



Haas Automation, Inc.

GM-2

Operator's Manual Supplement
96-0227
Revision C
December 2019
English
Original Instructions

Haas Automation Inc.
2800 Sturgis Road
Oxnard, CA 93030-8933
U.S.A. | HaasCNC.com

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LIMITED WARRANTY CERTIFICATE

Haas Automation, Inc.

Covering Haas Automation, Inc. CNC Equipment

Effective September 1, 2010

Haas Automation Inc. ("Haas" or "Manufacturer") provides a limited warranty on all new mills, turning centers, and rotary machines (collectively, "CNC Machines") and their components (except those listed below under Limits and Exclusions of Warranty) ("Components") that are manufactured by Haas and sold by Haas or its authorized distributors as set forth in this Certificate. The warranty set forth in this Certificate is a limited warranty, it is the only warranty by Manufacturer, and is subject to the terms and conditions of this Certificate.

Limited Warranty Coverage

Each CNC Machine and its Components (collectively, "Haas Products") are warranted by Manufacturer against defects in material and workmanship. This warranty is provided only to an end-user of the CNC Machine (a "Customer"). The period of this limited warranty is one (1) year. The warranty period commences on the date the CNC Machine is installed at the Customer's facility. Customer may purchase an extension of the warranty period from an authorized Haas distributor (a "Warranty Extension"), any time during the first year of ownership.

Repair or Replacement Only

Manufacturer's sole liability, and Customer's exclusive remedy under this warranty, with respect to any and all Haas products, shall be limited to repairing or replacing, at the discretion of the Manufacturer, the defective Haas product.

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This warranty is Manufacturer's sole and exclusive warranty, and is in lieu of all other warranties of whatever kind or nature, express or implied, written or oral, including, but not limited to, any implied warranty of merchantability, implied warranty of fitness for a particular purpose, or other warranty of quality or performance or noninfringement. All such other warranties of whatever kind are hereby disclaimed by Manufacturer and waived by Customer.

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Components subject to wear during normal use and over time, including, but not limited to, paint, window finish and condition, light bulbs, seals, wipers, gaskets, chip removal system (e.g., augers, chip chutes), belts, filters, door rollers, tool changer fingers, etc., are excluded from this warranty. Manufacturer's specified maintenance procedures must be adhered to and recorded in order to maintain this warranty. This warranty is void if Manufacturer determines that (i) any Haas Product was subjected to mishandling, misuse, abuse, neglect, accident, improper installation, improper maintenance, improper storage, or improper operation or application, including the use of improper coolants or other fluids, (ii) any Haas Product was improperly repaired or serviced by Customer, an unauthorized service technician, or other unauthorized person, (iii) Customer or any person makes or attempts to make any modification to any Haas Product without the prior written authorization of Manufacturer, and/or (iv) any Haas Product was used for any non-commercial use (such as personal or household use). This warranty does not cover damage or defect due to an external influence or matters beyond the reasonable control of Manufacturer, including, but not limited to, theft, vandalism, fire, weather condition (such as rain, flood, wind, lightning, or earthquake), or acts of war or terrorism.

Without limiting the generality of any of the exclusions or limitations described in this Certificate, this warranty does not include any warranty that any Haas Product will meet any person's production specifications or other requirements, or that operation of any Haas Product will be uninterrupted or error-free. Manufacturer assumes no responsibility with respect to the use of any Haas Product by any person, and Manufacturer shall not incur any liability to any person for any failure in design, production, operation, performance, or otherwise of any Haas Product, other than repair or replacement of same as set forth in the warranty above.

Limitation of Liability and Damages

Manufacturer will not be liable to Customer or any other person for any compensatory, incidental, consequential, punitive, special, or other damage or claim, whether in an action in contract, tort, or other legal or equitable theory, arising out of or related to any Haas product, other products or services provided by Manufacturer or an authorized distributor, service technician, or other authorized representative of Manufacturer (collectively, "authorized representative"), or the failure of parts or products made by using any Haas Product, even if Manufacturer or any authorized representative has been advised of the possibility of such damages, which damage or claim includes, but is not limited to, loss of profits, lost data, lost products, loss of revenue, loss of use, cost of down time, business good will, any damage to equipment, premises, or other property of any person, and any damage that may be caused by a malfunction of any Haas product. All such damages and claims are disclaimed by Manufacturer and waived by Customer. Manufacturer's sole liability, and Customer's exclusive remedy, for damages and claims for any cause whatsoever shall be limited to repair or replacement, at the discretion of Manufacturer, of the defective Haas Product as provided in this warranty.

Customer has accepted the limitations and restrictions set forth in this Certificate, including, but not limited to, the restriction on its right to recover damages, as part of its bargain with Manufacturer or its Authorized Representative. Customer realizes and acknowledges that the price of the Haas Products would be higher if Manufacturer were required to be responsible for damages and claims beyond the scope of this warranty.

Entire Agreement

This Certificate supersedes any and all other agreements, promises, representations, or warranties, either oral or in writing, between the parties or by Manufacturer with respect to subject matter of this Certificate, and contains all of the covenants and agreements between the parties or by Manufacturer with respect to such subject matter. Manufacturer hereby expressly rejects any other agreements, promises, representations, or warranties, either oral or in writing, that are in addition to or inconsistent with any term or condition of this Certificate. No term or condition set forth in this Certificate may be modified or amended, unless by a written agreement signed by both Manufacturer and Customer. Notwithstanding the foregoing, Manufacturer will honor a Warranty Extension only to the extent that it extends the applicable warranty period.

Transferability

This warranty is transferable from the original Customer to another party if the CNC Machine is sold via private sale before the end of the warranty period, provided that written notice thereof is provided to Manufacturer and this warranty is not void at the time of transfer. The transferee of this warranty will be subject to all terms and conditions of this Certificate.

Miscellaneous

This warranty shall be governed by the laws of the State of California without application of rules on conflicts of laws. Any and all disputes arising from this warranty shall be resolved in a court of competent jurisdiction located in Ventura County, Los Angeles County, or Orange County, California. Any term or provision of this Certificate that is invalid or unenforceable in any situation in any jurisdiction shall not affect the validity or enforceability of the remaining terms and provisions hereof, or the validity or enforceability of the offending term or provision in any other situation or in any other jurisdiction.

Customer Feedback

If you have concerns or questions regarding this Operator's Manual, please contact us on our website, www.HaasCNC.com. Use the "Contact Us" link and send your comments to the Customer Advocate.

Join Haas owners online and be a part of the greater CNC community at these sites:

-  haasparts.com
Your Source for Genuine Haas Parts
-  www.facebook.com/HaasAutomationInc
Haas Automation on Facebook
-  www.twitter.com/Haas_Automation
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-  www.linkedin.com/company/haas-automation
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Product videos and information
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Product photos and information

Customer Satisfaction Policy

Dear Haas Customer,

Your complete satisfaction and goodwill are of the utmost importance to both Haas Automation, Inc. and the Haas distributor (HFO) where you purchased your equipment. Normally, your HFO will rapidly resolve any concerns you have about your sales transaction or the operation of your equipment.

However, if your concerns are not resolved to your complete satisfaction, and you have discussed your concerns with a member of the HFO's management, the General Manager, or the HFO's owner directly, please do the following:

Contact Haas Automation's Customer Service Advocate at 805-988-6980. So that we may resolve your concerns as quickly as possible, please have the following information available when you call:

- Your company name, address, and phone number
- The machine model and serial number
- The HFO name, and the name of your latest contact at the HFO
- The nature of your concern

If you wish to write Haas Automation, please use this address:

Haas Automation, Inc. U.S.A.
2800 Sturgis Road
Oxnard CA 93030
Att: Customer Satisfaction Manager
email: customerservice@HaasCNC.com

Once you contact the Haas Automation Customer Service Center, we will make every effort to work directly with you and your HFO to quickly resolve your concerns. At Haas Automation, we know that a good Customer-Distributor-Manufacturer relationship will help ensure continued success for all concerned.

International:

Haas Automation, Europe
Mercuriusstraat 28, B-1930
Zaventem, Belgium
email: customerservice@HaasCNC.com

Haas Automation, Asia
No. 96 Yi Wei Road 67,
Waigaoqiao FTZ
Shanghai 200131 P.R.C.
email: customerservice@HaasCNC.com

Declaration of Conformity

Product: Mill (Vertical and Horizontal)*

*Including all options factory- or field-installed by a certified Haas Factory Outlet (HFO)

Manufactured By: Haas Automation, Inc.

2800 Sturgis Road, Oxnard, CA 93030

805-278-1800

We declare, in sole responsibility, that the above-listed products, to which this declaration refers, comply with the regulations as outlined in the CE directive for Machining Centers:

- Machinery Directive 2006/42/EC
- Electromagnetic Compatibility Directive 2014/30/EU
- Additional Standards:
 - EN 60204-1:2006/A1:2009
 - EN 614-1:2006+A1:2009
 - EN 894-1:1997+A1:2008
 - CEN 13849-1:2015

RoHS2: COMPLIANT (2011/65/EU) by Exemption per producer documentation.

Exempt by:

- a) Large scale stationary industrial tool.
- b) Lead as an alloying element in steel, aluminum, and copper.
- c) Cadmium and its compounds in electrical contacts.

Person authorized to compile technical file:

Jens Thing

Address:

Haas Automation Europe
Mercuriusstraat 28
B-1930 Zaventem
Belgium

USA: Haas Automation certifies this machine to be in compliance with the OSHA and ANSI design and manufacturing standards listed below. Operation of this machine will be compliant with the below-listed standards only as long as the owner and operator continue to follow the operation, maintenance, and training requirements of these standards.

- *OSHA 1910.212 - General Requirements for All Machines*
- *ANSI B11.5-1983 (R1994) Drilling, Milling, and Boring Machines*
- *ANSI B11.19-2010 Performance Criteria for Safeguarding*
- *ANSI B11.23-2002 Safety Requirements for Machining Centers and Automatic Numerically Controlled Milling, Drilling, and Boring Machines*
- *ANSI B11.TR3-2000 Risk Assessment and Risk Reduction - A Guideline to Estimate, Evaluate, and Reduce Risks Associated with Machine Tools*

CANADA: As the original equipment manufacturer, we declare that the listed products comply with regulations as outlined in the Pre-Start Health and Safety Reviews Section 7 of Regulation 851 of the Occupational Health and Safety Act Regulations for Industrial Establishments for machine guarding provisions and standards.

Further, this document satisfies the notice-in-writing provision for exemption from Pre-Start inspection for the listed machinery as outlined in the Ontario Health and Safety Guidelines, PSR Guidelines dated November 2016. The PSR Guidelines allow that notice in writing from the original equipment manufacturer declaring conformity to applicable standards is acceptable for the exemption from Pre-Start Health and Safety Review.



All Haas CNC machine tools carry the ETL Listed mark, certifying that they conform to the NFPA 79 Electrical Standard for Industrial Machinery and the Canadian equivalent, CAN/CSA C22.2 No. 73. The ETL Listed and cETL Listed marks are awarded to products that have successfully undergone testing by Intertek Testing Services (ITS), an alternative to Underwriters' Laboratories.



Haas Automation has been assessed for conformance with the provisions set forth by ISO 9001: 2015. Scope of Registration: Design and Manufacture of CNC Machines Tools and Accessories, Sheet Metal Fabrication. The conditions for maintaining this certificate of registration are set forth in ISA's Registration Policies 5.1. This registration is granted subject to the organization maintaining compliance to the noted standard. The validity of this certificate is dependent upon ongoing surveillance audits.

Original Instructions

User's Operator Manual and other Online Resources

This manual is the operation and programming manual that applies to all Haas Mills.

An English language version of this manual is supplied to all customers and is marked "**Original Instructions**".

For many other areas of the world, there is a translation of this manual marked "**Translation of Original Instructions**".

This manual contains an unsigned version of the EU required "**Declaration Of Conformity**". European customers are provided a signed English version of the Declaration of Conformity with Model Name and Serial Number.

Besides this manual, there is a tremendous amount of additional information online at: www.haascnc.com under the Service section.

Both this manual and the translations of this manual are available online for machines up to approximately 15 years old.

The CNC control of your machine also contains all of this manual in many languages and can be found by pressing the **[HELP]** button.

Many machine models come with manual supplement that is also available online.

All machine options also have additional information online.

Maintenance and service information is available online.

The online "**Installation Guide**" contains information and check list for Air & Electrical requirements, Optional Mist Extractor, Shipping Dimensions, weight, Lifting Instructions, foundation and placement, etc.

Guidance on proper coolant and Coolant Maintenance is located in the Operators Manual and Online.

Air and Pneumatic diagrams are located on the inside of the lubrication panel door and CNC control door.

Lubrication, grease, oil and hydraulic fluid types are listed on a decal on the machine's lubrication panel.

How to Use This Manual

To get the maximum benefit of your new Haas machine, read this manual thoroughly and refer to it often. The content of this manual is also available on your machine control under the HELP function.

IMPORTANT: Before you operate the machine, read and understand the Operator's Manual Safety chapter.

Declaration of Warnings

Throughout this manual, important statements are set off from the main text with an icon and an associated signal word: "Danger," "Warning," "Caution," or "Note." The icon and signal word indicate the severity of the condition or situation. Be sure to read these statements and take special care to follow the instructions.

Description	Example
Danger means that there is a condition or situation that will cause death or severe injury if you do not follow the instructions given.	 DANGER: No step. Risk of electrocution, bodily injury, or machine damage. Do not climb or stand on this area.
Warning means that there is a condition or situation that will cause moderate injury if you do not follow the instructions given.	 WARNING: Never put your hands between the tool changer and the spindle head.
Caution means that minor injury or machine damage could occur if you do not follow the instructions given. You may also have to start a procedure over if you do not follow the instructions in a caution statement.	 CAUTION: Power down the machine before you do maintenance tasks.
Note means that the text gives additional information, clarification, or helpful hints .	 NOTE: Follow these guidelines if the machine is equipped with the optional extended Z-clearance table.

Text Conventions Used in this Manual

Description	Text Example
Code Block text gives program examples.	G00 G90 G54 X0. Y0.;
A Control Button Reference gives the name of a control key or button that you are to press.	Press [CYCLE START] .
A File Path describes a sequence of file system directories.	Service > <i>Documents and Software</i> >...
A Mode Reference describes a machine mode.	MDI
A Screen Element describes an object on the machine's display that you interact with.	Select the SYSTEM tab.
System Output describes text that the machine control displays in response to your actions.	PROGRAM END
User Input describes text that you should enter into the machine control.	G04 P1.;
Variable n indicates a range of non-negative integers from 0 to 9.	Dnn represents D00 through D99.

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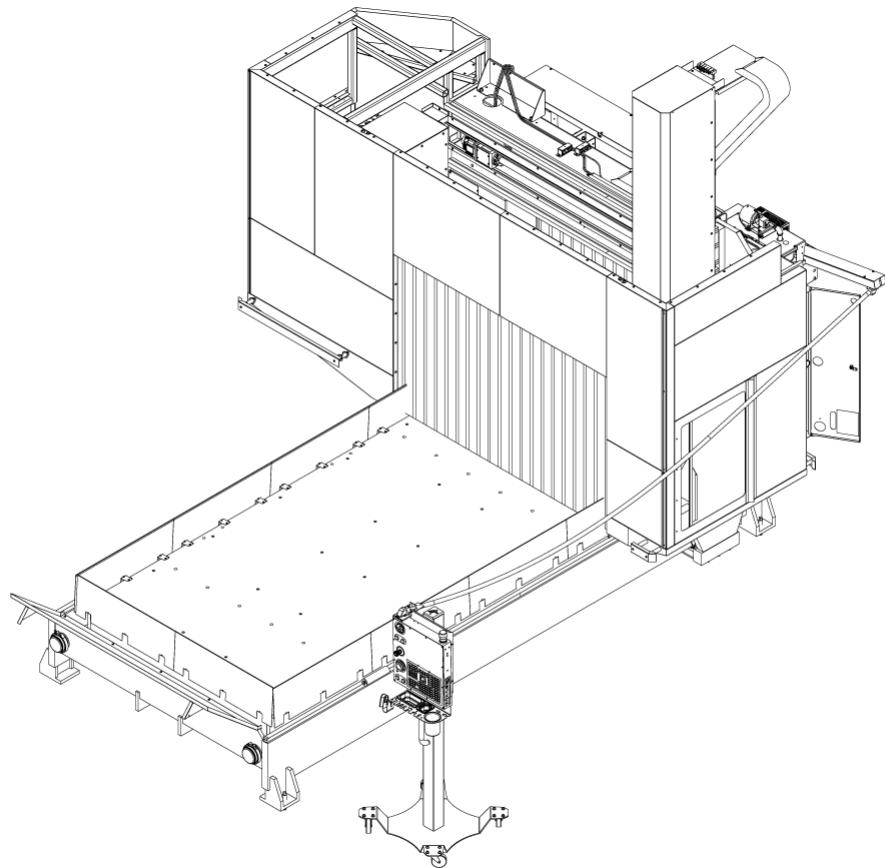
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Chapter 1: Introduction

1.1 Introduction

This manual outlines the unique features and functions of the GM-2 and GM-2-5AX gantry mill. Refer to your Mill Operator's Manual for control operation, programming, and other general mill information.

F1.1: **GM-2**



CAUTION:

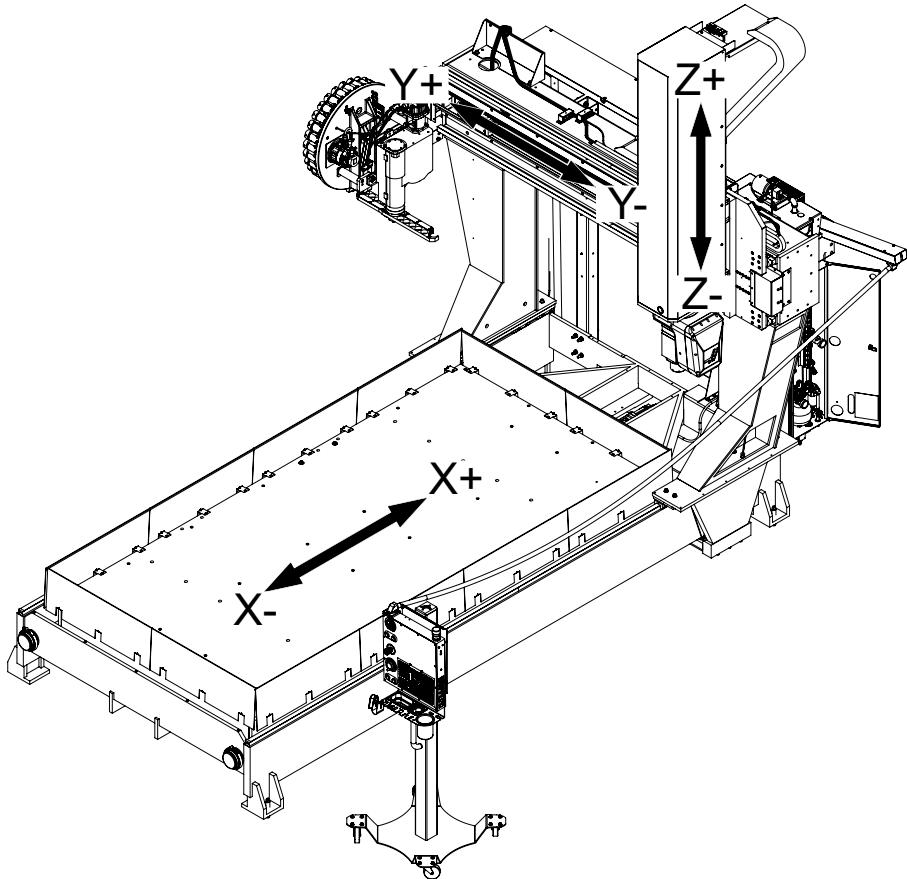
Only authorized and trained personnel may operate this equipment. You must always act in accordance with the Operator's manual, safety decals, safety procedures and instructions for safe machine operation. Untrained personnel present a hazard to themselves and the machine.

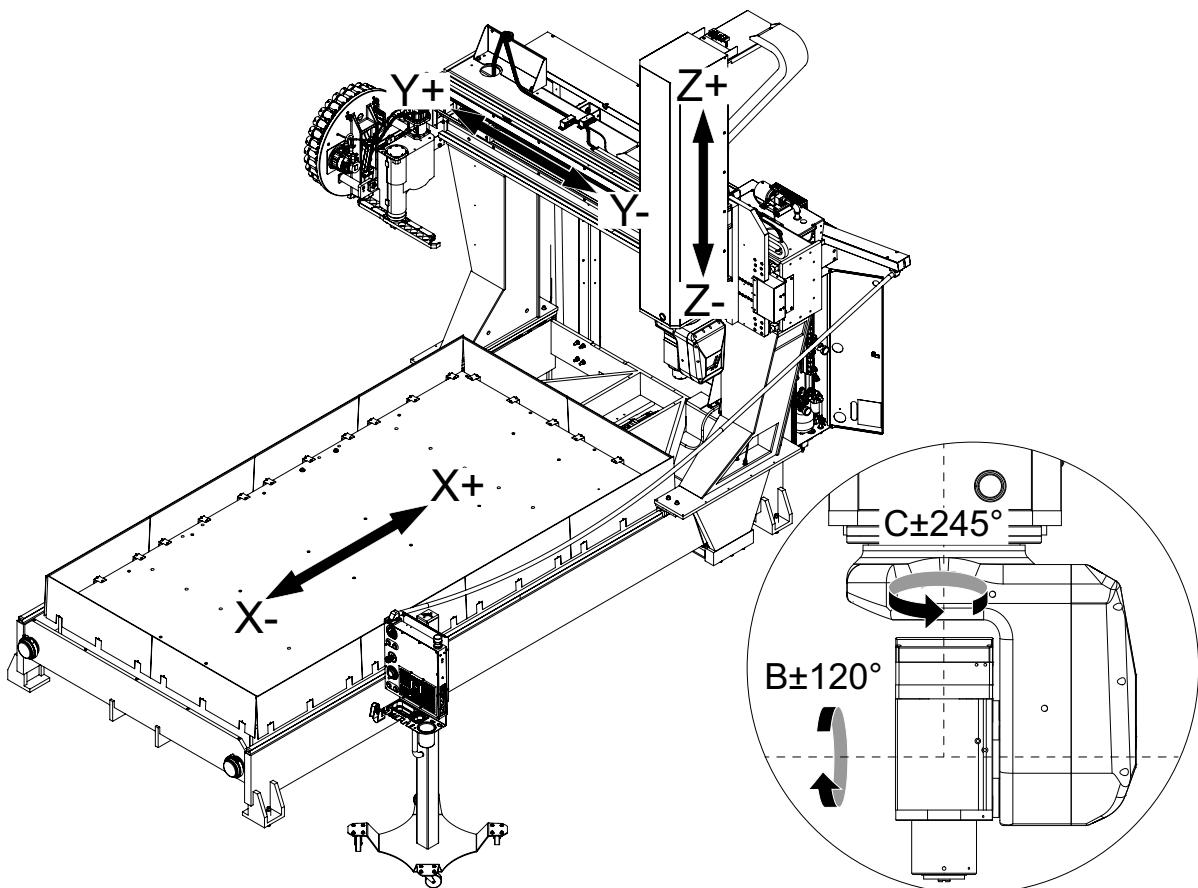


CAUTION: *Do not operate this machine until you have read all warnings, cautions, and instructions.*

1.2 Axis Definitions

F1.2: GM-2 Axis Definitions



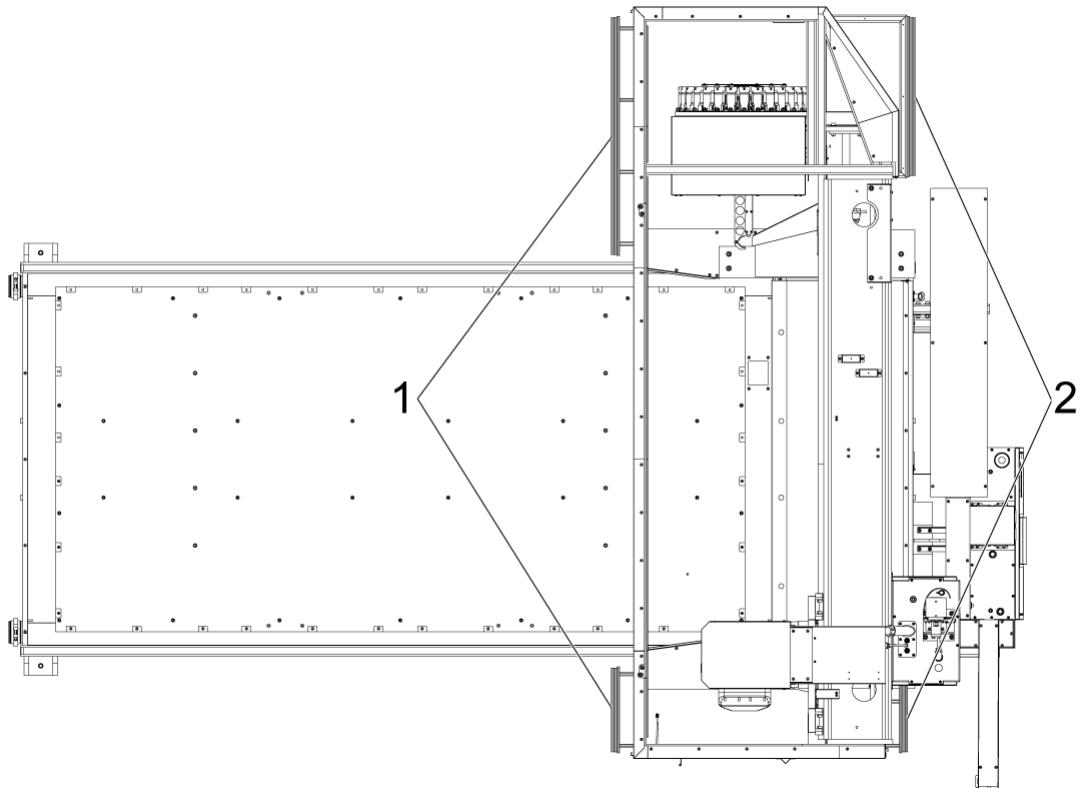
F1.3: GM-2-5AX Axis Definitions

Axis Definitions

Chapter 2: Operation

2.1 Safety Edge Sensors

F2.1: [1] -X axis safety edge sensors. [2] +X axis safety edge sensors



The GM-2-5AX is equipped with safety edge sensors, located on the X-axis gantry.

The safety edge sensors are triggered by pressure from a collision with an obstacle.

When a safety edge sensor is triggered while the machine is running a program, the machine will feed hold and decelerate to a stop before the obstacle can be pushed by the gantry.



DANGER:

The safety edge sensors are not active when the machine is in handle jog mode. If the X-axis gantry is handle jogged into an obstacle the collision will not be detected by the safety edge sensors.

2.2 Power Up / Zero Return

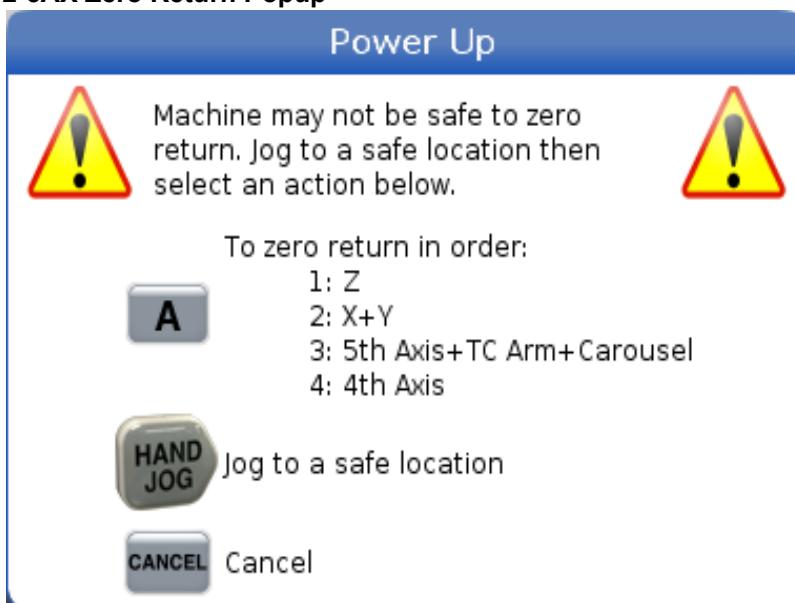
After the machine is powered on cycle the door and the [EMERGENCY STOP] button. Then press [POWER UP].

GM-2-5AX Zero Return

The Zero Return popup will appear. If the machine is in a safe position press A and the GM-2-5AX will zero return the axes in the following order:

1. Z
2. X and Y
3. C (5th), TC Arm, Carousel
4. B (4th)

F2.2: GM-2-5AX Zero Return Popup



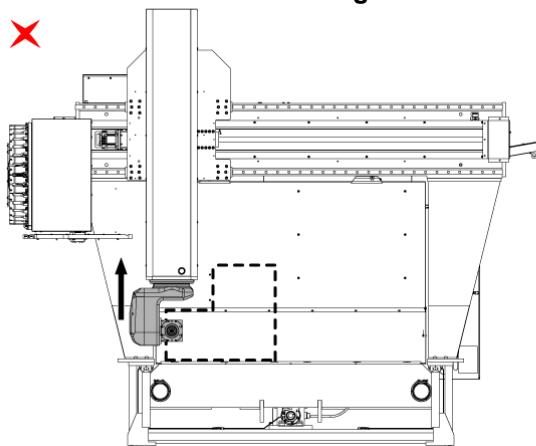
If there is an obstacle above the B/C axis assembly, such as the tool changer double arm, when the machine is commanded to zero return all axes, the B/C axis assembly will collide the double arm because the Z-Axis is always zeroed first.

To avoid this collision press **[HANDLE JOG]** when the Zero Return popup appears. This will temporarily enable Jog Without Zero Return. Jog the machine to a safe position, shown in Figure 1, and zero return all axes.

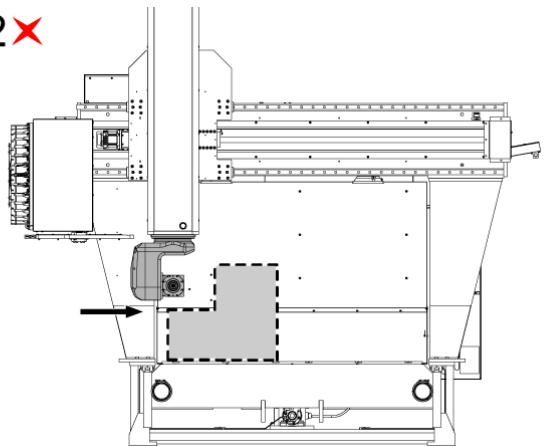
If a tool is in the spindle that is six inches or longer press **[HANDLE JOG]** when the Zero Return Popup appears and jog the B axis to the vertical position before initiating the full zero return sequence.

F2.3: GM-2-5AX Avoiding Collision On Zero Return

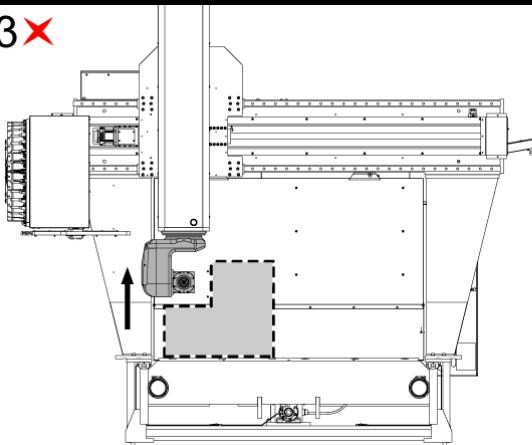
1✗



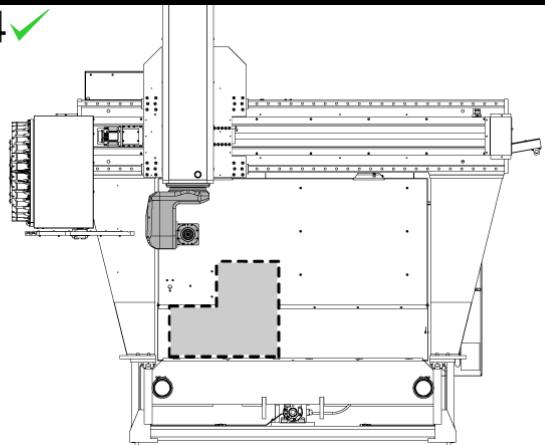
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3✗

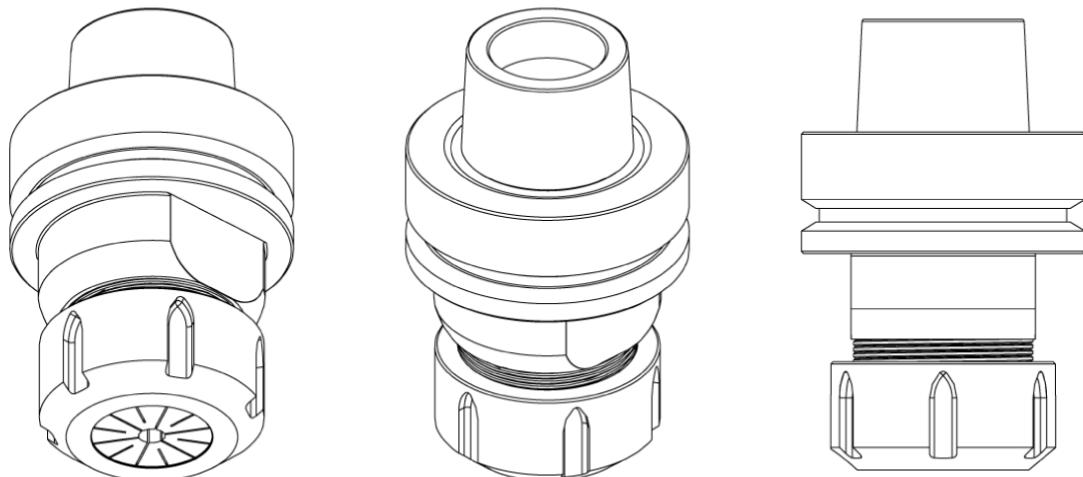


4✓



2.3 Tooling

F2.4: HSK63F Tool Holder



The GM-2-5AX uses HSK63F tool holders. All tools must be balanced to 20,000 RPM. Refer to the maintenance section for correct tool holder maintenance.



CAUTION:

Never operate the spindle without a tool holder. The machine will generate Alarm 973 - FIXTURE CLAMP FAILURE.

**CAUTION:**

Never leave a dirty or hot tool holder in the spindle overnight. This can cause the mating surfaces between the tool holder and the spindle to stick. Put a clean tool holder in the spindle at the end of the work day. The tool holder must be at room temperature, or it must be the HSK 63F Protective cone supplied by HSD.

2.4 Loading The Tool Changer

Press **[MDI]** and type **[T]** and the number of the tool you want to load. Press **[ATC FWD]**.

The second home feature can be used to quickly put the spindle into position to load tools.

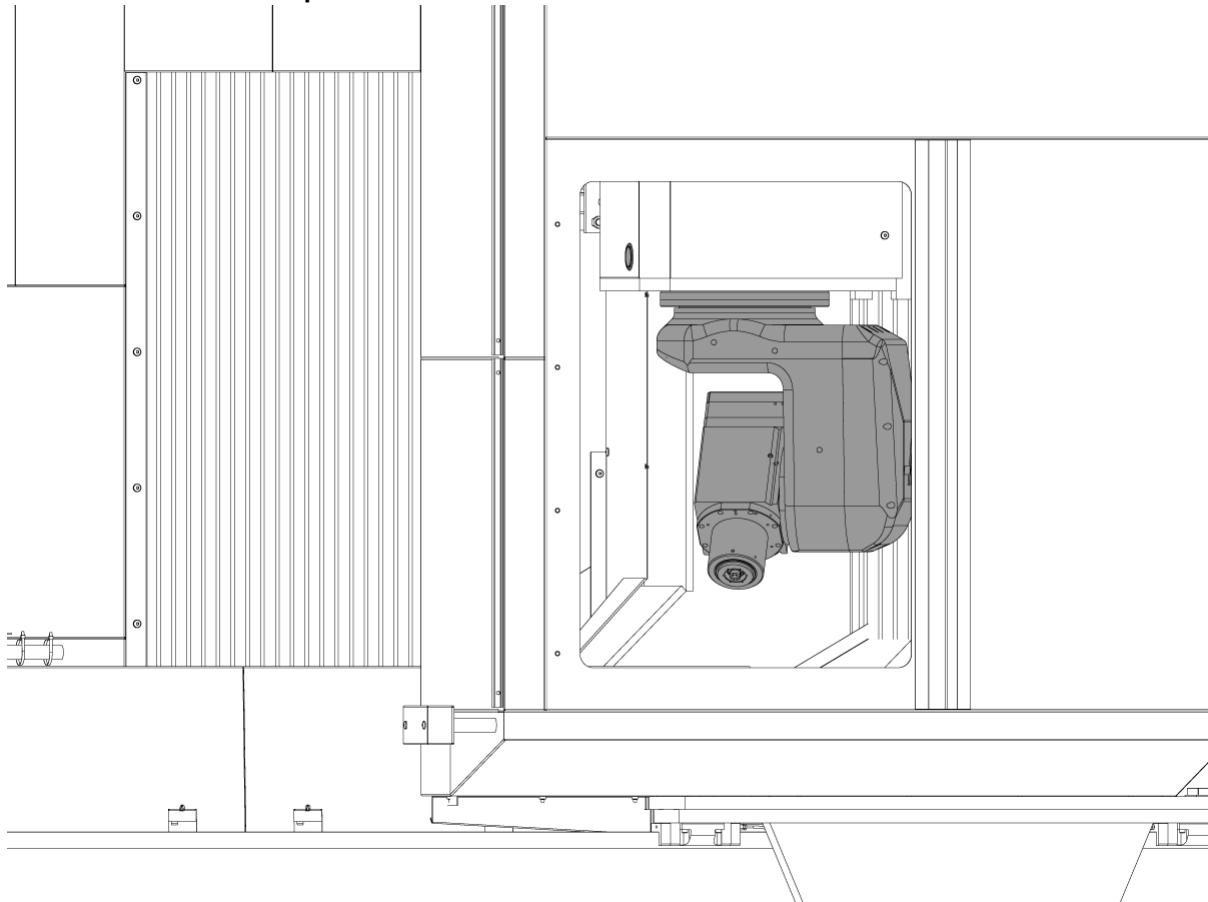
To set the second home position jog the machine to the position shown in the figure below. Press **[SETTINGS]** and navigate to the User Positions tab. Select Second Home Position and press **[F2]** on each axis second home position setting.

Press the **[SECOND HOME BUTTON]** on the side a the pendant to send the spindle to the tool load position.

**CAUTION:**

Second Home can crash the machine if there is an obstruction between the current spindle position and the second home position.

F2.5: GM-2-5AX Spindle and TOOL RELEASE Button

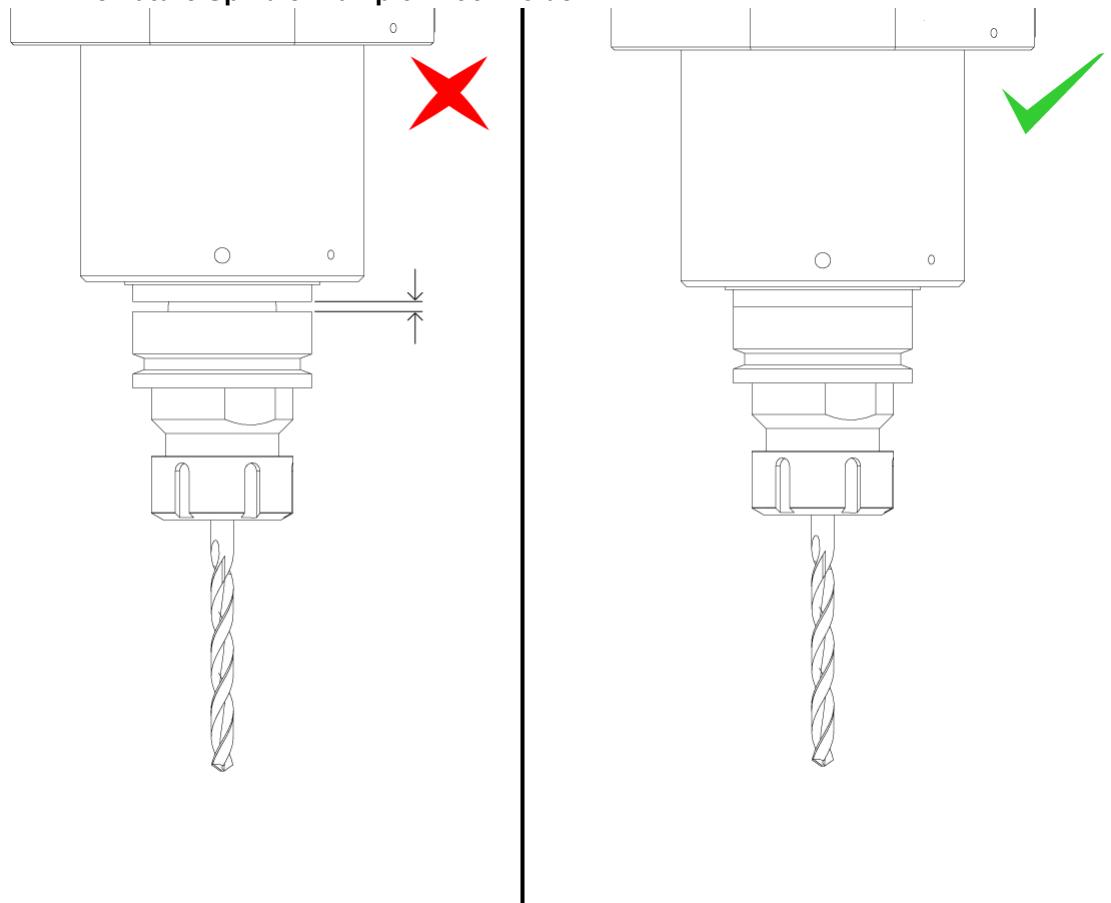


With the tool in your hand press and hold the [TOOL RELEASE] button located on the Z-Axis cover or pendant. Insert the tool into the spindle and release the [TOOL RELEASE] button.



CAUTION:

Make sure the tool is fully seated into the spindle so that the face of the tool holder mates flush with the spindle face. If the spindle clamps the tool holder prematurely there will be a gap between face of the tool holder and the spindle face. The spindle will not rotate, but a tool change can be commanded which will cause a tool change failure or the tool to be dropped

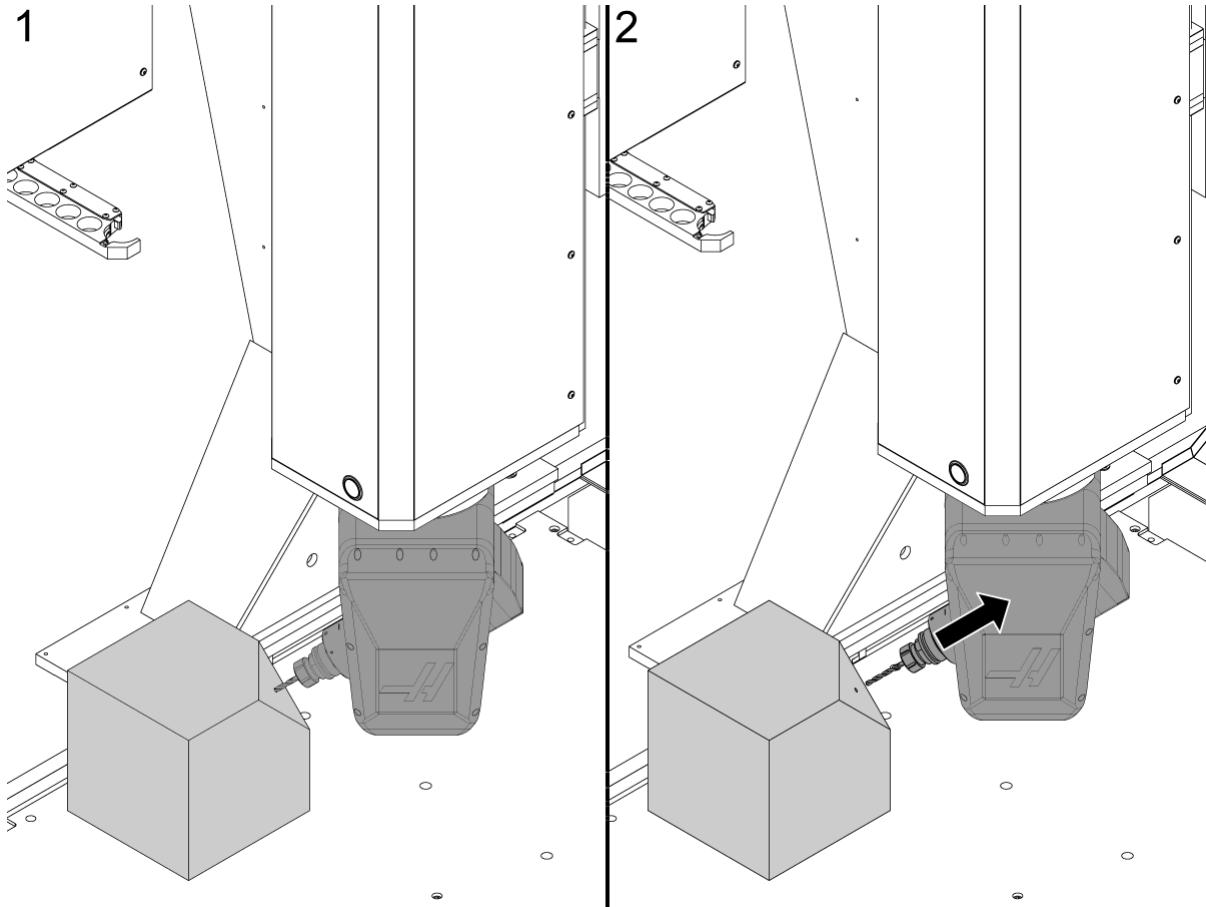
F2.6: Premature Spindle Clamp on Tool Holder

Cycle the tool into the tool changer and repeat this process until all the tools necessary for your application are loaded.

2.5 GM-2-5AX Vector Jog

The Vector Jog feature allows the operator to jog the machine along the vector of the current spindle orientation. Vector jogging can be used at any time. It is especially useful for recovering a tool if the machine loses power while machining a part.

F2.7: Recover a Tool After Power Loss



To recover a tool after power loss during machining press [**POWER UP**]. The Zero Return popup will appear.

Type VJ and press [**HANDLE JOG**]. Jogging in the positive direction will move the tool away from the part along the current spindle vector. Jogging in the negative direction will move the tool towards the part along the current spindle vector.

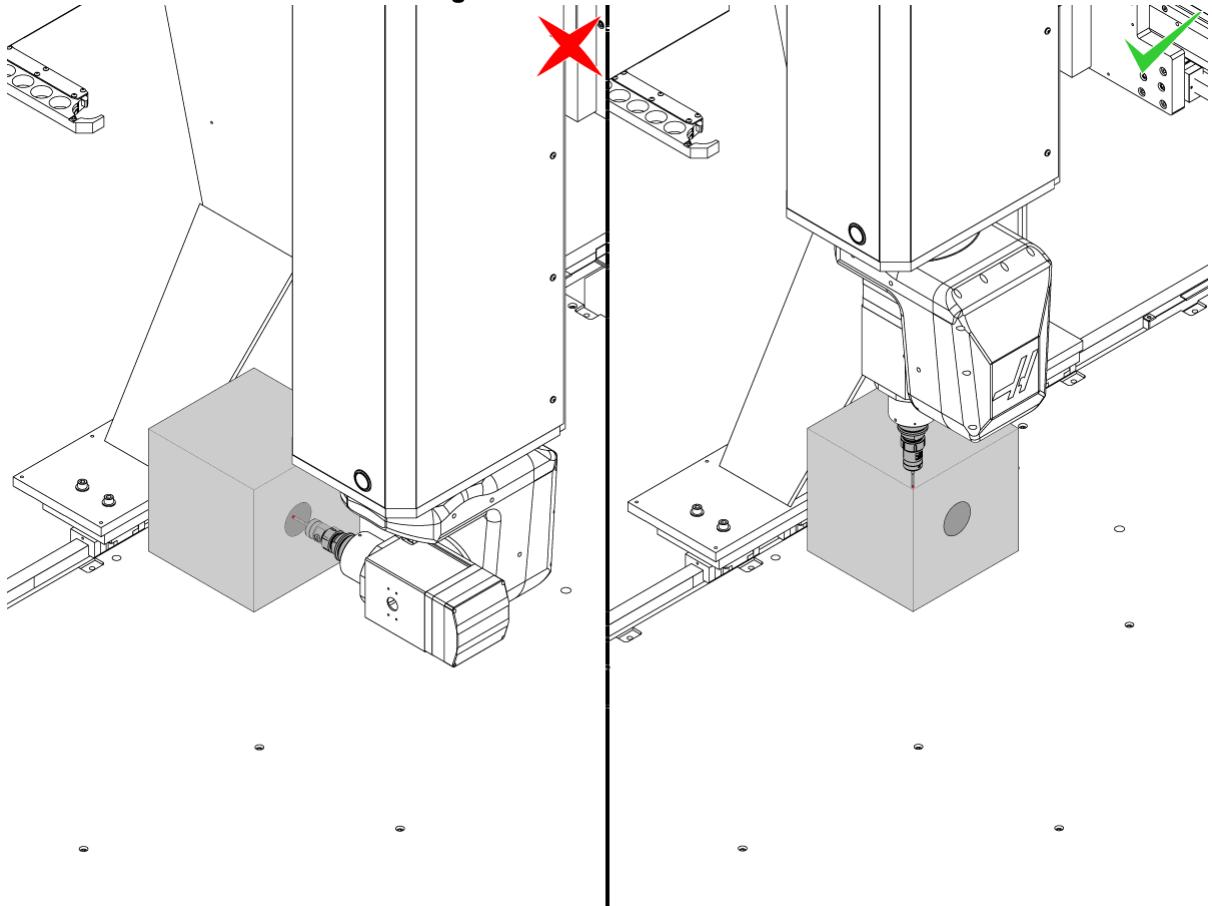
The Tap Recovery feature will automatically make use of vector jogging to recover taps from non vertical holes.

2.6 GM-2-5AX WIPS Basics

The Wireless Intuitive Probing System (WIPS) comes standard with the GM-2-5AX. This system is used to set work and tool offsets and also includes special probe routines specific to the GM-2-5AX. These special probe routines use the calibration sphere assembly.

F2.8:

Probe Work Offset Using WIPS



To probe work and tool offsets using WIPS the B and C axes must both be at zero.

If a WIPS tool or work offset probing routine is run while the B and C axes are not at zero
Alarm 1005/1006 JOG TO A SAFE PLACE AND ZERO B/C AXIS will be generated.

2.7 GM-2-5AX Safe Zones

GM-2-5AX software defines safe zones between the permanent elements of the machine.

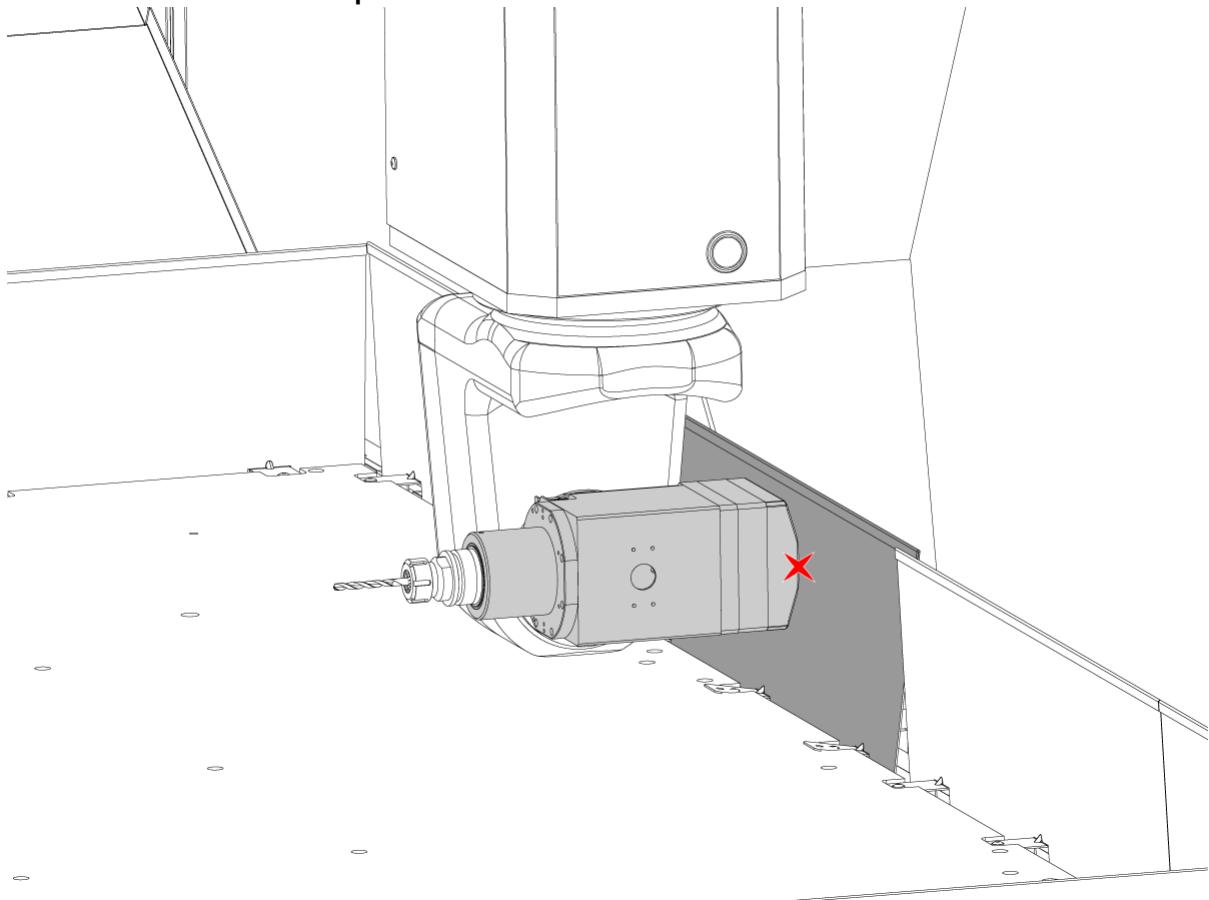
Permanent elements of the machine include:

1. B/C-axis Assembly
2. Table
3. X-axis Gantry Assembly
4. Tool Changer

The following are not permanent elements of the machine:

1. Table Splash Guards
2. WIPS Tool Probe

F2.9: Collision With Splash Guard





CAUTION: *Software defined safe zones are not active until the machine has been zero returned.*

If the machine is jogged near a safe zone jogging will halt before a collision can occur.

If the spindle is commanded to enter a safe zone by G-Code, alarm 9108 **POTENTIAL COLLISION DETECTED** will be generated before a collision can occur.

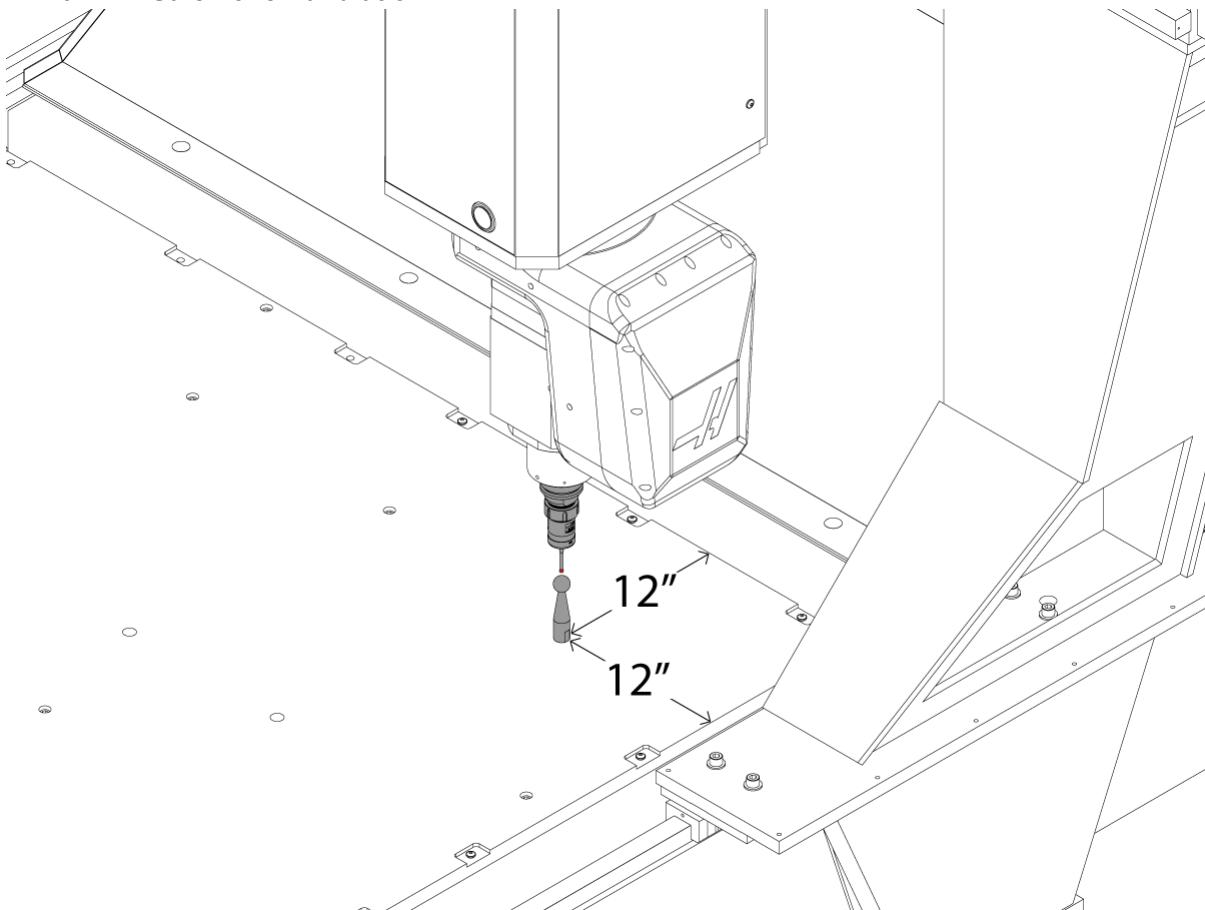


NOTE: *The software defined crash zones are tool length aware. In order for the safe zone feature to prevent collisions between the tool and the permanent elements of the machine the tool offsets must be correctly defined.*

2.7.1 GM-2-5AX Safe Zone Calibration

If a motor, proximity sensor, or proximity sensor flag is adjusted or replaced the safe zones must be recalibrated.

F2.10: Safe Zone Calibration



Mount the calibration sphere into the threaded hole in the table located 12" for the X+ side of the table and 12" from Y- side of the table using the short tapered post. The top of the calibration sphere should be 4.35" above the table

IMPORTANT: Make sure the calibration sphere is tightly attached to the calibration assembly. Do not over tighten the calibration sphere

With the B and C axes at 0, position the work probe over the center of the calibration sphere .25" above the top of the calibration sphere.

To recalibrate the safe zones press [EDIT]. Navigate to the **VPS** tab. Select **CALIBRATION**. Select **Safe Zone Calibration**. Follow the on screen instructions provided by the VPS template.

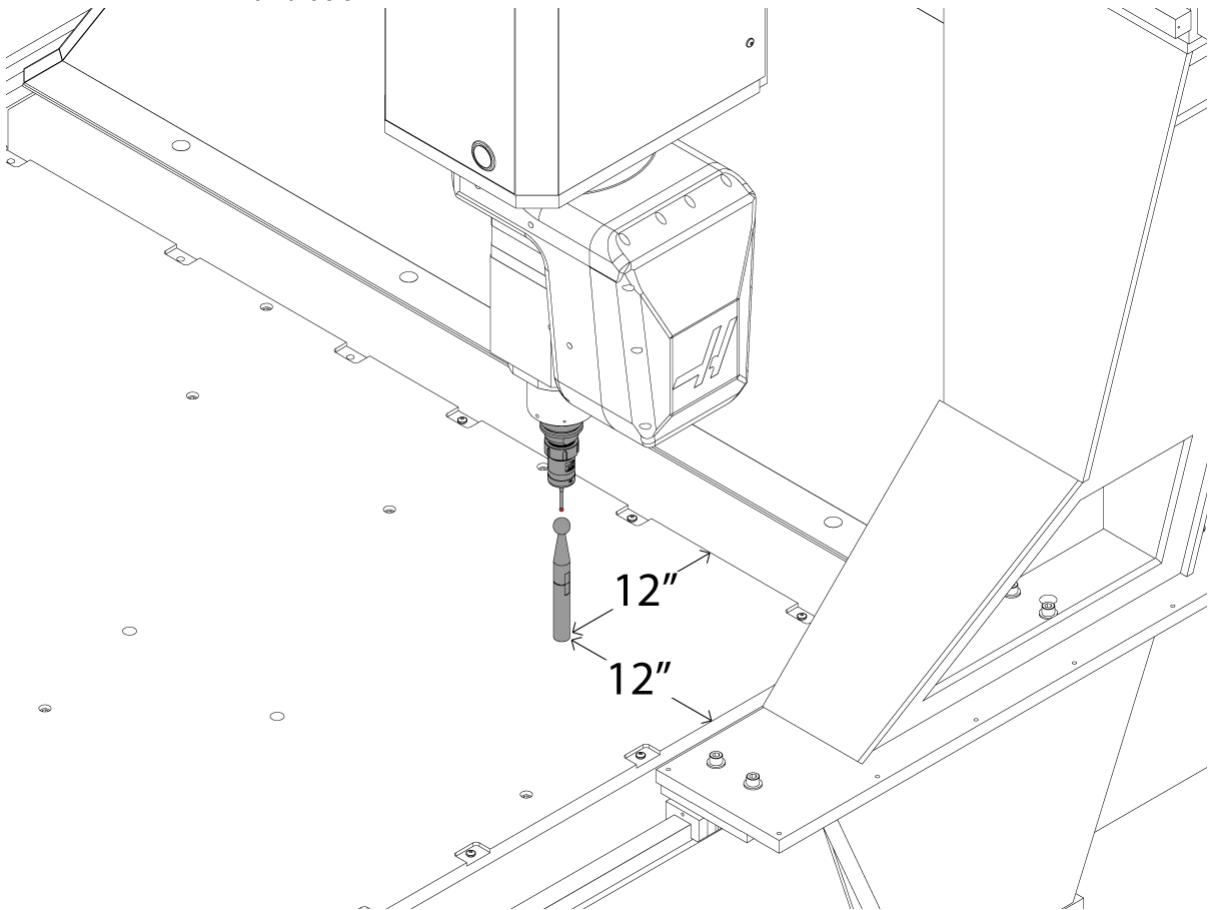
The machine will probe the calibration sphere and automatically populate macro variables **10378**, **10379**, and **10380**. Copy the values from the macro variables to the corresponding settings.

1. copy macro variable **10378** to setting **378**
2. copy macro variable **10379** to setting **379**
3. copy macro variable **10380** to setting **380**

2.8 GM-2-5AX Machine Rotary Zero Point (MRZP) Offsets Calibration

The Machine Rotary Zero Point (MRZP) Offsets are control settings that are used to calculate the distance between the B-axis and C-axis to compensate for the fact that these axes do not intersect.

The MRZP offsets are set at the factory but, they can change over time. To make sure the GM-2-5AX MRZP Offsets are correct do the following:

F2.11: MRZP Calibration

Mount the calibration sphere into the threaded hole in the table located 12" for the X+ side of the table and 12" from Y- side of the table using the tall (4") post. The top of the calibration sphere should be 8.35" above the table.

IMPORTANT: *Make sure the calibration sphere is tightly attached to the calibration assembly. Do not over tighten the calibration sphere.*

With the B and C axes at 0, position the work probe over the center of the calibration sphere .25" above the top of the calibration sphere.

To recalibrate the MRZP offsets press [EDIT]. Navigate to the **VPS** tab. Select **CALIBRATION**. Select **MRZP Calibration**. Select **MRZP GM-2-5AX**. Follow the on screen instructions provided by the VPS template.

The machine will probe the calibration sphere and automatically populate macro variables **10300**, **10301**, and **10305**. Copy the values from the macro variables to the corresponding settings.

1. copy macro variable **10300** to setting 300
2. copy macro variable **10301** to setting 301
3. copy macro variable **10305** to setting 305

Chapter 3: Programming

3.1 5 Axis G-Codes

G234, G268, G269, and G253 are 5 axis G-Codes used to program the GM-2-5AX. For information about G-Codes used to program Haas milling machines see the Mill Operator's Manual.

3.1.1 Pivot Length Adjustment and Tool Length Compensation

The default mode for programming the GM-2-5AX tracks the position of the spindle face by adding the pivot length vector to the B/C axis pivot point position. Setting 305 stores the magnitude of this vector. If tool length compensation is active, the active tool offset is added to the magnitude of the pivot length vector to track the tool tip.

The control knows the centers of rotation for the rotary axes (MRZP), the location of the workpiece (active work offset), and the tool length offset. The control uses this data to calculate the position of tool tip relative to the active work offset as the tool tip moves.

Use this mode for 3+1 axis or 3+2 axis positioning. Pivot Length Adjustment and Tool Length Compensation is not for simultaneous 4th or 5th axis machining. The GM-2-5AX software always uses Pivot Length Adjustment and Tool Length Compensation unless overridden by Tool Center Point Control (TCPC).

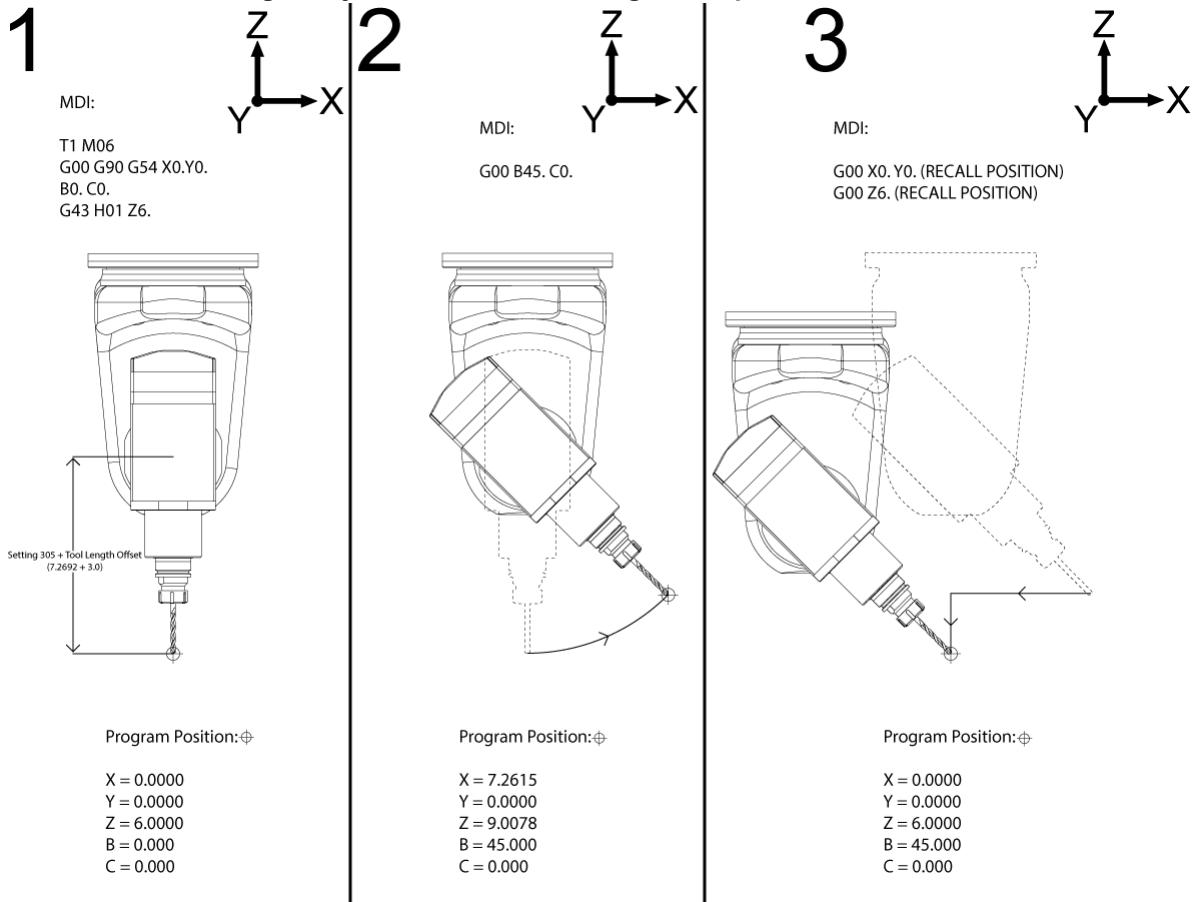
Pivot Length Adjustment and Tool Length Compensation replaces Dynamic Work Offsets (DWO) G254 on the GM-2-5AX. G254 is not available on the GM-2-5AX.

**CAUTION:**

Before rotary motion, use a G53 Non-Modal Machine Coordinate motion command to safely retract the tool from the workpiece and allow clearance for Z-axis motion. Command the Z axis to the home position. Command the rotary motion. Command an X-, Y-, and Z-Axis position before a cutting command, even if it recalls the current position. The program should specify the X- and Y-Axis position in one block and the Z-Axis position in a separate block.

The diagram below illustrates Pivot Length Adjustment and Tool Length Compensation positioning.

F3.1: Pivot Length Adjustment and Tool Length Compensation



Pivot Length Adjustment and Tool Length Compensation example program.

```
%  
000004 (PIVOT LENGTH ADJUSTMENT AND TOOL LENGTH COMPENSATION  
SAMPLE);  
G20;  
G00 G17 G40 G80 G90 G94 G98;  
G53 Z0.;  
T1 M06;  
G00 G90 G54 X0. Y0. B0. C0.;  
S1000 M03;  
G43 H01 Z6. (START POSITION 6.0 ABOVE THE TOP OF THE PART  
Z0.0);  
G01 Z-1. F20 (FEED INTO TOP OF THE PART 1.0);  
G00 G53 Z0. (RETRACT Z WITH G53);  
B90. C0. (POSITION 4TH + 5TH AXES);  
X-7. Y0. (X AND Y POSITION COMMAND);
```

```
Z-1. (START POSITION 6.0 AWAY FROM THE SIDE OF THE PART  
X-1.0);  
G01 X0. F20. (FEED INTO SIDE OF THE PART 1.0);  
X-7. F40. (RETRACT FROM SIDE OF PART);  
G00 G53 Z0. (RETRACT Z WITH G53);  
B0. C0.;  
M30;  
%
```

3.1.2 G234 - Tool Center Point Control (TCPC)

G234 Tool Center Point Control (TCPC) is a software feature in the Haas CNC control that allows a machine to correctly run a contouring 4- or 5-axis program when the workpiece is not located in the exact location specified by a CAM-generated program. This eliminates the need to repost a program from the CAM system when the programmed and the actual workpiece locations are different. The Haas CNC control combines the known centers of rotation for the rotary axes (MRZP) and the location of the workpiece (e.g., active work offset G54) into a coordinate system. TCPC makes sure that this coordinate system remains fixed relative to the table; when the rotary axes rotate, the linear coordinate system rotates with them. Like any other work setup, the workpiece must have a work offset applied to it. This tells the Haas CNC control where the workpiece is located on the machine table.

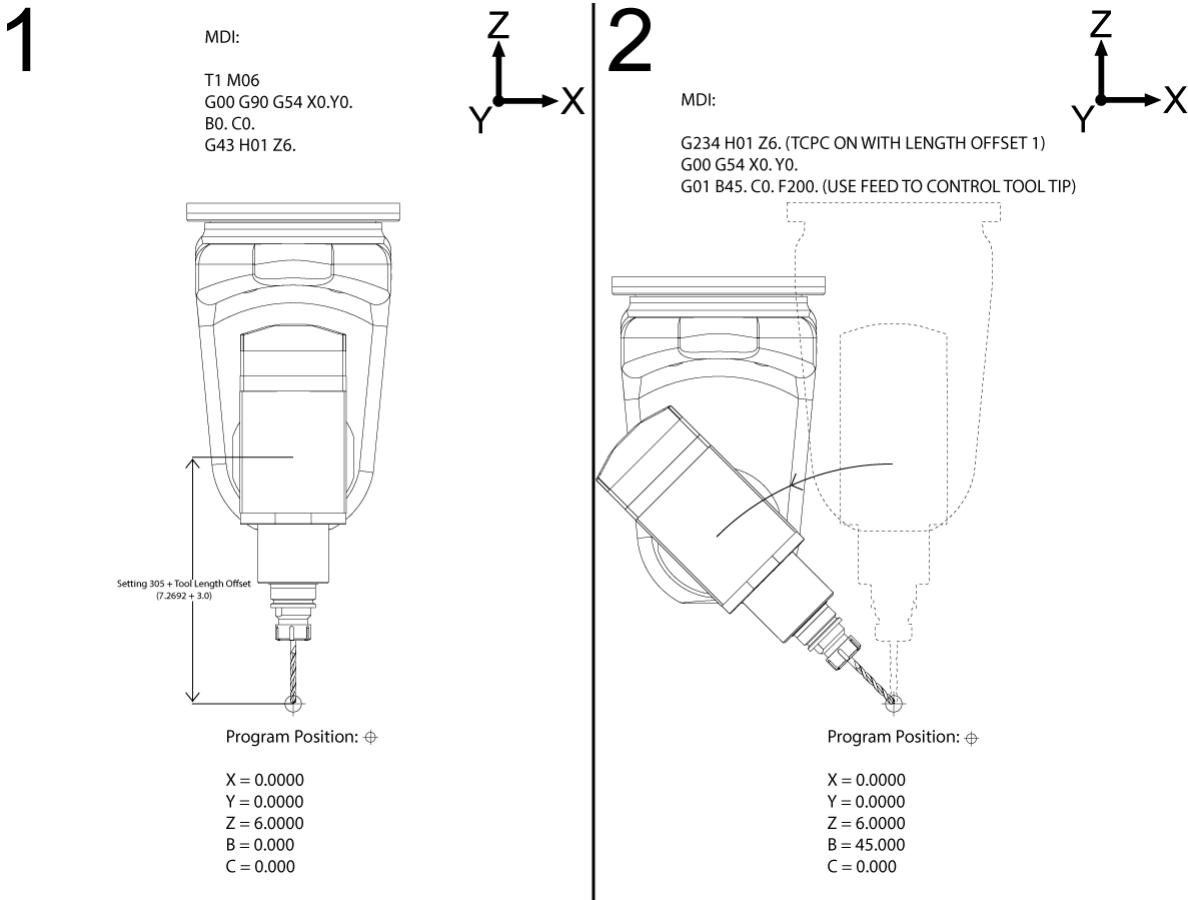
TCPC is activated with G234. G234 cancels the previous H-code. An H-code must therefore be placed on the same block as G234. G234 is canceled by G49, G42, and G44.

TCPC G-code is programmed from the tool tip. The control knows the centers of rotation for the rotary axes (MRZP), the location of the workpiece (active work offset), and the tool length offset. The control uses this data to calculate the position of tool tip relative to the active work offset and maintains a static tool tip position through rotary feed moves.

: *Tool tip position is not maintained during rapid rotary moves. Do not program rapid moves while TCPC is active.*

The diagram below illustrates TCPC positioning.

F3.2: GM-2-5AX TCPC



TCPC Program Example

```
%  
O00003 (TCPC SAMPLE);  
G20;  
G00 G17 G40 G80 G90 G94 G98;  
G53 Z0.;  
T1 M06;  
G00 G90 G54 B47.137 C116.354 (POSITION ROTARY AXES);  
G00 G90 X-0.9762 Y1.9704 S10000 M03 (POSITION LINEAR AXES);  
G234 H01 Z1.0907 (TCPC ON WITH LENGTH OFFSET 1, APPROACH IN  
Z-AXIS);  
G01 X-0.5688 Y1.1481 Z0.2391 F40.;  
X-0.4386 Y0.8854 Z-0.033;  
X-0.3085 Y0.6227 Z-0.3051;  
X-0.307 Y0.6189 Z-0.3009 B46.784 C116.382;  
X-0.3055 Y0.6152 Z-0.2966 B46.43 C116.411;
```

```
X-0.304 Y0.6114 Z-0.2924 B46.076 C116.44;  
X-0.6202 Y0.5827 Z-0.5321 B63.846 C136.786;  
X-0.6194 Y0.5798 Z-0.5271 B63.504 C136.891;  
X-0.8807 Y0.8245 Z-0.3486X-1.1421 Y1.0691 Z-0.1701;  
X-1.9601 Y1.8348 Z0.3884G49 (TCP OFF);  
G00 G53 Z0.;  
G53 B0. C0.;  
G53 Y0.;  
M30;  
%
```

3.1.3 G268 / G269 Feature Coordinate System (Group 02)

X - Feature coordinate system origin X coordinate in the WCS.

Y - Feature coordinate system origin Y coordinate in the WCS.

Z - Feature coordinate system origin Z coordinate in the WCS.

***I** - Rotation of feature coordinate system about working coordinate system X axis.

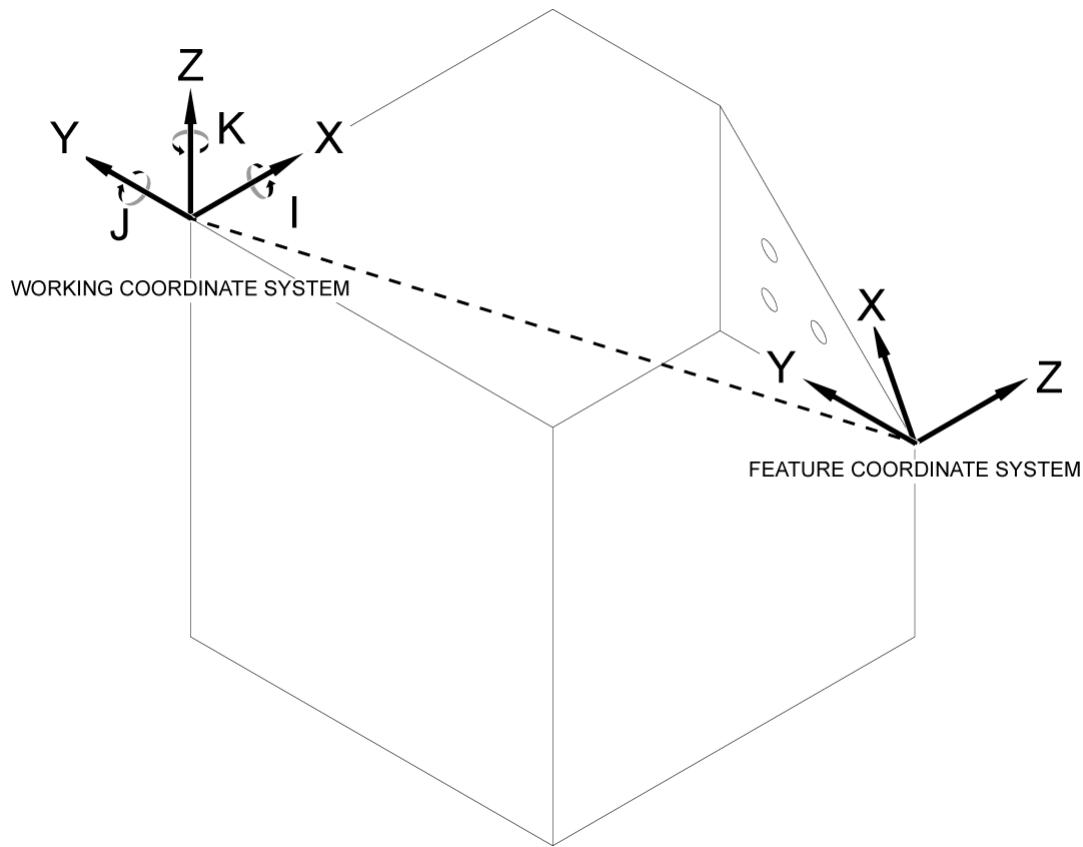
***J** - Rotation of feature coordinate system about working coordinate system Y axis.

***K** - Rotation of feature coordinate system about working coordinate system Z axis.

***Q** - Qnnn is used to define the order in which the I,J,K rotations will be applied. The default value used if Q is omitted, Q321 rotates about Z, then Y, then X. Q123 rotates about X, then Y, then Z.

* indicates optional

F3.3: G268 Feature Coordinate System



G268 is a 5 axis G-Code used to define a tilted feature coordinate system relative to the working coordinate system. Canned cycles and G-codes work normally within the feature coordinate system. Before activating G268, G43 Tool Length Compensation, must be activated. However, the transformation from the working coordinate system to the feature coordinate system is performed independently from the tool length offset. Calling G268 only establishes the feature coordinate system. It does not cause motion in any axis. After calling G268 the current position of the spindle must be recalled. G269 is used to cancel G268 and revert back the WCS.

There are two ways to define a feature coordinate system using G268. The first is to command the B and C axis to the desired angle and specify only the feature coordinate system origin using G268. The feature coordinate system plane will be the plane normal to the spindle axis at the moment G268 is called.

%

O00001 (G268 WITH G81 DRILL CANNED CYCLE) (ANGLE FROM SPINDLE POSITION)

```

T1 M06 (TOOL CHANGE)
G54 G00 G40 G80 G17 G90 (GENERAL SAFE STARTUP LINE)
X0 Y0 S1500 M03 (INITIAL XYZ LOCATION)
G00 B30. C45. (SET SPINDLE ANGLE)
G43 Z6. H01 (ENACT TOOL LENGTH COMP.)
G268 X2. Y2. Z0 (SET TILTED PLANE)
G00 X0 Y0 Z.5 (RECALL POSITION)
G81 G98 R0.1 Z-1. F75.
G80
G269 (CANCEL TILTED PLANE)
G00 G53 Z0 M05
G53 B0 C0
G53 X0 Y0
M30
%
```

The second way to define a feature coordinate system using G268 is to use the optional I, J, K, and Q address codes to specify rotation angles relative to the WCS and rotation order. By using this method, a feature coordinate system that is not normal to the spindle axis may be defined.

```

%
000002 (G268 WITH G81 DRILL CANNED CYCLE) (COMMAND ANGLE WITH
IJK & Q)
T1 M06 (TOOL CHANGE)
G54 G00 G40 G80 G17 G90 (GENERAL SAFE STARTUP LINE)
X0 Y0 S1500 M03 (INITIAL XYZ LOCATION)
G00 B30. C45. (SET SPINDLE ANGLE)
G43 Z06. H01 (ENACT TOOL LENGTH COMP.)
G268 X2. Y2. Z0 I0 J30. K45. Q123 (SET TILTED PLANE)
G00 X0 Y0 Z.5 (RECALL POSITION)
G81 G98 R0.1 Z-1. F75.
G80
G269 (CANCEL TILTED PLANE)
G00 G53 Z0 M05
G53 B0 C0
G53 X0 Y0
M30
%
```

3.1.4 G253 Orient Spindle Normal To Feature Coordinate System (Group 00)

G253 is a 5 axis G-Code used to orient the spindle normal the feature coordinate system. This code can only be used while G268 is active.

```
%  
O00005 (G268 WITH G81 DRILL CANNED CYCLE) (COMMAND ANGLE WITH  
IJK BEFORE MOVING TO OFFSET)  
T1 M06 (TOOL CHANGE)  
G54 G00 G40 G80 G17 G90 (GENERAL SAFE STARTUP LINE)  
X0 Y0 S1500 M03 (INITIAL XYZ LOCATION)  
G43 Z06. H01 (ENACT TOOL LENGTH COMP.)  
G268 X2. Y2. Z0 I0 J30. K45. Q123 (SET TILTED PLANE)  
G253 (MOVE SPINDLE PERPENDICULAR TO TILTED PLANE)  
G00 X0 Y0 Z.5 (MOVE TO START LOCATION)  
G81 G98 R0.1 Z-1. F75.  
G80  
G269 (CANCEL TILTED PLANE)  
G00 G53 Z0 M05  
G53 B0 C0  
G53 X0 Y0  
M30  
%
```

Chapter 4: Maintenance

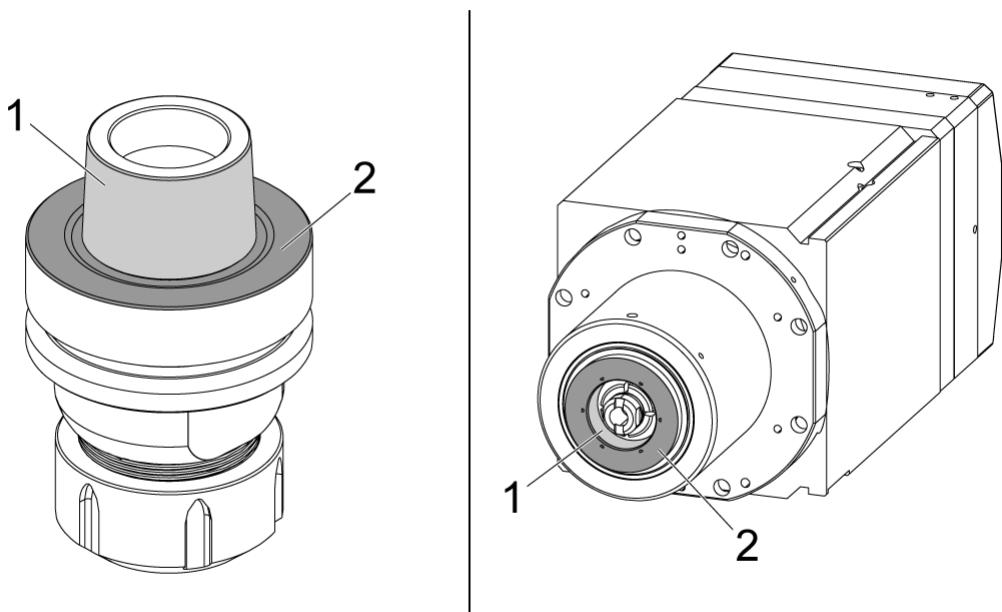
4.1 Basic Maintenance Schedule

Regular maintenance is important to make sure that your machine has a long and productive life with minimal downtime. The most common maintenance tasks are simple, and you can do them yourself.

Maintenance Item	Interval
Check and clean the tool holders and spindle mating surfaces	Weekly
Grease the tool clamp mechanism in the spindle	Monthly
Spindle chiller maintenance	As Needed

4.2 Weekly Maintenance

F4.1: Tool holder and spindle mating surfaces. [1] tapered surfaces, [2] flat surfaces.



Check the tool holders and the spindle weekly to make sure that these surfaces are thoroughly clean. Clean these surfaces at machine power up and power down. Make sure that they do not have traces of dust, grease, cooling liquid, oil, metal chips, machining residue, oxidation, or scale build-up. Always use a clean cloth rag when you clean these surfaces. Never use abrasive elements such as wire wool, metal scrapers, emery cloth, or acids.



CAUTION:

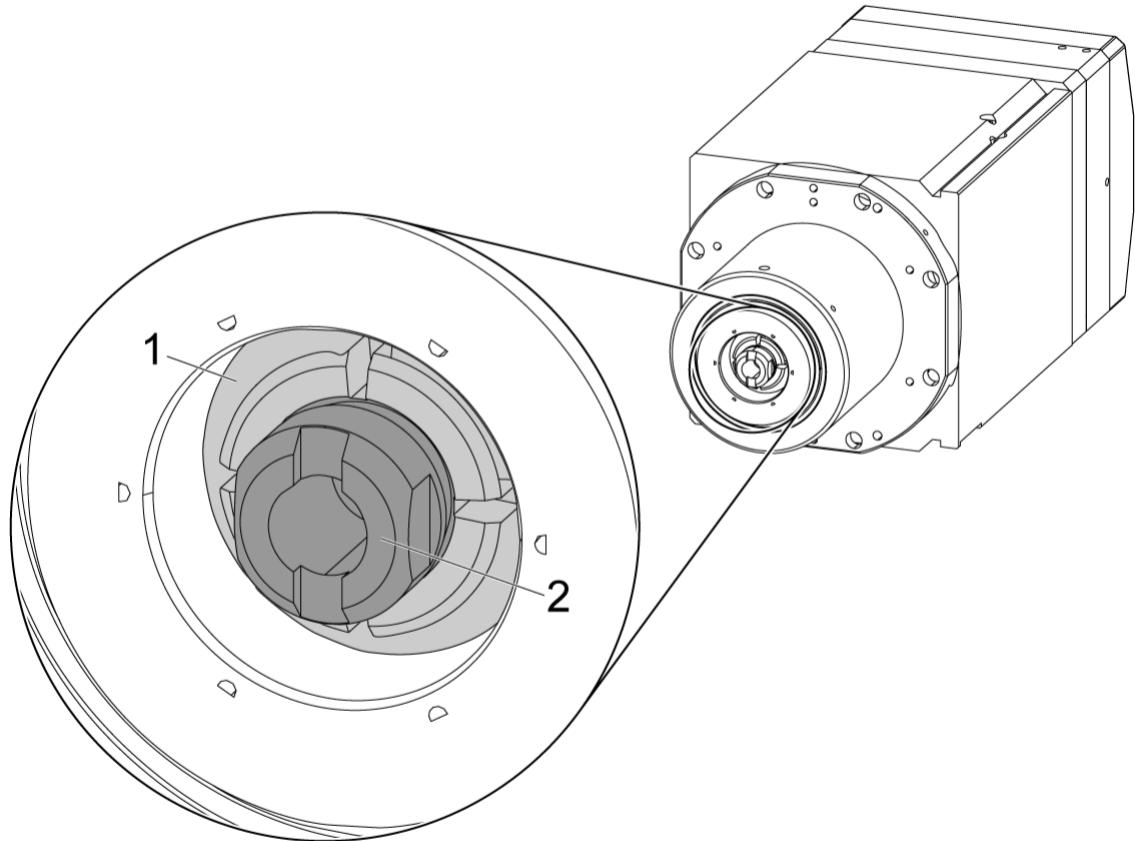
Never leave a dirty or hot tool holder in the spindle overnight. This can cause the mating surfaces between the tool holder and the spindle to stick. Put a clean tool holder in the spindle at the end of the work day. The tool holder must be at room temperature, or it must be one of the protective closing devices supplied by HSK, such as the HSK 63F Protective cone.



CAUTION: Never use compressed air to clean the inside of the spindle.

4.3 Monthly Maintenance

F4.2: HSK collet spindle clamp mechanism. [1] collet, [2] ejector.



The GR-712 5AX spindle uses an HSK collet to pull in the tool holder and clamp it in place. Once a month, lubricate this collet with METAFLUX-Fett-Paste No. 70-8508 or METAFLUX-Moly-Spray No. 70-82.

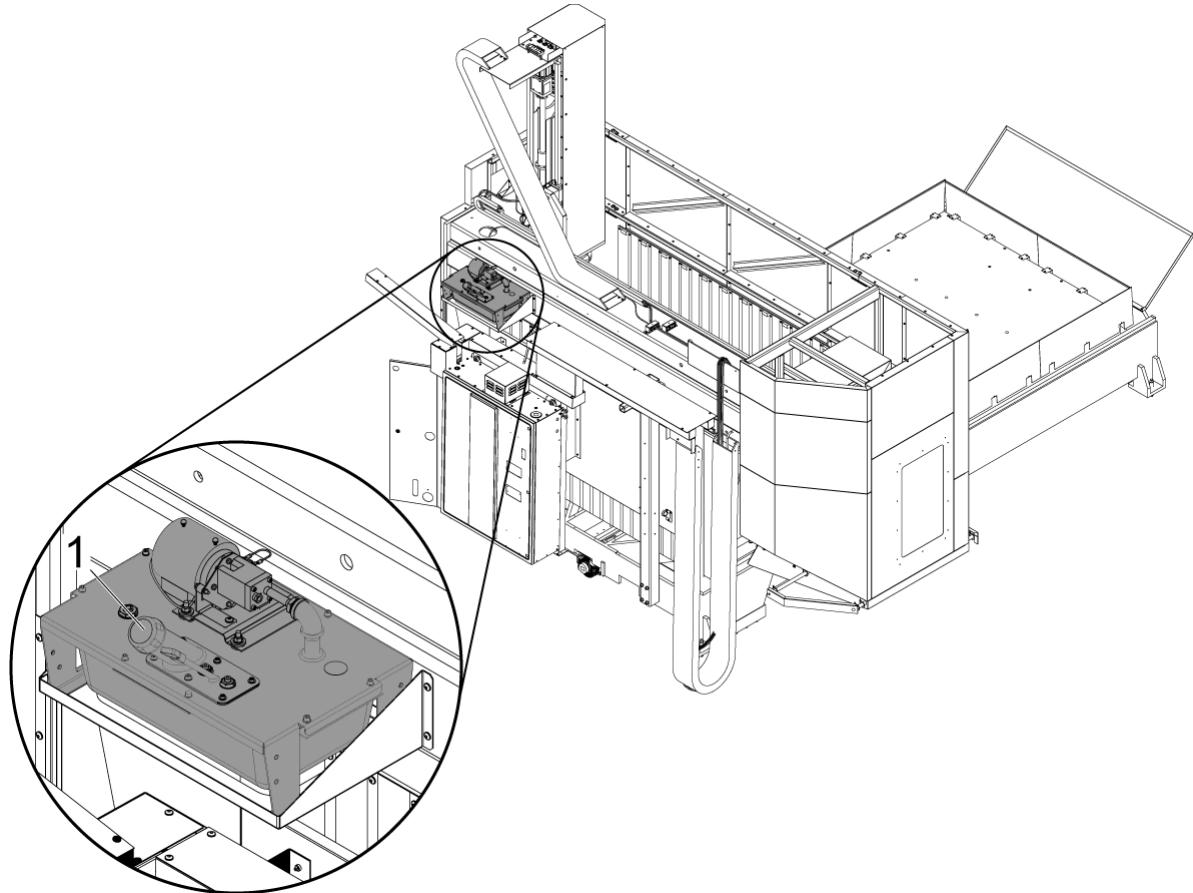
Follow these instructions to correctly grease the spindle:

1. Use a clean, thin, plastic tool to spread the grease in the gaps between the segments [1] of the collet and the ejector [2].
2. Command (10) tool changes to evenly distribute the grease.
3. Remove the tool holder from the spindle shaft.

4. Remove any visible remains of grease with a clean cloth.

4.4 Spindle Chiller Maintenance

F4.3: Spindle chiller fill cap [1]

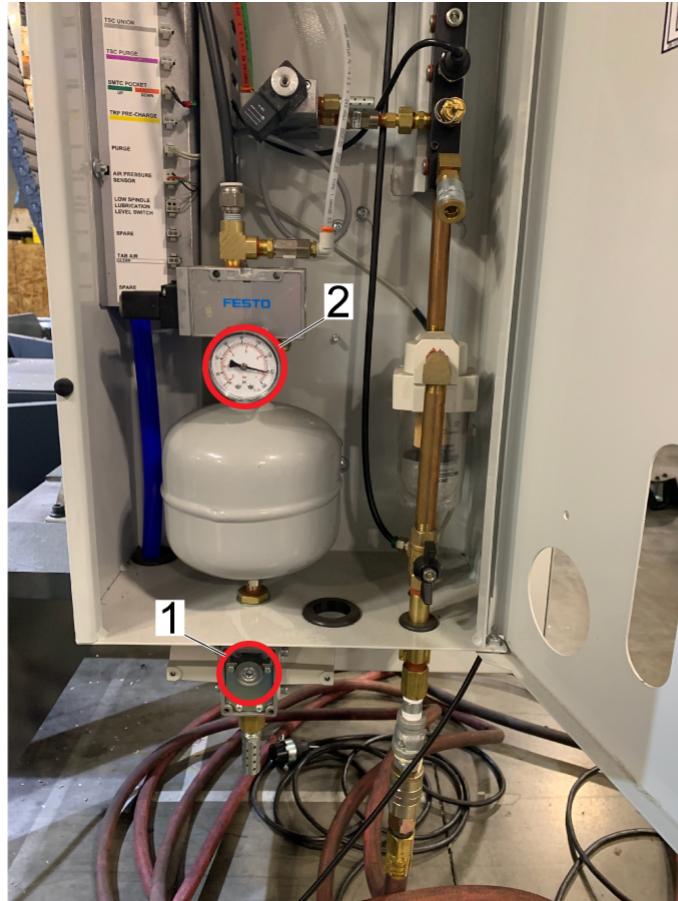


The chiller does not need regular maintenance. The control gives a message when the coolant level in the chiller gets low. When you get this message, remove the chiller cap [1] and top off the chiller with a 50/50 distilled water/glycol mixture (automotive antifreeze).

Chapter 5: Troubleshooting

5.1 Tool Changer Air Pressure

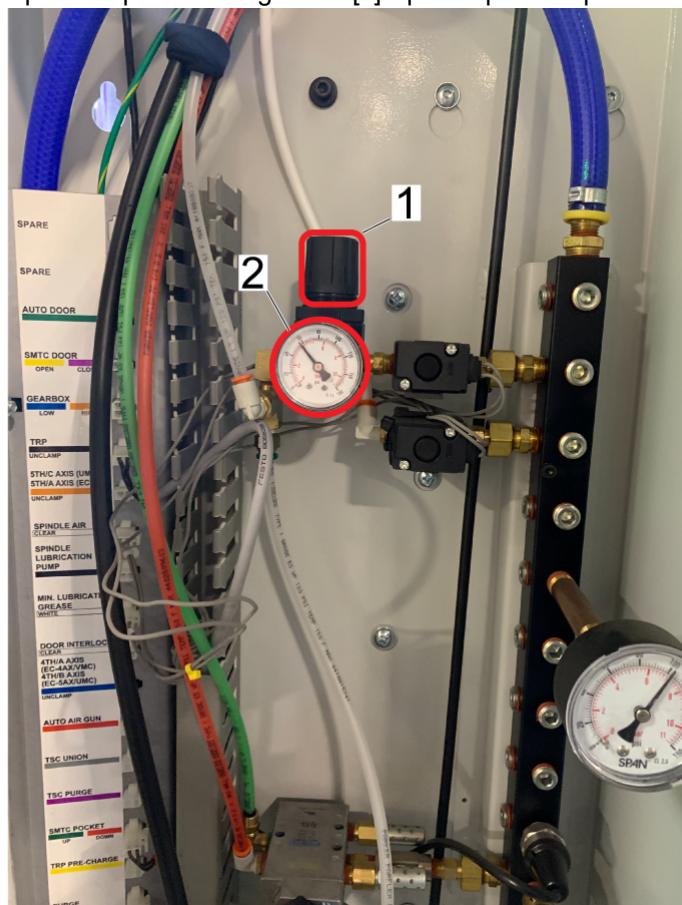
- F5.1: [1] Tool change air pressure doubler regulator. [2] Tool release solenoid air pressure gauge.



If the spindle fails to release the tool during a tool change or generates a tool clamp / unclamp alarm check the tool release solenoid air pressure gauge [2]. The pressure on this gauge must rise to 150-160 psi during the tool change. If the pressure does not rise to 150-160 psi adjust the pressure regulator [1].

5.2 Spindle Positive Air Pressure

F5.2: [1] Spindle positive pressure regulator. [2] Spindle positive pressure solenoid gauge.



The spindle positive pressure solenoid supplies constant air through the spindle to prevent contamination from entering the spindle during a tool change. During a tool change, the spindle positive pressure solenoid gauge [2] must rise to 55-60 psi. If the spindle does not rise to 55-60 psi adjust the pressure regulator [1].

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