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LT FR040B Floating Deburring Tools User Manual

Product Model: LT-FR040B-S4040





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Warranty

If the product is opened, it enters the warranty period. The user has a one-year warranty under normal use. The warranty does not cover malfunctions caused by improper use or installation, normal wear and tear, abuse, accident, neglect, fire, water, lightning or other acts of nature, causes external to the product, or other factors beyond the control of Linghang Robots, Inc.

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1. Foreword

1.1 Usage

This product is equipped with a spindle that conforms to the model on the deburring floating head, which can float 5° radially in 360° and 6.5mm axially. It can absorb the deformation of the product during the deburring process, adaptive processing, and effectively protect the tool. Reduce debugging difficulty. The floating deburring equipment installed by the robot system and various special equipment is suitable for removing general burrs of cast iron, steel, and aluminum alloys, processed flanges, joint lines, nozzles below 4mm, and chamfers below C4, etc.



- ☑ If the required cutting amount exceeds the output characteristics of the motor spindle, the burr cannot be removed.
- ☑ If the chamfer that needs to be removed is too large, the chamfer cannot be removed even with multiple constant-force floating deburring tools.

1.2 Prerequisite

Personnel carrying out the instructions in this manual must have knowledge and skills related to the use of spindles and understand the risks of using spindles and industrial equipment. You must read the E30-CX spindle controller instruction manual first.

1.3 Safety matters and instructions

Before using this product, please read the "Safety Precautions and Instructions" carefully and use this product correctly. These warnings and precautions guide you in using this product safely and preventing harm to yourself and others. Risks are classified according to their severity as follows.

Sorts	Explanation
 Warning	Precautions that may cause personal injury or property damage.
 Attention	Precautions that may result in moderate injury and property damage.



Warning

1. The air pipes and air pipe connectors shall be securely connected to pneumatic equipment including this product. Otherwise, the air pipe connector may be disconnected, and the disconnected air pipe may fly around and cause personal injury.
2. When installing on the robot, the power of the robot must be turned off before installing the constant force floating deburring tool.
3. Before installing the spindle on the floating mechanism, the main spindle power must be turned off when the spindle is not in use.
4. To prevent problems such as heat generation, please do not use this product with a pressure exceeding the recommended air supply pressure (0.1-0.4Mpa).
5. This product only has the function of preventing dust and fine particles, but does not have waterproof properties.
6. Do not apply cutting fluid or similar things directly to the product.



Attention

1. The floating part of this product floats through the air. Check the connection between the air pipe and the quick-plug connector regularly.
2. Do not drop or collide with hard objects, as this may cause product damage;
3. If the bolts are over-tightened or the wrong tools are used to tighten the bolts during product installation, the bolts may be deformed, damaged or unusable.
4. Provide clean air for the product. If air mixed with dust or moisture enters the product, it will cause product failure.
5. If the product produces smoke, abnormal sound, abnormal smell, etc., you should immediately turn off the power and air source and investigate the cause.
6. Before installing the spindle on the floating mechanism, please read and understand the instruction manual for the spindle.
7. Personnel using this manual must have basic knowledge and skills related to the use of spindles, and understand the risks of using spindles and industrial equipment.



2. Product Introduction

☑ Before using this product, you need to install deburring tools on the product, such as motor spindle, deburring head, etc. The motor spindle must be prepared by the user or ordered from us.

☑ The floating power of the constant force floating deburring tool can be adjusted through precision pressure regulating valves and proportional valves. Prepare pneumatic equipment (such as precision regulators, proportional valves) as the driving source of the air flotation components.

☑ When using this product, you need to install a transition plate to install the product on a robot system or similar system.

2.1 Tooling and fixture system

In order to meet the needs of customers using different diameter deburring heads during the use of deburring products, all our constant force floating deburring tool products use detachable chucks to facilitate customers to install cutting tools (deburring heads, milling cutters, drill bits, etc.). Tool replacement method: Use a wrench to loosen the fixing nut at the front end of the spindle, install a tool suitable for the diameter of the chuck into the chuck to a certain depth, and tighten the chuck nut. In constant force floating deburring tools, it is generally not allowed to install a tool extension rod and then add a deburring head (the tool stiffness is reduced after using the tool extension rod, and if the tool or extension rod flies out during use, it will cause damage to people or objects).

2.2 Positional installation

Installation the floating deburring tools



1. Connect with the adaptor plate, install on the robot or special equipment;
2. Install on the workbench with the workbench adapter, grip the workpiece by robots.

2.3 Operating environment

☑ Working temperature: 0°C-40°C; ☑ Storage temperature: 0°C-60°C;

☑ Working environment humidity: 20%Rh-85%Rh(No condensation);

☑ Storage humidity: 0%Rh-90%Rh(No condensation);

Storage conditions: Store the packaging of the product in a dry place. If possible, store the product in the delivery package.

☑ Execution facility: The product requires clean, dry, filtered, oil-free compressed air; A precision pressure regulator filter with a nominal value of 5 microns or less is required; Electric spindle cylinder discharger (TO), cylinder reset (TI) 0.6-0.7MPa, spindle dust removal pressure 0.2-0.3Mpa, spindle air seal pressure 0.25Mpa; Radial floating regulating air pressure 0.1-0.4MPa.

3. Characteristics and usage precautions of constant force floating deburring tool device

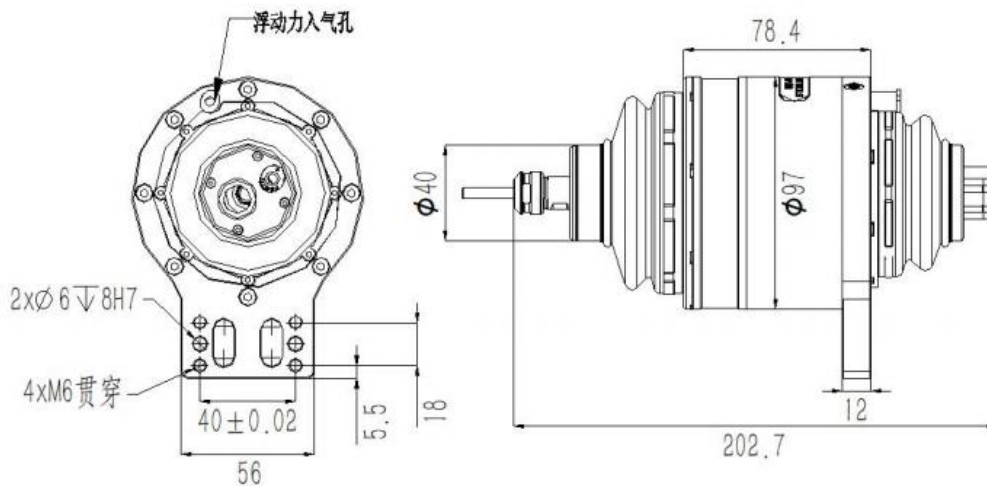


Figure 3-1 Appearance diagram of constant force floating deburring tool



3.1 Characteristics of constant force floating deburring tool device

- ☑ This product features floating deburring that can move freely 360° radially while tilting 5° at the center of the shaft, and it also has 6.5mm axial compression.
- ☑ A floating mechanism mounted on the motor spindle can be used to remove burrs while overall absorbing small deviations in the X, Y, and Z axes of the workpiece group on the machine.
- ☑ Fluid Use: Clean Air.
- ☑ Working pressure range: 0.1-0.4MPa.
- ☑ Range of working pressures: 0.1-0.4MPa;

Attention

Note: Clean and dry air must be provided when using constant force floating sanding tools.

3.2 Weight of constant force floating deburring tool device

The total weight of the constant force floating deburring tool: 3240.4g (including electric spindle).

4. How to install the supporting spindle

4.1 Installation procedures:

The electric spindle is installed in the following steps:

- ☑ Select a motor spindle that can be installed in the $\phi 40H7$ mounting hole of the product's floating component.
- ☑ Use a 4mm Allen wrench to loosen the 6 Allen screws that lock the limit ring (part indicated in green).
- ☑ Place the spindle into the middle of the floating head until the spindle reaches the required height (40mm).
- ☑ Before installing the motor spindle on the floating head, confirm the correct installation position of the motor spindle and refer to the motor spindle instruction



manual. Then tighten all screws with a torque of 16.8N.m.

Push the position of the spindle with your hand to ensure that it does not move. If the spindle still moves, loosen and tighten all screws again and repeat the operation. Until the spindle is firmly fixed and there is no movement.

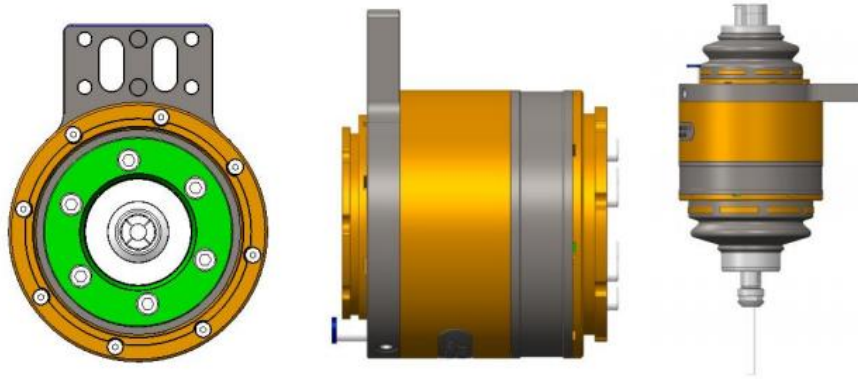


Figure 4-1 Reference diagram of floating spindle installation

Any problems during installation, please contact us (www.ltautotools.com)

4.2 Installation precautions

Attention

The user must ensure that the robot power supply is disconnected and that moving parts must be secured during this step; accidental movement may cause injury to equipment and workers.

Warning

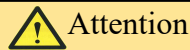
1. When installing the electric spindle, do not fix it at the position of the motor. Otherwise, the motor housing will be deformed, causing heat generation and



damage. When fixing the electric spindle, the screws must be applied evenly and reach the torque required for tightening the screws; 2. The electric spindle needs to be protected in the deburring environment for a long time; (the air seal must be turned on first during use, and the air seal must be turned on after deburring according to the dust concentration. In specific cases, the air seal must be disconnected last).

After installing the motor spindle to the product, be sure to install the dust boot.

Install the dust cover on the deburring tool installation side of the spindle. When installing the lower dust ring, you need to install the V-ring first for shaping. A well-installed dust boot will keep debris out.



Attention

Note: After the electric spindle is installed on the floating mechanism, be sure to install the dust cover and V-ring. If debris enters, it may cause malfunction.

5. How to install floating deburring tools

5.1 Inspection upon delivery

Upon receipt, the following should be checked:

- Delivered in accordance with shipping documents; packaging in good condition.
- If any packaging is damaged, or any shipment has been handled abnormally, open any parts that may be damaged for closer inspection. If necessary, please contact the Linghang robot tools changer to assist in evaluating the product condition.

5.2 Unpacking and moving

During transportation, storage and handling, the constant force floating sanding tool unit should always be placed in the supporting box. Pneumatic tubes and electrical



cables are connected, bundled, and must be mitigated from deformation in a manner that allows free movement during operation.

5.3 Installation

☑When installing constant force floating deburring tool products on robots or special equipment, a transition plate must be installed.

☑The installation size of the transition plate is designed according to the outline diagram of the constant force floating deburring tool in Figure 1. According to the different uses of users, our company provides more humane installation methods (one is the floating power inlet installation method shown in Figure 3-1; Another method is to fix the cover plate floating power inlet position with a plug can be interchangeable plug and quick-insert joint position).

☑Zhengzhou linghang robot CO.,LTD can also make transition plates for you,if necessary, please feel free to contact us (www.ltautotools.com).



Warning

Note: The user must ensure that the robot power switch is disconnected and that moving parts must be secured during this step. Accidental movement may cause injury to equipment and personnel.

6. Air supply connection

6.1 Pneumatic port connection

A precision pressure regulating filter (0-0.7Mpa) and a precision pressure regulating valve (0.1Map-0.4Mpa) must be installed on the product pipeline.



Figure 6-1 Connection of the constant force floating deburring tool system

☑As shown in the picture: Connect the air circuits in sequence as shown in the picture.

6.2 Atmospheric pressure standards and air circuit equipment

☑The standard air supply pressure of the product is 0.1-0.4Mpa.

The maximum pressure of the product is 0.4Mpa. Do not use air pressure exceeding this value on the product.

☑According to the usage conditions, if there are fine particles in the air, please install a $\phi 4$ air pipe with a filter function on the product to prevent the fine particles in the air from entering the product and causing piston wear and leakage.

☑For pipe diameter and pneumatic equipment (such as air filters, precision pressure regulating valves, electrical proportional valves, etc.), the connection should select the pipe diameter corresponding to the gas volume.

☑Using a smaller diameter air pressure pipe, or a pneumatic device with a smaller flow rate, will cause a loss of pressure and may not achieve the desired output.



Install air filters, air dryers, or similar devices in the main air ducts to remove dust and moisture from the air in order to provide clean air to the equipment.

The air filter removes moisture and dust from the air source. Discharge accumulated emissions when necessary.

 Attention

1. The maximum pressure of the product is 0.4Mpa. Do not use air pressure exceeding this value. Excessive air pressure for a long time will cause O-shaped Damage to the ring affects the service life of the product.
2. The floating inlet air pipe needs to be filled with clean and dry air.
3. To prevent pressure loss and insufficient flow, the main air pipe should be as large as possible.
4. When installing the pipeline, make the length of the pipeline from the precision regulating valve to the constant force floating deburring tool as small as possible. If the air pipe is too long, it will cause pressure loss and may not achieve good results.

7. Adjust the floating force by adjusting the air supply pressure value

In order to adjust the floating force, the user needs to adjust the air pressure value accordingly.

Connect the air source to the precision pressure regulating valve through the precision pressure regulating filter and to the floating force inlet of the constant force floating deburring tool through the air pipe.

Use a precision pressure regulating valve to adjust the air pressure value and obtain the required floating force. Please refer to the diagram below to adjust the air pressure.

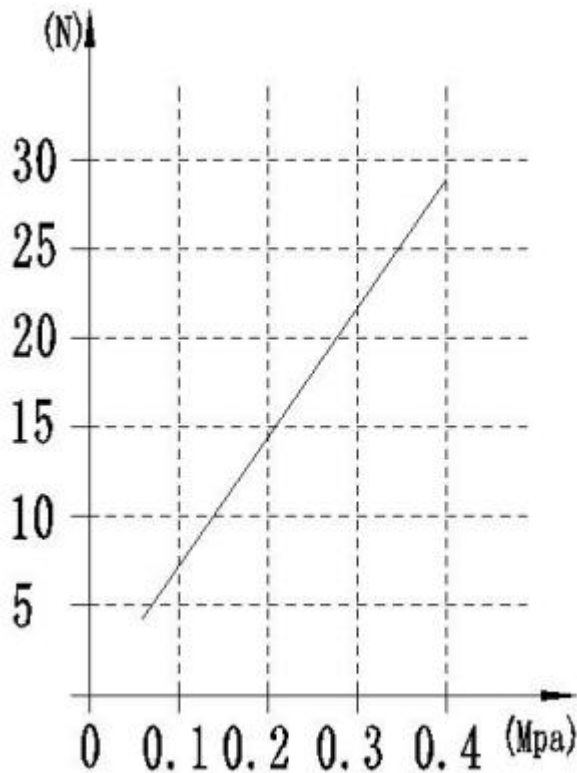



Figure 7-1 Floating force change diagram

If you need to automatically adjust the floating force, can install an electrical proportional valve to achieve.

 Attention

1. The graph in Figure 7-1 illustrates the change in flotation force with applied air pressure in the vertical direction, with the chuck pointing toward the ground. The measurement may vary from 0Mpa to 0.4Mpa and converts applied pressure into floating force. Actual force characteristics depend on the installation orientation and conditions of the device. In applications where the deburring tool is mounted horizontally, applying air pressure requires overcoming the weight of the motor. The amount of floating force also depends on the material of the workpiece, the type of tool, and the amount of material being removed.
2. The above floating force change diagram is based on the data obtained when the tungsten steel cylindrical head rotary file has a total length of 60, a clamping length of



16mm, and a distance of 44mm from the nut; the force on the tool tip; the length of the deburring head, the shape, and the installation length are different. Different buoyancy forces are also different.

8. Operation

These operating instructions are designed to assist system integrators in programming, starting up, and completing a robotic constant-force floating deburring tool assembly that contains a float mechanism and an electric spindle mounted on the float mechanism. The system integrator should have some programming and automation knowledge of deburring.

8.1 Safety precautions

All personnel involved in the operation of constant force floating deburring tools must have a comprehensive understanding of the operating procedures. Failure to follow these procedures or neglect of safety precautions may result in danger. It may even injure people or damage deburring devices and tools.

Warning

1. This device is a robot constant force floating deburring tool. Do not hold the constant force floating deburring tool while working.
2. Do not use the constant force floating deburring tool device in a manner that generates axial load.
3. Never use constant force floating deburring tools for countersinking or drilling.

Countersinking and drilling axially loaded metal forming processes should not be performed by floating deburring units. If the failure is caused by external force, it will be dangerous to personnel and equipment.

The floating deburring device cannot be used to remove burrs from fragile materials. The normally removed material is in the form of debris. Broken workpieces may cause material fragments to harm the surrounding working environment and personnel.



When the floating deburring tool is working, the feed speed should be reduced when it first comes into contact. In some cases, contact movement between the deburring tool and the workpiece may occur too quickly and a collision may occur. A collision can cause danger to personnel and equipment on both sides. When performing maintenance, always remember to tighten nuts and bolts.

 Attention

1. Select the constant force floating deburring tool according to the size of the burr. Small tools with large burrs will cause product damage; large burrs with small tools will cause the overload service life of the electric spindle to be reduced; and the ideal deburring effect cannot be achieved.
2. Do not use spare parts other than those recommended by the pilot company. Use of parts not provided and recommended by Linghang Company may damage the equipment and void the warranty.
3. When the deburring tool is started or running, do not appear near the deburring tool. Flying debris and rotating parts can cause damage. If it is necessary to approach the deburring tool while in motion, stand behind a suitable visual object.
4. Do not use or start the deburring tool without reading and understanding the relevant user manual. If you do not understand the installation and operating procedures before use, using the tools may cause personal injury or equipment damage.
5. If you have any questions during installation, please contact our company in time. Our company have professional personnel to answer your questions.

8.2 Normal operation

Air quality: The air source should be dry, filtered and oil-free. A precision pressure regulating filter needs to be installed before the main air source enters the floating tool (front filtration precision 5um, rear filtration precision 0.3um, water removal rate



99%).

- No lubrication: Any form of lubrication is strictly prohibited.
- Selection, design and maintenance of cutting tools: Use carbide cutting tools. The tool has a higher operating speed, and the tool speed must reach the specified speed range. Check tool quality regularly to ensure no wear. Using worn tools can result in defective products; do not use tool extensions as the combination of large moment loads and high speeds can be dangerous.

8.3 Constant force floating deburring tool working environment

As mentioned earlier, the constant force floating deburring tool device should be placed in an automated unit. The work unit must be protected by a fence and no personnel are allowed to enter. The work unit can be equipped with an access lock, and operation and maintenance personnel can only enter with authorization. The work unit may be partially or entirely composed of plexiglass to facilitate observation of deburring. Ensure that constant force floating deburring tools and robots stop working during system or constant force floating deburring tool maintenance. When installing and testing and when the constant force floating deburring tool is running, the personnel present should be equipped with safety helmets, protective glasses and other protection.

8.4 Tool center point positioning and programming

When the radial range of floating deburring is small, the deburring effect is the best. The floating deburring tool is not allowed to run when the robot is programmed. In the robot programming process, the floating pressure inlet must be ventilated, and the minimum value of the precision pressure regulator is 0.02Mpa.

The following two programming methods are recommended. The first method is to simulate the tool handle diameter method. When simulating the path of the robot, a cylindrical pin of the appropriate length of $\phi 3$ is installed at the position of the



deburbing head of the constant force floating deburring tool to replace the deburring head (simulating the tool handle). The handle extends sufficiently to the surface of the burr to be cut (Figure 8-1). The diameter of the tool should not exceed the diameter of the positioning pin, and should not exceed the floating range of the constant force floating deburring tool.

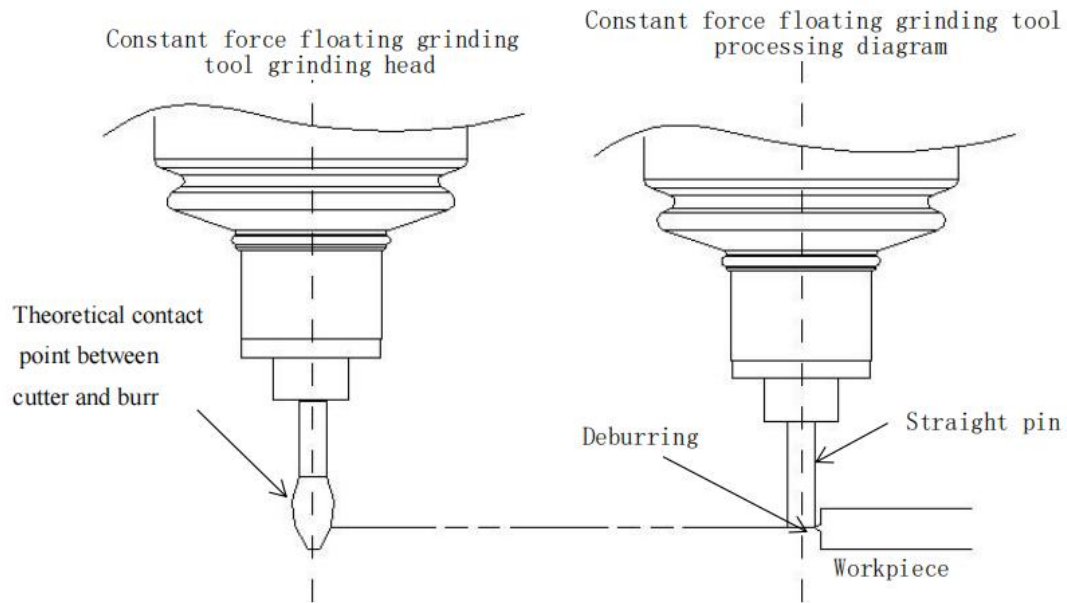


Figure 8-1 Teaching method of simulating knife handle

Another programming approach is to write the path along the part edge as a burr centerline guide, and then manually or automatically add offsets to the robot path to achieve the final correct burr path (see Figure 8-2). The programming method used will depend on the capabilities of the machining center or robot and the programming style of the programmer.



Constant force floating grinding tool processing diagram

Flexible deburring/sanding head

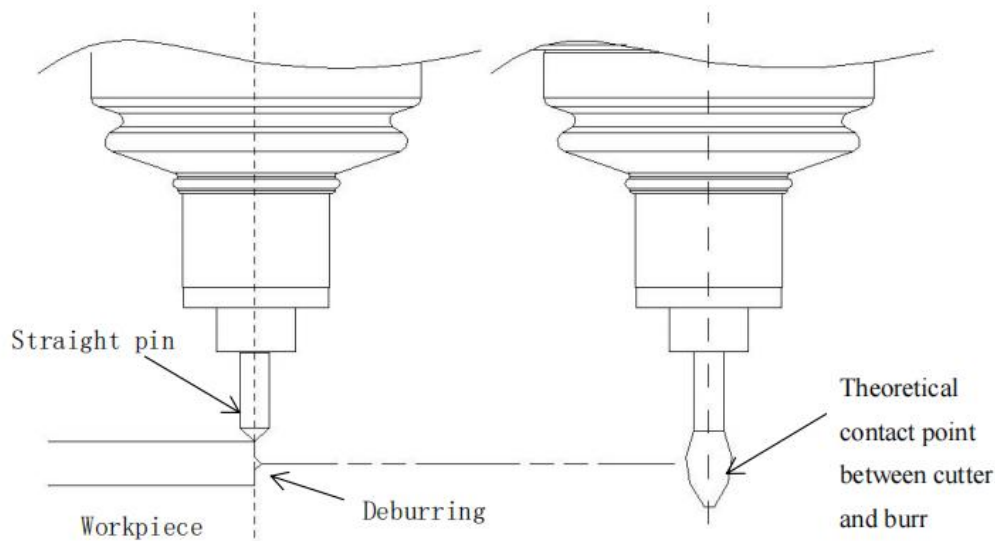


Figure 8-2 Center line guide of a burr

Corner fillets are a complication for flexible deburring spindles. Generally speaking, the tool cannot contact two vertical surfaces of the fillet at the same time. The resulting force imbalance in the two planes will lead to severe tool chatter. It is recommended that customers create a tool path that will prevent the tool from touching two perpendicular surfaces at the same time. A tapered tool can extend into such a fillet if the tool is oriented obliquely and close to the tool tip. (Note: Surface cutting speeds will decrease when working near a tapered tool tip.) A similar situation may occur when deburring within a radius.

Customers are advised not to attempt deburring with an internal diameter less than 1.5 times the desired tool diameter ($R_{min} = 1.5 \times \text{tool diameter}$). Depending on the depth of the cut, failure to follow these guidelines can result in excessive tool contact, resulting in excessive tool chatter. When the program was run for the first time, the radial compliance gas supply of the observed path dropped below 1Mpa; As the robot path speed increases, be aware that the robot may deviate from the programmed path. Once the robot path is determined, the burr compliance should be adjusted (Figure 8-1) to achieve the correct burr removal depth.

☑The approach path of the deburring tool should be slow and at an angle: The approach path of the deburring tool should be slow and at an angle as it approaches the workpiece. When starting to deburr, try to slowly reduce the angle while



maintaining a path that is slightly parallel to the surface. If the tool approaches the workpiece vertically and quickly, it can cause pits in the workpiece, damage to the tool and premature wear of the spindle bearings.

Collision is a dangerous situation for both personnel and equipment.

Program the robot to include 50% of the tool's floating travel: Program the robot to include 50% of the tool's moving on the marked path. When the part edge deviates from its normal path, the cutting drill bit can use float to move along high and low points without losing contact or hitting the workpiece. Do not put the floating mechanism "in the 0° position", make sure it reaches a position where it can float.

8.5 Selection of cutting tools and milling methods






Floating deburring units perform best in "climbing" milling. This means that the transverse direction of the cutting teeth and the direction of rotation of the cutting teeth are the same. In the case of float, tool rotation is clockwise. Climb milling therefore involves a clockwise motion on the outside of the deburred part. In climb milling, the heaviest cut is when the tool enters the workpiece. In a conventional milling process, the cutting moves in the opposite direction of tool rotation, which may contribute to tool stability in certain operations, however, the cutting edge of the tool is subject to higher friction and cutting forces. In this mode, tool wear is accelerated and surface finish quality typically deteriorates. When using traditional milling methods, extra care must be taken around corners, as cutting forces can deflect burrs, causing the tool to break as the robot continues along its path, creating a potential hazard.

Plastics present one of the most difficult deburring challenges because debris accumulates on the deburring head. During this process, if the tool is dull or the feed and speed of the material being moved is incorrect, the chips can cause it to melt and weld to the tool or workpiece. For plastics, the feed rate will be higher to reduce the temperature generated by cutting, but it will also produce greater cutting volume.







8.6 Tool selection

Linghang can provide guidance on the selection of cutting tools. The characteristics of the cutting tools correspond to the appropriate materials. Through communication with professional cutting tool manufacturers and a large amount of practice, the following data are obtained.

Cutters selection summary table		
Blade shape (φ3)	◎ Name/application	Features
	◎ Tungsten steel cylindrical deburring head, single groove flat head, medium tooth type A •For hardened and tough materials, super alloys, stainless steel, alloy steel and fiber reinforced plastics.	•The surface is smooth after cutting.
	◎ Tungsten steel cylindrical deburring head, double groove flat head, medium tooth type A •For hardened and tough materials, super alloys, stainless steel, alloy steel and fiber reinforced plastics.	•Higher cutting capability than standard cutting. •The surface is smooth after cutting.
	◎Diamond deburring head, type A •Suitable for deburring, beveling, chamfering; •For hardened and tough materials, super alloys and stainless steel; •Steel, alloy steel and fiber reinforced steel plastics.	•Higher cutting capability than standard cutting. •The surface is smooth after cutting.
	◎Aluminum alloy tool, cylindrical wide tooth type A •Suitable for hard aluminum alloy, soft non-ferrous metals and thermoplastics; •Used for deburring cast aluminum.	•The chips pass easily. •The chute does not clog, even when cutting sticky metal. •Smooth operation due to the peeling effect of the teeth.
	◎Oval coarse teeth E type •Suitable for cast aluminum and thermoplastics. Circular blade. •Used for deburring cast aluminum.	•The chips pass easily. •The chute does not clog, even when cutting sticky metal. •Smooth operation due to the peeling effect of the teeth.



	<p>◎ Single cross grooved L shape.</p> <ul style="list-style-type: none"> • Suitable for hardened and ductile materials, super alloys, stainless steel, alloy cast steel and fiber reinforced plastics. 	<ul style="list-style-type: none"> • The surface is smooth after cutting.
	<p>◎ Double cross grooves L-shaped;</p> <ul style="list-style-type: none"> • Suitable for hardened and ductile materials, super alloys, stainless steel, alloy cast steel and fiber reinforced plastics. 	<ul style="list-style-type: none"> • Higher cutting capability than standard cutting. • The surface is smooth after cutting.
	<p>◎ Round and spherical type D</p> <ul style="list-style-type: none"> • Suitable for hardened and tough materials, super alloy, stainless steel, alloy steel and fiber reinforced plastics. 	<ul style="list-style-type: none"> • Inner hole burr.
	<p>◎ Fiberglass deburring tool.</p> <ul style="list-style-type: none"> • Suitable for deburring and profile milling of all glass and carbon fiber reinforced plastics. 	<ul style="list-style-type: none"> • Due to the low cutting force, the special cutting geometry allows for high feed rates.

9. Trouble removal

Cutting tool wear	Hard to cut working material	Use a better grade of tool material to add coating.
	Excessive floating force	Reduced cutting width/continuous multiple deburring.
	Feed speed too low	Increase feed speed.
Cutting tool break	Excessive floating force	Reduced cutting width/continuous multiple deburring.
	Deflection at the corner	Straight milling, do not start from the sharp forward
	Collide	Reduce the contact entry speed at an Angle
Workpiece finish is poor	The feed rate is too high	reduce feed speed.
	Cutting tool wear	Check the cutting tool regularly
	Low speed	Increase speed
Secondary burrs appear after polishing	Cutting Tool selection error	Change the appropriate cutting tool
	Cutting tool wear	Change cutting tool
	Tool contact Angle is incorrect	Adjust the tool contact Angle
Shaking in the polishing process	The feed rate is too high	Reduce feed speed.
	Lack of rigidity	Increase radial compliance pressure
	Overcut	Reduced cutting width/continuous multiple deburring



10.Maintenance

In order to make the products run for a long time we provide reliable service; Constant force floating deburring tool users can repair very few parts. It is recommended that the user send the constant force floating deburring tool back to our company for repair.

☑This section describes how to maintain the product.

☑This product uses high-grade lubricating oil, the lubricating oil viscosity is high and not easy to lose, and the constant force floating deburring tool structure is designed with an oil storage chamber during the use of self-lubrication.

☑For the air pipeline, please strictly comply with the following regulations.

Warning

1. The bending radius of the trachea should not be less than 20mm. Do not bend or twist the trachea.
2. Keep away from fire sources, high-temperature objects, impact objects, and sharp surfaces.
3. The trachea air source pressure is not less than 0.4Mpa.

Note: This product is thread-locked and cannot be disassembled by itself. In order to use this product for a long time, it is recommended to perform regular maintenance (guidance once every 1-2 years, but it depends on the customer's situation); please contact us if you need regular maintenance and repair.



11. List of standard parts

The following accessories are standard for the floating deburring tool LT-FR040B.

No.	Name	Model	qty	remarks
1	Deburring floating head	LT-FR040B-S4040	1	SET
2	Precision pressure regulator	0.1-0.4Mpa	1	PC
3	Dust cover		2	pc
4	Air pipe	Φ4	10m	On demand
5	V-ring		1	pc
6	User manual		1	

12. Products parameter and drawing model.

<https://www.ltautotools.com/products/lt-fr040b-s4040-floating-deburring-spindle.html>

13.Contact us

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- Product specifications and appearance are subject to change without prior notice.
- The contents of this manual are subject to change without any prior notice.