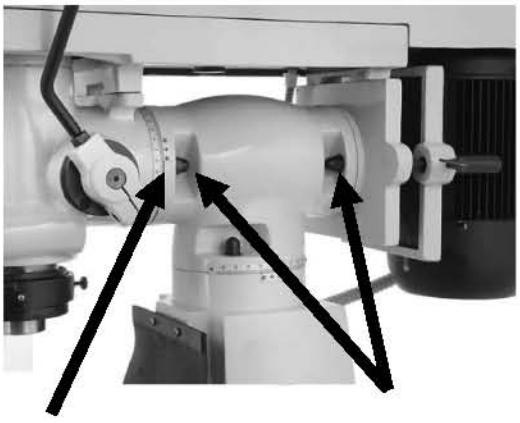
4.2 ADJUSTMENT

Headstock Tilting

The head tilts 90° from left to right.

To tilt the head:

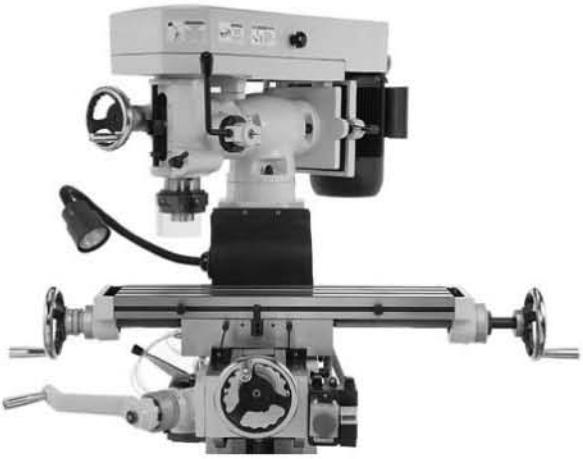
1. **Disconnect the mill form power**
2. **Loosen the four locking hex nuts on either side of the turret.**

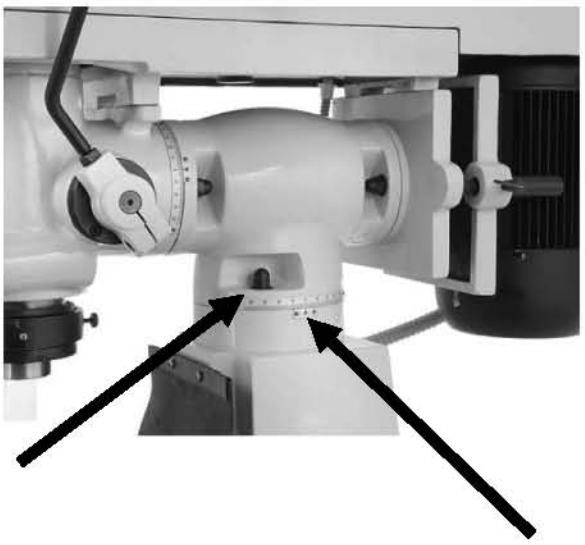


3. **Manually tilt the head to the left or right and use the head tilting scale to determine the angle.**
4. **Re-tighten the four locking hex nuts to secure the head.**

Headstock Turret Rotation

The turret rotates 360° around the column





To rotate the turret:

1. DISCONECT MILL FROM POWER!

NOTICE: Always lock the turret firmly in place after adjusting the rotation. Unexpected movement of the head during operations could cause the cutter to bind with the workpiece causing damage to the cutter and workpiece, and possible personal injury.

2. Loosen the three locking hex nuts on the turret.

3. Manually rotate the head and turret around the column to the left or right and use the turret rotation scale to determine the amount of rotation.

4. Re-tighten the three locking hex nuts to secure the head and turret in place before beginning operations.

Setting Spindle Speed

To select the correct spindle speed (RPM) for your milling operation, you will need to:
1) Determine the spindle speed needed for your workpiece, and 2) set the speed dial for the calculated speed.
This mill is designed to use most end mills, drill bits, and face cutters that are 3" in diameter or less.

Calculating Spindle Speed

1. Use the table in poto to determine the cutting speed or surface feet per minute (SFM) required for your workpiece material.

Cutting Speeds for High Speed Steel (HSS) Cutting Tools	
Workpiece Material	Cutting Speed (SFM)
Aluminum & alloys	300
Brass & Bronze	150
Copper	100
Cast Iron, soft	80
Cast Iron, hard	50
Mild Steel	90
Cast Steel	80
Alloy Steel, hard	40
Tool Steel	50
Stainless Steel	60
Titanium	50
Plastics	300-800
Wood	300-500
Note: *For carbide cutting tools, double the cutting speed. These values are a guideline only. Refer to the MACHINERY'S HANDBOOK for more detailed information.*	

2. Measure the diameter of your cutting tool in decimal inches.

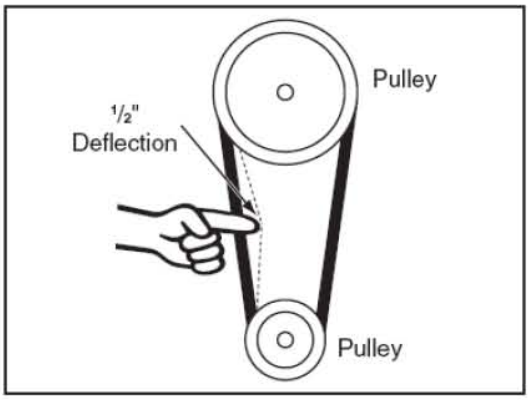
3. Use the following formula to calculate the required spindle speed (RPM) for your operation:

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

Configuring V-Belts

1. disconnect machine from power!
2. open the V-belt cover.
3. Support the motor with one hand and loosen the motor lock shown in bellow poto.
   Note: the motor lock secures the position of the tension pin.

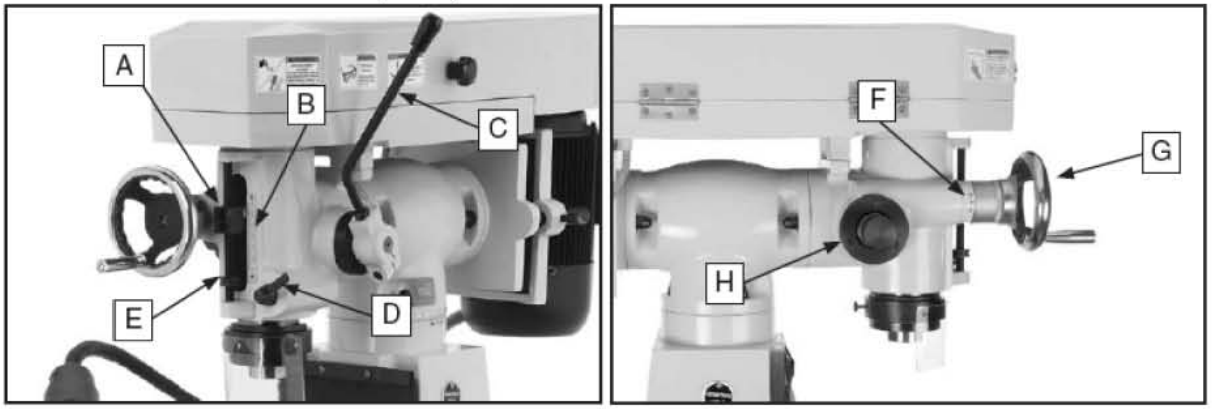
4. Press the motor toward the front to release the tension on the V-Belts, then use the motor lock to secure it in position.
5. Refer to the V-belt configuration chart on the inside of the V-belt cover.
6. When the V-belt are properly positioned on the pulleys, loosen the motor lock, pull the motor away from the machine with moderate force to tension the V-belts, then lock the tension pin in place by re-tightening the motor lock.
   Note: the pivot arm of the idler pulley will equally distribute the tension between the two B-belts.
7. Check the V-belt tension by applying moderate pressure on the V-belt with your finger between two pulleys. The proper amount of deflection of the V-belt for this machine is approximately 1/2”



8. Close the V-belt cover before beginning operations.

Downfeed Controls

Refer to the following descriptions and Figures to understand the functions of the downfeed controls for the quill/spindle.



Quill Dog: moves with the quill. Use the pointer on the side with the downfeed scale to determine the depth of downfeed travel.

A. Downfeed Scale: displays in inches the amount of quill travel.
B. Coarse Downfeed Lever: when this lever is enabled with the downfeed selector, it raises/lowers the quill quickly.
C. Quill Lock: locks the quill in place but does not affect spindle rotation.
D. Downfeed Stop & lock wheels: stops the downfeed travel when the quill dog reaches this point. Set the stop wheel along the downfeed scale for the desired depth of cut then secure it in place by tightening the lock wheel up to it.
E. Graduated Scale: Displays quill travel in 0.001" increments when the fine downfeed handwheel is used, with one full revolution represents 0.1" of quill travel.
F. Fine downfeed handwheel: when enabled, it raises/lowers the quill in small increments.
G. Downfeed Selector: enables either the coarse of fine downfeed control. Tighten the selector to enable the fine downfeed handwheel, and loosen it to enable the coarse downfeed lever.

Chip Characteristics

If chips produced by your operation are blue and burnt and overheated, but the cutting speed is correct, reduce the feed rate until the chips are silver. If the chips are powdery, increase the feed rate so the chips are more coarse but not overheated.

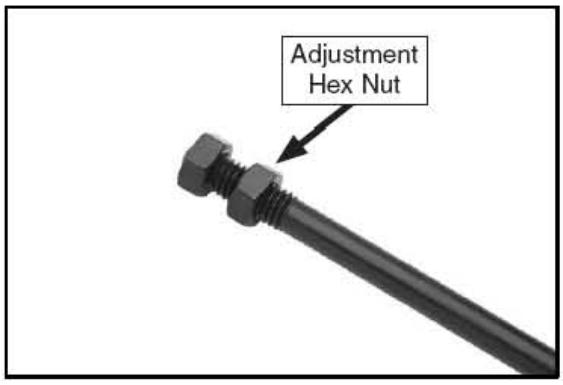
Loading/Unloading Tooling

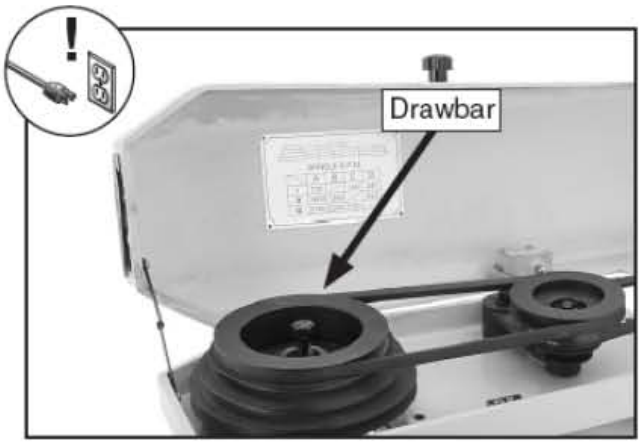
Loading Tooling

1. DISCONECT MILL FROM POWER!

2. Clean any debris or oily substances from the mating surfaces of the spindle and tool tapers.

3. Remove the drawbar cap and place the drawbar through the top of the spindle if it is not already installed.





4. Align the keyway of the tool (collet with cutter, face mill, or drill chuck with taper shank) with the protruding set screw inside the spindle, and push the tool firmly into the spindle taper to seat it.

5. While holding the tool in place with one hand, thread the drawbar into the tool until it is snug.

Note: *Make sure the drawbar is threaded into the tool a minimum of five to 10 turns.*

6. To fully seat the tool into the spindle, tighten the drawbar with a 19mm wrench.
Note: *Over-tightening the drawbar could make removing the tool difficult, so only snug the drawbar in place.*

7. Re-install the drawbar cap.

Unloading Tooling

1. DISCONECT MILL FROM POWER!

2. While wearing gloves, keep one hand on the tool, loosen the drawbar with the 19mm wrench, then completely unthread it.

— If the tool does not release from the spindle taper when the drawbar is unthreaded, turn the drawbar back into the tool five to ten threads, then tap the top of the drawbar with a dead-blow hammer or block of wood until the tool releases.

5. MAINTEANCE

5.1 MAINTENANCE & TROUBLE SHOOTING

Symptom	Possible Cause	Possible Solution
Machine does not start or a breaker trips.	1. Stop button is pushed in or is at fault.	1. Turn the stop button clockwise until it pops out; replace if faulty.
	2. ON button is at fault.	2. Replace faulty ON button.
	3. Plug/receptacle is at fault or wired incorrectly.	3. Test for good contacts; correct the wiring.
	4. Power supply is switched ***OFF*** or is at fault, or the breaker tripped.	4. Ensure hot lines have correct voltage on all legs and main power supply is switched ***ON***.
	5. Motor connection wired incorrectly.	5. Correct motor wiring connections
	6. Motor windings or motor is at fault.	6. Replace motor.
Machine stalls or is overloaded.	1. Machine is undersized for the task.	1. Use smaller sharp tooling; reduce the feed rate; reduce the spindle RPM; use coolant.
	2. Workpiece alignment is poor.	2. Eliminate workpiece binding; use vise or clamps as required for workpiece alignment control.
	3. Dull or incorrect cutting tool.	3. Use sharp and correct cutting tool for the operation.
	4. Motor connection is wired incorrectly.	4. Correct motor wiring connections
	5. Plug/receptacle is at fault.	5. Test for good contacts; correct the wiring.
	6. Pulley/sprocket slipping on shaft.	6. Replace loose pulley/shaft.
	7. Motor bearings are at fault.	7. Test by rotating shaft; rotational grinding/loose shaft requires bearing replacement.
	8. Motor has overheated.	8. Clean off motor, let cool, and reduce workload.
	9. Motor is at fault.	9. Test and repair or replace.
Machine has vibration or noisy operation.	1. Tool holder or cutter is at fault.	1. Replace out-of-round tool holder; replace/resharpen cutter; use appropriate feed rate and cutting RPM.
	2. Workpiece alignment is poor.	2. Eliminate workpiece binding; use vise or clamps as required for workpiece alignment control.
	3. Motor or component is loose.	3. Inspect/replace stripped or damaged bolts/nuts, and re-tighten with thread locking fluid.
	4. Pulley is loose.	4. Realign/replace shaft, pulley, setscrew, and key as required.
	5. Machine is incorrectly mounted or sits unevenly.	5. Tighten/replace mounting bolts in floor; relocate/ shim machine.
	6. Motor fan is rubbing on fan cover.	6. Replace dented fan cover or fan.
	7. Motor bearings are at fault.	7. Test by rotating shaft; rotational grinding/loose shaft requires bearing replacement.

Operation

Symptom	Possible Cause	Possible Solution
Tool slips in collet.	1. Collet is not fully drawn into spindle taper. 2. Wrong size collet. 3. Debris on collet or spindle mating surface. 4. Excessive depth of cut.	1. Snug up drawbar. 2. Use correct collet for shank diameter. 3. Remove oil and debris from collet and spindle mating surfaces, then re-install. 4. Decrease depth of cut and allow chips to clear.
Breaking tooling.	1. Spindle speed/feed rate too fast. 2. Tooling getting too hot. 3. Excessive depth of cut.	1. Use correct spindle RPM and feed rate 2. Use coolant; reduce spindle RPM/feed rate. 3. Decrease depth of cut and allow chips to clear.
Machine is loud when cutting; overheats or bogs down in the cut.	1. Excessive depth of cut. 2. Dull tooling. 3. Feed rate too fast.	1. Decrease depth of cut and allow chips to clear. 2. Use sharp tooling. 3. Decrease feed rate.
Workpiece vibrates or chatters during operation.	1. Locks not tight. 2. Workpiece not securely clamped to table or mill vise. 3. Tooling not secure or is damaged. 4. Spindle speed/feed rate too fast. 5. Gibs are too loose.	1. Tighten all locks on mill that are not associated with movement for the operation. 2. Check that clamping is tight and sufficient for the operation; make sure mill vise is tight to table. 3. Secure tooling; replace if damaged. 4. Use correct spindle RPM and feed rate 5. Adjust gibs properly
Table hard to move.	1. Locks are tightened down. 2. Chips have loaded up on the ways. 3. Ways are dry and in need of lubrication. 4. Gibs are too tight.	1. Fully loosen locks needed for movement. 2. Frequently clean away chips that load up during operations. 3. Use one-shot oiler to lubricate ways 4. Adjust gibs properly
Bad surface finish.	1. Wrong spindle speed/feed rate. 2. Dull/damaged tooling; wrong tooling for operation. 3. Wrong spindle rotation for tooling. 4. Workpiece not securely clamped to table or mill vise. 5. Gibs are too loose.	1. Use correct spindle RPM and feed rate 2. Sharpen/replace tooling; use correct tooling for operation. 3. Check for proper spindle rotation for tooling. 4. Check that clamping is tight and sufficient for the operation; make sure mill vise is tight to table. 5. Adjust gibs properly

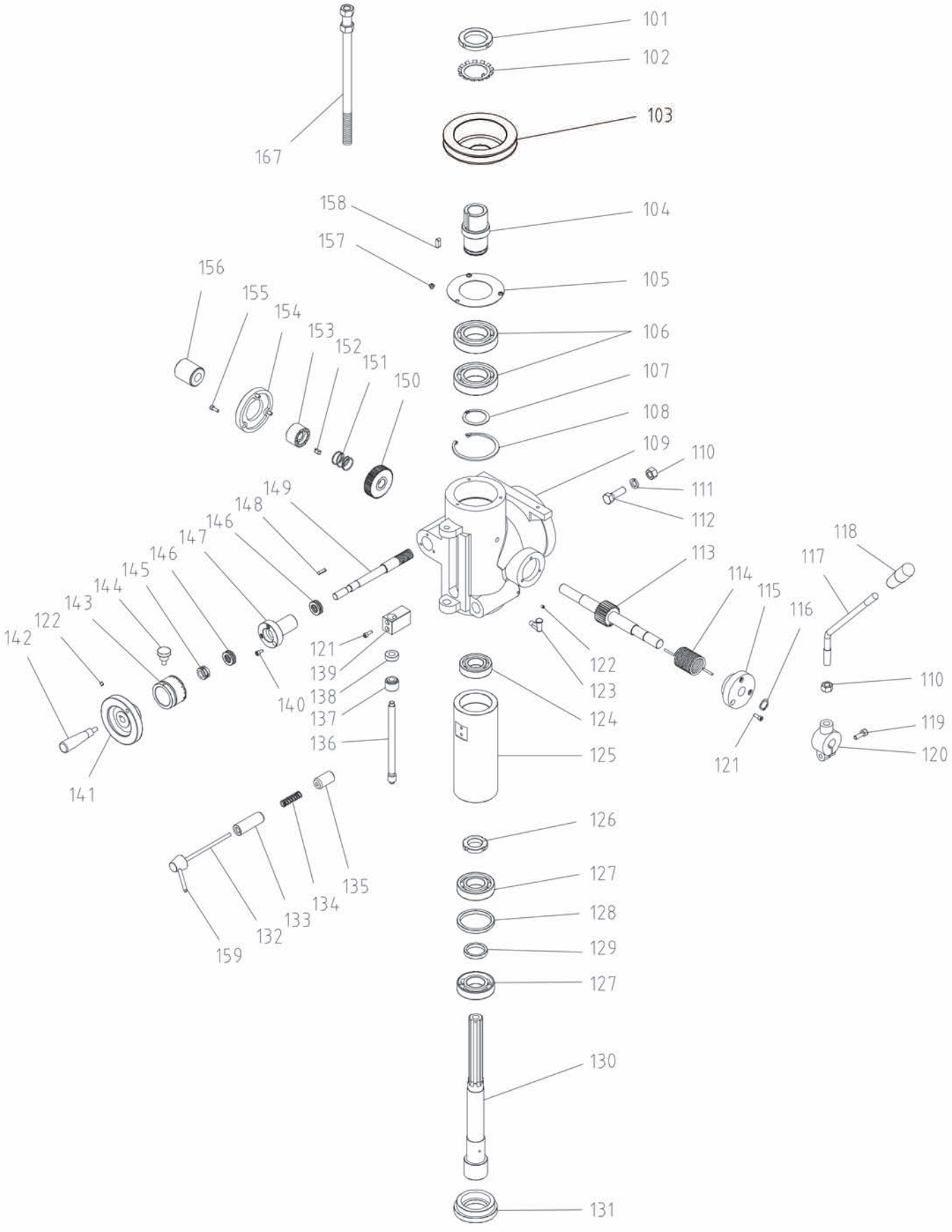
6. ELECTRIC

6.1 SAFETY RULES FOR ELECTRICAL CONTROL SYSTEM

1. Only personnel who are properly trained and have adequate knowledge and skill should undertake all electrical/electronic troubleshooting and repair.
2. Do not alter or bypass protective interlocks.
3. Before starting, read and observe all warning labels.
4. When trouble shooting make sure the power source has been disconnected and main switch has been locked.
5. Take extra precautions in damp areas to protect you from accidental grounding.
6. Before applying power to any equipment it must be established, without a doubt, that all persons are clear.
7. Do not open the electrical control panel unless it is necessary to check the electrical equipment.
8. Do not alter the electrical circuits unless authorized to do so by the manufacturer.
9. When replacing electrical components, make sure they conform to the manufacturer's specifications, including proper color coding.
10. Do not wear metal frame glasses, metallic necklaces or chains while working on any electrical equipment. Also do not wear any ring, watch or bracelet while operating electrical equipment.

6.2 ELECTRICAL WIRING DIAGRAM

PLEASE SEE ATTACHED.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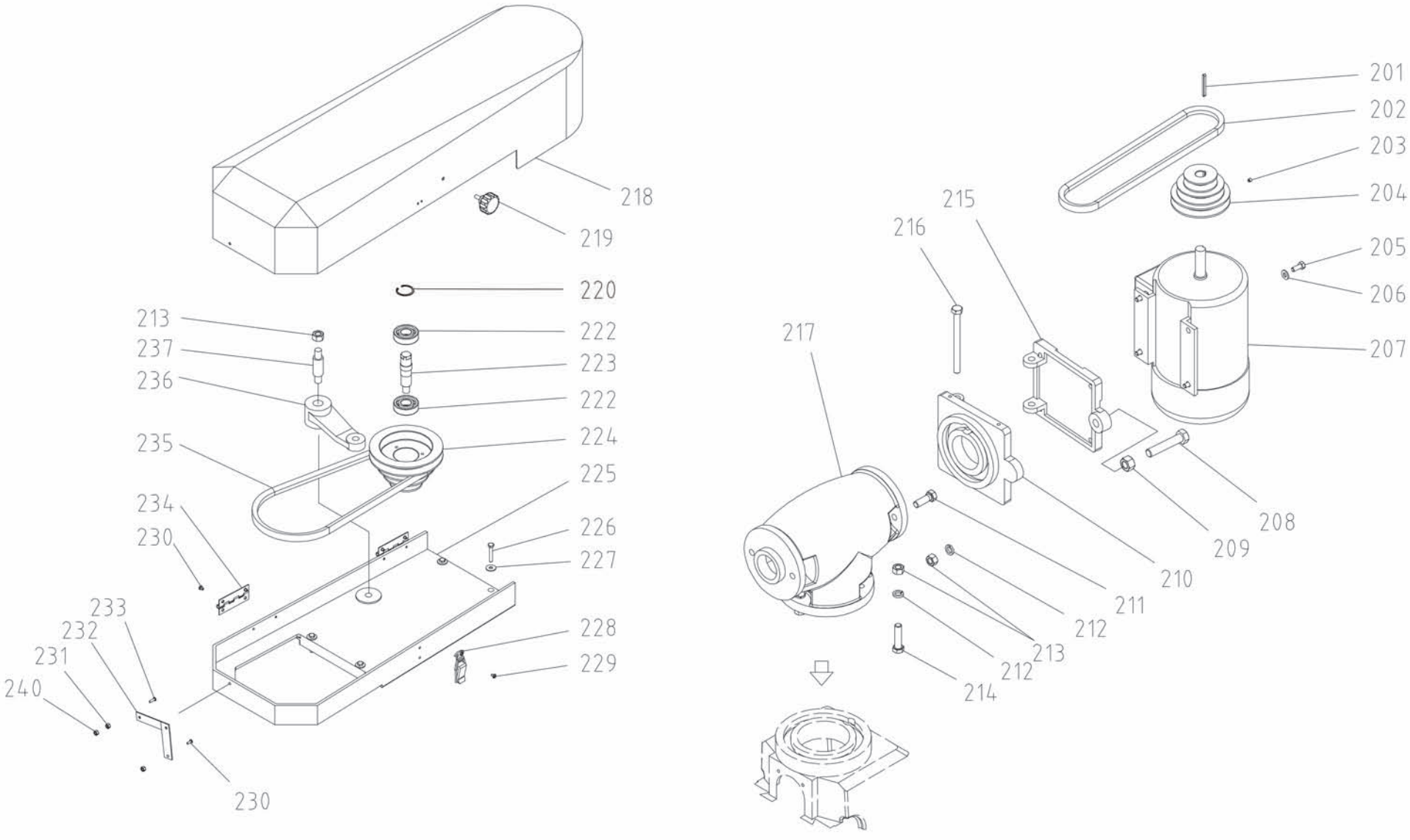
INDEX	DESCRIPTION
401	BAR BOX
402	FORW ARD/REVERSE SWITCH
403	COLUMN
405	SCREW - CAP SOC HD M6-1.0 X 8
406	GIB
407	SCREW
408	OIL JOINT
409	KNEE
410	KNEE COVER
411	SCREW - PAN HD M3-0.5 X 6
412	HANDLE BAR
413	OIL PUMP
415	NUT
416	WASHER - TAB
417	BEVEL GEAR
418	BEARING 6004ZZ
419	GEAR SHAFT SLEEVE
420	SCREW-CAP SOC HD M6-1.0X16
421	KEY M5 X 5 X 20 DRE
422	GEAR SHAFT
423	S-RING M20
424	COUPLING
425	SCREW - SET M6-1.0 X 8
426	DIAL POSITIONING SCREW
427	DIAL
428	CRANK ARM
429	S-RING 18
430	HANDLE
431	HANDLE WHEEL
432	DIAL
433	BEARING 51104
434	BEARING HOUSING
435	CROSS LEAD SCREW
436	BEARING 6204ZZ
437	LEAD SCREW
438	PEDESTAL
439	COVER
440	HOLDER
441	SCREW - CAP M10-1.5 X 30
442	SPACER
443	NUT - HEX M10-1.5
444	SCREW - CAP SOC HD M6-1.0X30
445	BOLT - HEX HD 1/2- X 2
446	WASHER - LOCK 1/2"
448	SWITCH
449	SCREW - PAN HD 3/16- 1/2
450	PLANE
451	SCREW - PAN HD M6-1.0 X 10
452	CORD
453	STRAIN RELIEF
454	SCREW - PAN HD 3/16- X 3/4
455	CORD
459	MACHINE BASE
460	HEX BOIT 3/8 X 2
461	HEX NUT 3/8
462	STAND

INDEX	DESCRIPTION
101	NUT - HEX
102	WASHER
103	SPINDLE PULLEY
104	SPINDLE SLEEVE
105	BEARING COVER
106	BEARING 6009ZZ
107	S-RING 45
108	C-RING 75
109	HEAD CASTING
110	NUT - HEX 1/2-13
111	WASHER - LOCK 1/2
112	BOLT - HEX 1/2- X 1 1/2
113	GEAR SHAFT
114	SPRING
115	FLANGE COVER
116	S-RING 19
117	HANDLE LEVER
118	KNOB
119	SCREW - CAP M8-1.25 X 25
120	HANDLE BASE
121	SCREW - CAP M5-0.8 X 16
122	SCREW - SET M6-1.0 X 8
123	OIL CUP
124	BEARING 6206ZZ
125	SPINDLE QUILL
126	NUT - SPANNER M30
127	BEARING 6007ZZ
128	WASHER - TOOTHED EXT M30
129	BEARING 7207
130	SPINDLE
131	SPINDLE NUT
132	LOCK KNOB SHAFT
133	LOCK BLOCK (L)
134	SPRING
135	LOCK BLOCK (S)
136	SCREW
137	NUT - LOCK
138	NUT - HEIGHT
139	BLOCK
140	SCREW - PAN HD M5-0.8 X 15
141	HAND WHEEL
142	HANDLE
143	STEPPED SLEEVE
144	DIAL POSITIONING SCREW
145	NUT - 9/16
146	BEARING 51102
147	SLEEVE
148	KEY 5 X 5 X 20 DRE
149	WORM SHAFT
150	COUPLING WORM GEAR
151	SPRING
152	KEY 6 X 6 X 15 DRE
153	COUPLING
154	PLATE
155	SCREW - PAN HD M5-0.8 X 10
156	KNOB
157	SCREW- PAN HD M5-0.8 X 8
158	KEY DRE
159	HANDLE - LOCK
167	DRAWBAR 7/16-20 X 12 3/8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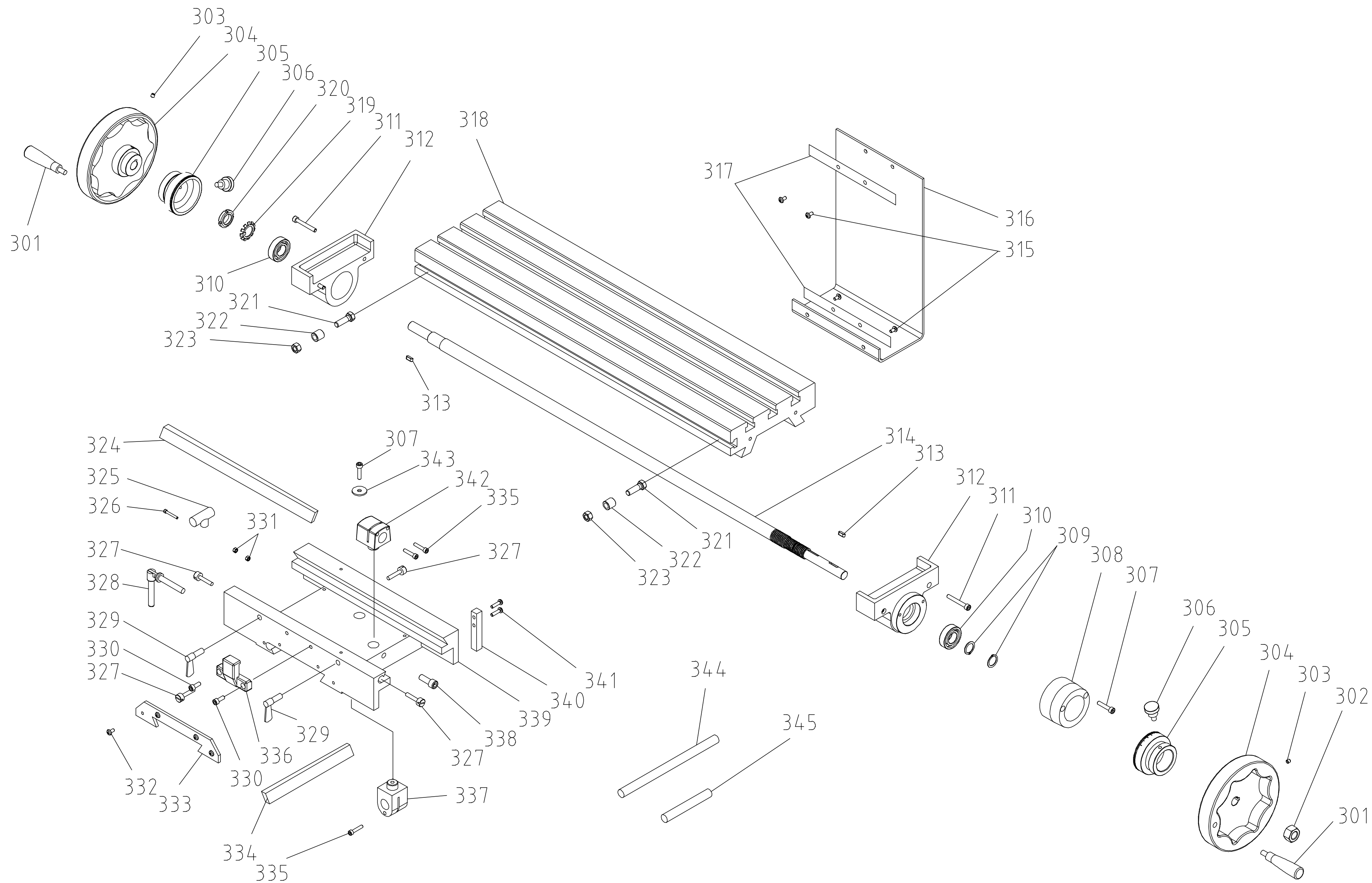
INDEX	DESCRIPTION
201	KEY 5 X 5 X 40 DRE
202	V-BELT A32
203	SCREW - SET M6-1.0 X 8
204	MOTOR PULLEY
205	SCREW - CAP M8-1.25 X 20
206	WASHER - FLAT M8
207	MOTOR
208	BOLT - HEX HD M16- X 75
209	NUT - HEX M16-
210	BRACKET
211	BOLT - HEX HD 1/2- X 1 1/2
212	WASHER - LOCK 1/2
213	NUT - HEX 1/2-
214	BOLT - HEX HD 1/2- X 1 3/4
215	MOUNTING PLATE
216	PIVOT
217	VERTICAL HEAD ADAPTER
218	UPPER BELT COVER
219	KNOB
220	C-RING INT M35
222	BEARING 6202ZZ
223	PULLEY PIVOT STUD
224	PULLEY
225	LOWER BELT COVER
226	SCREW - M6-1.0 X 35
227	WASHER - FLAT M6
228	LATCH
229	SCREW - PAN HD M3-0.5 X 8
230	SCREW - PAN HD M5-0.8 X 8
231	NUT - M5-0.8
232	COVER SUPPORTING ARM
233	SCREW - PAN HD M5-0.8 X 10
234	COVER HINGE
235	V-BELT A35
236	PULLEY - SWIVEL
237	SWIVEL STUD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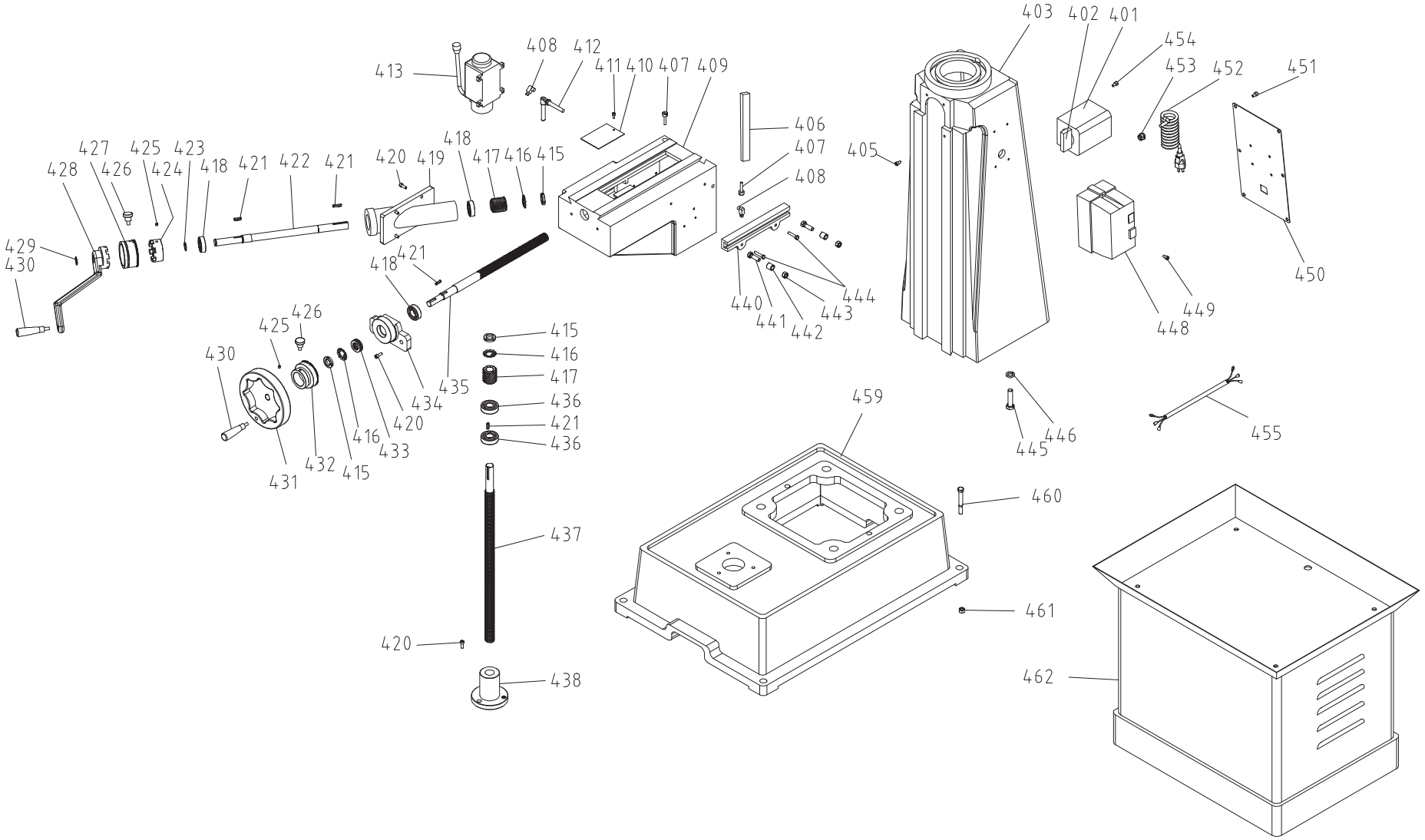
INDEX	DESCRIPTION
301	HANDLE
302	NUT - 5/8
303	SCREW - SET M6-1.0 X 8
304	HANDLE
305	DIAL
306	SCREW - (DIAL POSITIONING)
307	SCREW - CAP M6-1.0 X 25
308	SPACER
309	S-RING 20
310	BEARING 6004ZZ
311	SCREW - CAP M6-1.0 X 45
312	LEAD SCREW BRACKET (R)
313	KEY M5 X 5 X 20 DRE
314	LONG LEAD SCREW
315	SCREW - PAN HD M6-1.0 X 8
316	RUBBER SHEET
317	RUBBER SHEET HOLDER
318	TABLE
319	WASHER - STAR
320	NUT
321	SCREW M10-1.5 X 30
322	SLEEVE
323	NUT - M10-1.5
324	GIB
325	LIMIT BLOCK
326	SCREW - PAN HD M5-0.8 X 30
327	ADJUSTING SCREW
328	HANDLE BAR
329	TABLE LOCKING SCREW
330	SCREW-CAP SOC HD M6-1.0X16
331	NUT M5-0.8
332	SCREW - PAN HD M5-0.8 X 10
333	RUBBER SHEET
334	GIB
335	SCREW-CAP SOC HD M5-0.8X25
336	LIMIT SEAT
337	CROSS NUT
338	SCREW-CAP SOC HD M8-.25X25
339	SADDLE
340	STOP BLOCK
341	SCREW - PAN HD M5-0.8 X 20
342	LONGITUDINAL NUT
343	WASHER - FLAT M6
344	OIL TUBING L
345	OIL TUBING -R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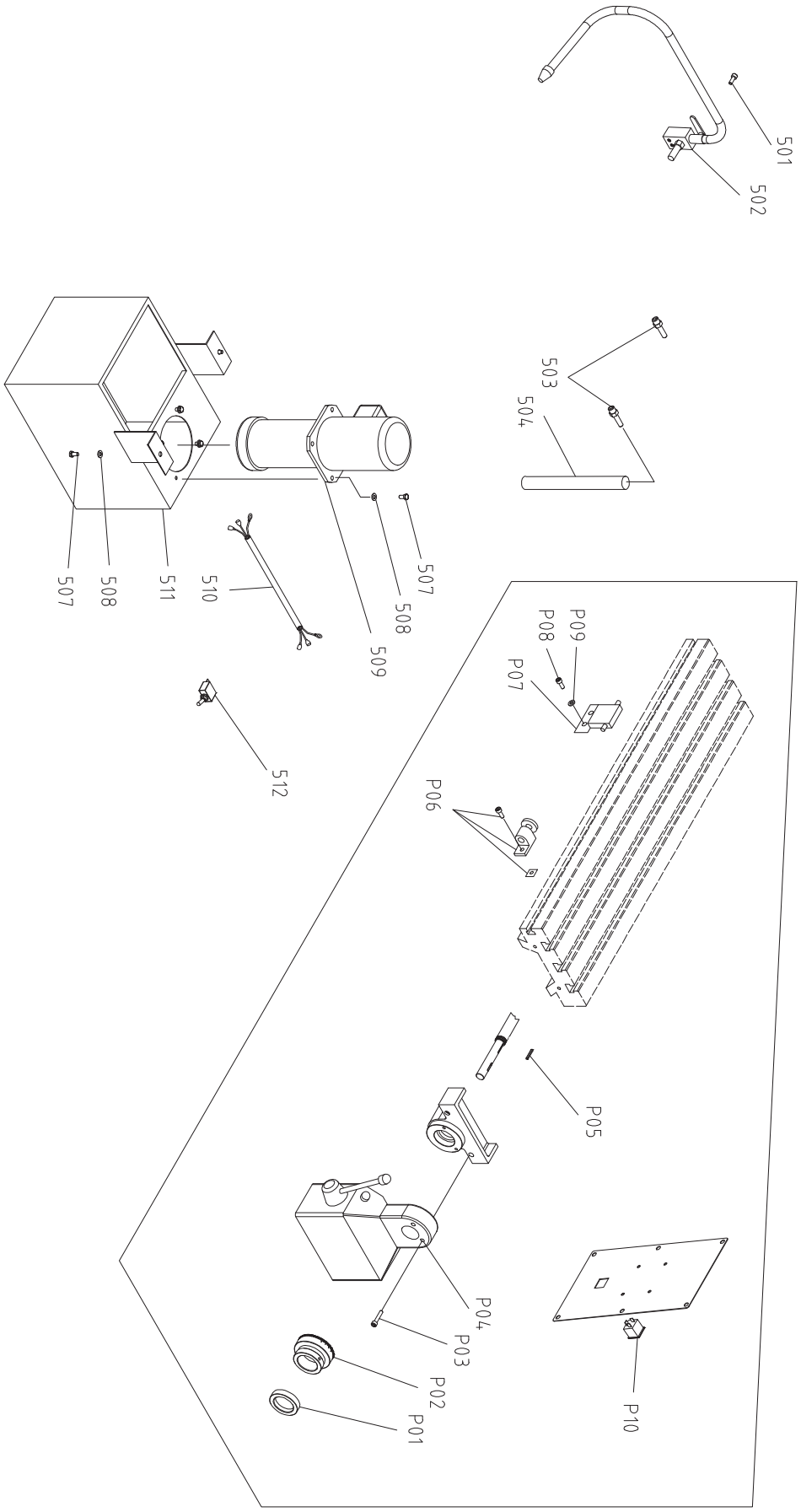
INDEX	DESCRIPTION
401	BAR BOX
402	FORW ARD/REVERSE SWITCH
403	COLUMN
405	SCREW - CAP SOC HD M6-1.0 X 8
406	GIB
407	SCREW
408	OIL JOINT
409	KNEE
410	KNEE COVER
411	SCREW - PAN HD M3-0.5 X 6
412	HANDLE BAR
413	OIL PUMP
415	NUT
416	WASHER - TAB
417	BEVEL GEAR
418	BEARING 6004ZZ
419	GEAR SHAFT SLEEVE
420	SCREW-CAP SOC HD M6-1.0X16
421	KEY M5 X 5 X 20 DRE
422	GEAR SHAFT
423	S-RING M20
424	COUPLING
425	SCREW - SET M6-1.0 X 8
426	DIAL POSITIONING SCREW
427	DIAL
428	CRANK ARM
429	S-RING 18
430	HANDLE
431	HANDLE WHEEL
432	DIAL
433	BEARING 51104
434	BEARING HOUSING
435	CROSS LEAD SCREW
436	BEARING 6204ZZ
437	LEAD SCREW
438	PEDESTAL
439	COVER
440	HOLDER
441	SCREW - CAP M10-1.5 X 30
442	SPACER
443	NUT - HEX M10-1.5
444	SCREW - CAP SOC HD M6-1.0X30
445	BOLT - HEX HD 1/2- X 2
446	WASHER - LOCK 1/2"
448	SWITCH
449	SCREW - PAN HD 3/16- 1/2
450	PLANE
451	SCREW - PAN HD M6-1.0 X 10
452	CORD
453	STRAIN RELIEF
454	SCREW - PAN HD 3/16- X 3/4
455	CORD
459	MACHINE BASE
460	HEX BOIT 3/8 X 2
461	HEX NUT 3/8
462	STAND

OPTIONAL PARTS



INDEX	DESCRIPTION
501	SCREW - PAN HD M5-0.8 X 15
502	NOZZLE HOSE
503	PIPE UNION
504	HOSE
507	SCREW - PAN HD M6-1.0 X 15
508	WASHER - FLAT M6
509	PUMP MOTOR
510	PUMP CORD
511	KETTLE
512	SWITCH
P01	NUT - SET
P02	DIAL
P03	SCREW - CAP M6-1.0 X 25
P04	POWER FEED
P05	KEY M3 X 3 X 30 DRE
P06	STOP W/ PLUNGER ASSY
P07	AUTO STOP SWITCH
P08	SCREW - PAN HD M6-1.0 X 16
P09	WASHER - FLAT M6
P10	TRANSFORMER

WARRANTY

CRAFTEX 3 YEARS LIMITED WARRANTY

Craftex warrants every product to be free from defects in materials and agrees to correct such defects where applicable. This warranty covers **three years** for parts and 90 days for labor (unless specified otherwise), to the original purchaser from the date of purchase but does not apply to malfunctions arising directly or indirectly from misuse, abuse, improper installation or assembly, negligence, accidents, repairs or alterations or lack of maintenance.

***Proof of purchase is necessary*.**

All warranty claims are subject to inspection of such products or part thereof and Craftex reserves the right to inspect any returned item before a refund or replacement may be issued.

This warranty shall not apply to consumable products such as blades, bits, belts, cutters, chisels, punches etceteras.

Craftex shall in no event be liable for injuries, accidental or otherwise, death to persons or damage to property or for incidental contingent, special, or consequential damages arising from the use of our products.

RETURNS, REPAIRS AND REPLACEMENTS

To return, repair, or replace a Craftex product, you must visit the appropriate Busy Bee Tools showroom or call 1-800-461-BUSY. Craftex is a brand of equipment that is exclusive to Busy Bee Tools.

For replacement parts directly from Busy Bee Tools, for this machine, please call 1-800-461-BUSY (2879), and have your credit card and part number handy.

- All returned merchandise will be subject to a minimum charge of 15% for re-stocking and handling with the following qualifications.
- Returns must be pre-authorized by us in writing.
- We do not accept *collect* shipments.
- Items returned for warranty purposes must be insured and shipped pre-paid to the nearest warehouse
- Returns must be accompanied with a copy of your original invoice as proof of purchase. Returns must be in an un-used condition and shipped in their original packaging a letter explaining your reason for the return. Incurred shipping and handling charges are not refundable.
- Busy Bee will repair or replace the item at our discretion and subject to our inspection.
- Repaired or replaced items will be returned to you pre-paid by our choice of carriers.
- Busy Bee reserves the right to refuse reimbursement or repairs or replacement if a third party without our prior authorization has carried out repairs to the item.
- Repairs made by Busy Bee are warranted for 30 days on parts and labour.
- Any unforeseen repair charges will be reported to you for acceptance prior to making the repairs.
- The Busy Bee Parts & Service Departments are fully equipped to do repairs on all products purchased from us with the exception of some products that require the return to their authorized repair depots. A Busy Bee representative will provide you with the necessary information to have this done.
- For faster service it is advisable to contact the nearest Busy Bee location for parts availability prior to bringing your product in for repairs.