

CE

# KM3000

## KEY MILL MACHINE OPERATING MANUAL

ORIGINAL INSTRUCTIONS



 **CLIMAX**  
Portable Machining & Welding Systems

P/N 16325  
May 2019  
Revision 10

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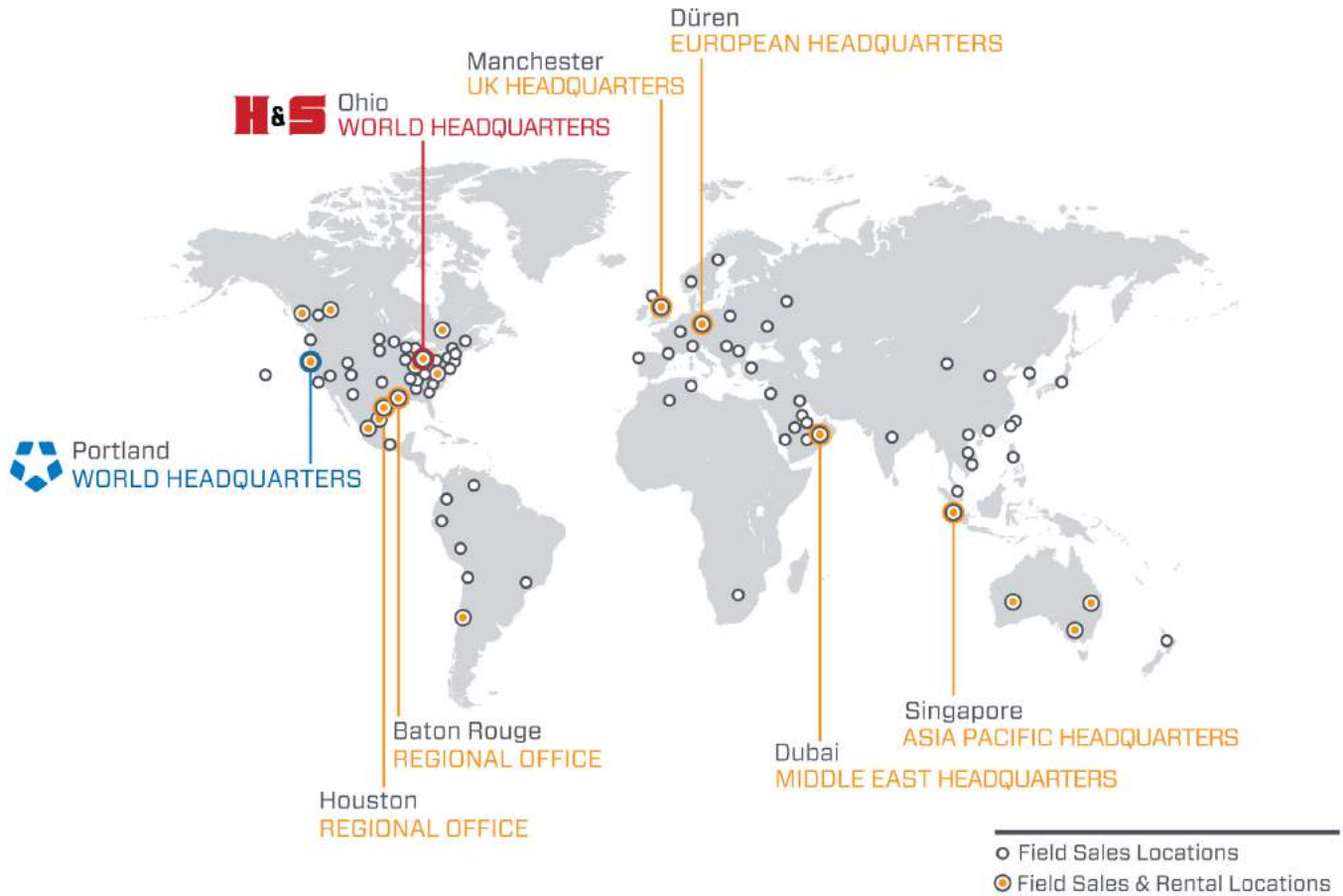
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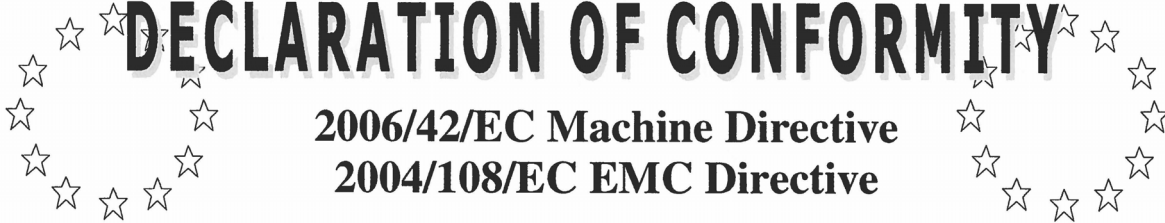
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## Description of product

Portable Key Mill Machine

## Name, type or model, batch or serial number

KM3000 & KM4000

Serial Number Range 14001731 - 20000000

## Standards used, including number, title, issue date and other relative documents

EN ISO 3744:2010, EN ISO 4413:2010, EN ISO 4414:2010, EN ISO 11201:2010, EN ISO 12100:2010, EN 13128:2001+A2:2009, EN ISO 13732-1:2008, EN ISO 13849-1:2008, EN ISO 13849-2:2008, EN ISO 13857:2008, EN 55011:2009, EN 60204-1:2006

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## Declaration

I declare that as the Manufacturer, the above information in relation to the supply / manufacture of this product, is in conformity with the stated standards and other related documents following the provisions of the above Directives and their amendments.

Signature of Manufacturer: 

Position Held: Engineering Team Leader

Date: 13 OCT 2014



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CLIMAX Portable Machine Tools, Inc. (hereafter referred to as “CLIMAX”) warrants that all new machines are free from defects in materials and workmanship. This warranty is available to the original purchaser for a period of one year after delivery. If the original purchaser finds any defect in materials or workmanship within the warranty period, the original purchaser should contact its factory representative and return the entire machine, shipping prepaid, to the factory. CLIMAX will, at its option, either repair or replace the defective machine at no charge and will return the machine with shipping prepaid.

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- Damage caused by unauthorized machine modification or repair
- Damage caused by machine abuse
- Damage caused by using the machine beyond its rated capacity

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# 1 INTRODUCTION

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## 1.1 HOW TO USE THIS MANUAL

This manual describes information necessary for the setup, operation, maintenance, storage, shipping, and decommissioning of the KM3000.

The first page of each chapter includes a summary of the chapter contents to help you locate specific information. The appendices contain supplemental product information to aid in setup, operation, and maintenance tasks.

Read this entire manual to familiarize yourself with the KM3000 before attempting to set it up or operate it.

## 1.2 SAFETY ALERTS

Pay careful attention to the safety alerts printed throughout this manual. Safety alerts will call your attention to specific hazardous situations that may be encountered when operating this machine.

Examples of safety alerts used in this manual are defined here<sup>1</sup>:

### **DANGER**

indicates a hazardous situation which, if not avoided, **WILL** result in death or severe injury.

### **WARNING**

indicates a hazardous situation which, if not avoided, **COULD** result in death or severe injury.

1. For more information on safety alerts, refer to *ANSI/NEMA Z535.6-2011, Product safety Information in Product Manuals, Instructions, and Other Collateral Materials*.

---

 **CAUTION**

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

**NOTICE**

indicates a hazardous situation which, if not avoided, could result in property damage, equipment failure, or undesired work results.

---

## 1.3 GENERAL SAFETY PRECAUTIONS

CLIMAX leads the way in promoting the safe use of portable machine tools and valve testers. Safety is a joint effort. You, the end user, must do your part by being aware of your work environment and closely following the operating procedures and safety precautions contained in this manual, as well as your employer's safety guidelines.

Observe the following safety precautions when operating or working around the machine.

**Training** – Before operating this or any machine tool, you should receive instruction from a qualified trainer. Contact CLIMAX for machine-specific training information.

**Risk assessment** – Working with and around this machine poses risks to your safety. You, the end user, are responsible for conducting a risk assessment of each job site before setting up and operating this machine.

**Intended use** – Use this machine in accordance with the instructions and precautions in this manual. Do not use this machine for any purpose other than its intended use as described in this manual.

**Personal protective equipment** – Always wear appropriate personal protective gear when operating this or any other machine tool. Flame-resistant clothing with long sleeves and legs is recommended when operating the machine. Hot chips from the workpiece may burn or cut bare skin.

**Work area** – Keep the work area around the machine clear of clutter. Restrain cords and hoses connected to the machine. Keep other cords and hoses away from the work area.

**Lifting** – Many CLIMAX machine components are very heavy. Whenever possible, lift the machine or its components using proper hoisting equipment and rigging. Always use designated lifting points on the machine. Follow lifting instructions in the setup procedures of this manual.

**Lock-out/tag-out** – Lock-out and tag-out the machine before performing maintenance.

**Moving parts** – CLIMAX machines have numerous exposed moving parts

and interfaces that can cause severe impact, pinching, cutting, and other injuries. Except for stationary operating controls, avoid contact with moving parts by hands or tools during machine operation. Remove gloves and secure hair, clothing, jewelry, and pocket items to prevent them from becoming entangled in moving parts.

**Sharp edges** – Cutting tools and workpieces have sharp edges that can easily cut skin. Wear protective gloves and exercise caution when handling a cutting tool or workpiece.

**Hot surfaces** – During operation, motors, pumps, HPUs, and cutting tools can generate enough heat to cause severe burns. Pay attention to hot surface labels, and avoid contact with bare skin until the machine has cooled.

---

## 1.4 MACHINE-SPECIFIC SAFETY PRECAUTIONS

**Eye hazard** – This machine produces metal chips during operation. Always wear eye protection when operating the machine.

**Sound level** – This machine produces potentially harmful sound levels. Hearing protection is required when operating this machine or working around it.

**Hazardous environments** – Do not operate the machine in environments where potentially explosive materials, toxic chemicals, or radiation may be present.

**Machine mounting** – Do not operate the machine unless mounted to a workpiece in accordance with this manual. If mounting the machine in an overhead or vertical position, do not remove hoist rigging until the machine is mounted to the workpiece in accordance with this manual.

---

## 1.5 RISK ASSESSMENT AND HAZARD MITIGATION

Machine Tools are specifically designed to perform precise material-removal operations.

Stationary Machine Tools include lathes and milling machines and are typically found in a machine shop. They are mounted in a fixed location during operation and are considered to be a complete, self-contained machine. Stationary Machine Tools achieve the rigidity needed to accomplish material-removal operations from the structure that is an integral part of the machine tool.

In contrast, Portable Machine Tools are designed for on-site machining applications. They typically attach directly to the workpiece itself, or to an adjacent structure, and achieve their rigidity from the structure to which it is attached. The design intent is that the Portable Machine Tool and the structure to which it is attached become one complete machine during the material-removal process.

To achieve the intended results and to promote safety, the operator must understand and follow the design intent, set-up, and operation practices that are unique to Portable Machine Tools.

The operator must perform an overall review and on-site risk assessment of the intended application. Due to the unique nature of portable machining applications, identifying one or more hazards that must be addressed is typical.

When performing the on-site risk assessment, it is important to consider the Portable Machine Tool and the workpiece as a whole.



## 1.6 RISK ASSESSMENT CHECKLIST

The following checklist is not intended to be an all inclusive list of things to watch out for when setting up and operating this Portable Machine Tool. However, these checklists are typical of the types of risks the assembler and operator should consider. Use these checklists as part of your risk assessment:

**TABLE 1-1. RISK ASSESSMENT CHECKLIST BEFORE SET-UP**

<b>Before set-up</b>	
<input type="checkbox"/>	I took note of all the warning labels on the machine.
<input type="checkbox"/>	I removed or mitigated all identified risks (such as tripping, cutting, crushing, entanglement, shearing, or falling objects).
<input type="checkbox"/>	I considered the need for personnel safety guarding and installed any necessary guards.
<input type="checkbox"/>	I read the machine assembly instructions (Section 3).
<input type="checkbox"/>	I created a lift plan, including identifying the proper rigging, for each of the setup lifts required during the setup of the support structure and machine.
<input type="checkbox"/>	I located the fall paths involved in lifting and rigging operations. I have taken precautions to keep workers away from the identified fall path.
<input type="checkbox"/>	I considered how this machine operates and identified the best placement for the controls, cabling, and the operator.
<input type="checkbox"/>	I evaluated and mitigated any other potential risks specific to my work area.

**TABLE 1-2. RISK ASSESSMENT CHECKLIST AFTER SET-UP**

<b>After set-up</b>	
<input type="checkbox"/>	I checked that the machine is safely installed (according to Section 3) and the potential fall path is clear. If the machine is installed at an elevated position, I checked that the machine is safeguarded against falling.
<input type="checkbox"/>	I identified all possible pinch points, such as those caused by rotating parts, and informed the affected personnel.
<input type="checkbox"/>	I planned for containment of any chips or swarf produced by the machine.
<input type="checkbox"/>	I followed the required maintenance checklist (Section 5.1) with the recommended lubricants (Section 5.2).
<input type="checkbox"/>	I checked that all affected personnel have the recommended personal protective equipment, as well as any site-required or regulatory equipment.
<input type="checkbox"/>	I checked that all affected personnel understand and are clear of the danger zone.
<input type="checkbox"/>	I evaluated and mitigated any other potential risks specific to my work area.

## 1.7 LABELS

The following warning and identification labels should be on your machine. If any are defaced or missing, contact CLIMAX immediately for replacements.

TABLE 1-3. KM3000 LABELS

	<p>P/N 59037</p> <p>Warning label: wear ear protection</p>		<p>P/N 59044</p> <p>Warning label: read the operating manual</p>
	<p>P/N 78741</p> <p>Warning label: wear steel-toed shoes</p>		<p>P/N 78748</p> <p>Label warning: wear eye protection</p>
	<p>P/N 78824</p> <p>Label warning: keep electrical cords away from water</p>		<p>P/N 79575</p> <p>Label warning: be cautious of moving parts</p>

## 2 OVERVIEW

### IN THIS CHAPTER:

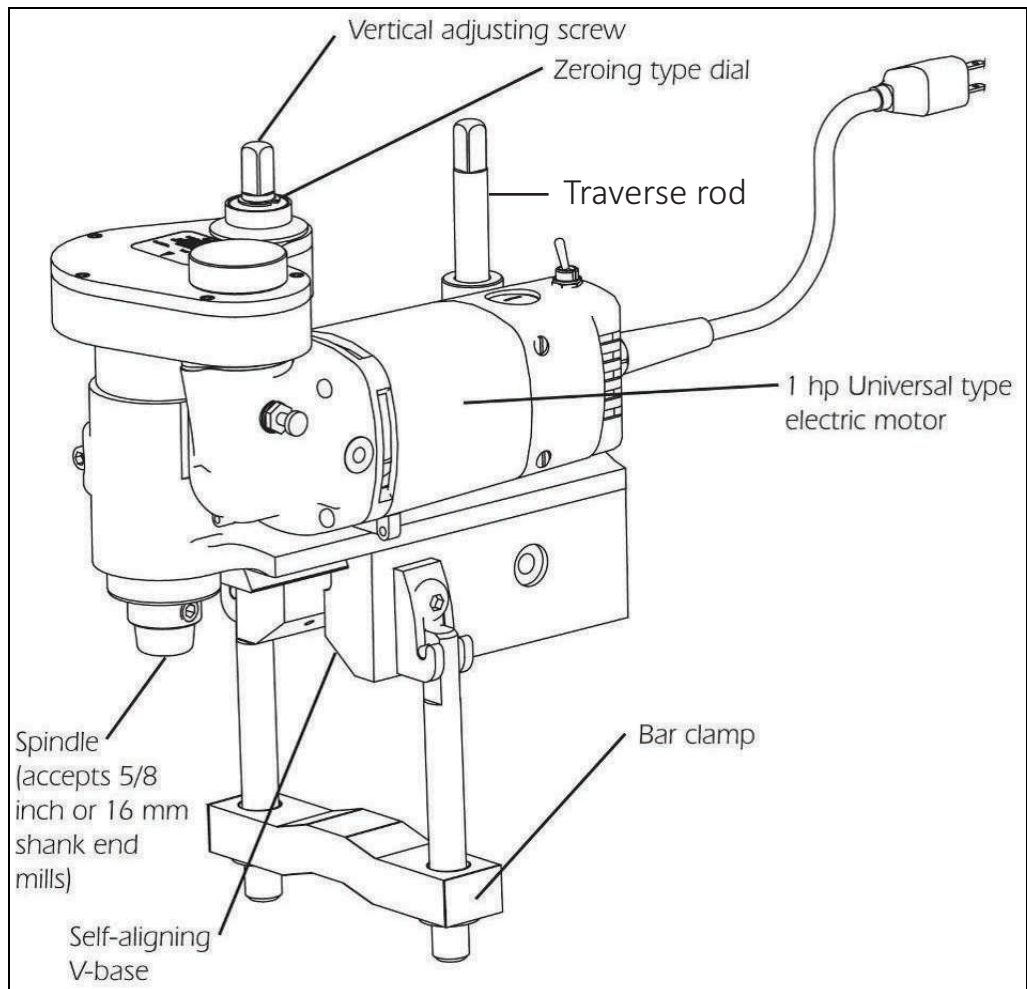
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## 2.1 FEATURES AND COMPONENTS

The KM3000 portable key mill machine is a simple, rugged, dependable machine tool designed to cut keyways in shafts without extensive dismantling. The automatically centering V-base is quick and easy to set up. The KM3000 clamps on any shaft up to 4.5" (114 mm) in diameter with the standard bar clamp. Cut stub-end keyways or mid-shaft keyways. Clamp the machine to a flat surface and you can cut motor mount slots. With the optional shim kit, you can cut keyways or slots in shafts as small as 0.75" (19 mm) in diameter.

The KM3000 key mill machine consists of the following:

- Slide assembly
- Leadscrew for traverse feed
- Gearbox (standard or hydraulic)
- Spindle and quill
- Vertical adjustment screw
- Motor (electric, air, or hydraulic)
- Speed controller



**FIGURE 2-1. COMPONENTS**

Features include the following:

- Compact, rugged, portable milling machine for on-site keyway and other milling jobs
- Self-centering and self-aligning V-base
- Standard Weldon-type spindle that accepts 5/8" (16 mm) shank end mills
- Zeroing-type vertical adjustment dial calibrated in 0.001" (0.0254 mm) increments
- Vertical and horizontal travel via hand crank
- Dovetail ways for accurate cutting action
- Precision ACME thread leadscrew with roller thrust bearings
- Sealed aluminum alloy gearbox permits operation at any angle
- Precision ground quill housing assures smooth operation
- The KM3000 key mill machine only needs 1.5" (38 mm) of shaft for clamping.

- The KM3000 clamps shafts up to 10.5" (266 mm) dia. with optional chain clamp
- Slotted V-base allows you to cut right to the end of the shaft
- Zeroing-type adjusting dial for controlling cutter depth

The KM3000 key mill machine is designed to mount onto shafts from 1.5–4.5" (38–114 mm) in diameter. An optional chain clamp extends its application to fit onto shafts up to 10.5" (267 mm) in diameter. To fit shafts as small as 0.75" (19.1 mm) diameter, an optional shim kit is available. Stub shafts as short as 1.5" (38.1 mm) clamping length can be held securely. Keyways up to 1.25 (32 mm) wide and 6.25" (159 mm) long are cut in just a single pass.

## 2.2 CONTROLS

The KM3000 is available in electric, pneumatic and hydraulic versions.

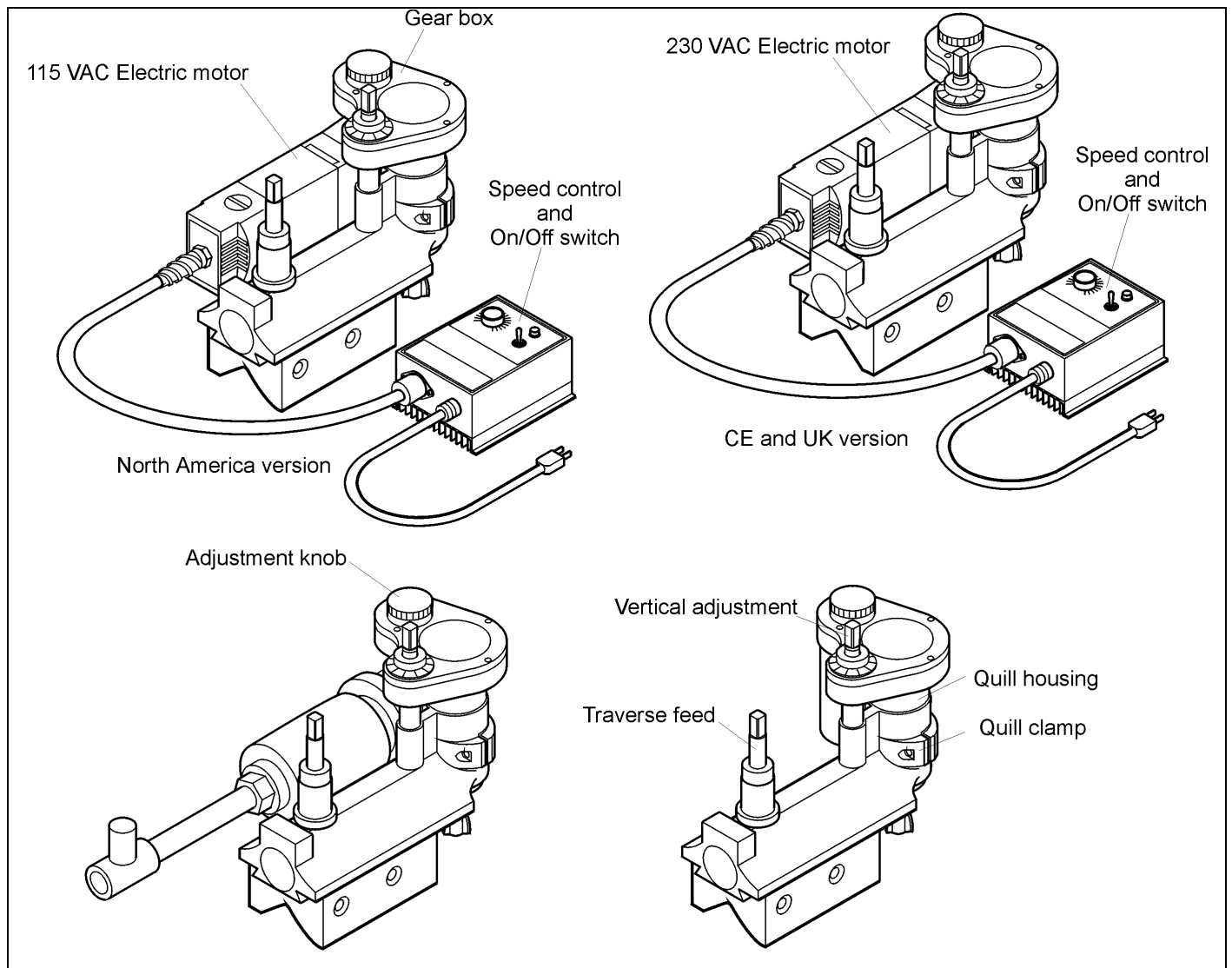


FIGURE 2-2. KM3000 POWER OPTIONS

## 2.2.1 Pneumatic power

Figure B-1 on page 85 shows the pneumatic schematic.

TABLE 2-1. PNEUMATIC SPECIFICATIONS

Maximum working pressure:	90 psi (6.2 Bar)
Working temperature range:	27–150°F (-3–65°C)
Flow rate:	48 SCFM (1.36 m <sup>3</sup> /min)
Maximum allowable motor speed:	1,100 RPM

### CAUTION

The motor must be operated with sufficient load to prevent speed from exceeding maximum allowable speed.

Adjust the speed by turning the needle valve (see Figure 2-3).

### CAUTION

Avoid damaging the air motor and voiding your warranty by routing incoming air through the filter and lubricator.

For machines with air motors, if the machine stops moving unexpectedly, lock out the pneumatic safety valve located at the filter lubricator assembly before performing any troubleshooting.

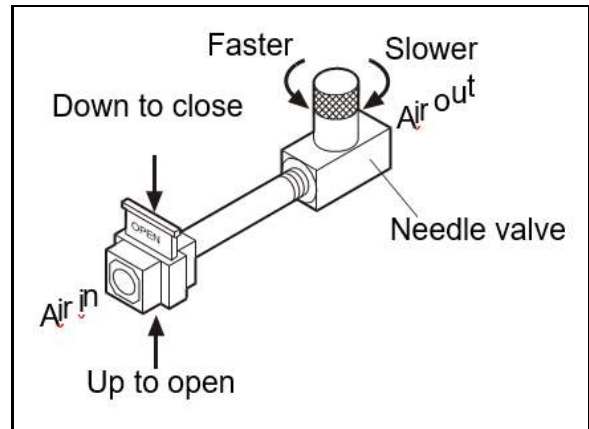


FIGURE 2-3. NEEDLE VALVE

## 2.2.2 Hydraulic power

Table 2-2 on page 11 lists operating specifications of the hydraulically powered version of the KM3000 using standard mineral-based hydraulic oil.

### CAUTION

A hydraulically powered KM3000 operating with flame retardant, water/glycol-based hydraulic fluid has operating specifications different from those listed below. Consult the hydraulic fluid manufacturer data for operating specifications.

TABLE 2-2. HYDRAULIC SPECIFICATIONS

Maximum working pressure:	2,050 psi (140 bar)
Working temperature range:	27–154°F (-3–65°C)
Flow rate:	21 L/min

Figure B-2 on page 85 shows the hydraulic schematic.

The hydraulic power unit (HPU) is an electrically-driven piston pump with horizontally mounted high-torque motor. Separate documentation detailing the HPU is available with the HPU.

**CAUTION**

To avoid damaging the power unit pump, connect the hydraulic motor to the power unit before turning it on.

The end mill turning direction on a hydraulically powered KM3000 depends on hydraulic line connections (see Figure 2-4).

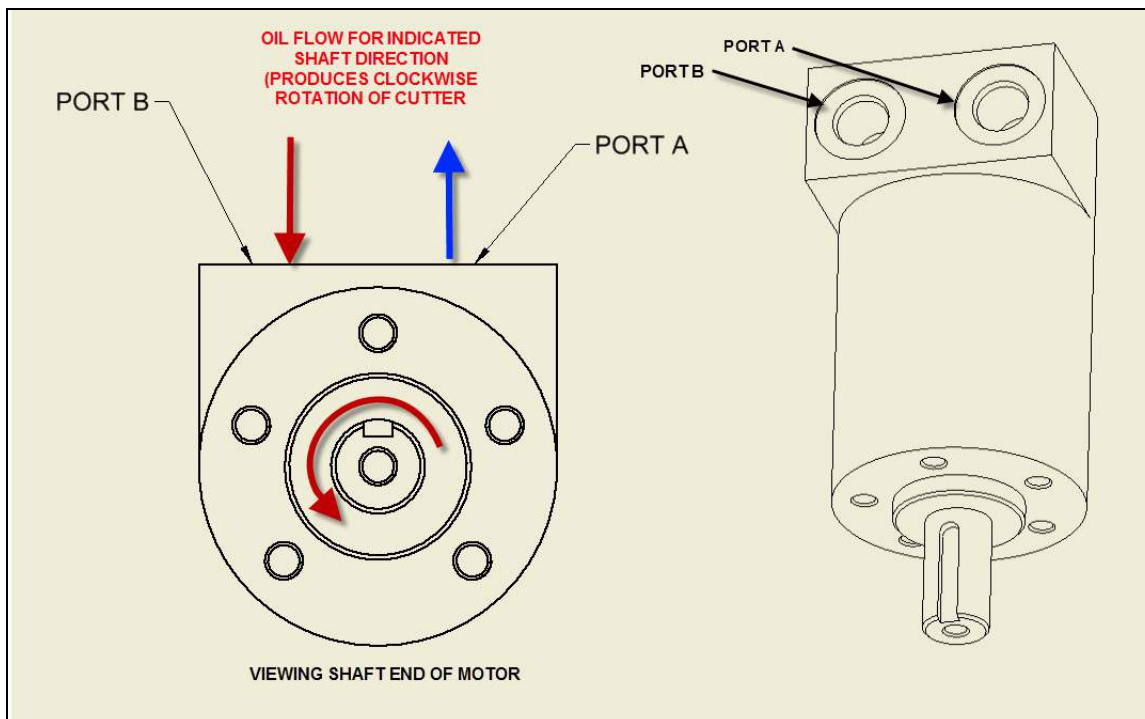


FIGURE 2-4. HPU CONNECTIONS

---

## **2.3 DIMENSIONS**

Figure 2-5 on page 13 show the machine and operating dimensions.



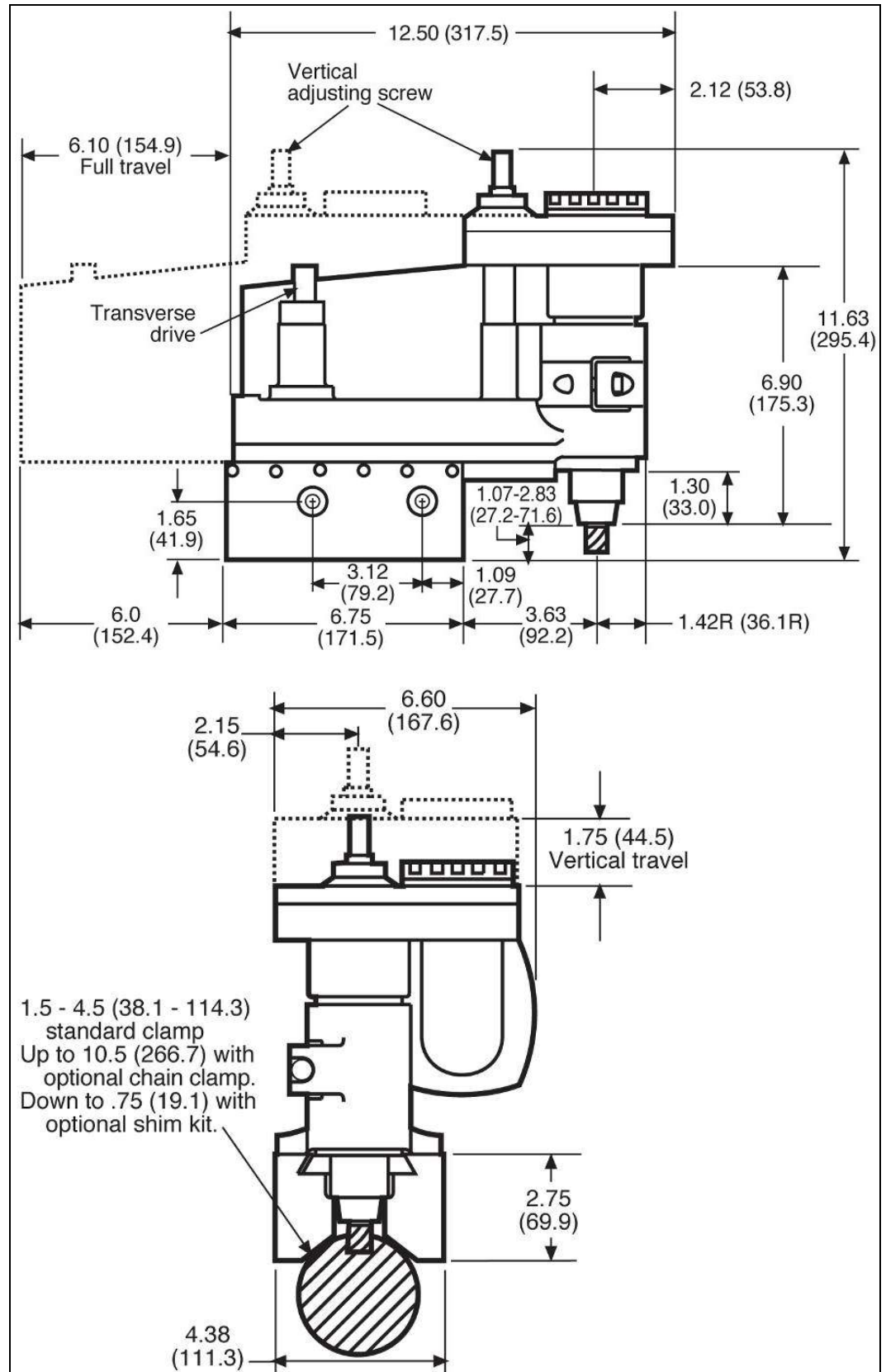


FIGURE 2-5. DIMENSIONS

## 2.4 SPECIFICATIONS

TABLE 2-3. SPECIFICATIONS

<b>Overall length:</b>	12.50" (317.5 mm)
<b>Overall width:</b>	6.6" (167.6 mm)
<b>Overall height:</b>	11.63" (295.4 mm)
<b>Base size:</b>	4.38" x 6.75" (111.3 x 171.5 mm)
<b>Stroke (slide travel) maximum:</b>	6" (152.4 mm)
<b>Vertical travel maximum:</b>	1.75" (44.5 mm)
<b>Electric power:</b>	115 V or 230 V, 50-60 Hz. 1 hp 0.75 kW
<b>Hydraulic power:</b>	4.7 hp 3.50 kW (other options available)
<b>Pneumatic power:</b>	1.2 hp 0.9 kW
<b>Spindle hole diameter:</b>	0.625" (16 mm)
<b>Maximum end mill diameter:</b>	1.25" (31.75 mm)
<b>Metal removal rate in C1018 steel:</b>	1 in <sup>3</sup> /min (16.4 cm <sup>3</sup> /min*)
<b>Maximum shaft diameter (standard bar clamp):</b>	4.5" (114.3 mm)
<b>Maximum shaft diameter (with optional chain clamp):</b>	10.5" (266.7 mm)
<b>Minimum shaft diameter (with optional shim kit on rear clamp only)<sup>1</sup>:</b>	0.75" (19.1 mm)
<b>Minimum clamping space required on stub shaft:</b>	1.5" (38.1 mm)
<b>Minimum shaft diameter for rear clamp<sup>2</sup>:</b>	1.5" (38.1 mm)
<b>Minimum shaft diameter for front clamp:</b>	2.6" (66 mm)
<b>Machine weight (with speed control):</b>	70 lb (31.8 Kg)
<b>Shipping weight:</b>	82 lb (37.3 kg)
<b>Shipping size:</b>	13 x 14 x 20 in. (33 x 36 x 51 cm)

1. See notice below.

2. See notice below.

### NOTICE

If the front clamp is used on diameters smaller than 2.6" (66 mm), the machine will produce undesired work results.

CLIMAX electrical equipment is suitable for use in the physical environment and operating conditions specified below. When the physical environment or the operating conditions are outside those specified, consult CLIMAX before putting the electrical equipment into service.

**TABLE 2-4. ELECTRICAL SPECIFICATIONS**

<b>Mains voltage (AC):</b>	±10% of nominal
<b>Mains frequency (AC):</b>	±1% of nominal
<b>Mains harmonics:</b>	10% of RMS volts 2nd through 30th harmonic
<b>Voltage imbalance (3-phase supplies):</b>	2% maximum
<b>Voltage impulses:</b>	200% of nominal 1.5 milliseconds (ms) maximum duration
<b>Voltage interruption:</b>	3 ms maximum with 1 second between
<b>Voltage dip (brownout):</b>	20% of peak volts for 1 second maximum
<b>Voltage supplied from batteries:</b>	±10% of nominal
<b>Voltage interruption (DC):</b>	5 ms maximum
<b>Ambient temperature (operating):</b>	41–104°F (5–40°C)
<b>Ambient temperature (transport and storage):</b>	-13–131°F (-25–55°C)
<b>Relative humidity:</b>	20–95% non-condensing
<b>Altitude:</b>	6,600 ft (2,000 m)
<b>Contaminants:</b>	IP54 environment except for some motors and slip ring assemblies that are IP 20
<b>Available fault current:</b>	Not greater than that listed on the controls nameplate
<b>Vibration</b>	
<b>Pushbuttons:</b>	5g at 5–300 Hz
<b>Relays, contactors, and breakers:</b>	2g at 5–300 Hz
<b>Touchscreen HMI:</b>	1g at 9–150 Hz
<b>Servo amplifiers and PLC:</b>	1g at 9–150 Hz
<b>Physical shock (impact)</b>	
<b>Pushbuttons:</b>	30g for 18ms
<b>Relays, contactors, and breakers:</b>	6g for 11ms
<b>Touchscreen HMI:</b>	15g three times in X, Y, and Z
<b>Servo amplifiers and PLC:</b>	1g three times in X, Y, and Z

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# 3 SETUP

**IN THIS CHAPTER:**

3.1 RECEIPT AND INSPECTION - - - - -17

3.2 LIFTING AND RIGGING - - - - -18

3.3 END MILL SETUP - - - - -18

3.4 TYPICAL SHAFT MOUNTING - - - - -19

3.5 STUB-END MOUNTING - - - - -21

3.6 LARGE SHAFT MOUNTING - - - - -21

3.7 SMALL SHAFT MOUNTING - - - - -22

3.8 BENCH VISE MOUNTING - - - - -22

3.9 HORIZONTAL FEED - - - - -22

3.10 VERTICAL ADJUSTMENT - - - - -23

This section describes the setup and assembly procedures for the KM3000 key mill machine.

## 3.1 RECEIPT AND INSPECTION

Your CLIMAX product was inspected and tested prior to shipment, and packaged for normal shipment conditions. CLIMAX does not guarantee the condition of your machine upon delivery.

When you receive your CLIMAX product, perform the following receipt checks:

1. Inspect the shipping containers for damage.
2. Check the contents of the shipping containers against the included invoice to make sure that all components have been shipped.
3. Inspect all components for damage.

Contact CLIMAX immediately to report damaged or missing components.

**NOTICE**

Keep the shipping container and all packing materials for future storage and shipping of the machine.

The machine ships from CLIMAX with a heavy coating of LPS 3. The recommended cleaner is LPS PreSolve Orange Degreaser. All parts must be cleaned before use.

---

## 3.2 LIFTING AND RIGGING

The KM3000 can be lifted from its crate by hand or using a strap fed underneath the gearbox between the quill and the vertical adjustment shaft, as shown in Figure 3-1 on page 18.



FIGURE 3-1. LIFTING FROM THE CRATE USING A STRAP

---

## 3.3 END MILL SETUP

### **WARNING**

Avoid serious personal injury by disconnecting the power source before setting up or adjusting the machine.

Do the following:

1. With the power source off and disconnected, loosen the end mill socket set-screw in the spindle.

2. Insert an end mill into the spindle with its flat aligned to the locking setscrew (see Figure 3-2).

**TIP:**

Degrease and thoroughly dry any collet used to hold small end mills.

3. While turning the vertical adjustment screw to raise or lower the quill housing, adjust the quill clamp to allow enough friction to hold the housing without preventing its travel.

When making a heavy cut, tighten the quill clamping screw securely after setting the end mill to the desired depth. Loosen the clamping screws before retracting the end mill.

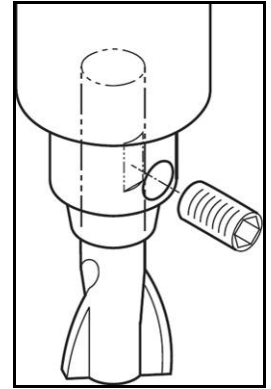


FIGURE 3-2. INSERTING AN  
END MILL

## 3.4 TYPICAL SHAFT MOUNTING

With the top slide fully engaged on the base, tighten each gib screw until there is noticeable drag on the slide then back off the setscrew slightly. Repeat until all gib screws are set.

Do the following:

1. Using the rearmost mounting holes, secure the key mill to the shaft with clamp blocks.

**TIP:**

A key mill with the bar clamp attached nearer the rear of the base is the most rigid setup and gives the best results (see Figure 3-3).

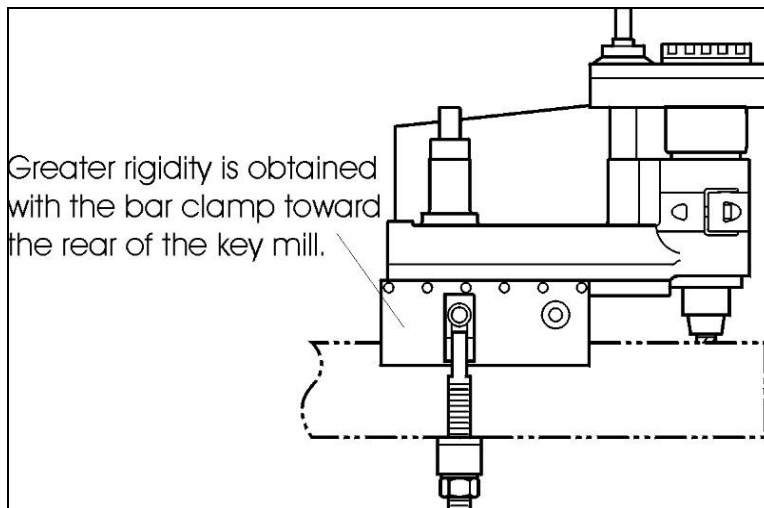


FIGURE 3-3. BAR CLAMP TO REAR OF BASE

2. Hook the clamp bolt assembly over the clamp blocks.
3. Level the machine. Place a precision level on the upper surface of the base to check that the machine is truly horizontal about the axis of the shaft. This is especially important when more than one in-line keyway or multiple axially spaced keyways will be cut.
4. Secure the key mill evenly to the shaft by alternating the tightening of one bar clamp nut then the other.
5. Start tightening at 20 ft-lbs (27.2 Nm) of torque. Torque the clamps evenly in 10 ft-lb (13.6 Nm) increments.

 **CAUTION**

To avoid damaging the clamp bar do not tighten the clamps over 60 ft-lbs (81.6 Nm.)



### 3.5 STUB-END MOUNTING

The mounting base of the key mill can extend beyond the end of a shaft provided the bar clamp is inboard not less than 1.5" (38 mm). See Figure 3-4

Do the following:

1. Set the key mill with the mounting base extending over the end of the shaft. The main spindle will be inward from the end of the shaft.
2. With the bar clamp close to the end of the shaft, proceed setting up as described in Section 3.4 on page 19.

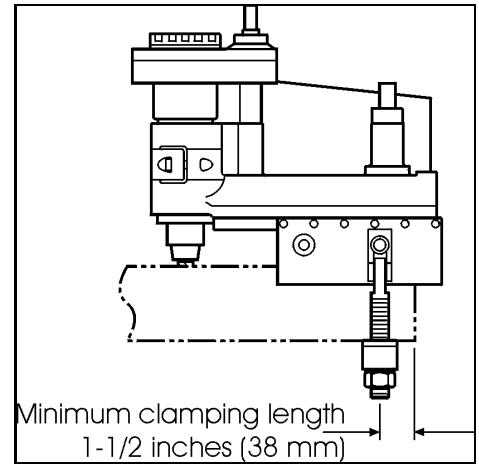


FIGURE 3-4. STUB END MOUNTING

### 3.6 LARGE SHAFT MOUNTING

Using the optional chain clamp assembly, shafts up to 10.5" (267 mm) in diameter can be milled.

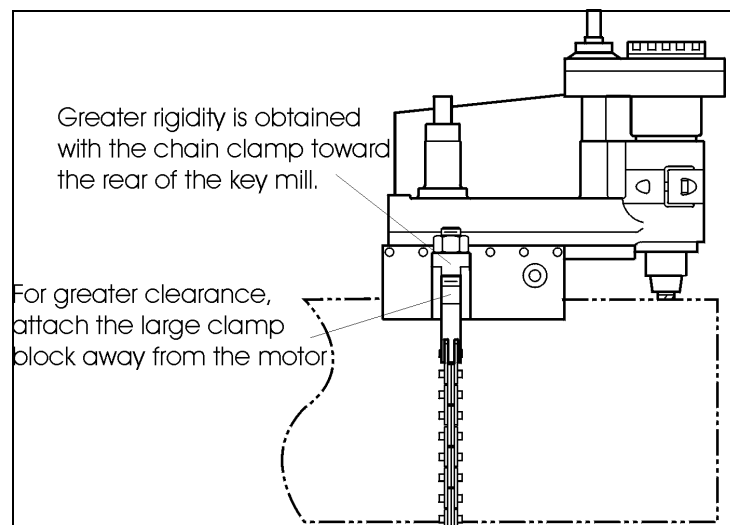


FIGURE 3-5. LARGE SHAFT MOUNTING

Proceed as described in Section 3.4 on page 19.

Do the following:

1. Hook the chain onto the small clamp block.
2. Set the rocker onto the large clamp block.

3. Insert the end of the chain into the end of the chain clamp bolt. Insert the pin to hold the chain in place.
4. Set the rocker on the large clamp block.
5. Wrap the chain and bolt around the shaft. Insert the chain clamp bolt, threaded end up, into the clamp and rocker from the bottom.
6. Screw the nut onto the bolt. Tighten the nut until the chain securely holds the machine onto the shaft.

---

## 3.7 SMALL SHAFT MOUNTING

Using the rear clamping holes, mount the key mill onto shafts 0.75–1.5" (19–38 mm) diameter by placing a matched pair of spacers, or shims, extending the full length of the base at the edge of the throat.

If the shaft diameter is between 1.5–2.9" (38.1–73.7 mm), use the front mounting holes in the base. Make sure the shaft is in the open part of the throat only. If it extends into the rear or the base, it will not be aligned with the key mill.

A shim kit (P/N 11669) is available from your factory representative or by calling CLIMAX.

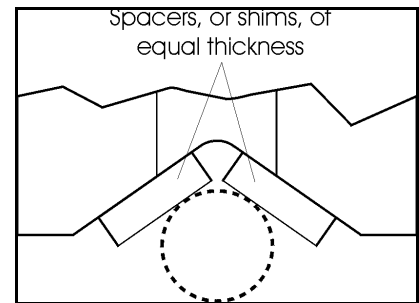


FIGURE 3-6. SMALL SHAFT MOUNTING

---

## 3.8 BENCH VISE MOUNTING

One available configuration is to clamp the key mill in a bench vise and use it as a stationary milling machine for small parts.

A few typical applications include:

- Slotting angle iron
- Slotting tubes
- Notching spanner nuts
- Slotting gear pullers

---

## 3.9 HORIZONTAL FEED

To feed horizontally, manually crank the key mill along the key way with the traverse hand feed. One turn of the hand crank will feed the top slide 0.067" (1.69 mm).

## 3.10 VERTICAL ADJUSTMENT

The vertical adjustment screw sets the depth of the end mill. Turning clockwise moves the end mill down; counterclockwise moves it up. The dial is graduated in 0.001" (.025 mm) increments.

### CAUTION

The key mill has a maximum vertical adjustment height of 1.75" (44 mm) from the bottommost position. Cranking the key mill above this height will cause the vertical adjustment jackscrew to unthread from the base.

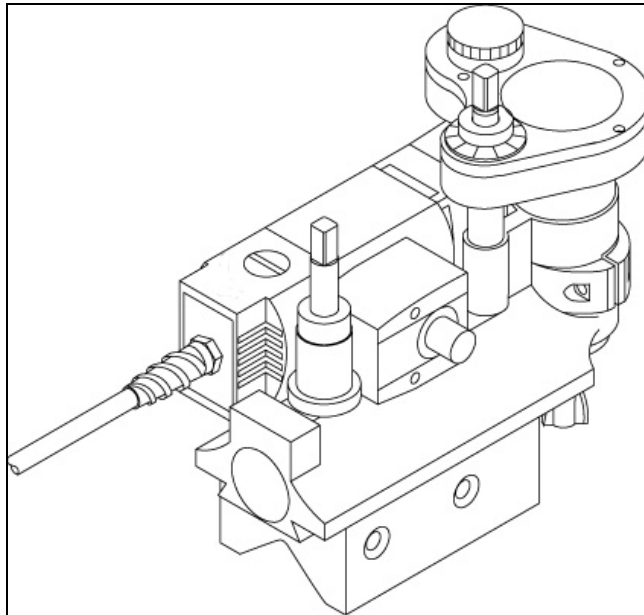


FIGURE 3-7. VERTICAL AND HORIZONTAL FEED CONFIGURATION

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# 4 OPERATION

## IN THIS CHAPTER:

4.1 PRE-OPERATION CHECKS	-25
4.2 OPERATION MODES	-25
4.2.1 ELECTRIC MACHINES	-26
4.2.2 PNEUMATIC MACHINE	-26
4.2.3 HYDRAULIC MACHINE	-27
4.3 SPECIAL REQUIREMENTS	-27
4.4 EXTENDED KEYWAYS	-28
4.5 AXIALLY SPACED KEYWAYS	-28
4.6 CROSS MILLING	-30

## 4.1 PRE-OPERATION CHECKS

Do the following checks before operating the machine:

- Complete the risk assessment checklist in Table 1-3 on page 5.
- Check that the work area is clear of non-essential personnel and equipment.
- Check that the machine control/observation area will not be in the path of hot flying chips during machine operation.
- Check the machine is securely mounted to the workpiece.
- Check that air hoses are routed and secured to avoid tripping, entanglement, damage from hot chips, or other damage should an air hose or connection fail.
- Check the tool condition and sharpness.
- Check all hand tools are removed from inside the machine and the work area.

## 4.2 OPERATION MODES

Aside from issues directly related to the power source, setup and operation of the different machine versions is essentially the same. In all cases, prior to installing or setting up the key mill, for your safety and protection, disconnect the power source.

### **CAUTION**

For machines with air motors, if the machine stops moving unexpectedly, lock out the pneumatic safety valve located at the filter lubricator assembly before performing any troubleshooting.

---

Always make a visual inspection of the entire machine paying particular attention to cables, hoses and their connectors, that they are clean and functional. Repair or replace any parts that show signs of wear or damage.

Mount the machine as described in Section 3.4 on page 19.

With the power source disconnected, move the machine around its entire travel range to ensure that it is free of obstacles.

 **CAUTION**

When the mill is set at an extreme angle, metal chips created from machining the workpiece can foul the leadscrew.

#### 4.2.1 Electric machines

 **CAUTION**

To avoid injury by shock or explosion, do not operate electric motors in damp or volatile conditions.

Do the following:

1. With the end mill properly mounted on the shaft, set the speed control to the desired spindle rpm.
2. Lower the end mill to cut a flat on the shaft equal to the diameter of the end mill.
3. Set the depth dial to zero. The dial is calibrated to move the spindle and end mill 0.100" (2.5 mm) per revolution.
4. Plunge the end mill by cranking the vertical adjustment clockwise until the end mill is at the required depth.
5. Operate the traverse drive to cut the full length of the keyway.
6. After the keyway has been cut, raise the end mill clear of the work piece.

#### 4.2.2 Pneumatic machine

With the end mill properly mounted on the shaft, do the following:

1. Check that the incoming air pressure is at 80 psi (5.5 bar).
2. Push the emergency stop lever down until the word CLOSED and the lockout can be seen from the bottom.
3. Turn the needle valve clockwise all the way. No colored bands will be visible when the valve is completely closed.
4. Connect the air supply line.
5. Press the emergency lever up until the word OPEN can be seen from the top of the valve. Check that the lever is pushed all the way.

6. Slowly turn the needle valve counterclockwise until the appropriate machine speed is reached. The more colored bands you see the faster the speed.
7. Lower the end mill to cut a flat on the shaft equal to the diameter of the end mill.
8. Set the depth dial to zero. The dial is calibrated to move the spindle and end mill 0.100" (2.5 mm) per revolution.
9. Plunge the end mill by turning the vertical adjustment clockwise until the end mill is at the required depth.
10. Operate the traverse drive to cut the full length of the keyway.
11. After the keyway has been cut, raise the end mill clear of the work.

### 4.2.3 Hydraulic machine

With the end mill properly mounted on the shaft, do the following:

1. Connect hoses for the hydraulic motor to the power unit.
2. Press START on the remote pendant to turn on the hydraulic power unit pump.
3. Jog the motor to be sure the pump is turning in the correct direction. Reverse the hoses if necessary.
4. Turn the hydraulic motor speed control knob on the HPU to set the motor speed (see Figure 4-1). Clockwise decreases motor speed; Counterclockwise increases speed.
5. Lower the end mill to cut a flat on the shaft equal to the diameter of the end mill.
6. Set the depth dial to zero. The dial is calibrated to move the spindle and end mill 0.100" (2.5 mm) per revolution.
7. Plunge the end mill by cranking the vertical adjustment clockwise until the end mill is at the desired depth.
8. Crank the traverse drive to cut the full length of the keyway.
9. After the keyway has been cut, raise the end mill clear of the workpiece.

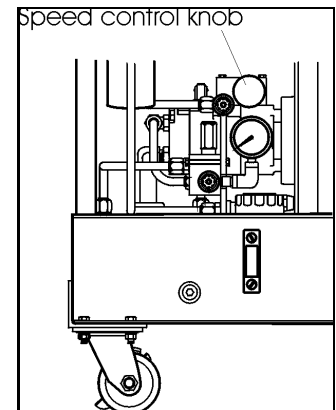


FIGURE 4-1. HPU SPEED CONTROL

## 4.3 SPECIAL REQUIREMENTS

Machining out-of-the-ordinary keyways and other exceptional on-site milling jobs are well within the scope of the KM3000. With just a little creativity, the KM3000 works well on almost any operation calling for the milling of slots, flats, elongated holes, or other like features.

---

## 4.4 EXTENDED KEYWAYS

Single keyways can be extended, or two or more keyways precisely aligned along the length of a shaft.

Do the following:

1. Secure the shaft so it will not rotate.
2. Mount the key mill to the shaft as described earlier in Mount the machine as described in Section 3.4 on page 19.
3. Cut the keyway.
4. Without disturbing the position of the shaft, remove the machine and reposition it some predetermined distance along the shaft in readiness for cutting a new keyway (or extending the first).

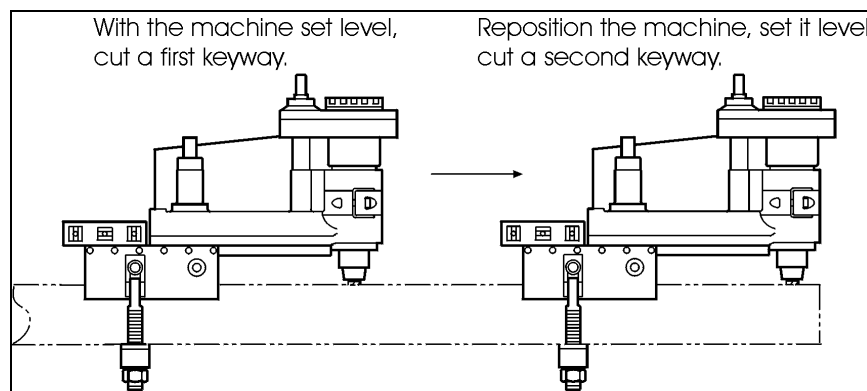


FIGURE 4-2. LONG OR ALIGNED KEYWAYS

5. Again, carefully level the key mill about the axis of the shaft.
6. Proceed with milling in the usual way.

### TIP:

If the machine is accurately leveled each time, the keyways will always be in line.

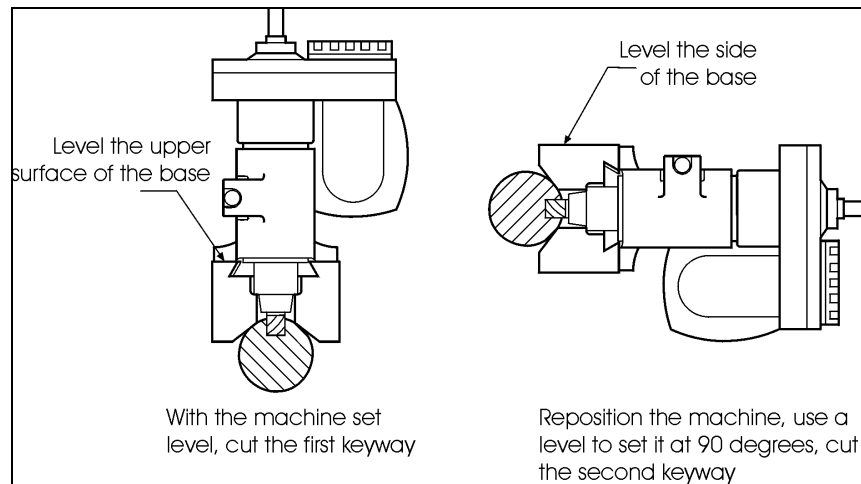
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## 4.5 AXIALLY SPACED KEYWAYS

Do the following:

1. Secure the shaft so it will not rotate.
2. Referring to Figure 8 below, mount the key mill on top of the shaft, setting it level as described in Section 3.4 on page 19.





**FIGURE 4-3. AXIALLY SPACED KEYWAYS**

3. Cut the keyway as described in Section 4.2 on page 25.
4. Reposition the machine to the side of the shaft. Place a level on the side of the base to verify the machine is 90° to the first keyway.
5. Cut the second keyway.

Do the following to cut keyways 120° apart:

1. Secure the shaft so it will not rotate.
2. Mount the key mill to the top of the shaft as described in Section 3.4 on page 19.
3. Cut the keyway as described in Section 4.2 on page 25.
4. Using an appropriate angle gauge or block, rotate the shaft 120°. Cut the second keyway.
5. Again, using an angle block, rotate the shaft 120°. Cut the third keyway.

Do the following to cut keyways 180° apart:

1. Set the key mill level on the side of the shaft. Cut the first keyway.
2. Position the key mill level on the other side of the shaft. Cut the second keyway.

---

## 4.6 CROSS MILLING

An optional adapter is specially designed to mill features perpendicular to the axis of the shaft. The self-centering adapter mounts easily on either side as well as either end of the base of the key mill.

Do the following to cross-mill a keyway:

1. Mount the adapter to the base of the key mill.
2. Set the key mill level on the shaft.
3. Secure the key mill to the shaft evenly by alternating tightening one bar clamp nut then the other.

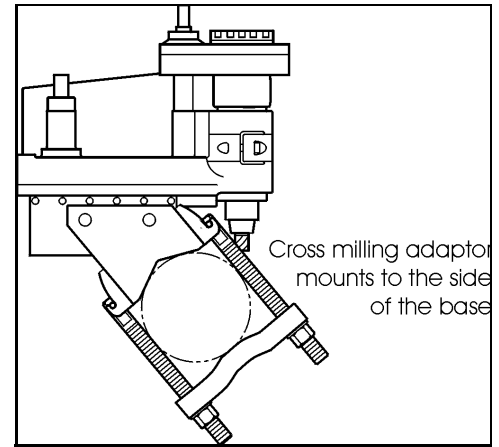


FIGURE 4-4. CROSS MILLING

# 5 MAINTENANCE

**IN THIS CHAPTER:**

- 5.1 MAINTENANCE CHECKLIST - - - - -31
- 5.2 APPROVED LUBRICANTS - - - - -32
- 5.3 MAINTENANCE TASKS - - - - -33
  - 5.3.1 SLIDE ASSEMBLY - - - - -33
  - 5.3.2 LEADSCREW - - - - -33
  - 5.3.3 BAR CLAMP - - - - -33
  - 5.3.4 VERTICAL ADJUSTMENT SCREW - - - - -33
  - 5.3.5 GEARBOX, SPINDLE, QUILL ASSEMBLY - - - - -34
  - 5.3.6 ATTACHING MOTOR - - - - -34
  - 5.3.7 ADJUSTING SCREW AND COVER - - - - -34
  - 5.3.8 ELECTRIC POWER SYSTEMS - - - - -35
  - 5.3.9 PNEUMATIC POWER SYSTEMS - - - - -35
  - 5.3.10 HYDRAULIC POWER SYSTEMS - - - - -36
    - 5.3.10.1 HYDRAULIC MOTOR - - - - -36
    - 5.3.10.2 HYDRAULIC FILTER AND FLUID - - - - -36

## 5.1 MAINTENANCE CHECKLIST

Table 5-1 lists maintenance intervals and tasks.

**TABLE 5-1. MAINTENANCE INTERVALS AND TASKS**

Interval	Task	Reference
<b>Before each use</b>	Lubricate the quill where it slides in the quill clamp with Jet Lube 550.	Section 5.3.5 on page 34
	Before operating the key mill, check the condition of the power cord. Replace or repair any damaged or worn parts.	Section 5.3.8 on page 35
	Fill the air lubricator oil cup with Marvel Air Tool Oil.	Section 5.3.9 on page 35
<b>Before and after each use</b>	Remove debris, oil, and moisture from machine surfaces.	--
	Clean and lubricate the dovetail ways	Section 5.3.1 on page 33
	Drain the air filter.	Section 5.3.9 on page 35
<b>During use</b>	Frequently brush chips away from the leadscrew.	Section 5.3.2 on page 33

**TABLE 5-1. MAINTENANCE INTERVALS AND TASKS**

Interval	Task	Reference
Periodically	Inspect the chain links and lightly coat with LPS1 or LPS2 to prevent corrosion.	Section 5.3.3 on page 33
	Lubricate the leadscrew.	Section 5.3.2 on page 33
	After 72 hours of operation, do the following: <ul style="list-style-type: none"> <li>• Replace the filter cartridge.</li> <li>• Check the heat exchanger for leaks.</li> <li>• Clean the filler/breather.</li> </ul>	Section 5.3.10 on page 36
	Repack the gearbox every 500 hours.	Section 5.3.5 on page 34
	Repack the gear case every six months or 500 hours with one ounce of gear grease.	Section 5.3.8 on page 35
	After 100 hours of operation, inspect the brushes.	Section 5.3.8 on page 35
	Check periodically that air pressure is 80 psi (5.5 bar.)	Section 5.3.9 on page 35

## 5.2 APPROVED LUBRICANTS

CLIMAX recommends using the following lubricants at the locations indicated. Failure to use the appropriate lubricants can result in damage and premature machine wear.

### NOTICE

Before servicing the machine with any of the lubricants in Table 5-2, consult the manufacturer's MSDS.

### CAUTION

Avoid damage, premature machine wear, and protect your warranty by using only approved lubricants.

**TABLE 5-2. APPROVED LUBRICANTS**

Lubricant	Brand	Application Area
Gear grease	Conoco Polytac EP 2	Gearbox gears, thrust bearings
Light oil	LPS1™ or LPS2™	Unpainted surfaces
Cutting oil	UNOCAL KOOLKUT	Tool bits, workpiece
Air tool oil	Ingersoll-Rand Pneu Lube Light oil no. 10	Air lubricator oil cup

TABLE 5-2. APPROVED LUBRICANTS

Lubricant	Brand	Application Area
Lubricant	Jet Lube 550	Cutting bit set screw in quill
Way oil	Mobil VACTRA #2 Heavy-Medium Way Oil	Dovetail ways
Hydraulic fluid	Mobil DTE-24	Hydraulic system Quill housing

 **WARNING**

Disconnect the machine from power before servicing the machine.

 **CAUTION**

Avoid damage to the machine and protect your warranty by using only approved lubricants.

## 5.3 MAINTENANCE TASKS

Maintenance tasks are described in the following sections.

### 5.3.1 Slide assembly

Clean and lubricate the dovetail ways (see Table 5-2 on page 32) before and after using the machine.

 **CAUTION**

Keep chips from interfering with gears, threads, and moving parts of the slide assembly.

### 5.3.2 Leadscrew

During operation, frequently brush chips away from the leadscrew. Lubricate the leadscrew from time to time.

### 5.3.3 Bar clamp

Periodically inspect the chain links and lightly coat with LPS1 or LPS2 to prevent corrosion.

### 5.3.4 Vertical adjustment screw

Lubricate the screw threads.

---

### 5.3.5 Gearbox, spindle, quill assembly

The gearbox is packed with Conoco Polytac EP 2 grease.

Every 500 hours, repack the gearbox by doing the following:

1. Remove the knob, crank handle, snap ring, finger spring washer, thrust washer, and dial.
2. Unscrew the 6 socket-head cap screws.
3. Remove the gearbox lid.
4. Pack gears with grease.
5. Attach quill with spindle to gearbox using six 10-32 x 5/8 screws.
6. Apply a thick bead of grease around spindle.
7. Using a hydraulic press, place gear on top of spindle.
8. Place a spacer (a washer with an ID of 1" [25 mm] and 0.125" [3.2 mm] thickness will work) on the gear.
9. Press the gear into the spindle. Once you start pressing, do not stop until it is completely inserted, or it may not fully enter.

#### NOTICE

The press must be capable of 5,000 psi (345 bar).

Before each use, lubricate the quill where it slides in the quill clamp with Jet Lube 550. The ball and roller bearings are sealed and lubricated for life.

### 5.3.6 Attaching motor

Do the following to attach the motor:

1. Remove the motor from the old gearbox.
2. Remove the adjusting knob from the motor by pressing in the lock on the motor and turning the knob counter-clockwise.
3. Use the chemical thread locker on the two screws that hold the motor to the gearbox. These may need to be heated up to break loose.
4. Install the motor to the new gearbox.
5. Use the chemical thread locker on the screws.
6. There should be at least a 0.015" (0.381 mm) gap between the teeth on the two gears.
7. Put a coat of grease over gears and in all crevices.

### 5.3.7 Adjusting screw and cover

Do the following to adjust the screw and cover:

1. Place the vertical adjusting lead screw into the gearbox.

2. Place the cover on the gearbox and screw down using six 8-32 x 5/8" screws.

## **NOTICE**

Do not over-tighten the screws.

3. Push the dial knob onto the vertical lead screw, followed by the spring washer, thrust washer and then the snap ring.
4. Place the adjusting knob on the motor.

### **5.3.8 Electric power systems**

Do the following to maintain the electric power systems:

- Repack the gear case every six months or 500 hours with one ounce of gear grease. Remove the gear case, being careful not to dislodge the armature. Do not dismantle the gears.
- After 100 hours of operation, inspect the brushes by doing the following:
  - a) Always replace brushes in sets.
  - b) Unscrew the retainer caps on the motor housing.
  - c) Pull out the retainer springs and brushes.
  - d) Replace brushes when they have worn down to 1/4" (6.4 mm).
- Before operating the key mill, check the condition of the power cord. Replace or repair any damaged or worn parts. Use only grounded, properly rated electrical outlets.

### **5.3.9 Pneumatic power systems**

Do the following to maintain the air motor:

- Route incoming air through a lubricator and filter.
- Use nonrestrictive air lines and fittings.
- Check periodically that air pressure is 80 psi (5.5 bar.)
- Adjust motor speed only by resetting the needle valve, not by changing in-line air pressure.
- Fill the air lubricator oil cup with Marvel Air Tool Oil before using the machine. Drain the air filter before and after using the machine.

## **CAUTION**

To protect the pneumatic systems and maintain your warranty, only the air filter and lubricator supplied with the machine must be used. The lubricator should deliver oil at a rate of 2–4 drops per minute.

---

## 5.3.10 Hydraulic power systems

After 72 hours of operation, do the following:

- Replace the filter cartridge.
- Check the heat exchanger for leaks.
- Clean the filler/breather.

### 5.3.10.1 Hydraulic motor

The hydraulic motor is maintenance-free. Fluid passing through the motor lubricates internal moving parts. To ensure long life and dependable operation, use Mobil DTE-24 hydraulic fluid.

### 5.3.10.2 Hydraulic filter and fluid

Although the hydraulic power unit requires little maintenance, timely replacement of the filter and fluid is required for proper operation.

When new, change the filter after the first 72 hours of operation to remove any impurities in the system. From then on, replace the filter every 150–200 hours.

Use a high-quality filter. CLIMAX recommends a 10-micron industrial-grade filter. If the filtering system has a change-warning gauge, change the filter as often as the gauge indicates. Clean hydraulic fluid will help keep the power unit and motor running properly.

The following hydraulic filter element components are available for purchase from CLIMAX:

- Hydraulic filter element replacement P/N 39099
- Hydraulic filter element upgrade kit P/N 39250

The hydraulic fluid should be changed under the following conditions:

- When the oil becomes contaminated
- When the power unit is operated at high temperatures for extended periods
- At least every 2 years

Fluid level should never drop below the red bar on the level/temperature gauge. Add only clean filtered fluid to the system. Do not return leaked fluid to the unit.



# 6 STORAGE AND SHIPPING

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## 6.1 STORAGE

Proper storage of the key mill machine will extend its usefulness and prevent undue damage.

Before storing, do the following:

1. Clean the machine with solvent to remove grease, metal chips, and moisture.
2. Drain all liquids from the pneumatic conditioning unit.

Store the key mill machine in its original shipping container. Keep all packing materials for repackaging the machine.

### 6.1.1 Short-term storage

Do the following for short-term storage (three months or less):

1. Retract the tool head from the workpiece.
2. Remove the tooling.
3. Remove hoses.
4. Drain the air filter on pneumatic machines.
5. Remove the machine from the workpiece.
6. Clean the machine to remove dirt, grease, metal chips, and moisture.
7. Spray all unpainted surfaces with LPS-2 to prevent corrosion.
8. Store the key mill machine in its original shipping box.

### 6.1.2 Long-term storage

Do the following for long-term storage (longer than three months):

1. Follow the short-term storage instructions, but use LPS-3 instead of LPS-2.
2. Add a desiccant pouch to the shipping container. Replace according to manufacturer instructions.
3. Store the shipping container in an environment out of direct sunlight with temperature < 70°F (21°C) and humidity < 50%.

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## **6.2 SHIPPING**

The key mill machine can be shipped in its original shipping container.

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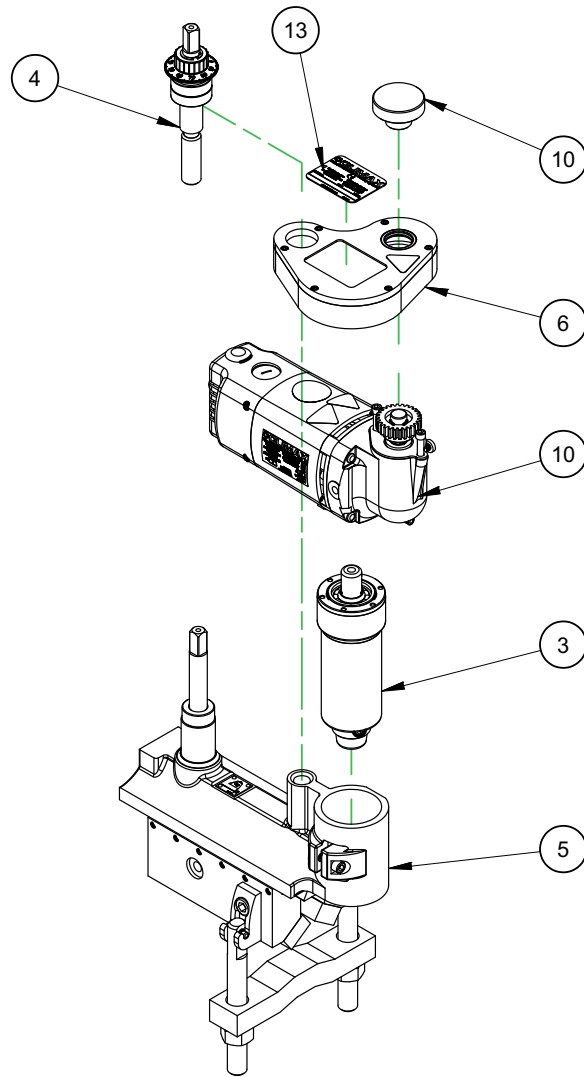
## **6.3 DECOMMISSIONING**

To decommission the key mill machine prior to disposal, remove the drive assembly from the RDU and dispose of the drive assembly separately from the rest of the machine components. Refer to Appendix A for component assembly information.

# APPENDIX A ASSEMBLY DRAWINGS

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AVAILABLE CONFIGURATIONS	
PART NO.	DESCRIPTION
16001	MODEL KM3000 INCH 230V W/ SPEED CONTROL CE
16004	MODEL KM3000 METRIC 230V W/ SPEED CONTROL CE
36783	MODEL KM3000 METRIC 120V W/ SPEED CONTROL CE
37000	MODEL KM3000 INCH 120V W/ SPEED CONTROL DOM
39572	MODEL KM3000 METRIC 120V W/SPEED CONTROL DOM.

FIGURE A-1. KM3000 ASSEMBLY WITH SPEED CONTROL (P/N 85119)

PARTS LIST P/N 16001			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
3	1	15651	SPINDLE & QUILL ASSY INCH 3RD KM3000
4	1	15655	ASSY LEADSCREW VERT ADJ INCH 3RD KM3000
5	1	28839	BASE AND TOP SLIDE ASSY W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
10	1	33291	MTR/SPD CONTROLLER ASSY 65/72/CPM 230V
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

PARTS LIST P/N 16004			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
2	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
3	1	16022	SPINDLE & QUILL ASSY METRIC KM3000
4	1	16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
5	1	30459	BASE AND TOP SLIDE ASSY METRIC W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
10	1	36686	MTR/SPD CONTROLLER ASSY 230V KM3000
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

PARTS LIST P/N 36783			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
2	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
3	1	16022	SPINDLE & QUILL ASSY METRIC KM3000
4	1	16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
5	1	30459	BASE AND TOP SLIDE ASSY METRIC W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
10	1	36779	MTR/SPD CONTROLLER ASSY KM3000 120V UK CE
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

FIGURE A-2. KM3000 ASSEMBLY WITH SPEED CONTROL PARTS LIST (P/N 85119)

PARTS LIST P/N 37000			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
3	1	15651	SPINDLE & QUILL ASSY INCH 3RD KM3000
4	1	15655	ASSY LEADSCREW VERT ADJ INCH 3RD KM3000
5	1	28839	BASE AND TOP SLIDE ASSY W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
7	1	36987	MOTOR ASSY ELECTRIC 120V 4TH 2-POLE CONNECTOR
11	1	36549	(NOT SHOWN) CONTROL SPEED ASSY KM3000 120V 4TH GEN DOM
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

PARTS LIST P/N 39572			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
2	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
3	1	16022	SPINDLE & QUILL ASSY METRIC KM3000
4	1	16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
5	1	30459	BASE AND TOP SLIDE ASSY METRIC W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
7	1	36987	MOTOR ASSY ELECTRIC 120V 4TH 2-POLE CONNECTOR
11	1	36549	(NOT SHOWN) CONTROL SPEED ASSY KM3000 120V 4TH GEN DOM
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

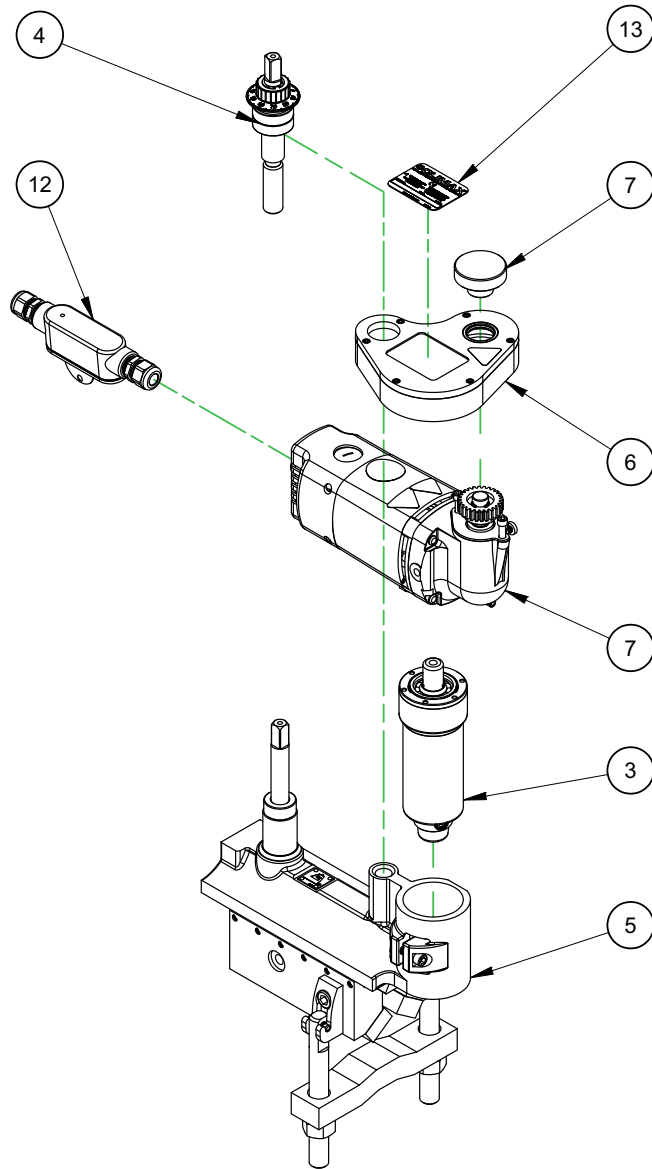
FIGURE A-3. KM3000 ASSEMBLY WITH SPEED CONTROL PARTS LIST (P/N 85119)

PARTS LIST P/N 16001			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
3	1	15651	SPINDLE & QUILL ASSY INCH 3RD KM3000
4	1	15655	ASSY LEADSCREW VERT ADJ INCH 3RD KM3000
5	1	28839	BASE AND TOP SLIDE ASSY W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
10	1	33291	MTR/SPD CONTROLLER ASSY 65/72/CPM 230V
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

PARTS LIST P/N 16004			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
2	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
3	1	16022	SPINDLE & QUILL ASSY METRIC KM3000
4	1	16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
5	1	30459	BASE AND TOP SLIDE ASSY METRIC W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
10	1	36686	MTR/SPD CONTROLLER ASSY 230V KM3000
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

PARTS LIST P/N 36783			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
2	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
3	1	16022	SPINDLE & QUILL ASSY METRIC KM3000
4	1	16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
5	1	30459	BASE AND TOP SLIDE ASSY METRIC W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
10	1	36779	MTR/SPD CONTROLLER ASSY KM3000 120V UK CE
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

FIGURE A-4. KM3000 ASSEMBLY WITH SPEED CONTROL PARTS LIST (P/N 85119)



AVAILABLE CONFIGURATIONS	
PART NO.	DESCRIPTION
16000	MODEL KM3000 INCH 120V DOMESTIC
16003	MODEL KM3000 METRIC 120V DOMESTIC
39571	MODEL KM3000 METRIC 230V 4TH

FIGURE A-5. KM3000 ASSEMBLY (P/N 85122)

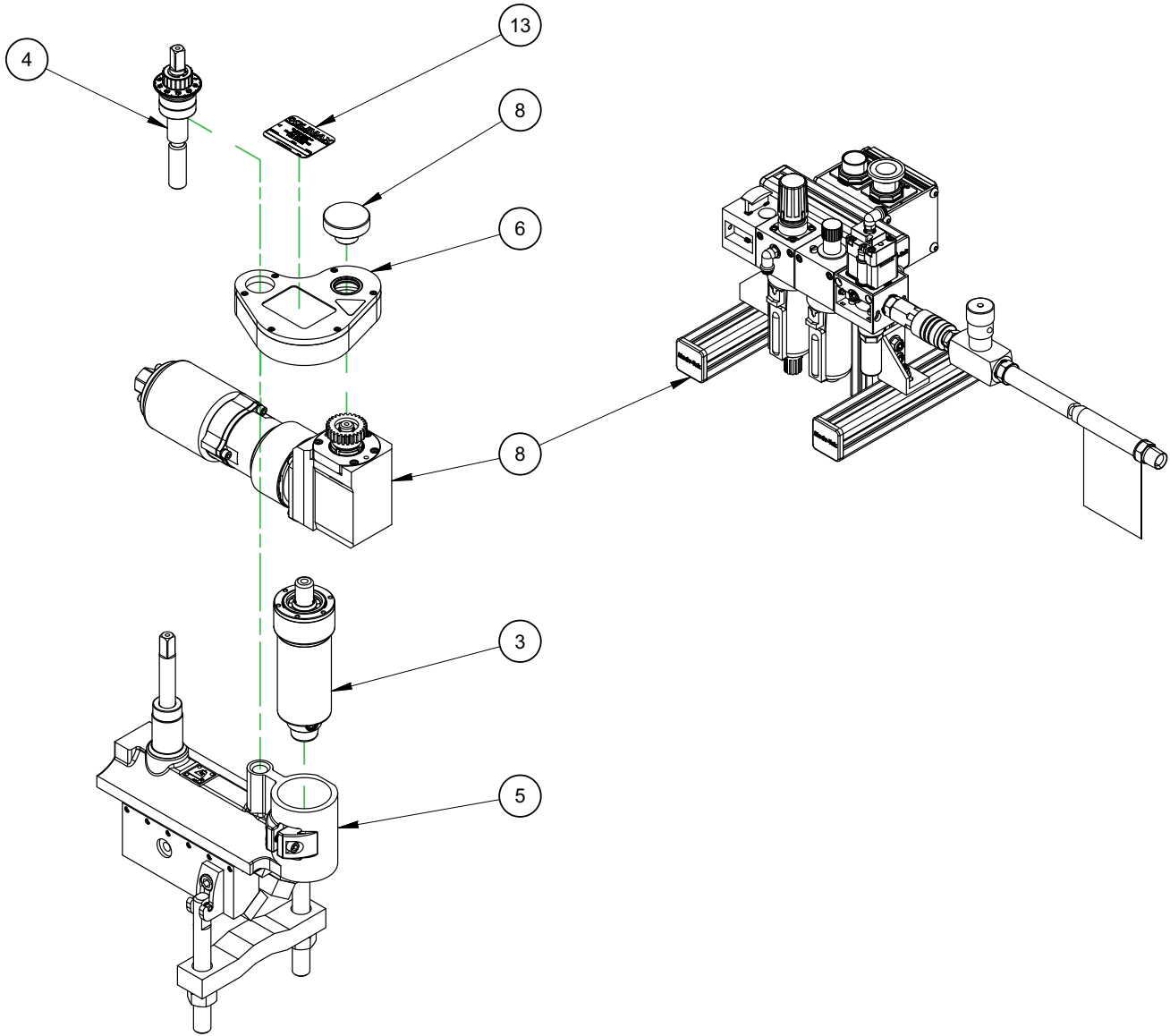


PARTS LIST P/N 16000			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
3	1	15651	SPINDLE & QUILL ASSY INCH 3RD KM3000
4	1	15655	ASSY LEADSCREW VERT ADJ INCH 3RD KM3000
5	1	28839	BASE AND TOP SLIDE ASSY W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
7	1	36987	MOTOR ASSY ELECTRIC 120V 4TH 2-POLE CONNECTOR
12	1	37388	SWITCH KM3000 INLINE 120V 2-POLE CONNECTOR
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

PARTS LIST P/N 16003			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
2	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
3	1	16022	SPINDLE & QUILL ASSY METRIC KM3000
4	1	16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
5	1	30459	BASE AND TOP SLIDE ASSY METRIC W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
7	1	36987	MOTOR ASSY ELECTRIC 120V 4TH 2-POLE CONNECTOR
12	1	37388	SWITCH KM3000 INLINE 120V 2-POLE CONNECTOR
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

PARTS LIST P/N 39571			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
2	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
3	1	16022	SPINDLE & QUILL ASSY METRIC KM3000
4	1	16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
5	1	30459	BASE AND TOP SLIDE ASSY METRIC W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
7	1	36684	MOTOR ASSY ELECTRIC 230V
12	1	37389	SWITCH KM3000 INLINE 230V 3-POLE CONNECTOR
13	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63

FIGURE A-6. KM3000 ASSEMBLY PARTS LIST (P/N 85122)



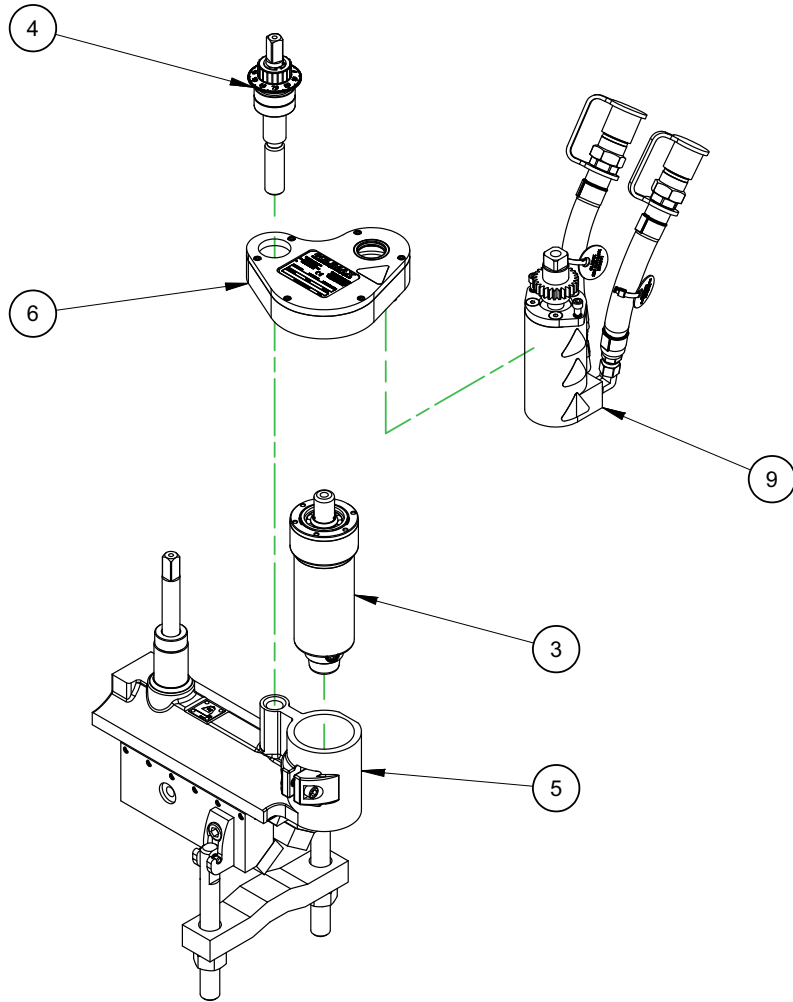
AVAILABLE CONFIGURATIONS	
PART NO.	DESCRIPTION
16002	MODEL KM3000 INCH AIR
16005	MODEL KM3000 METRIC AIR

FIGURE A-7. KM3000 PNEUMATIC ASSEMBLY (P/N 85123)

PARTS LIST P/N 16002			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
3	1	15651	SPINDLE & QUILL ASSY INCH 3RD KM3000
4	1	15655	ASSY LEADSCREW VERT ADJ INCH 3RD KM3000
5	1	28839	BASE AND TOP SLIDE ASSY W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
8	1	38716	DRIVE AIR ASSY KM3000
13	1	45887	PLATE SERIAL YEAR MODEL 2.0 X 2.63

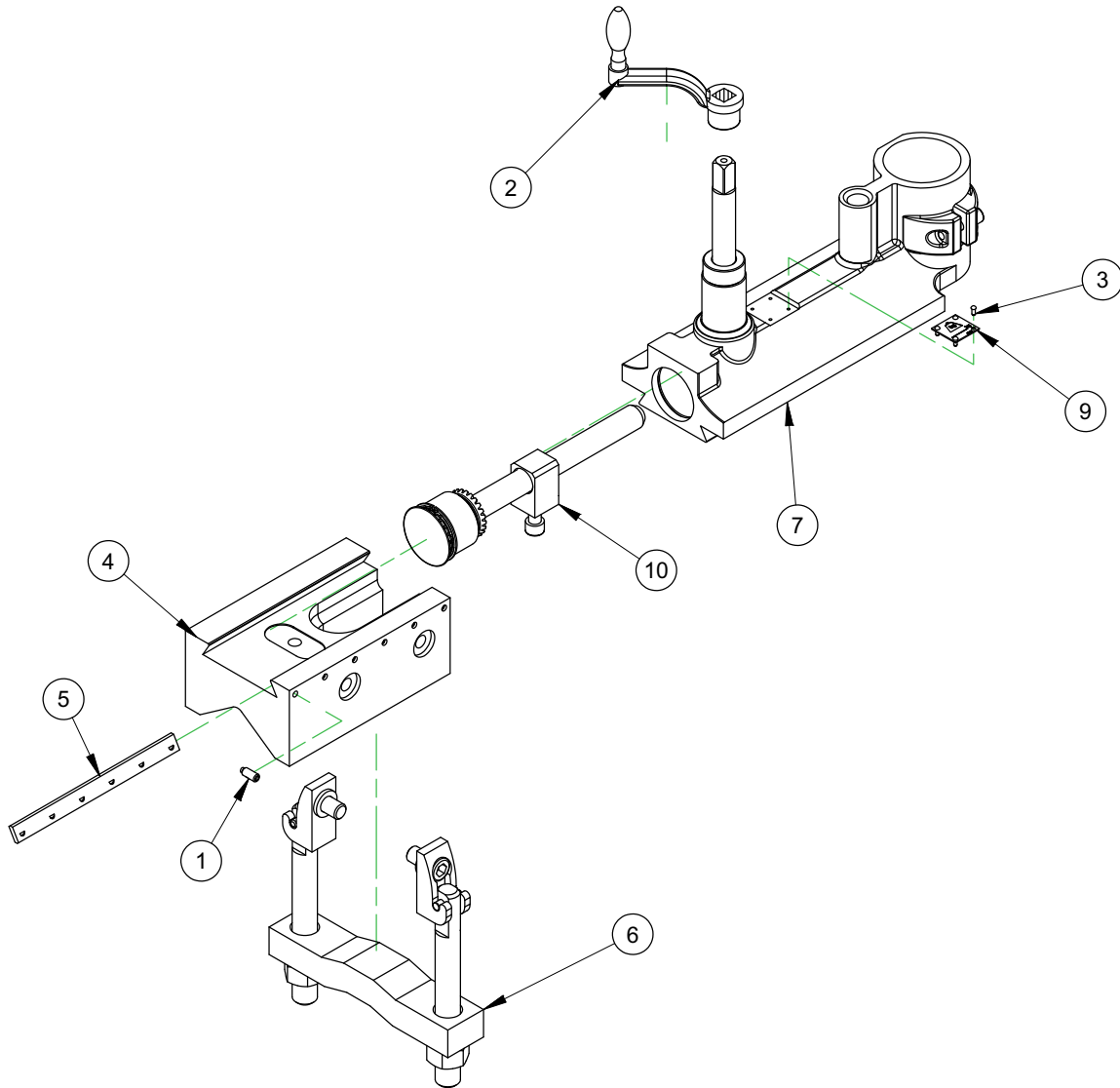
PARTS LIST P/N 16005			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	(NOT SHOWN) KIT TOOL KM3000 KM4000 PM4000
2	1	15369	(NOT SHOWN) CRATE 18 X 19 X 13-5/8 KM4000 5/8 PLY HINGED
3	1	16022	SPINDLE & QUILL ASSY METRIC KM3000
4	1	16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
5	1	30459	BASE AND TOP SLIDE ASSY METRIC W/ BAR CLAMP
6	1	34403	ASSY GEAR BOX SPINDLE DRIVETOP
8	1	38716	DRIVE AIR ASSY KM3000
13	1	45887	PLATE SERIAL YEAR MODEL 2.0 X 2.63

**FIGURE A-8. KM3000 PNEUMATIC ASSEMBLY PARTS LIST (P/N 85123)**



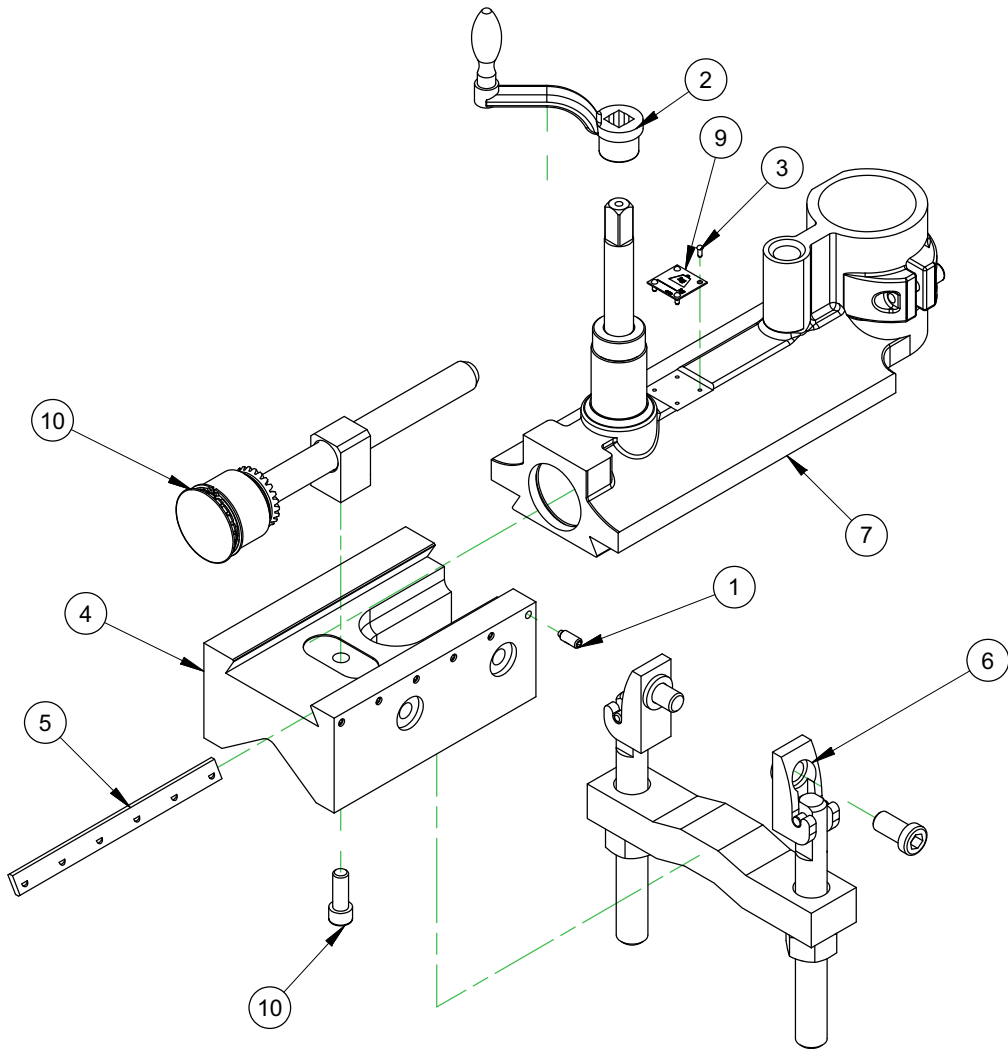
AVAILABLE CONFIGURATIONS	
PART NO.	DESCRIPTION
16008	MODEL KM3000 INCH HYD 274 RPM @ 5 GPM W/O HPU
16009	MODEL KM3000 INCH HYD 430 RPM @ 5 GPM W/O HPU
16010	MODEL KM3000 INCH HYD 664 RPM @ 5 GPM W/O HPU
45134	MODEL KM3000 METRIC HYD 430 RPM @ 5 GPM (HPU NOT INCLUDED)

FIGURE A-9. KM3000 PNEUMATIC ASSEMBLY (P/N 85124)



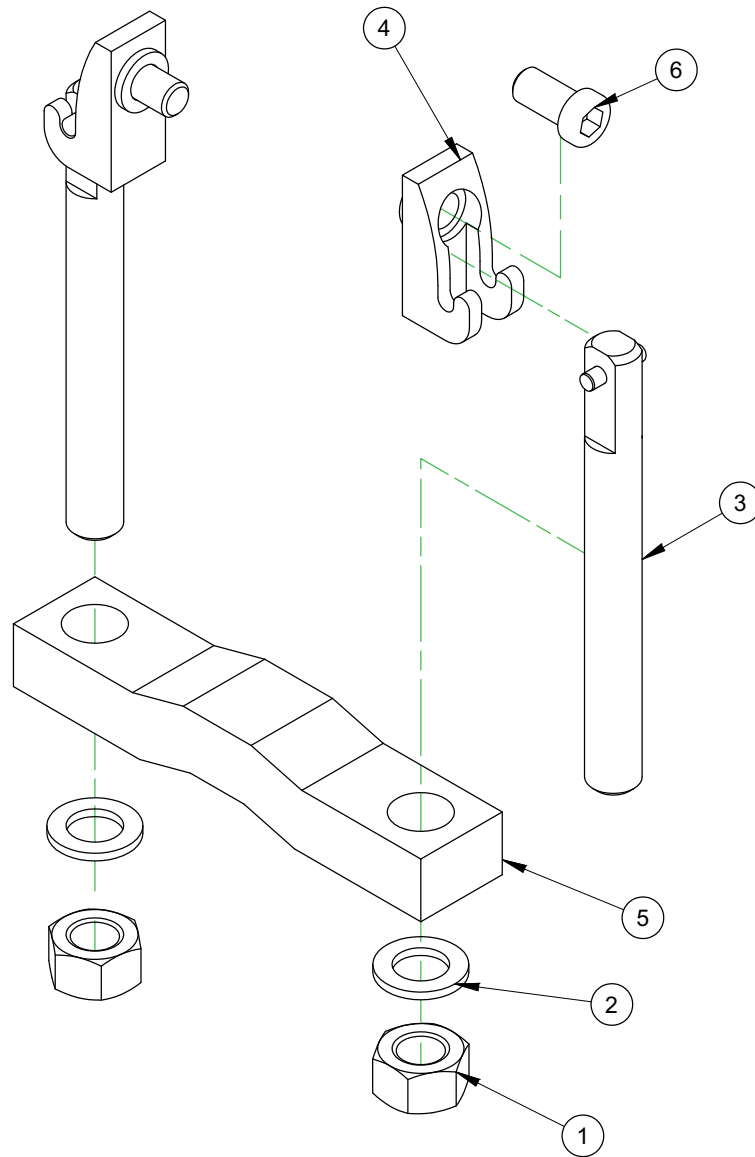
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10189	SCREW 1/4-20 X 5/8 SSSHPPL
2	1	10203	CRANK HANDLE 1/2 SQUARE
3	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
4	1	15505	BASE 2ND KM3000
5	1	15616	GIB .4915 X .1562 X 6.76 0-1 6 SS X 1.25
6	1	15647	CLAMP ASSY STANDARD KM3000
7	1	15656	ASSY TOP SLIDE INCH 2ND KM3000
8	1	16011	CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED (NOT SHOWN)
9	1	29152	PLATE MASS CE
10	1	38091	ASSY LEADSCREW TOP SLIDE KM3000

FIGURE A-10. BASE AND TOP SLIDE ASSEMBLY (P/N 28839)



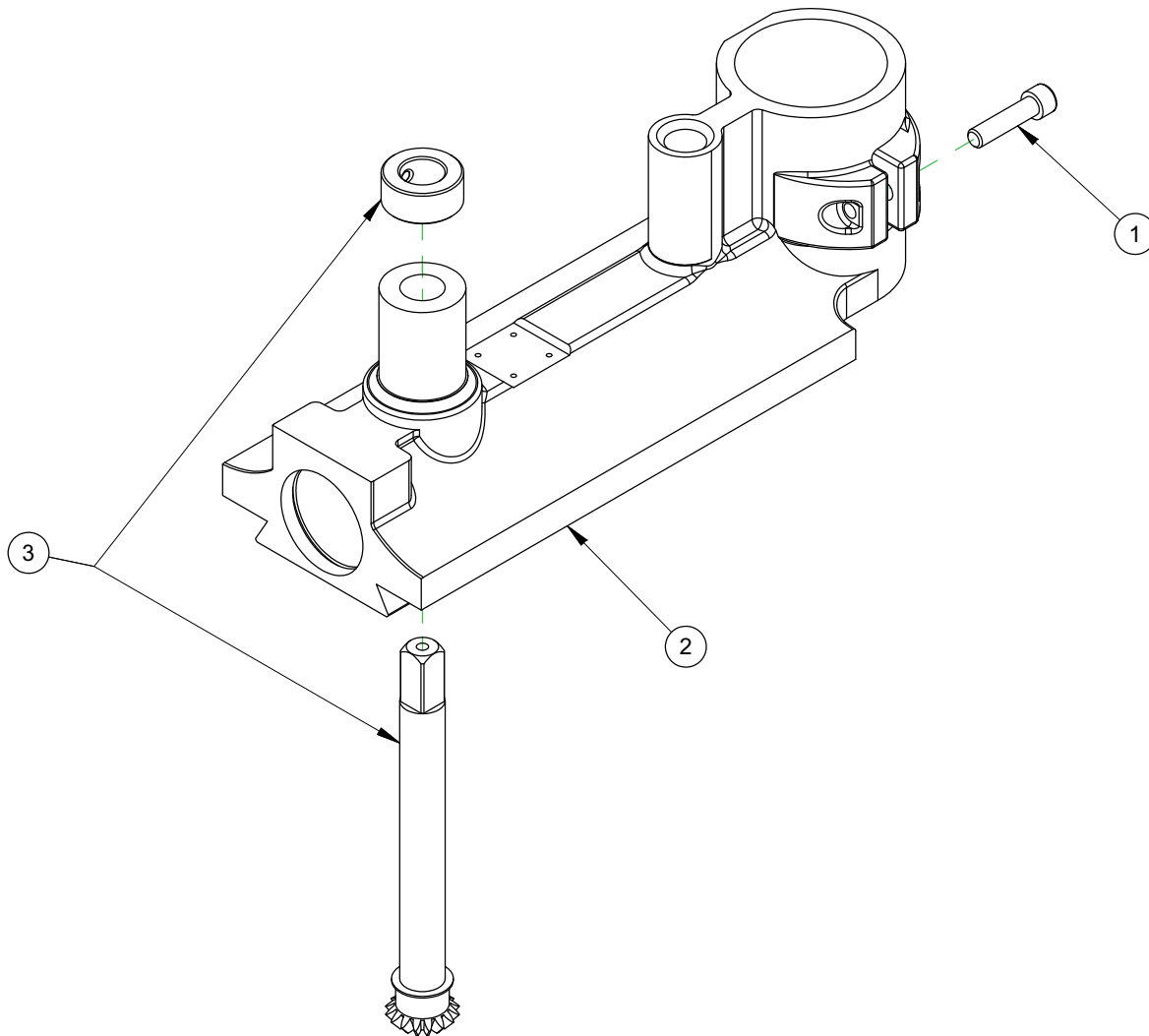
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10189	SCREW 1/4-20 X 5/8 SSSHPPL
2	1	10203	CRANK HANDLE 1/2 SQUARE
3	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
4	1	15505	BASE 2ND KM3000
5	1	15616	GIB .4915 X .1562 X 6.76 0-1 6 SS X 1.25
6	1	15647	CLAMP ASSY STANDARD KM3000
7	1	16025	ASSY TOP SLIDE METRIC 2ND KM3000
8	1	16325	MANUAL INSTRUCTION KM3000 KEY MILL 4TH GEN (NOT SHOWN)
9	1	29152	PLATE MASS CE
10	1	38091	ASSY LEADSCREW TOP SLIDE KM3000

FIGURE A-11. BASE AND TOP SLIDE ASSEMBLY METRIC (P/N 30459)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	10197	NUT 3/4-10 STDN ZINC PLATED
2	2	10198	WASHER THRUST .750 ID X 1.250 OD X .123
3	2	10422	ASSY CLAMP BOLT KM3000
4	2	15504	CASTING BLOCK CLAMP SMALL
5	1	15643	CLAMP BAR
6	2	15670	SCREW 1/2-13 X 1 LHSCS

FIGURE A-12. CLAMP ASSEMBLY (P/N 15647)

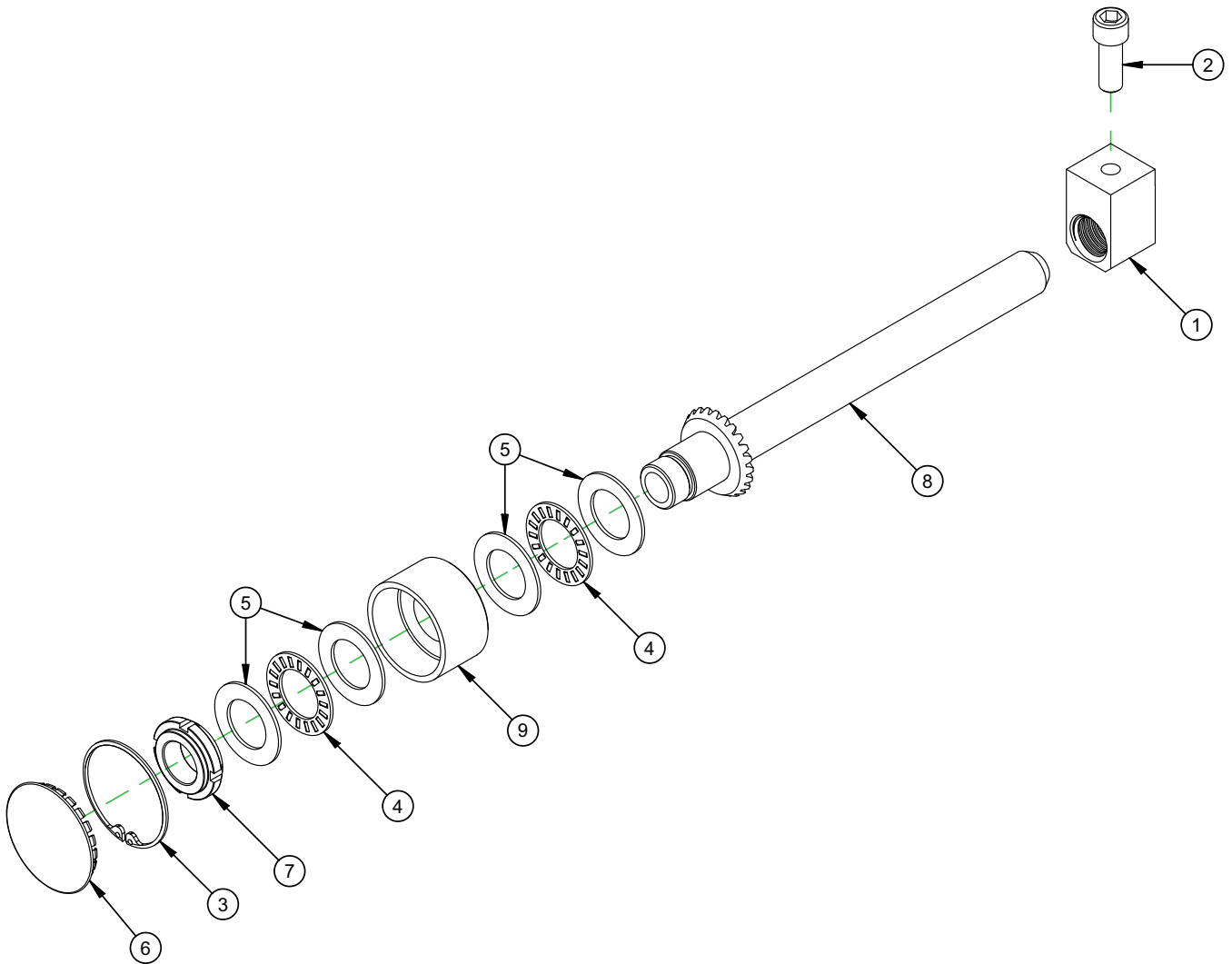


AVAILABLE CONFIGURATIONS	
PART NO	DESCRIPTION
15656	ASSY TOP SLIDE INCH 2ND KM3000
16025	ASSY TOP SLIDE METRIC 2ND KM3000

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	11735	SCREW 5/16-18 X 1-1/4 SHCS
2	1	15507	SLIDE TOP INCH 2ND KM3000
		16026	SLIDE TOP METRIC 2ND KM3000
3	1	15657	SHAFT ASSY TRAVERSE DRIVE 2ND KM3000

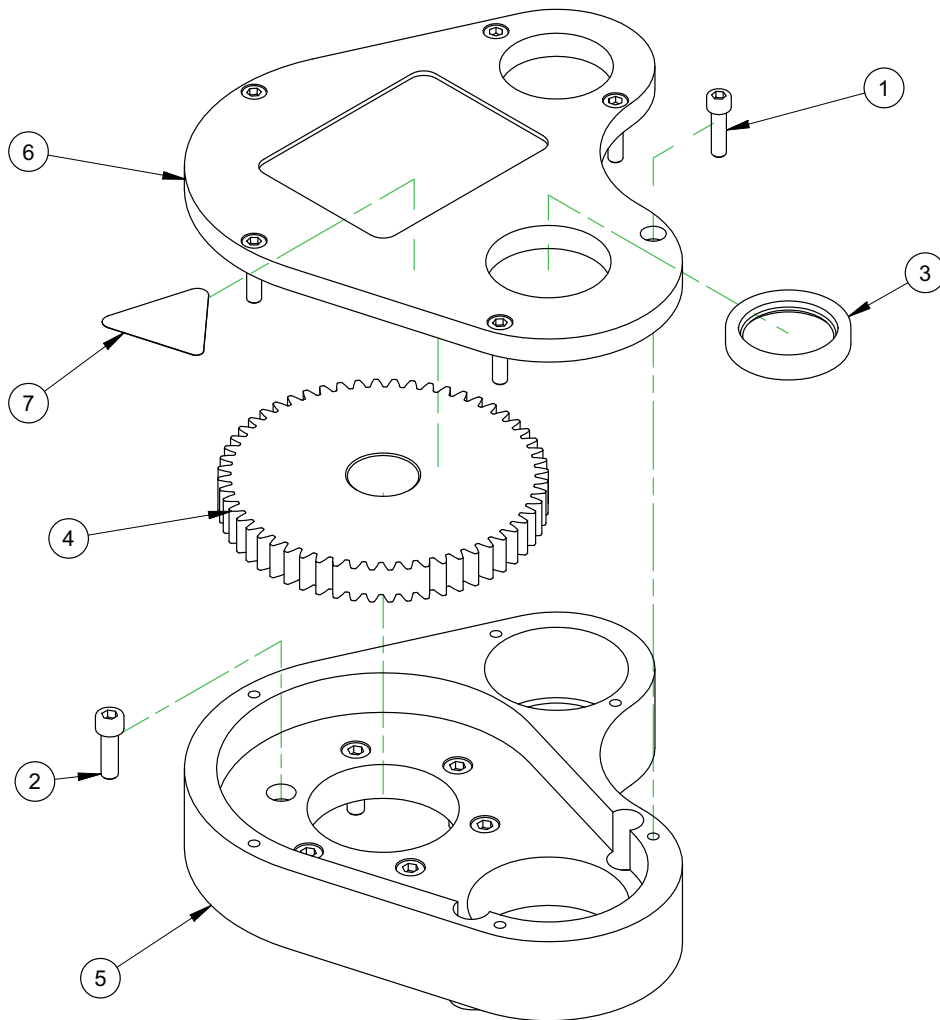
FIGURE A-13. TOP SLIDE ASSEMBLY (P/N 75077)





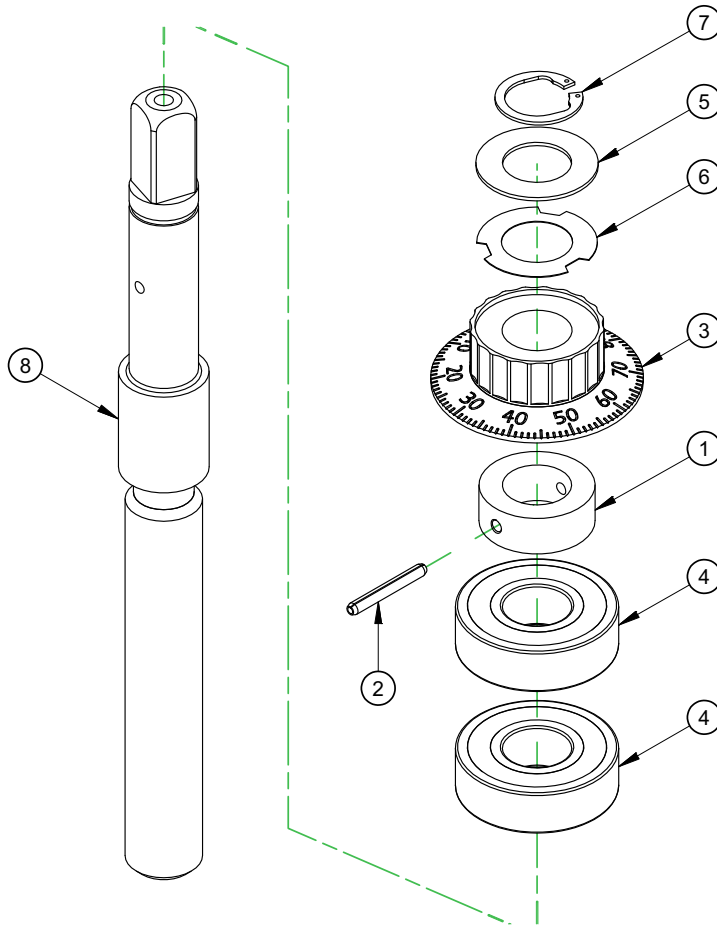
PARTS LIST			
ITEM	QTY	PART No.	DESCRIPTION
1	1	10190	LEADNUT BRASS 3/4-10 ACME
2	1	10191	SCREW 3/8-16 X 1 SHCS
3	1	10193	RING SNAP 1.75 ID BEVEL LEADSCREW
4	2	13174	BRG THRUST .875 ID X 1.437 OD X .0781
5	4	13175	WASHER THRUST .875 ID X 1.437 OD X .060
6	1	15999	PLUG HOLE 1-3/4 DIA MODIFIED
7	1	37981	NUT SELF LOCKING BRG ADJ SZ 4
8	1	38092	LEADSCREW TOPSLIDE KM3000
9	1	38116	COLLAR LEADSCREW BEARING

FIGURE A-14. TOP SLIDE LEADSCREW ASSEMBLY (P/N 38091)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10156	SCREW 8-32 X 5/8 SHCS
2	6	10157	SCREW 10-32 X 5/8 SHCS
3	1	10167	SEAL 1.000 ID X 1.375 OD X .250
4	1	15517	GEAR SPUR 16DP 56T 20PA .43 X .97LG STEEL
5	1	34284	GEARBOX 4TH GENERATION KM3000
6	1	34285	GEARBOX COVER KM3000
7	1	79848	LABEL WARNING - CUTTING OF FINGERS OR HAND ROTATING BLADE GRAPHIC 1.13 TALL TRIANGLE YELLOW

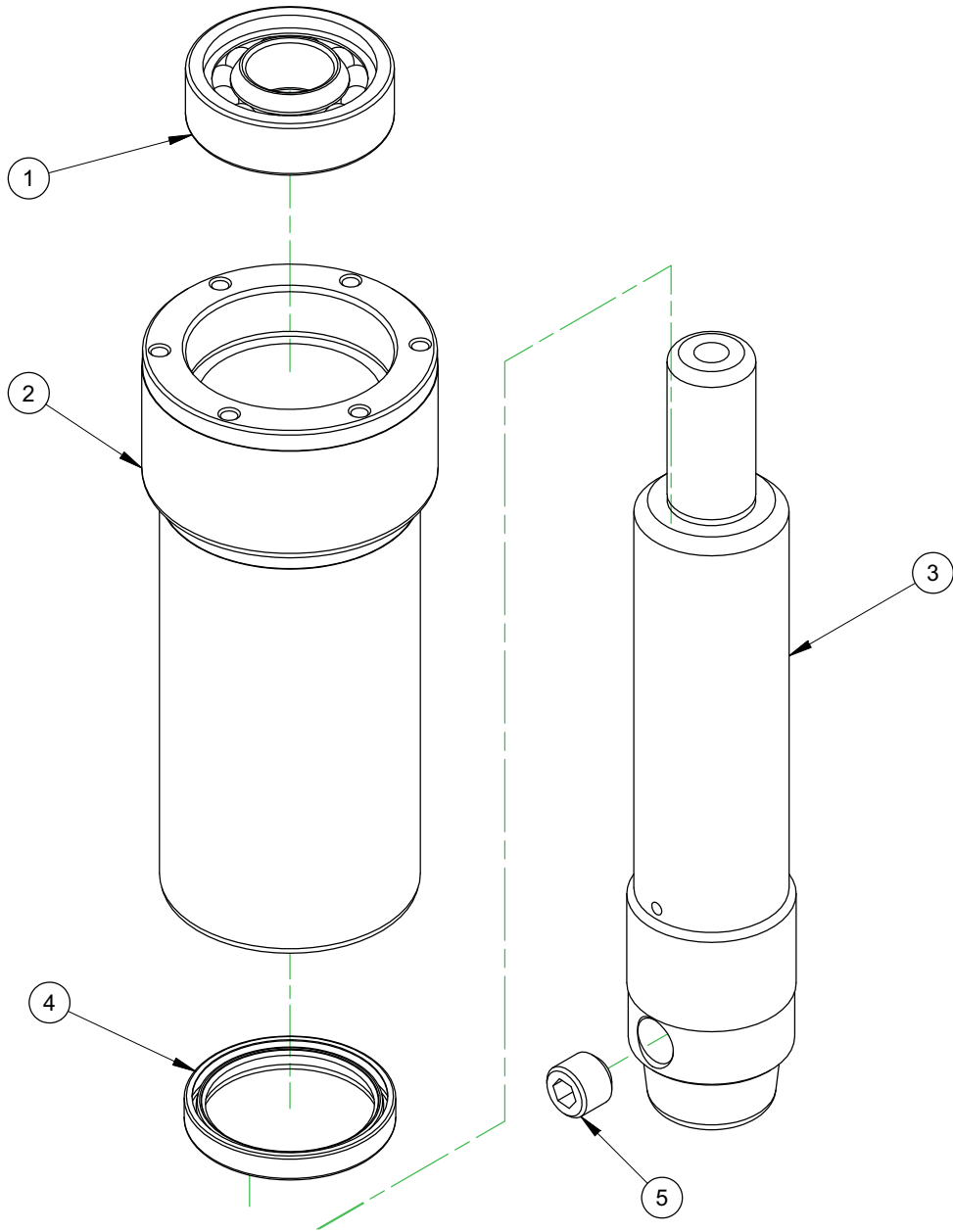
FIGURE A-15. GEARBOX SPINDLE DRIVETOP ASSEMBLY (P/N 34403)



AVAILABLE CONFIGURATIONS	
P/N	DESCRIPTION
15655	ASSY LEADSCREW VERT ADJ INCH 3RD KM3000
16021	ASSY LEADSCREW VERT ADJ METRIC 3RD KM3000
19648	ASSY LEADSCREW VERT ADJ INCH 3RD KM4000 CPM
19649	ASSY LEADSCREW VERT ADJ METRIC 3RD KM4000 CPM

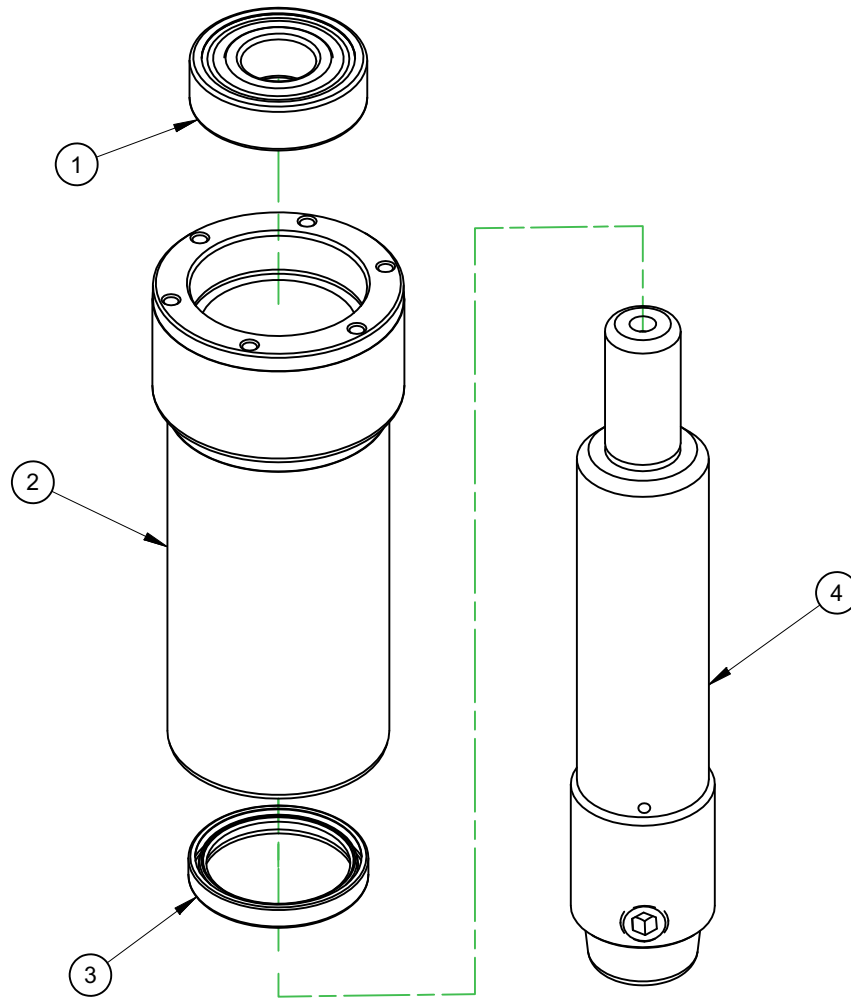
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10165	COLLAR
2	1	10166	PIN ROLL 1/8 DIA X 1
3	1	10169	DIAL INCH
		10170	DIAL METRIC
4	2	10365	BRG BALL .6693 ID X 1.5748 OD X .4724 2 SEALS
5	1	15666	WASHER THRUST .669 ID X 1.181 OD X .039
6	1	15667	WASHER SPRING FINGER .688 ID X 1.164 OD
7	1	15668	RING SNAP .672 OD X .035 THICK INVERTED
8	1	19492	LEADSCREW VERT ADJ INCH 3RD KM4000 CPM 4.67 INCH (19648)
		15635	LEADSCREW VERT ADJ INCH 3RD KM3000 2.50 INCH (15655)
		16020	LEADSCREW VERT ADJ METRIC 3RD KM3000 2.50 INCH (16021)
		19634	LEADSCREW VERT ADJ METRIC 3RD KM4000 CPM 4.67 INCH (19649)

FIGURE A-16. VERTICAL LEADSCREW ASSEMBLY (P/N 75096)



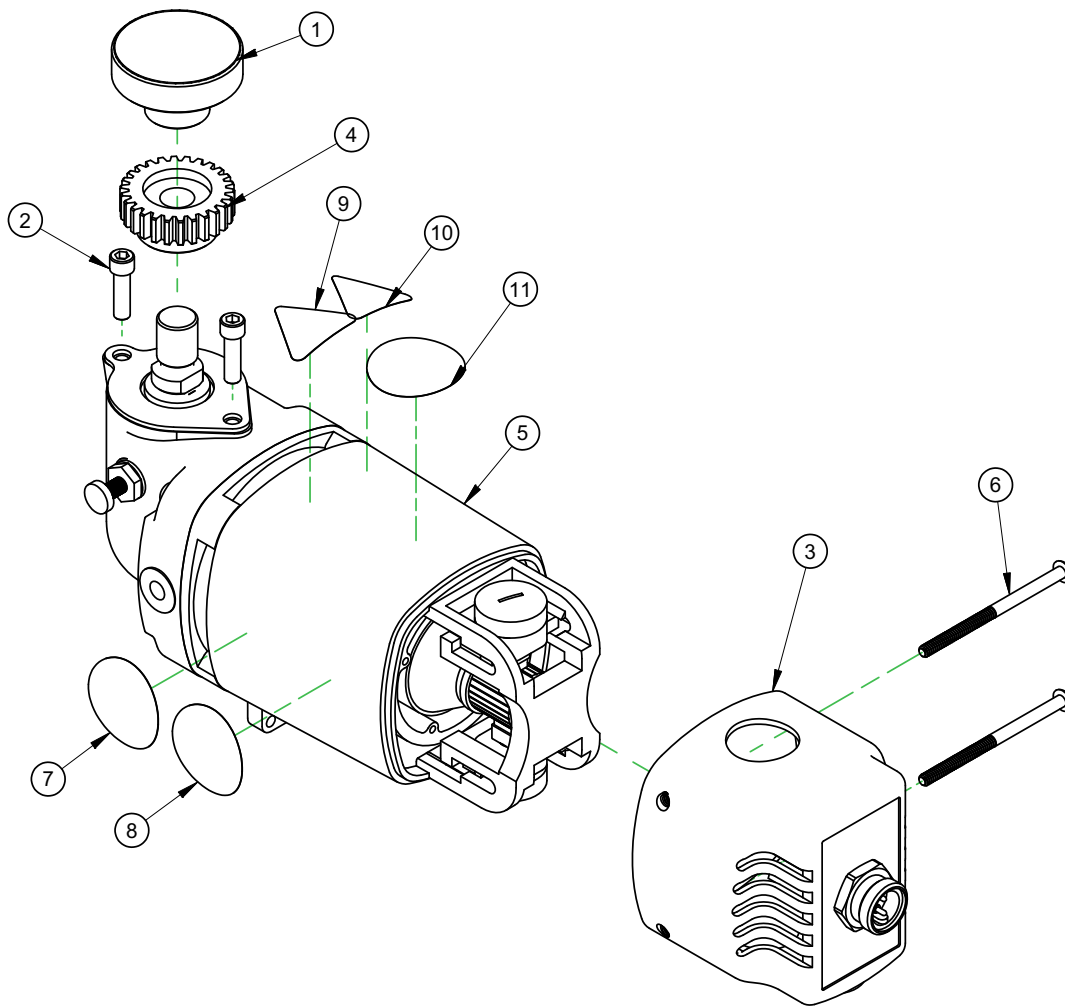
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10150	BRG BALL .7874 ID X 1.8504 OD X .5512
2	1	15514	ASSY QUILL 2ND KM3000 1.75 TRAVEL
3	1	15518	SPINDLE INCH 5/8 3RD KM3000
4	1	15669	SEAL 1.500 ID X 1.874 OD X .250
5	1	37405	SCREW 1/2-20 X .425 END MILL SET SCREW

FIGURE A-17. SPINDLE AND QUILL ASSEMBLY (P/N 15651)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10150	BRG BALL .7874 X 1.8504 X .5512 2/SHLDS
2	1	15514	ASSY QUILL 2ND KM3000 1.75 TRAVEL
3	1	15669	SEAL 1.500 ID X 1.874 OD X .250
4	1	16023	ASSY SPINDLE 16MM METRIC 3RD KM3000

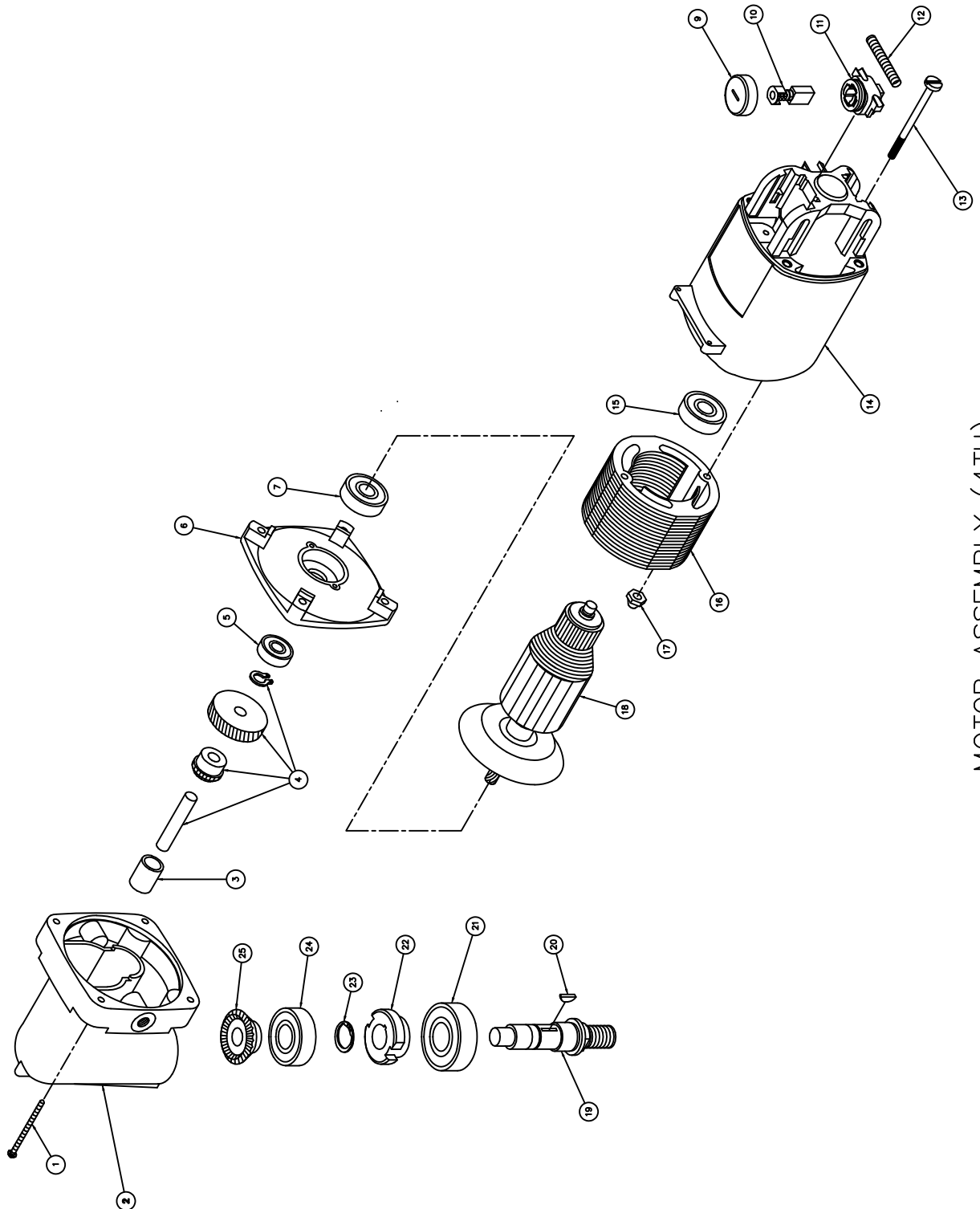
FIGURE A-18. SPINDLE AND QUILL ASSEMBLY METRIC (P/N 16022)



AVAILABLE CONFIGURATIONS	
P/N	DESCRIPTION
36987	MOTOR ASSY ELECTRIC 120V 4TH 2-POLE CONNECTOR
36684	MOTOR ASSY ELECTRIC 230V 4TH 3-POLE CONNECTOR

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10168	KNOB ADJUSTMENT 2 INCH KNURLED
2	2	17131	SCREW 1/4-20 X 7/8 SHCS
3	1	34142	CAP MOTOR END ASSY W/ 2-POLE CONNECTOR 120V (FOR 36987)
		35973	CAP MOTOR END ASSY W/3-POLE CONNECTOR 230V (FOR 36684)
4	1	34653	GEAR SPUR 16DP 26T 20PA .437 X .78LG STEEL
5	1	34662	MOTOR ELEC 120V 4TH MODIFIED ( FOR 36987)
		36688	MOTOR MODIFIED ELEC 230V KM & PM 4TH (FOR 36684)
6	2	42724	SCREW 10-24 X 3 SRHMS
7	1	59037	LABEL WARNING - WEAR EAR PROTECTION
8	1	59044	LABEL WARNING - CONSULT OPERATOR'S MANUAL
9	1	78741	LABEL WARNING CRUSH FOOT
10	1	78748	LABEL WARNING FLYING DEBRIS/LOUD NOISE
11	1	78824	LABEL WARNING - DO NOT EXPOSE TO WATER

FIGURE A-19. MOTOR ELECTRIC ASSEMBLY (P/N 81474)



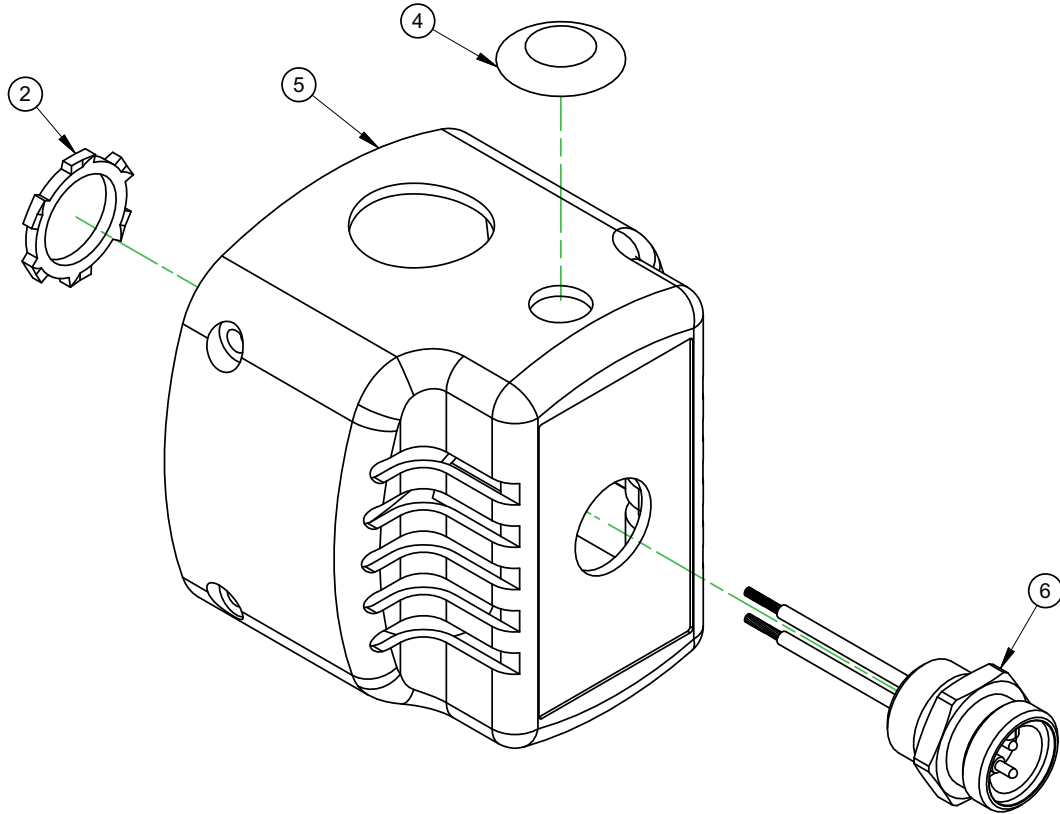
MOTOR ASSEMBLY (4TH)

FIGURE A-20. MOTOR ASSEMBLY (P/N 11895)

<b>11895 MOTOR ELECTRIC 120V MILWAUKEE 5455 AND 36688 MOTOR ELECTRIC 230V MILWAUKEE 5455</b>		
<b>BALLOON</b>	<b>PART</b>	<b>DESCRIPTION</b>
1	12543	SP SCREW 3rd
2	12544	SP BOX GEAR MODIFIED 3rd
3	12545	SP BRG NEEDLE 3rd
4	12546	SP GEAR INTERMEDIATE ASSY 3rd
5	10233	SP BRG BALL 1st 2nd & 3rd
6	12547	SP DIAPHRAGM 3rd
7	12548	SP BRG BALL MILWAUKEE 5455 ARMATURE UPPER
9	12553	SP SCREW BRUSH RETAINING 3rd
10	15482	SP BRUSH ASSY CARBON 3rd
11	12555	SP HOLDER BRUSH ASSY 3rd
12	12556	SP SPRING HOLDER BRUSH 3rd
13	10353	SP SCREW 2nd & 3rd
14	12552	SP HOUSING MOTOR 3rd
15	12551	SP BRG BALL MILWAUKEE 5455 ARMATURE LOWER
16	12550	SP FIELD 120 VOLT 3 <sup>rd</sup> <b>(11895 ONLY)</b>
	31437	SP FIELD 230 VOLT MILWAUKEE 5535 AND 5455 <b>(36688 ONLY)</b>
17	10355	SP NUT HEX LOCKING 2nd & 3rd
18	12549	SP ARMATURE 3rd 120V <b>(11895 ONLY)</b>
	39304	SP ARMATURE 230V REWIND <b>(36688 ONLY)</b>
19	12539	SP SHAFT SPINDLE 3rd
20	12538	SP KEY WOODRUFF 3rd
21	10358	SP BRG BALL 2nd & 3rd
22	10367	SP COG LOCK 2nd & 3rd
23	12540	SP RING RETAINER 3rd
24	10365	BRG BALL .6693 ID X 1.5748 OD X .4724 2 SEALS
25	12542	SP GEAR BEVEL 3rd
NOT SHOWN	38200	SP 1-1/4 OZ TYPE G GREASE MILWAUKEE
NOT SHOWN	10368	SP KEY WOODRUFF 2nd & 3rd
NOT SHOWN	34791	SP PLATE BEARING RETAINING
NOT SHOWN	10357	SP SCREW BRUSH HOLDER 2nd & 3rd
NOT-SHOWN	16501	SP SPINDLE LOCK ASSY
NOT-SHOWN	16500	SP WASHER FLAT

FIGURE A-21. MOTOR ASSEMBLY PARTS LIST (P/N 11895)

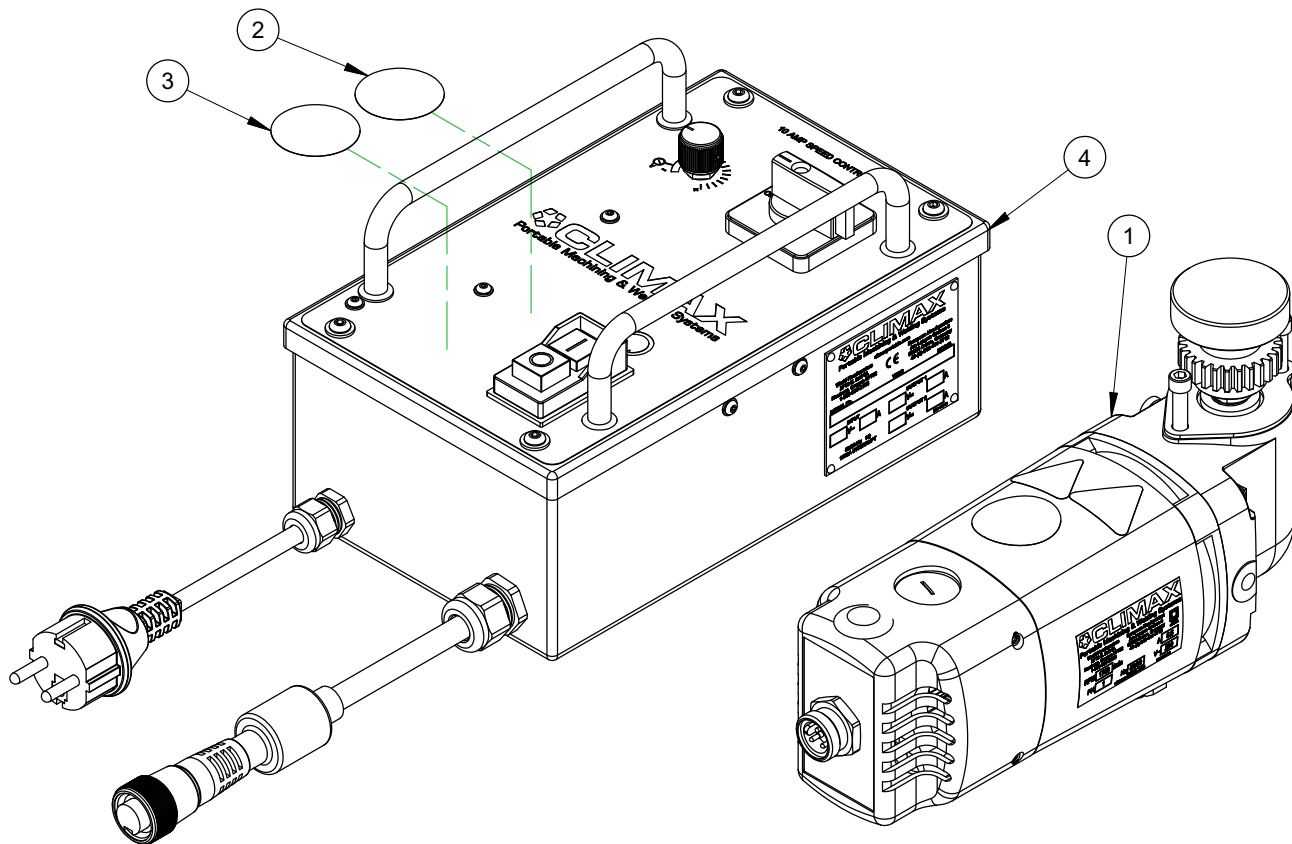




AVAILABLE CONFIGURATIONS	
P/N	DESCRIPTION
34142	CAP MOTOR END ASSY W/2-POLE CONNECTOR 120V
35973	CAP MOTOR END ASSY W/3-POLE CONNECTOR 230V

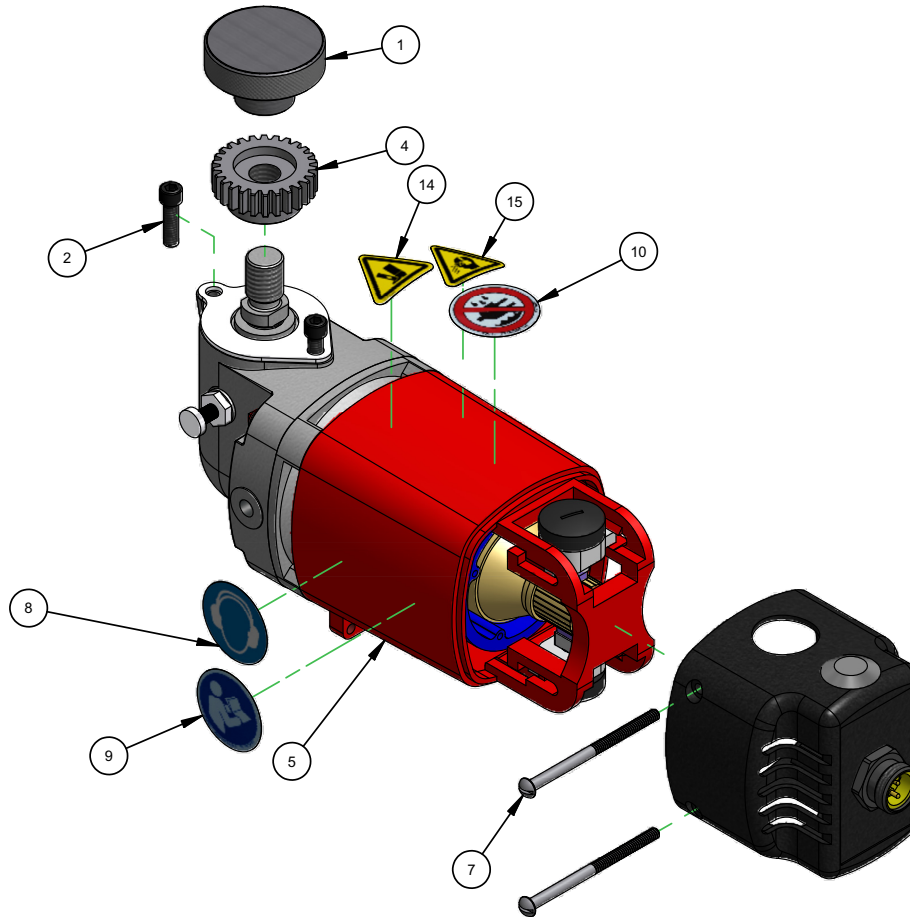
PARTS LIST			
ITEM	QTY	PART No.	DESCRIPTION
1	2	10313	CONNECTOR PLUG MALE SNAP BULLET 16-14 GA (KB) (NOT SHOWN)
2	1	12574	CONDUIT NUT 1/2 NPT
3	2	15022	CONNECTOR PLUG FEMALE SNAP BULLET 16-14 GA .180 DIA (KB) (NOT SHOWN)
4	1	31734	PLUG 1/2 DIA PLASTIC
5	1	31736	CAP MILWAUKIE ELECTRIC MOTOR CORD ENTRANCE
6	1	34255	CONNECTOR 2-POLE 13AMP MALE 1/2 NPT PANEL MT (34142)
		33929	COMMECTOR 3-POLE 10AMP MALE 1/2 NPT PANEL MT (35973)

FIGURE A-22. CAP MOTOR END ASSEMBLY (P/N 81475)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	36684	MOTOR ASSY ELECTRIC 230V
2	1	59044	LABEL WARNING - CONSULT OPERATOR'S MANUAL
3	1	78824	LABEL WARNING - DO NOT EXPOSE TO WATER
4	1	79218	CONTROLLER BB3000 230V 50/60 HZ CE

FIGURE A-23. MTR/SPD CONTROLLER ASSEMBLY (P/N 36686)



PARTS LIST			
ITEM	QTY	PART No.	DESCRIPTION
1	1	10168	KNOB ADJUSTMENT 2 INCH KNURLED
2	2	17131	SCREW 1/4-20 X 7/8 SHCS
3	1	34142	CAP MOTOR END ASSY W/ 2-POLE CONNECTOR 120V (36780)
		35973	CAP MOTOR END ASSY W/ 3-POLE CONNECTOR 230V (36684)
4	1	34653	GEAR SPUR 16DP 26T 20PA .437 X .78LG STEEL
5	1	34662	MOTOR ELEC 120V 4TH MODIFIED (36780)
		36688	MOTOR MODIFIED ELEC 230V KM & PM 4TH (36684)
7	2	42724	SCREW 10-24 X 3 SRHMS
8	1	59037	LABEL WARNING - WEAR EAR PROTECTION
9	1	59044	LABEL WARNING - CONSULT OPERATOR'S MANUAL
14	1	78741	LABEL WARNING CRUSH FOOT
		65217	
15	1	78748	LABEL WARNING FLYING DEBRIS/LOUD NOISE
10	1	78824	LABEL WARNING - DO NOT EXPOSE TO WATER

FIGURE A-24. ELECTRIC MOTOR ASSEMBLIES 120V (P/N 36780) AND 230V (P/N 36684)

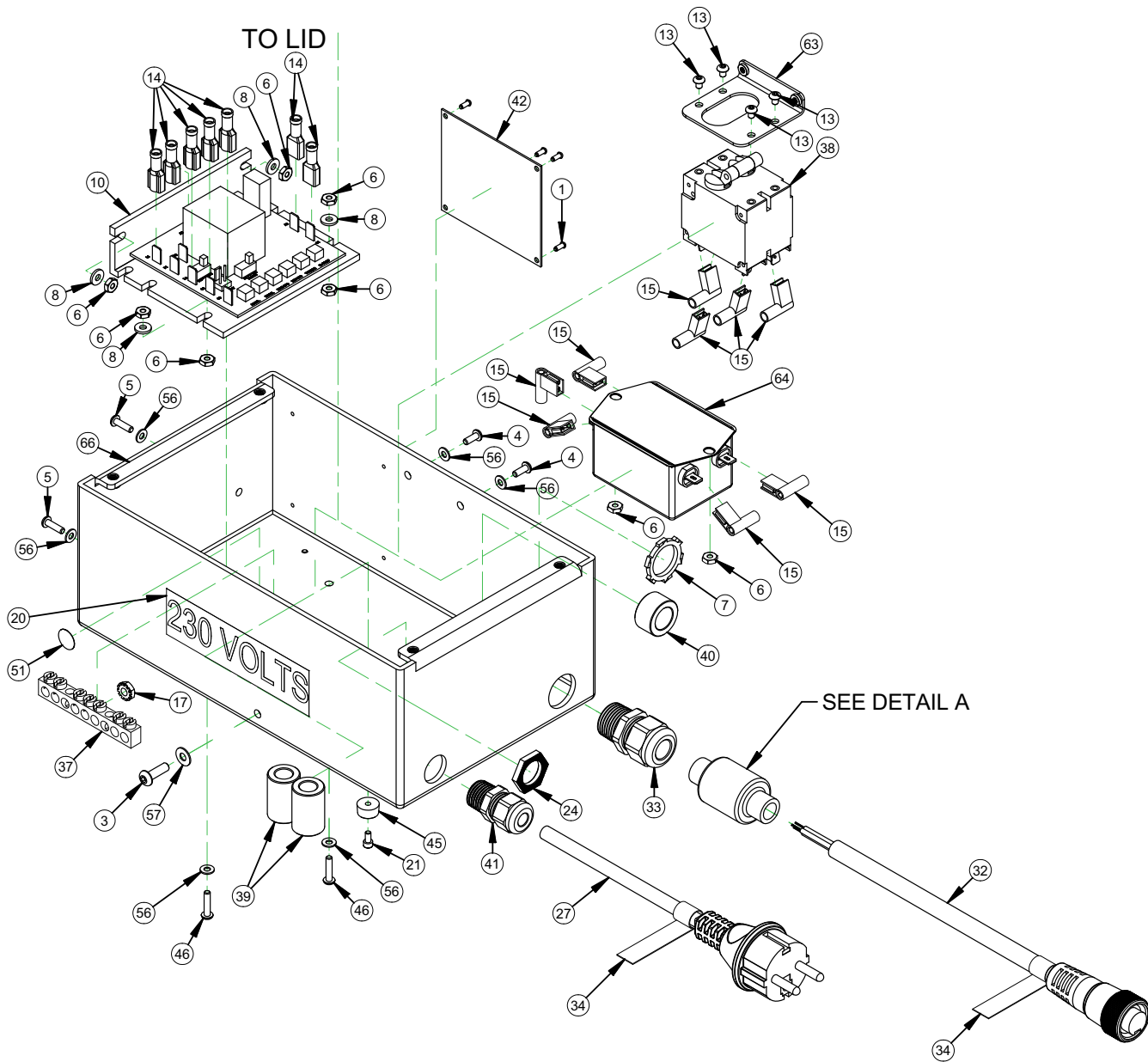


FIGURE A-25. 230V 50/60 Hz CE CONTROLLER (P/N 79218)

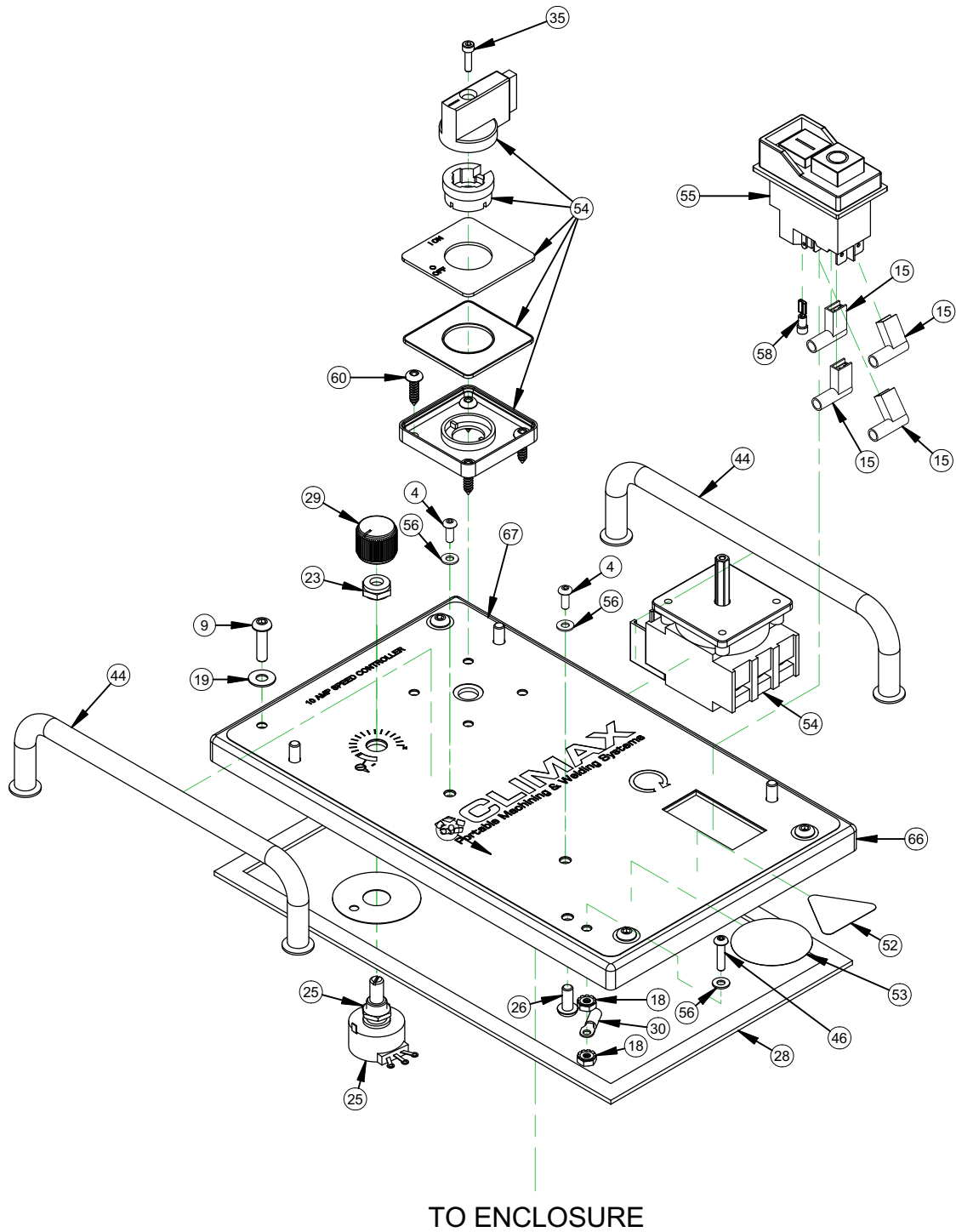


FIGURE A-26. MULTIPLE MODEL CONTROLLER (P/N 79218)

PARTS LIST				PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION	ITEM	QTY	P/N:	DESCRIPTION
1	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089	38	1	42798	CIRCUIT BREAKER 20 AMP DOUBLE POLE
2	10	10673	(NOT SHOWN) WIRE TIE SMALL .09 X 3.5	39	2	45158	FERRITE BEAD TUBULAR .398 ID X .735 OD X 1.125 LG
3	1	11674	SCREW #10-32 x 5/8 BHSCS	40	1	45159	FERRITE BEAD TUBULAR .545 ID X .88 OD X .50
4	4	11677	SCREW 6-32 X 3/8 BHSCS	41	1	46383	CORD GRIP .105-.312 DIA 3/8 NPT
5	2	11686	SCREW 6-32 X 1/2 BHSCS	42	1	47981	NAMEPLATE ELECTRICAL CONTROL PANELS CE
6	8	11687	NUT 6-32 STDN ZINC PLATED	43	1	48778	CHOKO FERRITE 1.02 OD X 0.505 ID X 1.125 125 OHM @25MHZ
7	1	12574	CONDUIT NUT 1/2 NPT				
8	4	12621	WASHER #6 FLTW SAE BLACK OXIDE	44	2	52160	HANDLE 180MM X 43MM U-SHAPED CHROME
9	4	18902	SCREW 10-32 X 3/4 BHSCS	45	4	55771	BUMPER 1/2 OD X 1/4 TALL X 1/8 CENTER HOLE
10	1	20557	CONTROL SPEED SCR MM23001C	46	3	62944	SCREW 6-32 X 5/8 BHSCS
11	2	22351	(NOT SHOWN) WIRE 18 AWG 600V RED TYPE MTW	47	3	70657	TUBING HEAT SHRINK .75 ID 2:1 SHRINK RATIO CLEAR 50 FT SPOOL
12	9	22800	(NOT SHOWN) TUBE SHRINK .125 DIA BLACK				
13	4	26468	SCREW 6-32 X 3/16 BHSCS	48	2	70901	TUBING HEAT SHRINK .19 ID 2:1 SHRINK RATIO
14	7	26629	TERMINAL SPADE 16-14 AWG .250 X .032 FEMALE INSULATED	49	20	71021	(NOT SHOWN) WIRE 18 AWG BLUE TYPE MTW MIN. 600V 0.1 OD
15	13	27377	TERMINAL SPADE 90DEG 16-14AWG .250 FM INSUL	50	2	73782	(NOT SHOWN) VARISTOR 420VAC RMS 560VDC 4.5KA PEAK CURRENT 14MM DIA
16	29	27571	(NOT SHOWN) WIRE 16 AWG GRN/YEL TYPE MTW				
17	1	28060	NUT, 10-32 UNF KEPS	51	1	77568	LABEL PROTECTIVE EARTH 1/2" DIA
18	2	29450	NUT 6-32 LOCKING STAR WASHER	52	1	78593	LABEL WARNING - ELECTRICAL SHOCK/ELECTROCUTION 1.13" TRIANGLE
19	4	29458	WASHER #10 FLTW NYLON .031 THICK				
20	1	30081	LABEL VOLTAGE 230V (KB)	53	1	78824	LABEL WARNING - DO NOT EXPOSE TO WATER
21	4	30828	SCREW 5-40 X 1/4 SHCS	54	1	78953	DISCONNECT SWITCH DOOR MOUNT IP55 16 AMP RED/YELLOW HANDLE
22	4	32304	(NOT SHOWN) TERMINAL PIN 14-16 AWG				
23	1	32926	SEAL POTENTIOMETER HEXNUT .25 SHAFT 3/8-32 TH	55	1	79231	SWITCH 230V LOW-VOLTAGE DROPOUT
24	1	33099	NUT CONDUIT 3/8 STEEL	56	9	79316	WASHER #6 NYLON .15 ID X .32 OD X .03 BLACK
25	1	33182	POTENTIOMETER 10K LIN 1/4 SHAFT 3/8 BUSHING	57	1	79348	WASHER #10 NYLON .19 ID X .44 OD X .03 BLACK
26	4	34481	SCREW M5 X 0.8 X 12 mm BHSCS	58	1	79574	TERMINAL SPADE 22-18 AWG .110 X .032 FEMALE INSULATED RED
27	1	34829	CORDSET CEE 7/7 STRAIGHT MOLDED PLUG 250V 16AMP 2.5M	59	11	79605	(NOT SHOWN) HOLDER CABLE TIE 3/4 X 3/4 3/16 CABLE TIE
28	34	35655	SEAL NEOPRENE SPONGE 3/8 X 5/32 ADHESIVE BACK				
29	1	35766	KNOB POTENTIOMETER AL .75 DIA .25 SHAFT	60	4	79643	SCREW #8 X 5/8 SHEET METAL #2 SQUARE DRIVE
30	1	35799	TERMINAL RING 22-16 #6/M3.5 STUD	61	80	79864	(NOT SHOWN) WIRE 14 AWG BRN TYPE MTW
31	11	36428	(NOT SHOWN) WIRE 16 AWG GRY TYPE MTW	62	80	79867	(NOT SHOWN) WIRE 14 AWG LT BLU TYPE MTW
32	1	36718	CORDSET 3-POLE 13A FEMALE CONNECTOR 144 IN	63	1	80091	BRACKET CIRCUIT BREAKER CE SPEED CONTROLLER
33	1	37739	CORD GRIP NONMETALLIC .17-.47 DIA X 1/2 NPT	64	1	80337	FILTER RFI/EMI 16AMP 120/250VAC 50/60HZ
34	2	37749	WIRE TIE VELCRO 11 LONG	65	2.5	81002	TUBING HEAT SHRINK 3:1 ADHESIVE 1.1 ID SHRINK TO .38 RED
35	1	37817	SCREW M3 X 0.5 X 12mm SHCS				
37	1	38444	GROUND BUSS 7 POLE COPPER CE CERTIFIED	66	1	82961	ENCLOSURE 230V BB3000 PL2000 CONTROLLER CE
36	2	38324	(NOT SHOWN) TERMINAL SPADE FEMALE 90 DEG 12-10 AWG	67	1	82984	LEGEND PLATE BB3000 120/230V SPEED CONTROLLER

FIGURE A-27. CONTROLLER PARTS LIST (P/N 79218)

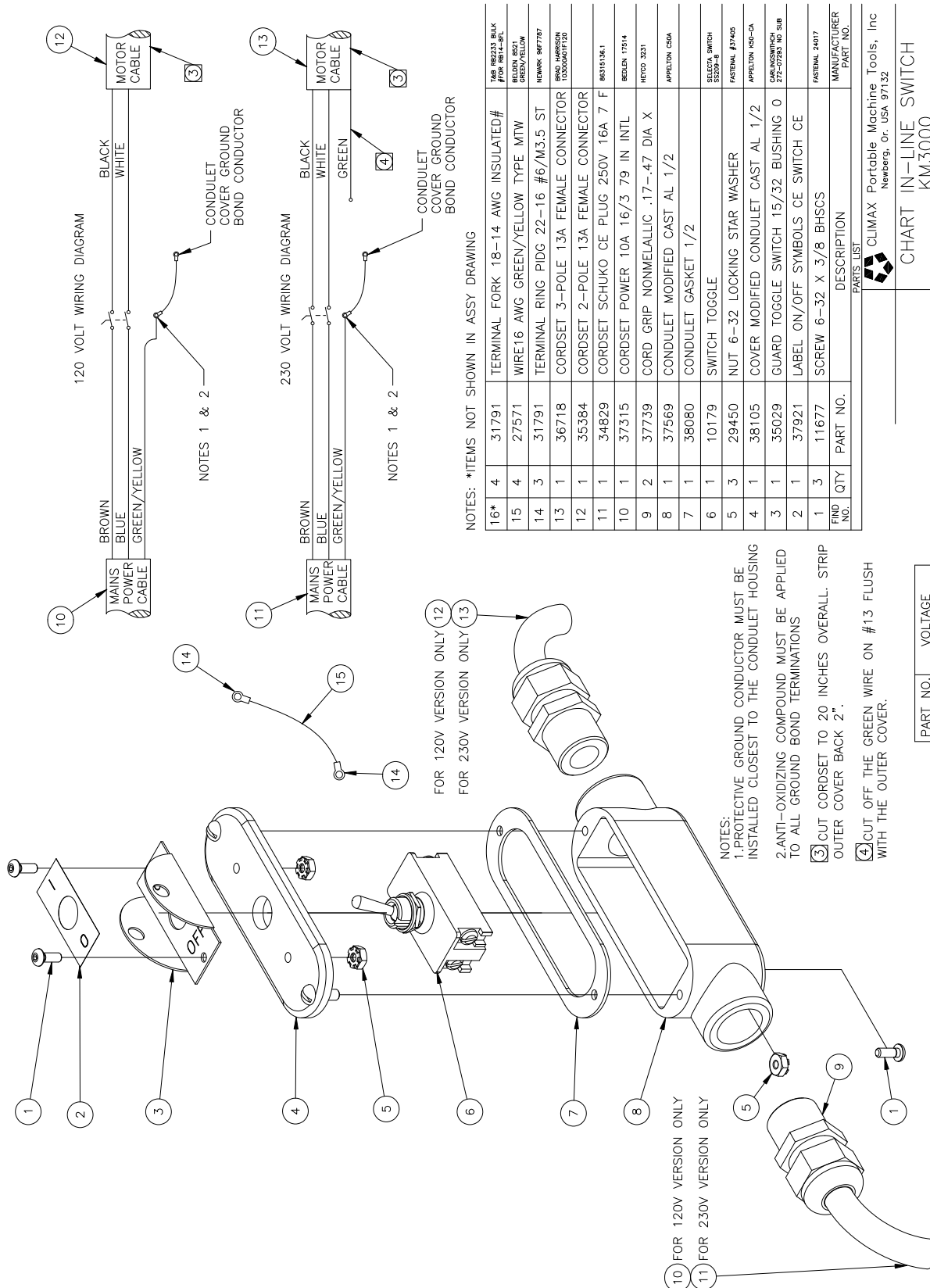


FIGURE A-28. IN-LINE SWITCH (P/N 37938)

NOTES: \*ITEMS NOT SHOWN IN ASSY DRAWING

NO.	QTY	PART NO.	DESCRIPTION	MANUFACTURER PART NO.
16*	4	31791	TERMINAL FORK 18-14 AWG INSULATED#	766 16223 BULK
15	4	27571	WIRE16 AWG GREEN/YELLOW TYPE MTW	BELEN 8531 GREEN/YELLOW
14	3	31791	TERMINAL RING PIDG 22-16 #6/M3.5 ST	HOMER 967707
13	1	36718	CORDSET 3-POLE 13A FEMALE CONNECTOR	BRAD JARVISON 10300401720
12	1	35384	CORDSET 2-POLE 13A FEMALE CONNECTOR	
11	1	34829	CORDSET SCHUKO CE PLUG 250V 16A 7 F	8615136.1
10	1	37315	CORDSET POWER 10A 16/3 79 IN INTL	BELEN 12514
9	2	37739	CORD GRIP NONMELALLIC .17-.47 DIA X	HECO 321
8	1	37569	CONDULET MODIFIED CAST AL 1/2	APPELTON C50A
7	1	38080	CONDULET GASKET 1/2	
6	1	10179	SWITCH TOGGLE	SELECTA SWITCH 5500P-8
5	3	29450	NUT 6-32 LOCKING STAR WASHER	FABTEAL #37405
4	1	38105	COVER MODIFIED CONDULET CAST AL 1/2	APPELTON 1650-CA
3	1	35029	GUARD TOGGLE SWITCH 15/32 BUSHING 0	CARLINSWITCH 272-07265 NO SUB
2	1	37921	LABEL ON/OFF SYMBOLS CE SWITCH CE	
1	3	11677	SCREW 6-32 X 3/8 BHSCS	FABTEAL 24017

- NOTES:
- 1. PROTECTIVE GROUND CONDUCTOR MUST BE INSTALLED CLOSEST TO THE CONDULET HOUSING
  - 2. ANTI-OXIDIZING COMPOUND MUST BE APPLIED TO ALL GROUND BOND TERMINATIONS
  - 3. CUT CORDSET TO 20 INCHES OVERALL. STRIP OUTER COVER BACK 2".
  - 4. CUT OFF THE GREEN WIRE ON #13 FLUSH WITH THE OUTER COVER.

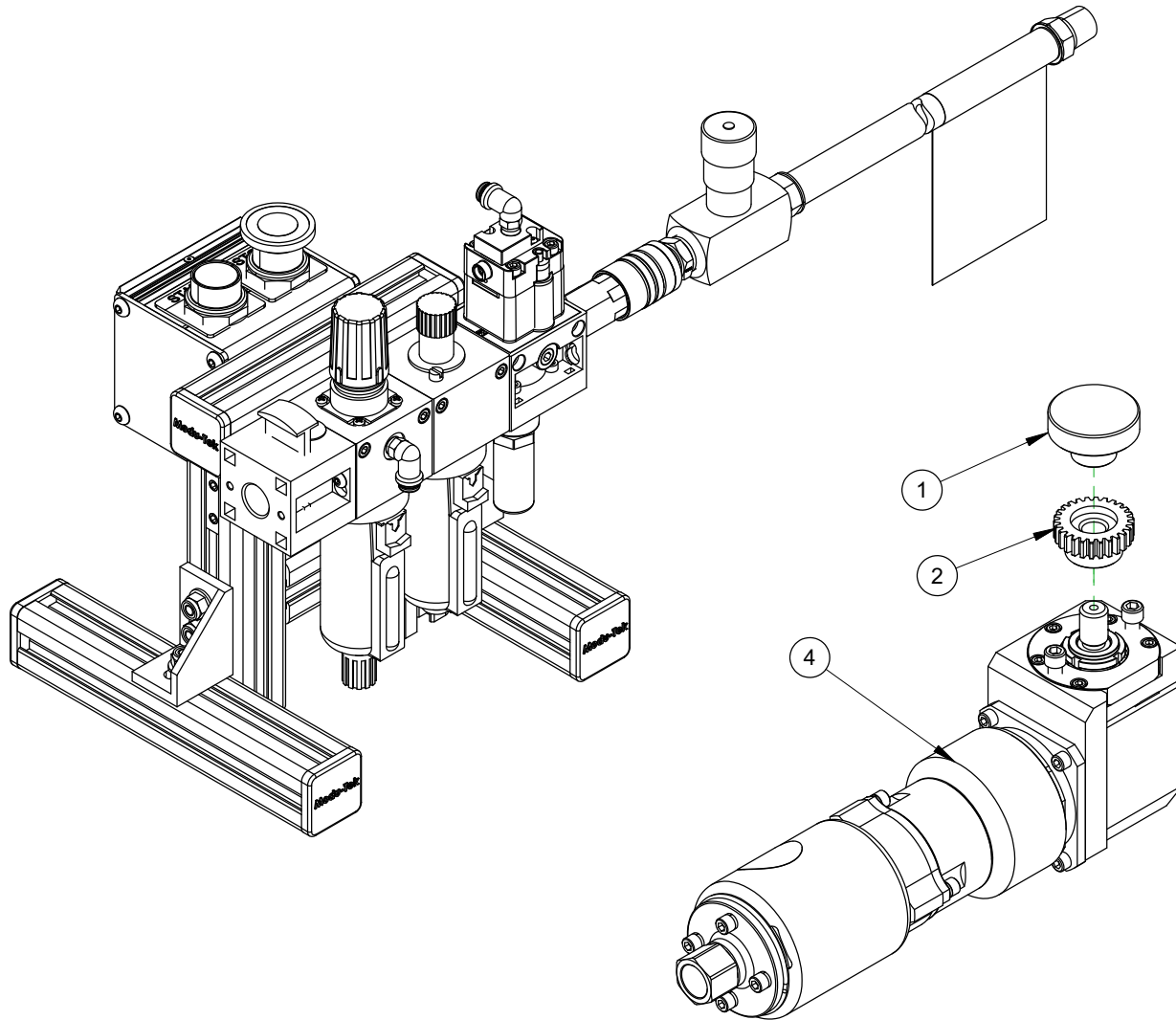
PART NO.	VOLTAGE
37388	120 V IN-LINE
37389	230 V IN-LINE

CLIMAX Portable Machine Tools, Inc  
Newberg, Or. USA 97132

CHART IN-LINE SWITCH  
KM3000

IMP NO. 37938

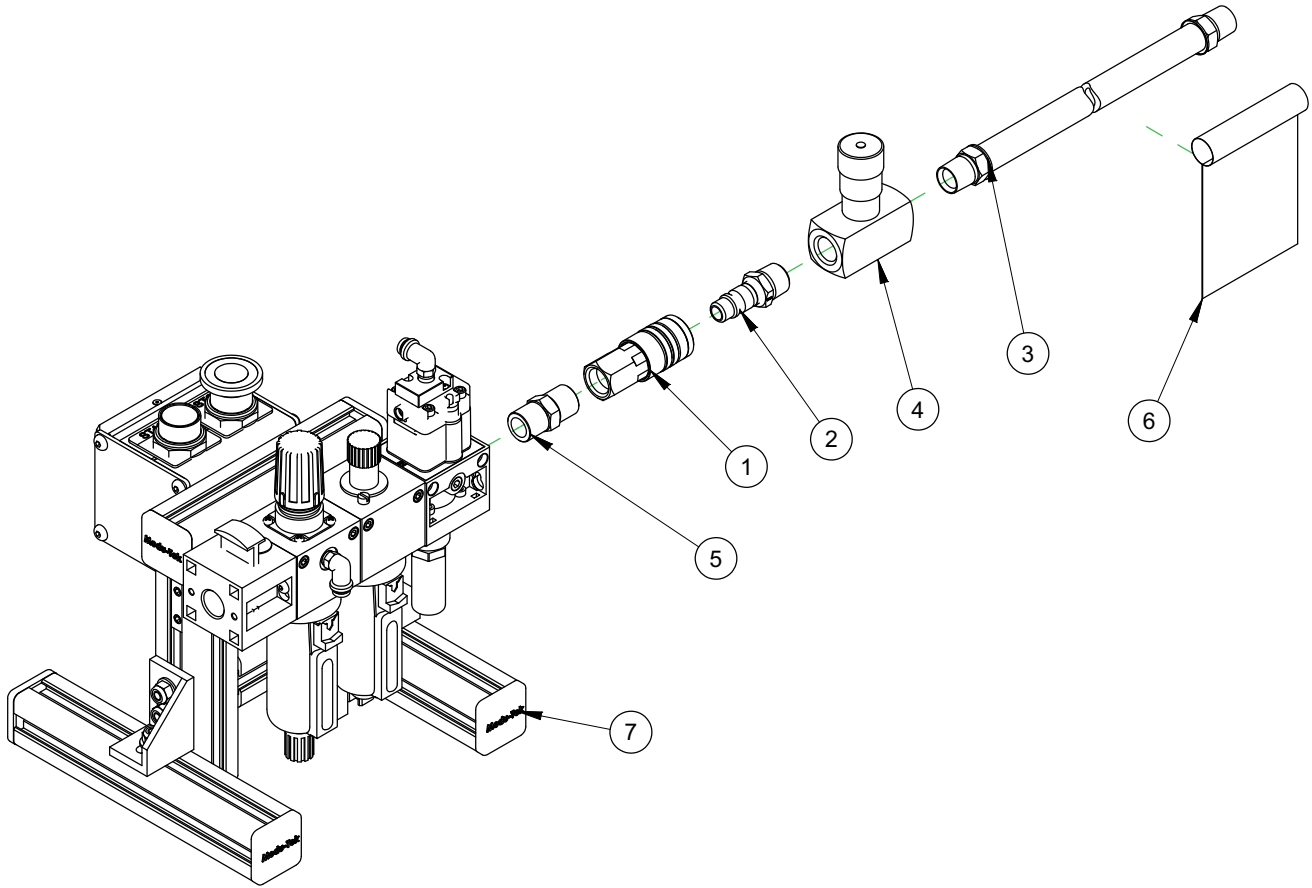
SHEET 1 OF 1



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10168	KNOB ADJUSTMENT 2 INCH KNURLED
2	1	10326	GEAR SPUR 26T 16DP 1.625PD
3	1	10380	VALVE & HOSE ASSY AIR KM3000 KM4000 PM4000
4	1	38708	MOTOR AIR ASSY KM3000

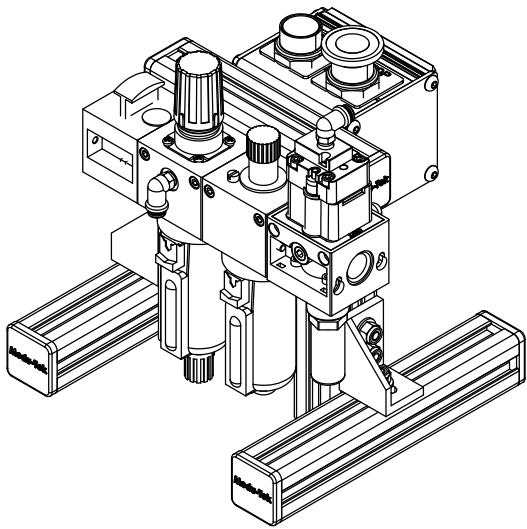
FIGURE A-29. PNEUMATIC DRIVE ASSEMBLY (P/N 38716)





PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13208	FTG QD COUPLER 1/2B 1/2 NPTF PNEUMATIC
2	1	13209	FTG QD NIPPLE 1/2B 1/2 NPTM PNEUMATIC
3	1	15915	HOSE ASSY 801 1/2 X 1/2 NPTMS X 1/2 NPTMS X 72
4	1	22229	VALVE NEEDLE 1/2 IN.
5	1	33809	FTG NIPPLE 1/2 NPT CLOSE BRASS
6	1	34734	LABEL WARNING 3-1/2 X 11
7	1	78264	PNEUMATIC CONDITIONING UNIT 1/2 IN LOW PRES. DROPOUT

FIGURE A-30. VALVE AND HOSE AIR ASSEMBLY (P/N 10380)



**ASSEMBLED**  
SCALE 1 : 5

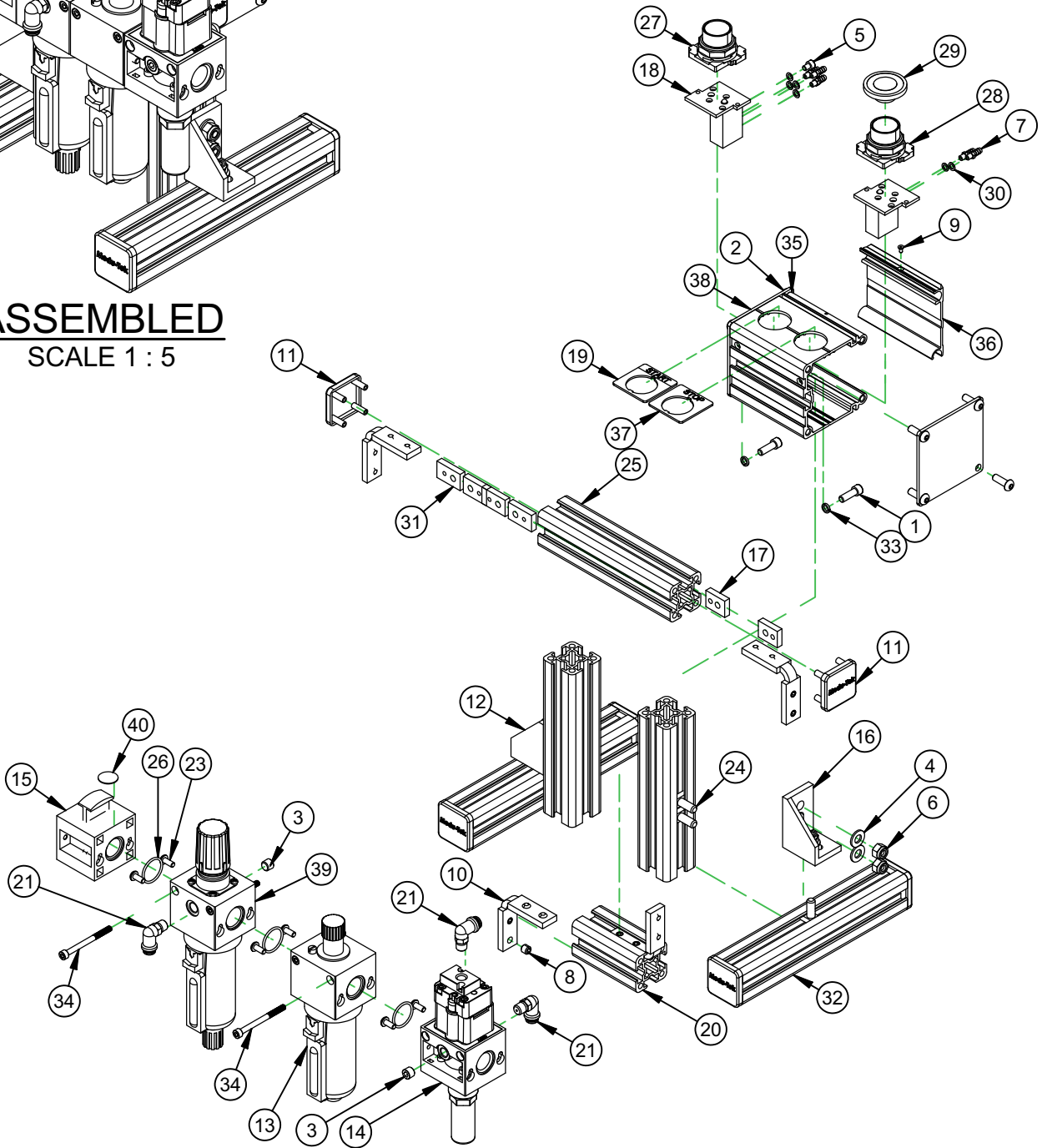


FIGURE A-31. PNEUMATIC CONDITIONING UNIT ASSEMBLY (P/N 78264)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	10160	SCREW 1/4-20 X 3/4 SHCS
2	8	11365	SCREW 1/4-20 X 3/4 BHSCS
3	2	12616	FTG PLUG 1/8 NPTM SOCKET
4	6	13489	WASHER 5/16 FLTW SAE
5	1	14726	SCREW 10-32 X 1/4 SHCS
6	6	19729	NUT 5/16-18 NYLON INSERT LOCKNUT
7	5	22235	FTG BARB #10-32 X 1/8 HOSE
8	16	27895	SCREW 5/16-18 X 5/16 SSSFP
9	1	35857	SCREW 4-40 X 1/4 FHSCS
10	4	46761	BRACKET 90DEG JOINER MODU-TEK
11	6	46764	ENDCAP 1 X 1 FOR 1.63SQ MODU-TEK EXTRUSION
12	1	46765	BRACKET 1X2 SLOT HALF WEB LEFT MODU-TEK
13	1	46768	LUBRICATOR AIR 1/2 NPTF 3.8oz BOWL W/SIGHT
14	1	46769	VALVE EXHAUST QUICK PILOT 1/2NPTF MUFFLER
15	1	46777	VALVE SHUT OFF VS22 SERIES
16	1	46783	BRACKET 1X2 SLOT HALF WEB RIGHT MODU-TEK
17	2	46784	NUT SQUARE 5/16-18 AND 1/4-20
18	2	46785	VALVE PUSHBUTTON 5 PORT PNEUMATIC
19	1	46797	LEGEND PLATE START 10250 SERIES
20	1	46802	1.63 X 1.63 X 3.375L MODU-TEK EXTRUSION
21	3	48648	FTG ELBOW 1/8 NPTM X 1/4 TUBE PRESTOLOK
22	60	48650	(NOT SHOWN) TUBING 1/4 OD POLYURETHANE (INCH)
23	6	53617	SCREW M5 X 0.8 X 12MM BHCS BLACK FINISH
24	6	59436	SCREW 5/16-18 X 3/4 T-BOLT
25	3	59437	1.63 X 1.63 X 7.00L MODU-TEK EXTRUSION
26	3	59442	O-RING 2mm X 23mm ID X 25mm OD
27	1	59458	PUSHBUTTON GREEN FLUSH
28	1	59459	PUSH BUTTON PUSH PULL MAINTAINED (M-M)
29	1	59462	PUSH BUTTON OPERATOR RED 1-5/8
30	6	59480	WASHER #10 FLTW PLASTIC .32 OD .025 THICK
31	4	59705	NUT PLATE M5 X .08 AND 5/16-32 .75 X 1.25 X .25
32	2	59739	EXTRUSION 1.63 X 1.63 X 8.75 MODU-TEK
33	2	59745	WASHER 1/4 LOCW .37 OD .07 THICK
34	4	91222	SCREW M5 X 0.8 X 60MM SHCS
35	1	59820	ENCLOSURE PNEUMATIC CONTROL VALVE 3.38 X 3.435 X 3.9
36	1	59821	COVER PNEUMATIC CONTROL VALVE ENCLOSURE 3.38 X 3.435 X 3.9
37	1	59825	LEGEND PLATE STOP 10250SERIES YELLOW BACKGROUND
38	2	68644	PLATE COVER EXTRUDED WIREWAY
39	1	78054	FILTER/REGULATOR PARTICULATE 1/2NPTF METAL BOWL GLASS
40	1	81132	LABEL WARNING - INSERT SAFETY LOCK

FIGURE A-32. PNEUMATIC CONDITIONING UNIT ASSEMBLY PARTS LIST (P/N 78264)

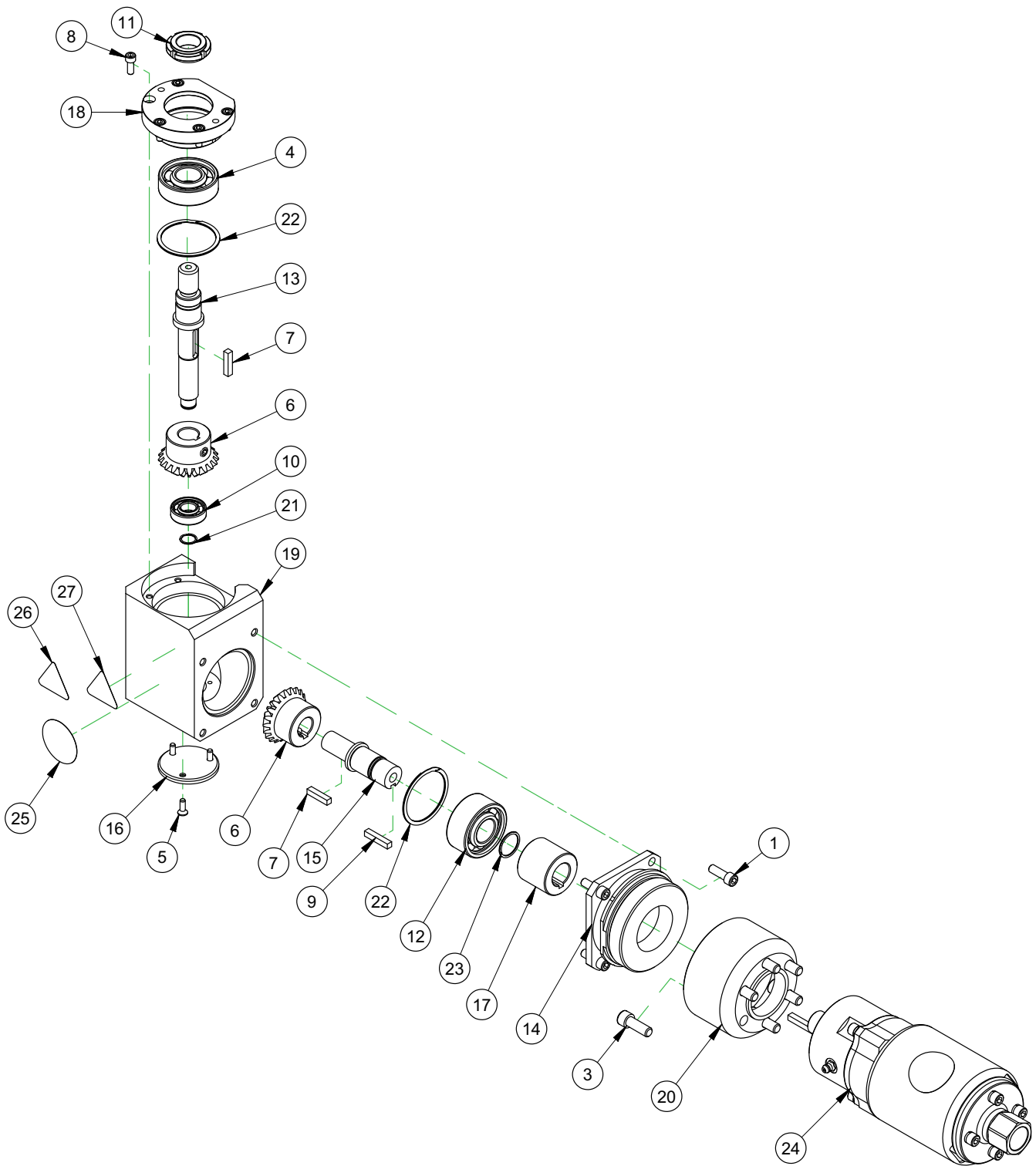
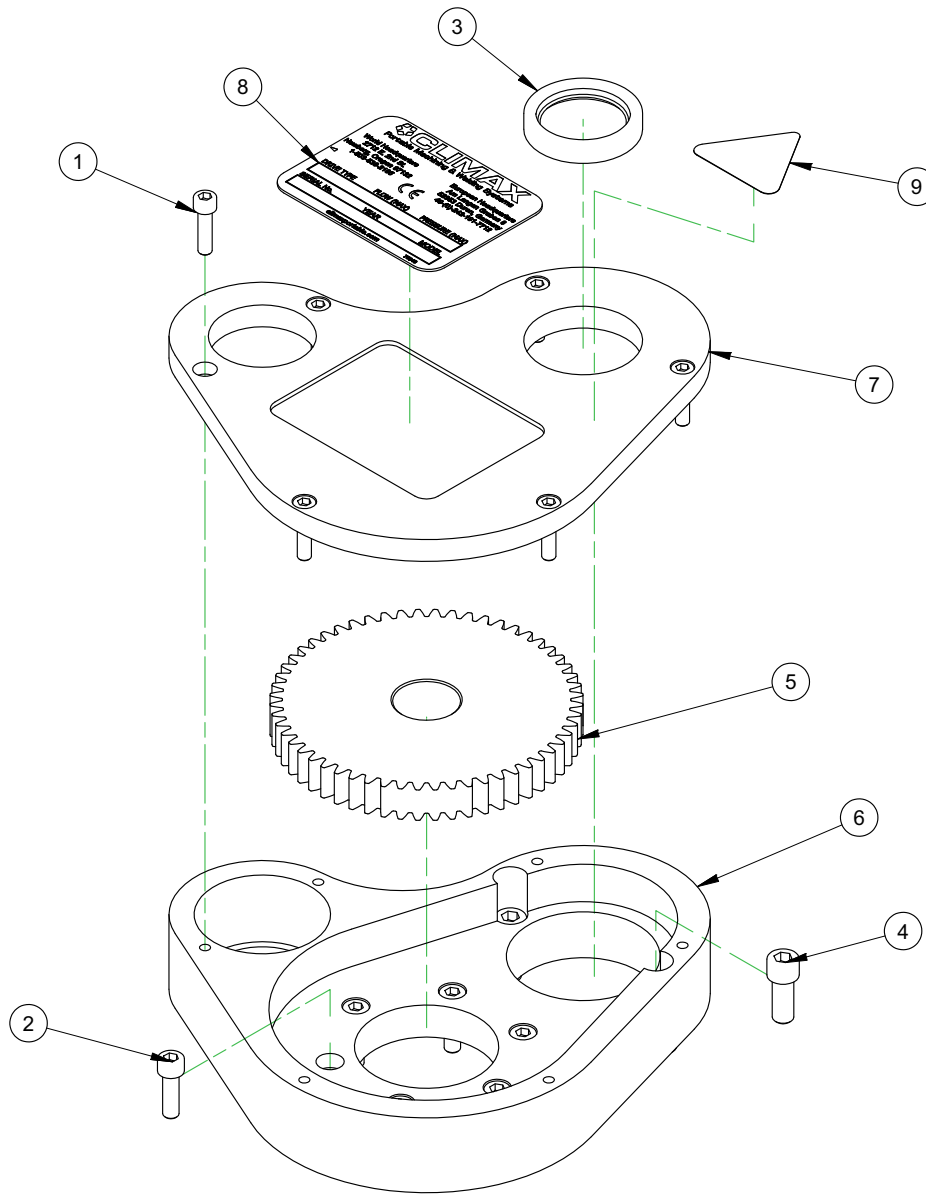


FIGURE A-33. PNEUMATIC MOTOR ASSEMBLY (P/N 38708)

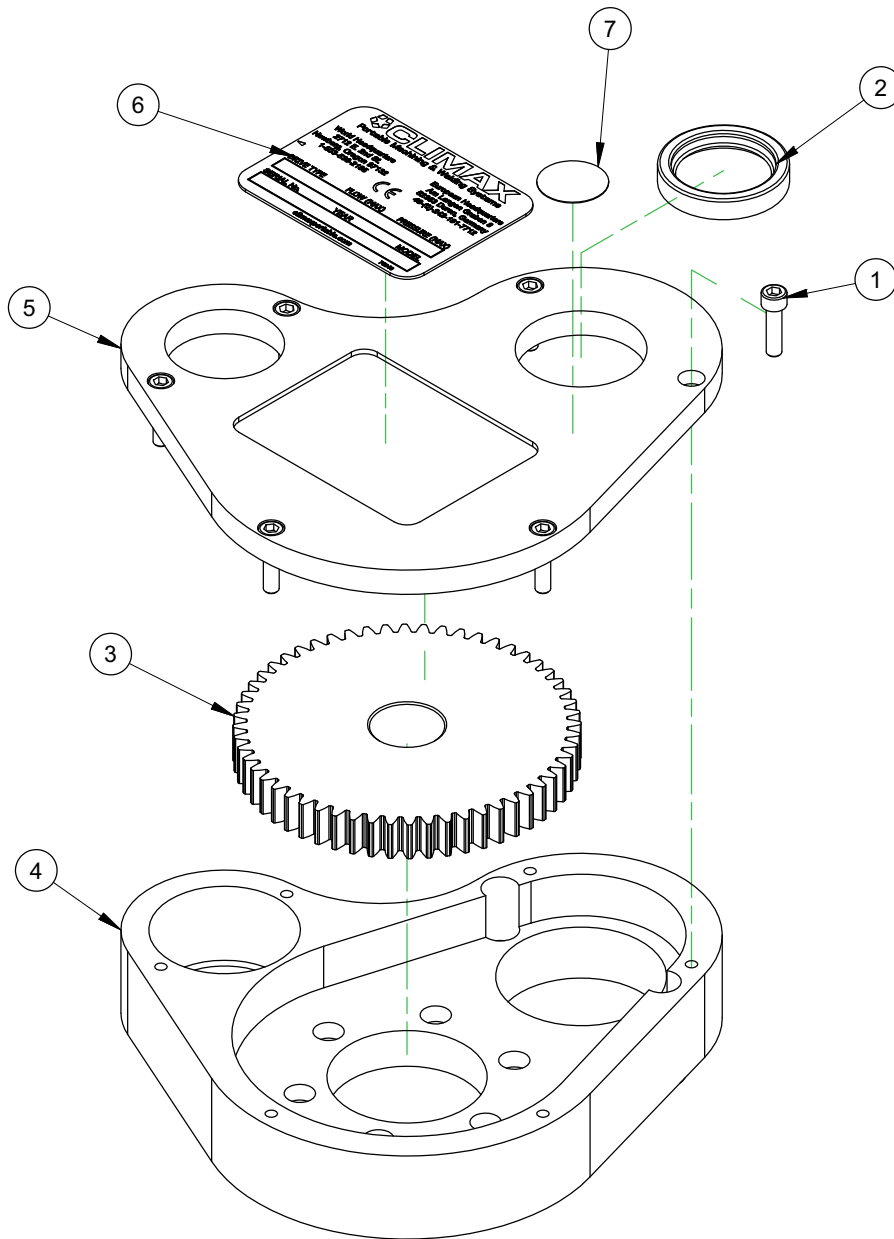
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10160	SCREW 1/4-20 X 3/4 SHCS
3	6	10830	SCREW 5/16-18 X 7/8 SHCS
4	1	10891	BRG BALL .7874 ID X 1.8504 OD X .5512 W/SEALS
5	3	11257	SCREW 8-32 X 1/2 FHSCS
6	2	12484	GEAR BEVEL 12DP 21T 1:1 20PA 1.75 PD HARDENED
7	2	12657	KEY 3/16 SQ X .87 SQ BOTH ENDS
8	5	12743	SCREW 10-24 X 1/2 SHCS
9	1	13080	KEY 3/16 SQ X 1.00 SQ BOTH ENDS
10	1	21077	BRG BALL .4724 ID X 1.1024 OD X .3150 W/SEALS
11	1	37981	NUT SELF LOCKING BRG ADJ SZ 4
12	1	38686	BRG ANGULAR CONTACT .7874 X 1.8504 OD X .811
13	1	38691	SHAFT OUTPUT RIGHT ANGLE DRIVE
14	1	38692	FLANGE AIR MOTOR ADAPTER
15	1	38693	SHAFT INPUT RIGHT ANGLE DRIVE
16	1	38694	CAP BOTTOM HOUSING
17	1	38695	COUPLING SHAFT
18	1	38696	ADAPTER HOUSING TOP FLANGE KM3000
19	1	38697	HOUSING ELBOW PNEUMATIC MOTOR
20	1	38698	ADAPTER AIR MOTOR KM3 KM4 PM4
21	1	38709	RING SNAP 15/32 ID X .025 TH SPIRAL HEAVY DUTY
22	2	38710	RING SNAP 1.850 OD SPIRAL MEDIUM DUTY
23	1	38711	RING SNAP 25/32 OD X .031 TH SPIRAL MEDIUM DUTY
24	1	38715	MOTOR MODIFIED AIR KM3000 KM4000 520 RPM
25	1	59044	LABEL WARNING - CONSULT OPERATOR'S MANUAL
26	1	78741	LABEL WARNING CRUSH FOOT
27	1	78748	LABEL WARNING FLYING DEBRIS/LOUD NOISE

**FIGURE A-34. PNEUMATIC MOTOR ASSEMBLY PARTS LIST (P/N 38708)**



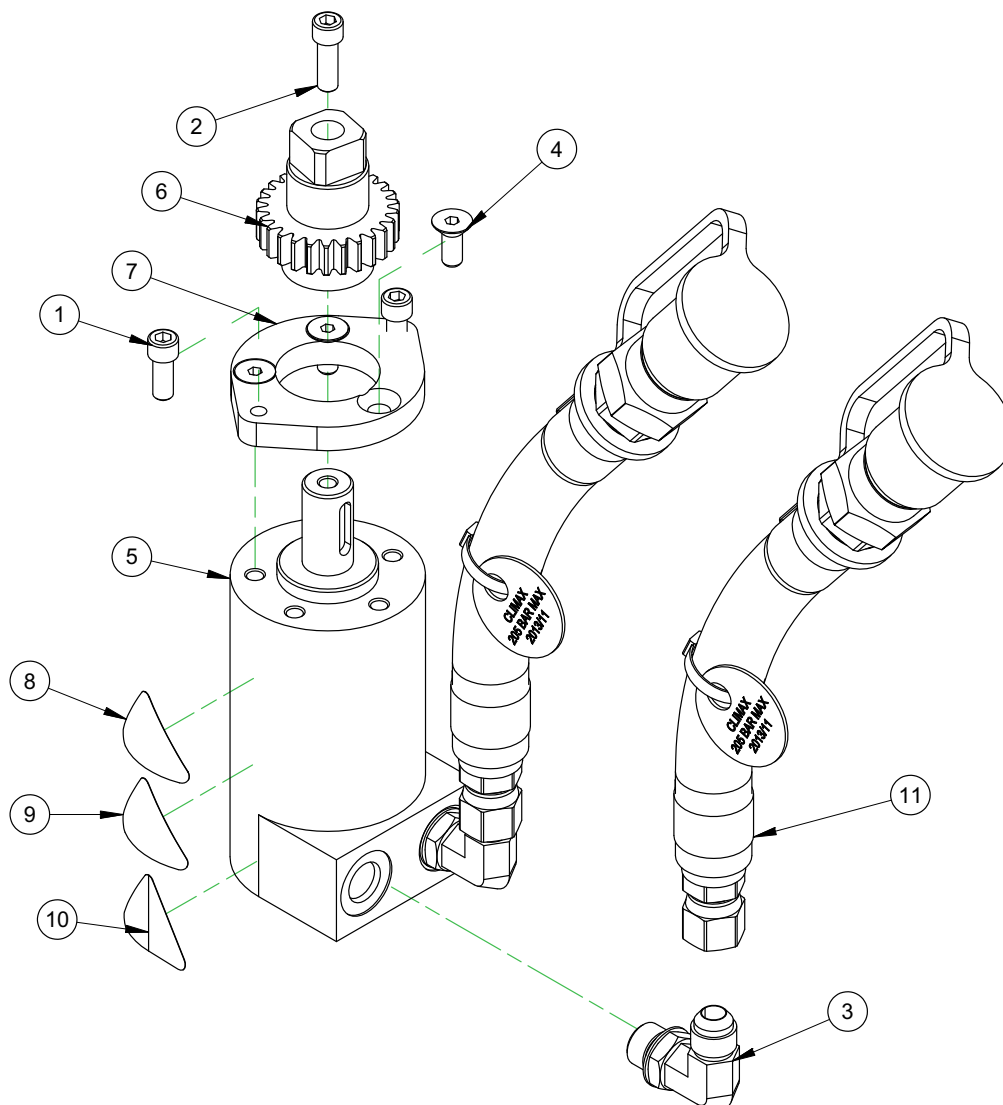
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10156	SCREW 8-32 X 5/8 SHCS
2	6	10157	SCREW 10-32 X 5/8 SHCS
3	1	10167	SEAL 1.000 ID X 1.375 OD X .250
4	2	12418	SCREW 1/4-20 X 5/8 SHCS
5	1	15517	GEAR SPUR 16DP 56T 20PA .43 X .97LG STEEL
6	1	34284	GEARBOX 4TH GENERATION KM3000
7	1	34285	GEARBOX COVER KM3000
8	1	75048	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63
9	1	79848	LABEL WARNING - CUTTING OF FINGERS OR HAND ROTATING BLADE GRAPHIC 1.13 TALL TRIANGLE YELLOW

FIGURE A-35. HYDRAULIC KEY MILL GEARBOX (P/N 34935)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10156	SCREW 8-32 X 5/8 SHCS
2	1	10167	SEAL 1.000 ID X 1.375 OD X .250
3	1	15517	GEAR SPUR 16DP 56T 20PA .43 X .97LG STEEL
4	1	34284	GEARBOX 4TH GENERATION KM3000
5	1	34285	GEARBOX COVER KM3000
6	1	75048	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63
7	1	79328	LABEL WARNING - CONSULT OPERATOR'S MANUAL GRAPHIC .75 DIA

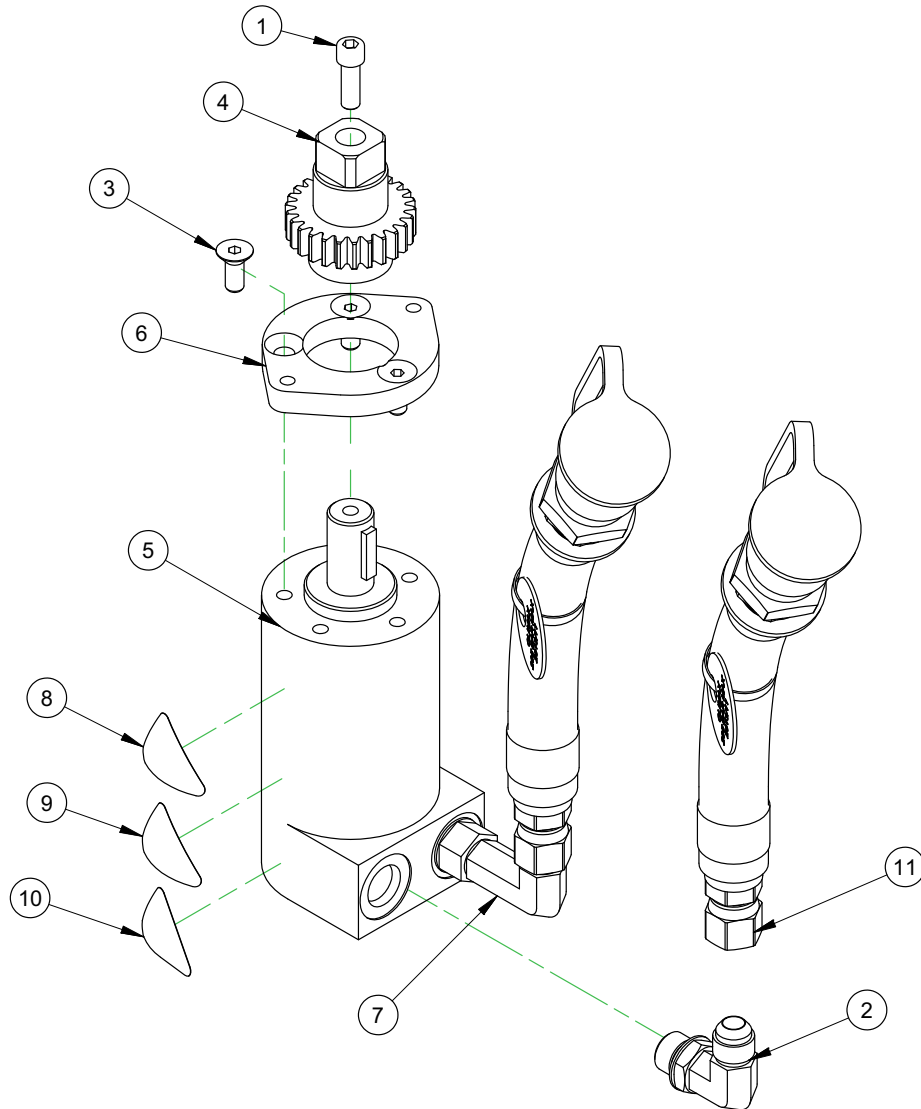
FIGURE A-36. BOX GEAR ASSEMBLY (P/N 21022)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	12418	SCREW 1/4-20 X 5/8 SHCS
2	1	12647	SCREW 1/4-28 X .75 SHCS
3	2	12849	FTG ELBOW SAE-6 MALE X #6 JIC MALE 90 DEG
4	3	12853	SCREW 1/4-28 X 5/8 FHSCS
5	1	14261	MOTOR HYD 0.79 CU IN STRAIGHT SAE O-RING
6	1	20379	GEAR SPUR MOTOR 16DP 1.625PD SPECIAL HYD MOTOR
7	1	35003	FLANGE MOTOR MTG HYD 4TH GEN GEARBOX
8	1	78741	LABEL WARNING CRUSH FOOT
9	1	78748	LABEL WARNING FLYING DEBRIS/LOUD NOISE
10	1	79848	LABEL WARNING - CUTTING OF FINGERS OR HAND ROTATING BLADE GRAPHIC 1.13 TALL TRIANGLE YELLOW
11	2	80041	ASSY HOSE 3/8 X 1/2 QD MALE X #6 JICF X 24 CE

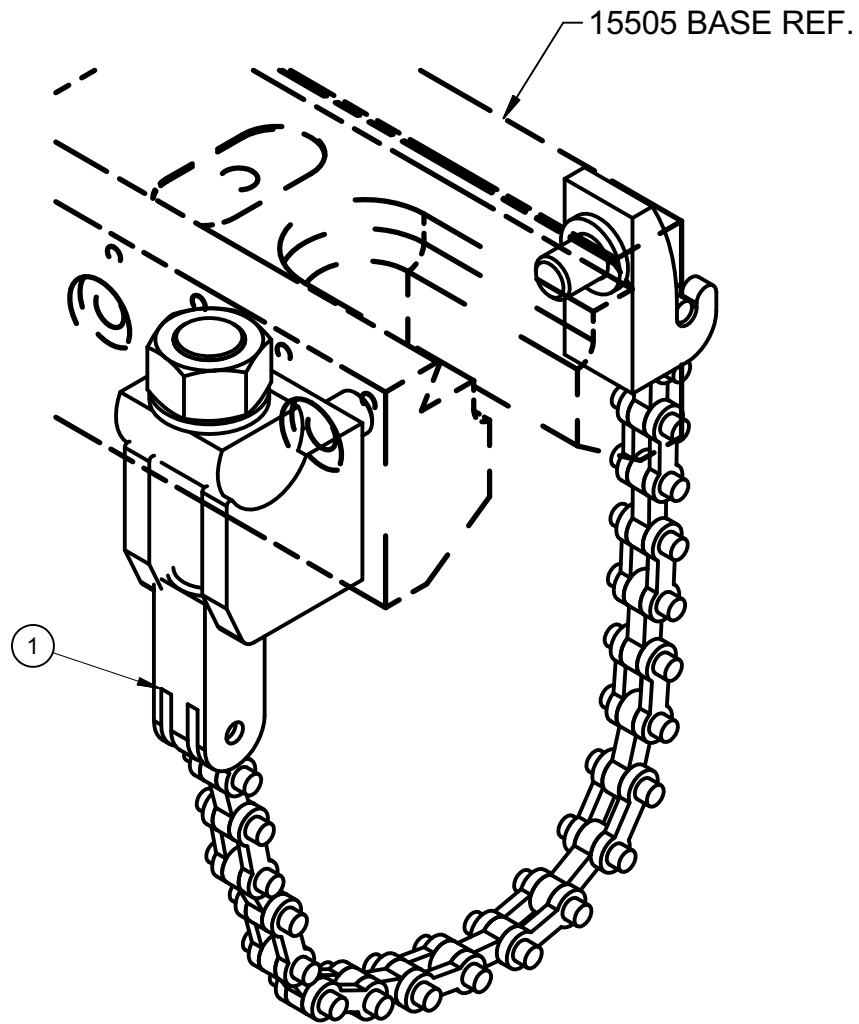
FIGURE A-37. HYDRAULIC MOTOR ASSEMBLY (P/N 35002)





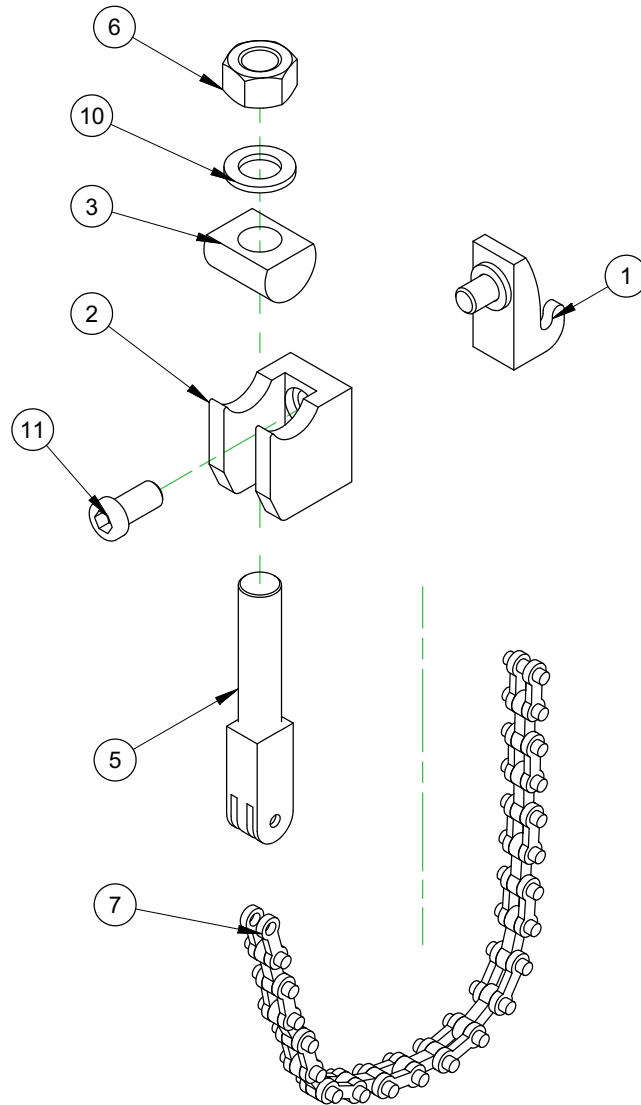
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	12647	SCREW 1/4-28 X .75 SHCS
2	1	12849	FTG ELBOW SAE-6 MALE X #6 JIC MALE 90 DEG
3	3	12853	SCREW 1/4-28 X 5/8 FHSCS
4	1	20379	GEAR SPUR MOTOR 16DP 1.625PD SPECIAL HYD MOTOR
5	1	21025	MOTOR HYD 1.21 CU IN. CHAR-LYNN
6	1	35003	FLANGE MOTOR MTG HYD 4TH GEN GEARBOX
7	1	56793	FITTING ELBOW MALE JIC-6 TO MALE SAE-6 90°
8	1	78741	LABEL WARNING CRUSH FOOT
9	1	78748	LABEL WARNING FLYING DEBRIS/LOUD NOISE
10	1	79848	LABEL WARNING - CUTTING OF FINGERS OR HAND ROTATING BLADE GRAPHIC 1.13 TALL TRIANGLE YELLOW
11	2	80072	ASSY HOSE 3/8 X 1/2 QD MALE X #6 JICF X 28 CE

FIGURE A-38. 250-450 RPM HYDRAULIC MOTOR ASSEMBLY (P/N 41432)



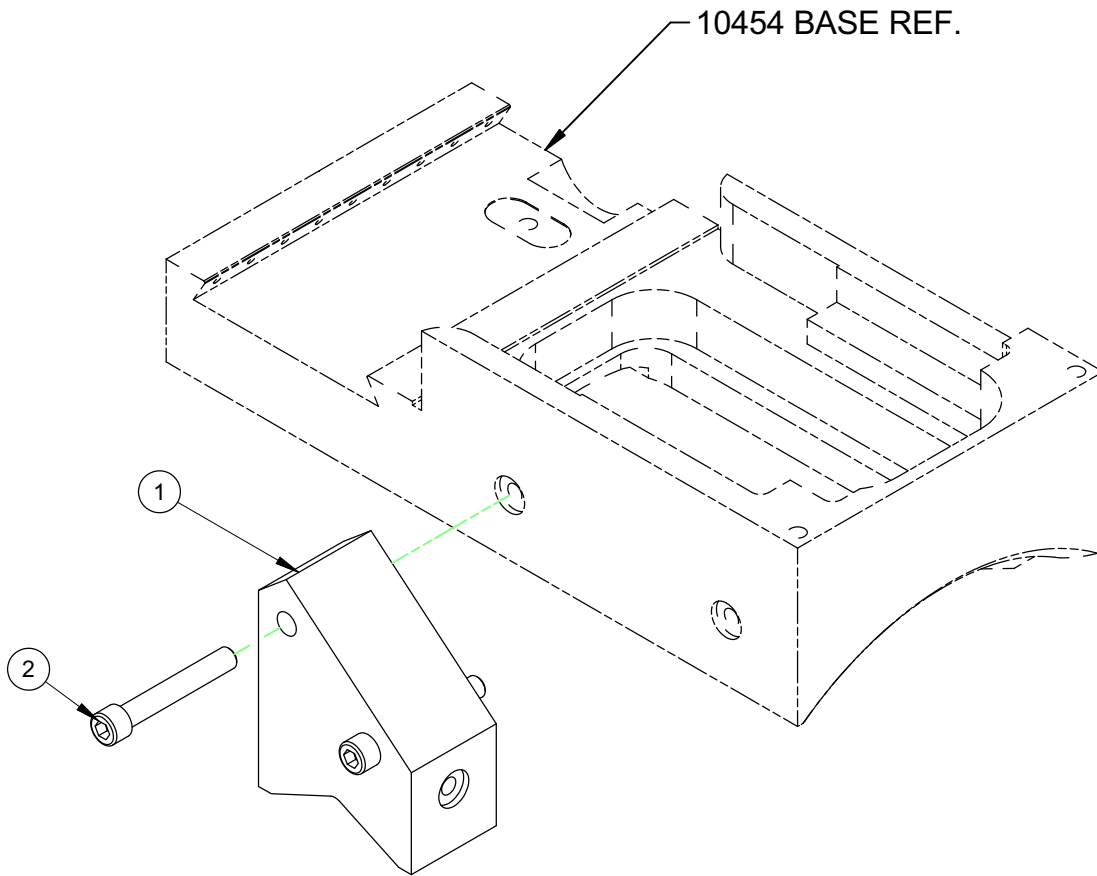
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	27364	CHAIN CLAMP ASSY 10-1/2 DIA KM3000 2ND

FIGURE A-39. CHAIN CLAMP ASSEMBLY (P/N 10378)



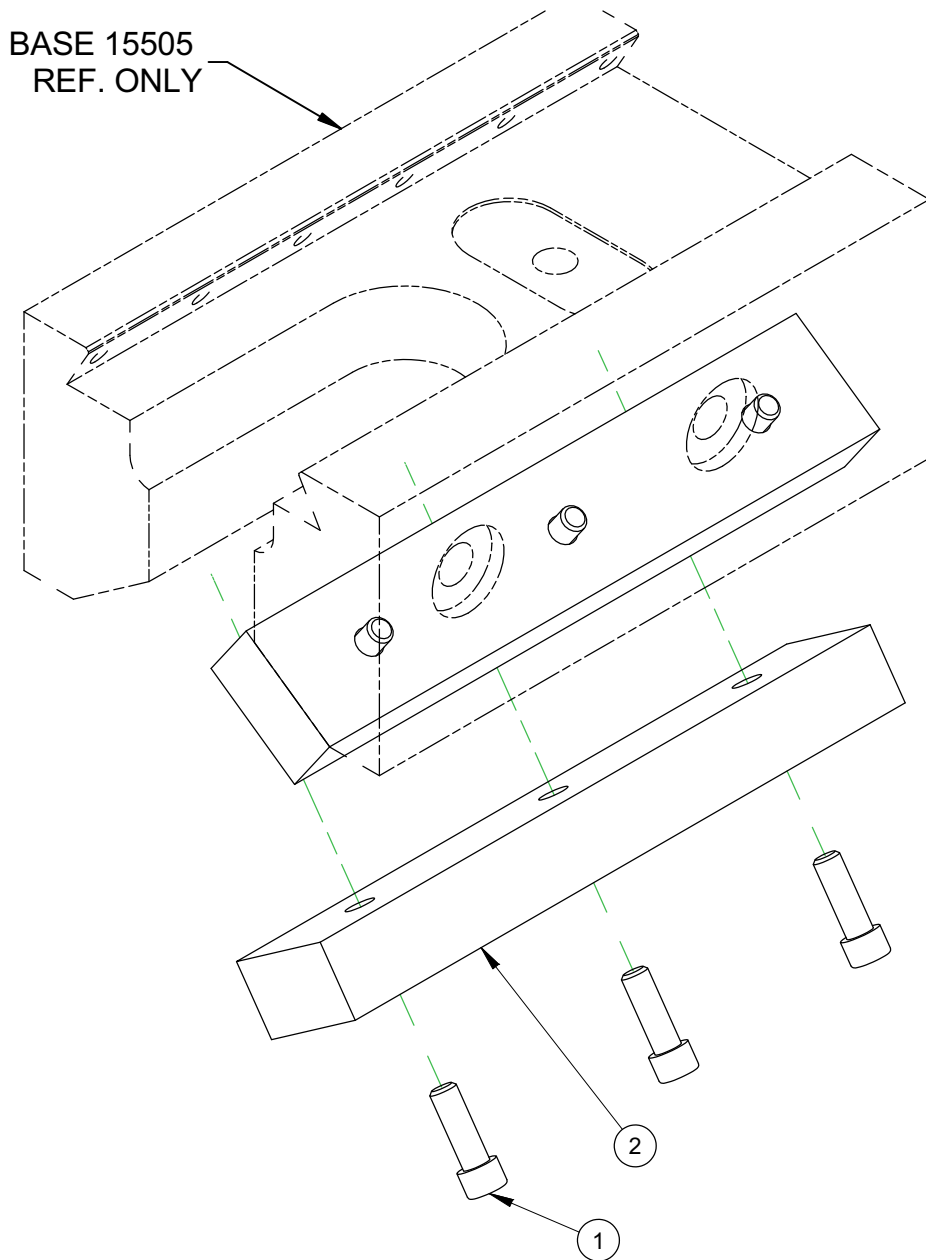
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	15504	CASTING BLOCK CLAMP SMALL
2	1	15835	CASTING -BLOCK CLAMP
3	1	10206	ROCKER CHAIN CLAMP
5	1	27385	BOLT - CHAIN CLAMP
6	1	10197	NUT 3/4-10 STDN ZINC PLATED
7	1	27366	CHAIN WRENCH 3/4 PITCH .240 DIA PIN (VMI)
10	1	10198	WASHER THRUST .750 ID X 1.250 OD X .123
11	2	15670	SCREW 1/2-13 X 1 LHSCS

FIGURE A-40. CHAIN CLAMP ASSEMBLY 10-1/2 DIAMETER (P/N 27364)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10255	CROSS MILLING ADAPTER
2	2	19950	SCREW 1/2-13 X 3 1/4 SHCS

**FIGURE A-41. CROSS MILLING ADAPTER (KM4000 BASE SHOWN) (P/N 10381)**



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10160	SCREW 1/4-20 X 3/4 SHCS
2	1	11668	SHIM SET SMALL DIA MILLING KM3000 (KB)
3	1	19605	(NOT SHOWN) DRAWING INSTRUCTIONS SHIM INSTALLATION KM3000

FIGURE A-42. SHIM KIT ASSEMBLY (P/N 11669)

The following critical parts may occasionally need to be replaced due to loss, wear, or damage, and are available for purchase from CLIMAX..

**TABLE A-1. SERVICE PARTS LIST**

<b>Part number</b>	<b>Description</b>	<b>Quantity</b>
10189	SCREW 1/4-20 X 5/8 SSSHDPPL	6
10190	LEADNUT BRASS	1
10191	SCREW 3/8-16 X 1 SHCS	1
10193	RING SNAP 1-3/4 ID BEVELED .062 TH (VMI)	1
10197	NUT 3/4-10 STDN ZINC PLATED	1
10199	WRENCH HEX 1/4 SHORT ARM	1
10200	WRENCH HEX 1/8 SHORT ARM	1
10203	CRANK HANDLE 1/2 SQUARE	1
10206	ROCKER CHAIN CLAMP	1
10302	COLLET 16mm (.630) OD X 12mm (.472) ID	1
10386	ENDMILL SET INCH 1/16 IN. INCREMENTS	1
10387	ENDMILL SET METRIC 8 10 12 16 18	1
11735	SCREW 5/16-18 X 1-1/4 SHCS	1
12546	SP ASSY GEAR INTERMEDIATE MILWAUKIE MOTOR	1
12549	SP ARMATURE 3RD 120V	1
12553	SP SCREW BRUSH RETAINING 3RD	2
13174	BRG THRUST .875 ID X 1.437 OD X .0781 (VMI)	2
13175	WASHER THRUST .875 ID X 1.437 OD X .060 (VMI)	4
15482	SP SET BRUSH ASSY CARBON 120V 3RD	2
15635	LEADSCREW VERT ADJ INCH 3RD KM3000 2.50 INCH	1
15647	CLAMP ASSY STANDARD KM3000	1
15657	SHAFT ASSY TRAVERSE DRIVE 2ND KM3000	1
16020	LEADSCREW VERT ADJ METRIC 3RD KM3000 2.50 INCH	1
16325	MANUAL INSTRUCTION KM3000 KEY MILL 4TH GEN	1
27366	CHAIN WRENCH 3/4 PITCH .240 DIA PIN (VMI)	32" (812 mm)
27385	BOLT CHAIN CLAMP 3/4 PITCH WRENCH CHAIN (KB)	1
27385	BOLT CHAIN CLAMP 3/4 PITCH WRENCH CHAIN (KB)	1
31436	SP FIELD 120 VOLT MILWAUKEE 5535 AND 5455	1
31437	SP FIELD 230 VOLT MILWAUKEE 5535 AND 5455	1

**TABLE A-1. SERVICE PARTS LIST**

<b>Part number</b>	<b>Description</b>	<b>Quantity</b>
31769	SP BRUSH CARBON KM3000/87 MOTOR 230V	2
37405	SCREW MODIFIED 1/2-20 X .425 END MILL SCREW	1
37981	NUT SELF LOCKING BRG ADJ SZ 4 (VMI)	1
38091	ASSY LEADSCREW TOP SLIDE KM3000	1
38116	COLLAR LEADSCREW BEARING	1
39304	SP ARMATURE 230V REWIND	1

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# APPENDIX B SCHEMATICS

## Schematic list

FIGURE B-1. PNEUMATIC SCHEMATIC (P/N 59246) - - - - -85  
 FIGURE B-2. HYDRAULIC SCHEMATIC - - - - -85  
 FIGURE B-3. ELECTRICAL SCHEMATIC - - - - -86  
 FIGURE B-4. CONTROLLER SCHEMATIC (P/N 36549) - - - - -87

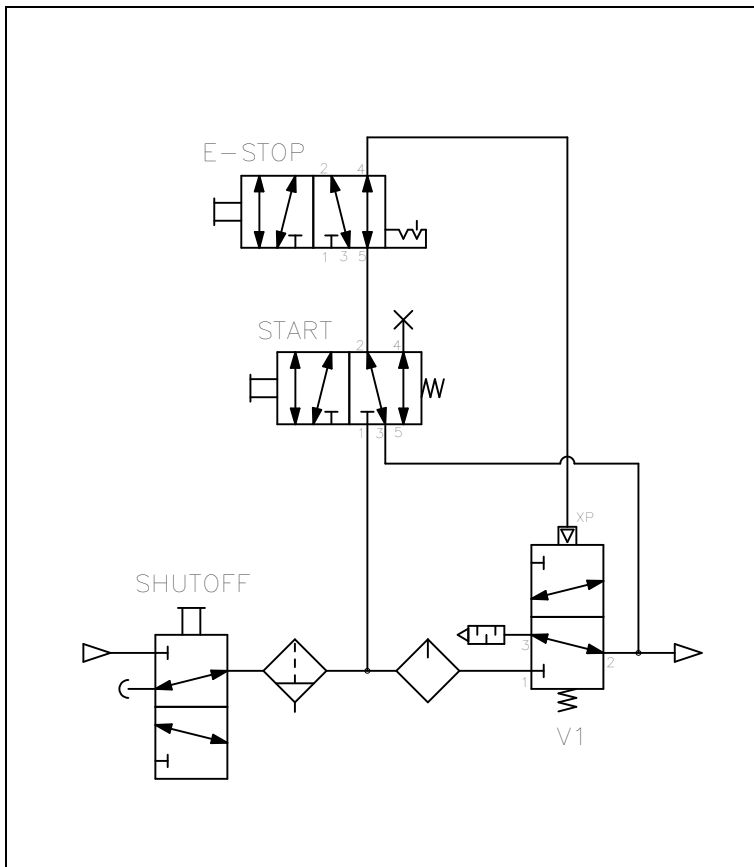


FIGURE B-1. PNEUMATIC SCHEMATIC (P/N 59246)

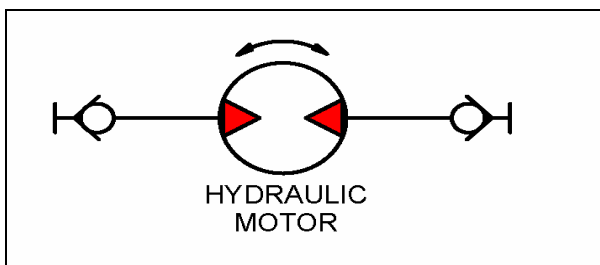


FIGURE B-2. HYDRAULIC SCHEMATIC

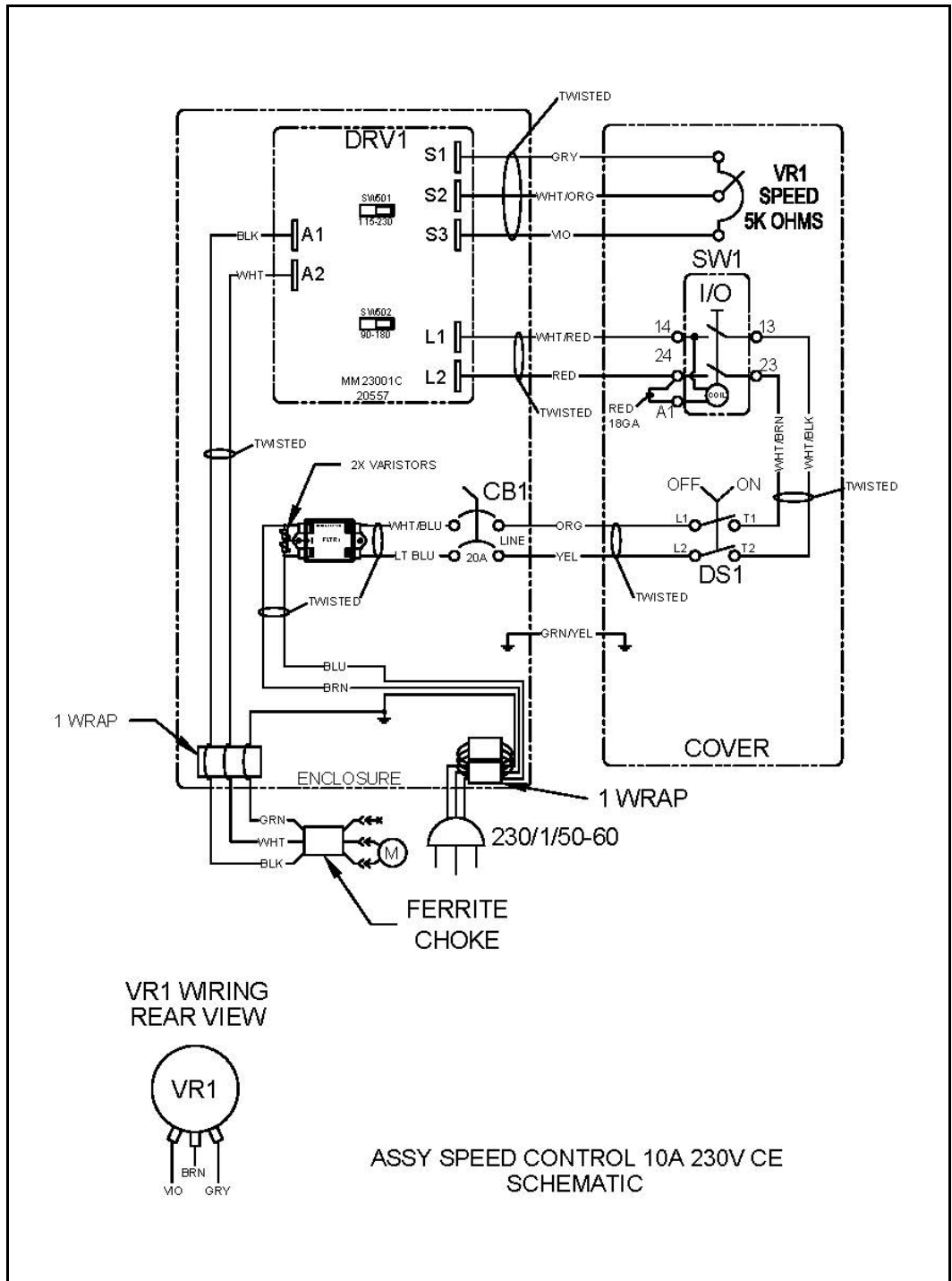


FIGURE B-3. ELECTRICAL SCHEMATIC

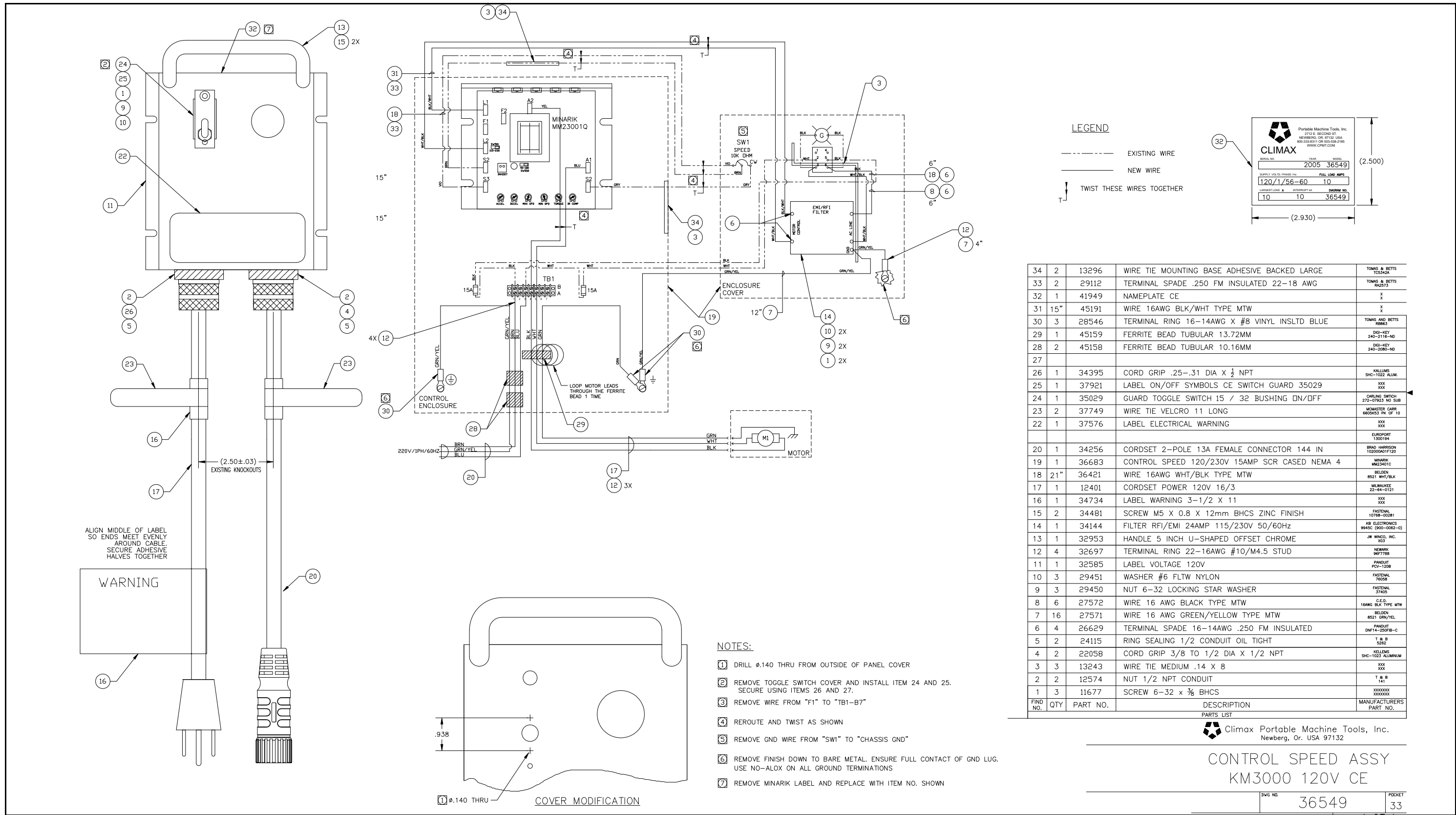


FIGURE B-3. CONTROLLER SCHEMATIC (P/N 36549)

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## APPENDIX C SDS

Contact CLIMAX for the current Safety Data Sheets.

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 **CLIMAX**

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 **BORTECH**  **CALDER** **H&S** **TOOL**