CE

FF1200
FF2400
FF3600

COMPACT FLANGE FACER

OPERATING MANUAL

ORIGINAL INSTRUCTIONS

FF1200

FF2400

FF3600

CLIMAX
Portable Machining & Welding Systems

P/N 95936
July 2019
Revision 0

CLIMAX | BORTECH CALDER H&S TOOL

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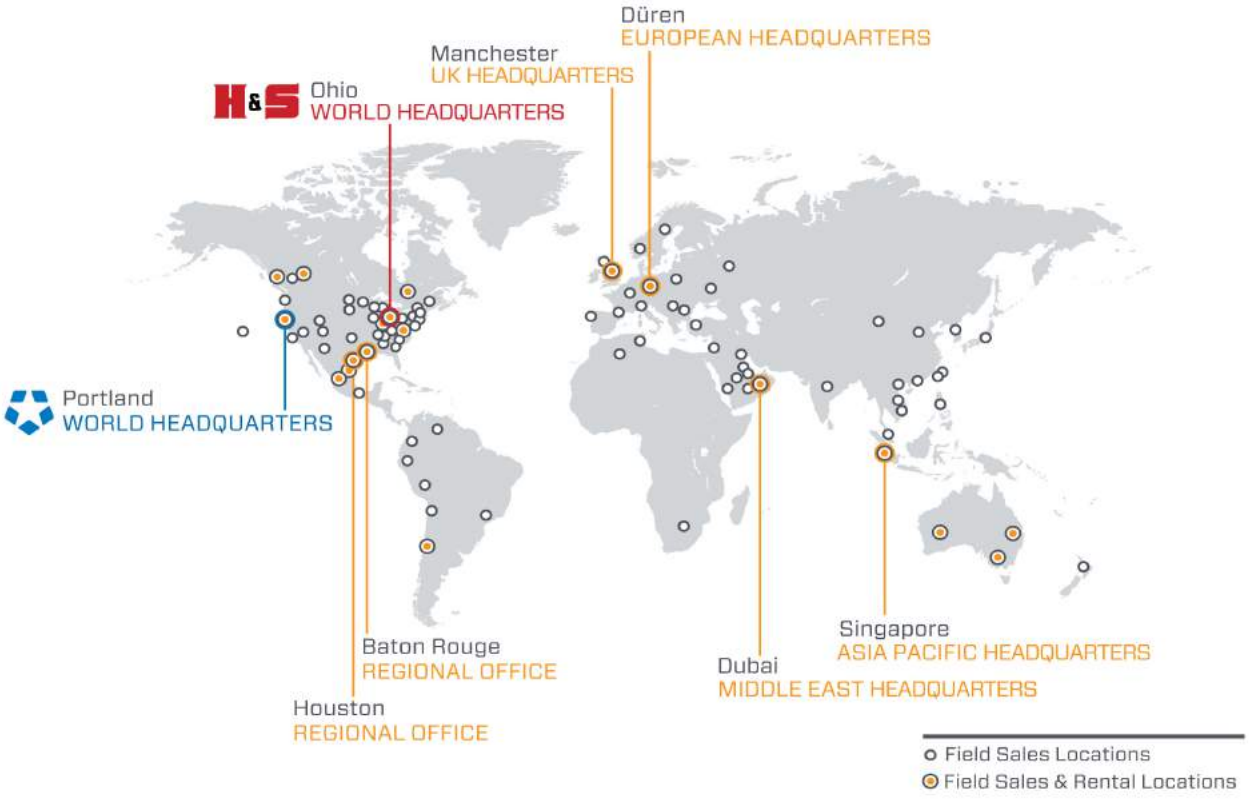
CLIMAX GLOBAL LOCATIONS



CE DOCUMENTATION

DECLARATION OF CONFORMITY

2006/42/EC Machine Directive

Name of manufacturer or supplier
Climax Portable Machining And Welding Systems

Full postal address including country of origin
2712 E Second Street
Newberg, OR 97132
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Description of product
Portable Flange Facing Machine

Name, type or model, batch or serial number

FF1200, FF2400 and FF3600 Flange Facers	Serial Number 1500000 and up
Pneumatically powered, Outside Diameter mounted	Machine Range: 0" (0MM) to 12" (305MM), 0" (0MM) to 24" (610MM), 0" (0MM) to 36" (914MM)

Standards used, including number, title, issue date and other relative documents
EN 953, EN 3744, EN 4414, EN 11201, EN 12100, EN 13128, EN 13732-1, EN 13849, EN 13857

Name of Responsible Person within the EU Tom Cunningham

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Declaration

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

Signature of Manufacturer:

Position Held: VP of Engineering; R&D

Date: July 20, 2017

CE

LIMITED WARRANTY

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

CLIMAX warrants that all parts are free from defects in materials and workmanship, and that all labor has been performed properly. This warranty is available to the customer purchasing parts or labor for a period of 90 days after delivery of the part or repaired machine or 180 days on used machines and components. If the customer purchasing parts or labor finds any defect in materials or workmanship within the warranty period, the purchaser should contact its factory representative and return the part or repaired machine, shipping pre-paid, to the factory. CLIMAX will, at its option, either repair or replace the defective part and/ or correct any defect in the labor performed, both at no charge, and return the part or repaired machine shipping prepaid.

These warranties do not apply to the following:

- Damage after the date of shipment not caused by defects in materials or workmanship
- Damage caused by improper or inadequate machine maintenance
- Damage caused by unauthorized machine modification or repair
- Damage caused by machine abuse
- Damage caused by using the machine beyond its rated capacity

All other warranties, express or implied, including without limitation the warranties of merchantability and fitness for a particular purpose are disclaimed and excluded.

Terms of sale

Be sure to review the terms of sale which appear on the reverse side of your invoice. These terms control and limit your rights with respect to the goods purchased from CLIMAX.

About this manual

CLIMAX provides the contents of this manual in good faith as a guideline to the operator. CLIMAX cannot guarantee that the information contained in this manual is correct for applications other than the application described in this manual. Product specifications are subject to change without notice.

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1 INTRODUCTION

IN THIS CHAPTER:

1.1 How to use this manual

This manual describes information necessary for the setup, operation, maintenance, storage, shipping, and decommissioning of the FF1200-FF2400-FF3600.

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 FF1200-FF2400-FF3600 before attempting to set it up or operate it.

1.2 Safety alerts

Pay careful attention to the safety alerts printed throughout this manual. Safety alerts will call your attention to specific hazardous situations that may be encountered when operating this machine. Examples of safety alerts used in this manual are defined here[1] :

⚠ 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. 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 levels[1] listed in Table 1-1.

TABLE 1-1. SOUND LEVELS

Sound power	91.8 dBA
Operator sound pressure	84.0 dBA
Bystander sound pressure	89.7 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. In any mounting position, verify that the machine is tethered and mounted so that if the machine slips or rotates, no injury or damage will occur.

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.

Stationery 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. Stationery Machine Tools achieve the rigidity needed to accomplish material-removal operations from the structure that is an integral part of the machine tool.

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 be considering. Use these checklists as part of your risk assessment:

TABLE 1-2. RISK ASSESSMENT CHECKLIST BEFORE SET-UP

☐	I took note of all the warning labels on the machine.
☐	I removed or mitigated all identified risks (such as tripping, cutting, crushing, entanglement, shearing, or falling objects).
☐	I considered the need for personnel safety guarding and installed any necessary guards.
☐	I read the machine assembly instructions (Section 3).
☐	I took inventory of all the items required but not supplied (Section 2.3).
☐	I considered how this machine operates and identified the best placement for the controls, cabling, and the operator.
☐	I have assessed for additional risks unique to this application of the Portable Machine tool.

TABLE 1-3. RISK ASSESSMENT CHECKLIST AFTER SET-UP

	After Set-up
☐	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.
☐	I identified all possible pinch points, such as those caused by rotating parts, and informed the affected personnel.
☐	I planned for containment of any chips or swarf produced by the machine.
☐	I followed the required maintenance checklist (Section 5.1) with the recommended lubricants (Section 5.2).
☐	I checked that all affected personnel have the recommended personal protective equipment, as well as any equipment required by the site or other regulations.
☐	I checked that all affected personnel understand the danger zone and are clear of it.
☐	I have assessed for additional risks unique to this application of the Portable Machine tool.

1.7 LABELS

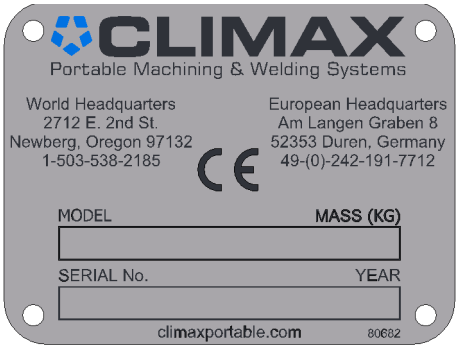
Label identification

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

TABLE 1-4. LABELS

	P/N 29152 Mass plate		P/N 46902 Warning label: hot surface
	P/N 59035 Warning label: wear eye protection		P/N 59037 Wear ear protection warning label
	P/N 59039 Lift point warning label		P/N 59042 Warning label: hand crunch/moving parts
	P/N 59044 Read operators manual warning label		P/N 81132 Warning label: lock-out/tag out

TABLE 1-4. LABELS

	P/N 70226 CLIMAX logo
	P/N 80569 Air direction and pressure label
	P/N 80682 Serial, year, model, mass plate CE Plate
	P/N 84645 High temperature warning; read manual
	P/N 84856 Warning label: tether machine before use

Label location

The following figures display the location of the labels on each of the components of the FF1200-FF2400-FF3600. For further identification of location placement refer to the exploded views in Appendix A.

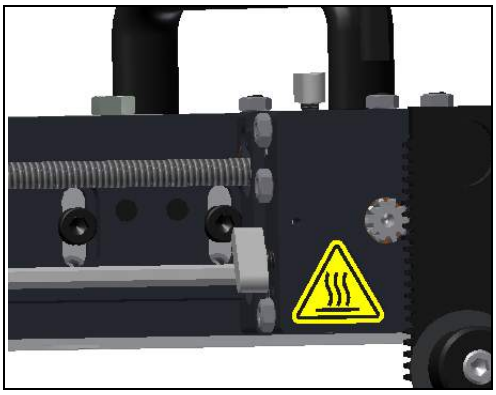


FIGURE 1-1. TOOL HEAD HOLDER LABEL LOCATION

Label P/N: 46902

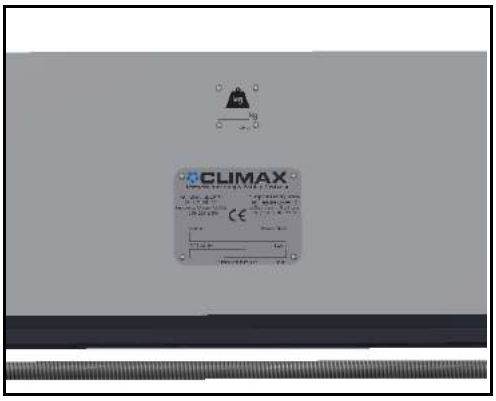


FIGURE 1-2. FF1200 RADIAL SLIDE ASSEMBLY LABEL LOCATION

Label P/N: 29152, 80682

FIGURE 1-3. FF2400 AND FF3600 RADIAL SLIDE ASSEMBLY LABEL LOCATION

Label P/N: 29152, 80682

FIGURE 1-4. RDU TOP LABEL LOCATION

Label P/N: 59035, 59042, 59044, 70226

FIGURE 1-5. RDU SIDE LABEL LOCATIONS

Label P/N: 84645, 84856, 59039

FIGURE 1-6. PNEUMATIC MOTOR LABEL LOCATIONS

Label P/N: 59037, 80569

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2 OVERVIEW

IN THIS CHAPTER:

2.1 FEATURES AND COMPONENTS

The FF1200-FF2400-FF3600 is a portable, air-powered, belt-driven, single-point flange facing machine for use on workpieces with the outside diameters listed in Table 2-1.

TABLE 2-1.OUTSIDE DIAMETER RANGES

FF1200 outside diameter:	2.0–12.1" (51–307 mm)
FF2400 outside diameter:	8–26" (20.3–66 mm)
FF3600 outside diameter:	20–38" (50.8–96.5 mm)

FF1200-FF2400-FF3600 principal components are shown respectively in Figure 2-1, Figure 2-2 on page 12, and Figure 2-3 on page 12. See Table 2-1 on page 12 for text identification within the figure.

Pneumatic motor – The pneumatic motor is available in the straight option (1.07 hp for the FF1200; 2.2 hp for the FF2400 and FF3600), as shown in Figure 2-1, Figure 2-2 on page 12, and Figure 2-3.
A right-angle 2.2 hp option is also available, as shown in Figure A-29 on page 100.

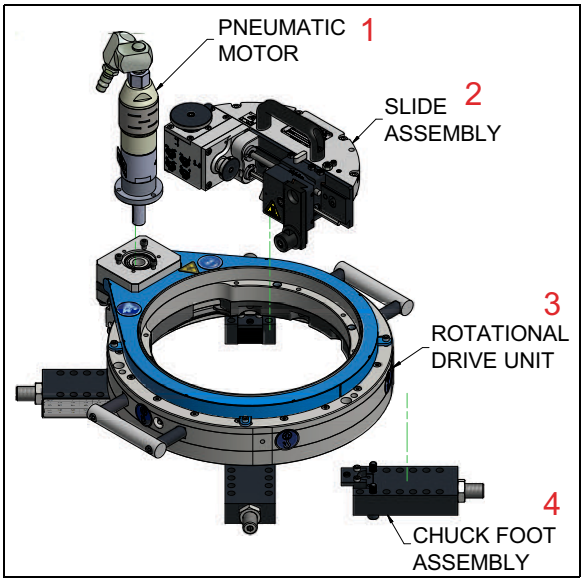

FIGURE 2-1. FF1200 PRINCIPAL COMPONENTS

Slide assembly —The tool head slide way can be adjusted for tapered facing operations. The angle of the tool head is also adjustable for feeding axially at an angle. The tool post can be rotated independently to maintain tool geometry. The radial and axial feeds can be manually adjusted using the hand knobs. The radial and axial feeds are exclusive, so only one direction can be automatically or manually fed at a time.

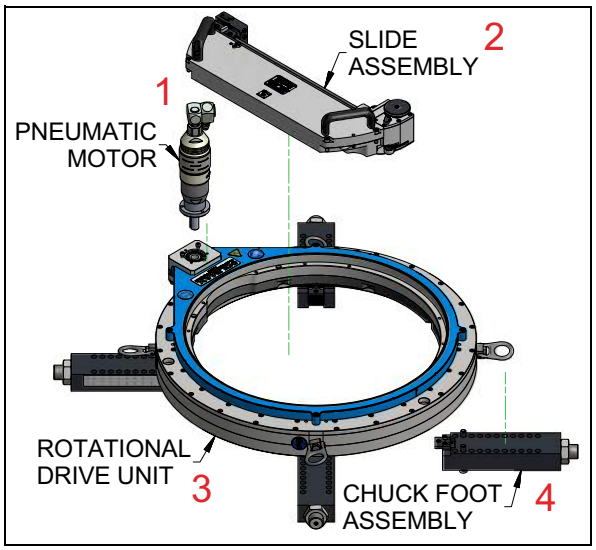

FIGURE 2-2. FF2400 PRINCIPAL COMPONENTS

Rotational drive unit — The rotational drive unit (RDU) includes the main bearing and the feed drive unit. The rate of the feed is adjustable from the stationary portion of the FF1200-FF2400-FF3600.

Chuck foot assembly – The chuck foot assembly is designed for OD mounting only. Refer to Section 3.3.1 on page 28 through Section 3.3.3 on page 30 (depending on the machine model) for more mounting dimensional constraints.

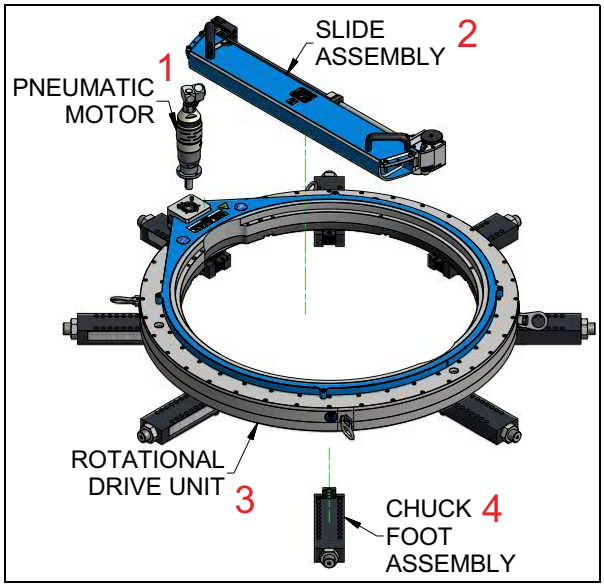

FIGURE 2-3. FF3600 PRINCIPAL COMPONENTS

TABLE 2-1. FF1200-FF2400-FF3600 COMPONENT IDENTIFICATION

Number	Component
1	Pneumatic motor
2	Slide assembly
3	Rotational drive unit
4	Chuck foot assembly

2.2 CONTROLS

The FF1200-FF2400-FF3600 controls are all located on the machine (Figure 2-4, Figure 2-5) or on the pneumatic conditioning unit (PCU) (Figure 2-6).

⚠ WARNING

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

Emergency shutdown

To stop machine operation immediately, press the EMERGENCY STOP button on the PCU (Figure 2-6). Before restarting the FF1200-FF2400-FF3600, do the following:

1. Close the speed adjustment valve.
2. Pull the EMERGENCY STOP button up.
3. Press the START button.

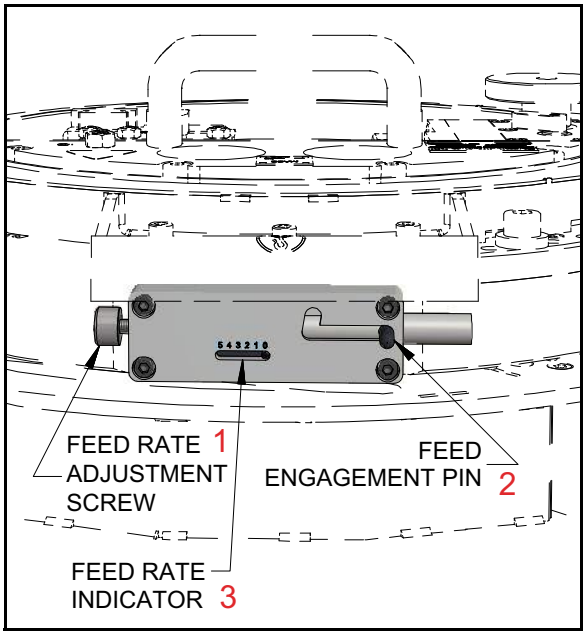

FIGURE 2-4. FEED ENGAGEMENT AND FEED RATE ADJUSTMENT CONTROLS (FF1200 SHOWN)

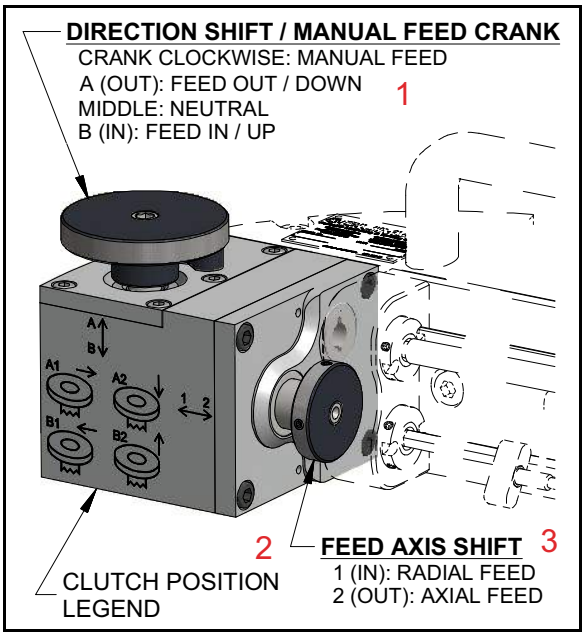

FIGURE 2-5. FEED CONTROLS (FF1200 SHOWN)

Figure 2-4 identification:

1. Feed rate adjustment screw
2. Feed engagement pin
3. Feed rate indicator

Figure 2-5 identification:

1. Direction shift/manual feed crank:
   Crank clockwise: manual feed
   A (out) feed out/down
   Middle: neutral
   B (in) feed in/up
2. Clutch position legend
3. Feed axis shift
   1 (in): radial feed
   2 (out): axial feed

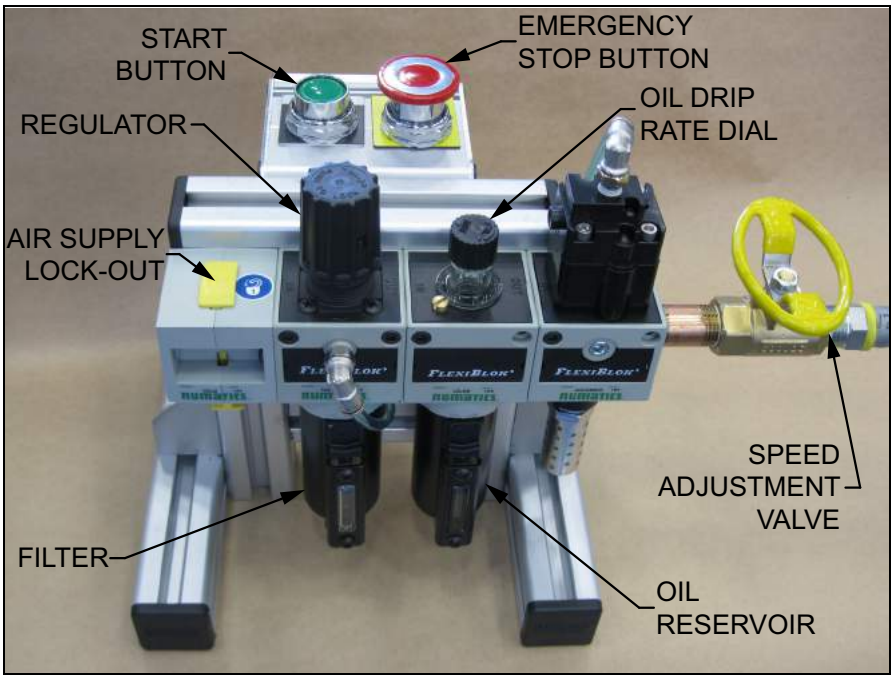

FIGURE 2-6. PCU CONTROLS AND FEATURES

TABLE 2-2. PCU CONTROL IDENTIFICATION

Number	Component
1	Air supply lock-out
2	Regulator
3	Start button
4	Emergency stop button
5	Oil drip rate dial
6	Speed adjustment valve
7	Oil reservoir
8	Filter

2.3 ITEMS REQUIRED BUT NOT SUPPLIED

- Torque wrench
- Dial indicator
- Wood blocks

2.4 DIMENSIONS

Machine and operating dimensions are shown in Figure 2-9 and Figure 2-12 on the subsequent pages.

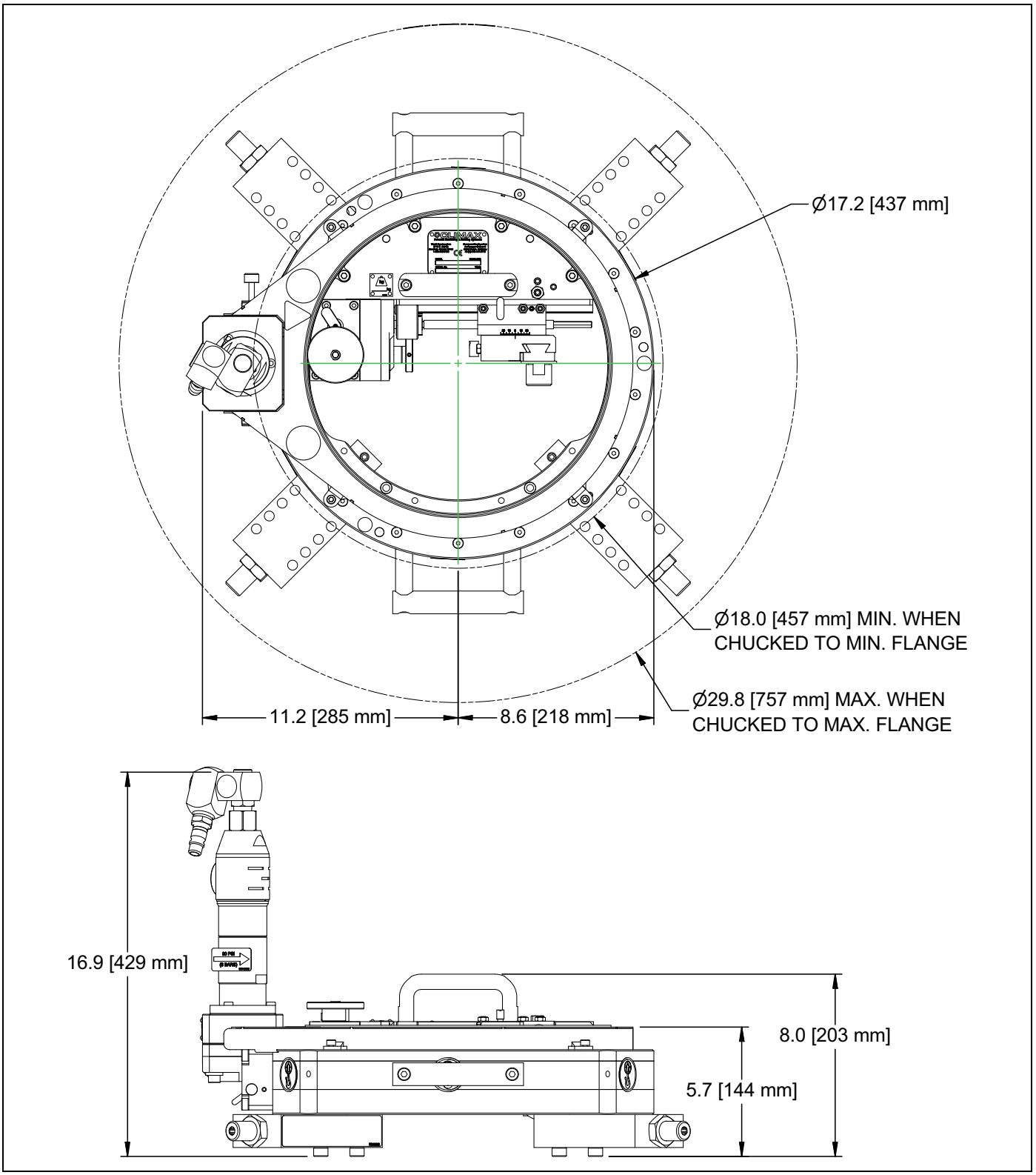

FIGURE 2-7. FF1200 MACHINE DIMENSIONS

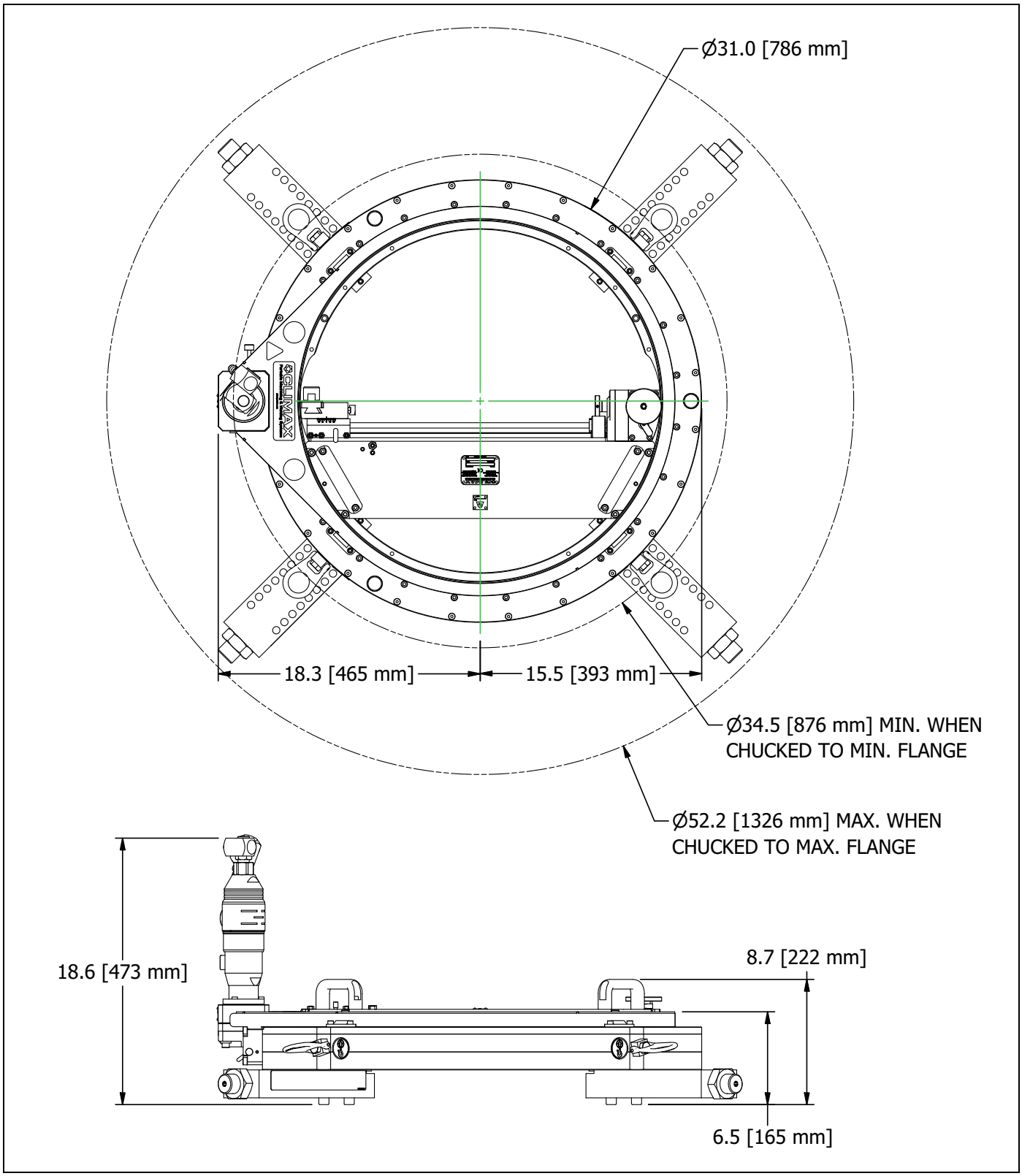

FIGURE 2-8. FF2400 MACHINE DIMENSIONS

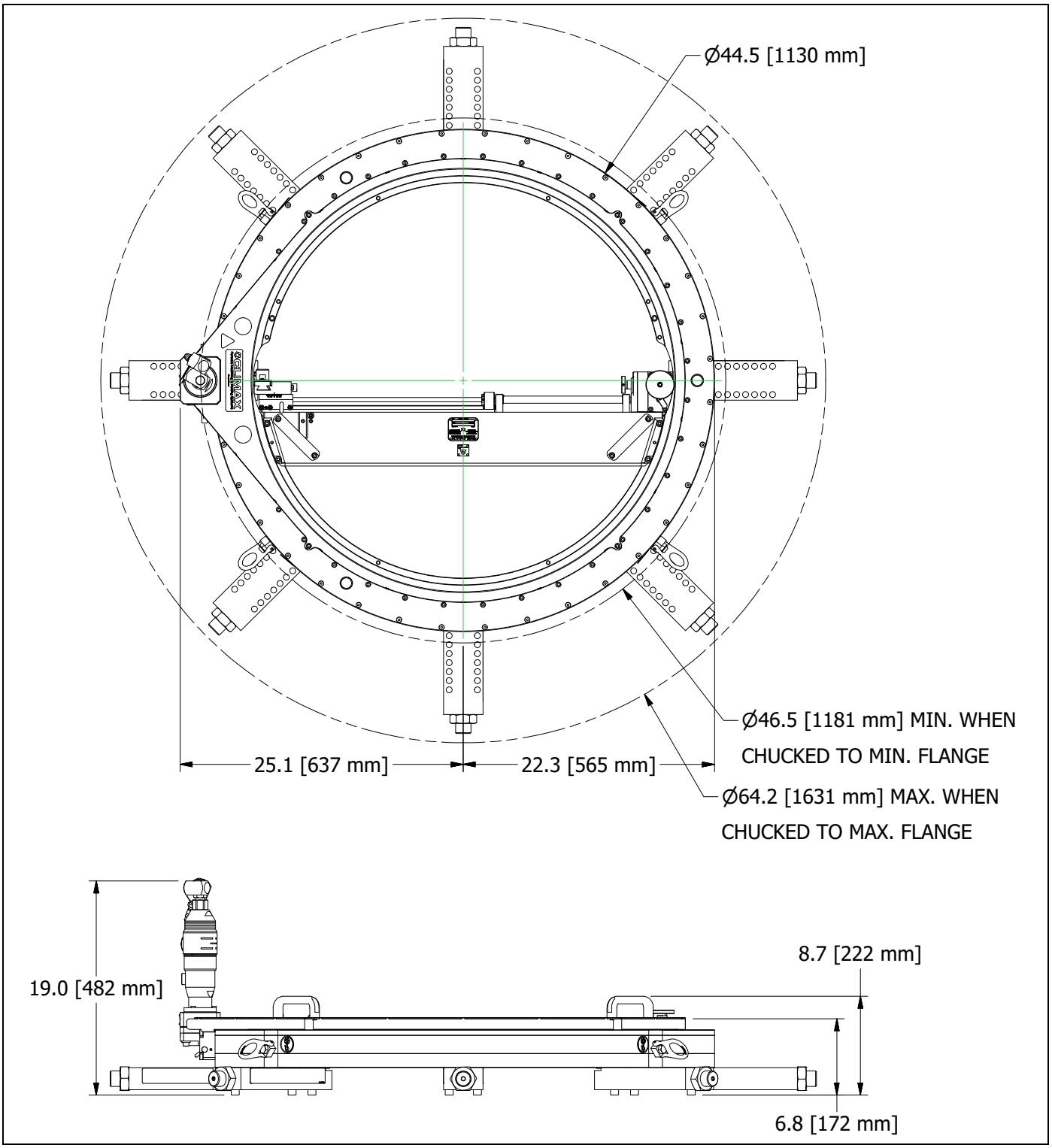

FIGURE 2-9. FF3600 MACHINE DIMENSIONS

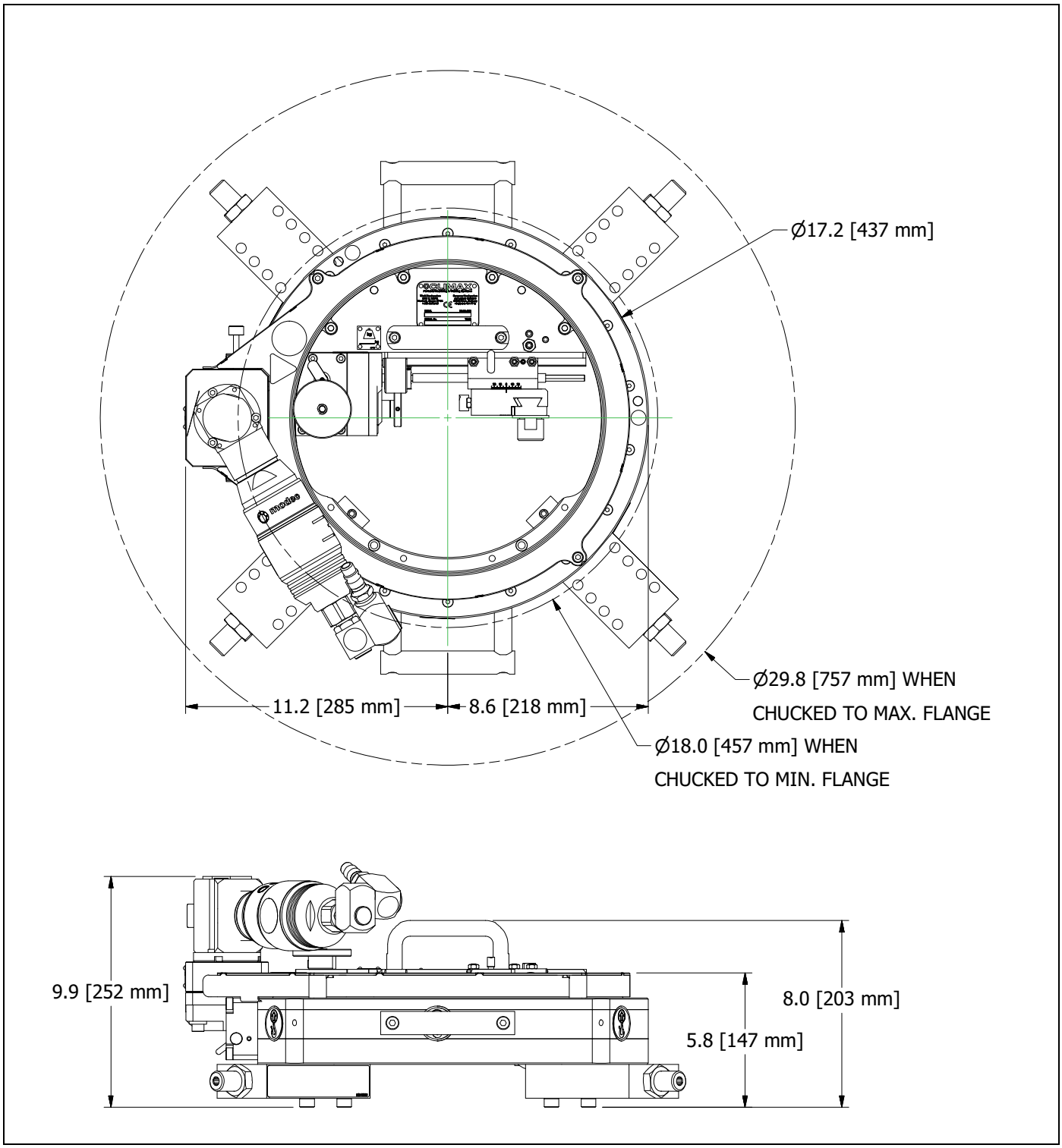

FIGURE 2-10. FF1200 MACHINE DIMENSIONS

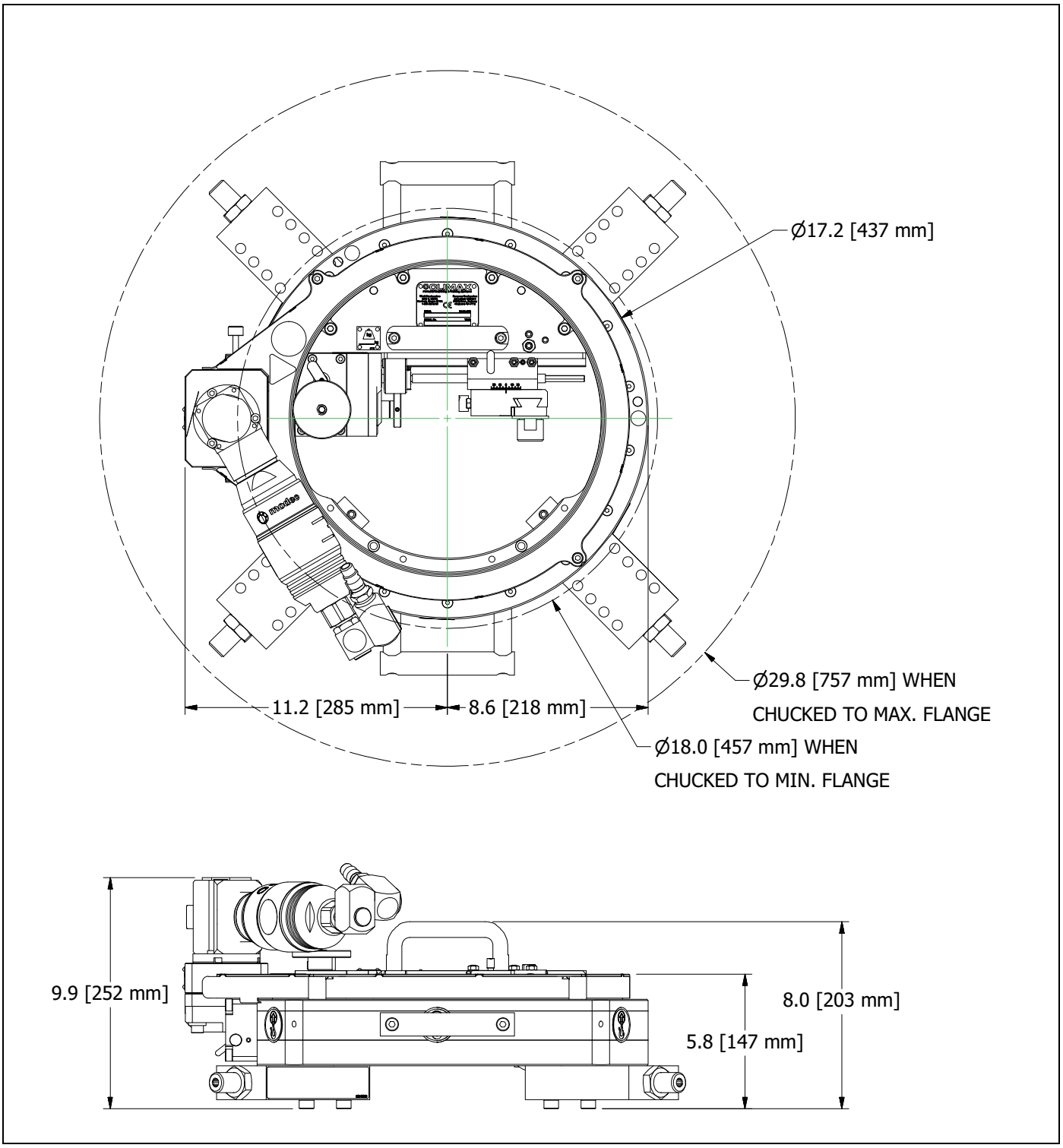

FIGURE 2-11. FF2400 MACHINE DIMENSIONS

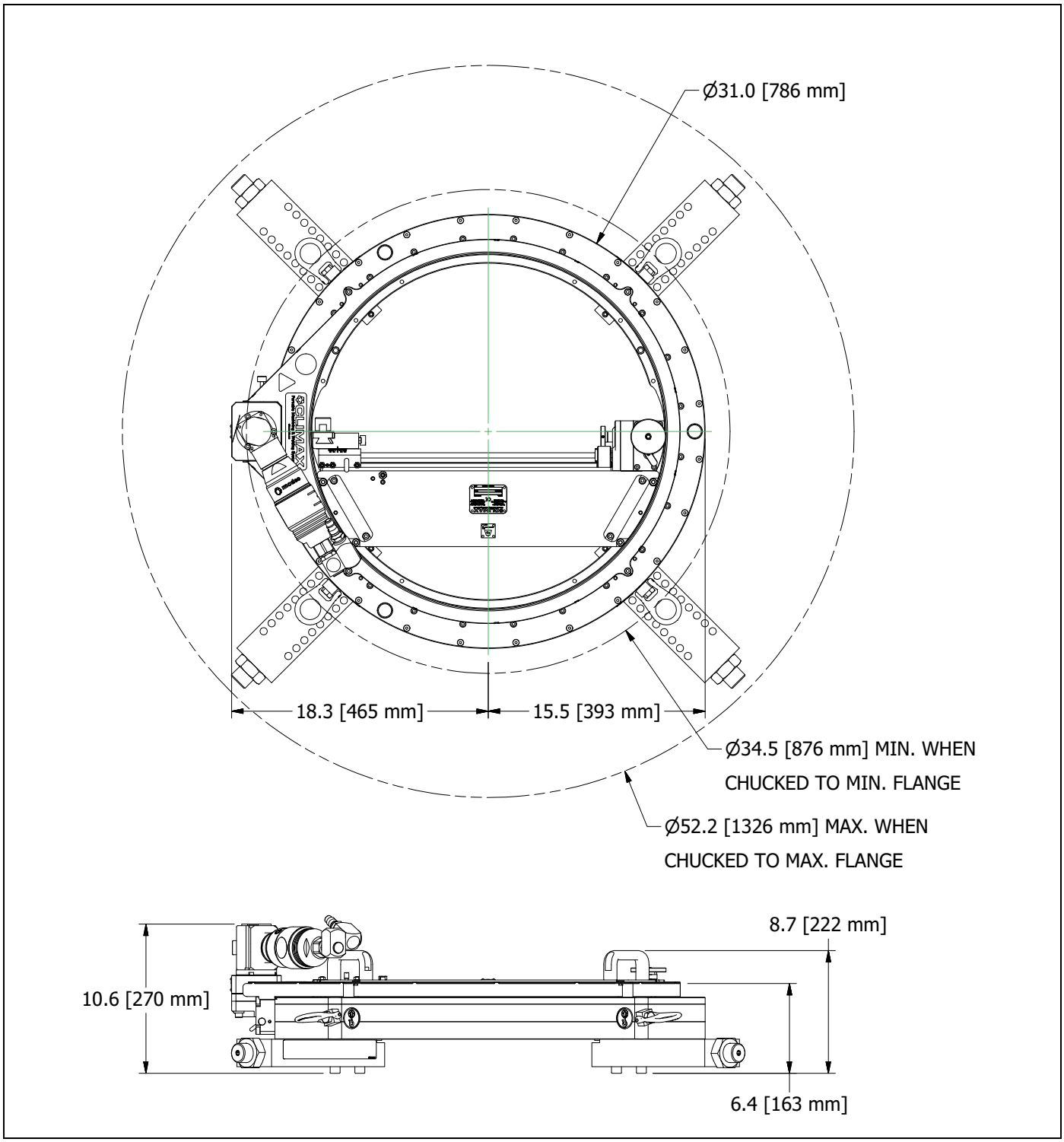

FIGURE 2-12. FF3600 RIGHT-ANGLE PNEUMATIC MOTOR MACHINE DIMENSIONS

2.5 SPECIFICATIONS

TABLE 2-3. FF1200 SUB-COMPONENT MASS

Sub-assembly number	Component	Mass
1	Chuck Foot P/N 78911	7.85 lbs (3.56 kg)
2	Rotational Drive Unit P/N 79752	85 lbs (38.5 kg)
3	Radial Axial Slide P/N 79192	21.8 lbs (9.89 kg)
4	1.07 hp Straight Air Motor P/N 80570	6.64 lbs (3.01 kg)
	Total	143 lbs (64.9 kg)

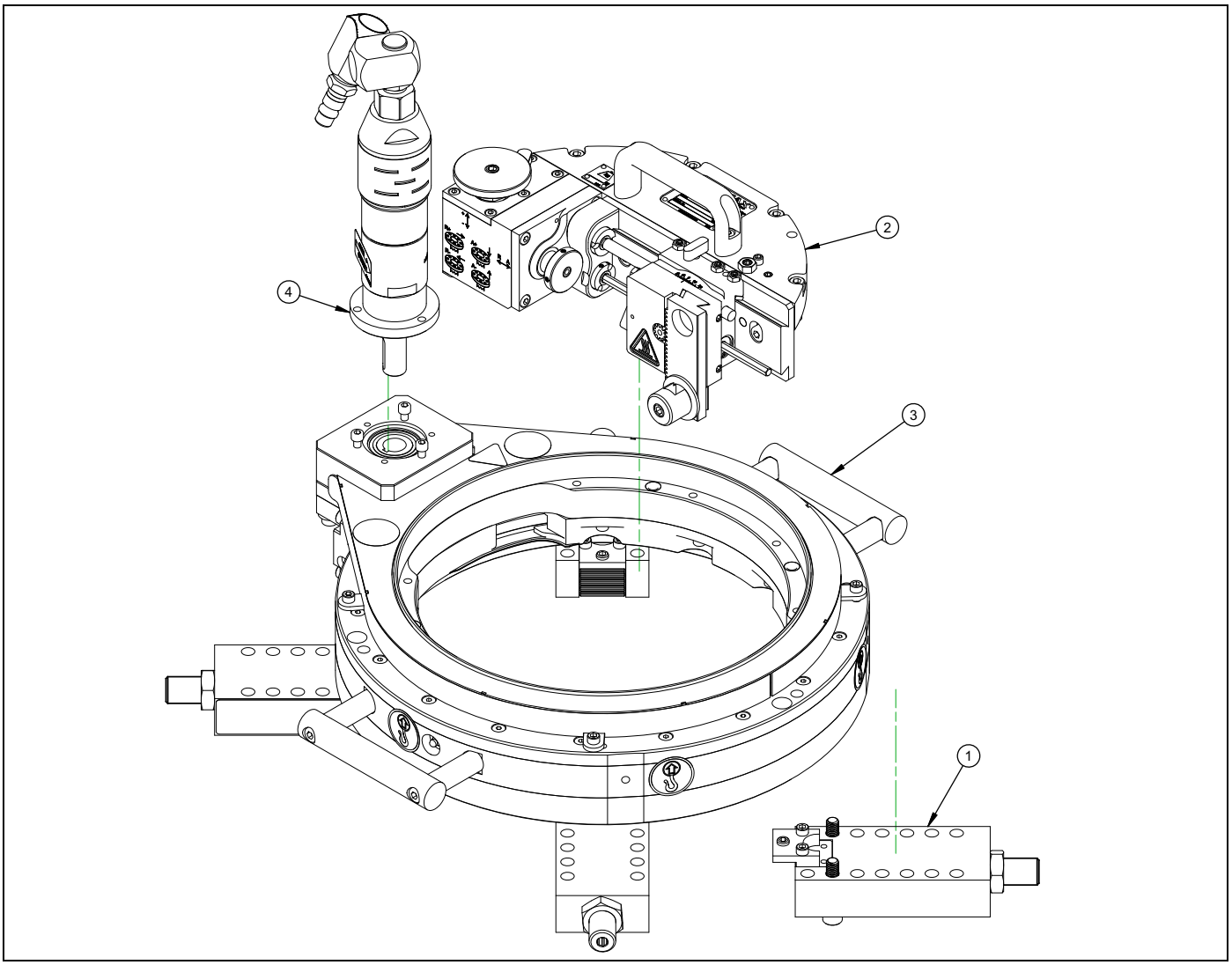

FIGURE 2-13. FF1200 SUB-ASSEMBLIES

TABLE 2-4. FF2400 SUB-COMPONENT MASS

Sub-assembly number	Component	Mass
1	Chuck Foot P/N 78979	20.2 lbs (9.16 kg
2	Rotational Drive Unit P/N 79903	204 lbs (92.7 kg)
3	2.2 hp Straight Air Motor P/N 80632	8.84 lbs (4.01 kg)
4	Radial Axial Slide P/N 80683	49.2 lbs (22.3 kg)
	Total	343 lbs (156 kg)

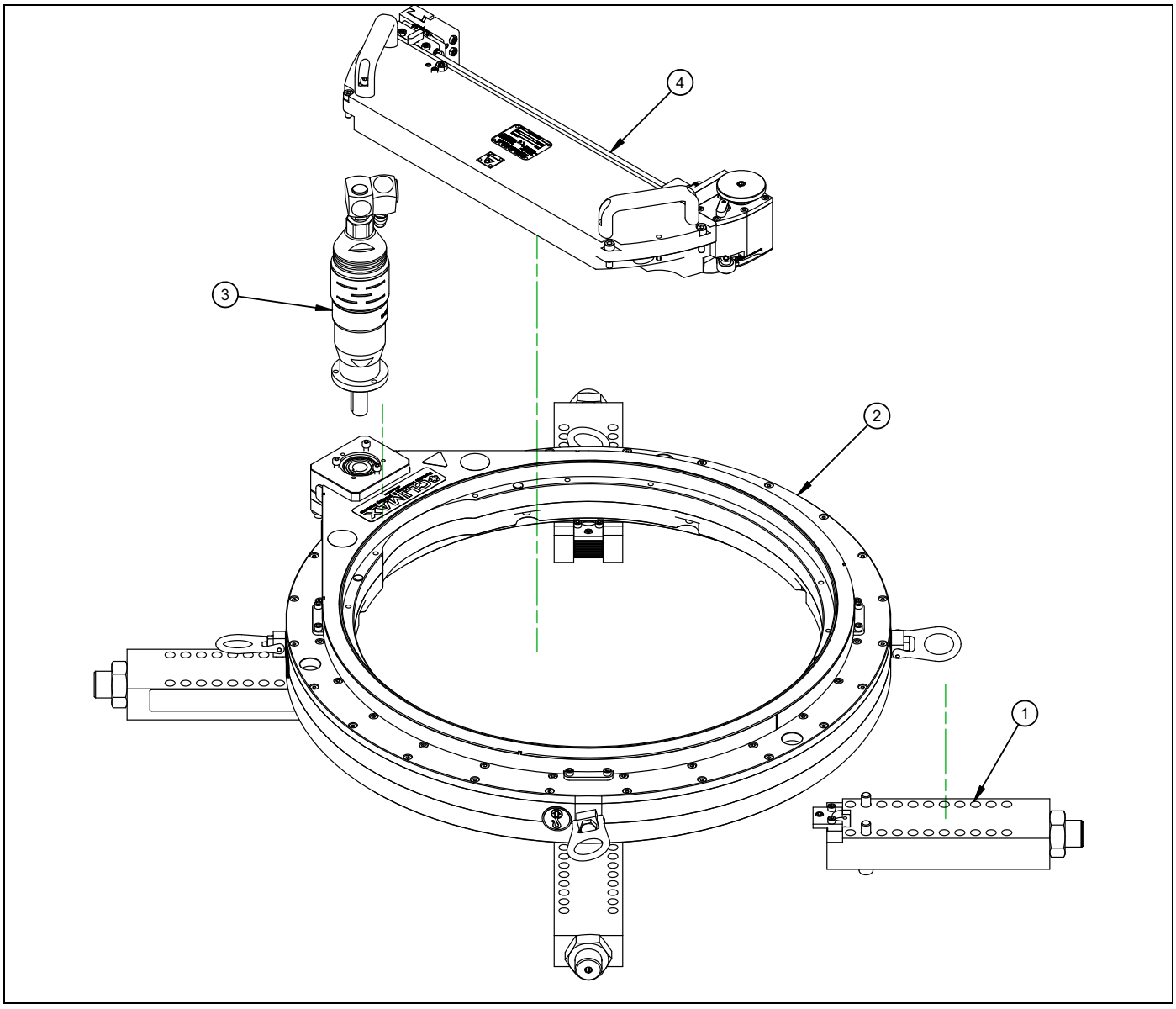

FIGURE 2-14. FF2400 SUB-ASSEMBLIES

TABLE 2-5. FF3600 SUB-COMPONENT MASS

Sub-assembly number	Component	Mass
1	Rotational Drive Unit P/N 80017	428 lbs (194 kg)
2	Chuck Foot P/N 78979	20.2 lbs (9.16 kg)
3	2.2 hp Straight Air Motor P/N 80632	8.84 lbs (4.01 kg)
4	Radial Axial Slide P/N 80702	68.2 lbs (30.9 kg)
	Total	666 lbs (302 kg)

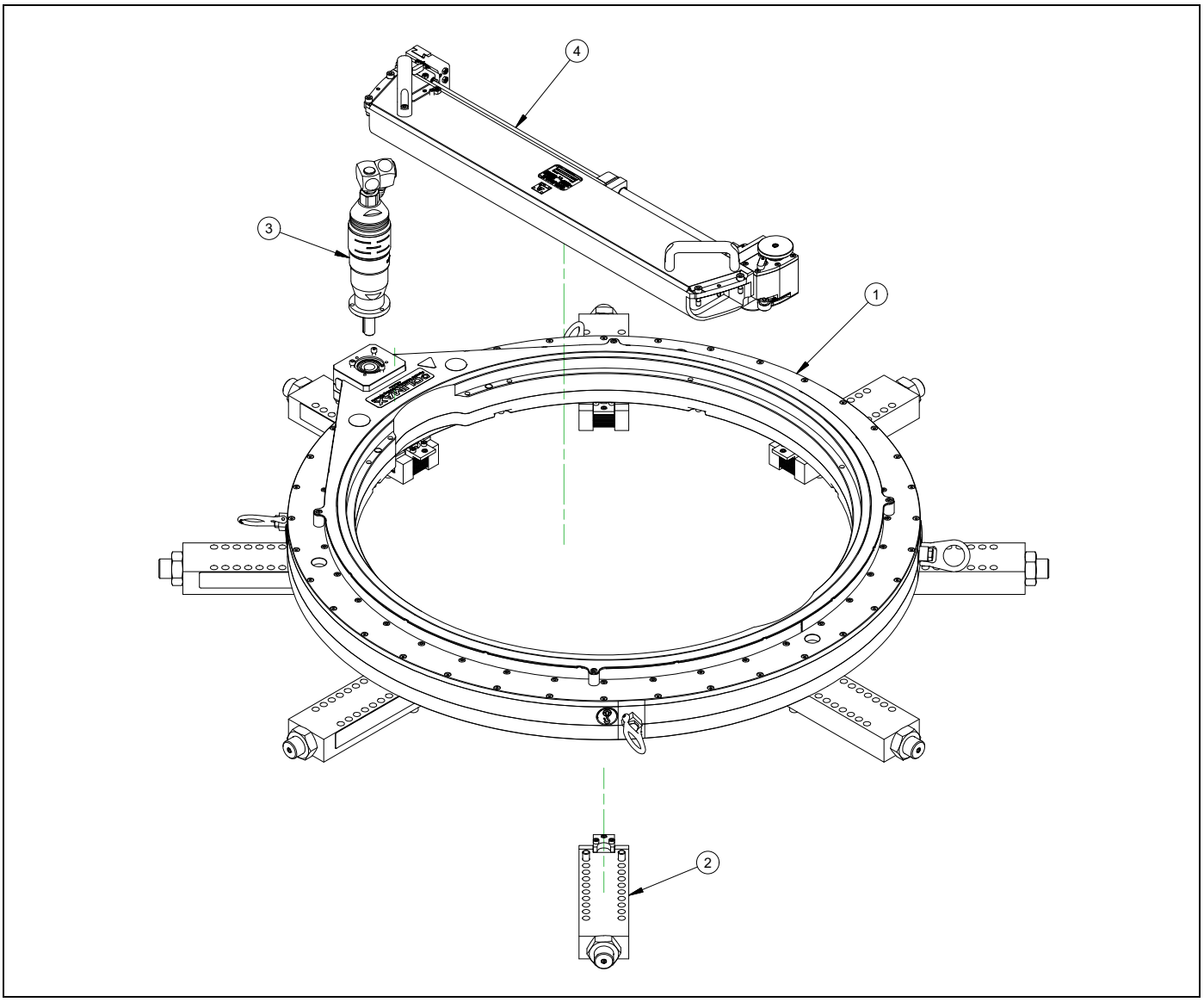

FIGURE 2-15. FF3600 SUB-ASSEMBLIES

3 SETUP

IN THIS CHAPTER:

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.

3.2 LIFTING AND RIGGING

Before lifting, make sure all parts are securely attached to the rotational drive unit (RDU).

⚠ DANGER

The FF1200-FF2400-FF3600 can weigh up between 143–-666 lbs (65–302 kg) when fully assembled (see Table 2-3 through Table 2-5 on page 24). To prevent serious injury to yourself and others, always follow the operating procedures outlined in this manual, your own company rules, and local regulations for heavy lifting. Serious injury or fatalities can result from improper lifting methods.

⚠ CAUTION

Falling or uncontrolled swinging of machinery can cause serious injury or be fatal to the operator and bystanders. Only lift the machine by the hoist rings marked by Figure 3-1. Do not lift the FF1200-FF2400-FF3600 by the handles on the slide assembly.

FIGURE 3-1. LIFTING POINT IDENTIFICATION LABEL

For the FF2400 and FF3600: Attach separate hoist shackles to each hoist ring on the RDU (Figure 3-2).

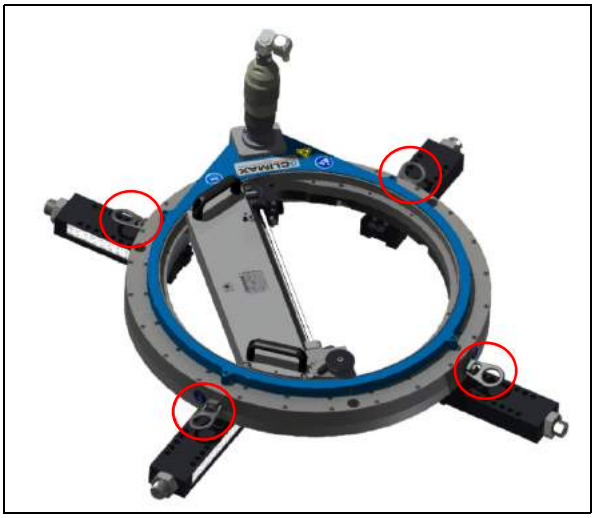

FIGURE 3-2. LIFTING POINTS ON RDU FOR THE FF2400 AND FF3600 (FF2400 SHOWN)

For the FF1200: The rotational drive unit (RDU) is the lifting point for the FF1200, Figure 3-3. The RDU has four M8 tapped holes for optional lifting eyes, otherwise, the handles on the RDU are rated for lifting the machine. The FF1200 can weigh 143 lbs (64.9 kg). Use caution if manually lifting by the handles).

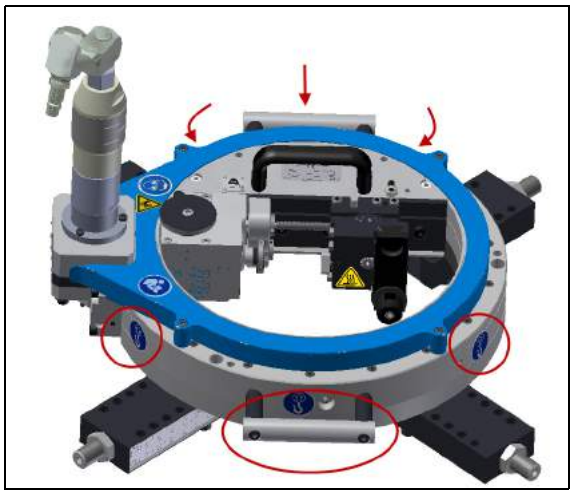

FIGURE 3-3. LIFTING POINTS ON FF1200

⚠ CAUTION

Make sure the rigging is correctly attached before lifting the machine. Lift the machine slowly, making sure that no components will be crushed or bent if the machine is lifted in the vertical orientation. If the rigging causes the FF1200-FF2400-FF3600 to swing or become unstable, lower it and adjust the rigging.

3.3 MACHINE ASSEMBLY

3.3.1 FF1200: Determining the chucking range

Do the following to set the chucking range and attach the chucking feet to the machine body:

1. Measure the workpiece outside diameter.
2. If the workpiece diameter is smaller than 12.5" (31.8 mm), attach the setup fingers to the chucking feet as shown in Figure 3-4.
3. Tighten the two setup finger screws to 9 ft-lbs (12 Nm).
4. Use the chart on the side of each chucking foot (Table 3-2) to determine the correct chucking range for the workpiece.

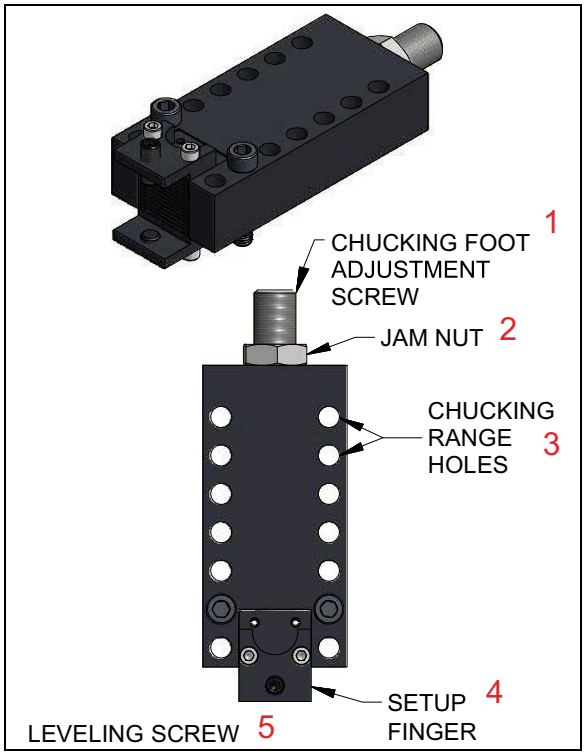

FIGURE 3-4. FF1200 CHUCKING FOOT COMPONENTS

TABLE 3-1. CHUCKING FOOT COMPONENT IDENTIFICATION

Number	Component
1	Chucking foot adjustment screw
2	Jam nut
3	Chucking range holes
4	Setup finger
5	Leveling screw

TABLE 3-2. FF1200 CHUCKING RANGE CHART (P/N 80083)

	RANGE	1	2	3	4	5	6	7
MAX	inch	4.50	6.10	7.70	9.30	10.90	12.50	14.10
	mm	114	155	196	236	277	318	358
MIN	inch	2.00	4.10	5.70	7.30	8.90	10.50	12.10
	mm	51	104	145	185	226	267	307

3.3.2 FF2400: Determining the chucking range

Do the following to set the chucking range and attach the chucking feet to the machine body:

1. Measure the workpiece outside diameter.
2. If the workpiece diameter is smaller than 24.5" (62.2 mm), attach the setup fingers to the chucking feet as shown in Figure 3-5.
3. Tighten the two setup finger screws to 9 ft-lbs (12 Nm).
4. Use the chart on the side of each chucking foot (Table 3-3) to determine the correct chucking range for the workpiece. See Table 3-1 on page 28 for text identification within the figure.

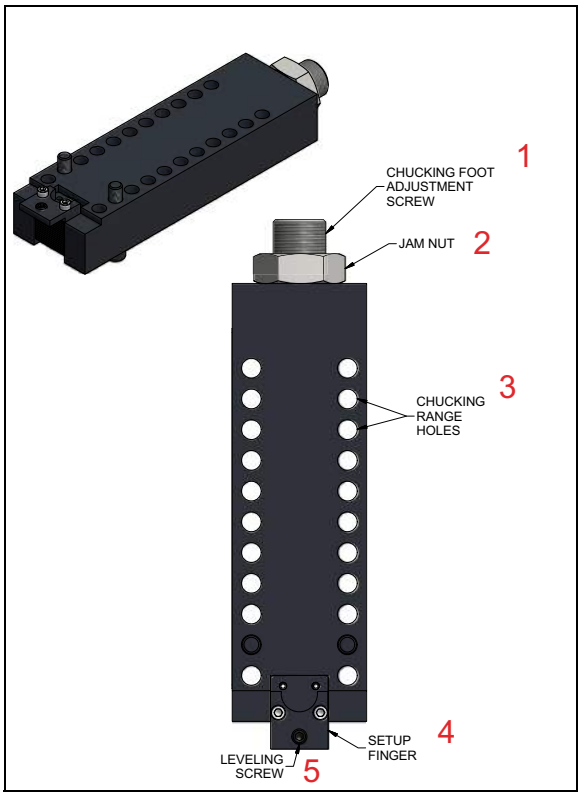

FIGURE 3-5. FF2400 CHUCKING FOOT COMPONENTS

TABLE 3-3. FF2400 CHUCKING RANGE CHART (P/N 79901)

	RANGE	1	2	3	4	5	6	7
MAX	inch	10.0	11.6	13.2	14.8	16.4	18.0	19.6
	mm	254	295	335	376	417	457	498
MIN	inch	8.00	9.60	11.2	12.8	14.4	16.0	17.6
	mm	203	244	284	325	366	406	447
	RANGE	**8**	**9**	**10**	**11**			
MAX	inch	21.2	22.8	24.4	26.0			
	mm	538	579	620	660			
MIN	inch	19.2	20.8	22.4	24.0			
	mm	488	528	569	610			

3.3.3 FF3600: Determining the chucking range

Do the following to set the chucking range and attach the chucking feet to the machine body:

1. Measure the workpiece outside diameter.
2. If the workpiece diameter is smaller than 36.5" (927 mm), attach the setup fingers to the chucking feet as shown in Figure 3-6.
3. Tighten the two setup finger screws to 9 ft-lbs (12 Nm).
4. Use the chart on the side of each chucking foot (Table 3-4) to determine the correct chucking range for the workpiece. See Table 3-1 on page 28 for text identification within the figure.

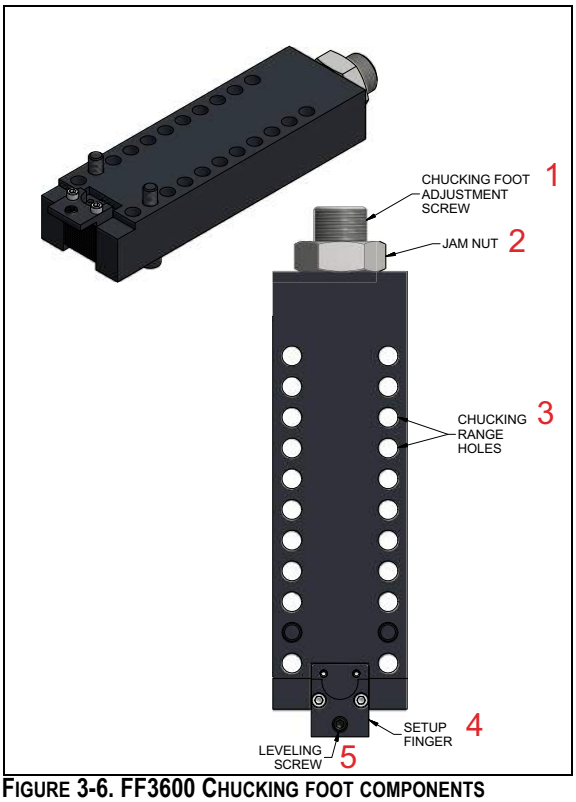

FIGURE 3-6. FF3600 CHUCKING FOOT COMPONENTS

TABLE 3-4. FF3600 CHUCKING RANGE CHART (P/N 80088)

	RANGE	1	2	3	4	5	6	7
MAX	inch	22.0	23.6	25.2	26.8	28.4	30.0	31.6
	mm	559	599	640	681	721	762	803
MIN	inch	20.0	21.6	23.2	24.8	26.4	28.0	29.6
	mm	508	549	589	630	671	711	752
	RANGE	**8**	**9**	**10**	**11**			
MAX	inch	33.2	34.8	36.4	38.0			
	mm	843	884	925	965			
MIN	inch	31.2	32.8	34.4	36.0			
	mm	792	833	874	914			

3.3.4 Attaching the chucking feet

After determining the chucking range, do the following to attach the chucking feet:

1. Turn the RDU upside down (Figure 3-7).
2. Place the chucking foot with the setup finger side down on the RDU (Figure 3-8).
3. Insert the two chucking foot screws through the correct chucking range holes (Figure 3-8), and turn them into the RDU. Tighten both screws to 36 ft-lbs (49 Nm).
4. Turn the jam nut away from the chucking foot body.
5. Turn the chucking foot setscrew to retract the chucking foot all the way open.
6. Repeat steps 2-5 for each chucking foot.
7. In small increments, turn opposite pairs of chucking foot setscrews to adjust the distance between opposite pairs of chucking feet to slightly larger than the workpiece diameter (Figure 3-8).

FIGURE 3-7. RDU INVERTED (FF1200 SHOWN)

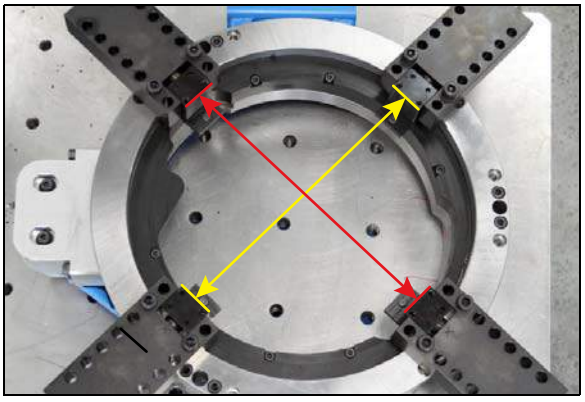

FIGURE 3-8. RDU WITH ALL CHUCKING FEET ATTACHED (FF1200 SHOWN)

8. Turn the jam nuts away from the chucking foot bodies as necessary (Figure 3-9).

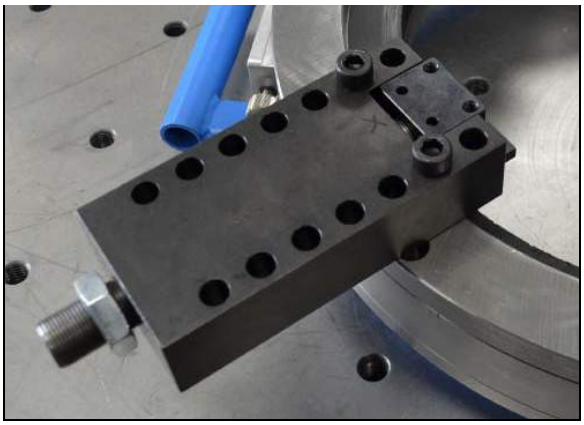

FIGURE 3-9. CHUCKING FOOT ASSEMBLY ATTACHED TO RDU (FF1200 SHOWN)

3.3.5 Mount the chuck to the workpiece

Do the following to mount the chuck to the workpiece:

1. Place the machine on the on workpiece (Figure 3-10).

NOTICE

If the workpiece diameter is larger than 12.5 inches, the setup fingers cannot be used. In this case, the RDU will rest directly on the workpiece.

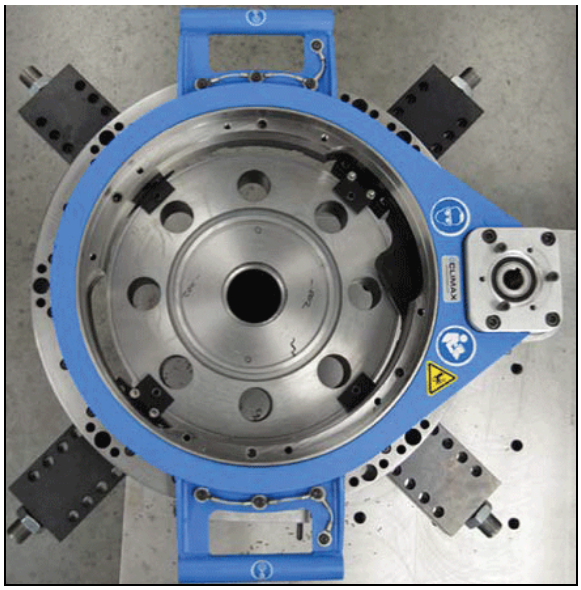

FIGURE 3-10. MOUNT THE MACHINE TO THE WORKPIECE (FF1200 SHOWN)

2. In approximately 20 ft-lb (27 Nm) increments, turn two opposing chucking foot setscrews to tighten the opposing chucking feet to the workpiece.
3. Repeat step 2 for the other opposing pair of chucking feet.
4. Attach an appropriate tether restraint. See Figure 3-11, Figure 3-12, Figure 3-13, Figure 3-14, Figure 3-15, and Figure 3-16 for example tether arrangements for horizontal, vertical, and upside-down mounting.

⚠ WARNING

Failure to properly mount and tether the machine may allow the machine to rotate or fall.

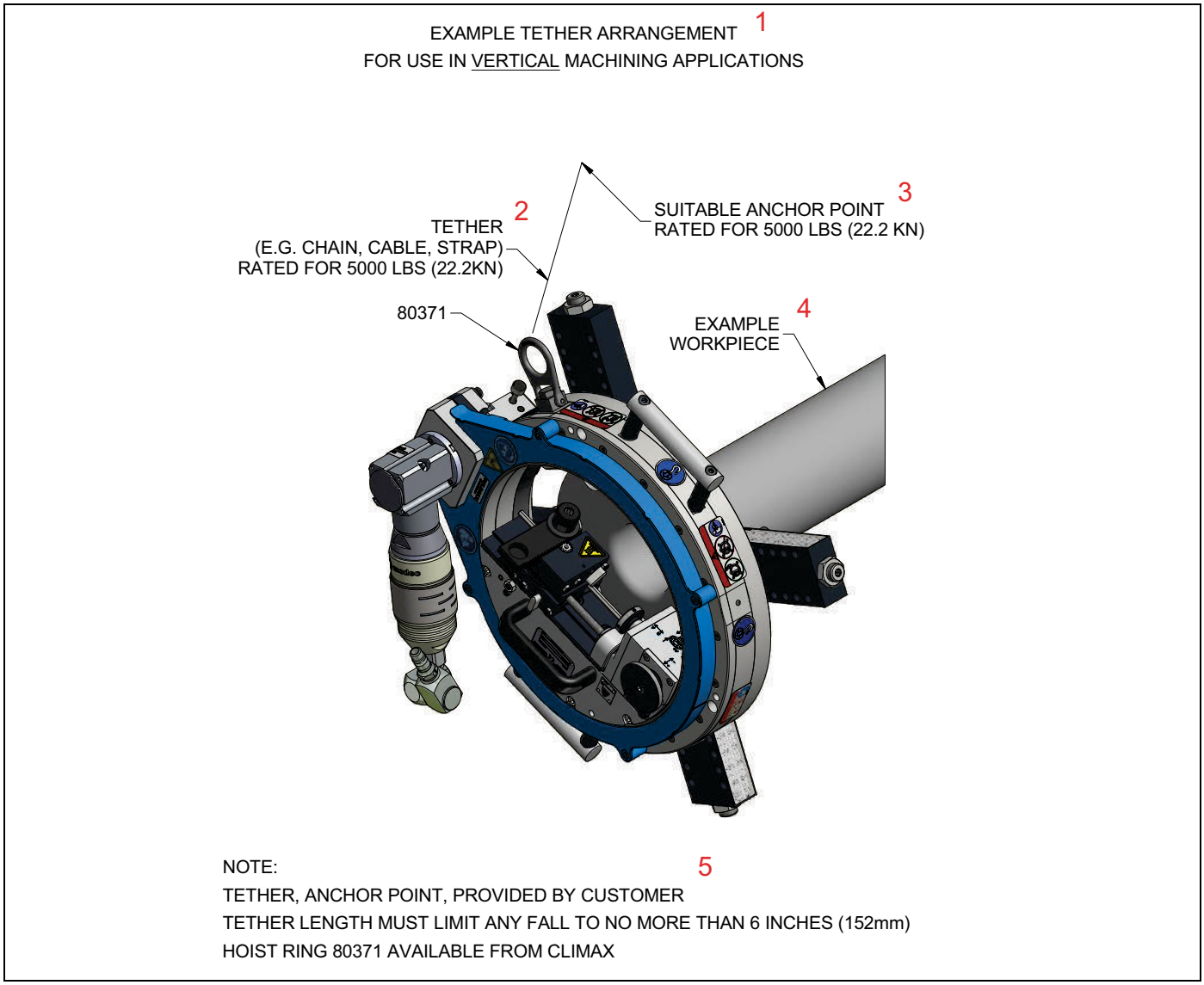

FIGURE 3-11. VERTICAL EXAMPLE WITH TETHER

TABLE 3-5. VERTICAL TETHER IDENTIFICATION

Number	Component
1	Example tether arrangement for use in vertical machining applications
2	Tether (e.g. chain, cable, strap) rated for 5000 lbs (22.2 kN)
3	Suitable anchor point rated for 5000 lbs (22.2 kN)
4	Example workpiece
5	Note: tether, anchor point, provided by customer Tether length must limit any fall to no more than 6 inches (152mm) Hoist ring 80371 available from CLIMAX

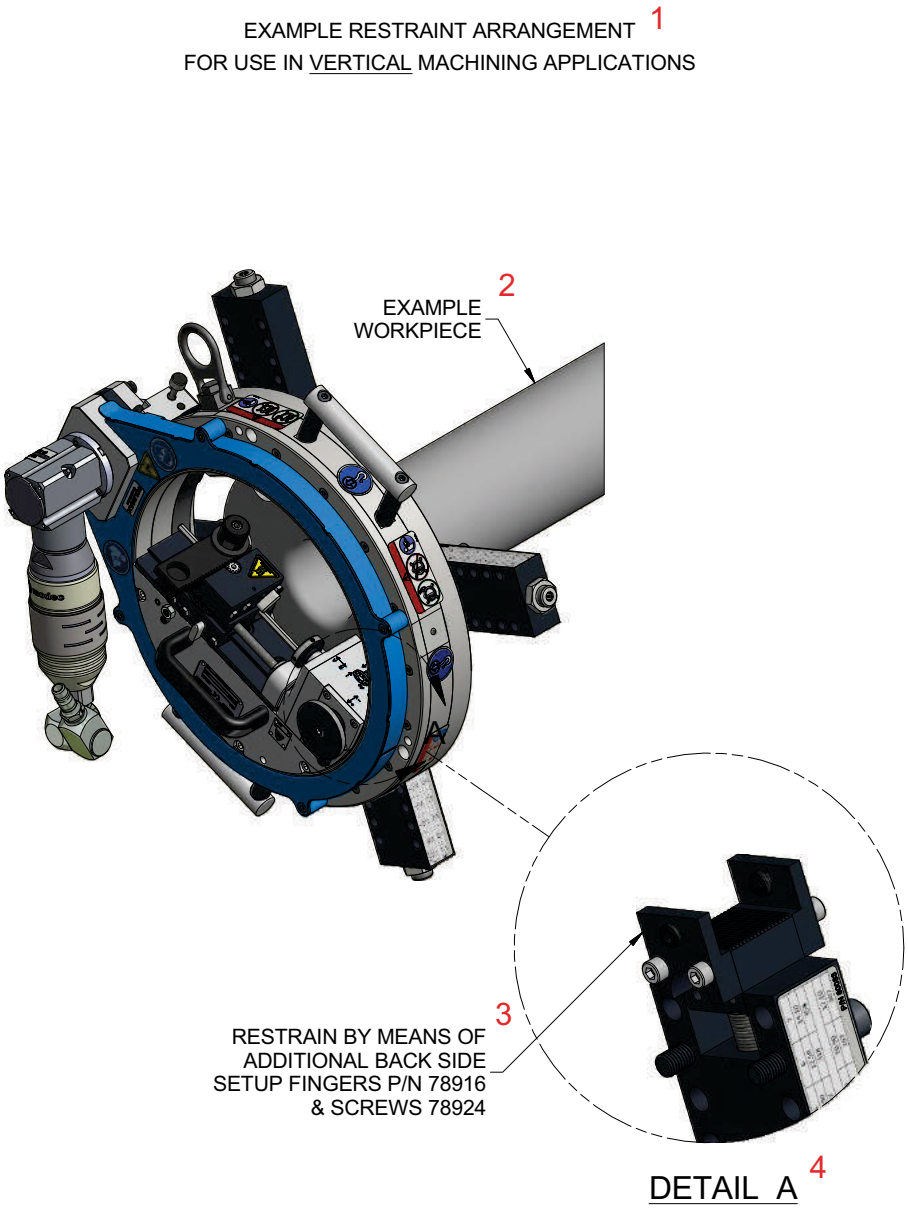

FIGURE 3-12. VERTICAL EXAMPLE WITH SETUP FINGERS

TABLE 3-6. VERTICAL EXAMPLE WITH SETUP FINGERS IDENTIFICATION

Number	Component
1	Example restraint arrangement for use in vertical machining applications
2	Example workpiece
3	Restrain by means of additional back side setup fingers P/N 78916 & screws 78924
4	Detail A

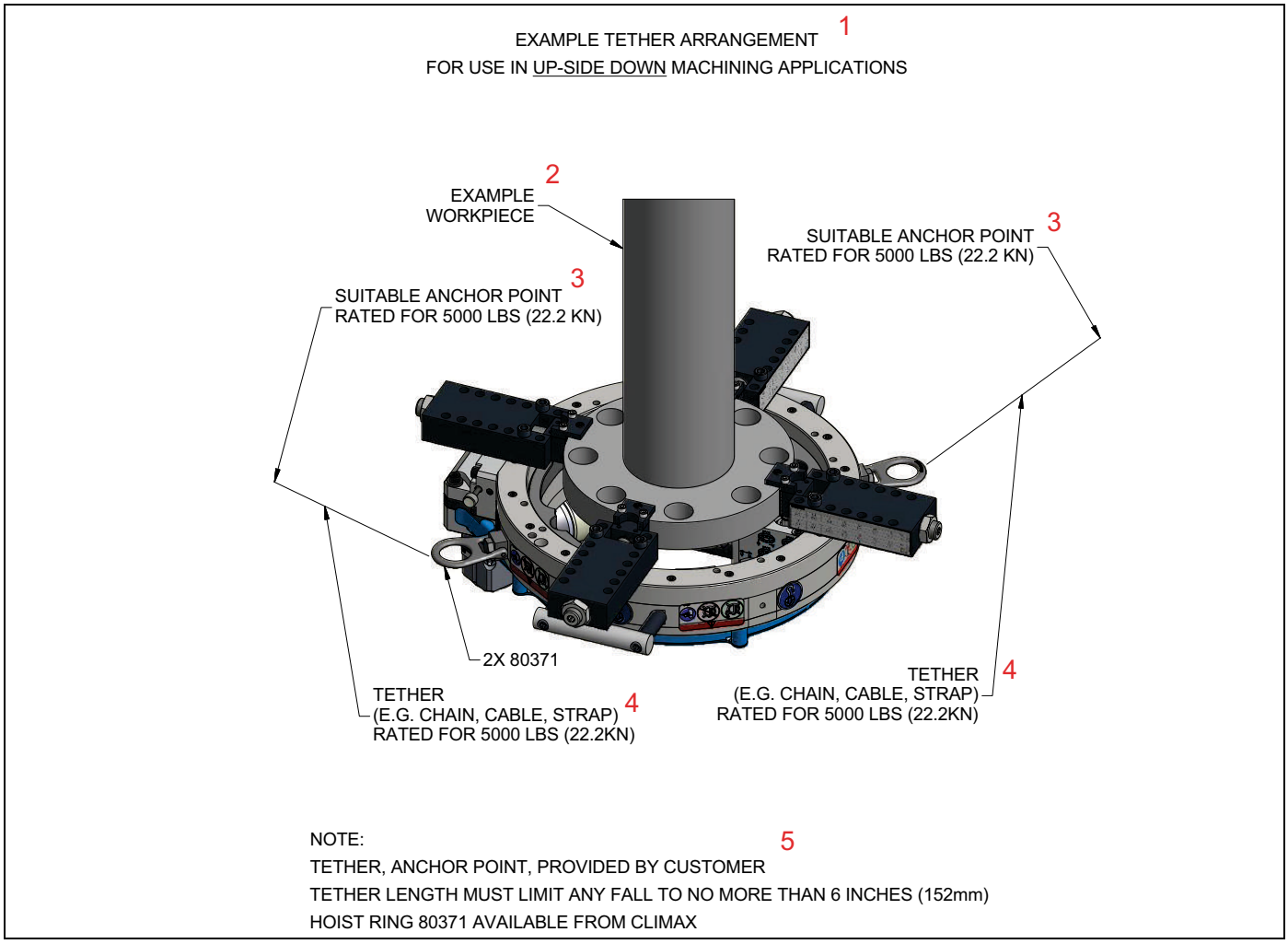

FIGURE 3-13. UPSIDE-DOWN EXAMPLE WITH TETHER

TABLE 3-7. UPSIDE-DOWN TETHER IDENTIFICATION

Number	Component
1	Example tether arrangement for use in upside down machining applications
2	Example workpiece
3	Suitable anchor point rated for 5,000 lbs (22.2 kN)
4	Tether (e.g. chain, cable, strap) rated for 5000 lbs (22.2kN)
5	Note: tether, anchor point, provided by customer Tether length must limit any fall to no more than 6 inches (152mm) Hoist ring 80371 available from CLIMAX

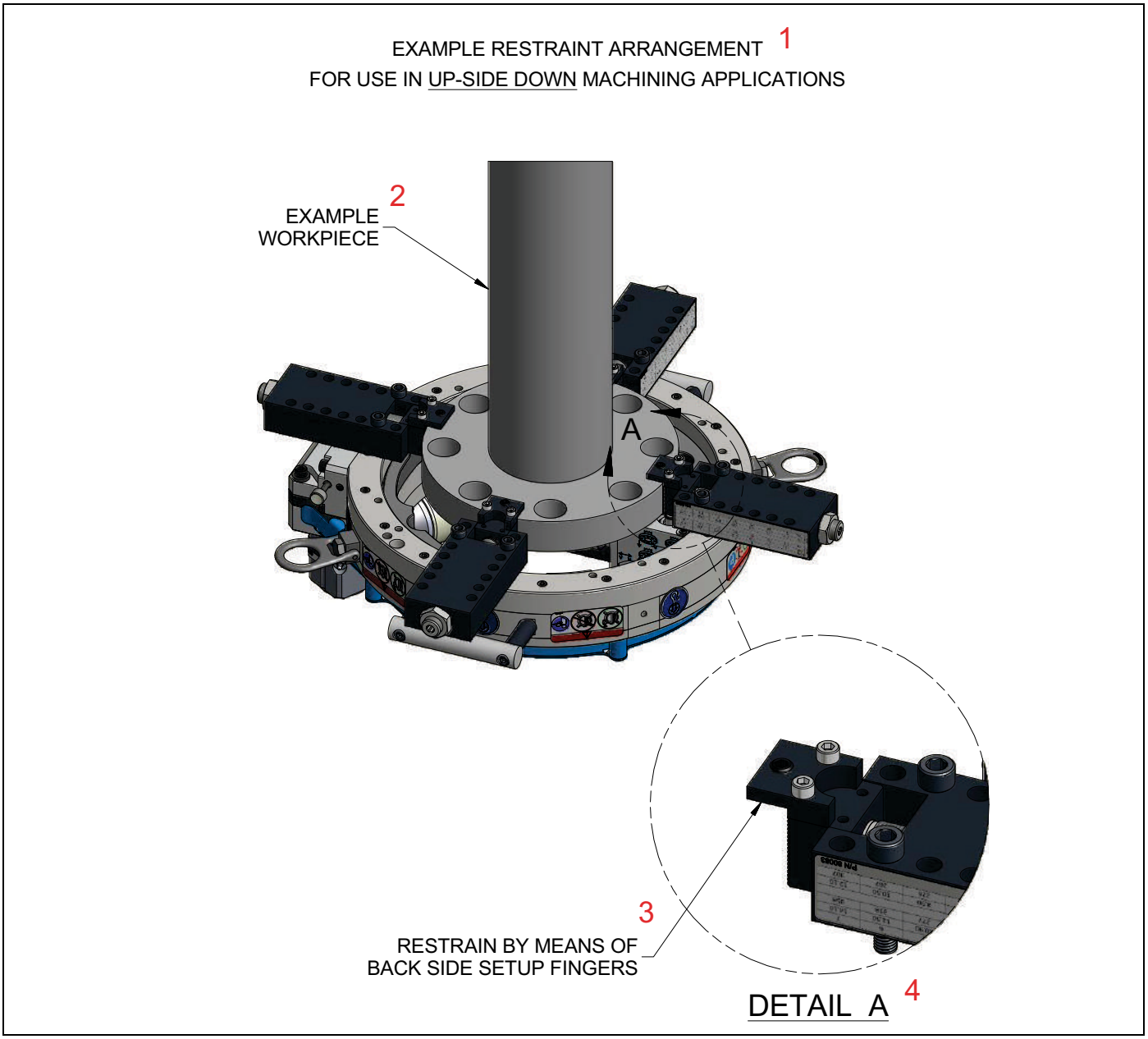

FIGURE 3-14. UPSIDE-DOWN EXAMPLE WITH SETUP FINGERS

TABLE 3-8. UPSIDE-DOWN EXAMPLE WITH SETUP FINGERS IDENTIFICATION

Number	Component
1	Example restraint arrangement for use in upside down machining applications
2	Example workpiece
3	Restrain by means of back side setup fingers
4	Detail A

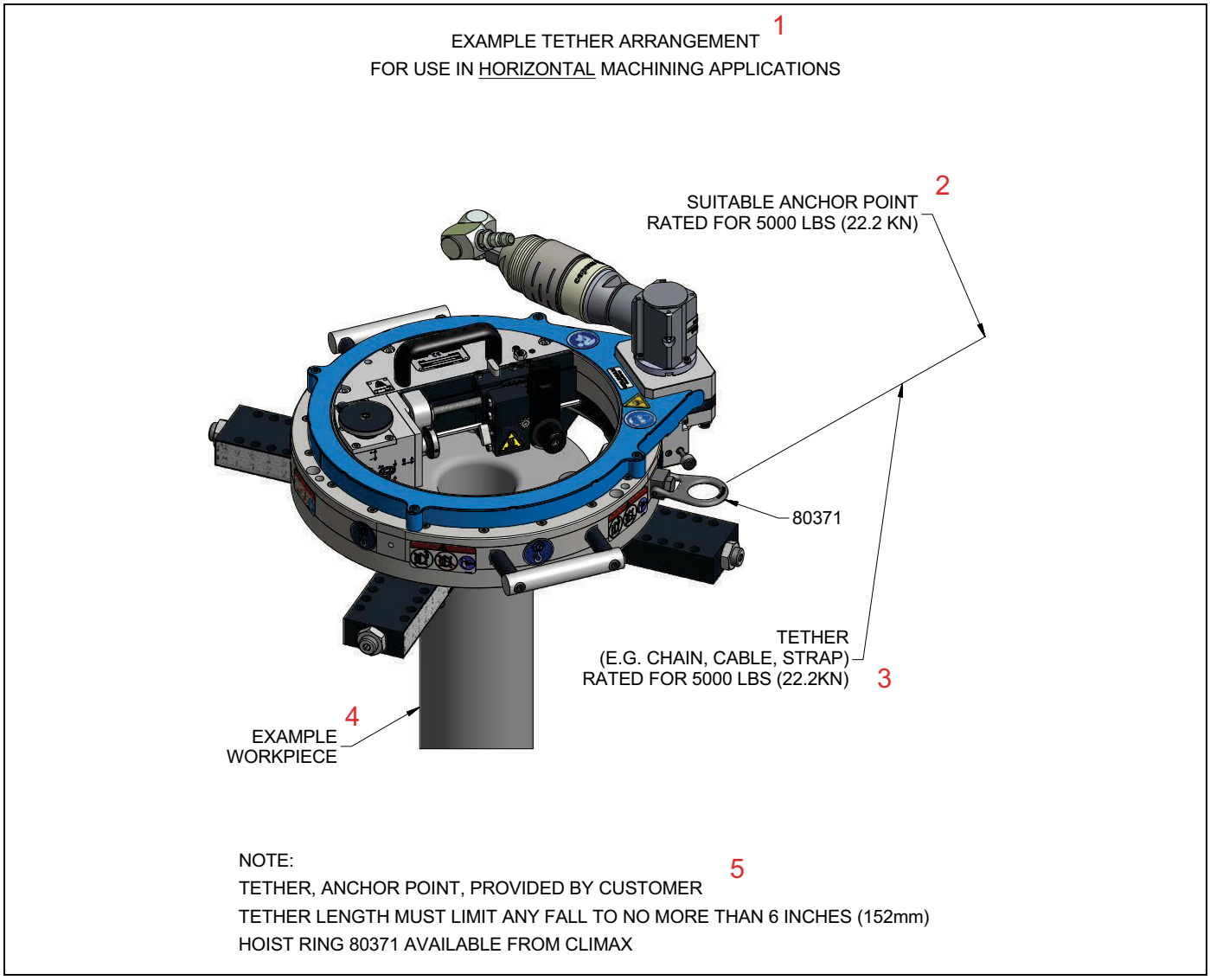

FIGURE 3-15. HORIZONTAL EXAMPLE WITH TETHER

TABLE 3-9. HORIZONTAL TETHER IDENTIFICATION

Number	Component
1	Example tether arrangement for use in horizontal machining applications
2	Suitable anchor point rated for 5000 lbs (22.2 kN)
3	Tether (e.g. chain, cable, strap) rated for 5000 lbs (22.2kN)
4	Example workpiece
5	Note: tether, anchor point, provided by customer Tether length must limit any fall to no more than 6" (152 mm) Hoist ring 80371 available from CLIMAX

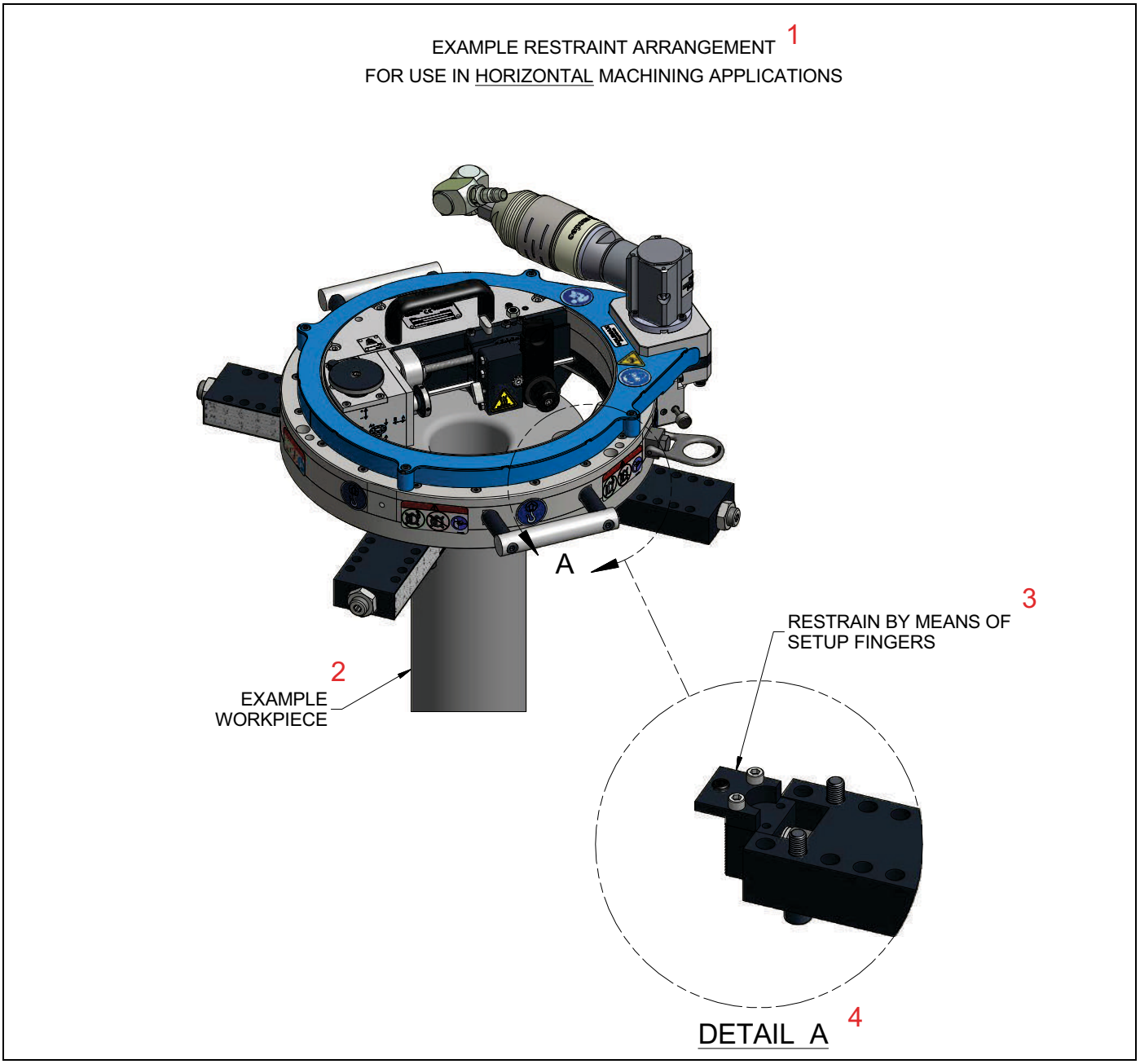

FIGURE 3-16. HORIZONTAL EXAMPLE WITH SETUP FINGERS

TABLE 3-10. HORIZONTAL EXAMPLE WITH SETUP FINGERS IDENTIFICATION

Number	Component
1	Example restraint arrangement for use in horizontal machining applications
2	Example workpiece
3	Restraint by means of setup fingers
4	Detail A

3.3.5.1 Level the RDU

Do the following to level the RDU:

1. Set up a dial indicator between the RDU and a reference surface on the workpiece to measure machine leveling (Figure 3-17).
2. Insert the supplied 5/16″ rods into one of the slide assembly bushings (Figure 3-18). Use the rods to rotate the RDU bearing.
3. Measure level and adjust the setup finger leveling setscrews as necessary (Figure 3-17).
4. Alternate the centering procedure (Section 3.3.5.2) and this procedure until the desired alignment is achieved.

FIGURE 3-17. LEVEL THE RDU (FF3600 SHOWN)

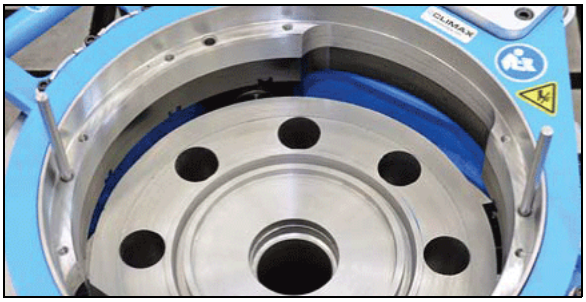

FIGURE 3-18. 5/16" RODS FOR MANUALLY ROTATING THE RDU BEARING (FF1200 SHOWN)

3.3.5.2 RDU centering

Do the following to center the RDU:

1. Set up the dial indicator between the RDU and a reference surface on the workpiece to measure machine centering (Figure 3-19).
2. Insert the supplied 5/16 rods into the slide assembly bushings (Figure 3-19). Use the rods to rotate the RDU bearing.
3. Measure RDU center and adjust the chuck foot setscrews as necessary (Figure 3-19).

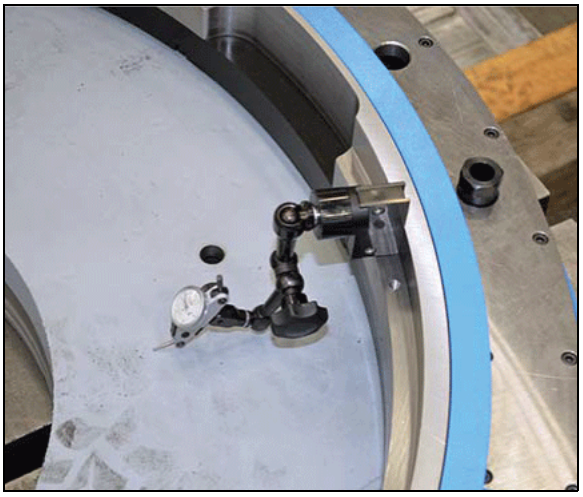

FIGURE 3-19. CENTER THE RDU (FF3600 SHOWN)

4. Alternate the leveling procedure (Section 3.3.5.1) and this procedure until desired alignment is achieved.
5. Tighten all four chucking foot setscrews to a minimum torque of the following, depending on your machine:
   - For the FF1200, a minimum torque of 20 ft-lbs (9.1 Nm).
   - For the FF2400 or FF3600, a minimum torque of 60 ft-lbs (27 Nm).

⚠ CAUTION

Do not tighten the chucking foot setscrews beyond 40 ft-lbs (18 Nm) for the FF1200, or 100 ft-lbs (45 Nm) for the FF2400 or FF3600. Exceeding the maximum torque value may cause damage to the machine or workpiece.

6. Hand tighten the jam nut on each chuck foot.
7. Remove the 5/16" rods from the slide assembly bushings.

NOTICE

Do not over-tighten the chucking foot setscrews. If you over-tighten these screws, you could warp the RDU frame and cause undesirable machining results.

3.3.6 Install the slide assembly

Do the following to install the slide assembly:

1. Make sure that the tool (if installed) or tool holder is retracted far enough that it will not contact the work-piece when installing the slide assembly.
2. Set the feed direction shift knob in the neutral (middle) position. Refer to Section 2.2 on page 13 for controls information.
3. Turn and hold the cam release key clockwise (Figure 3-20).

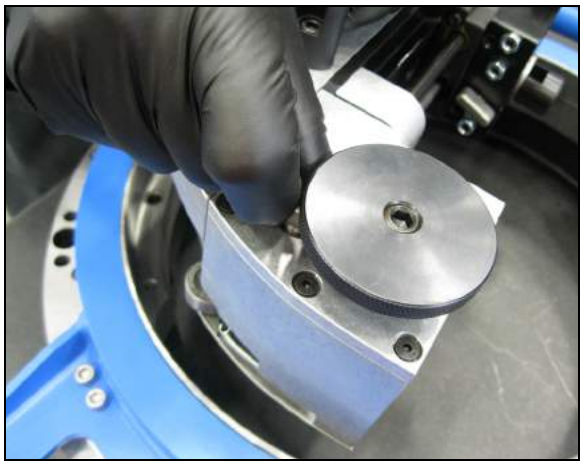

FIGURE 3-20. ALIGN THE SLIDE BODY OVER THE CAM SLOT (FF1200 SHOWN)

4. With the feed body cam aligned over the cam slot, place the slide body onto the RDU bearing (Figure 3-21).

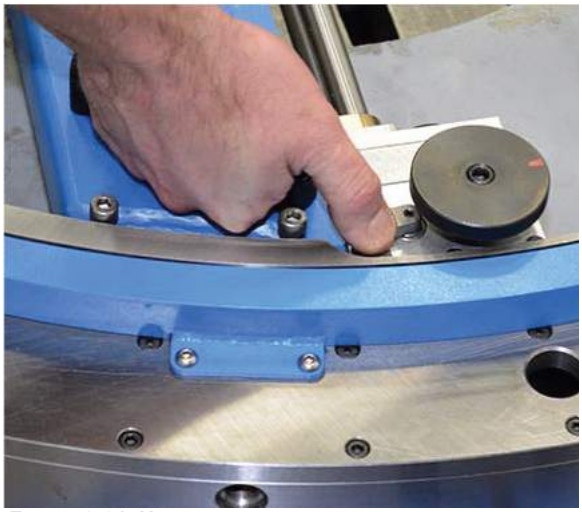

FIGURE 3-21. HOLDING CAM RELEASE KEY WHILE INSERTING (FF3600 SHOWN)

5. For the FF2400 and FF3600 only: Tighten the four socket head cap screws fixed in the slide assembly (see Figure 3-22). Tighten to 10 ft-lb (14 Nm).

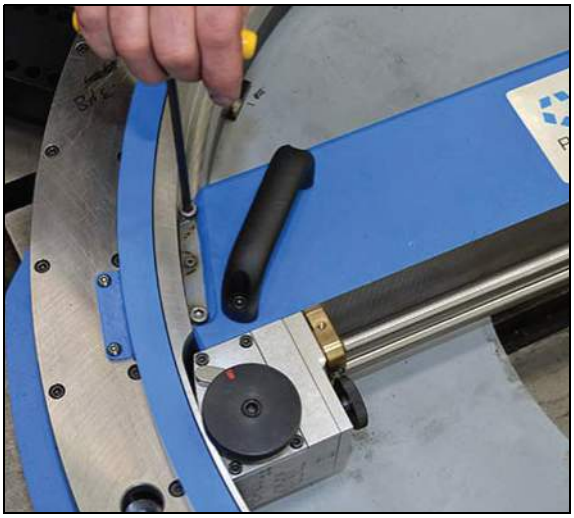

FIGURE 3-22. ATTACH THE SLIDE ASSEMBLY TO THE RDU (FF3600 SHOWN)

3.3.7 Install or replace the cutting tool

NOTICE

The FF1200-FF2400-FF3600 is designed to drag the cutting tool around the workpiece surface. The RDU and slide assembly rotate only in the counterclockwise direction. Keep these characteristics in mind when installing a new tool in the machine.

Do the following to install or replace the cutting tool:

1. With a 6-mm hex key, loosen the tool clamp set-screw.
2. Insert a tool horizontally into the tool post (Figure 3-23) and rotate it in the clamp to the desired position.
3. Tighten the tool clamp set-screw.

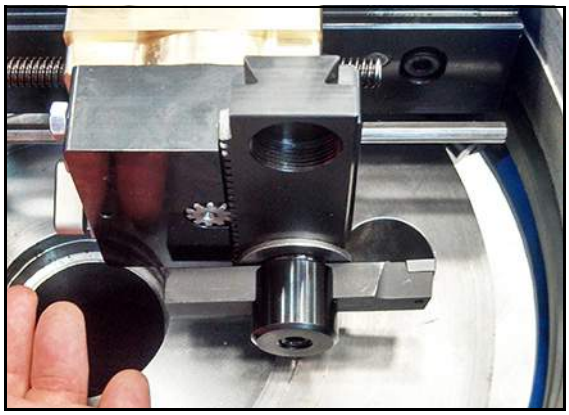

FIGURE 3-23. INSTALL THE TOOL HORIZONTALLY (FF1200 SHOWN)

⚠ WARNING

Do not adjust the cutting tool unless the machine is turned off, the air hose has been disconnected, and any required lockout/tag out has been performed.

3.3.8 Install the motor

Do the following to install the motor:

1. Align the motor key with the motor coupling keyway (Figure 3-24).

FIGURE 3-24. ALIGN THE AIR MOTOR (FF1200 SHOWN)

2. Mate the motor to the drive assembly (Figure 3-25).
3. Align the motor flange holes with the drive assembly threaded holes.
4. Insert the three M5x20 socket head cap screws. tighten to 106 in-lb (12 Nm).

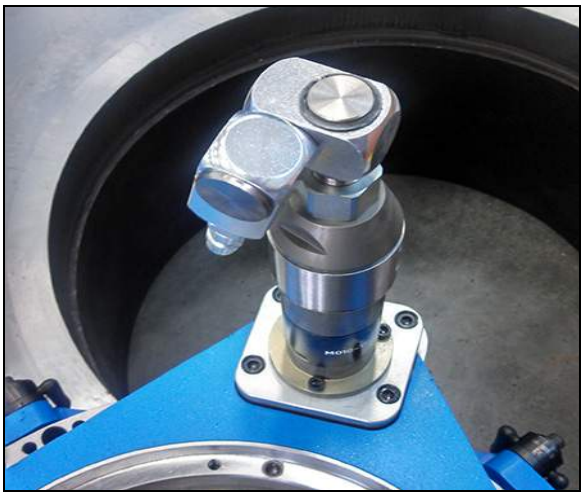

FIGURE 3-25. MOTOR INSTALLED (FF1200 SHOWN)

3.3.9 Set up the PCU

Do the following to set up the PCU, referring to Figure 2-6 on page 14:

1. Make sure that the air supply lock-out valve is closed.
2. Make sure that the speed adjustment valve is closed.
3. Connect the PCU to an air supply with the following specifications, depending on the machine:
   - For the FF1200, connect to an air supply with minimum 90 psi (6.21 bar) at 55 cfm (1.6 m^3/min). For the right angle air motor, the PCU should be set to 75 cfm (2.2 m^3/min).
   - For the FF2400 or FF3600, connect to an air supply with minimum 90 psi (6.21 bar) at 75 cfm (2.2 m^3/min) for both the straight and right angle pneumatic motor.
4. Connect the PCU air supply hose to the motor.

⚠ CAUTION

Make sure 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. Failure to do so may result in injury from uncontrolled discharging pneumatic components.

3.4 MACHINE CONFIGURATION

Some configuration procedures described here may require partial disassembly of an assembled machine.

⚠ WARNING

Do not adjust the cutting depth or axial slide tilt unless the machine is turned off, the air hose has been disconnected, and any required lockout/tag out has been performed.

3.4.1 Set the tool cutting depth

Do the following to set the tool cutting depth:

1. Set up a dial indicator between the axial feed and the workpiece to measure cut depth.
2. Use standard machining practices to touch off the tool.
3. Shift the feed box to radial feed and use the manual feed knob to move the tool to the beginning of the cut.
4. Use the supplied 1/4 wrench to turn the axial feed drive shaft to adjust tool depth (Figure 3-26).
   OR
   Shift the feed box to axial feed and use the manual feed knob to adjust tool depth.
5. Finger tighten the axial gib lock screw (Figure 3-27).

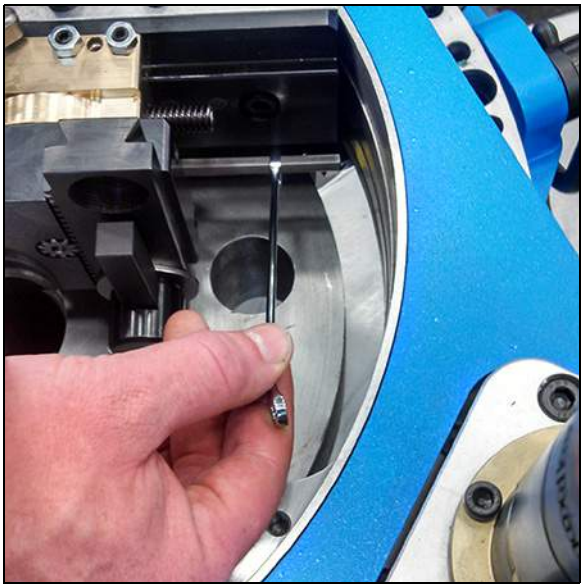

FIGURE 3-26. TURN THE AXIAL FEED DRIVE SHAFT TO ADJUST TOOL HEIGHT (FF1200 SHOWN)

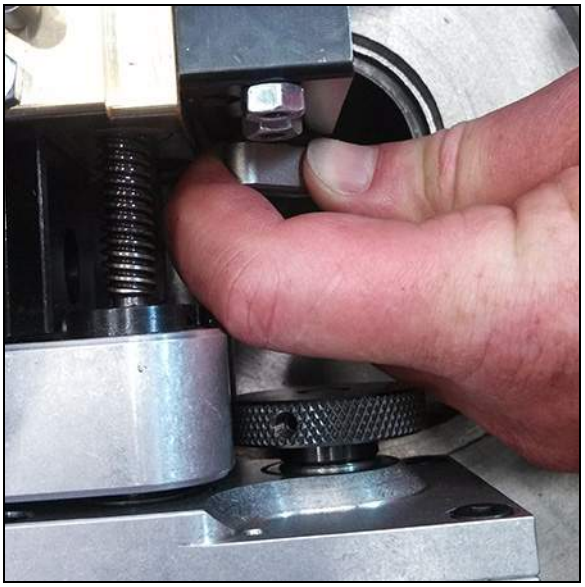

FIGURE 3-27. AXIAL GIB LOCK SCREW (FF1200 SHOWN)

3.4.2 Tilt the axial slide

The axial slide can be tilted by swiveling the tool head to within 0.5° of any desired angle using its built-in protractor. There are detents at 0°, 23°, and -23° for convenience.

Do the following to angle the axial slide:

1. Using a 4 mm hex key, loosen the swivel lock setscrews on the gib screw side of the tool head (Figure 3-28) two full turns.
2. Using an 4 mm hex key, tighten the two swivel release setscrews on the side of the tool head opposite the gib screw (Figure 3-29) until you feel the internal pins give way.

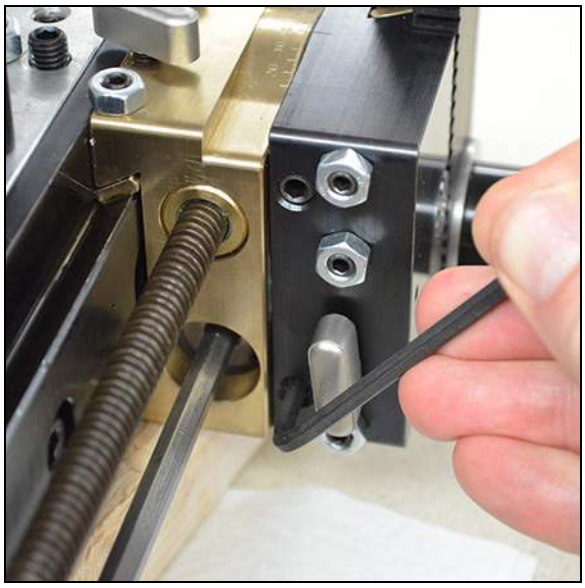

FIGURE 3-28. LOOSEN THE SWIVEL LOCK SETSCREWS

3. Loosen both swivel release setscrews about two turns.

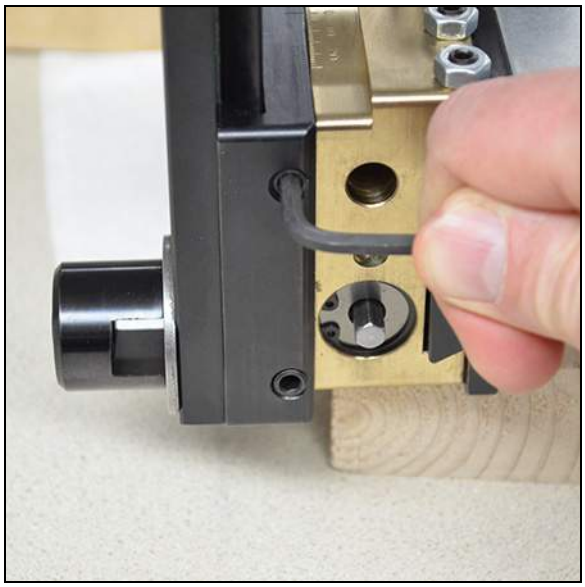

FIGURE 3-29. TIGHTEN THE SWIVEL RELEASE SETSCREWS

4. Swivel the tool head until the tick mark lines up with the desired angle reading on the protractor (Figure 3-30). If the tool head resists moving, repeat steps 2 and 3.
5. Tighten both swivel lock setscrews to 30 in-lb (3 Nm).
6. Hand tighten both swivel release setscrews to prevent the setscrews from vibrating out during operation.

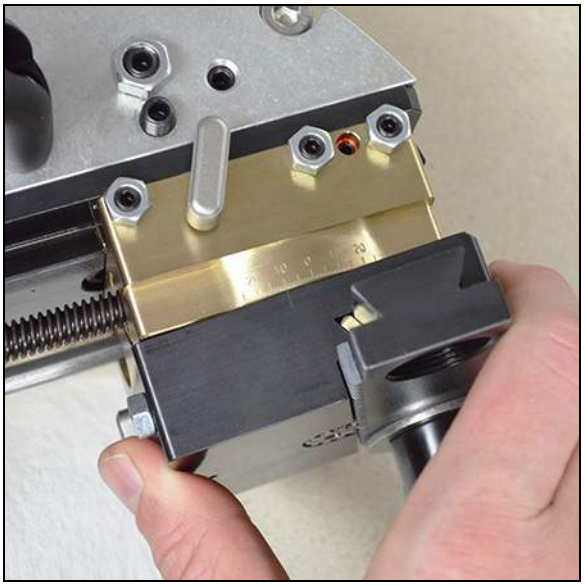

FIGURE 3-30. SWIVEL THE TOOL HEAD (FF1200 SHOWN)

3.4.3 Tilt the radial slide

The radial slide can be tilted to enable machining of tapered flanges.

Do the following to tilt the radial slide:

1. Flip the slide body upside down.
2. With a 13 mm socket, loosen the recessed setscrew jam nut (Figure 3-31).
3. With a 4 mm hex key, loosen recessed setscrew out about two full turns.
4. Flip the slide body upright.

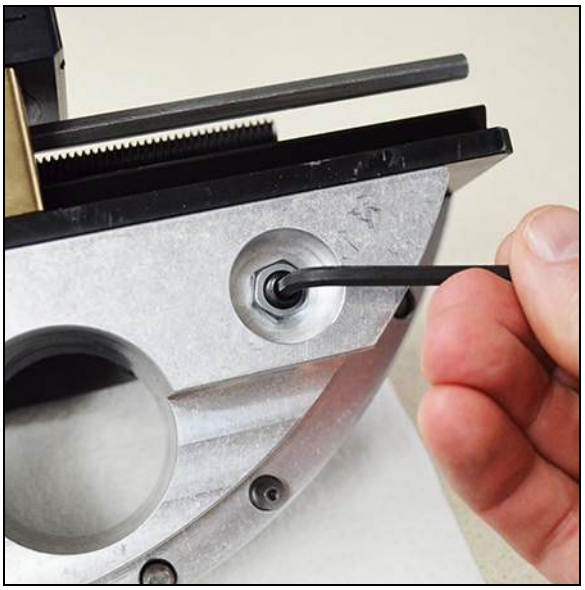

FIGURE 3-31. LOOSEN THE SLIDE PIN BACKING SETSCREW (FF1200 SHOWN)

5. Position the slide body on blocks so that the outer block and radial slide are resting on the same surface (Figure 3-32).

FIGURE 3-32. SUPPORT THE RADIAL SLIDE (FF1200 SHOWN)

6. Set the feed axis shift knob to position 1 (radial) (Figure 3-33).

TABLE 3-11. FEED CONTROL IDENTIFICATION

Number	Component
1	Direction shift/manual feed crank: Crank clockwise: manual feed A (out) feed out/down Middle: neutral B (in) feed in/up
2	Clutch position legend
3	Feed axis shift 1 (in): radial feed 2 (out): axial feed

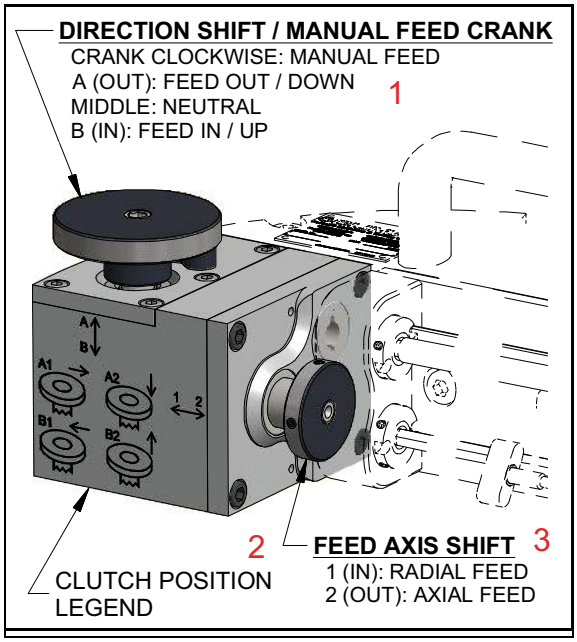

FIGURE 3-33. FEED CONTROLS (FF1200 SHOWN)

7. With a 4 mm hex key, remove the plug setscrew from the top of the slide body (Figure 3-34).

FIGURE 3-34. REMOVE THE PLUG SCREW (FF1200 SHOWN)

8. Position a depth gauge with a flat contact head to measure from the top of the slide body to the dowel pin in the radial slide (Figure 3-35). Either zero the dial indicator or record this value.

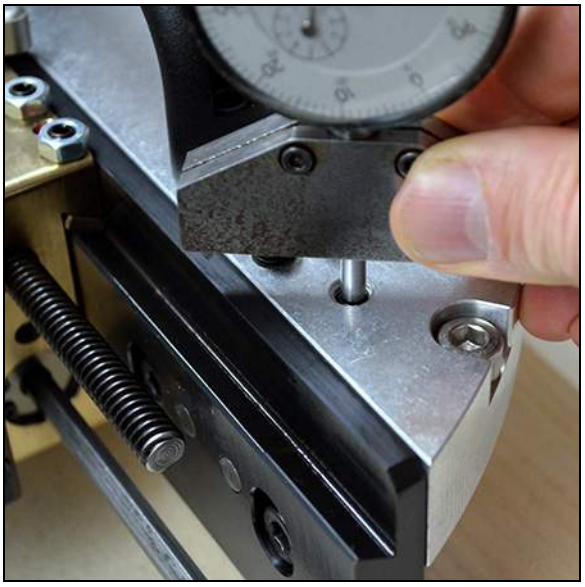

FIGURE 3-35. POSITION THE DIAL INDICATOR (FF1200 SHOWN)

9. With a 6 mm hex key, loosen the four radial slide bolts. Use the feed direction knob to move the tool head as needed.
10. Tighten the outermost radial slide bolt slightly to prevent the slide from slipping.
11. Move the slide body on the blocks so that the radial slide is not supported.
12. Find the correct slide tilt angle and corresponding dowel pin depth in Table 3-12 on page 51 (for the FF1200) or Table 3-13 on page 52 (for the FF2400 or FF3600).
13. With a 4-mm hex key, slowly turn the tilt adjust setscrew until the dial indicator reads the desired depth change (Figure 3-37).
14. If the tilt adjust setscrew tightens before reaching the desired depth, repeat steps 1-4.
15. Tighten the radial slide screws to 140 in-lb (16 Nm).
16. Flip the slide body upside down.
17. Tighten the jam nut (see Figure 3-27) on the recessed setscrew.

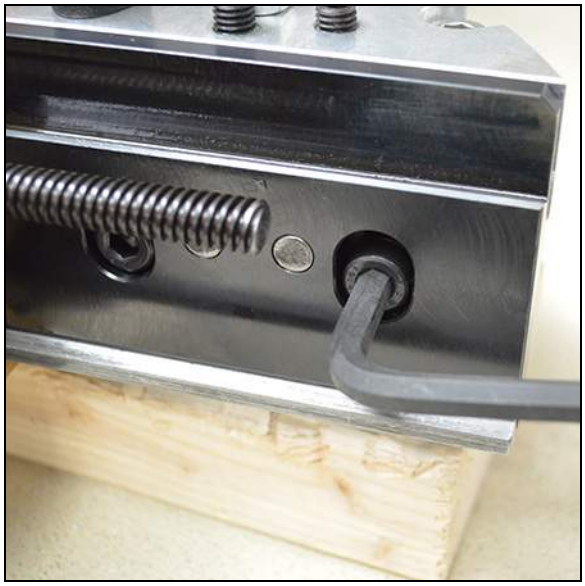

FIGURE 3-36. LOOSEN THE RADIAL SLIDE SCREWS (FF1200 SHOWN)

FIGURE 3-37. SET THE RADIAL SLIDE TILT (FF1200 SHOWN)

TIP:

If the radial slide tilt angle will be used frequently, the recessed bottom setscrew can be adjusted until it touches the dowel pin and then locked into place. If not, tighten the lock nut to prevent the setscrew from vibrating out. The slide can now be moved between level and the slide tilt angle by simply loosening and re-torquing the four radial slide bolts.

For the FF1200, use Table 3-12 to calculate the radial slide tilt angle and corresponding dowel pin depth.

TABLE 3-12. FF1200 RADIAL SLIDE TILT ANGLE CONVERSION

Slide angle	Dowel pin depth	Slide angle	Dowel pin depth
0.10°	0.0126" (0.32 mm)	0.85°	0.1068" (2.71 mm)
0.15°	0.0188" (0.48 mm)	0.90°	0.1131" (2.87 mm)
0.20°	0.0251" (0.64 mm)	0.95°	0.1194" (3.03 mm)
0.25°	0.0314" (0.80 mm)	1.00°	0.1257" (3.19 mm)
0.30°	0.0377" (0.96 mm)	1.05°	0.1319" (3.35 mm)
0.35°	0.0440" (1.12 mm)	1.10°	0.1382" (3.51 mm)
0.40°	0.0503" (1.28 mm)	1.15°	0.1445" (3.67 mm)
0.45°	0.0565" (1.44 mm)	1.20°	0.1508" (3.83 mm)
0.50°	0.0628" (1.60 mm)	1.25°	0.1571" (3.99 mm)
0.55°	0.0691" (1.76 mm)	1.30°	0.1633" (4.15 mm)
0.60°	0.0754" (1.92 mm)	1.35°	0.1696" (4.31 mm)
0.65°	0.0817" (2.07 mm)	1.40°	0.1759" (4.47 mm)
0.70°	0.0880" (2.23 mm)	1.45°	0.1822" (4.63 mm)
0.75°	0.0942" (2.39 mm)	1.50°	0.1885" (4.79 mm)
0.80°	0.1005" (2.55 mm)		

For the FF2400 or FF3600, use Table 3-13 to calculate the radial slide tilt angle and corresponding dowel pin depth.

TABLE 3-13. FF2400 AND FF3600 RADIAL SLIDE TILT ANGLE CONVERSION

Slide angle	Dowel pin depth	Slide angle	Dowel pin depth
0.10°	0.0301" (.77 mm)	0.85°	0.2562" (6.51 mm)
0.15°	0.0452" (1.15 mm)	0.90°	0.2713" (6.89 mm)
0.20°	0.0603" (1.53 mm)	0.95°	0.2863" (7.27 mm)
0.25°	0.0754" (1.91 mm)	1.00°	0.3014" (7.66 mm)
0.30°	0.0904" (2.30 mm)	1.05°	0.3165" (8.04 mm)
0.35°	0.1055" (2.68 mm)	1.10°	0.3315" (8.42 mm)
0.40°	0.1206" (3.06 mm)	1.15°	0.3466" (8.80 mm)
0.45°	0.1356" (3.45 mm)	1.20°	0.3617" (9.19 mm)
0.50°	0.1507" (3.83 mm)	1.25°	0.3767" (9.57 mm)
0.55°	0.1658" (4.21 mm)	1.30°	0.3918" (9.95 mm)
0.60°	0.1808" (4.59 mm)	1.35°	0.4069" (10.33 mm)
0.65°	0.1959" (4.98 mm)	1.40°	0.4219" (10.72 mm)
0.70°	0.2110" (5.36 mm)	1.45°	0.4370" (11.10 mm)
0.75°	0.2261" (5.74 mm)	1.50°	0.4521" (11.48 mm)
0.80°	0.2411" (6.12 mm)		

For exact slide tilt angles not shown in the table, use the following calculation to determine the dowel pin depth change:

- For the FF1200: dowel pin depth = 7.2" (182.88 mm) x sin (tilt angle)
- For the FF2400 or FF3600: dowel pin depth = 17.27" (438.66 mm) x sin (tilt angle)

4 OPERATION

IN THIS CHAPTER:

4.1 OPERATION MODES

TheFF1200-FF2400-FF3600 can machine a face, groove, or bevel on a flat or tapered flange. The following subsections explain how to set up the machine for these operating modes. Refer to Section 2.2 on page 13 for controls information.

4.1.1 Configure for machining on a flat flange

Flat facing is the default operating mode of the FF1200-FF2400-FF3600.

⚠ WARNING

Do not configure or adjust the machining direction unless the machine is turned off, the air hose has been disconnected, and any required lockout/tag out has been performed.

Do the following to configure the FF1200-FF2400-FF3600 for machining a face on a flat flange:

1. Assemble the FF1200-FF2400-FF3600 on the workpiece (see Section 3.3 on page 28).
2. Complete all pre-operation checks (see Section 4.2 on page 55).
3. Use the feed axis and direction knobs to move the cutting tool to the starting point of the cut.

4. Set the feed axis shift knob (Figure 4-1) to one of the following:
   - Position 1 (radial) for facing
   - Position 2 (axial) for grooving or beveling.
5. Set the feed direction shift knob (Figure 4-1) to the desired direction.

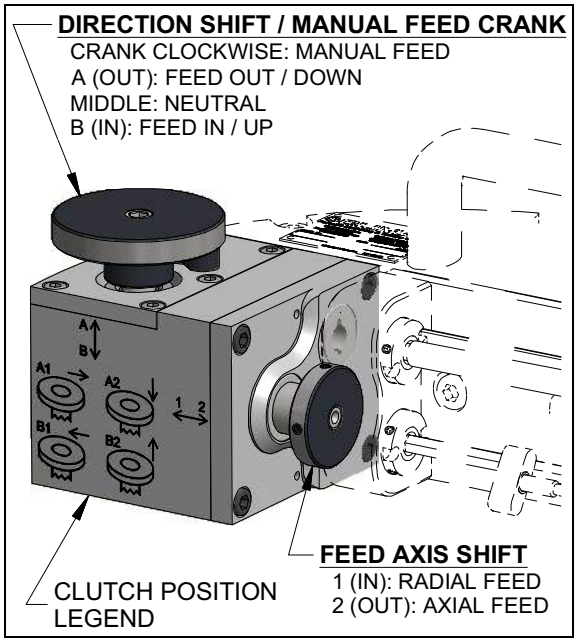

FIGURE 4-1. FEED CONTROLS (FF1200 SHOWN)

TABLE 4-1. FEED CONTROL IDENTIFICATION

Number	Component
1	Direction shift/manual feed crank: Crank clockwise: manual feed A (out) feed out/down Middle: neutral B (in) feed in/up
2	Clutch position legend
3	Feed axis shift 1 (in): radial feed 2 (out): axial feed

4.1.2 Configure for machining on a tapered flange

The FF1200-FF2400-FF3600 can face or groove a flange with a taper of up to 1.5° with its precision tilting radial slide.

Do the following to face or groove a tapered flange:

1. Assemble the FF1200-FF2400-FF3600 on the workpiece (see Section 3.3 on page 28).
2. Set the radial slide to the correct tilt (see Section 3.4.3 on page 47).
3. Complete all pre-operation checks (see Section 4.2 on page 55).
4. Use the feed axis and direction knobs to move the cutting tool to the starting point of the cut.
5. Set the feed axis shift knob to position 1 (radial) for facing or position 2 (axial) for grooving or beveling.
6. Set the feed direction shift knob to position A (down).

7. Unlock the radial gib lock screw if facing (Figure 4-2), or the axial gib lock screw if grooving (Figure 4-3).
8. Hand tighten the axial gib lock screw, if facing, or the radial gib lock screw, if grooving.

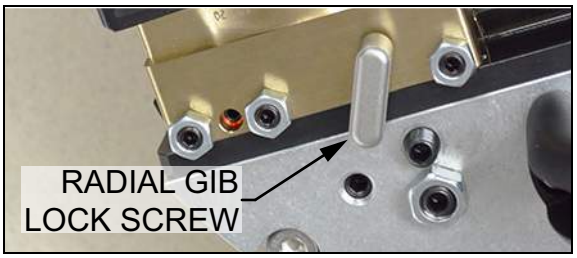

FIGURE 4-2. RADIAL GIB LOCK SCREW (FF1200 SHOWN)

9. Adjust the cutting tool to the desired cutting depth (see Section 3.4.1 on page 45).
10. Open the lock-out/tag-out valve on the PCU (Figure 4-4).
11. Pull up on the emergency stop button on the PCU (Figure 4-4).

FIGURE 4-3. AXIAL GIB LOCK SCREW (FF1200 SHOWN)

4.2 PRE-OPERATION CHECKS

Check the following before operating:

1. Check that the work area is clear of non-essential personnel and equipment.
2. Check that the machine control/observation area will not be in the path of hot flying chips during machine operation.
3. Check that the machine is securely mounted to the work piece.
4. Check that the air hoses are routed and secured to avoid tripping, entanglement, damage from hot chips, or other damage should an air hose or connection fail.
5. Check the tool condition and sharpness.
6. On the PCU, check that the oil drip rate is set to 6 drips per minute.
7. Check that all hand tools are removed from inside the machine and the work area.
8. Complete the risk assessment checklist in Table 1-3 on page 5.

4.3 OPERATION

4.3.1 Start the machine

Do the following to start the machine:

1. On the PCU, press the START button (Figure 4-4).
2. Set the feed rate to zero (Figure 4-4).
3. Slowly open the PCU ball valve until the rotary speed reaches the desired rate (Figure 4-4).
4. Engage the feed on the rotational drive unit (RDU) (Figure 4-5).
5. Slowly turn the feed rate screw to increase the feed rate until you reach the desired feed rate. (Figure 4-4).
6. Adjust the feed rate and rotary speed as necessary to maintain the desired cut.
7. Adjust the oil drip rate as needed. (Figure 4-4).

NOTICE

For best machine performance and service life, CLIMAX recommends that the PCU oil drip rate not be adjusted below 6 drips per minute.

⚠ WARNING

Do not operate the machine if the bearing heats up significantly (that is, more than approximately 15ºF (10ºC) above the ambient temperature). Bearing heat may lead to thermal expansion and a loss of chucking force, leading to a machine fall. Consult Section 5.5 on page 64 if the bearing heats significantly.

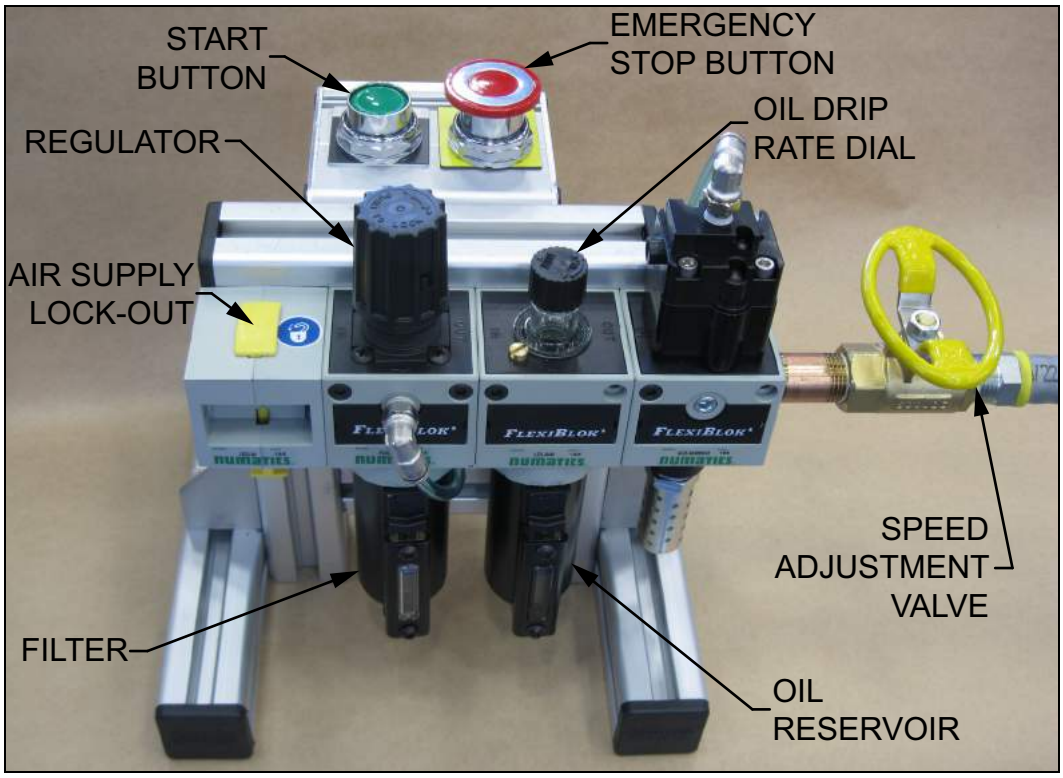

FIGURE 4-4. PCU COMPONENTS

TABLE 4-2. PCU CONTROL IDENTIFICATION

Number	Component
1	Air supply lock-out
2	Regulator
3	Start button
4	Emergency stop button
5	Oil drip rate dial
6	Speed adjustment valve
7	Oil reservoir
8	Filter

4.3.2 Stop the machine

Do the following to stop the machine:

1. Disengage the feed (Figure 4-5).
2. Turn the speed adjustment valve clockwise to close it.
3. Press the lock-out/tag-out valve down to close it (Figure 4-4). This will release residual air pressure in the PCU circuit.

TABLE 4-3. FEED RATE CONTROL IDENTIFICATION

Number	Component
1	Feed rate adjustment screw
2	Feed engagement pin
3	Feed rate indicator

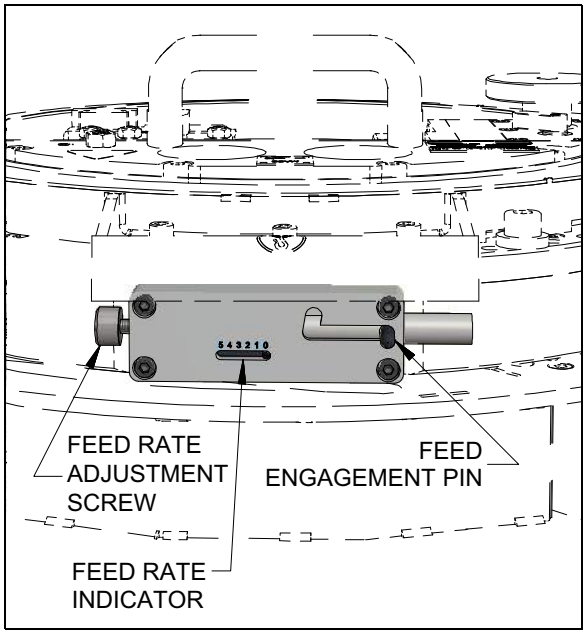

FIGURE 4-5. FEED ENGAGEMENT AND FEED RATE ADJUSTMENT CONTROLS (FF1200 SHOWN)

4.3.3 Adjust the machine settings

Do the following to manually adjust the cutting tool position or angle:

1. Disengage the feed (see Figure 4-5).
2. Stop the and lock out the machine (see Section 4.3.2).
3. Manually adjust the cutting tool position or angle (see Section 3.4 on page 44).

⚠ WARNING

Do not attempt to manually adjust the cutting tool angle or change the feed box settings during operation. Attempting to operate the feed box controls by hand or with hand tools while the machine is running may result in severe injury.

5 MAINTENANCE AND TROUBLESHOOTING

IN THIS CHAPTER:

5.1 Maintenance checklist

Maintenance intervals and their associated tasks are listed in Table 5-1.

Table 5-1. Maintenance intervals and tasks

Interval	Task	Section ref.
Before each use	Check the pneumatic conditioning unit (PCU) oil reservoir level and particulate filter trap.	Section 5.3.1 on page 61
	Check air lines for damage and wear.	--
	Check the cutting tool for sharpness. Replace as necessary.	Section 3.3.7 on page 42
	Perform a PCU drop-out circuit check.	Section 5.3.2 on page 61
Before and after each use	Remove debris, oil, and moisture from machine surfaces.	--
Every ten operation cycles	Lubricate the radial and axial feed dovetail ways.	Section 5.3.4 on page 61
	Lubricate the rotational drive unit (RDU) bearing.	Section 5.3.5 on page 62

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.

⚠ CAUTION

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

TABLE 5-2. APPROVED LUBRICANTS

Application Area	Lubricant	Biodegradable Lubricant	Viscosity (cSt)	Quantity	Frequency
Daily					
Rectangular & dovetail ways[a]	Mobil Vactra Oil Heavy Medium	N/A	>68 @ 40C	As required	Daily during machine use
Each use					
Pneumatic conditioning unit	Unax AW 32	N/A	22-68 @ 40°C 4.3-8.7 @ 100°C	Refill oil lubricator	Each use
Unpainted Surfaces	LPS1 or LPS2	N/A	38 @ 25C	As required	Each use, and before storage
Weekly					
Lead screw on single point tool head	-NOOK E-100 spray lube -NOOK PAG-1 grease	CASTROL BioTac EP 2	96 @ 40C 113 @ 100C	Light coating applied by hand or spray	Weekly during machine use
Chuck jacking screws	Moly Grade Anti-Seize	N/A	N/A	1 cc per screw	Weekly during machine use, and before storage
Yearly					
Main bearing	Mobilith SHC 460	N/A	414 @ 40C 47 @ 100C	24 cc	Once per year

a. Use highly anti-corrosive, refined mineral or synthetic oil that forms a strong oil film and is not easily emulsified or washed away by coolant. Hydraulic oils are typically not suitable for slide way lubrication.

5.3 MAINTENANCE TASKS

Maintenance tasks are described in the following sections.

5.3.1 Check the PCU oil reservoir and particulate filter trap

Do the following to check the PCU oil reservoir and particulate filter trap, referring to Figure 2-6 on page 14:

1. Check the PCU oil reservoir sight glass. Refill as necessary.
2. Check the PCU particulate filter trap sight glass. Empty as necessary.

5.3.2 PCU drop-out circuit check

The PCU drop-out circuit prevents the machine from restarting unexpectedly after air supply to the PCU is lost and restored.

Do the following to check the PCU drop-out circuit:

1. Check that the PCU is connected to a shop air supply and the FF1200-FF2400-FF3600.
2. Check that the air-supply lock-out is open (pulled up) (Figure 2-6 on page 14).
3. Press the START button.
4. Slowly open the PCU speed adjustment valve until the rotary drive engages.
5. Close (press down) the lock-out valve.
6. Check that the FF1200-FF2400-FF3600 stops.
7. Open the lock-out valve.
8. Verify that the machine does not start.

5.3.3 Emergency stop test

Do the following to test the emergency stop:

1. With the machine running, press the emergency stop button.
2. Make sure the machine stops.
3. Reset the emergency stop by pulling the button up.
4. Make sure the machine does not re-start.

5.3.4 Dovetail ways

5.3.4.1 Radial dovetail ways

Do the following to maintain the radial dovetail ways:

1. On the slide assembly, use the feed box controls to move the tool head to one end of the radial feed track.

2. Wipe down the exposed dovetail ways and lubricate them with Mobil VACTRA medium heavy way oil or equivalent.
3. Move the tool head assembly to the other end of the radial feed track.
4. Wipe down the remaining exposed dovetail ways and lubricate them with Mobil VACTRA medium heavy way oil or equivalent.

5.3.4.2 Axial dovetail ways

Do the following to maintain the axial dovetail ways:

1. On the slide assembly, use the feed box controls to move the tool slide to one end of the axial feed track.
2. Wipe down the exposed dovetail ways and lubricate them with Mobil VACTRA medium heavy way oil or equivalent.
3. Move the tool slide to the other end of the axial feed track.
4. Wipe down the remaining exposed dovetail ways and lubricate them with Mobil VACTRA medium heavy way oil or equivalent.

5.3.5 Lubricate the RDU bearing

On the outside surface of the RDU, lubricate the bearing at the grease fitting under the handle (Figure 5-1) with 1.5 in^3 (24 mL) of Mobil Mobilith SHC 460 grease or equivalent.

NOTICE

Do not over-lubricate the RDU bearing. Excess lubrication could leak from the bearing space and damage the rotary drive belt.

FIGURE 5-1. RDU BEARING GREASE FITTING

5.4 RESETTING THE CAM ARM

The feed box on the slide assembly is designed to prevent damage to the tool if it is fed into the workpiece or part of the machine.

If the feed force is too great, then the cam arm that transfers motion from the cam to the feed box, will slip on the shaft and prevent the tool from advancing. The cam key on the top of the feed box will still turn because of the spring mechanism and the clutch bearings system.

The key will eventually turn into the feed direction knob and stop advancing. Once this happens, the FF1200-FF2400-FF3600 will not be able to feed the tool, regardless of the cutting resistance.

Do the following to readjust the feed box so that it is operational:

1. Loosen the clamp screw on the cam arm, using a 3mm Allen wrench, shown in Figure 5-2.

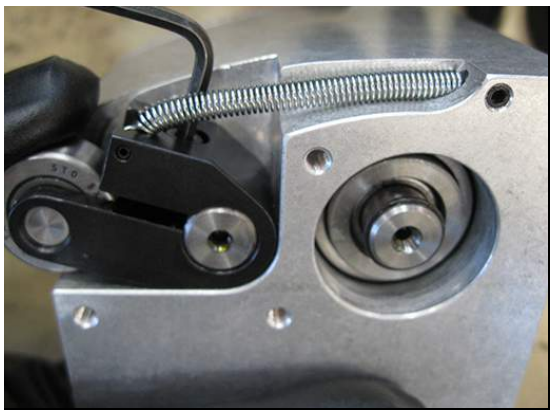

FIGURE 5-2. CAM ARM CLAMP SCREW

2. Adjust the key and cam arm so that they are positioned as shown to the right, Figure 5-3. This position will allow the key to advance as the cam arm slips, as the cam arm clamp screw is adjusted to the correct torque value.
3. Tighten the cam arm clamp screw so that it is moderately tight.

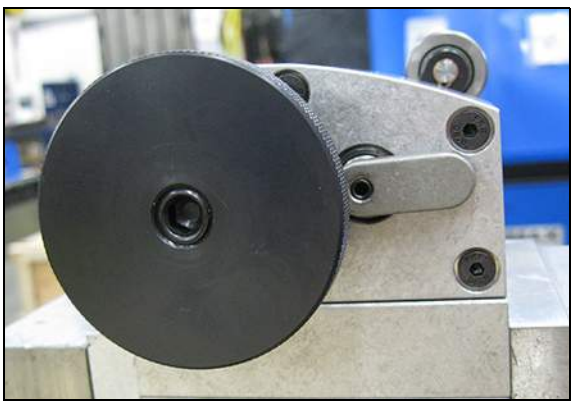

FIGURE 5-3. CAM ARM AND KEY POSITION

4. Adjust the cam arm clamp screw until the cam arm slips on the shaft between 150–160 in-lbs (16.9–18.1 Nm) applied clockwise on the large knurled knob, shown in Figure 5-4.
5. If this must be done in the field and a torque wrench is not available, tighten the cam arm clamp screw to about 10 in-lbs (1.1 Nm) for a temporary fix. Do not tighten the clamp screw past this value or the tool may be damaged during operation.

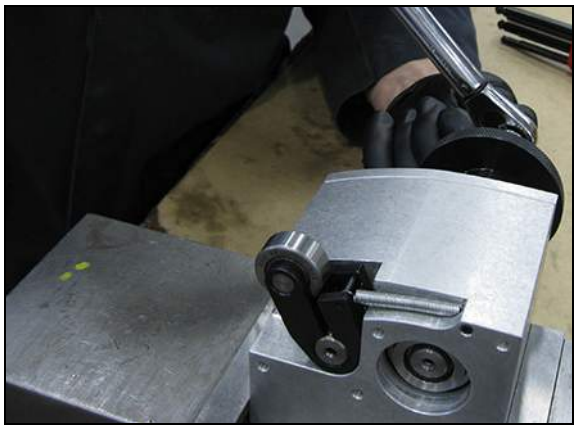

FIGURE 5-4. ADJUSTING CAM ARM SCREW TO CORRECT TORQUE VALUE

6. After correctly adjusting the torque value of cam arm clamp screw, turn the feed knob until the cam slips and is aligned with the cam key, as shown in Figure 5-5.

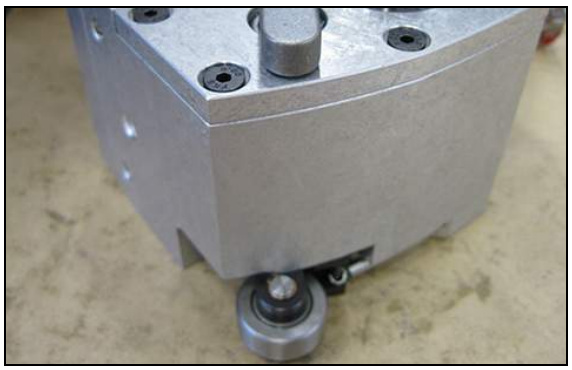

FIGURE 5-5. CAM ARM AND KEY OPERATIONAL ALIGNMENT

5.5 TROUBLESHOOTING

This section is intended to help you solve basic machine performance problems. For serious maintenance or if you have questions on the following procedures, contact CLIMAX.

5.5.1 The machine isn't turning

If the machine is not rotating, check the following:

1. The power source is connected and energized.
2. The emergency stop is reset (Section 4.3.1 on page 56 and Section 5.3.3 on page 61).
3. The air regulator is open and not broken (Figure 4-4 on page 57).
4. There is air pressure entering and leaving the PCU. Check the air pressure by disconnecting the hose quick disconnects and checking for air bleed (Figure 4-4 on page 57).

5. All the valves are open (Figure 4-4 on page 57).
6. All the quick disconnects are fully engaged (Figure A-1 on page 72 through Figure A-1 on page 72, depending on the machine model, and Figure A-24 on page 95).
7. Check machine movement by first making sure that the power to the machine drive is isolated and locked out, then by manually rotating the machine using the handles on the turning arm.

5.5.2 The machine bearing is overheating

If the bearing temperature rises significantly (that is, more than approximately 15ºF [10ºC] above the ambient temperature), check that the machine is chucked correctly (Section 3.3.2 on page 29), including chucking to the torque value in multiple smaller steps to maintain bearing roundness.

⚠ WARNING

Do not run the machine if the bearing temperature rises significantly (that is, more than approximately 15ºF [10ºC] above the ambient temperature), as the bearing may expand thermally and fall off the workpiece.

5.5.3 The machine isn't feeding

If the machine isn't feeding properly, check the following:

1. The feed is engaged (see Section 4.3.3 on page 58).
2. The leadscrew and hex shaft are free to turn in the desired directions.

5.5.4 The machine is performing poorly

If the machine is performing poorly, check the following:

1. The tool is installed correctly (see Section 3.3.7 on page 42).
2. The machine is tight to workpiece (see Section 3.3.5 on page 32).
3. The turning arm clamp screws are tight (see Section 3.3.7 on page 42).
4. The gib screws on the radial and axial slides are adjusted correctly (see Section 3.4.1 on page 45 and Section 4.1.2 on page 54).
5. The tool swivel is tight (see Section 3.3.7 on page 42).
6. The cutting tool or insert is sharp and has the correct geometry for the material and type of cut.
7. The speed and feed rates are set correctly. If necessary, experiment with different speeds and feed rates. Typically, slower speeds and shallower cuts produce less tool chatter.

5.5.5 The machine isn’t cutting flat

If the machine is not cutting flat, do the following:

1. Before making a critical finish pass, run the machine continuously for at least 15 minutes to make sure that the machine is warmed up to operating temperature.
2. Check the machine for level (see Section 3.3.5.1 on page 39).
3. Tram the turning arm, as necessary (see Section 3.4.2 on page 45).

6 STORAGE AND SHIPPING

IN THIS CHAPTER:

6.1 SHORT-TERM STORAGE

Do the following for short-term storage:

1. Retract the tool head from the work piece.
2. Remove the tooling.
3. Remove hoses.
4. Remove the machine from the work piece.
5. Clean the machine to remove dirt, grease, metal chips, and moisture. Make sure the machine is free from dirt, grease, chips, and other debris before storage.
6. Apply a moisture preventative material to unpainted surfaces (LPS-2 for short-term storage, LPS-3 for long-term storage) to prevent corrosion.
7. Store the machine in a stable position on a stand or in storage container a according to your company policies.
8. Store the FF1200-FF2400-FF3600 in its original shipping box.

6.2 LONG-TERM STORAGE

Do the following for long-term storage:

1. Follow short-term storage instructions.
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 < 70ºF and humidity < 50%.

6.3 SHIPPING

The FF1200-FF2400-FF3600 can be shipped in its original shipping container (see Figure 6-1, Figure 6-2, and Figure 6-3).

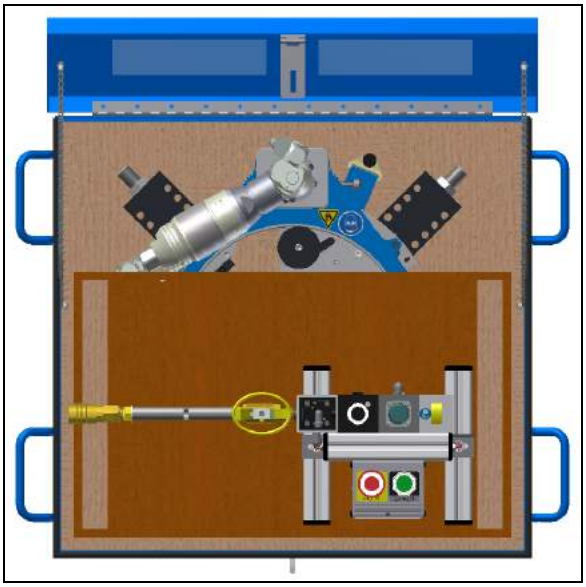

FIGURE 6-1. FF1200 SHIPPING CONTAINER

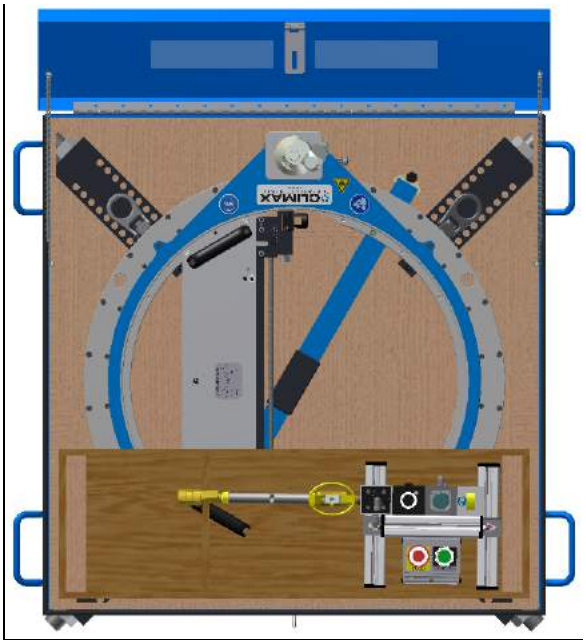

FIGURE 6-2. FF2400 SHIPPING CONTAINER

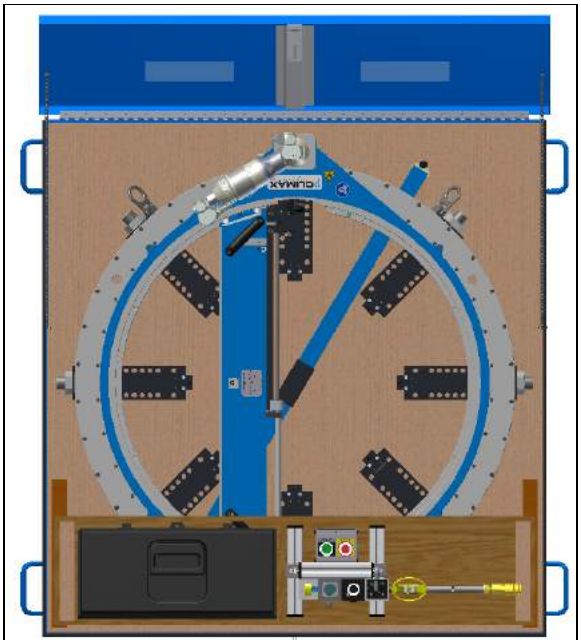

FIGURE 6-3. FF3600 SHIPPING CONTAINER

6.4 DECOMMISSIONING

To decommission the FF1200-FF2400-FF3600 before disposal, remove the drive assembly from the RDU and dispose of the drive assembly separately from the rest of the machine components. Refer to Appendix A for component assembly information.

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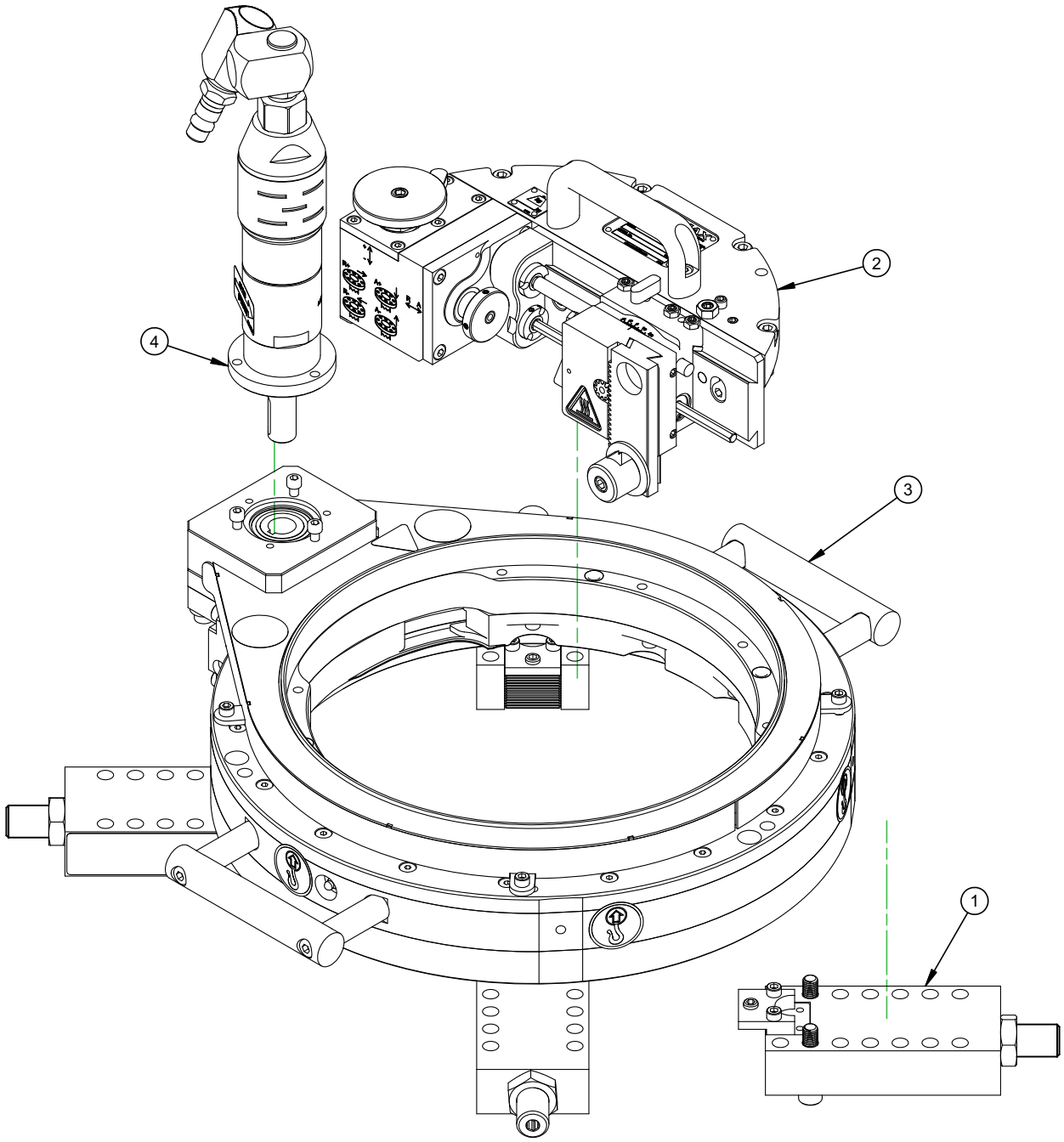
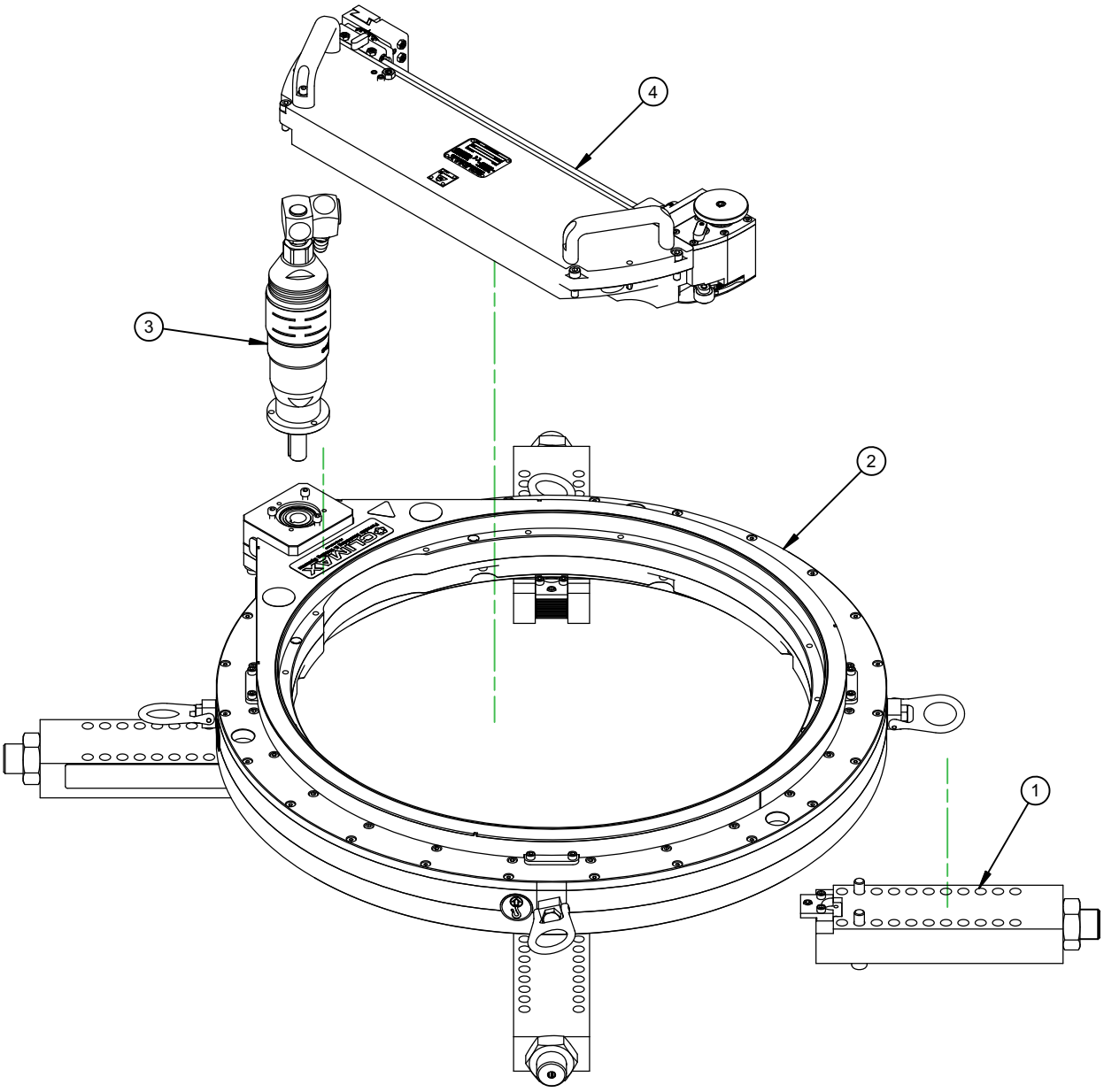
APPENDIX A ASSEMBLY DRAWINGS

Drawing list



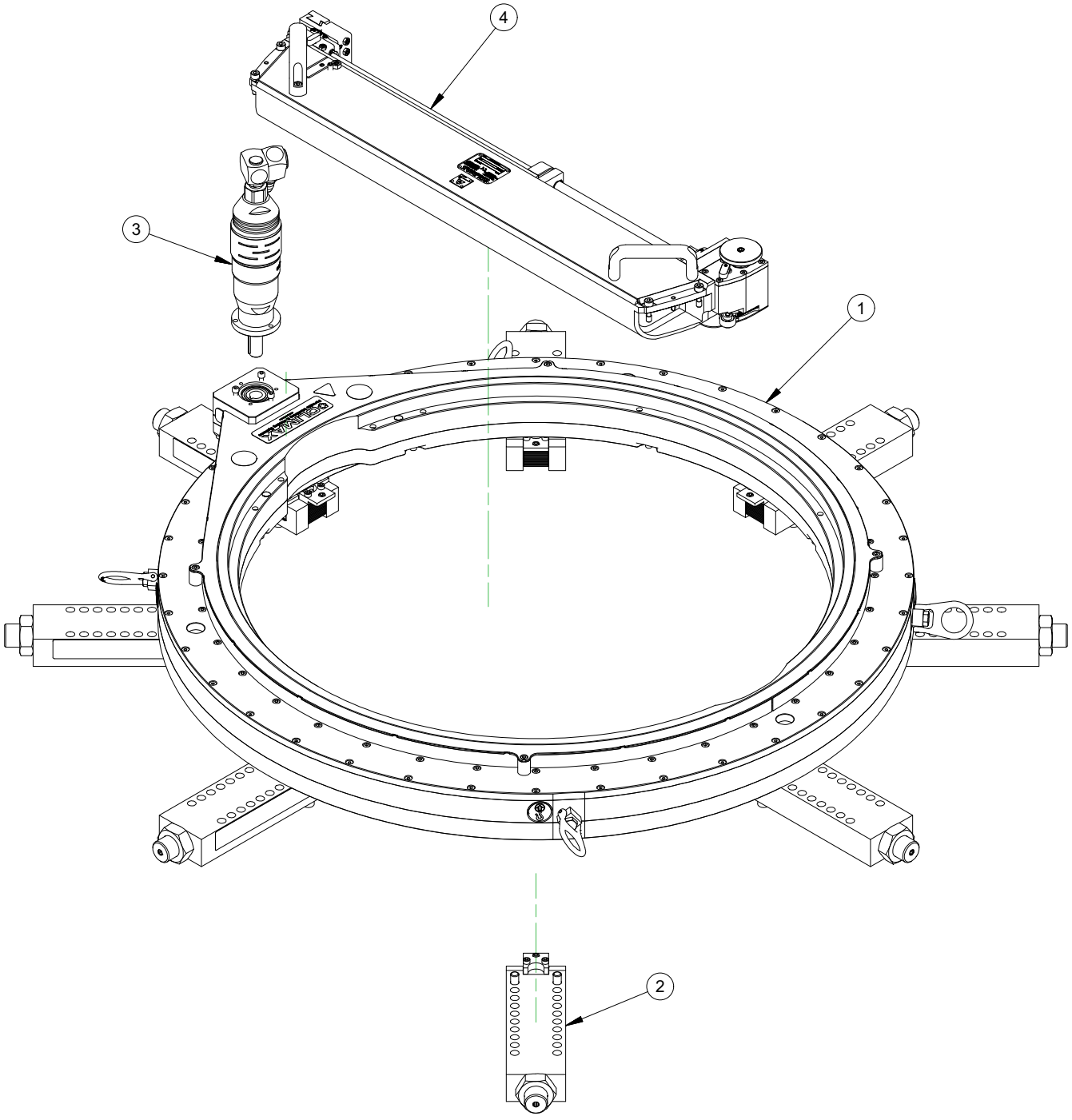
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	78911	ASSY CHUCK FOOT 12
2	1	79192	ASSY RADIAL AND AXIAL SLIDE
3	1	79752	ASSY RDU 0-12 INCH OD FF
4	1	80570	ASSY MOTOR AIR 1.07HP STRAIGHT

FIGURE A-1. FF1200 PRINCIPAL COMPONENTS



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	78979	ASSY CHUCK FOOT 24
2	1	79903	ASSY RDU 0-24 INCH OD FF
3	1	80632	ASSY MOTOR AIR 2.2HP STRAIGHT
4	1	80683	ASSY AXIAL RADIAL & AXIAL SLIDE 0-24

FIGURE A-2. FF2400 PRINCIPAL COMPONENTS



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	80017	ASSY RDU 0-36 INCH
2	8	80097	ASSY CHUCK FOOT 36
3	1	80632	ASSY MOTOR AIR 2.2HP STRAIGHT
4	1	80702	ASSY AXIAL & RADIAL SLIDE 0-36 INCH

FIGURE A-3. FF3600 PRINCIPAL COMPONENTS

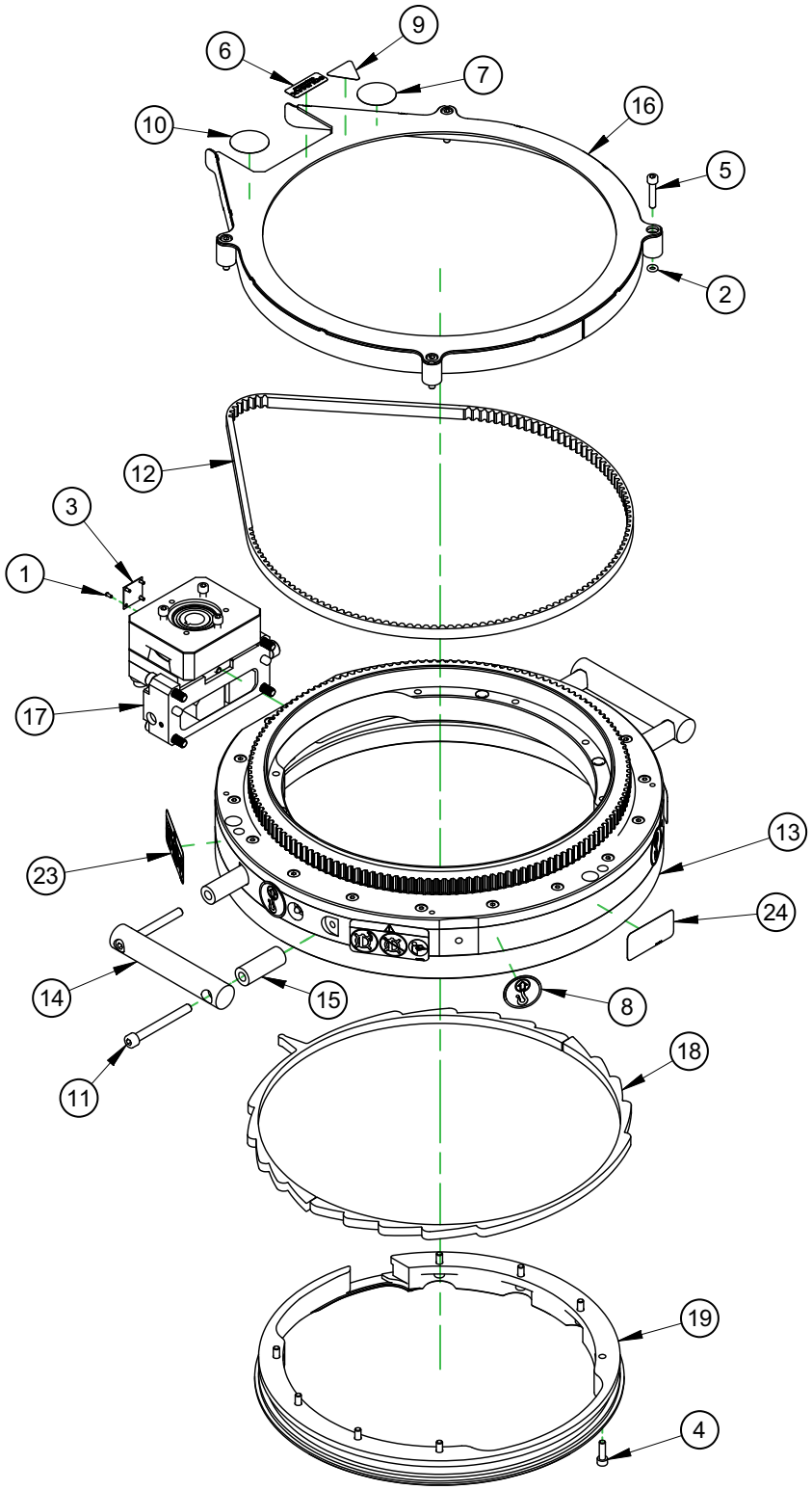


FIGURE A-4. FF1200 ROTATIONAL DRIVE UNIT ASSEMBLY (P/N 79752)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
2	4	13622	RING O 3/32 X 7/32 ID X 13/32 OD
3	1	29152	PLATE MASS CE
4	8	35009	SCREW M6 X 1.0 X 20 SHCS
5	4	35505	SCREW M6 X 1.0 X 30 SHCS
6	1	56300	LABEL CLIMAX LOGO .66 X 1.75
7	1	59035	LABEL WARNING - WEAR EYE PROTECTION
8	6	59039	LABEL WARNING LIFT POINT ROUND 1.5"
9	1	59042	LABEL WARNING - HAND CRUSH/MOVING PARTS
10	1	59044	LABEL WARNING - CONSULT OPERATOR'S MANUAL
11	4	59998	SCREW M8 X 1.25 X 75 MM SHCS
12	1	74581	BELT POLYCHAIN 8MM PITCH X 12MM WIDE X 160 TEETH
13	1	78999	BRG SLEWING ASSY 0-12 IN
14	2	79746	HANDLE BAR
15	4	79747	HANDLE TUBE
16	1	79748	WELDMENT BELT GUARD 0-12 OD FF
17	1	79749	ASSY DRIVE WITH FEED CONTROL
18	1	79758	CAM SET 0-12 INCH
19	1	80541	CAM GUARD 0-12
24	1	84645	LABEL DANGER - DO NOT RUN IF HOT 2.5 X 1.25
23	4	84856	LABEL DANGER - ODFF TETHER MACHINE BEFORE USE

FIGURE A-5. FF1200 ROTATIONAL DRIVE UNIT ASSEMBLY PARTS LIST (P/N 79752)

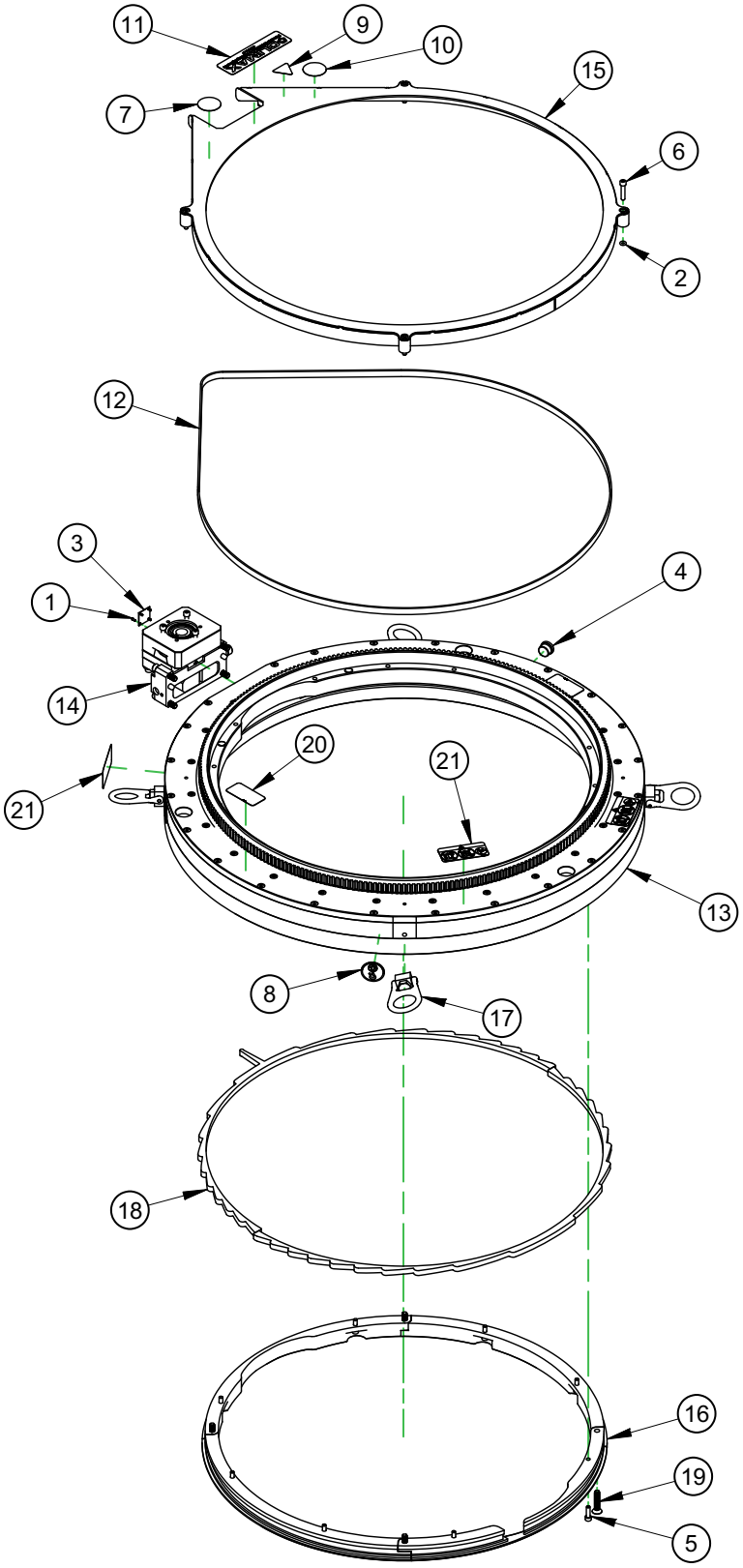


FIGURE A-6. FF2400 ROTATIONAL DRIVE UNIT ASSEMBLY (P/N 79903)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
2	4	13622	RING O 3/32 X 7/32 ID X 13/32 OD
3	1	29152	PLATE MASS CE
4	1	32862	FTG PLUG 3/4-16 SAE O-RING INTERNAL SOCKET HEAD STEEL
5	8	35009	SCREW M6 X 1.0 X 20 SHCS
6	4	35505	SCREW M6 X 1.0 X 30 SHCS
7	1	59035	LABEL WARNING - WEAR EYE PROTECTION
8	4	59039	LABEL WARNING LIFT POINT ROUND 1.5"
9	1	59042	LABEL WARNING - HAND CRUSH/MOVING PARTS
10	1	59044	LABEL WARNING - CONSULT OPERATOR'S MANUAL
11	1	70226	LABEL CLIMAX LOGO 1.5 X 5.5
12	1	75520	BELT POLYCHAIN 8mm PITCH X 12mm WIDE X 280 TEETH
13	1	79647	BRG SLEWING ASSY 0-24 IN
14	1	79749	ASSY DRIVE WITH FEED CONTROL
15	1	79805	WELDMENT BELT GUARD 0-24
16	1	79902	CAM GUARD 0-24
17	4	80371	HOIST RING M8 X 1.25 X 12.5MM 38.1 ID 57.2 OD 102.3 OAL 880 LBS 400 KG SWIVEL
18	1	80709	CAM SET 0-24 INCH
19	4	84503	SCREW M8 X 1.25 X 40MM FHSCS
20	2	84645	LABEL DANGER - DO NOT RUN IF HOT 2.5 X 1.25
21	4	84856	LABEL DANGER - ODFF TETHER MACHINE BEFORE USE

FIGURE A-7. FF2400 ROTATIONAL DRIVE UNIT ASSEMBLY PARTS LIST (P/N 79903)

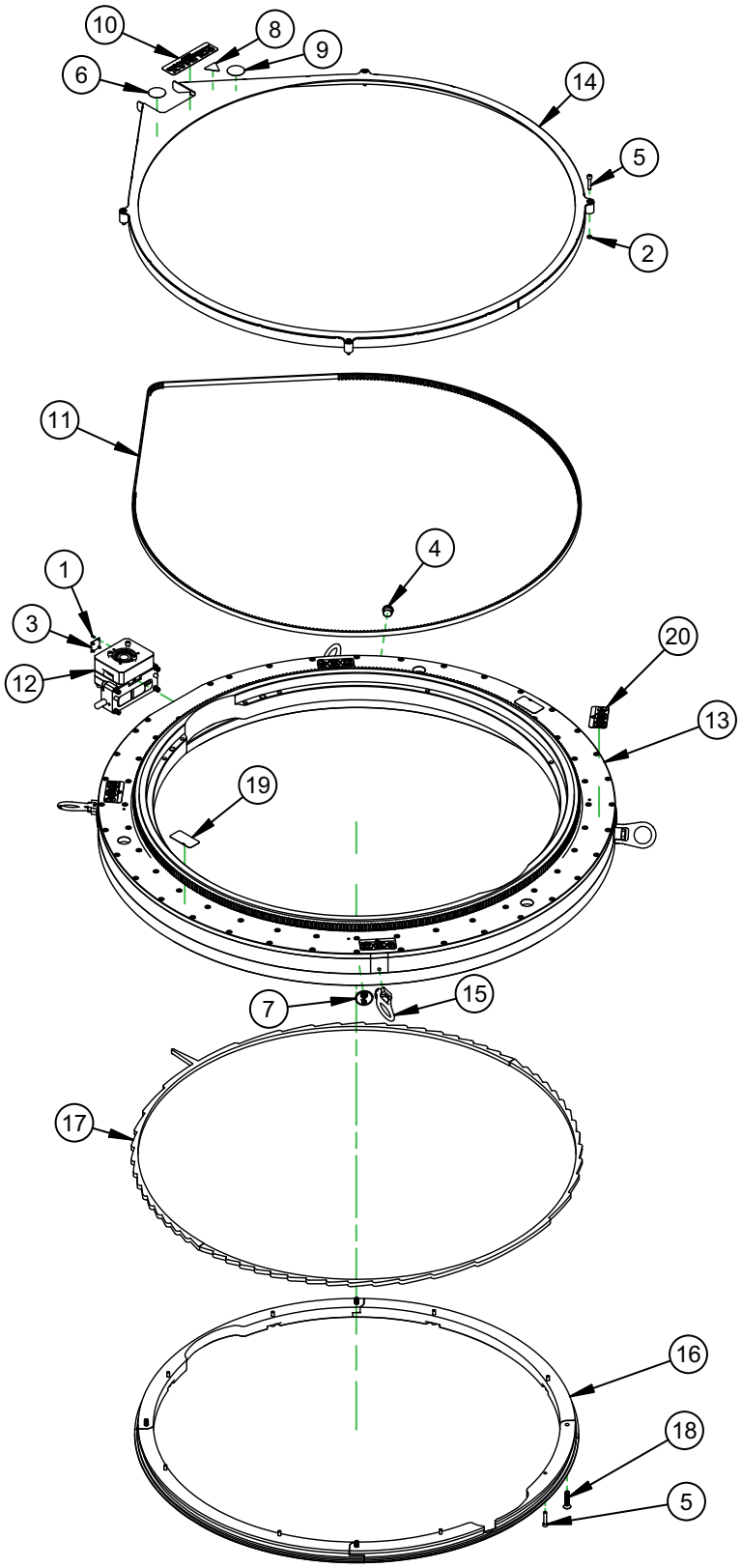
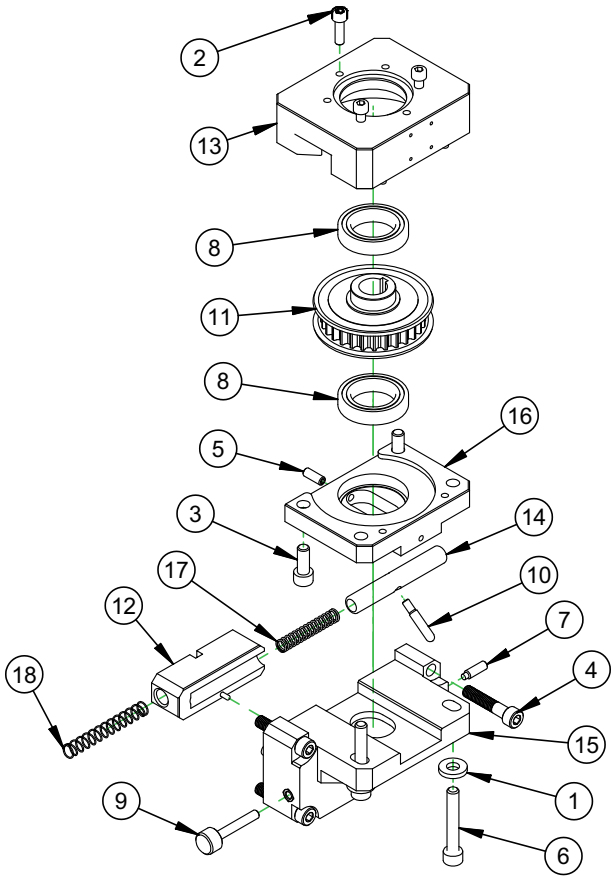


FIGURE A-8. FF3600 ROTATIONAL DRIVE UNIT ASSEMBLY (P/N 80017)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
2	4	13622	RING O 3/32 X 7/32 ID X 13/32 OD
3	1	29152	PLATE MASS CE
4	1	32862	FTG PLUG 3/4-16 SAE O-RING INTERNAL SOCKET HEAD STEEL
5	12	35505	SCREW M6 X 1.0 X 30 SHCS
6	1	59035	LABEL WARNING - WEAR EYE PROTECTION
7	4	59039	LABEL WARNING LIFT POINT ROUND 1.5"
8	1	59042	LABEL WARNING - HAND CRUSH/MOVING PARTS
9	1	59044	LABEL WARNING - CONSULT OPERATOR'S MANUAL
10	1	70226	LABEL CLIMAX LOGO 1.5 X 5.5
11	1	76006	BELT POLYCHAIN 8MM PITCH X 12MM WIDE X xxx TEETH
12	1	79749	ASSY DRIVE WITH FEED CONTROL
13	1	79924	BRG SLEWING ASSY 0-36 IN
14	1	80018	WELDMENT BELT GUARD 0-12 OD FF
15	4	80371	HOIST RING M8 X 1.25 X 12.5MM 38.1 ID 57.2 OD 102.3 OAL 880 LBS 400 KG SWIVEL
16	1	80707	CAM GUARD 0-36
17	1	80708	CAM SET 0-36 INCH
18	4	84503	SCREW M8 X 1.25 X 40MM FHSCS
19	2	84645	LABEL DANGER - DO NOT RUN IF HOT 2.5 X 1.25
20	4	84856	LABEL DANGER - ODFF TETHER MACHINE BEFORE USE

FIGURE A-9. FF3600 ROTATIONAL DRIVE UNIT ASSEMBLY PARTS LIST (P/N 80017)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	21798	WASHER 5/16 FLTW HARDENED
2	3	35009	SCREW M6 X 1.0 X 20 SHCS
3	2	50458	SCREW M8 X 1.25 X 20mm SHCS
4	4	61225	SCREW M8 X 1.25 X 40MM SHCS
5	1	68514	SCREW M6 X 1.0 X 16MM SSSFP
6	2	72753	SCREW M8 X 1.25 X 50MM SHCS
7	1	74296	SCREW M6 X 1.0 X 20MM SSSDPPL
8	2	76242	BRG BALL 1.1811 ID X 1.8504 OD X .3543 2 SEALS
9	1	76599	SCREW M6 X 1.0 X 40MM KNURLED HEAD
10	1	76601	PIN LOCATING 6MM OD X 20MM X M5 X .8 THREAD
11	1	77277	PULLEY POLYCHAIN 8mm PITCH X 12mm WIDE X 28 TEETH
12	1	79753	BLOCK CAM ACTUATOR
13	1	79754	BLOCK CUP BEARING
14	1	79755	LATCH BOLT CAM ACTUATOR
15	1	79756	MOTOR MOUNT FOR PULLEY SUPPORT
16	1	79757	PLATE PULLEY
17	1	79917	SPRING COMP .36 OD X .042 WIRE X 2 LONG
18	1	79918	SPRING COMP .39 OD X .027 WIRE X 2.76 LG 1.14 LBS/IN

FIGURE A-10. RDU DRIVE WITH FEED CONTROL ASSEMBLY (P/N 79749)

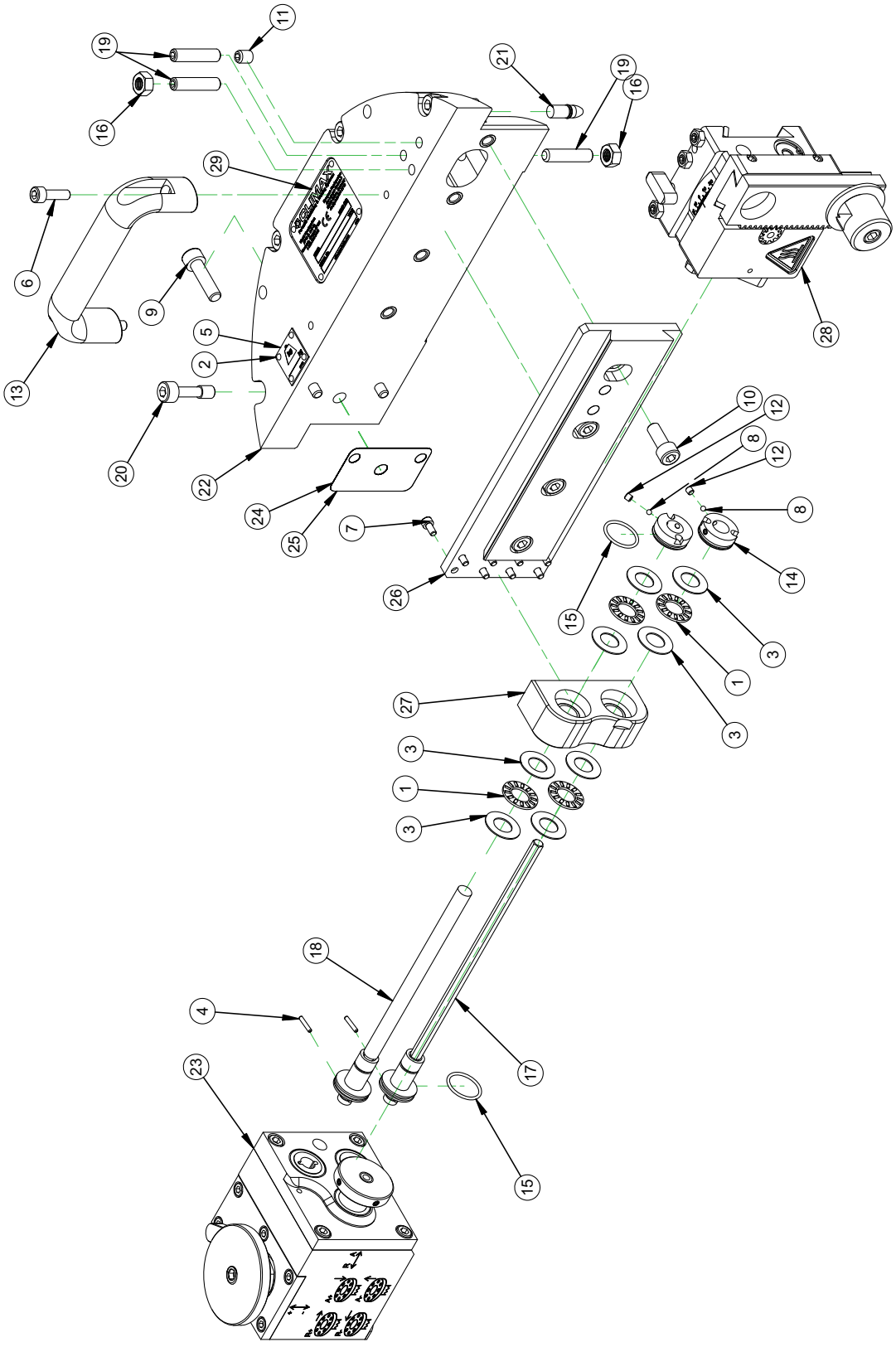


FIGURE A-11. FF1200 RADIAL AND AXIAL SLIDE ASSEMBLY (P/N 79192)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10437	BRG THRUST .500 ID X .937 OD X .0781
2	8	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
3	8	11736	WASHER THRUST .500 ID X .937 OD X .030
4	2	14315	PIN DOWEL 3/32 DIA X 1/2
5	1	29152	PLATE MASS CE
6	2	35009	SCREW M6 X 1.0 X 20 SHCS
7	8	35910	SCREW M4 X 0.7 X 8MM SHCS
8	4	43489	BALL NYLON 1/8 DIA
9	1	45530	SCREW M8 X 1.25 X 30mm SHCS
10	4	50458	SCREW M8 X 1.25 X 20mm SHCS
11	1	51261	SCREW M8 X 1.25 X 10 SSSFP
12	4	53365	SCREW M4 X 0.7 X 4 mm SSSFP
13	1	53462	HANDLE PULL 1/4 CBORE MTG 2.0 X 5.12 X 1.02W PLASTIC COATED
14	2	57214	BRG RETAINING NUT AXIAL FEED LEADSCREW
15	4	57320	RING O 1/16 X 13/16 ID X 15/16 OD
16	2	67546	NUT M8 X 1.25 STDN ZINC PLATED
17	1	74228	DRIVE SHAFT AXIAL FEED 0-12 INCHES
18	1	74231	LEADSCREW RADIAL FEED 0-12 INCH
19	3	74291	SCREW M8 X 1.25 X 35 SSSFP
20	4	74632	SCREW M8 X 1.25 X 30 OAL X 10 THD L STAINLESS
21	2	75339	PIN DOWEL - BULLET NOSE .3125 OD
22	1	79193	MOUNT SLIDE
23	1	79194	ASSY FEED BOX
24	3	79250	SHIM FEEDBOX MOUNTING .005 SS
25	3	79251	SHIM FEEDBOX MOUNTING .002 SS
26	1	79256	SLIDE DOVETAIL 3 IN WIDE X 7.63 IN LONG
27	1	79257	BEARING BLOCK DUAL LEADSCREW
28	1	80407	ASSY TOOL HEAD
29	1	80682	PLATE SERIAL YEAR MODEL MASS CE 2.0 X 2.63

FIGURE A-12. FF1200 RADIAL AND AXIAL SLIDE ASSEMBLY PARTS LIST (P/N 79192)

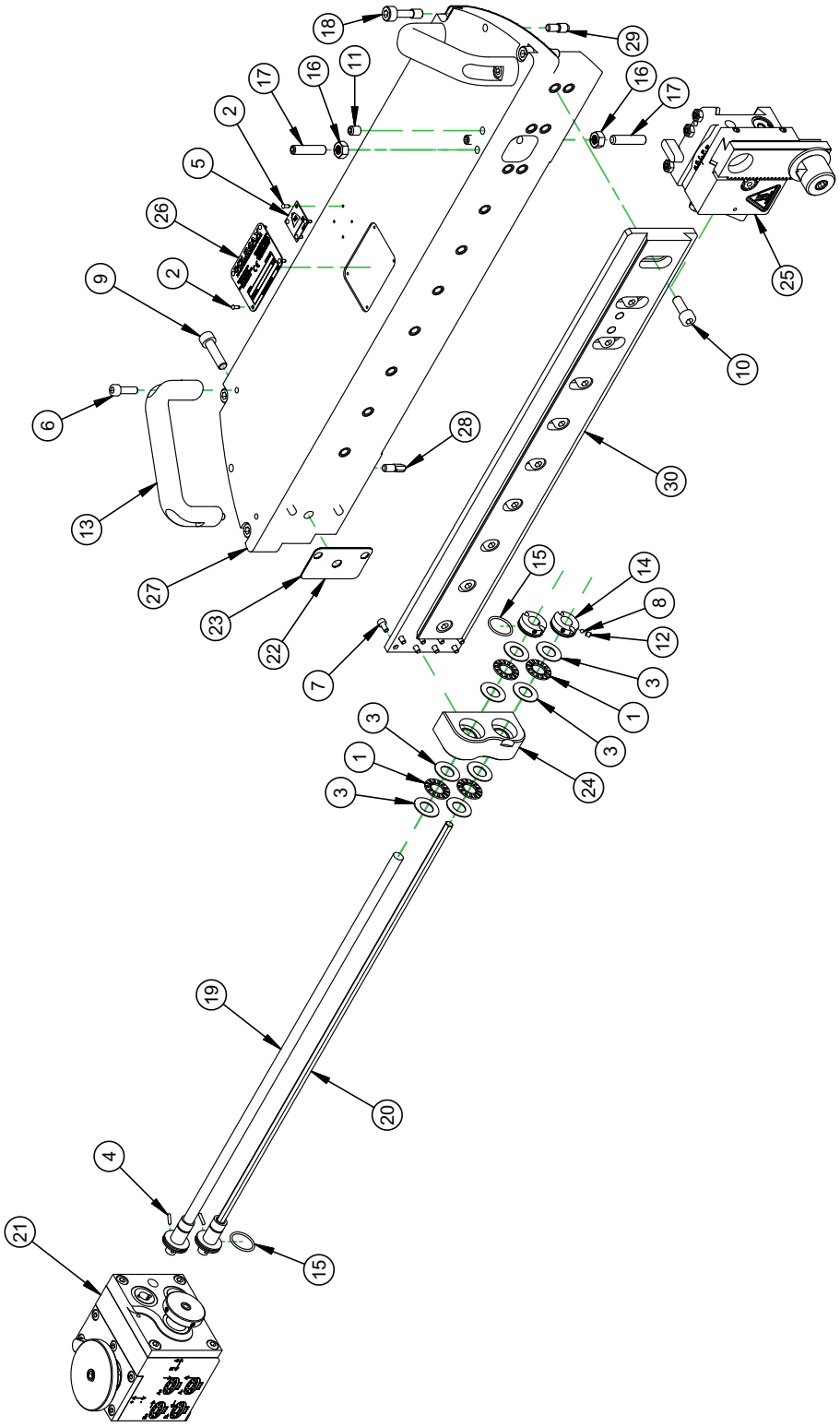


FIGURE A-13. FF2400 RADIAL AND AXIAL SLIDE ASSEMBLY (P/N 80683)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10437	BRG THRUST .500 ID X .937 OD X .0781
2	8	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
3	8	11736	WASHER THRUST .500 ID X .937 OD X .030
4	2	14315	PIN DOWEL 3/32 DIA X 1/2
5	1	29152	PLATE MASS CE
6	4	35009	SCREW M6 X 1.0 X 20 SHCS
7	8	35910	SCREW M4 X 0.7 X 8MM SHCS
8	4	43489	BALL NYLON 1/8 DIA
9	1	45530	SCREW M8 X 1.25 X 30mm SHCS
10	10	50458	SCREW M8 X 1.25 X 20mm SHCS
11	1	51261	SCREW M8 X 1.25 X 10 SSSFP
12	4	53365	SCREW M4 X 0.7 X 4 mm SSSFP
13	2	53462	HANDLE PULL 1/4 CBORE MTG 2.0 X 5.12 X 1.02W PLASTIC COATED
14	2	57214	BRG RETAINING NUT AXIAL FEED LEADSCREW
15	4	57320	RING O 1/16 X 13/16 ID X 15/16 OD
16	2	67546	NUT M8 X 1.25 STDN ZINC PLATED
17	3	74291	SCREW M8 X 1.25 X 35 SSSFP
18	4	74632	SCREW M8 X 1.25 X 30 OAL X 10 THD L STAINLESS
19	1	75302	LEADSCREW RADIAL FEED 0-24 & 36 INCH
20	1	75303	DRIVE SHAFT 0-24 & 36 INCH
21	1	79194	ASSY FEED BOX
22	3	79250	SHIM FEEDBOX MOUNTING .005 SS
23	3	79251	SHIM FEEDBOX MOUNTING .002 SS
24	1	79257	BEARING BLOCK DUAL LEADSCREW
25	1	80407	ASSY TOOL HEAD
26	1	80682	PLATE SERIAL YEAR MODEL MASS CE 2.0 X 2.63
27	1	80685	MOUNT SLIDE 0-24
28	1	80697	PIN DIAMOND LOCATOR 5/16 DIA X 7/8 L
29	1	80698	PIN LOCATOR 5/16 DIA X 7/8 L
30	1	80700	SLIDE DOVETAIL 0-24 IN

FIGURE A-14. FF2400 RADIAL AND AXIAL SLIDE ASSEMBLY PARTS LIST (P/N 80683)

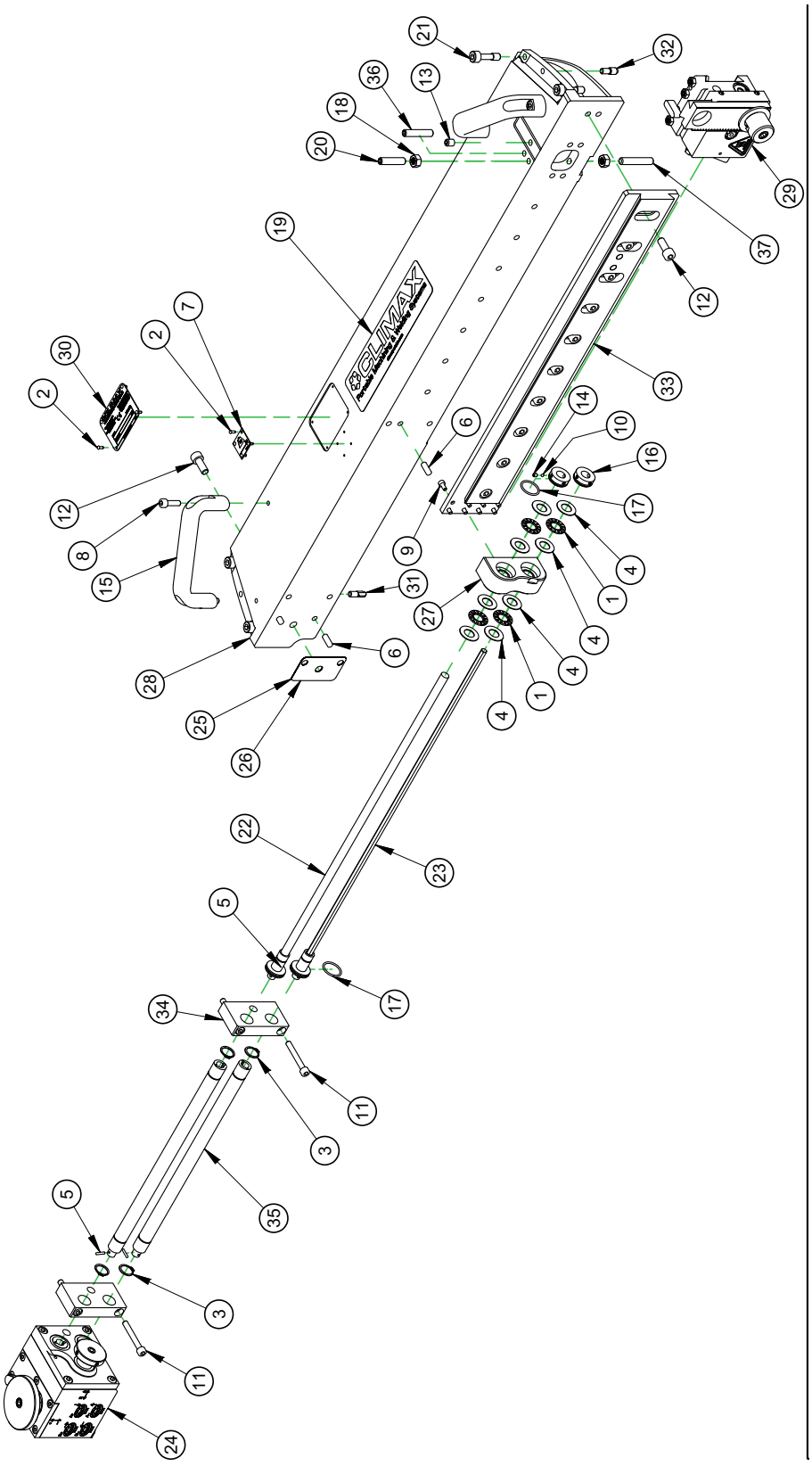


FIGURE A-15. FF3600 RADIAL AND AXIAL SLIDE ASSEMBLY (P/N 80702)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	4	10437	BRG THRUST .500 ID X .937 OD X .0781
2	8	10588	SCREW DRIVE #2 x 1/4 HOLE SIZE .089
3	4	11019	RING SNAP 5/8 OD X .035 THICK
4	8	11736	WASHER THRUST .500 ID X .937 OD X .030
5	4	14315	PIN DOWEL 3/32 DIA X 1/2
6	3	15756	PIN DOWEL 1/4 DIA X 5/8
7	1	29152	PLATE MASS CE
8	4	35009	SCREW M6 X 1.0 X 20 SHCS
9	8	35910	SCREW M4 X 0.7 X 8MM SHCS
10	4	43489	BALL NYLON 1/8 DIA
11	4	43815	SCREW M6 X 1.0 X 45mm SHCS
12	11	50458	SCREW M8 X 1.25 X 20mm SHCS
13	1	51261	SCREW M8 X 1.25 X 10 SSSFP
14	5	53365	SCREW M4 X 0.7 X 4 mm SSSFP
15	2	53462	HANDLE PULL 1/4 CBORE MTG 2.0 X 5.12 X 1.02W PLASTIC COATED
16	2	57214	BRG RETAINING NUT AXIAL FEED LEADSCREW
17	4	57320	RING O 1/16 X 13/16 ID X 15/16 OD
18	2	67546	NUT M8 X 1.25 STDN ZINC PLATED
19	1	70227	LABEL CLIMAX LOGO 2 X 8
20	1	74291	SCREW M8 X 1.25 X 35 SSSFP
21	4	74632	SCREW M8 X 1.25 X 30 OAL X 10 THD L STAINLESS
22	1	75302	LEADSCREW RADIAL FEED 0-24 & 36 INCH
23	1	75303	DRIVE SHAFT 0-24 & 36 INCH
24	1	79194	ASSY FEED BOX
25	3	79250	SHIM FEEDBOX MOUNTING .005 SS
26	3	79251	SHIM FEEDBOX MOUNTING .002 SS
27	1	79257	BEARING BLOCK DUAL LEADSCREW
28	1	80270	WELDMENT MOUNT SLIDE 0-36 INCH
29	1	80407	ASSY TOOL HEAD
30	1	80682	PLATE SERIAL YEAR MODEL MASS CE 2.0 X 2.63
31	1	80697	PIN DIAMOND LOCATOR 5/16 DIA X 7/8 L
32	1	80698	PIN LOCATOR 5/16 DIA X 7/8 L
33	1	80700	SLIDE DOVETAIL 0-24 IN
34	2	80705	CARRIER BLOCK FEED SHAFTS 0-36 INCH
35	2	80706	SHAFT DRIVER RECIEVER 0-36 INCH
36	1	81228	SCREW M8 X 1.25 X 40 SSSFP
37	1	81229	SCREW M8 X 1.25 X 45 SSSFP

FIGURE A-16. FF3600 RADIAL AND AXIAL SLIDE ASSEMBLY PARTS LIST (P/N 80702)

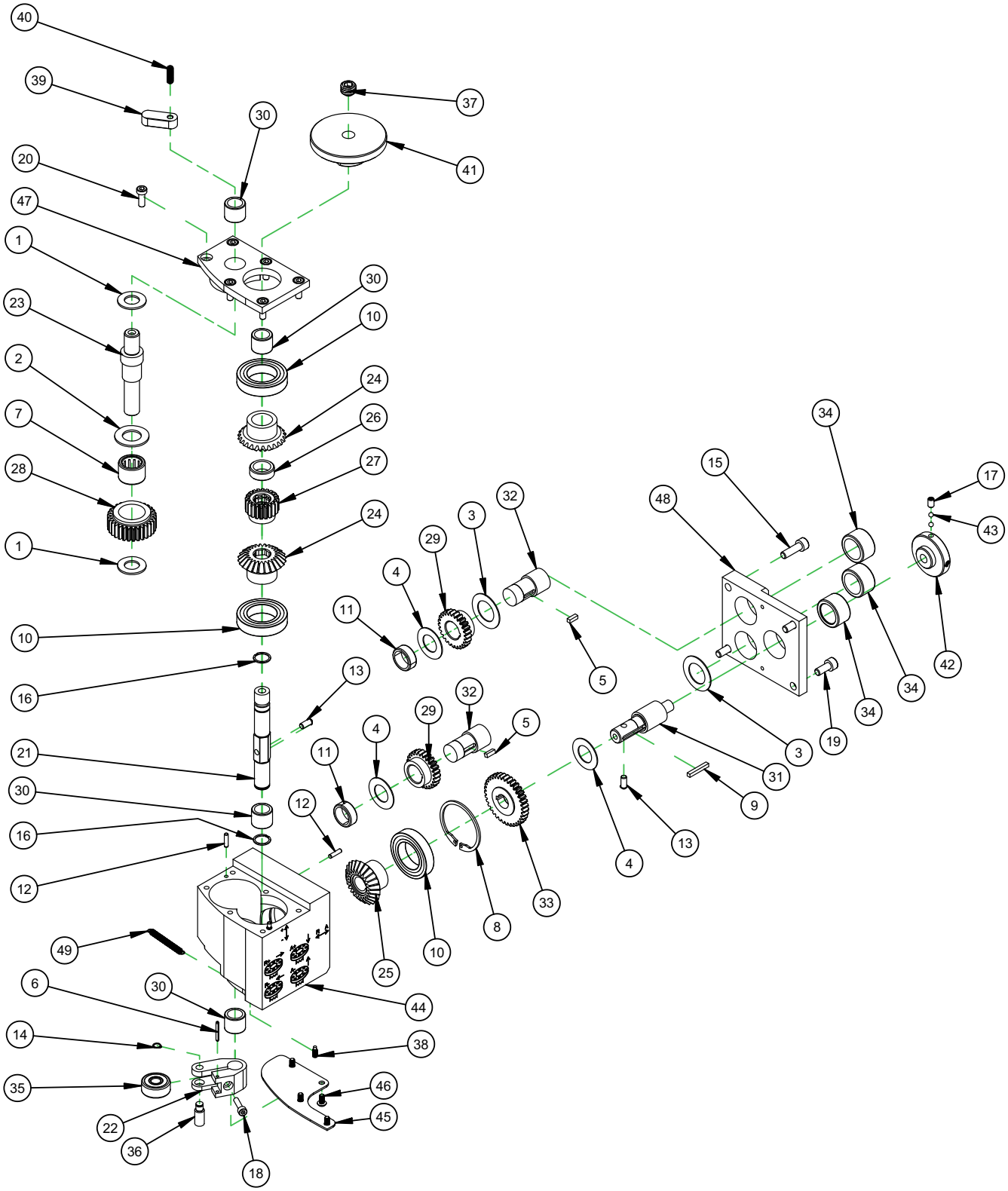


FIGURE A-17. FEED BOX ASSEMBLY (P/N 79194)

PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	10436	WASHER THRUST .500 ID X .937 OD X .060
2	1	11165	WASHER THRUST .625 ID X 1.125 OD X .060
3	2	11739	WASHER THRUST .750 ID X 1.250 OD X .0312
4	3	11823	WASHER THRUST .625 ID X 1.125 OD X .030
5	2	12360	KEY 1/8 SQ X .37
6	1	12895	PIN ROLL 3/32 DIA X 3/4
7	1	17071	BEARING ROLLER CLUTCH 5/8 ID X 7/8 OD X .625
8	1	17857	RING SNAP INT. 42MM X .062
9	1	17862	KEY 1/8 SQ X .87 BOTH ENDS
10	3	21295	BRG BALL .9843 ID X 1.6535 OD X .3543 W/SEALS
11	2	21392	BRG NEEDLE 5/8 ID X 13/16 OD X .312 OPEN
12	4	22480	PIN DOWEL 1/8 DIA X 1/2
13	2	26828	PLUNGER BALL PUSHFIT
14	1	34420	RING SNAP 15/64 OD X .015 TH (6MM)
15	2	35009	SCREW M6 X 1.0 X 20 SHCS
16	2	38648	RING SNAP 1/2 OD SPIRAL HEAVY DUTY
17	2	54724	SCREW M5 X 0.8 X 8MM SSSFP
18	1	58672	SCREW M4 X 0.7 X 16MM SHCS
19	2	59003	SCREW M6 X 1.0 X 14MM SHCS
20	6	62166	SCREW M5 X 0.8 X 14 LHSCS
21	1	74244	SHAFT FEED DIRECTION
22	1	74248	ARM CAM FOLLOWER
23	1	74249	SHAFT CAM FOLLOWER
24	2	74253	GEAR BEVEL 16 DP 24T 1:1 20PA STL KEYWAY MODIFIED HEX BORE
25	1	74255	GEAR BEVEL 16DP 24T 1:1 20PA STL MODIFIED KEYWAY
26	1	74262	SPACER GEAR .85 IN HEX BORE
27	1	74266	GEAR SPUR 20DP 20T 20PA 1/2 FACE MODIFIED .75LG HEX ID
28	1	74270	GEAR SPUR 20DP 30T 20PA .625LG STEEL MODIFIED
29	2	74275	GEAR SPUR 20DP 25T 0.5 FACE MODIFIED .625LG .875ID
30	4	74277	BRG NEEDLE 1/2 ID X 11/16 OD X .562 ONE SEAL
31	1	74280	SHAFT RADIAL AXIAL SHAFT
32	2	74288	SHAFT DRIVE RECEIVER
33	1	74299	GEAR SPUR 20 DP 35T 20PA MODIFIED .25 FACE
34	3	74633	BRG NEEDLE 3/4 ID X 1 OD X .562 ONE SEAL
35	1	74634	BRG CAM FOLLOWER SHAFT MOUNT 8 mm ID X 24 mm OD X 10 mm
36	1	74636	PIN CAM FOLLOWER 8 mm X .80
37	1	74836	SCREW 1/2-13 X 3/8 SSSFP
38	1	76477	SCREW M4 X 0.7 X 10 MM SSSHDP
39	1	76480	KEY 8MM X 12MM X 30MM RADIUS BOTH ENDS W/ M5 THREAD
40	1	76481	SCREW M5 X 0.8 X 16MM SSSCP
41	1	76755	KNOB FEED KNURLED 2.5 OD X 1/2 -13 ID THDS
42	1	76756	KNOB KNURLED 1.5 OD X 3/8-16 ID THDS
43	4	76945	BALL NYLON 5/32 DIA
44	1	79200	HOUSING FEED BOX
45	1	79201	COVER FEEDBOX CAM FOLLOWER
46	4	79219	SCREW M4 X 0.7 X 8MM BHSCS
47	1	79245	PLATE COVER TOP FEEDBOX HOUSING
48	1	79246	PLATE COVER SIDE FEEDBOX HOUSING
49	1	79528	SPRING EXT .188 OD X .023 WIRE X 1.75 LONG

FIGURE A-18. FEED BOX ASSEMBLY PARTS LIST (P/N 79194)

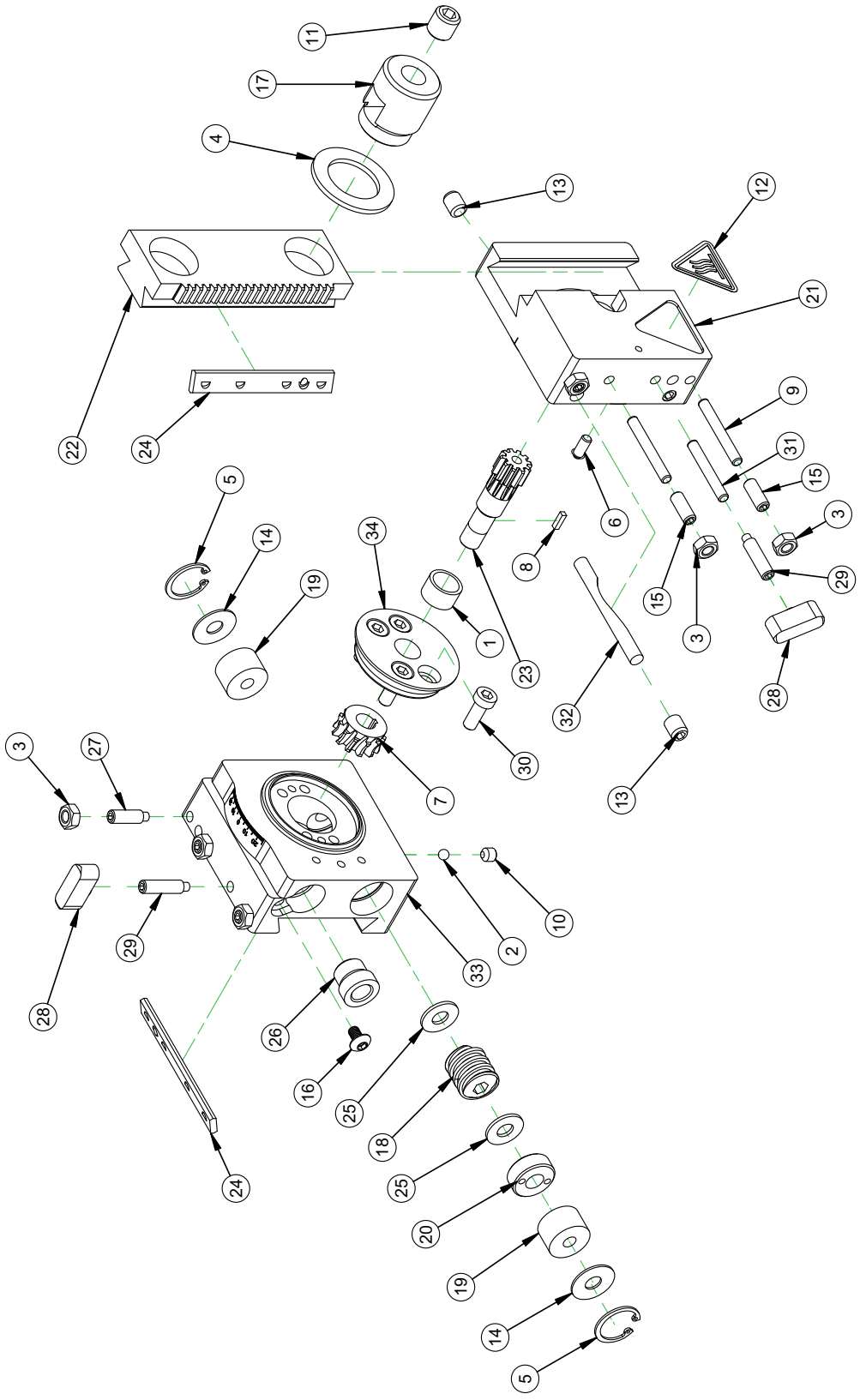
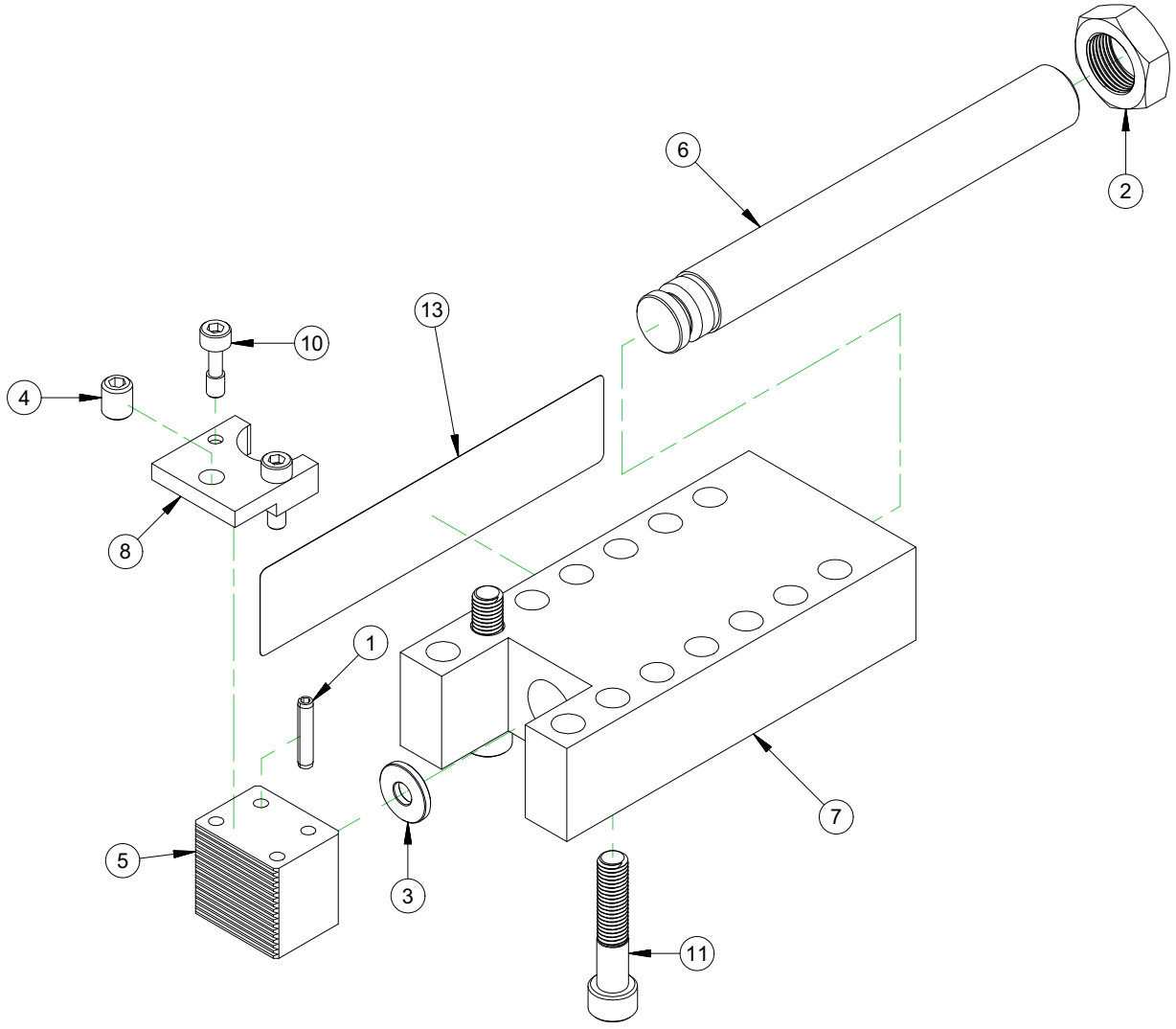


FIGURE A-19. TOOL HEAD ASSEMBLY (P/N 80407)

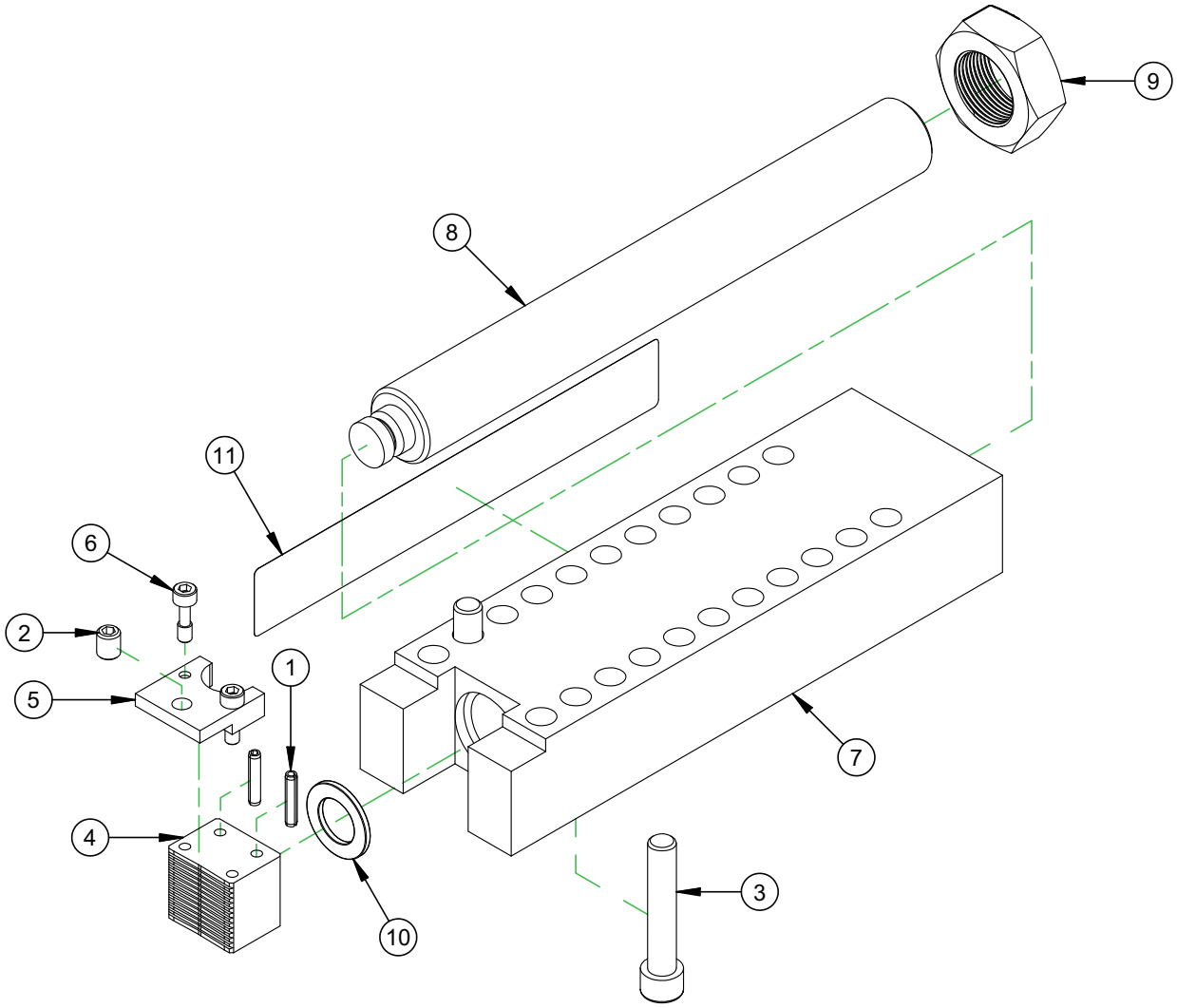
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	14335	BUSHING OILITE 1/2 ID X 5/8 OD X 3/8
2	1	16594	BALL NYLON 3/16 DIA
3	6	20772	NUT M6 X 1.0 STDN ZINC PLATED
4	1	22402	WASHER THRUST 1.000 ID X 1.562 OD X .095
5	2	23669	RING SNAP 13/16 ID
6	1	26828	PLUNGER BALL PUSHFIT
7	1	27812	WORM GEAR .75 PD 16 DP SINGLE RH
8	1	29385	KEY 3/32 SQ X 11/32 SQ BOTH ENDS
9	3	35600	PIN DOWEL 3/16 DIA X 1-1/2
10	1	36150	SCREW M6 X 1.0 X 6mm SSSCP
11	1	43925	SCREW M12 X 1.75 X 12 SSSFP
12	1	46902	LABEL WARNING HOT SURFACE GRAPHIC 1.13" TALL
13	4	51261	SCREW M8 X 1.25 X 10 SSSFP
14	2	57426	WASHER THRUST 8MM ID X 21MM OD X 1.00MM
15	3	68514	SCREW M6 X 1.0 X 16MM SSSFP
16	1	73447	SCREW M6 X 1.0 X 8MM BHSCS
17	1	74227	CLAMP TOOL BIT
18	1	74238	DRIVE WORM AXIAL FEED
19	2	74239	FELT SEAL 1/4 HEX SHAFT .79 OD
20	1	74241	NUT WORM RETAING
21	1	74243	BASE TOOL HEAD
22	1	74245	SLIDE SWIVELING TOOL HEAD
23	1	74246	SHAFT PINION DOWN FEED
24	2	74292	GIB .365 X .125 X 3 4 SS UNEVEN SP
25	2	74293	WASHER M8 FLTW 1.5 MM
26	1	74295	NUT LEADSCREW ACME 3/8-6 BRONZE LH
27	3	74296	SCREW M6 X 1.0 X 20MM SSSDPPL
28	2	74657	NUT M6 X 1.0 WING
29	2	74658	SCREW M6 X 1 X 25MM SSSDP
30	4	75433	SCREW M6 X 1.0 X 12MM LHSCS 10.9 BLACK
31	1	75817	PIN DOWEL 3/16 DIA X 1-3/8
32	2	78964	PIN TAPERED ROTATING TOOL HEAD BRONZE
33	1	80404	SLIDE RADIAL FEED
34	1	80406	DOVETAIL CIRCULAR BOLT ON

FIGURE A-20. TOOL HEAD ASSEMBLY PARTS LIST (P/N 80407)



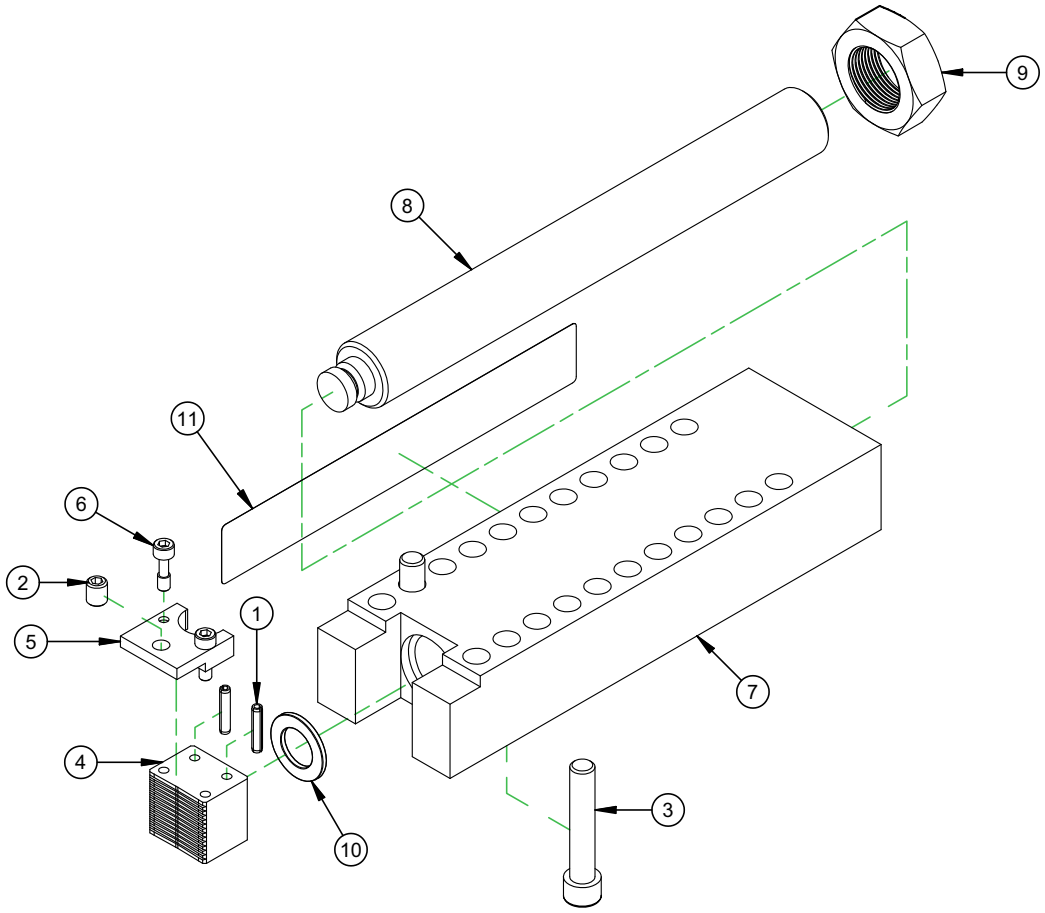
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	12959	PIN ROLL Ø3/16 X 1
4	1	42969	SCREW M10 X 1.5 X 12MM SSSFP
11	2	66826	SCREW M10 X 1.5 X 50MM SHCS
3	1	75359	WASHER THRUST 8MM ID X 21MM OD X 2.75MM THICK
7	1	78913	HOUSING CHUCK FOOT 12
6	1	78914	SCREW ADJUSTING CHUCK FOOT 12
5	1	78915	JAW CHUCK FOOT
8	1	78916	FINGER SETUP FFOD
2	1	78917	NUT M22 X 1.5 JAMN ZINC PLATED
10	2	78924	SCREW M6 X 1.0 X 20MM SHCS CAPTIVE 8 THD STAINLESS
13	1	80083	LABEL 0-12 INCH CHUCK RANGES

FIGURE A-21. FF1200 CHUCKING FOOT ASSEMBLY (P/N 78911)



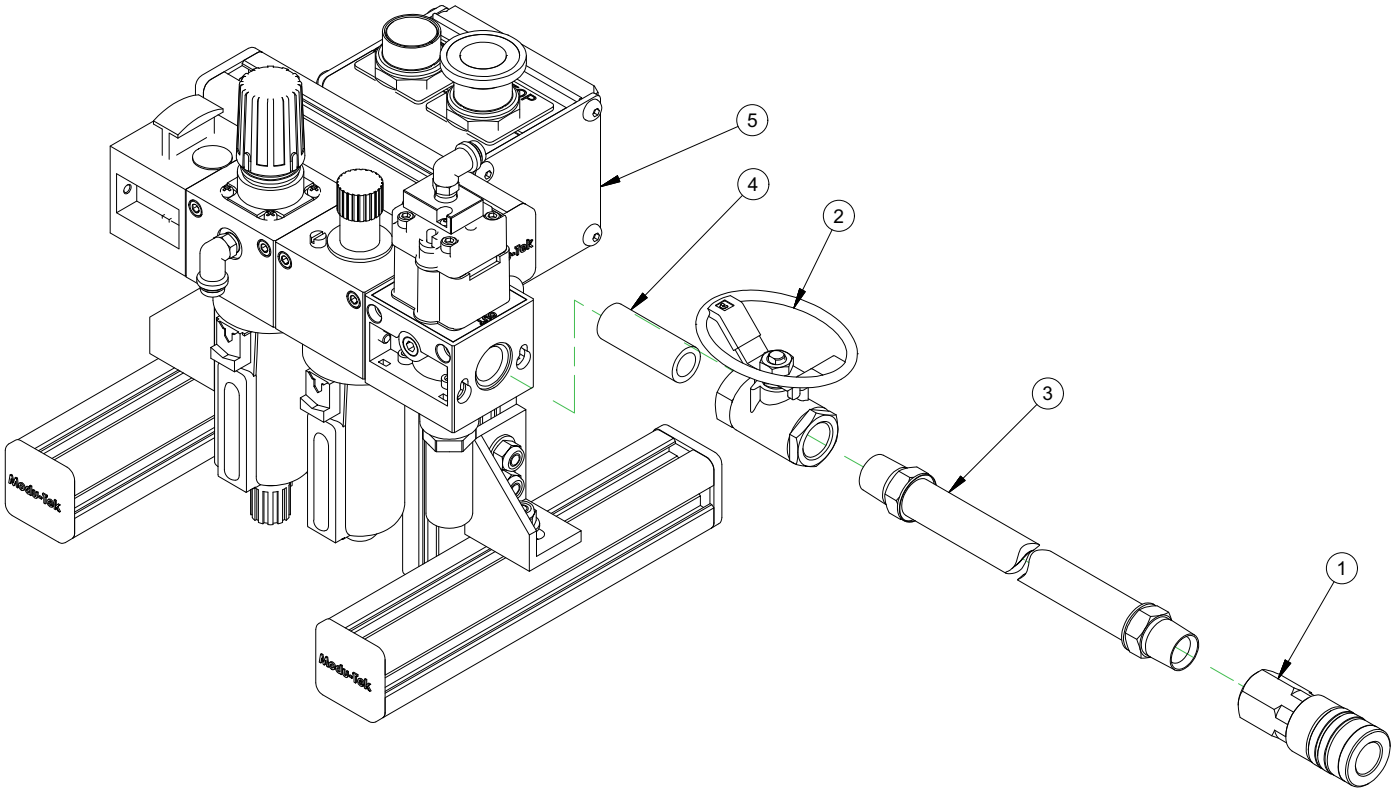
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	12959	PIN ROLL Ø3/16 X 1
2	1	42969	SCREW M10 X 1.5 X 12MM SSSFP
3	2	43182	SCREW M12 X 1.75 X 65mm SHCS
4	1	78915	JAW CHUCK FOOT
5	1	78916	FINGER SETUP FFOD
6	2	78924	SCREW M6 X 1.0 X 20MM SHCS CAPTIVE 8 THD STAINLESS
7	1	78980	HOUSING CHUCK FOOT 24
8	1	78981	SCREW ADJUSTING CHUCK FOOT 24 36
9	1	78984	NUT 1-3/8-12 JAMN
10	1	79003	WASHER THRUST .787 ID X 1.378 OD X .108 HOUSING PILOTED
11	1	79901	LABEL 0-24 INCH CHUCK RANGES

FIGURE A-22. FF2400 CHUCKING FOOT ASSEMBLY (P/N 78979)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	12959	PIN ROLL Ø3/16 X 1
2	1	42969	SCREW M10 X 1.5 X 12MM SSSFP
3	2	43182	SCREW M12 X 1.75 X 65mm SHCS
4	1	78915	JAW CHUCK FOOT
5	1	78916	FINGER SETUP FFOD
6	2	78924	SCREW M6 X 1.0 X 20MM SHCS CAPTIVE 8 THD STAINLESS
7	1	78980	HOUSING CHUCK FOOT 24
8	1	78981	SCREW ADJUSTING CHUCK FOOT 24 36
9	1	78984	NUT 1-3/8-12 JAMN
10	1	79003	WASHER THRUST .787 ID X 1.378 OD X .108 HOUSING PILOTED
11	1	80088	LABEL 0-36 INCH CHUCK RANGES

FIGURE A-23. FF3600 CHUCKING FOOT ASSEMBLY (P/N 80097)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13208	FTG QD COUPLER 1/2B 1/2 NPTF PNEUMATIC
2	1	36328	VALVE BALL 1/2 NPTF X 1/2 NPTF OVAL HANDLE
3	1	37008	HOSE ASSY 801 1/2 X 1/2 NPTM X 1/2 NPTMS X 96
4	1	76030	FTG NIPPLE 1/2 NPTM X 2 INCH BRASS
5	1	78264	PNEUMATIC CONDITIONING UNIT 1/2 IN LOW PRES. DROPOUT

FIGURE A-24. PNEUMATIC DRIVE ASSEMBLY (P/N 76027)

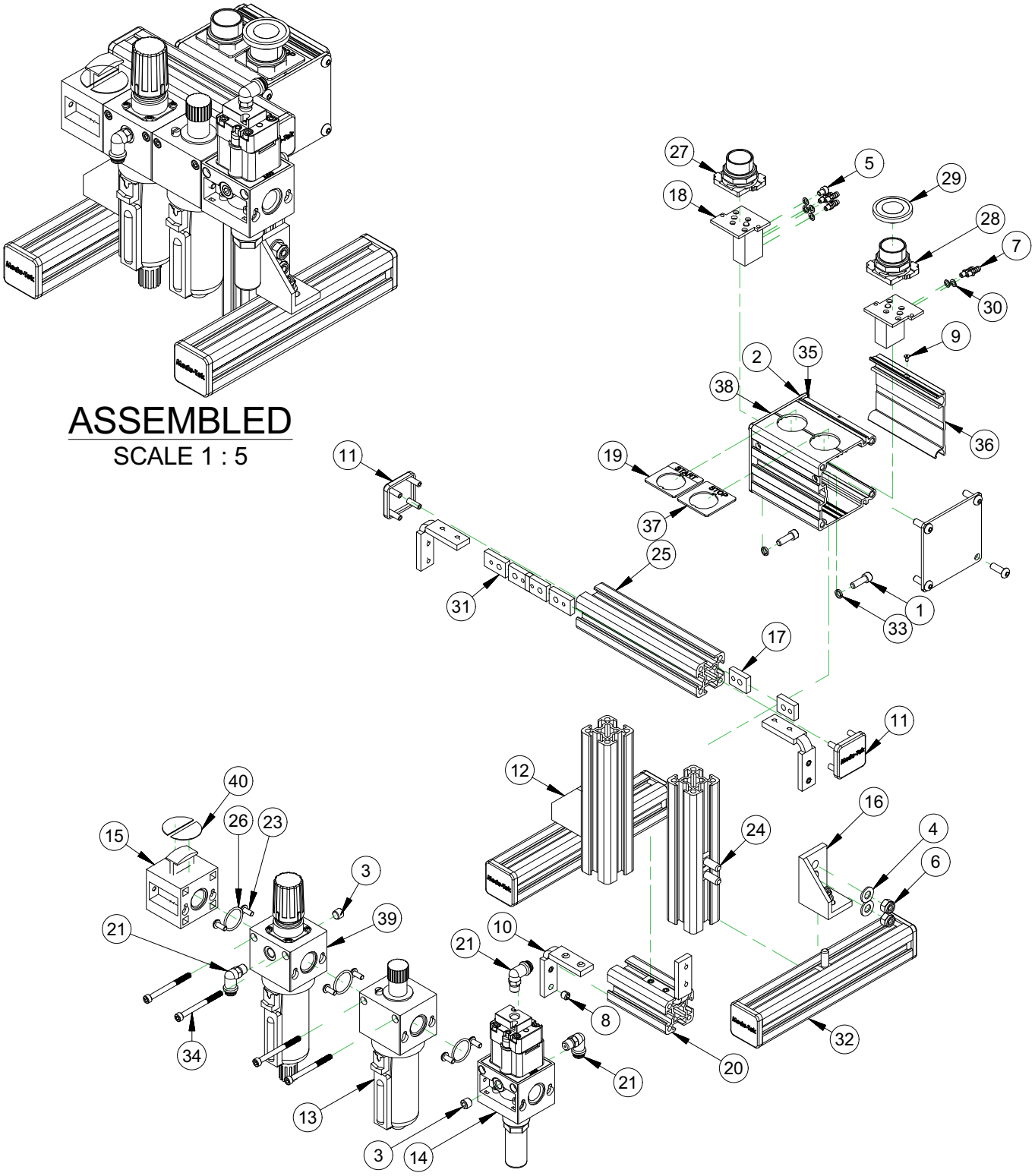
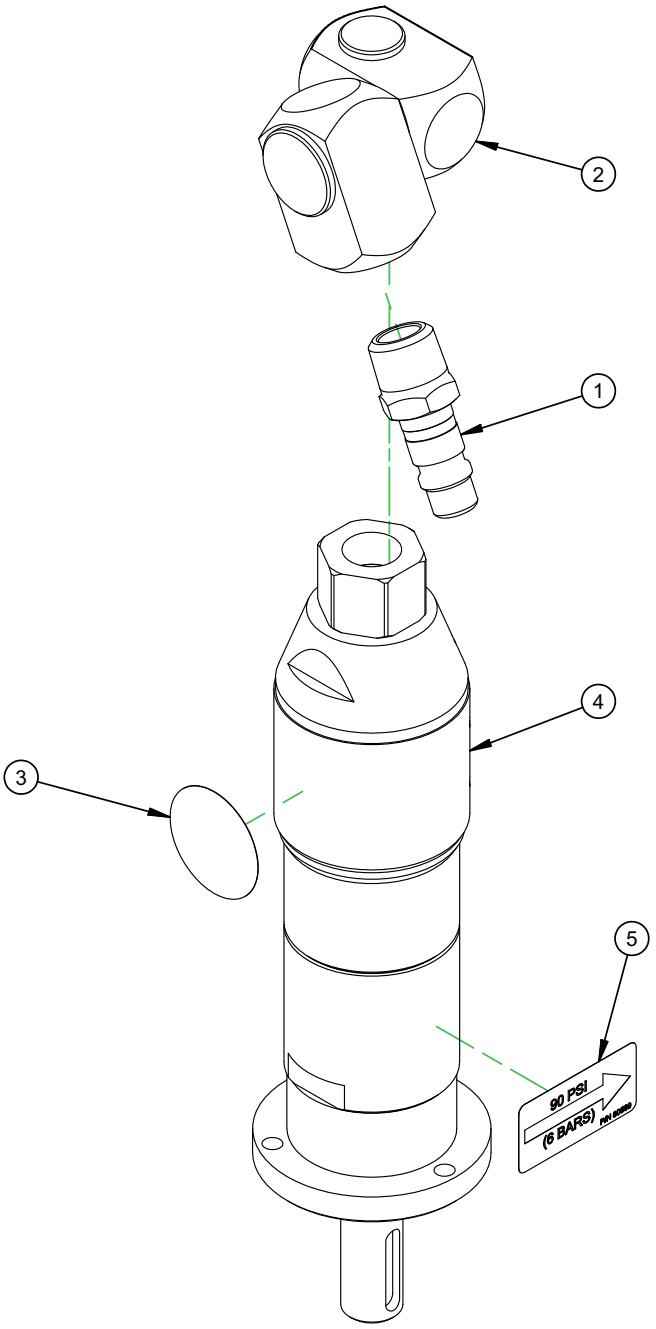


FIGURE A-25. PNEUMATIC CONDITIONING UNIT (PCU) ASSEMBLY (P/N 78264)

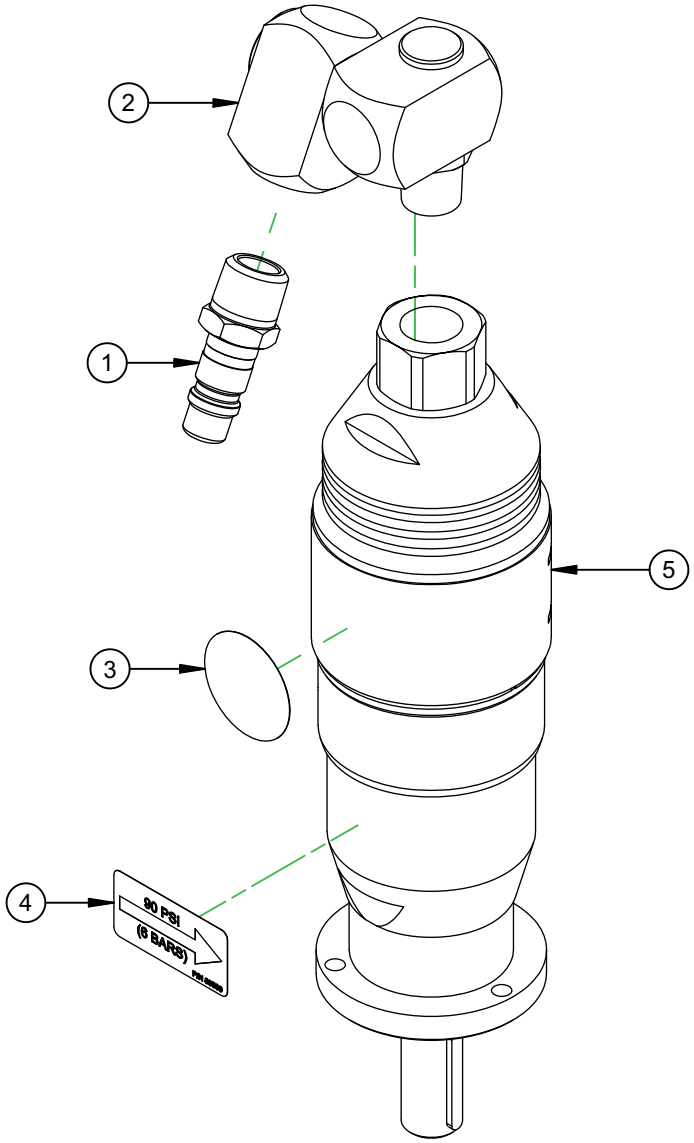
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	2	10160	SCREW 1/4-20 X 3/4 SHCS
2	8	11365	SCREW 1/4-20 X 3/4 BHSCS
3	2	12616	FTG PLUG 1/8 NPTM SOCKET
4	6	13489	WASHER 5/16 FLTW SAE
5	1	14726	SCREW 10-32 X 1/4 SHCS
6	6	19729	NUT 5/16-18 NYLON INSERT LOCKNUT
7	5	22235	FTG BARB #10-32 X 1/8 HOSE
8	16	27895	SCREW 5/16-18 X 5/16 SSSFP
9	1	35857	SCREW 4-40 X 1/4 FHSCS
10	4	46761	BRACKET 90DEG JOINER MODU-TEK
11	6	46764	ENDCAP 1 X 1 FOR 1.63SQ MODU-TEK EXTRUSION
12	1	46765	BRACKET 1X2 SLOT HALF WEB LEFT MODU-TEK
13	1	46768	LUBRICATOR AIR 1/2 NPTF 3.8oz BOWL W/SIGHT
14	1	46769	VALVE EXHAUST QUICK PILOT 1/2NPTF MUFFLER
15	1	46777	VALVE SHUT OFF VS22 SERIES
16	1	46783	BRACKET 1X2 SLOT HALF WEB RIGHT MODU-TEK
17	2	46784	NUT SQUARE 5/16-18 AND 1/4-20
18	2	46785	VALVE PUSHBUTTON 5 PORT PNEUMATIC
19	1	46797	LEGEND PLATE START 10250 SERIES
20	1	46802	1.63 X 1.63 X 3.375L MODU-TEK EXTRUSION
21	3	48648	FTG ELBOW 1/8 NPTM X 1/4 TUBE PRESTOLOK
22	60	48650	TUBING 1/4 OD POLYURETHANE (INCH) (NOT SHOWN)
23	6	53617	SCREW M5 X 0.8 X 12MM BHCS BLACK FINISH
24	6	59436	SCREW 5/16-18 X 3/4 T-BOLT
25	3	59437	1.63 X 1.63 X 7.00L MODU-TEK EXTRUSION
26	3	59442	O-RING 2mm X 23mm ID X 25mm OD
27	1	59458	PUSHBUTTON GREEN FLUSH
28	1	59459	PUSH BUTTON PUSH PULL MAINTAINED (M-M)
29	1	59462	PUSH BUTTON OPERATOR RED 1-5/8
30	6	59480	WASHER #10 FLTW PLASTIC .32 OD .025 THICK
31	4	59705	NUT PLATE M5 X .08 AND 5/16-32 .75 X 1.25 X .25
32	2	59739	EXTRUSION 1.63 X 1.63 X 8.75 MODU-TEK
33	2	59745	WASHER 1/4 LOCW .37 OD .07 THICK
34	4	59754	SCREW M5 X 0.8 X 40MM SHCS
35	1	59820	ENCLOSURE PNEUMATIC CONTROL VALVE 3.38 X 3.435 X 3.9
36	1	59821	COVER PNEUMATIC CONTROL VALVE ENCLOSURE 3.38 X 3.435 X 3.9
37	1	59825	LEGEND PLATE STOP 10250SERIES YELLOW BACKGROUND
38	2	68644	PLATE COVER EXTRUDED WIREWAY
39	1	78054	FILTER/REGULATOR PARTICULATE 1/2NPTF METAL BOWL GLASS
40	1	78067	LABEL WARNING - INSERT SAFETY LOCK

FIGURE A-26. PCU ASSEMBLY PARTS LIST (P/N 78264)



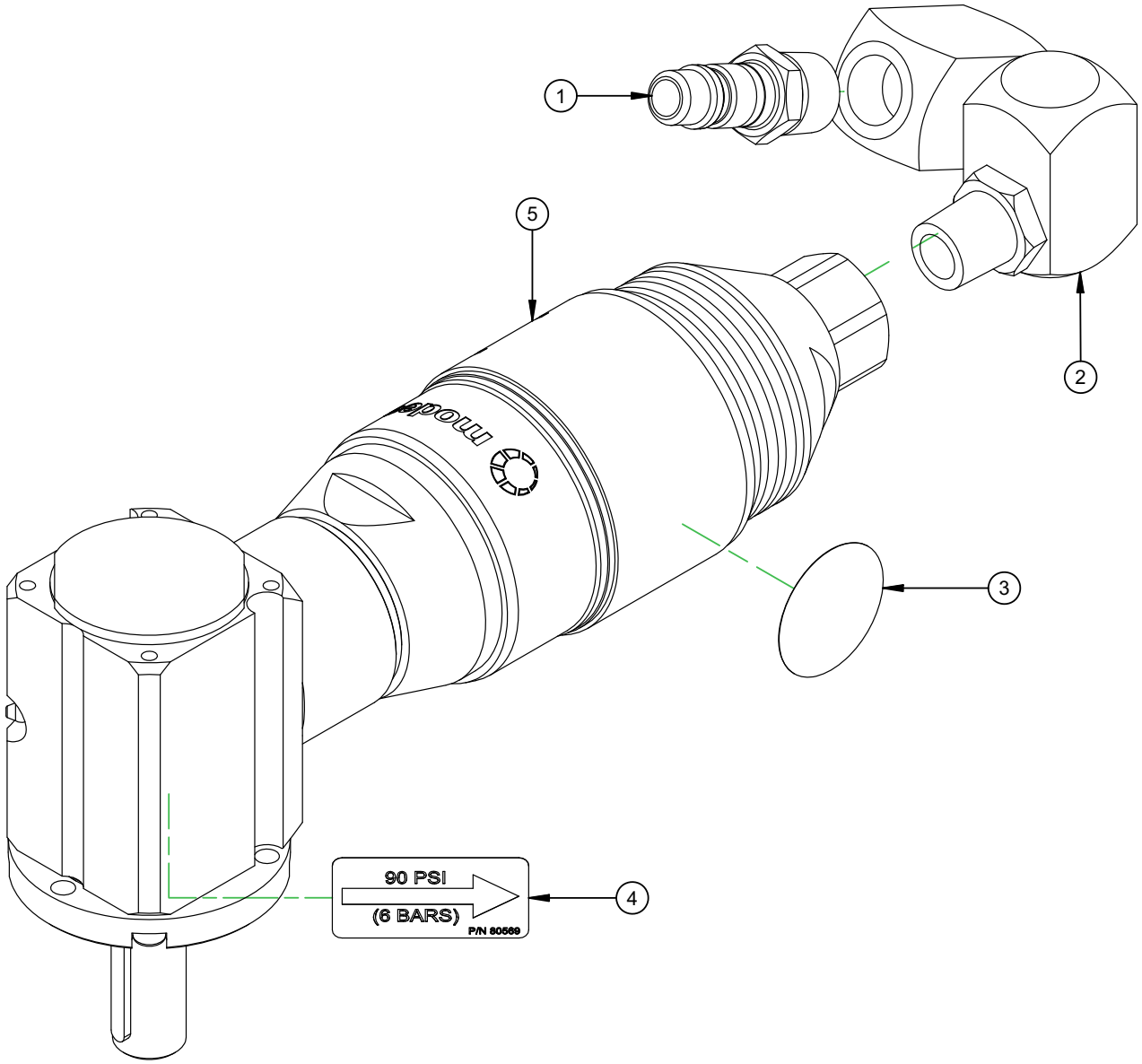
PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13209	FTG QD NIPPLE 1/2B 1/2 NPTM PNEUMATIC
2	1	35670	FTG SWIVEL AIR 1/2 NPTM X 1/2 NPTF
3	1	59037	LABEL WARNING - WEAR EAR PROTECTION
4	1	74585	MOTOR AIR 1.07HP 382 RPM FS 177 RPM MAX 54TQ STALL
5	1	80569	LABEL AIR MOTOR DIRECTION AND PRESSURE

FIGURE A-27. FF1200 1.07 HP STRAIGHT AIR MOTOR (P/N 80570)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13209	FTG QUICK COUPLER 1/2B 1/2 NPTM MALE AIR
2	1	35670	FTG SWIVEL AIR 1/2 NPTM X 1/2 NPTF
3	1	59037	LABEL WARNING - WEAR EAR PROTECTION
4	1	80569	LABEL AIR MOTOR DIRECTION AND PRESSURE
5	1	80614	MOTOR AIR 486 RPM FS 208 RPM MAX 160 NM TQ 3 BOLT FLANGE 3/4" SHAFT

FIGURE A-28. FF2400 AND FF3600 2.2 HP STRAIGHT AIR MOTOR (P/N 80632)



PARTS LIST			
ITEM	QTY	P/N:	DESCRIPTION
1	1	13209	FTG QD NIPPLE 1/2B 1/2 NPTM PNEUMATIC
2	1	35670	FTG SWIVEL AIR 1/2 NPTM X 1/2 NPTF
4	1	80569	LABEL AIR MOTOR DIRECTION AND PRESSURE
3	1	59037	LABEL WARNING - WEAR EAR PROTECTION
5	1	80617	MOTOR AIR RIGHT ANGLE 448 RPM FS 219 RPM MAX 101 NM TQ 3 BOLT FLANGE 3/4" SHAFT

FIGURE A-29. 2.2 HP RIGHT ANGLE AIR MOTOR (P/N 80618)

TABLE A-1. FF1200 SPARE PARTS KIT (P/N 78263)

Part number	Description
10437	BRG THRUST .500 ID X .937 OD X .0781 (VMI)
11736	WASHER THRUST .500 ID X .937 OD X .030 (VMI)
12895	PIN ROLL 3/32 DIA X 3/4
14315	PIN DOWEL 3/32 DIA X 1/2
20772	NUT M6 X 1.0 STDN ZINC PLATED
22402	WASHER THRUST 1.000 ID X 1.562 OD X .095 (VMI)
34420	RING SNAP 15/64 OD X .015 TH (6MM)
35600	PIN DOWEL 3/16 DIA X 1-1/2
35651	SCREW M6 X 1.0 X 55MM SHCS
43926	SCREW MODIFIED M12 X 1.75 X 8 SSSFP
44519	SCREW M12 X 1.75 X 30MM SSSFP
51261	SCREW M8 X 1.25 X 10MM SSSFP
54724	SCREW M5 X 0.8 X 8mm SSSFP
57214	BRG RETAINING NUT LEADSCREW AXIAL/RADIAL FEED FF LINE (KB)
57320	RING O 1/16 X 13/16 ID X 15/16 OD
58672	SCREW M4 X 0.7 X 16MM SHCS BLACK OXIDE
67573	SCREW M8 X 1.25 X 50MM SSSHDP
68514	SCREW M6 X 1.0 X 16MM SSSFP
72222	SCREW M10 X 1.5 X 70MM SHCS
74227	CLAMP TOOL BIT METRIC
74228	DRIVE SHAFT AXIAL FEED 0-12 INCHES
74231	LEADSCREW RADIAL FEED 0-12 INCH
74245	SLIDE SWIVELING TOOL HEAD
74248	ARM CAM FOLLOWER
74292	GIB .365 X .125 X 3 4 SS UNEVEN SP
74295	NUT LEADSCREW ACME 3/8-6 BRONZE LH
74296	SCREW M6 X 1.0 X 20 SSSHDP
74581	BELT POLYCHAIN 8mm PITCH X 12mm WIDE X 160 TEETH
74632	SCREW M8 X 1.25 X 30MM SHCS CAPTIVE 10 THD STAINLESS
74634	BRG CAM FOLLOWER SHAFT MOUNT 8 mm ID X 24 mm OD X 10 mm
74636	PIN CAM FOLLOWER 8 mm X .80

TABLE A-1. FF1200 SPARE PARTS KIT (P/N 78263) (CONTINUED)

Part number	Description
74657	NUT M6 X 1.0 WING
74658	SCREW M6 X 1 X 25MM SSSDP
74836	SCREW 1/2-13 X 3/8 SSSFP
76480	KEY 8MM X 12MM X 30MM RADIUS BOTH ENDS W/ M5 THREAD
76599	SCREW M6 X 1.0 X 40MM KNURLED HEAD
76601	PIN LOCATING 6MM OD X 20MM X M5 X .8 THREAD
76755	KNOB FEED KNURLED 2.5 OD X 1/2 -13 ID THDS
76756	KNOB KNURLED 1.5 OD X 3/8-16 ID THDS
78911	ASSY CHUCK FOOT 12
78964	PIN TAPERED ROTATING TOOL HEAD BRONZE
79185	CAM GUARD 0-12 FIRST GEN
79194	ASSY FEED BOX
80210	ASSY SETUP FINGER
80407	ASSY TOOL HEAD

TABLE A-2. FF2400 SPARE PARTS KIT (P/N 81453)

Part number	Description
74245	SLIDE SWIVELING TOOL HEAD
58672	SCREW M4 X 0.7 X 16MM SHCS BLACK OXIDE
78964	PIN TAPERED ROTATING TOOL HEAD BRONZE
68514	SCREW M6 X 1.0 X 16MM SSSFP
54724	SCREW M5 X 0.8 X 8mm SSSFP
74296	SCREW M6 X 1.0 X 20 SSSHDP
35600	PIN DOWEL 3/16 DIA X 1-1/2
43926	SCREW MODIFIED M12 X 1.75 X 8 SSSFP
76599	SCREW M6 X 1.0 X 40MM KNURLED HEAD
76756	KNOB KNURLED 1.5 OD X 3/8-16 ID THDS
34420	RING SNAP 15/64 OD X .015 TH (6MM)
10437	BRG THRUST .500 ID X .937 OD X .0781 (VMI)
72222	SCREW M10 X 1.5 X 70MM SHCS
20772	NUT M6 X 1.0 STDN ZINC PLATED

TABLE A-2. FF2400 SPARE PARTS KIT (P/N 81453) (CONTINUED)

Part number	Description
74248	ARM CAM FOLLOWER
74658	SCREW M6 X 1 X 25MM SSSDP
76480	KEY 8MM X 12MM X 30MM RADIUS BOTH ENDS W/ M5 THREAD
74634	BRG CAM FOLLOWER SHAFT MOUNT 8 mm ID X 24 mm OD X 10 mm
67573	SCREW M8 X 1.25 X 50MM SSSHDP
74632	SCREW M8 X 1.25 X 30MM SHCS CAPTIVE 10 THD STAINLESS
78979	ASSY CHUCK FOOT 24
80407	ASSY TOOL HEAD
74657	NUT M6 X 1.0 WING
57214	BRG RETAINING NUT LEADSCREW AXIAL/RADIAL FEED FF LINE (KB)
75302	LEADSCREW RADIAL FEED 0-24 & 36 INCH
75520	BELT POLYCHAIN 8mm PITCH X 12mm WIDE X 280 TEETH
74227	CLAMP TOOL BIT METRIC
35651	SCREW M6 X 1.0 X 55MM SHCS
44519	SCREW M12 X 1.75 X 30MM SSSFP
80210	SP ASSY SETUP FINGER
76755	KNOB FEED KNURLED 2.5 OD X 1/2 -13 ID THDS
74292	GIB .365 X .125 X 3 4 SS UNEVEN SP
79194	ASSY FEED BOX
14315	PIN DOWEL 3/32 DIA X 1/2
75303	DRIVE SHAFT 0-24 & 36 INCH
11736	WASHER THRUST .500 ID X .937 OD X .030 (VMI)
22402	WASHER THRUST 1.000 ID X 1.562 OD X .095 (VMI)
12895	PIN ROLL 3/32 DIA X 3/4
51261	SCREW M8 X 1.25 X 10MM SSSFP
74636	PIN CAM FOLLOWER 8 mm X .80
74836	SCREW 1/2-13 X 3/8 SSSFP
74295	NUT LEADSCREW ACME 3/8-6 BRONZE LH
76601	PIN LOCATING 6MM OD X 20MM X M5 X .8 THREAD
57320	RING O 1/16 X 13/16 ID X 15/16 OD

TABLE A-3. FF3600 SPARE PARTS KIT (P/N 81454)

Part number	Description
74245	SLIDE SWIVELING TOOL HEAD
58672	SCREW M4 X 0.7 X 16MM SHCS BLACK OXIDE
78964	PIN TAPERED ROTATING TOOL HEAD BRONZE
68514	SCREW M6 X 1.0 X 16MM SSSFP
54724	SCREW M5 X 0.8 X 8mm SSSFP
74296	SCREW M6 X 1.0 X 20 SSSHDP
35600	PIN DOWEL 3/16 DIA X 1-1/2
43926	SCREW MODIFIED M12 X 1.75 X 8 SSSFP
76599	SCREW M6 X 1.0 X 40MM KNURLED HEAD
76756	KNOB KNURLED 1.5 OD X 3/8-16 ID THDS
34420	RING SNAP 15/64 OD X .015 TH (6MM)
10437	BRG THRUST .500 ID X .937 OD X .0781 (VMI)
76006	BELT POLYCHAIN 8mm PITCH X 12mm WIDE X 400 TEETH
72222	SCREW M10 X 1.5 X 70MM SHCS
20772	NUT M6 X 1.0 STDN ZINC PLATED
74248	ARM CAM FOLLOWER
74658	SCREW M6 X 1 X 25MM SSSDP
76480	KEY 8MM X 12MM X 30MM RADIUS BOTH ENDS W/ M5 THREAD
74634	BRG CAM FOLLOWER SHAFT MOUNT 8 mm ID X 24 mm OD X 10 mm
67573	SCREW M8 X 1.25 X 50MM SSSHDP
74632	SCREW M8 X 1.25 X 30MM SHCS CAPTIVE 10 THD STAINLESS
80407	ASSY TOOL HEAD
74657	NUT M6 X 1.0 WING
57214	BRG RETAINING NUT LEADSCREW AXIAL/RADIAL FEED FF LINE (KB)
75302	LEADSCREW RADIAL FEED 0-24 & 36 INCH
74227	CLAMP TOOL BIT METRIC
35651	SCREW M6 X 1.0 X 55MM SHCS
44519	SCREW M12 X 1.75 X 30MM SSSFP
80210	SP ASSY SETUP FINGER
76755	KNOB FEED KNURLED 2.5 OD X 1/2 -13 ID THDS
74292	GIB .365 X .125 X 3 4 SS UNEVEN SP

TABLE A-3. FF3600 SPARE PARTS KIT (P/N 81454) (CONTINUED)

Part number	Description
79194	ASSY FEED BOX
14315	PIN DOWEL 3/32 DIA X 1/2
75303	DRIVE SHAFT 0-24 & 36 INCH
11736	WASHER THRUST .500 ID X .937 OD X .030 (VMI)
22402	WASHER THRUST 1.000 ID X 1.562 OD X .095 (VMI)
12895	PIN ROLL 3/32 DIA X 3/4
51261	SCREW M8 X 1.25 X 10MM SSSFP
74636	PIN CAM FOLLOWER 8 mm X .80
74836	SCREW 1/2-13 X 3/8 SSSFP
74295	NUT LEADSCREW ACME 3/8-6 BRONZE LH
80097	ASSY CHUCK FOOT 36
76601	PIN LOCATING 6MM OD X 20MM X M5 X .8 THREAD
57320	RING O 1/16 X 13/16 ID X 15/16 OD

TABLE A-4. TOOL KIT P/N 78262

Part number	Description
38678	WRENCH HEX SET 1.5 - 10MM BOUNDHUS BALL END (KB)
77771	WRENCH END 1/4" COMBINATION
78261	SHAFT STEEL 5/16 OD X 4INCH

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APPENDIX B SCHEMATICS

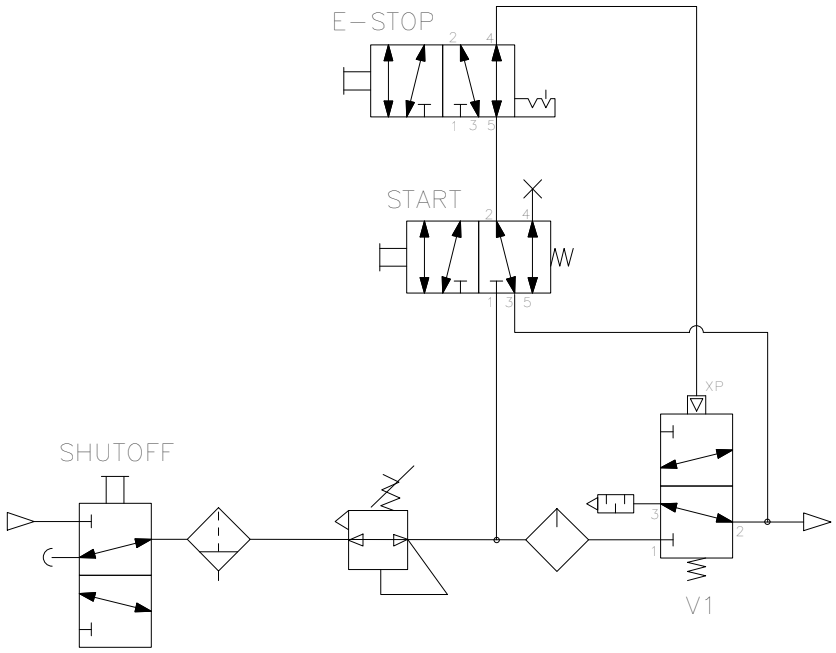

FIGURE B-1.PNEUMATIC SCHEMATIC (P/N 78264)

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APPENDIX C SDS

Contact CLIMAX for the current safety data sheets.

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