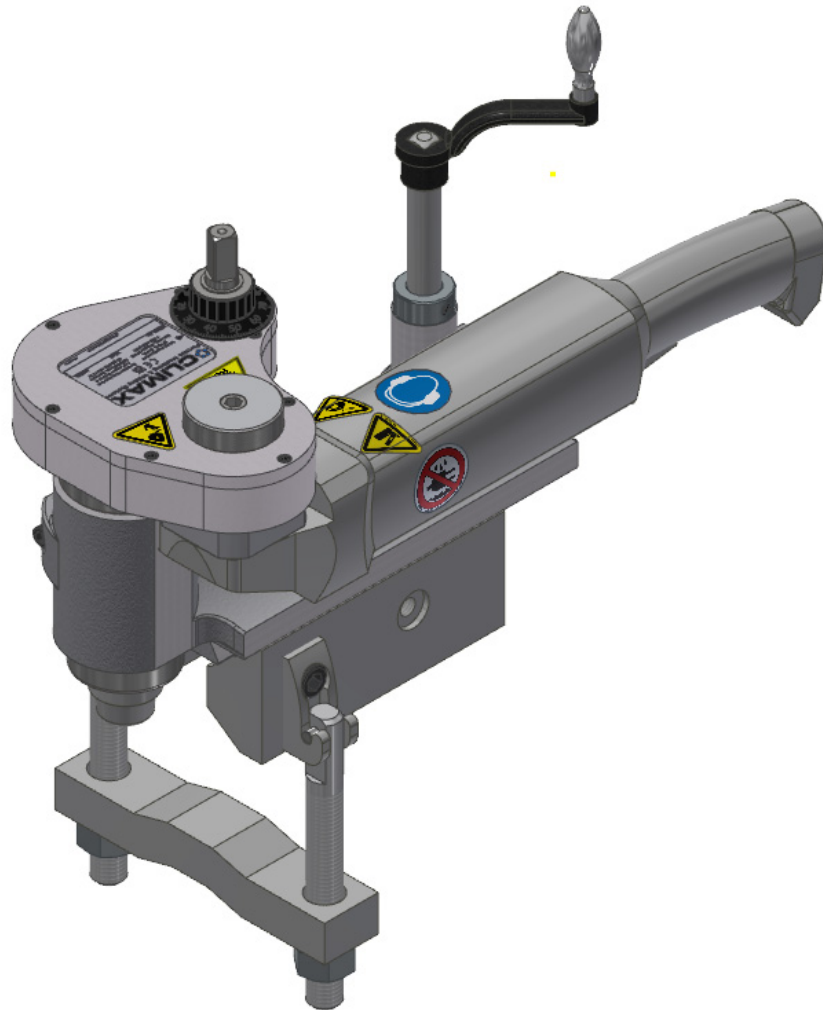


CE

KM3000/ KM4000

KEY MILL MACHINE



 **CLIMAX**
Portable Machining & Welding Systems

P/N 104075
May 2023
Revision 0

 **CLIMAX** |  **BORTECH**  **CALDER**  **H&S**  **TOOL**

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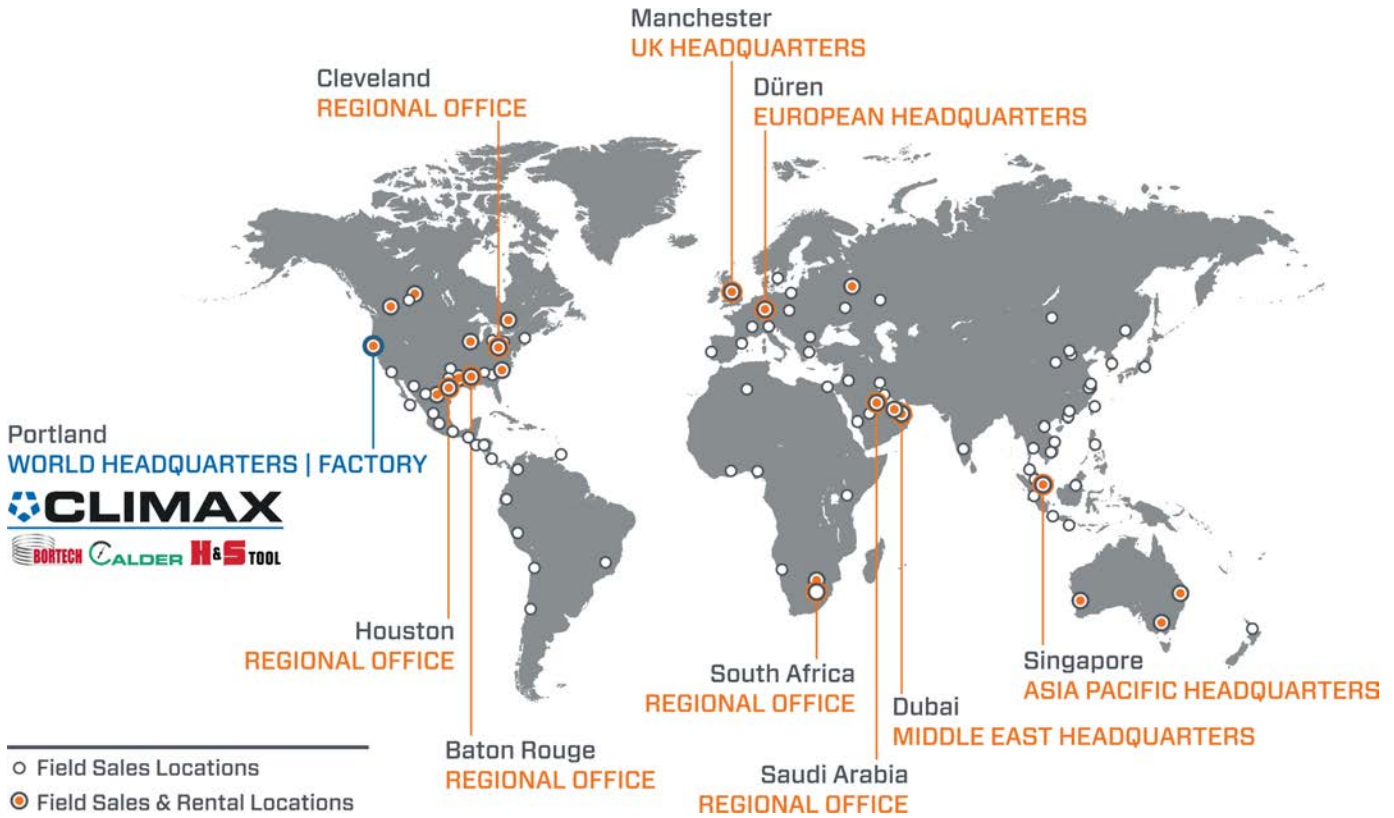
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1 INTRODUCTION

IN THIS CHAPTER:

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1.3 GENERAL SAFETY PRECAUTIONS	2
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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/KM4000.

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/KM4000 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 here¹:

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. During testing, the machine produced the sound levels¹ listed in Table 1-1.

TABLE 1-1. SOUND LEVELS

	Electric motor
Sound power	88.8 dBA
Operator sound pressure	89.4 dBA
Bystander sound pressure	84.5 dBA

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. Machine sound testing was conducted in accordance with European Harmonized Standards EN ISO 3744:2010 and EN 11201:2010.

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 1-2. RISK ASSESSMENT CHECKLIST BEFORE SET-UP

Before set-up	
<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 3.3).
<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 potential fall paths in lifting and rigging operations. I have taken precautions to keep workers away from the identified fall paths.
<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 1-3. RISK ASSESSMENT CHECKLIST AFTER SET-UP

After set-up	
<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 5.1).
<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. I understand that leaving the workspace with the machine running and unattended may cause personnel injury and machine or workpiece damage.
<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 1-4. KM3000/KM4000 LABELS

	<p>P/N 53464 Warning label: hot surface (electric motor only)</p>		<p>P/N 59037 Warning label: wear ear protec- tion</p>
	<p>P/N 59039 (KM4000 only) Label: lift point</p>		<p>P/N 59044 Warning label: read the operating manual</p>
	<p>P/N 78741 Warning label: wear steel-toed shoes</p>		<p>P/N 78748 Label warning: wear eye protec- tion</p>
	<p>P/N 78824 Label warning: keep electrical cords away from water (electric motor only)</p>		<p>P/N 79575 Label warning: be cautious of mov- ing parts</p>

For label locations, see Appendix A (Figure A-6 on page 61 for KM4000 labels).

2 OVERVIEW

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2.1 FEATURES AND COMPONENTS

2.1.1 KM3000 features and components

The KM3000 portable key mill machine is designed to cut keyways in shafts. The automatically centering V-base is quick and easy to set up. The universal type motor and triple gear reduction produce plenty of torque for most operations.

The KM3000 has many capabilities, including but not limited to the following:

- Clamps on any shaft from 1.5–4.5" (38–114 mm) in diameter with the standard bar clamp
- Cuts stub-end keyways or mid-shaft keyways
- Clamping the machine to a flat surface to cut motor mount slots
- With the optional shim kit, cut keyways or slots in shafts as small as 0.75" (19 mm) in diameter
- Keyways up to 1.25" (32 mm) wide and 6.0" (152 mm) long may be cut in a single pass

Features include the following:

- Compact, rugged, portable milling machine for on-site keyway and other milling jobs
- Electronic speed control offering precision control of spindle speeds
- 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 only needs 1.5" (38 mm) of shaft for clamping.
- The KM3000 clamps shafts up to 10.5" (266 mm) diameter 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

Figure 2-1 shows the KM3000's main components.

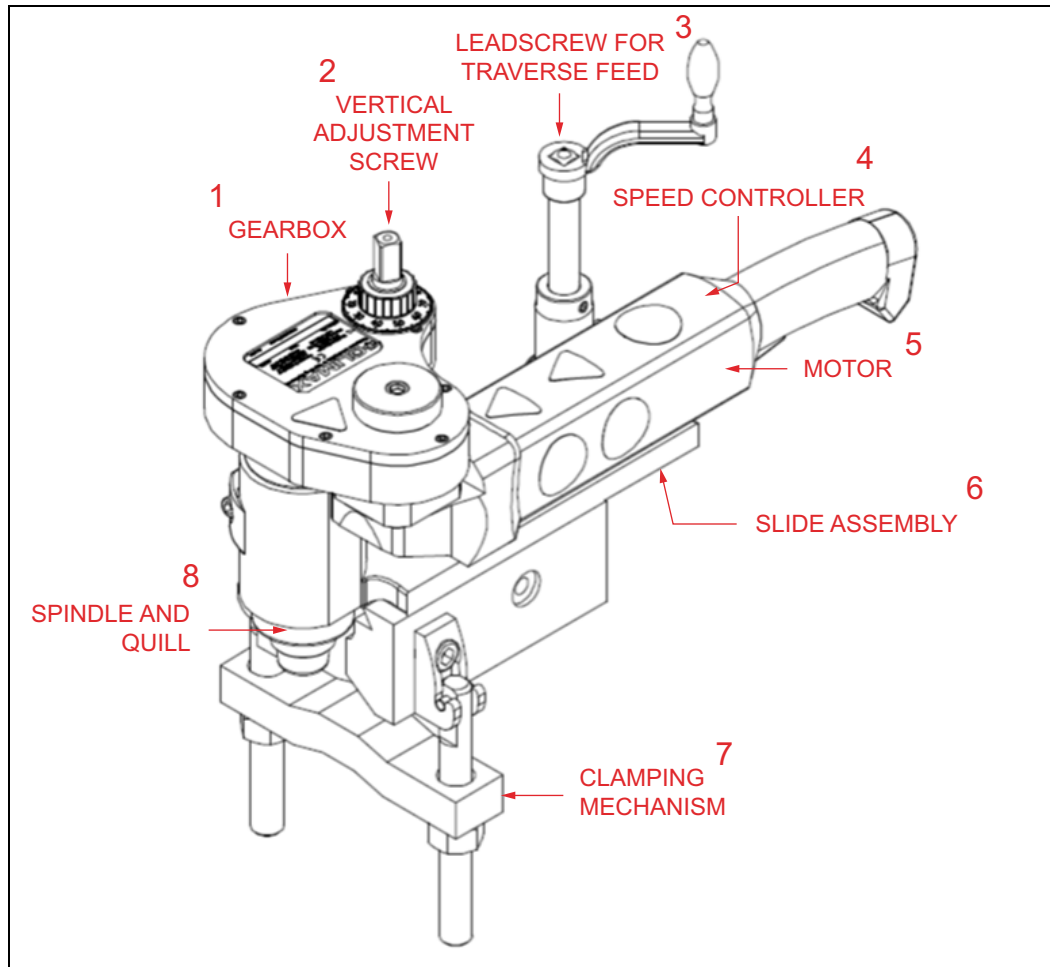


FIGURE 2-1. KM3000 COMPONENTS

TABLE 2-1. KM3000 COMPONENT IDENTIFICATION

Number	Component
1	Gearbox
2	Vertical adjustment screw
3	Leadscrew for traverse feed
4	Speed controller
5	Motor

TABLE 2-1. KM3000 COMPONENT IDENTIFICATION

Number	Component
6	Slide assembly
7	Clamping mechanism
8	Spindle and quill

2.1.2 KM4000 features and components

The KM4000 key mill machine is designed to cut extra wide keyways, stress relief pockets, motor mount slots, and more. Built for rugged duty, the machine features permanently lubricated reduction gears so the machine can be operated at any angle. Anti-friction bearings are used throughout.

The dovetail ways are machined to offer smooth movement in both the longitudinal and side travel directions.

An electronic speed control offers precision control of spindle speeds.

The 2" (51 mm) side travel allows cutting wide pockets or slots with a single end mill.

The KM4000 mounts on shafts up to 24" (609 mm) in diameter (with optional extra chain) and may be used anywhere along the shaft. With the optional shim kit the machine can be used on shafts as small as 4" (100 mm) in diameter.

- Compact, rugged, portable milling machine for on-site keyway and other milling jobs
- Mounts on shafts from 4–24" (101–610 mm) in diameter
- Cuts new keyways up to 3.25" (83 mm) wide and 7.88" (200 mm) long in one setup (cut dimensions include the width of the end mill)
- Contoured base is self-aligning with the shaft
- Triple gear reduction with permanently sealed lubrication
- Zeroing type adjusting dial for controlling cutter depth

Figure A-5 on page 60 shows the KM4000 components.

2.2 CONTROLS

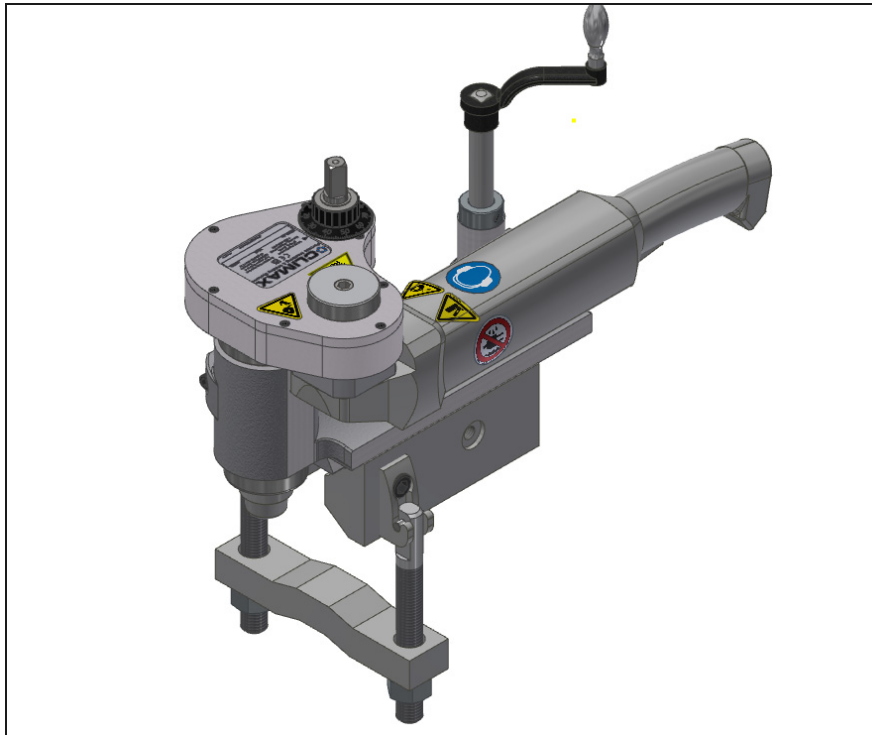


FIGURE 2-2. KM3000 MOTOR

The KM3000/KM4000 key mill machine is available in electric, pneumatic and hydraulic versions.

2.2.1 KM3000/KM4000 electric power

Table 2-2 lists operating specifications of the electrically powered version of the KM3000/KM4000.

TABLE 2-2. ELECTRIC POWER SPECIFICATIONS

Voltage type:	110-130 VAC 50/60Hz	220-240 VAC 40/60Hz
Design current:	13A	6.6A
Maximum current:	15A	7.0A
Duty cycle:	75% (45 min per hour)	75% (45 min per hour)

CAUTION

Prolonged operation of the motor above the design current will result in excessive heat generation and motor damage. Motor failure can occur suddenly and without warning above the maximum current.

Figure 2-3 shows the motor controls. The motor uses an integrated speed controller and has a lock function on the control trigger. The speed controller monitors motor speed to maintain constant motor speed as the load on the spindle increases.



FIGURE 2-3. MOTOR CONTROLS

TABLE 2-3. MOTOR CONTROL IDENTIFICATION

Number	Component
1	Speed control
2	Trigger lock
3	Control trigger

The motor has built in restart protection and soft start. A flashing light on the speed control indicates that the trigger needs to be reset before the motor can start.

⚠ CAUTION

To avoid damaging the motor, the KM3000 should be used with a circuit breaker sized to prevent the motor from running above the maximum current.

Table 2-4 on page 12 shows the approximate spindle speed at specific motor settings.

TABLE 2-4. SPINDLE SPEED SPECIFICATIONS

Motor Setting	Spindle Speed
Setting 1	180 RPM
Setting 2	260 RPM
Setting 3	320 RPM
Setting 4	390 RPM
Setting 5	460 RPM
Setting 6	530 RPM

2.2.2 KM3000/KM4000 pneumatic power

Figure B-1 on page 79 shows the pneumatic schematic.

TABLE 2-5. 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 ³ /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.

Emergency shutdown

To stop machine operation immediately, press the emergency stop button on the PCU.

Before restarting a pneumatic-powered KM3000/KM4000, do the following:

1. Check that the area around the machine swing area is free from loose tools, obstructions or personnel.
2. Close the speed adjustment valve.
3. Pull the emergency stop button up.
4. Press the start button (repeat step 1 if necessary).

The KM3000/KM4000 controls are located on the PCU, shown in Figure 2-4 on page 13.

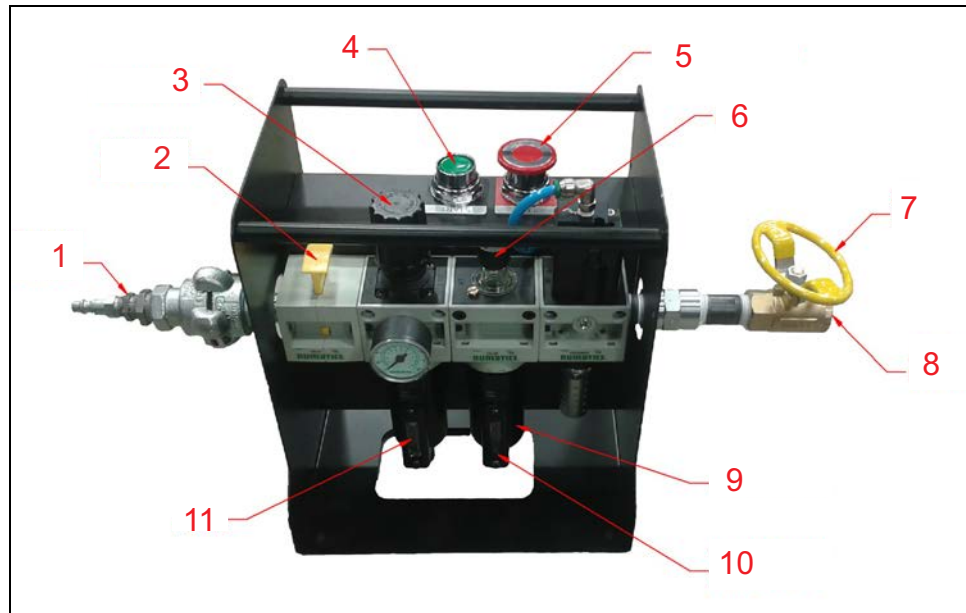


FIGURE 2-4. PCU COMPONENTS

TABLE 2-6. PCU CONTROLS IDENTIFICATION

Number	Component	Function
1	Air hose quick disconnect ¹	Connects the PCU to the operator’s compressed air source.
2	Air supply lock-out	Isolates air pressure from the machine and provides the ability to lock the valve closed before performing maintenance.
3	Regulator	Controls the air pressure supplied to the machine. The regulator is preset at the factory and does not require adjustment.
4	START (system reset)	Resets the low-pressure dropout.
5	Emergency STOP	Isolates the supply air and vents the downstream air. Press down to stop the machine; pull up to reset.
6	Oil drip rate dial	Controls the air lubricator drip rate.
7	Speed adjustment valve	Controls the machine’s rate of rotation and is located on the exhaust of the pneumatic assembly.
8	Air hose to the machine	Supplies the air to the machine.
9	Oil reservoir	Holds lubricating oil for the machine air motor.
10	Oil reservoir sight glass	Shows the amount of oil in the reservoir.
11	Filter	Removes foreign particulates from the air supply and protects the downstream valves and motor.

1. Figure 2-4 shows the H&S quick disconnect. Your disconnect may look different.

! WARNING

Always stop the machine and lock-out/tag-out the PCU before making adjustments to controls or machine components. Failure to follow this safety precaution may result in severe injury.

! WARNING

Always stop the machine using the E-stop button on the PCU. This removes all pressure from the pneumatic drive motor.

! WARNING

The motor can operate unexpectedly when the air hose is connected. Close the valve to the pneumatic motor before connecting the air hose.

! 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.

2.2.3 KM3000/KM4000 hydraulic power

Table 2-7 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 2-7. 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 79 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 2-5).

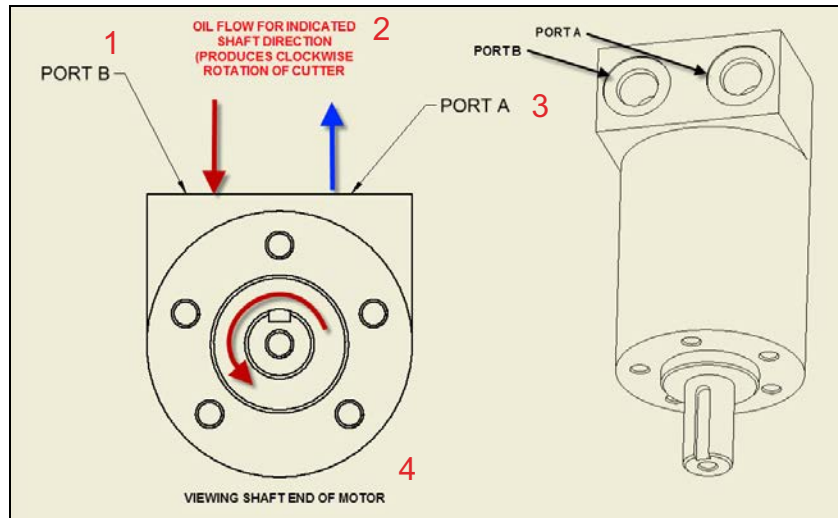


FIGURE 2-5. HPU CONNECTIONS

TABLE 2-8. HPU CONNECTIONS IDENTIFICATION

Number	Component
1	Port B
2	Oil flow for indicated shaft direction (produces clockwise rotation of cutter)
3	Port A
4	Viewing shaft end of motor

2.3 KM3000 DIMENSIONS

Figure 2-6 on page 16 show the KM3000 machine and operating dimensions.

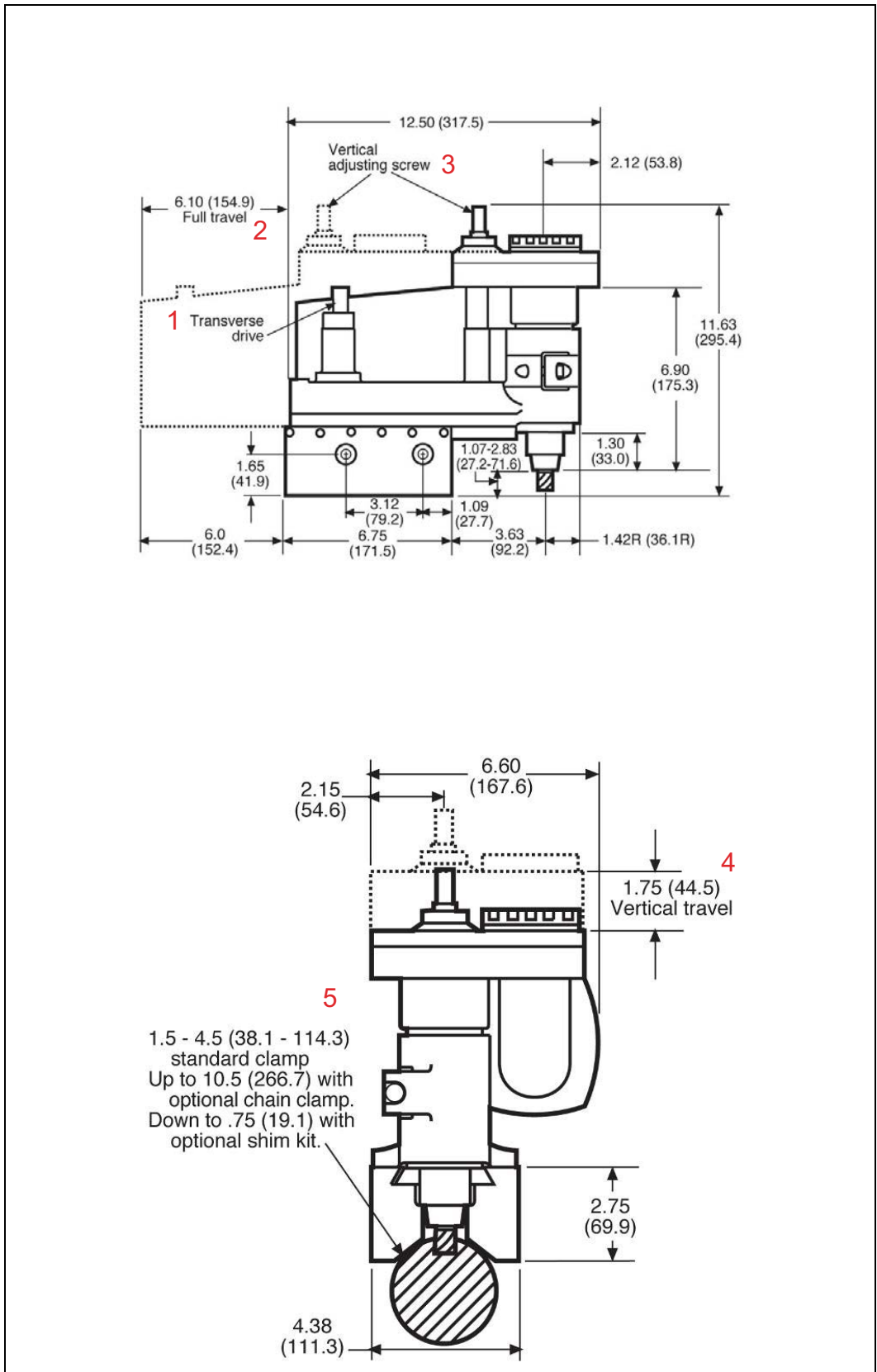


FIGURE 2-6. KM3000 DIMENSIONS

TABLE 2-9. DIMENSIONS IDENTIFICATION

Number	Component
1	Transverse drive
2	Full travel
3	Vertical adjusting screw
4	Vertical travel
5	1.5–4.5" (38.1–114.3 mm) standard clamp. Up to 10.5" (266.7 mm) with the optional chain clamp. Down to 0.75" (19.1 mm) with the optional shim kit.

2.4 SPECIFICATIONS

TABLE 2-10. KM3000/KM4000 SPECIFICATIONS

	KM3000	KM4000
Overall length:	12.50" (317.5 mm)	18.5" (469.9 mm)
Overall width:	6.6" (167.6 mm)	14" (355.6 mm)
Overall height:	11.63" (295.4 mm)	13.25" (336.6 mm)
Base size:	4.38" x 6.75" (111.3 x 171.5 mm)	9.0" x 18.5" (228.6 x 469.9 mm)
Stroke (slide travel) maximum:	6" (152.4 mm)	7.88" (200.2 mm)
Slide travel, transversal:	NA	2.0" (50.8 mm)
Vertical travel maximum:	1.75" (44.5 mm)	3.0" (76.2 mm)
Electric power (120V or 230V, 50-60Hz):	1 hp (0.75 kW)	1 hp (0.75 kW)
Pneumatic power:	1.5 hp (1.12 kW)	1.2 hp (0.9 kW)
Hydraulic power:	0.79 in ³ , 4.0 hp (3.0 kW) 1.93 in ³ , 3.3 hp (2.5 kW)	4.0 Hp (2.98 kWa)
No load variable spindle speed:	365–675 RPM	350–675 RPM
Spindle hole diameter:	0.625" (16 mm)	Inch: 0.75" (20 mm) Metric: 0.79" (20 mm)
Maximum end mill diameter:	1.25" (31.75 mm)	1.25" (31.75 mm)
Metal removal rate for hydraulic power in C1018 steel:	1 in ³ /min (16.4 cm ³ /min*)	1 in ³ /min (16.4 cm ³ /min*)
Metal removal rate for electrical power in C1018:	0.4 in ³ /min (6.5 cm ³ /min)	0.4 in ³ /min (6.5 cm ³ /min)

TABLE 2-10. KM3000/KM4000 SPECIFICATIONS

	KM3000	KM4000
Maximum shaft diameter (standard bar clamp):	4.5" (114.3 mm)	18.0" (457.2 mm)
Maximum shaft diameter (with optional chain clamp):	10.5" (266.7 mm)	24.0" (609.6 mm)
Minimum shaft diameter (standard bar clamp)¹:	1.5" (38.1 mm)	8.0" (203.2 mm)
Minimum shaft diameter (with optional shim kit on rear clamp only)²:	0.75" (19.1 mm)	4.0" (101.6 mm)
Minimum clamping space required on stub shaft:	1.5" (38.1 mm)	8.0" (203.2 mm)
Minimum clamping space required on obstructed shaft:	NA	10.5" (266.7 mm) ³
Minimum shaft diameter for rear clamp⁴:	1.5" (38.1 mm)	NA
Minimum shaft diameter for front clamp:	2.6" (66 mm)	NA
Diameter of one end mill included:	NA	0.75" (20 mm)
Shipping weight:	82 lb (37.3 kg)	195 lb (89 kg)
Machine weight (with speed control):	70 lb (31.8 Kg)	250 lb (114 kg)
Shipping size:	13" x 14" x 20" (330 x 360 x 510 cm)	24" x 24" x 19" (610 x 610 x 483 mm)

1. See notice below.
2. See notice below.
3. The KM4000 can cut keyways within 2.2" (55.88 mm) of the obstruction.
4. 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 2-11. ELECTRICAL SPECIFICATIONS

Mains voltage (AC):	±10% of nominal
Mains frequency (AC):	±1% of nominal
Mains harmonics:	10% of RMS volts 2nd through 30th harmonic
Voltage imbalance (3-phase supplies):	2% maximum

TABLE 2-11. ELECTRICAL SPECIFICATIONS

Voltage impulses:	200% of nominal 1.5 milliseconds (ms) maximum duration
Voltage interruption:	3 ms maximum with 1 second between
Voltage dip (brownout):	20% of peak volts for 1 second maximum
Voltage supplied from batteries:	±10% of nominal
Voltage interruption (DC):	5 ms maximum
Ambient temperature (operating):	41–104°F (5–40°C)
Ambient temperature (transport and storage):	-13–131°F (-25–55°C)
Relative humidity:	20–95% non-condensing
Altitude:	6,600 ft (2,000 m)
Contaminants:	IP54 environment except for some motors and slip ring assemblies that are IP 20
Available fault current:	Not greater than that listed on the controls nameplate

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3 SETUP

IN THIS CHAPTER:

3.1 RECEIPT AND INSPECTION - - - - -21

3.2 LIFTING AND RIGGING - - - - -22

3.3 KM3000/KM4000 TOOLING SETUP - - - - -22

3.4 KM3000 STANDARD SHAFT MOUNTING - - - - -23

3.5 KM4000 STANDARD SHAFT MOUNTING - - - - -24

3.6 KM3000 STUB-END MOUNTING - - - - -26

3.7 KM4000 STUB-END MOUNTING - - - - -26

3.8 LARGE SHAFT MOUNTING - - - - -26

3.9 KM3000 SMALL SHAFT MOUNTING - - - - -28

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3.11 KM3000/KM4000 EXTRA LONG SHAFT MOUNTING - - - - -28

3.12 KM3000/KM4000 BENCH VISE MOUNTING - - - - -29

3.13 KM3000 CROSS MILLING SETUP - - - - -29

3.14 KM3000/KM4000 TRAVERSE FEED - - - - -29

3.15 KM3000/KM4000 VERTICAL ADJUSTMENT - - - - -29

This section describes the setup and assembly procedures for the KM3000/ KM4000 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 may be lifted from the crate by hand.

The KM4000 must be lifted using the supplied lifting eyes.

WARNING

For the KM4000: When moving the machine and setting it up on the workpiece, support the machine by its lifting eyes with proper rigging. Failure to do so could allow the machine to shift or slip suddenly or fall, resulting in death or severe crushing or pinching injury.

3.3 KM3000/KM4000 TOOLING SETUP

WARNING

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

CAUTION

Tools are very sharp. Handle with extreme care and follow all safety procedures for dealing with sharp objects.

Do the following to set up the KM3000/KM4000 tooling:

1. Loosen the quill clamping screws.
2. Crank the gearbox assembly up until the vertical adjustment screw is free of the top slide. Remove the gearbox assembly from the machine.
3. Loosen the end mill socket set screw in the spindle.
4. Insert the end mill into the spindle. Turn the end mill until the flat in the shank is directly under the setscrew. It may be necessary to remove the set-screw to locate the flat (see Figure 3-1). Tighten the setscrew. Before using small end mill collets, degrease the collets with solvent and dry them.

NOTICE

Check that the setscrew seats firmly against the flat on the end mill shank.

5. Place the gearbox assembly on the top slide. Crank the gearbox assembly down until the quill housing is below the bottom quill clamping screw.

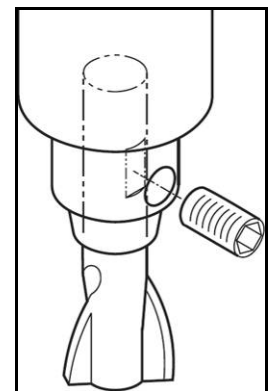


FIGURE 3-1. INSERTING AN
END MILL

6. Adjust the tension of the quill clamping screws by doing the following:
 - a) Crank the vertical adjustment leadscrew to raise and lower the quill housing.
 - b) Adjust the tension on the screws to firmly hold the quill housing without preventing its travel.

 **WARNING**

Never tighten the quill clamping screws if the quill housing is above the bottom screw.

When making a heavy cut, set the end mill to the desired depth before tightening the quill clamping screws. Remember to loosen the clamping screws before retracting the end mill.

At any time during operation, the gearbox assembly may be removed to sharpen or replace the end mill. Because the end mill is positioned from side-to-side by the top slide and cross slide, the end mill does not have to be repositioned. The depth of the end mill will have to be reset.

3.4 KM3000 STANDARD 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 for standard shaft mounting with the KM3000:

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 3-2).

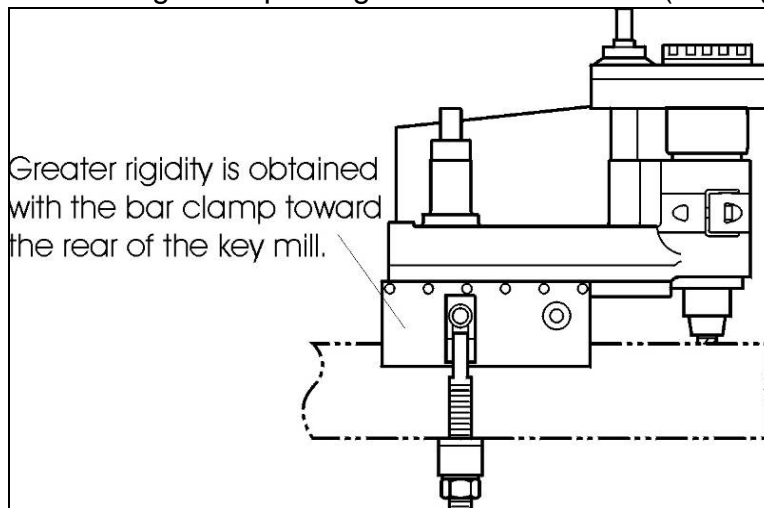


FIGURE 3-2. BAR CLAMP TO REAR OF BASE

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 KM4000 STANDARD SHAFT MOUNTING

WARNING

Support the machine with rigging while securing it to the workpiece. Failure to do so will allow the machine to fall, causing death or serious crushing injury.

Do the following for standard shaft mounting with the KM4000:

1. Use a hoist to set the key mill on the shaft. Because the key mill has sealed lubrication, it can be mounted in any position.
2. Mount the chain clamp assemblies to the clamp blocks on the side of the base.
3. Secure the key mill to the shaft by tightening first one chain clamp nut and then the other chain clamp nut. Torque the clamp nuts to 60 ft-lb (81 Nm).



WARNING

Under-torquing the chain clamp nuts may allow the machine to slip off of the workpiece, resulting in death or severe crushing injury.

4. Center the cross slide by aligning the zero mark on the back of the slide with the zero mark on the back of the base.
5. Level the machine. Place a level on the machined upper surface of the base to be sure the key mill is level. This is crucial when cutting in-line keyways.

NOTICE

Careful centering and leveling of the key mill will ensure that all keyways will be in line.

6. Adjust the tension of the cross slide gib screws by cranking the cross slide leadscrew to move the cross slide along the dovetail of the base. When the slide is centered over a gib screw, tighten that screw until there is noticeable drag on the slide. Unscrew the setscrew slightly. Repeat until all gib screws are adjusted.
7. Adjust the tension of the top slide gib screws by cranking the top slide leadscrew to move the top slide along the dovetail of the cross slide. When the slide is centered over a gib screw, tighten that screw until there is noticeable drag on the slide. Unscrew the setscrew slightly. Repeat until all gib screws are adjusted.

3.6 KM3000 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 3-3

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 23.

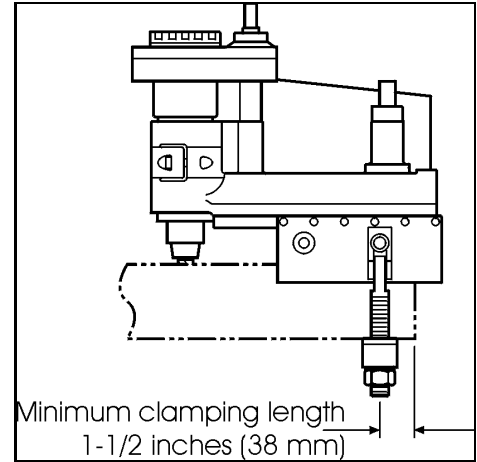


FIGURE 3-3. STUB END MOUNTING

3.7 KM4000 STUB-END MOUNTING

The KM4000 key mill can be mounted to stub ends as short as 8" (200 mm).

1. Turn the cutter end of the key mill toward the middle of the shaft.
2. Position the machine so that both chains are on the shaft and can be tightened.
3. Set up the machine as described in step 2 through step 7 of Section 3.5 on page 24.

3.8 LARGE SHAFT MOUNTING

With the KM4000, shafts up to 24" (609 mm) in diameter can be machined using the optional chain clamp assembly.

With the KM3000, shafts up to 10.5" (267 mm) in diameter can be machined using the optional chain clamp assembly.

Figure 3-4 shows the large shaft mounting for the KM3000.

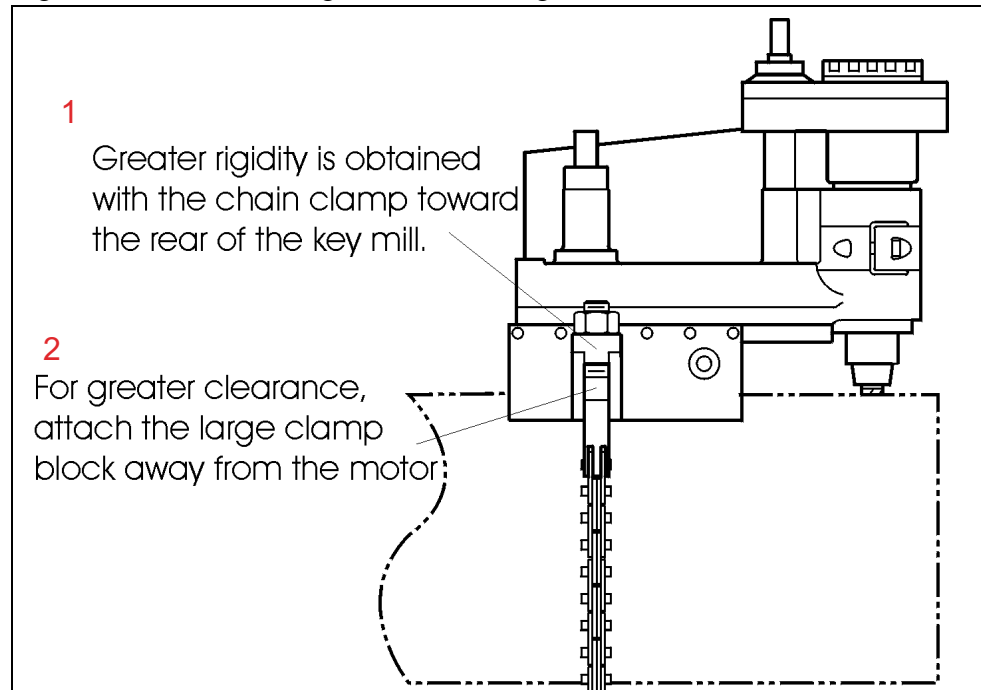


FIGURE 3-4. KM3000 LARGE SHAFT MOUNTING

TABLE 3-1. LARGE SHAFT MOUNTING IDENTIFICATION

Number	Component
1	Greater rigidity is obtained with the chain clamp toward the rear of the key mill
2	For greater clearance, attach the large clamp block away from the motor.

Proceed as described in Section 3.4 on page 23.

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.

3.9 KM3000 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.

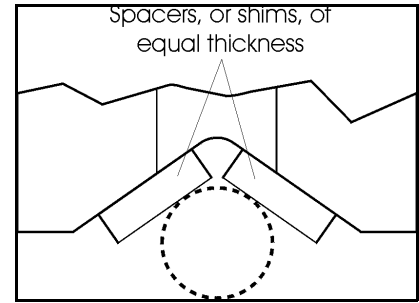


FIGURE 3-5. SMALL SHAFT MOUNTING
(SHIMS OF EQUAL THICKNESS)

NOTICE

Check that the shaft is in the open part of the throat only. If it extends into the rear or the base, it will not align with the key mill.

Contact CLIMAX for a shim kit (P/N 11669).

3.10 KM4000 SMALL SHAFT MOUNTING

When mounting the KM4000 to shafts less than 7" (178 mm) diameter, an optional shim kit is recommended. Shims are mounted to the base throat with flat-headed cap screws. The shim kit (P/N 11851) enables the key mill to be mounted to shafts with diameters as small as 4" (100 mm).

If the shaft is disassembled, the key mill may be bench mounted and the shaft clamped to the machine.

3.11 KM3000/KM4000 EXTRA LONG SHAFT MOUNTING

If the shaft is long enough, V-blocks can be used to secure the shaft. A chain wrench or C-clamp may be used to hold the shaft and V-blocks together.

TIP:

Extra long shaft mounting setup and operation of the key mill is the same as for standard shafts.

Place a level on the keymill top slide to maintain keyway alignment along a long shaft.

3.12 KM3000/KM4000 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

3.13 KM3000 CROSS MILLING SETUP

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 set up for cross-milling a shaft:

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.

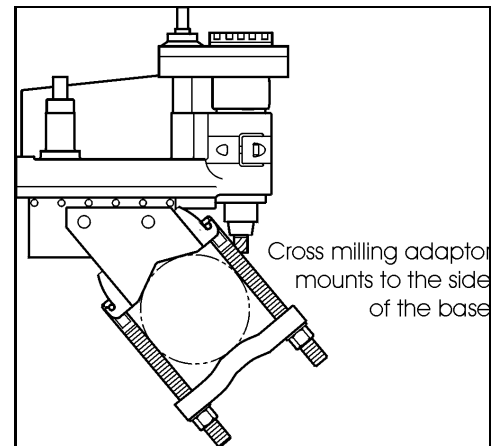


FIGURE 3-6. CROSS MILLING ADAPTER MOUNTS TO THE SIDE OF THE BASE

3.14 KM3000/KM4000 TRAVERSE 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).

Note that the KM3000 is capable of traverse and vertical feed. The cross-slide kit included is for mounting, not machining.

The KM4000 is capable of traverse, vertical, and cross-slide feed.

3.15 KM3000/KM4000 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" (0.025 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 leadscrew to unthread from the base.

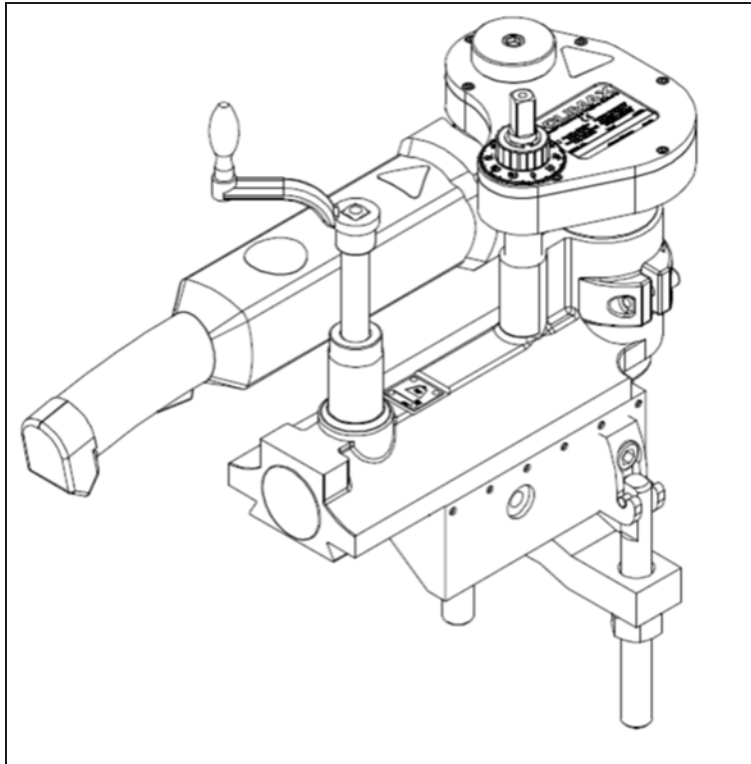


FIGURE 3-7. VERTICAL AND HORIZONTAL FEED CONFIGURATION

4 OPERATION

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 - 4.1.2 PNEUMATIC CHECKS - - - - -33
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- 4.2 KM3000/KM4000 OPERATION - - - - -33
 - 4.2.1 ELECTRIC POWER: STARTING THE MACHINE - - - - -33
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- 4.3 OPERATION BASED ON POWER TYPE - - - - -35
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 - 4.6.5 KM4000 WIDE KEYWAYS - - - - -43



Always wear eye and ear protection when operating the key mill.

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.
- Make sure the end mills are sharp and free from nicks.
- Lubricate all gibs.
- Check that moving parts move freely.
- Clean chips away from threaded parts.

NOTICE

During operation, arrange cables in a serpentine pattern as shown in Figure 4-1 on page 32. Do not coil the cables, as it could cause the machine to malfunction.

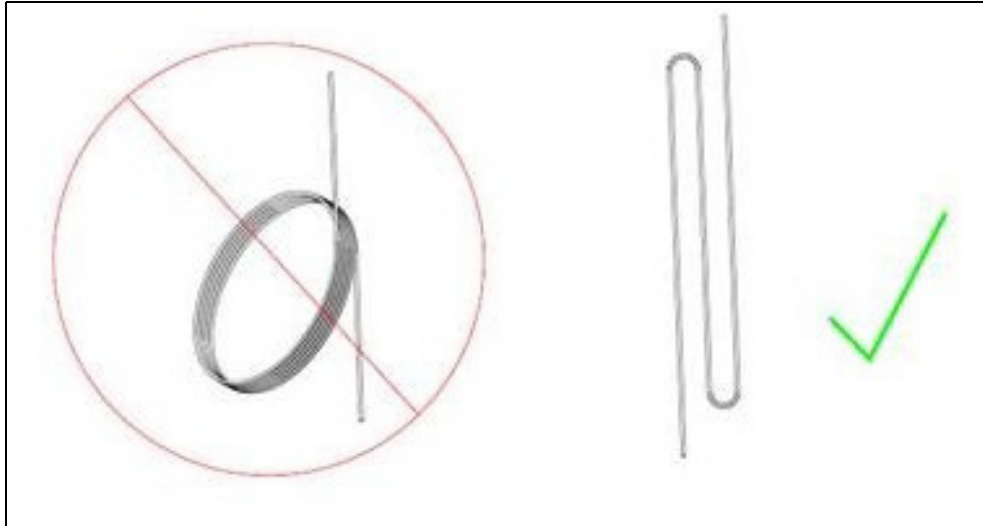


FIGURE 4-1. CABLES IN SERPENTINE ARRANGEMENT, NOT COILED

- Check the tool condition and sharpness.
- Check all hand tools are removed from inside the machine and the work area.

CAUTION

Leaving the workspace with the machine running and unattended may cause personnel injury and machine or workpiece damage.

NOTICE

For optimal results, please run machine unloaded for 20 minutes before cutting operation. Thermal expansion of the components may result in changes to machined features if machining is initiated from a cold start.

4.1.1 Electric checks

Check electrical parts for damage. Repair or replace any damaged parts.

Check that the motor control trigger is in the off position.

Plug the machine into a properly grounded outlet.

 **WARNING**

The electric motor is not rated to run motor in a damp or explosive environment. Keep liquids away from the motor.

4.1.2 Pneumatic checks

Fill the air lubricator on the PCU with air oil. Use Marvel Air Tool Oil lubricator oil or equivalent.

Drain the air filter.

Close the ball valve before connecting the key mill to the air supply.

Be sure the in-line air pressure is 80 psi. Check that the air lines are not obstructed or damaged.

4.1.3 Hydraulic checks

Turn the hydraulic power unit OFF.

Check the reservoir level - fill the reservoir to above the red bar with hydraulic oil or equivalent.

Fill the pump case with hydraulic oil. To fill the case, remove the small hex cap (toward the pump motor) on top of the case housing.

Be sure the power unit wiring matches the electric source.

Be sure the power unit is level.

Clean all hydraulic fittings before connecting them.

4.2 KM3000/KM4000 OPERATION

4.2.1 Electric power: starting the machine

 **CAUTION**

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

Do the following to start the electric machine:

1. Turn off the motor.
2. Check the power cord for damage. Repair or replace the cord if necessary.
3. Plug in the motor.
4. Press the motor control trigger to start the motor. While holding the trigger, press the trigger lock to latch the trigger in the on position.
5. Position the end mill on the shaft.

4.2.2 Electric power: stopping the machine

To stop the electric machine, press and release the motor trigger control. The trigger lock should release the trigger and the trigger should return to the off position.

4.2.3 Hydraulic power: starting and stopping the machine

Do the following to start the hydraulic machine:

1. Clean all fittings. Connect the hydraulic motor to the power unit.

CAUTION

Connect the hydraulic motor to the power unit pump before turning on the power unit. Failure to do so will damage the pump and void all warranties.

2. Jog the motor to be sure the pump is turning in the correct direction. Reverse the hoses if necessary.
3. Turn on the hydraulic power unit by pressing the ON button on the pendant.

To stop the hydraulic motor, press the red stop button on the HPU pendant.

4.2.4 Pneumatic power: starting the machine

WARNING

Securely mount the key mill to the work piece before connecting the air supply.

The air filter and lubricator supplied with the machine must be used or the machine warranty is void. Set the lubricator to deliver oil at a rate of 20–30 drops per minute at full throttle.

CAUTION

Using air that is not filtered or lubricated can damage the air motor. Avoid damage by routing incoming air through the filter and lubricator.

The air line should be at least 0.5" (13 mm) in diameter. Use only nonrestrictive fittings on all air lines.

Do the following to start the pneumatic machine, referring to Section 2.2 on page 10:

1. Push the emergency stop lever down until the word CLOSED and the lock-out can be seen from the bottom of the valve. Be sure the lever is pushed all the way.

2. Turn the needle valve clockwise all the way. When the valve is completely closed, no colored bands will be visible.
3. Connect the air supply line through the filter and lubricator to the motor.

 **WARNING**

Rotating machinery can seriously injure the operator. Secure the machine to the work piece before connecting the air supply line.

4. Press the emergency stop lever up until the word OPEN can be seen from the top. Check that the lever is pushed all the way.
5. Slowly turn the needle valve counter-clockwise until the desired machine feed is reached. The more colored bands visible on the valve, the faster the machine speed.

 **WARNING**

The gear box knob rotates at up to 875 RPM during operation. Keep fingers away from the gear box knob to avoid entanglement and pinching injury.

4.2.5 Pneumatic power: stopping the machine

Do the following to stop the machine:

1. Turn the needle valve clockwise all the way. When the valve is completely closed, no colored bands will be visible.
2. Push the emergency stop lever down until the word CLOSED and the lock-out can be seen from the bottom of the valve. Check that the lever is pushed in all the way. Lock out the machine with a padlock.
3. Disconnect the air line supply at the quick disconnects.

4.3 OPERATION BASED ON POWER TYPE

Aside from issues directly related to the power source, setup and operation of the different machine versions is essentially the same.

In all cases, before installing or setting up the key mill, 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 or wear or damage.

Mount the machine as described in Section 3.4 on page 23.

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.

4.3.1 KM3000/KM4000 electric machines

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.

4.3.2 KM3000/KM4000 pneumatic machine

 **WARNING**

Securely mount the key mill to the work piece before connecting the air supply.

The air filter and lubricator supplied with the machine must be used or the machine warranty is void. Set the lubricator to deliver oil at a rate of 20–30 drops per minute at full throttle.

 **CAUTION**

Using air that is not filtered or lubricated can damage the air motor. Avoid damage by routing incoming air through the filter and lubricator.

The air line should be at least 0.5" (13 mm) in diameter.

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 lock-out can be seen from the bottom.
3. Turn the needle valve clockwise all the way. No colored bands are visible when the valve 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 visible, 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.

4.3.3 KM3000/KM4000 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 check that 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 4-2). 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.

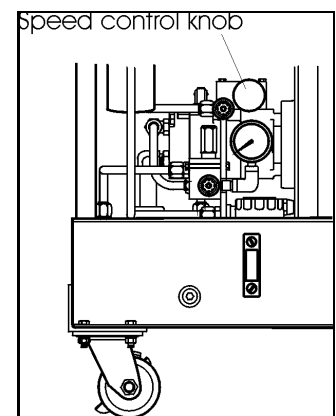


FIGURE 4-2. HPU SPEED CONTROL KNOB

-
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.
-

4.4 KM3000/KM4000 KEYWAY CUTTING

Do the following for keyway cutting:

1. Position the end mill at the end of the shaft where the keyway will be cut.
2. Turn on the motor and adjust the motor speed, referring to the Heading 3 sections depending on the drive type
3. Lower the end mill by cranking the vertical adjustment leadscrew clockwise until the mill cuts a flat on the shaft equal to the diameter of the end mill. (Cut to the minimum depth that will cut a full-circle in the shaft).
4. Set the depth dial to zero. The dial is calibrated to 0.001" increments. The dial on metric machines is calibrated to 0.01 mm.
5. Plunge the end mill by cranking the vertical adjustment leadscrew clockwise until the end mill is at the desired depth.
6. Crank the traverse drive shaft until the end mill has cut the desired length keyway. Turn the crank clockwise to move the spindle and end mill toward the base.

WARNING

For the KM4000 only: The cross slide does not have a built-in stop. Do not allow the cross slide to feed all the way out of the frame. Doing so may result in death or severe crushing injury.

WARNING

Never use your hands, compressed air, or metal tools to remove chips. Doing so during machine operation could cause severe entanglement or projectile injury.

7. After the keyway has been cut, crank the vertical adjustment leadscrew counterclockwise to raise the end mill up from the work piece.
8. Crank the gearbox assembly up until the vertical adjustment screw is free of the top slide. Remove the gearbox assembly from the machine.

WARNING

The vertical feed has no built-in top position stop. Do not allow the vertical feed to feed all the way out of the frame. Doing so may result in death or severe crushing injury.

9. Loosen the end mill socket set screw in the spindle.

- 10. Remove the end mill from the spindle.
- 11. Remove the key mill from the shaft.

4.5 KM4000 LATERAL FEED (CROSS SLIDE)

Hand crank the cross slide leadscrew. One complete turn of the leadscrew will move the key mill 0.100" (2.50 mm on metric machines).

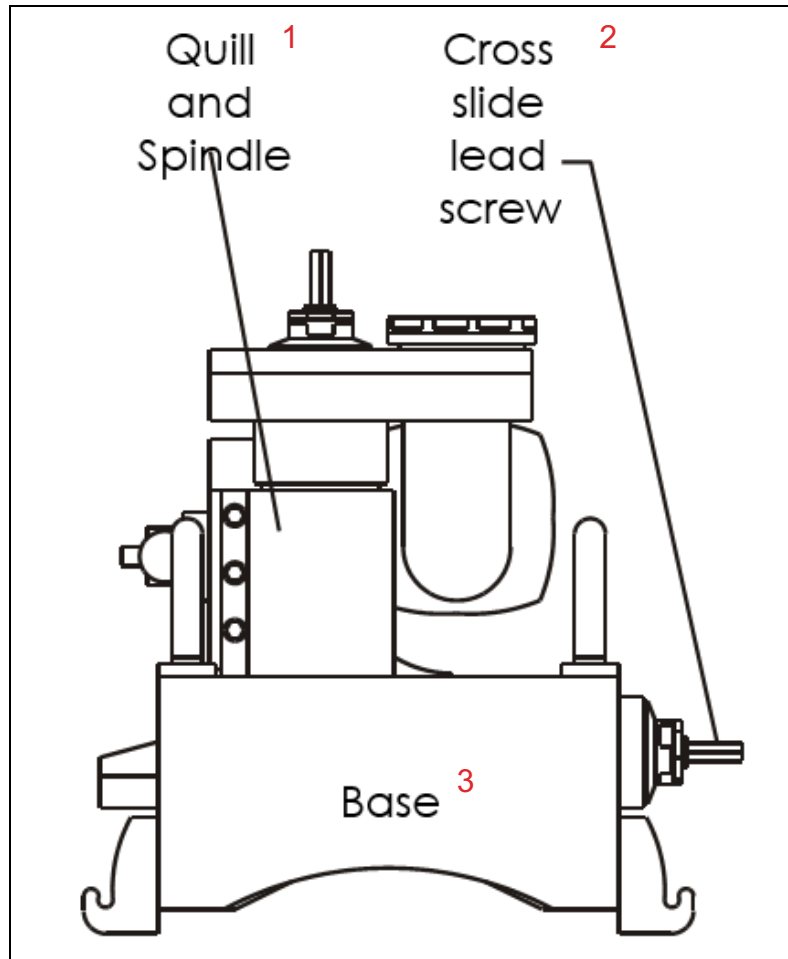


FIGURE 4-3. KM4000 FEED COMPONENTS

TABLE 4-1. FEED COMPONENTS IDENTIFICATION

Number	Component
1	Quill and spindle
2	Cross slide lead screw
3	Base

4.6 KM3000/KM4000 SPECIAL APPLICATIONS

The KM3000/KM4000 is well suited for machining unusual keyways and other exceptional on-site milling jobs. The KM3000/KM4000 works well on almost any operation calling for the milling of slots, flats, elongated holes, or other like features.

4.6.1 KM3000/KM4000 long/extended keyways

Do the following to cut in-line keyways:

1. Secure the shaft so it will not rotate. V-blocks may be used to hold long shafts. Secure the shaft to the V-blocks with C clamps.
2. Mount the key mill to the shaft as described in Section 3.4 on page 23.
3. Carefully level the key mill on top of the shaft. A level can be placed on the machined upper surface of the base to check the key mill.
4. Cut the keyway as described in Section 4.4 on page 38.
5. Reposition the machine along the shaft.
6. Again, carefully level the key mill on top of the shaft.

TIP:

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

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

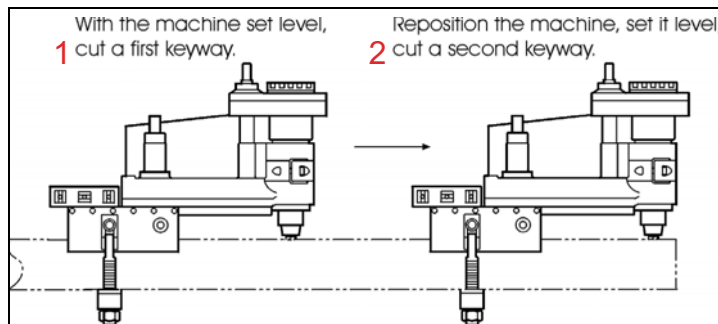


FIGURE 4-4. LONG OR ALIGNED KEYWAYS

TABLE 4-2. LONG OR ALIGNED KEYWAYS IDENTIFICATION

Number	Component
1	With the machine set level, cut a first keyway.
2	Reposition the machine, set it level, cut a second keyway.

4.6.2 KM3000/KM4000 axially aligned keyways

Do the following for axially aligned keyways:

1. Secure the shaft so it will not rotate.
2. Referring to Figure 4-5 on page 41, mount the key mill on top of the shaft, setting it level as described in Section 3.4 on page 23.

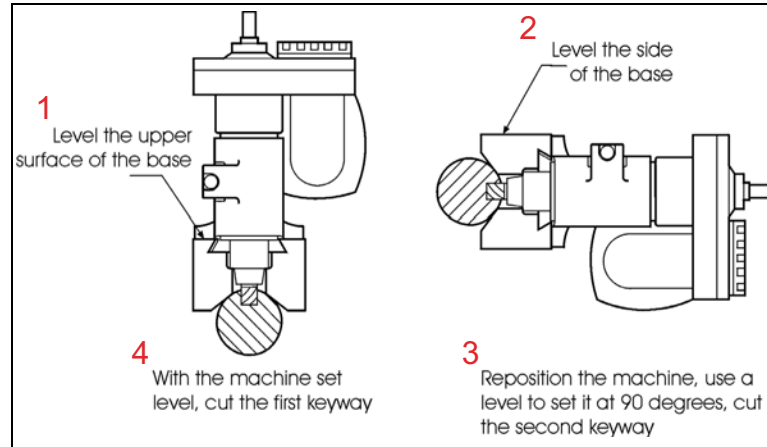


FIGURE 4-5. AXIALLY ALIGNED KEYWAYS

TABLE 4-3. AXIALLY ALIGNED KEYWAYS IDENTIFICATION

Number	Component
1	Level the upper surface of the base
2	Level the side of the base
3	Reposition the machine, use a level to set it at 90 degrees, cut the second keyway
4	With the machine set level, cut the first keyway

3. Cut the keyway as described in Section 4.2 on page 33 and Section 4.3 on page 35.
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 23.
3. Cut the keyway as described in Section 4.3 on page 35.
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.

4.6.3 KM3000/KM4000 rotated keyways

Do the following to cut keyways 90° apart:

1. Set up the key mill as described in Section 3.4 on page 23.
2. Check that the machine is level.
3. Cut the first keyway.
4. Reposition the machine on the side of the shaft.
5. Place a level on the side of the base to verify that the machine is 90° to the first keyway.
6. Cut the second keyway.

Do the following to cut keyways 120° apart:

1. Set up the machine as described in Section 3.4 on page 23.
2. Check that the machine is level.
3. Cut the first keyway.
4. With angle blocks, position the machine 120° from the first keyway. Cut the keyway.
5. With angle blocks, again position the machine 120° from the first keyway. Cut the third keyway.

Do the following to cut keyways 180° apart:

1. Set up the key mill on the side of the shaft.
2. Place a level on the side of the base to be sure the machine is flat on its side.
3. Cut the first keyway.
4. Position the machine on the other side of the shaft.
5. Place a level on the side of the base to be sure the machine is again flat on its side.
6. Cut the other keyway.

4.6.4 KM3000/KM4000 end mill feed (vertical adjustment)

The vertical adjustment leadscrew adjusts the depth of the end mill.

Crank the leadscrew clockwise to move the end mill down.

Crank the leadscrew counterclockwise to move the end mill up. One complete turn of the leadscrew will move the tool 0.100" (2.50 mm on metric machines).

4.6.5 KM4000 wide keyways

Extra wide keyways, up to 3.5" (88 mm) can be cut with the KM4000 key mill. For key width measuring, the cross slide leadscrew dial is calibrated in 0.001" (0.025 mm) increments.

For precisely accurate cutting, verify the measurements with a dial indicator.

Do the following to cut wide keyways:

1. Set the cross slide leadscrew dial to zero.
2. Position the end mill by cranking the cross slide leadscrew. See Section 4.5 on page 39 for feed information.
3. Operate the key mill as described in Section 4.2 on page 33 and Section 4.3 on page 35.

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5 MAINTENANCE

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5.1 MAINTENANCE CHECKLIST

NOTICE

For optimal results, please run the machine unloaded for 20 minutes before cutting operation. Thermal expansion of the components may result in changes to machined features if machining is initiated from a cold start.

Table 5-1 lists maintenance intervals and tasks.

TABLE 5-1. MAINTENANCE INTERVALS AND TASKS

Interval	Task	Reference
Before each use	Lubricate the quill where it slides in the quill clamp with Jet Lube 550.	Section 5.3.5 on page 48
	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 49
	Fill the air lubricator oil cup with Marvel Air Tool Oil.	Section 5.3.9 on page 49
Before and after each use	Remove debris, oil, and moisture from machine surfaces.	--
	Clean and lubricate the dovetail ways	Section 5.3.1 on page 48
	Drain the air filter.	Section 5.3.9 on page 49
During use	Frequently brush chips away from the leadscrew.	Section 5.3.2 on page 48

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 48
	Lubricate the leadscrew.	Section 5.3.2 on page 48
	After 72 hours of operation, do the following: <ul style="list-style-type: none"> • Replace the filter cartridge. • Check the heat exchanger for leaks. • Clean the filler/breather. 	Section 5.3.10 on page 50
	Repack the gearbox every 500 hours.	Section 5.3.5 on page 48
	Repack the gear case every six months or 500 hours with one ounce of gear grease.	Section 5.3.8 on page 49
	After 100 hours of operation, inspect the brushes.	Section 5.3.8 on page 49
	Check periodically that air pressure is 80 psi (5.5 bar.)	Section 5.3.9 on page 49

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.

WARNING

Disconnect the machine from power before servicing the machine.

NOTICE

Before servicing the machine with any of the lubricants in Table 5-2, consult the manufacturer's Safety Data Sheets (SDS).

CAUTION

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

TABLE 5-2. KM3000/KM4000 APPROVED LUBRICANTS

Lubricant	Brand	Application Area
Gear grease	Mobil Mobilith SHC 220	Gearbox gears, thrust bearings
Light oil	LPS1™ or LPS2™	Unpainted surfaces
Cutting oil	UNOCAL KOOLKUT	Tool bits, workpiece
Anti-seize	Jet Lube 550	Cutting bit set screw in quill

TABLE 5-2. KM3000/KM4000 APPROVED LUBRICANTS

Lubricant	Brand	Application Area
Air tool oil	Mobil Almo 525	Air lubricator oil cup
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
Leadscrew grease	Mobil Mobilith SHC 460	Leadscrews
Thread locker	Loctite 242	Critical fasteners

! 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.

NOTICE

During operation, arrange cables in a serpentine pattern as shown in Figure 5-1 on page 47. Do not coil the cables, as it could cause the machine to malfunction.

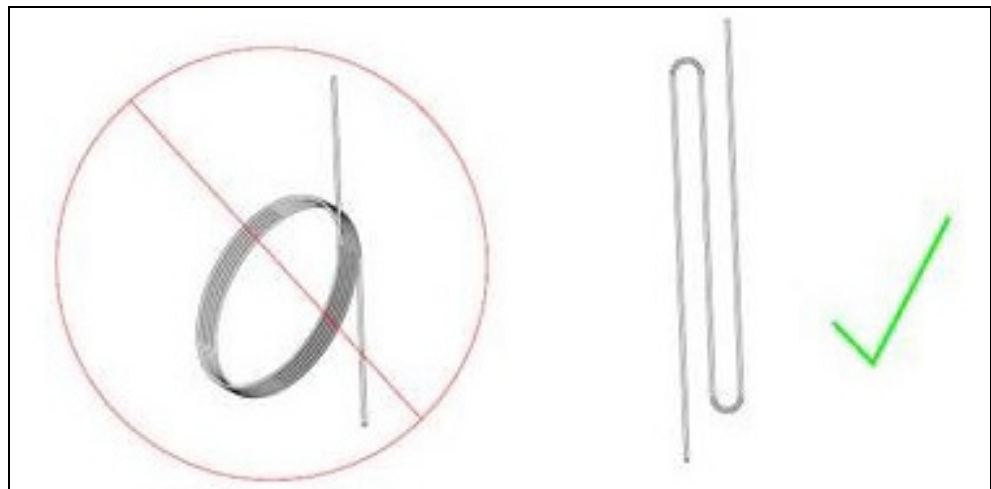


FIGURE 5-1. CABLES IN SERPENTINE ARRANGEMENT, NOT COILED

5.3.1 KM3000/KM4000 slide assemblies

Clean and lubricate the dovetail ways (see Table 5-2 on page 46) before and after using the machine.



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

The top slide gear and worm gear are packed with soft gear grease. Under normal use, these parts are greased for the life of the machine.

Thrust bearings should be lubricated every 6 months or 500 hours with heavy gear grease (Mobil Mobilith 460).

Always keep chips away from gears, threads, and moving parts of the top slide.

5.3.2 KM3000/KM4000 leadscrew

During operation, frequently brush chips away from the leadscrew. If necessary, lightly oil the leadscrew.

5.3.3 KM3000/KM4000

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

5.3.4 KM3000/KM4000 vertical adjustment screw

Occasionally lubricate the vertical adjustment screw threads with Jet Lube 550.

5.3.5 KM3000/KM4000 gearbox, spindle, quill assembly

The gearbox is packed with Mobil Mobilith SHC 22 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 six socket-head cap screws.
3. Remove the gearbox lid.
4. Repack the 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 the 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.

5.3.6 KM3000/KM4000 replacing motor

Do the following to attach the motor:

1. Remove the adjusting knob from the motor by pressing in the lock on the motor and turning the knob counter-clockwise.
2. Remove the idler gears.
3. Use Loctite 242 or equivalent on the four 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 Loctite 242 or equivalent on the screws.
6. Install the idler gears.
7. Put a coat of grease over gears and in all crevices.

5.3.7 KM3000/KM4000 installing the vertical leadscrew and cover

Do the following to install the vertical leadscrew and cover:

1. Place the vertical adjusting lead screw into the gearbox.
2. Place the cover on the gearbox and screw down using seven 8-32 x 5/8" screws.

NOTICE

Do not over-tighten the screws. This will damage 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 KM3000/KM4000 electric power systems

After 100 hours of operation, inspect the brushes by doing the following:

1. Always replace brushes in sets.
2. Unscrew the retainer caps on the motor housing.
3. Pull out the retainer springs and brushes.
4. Replace brushes when they have worn down to 1/4" (6.4 mm).

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.

-
- Use nonrestrictive 1/2" (13 mm) air lines and fittings supplied by CLIMAX.
 - 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.
 - Adjust the air motor speed by opening or closing the ball valve. Do not attempt to control motor speed by changing the air line pressure from 90 psi.
 - Fill the air lubricator oil cup with Mobil Almo 525 before using the machine. The lubricator should oil the air at a maximum rate of 20–30 drops per minute at full throttle.

 **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 minimum rate of 2–4 drops per minute.

5.3.10 KM3000/KM4000 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 two 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.

5.3.10.3 KM4000 hydraulic hoses and fittings

Before operation, inspect all hydraulic hoses and fittings for damage, kinks, leaks, and fit. Replace damaged or suspect components.

WARNING

Hydraulic hoses operate under extreme pressure. Operating a hydraulically powered machine using damaged hydraulic hoses or fittings could cause high-velocity leaks of hydraulic fluid, resulting in blindness, fire, or severe cutting or impact injury.

5.3.11 Chain clamp

Periodically check chain links for wear. After using the key mill, spray the links with lubricant.

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6 STORAGE AND SHIPPING

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. Remove the tooling.
2. Remove hoses.
3. Drain the air filter on pneumatic machines.
4. Remove the machine from the workpiece.
5. Clean the machine to remove dirt, grease, metal chips, and moisture.
6. Spray all unpainted surfaces with LPS-2 to prevent corrosion.
7. 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%.

6.2 SHIPPING

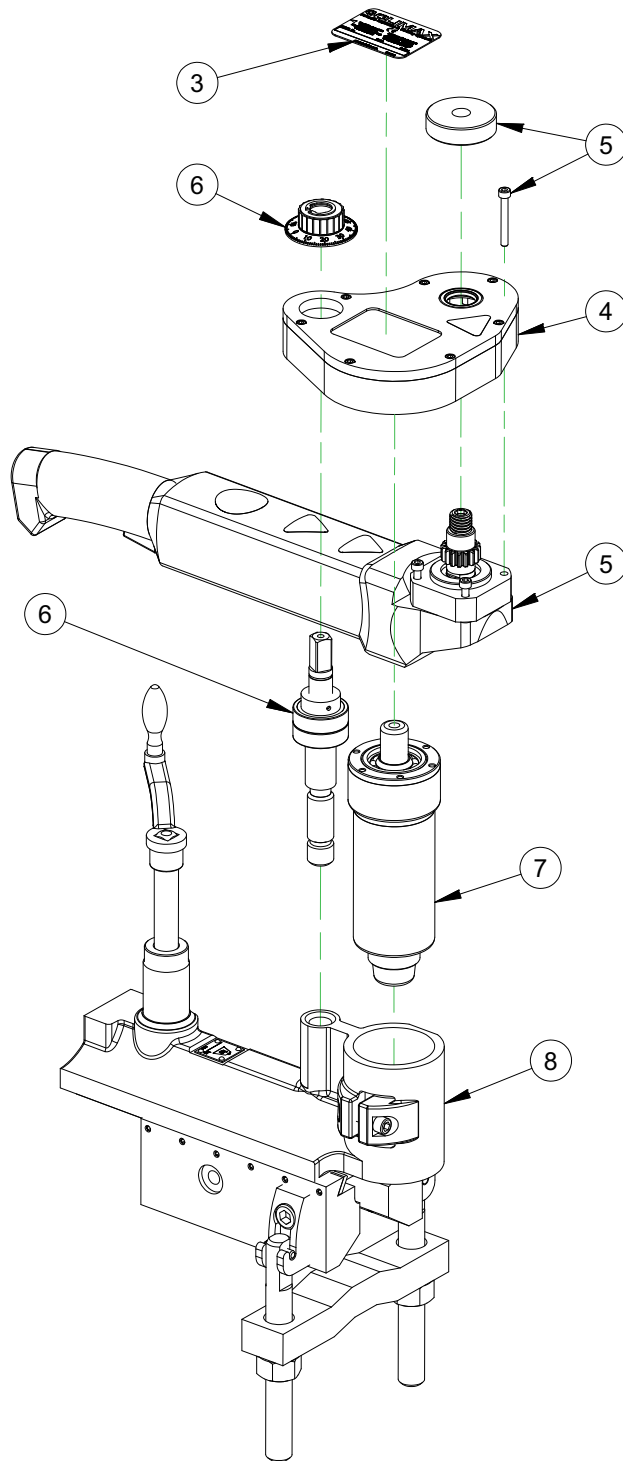
The key mill machine can be shipped in its original shipping container.

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APPENDIX A ASSEMBLY DRAWINGS

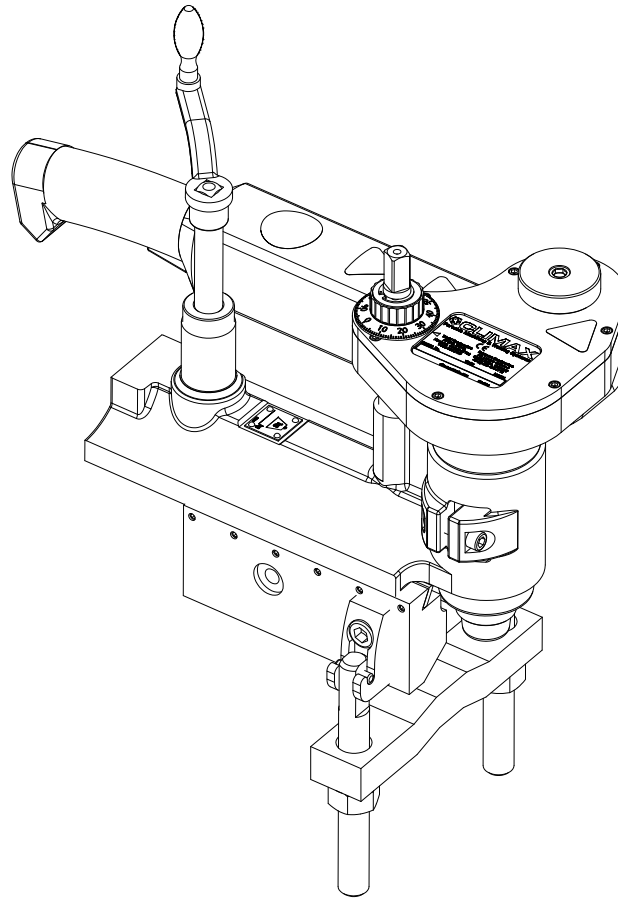
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CONFIGURATION 103698 SHOWN

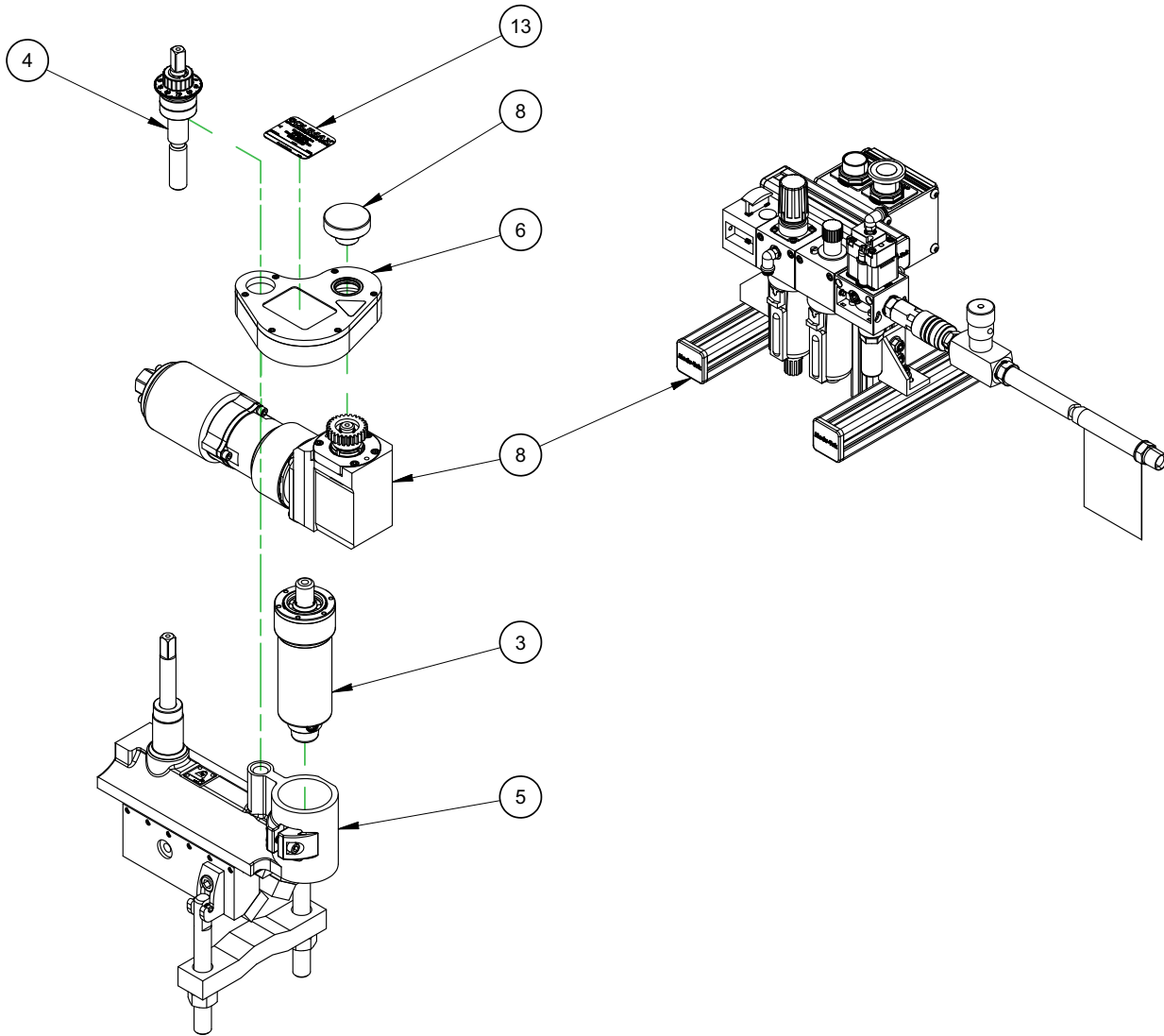
FIGURE A-1. KM3000/KM4000 ASSEMBLY (P/N 103548)



AVAILABLE CONFIGURATIONS						
PART NO.	Description	ITEM 4 GEARBOX	ITEM 5 MOTOR	ITEM 6 LEAD SCREW	ITEM 7 SPINDLE	ITEM 8 BASE
103468	KM3000 HIGH SPEED GEARBOX 120V INCH	103470	103467	15655	15651	28839
103552	KM3000 HIGH SPEED GEARBOX 230V INCH	103470	103550	15655	15651	28839
103553	KM3000 HIGH SPEED GEARBOX 120V METRIC	103470	103467	16021	16022	30459
103554	KM3000 HIGH SPEED GEARBOX 230V METRIC	103470	103550	16021	16022	30459
103698	KM3000 HIGH TORQUE GEARBOX 120V INCH	103341	103342	15655	15651	28839
103700	KM3000 HIGH TORQUE GEARBOX 230V INCH	103341	103703	15655	15651	28839
103699	KM3000 HIGH TORQUE GEARBOX 120V METRIC	103341	103342	16021	16022	30459
103701	KM3000 HIGH TORQUE GEARBOX 230V METRIC	103341	103703	16021	16022	30459

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
2	1	34181	(NOT SHOWN) WRENCH HEX SET FOLDING 5/64 - 1/4 9 PCS CLIMAX LOGO
3	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63
4	1	SEE CHART	ASSY GEAR BOX
5	1	SEE CHART	MOTOR ASSY ELECTRIC
6	1	SEE CHART	ASSY LEADSCREW VERT ADJ 3RD KM3000
7	1	SEE CHART	CHART SPINDLE & QUILL ASSY
8	1	SEE CHART	CHART BASE AND TOP SLIDE ASSY W/ BAR CLAMP

FIGURE A-2. KM3000/KM4000 ASSEMBLY CONFIGURATIONS AND PARTS LIST (P/N 103548)



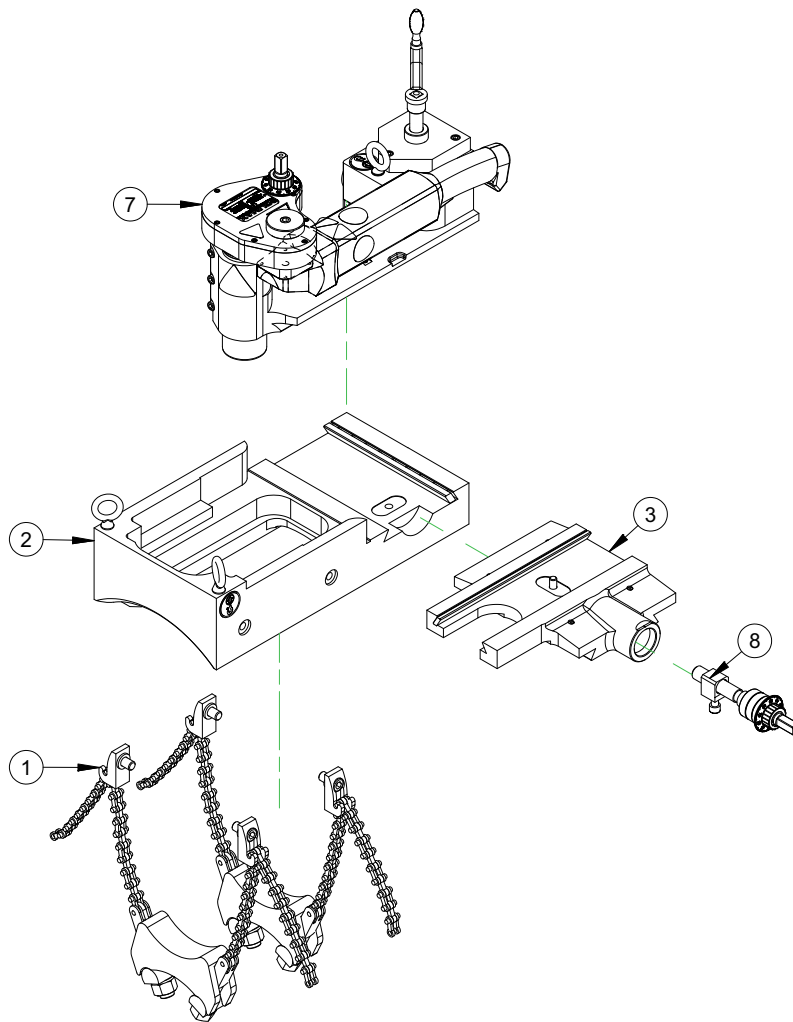
AVAILABLE CONFIGURATIONS	
PART NO.	DESCRIPTION
16002	MODEL KM3000 INCH AIR
16005	MODEL KM3000 METRIC AIR

FIGURE A-3. KM3000/KM4000 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-4. KM3000/KM4000 PNEUMATIC ASSEMBLY PARTS LIST (P/N 85123)



AVAILABLE CONFIGURATIONS			
PART NO.	DESCRIPTION	ITEM 7	ITEM 8
103907	MODEL KM4000 INCH 120V	103899	16263
103908	MODEL KM4000 METRIC 120V	103900	16264
103909	MODEL KM4000 INCH 230V	103901	16263
103910	MODEL KM4000 METRIC 230V	103902	16264

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10491	CLAMP ASSY CHAIN KM4000
2	1	13262	BASE ASSY KM4000
3	1	13736	SLIDE CROSS ASSY KM4000
4	1	15369	(NOT SHOWN) CRATE 18 X 19 X 13-5/8 KM4000 5/8 PLY HINGED
6	1	104075	(NOT SHOWN) MANUAL INSTRUCTION KM3000 KM4000 KEY MILL
5	1	34181	(NOT SHOWN) WRENCH HEX SET FOLDING 5/64 - 1/4 9 PCS CLIMAX LOGO (KB)
7	1	SEE CHART	ASSY TOPSLIDE WELDON SHANK ELECTRIC INCH/METRIC KM4000 PM4200
8	1	SEE CHART	ASSY LEADSCREW CROSS SLIDE

FIGURE A-5. KM4000 CHART ASSEMBLY (P/N 103884)

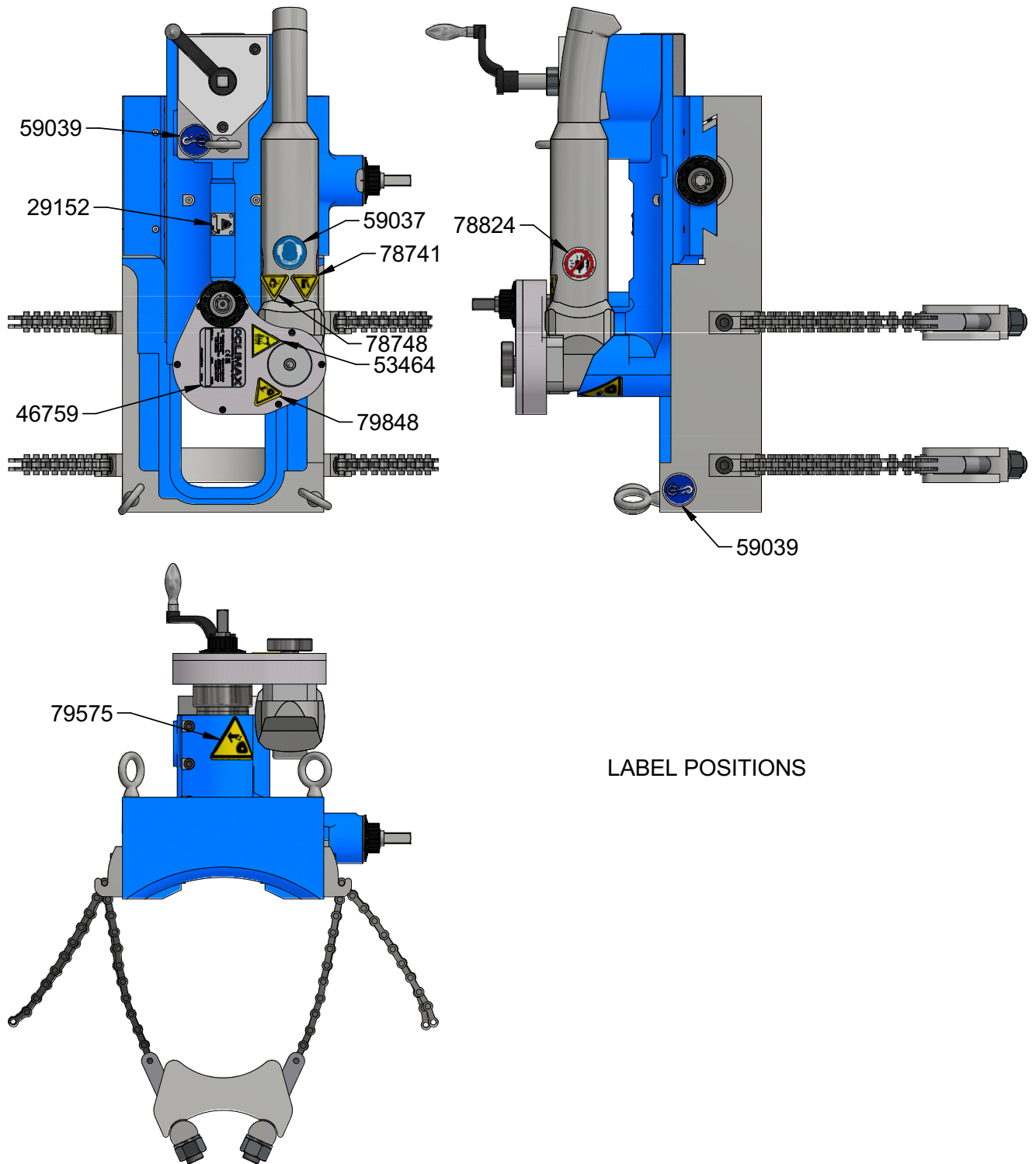


FIGURE A-6. KM4000 LABEL LOCATIONS (P/N 103884)

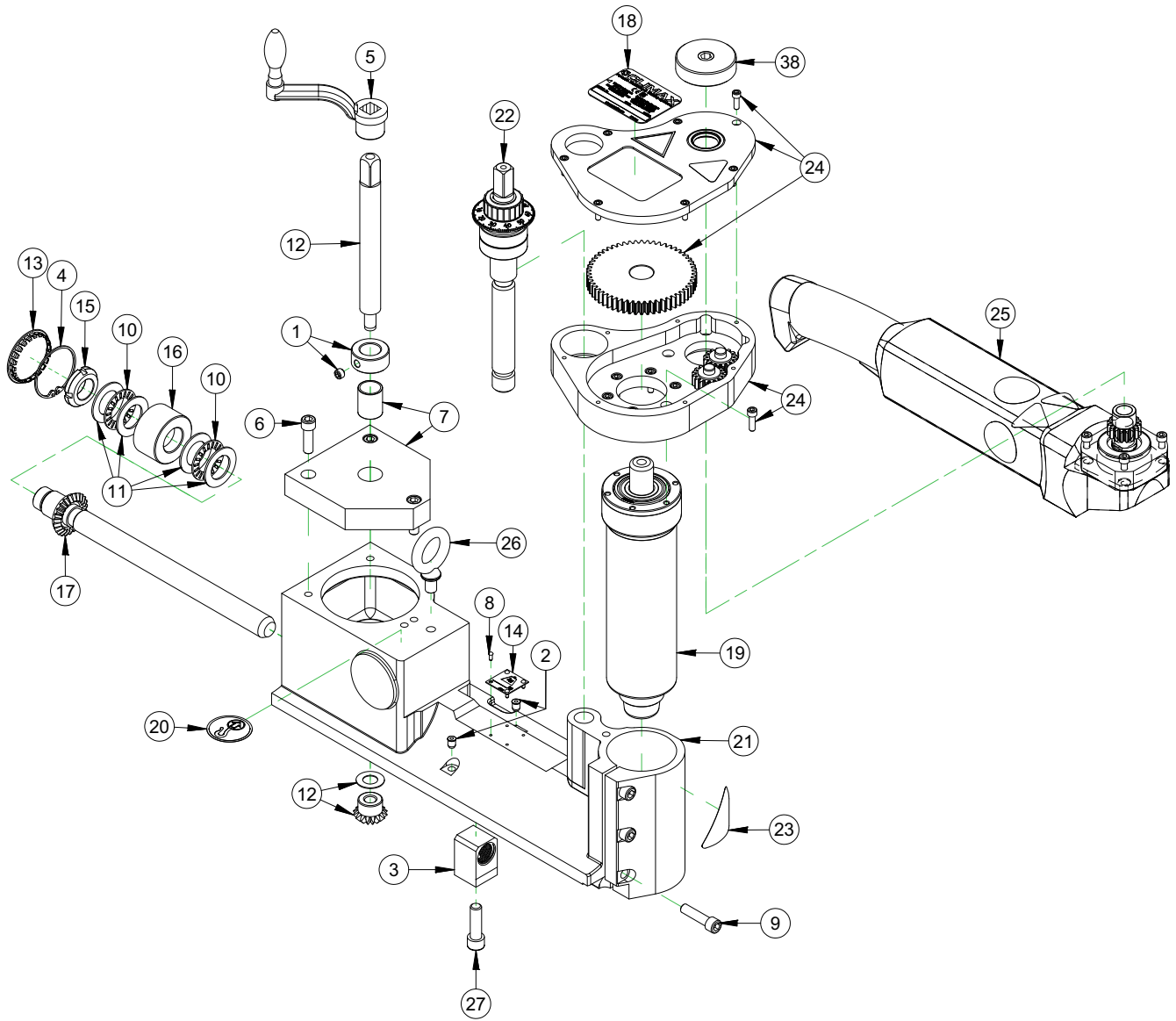
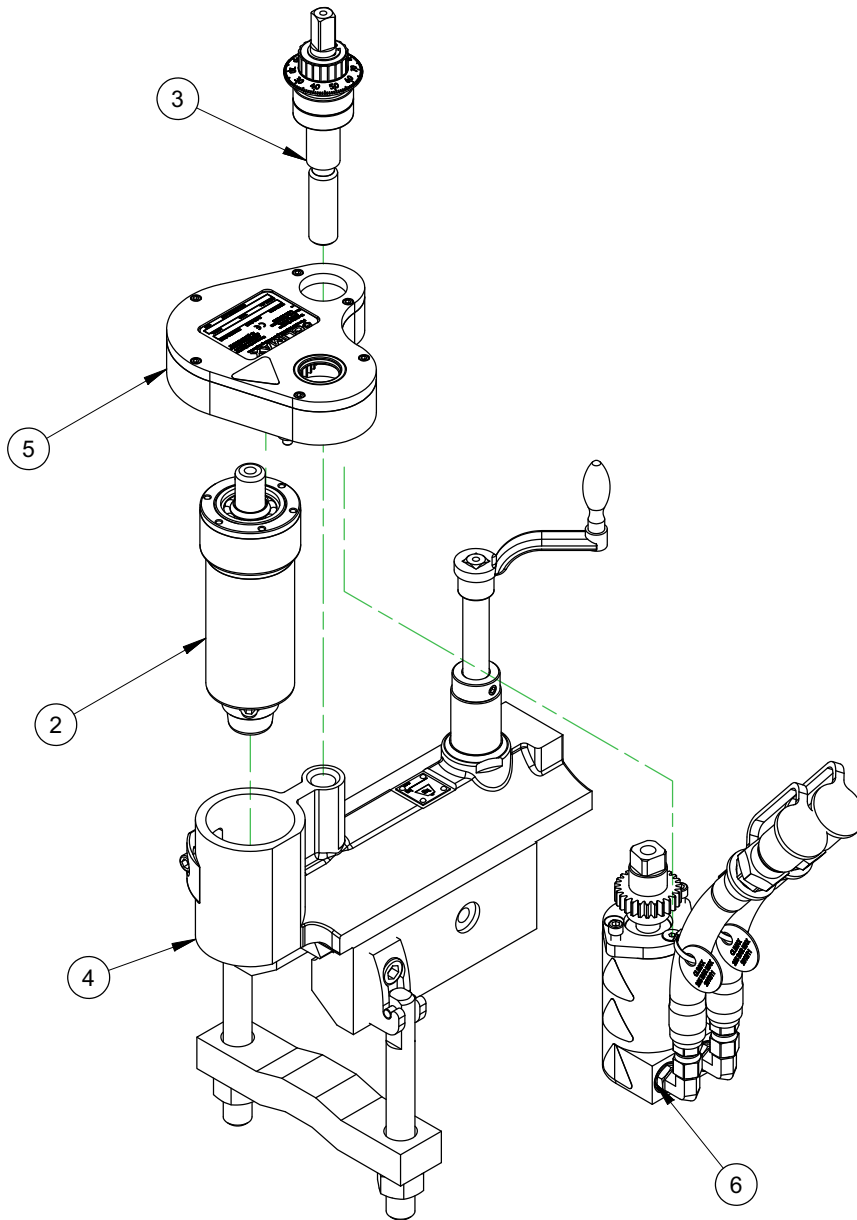


FIGURE A-7. TOPSLIDE WELDON SHANK INCH 120V ELECTRIC ASSEMBLY (P/N 103899)

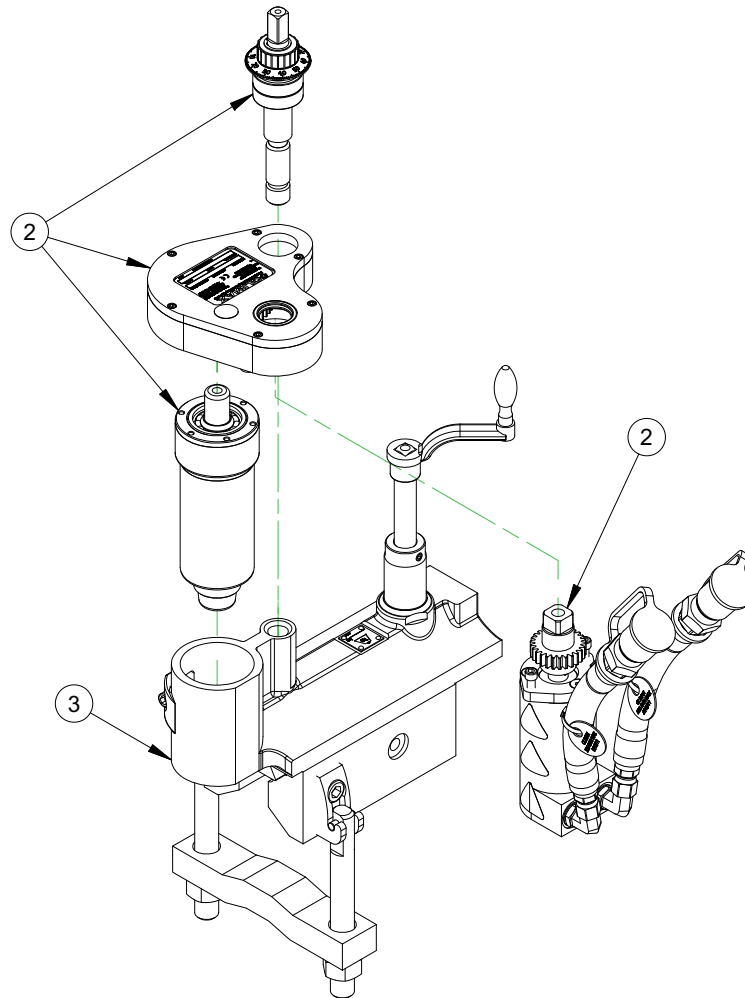
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10134	COLLAR 11/16 DIA SHAFT WITH 5/16-18 SET SCREW
2	2	10139	OILER BALL VALVE DRIVE IN
3	1	10190	LEADNUT BRASS 3/4-10 ACME
4	1	10193	RING SNAP 1.75 ID BEVEL LEADSCREW
5	1	10203	CRANK HANDLE 1/2 SQUARE
6	3	10431	SCREW 5/16-18 X 1 SHCS
7	1	10500	COVER GEAR BOX ASSY KM4000
8	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
9	3	11735	SCREW 5/16-18 X 1-1/4 SHCS
10	2	13174	BRG THRUST .875 ID X 1.437 OD X .0781
11	4	13175	WASHER THRUST .875 ID X 1.437 OD X .060
12	1	15618	SHAFT ASSY 2ND KM3000
13	1	15999	PLUG HOLE 1-3/4 DIA MODIFIED
14	1	29152	PLATE MASS CE
15	1	37981	NUT SELF LOCKING BRG ADJ SZ 4
16	1	38116	COLLAR LEADSCREW BEARING
17	1	38117	LEADSCREW TOP SLIDE KM4000 PM2000 PM3000
18	1	46759	PLATE SERIAL YEAR MODEL CE 2.0 X 2.63
19	1	SEE CHART	SPINDLE & QUILL ASSY KM4000/PM4000
20	1	SEE CHART	LABEL WARNING LIFT POINT ROUND 1.5"
21	1	SEE CHART	TOPSLIDE PM4200 KM4000
22	1	SEE CHART	ASSY LEADSCREW VERT ADJ KM/PM
23	1	79575	LABEL WARNING - CUTTING OF FINGERS OR HAND ROTATING BLADE GRAPHIC TRIANGLE YELLOW
24	1	103341	ASSY GEAR BOX 3.5 RATIO
25	1	SEE CHART	MOTOR ASSY ELECTRIC 16T
26	1	SEE CHART	LIFTING EYE
27	1	SEE CHART	SCREW

FIGURE A-8. TOPSLIDE WELDON SHANK INCH 120V ELECTRIC ASSEMBLY (P/N 103899)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13737	KIT TOOL KM3000 KM4000 PM4000 (NOT SHOWN)
2	1	15651	SPINDLE & QUILL ASSY INCH 3RD KM3000
3	1	15655	ASSY LEADSCREW VERT ADJ INCH 3RD KM3000
4	1	28839	BASE AND TOP SLIDE ASSY W/ BAR CLAMP
5	1	34935	GEARBOX, KEYMILL 4th GENERATION HYDRAULIC
6	1	35002	MOTOR ASSY HYD KM3000 4TH GEN GEAR BOX

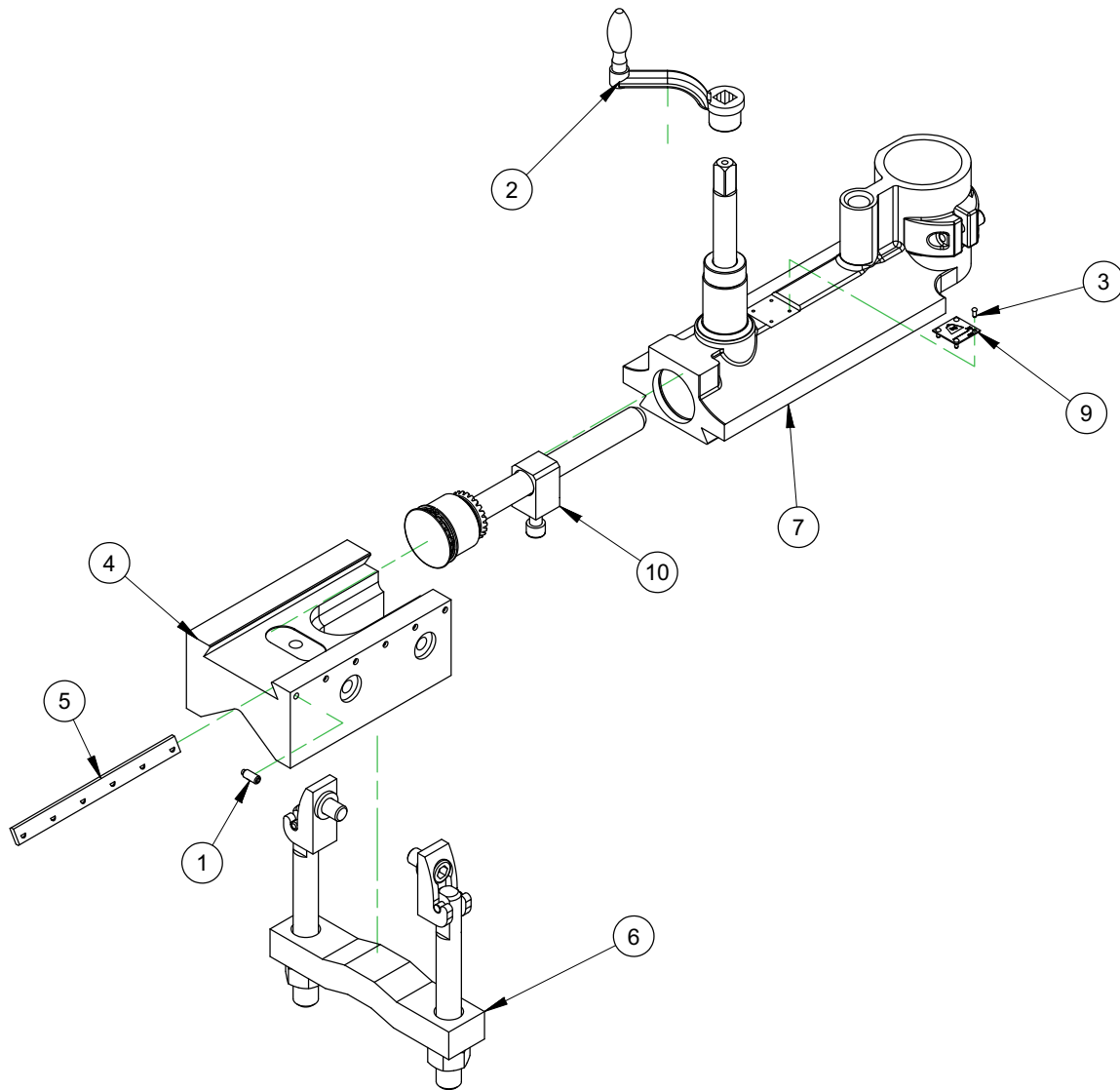
FIGURE A-9. 4TH GENERATION HYDRAULIC KEYMILL ASSEMBLY (P/N 34933)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	16011	(NOT SHOWN) CRATE 9 X 24 X 11-7/8 KM3000 5/8 PLY HINGED
2	1	21031	ASSY POWER UNIT INCH HYD 274 RPM @ 5 GPM KM3000
3	1	28839	BASE AND TOP SLIDE ASSY W/ BAR CLAMP
4	1	34181	(NOT SHOWN) WRENCH HEX SET FOLDING 5/64 - 1/4 9 PCS CLIMAX LOGO

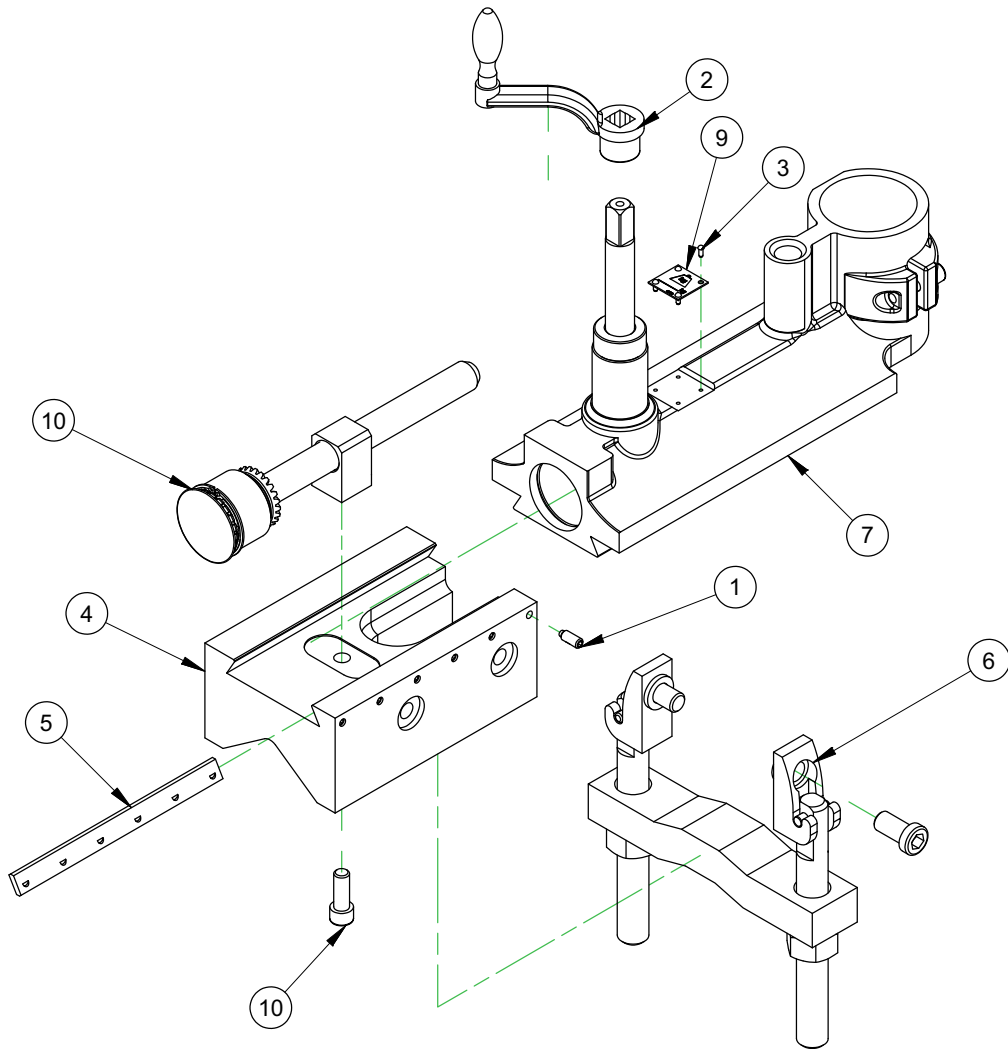
35088 - ASSY KEYMILL INCH HYD 274 RPM 3RD GEN GEARBOX - REV B

FOR REFERENCE ONLY
FIGURE A-10. 3RD GENERATION HYDRAULIC KEYMILL ASSEMBLY (P/N 35088)



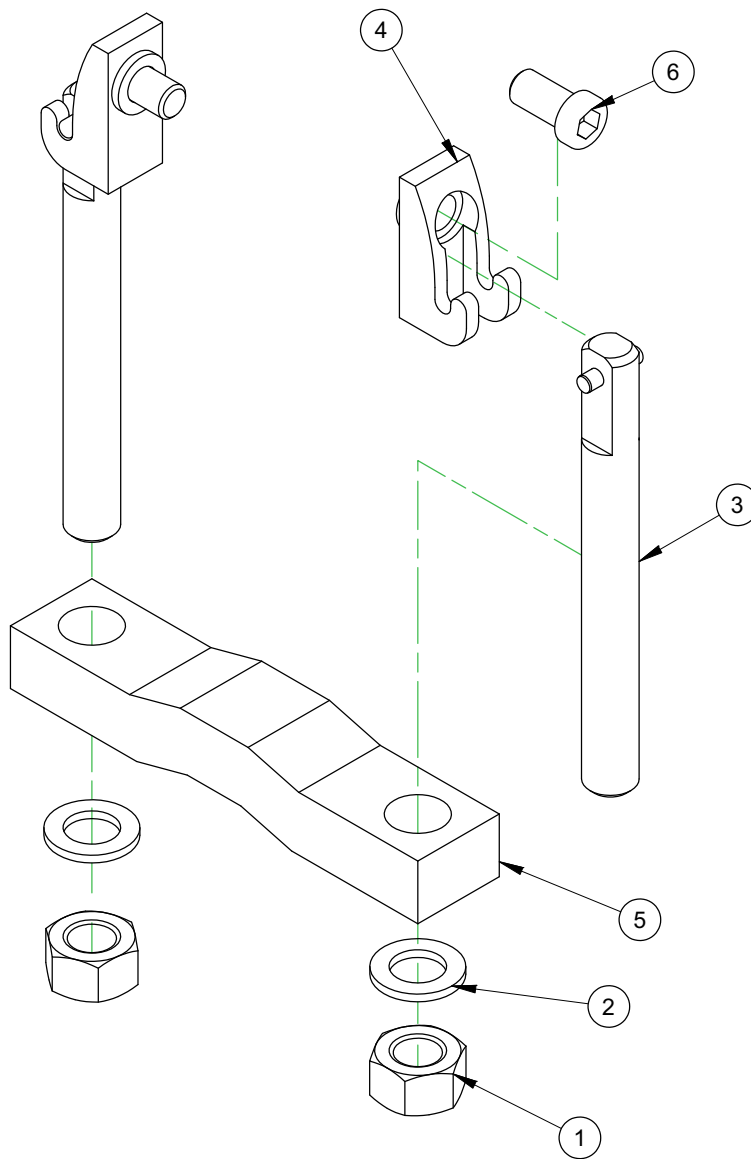
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10189	SCREW 1/4-20 X 5/8 SSSHPPL
2	1	10203	CRANK HANDLE 1/2 SQUARE
3	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
4	1	15505	BASE 2ND KM3000
5	1	15616	GIB .4915 X .1562 X 6.76 0-1 6 SS X 1.25
6	1	15647	CLAMP ASSY STANDARD KM3000
7	1	15656	ASSY TOP SLIDE INCH 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-11. BASE AND TOP SLIDE ASSEMBLY (P/N 28839)



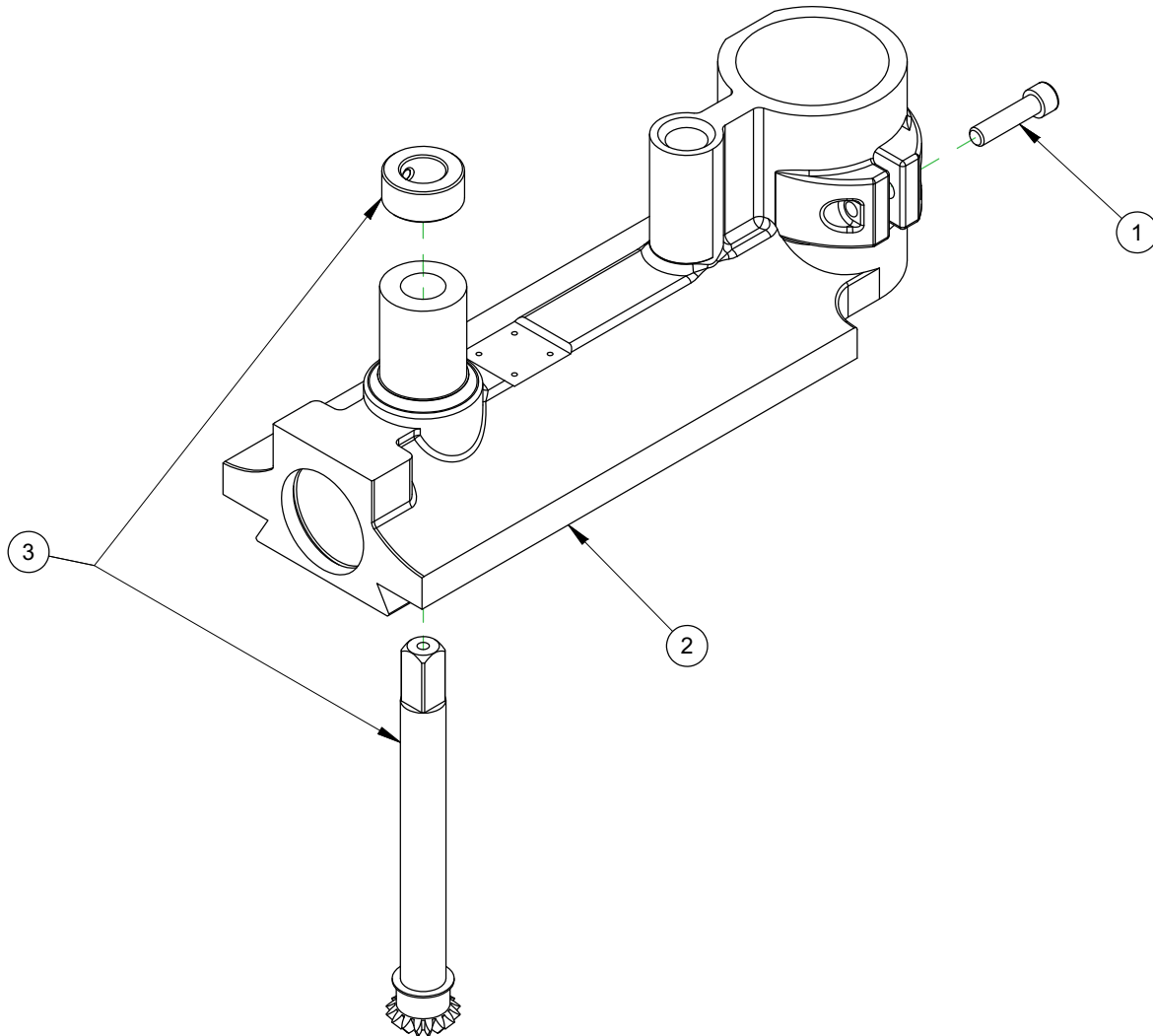
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10189	SCREW 1/4-20 X 5/8 SSSHDPPPL
2	1	10203	CRANK HANDLE 1/2 SQUARE
3	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
4	1	15505	BASE 2ND KM3000
5	1	15616	GIB .4915 X .1562 X 6.76 0-1 6 SS X 1.25
6	1	15647	CLAMP ASSY STANDARD KM3000
7	1	16025	ASSY TOP SLIDE METRIC 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-12. 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

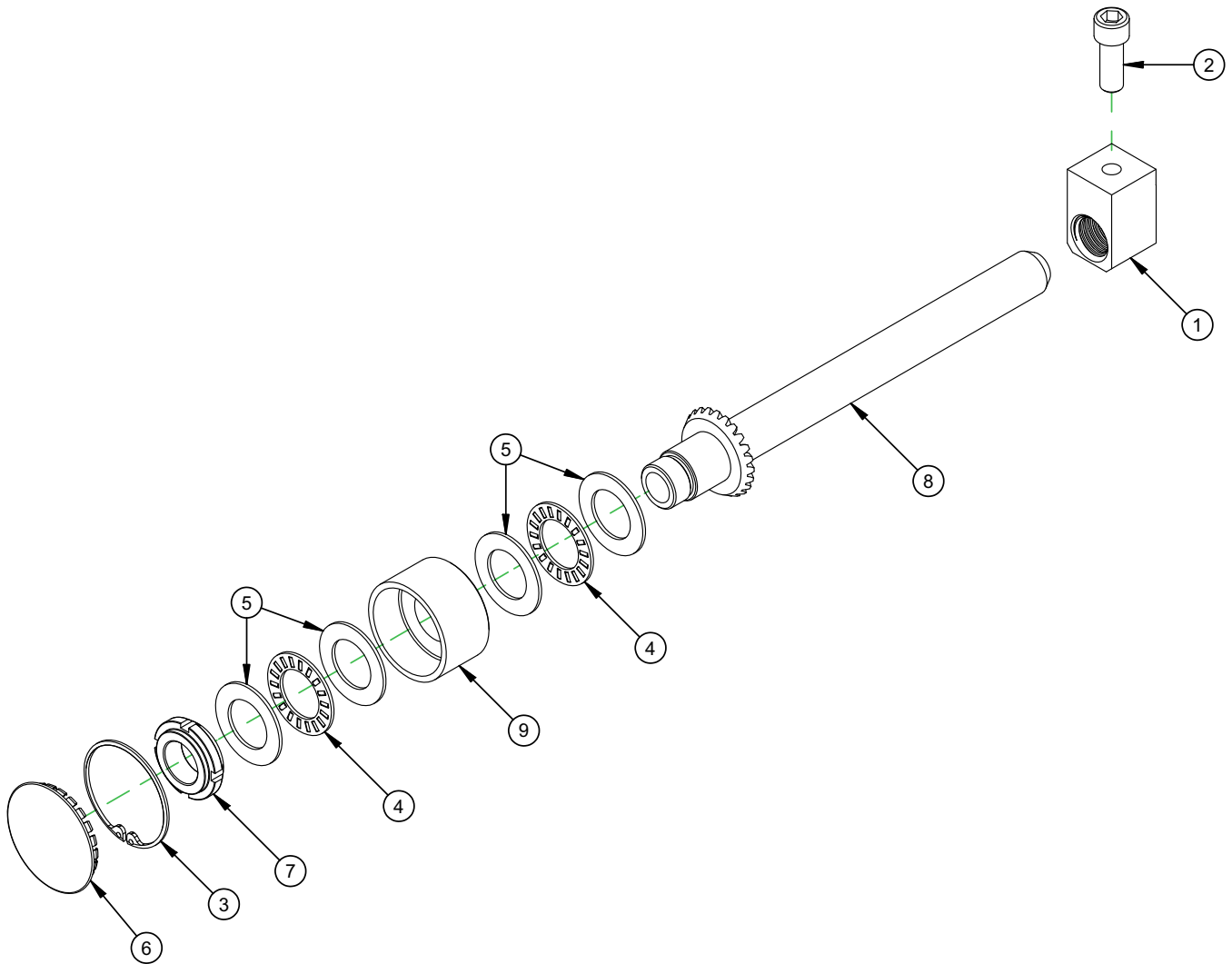
FIGURE A-13. CLAMP ASSEMBLY (P/N 15647)



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

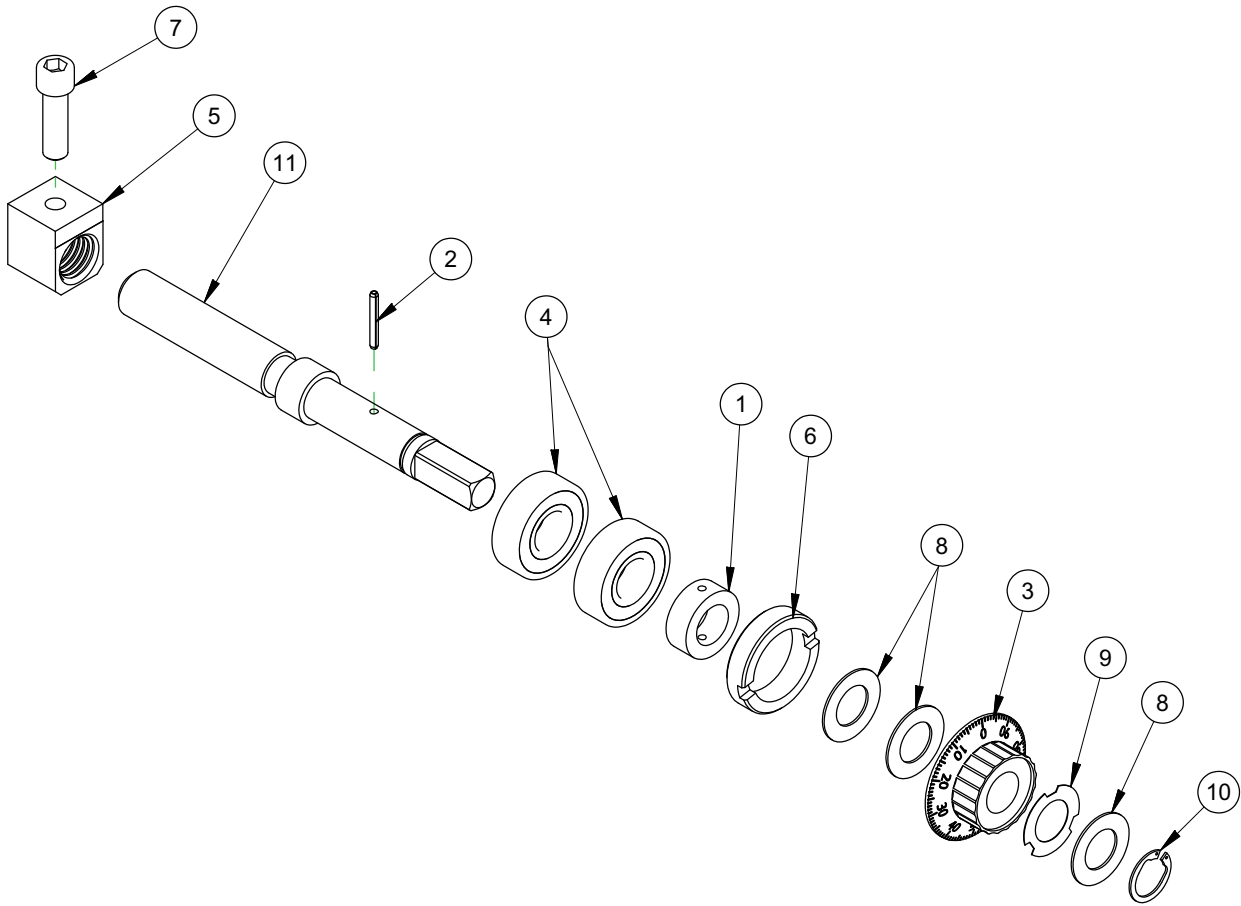
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	11735	SCREW 5/16-18 X 1-1/4 SHCS
2	1	15507	SLIDE TOP INCH 2ND KM3000
		16026	SLIDE TOP METRIC 2ND KM3000
3	1	15657	SHAFT ASSY TRAVERSE DRIVE 2ND KM3000

FIGURE A-14. TOP SLIDE ASSEMBLY (P/N 75077)



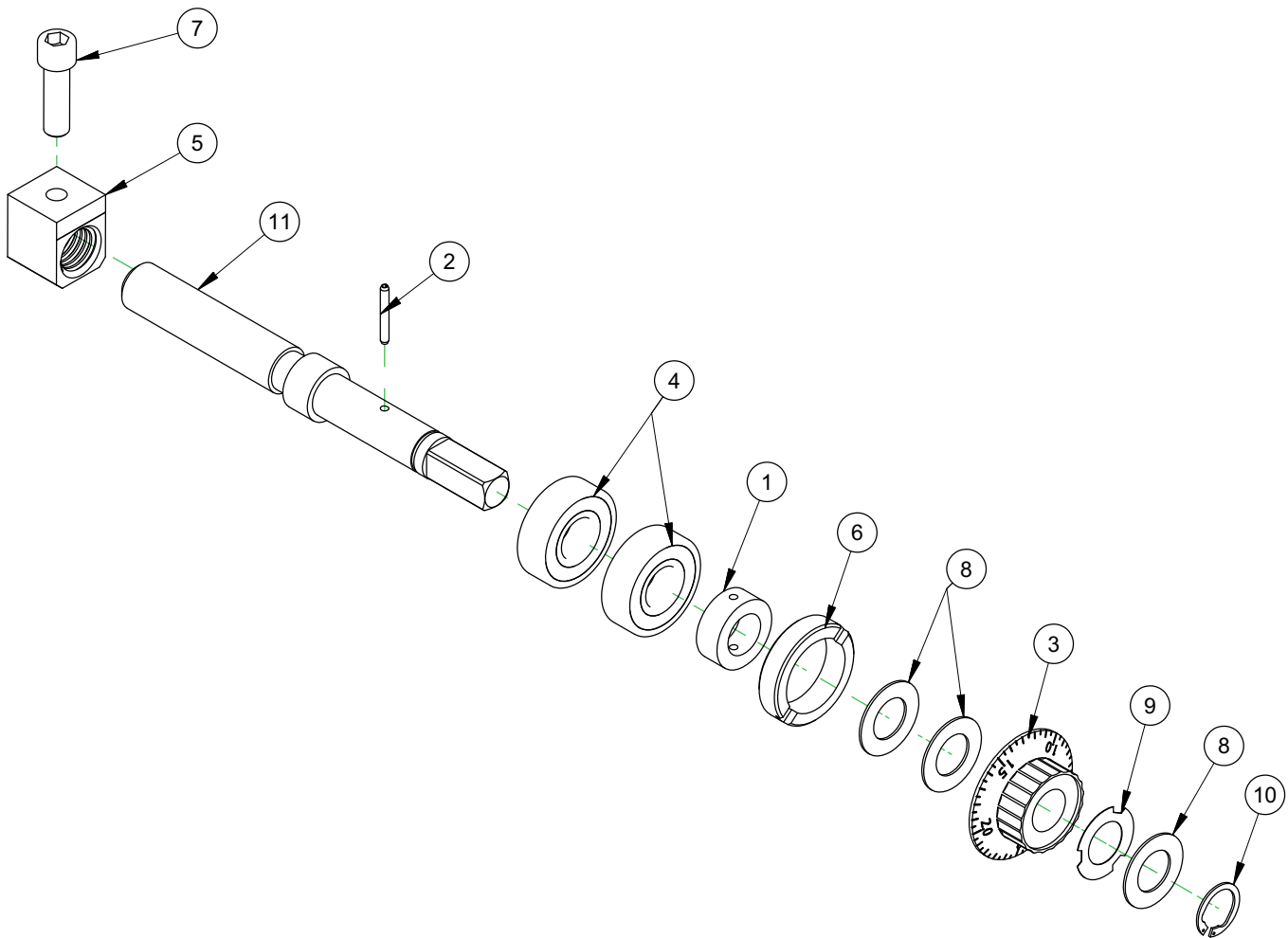
PARTS LIST			
ITEM	QTY	PART No.	DESCRIPTION
1	1	10190	LEADNUT BRASS 3/4-10 ACME
2	1	10191	SCREW 3/8-16 X 1 SHCS
3	1	10193	RING SNAP 1.75 ID BEVEL LEADSCREW
4	2	13174	BRG THRUST .875 ID X 1.437 OD X .0781
5	4	13175	WASHER THRUST .875 ID X 1.437 OD X .060
6	1	15999	PLUG HOLE 1-3/4 DIA MODIFIED
7	1	37981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

FIGURE A-15. TOP SLIDE LEADSCREW ASSEMBLY (P/N 38091)



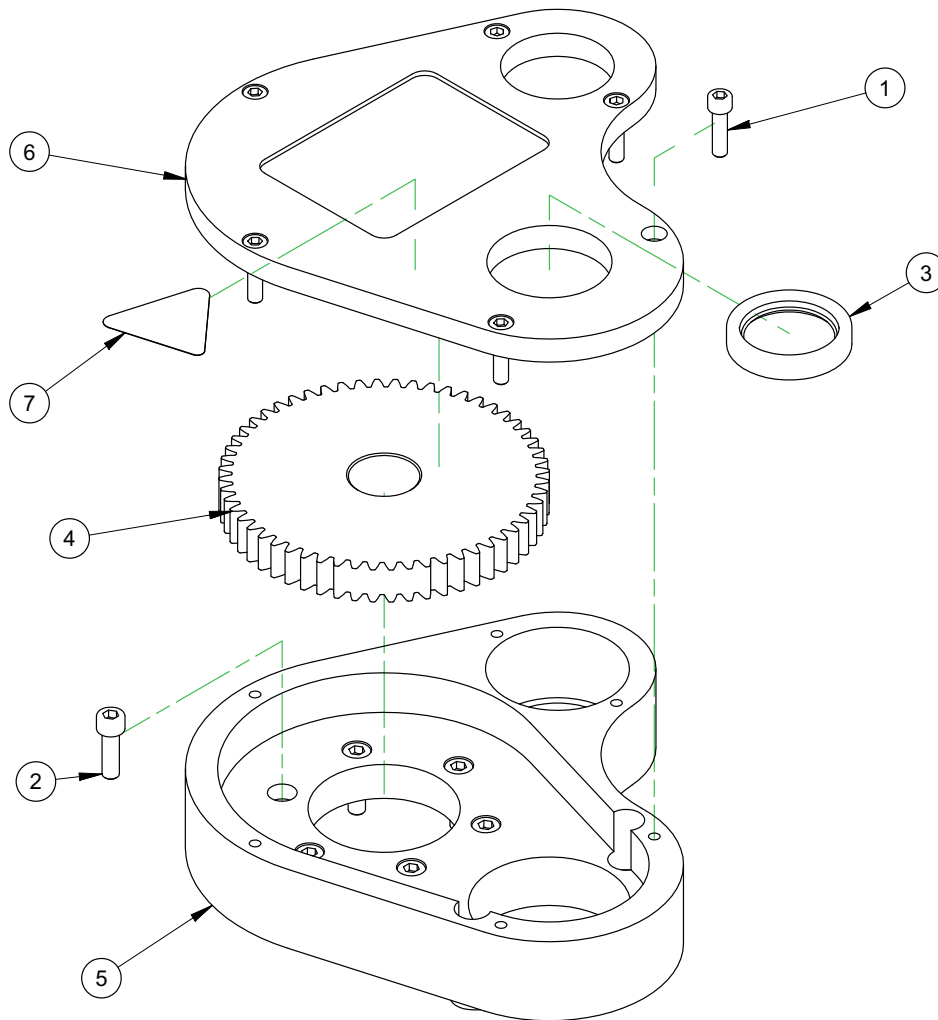
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10165	COLLAR
2	1	10166	PIN ROLL 1/8 DIA X 1
3	1	10169	DIAL INCH
4	2	10365	BRG BALL .6693 ID X 1.5748 OD X .4724 2 SEALS
5	1	10449	LEAD NUT
6	1	10451	NUT BEARING RETAINER
7	1	10453	SCREW 3/8-16 X 1 1/4 SHCS
8	3	15666	WASHER THRUST .669 ID X 1.181 OD X .039
9	1	15667	WASHER SPRING FINGER .688 ID X 1.164 OD
10	1	15668	RING SNAP .672 OD X .035 THICK INVERTED
11	1	16253	LEADSCREW CROSS SLIDE INCH 2ND KM4000

FIGURE A-16. KM4000 CROSS SLIDE LEADSCREW INCH ASSEMBLY (P/N 16263)



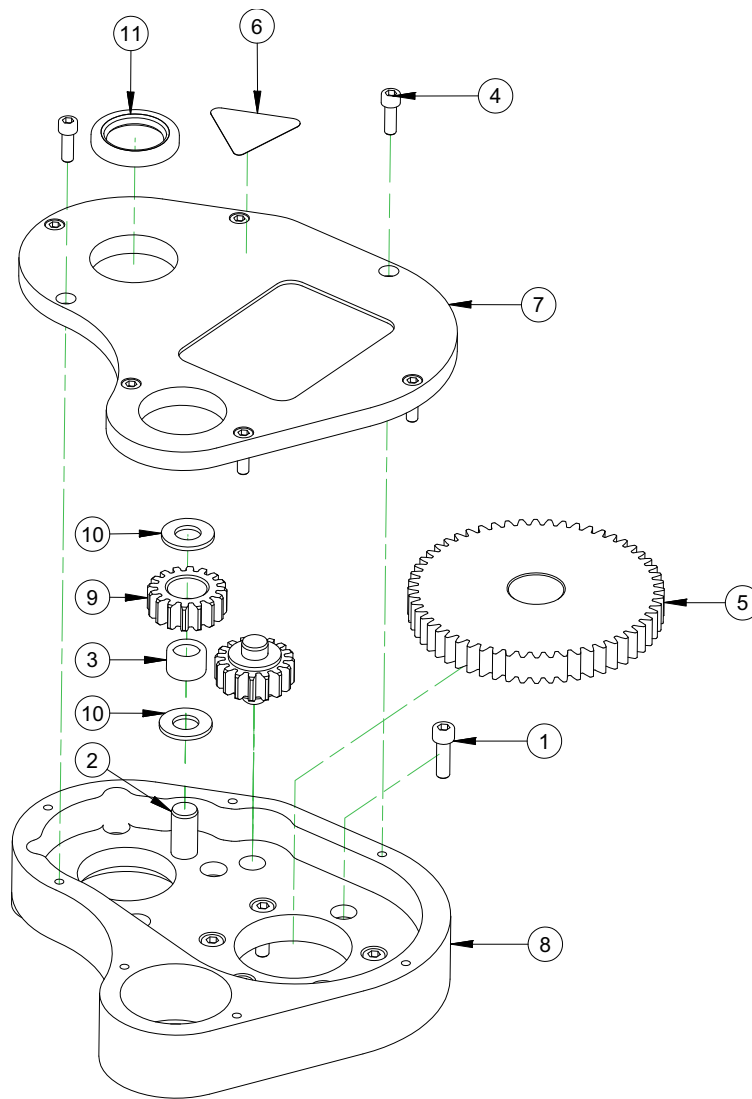
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
11	1	16254	LEADSCREW CROSS SLIDE METRIC 2ND KM4000
4	2	10365	BRG BALL .6693 ID X 1.5748 OD X .4724 2 SEALS
1	1	10165	COLLAR
10	1	15668	RING SNAP .672 OD X .035 THICK INVERTED
5	1	10450	NUT BRASS METRIC
7	1	10453	SCREW 3/8-16 X 1 1/4 SHCS
8	3	15666	WASHER THRUST .669 ID X 1.181 OD X .039
6	1	10451	NUT BEARING RETAINER
2	1	10166	PIN ROLL 1/8 DIA X 1
9	1	15667	WASHER SPRING FINGER .688 ID X 1.164 OD
3	1	10170	DIAL METRIC

FIGURE A-17. KM4000 CROSS SLIDE LEADSCREW METRIC ASSEMBLY (P/N 16264)



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

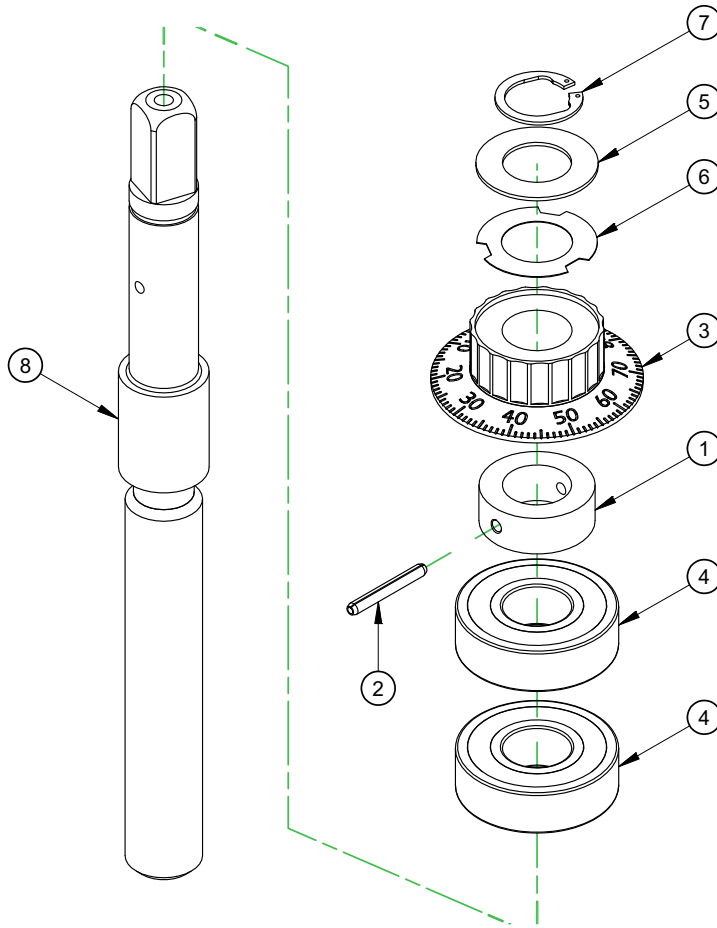
FIGURE A-18. GEARBOX SPINDLE DRIVETOP ASSEMBLY (P/N 34403)



PARTS LIST

ITEM	QTY	P/N:	DESCRIPTION
1	6	10157	SCREW 10-32 X 5/8 SHCS
2	2	11027	PIN DOWEL 3/8 DIA X 1
3	2	11037	BRG NEEDLE 3/8 ID X 9/16 OD X .500 OPEN
4	7	11845	SCREW 8-32 x 1/2 SHCS
5	1	15517	GEAR SPUR 16DP 56T 20PA .43 X .97LG STEEL
6	1	79848	LABEL WARNING - CUTTING OF FINGERS OR HAND ROTATING BLADE GRAPHIC 1.13 TALL TRIANGLE YELLOW
7	1	103343	3.5 RATIO GEARBOX COVER
8	1	103344	3.5 RATIO GEARBOX HOUSING
9	2	103346	GEAR SPUR 16DP 16T 20PA .38LG STEEL
10	4	103781	WASHER THRUST 3/8 ID X 3/4 OD X 1/16 OILITE
11	1	103792	SEAL .8125 ID X 1.250 OD X .18

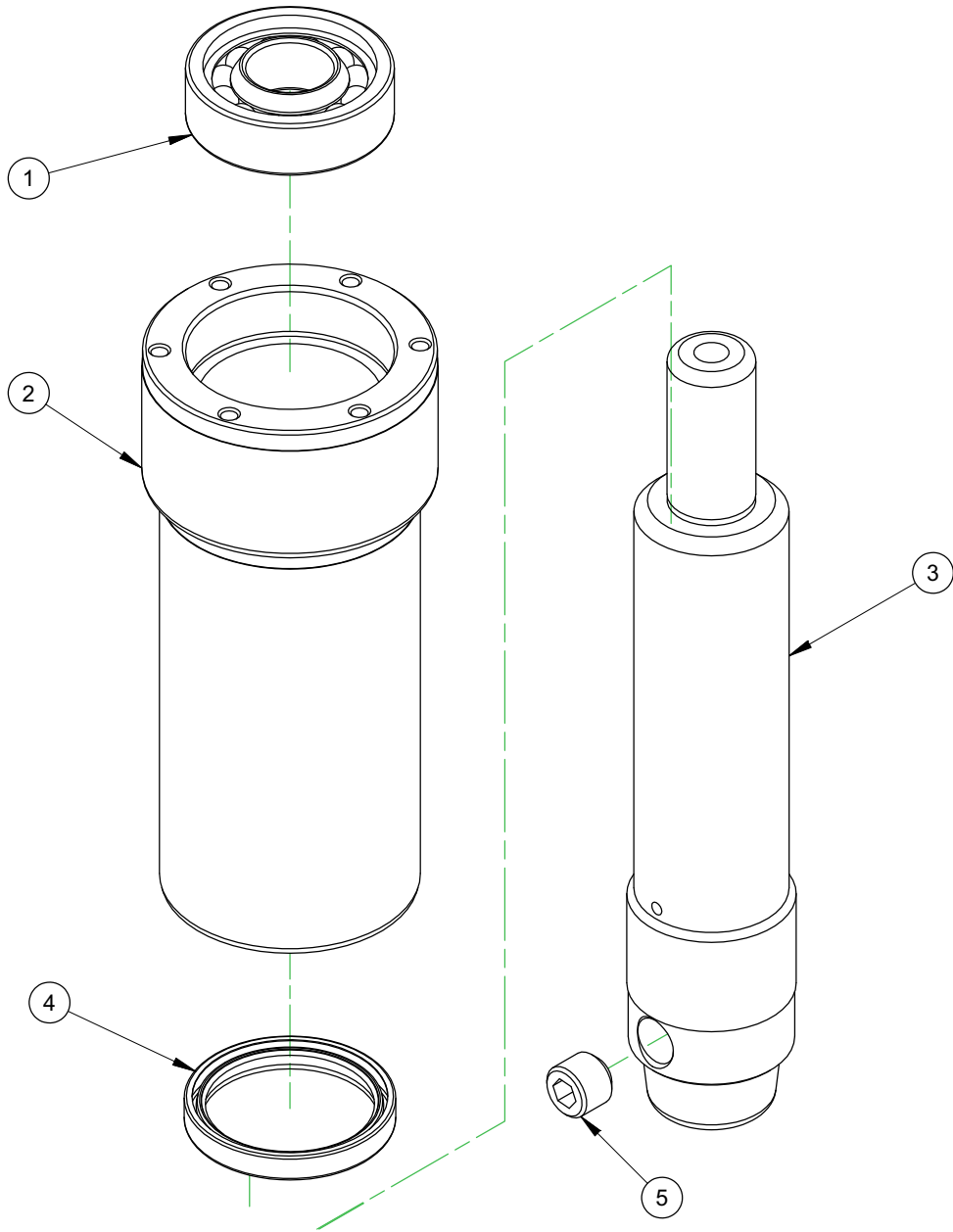
FIGURE A-19. GEARBOX 3.5 RATIO ASSEMBLY (P/N 103341)



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

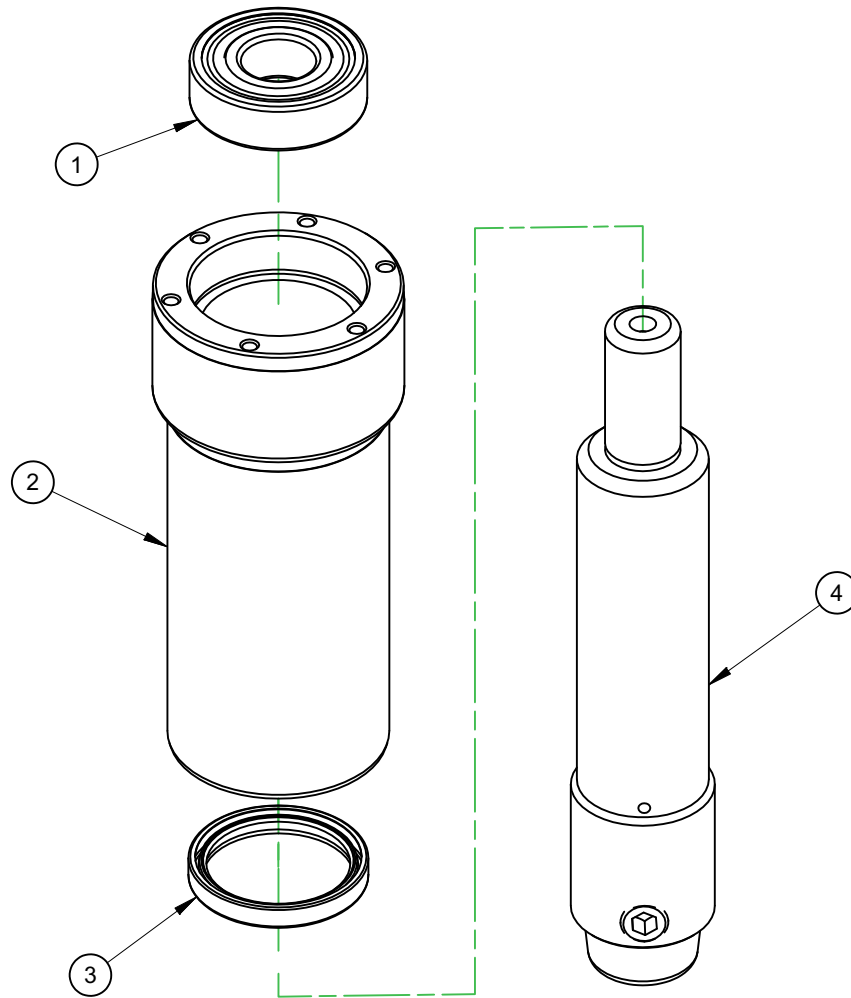
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10165	COLLAR
2	1	10166	PIN ROLL 1/8 DIA X 1
3	1	10169	DIAL INCH
		10170	DIAL METRIC
4	2	10365	BRG BALL .6693 ID X 1.5748 OD X .4724 2 SEALS
5	1	15666	WASHER THRUST .669 ID X 1.181 OD X .039
6	1	15667	WASHER SPRING FINGER .688 ID X 1.164 OD
7	1	15668	RING SNAP .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-20. VERTICAL LEADSCREW ASSEMBLY (P/N 75096)



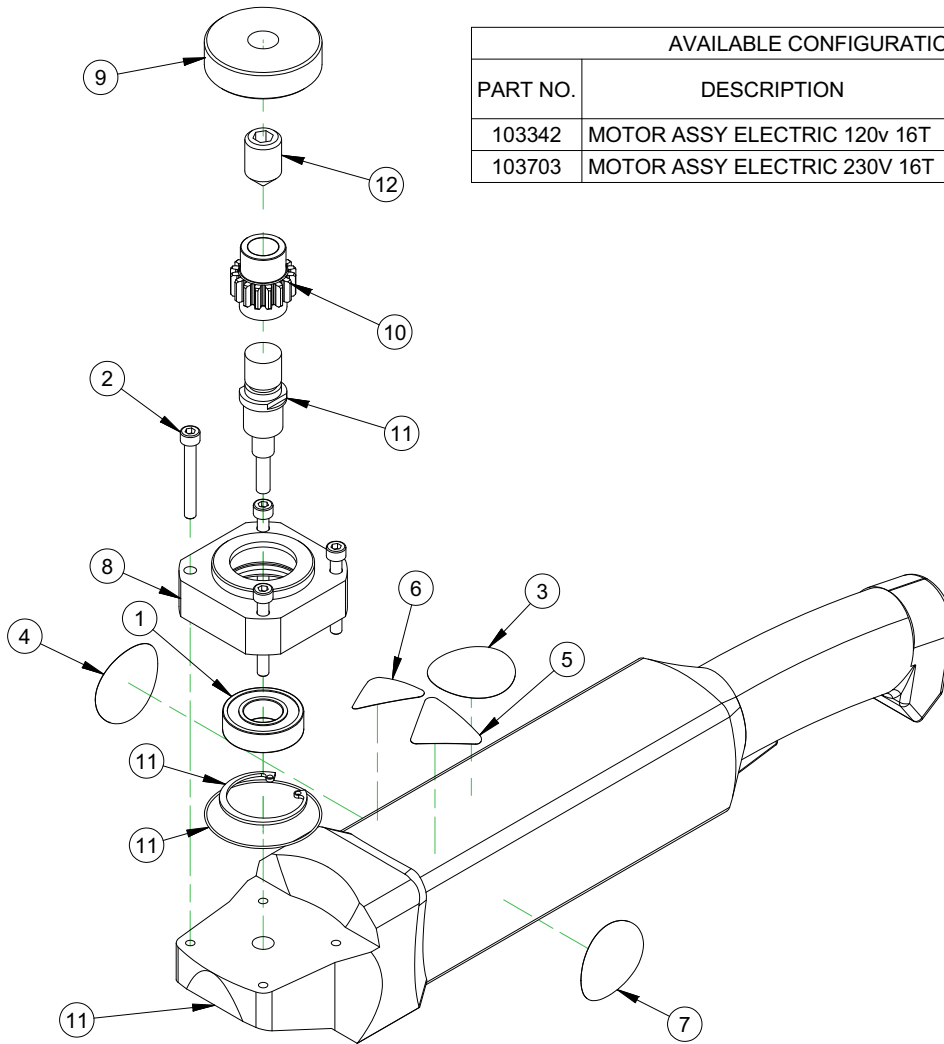
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	10150	BRG BALL .7874 ID X 1.8504 OD X .5512
2	1	15514	ASSY QUILL 2ND KM3000 1.75 TRAVEL
3	1	15518	SPINDLE INCH 5/8 3RD KM3000
4	1	15669	SEAL 1.500 ID X 1.874 OD X .250
5	1	37405	SCREW 1/2-20 X .425 END MILL SET SCREW

FIGURE A-21. 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-22. SPINDLE AND QUILL ASSEMBLY METRIC (P/N 16022)



AVAILABLE CONFIGURATIONS			
PART NO.	DESCRIPTION	ITEM 11	ITEM 12
103342	MOTOR ASSY ELECTRIC 120v 16T	103347	103499
103703	MOTOR ASSY ELECTRIC 230V 16T	103705	103500

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	11849	BRG BALL .6693 ID X 1.3780 X .39
2	4	57541	SCREW M5 X .8 X 40mm SHCS
3	1	59037	LABEL WARNING - WEAR EAR PROTECTION
4	1	59044	LABEL WARNING - CONSULT OPERATOR'S MANUAL 1.5 DIA
5	1	78741	LABEL WARNING CRUSH FOOT GRAPHIC 1.13 TALL TRIANGLE YELLOW
6	1	78748	LABEL WARNING FLYING DEBRIS/LOUD NOISE
7	1	78824	LABEL WARNING - DO NOT EXPOSE TO WATER
8	1	103681	NFIS ADAPTER METABO ANGLE POLISHER
9	1	103811	KNOB ADJUSTMENT 2 INCH KNURLED LOW PROFILE
10	1	SEE CHART	GEAR SPUR
11	1	SEE CHART	CHART NFIS MOTOR ELEC
12	1	103886	SCREW 5/8-11 X 1 SSSCN

FIGURE A-23. ELECTRIC MOTOR ASSEMBLY (P/N 103702)

PCU REPLACEMENT PARTS:

MFG=AVENTICS SERIES 652 AIR PREP UNIT COMPONENTS

A T652AT502468001 = END PLATES

B P652AT502466001 = BODY CONNECTOR

C P699AT502467001 = BRACKET ATTACHMENT FOR BODY CONN

① 8652A3M04011100 = SHUT OFF VALVE

D M652AY524218002 = SIDE COVER PLASTIC

E M2MN = METAL SILENCER

② 8652APAM4FA00GA = FILTER/REGULATOR

F M652AU440511003 = BOWL POLYIMIDE

G M699AQ501862001 = DRAIN COCK

D M652AY524218002 = SIDE COVER PLASTIC

H M652AE433582003 = ELEMENT 40 MICRON

J M699AG438047004 = GAUGE 0-175 PSI

③ 8652AL0M40A0000 = LUBRICATOR

F M652AU440511003 = BOWL POLYIMIDE

K M699AQ440512001 = DRAIN COCK PLUG

L M699AY506842001 = SIGHT DOME ASSEMBLY NBR

④ 8652A5E04NA0000 = 3/2 VALVE

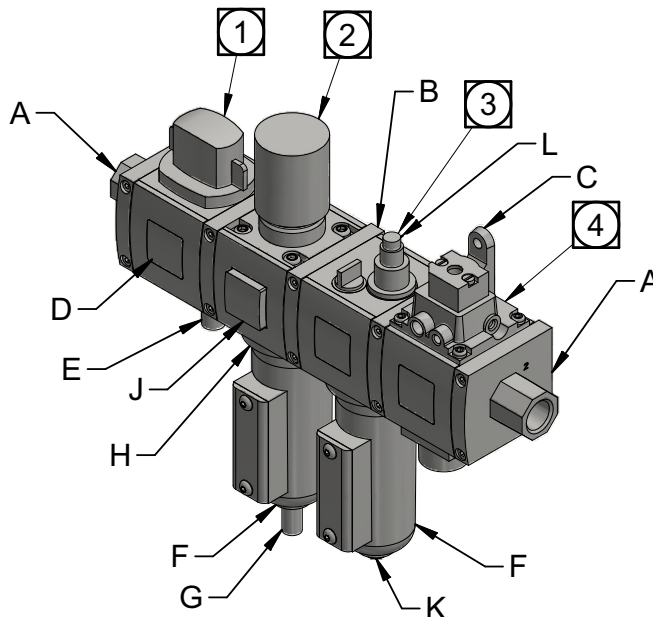
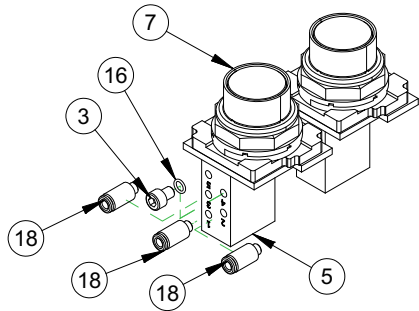
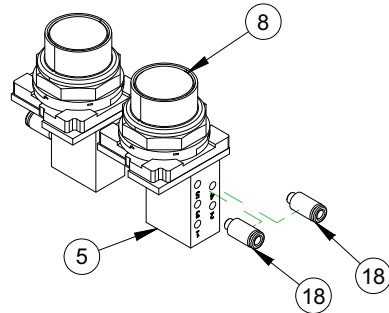


FIGURE A-24. PNEUMATIC CONDITIONING UNIT ASSEMBLY 1 (P/N 101920)



DETAIL A
SCALE 1/3



DETAIL B
SCALE 1/3

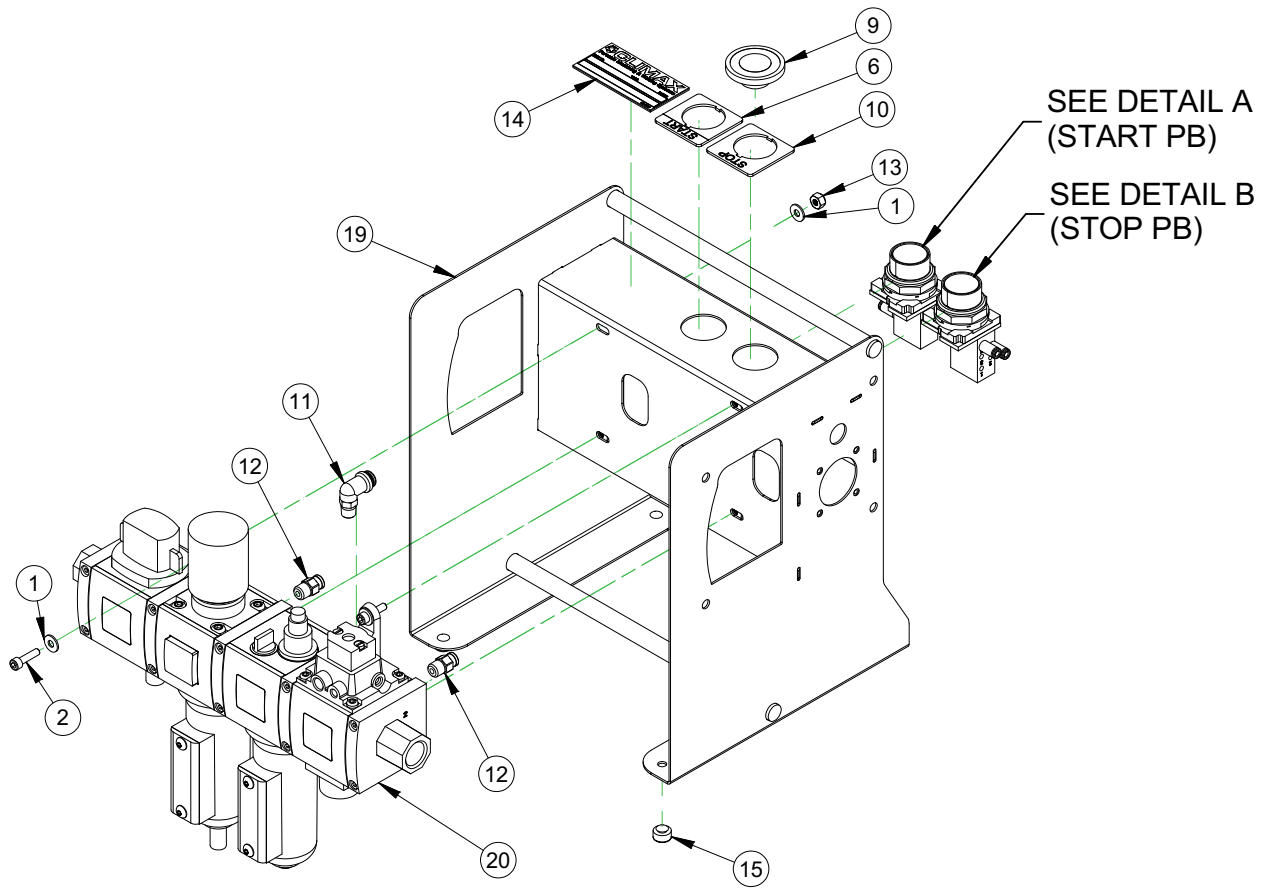
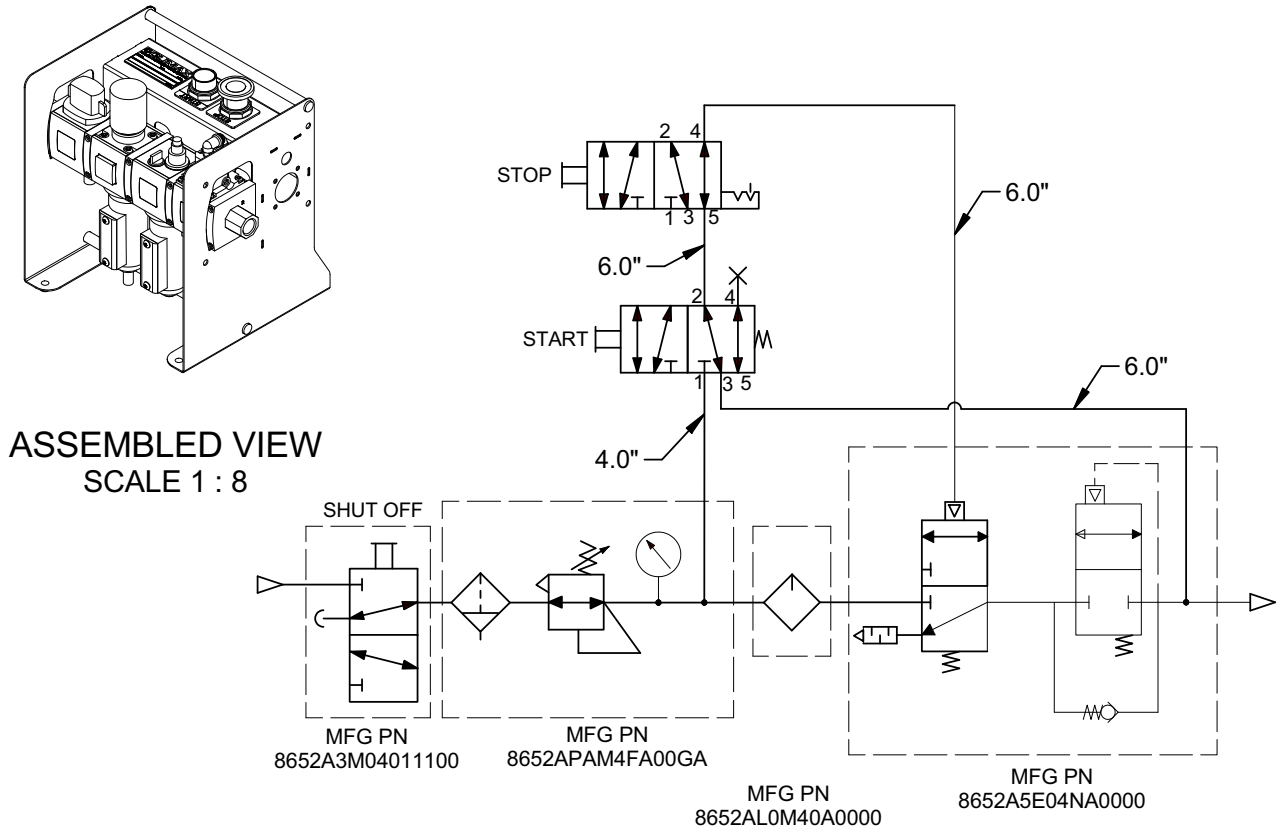


FIGURE A-25. PNEUMATIC CONDITIONING UNIT ASSEMBLY 2 (P/N 101920)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	8	11315	WASHER #10 FLTW BLACK OXIDE
2	4	12648	SCREW 10-24 X 3/4 SHCS
3	1	14726	SCREW 10-32 X 1/4 SHCS
4	2	15285	(NOT SHOWN) FTG REDUCING ADAPTER 1 NPTF X 1/2 NPTM
5	2	46785	VALVE PUSHBUTTON 5 PORT PNEUMATIC
6	1	46797	LEGEND PLATE START 10250 SERIES
7	1	59458	PUSHBUTTON GREEN FLUSH
8	1	59459	PUSH BUTTON PUSH PULL MAINTAINED (M-M)
9	1	59462	PUSH BUTTON OPERATOR RED 1-5/8
10	1	59825	LEGEND PLATE STOP 10250SERIES YELLOW BACKGROUND
11	1	83517	FTG ELBOW 1/8 NPTM X 5/32 TUBE PRESTOLOK
12	2	83520	FTG, STRAIGHT, 1/8 NPTM X 5/32 TUBE PRESTOLOK
13	4	87533	NUT 10-24 STDNYLOC SS
14	1	91792	PLATE PART NO YEAR MODEL 1.5 X 3.0 ADHESIVE BACKED
15	4	96348	BUMPER RUBBER 1/4" ID X 1/2" OD 1/16" MATL THICKNESS
16	1	98553	O-RING 4.5MM ID X 6.5MM OD X 1MM W NITRILE 70A DUROMETER
17	24	98554	(NOT SHOWN) TUBING 5/32 OD POLYURETHANE (INCHES)
18	5	98555	FTG STRAIGHT SOCKET HEAD 5/32 TUBE PUSH LOCK 10/32UNF
19	1	101003	STAND PCU
20	1	101206	FILTER REGULATOR LUBRICATOR CONTROL VALVE W SEMI AUTO DRAIN
21	2	2151012	(NOT SHOWN) FTG COUPLER 1/2 NPTM X CHICAGO W/ SAFETY PIN & LANYARD

FIGURE A-26. PNEUMATIC CONDITIONING UNIT SCHEMATIC AND PARTS LIST (P/N 101920)

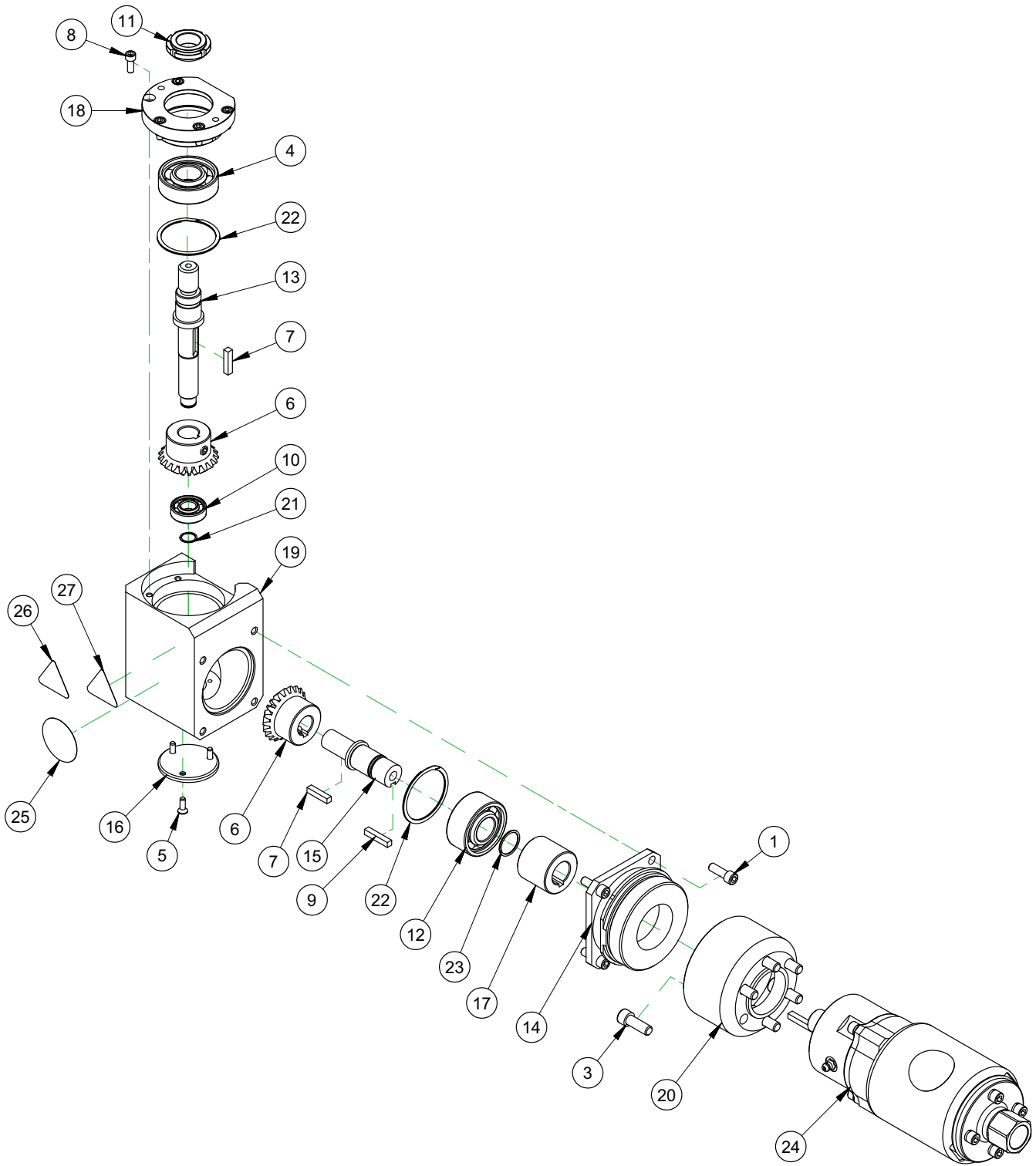
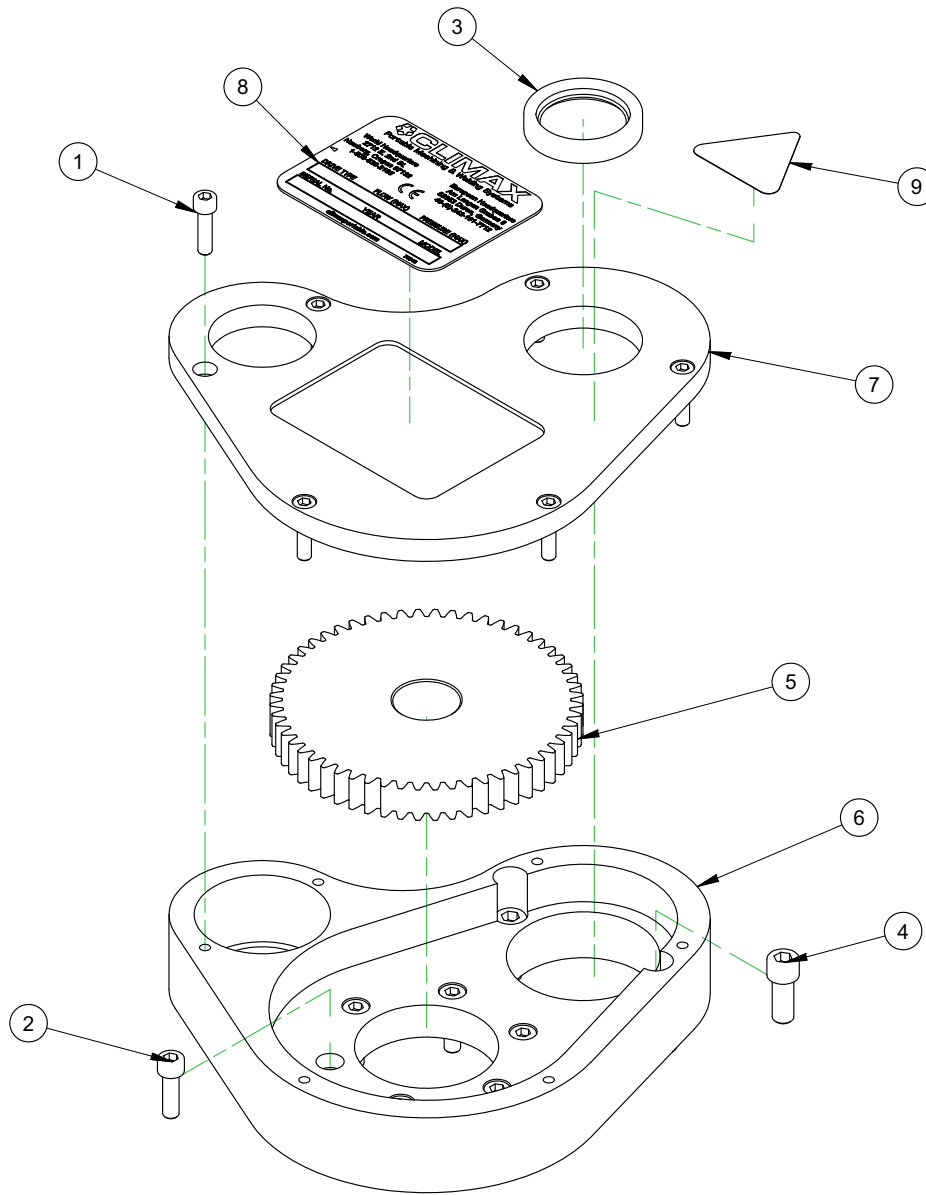


FIGURE A-27. PNEUMATIC MOTOR ASSEMBLY (P/N 38708)

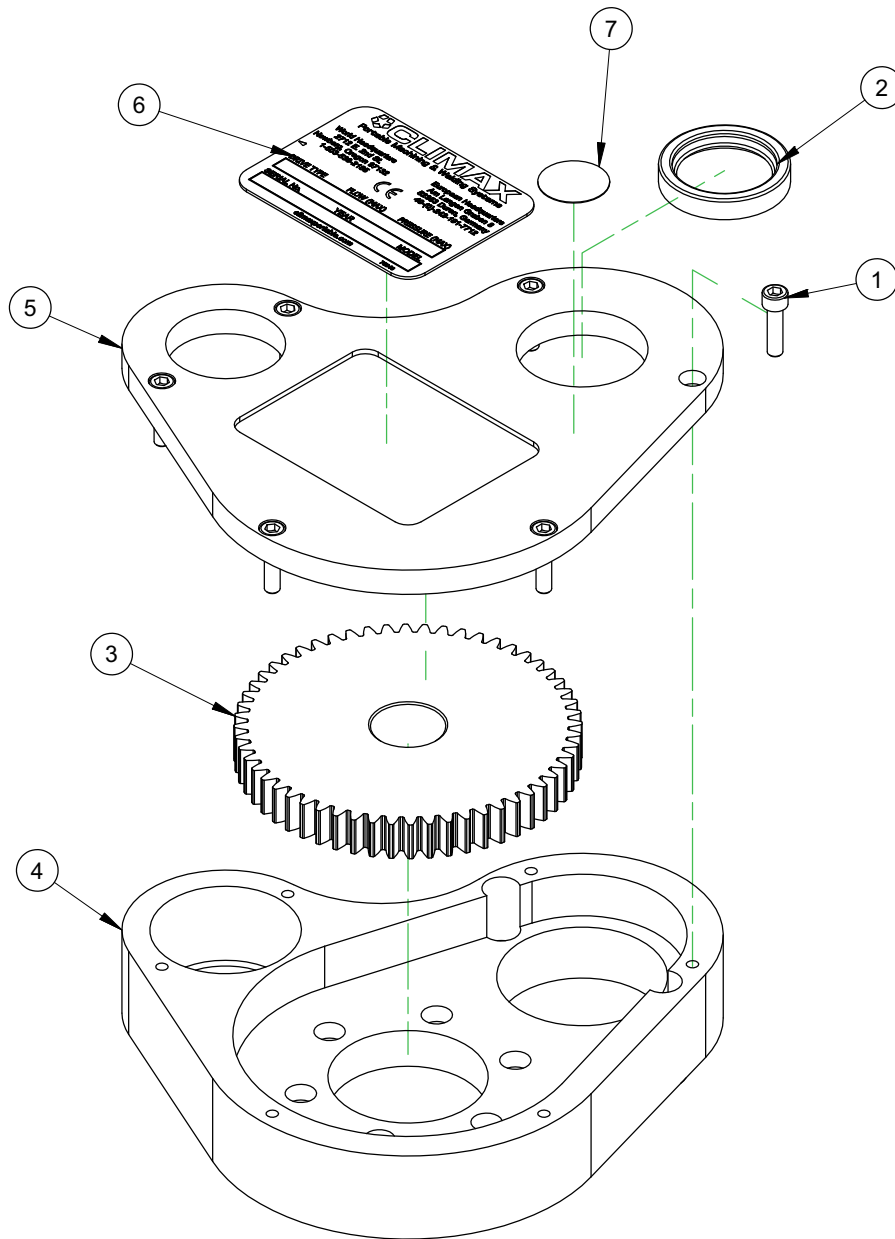
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10160	SCREW 1/4-20 X 3/4 SHCS
3	6	10830	SCREW 5/16-18 X 7/8 SHCS
4	1	10891	BRG BALL .7874 ID X 1.8504 OD X .5512 W/SEALS
5	3	11257	SCREW 8-32 X 1/2 FHSCS
6	2	12484	GEAR BEVEL 12DP 21T 1:1 20PA 1.75 PD HARDENED
7	2	12657	KEY 3/16 SQ X .87 SQ BOTH ENDS
8	5	12743	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-28. PNEUMATIC MOTOR ASSEMBLY PARTS LIST (P/N 38708)



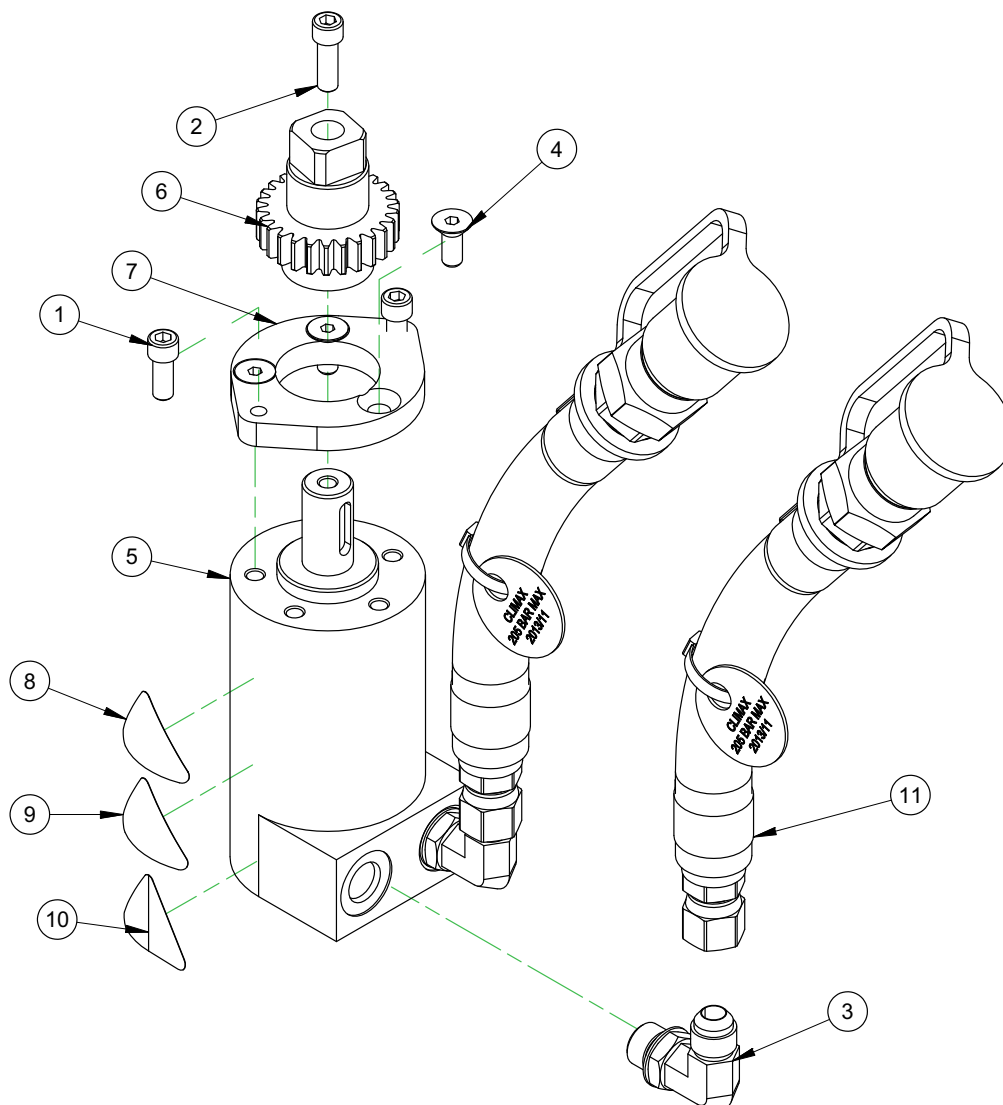
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	6	10156	SCREW 8-32 X 5/8 SHCS
2	6	10157	SCREW 10-32 X 5/8 SHCS
3	1	10167	SEAL 1.000 ID X 1.375 OD X .250
4	2	12418	SCREW 1/4-20 X 5/8 SHCS
5	1	15517	GEAR SPUR 16DP 56T 20PA .43 X .97LG STEEL
6	1	34284	GEARBOX 4TH GENERATION KM3000
7	1	34285	GEARBOX COVER KM3000
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-29. 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-30. 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-31. HYDRAULIC MOTOR ASSEMBLY (P/N 35002)

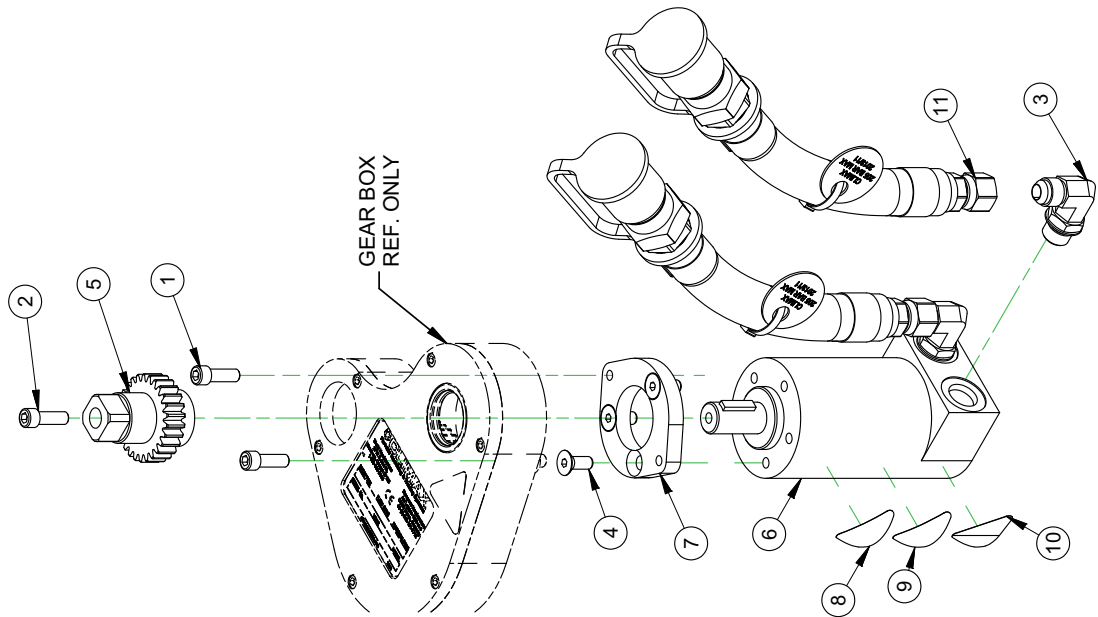
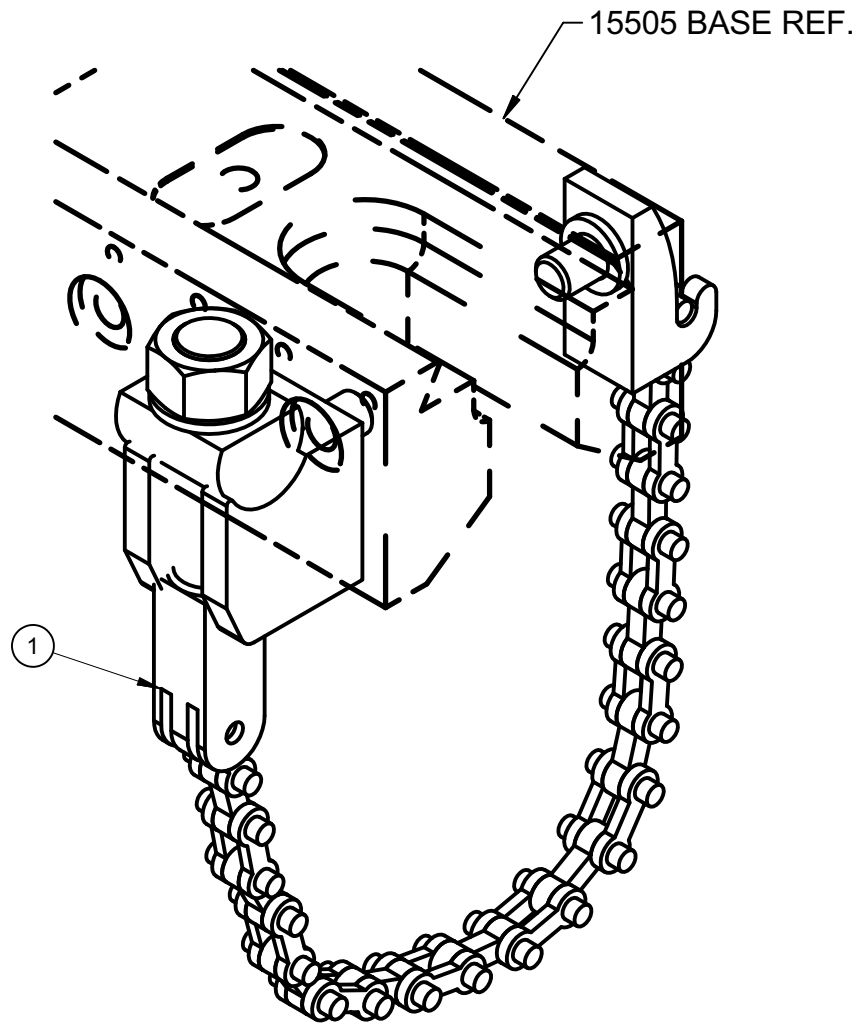


FIGURE A-32. HYDRAULIC MOTOR ASSEMBLY (P/N 81521)

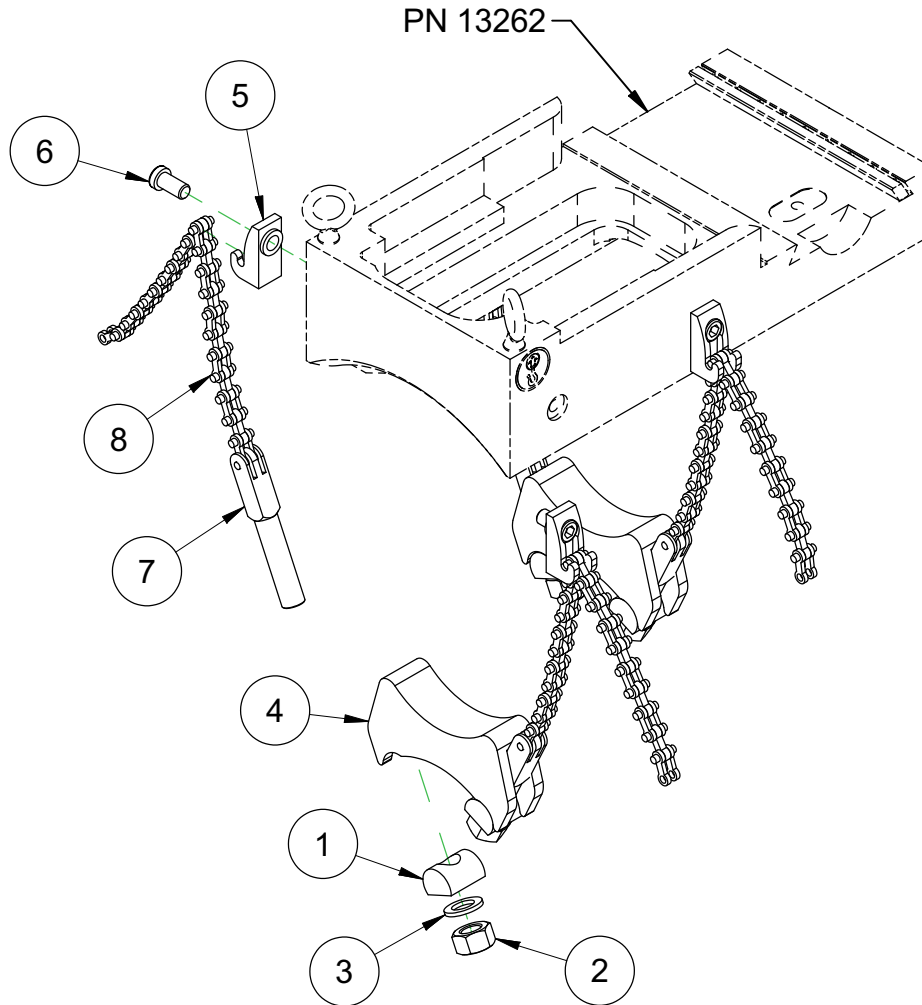
AVAILABLE CONFIGURATIONS	
P/N	DESCRIPTION
21023	MOTOR HYD ASSY 1.21 CU IN. CHAR-LYNN KM3000 KM4000 CPM (SHOWN)
21027	MOTOR HYD ASSY 1.93 CU IN. CHAR-LYNN KM300 KM4000 CPM
21029	MOTOR HYD ASSY .79 CU IN. CHAR-LYNN KM3000 KM4000 CPM

PARTS LIST		
ITEM	QTY	PART No. DESCRIPTION
1	2	10160 SCREW 1/4-20 X 3/4 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	20379 GEAR SPUR MOTOR 16DP 1.625PD SPECIAL HYD MOTOR
6	1	14261 MOTOR HYD .79 CU IN. 5/8 STRAIGHT SAE -6F SIDE PORTS
		20371 MOTOR HYD 1.93 CU IN. 5/8 STRAIGHT SAE O-RINGS SIDE PORTS
		21025 MOTOR HYD 1.21 CU IN. CHAR-LYNN
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



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

FIGURE A-33. CHAIN CLAMP ASSEMBLY (P/N 10378)



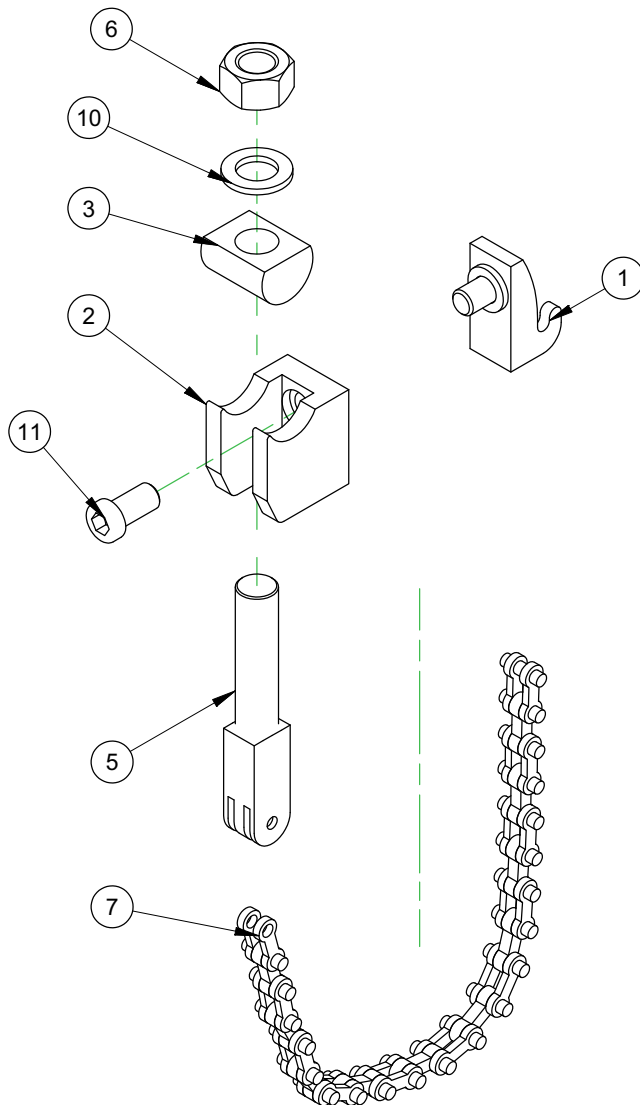
NOTES

1 BREAK CHAIN INTO 20 INCH LENGTHS (QTY 4)

PARTS LIST

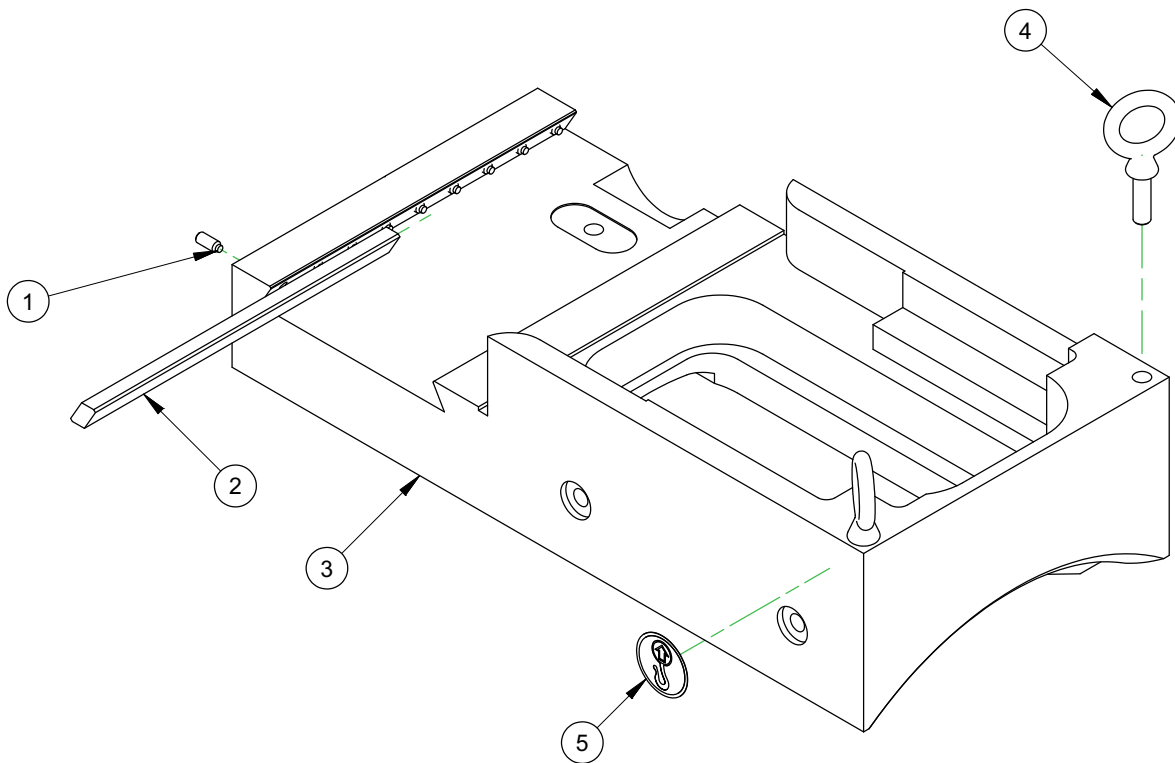
ITEM	QTY	P/N:	DESCRIPTION
1	4	10206	ROCKER CHAIN CLAMP
2	4	10197	NUT 3/4-10 STDN ZINC PLATED
3	4	10198	WASHER THRUST .750 ID X 1.250 OD X .123
4	2	10462	CLAMP BAR
5	4	15504	CASTING BLOCK CLAMP SMALL
6	4	15670	SCREW 1/2-13 X 1 LHSCS
7	4	27385	BOLT - CHAIN CLAMP 3/4 PITCH CHAIN
8	80 IN	27366	CHAIN WRENCH 3/4 PITCH .240 DIA PIN (VMI)

FIGURE A-34. KM4000 CHAIN CLAMP ASSEMBLY (P/N 10491)



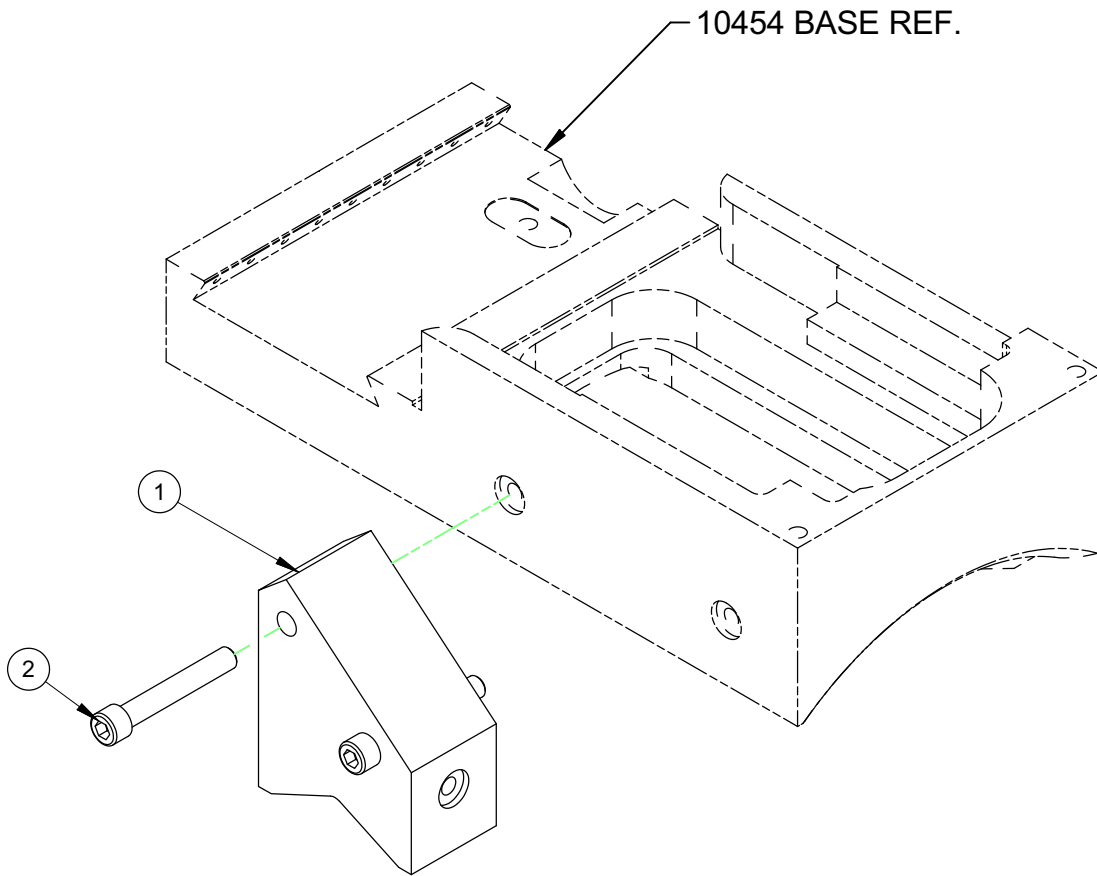
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	15504	CASTING BLOCK CLAMP SMALL
2	1	15835	CASTING -BLOCK CLAMP
3	1	10206	ROCKER CHAIN CLAMP
5	1	27385	BOLT - CHAIN CLAMP
6	1	10197	NUT 3/4-10 STDN ZINC PLATED
7	1	27366	CHAIN WRENCH 3/4 PITCH .240 DIA PIN (VMI)
10	1	10198	WASHER THRUST .750 ID X 1.250 OD X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

FIGURE A-35. CHAIN CLAMP ASSEMBLY 10-1/2 DIAMETER (P/N 27364)



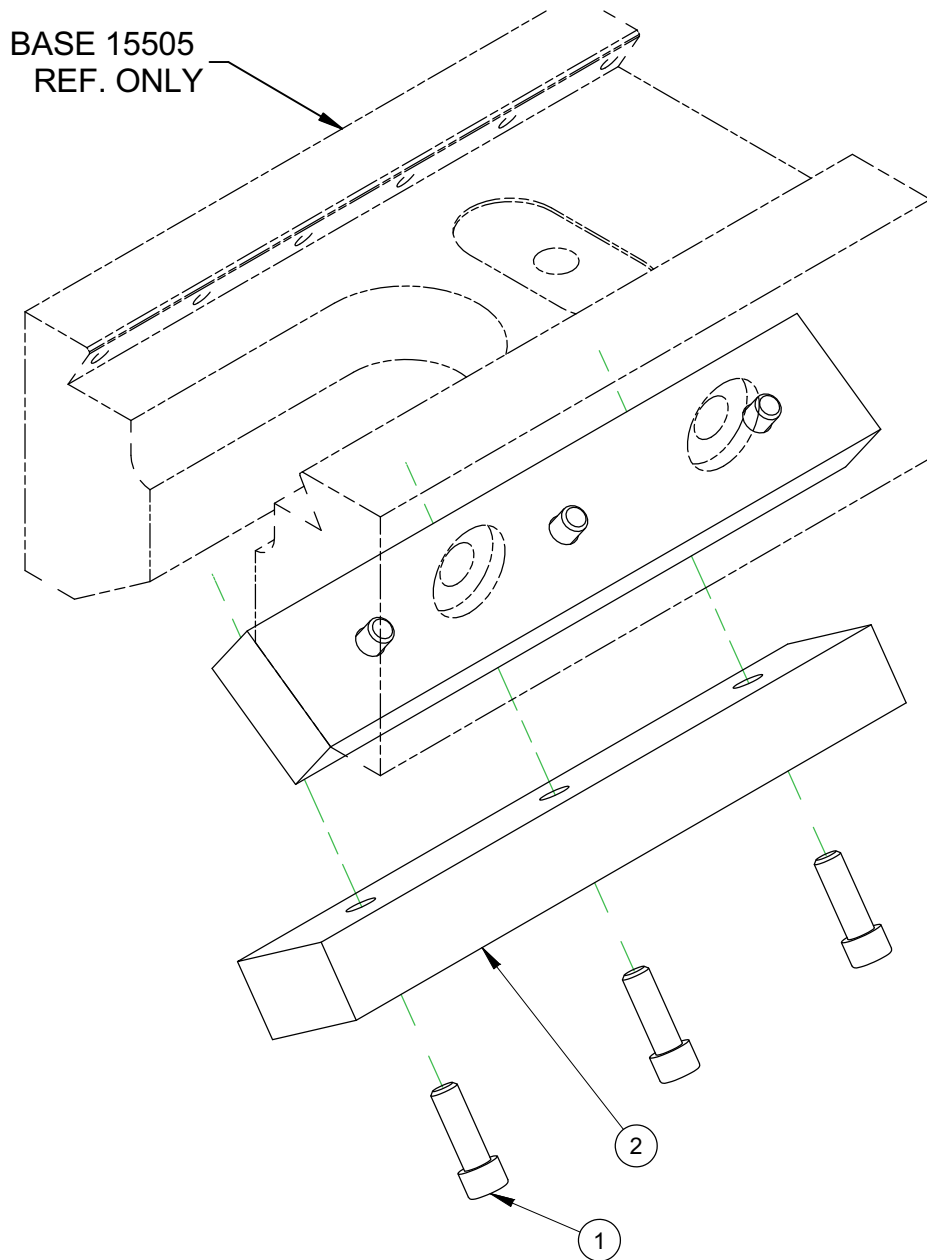
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	9	10189	SCREW 1/4-20 X 5/8 SSSHPPL
2	1	10452	GIB .615 X .375 X 8.97 0-1 9 SS X 1.0
3	1	10454	BASE KM4000 HYD
4	2	10460	EYE LIFTING 3/8-16 X 1-1/4 THREAD 1300 LBS
5	2	59039	LABEL WARNING LIFT POINT ROUND 1.5"

FIGURE A-36. KM4000 BASE ASSEMBLY (P/N 13262)



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-37. 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-38. 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. KM4000 120V INCH SPARE PARTS KIT (P/N 103963)

Part number	Description	Quantity
10134	COLLAR 11/16 DIA SHAFT WITH 5/16-18 SET SCREW	1
10157	SCREW 10-32 X 5/8 SHCS	6
10190	LEADNUT BRASS (KB)	1
10193	RING SNAP 1-3/4 ID BEVELED .062 TH	1
10199	WRENCH HEX 1/4" SHORT ARM	1
10200	WRENCH HEX 1/8" SHORT ARM	1
10203	CRANK HANDLE 1/2 SQUARE (KB)	1
103346	GEAR SPUR 16DP 16T 20PA .38LG STEEL	2
103347	GEAR SPUR 16DP 16T 20PA .43 X .73LG STEEL	1
10365	BRG BALL .6693 ID X 1.5748 OD X .4724 2 SEALS	2
103781	WASHER THRUST 3/8 ID X 3/4 OD X 1/16 OILITE	4
103792	SEAL .8125 ID X 1.250 OD X .188	1
10386	SET END MILL INCH 1/16 INCH INCREMENTS	1
104104	SP ARMATURE 120V	1
104105	SP FIELD COIL 120V	1
104106	SP CABLE WITH PLUG 120V	1
104107	SP ELECTRONIC UNIT WITH SWITCH 120V	1
104108	SP BRG BALL 6 X 19 X 6 METABO	1
104109	SP BRG BALL 8 X 22 X 7 METABO	1
104110	SP SPINDLE 120V	1
104111	SP POTI SWITCH METABO	1
104112	SP FAN METABO	1
104113	SP TACHO DISC METABO	1
104114	SP GREASE METABO	1
10431	SCREW 5/16-18 X 1 SHCS	3
10453	SCREW 3/8-16 X 1-1/4 SHCS	1
10588	SCREW DRIVE #2 X 1/4 FOR .089 X .250 DP HOLE	4
11037	BRG NEEDLE 3/8 ID X 9/16 OD X .375 OPEN	2
11735	SCREW 5/16-18 X 1-1/4 SHCS	1

TABLE A-1. KM4000 120V INCH SPARE PARTS KIT (P/N 103963)

Part number	Description	Quantity
11736	WASHER THRUST .500 ID X .937 OD X .030	1
11845	SCREW 8-32 X 1/2 SHCS	7
11849	BRG BALL .6693 ID X 1.3780 OD X .3937 2 SEALS	1
13174	BRG THRUST .875 ID X 1.437 OD X .0781	2
13175	WASHER THRUST .875 ID X 1.437 OD X .060	4
13542	BRG ANGULAR CONTACT .787 ID X 1.850 OD X .551	2
15618	SHAFT ASSY 2ND KM3000 (KB)	1
15654	BRG NEEDLE 1-1/2 ID X 1-7/8 OD X .625 OPEN	1
15666	WASHER THRUST .669 ID X 1.181 OD X .039	1
15667	WASHER SPRING FINGER .688 ID X 1.164 OD (KB)	1
15668	RING SNAP .672 OD X .035 THICK INVERTED	1
15999	PLUG HOLE 1-3/4 DIA MODIFIED (KB)	1
19016	BRG NEEDLE 1-1/2 ID X 1-7/8 OD X .625 OPEN GR	1
19492	LEADSCREW VERT ADJ INCH 3RD KM4000 CPM 4.67 INCH (KB)	1
104074	MANUAL INSTRUCTION KM3000 KM4000 KEY MILL	1
37405	SCREW MODIFIED 1/2-20 X .425 END MILL SCREW	1
37981	NUT SELF LOCKING BRG ADJ SZ 4	1
38116	COLLAR LEADSCREW BEARING (KB)	1
38117	LEADSCREW TOP SLIDE KM4000 PM2000 PM3000 (KB)	1
38120	GEAR BEVEL 16DP 24T 1-1/2:1 20PA STEEL	1
57541	SCREW M5 X 0.8 X 40MM SHCS	4

TABLE A-2. KM4000 230V INCH SPARE PARTS KIT (P/N 103964)

Part number	Description	Quantity
10134	COLLAR 11/16 DIA SHAFT WITH 5/16-18 SET SCREW	1
10157	SCREW 10-32 X 5/8 SHCS	6
10190	LEADNUT BRASS (KB)	1
10193	RING SNAP 1-3/4 ID BEVELED .062 TH	1
10199	WRENCH HEX 1/4" SHORT ARM	1
10200	WRENCH HEX 1/8" SHORT ARM	1
10203	CRANK HANDLE 1/2 SQUARE (KB)	1

TABLE A-2. KM4000 230V INCH SPARE PARTS KIT (P/N 103964)

Part number	Description	Quantity
10302	COLLET 16mm (.630) OD X 12mm (.472) ID	1
103346	GEAR SPUR 16DP 16T 20PA .38LG STEEL	2
10365	BRG BALL .6693 ID X 1.5748 OD X .4724 2 SEALS	2
103705	GEAR SPUR 16DP 16T 20PA .43 X .73LG M14 STEEL	1
103781	WASHER THRUST 3/8 ID X 3/4 OD X 1/16 OILITE	4
103792	SEAL .8125 ID X 1.250 OD X .188	1
103863	SP BRUSH CARBON PE 15-20 RT MOTOR 230V	1
10387	SET END MILL METRIC 8 10 12 16 18	1
103886	SCREW 5/8-11 X 1 SSSCN	1
104108	SP BRG BALL 6 X 19 X 6 METABO	1
104109	SP BRG BALL 8 X 22 X 7 METABO	1
104111	SP POTI SWITCH METABO	1
104112	SP FAN METABO	1
104113	SP TACHO DISC METABO	1
104114	SP GREASE METABO	1
104115	SP ARMATURE 230V	1
104116	SP FIELD COIL 230V	1
104119	SP CABLE WITH PLUG 230V	1
104120	SP ELECTRONIC UNIT WITH SWITCH 230V	1
104121	SP SPINDLE 230V	1
10431	SCREW 5/16-18 X 1 SHCS	3
10453	SCREW 3/8-16 X 1-1/4 SHCS	1
10588	SCREW DRIVE #2 X 1/4 FOR .089 X .250 DP HOLE	4
11037	BRG NEEDLE 3/8 ID X 9/16 OD X .375 OPEN	2
11735	SCREW 5/16-18 X 1-1/4 SHCS	1
11736	WASHER THRUST .500 ID X .937 OD X .030	1
11845	SCREW 8-32 X 1/2 SHCS	7
11849	BRG BALL .6693 ID X 1.3780 OD X .3937 2 SEALS	1
13174	BRG THRUST .875 ID X 1.437 OD X .0781	2
13175	WASHER THRUST .875 ID X 1.437 OD X .060	4
13542	BRG ANGULAR CONTACT .787 ID X 1.850 OD X .551	2
15618	SHAFT ASSY 2ND KM3000 (KB)	1

TABLE A-2. KM4000 230V INCH SPARE PARTS KIT (P/N 103964)

Part number	Description	Quantity
15654	BRG NEEDLE 1-1/2 ID X 1-7/8 OD X .625 OPEN	1
15666	WASHER THRUST .669 ID X 1.181 OD X .039	1
15667	WASHER SPRING FINGER .688 ID X 1.164 OD (KB)	1
15668	RING SNAP .672 OD X .035 THICK INVERTED	1
15999	PLUG HOLE 1-3/4 DIA MODIFIED (KB)	1
19016	BRG NEEDLE 1-1/2 ID X 1-7/8 OD X .625 OPEN GR	1
19634	LEADSCREW VERT ADJ METRIC 3RD KM4000 CPM 4.67 INCH	1
104074	MANUAL INSTRUCTION KM3000 KM4000 KEY MILL	1
37405	SCREW MODIFIED 1/2-20 X .425 END MILL SCREW	1
37981	NUT SELF LOCKING BRG ADJ SZ 4	1
38116	COLLAR LEADSCREW BEARING (KB)	1
38117	LEADSCREW TOP SLIDE KM4000 PM2000 PM3000 (KB)	1
38120	GEAR BEVEL 16DP 24T 1-1/2:1 20PA STEEL	1
57541	SCREW M5 X 0.8 X 40MM SHCS	4

TABLE A-3. 120V INCH SPARE PARTS KIT (P/N 75012)

Part number	Description	Quantity
10189	SCREW 1/4-20 X 5/8 SSSHDPL	6
10190	LEADNUT BRASS (KB)	1
10191	SCREW 3/8-16 X 1 SHCS	1
10193	RING SNAP 1-3/4 ID BEVELED .062 TH	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 (KB)	1
10206	ROCKER CHAIN CLAMP (KB)	1
10386	SET END MILL INCH 1/16 INCH INCREMENTS	1
11735	SCREW 5/16-18 X 1-1/4 SHCS	1
12549	SP ARMATURE 3RD 120V	1
12553	SP SCREW BRUSH RETAINING 3RD	2
12554	SP (PLM) BRUSH CARBON 120V 3RD (NOT A PAIR)	4

TABLE A-3. 120V INCH SPARE PARTS KIT (P/N 75012)

Part number	Description	Quantity
13174	BRG THRUST .875 ID X 1.437 OD X .0781	2
13175	WASHER THRUST .875 ID X 1.437 OD X .060	4
15635	LEADSCREW VERT ADJ INCH 3RD KM3000 2.50 INCH (KB)	1
15647	CLAMP ASSY STANDARD KM3000	1
15657	SHAFT ASSY TRAVERSE DRIVE 2ND KM3000	1
104074	MANUAL INSTRUCTION KM3000 KM4000 KEY MILL	1
27366	CHAIN WRENCH 3/4 PITCH .240 DIA PIN	32
27385	BOLT CHAIN CLAMP 3/4 PITCH WRENCH CHAIN (KB)	1
34653	GEAR SPUR 16DP 26T 20PA .437 X .78LG STEEL	1
37405	SCREW MODIFIED 1/2-20 X .425 END MILL SCREW	1
37981	NUT SELF LOCKING BRG ADJ SZ 4	1
38091	ASSY LEADSCREW TOP SLIDE KM3000	1
38116	COLLAR LEADSCREW BEARING (KB)	1

TABLE A-4. 230V METRIC SPARE PARTS KIT (P/N 68419)

Part number	Description	Quantity
10189	SCREW 1/4-20 X 5/8 SSSHDPL	6
10190	LEADNUT BRASS (KB)	1
10191	SCREW 3/8-16 X 1 SHCS	1
10193	RING SNAP 1-3/4 ID BEVELED .062 TH	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 (KB)	1
10206	ROCKER CHAIN CLAMP (KB)	1
10302	COLLET 16mm (.630) OD X 12mm (.472) ID	1
10387	SET END MILL METRIC 8 10 12 16 18	1
11735	SCREW 5/16-18 X 1-1/4 SHCS	1
12553	SP SCREW BRUSH RETAINING 3RD	2
13174	BRG THRUST .875 ID X 1.437 OD X .0781	2

TABLE A-4. 230V METRIC SPARE PARTS KIT (P/N 68419)

Part number	Description	Quantity
13175	WASHER THRUST .875 ID X 1.437 OD X .060	4
15647	CLAMP ASSY STANDARD KM3000	1
15657	SHAFT ASSY TRAVERSE DRIVE 2ND KM3000	1
16020	LEADSCREW VERT ADJ METRIC 3RD KM3000 2.50 INCH (KB)	1
104074	MANUAL INSTRUCTION KM3000 KM4000 KEY MILL	1
27366	CHAIN WRENCH 3/4 PITCH .240 DIA PIN	32
27385	BOLT CHAIN CLAMP 3/4 PITCH WRENCH CHAIN (KB)	1
31437	SP FIELD 230 VOLT MILWAUKEE 5535 AND 5455	1
31769	SP (PLM) BRUSH CARBON KM3000/87 MOTOR 230V	4
34653	GEAR SPUR 16DP 26T 20PA .437 X .78LG STEEL	1
37405	SCREW MODIFIED 1/2-20 X .425 END MILL SCREW	1
37981	NUT SELF LOCKING BRG ADJ SZ 4	1
38091	ASSY LEADSCREW TOP SLIDE KM3000	1
38116	COLLAR LEADSCREW BEARING (KB)	1
39304	SP ARMATURE 230V REWIND	1

TABLE A-5. PNEUMATIC INCH SPARE PARTS KIT (P/N 103866)

Part number	Description	Quantity
10167	SEAL 1.000 ID X 1.375 OD X .250	1
10189	SCREW 1/4-20 X 5/8 SSSHPPL	6
10190	LEADNUT BRASS (KB)	1
10191	SCREW 3/8-16 X 1 SHCS	1
10193	RING SNAP 1-3/4 ID BEVELED .062 TH	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 (KB)	1
10206	ROCKER CHAIN CLAMP (KB)	1
10326	GEAR SPUR 26T 16DP 1.625PD	1
10386	SET END MILL INCH 1/16 INCH INCREMENTS	1
11735	SCREW 5/16-18 X 1-1/4 SHCS	1

TABLE A-5. PNEUMATIC INCH SPARE PARTS KIT (P/N 103866)

Part number	Description	Quantity
13174	BRG THRUST .875 ID X 1.437 OD X .0781	2
13175	WASHER THRUST .875 ID X 1.437 OD X .060	4
15635	LEADSCREW VERT ADJ INCH 3RD KM3000 2.50 INCH (KB)	1
15647	CLAMP ASSY STANDARD KM3000	1
15657	SHAFT ASSY TRAVERSE DRIVE 2ND KM3000	1
104074	MANUAL INSTRUCTION KM3000 KM4000 KEY MILL	1
27366	CHAIN WRENCH 3/4 PITCH .240 DIA PIN	32
27385	BOLT CHAIN CLAMP 3/4 PITCH WRENCH CHAIN (KB)	1
37405	SCREW MODIFIED 1/2-20 X .425 END MILL SCREW	1
37981	NUT SELF LOCKING BRG ADJ SZ 4	1
38091	ASSY LEADSCREW TOP SLIDE KM3000	1
38116	COLLAR LEADSCREW BEARING (KB)	1

TABLE A-6. HYDRAULIC INCH SPARE PARTS KIT (P/N 103867)

Part number	Description	Quantity
10167	SEAL 1.000 ID X 1.375 OD X .250	1
10189	SCREW 1/4-20 X 5/8 SSSHD PPL	6
10190	LEADNUT BRASS (KB)	1
10191	SCREW 3/8-16 X 1 SHCS	1
10193	RING SNAP 1-3/4 ID BEVELED .062 TH	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 (KB)	1
10206	ROCKER CHAIN CLAMP (KB)	1
10386	SET END MILL INCH 1/16 INCH INCREMENTS	1
11735	SCREW 5/16-18 X 1-1/4 SHCS	1
13174	BRG THRUST .875 ID X 1.437 OD X .0781	2
13175	WASHER THRUST .875 ID X 1.437 OD X .060	4
15635	LEADSCREW VERT ADJ INCH 3RD KM3000 2.50 INCH (KB)	1
15647	CLAMP ASSY STANDARD KM3000	1

TABLE A-6. HYDRAULIC INCH SPARE PARTS KIT (P/N 103867)

Part number	Description	Quantity
15657	SHAFT ASSY TRAVERSE DRIVE 2ND KM3000	1
104074	MANUAL INSTRUCTION KM3000 KM4000 KEY MILL	1
20379	GEAR SPUR MOTOR 26T 16DP 1.625PD HYD MOTOR	1
27366	CHAIN WRENCH 3/4 PITCH .240 DIA PIN	32
27385	BOLT CHAIN CLAMP 3/4 PITCH WRENCH CHAIN (KB)	1
37405	SCREW MODIFIED 1/2-20 X .425 END MILL SCREW	1
37981	NUT SELF LOCKING BRG ADJ SZ 4	1
38091	ASSY LEADSCREW TOP SLIDE KM3000	1
38116	COLLAR LEADSCREW BEARING (KB)	1

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APPENDIX B SCHEMATICS

Schematic list

FIGURE B-1. PNEUMATIC SCHEMATIC (P/N 59246) - - - - - 103
 FIGURE B-2. HYDRAULIC SCHEMATIC - - - - - 103

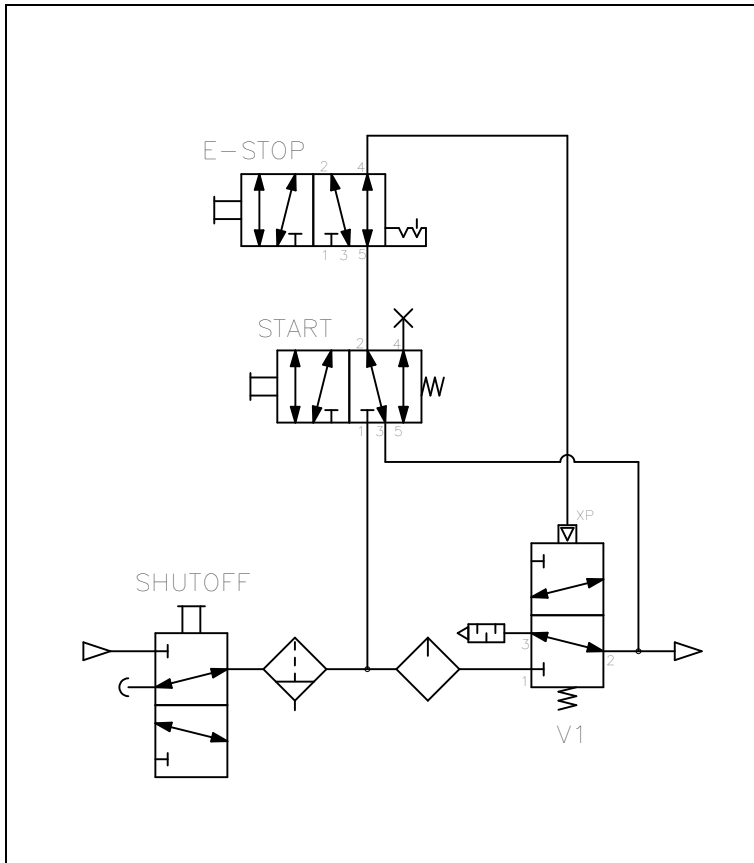


FIGURE B-1. PNEUMATIC SCHEMATIC (P/N 59246)

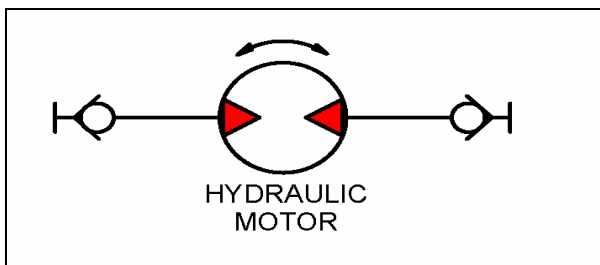


FIGURE B-2. HYDRAULIC SCHEMATIC

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APPENDIX C SDS

Contact CLIMAX for the current Safety Data Sheets.

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