ATI Axially Compliant Robotic Deburring Tools Speedeburr™

(Models 9150-AC-90 and 9150-AC-180)

Product Manual

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Engineered Products for Robotic Productivity

Pinnacle Park • 1031 Goodworth Drive • Apex, NC 27539 USA • Tel: +1 919-772-0115 • Fax: +1 919-772-8259 • www.ati-ia.com

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.

How to reach us:

Sale, Service and Information about ATI products:

ATI Industrial Automation
1031 Goodworth Drive
Apex, NC 27539 USA
www.ati-ia.com
Tel: +1 919-772-0115
Fax: +1 919-772-8259

Application Engineering
Tel: +1 919-772-0115
Fax: +1 919-772-8259
E-mail: *ATI-MRapplications@novanta.com*
24/7 Support: +1 855 ATI-IA 00 (+1 855-284-4200)

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Glossary

Term	Definition
AC	Axially compliant.
Adapter Plate	Device for attaching the deburring tool to either a robot flange or a stationary mounting surface.
Air Filter	Device for removing contamination from air supply lines. Typically refers to removal of particulates.
Bur	Cutting tool used to remove burrs from the workpiece. Alternatively referred to as a rotary file, cutter, or bit.
Burr	Any unwanted, raised protrusion on the workpiece.
Chattering	Machine vibrations. The cutting tool bounces as it contact the work surface.
Coalescing Filter	Device designed to remove liquid aerosols from the supply air lines.
Collet	Gripping device used to hold cutting tools in the spindle.
Compliance	The ability of the spindle to passively move in response to protrusions on or deviations of the workpiece.
Deburr	To remove the burrs from a piece of machined work.
End-Effector	Tool used by the robot to perform a particular function.
FFP	Free flying piston. An assembly that moves within the cylinder and spline in the deburring tool. The FFP attaches to the bur.
ISO	A series of standards that are developed and published by the International Organization for Standardization (ISO). The standards define, establish, and maintain an effective quality assurance system for manufacturing and service industries.
Positive Displacement	A device that captures fluid of air and discharges that fluid or air at a fixed rate.
Positive Stop	The tool has contacted a physical limitation and can no longer move.
Regulator	Device used to set and control the supplied air pressure to lower acceptable levels.
Solenoid Valve	Electrically controlled device for switching air supplies on and off.
Speedeburr	An ATI series of deburring tools that use a vane-type motor and a floating rotary cutting bur for edge-deburring and chamfering of parts.
Vane-Type	A positive displacement air motor design utilizing partitions (vanes) to separate expansion regions inside a housing.
VG	Viscosity Grade.

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

Prior to purchase, installation, and operation of the Speedeburr product, the customer should first read and understand the operating procedures and information described in this manual. Never use the deburring tool for any purposes, or in any ways, 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 spare parts other than ATI spare parts. Use of spare parts not supplied by ATI can damage equipment and void the warranty. Always use genuine ATI spare parts.

CAUTION: Do not perform maintenance or repair on the Speedeburr 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 Speedeburr product.

2. Product Overview

The AC deburring tool, which is also known as Speedeburr, is a robust, high-speed, and lightweight vane-type air motor deburring unit with a floating rotary cutting bur for edge-deburring and chamfering of materials such as aluminum, plastic, and steel.

The AC deburring tool's pneumatically controlled, articulated design allows the bur to follow the part profile and compensate for surface irregularities while maintaining a constant force. This axial force/compliance air supply system provides increased stiffness in the path direction and decreased stiffness in the contact force direction, both of which prevent the tool from chattering.

The AC deburring tool utilizes a rotary cutting bur of tungsten carbide or coated with PCD or CBN. Because the rotary bur has a 45° cutting angle, compliance is lateral and axial.

Custom adapter plates for mounting to the robot, work bench, or a tool fixture are available from ATI. *Refer to https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf and https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf* for more information.

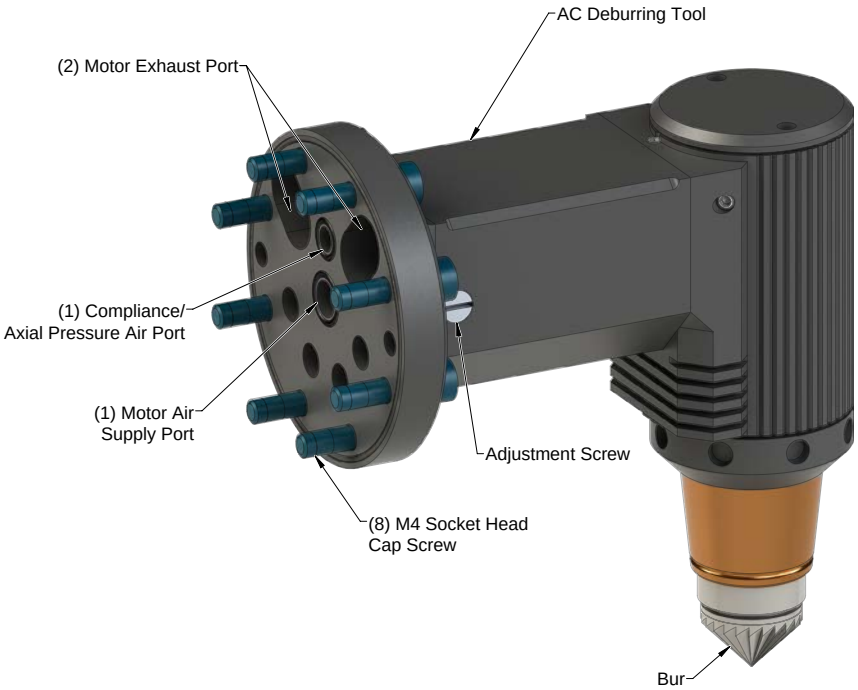
The AC deburring tools have the following pneumatic ports:

- (1) port for axial force/compliance supply that provides constant force on the bur.
- (1) port for motor air supply.
- (2) port(s) for motor exhaust.

ATI has (2) models of the AC deburring tool: 9150-AC-90 and 9150-AC-180. Both models are similar except for the following features:

- On the AC-90, the motor housing extends perpendicular, at a 90° angle, from the mounting bracket. On the AC-180, the motor housing extends linearly, 180°, with the mounting bracket. *Refer to https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf and https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*.
- On the side of the 90° angled bracket, the AC-90 has an adjustment screw with which the user can use a small flat-blade screwdriver to adjust the motor speed. The motor speed can also be adjusted on both models by adjusting the motor air supply pressure. Refer to *Section 4.5—Programming the Deburring Tool Path* for more information.

Figure 2.1—AC Deburring Tool (9150-AC-90 Shown)



2.1 Free Flying Piston (FFP)

The FFP is an important component of the AC deburring tool.

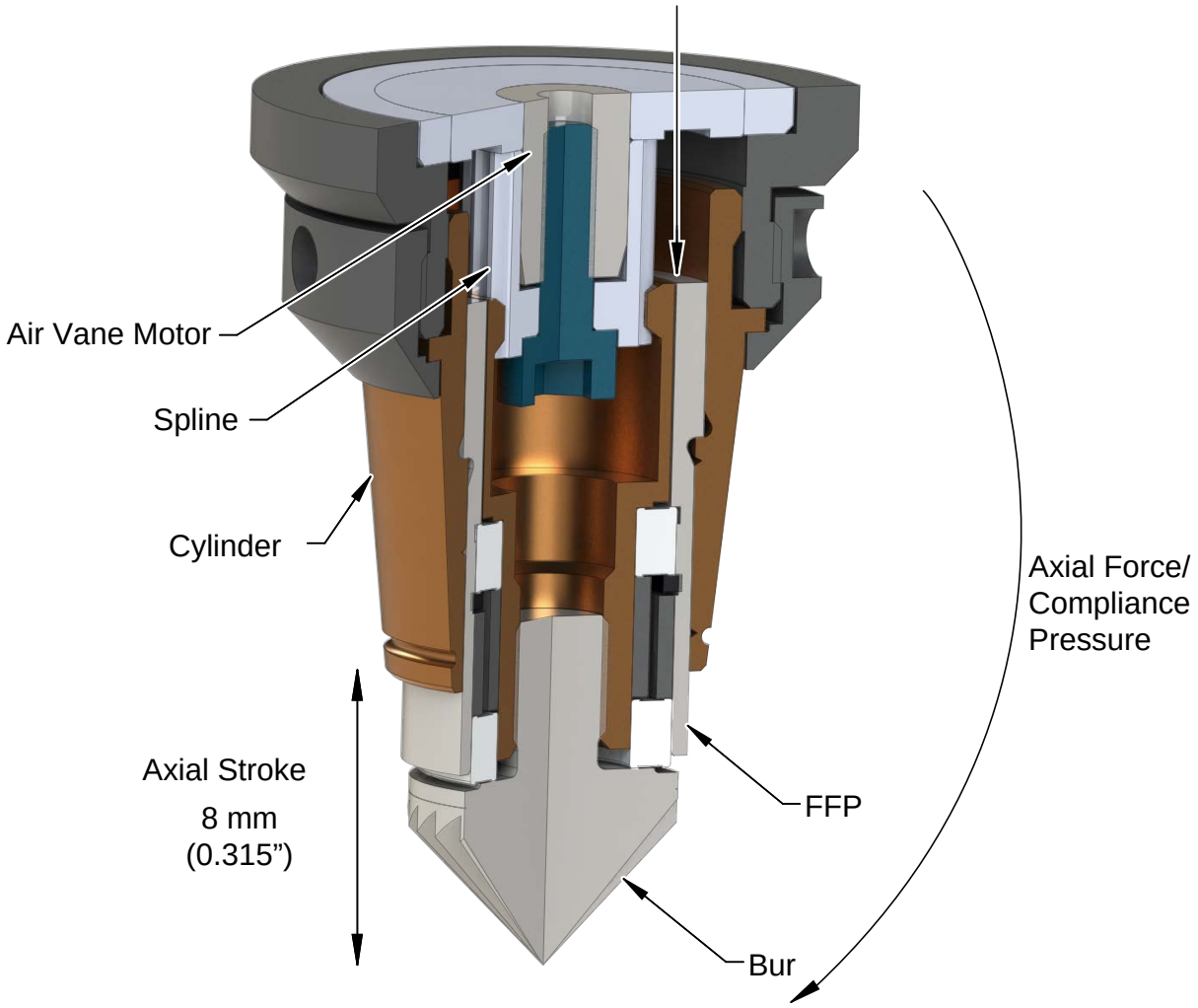
A remotely controlled axial force/compliance air pressure pushes the FFP forward into contact with the bur edge.

Then the air vane motor uncouples from the linear movement of the FFP to reduce inertia and increase the stability of the contact force during deburring.

Then the spline coupling transmits torque to the bur. Ball bearings within the motor compartment of the tool ensure the bur operates evenly.

A small amount of frictional torque is transmitted through the ball bearings to the FFP cylinder that rotates slowly inside the stationary outer cylinder. This small frictional torque prevents stick-slip or static friction of the FFP. The FFP cylindrical body is precision grounded to minimize friction in the axial direction.

Figure 2.2—FFP (AC-180 Shown)



2.2 Technical Description

A technical overview of the product is provided in the following tables and graph. 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.
	Mounted to a table or stand by means of the bench adapter. The robot is carrying the work piece to the deburring tool.
Temperature Range	5 °C – 35 °C 41 °F – 95 °F
Utilities	The tool requires the following: • Clean, dry, filtered, and lubricated air. • A coalescing filter and filter elements that are rated 5 micron or better. • Air supply to the spindle must be 6.2 bar (90 psi) to develop the full rated power. • The axial force/compliance air must be supplied at 1.0–4.1 bar (15–60 psi) from a regulated source.

2.2.1.2 Storage

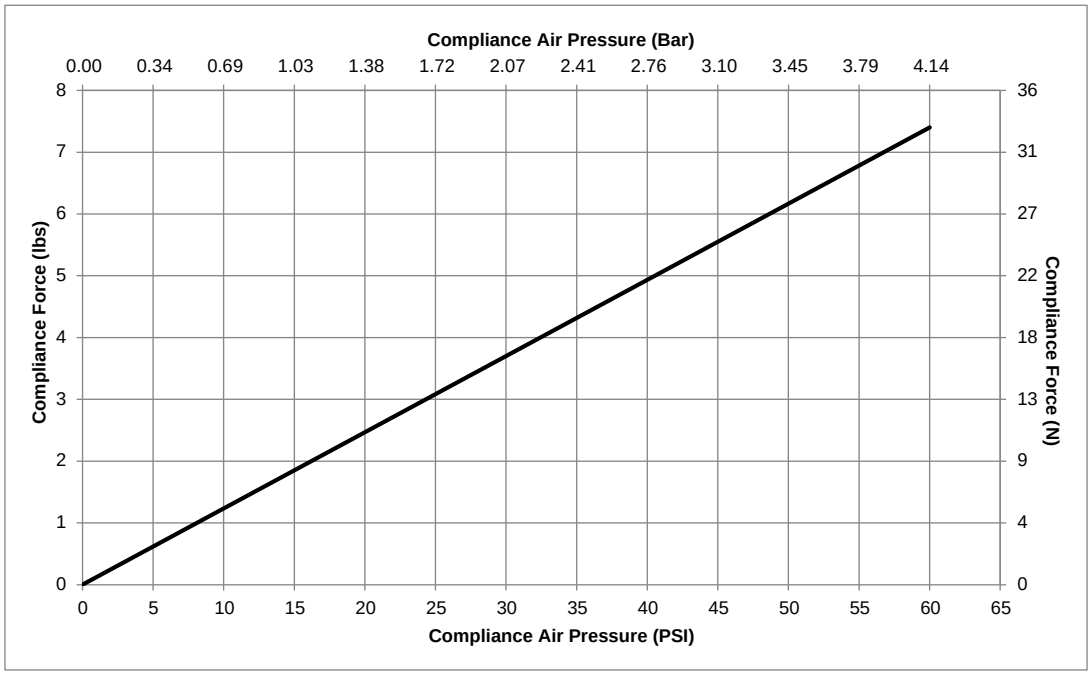
Table 2.2—Storage	
Temperature Range	0 °C – 45 °C 32 °F – 113 °F
Conditions	The tool should be stored in its crate and in a dry place. When not in use, keep the unit in its crate if possible. Consult *Section 3.4—Storage and Preventive Maintenance During Storage* of this manual.

2.2.2 Axial Force/ Compliance Unit Performance

The following graph illustrates the variation of compliance force with applied axial force/ compliance air pressure. Measurements may vary from one product to another and should only be treated as nominal.

Axial force/compliance is also dependent upon the material of the work piece, type of bur tool, and the amount of material that is removed.

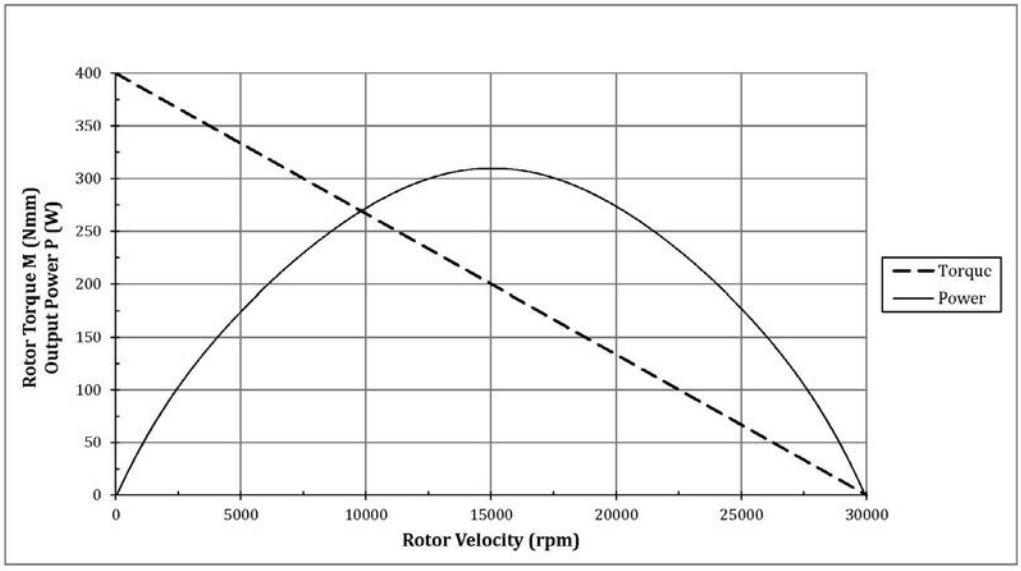
Figure 2.3—AC Axial Contact Force (Measured with the Rotary Bur Pointing Down)



2.2.3 Air Motor Performance

The following graphs illustrate the motor torque and power performance. The air motor operating speed changes according to the applied load, until the motor develops the power that is required to perform the specific task. The idle speed of the motor is at maximum, when no load is applied. Without an applied load, the motor decreases to a slower operating speed at which the motor develops maximum torque. ATI recommends a working speed of 15,000 to 25,000 RPM for maximum possible output. The operating speed that is less than 15,000 RPM risks the motor stalling because of the higher torque at lower speeds.

Figure 2.4—AC Output Torque and Power



3. Installation

The deburring tool is delivered fully assembled. Optional equipment such as mounting adapter plates and bur tools are separate.

3.1 Protection During Transportation

The deburring tool arrives in packaging that secures and protects the tool during transportation. Always use this packaging when storing or transporting the deburring tool in order to minimize the risk of damage.

3.2 Inspection of Condition When Delivered

Upon receipt, the following should be checked:

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

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

3.3 Unpacking and Handling

The deburring tool should always be placed inside the accompanying packaging, while transporting, storing, and handling.

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

3.4 Storage and Preventive Maintenance During Storage

The deburring tool should always be stored in its accompanying packaging, when not in use. The deburring tool should be stored in a dry place.

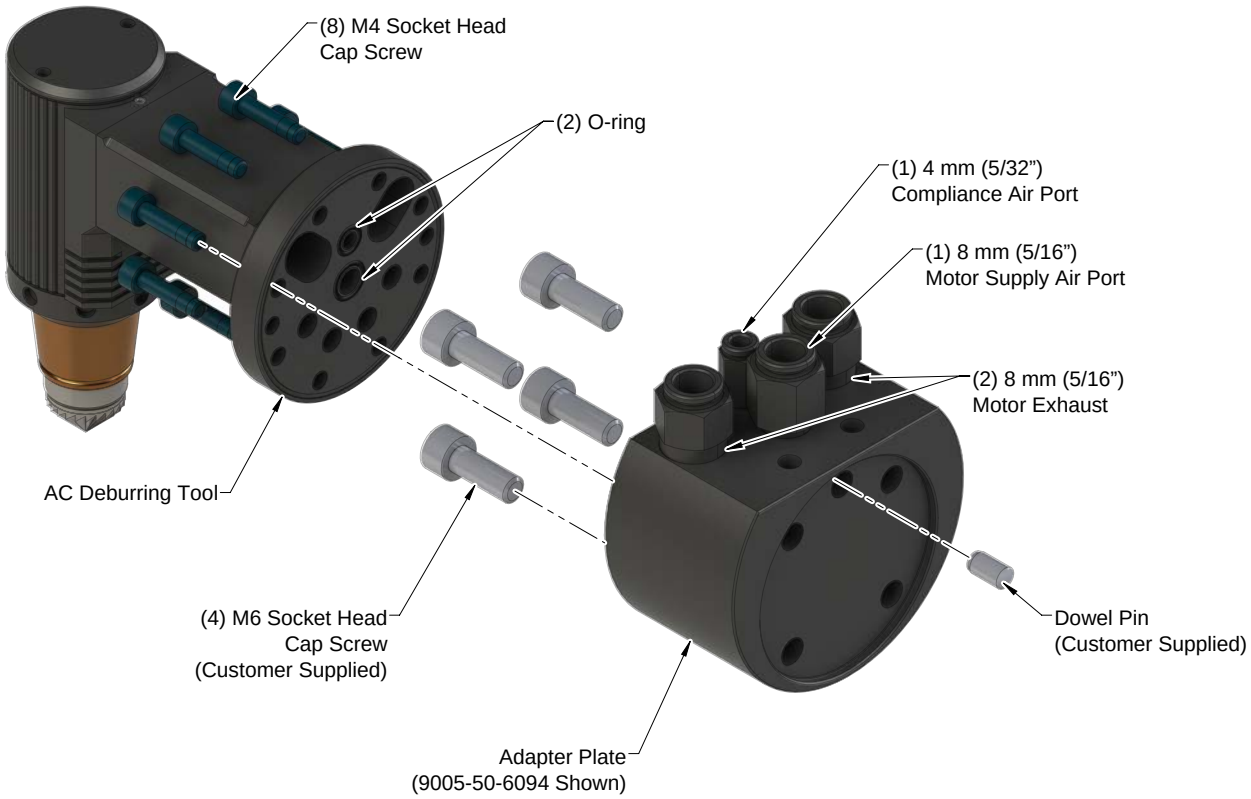
For long-term storage, the deburring tool should be thoroughly cleaned of any burrs or debris. Do not disassemble the deburring tool. After cleaning, fill the deburring tool with oil of the same type that was used as a lubrication during operation. Lubrication is necessary to keep the blades in the air-vane motor from drying out and prevent corrosion. Place the deburring tool inside a sealed plastic bag. Place the bag with its contents inside the crate.

3.5 Mounting Installation

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 mounting pattern of the AC deburring tool consists of (8) M4 through holes. Refer to the following figure and *https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf* and *https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*. An adapter plate allows the deburring tool to attach to a robot arm, other work surface, or an intermediate adapter plate. Verify the O-rings are positioned correctly into the grooves on the deburring tool bracket before mounting the tool to the adapter plate. If the AC deburring tool is permanently mounted to a work surface, the robot carries the part to be deburred to the deburring tool.

Figure 3.1—Mounting Installation



3.6 Pneumatics

Conventional, customer-supplied, pneumatic components are used to control the air supply to the deburring tool. Consult the valve and regulator supplier's literature when selecting these components.

https://www.ati-ia.com/app_content/Documents/9230-50-1071.auto.pdf shows the (2) connection options for the motor and axial (compliance) force air supplies:

- Option 1: (1) solenoid valve to control both the motor drive air supply and axial force air supply.
- Option 2: (1) solenoid valve to control the motor air supply and another solenoid valve to control axial force air supply.

A robot controller actuates the solenoid valves by issuing a digital output signal.

CAUTION: No lubrication causes damage to the motor within a short period of time. If the motor is not properly lubricated, the motor operates audibly slower than normal and the speed varies. Ensure the deburring tool is properly lubricated. Install the lubrication equipment near the robot base and a maximum of (16) feet away from the deburring tool. Refer to *Section 4.2.2—Lubrication* for more information.

CAUTION: When the system is first installed, use a higher oil setting that is approximately twice the recommended setting. Stay at this setting, until the unit is receiving consistently oiled air. Run the oil through the entire pneumatic tube between the oiler and the unit before normal operation.

CAUTION: It is recommended that the customer use a coalescing filter and filter elements rated 5 micron or better.

ATI recommends that the user install a pneumatic pressure regulator (ATI Part # 9005-50-6174, or equivalent) to achieve a stable air supply of 6.2 bar (90 psi) to the motor. Refer to *Section 8—Specifications* for the maximum flow requirements. Because the deburring motor is a positive displacement device, lower operating speeds can be achieved by reducing the motor supply air pressure.

Ensure the air lubrication system is filled with oil. Refer to *Section 4.2.2—Lubrication* for more information. Use a coalescing filter with elements that are rated for 5 micron or better. An oil recovery unit may be installed on the exhaust line to avoid the mist lubrication droplets from entering the atmosphere around the robot installation.

Use a second, precision, self-relieving regulator (ATI Part # 9005-50-6164, or equivalent) for the axial force/compliance mechanism. Compliance corresponds to the axially applied force on the rotary bur. The axial force/compliance air supply must be lubricated. Because very little airflow is required, a smaller valve can be used.

If the complete work piece can be deburred with equal force, a conventional, manual pressure regulator can be used for the axial force/compliance air supply. If the burrs, which are to be removed, 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.

The axial force/compliance air supply pressure regulator should have a 1.0-4.1 bar (15-60 psi) range. When testing for the proper contact force, start with a very low pressure and increase slowly until the desired chamfer is achieved. Typically start at 3 psi (0.21 bar) for aluminum and at a higher pressure for steel workpieces.

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
	Adapter P/N 9005-50-6094	
Motor Air Supply	8 mm (5/16")	90 psi (6.2 bar)
Axial Force/Compliance Air Supply	4 mm (5/32")	1.0–4.1 bar (15–60 psi)
Exhaust	Vented to the atmosphere through (2) 8 mm (5/16")	Not Applicable

For the motor air supply, use flexible plastic tubing or hose that has a 8 mm (5/16") diameter. For the axial force/compliance air supply, 4 mm (5/32”) outer diameter plastic tubing is sufficient.

To keep the sound level to a minimum mount (2) silencers on the (2) exhaust outlets or route exhaust to a remote outlet location or oil recovery device. Use a minimum of 13 mm (1/2") diameter plastic tubing. Always use the largest size exhaust tubing possible with the minimum required length to limit backpressure.

Refer to *Section 8—Specifications* for information about the sound level of the deburring tool. The sound level around deburring equipment cannot be predicted by ATI, because the sound pressure from deburring operations is process and part dependent. To reduce the sound from the cutting operation in nearby working areas, a customer-supplied barrier surrounding the installation may be installed (Plexiglas® or Lexan® is preferred).

4. Operation

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

4.1 Safety Precautions

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

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

WARNING: All personnel, who are involved in the operation of the deburring 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 deburring installation and the deburring tool.

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

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

CAUTION: Only use burs that are supplied by ATI. Using a bur, which is from another distributer, is not properly designed for the ATI deburring tool and may cause injury or damage equipment.

CAUTION: Failure to properly handle the lubrication material and long-time exposure to air that contains oil could cause injury to personnel. Refer to the lubrication safety data sheet (SDS) for more information about the material properties, proper handling/ storage/disposal practices, and what to do in the event of an accidental exposure.

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

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

CAUTION: Protect the brass cylinder that encloses the FFP from collisions. If struck, the cylinder may be damaged and need to be replaced in order to continue normal operations.

4.2 Normal Operation

The following sections describe the normal operating conditions for the AC deburring tools.

4.2.1 Air Quality

The air supply should be clean, dry, filtered, and lubricated. A coalescing filter that has elements rated for 5 micron or better is required. The air must be supplied at 6.2 bar (90 psi).

Air quality affects tool performance more than almost any other factor. Particulate can block airflow or impede vane motion. If deburring tools do not receive the proper air pressure, the tool stalls. Any water in the system damages the housing and blades.

4.2.2 Lubrication

Vane motors for the AC deburring tool must have oil in the motor air supply. Otherwise, the vane material wears against the housing and degrades quickly. Premature failure results, when using the deburring tool without lubrication.

Use a brand name air tool oil with a viscosity in the range of IS0 VG 32 to ISO VG 46. For example, use Mobil™ ALMO OIL 525, which is available from many industrial suppliers.

Do not use oilfog air lubrication systems. Only use microfog systems.

Lubricate the air supply with 3-4 drops of oil per minute.

The length of the lubrication supply hose between the lubricator and the air motor should be no more than 5 m (16 feet).

4.2.3 Media Selection, Design, and Maintenance

Use genuine, proprietary ATI carbide burs.

Check media quality regularly to ensure it is not dull or worn. Using worn media causes poor surface finish and premature tool failure because of increased wear on the bearings.

Under normal conditions, no cooling or lubrication of the bur is necessary.

4.2.4 Deburring Tool Approach Path Should Be Slow and At an Angle

The deburring tool should approach the workpiece slowly and at an angle.

When beginning a deburring 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.

If the tool quickly approaches perpendicularly to the workpiece, the result is gouging and premature wear of the tool bearings and results in premature failing of the unit. Additionally, collisions could result and create a hazardous situation for both personnel and equipment.

4.2.5 No Radial Loading

Do not apply radial loads that are perpendicular to the axis of rotation.

Do not use the AC deburring tool to perform grinding, countersinking, or other metal-forming processes.

4.2.6 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 impacts on the positive stop can damage the compliance mechanism or motor.

4.3 Speedeburr Working Environment

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

The work cell must be secured by means of 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 deburring operations.

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

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

Be aware of high sound levels. Always use hearing protection while working in the proximity of the deburring cell.

The deburring tool should not be used to deburr 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 Tool Center Point (TCP) Position

The overall deburring tool dimensions are shown in *https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf* and *https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*. When setting the TCP position in the robot controller, use the mid-position of the 8 mm(0.315") axial stroke of the FFP. Also, take into account the depth of the Speedeburr adapter plate. If an additional interface plate is used to fit the adapter to the robot, this depth must be considered while setting the TCP position.

Table 4.1—Setting the TCP Distance for X, Y, and Z

Configuration	Distance for AC-90			Distance for AC-180		
	X	Y	Z	X	Y	Z
Without the Speedburr adapter	74.93 mm (2.95")	0	-69.85 mm (-2.75")	N/A		-114.81 mm (-4.52")
With the Speedeburr adapter	109.98 mm (4.33")					-149.86 mm (-5.90")

4.5 Programming the Deburring Tool Path

The overall deburring tool dimensions are shown in *https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf* and *https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*.

While various methods are available to program the robot path, the bur should be nominally at the mid-point of its stroke while deburring a part. The bur moves up and down with part and path variation. The method that is used depends upon the capabilities of the robot and the programmer's preferences.

One programming method is to use the point of the bur as a guide, follow the edge of the part, and then manually or automatically add offsets to the path points to achieve the correct path.

Another programming method is to input into the robot the actual points that are along the path. If this method is used, make sure that at each point the bur is at its nominal mid-point when in contact with the part and that there are no radial forces.

If an application requires the deburring of sharp inner corners, it may be required to use the area of the bur that is closer to tip. In this case, compensation and cutting surface speed of the deburring tool are reduced.

When first running the robot program, observe the path with the axial force/compliance air supply turned off. When increasing the path speed, notice if the path deviates. Verify that at the operational robot path speed the bur remains near the mid-point of its axial travel.

Adjust the axial force/compliance air supply as described in *Section 3.6—Pneumatics* to achieve the correct sized and even chamfer.

To change the motor speed, adjust the main supply pressure, for example: increasing the pressure, increases the speed. On the AC-90, the user can adjust the speed by using a small flat-blade screwdriver to turn the adjustment screw on the side of the 90° bracket (refer to *Figure 2.1*). This adjustment varies the flow rate, for example: clockwise to decrease and counter-clockwise to increase the flow rate and speed. In most applications, it is best to adjust the regulator to a maximum pressure 6.2 bar (90 psi) with the adjustment screw in the full out position, which is approximately flush with the surface.

4.6 Cutter Operation and Burr Selection

To obtain optimal results, the FFP should operate with little friction in the cylinder. Refer to *Section 5—Maintenance* for more information.

The deburring tool should not be operated for extensive periods of time with the cutting tip pointing up. This orientation increases the amount of debris that enters the cylinder and causes premature damage to the cylinder and FFP. If the deburring tool must be operated in this orientation, then a continuous or regular burst of high velocity air should be used to blow debris away from the FFP and cylinder to ensure minimal friction between the components.

The selection of a cutting tool is highly dependent upon the part material and geometry, and the depth of cut. Please see *Section 4.6.1—Bur Selection* for a bur and suitable applications.

4.6.1 Bur Selection

ATI can provide guidance in bur selection; however, only experimentation yields the results desired. The following table may assist in bur selection.

Table 4.2—Bur Selection

	Description	Application
	**9150-HIAC-4579-C2** • Tungsten carbide bur, C2 micro-grain. • 90° cone shape, 16 mm (0.63") diameter. • 20.3 mm (0.8") overall length. • 24 teeth, straight flutes. • 3° negative rake angle.	• General purpose deburring, for example: ferrous materials.
	**9150-HIAC-4579-C5** • Tungsten carbide bur, C5 micro-grain. • 90° cone shape, 16 mm (0.63") diameter. • 20.3 mm (0.8") overall length. • 24 teeth, straight flutes. • 3° negative rake angle.	• Deburring alloy steels. • Increased wear resistance. • Longer tool life.

Table 4.2—Bur Selection		
	Description	**Application**
	**9150-HIAC-4153-C5**	
	• Tunsten carbide bur, C5 micro-grain. • 90° cone shape, 16 mm (0.63") diameter. • 20.3 mm (0.8") overall length. • 27 teeth, spiral flutes. • 3° positive rake angle.	• General purpose deburring. • Improved surface finish on most materials.
	**9150-43967**	
	• Tungsten carbide bur. • 90° cone shape, 16 mm (0.63") diameter. • 20.3 mm (0.8") overall length. • 16 teeth, straight flutes, chip breaker. • 5° negative rake angle.	• Deburring reinforced plastics and composites.
	**9150-HIAC-1010-C2**	
	• Tungsten carbide bur, C2 Micro-Grain. • 80° cone shape, 16 mm (0.63") diameter. • 24 mm (0.94") overall length. • 24 teeth, straight flutes. • 3° negative rake angle.	• General purpose deburring of non-ferrous materials, for example: aluminum.

5. Maintenance

To obtain the best results, the FFP should operate with little friction in the cylinder. At periodic maintenance intervals remove debris within the cylinder. Keep the outside of the deburring tool clean to ensure proper cooling.

While simple in design, there are few user-serviceable parts in the assembly. The user is encouraged to return the unit to ATI for service. *Section 6—Troubleshooting and Service Procedures* is provided to assist the user in cleaning, inspecting, and replacing burs, the FFP, cylinder, and pneumatic connection O-rings.

For all service, it is recommended that the air supply (before the solenoid valves) be disconnected. Drain 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 *https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf and https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*.

5.1 Pneumatics

Routinely check the air lines for their general condition and replaced as required. 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. For to *Section 3.6—Pneumatics* for more information about pneumatic connections.

5.2 Lubrication

Ensure the air motor is being lubricated. Refer to *Section 4.2.2—Lubrication*.

5.3 Bur, FFP, Cylinder, Spline, and Lock Ring Inspection

The bur, FFP, cylinder, spline, and lock ring may wear depending on cut depth, feed rate, and the material that is being deburred. Inspect these components regularly for wear and refer to *Section 6—Troubleshooting and Service Procedures* for symptoms of worn components. If necessary, replace applicable parts. Refer to *Section 6.2.1—Cleaning, Inspection, and Replacement of the Spline, Cylinder, and Lock Ring*. Only use genuine ATI components.

WheNever the bur is replaced, inspect the FFP and cylinder. The FFP should rotate freely by hand in the cylinder with no binding. If binding is detected, the FFP and cylinder should be replaced. Refer to *Section 6.2—Service Procedures*.

5.4 Overhaul

Return the deburring tool to ATI for repairs or overhaul in order to maintain the technical specifications and tool life of the deburring tool. Symptoms of a diminished motor, which doesn't match the specifications in *Table 8.1* and that the deburring tool should be overhauled, include but are not limited to the following:

- decreased or stalling motor speed.
- increased air consumption by the motor.
- increased noise during operation.

Refer to *Section 6—Troubleshooting* for other signs that the deburring tool should be returned to ATI.

6. Troubleshooting and Service Procedures

The following section provides troubleshooting information to help diagnose conditions with the product and service procedures to help resolve these conditions.

6.1 Troubleshooting

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

Table 6.1—Troubleshooting

Symptom	Cause	Resolution
Bur wear	Hard work material	Use better grade bur material. Refer to *Section 4.6—Cutter Operation and Burr Selection*
	Too heavy a cut	Decrease the width of cut, make multiple passes
	Feed rate is too slow	Increase the feed rate
Bur breakage	Too heavy a cut	Decrease the width of cut, make multiple passes
	Deflection at corner	Do not begin the path at a sharp corner
	Impacting the part	Decrease feed rate at contact, enter part at an angle
Unequal compliance	The regulator is defective	Replace the regulator
	The O-rings on the mounting bracket of the deburring tool are worn	Replace the O-rings. Refer to *Section 6.2.3—O-Ring Replacement for the Air Supply Ports and Tool Flange*
	The FFP is not moving freely in the cylinder	Clean components. Replace as necessary. Refer to *Section 5.3—Bur, FFP, Cylinder, Spline, and Lock Ring Inspection* and *Section 6.2.2—Bur and FFP Replacement*
Poor finish on work piece	Feed rate is too fast	Reduce feed rate.
	Bur is worn	Inspect bur if worn, replace. Refer to *Section 6.2.2—Bur and FFP Replacement*
Bur is chattering during cut	Feed rate is too fast	Reduce feed rate
	Lack of rigidity	Increase axial force/ compliance pressure
	Too heavy a cut	Decrease the width of cut, make multiple passes
	Improper bur selection	Motor spindle is sticking . Refer to *Section 4.6—Cutter Operation and Burr Selection*
	The bur is worn	Inspect bur. If worn, replace. Refer to *Section 6.2.2—Bur and FFP Replacement*
Secondary burrs are created on the work piece after cut	Incorrect feed rate	Reduce the feed rate
	Too heavy a cut	Decrease the width of cut, make multiple passes
	Improper bur selection	Motor spindle is sticking . Refer to *Section 4.6—Cutter Operation and Burr Selection*
	Bur is worn	Inspect bur. If worn, replace. Refer to *Section 6.2.2—Bur and FFP Replacement*
Chip packing of bur	Too heavy a cut	Decrease the width of cut, make multiple passes
	Not enough chip clearance	Use a bur with less flutes Refer to *Section 4.6—Cutter Operation and Burr Selection*

Table 6.1—Troubleshooting		
Symptom	**Cause**	**Resolution**
Bur stalls	Not enough or no motor supply air	Verify the motor supply air regulator is operating at 90 PSI (6.2 Bar), and check for leaks
	The O-rings on the rear flange of the deburring tool are worn	Replace the O-rings. Refer to *Section 6.2.3—O-Ring Replacement for the Air Supply Ports and Tool Flange*
	The deburring tool is not properly lubricate	Ensure the deburring tool is properly lubricated. Refer to *Section 4.2.2—Lubrication*
	The FFP is not moving freely in the cylinder	Clean components. Replace as necessary. Refer to *Section 5.3—Bur, FFP, Cylinder, Spline, and Lock Ring Inspection*
	Air motor must be replaced	Contact ATI

6.2 Service Procedures

The following service procedures provide instructions for component replacement, when the user chooses to service the unit in the field. For all service, the user should disconnect the air supply before the solenoid valves and vent trapped air pressure from the lines. This step prevents accidental operation of the spindle.

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.

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

6.2.1 Cleaning, Inspection, and Replacement of the Spline, Cylinder, and Lock Ring

Refer to *Figure 6.1*.

Parts required: *Refer to https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf and https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*

Tools required: *Hook spanner wrench (P/N 3810-51-1004), 3 mm hex key, torque wrench*

Supplies required: *Clean rag, mild solvent, same lubrication oil that is used for operational air lubrication (refer to Section 4.2.2—Lubrication)*

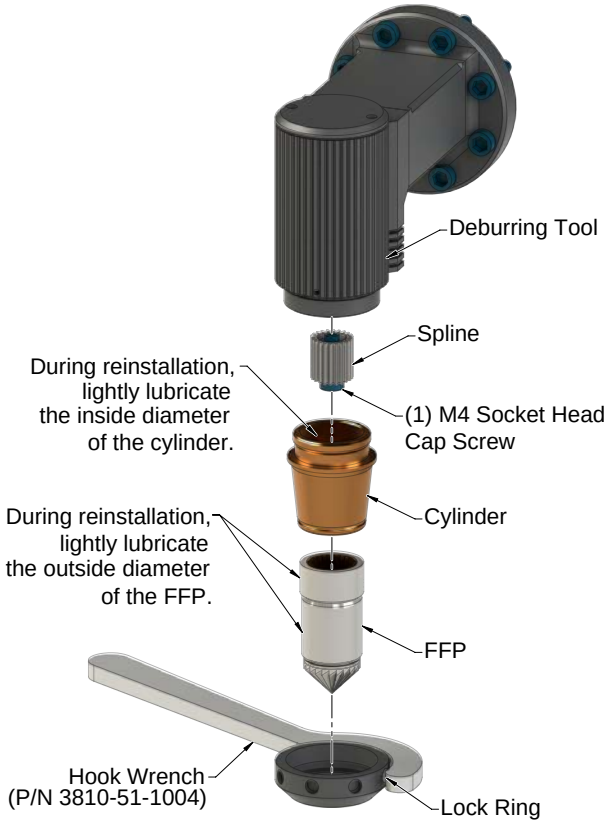
1. De-energize all energized circuits such as air and power.
2. Using the hook spanner wrench, remove the lock ring from the deburring tool housing.
3. Gently remove the cylinder and FFP.
4. Using a mild solvent, clean the spline, interior of the deburring tool housing, and the lock ring.
   - If necessary to remove the spline, use a 3 mm hex key to unscrew the M4 socket head cap screw. To re-install the spline, tighten the M4 socket head cap screw to 25 in-lbs (2.825 Nm).
5. Verify the bur and FFP spin together.
   a. By keeping the cylinder stationary, verify the FFP and bur spin together. The bur should move freely.
      i. If the bur does not move freely, replace the FFP and/or cylinder. Refer to *Section 6.2.2—Bur and FFP Replacement* for replacing the FFP without the bur.

6. Inspect and clean the FFP and cylinder.
   a. Separate the FFP from the cylinder.
   b. Using a clean rag, remove debris from the surfaces of the FFP and cylinder.
   c. Inspect the FFP and cylinder for scratches.
      i. If the scratches are deep, replace the FFP and Cylinder. For replacement procedures for the FFP without replacing the bur, refer to *Section 6.2.2—Bur and FFP Replacement*.
7. Install the cylinder, FFP, and lock ring on the deburring tool.
   a. Lightly lubricate the outside diameter of the FFP and the inside diameter of the cylinder.

NOTICE: The fit between the FFP and the cylinder provides the seal that is for the axial down force air pressure. The fit must be consistent and without excessive play.

   b. Verify the FFP moves freely without excessive play.
      i. If the play is excessive, replace the cylinder.
   c. Install the cylinder and FFP. The FFP inside diameter interfaces with the outside diameter on the spline.
   d. Using a hook wrench, secure the cylinder and FFP on the deburring tool housing with the lock ring. Tighten the lock ring hand tight.
8. When the procedure is complete, return to normal operation.

Figure 6.1—Cleaning, Inspection, and Replacement



6.2.2 Bur and FFP Replacement

Refer to *Figure 6.2* and *Figure 6.3*.

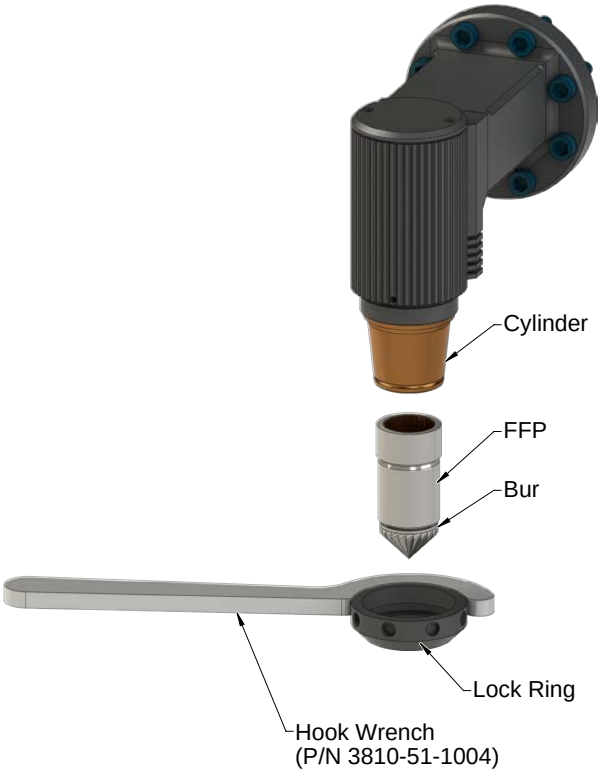
Parts required: *Refer to https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf and https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*

Tools required: *Hook spanner wrench (P/N 3810-51-1004), pincer assembly (P/N 9040-51-1000), and holder assembly (P/N 9040-51-1001), 5 mm hex key*

Supplies required: *Clean rag, mild solvent, same lubrication oil that is used for operational air lubrication (refer to Section 4.2.2—Lubrication)*

1. De-energize all energized circuits such as air and power.
2. Using the hook spanner wrench, remove the lock ring from the deburring tool housing.
3. Remove the bur, FFP, and cylinder.
4. Inspect the FFP and cylinder.
   a. Verify the FFP can rotate freely by hand in the cylinder without binding.
      i. If binding is detected, replace the FFP and/or cylinder.
5. Gently remove the FFP and bur from the cylinder.

Figure 6.2—Remove the Lock Ring



6. Remove the bur from the FFP.
   a. Insert the holder assembly into the FFP.
   b. Use a 5 mm hex key to loosen the M6 socket head cap screw to open the pincer assembly so that it fits over the large diameter of the bur.
   c. Use a 5 mm hex key to tighten the M6 socket head cap screw to close the pincer assembly around bur.
   d. Holding the FFP stationary with the holder assembly, turn the pincer assembly counter-clockwise until the bur is removed from the FFP.

Figure 6.3—FFP and Bur Replacement

7. Install the new bur in the FFP.
   a. Using a 5 mm hex key, loosen the M6 socket head cap screw to open the holder assembly so that it fits over the large diameter of the bur.
   b. Use a 5 mm hex key to tighten the M6 socket head cap screw so that the holder assembly closes around the bur.
   c. If applicable, insert the pincer assembly in the new FFP.
   d. Holding the FFP stationary with the pincer assembly, turn the holder assembly clockwise until the bur is hand tight in the FFP.
8. Install the cylinder, FFP, and lock ring on the deburring tool.
   a. Lightly lubricate the outside diameter of the FFP and the inside diameter of the cylinder.

NOTICE: The fit between the FFP and the cylinder provides the seal that is for the axial down force air pressure. The fit must be consistent and without excessive play.

   b. Verify the FFP moves freely without excessive play.
      i. If play is excessive, replace the cylinder.
   c. Install the cylinder and FFP. The FFP inside diameter interfaces with the outside diameter on the spline.
   d. Using a hook wrench, secure the cylinder and FFP on the deburring tool housing with the lock ring. Tighten the lock ring hand tight.
9. When the procedure is complete, return to normal operation.

6.2.3 O-Ring Replacement for the Air Supply Ports and Tool Flange

Refer to *Figure 6.4*.

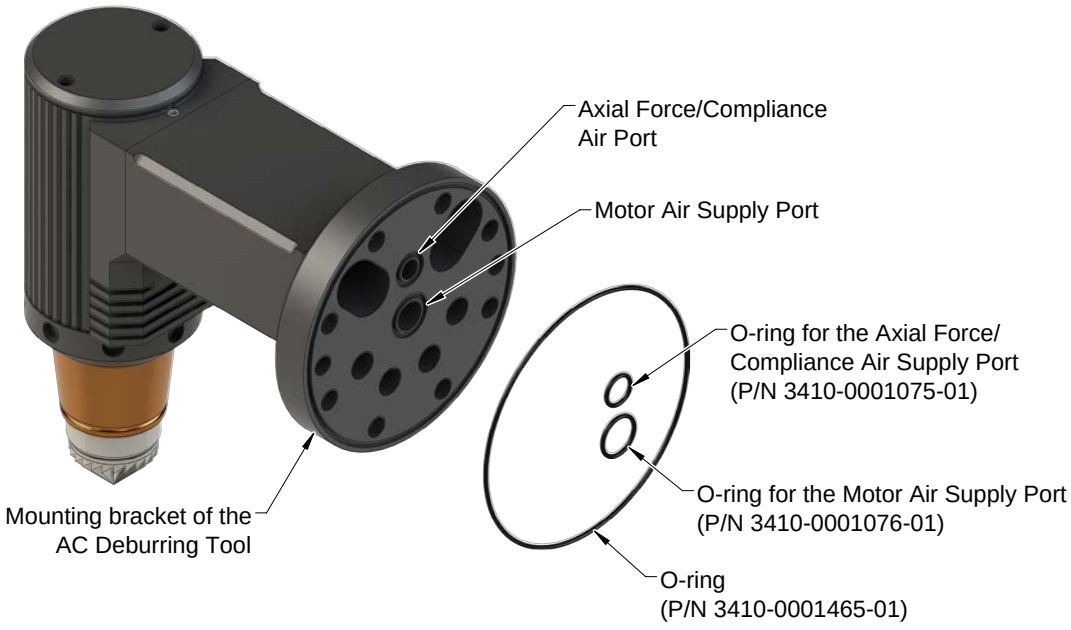
Parts required: *Refer to https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf and https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*

Tools required: *Hook spanner wrench (P/N 3810-51-1004), pincer assembly (P/N 9040-51-1000), and holder assembly (P/N 9040-51-1001), 5 mm hex key*

Supplies required: *Clean rag, Magnalube*

1. De-energize all energized circuits such as air and power.
2. Remove the deburring tool from the robot or work location.
3. If applicable remove the adapter plate from the deburring tool.
4. Remove the following (3) O-rings: the large O-ring that is along the edge of the mounting bracket and the (2) O-rings for the air supply ports.
5. Clean debris from the deburring tool using compressed air and a clean rag to wipe any grease from the outer surfaces and O-ring grooves.
6. Install the following (3) O-rings dry: the large O-ring that is along the edge of the mounting bracket and the (2) O-rings for the air supply ports.
7. Apply Magnalube to the O-rings that were installed in the previous step.
8. If applicable, attach the adapter plate to the deburring tool. Refer to *Section 3.5—Mounting Installation*.
9. Install the deburring tool on the robot or work location.
10. After the procedure is complete, return to normal operation.

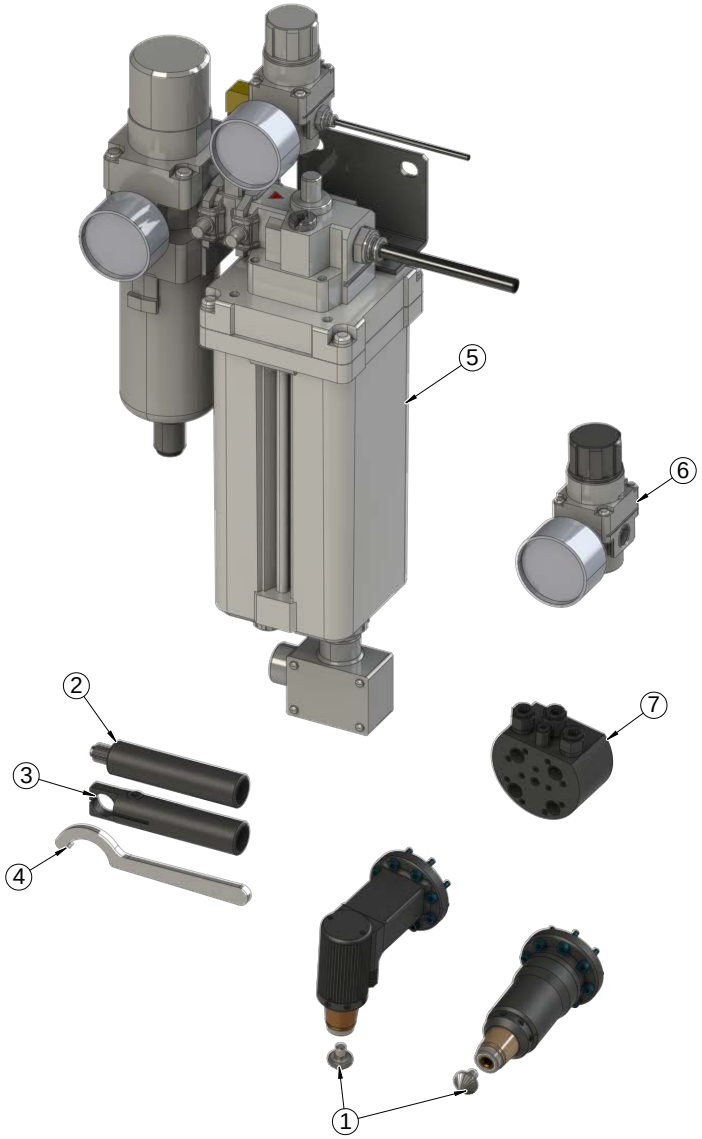
Figure 6.4—O-ring Replacement



7. Serviceable Parts

The serviceable parts for the 9150-AC-90 and 9150-AC-180 are shown in *https://www.ati-ia.com/app_content/Documents/9630-50-AC-90.auto.pdf* and *https://www.ati-ia.com/app_content/Documents/9630-50-AC-180.auto.pdf*.

7.1 Accessories



Item No.	Qty	Part Number	Description
1	1	Refer to *Table 4.2* for bur part numbers and descriptions.	
2	1	9040-51-1001	Bur Tool Holder Assembly
3	1	9040-51-1000	Bur Change Tool Pincer Assembly
4	1	3810-51-1004	Hooked Spanner Wrench
5	1	9005-50-6174	High-Flow Filter/Regulator Assembly
6	1	9005-50-6164	Precision Regulator
7	1	9005-50-6094	AC Tool Adapter Kit

8. Specifications

Table 8.1—Specifications for 9150-AC-90 and 9150-AC-180	
Parameter	**Rating**
Motor	Air Motor, vane type
Idle Speed	30,000 RPM
Working Speed	18,000 - 25,000 RPM
Torque (at lower speeds)	0.35 Nm (0.295 ft-lbs)
Power	250 Watts (0.34 hp) @ 20,000 RPM
Weight (total)	0.51 kg (1.124 lb)
Weight of the FFP with bur	0.05 kg (0.11 lb)
Compensation (bur float)	Axial: ± 4.1 mm (0.16") maximum. Effective Lateral: ± 2 mm (0.08") recommended.
Axial Force	8.45 - 32.92 N (1.9 - 7.4 lb) at a supply pressure of 1.0 - 4.1 bar (15 - 60 psi).
Bur Surface Speed	7.6 - 11 m/sec (25 - 35 ft/s) measured at 8 mm diameter (halfway between the center tip and outer rim)
Air Consumption	Approximately 9.44 L/s (20 CFM)
Bur Type	Refer to *Table 4.2*.
Special Tools	Refer to *Section 7.1—Accessories*.
Sound Pressure Level[1,2]	80 dB No-Load at a distance of 1.5 meters (5 feet) from the tool.

Notes:

1. The equivalent continuous weighted sound pressure level.
2. Because the working environment is unknown, it is impossible to predict the noise that will occur during an operation. The tool may also excite resonant frequencies on equipment to which it is mounted creating higher sound pressure levels than the unit by itself.

9. Terms and Conditions of Sale

The following Terms and Conditions are a supplement to and include a portion of ATI's Standard Terms and Conditions, which are on file at ATI and available upon request.

ATI warrants the compliant tool product will be free from defects in design, materials, and workmanship for a period of one (1) year from the date of shipment and only when used in compliance with the manufacturer's specified normal operating conditions. This warranty does not extend to tool components that are subject to wear and tear under normal usage; including but not limited to those components that require replacement at standard service intervals. The warranty period for repairs made under a RMA shall be for the duration of the original warranty, or ninety (90) days from the date of repaired product shipment, whichever is longer. This warranty is void if the unit is not used in accordance with guidelines that are presented in this document. ATI will have no liability under this warranty unless: (a) ATI is given written notice of the claimed defect and a description thereof within thirty (30) days after the Purchaser discovers the defect and in any event not later than the last day of the warranty period; and (b) the defective item is received by ATI no later then ten (10) days after the last day of the warranty period. ATI's entire liability and Purchaser's sole remedy under this warranty is limited to repair or replacement, at ATI's election, of the defective part or item or, at ATI's election, refund of the price paid for the item. The foregoing warranty does not apply to any defect or failure resulting from improper installation, operation, maintenance, or repair by anyone other than ATI.

ATI will in no event be liable for incidental, consequential or special damages of any kind, even if ATI has been advised of the possibility of such damages. ATI's aggregate liability will in no event exceed the amount paid by purchaser for the item which is the subject of claim or dispute. ATI will have no liability of any kind for failure of any equipment or other items not supplied by ATI.

No action against ATI, regardless of form, arising out of or in any way connected with products or services supplied hereunder may be brought more than one (1) year after the cause of action occurred.

No representation or agreement varying or extending the warranty and limitation of remedy provisions contained herein is authorized by ATI, and may not be relied upon as having been authorized by ATI, unless in writing and signed by an executive officer of ATI.

Unless otherwise agreed in writing by ATI, all designs, drawings, data, inventions, software and other technology made or developed by ATI in the course of providing products and services hereunder, and all rights therein under any patent, copyright or other law protecting intellectual property, shall be and remain ATI's property. The sale of products or services hereunder does not convey any express or implied license under any patent, copyright or other intellectual property right owned or controlled by ATI, whether relating to the products sold or any other matter, except for the license expressly granted below.

In the course of supplying products and services hereunder, ATI may provide or disclose to Purchaser confidential and proprietary information of ATI relating to the design, operation or other aspects of ATI's products. As between ATI and Purchaser, ownership of such information, including without limitation any computer software provided to Purchaser by ATI, shall remain in ATI and such information is licensed to Purchaser only for Purchaser's use in operating the products supplied by ATI hereunder in Purchaser's internal business operations.

Without ATI's prior written permission, Purchaser will not use such information for any other purpose or provide or otherwise make such information available to any third party. Purchaser agrees to take all reasonable precautions to prevent any unauthorized use or disclosure of such information.

Purchaser will not be liable hereunder with respect to disclosure or use of information which: (a) is in the public domain when received from ATI; (b) is thereafter published or otherwise enters the public domain through no fault of Purchaser; (c) is in Purchaser's possession prior to receipt from ATI; (d) is lawfully obtained by Purchaser from a third party entitled to disclose it; or (f) is required to be disclosed by judicial order or other governmental authority, provided that, with respect to such required disclosures, Purchaser gives ATI prior notice thereof and uses all legally available means to maintain the confidentiality of such information.

9.1 Motor Life and Service Interval Statement

The air motors that are used in ATI deburring/finishing tools are subject to wear and have a finite life. Motors that fail, during the warranty period, will be repaired or replaced by ATI as long as there is no evidence of abuse or neglect and that the normal operating practices outlined in this manual have been observed.

Components such as motor vanes, bearings, any gear reduction components, and collet nuts/chucks are considered consumable and are not covered by warranty. The customer should expect to service or replace these items at designated service intervals. For any part this is not detailed in this manual, contact ATI for part numbers and pricing.

Premature bearing failure can occur from exposing the deburring tool to coolants and water or impacts from collisions. Other failure modes that are outlined in the manual and relate to improper machining practices and deburring media selection.

9.1.1 Vane Motor Products

Vane type motors have a finite life and require regular service. At that time the customer should expect to replace the bearings and motor vanes. Any gear reduction components should also be inspected and replaced as necessary. Vane type motors perform best and longest when supplied with lubricated air. The service interval will be catastrophically shortened if the tool is ran without lubrication. The expected life of a properly lubricated vane motor in normal operation is entirely application dependent based on a multitude of factors. To maximize the life of a vane type motor products the customer should follow closely the normal operation guide in the product manual. The supplied air must be lubricated, and filtered to remove particulates and moisture. Premature bearing failure can occur from exposing the deburring tool to coolants and water or impacts from collisions. Other failure modes are outlined in the manual and relate to improper machining practices and deburring media selection.