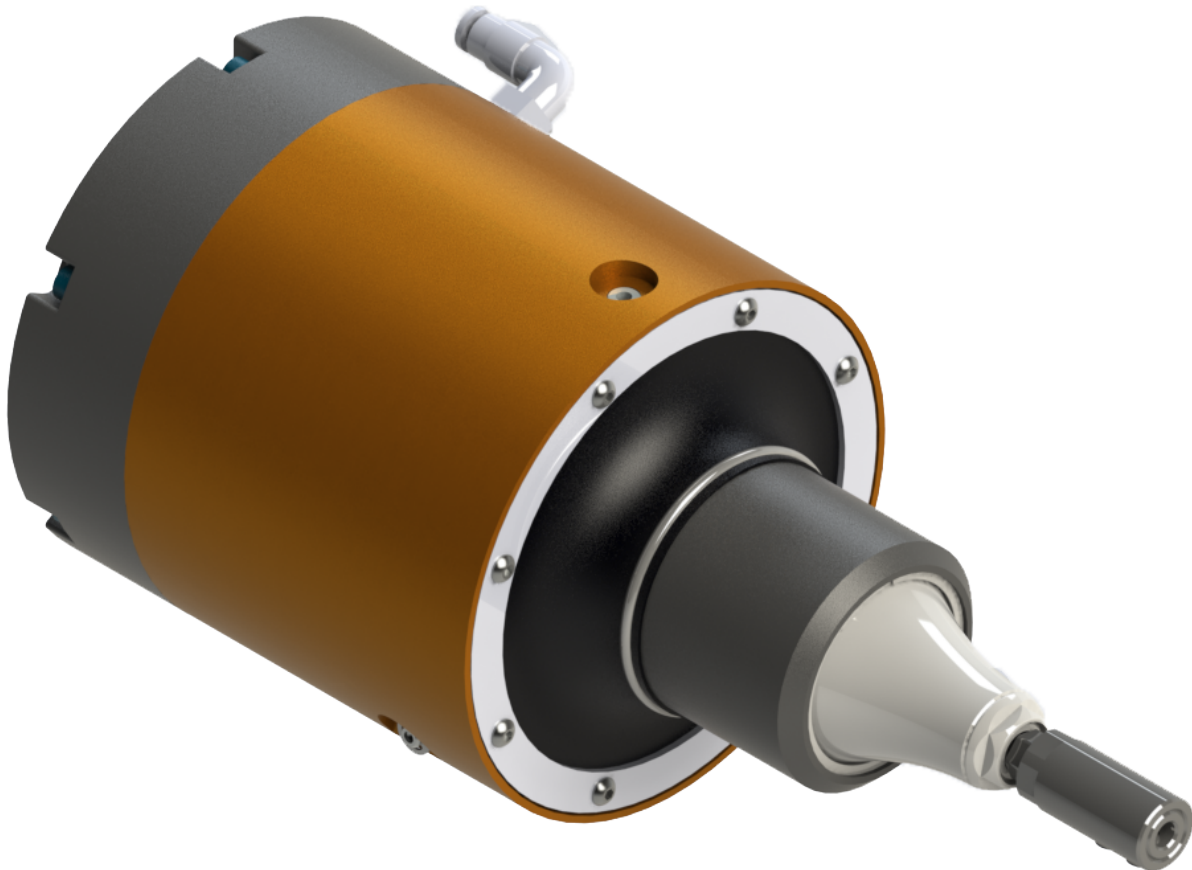




ATI Compliant Reciprocating Tool

(Model 9150-CRT)

Product Manual



Document #: 9610-50-1028

Engineered Products for Robotic Productivity

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Foreword



CAUTION: This manual describes the function, application, and safety considerations of this product. This manual must be read and understood before any attempt is made to install or operate the product, otherwise damage to the product or unsafe conditions may occur.

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Glossary

Term	Definition
Adapter Plate	Device for attaching the CRT (Compliant Reciprocating Tool) to either a robot flange or a stationary mounting surface.
Aerosols	Suspension of fine solid or liquid particles in gas.
Air Filter	Device for removing contamination from air supply lines. ATI suggests air filters for the removal of up to 30 microns particulates.
Boot	Flexible protective cover.
Burr	Any unwanted, raised protrusion on the workpiece.
Coalescing Filter	Device designed to remove liquid aerosols from the supply air lines.
Compliance	The ability of the spindle to passively move in response to deviations of the workpiece.
CRT	Compliant Reciprocating Tool
Deburr	To remove the burrs from a machined piece of machined work.
End-Effector	Tool used by the robot to perform a particular function.
File	Hardened steel tool with cutting ridges for smoothing surfaces.
Flash	Extra material left from molding process.
Holder	Gripping device used to hold cutting tools in the spindle.
Parting Lines	The line along which sections of a foundry mold, die, or pattern separate.
Regulator	Device used to set and control the supplied air pressure to acceptable levels.
Solenoid Valve	Electrically controlled device for switching air supplies on and off.

1. Safety

The safety section describes general safety guidelines to be followed with this product, explanations of the notifications found in this manual, and safety precautions that apply to the product. Product specific notifications are imbedded within the sections of this manual (where they apply).

1.1 Explanation of Notifications

These notifications are used in all of ATI manuals and are not specific to this product. The user should heed all notifications from the robot manufacturer and/or the manufacturers of other components used in the installation.



DANGER: Notification of information or instructions that if not followed will result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.



WARNING: Notification of information or instructions that if not followed could result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.



CAUTION: Notification of information or instructions that if not followed could result in moderate injury or will cause damage to equipment. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

NOTICE: Notification of specific information or instructions about maintaining, operating, installing, or setting up the product that if not followed could result in damage to equipment. The notification can emphasize, but is not limited to: specific grease types, best operating practices, and maintenance tips.

1.2 General Safety Guidelines

The customer should first read and understand the operating procedures and information described in this manual. Never use the CRT for any purpose not explicitly described in this manual. Follow installation instructions and pneumatic connections as described in this manual.

All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of pneumatic lines must minimize the possibility of stress/strain, kinking, rupture, etc. Failure of critical pneumatic lines to function properly may result in equipment damage.

1.3 Safety Precautions



CAUTION: Do not use files rated for less than the speed of the CRT. Using these may cause injury or damage equipment. Always use files rated for at least the speed of the CRT.



CAUTION: Do not use serviceable parts other than original ATI serviceable parts. Use of serviceable parts not supplied by ATI can damage equipment and void the warranty. Always use original ATI serviceable parts.



CAUTION: Do not perform maintenance or repair on the reciprocating tool product unless the tool is safely supported or placed in the tool stand and air has been turned off. Injury or equipment damage can occur with tool not placed in a tool stand and air remaining on. Place the tool safely in the tool stand and turn off the air before performing maintenance or repair on the reciprocating tool product.

2. Product Overview

ATI's Compliant Reciprocating Tool (CRT) is a robust, high-speed, and lightweight reciprocating material removal unit for materials such as: aluminum, plastic, and steel with a robot. The CRT is especially well-suited for removal of parting lines and flash from parts; however, its flexible design allows it to be used in a variety of applications.

The reciprocating tool's pneumatically controlled, articulated design allows the file to follow the part profile and compensate for surface irregularities while maintaining a constant, configurable force. This allows high feed rates with uniform quality in any orientation. The CRT has a single axis lockout feature to limit articulation which provides increased rigidity that is parallel to the direction of file motion. The rigid parallel support is capable of producing greater control of surface finish and reduces tool chatter. Maintaining the proper orientation of the cutting tool and the part profile requires more skill and effort in robot programming.

Compliance is supported by air pressure applied to the motor of the unit and is used to perform consistent reciprocating on irregular part patterns.

The CRT provides a side mounting with (2) dowel pin locations and threaded holes. Custom adapter plates for side mounting are available from ATI (refer to [Section 9—Drawings](#) for more information).

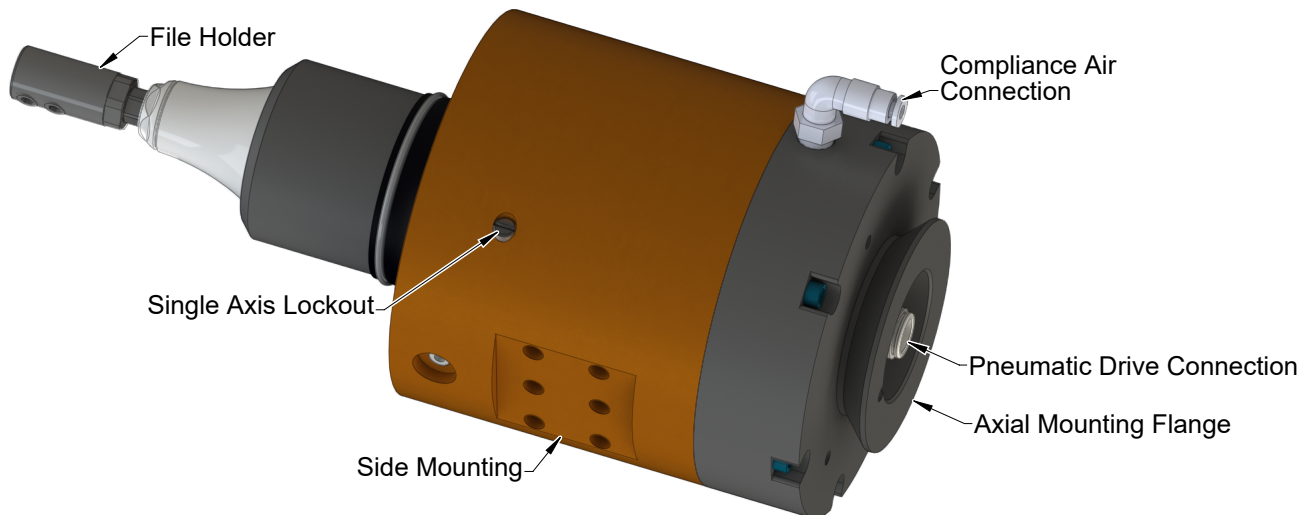
The CRT is equipped with a 3/8" (10 mm) push-to-connect fitting to supply the motor air and a 5/32" (4 mm) push-to-connect fitting to supply the compliance air.

A 5 mm file holder system secures the file. Many file tools are available to accommodate a wide variety of applications.

The CRT can be locked to single axis compliance using the single axis lockout (refer to [Section 4.5—Locking and Unlocking Single Axis Compliance](#) for more information).

The selection of a file is dependent upon the workpiece material, geometry, and the depth of cut. Please see [Section 4.4—File Operation and File Selection](#) for a short list of files and suitable applications.

Figure 2.1—CRT Reciprocating Tool



2.1 File Holder Systems

The file holding system for CRT series of products is an industry standard 5 mm file holder design. The 5 mm file holder system is used worldwide on machine tools which allows users to procure different holder sizes from local industrial supply firms.

The holder retaining set screws are loosened to open the holder, allowing files to be removed and inserted. Once the tool is set to the desired depth, a hex key is used to tighten the holder set screws securing the file.

2.1.1 Reciprocating Tool Part Number Structure

For the following part number: 9150-CRT-XX-X

- “CRT” designates a multi-axis a tool of radial compliance and reciprocating tool
- “XX” designates the strokes per minute in thousands
- “X” designates the length of stroke in millimeters

2.2 Technical Description

A technical overview of the product is provided in the following section: For additional technical specifications, refer to [Section 8—Specifications](#).

2.2.1 Environmental Limitations

2.2.1.1 Operation

Table 2.1—Operation	
Installation Position	Mounted to robot with the side mounting pattern.
	Mounted to a table or stand by means of the bench adapter. The robot is carrying the work piece to the CRT.
Temperature Range	5°C – 35°C 41°F – 95°F
Utilities	The tool requires the following: <ul style="list-style-type: none"> • Clean, dry, filtered air. The motor can be operated with 1-2 drops per minute of air tool oil to the motor air supply. • A coalescing filter and filter elements rated 30 micron or better. • Air supply to the spindle must be supplied at 6.2 bar (90 psi) to develop the full rated power. • The radial compliance (centering) air must be supplied at 1.0–4.1 bar (15–60 psi) from a regulated source.

2.2.1.2 Storage

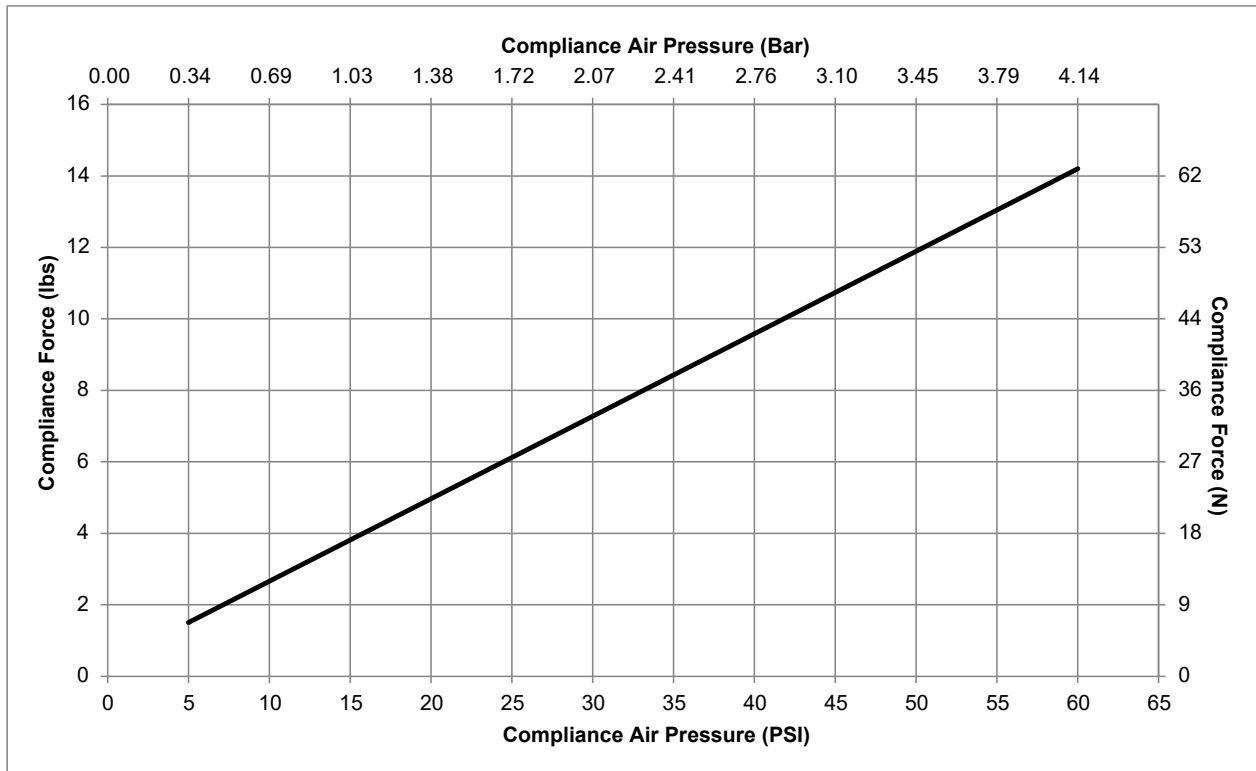
Table 2.2—Storage	
Temperature Range	0°C – 45°C 32°F – 113°F
Conditions	The tool should be stored in its crate and in a dry place. When not in use, keep the unit in its crate if possible. Consult Section 3.4—Storage and Preventive Maintenance During Storage of this manual.

2.2.2 Compliance Unit Performance

The following graph illustrates the variation of compliance force with applied air pressure in the vertical orientation with the holder pointed downward (toward the ground). Measurements may vary from one product to another and should only be regarded as nominal.

The actual force characteristics are dependent on the mounting orientation and condition of the unit. In applications where the CRT is mounted horizontally, additional compliance air pressure is required to overcome the weight of the motor. Compliance pressure is also dependent upon the material of the workpiece, type of file tool, and the amount of material that is removed.

Figure 2.2—CRT Compliance Force Curves (Measured at the Spindle Tip)



3. Installation

The CRT is delivered fully assembled. Optional equipment, such as: mounting adapter plates and files will be sold separately.

3.1 Protection During Transportation

The CRT is packaged in a crate that secures and protects the tool during transportation. Always use the crate when storing and transporting the CRT in order to minimize the risk of damage.

3.2 Inspection of Condition When Delivered

The following should be checked upon receipt of the CRT:

- Delivery in accordance with freight documents
- Packaging is in good condition

If there is damage to any of the packaging, or if any of the goods have been exposed to improper handling, unpack those parts that may have been damaged for a closer inspection. Notify ATI for assistance in the evaluation of the product condition, if necessary.

3.3 Unpacking and Handling

The CRT should always be placed inside the accompanying crate while storing and handling.

Pneumatic lines are attached, bundled, and must be strain-relieved in a manner that allows for freedom of movement during operation.

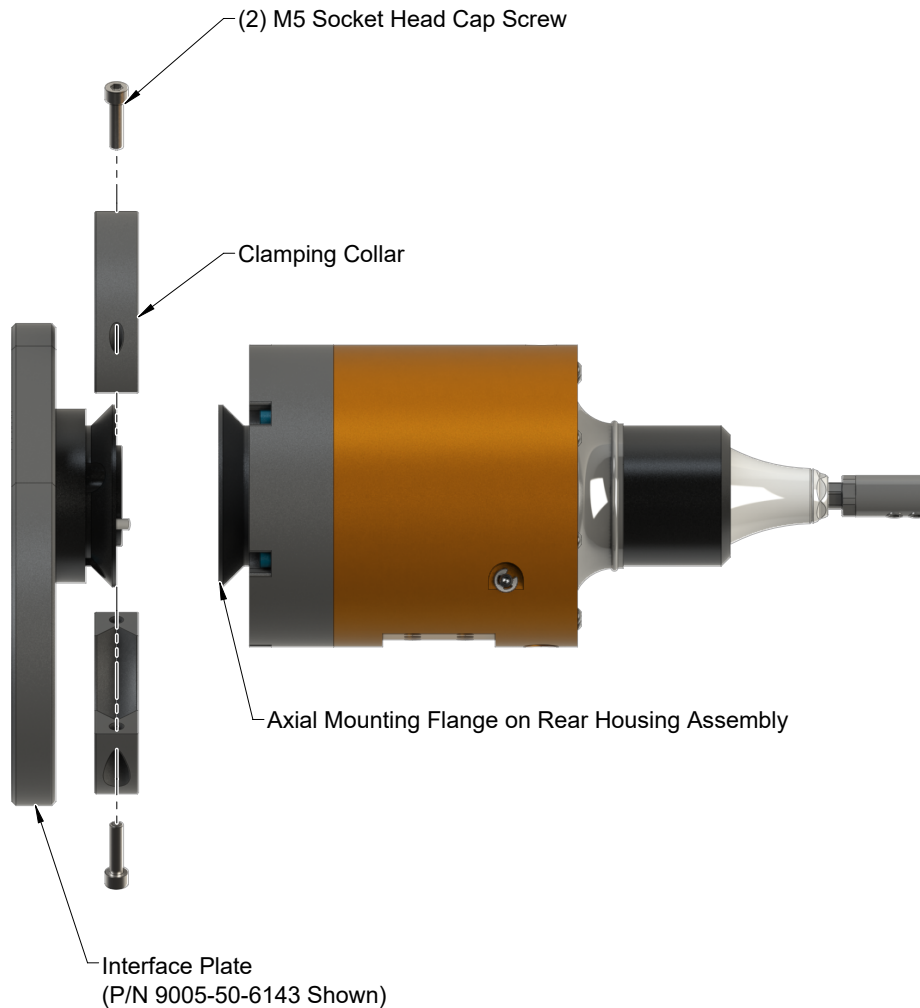
3.4 Storage and Preventive Maintenance During Storage

The CRT should always be stored in its crate, when not in use. The CRT should be stored in a dry place. For long-term storage, the CRT should be thoroughly cleaned of any burrs or debris. Do not disassemble the CRT. Place the CRT within a sealed plastic bag inside the crate.

3.5 Axial Mounting Installation

A blank robot adapter plate is also available to allow axial mounting of the rear of the deburring tool housing. This plate may be modified by the system integrator or by the owner/user. ATI can provide custom interface plates and adapters upon request. An optional bench mount adapter plate allows the deburring tool to be permanently attached to a bench or other work surface (see [Figure 3.2](#)).

Figure 3.1—Axial Installation



3.6 Side Mounting Installation



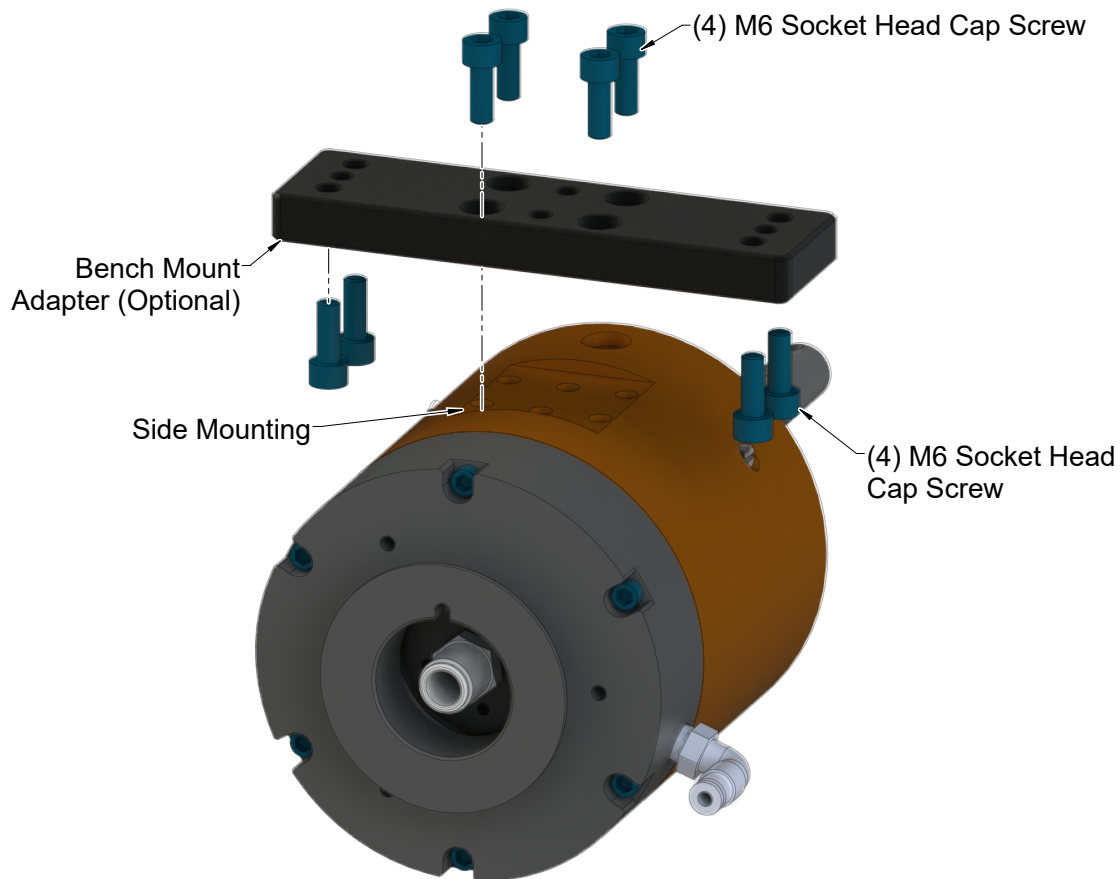
CAUTION: The length of the fasteners should not interfere with the compliant motion of the air motor spindle. Refer to [Section 9—Drawings](#) for the maximum fastener length. Do not use fasteners that exceed the maximum length; otherwise, damage will occur.



CAUTION: Lock washers are recommended on all mounting fasteners. Liquid thread lockers should not be used for the mounting fasteners as this may damage or remove thread inserts during disassembly.

The side mounting pattern of the CRT consists of (2) dowel pin holes and (4) threaded holes (refer to [Figure 3.2](#) and [Section 9—Drawings](#)). An optional bench mount adapter plate allows the CRT to attach to a bench or other work surface. The bench mount adapter may also be used with intermediate plates to attach the CRT to a robot flange or to an ATI Tool Changer. If the CRT is permanently mounted to a work surface, the robot carries the part to the reciprocating tool to be deburred.

Figure 3.2—Side Mounting Installation



3.7 Pneumatics

Connect the CRT as shown in the pneumatic diagram [9630-50-RCV-PNEUMATIC](#).



CAUTION: Pneumatic components used for the drive circuit must be capable of meeting the air consumption requirements (see [Section 8—Specifications](#)). Poor performance will result if the correct components are not used.

Conventional, customer-supplied, pneumatic components are used to control the air supply to the CRT.

To utilize full power from the pneumatic drive, ATI recommends that the user install a high-flow pneumatic pressure regulator (ATI Part # 9005-50-6174, or equivalent) and a high-flow valve to properly supply a stable air supply of 6.2 bar (90 psi) to the drive. See [Section 8—Specifications](#) for the maximum flow requirements. Lubrication is required for the motor. The air supply should be dry and filtered, using a coalescing filter with elements rated for 30 micron or better.

A second self-relieving regulator (ATI Part # 9005-50-6164, or equivalent) and valve supply the compliance (centering) mechanism. The compliance air pressure corresponds radially applied force on the file. Adjust the compliance air pressure and robot traverse speed to achieve the desired finish. The compliance air supply must be dry. Because very little airflow is required, a significantly smaller valve can be used (consult the valve and regulator manufacturer’s literature when selecting these components).

If the work piece can be filed with equal force, a conventional manual pressure regulator can be used for the compliance air supply. If the burrs vary from place to place on the work piece, and this variation is repeatable for all work pieces of the same type, it may be necessary to adjust the force using an analog pressure regulator that is controlled from the robot. An analog output port in the robot or logic controller will be needed.

All solenoid valves are actuated from the robot or program logic controller by means of a digital output signal.



WARNING: All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of pneumatic lines must minimize the possibility of over stressing, pullout, or kinking the lines. Failure to do so can cause some critical pneumatic lines not to function properly and may result in damage to the equipment.

Table 3.1—Pneumatic Connections

Connection Function	Connection Type	Pressure Requirement
Pneumatic Drive Inlet	3/8" (10 mm) push-to-connect	6.2 bar (90 psi)
Compliance (Radial) Force Inlet	5/32" (4 mm) quick-connect tube	1.0–4.1 bar (15–60 psi) (Maximum)
Exhaust	Vented to atmosphere	Not Applicable

The sound level around reciprocating equipment cannot be predicted by ATI because the sound pressure from reciprocating operations is process and part dependent. To reduce the sound from the cutting operation in neighboring work areas, a customer-supplied barrier surrounding the installation may be installed (Plexiglas® or Lexan® is preferred, see [Section 8—Specifications](#)).

The compliance force, air supply pressure regulator should have a range of 1-4.1 bar (15-60 psi). When testing for the proper contact force, start with about 1 bar (15 psi) and increase slowly until the desired cut is achieved.

4. Operation

These operating instructions are intended to help system integrators program, start up, and set up a robotic reciprocating cell containing a reciprocating tool. The system integrator should be familiar with the task of reciprocating and have extensive knowledge about automation applications that incorporate robots.

4.1 Safety Precautions



DANGER: Never use the CRT for purposes other than robotic deburring. If used in any other way, serious injury or damage to equipment may occur.



DANGER: Never use the CRT as a hand-held machine. If used in this way, serious injury or damage to equipment will occur.



WARNING: All personnel involved in the operation of the reciprocating tool, should have a thorough understanding of the operating procedures. Failure to follow these procedures or neglecting safety precautions can create hazardous situations that may injure personnel or damage the reciprocating installation and the CRT.



WARNING: Never operate the CRT product without wearing hearing protection. High sound levels can occur during cutting. Failure to wear hearing protect can cause hearing impairment. Always use hearing protection while working in proximity of the CRT.



WARNING: Never operate the CRT product without wearing eye protection. Flying debris can cause injury. Always use eye protection while working in the neighborhood of the CRT.



CAUTION: Do not use files that are rated for less than the speed of the CRT. Using lower speed files, may cause injury or damage equipment. Always use files rated for at least the speed of the CRT that is being used.



CAUTION: Never be present near the CRT while it is started or in operation. Flying debris and rotating parts can cause injury. If it is necessary to approach the CRT while in motion, stand behind appropriate Plexiglas or Lexan windows. Provide a barrier to prohibit people from approaching the CRT while in operation.



CAUTION: Never use or start the CRT without first reading and understanding the operating procedures described in this manual. Never use the CRT for any purposes, or in any ways, not explicitly described in this document. Using the deburring tool without fully understanding the installation and operating procedures may cause injury to personnel or damage to equipment. Mount the CRT and connect the pneumatic control equipment as described in this manual. Operate the CRT as described in the manual.

4.2 Normal Operation

The following sections describe the normal operating conditions for the CRT.

4.2.1 Air Quality

The air supply should be clean, dry, filtered, and lubricated. A coalescing filter that has elements rated for 30 micron or better is required. The air must be supplied at 6.2 bar (90 psi).

Air quality can affect tool performance substantially. Particulates can block airflow or impede reciprocating motion. If reciprocating tools do not receive the proper air pressure, the tool stalls. Any water in the system damages the housing and pneumatic drives.

4.2.2 Lubrication

Lubricate the air supply with 1-2 drops of commercial air tool oil per minute (SAE 10W recommended).

The CRT should be run with lubrication in the air supply to maximize motor life.

4.2.3 Media Selection, Design, and Maintenance

Check media quality regularly to ensure it is not dull or worn. Using worn media causes a poor surface finish and increased wear on the tool that results in premature tool failure.

In many robotic reciprocating applications, including steel and aluminum, no cooling or lubrication of the rotary file is necessary. For some materials and applications, the addition of coolants or compressed air may aid the cutting process. If it is determined that liquid coolants are required, a non-oil cutting fluid should be used to prevent premature wear of the tool.

4.2.4 Reciprocating Tool Approach Path Should Be Slow and at an Angle

The CRT should approach the workpiece slowly and at an angle.

When beginning a reciprocating pass, try to minimize the initial impact on the work piece by slowly approaching the tool at an angle while maintaining a slightly parallel path with the surface.

Gouging and premature wear of the tool can occur if the tool perpendicularly approaches the workpiece too quickly. Additionally, collisions could result and create a hazardous situation for both personnel and equipment.

4.2.5 Program the Robot to Incorporate 50% Compliance Travel of the Tool

Program the robot to have the tool's compliance at 50% travel when on the nominal path.

As the part's edge deviates from the perfect path, the cutting bit can use compliance to follow along high and low spots without losing contact or hitting the positive stop and gouging.

Do not "bottom out" the compliance and hit the positive stop.

Repeated impact on the positive stop creates "slop" in the compliance and reduces recentering.

4.3 Reciprocating Tool Working Environment

As described in previous sections, the CRT should only be used in conjunction with a robot in a secured work cell/chamber.

The work cell must be secured by barriers to prohibit personnel from entering the cell. A lockable door should be included as a part of the barrier in order to facilitate access to the cell for authorized personnel only. The barrier could consist partly or fully of Plexiglas to facilitate observation of the reciprocating operations.

During system or reciprocating tool maintenance, make sure the CRT and robot are stopped before entering the robot cell. When installing and testing, never be present in the cell when the CRT is running.

Be aware of rotating parts. Use eye-protection while working around the CRT.

Be aware of high sound levels. While the CRT air motor is not loud, the cutting action associated with reciprocating frequently is loud. Always use hearing protection while working in the proximity of the material removal cell.

The CRT should not be used to remove materials that are prone to fracture. A fracturing work piece may result in pieces of material damaging surrounding working environment and personnel. Material removed correctly should be in the form of chips.

4.4 File Operation and File Selection

A family of files is available for working with die cast alloys, aluminum, and plastics; these files have fewer teeth and increased relief to minimize chip loading.

Plastics represent a difficult deburring challenge due to the phenomenon of chip re-welding. In this process, if the file is dull or the settings are not correct for the material, chips will melt and weld to the file or work piece. This can quickly load a file and produce unacceptable results.

ATI can provide guidance in bur selection; however, only experimentation will yield desired result. The following table includes files recommended for particular applications.

Table 4.1—File Selection	
Materials/Application	Features/Benefits
3710-50-1459, File, Rectangular	
<ul style="list-style-type: none">For steels, plastics, soft metals, wood	<ul style="list-style-type: none">General purpose work, accessing deep cavities
3710-50-1460, File, Round	
<ul style="list-style-type: none">For steels, plastics, soft metals, wood	<ul style="list-style-type: none">Complex geometries, opening holes or slots, accessing deep cavities
3710-50-1461, File, Half Round	
<ul style="list-style-type: none">For steels, plastics, soft metals, wood	<ul style="list-style-type: none">For use on flat, concave or convex surfaces. Great for cylindrical surfaces
3710-50-1462, File, Triangular	
<ul style="list-style-type: none">For steels, plastics, soft metals, wood	<ul style="list-style-type: none">For acute internal angles or to clear out square corners

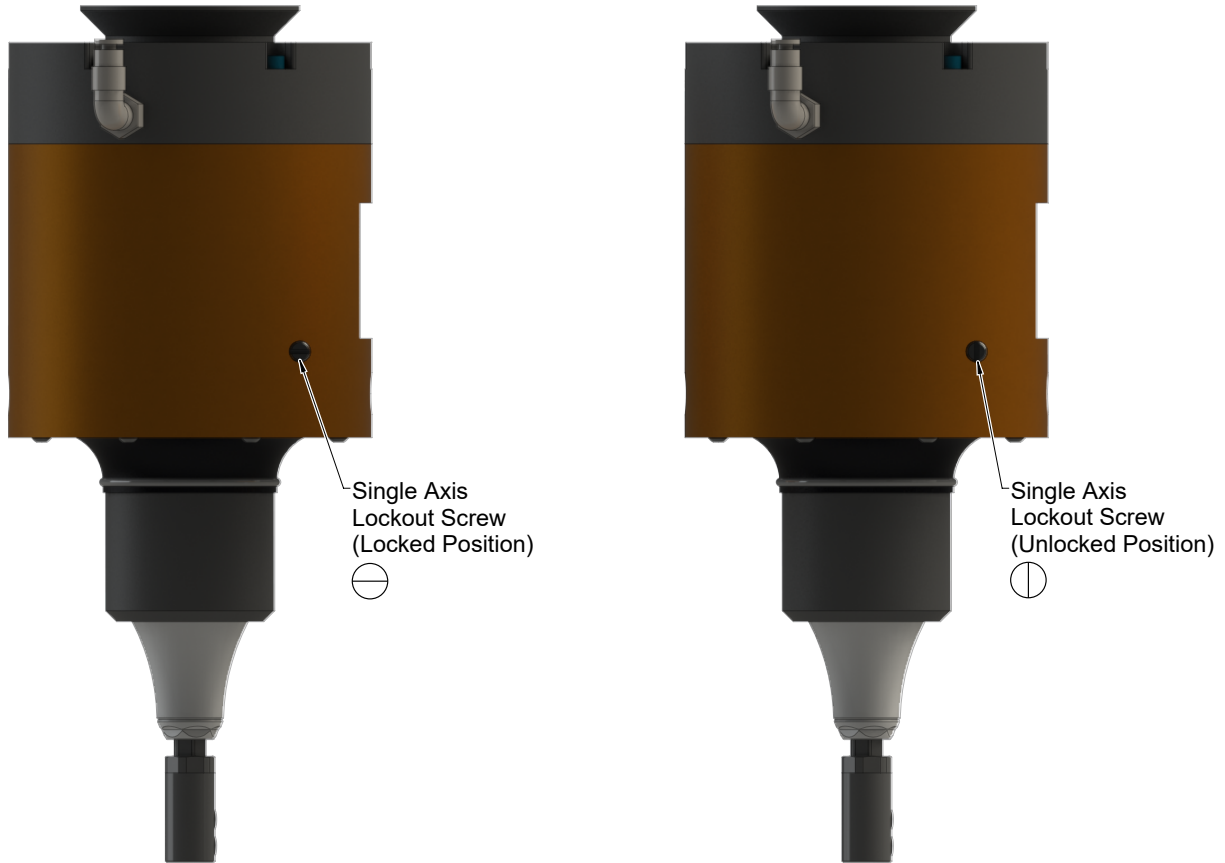
4.5 Locking and Unlocking Single Axis Compliance

The CRT can be locked to be compliant in a single axis.

Tools required: Flat headed screwdriver

1. Turn the single axis lockout screw as shown in [Figure 4.1](#) for desired compliance.
 - Locked = Single axis compliance
 - Unlocked = 360° of compliance

Figure 4.1—Single Axis Compliance



5. Maintenance

The CRT is designed to provide reliable service for long periods of operation. While simple in design, there are parts in the assembly that are not serviceable by the user. The user is encouraged to return the unit to ATI for service. [Section 6—Troubleshooting and Service Procedures](#) is provided to assist the user when they choose to service the unit in the field.

For all service, it is recommended that the air supply (before the solenoid valves) be disconnected. Purge any trapped air pressure in the lines. It is suggested that the air supply be “locked out” to prevent accidental operation of the spindle. During maintenance operations, refer to [Section 6—Troubleshooting and Service Procedures](#) for maintenance instructions. Service and repair parts are identified in [Section 7—Serviceable Parts](#) and [Section 9—Drawings](#).

The CRT is of modular construction. The subassemblies shown in [Section 9—Drawings](#) may be purchased and installed quickly to return a unit to operation.

5.1 Pneumatics

The air lines to the reciprocating tools should be checked routinely for their general condition and replaced as "required". The air to the CRT must be filtered and lubricated. The air filters should be checked and replaced as required to maintain optimum performance. The life of the filter elements is dependent on the quality of compressed air at the customer's facility and therefore cannot be estimated.

5.2 Lubrication

The CRT air motor must be supplied with clean, filtered, and lubricated air. See [Section 3.7—Pneumatics](#) for details on air supply and quality.



CAUTION: It is recommended that the customer use a coalescing filter and filter elements rated 30 micron or better.

5.3 File Inspection

The file will wear depending on cut depth, feed rate, and the material that is being filed. Inspect the file regularly for wear and refer to [Section 6—Troubleshooting and Service Procedures](#) for symptoms of a worn file. If necessary, replace the file (refer to [Section 6.2.1—File Replacement](#)).

5.4 Spindle Boot Inspection

The spindle boot prevents debris from entering the housing and protects internal components. Inspect the boot regularly for damage (refer to [Section 6.2.3—Boot Replacement](#)).

6. Troubleshooting and Service Procedures



CAUTION: Thread locker applied to fasteners must not be used more than once. Fasteners might become loose and cause equipment damage. Always apply new thread locker when reusing fasteners.

The CRT is designed to provide reliable service for long periods of operation. While simple in design, there are parts in the assembly that are not serviceable by the user. The user is encouraged to return the unit to ATI for service. [Section 6.1—Troubleshooting](#) is provided to assist the user when they choose to service the unit in the field.

For all service, it is recommended that the air supply be disconnected. Purge any trapped air pressure in the lines. It is suggested that the air supply be "locked out" to prevent accidental operation during troubleshooting. During maintenance operations, refer to [Section 6.2—Service Procedures](#) for instructions. Service and repair parts are identified in [Section 7—Serviceable Parts](#) and [Section 9—Drawings](#).

6.1 Troubleshooting

Reciprocating process development is an iterative, learning task. The following table is presented to assist in solving problems.

Symptom	Cause	Resolution
File wear	Hard work material	Use better grade burr material add coating (TiAIN)
	Too heavy a cut	Decrease depth of cut, make multiple passes
	Feed rate is too slow	Increase feed rate
File breakage	Too heavy a cut	Decrease depth of cut, make multiple passes
	Impacting the part	Decrease feed rate at contact, enter part at an angle
Unequal compliance	Regulator is defective	Replace regulator
	Worn ring cylinder	Replace ring cylinder. Refer to Section 6.2.2—Motor Replacement .
Poor finish on work piece	Feed rate is too fast	Reduce feed rate.
	File is worn	Inspect file if worn, replace. Refer to Section 6.2.1—File Replacement .
File is chattering during cut	Feed rate is too fast	Reduce feed rate
	Lack of rigidity	Increase radial compliance pressure
	Too heavy a cut	Decrease depth of cut, make multiple passes
	Improper file selection	Choose file designed for work material
	File is worn	Inspect file. If worn, replace. Refer to Section 6.2.1—File Replacement .
Secondary burrs are created on work piece after cut	Incorrect feed rate	Reduce feed rate
	Too heavy a cut	Decrease depth of cut, make multiple passes
	Improper file selection	Choose file designed for work material
	File is worn	Inspect file. If worn, replace. Refer to Section 6.2.1—File Replacement .
Chip packing of file	Too heavy a cut	Decrease depth of cut, make multiple passes
	Not enough chip clearance	Use a file with fewer rasps
File stalls	Not enough or no drive air	Verify drive air regulator is operating at 90 psi (6.2 bar), and check for leaks
	File is not secure in holder	Properly tighten file in holder
	Too much side load	Decrease depth of cut, make multiple passes

6.2 Service Procedures

Component replacement and adjustment procedures are provided in the following section:



CAUTION: During operation of the reciprocating tool, the file reaches high temperatures. Failure to wear proper personal protection equipment or not allowing the file to cool could result in serious injury to the user. Be aware that during operation, the file becomes very hot, and removing the bur, take necessary safety precautions to avoid injury.

6.2.1 File Replacement

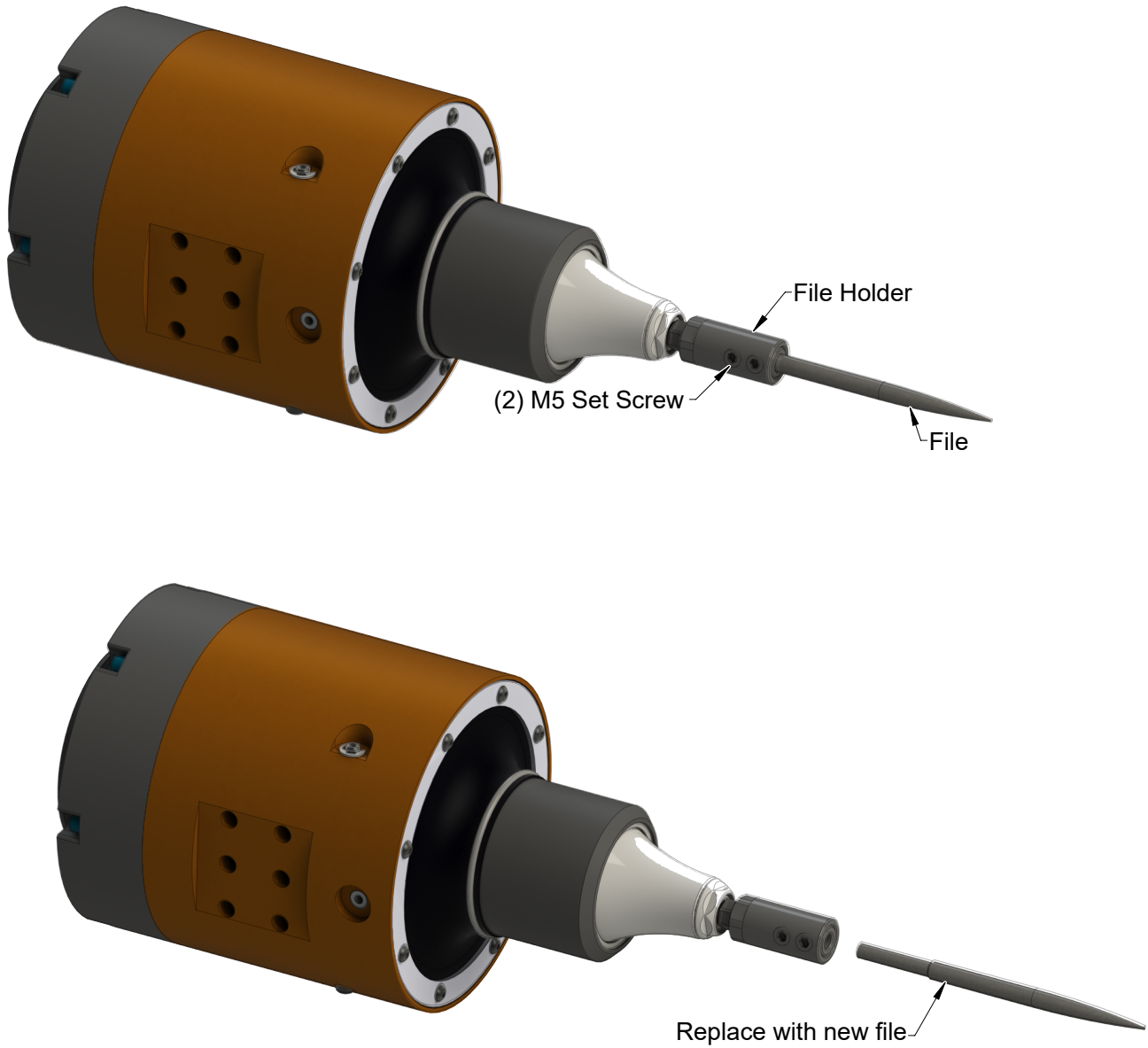
The file becomes worn during normal operation. If improper feeds and speeds are used, the file may become “loaded” with material. In both instances, replace the file. During initial production, the file and the workpiece should be examined often in order to determine when the file should be replaced.

Refer to the following steps for replacing the file (*Figure 6.1* on the following page):

Tools required: 2.5 mm hex key

1. Lock-out and remove the reciprocating drive air supply for safety. De-energize all energized circuits such as: air and power.
2. Use a 2.5 mm hex key to loosen the (2) M5 set screws in the body of the file holder.
3. To remove a worn file, pull the file out of the holder by hand.
4. Replace the file.
5. Use a 2.5 mm hex key to tighten the (2) M5 set screws in the body of the file holder securing the file in place.
6. Safely resume normal operation.

Figure 6.1—File Replacement



6.2.2 Motor Replacement

After extended operation, the CRT motor may need to be replaced. To replace the motor assembly, perform the following procedure:

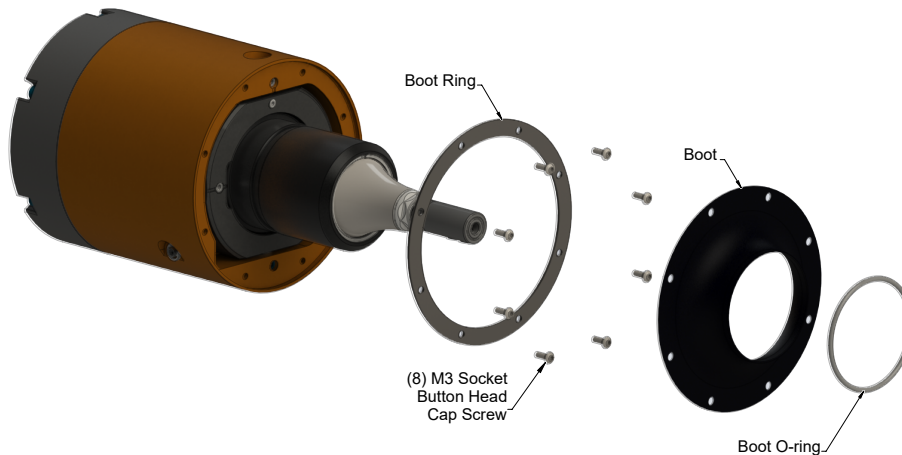
Parts required: Refer to [Section 9—Drawings](#).

Tools required: 0.25 in, 2 mm, 2.5 mm hex keys, M3 bolt, torque wrench, pin spanner wrench

Supplies required: Clean rag, Loctite 222, 242, 569, 7649; Magnalube

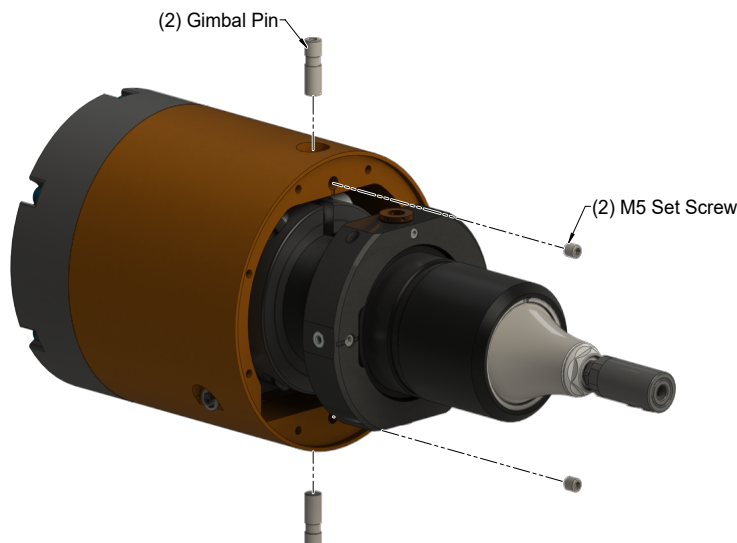
1. Lock-out and remove the reciprocating drive air supply for safety. De-energize all energized circuits such as: air and power (Note: The CRT unit can remain mounted to the robot or bench while performing the motor replacement procedure).
2. Ease the boot O-ring off the spindle.
3. Using a 2 mm hex key, remove the (8) M3 socket button head cap screws that secure the boot ring to the housing.
4. Remove the boot ring and boot.

Figure 6.2—Remove Boot O-ring, Boot, Boot Ring



5. Using a 2.5 mm hex key, remove the (2) M5 set screws securing the outer gimbal pins to the CRT body.
6. Using an M3 bolt, remove the two outer gimbal pins.

Figure 6.3—Remove Gimbal Pins



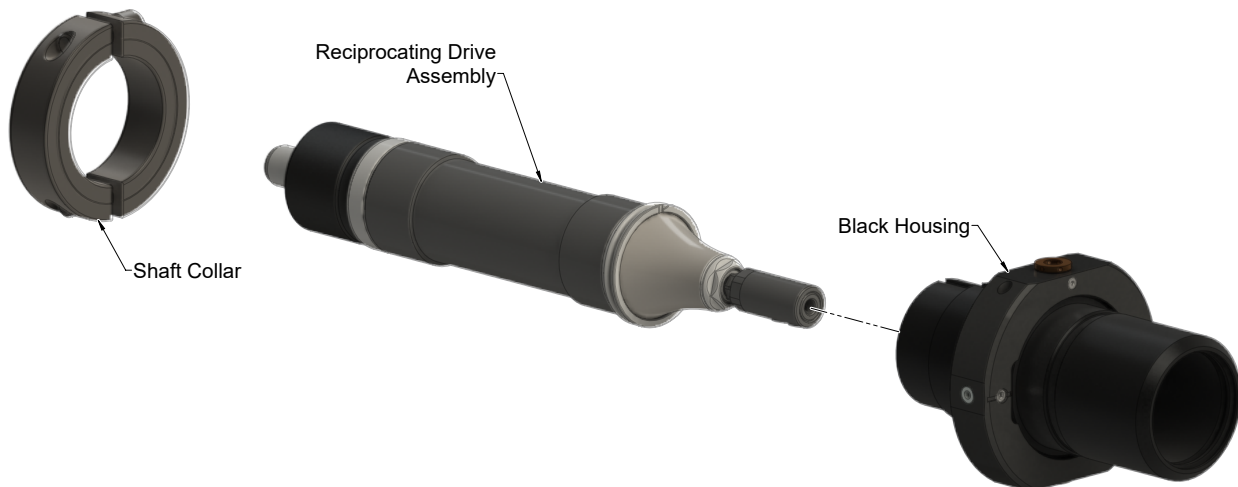
7. Rotate the motor assembly by a single turn for clearance to remove motor.
8. Remove motor assembly out from the tool housing body.

Figure 6.4—Remove Motor Assembly from Housing



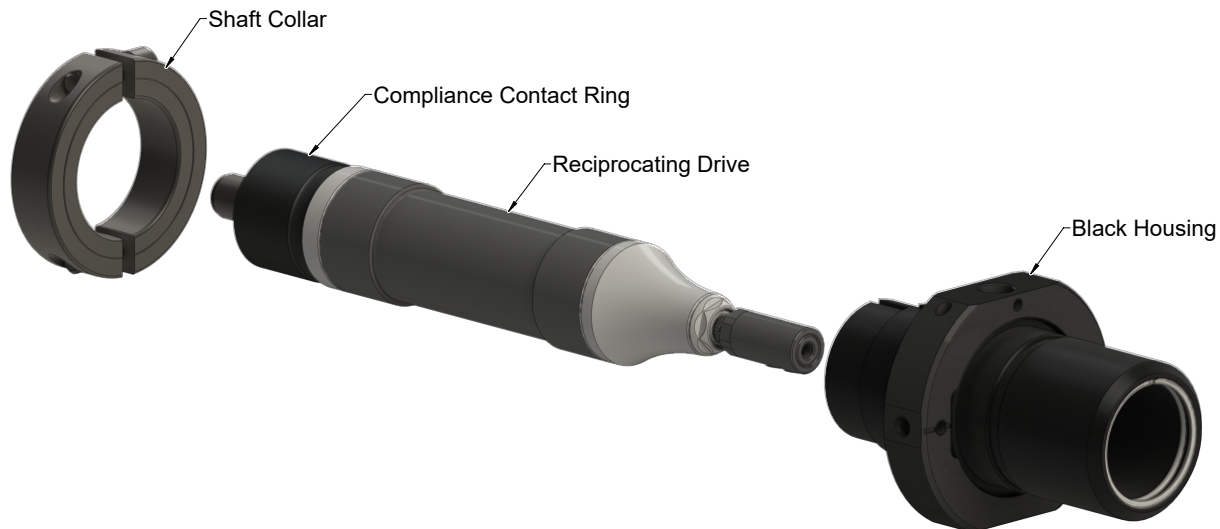
9. Using a 0.25 in hex key, remove the shaft collar from the motor assembly.
10. Slide reciprocating drive assembly out of black housing.

Figure 6.5—Remove Shaft Collar and Black Housing



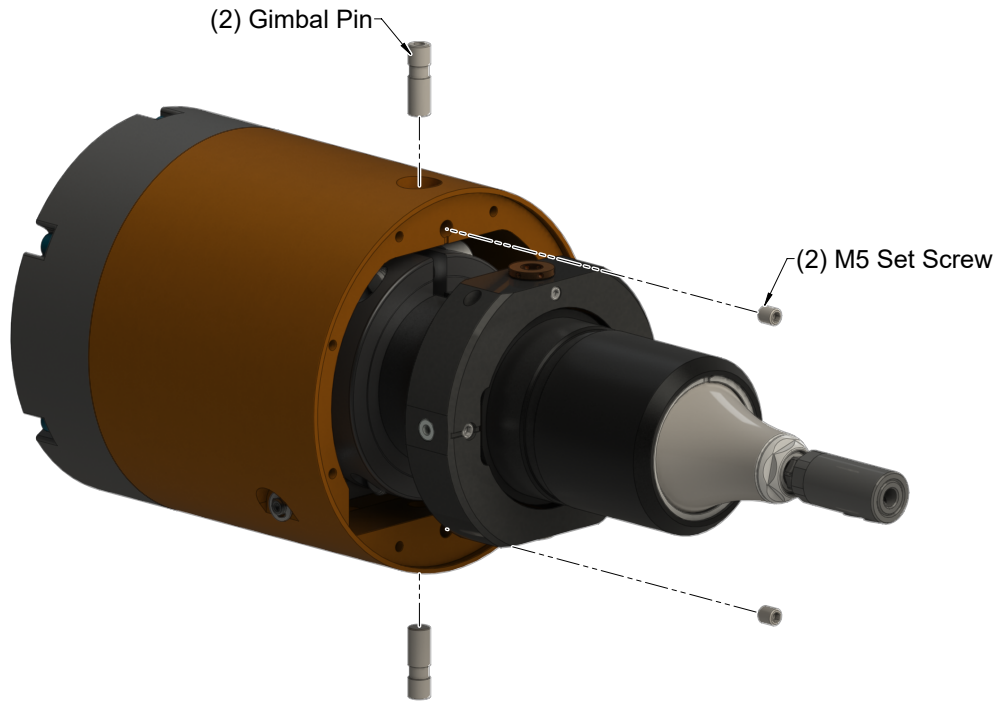
11. Insert the reciprocating drive all the way into the black housing. Ensure the notch on the side of the inner gimbal aligns with the set screws on the file holder
12. Apply Loctite 7649 primer then Loctite 242 to the collar bolts.
13. Attach the shaft collar to the black housing, ensuring the collar aligns with the notches on the black housing, refer to [Figure 6.6](#). Torque each bolt to 89 in-lb. (10.06 Nm).

Figure 6.6—Reinstall Shaft Collar and Black Housing



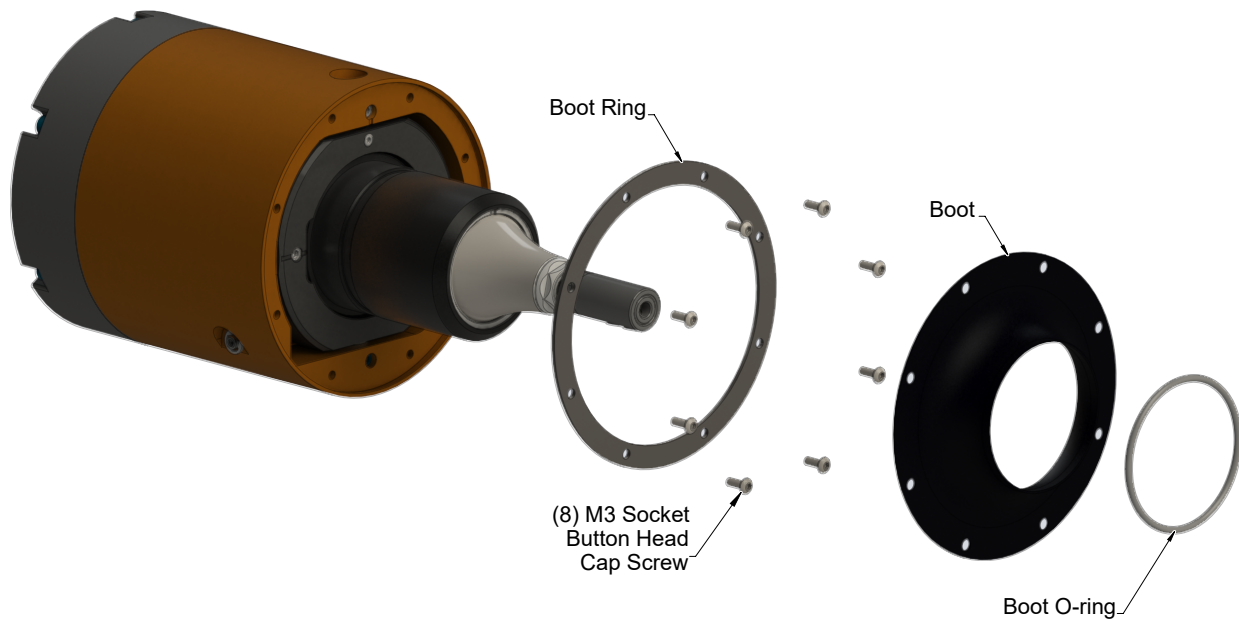
14. Insert the motor assembly into the housing.
15. Apply magnalube to the (2) gimbal pins and insert the pins into the housing using an M3 screw. The gimbal pins should be positioned flush with the bottom of each bore.
16. Apply Loctite 222 to the (2) M5 set screws and insert screws into the housing.
17. Using a 2.5 mm hex key wrench, tighten the (2) M5 set screws to 25 in-lb (2.82 Nm).

Figure 6.7—Reinstall Gimbal Pins



18. Align the boot ring and boot with the holes in the housing and slide the boot onto the spindle. Align the edge of the boot to the edge of the contact surface.
19. Apply Loctite 7649 primer and Loctite 222 to the threads of the (8) M3 socket button head cap screws.
20. Using a 2 mm hex key, install the (8) M3 socket button head cap screws that secure the boot to the housing. Tighten to contact plus one half turn.

Figure 6.8—Boot Replacement



21. Stretch the O-ring over the boot.
22. Connect the hoses to the fittings on the rear of the CRT.
23. Install the CRT to the robot or work location.
24. Safely resume normal operation.

6.2.3 Boot Replacement

The boot prevents debris from entering the housing and protects internal components. Replace the boot if it shows signs of damage. Refer to [Figure 6.8](#).

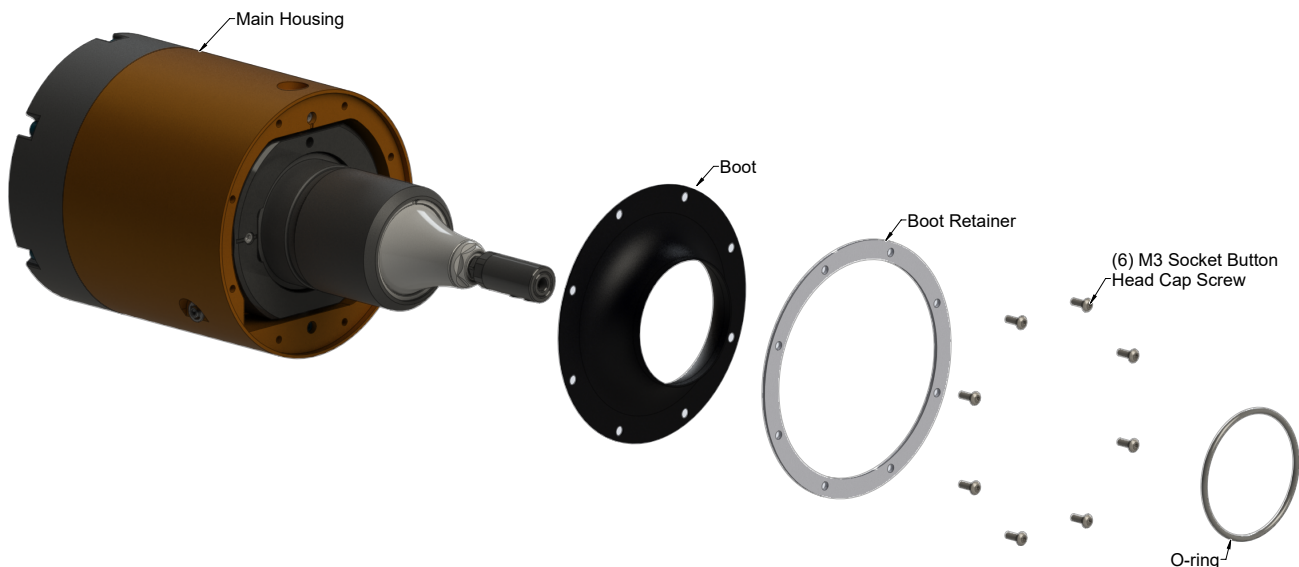
Parts required: Refer to [Section 9—Drawings](#).

Tools required: 2 mm hex key, torque wrench

Supplies required: Clean rag, Loctite 222, 7649

1. Lock-out and remove the spindle motor air supply (De-energize all energized circuits such as: air and power).
2. Remove the CRT from the robot or work location.
3. Clean debris from the CRT using compressed air and a clean rag to wipe any grease from the outer surfaces.
4. Ease the O-ring off the spindle.
5. Using a 2 mm hex key, remove the (6) M3 socket button head cap screws that secure the boot ring to the housing.
6. Remove the boot ring and boot.
7. Align the boot ring and boot with the holes in the housing and slide the boot onto the spindle. Align the edge of the boot to the edge of the contact surface.
8. Apply Loctite 7649 primer then Loctite 222 to the threads of the (6) M3 socket button head cap screws.
9. Using a 2 mm hex key, install the (6) M3 socket button head cap screws that secure the boot to the housing. Tighten to contact plus one half turn.
10. Stretch the O-ring over the boot.
11. Install the CRT to the robot or work location.
12. Safely resume normal operation.

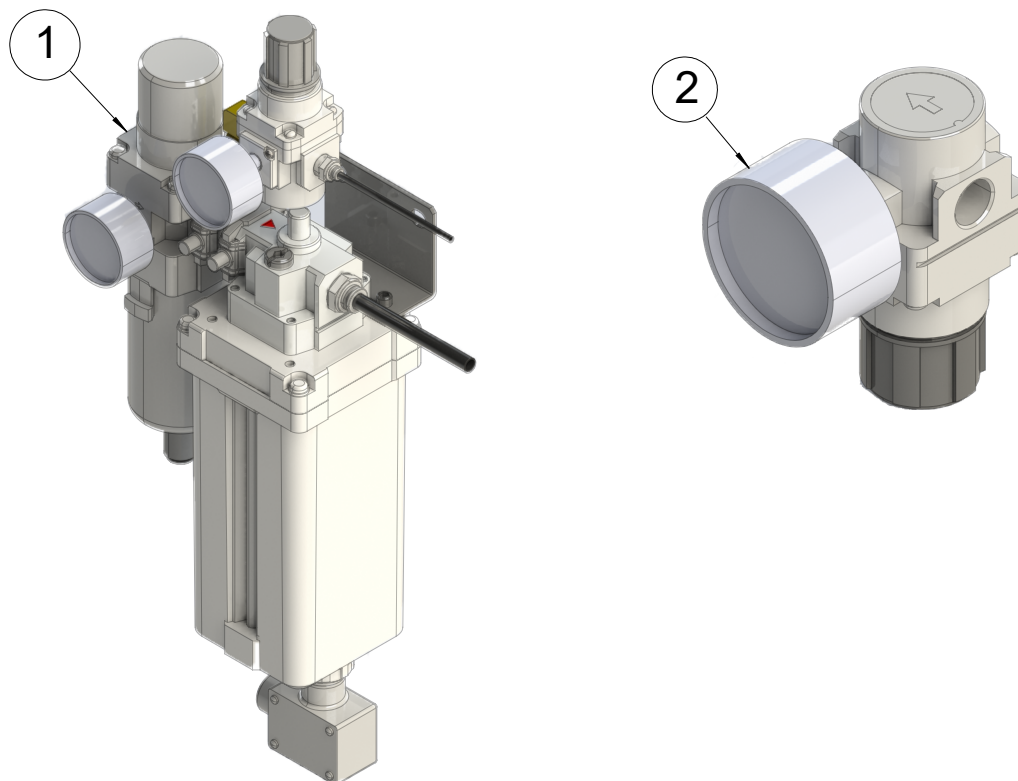
Figure 6.9—Boot Replacement



7. Serviceable Parts

The serviceable parts for the 9150-CRT are shown in *Section 9—Drawings*.

7.1 Accessories



Item No.	Qty	Part Number	Description
1	1	9005-50-6174	FRL (Filter Regulator Lubricator) Unit with Oil Level Switch
2	1	9005-50-6164	Air Pressure Regulator
*	1	9005-50-6090	Replacement Motor
*	1	3700-50-9048	Replacement Boot
*	1	9005-50-6091	Interface Plate Kit, Benchmount Style A to (4) M6, (2) Dowel 6, .75" x 4.5"
*	1	9005-50-6143	Interface Plate Kit, Dovetail Style B to 100 mm Axial Offset Blank
*	1	9005-50-6121	Chuck Kit, CRT-12-5, 6mm/.25"
*	1	9005-50-6120	Chuck Kit, CRT-12-5, 4mm
*	1	9005-50-6119	Chuck Kit, CRT-12-5, 3mm/.125"
*	1	3710-50-1459	File, Rectangular, 5mm Shank
*	1	3710-50-1460	File, Round, 5mm Shank
*	1	3710-50-1461	File, Half Round, 5mm Shank
*	1	3710-50-1462	File, Triangular, 5mm Shank

8. Specifications

Table 8.1—CRT-12-5 Specifications	
Parameter	Rating
Motor	Pneumatic drive type
Idle Speed	12,000 Strokes Per Minute (SPM)
Weight	6.8 lbs (3.08 kg).
Compensation (Radial)	+/- .32" (8 mm) recommended
Compliance Force (Measured at Holder)	4 - 14 lb (17.8 - 62.3 N)
Reciprocating Air Pressure	90 psi (6.2 bar)
Air Consumption (Max.)	6 CFM at load
Holder Size	5 mm

9. Drawings

The following links provide access to the CRT Drawings:

- CRT Customer Drawing: [9630-50-CRT-12-5](#)
- Pneumatic Diagram: [9630-50-RCV-PNEUMATIC](#)
- Interface Plate Drawing: [9230-50-1090](#)

10. Terms and Conditions of Sale

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