blue photon®

Technology & Workholding Systems

User & Operating Guide

CNC Spindle Mounted Cleaning Tool

The spindle mounted gripper cleaning tool loads in a CNC machine to remove cured adhesive from grippers.

Part #: 82400 - Gripper Cleaning Tool Assembly

Part #: 82500 - Replacement Head

P/N 82400

P/N 82500

Features

- Mounts in any 3/4 diameter collet or end mill holder.
- Replaceable head for P/N 82400 tool assembly.
- Cleans an estimated 1,000 grippers before replacing head.

Do not use with corrosion resistant grippers.

1. Introduction

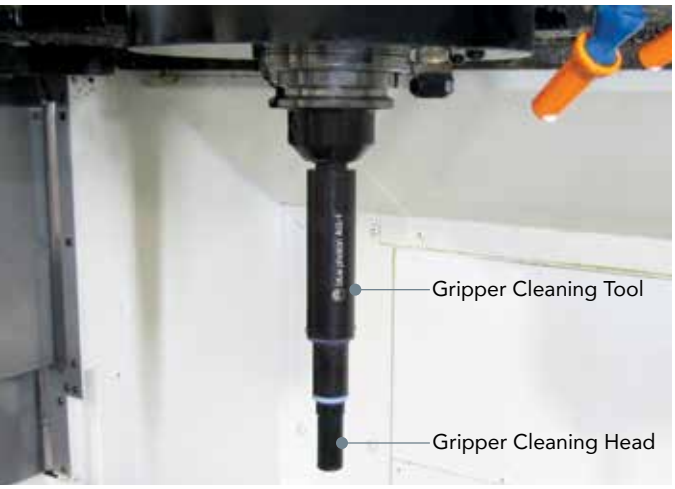
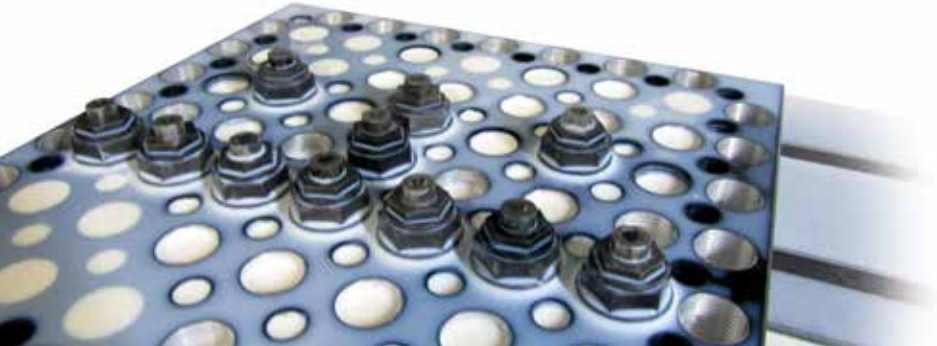


Figure 1. CNC spindle mounted cleaning tool assembly

To clean the grippers, the axis of the grippers must be parallel to the spindle axis. The system ***(Figure 1)*** consists of a spindle mounted gripper cleaning tool and a cleaning head. The head is the wearable component that grinds adhesive from the gripper and is replaceable.

During cleaning, it is recommended that cutting fluid flood the grind zone. This will reduce grinding head wear, eliminate airborne dust, and wash debris from the gripper. It is also highly recommended that the machining center is equipped with a table mounted, tool pre-setter, such as the one illustrated in ***Figure 2***. The pre-setter provides a convenient means to automatically obtain the tool length offset. This value is useful in determining changes in head length due to wear after an interval of gripper cleanings. Within an interval, the grinder length offset is simply decreased after each gripper cleaning by the estimated wear (.0002-.0005" typical).

Figure 2. Use of a table mounted tool pre-setter to obtain gripper cleaning tool assembly length



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2. Recommended Tool Paths, Process Parameters, and Operation

It is recommended that the axial cleaning process is carried out with the tool paths described in this section. Use the tool pre-setter to define the length offset, H, of the tool with the slider in its normally extended position.

The axial cleaning cycle initiates with the gripper cleaning head positioned as shown in ***Figure 3***. In this case, the axis of the cleaning head is in-line with the axis of the gripper. The tip of the cleaning head lies on a reference plane, a distance RPH above the gripper. **Note** that RPH and all other height/depth values are defined relative to a clean gripper surface. The gripper cleaning head is spinning at a rotational speed of N. A stream of cutting fluid is showering the cleaning head tip.

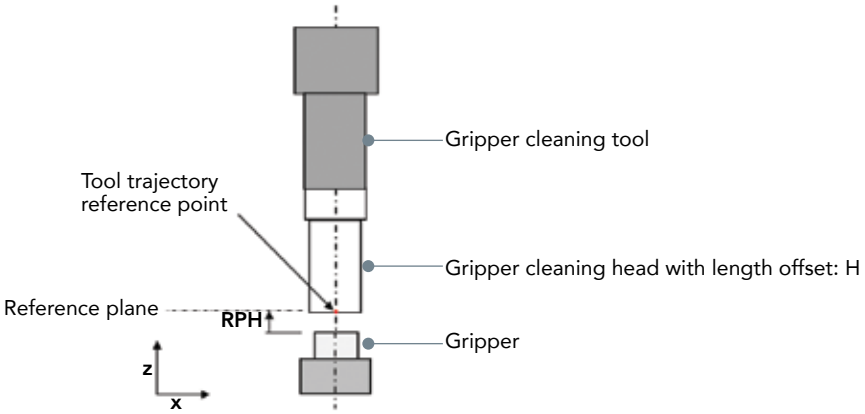

Figure 3. Position of gripper cleaning tool at the starter of the cleaning cycle

The cleaning cycle proceeds as illustrated in ***Figure 4***. **Note** that the tool path shown is that of the tip center assuming that the slider is in the fully extended position. In reality, the slider is depressed. The cycle starts with the tool doing a rapid traverse move parallel to the gripper until it reaches a distance, LR, from the gripper axis. The gripper then translates downward at feed rate F until it reaches the height of the bare gripper surface.

It then travels along a helical path toward the gripper until it reaches the loop plane, which is a distance, LPD, below the gripper surface. Once it reaches this plane, the cleaning head follows a circular path around the gripper axis M times while maintaining the same feed rate. It then follows a helical path away from the gripper until it reaches the height of the gripper surface. As a final move, it does a rapid traverse to the reference place followed by a rapid traverse to the gripper center. At the end of the cycle, the tool length offset is decreased by the amount of the expected loss (TW) in tool length.

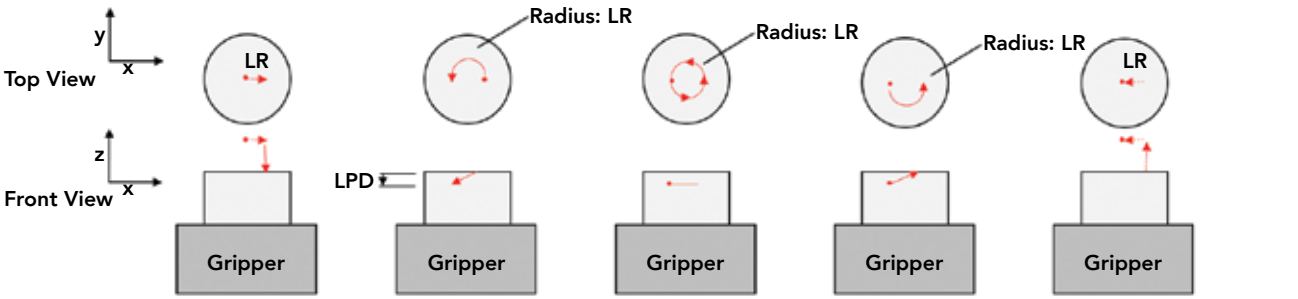

Figure 4. Gripper adhesive cleaning

The recommended process parameters for the axial grinding cycle are as follows:

- N = 7500 RPM
- F = 112 in./min.
- RPH = .1 in.
- LR = .125 in.
- LPD = .15 in.

These values work equally well for cleaning part numbers 12130/15130, 12230/15230, 13160/16160 and 13260/16260 grippers. LPD is the most critical variable, because it controls the minimum depression on the slider, which in turn controls the minimum, grinding pressure. If the grinding pressure is too light, the process may not effectively strip off the adhesive. If the pressure becomes too large for too long, micro-chipping of the edges of the gripper pin can occur. The values of M and TW are dependent on the thickness and coverage of the adhesive on the grippers. They must be determined by trial, observation, and measurement. This will be described in ***Section 3***.

A grinding subprogram (O07666) for executing this motion cycle in a HAAS VF2 machining center is presented in Appendix A1. In this example, the values of M and TW are 5 and .0005" respectively. An example CNC program (O03336) for cleaning four grippers mounted in a fixture is presented in Appendix A2. **Note** that this program uses five variables that have yet to be defined. They are:

- NGF: Number of grippers to be cleaned per fixture
- GCC: Gripper cleaning count
- GCI: Number of gripper cleanings per interval
- NLO: Tool length offset corresponding to a newly installed cleaning head
- ARHL: Allowable reduction in head length before replacement

Similar to M, TW, and GCI needs to be determined by trial as will be described in ***Section 3***. The value of ARHL is 1.1".

The program starts by moving over each gripper and calling the grinding subprogram to strip off the adhesive. It then increases GCC by NGF. It subsequently compares GCC to GCI. If the value of GCC is less than or equal to GCI, the program terminates. If the value of GCC exceeds GCI, the program calls subroutine (9023) to automatically use the tool pre-setter to measure the length offset. It then resets GCC to zero. Subsequently it compares the current length offset to a minimum limit (NLO-ARHL). If the offset is above the limit, the program terminates. Otherwise it pauses the program, and requests the operator to replace the grinding head and execute the grinding process reset program (O03338).

The grinding process reset program (O03338) is presented in Appendix A3. This program automatically determines the length offset of the newly replaced cleaning head. It also resets the values of NGF, GCC, GCI, NLO, and ARHL.

3. Derivations of M, TW, and GCI

The values of M and TW increase with the volume of adhesive to be stripped from a gripper. In turn, this volume increases with joint thickness and coverage after debonding. Typical coverage is dictated by workpiece debonding method and the roughness of the workpiece surface.

Keeping this in mind, the value of M is set to a value sufficiently large to insure that all grippers are consistently cleaned. This is determined by trial and observation. Likewise the corresponding value of TW is determined by measuring the total wear that results from cleaning a set of grippers cleaning using M loops. TW is the total wear divided by the number of grippers cleaned. As a point of reference, five loops is typically sufficient to clean a gripper that is fully covered with a .03" thick layer of adhesive. The corresponding value of TW is typically .0005".

The last variable that needs to be determined is GCI: the number of grippers to be cleaned before the tool length offset is measured. The rule to be followed is that the difference between predicted, accumulated wear and actual wear should not exceed .05". If it does, the gripper cleaning tool will ultimately exert too much pressure on the cleaning head or too little. The former could chip the edges of the gripper pin and the latter reduce the cleaning effectiveness. Similar to M, and TW, the appropriate value of GCI can only be determined by trial and observation. In general, smaller values of TW, lead to greater values of GCI. A minimum limit on GCI is simply the ratio of .05"/TW.

Axial Grinding Cycle Subprogram *(for Haas)*

Actual program may need to be different depending on the machine.

O07666 *(Axial grinding cycle subprogram)*
(Subprogram used to axially clean adhesive from a Blue Photon gripper)

(Critical assumptions are as follows:)

(#1 Grinding tool is tool #18)
(#2 Grinding head is centered over the gripper center on the)
(Reference plane at the beginning of the cycle)
(#3 Cutting fluid is on)
(#4 Tool length offset #18 is increased by the anticipated)
(Tool wear at the end of the subprogram)
(#5 User selected process variables are:)

#100=7500 (Spindle speed <rpm>)
#101=112.0 (Feed rate <ipm>:)
#102=.1 (Reference plane height)
#103=.15 (Loop plane depth <in.>)
#104=.125 (Loop radius <in.>)
#105=5 (Number of loops)
#106=.0005 (Expected head wear <in.>)

(Process control variables are:)
#107=0 (Loop count):
#108=2*#104 (Loop diameter:)

S#100 (Confirm spindle speed)
G91 (Set to relative positioning)
G00 X#104 (Rapid to loop radius)
G01 Z-#102 F#101 (Go to gripper top)
G03 X-#108 R#104 Z-#103 (Helix to loop plane)
WH[#107 LT #105] DO 1 (Loop around gripper)
X#108 R#104 (Half a loop)
X-#108 R#104 (Half a loop)
#107=#107+1 (Increment loop count)
END1
X#108 R#104 Z#103 (Helix to gripper top)
G00 z#102 (Rapid to reference plane)
X-#104(Rapid to gripper center)
G10 L10 G91 P18 R-#106 (Subtract pred. tool wear from length offset)
G90
M99
%

New Axial Gripper Head

Process variable reset program

%
O03338 *(Axial grinding system reset)*

#109=4 (Number of grippers to be cleaned per fixture)
#110=0 (Gripper cleaning count)
#111=12 (Number of gripper cleanings per interval)
#113=1.1 (Allowable reduction in head length "in." before replacement)

T18 M6 (Load tool number 18: gripper cleaning tool)
G65 P9023 A12. T18 (Auto measure length offset number 18)
#112=#2018 (Store new length offset in variable 112)
M30
%

Fixture Cleaning Program

%
O03336 *(Fixture cleaning cycle)*
(This program uses the axial adhesive cleaning process)
(To strip adhesive from four 12130 grippers mounted)
(In a machining fixture.)

(The workpiece offsets are as follows:)

(G55 X - Left fixture edge)
(G55 Y - Bottom fixture edge)
(G55 Z - Top of gripper 1)

(The gripper locations relative to G55 are as follows:)
(Gripper 1: X = 1.6, Y = .805)
(Gripper 2: X = 3.4, Y = .805)
(Gripper 3: X = 3.4, Y = 3.155)
(Gripper 4: X = 1.6, Y = 3.155)

(T18: BP axial adhesive grinder)

(TURN ON OPTIONAL STOP)**

N23 T18 M06 (Load gripper cleaning tool)
N24 S7500 M03 (Turn spindle on; set speed to 7500RPM)
M08 (Cutting fluid on)

N25 G00 G90 G55 X1.6 Y0.805 (Over gripper #1)
N26 G43 H18 Z0.1 (Drop to ref plane)
N27 M98 P7666 L1 (Run grinding cycle)
N28 G90 G00 Z0.5 (Up to clearance plane)

N29 G00 G90 G55 X3.4 Y0.805 (Over gripper #2)
N30 G43 H18 Z0.1 (Drop to ref plane)
N31 M98 P7666 L1 (Run grinding cycle)
N32 G90 G00 Z0.5 (Up to clearance plane)

N33 G00 G90 G55 X3.4 Y3.155 (Over gripper #3)
N34 G43 H18 Z0.1 (Drop to ref plane)
N35 M98 P7666 L1 (Run grinding cycle)
N36 G90 G00 Z0.5 (Up to clearance plane)

N37 G00 G90 G55 X1.6 Y3.155 (Over gripper #4)
N38 G43 H18 Z0.1 (Drop to ref plane)
N39 M98 P7666 L1 (Run grinding cycle)

N40 G90 G00 Z3. (Up to clearance plane)
N41 M05
M09 (Coolant off)

#110=#110+#109 (Increment cleaning count)
IF[#110 LE #111]GOTO1 (If cleaning count does not exceed limit go to block 1)
G65 P9023 A12. T18 (Auto measure offset number 18)
(Measure tool length offset)
#110=0 (Reset cleaning count to zero)
IF [#2018 LE #112-#113] GOTO1 (If grinding head length is below limit, go to block 1)
M01 (Change cleaning head and run program O03338)
N1 G91 G28 Z0. M09 (Turn spindle off/go home)
M30
%

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