



Service Manual

Innovation, Quality & Honesty

DL-NCD Door Lite System

Service Manual

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Service Manual for the DL-NCD

The screenshot displays a software interface for configuring a door lite system. On the left, a 3D model of the DL-NCD Door Lite System is shown. Below the model is a control panel with buttons for 'Add Group', 'Add Child', 'Add From Library', and 'Delete'. A 'Selected Feature Details' section shows 'Feature Group Name: Doorlite' and a 'Description' field. Below this is a 'Locations' section with 'Add Location' and 'Remove Location' buttons, and a table with columns for 'T Location', 'W Location', and 'L Location', all containing the value '0'. On the right, a 'Job Preview (Hinge Pivot Face)' window shows a top-down view of a door lite with a grid. The preview includes labels for 'Top End', 'Bottom End', 'Lock Edge', and 'Hing'. Dimensions 'L' (height) and 'W' (width) are indicated with arrows. A blue square highlights a specific area on the door lite. At the bottom of the preview window, there are settings for 'Scale Percent: 10', 'Grid Lines (in): 0.5', 'Grid Lines On: ', 'Preview Surface: Hinge Pivot Face', and a dropdown menu.

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CHAPTER 1 Introduction to the DL-NCD

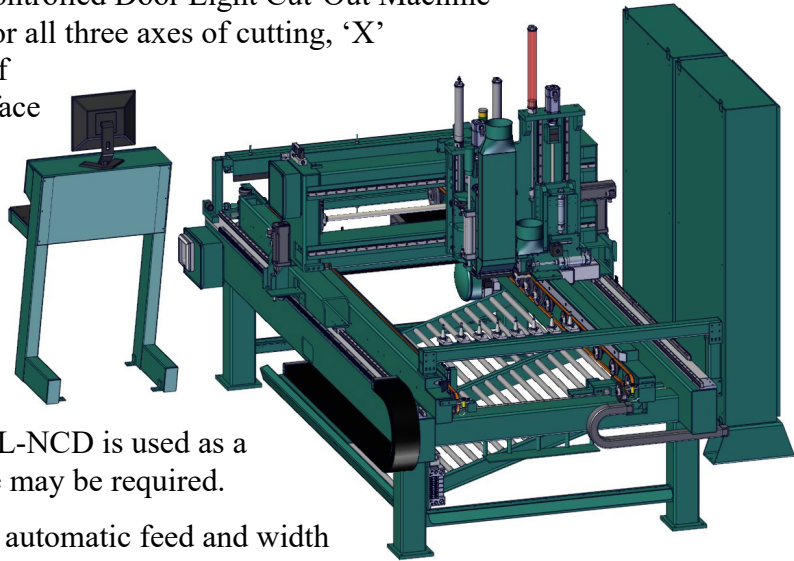
This chapter provides an overview of the **KVAL DL-NCD** machine and important safety information to follow when operating the machine.

Chapter 1 at a Glance

Section Name	Summary	Page
Overview of the DL-NCD System	This section provides an overview of the machine. It includes a general description and a table of available options	page 1-2
Safety First!	IMPORTANT safety information is described in this section	page 1-5
Lockout-Tagout Guidelines	Procedures describing Lockout Tagout.	page 1-9
Zero-Energy to Start-Up	Procedure to power up your machine for the first time.	page 1-12
Getting Help from KVAL	This section describes the method to contact the KVAL service center for help. The section includes how to get information from the specification plate to provide to KVAL, service center hours, and return procedures	page 1-14
Safety Sign-Off Sheet	A record to track operators that are trained on the machine.	page 1-19

Overview of the DL-NCD

The DL-NCD is a Numerically-Controlled Door Light Cut-Out Machine equipped with AC servo control for all three axes of cutting, 'X' (Length of the door), 'Y' (width of the door), and 'Z' (Depth into the face of the door). The 'Z' axis servo control makes it simple to program for security locks where the face bore is machined to a precise depth and also allows the operator to reduce the plunge speed to minimize tearout in the bottom face when machining small diameter holes. When the DL-NCD is used as a drill, deburring on the bottom face may be required.



The DL-NCD is equipped with an automatic feed and width adjust system to automatically receive doors, position the door against the stop, clamp the door and start the machining sequence if the instructions have been downloaded.

The DL-NCD can process doors that vary in height from 6'-6" to 8'-0", 12" to 3'-6" in width and 1-3/4" in thickness. Minimum distance from edge of cutout to edge of door is 1-1/2" on both sides. The direct drive high frequency spindle motor for cutting the door is equipped with an automatic tool changer and access to eight (8) additional tool holders placed in a fixture along the fixed side of the machine. Programs can call for an automatic tool change to match the specified door cutting process.

RPM adjustment for wood, fiberglass or steel doors.

Individual door light patterns are created at the machine console, or remotely using a standard PC. The DL-NCD includes an industrial PC with a standard Ethernet connection for file transfer and library backup, as well as occasional internet support and updates from Kval.

With Purchase, the Customer may submit up to Eight(8) door specifications/cutout templates which will be pre-programmed prior to shipment. Kval suggests the customer submit their more difficult templates, such as ovals, for the Kval programmers to implement.

KvalCAM Architectural Door Software

KvalCAM, proprietary architectural door software, provides simple machinery programming and automated G-Code creation. KvalCAM allows customers to easily create template files for a wide variety of hardware (locks, closers, sweeps, hinges, etc.) by the shape, dimensions, and location of the hardware cuts. Understanding G-Code machine-logic is no longer needed to develop programs for new templates.



The unique feature of this powerful software is providing the capability to utilize one hardware template for each piece of hardware even if it requires an array of face and edge detailing mortises. KvalCAM integrates multiple machines and tools into a singular functioning unit with each machine communicating in unison pulling information from the same door file.

For example, a mortise lock that has five different size face holes (on both faces of the door), an edge face plate, a mortise pocket, and an extended electrical wire pocket can be grouped as one hardware template utilizing multiple machines and tools in-line.

Once hardware templates are created, the customer defines specific doors with all hardware and location to be machined. This can be done with the KvalCAM software off-line, through a customer's database, or by the operator at the machine. When the door is loaded, KvalCAM checks the tools and machines available, and automatically generates the G-Code and optimizes the machining sequence for the entire process.

Furthermore, KvalCAM offers increased supportability and troubleshooting capabilities. Newly developed error codes and code definitions quickly identify any problems to the operator or Kval tech.

For more information regarding the full functionality and benefits of KvalCAM, please refer to your Kval Sales Engineer.

All DL-NCD installations require that the integrated PC computer has access to broadband internet for real-time diagnostics and program updates. On-board diagnostic programs allow the user to determine the source of operating errors and failures, even after they have occurred.

A tool holder stand and torque wrench are included so tool changes may be done quickly and accurately.

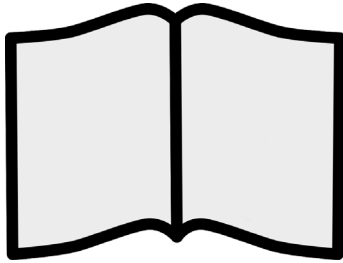
STANDARD ORIENTATION: Standing at the fixed fence, the DL-NCD feeds from left to right. Entry doors are oriented sill end leading, with the lock side against the fixed fence. Doors are usually aligned so the lock side of the door is against the fixed fence to ensure the lock bore backset is accurate.

About this Manual

This manual is part of a package delivered with the machine line.

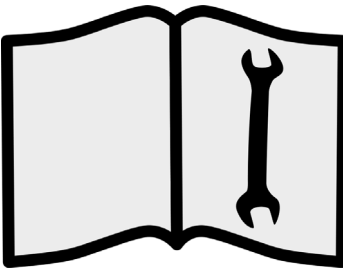
Integration Package includes the following:

Operation Manual includes the following:



Chapter	Title	Description
1	Introduction	Descriptions of Machine Line and Safety Information.
2	About KvalCAM	Descriptions of the KvalCam user interface.
3	Operation Interface	Descriptions of how to power machine line, and operator interface user screens.
4	Calibration	Descriptions of Calibration Routines and how to use the interfaces
5	Tour of DL-NCD	Identification and descriptions of the DL-NCD machine assemblies.

Service Manual includes the following



Chapter	Title	Description
1	Introduction	Safety Information.
2	System IT Administration	Descriptions of the PLC system, and computer system.
3	Maintenance	Maintenance steps for the machine line
4	Trouble Shooting	Troubleshooting tips and theory of operation.

Safety Sheet Sign-Off Sheet

At the end of this chapter, there is a safety sign-off sheet. It lists personnel and machine safety criteria to understand before operating the machine. It is highly recommended that personnel operating, working on a machine meet the criteria listed in this sheet. It is recommended the sheet be signed and kept for records. See “Safety Sign-Off Sheet” on page 1-19.

Safety First!



This machine is a powerful electro-mechanical motion control system. You should test your motion system for safety under all potential conditions. **Failure to do so can result in damage to equipment and/or serious injury to personnel.**

Safety Sheet Sign-Off Sheet

At the end of this chapter, there is a safety sign-off sheet. It lists personnel and machine safety criteria to understand before operating the machine. It is highly recommended that personnel operating, working on a machine meet the criteria listed in this sheet. It is recommended the sheet be signed and kept for records. See “Safety Sign-Off Sheet” on page 1-19.

Safety Terminology of Labels

In addition to the nameplate, KVAL machines may have other warning labels or decals that provide safety information to operators. Safety labels should be clearly visible to the operator and must be replaced if missing, damaged, or illegible.

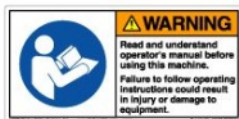
There are three types of warning labels or decals:

- **DANGER** means if the danger is not avoided, it will cause death or serious injury.
- **WARNING** means if the warning is not heeded, it can cause death or serious injury.
- **CAUTION** means if the precaution is not taken, it may cause minor or moderate injury.

Safety Guidelines

In addition to the caution and warning labels affixed to this machine, follow the guidelines below to help ensure the safety of equipment and personnel.

Training



Ensure that all employees who operate this machine are aware of and adhere to all safety precautions posted on the machine and are trained to operate this machine in a safe manner.

Protective Gear



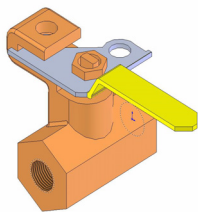
Never operate the machine without proper eye and ear protection.

When the Machine is ON



- **Never** reach hands beyond safety cage. Servo motors can unexpectedly move quickly.
- **Never** clear screws or hinges out of the machine while it is running.
- **Never** reach into the router area to retrieve a hinge. The router may still be running down after shut down.
- **Never** perform any maintenance unless machine is at zero state.
- **Never** clean the machine while it is running.
- **Never** walk away from the machine while it is running.

Compressed Air



The compressed air system connected to this machine should have a three-way air valve for shut-off and pressure relief.

All cylinders on machine are under high pressure and can be very dangerous when activated. Before performing any maintenance or repairs on this machine turn off the main air disconnect. **Lockout and tagout this connection.**

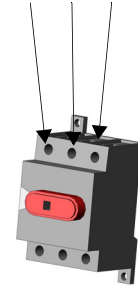
See “Lockout Tagout Procedure” on page 1-10.

Electrical



Electrical circuitry on this machine is protected by an approved lockable disconnect circuit. In addition to this equipment, you must install an approved disconnect for the electrical power supplying this machine.

Still has power in OFF position



When opening the cabinet you must first turn off the disconnect switch. When the cabinet door is open there is **still power on the top side of the disconnect switch**. Some machines are powered by more than one supply located at different locations. Before performing any repairs or maintenance, lockout and tagout **must be installed at all locations**

All maintenance and repairs to electrical circuitry should only be performed by a qualified electrician.

Before Conducting Maintenance



Prior to performing any maintenance, repairs, cleaning or when clearing jammed debris, you must disconnect, tag out, or lock out the electrical and air pressure systems. This should be done in accordance with applicable state and/or federal code requirements.

Laser Warnings

On some machines, laser indicators are used to set boundaries. Follow the manufacturers safety precautions.



Class 2

Lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing.

Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

Compliance with Codes and Regulations



KVAL advises that you request an on-site state safety review of your installation of this machine. This is to ensure conformance to any additional specific safety and health regulations which apply in your geographic area.

Other Hazard Control Action

Report a Hazard Before You Report an Accident



If you believe any part or operation of this machine is in violation of any health or safety regulation, **STOP** production. It is your responsibility to immediately protect your employees against any such hazard.

Additional detailed safety guidelines are included in the operating instructions of this manual. KVAL will be pleased to review with you any questions you may have regarding the safe operation of this machine

Follow Your Company's Safety Procedures



In addition to these safety guidelines. Your company should have on-site and machine specific safety procedures to follow.

Lockout-Tagout Guidelines

- Place a tag on all padlocks. On the tag, each operator must put their own name and date. **(These locks are only to be removed by the person who signs the tag)**
- If more than one person is working on the machine, each additional person places a lock and tag on each disconnect.
- Only each operator may remove their own lock and tag.

Important: When many people are all working on the same machine you will need a multiple lockout device, such as the one shown here.



Follow the **P-R-O-P-E-R** lockout rule of thumb.

- P**..... Process shutdown
- R** Recognize energy type (electrical, pneumatic, mechanical, etc.)
- O**..... OFF! Shut off all power sources and isolating devices
- P**..... Place lock and tag
- E**..... ENERGY: Release stored energy to a zero-energy state
- R** Recheck controls and test to ensure they are in the “OFF” state

Lockout Tagout Procedure



This policy is required by OSHA regulation 1910.147 and Cal OSHA'S SB198 ruling of July 1991.

Use the following lockout procedure to secure this machine while it is powered down. During a lockout, you disconnect all power and shut off the air supply. Be sure to use the tagout guidelines noted below.

Pre-Steps Before Lockout Tagout

Inspect



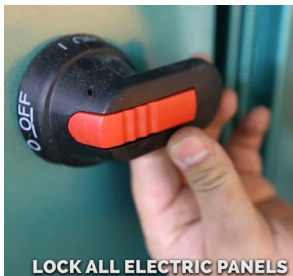
1. Evaluate the equipment to fully understand all energy sources (multiple electrical supplies, air supply and pressure, spring tension, weight shifts, etc.).
2. Inform all affected personnel of the eminent shutdown, and the duration of the shutdown.
3. Obtain locks, keys, and tags from your employer's lockout center.

Lockout Tagout Power

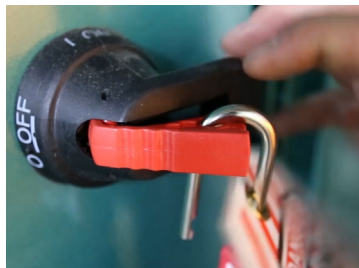
Power



4. Turn off machine. See Chapter 2 for power down and power up procedures.
5. Turn the disconnect switches on **ALL** electrical and frequency panels to the OFF position. Then push the red tab to pop it out. Place a padlock through the hole. Place your tag on the padlock, as per the tagout guidelines below. (see illustration below).



Turn Switch to the OFF position



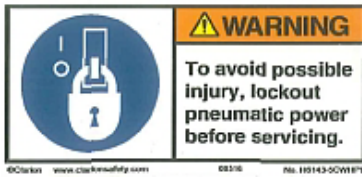
Insert Lock into hole.



Lock and Tag out

Note: When multiple people are working on the machine, each person needs to have a lock on the handle in the extra holes provided.

Lockout Tagout Air Supply



6. Turn all air valves to the OFF position and place a padlock through the hole (see illustration below).
NOTE: Place your tag on the padlock, as per the tagout guidelines.



Start Maintenance

7. Once the locks and tags are in place and all personnel are clear, attempt to operate the machine to ensure equipment will not operate.
8. Maintenance or repairs may started.

Post Maintenance Steps

9. After maintenance is completed, the person performing the work must ensure all tools, spare parts, test equipment, etc., are completely removed and that all guards and safety devices are installed.
10. Before removing the locks and tags, the person who attached them shall inspect the equipment to ensure that the machine will not be put in an unsafe condition when re-energized.
11. The lock and tag can now be removed (only by the person(s) who placed them), and the machine can be re-energized.
12. The tags must be destroyed and the locks and keys returned to the lockout center.



Zero-Energy to Start-Up

Starting the equipment properly is just as important as the lockout/tagout guidelines in terms of safety.

Start-up Guidelines

The following guidelines below should be followed to start the equipment.

Inspect

The equipment must be inspected for proper adjustment before starting equipment.

Clean Up

All materials and debris must be cleaned up. Any combustible materials or old parts used during repairs must be cleaned up and/or properly disposed of.

Replace Guards

Replace all equipment guards. If part of equipment cannot be properly adjusted after start-up with guard on, contact the KVAL Service team. See “Getting Help from KVAL” on page 1-14.

Check Controls

Confirm that all switches are in the “OFF” position. Please be advised that some components of the machine may start automatically when energy is restored.

Remove Locks

Each operator must remove his or her own lock and tag. This will ensure that all operators are in a safe place when the equipment is started.

Perform Visual Checks

If the equipment is too large to see all around it, station personnel around the area and sound the personnel alarm before starting the equipment. If your operation is more complex, your company’s comprehensive safety procedure may involve additional steps. You will need to ask your supervisor about these procedures. The company’s lockout procedure should be posted at each machine. On larger or long-term maintenance or installation projects, the company’s procedures must be explained to all new operators and a copy of the company’s procedures should be posted on-site for the duration of the work.

The Company’s procedures should also include provisions for safely handling shift changes and changes in operators or new operators. Comprehensive lockout/tagout may use a gang box or other system to ensure that locks are secure and not removed without authorization.

Remember, lockout/tagout procedures work because you are the only one with the key to your lock. Proper lockout/tagout can save lives, limbs, and money. Help make your work environment safe for you and your fellow workers. Be sure to follow the P-R-O-P-E-R lockout/tagout procedures, and that those around you do also.

Close the Cage Gate

Verify all cage gates are securely closed. Ensure all safety protocols are in effect.



Getting Help from KVAL

Before you seek help, first try the troubleshooting procedures. Follow the procedures below.

If you are unable to resolve the problem:

1. Locate the machine's Specification Plate and record the serial number, 3 phase volts, electrical print number, and air print number.



Air Driven Machines

2. Contact our customer support team:

- In the U.S and Canada, call (800) 553-5825 or fax (707) 762-0485
- Outside the U.S. and Canada, call (707) 762-7367 or fax (707) 762-0485
- Email address is service@kvalinc.com
- Hours:

6:00 AM to 4:00 PM Pacific Standard Time, Monday through Thursday

6:30 AM to 1:30 PM Pacific Standard Time, Friday

On-Line Help

On machines with a Beckhoff® PLC and an internet connection, our service team are able to connect, run, and troubleshoot your machine.

Product Return Procedure

If you've contacted Kval for help and it is determined that a return is necessary, use the procedure below to return the machine or part.

Note: Non-Warranty returns are subject to a 15% restocking charge.

1. Obtain the packing slip and/or invoice numbers of the defective unit, and secure a purchase order number to cover repair costs in the event the unit is determined to be out of warranty.
2. Reason for return: Before you return the unit, have someone from your organization with a technical understanding of the machine and its application include answers to the following questions:
 - What is the extent of the failure/reason for return? What are the relevant error messages or error codes?
 - How long did it operate?
 - Did any other items fail at the same time?
 - What was happening when the unit failed (e.g., installing the unit, cycling power, starting other equipment, etc.)?
 - How was the product configured (in detail)?
 - Which, if any, cables were modified and how?
 - With what equipment is the unit interfaced?
 - What was the application?
 - What was the system environment (temperature, spacing, contaminants, etc.)?
3. Call Kval customer support for a Return Material Authorization (RMA). When you call:
 - Have the packing slip or invoice numbers available.
 - Have the documented reason for return available.
4. Send the merchandise back to Kval.
 - Make sure the item(s) you are returning are securely packaged and well protected from shipping damage
 - Include the packing slip or invoice numbers.
 - Include the documented reason for return.
 - Include the RMA number with the parts package.

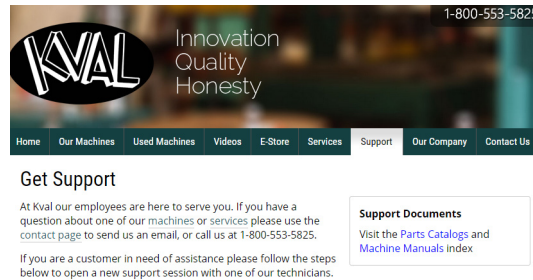


How to Download the Service Application

On machines with Windows (8.1 / 8 / 7 / Vista / XP) and an internet connection, our service team are able to connect, run, and troubleshoot your machine by way of the operator station.

Download Application

1. To download the application, go to the KVAL website (<http://www.kvalinc.com>)
2. At the KVAL website, select the **Support** tab. Follow the instructions on the Support web page.



3. Click the Download button to download the application that allows the KVAL technician to have access to the operator station.

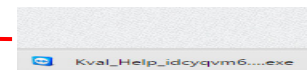
1 Download the support app
To initiate a support session first download our support app and save it to an easily accessible area on your hard drive (like your Desktop).
[Download](#)

4. After the download is completed, double-click the program icon.

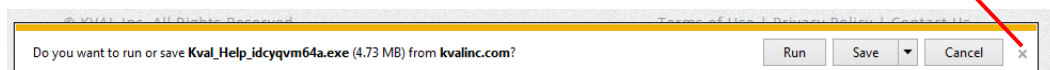
2 Open the app
Double-click on the **Kval_Help_idcyqvm64a.exe** you just downloaded to open the Kval support app.

Note: Web browsers have different methods of downloading programs. Below are samples of i.e Explorer and Google web browsers.

Sample of Google Browser: Located at the bottom left of the screen.

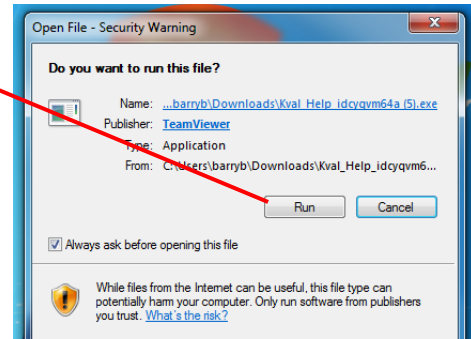


Sample of i.e Explorer: Located at the bottom of the screen. select the **arrow** and choose **Save and Run**



- A pop-up window is displayed.
Accept the request to run the program.

Note: Security settings may differ from plant to plant. If issues occur, contact your IT department.



- The interface of the **KVAL Support App** will be displayed. Enter your name in the **Your Name** field. The fields are described below:

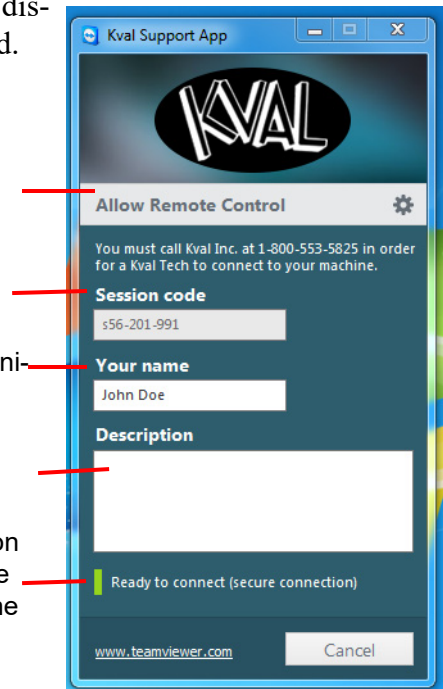
Allow Remote Control: Program is ready to allow technicians to access machine computer

Session code: An internal number to track this machine. It is auto filled.

Your Name Field: Enter your name. The KVAL technician will use this field to identify this machine.

Description: Enter machine Serial number and issue.

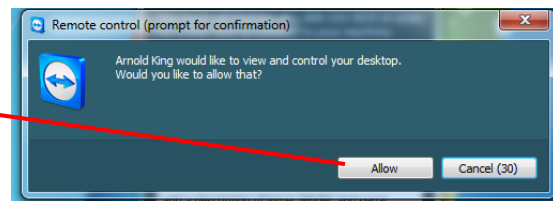
Indicator: Green indicates there is a good connection to the service center. If red, there could be an issue with a LAN connection. Check the connections in the plant.



- After the **KVAL Support App** is loaded and completed, call the KVAL service center(1-800-553-5825) and have the technician connect to the machine computer.

3 Give us a call
Dial 1-800-553-5825 and let us know you're ready and we'll take care of the rest!

- Click the **Allow** button to give the KVAL service technician permission to access the operator station.
We are now ready to troubleshoot.





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Safety Sign-Off Sheet

Machine Model Number: _____

A Note to the Operator:

This machine can help you be highly productive only if you understand how to use it properly and follow the safe operating practices described in this document and the machine’s manual. If you do not understand the machine’s proper operation or ignore the safe operating practices, this machine can hurt or kill you. It’s in your best interest to safely and properly operate this machine.

Personnel Safety Concerns:

- I have been properly trained in the operation of this machine.
- I will always wear ear protection when operating this machine.
- I will always wear eye protection when operating this machine.
- I will never wear loose clothing or gloves when operating this machine.
- I will watch out for other people. Make sure everyone is clear of this machine before operation.
- I will always follow my company’s safety procedures. I have read and understand these guidelines.

Machine Safety Concerns:

- I have been given a tour of the machine and understand all the safety labels, E-Stops and the actions to take in case of an emergency.
- I will make sure all guards are in place before operation
- I will turn off the compressed air, before loading hardware (staples, screws, etc)
- I will turn off the electrical power, for setup
- If the machine should operate in an unexpected manner stop production I will immediately and notify a manager, a supervisor, or a qualified service technician.

I have read and understand this document and agree to operate this machine in a safe manner as described above.

Employee

Name (print): _____ Signature: _____ Date: ___ / ___ / ___

Supervisor/Safety Officer/Trainer

Name (print): _____ Signature: _____ Date: ___ / ___ / ___

Note: It is recommended you make a copy of this sheet for new operators. If a copy is needed, you may download a PDF at the KVAL website (<http://www.kvalinc.com>). You may also contact our Service Department at (800) 553-5825 or email at service@kvalinc.com.

CH-1
Intro/Safety





CHAPTER 2 System IT Administration

This chapter describes the machine controllers. The controllers are on board computers that supply the user interface and control the operation of the machine.

Note: With the controller, KVAL can remotely help troubleshoot your machine.

Chapter 2 at a Glance

Section Name	Summary	Page
System IT Administration	This section describes the basic parts of the operation of the PLC in the machine. Such as: <ul style="list-style-type: none">• About the PLC• Connections on the PLC• Backing up the Computer• About Remote Connection to KVAL Service	page 2-2

System IT Administration

For optimum support, the machines require internet access. With internet access, KVAL Service Support will be able to access your machine through your company's Intranet and help solve any issues that may occur. Connection to the Intranet is achieved by interfacing with the machine's controller. The location of the Intranet connection is identified in the figure below (RJ45 to Intranet.)

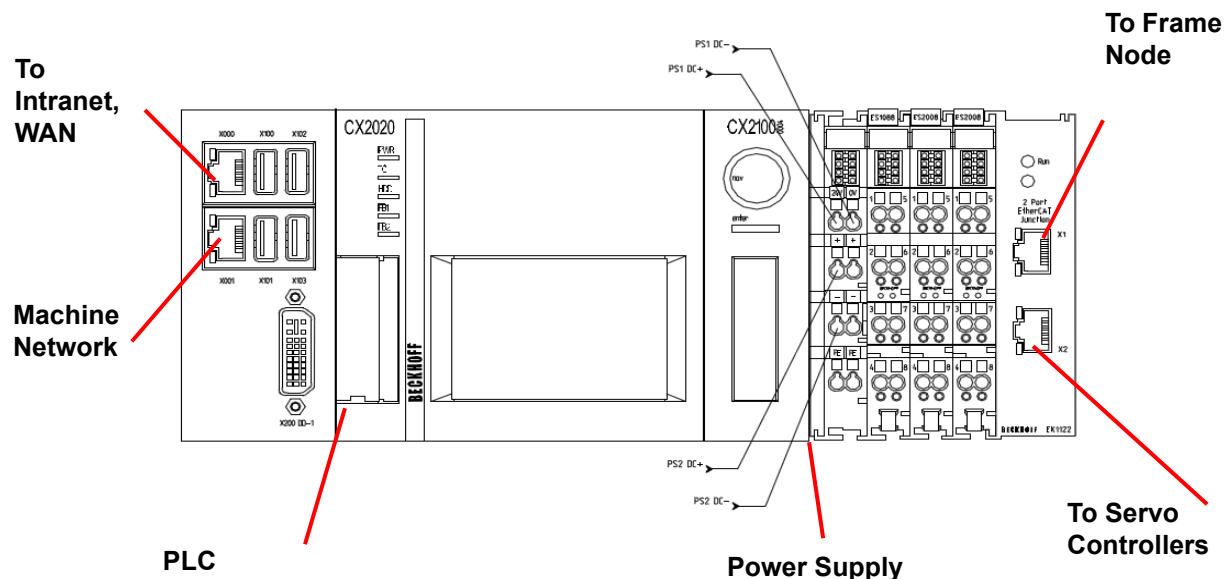
About the Machine Line Computer

The Machine Line uses a Beckhoff[®] CPU module as a PLC (Programmable Logic Controller.) In addition to the CPU and the chipset, the module also contains internal main memory. The computer has a removable Compact Flash card from which it boots. Each controller utilize a Windows[®] based operating system with TwinCAT 2[®] automation software to create the PLC and Motion Control method.

Interface modules include:

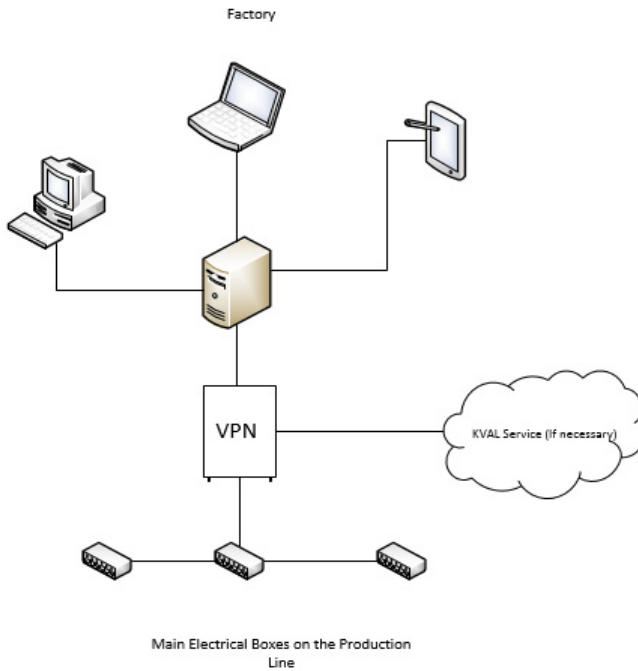
- A smart power supply to connect to EtherCat[®] terminals. This supply contains a LCD to display system and user messages.
- A DVI/USB module to connect to the user interface.
- An Ethernet module to connect to the servo amplifiers.

Connections on the PLC



Network Diagram

The desired network topology is illustrated below





About Backing up Data and Checking the Revision Status

Right Click the KVAL Icon at the bottom of the screen to display this popup.

Note: Select icon from the windows screen and drag to the favorites bar for access to this icon.

Exit: Select to close the running KvalCAM program.

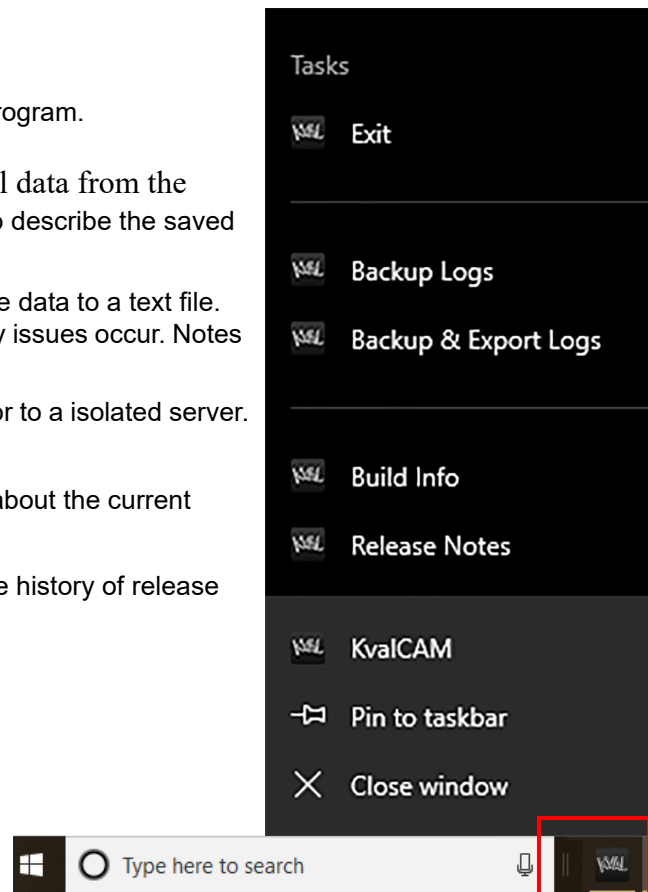
Backup Logs: Select to save the to save all data from the machine operation. Notes may be added to describe the saved file.

Backup and Export: Select to send machine data to a text file. The file may be sent to Service Support if any issues occur. Notes may be added to describe the saved file.

Note: Kval recommends backing up locally or to a isolated server.

Build Info Select to view upper level notes about the current build.

Release Notes: Select to open a PDF of the history of release notes on this version o software.



About Remote Connection to KVAL Service

Remote access is a powerful tool to help fix issues that occur with the Machine Line machine. With the remote access, our KVAL service technician is able to observe your user screen in real time, read, and adjust programming code. For access, the Intranet connection on the machine controller must have outside access to the Internet.





CHAPTER 3 Maintenance of the DL-NCD

This chapter describes preventative maintenance steps for **KVAL DL-NCD**. The content is geared to guide technicians to keep a regular maintenance schedule for your KVAL machine. Keeping your KVAL machine maintained is an important piece for successful operation of your door production process.

Chapter 3 at a Glance

Section	Description	Page
Maintenance Schedule	This section describes the assemblies to schedule for maintenance.	page 3-2
Lubrication Requirements	This section describes the lubrication requirements for the machine, including types of lube to use. This section includes: <ul style="list-style-type: none">• Linear Bearings, Flange Bearing, and Pillow Blocks• Gear Motor Lubrication Requirements• Ball Screws• Description of Air Input System• Adjusting the Air Line Lubricator• Priming the Air Line Lubricator	page 3-14
Replacing the X-Axis Self Lubricator	This section describes the steps to replace the Self Lubricator	page 3-31
Lubrication Points	This section identifies lubrication points on the machine	page 3-20



Maintenance Schedule

KVAL recommends the following maintenance schedule to ensure that the machine operates properly. Cycles refers to the quantity of processed doors. Cleaning curtains build up of sawdust and grime which causes issues with the operation of the machine. Inspecting, finds issues before they become problems. Lubricating decreases wear and keeps this machine running smoothly. Refer to sections following these tables for further description of the maintenance steps.

Note: The steps in the tables below are designed to perform maintenance on a production line. Some of the steps may not pertain to all machines.



Prior to performing any maintenance, repairs, cleaning or when clearing jammed debris, you must disconnect, tagout, or lockout the electrical and air pressure systems. This should be done in accordance with applicable state and/or federal code requirements



To view a video of the maintenance process, visit the KVAL website. Select the Video Tab to view videos.



<http://www.kvalinc.com/>

300 Cycles	
Clean	Use pressured air to blow off dust and debris on entire machine
Clean	Blow out dust collection cans

600 Cycles	
Inspect	Air Pressure Gages. Adjust, if necessary, to the proper PSI located on the label. (Adjust only if Trained in Maintenance)
Inspect	Inspect Air Filter Water Traps. Empty if necessary
Inspect	Inspect the Tooling for wear, (Drill Bits, Cutting Tools, Screw Driver Bits)
Clean	Empty All Dust Collection Units
Clean	Check and Clean Filter on Lift Vacuum System

3,000 Cycles

Inspect	Inspect feed belts for proper tension or damage.
Inspect	Inspect screw drop tubes for kinks, cracks or wear from rubbing. Ensure tube clamps are tight.
Inspect	Inspect all photo eyes secure and tight.
Inspect	Inspect all limit switch arms for tightness or breaks
Inspect	Inspect all airlines for kinks or rubbing.
Lubricate	Refill all lubricators. Replace fluid if milky or discolored. Use ab ISO 32 standard hydraulic oil (KVAL PN:SYS-LUBEG).
Lubricate	Grease Ball Nut bearings (if applicable).
Clean	Clean all bearing shafts with clean, dry cloth.

12,000 Cycles

Inspect	Inspect chains for proper tension or damage
Inspect	Inspect all air cylinders for air leaks. Replace if seal is leaking
Inspect	Inspect hydraulic lines for loose fittings, leaks and cracks.
Inspect	Inspect ball rail shafts for pitting or abrasions.
Lubricate	Clean and lubricate all slides and cylinder rods with dry silicone spray
Lubricate	Lubricate all bearing shafts with silicone and clean rag.

72,000 Cycles

Inspect	Inspect all nuts and bolts for tightnesses Tighten is necessary.
Inspect	Check that there is a smooth transition with a door feeding into and out of machine.
Back-up	Backup computer software.
Clean	Wash filter and lubricator bowls with soapy water.

300 Cycle Maintenance Steps

Follow Lockout Tagout procedures.

Clean, Clean, Clean!

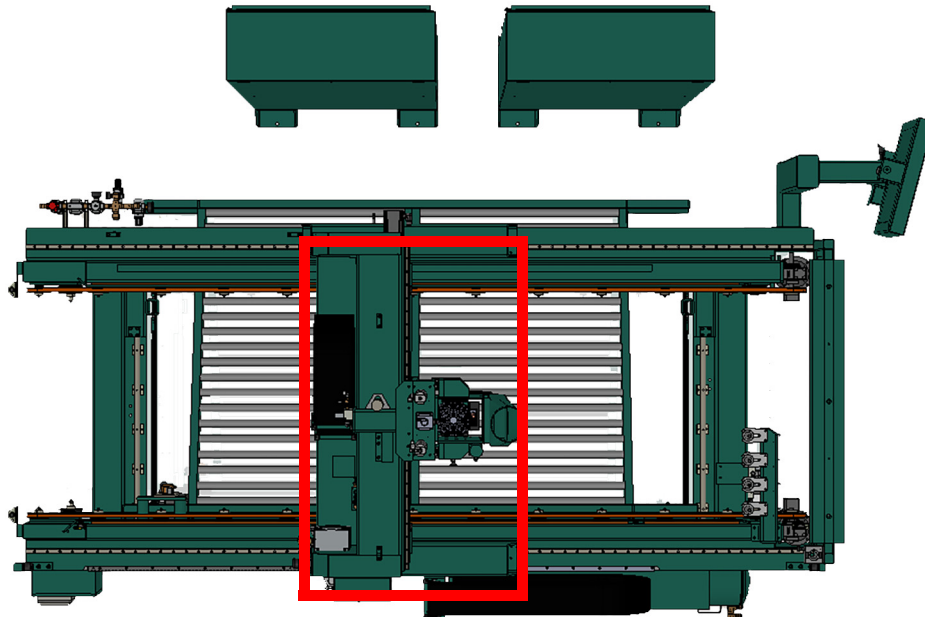
Sawdust and grime build-up can cause issues with the operation of the machine.

Use pressured air to blow off dust and debris on entire machine. Use a clean rag to clean areas not affected by pressurized air.

Also blow out any dust collection units.

Check vertical bearings for loose screws. **Loose screws could cause bearing damage.**

High Dust Accumulation Areas



600 Cycle Maintenance Steps

Follow Lockout Tagout procedures.

Check Air Gauges and Inspect Water Traps

Air Pressure Gages. Adjust, if necessary, to the proper PSI located on the label. **(Adjust only if Trained in Maintenance)**

Inspect Air Filter Water Traps.
Empty trap if necessary

Slide locking switch down to unlock twist trap to remove.

Reverse action when installing trap.

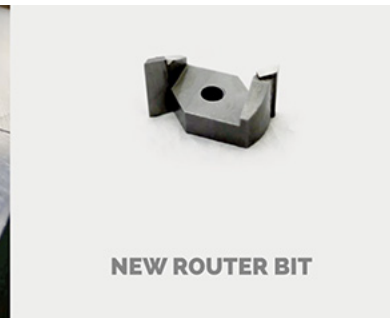


Maintenance
CH-3

Inspect Tooling

Inspect the Tooling for wear,
(Drill Bits, Cutting Tools)

See “Changing a Tool Bit and Using Tool-Change Tightening Fixture” on page 3-28 .



Empty Dust Collection Units

Check and empty any dust collection units. Clean any dust filters. Dust collection systems vary from machine to machine. Follow manufacturers directions to empty dust collection units.

Filters

Dust Collection
Containers

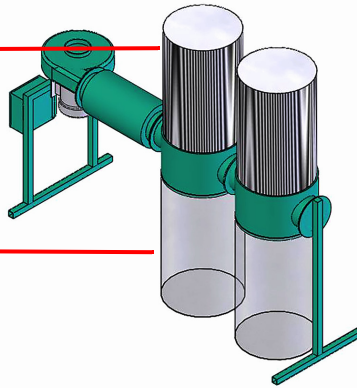


FIGURE 3-2. Typical Dust Collection Unit

3,000 Cycle Maintenance Steps

Follow Lockout Tagout procedures.

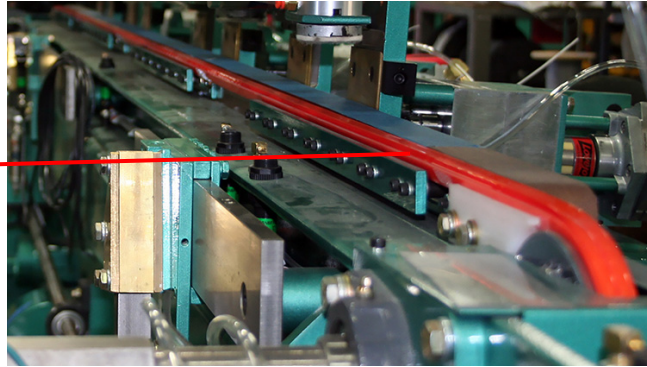
Inspect Feed Belts

Inspect feed belts for proper tension or damage.

Check belts for cuts and nicks.

Belts can stretch over time. Check for looseness. A rule of thumb is to pull belt, if belt moves too freely, then replace belt.

Belts can become slick from use, lessening traction on door. Check belts for slickness or door slippage.

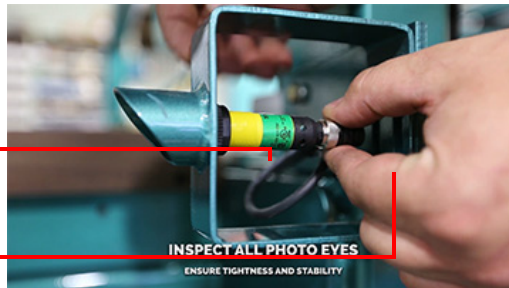


Inspect all Photo Eyes

Inspect all photo eyes secure and tight.

Check Nut that attaches Photo Eye to Machine

Check Connection to Photo Eye

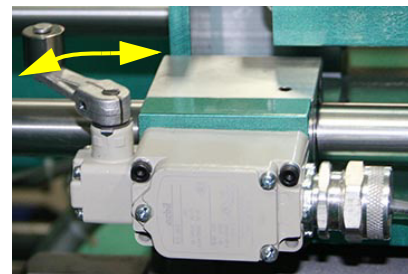


Inspect Limit Switches

Inspect all limit switch arms for tightness or breaks.

Inspect the switch for cracks in the body and check that the switch arm actuates (clicking sound) when moved to the extreme.

Note: Depending on the model of limit switch, the amount of "pre-travel" (amount of movement from the arms resting position) is either 5 or 20 degrees before the limit switch actuates.

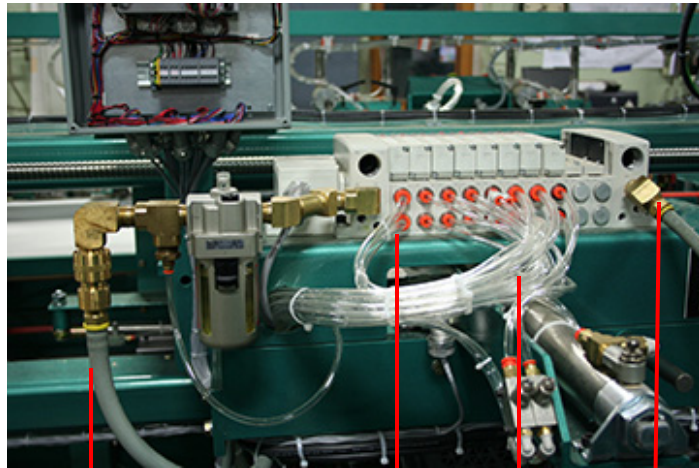


Inspect Airlines

Inspect all airlines for kinks, rubbing and leaks. Perform pull test on push on hose connectors.

Check all airline connections, assemblies, air valves, and hoses.

Check from source to end assembly.



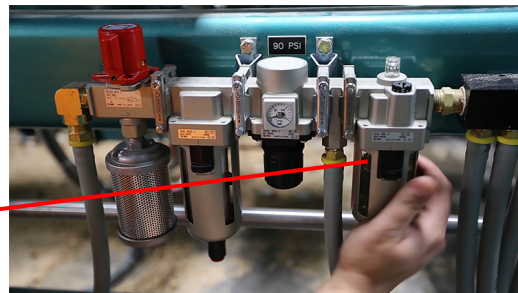
Check Hoses for kinks and rubbing, manifold connections and Air Cylinder connections.

Refill Lubricators

Ensure Air is turned off.

Refill all lubricators. Replace fluid if milky or discolored. Use ab ISO 32 standard hydraulic oil (KVAL PN: SYS-LUBEG).

Slide locking switch down twist bowl and remove.



Refill bowl. Reverse action when installing trap.



Grease Ball Screw Bearings

Grease ball screw bearings (if applicable). For a table of lubrication types to use, [Lubrication Schedule](#). For locations to lubricate, [See Grease Ball Screw Bearings](#)

Clean Bearing Shafts

Clean all bearing shafts with clean, dry cloth.

Spray shaft with silicone oil and clean build up grime and dirt.



12,000 Cycle Maintenance Steps

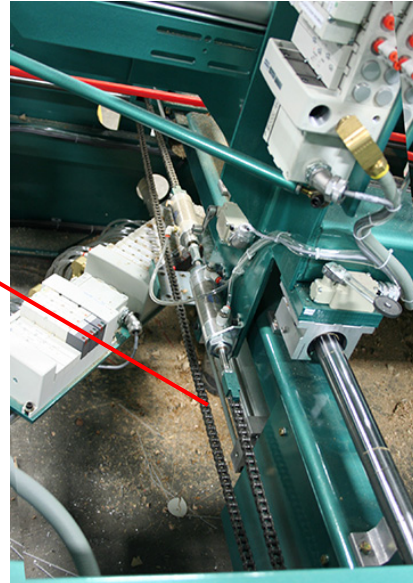
Follow Lockout Tagout procedures.

Inspect Chains for Proper Tension

Inspect chains for proper tension or damage.

Check for sagging chains. Chains can stretch over time of use.

Check for chain stiffness. Stiff chains do not provide a tight fit over the gears.



Inspect Air Cylinders

Inspect all air cylinders for air leaks. Replace the cylinder if seal is leaking. Symptoms include a cylinder not extracting or retracting to the limits. Cylinders not holding their position.

Inspect Ball Rail Shafts and Ball Screws

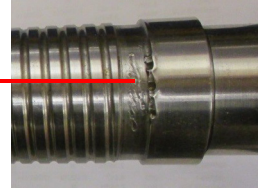
Inspect ball rail shafts for pitting or abrasions.

Example of a Pitted Ball Rail



Inspect ball screws for pitting or abrasions.

Example of a Pitted Ball Screw



Clean and Lubricate Slides, Cylinder Rods and Bearing Shafts

Clean and lubricate all slides and cylinder rods with dry silicone spray.

72,000 Cycle Maintenance Steps

Follow Lockout Tagout procedures,

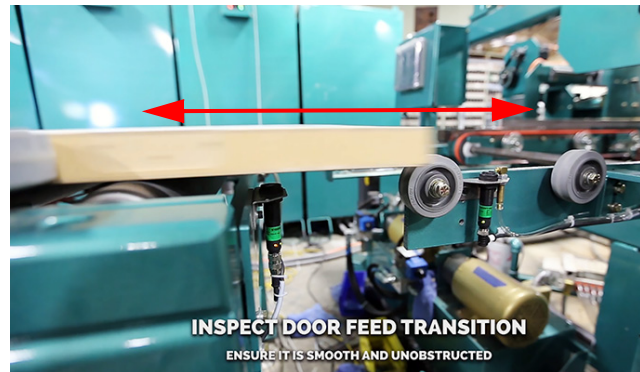
Inspect Nuts and Bolts

Inspect all nuts and bolts for tightness. Tighten if necessary. Use appropriate tool to verify that the hardware is tight.

Check Door Feeding Transition

Check that there is a smooth transition with a door feeding into and out of machine.

Feed door in and out to verify smooth transition is repeatable.



Electrical

Check all connections in each node box and electrical panel. Wires may become loose due to vibration. Check contactors for wear.

Wash Filter and Lubricator Bowls

Wash filter and lubricator bowls with soapy water.

- Slide lock down to unlock.
- Twist bowl to remove it.
- Remove filter from Air filter assembly. Inspect and clean or replace if necessary.
- Clean bowls and reassemble.



Maintenance NO-GOES

Do not perform the following. This machine is tuned and calibrated at the factory. If any of these conditions are changed, timing, accuracy, or **damage** may occur during the machine process.

- **Do not adjust air PSI above or below factory settings**
- **Do not adjust any and all flow controls from factory settings**
- **Do not remove shim stock**
- **Do not Change or Alter any safety assemblies (E-Stops, Gate Locks, etc)**
- **Do not Change programs in PLC's or PC's**
- **Do not Alter Electrical Components**

Lubrication Schedule

KVAL recommends the following lubrication schedule to ensure that the machine operates properly.

TABLE 3-1. Recommended Lubrication Schedule

Type of Assembly	Recommended Schedule	Recommended Lubrication Type
Linear Bearing	Every 250 Hours of Machine Operation	Dura-Lith Grease (KVAL P/N Lube EP-2)
Pillow Block Bearing		
Flange Block Bearing		
Ball Screw	Every 80 Hours of Machine Operation	
Idler Shafts (Pulley)	Monthly	
Tapered Bearing	One Pump 4 Times a Year	
Air Line Lubricator	One drop of oil every 2 or 3 cycles Check the lines every week to two weeks Note: Some CNC Machines drop every 5-10 cycles.	Either lubricant listed below is approved to use. <ul style="list-style-type: none"> • KVAL P/N SYSLUBG • Chevron AW Hydraulic Oil 32 • G-C lubricants light AW R&O • Mobile DTE 24 • Shell Tellus32 • Gulf Harmony 32

Typical Lucubration Kit

KVAL Part Number: LUBEKIT



Lubrication Requirements

This section describes the parts of the machine that require periodic lubrication, and specifies the lubricants. In addition, it explains how to maintain the lubrication systems on the machine.

If the bearing is equipped with a grease fitting (Zerk Fitting).

The Zerk fitting is basically a valve that opens under pressure to allow lubricant to pass through a channel and be forced into the voids of the bearing. When the pressure stops, the ball returns to its closed position. The ball excludes dirt and functions as a check valve to prevent grease escaping back out of the fitting.

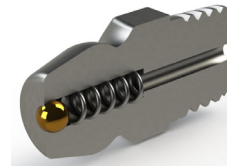
The ball is almost flush with the surface of the fitting so that it can be wiped clean to reduce the amount of debris carried with the grease into the bearing.

Note: Bearings without grease fittings have been pre-lubricated at the factory and do not require further lubrication.

Note: Clean excess grease to avoid contact with feed belts, clamping areas, or the door.



Zerk Fitting



Maintenance
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Pillow Block Bearing Housings

A pillow block is any mounted bearing where the mounted shaft is in a parallel plane to the mounting surface, and perpendicular to the center line of the mounting holes, as compared to different types of flange blocks or flange units. The type of rolling element defines the type of pillow block.

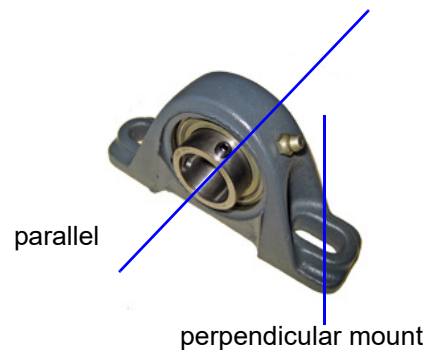
Opened Pillow Block



Closed Pillow Block



Hub Style



Greasing

Approximately 1 Gram (one pump from grease gun) of Dura-Lith Grease (KVAL P/N: Lube EP-2).
Every 250 hours of operation.

FIGURE 3-3. Pillow Block Bearings

Flange Bearing Housings

A flange bearing is designed to aid in mounting and positioning. The lip of the flange helps center and align the bearing.

Flanges are also used with bearings on external housings used to mount a bearing unit. A mounted bearing unit acts as a system to position the bearing securely for reliable operation.

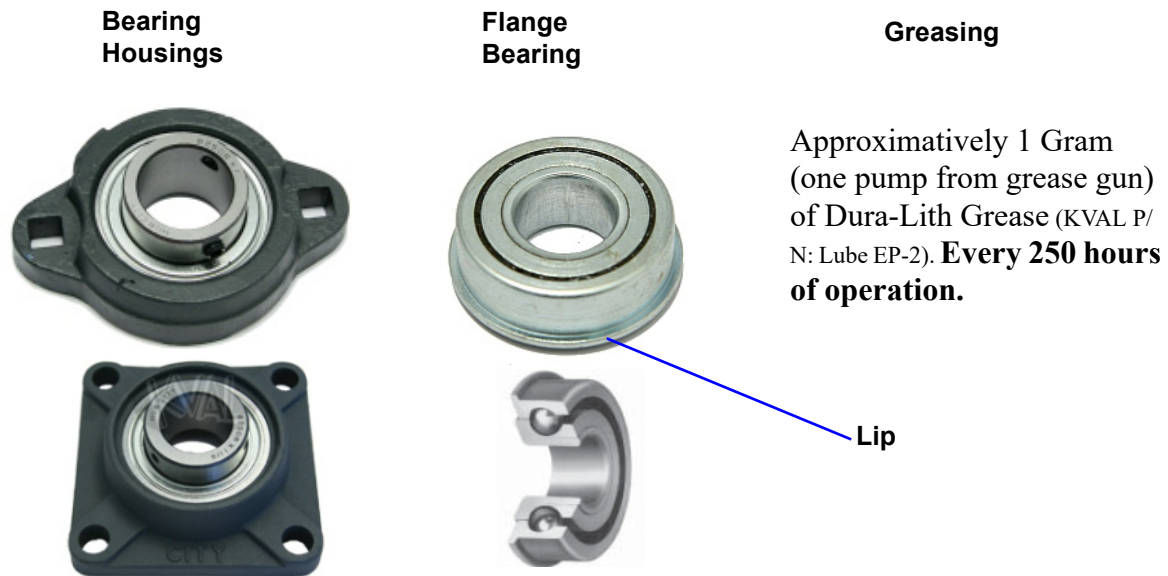


FIGURE 3-4. Flange Bearings

Ball Rail Bearing

Ball Rail Bearings are linear bearings that are attached to positioning rails. In most cases, the bearings are attached to assemblies to move them in the X, Y, or Z direction.

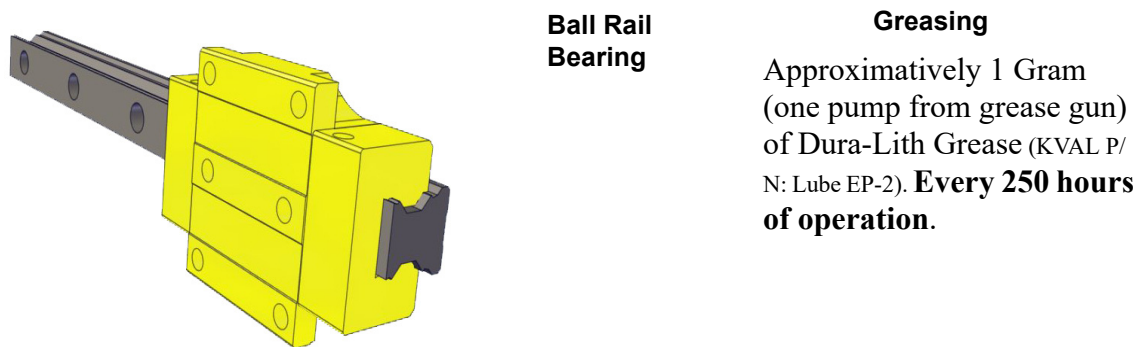


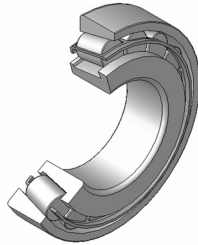
FIGURE 3-5. Ball Rail Bearings

About Taper Bearings

Taper bearings are used for moving the axes of heavy loads with stability. The tapered roller bearing in combination with lubricants is extremely durable and is used in applications involving rotating axle and transmission shafts.

Note: Bearing durability is such an asset that the bearing blocks often require no maintenance for the life of the machine.

Cross Section of Tapered Bearing



Greasing
Recommend One Pump a Year
Tapered Bearing

Maintenance
CH-3

FIGURE 3-6. Sample of Tapered Bearing

Tapered Bearing Housings

The taper bearings differ from other machine bearing assemblies, in that they are in a sealed environment. To identify a **Tapered Bearing Housing**, look at the enclosure and verify there are seals between the screw and the housing.

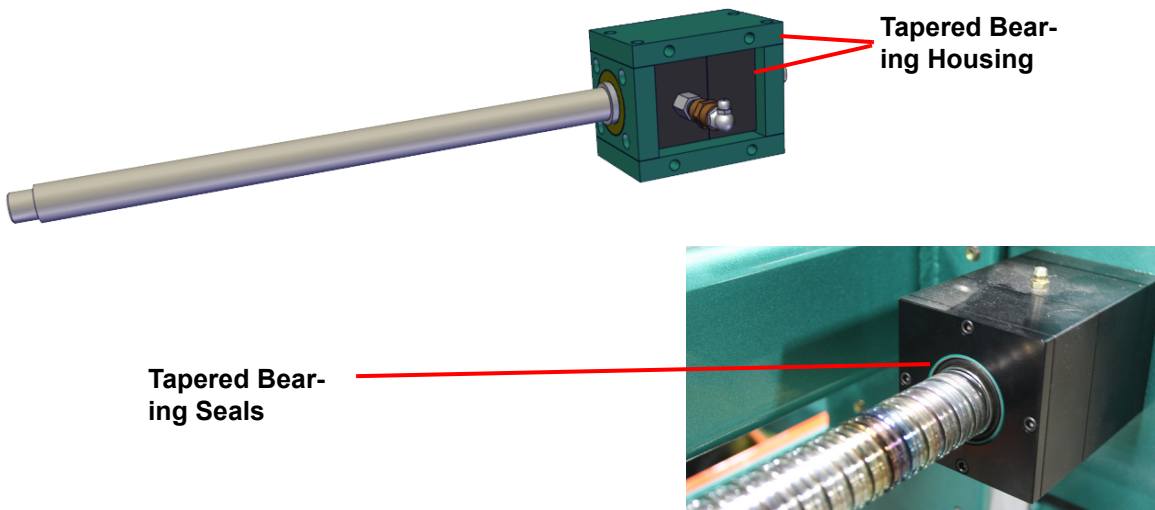


FIGURE 3-7. Tapered Bearing Housing

Ball Screw Nut

The **Ball Screw Nut** is an assembly with recirculating ball bearings that interfaces with the ball screw. The ball screw drive and the ball screw nut create very low friction coefficients resulting in a smooth, accurate, efficient movement.



FIGURE 3-8. Example of a Typical Ball Nut

Ball Screw Drive Assembly

Including the **Ball Screw Nut** other types of bearings may be included on the assembly. The figure below shows a typical **Ball Screw Drive Assembly**.

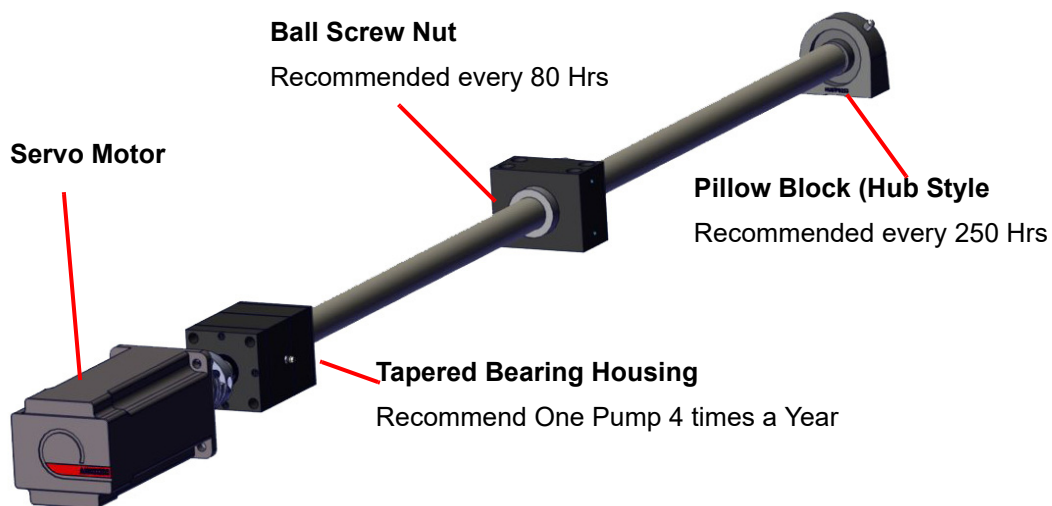
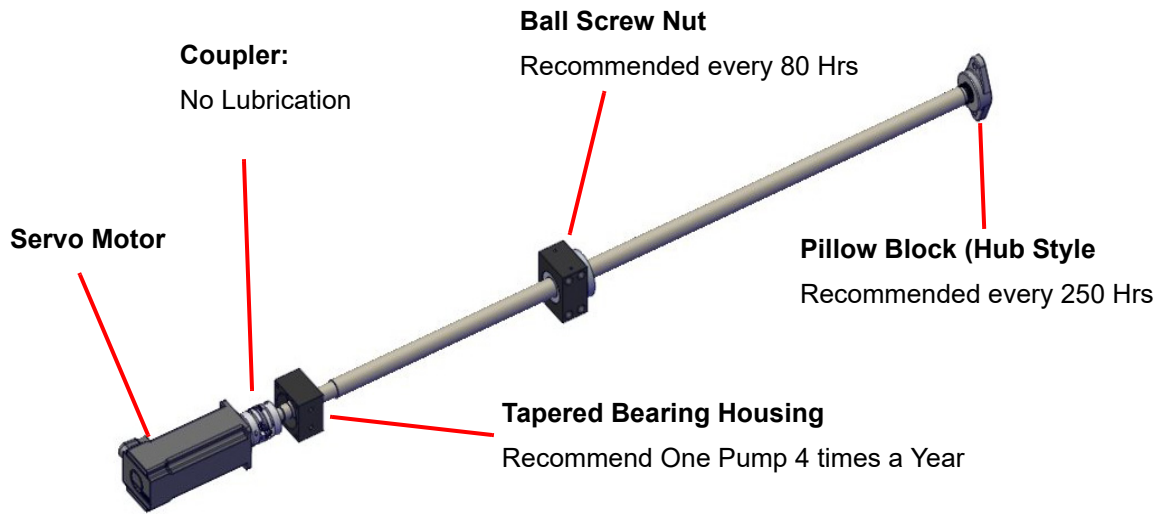


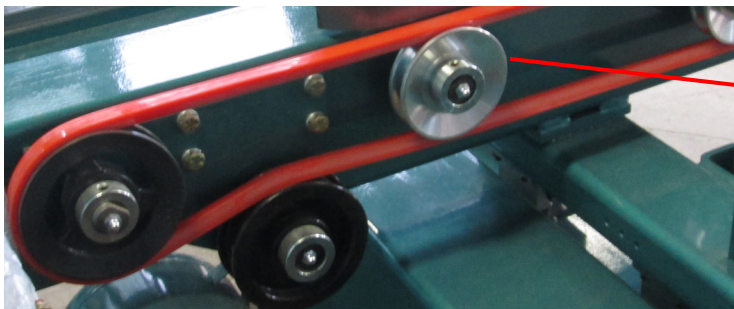
FIGURE 3-9. Ball Screw Drive Assembly



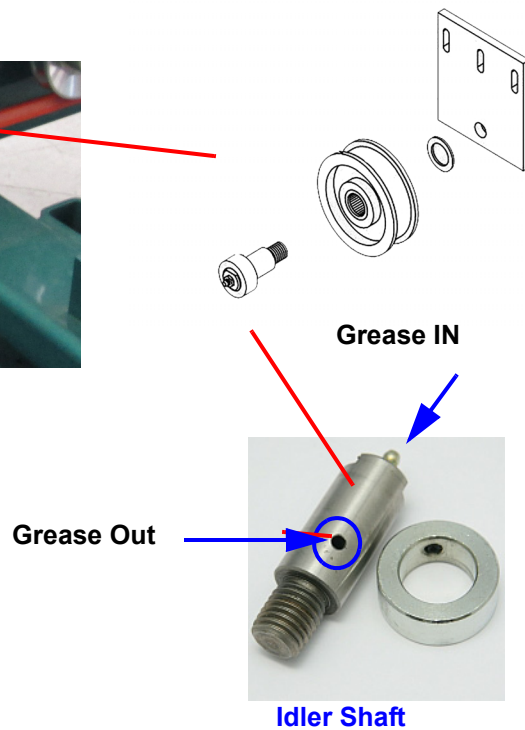
Pulley and Idler Shafts

Transport systems on the machine contain pulleys and a belt to transport the door in and out of the machine. Each pulley contains an idler shaft that has a zerk fitting to apply grease. An opening in the idler shaft dispenses grease to the inner diameter of the pulley.

Pulley in Action



Breakout of Pulley Assembly



Note: It is important not to overfill the Idler Shaft. Avoid getting excess grease on the belts

Approximately 1 Gram (one pump from grease gun) of Dura-Lith Grease (KVAL P/N: Lube EP-2). **Monthly**

Sample of Grease Locations for DL-NCD

Caution

This machine is a powerful electro-mechanical motion control system. If servicing this machine, follow the safety guidelines. Failure to do so can result in damage to equipment and/or serious injury to personnel.

Shutdown the machine and follow the “**Lock Out Tag Out**” procedures



Grease Locations DL-NCD Frame

Identify zerk fittings and apply EP-2 grease. Find the X, Y and Z axis rails to identify bearings. Some bearings may be difficult to get access to. Use an extender to reach tight areas. Make sure that **Lockout/Tagout** has been performed before maintenance. see “[Lubrication Schedule](#)” on page 3-14.

Note: Use an extension needle to access hard to reach bearings.

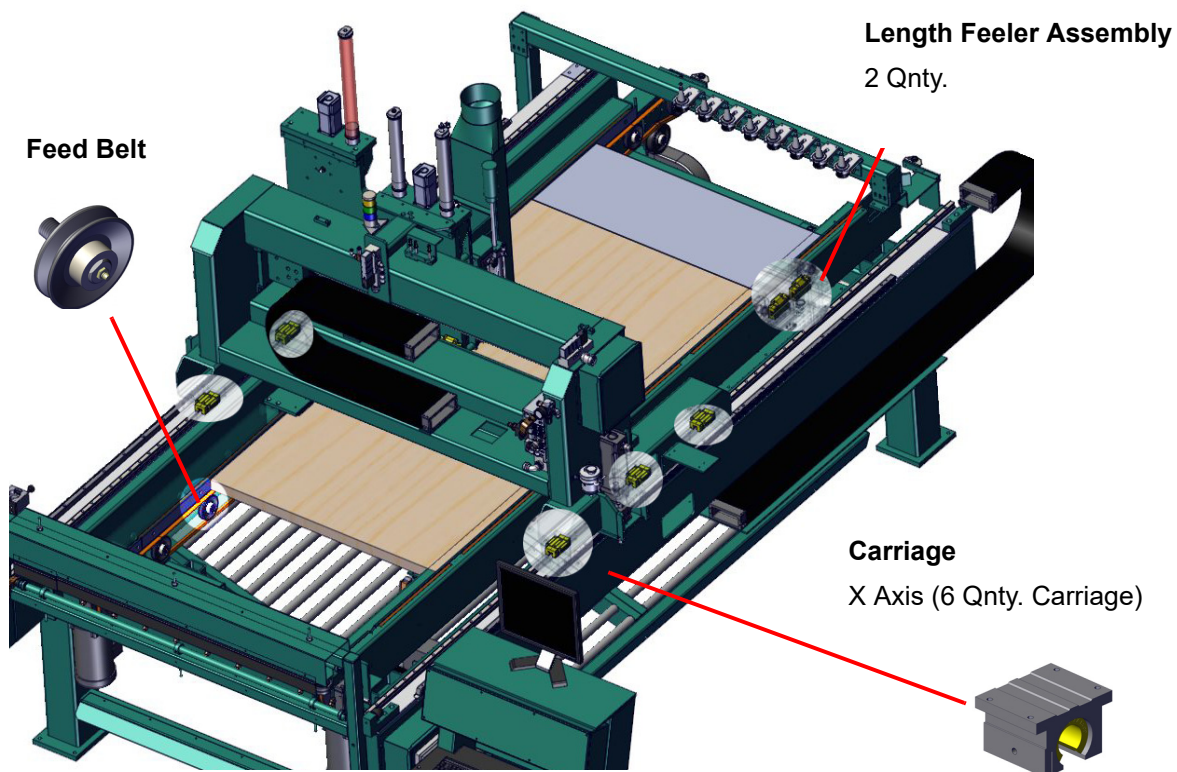
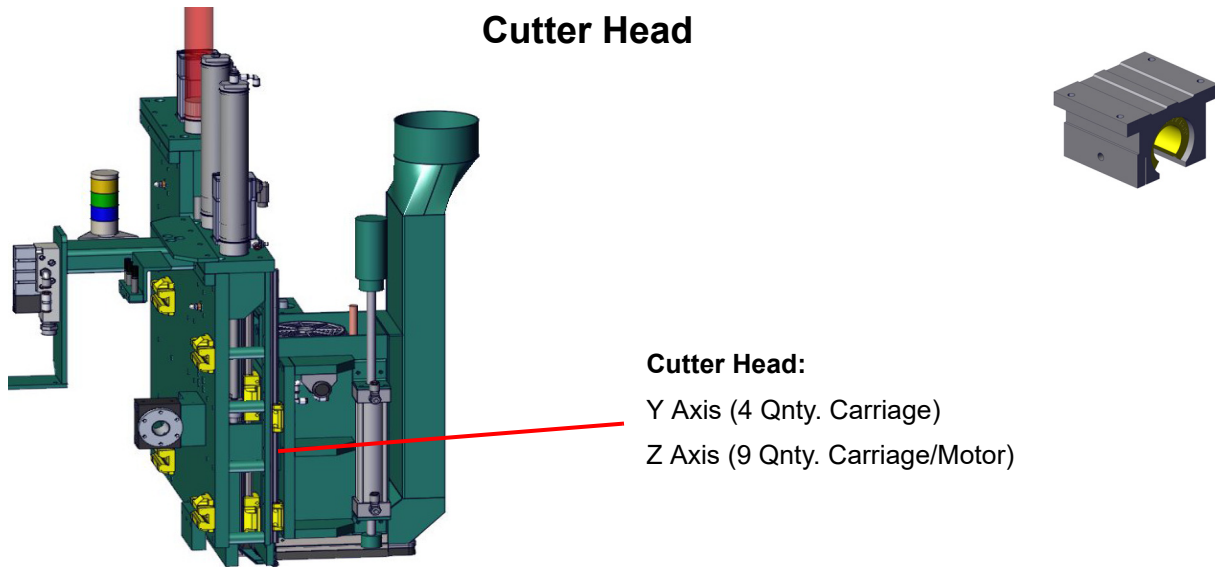


FIGURE 3-10. Frame Bearing and Pulley Locations

Grease Locations Cutter Head

Identify zerk fittings and apply EP-2 grease. Find the X, Y and Z axis rails to identify bearings. Some bearings may be difficult to get access to. Use an extender to reach tight areas. Make sure that **Lockout/Tagout** has been performed before maintenance. see “[Lubrication Schedule](#)” on page 3-14.

Note: Use an extension needle to access hard to reach bearings.



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FIGURE 3-11. Cutter Head Bearing Locations

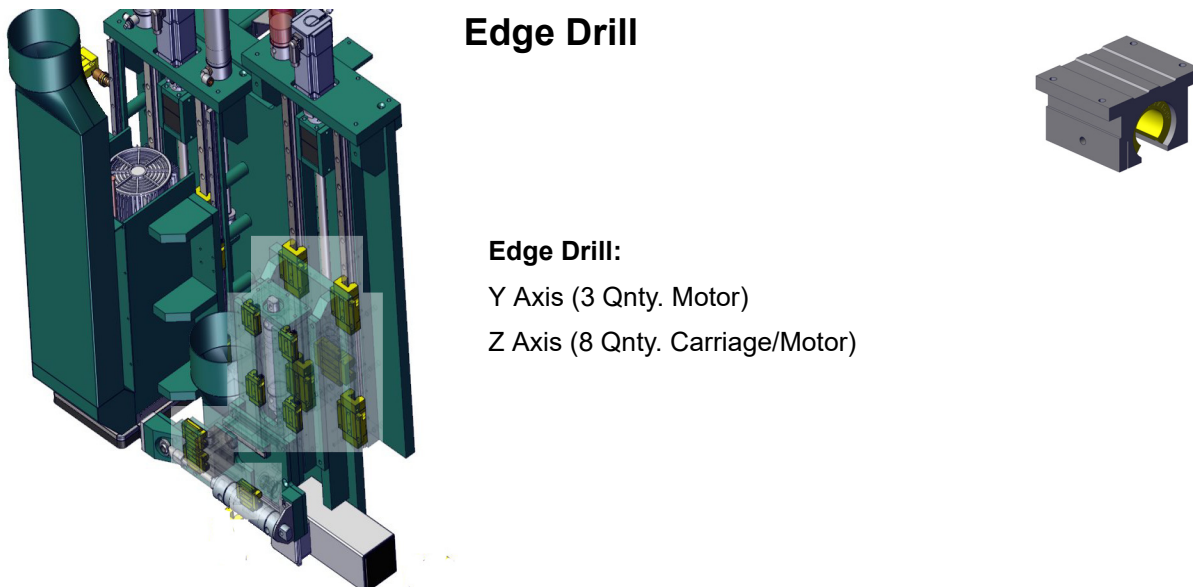
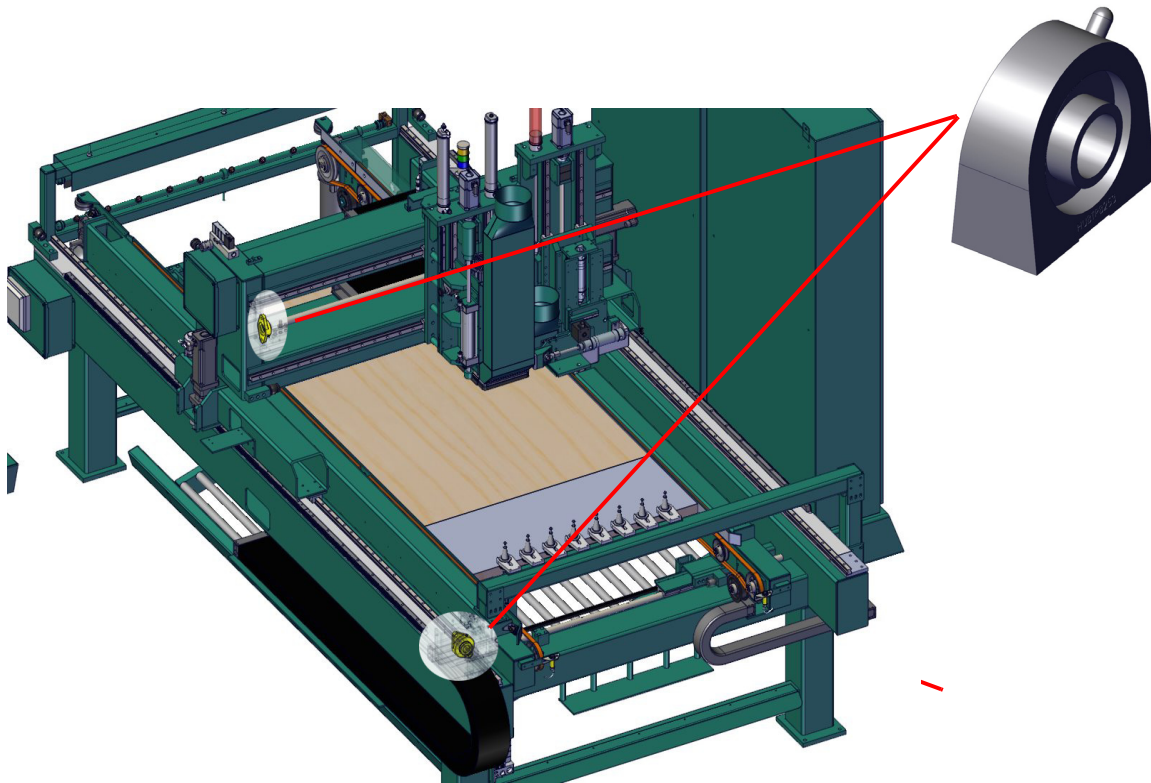


FIGURE 3-12. Edge Drill Bearing Locations

Grease Locations Axial

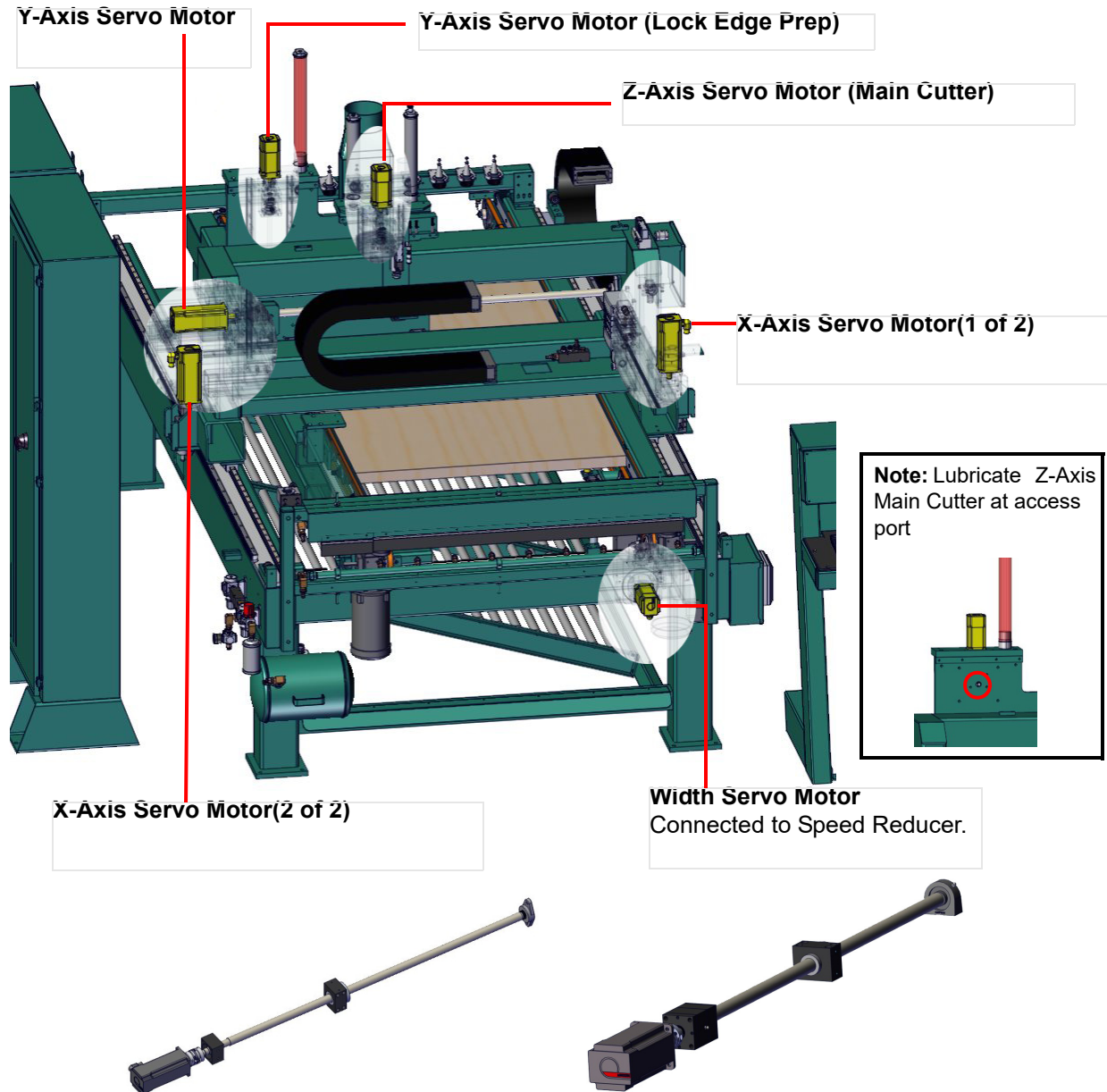
Identify zerk fittings and apply EP-2 grease. Use an extender to reach tight areas. Make sure that **Lockout/Tagout** has been performed before maintenance. For recommended greasing schedule, see “[Lubrication Schedule](#)” on page 3-14.

Note: Use an extension needle to access hard to reach bearings.



Servo Motor Drive Assembly Locations (DL-NCD)

Identify zerk fittings and apply EP-2 grease. Find the X, Y and Z axis rails to identify bearings. Some bearings may be difficult to get access to. Use an extender to reach tight areas. Make sure to **Lockout/Tagout** before maintenance. For recommended greasing schedule, see “[Lubrication Schedule](#)” on page 3-14.



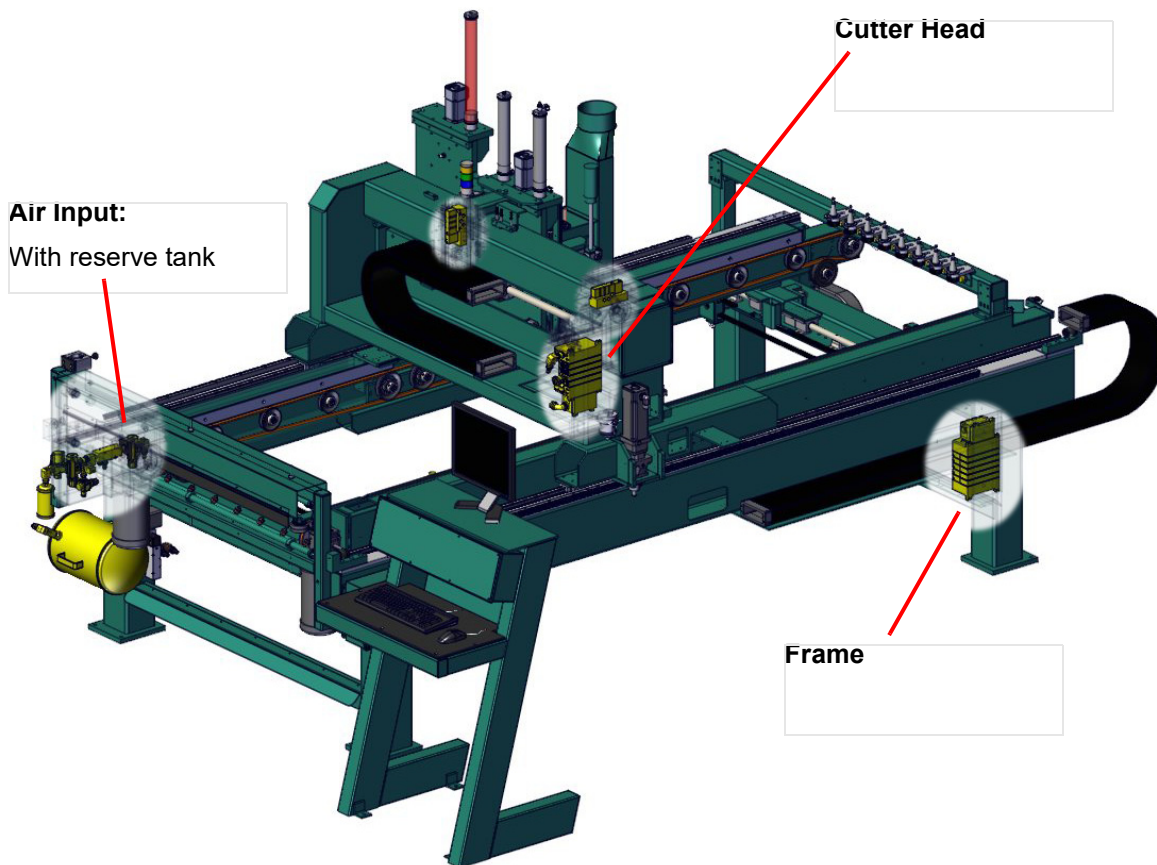
Description of Air Input System

This section describes the air system and air assembly locations on the machine.

Note: There are two types of air inputs on KVAL machinery. Not all machines have lubricator option installed. Check your machine or Air prints to verify installation.

Air Assembly Locations

The figure below shows the locations of the air system assemblies.



Air Input with Lubrication

The air input system takes in shop air and supplies clean dry air (CDA) and lubricated air to the machine. The clean dry air is diverted to blow off nozzles. The lubricator, located after the CDA filters, delivers the lubricated air to valve banks and air cylinders.

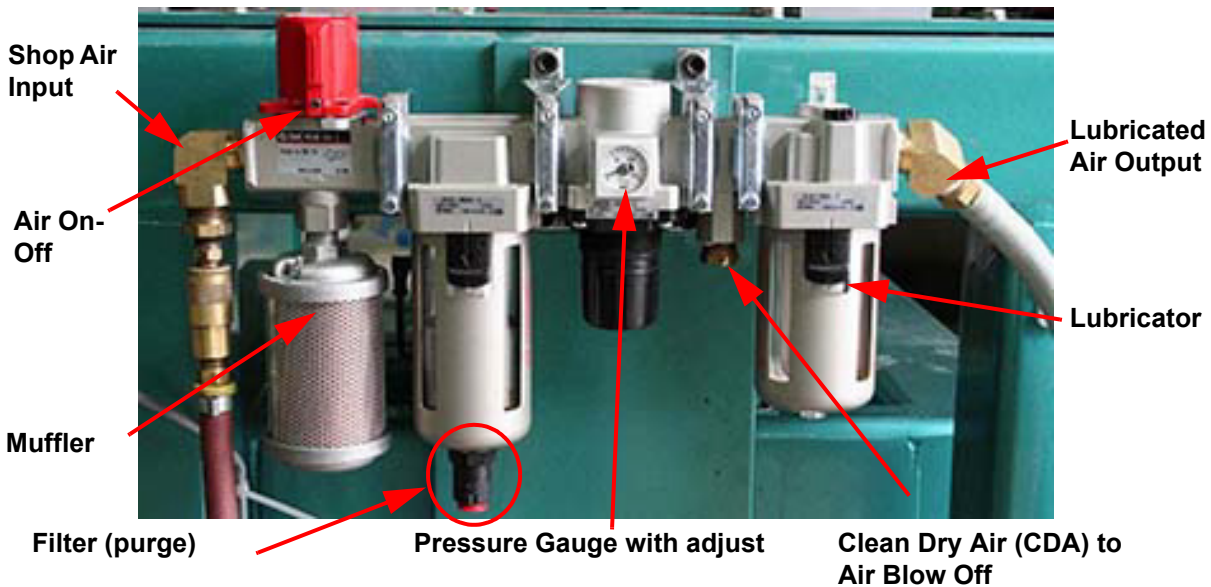


FIGURE 3-13. Typical Air Line Filter and Lubrication System

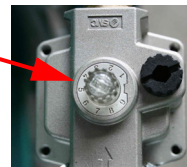
Adjusting the Air Line Lubricator

Using the knob on the top of the lubricator, adjust until one drop per every other cycle is used (as observed through sight glass.)

(Sight Glass). When the oiler has run dry, open the knob all the way until flow begins. Once you have a steady flow, tighten knob back down until you have one drop per every other cycle.

Drop will form at end of cane shaped tube visible inside glass.

Top of Lubricator



Priming the Air Line Lubricator

New and used machinery run out of oil from time to time. It is a good practice to check your machine lubricator to insure that it is putting the proper dose of oil in the air lines. Usually 1 drop of oil every other cycle is a good rule of thumb. The approved list of oil for lubricators is as follows:

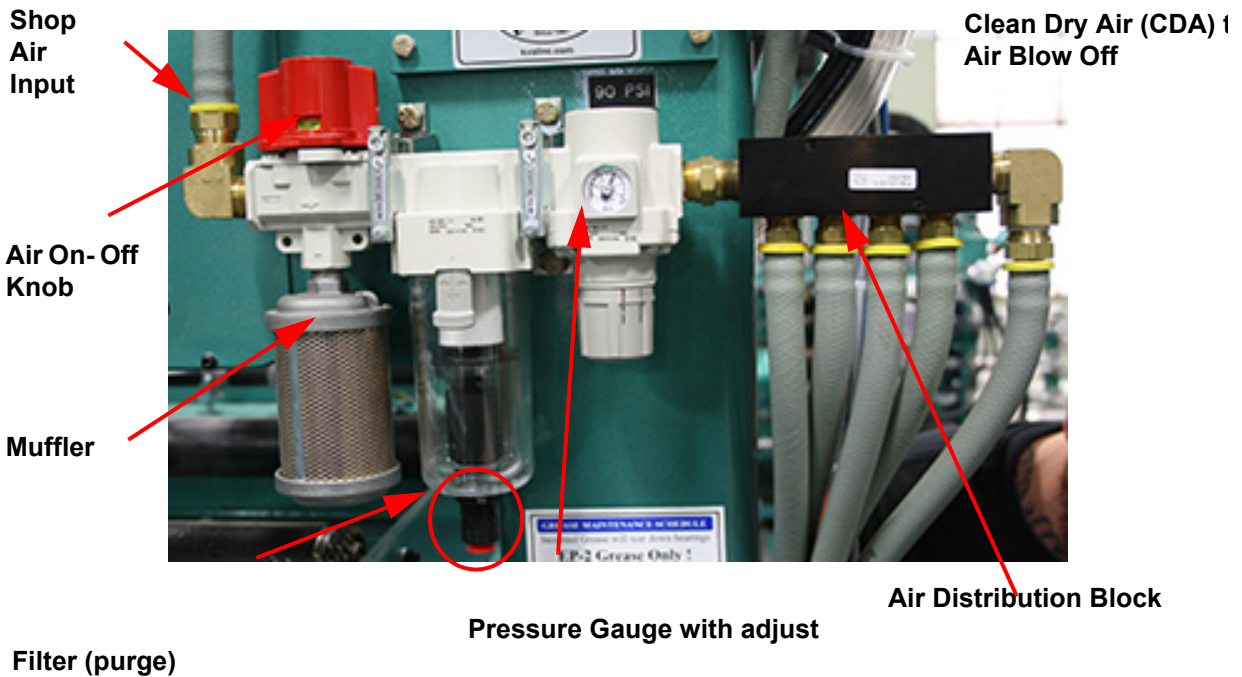
- KVAL P/N SYSLUBG
- Chevron AW Hydraulic Oil 32
- G-C lubricants light AW R&O
- Mobile DTE 24
- Shell Tellus32
- Gulf Harmony 32

To prime the lubricator, find an air line on the carriage section of the machine that is energized, and disconnect it, allowing the air stream to bleed air pressure away from any persons. Direct the air stream at the machine so you can see when there is an oily film blowing out of the air hose. Repeat this same procedure for the back section and other trouble areas.

It is recommended to check the lines every week to two weeks.

Air Line Without Lubricator

The air input system takes in shop air and supplies clean dry air (CDA).



Removing the Tool Holder from the Cutter Head

For normal operations, the tool is changed automatically. The DL-NCD is programmed to select the appropriate tool for the door material. However, a tool may also be changed manually, (for example, to change a dull bit, if there is a mechanical problem with the tool changer, or if you want to replace the tool when the machine is off). See instructions to change a tool on the next page.

Note: After the tool is changed, home the machine to reset reference.

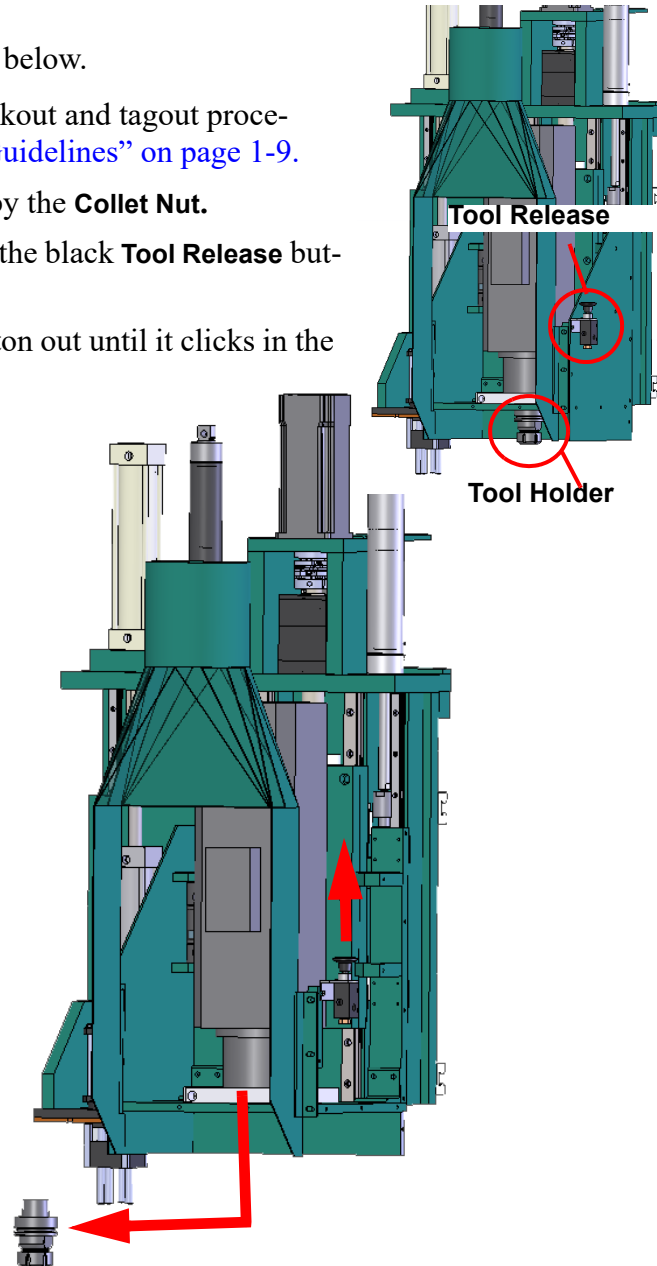
To change a tool manually, follow the steps below.

1. Turn off power and follow lockout and tagout procedures. See “[Lockout-Tagout Guidelines](#)” on page 1-9.
2. Grasp the **Tool Holder** firmly by the **Collet Nut**.
3. Using the other hand, pull out the black **Tool Release** button (location may vary)

Note: Make sure to pull the button out until it clicks in the ON position (Leave the button in this position until instructed to push it in at the insert of a new tool holder).

4. Once the tool is released from the motor, slide it down and away from the motor. Set the old tool aside.
5. Using one hand, insert the new tool into the spindle. Be sure to push the tool all the way up until the collet can go no farther into the spindle.
6. While holding the tool firmly in place, use the other hand to push in the **Tool Release** button.

Note: Do not let go of the tool until the spindle clamping assembly pulls the collet up into place!

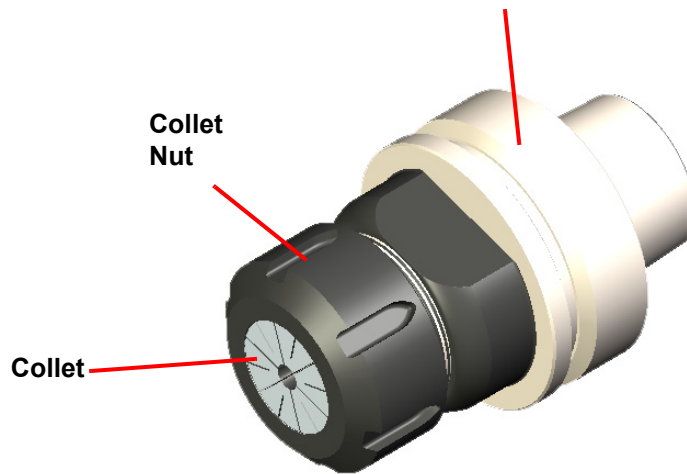


Changing a Tool Bit and Using Tool-Change Tightening Fixture

The section describes how to change the bit in a tool, use the Tool-Change Tightening Fixture, and enter data into the **Tool Setup Group**.

HSK Tool Holder Option

HSK Flange Spindle



V-Flange Spindle Tool Holder Option



V-Flange Spindle

Collet

Collet Nut

Bit

Assembled Tool Holder

FIGURE 3-14. Exploded and Assembled Views of Tool Holder

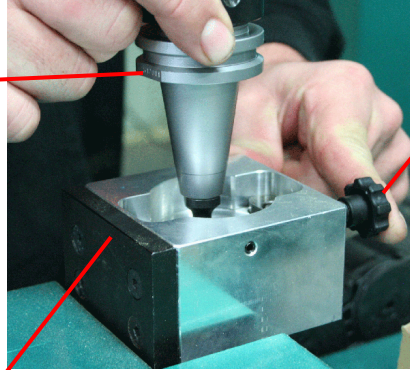
How to Change a Tool Bit

1. Set the tool in the Tool-Change Tightening Fixture.

e

V-Flange:

Flat Edges are Orientated in Line with Knob



Quick Release will snap into place after collet is inserted into base

Tool-Change Fixture

Fully Assembled Tool Locked in to Place



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For HSK Tool Holders, follow the same steps in this section, except use a HSK tool Holder.

Note: There is no quick release on this model. The collet nut will snap into place automatically when aligned correctly.



FIGURE 3- 15. Using Tool Change Fixture

2. Use the collet wrench to loosen the collet nut, freeing the bit.
3. Remove the old bit, clean the collet with compressed air.

Note: Never use a torque wrench to loosen hardware. It could damage the wrench.

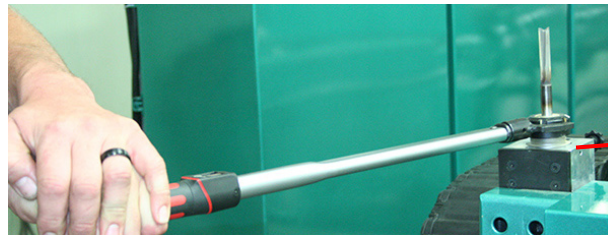
4. Check collet for bluing or damage

Note: Bluing is a condition that occurs when the collet is overheated. The overheating causes the metal to turn blue. If bluing occurs, the collet must be scrapped.

5. Reassemble the tool. When assembling, bottom out tool and back up about 1/4" to ensure the correct distance. *Tool should not stay bottomed out.*

Note: The collet should snap into place into the collet nut

6. Insert the tool into the Tool-Change Tightening Fixture and tighten to a torque rating of 130 ft/lbs.



Torque to 130 ft lbs

Note: Always return your torque wrench to zero after it is used.

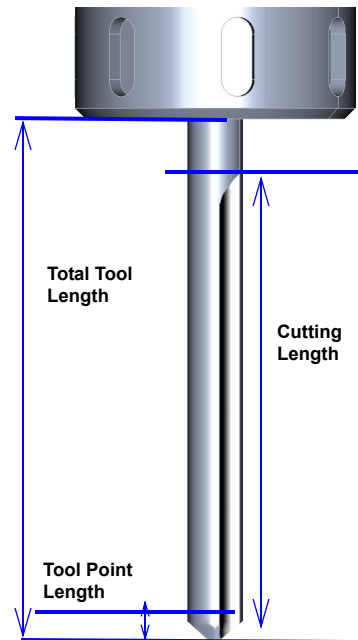
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7. Measure the parameters listed below:

- Total Tool Length - The distance from the collet face to the tool's tip of the pit
- Tool Cutting Length - The distance from start of the cutting area to the tip of the bit.
- Tool Point Length- From the point where the point starts to the end of the bit.

8. Update the data in the **Tool Setup Group**, if needed. [See the Operation Manual.](#)

Important: The accuracy of the data **Tool Setup Group** is important. Any errors could **damage tooling or product.**



Tool Slot 1		
Tool Type:	Router	
Enabled:	<input checked="" type="checkbox"/>	
Tool Name:	Router 1	
Tool Id:	1	
Diameter (inches):	0.5	
Min Diameter Plunge (inches):	0.6	
Total Tool Length (inches):	3.0	
Tool Cutting Length (inches):	3.0	
Tool Point Length (inches):	3.0	
Depth Per Helical Plunge (inches):	0.5	
Max Bite Per Lateral Top Depth Pass (inches):	0.5	
Cut Overlap in Top Depth Passes (inches):	0.015	
Material Type:	Wood/FG	
Reciprocation:	<input type="checkbox"/>	
Max Tool Spindle Speed (RPM)	15000	
Max Feedrate (inches/min):	200	
Perimeter Feed %:	100	Result (inch/min): 200
Plunge Feed %:	100	Result (inch/min): 200

Replace the X-Axis Self Lubricator

The DL-NCD contains a two self lubricating gear assemblies too lubricate the X axis. The self-lubricator is electronic and produces nitrogen gas in the well to increase pressure to push the oil out. The lubricator well sends a replacement alert to the user screen when oil is low (5%). The alert is a 30 day warning, but it is recommended to change it as soon as possible. Refer to Electrical Drawing for connections labels.

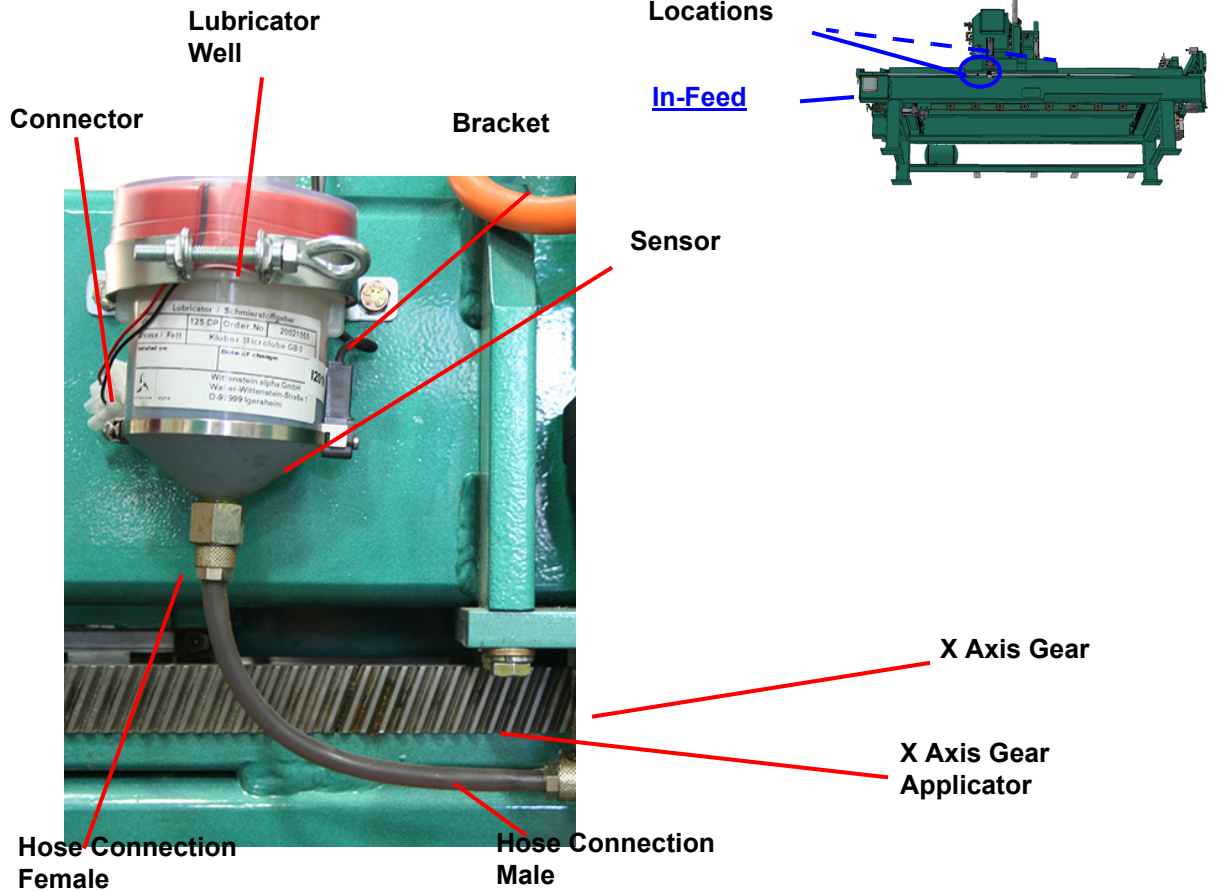


FIGURE 3-16. Auto Lubricator Assembly

Replace the Lubricator Well

The lubricator kit part number is “Wit Lubricating Kit”. It contains, lubricator well, hose (with oil) and its connectors, bracket, and sensor. Follow the instructions on the next page.

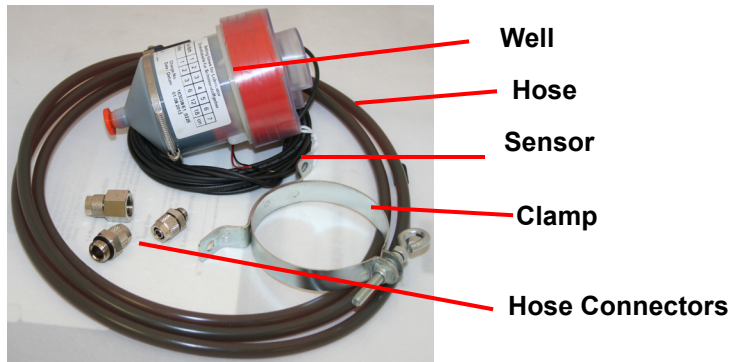
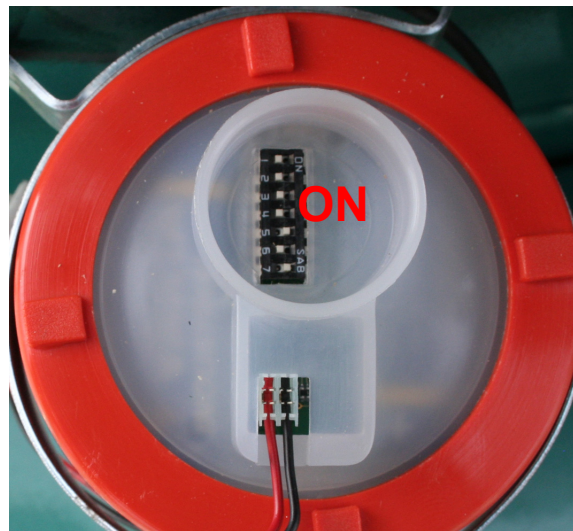


FIGURE 3-17. Wit Lubricating Kit

1. Shutdown the machine and follow the Lockout Tagout procedure, in Chapter 1.
2. To prepare, cut the hose included in the kit to match the one on the machine.
3. Add the two hose connectors to the ends of the new hose.
4. On the new lubricator well, set the dip switches.

- a. Remove the protection top from lubricator well. Dip switch is located on the top.
- b. Set the number 5 switch to the “ON” position. This sets Lubricator to a yearly flow cycle.
- c. Set the number 7 switch to the “ON” position. This turns the Lubricator “ON”
- d. Ensure the remaining switches are set to “OFF”



5. Disconnect the black and red wires from the machine connector with a small screwdriver.
6. Disconnect the sensor wires from the Frame Node. (Blue to - VDC, Brown to + VDC, Black to input I-2016)
7. Loosen the bracket, and remove the well from the side of the machine. Do not discard yet.

8. Remove the old hose from the bottom of lubricator well and the applicator.
 9. Attach the new hose to the new well and the applicator.
 10. Bracket the new well against the machine.
 11. Slide the black and red wires into the connector. Secure with a small screw driver.
- Note:** Polarity is not an issue, but for consistency replace wires as they were.
12. Route sensor wires to Frame Node and connect to nodes in step 6. Secure wires.
 13. After lubricator well is secure on machine, run a test run.
 14. Verify the oil is being applied to the gear and there is no alert on the user screen.
 15. Close frame and secure wires with a zip tie.





CHAPTER 4 Troubleshooting the Machine Line

This chapter describes troubleshooting steps to help technicians solve issues that may occur with your KVAL machine. If help is needed, call or contact our KVAL Service team at (800) 553-5825 or <http://www.kvalinc.com>.

Note:

Refer to the Air and Electrical drawings provided with delivery of the machine. The drawings are normally located in the Electrical Panel. If copies are unavailable, contact the KVAL Service Department. Have drawings numbers, model number, and serial number of machine readily available.

Chapter 4 at a Glance

The following information is available in this chapter.

Section Name	Summary	Page
Troubleshooting Basics	This section includes basic troubleshooting information. Includes analyzing sub systems to designate a starting point for troubleshooting.	page 4-2
About Motion Control	This section contains basic information on the operation of motion control circuits. Includes diagrams of the control circuits.	page 4-4
Describing Control Circuits	These sections describe the operation of the Contactor, VFD, Pneumatic Controls, and Servo Drives.	page 4-7 to page 4-18
Using Sensors to Troubleshoot	Includes the voltage values of sensors during machine operation.	page 4-19
Troubleshooting Electrical Problems	Includes voltages in the electrical panels, using the Status Light panel to troubleshoot, and VFD troubleshooting.	page 4-21

Troubleshooting Basics

Good trouble shooting starts with looking at the whole machine, where every part is suspect. Then narrowing down the view to the bad part.

Ask: Ask basic questions. For example:

- What was the Machine Trying to Do?
- What Was the Machine Trying to Do Next?
- Was the machine working before?
- Did it happen on first power up or during process?

Narrow: Narrow or determine the sequence and subsystem where the issue occurs. For example:

- Did the issue happen when door was being fed in?
- Is the router not cutting?
- Is the cut out of specification?

Verify: Verify or analyze the subsystem assembly that is responsible for the issue. For example:

- How is the subsystem supposed to work?
- What is keeping the subsystem from working?

Before you Adjust

Sometimes simple problems can seem to be complex issues. Before making adjustments, check for the following common issues.

1. Is the loaded setup correct for the current cut?
2. Are the stops set up correctly?
3. When did the problem first start?
 - At first Start-Up?
 - During the Run?
4. When was the last calibration?
5. Is the door true?
6. Use Router Bit Depth Gauge (PN: 432C) to check depth of Bits
7. Check tools for wear.
8. (990 Series) Check back side of “H” blocks for sawdust build-up, which may affect depth.

Basic Troubleshooting Steps

Ask

Determine Where:

The Sequence Step Where the Failure Occurs

What was the Machine Trying to Do?

What Was the Machine Trying to Do Next?

Check the Sequences in the Table Below.

Narrow

Determine What:

What Subsystem is Responsible for the Failed Sequence Step.

What Part of the Machine is not Working?

Check the Subsystems in the Table Below.

Verify

Analyze the subsystem:

Check the Load.

Check the Position Feed Back.

Check the Positioning System

How is the Broken Section Suppose to Work?

What is Keeping the Broken Section From Working?

TABLE 4-1. Typical KVAL Machine Sequence

Typical Machine Sequence	Responsible Subsystem
1. Move Door into Position	Feed System
2. Clamp the Door	Door Clamp
3. Make the Cuts	Cutter Positioning Cutter Power
4. Unclamp the Door	Door Clamp
5. Move Door Out	Feed System
6. Wait for Next Door	Feed System

Analyze the Sub Systems

1. Check the **Load** for mechanical issues

- Is the Load “bound up?”
- Is there sufficient lubrication?
- Is it an alignment issue?
- Is anything damaged?

2. Check the **Position Feed Back**.

- Does the **Position Feed Back** agree with the **Load** position?

In other words are the correct photo eyes, limit switches or ferrous sensors activated? Check the controller inputs to insure the proper sensors are activated. If the controller is a PLC, an activated input is lit. Some touch screens have inputs status also.

3. Common Position Feedback failures:

- **Photo Eye:** Bad element or bad cable
- **Limit Switch:** Stuck, or failure
- **Wiring:** Broken, worn insulation
- **PLC:** Bad input port.

4. Check the **Positioning System**

- Follow the circuit from the **Controller** output to the **Load** and check for component failures.

About Motion Control

This section describes the positioning systems found in KVAL machinery. There are three basic types of motion control methods used in KVAL Machinery.

Sequencing

Sequencing is a series of events executed in a predetermined order. Most KVAL machines use a form of sequential motion control. A typical series of events for a KVAL machine is:

1. Move the door into position.
2. Clamp the door.
3. Make the cuts.
4. Unclamp the door.
5. Move the door out.
6. Wait for the next door.

Point to Point

Point to point motion control involves moving a load from one fixed position to another fixed position at a constant speed and along one line (axis X,Y, or Z). A typical point to point would be a drill with a fixed-depth. The drill is either retracted or extended using a pneumatic cylinder. Typically the drills travel is limited by physical stops.

Incremental

Incremental motion control is used when the load is required to be moved with high accuracy to multiple locations, sometimes in multiple directions (axes). A typical KVAL usage for this system is a computer controlled router in a door light machine where there is great variety in the cut size, shape and location.

Basic Control Circuit

This section describes a basic control circuit. The Figure below shows a block diagram of a common control circuit. There are four parts to a motion control system:

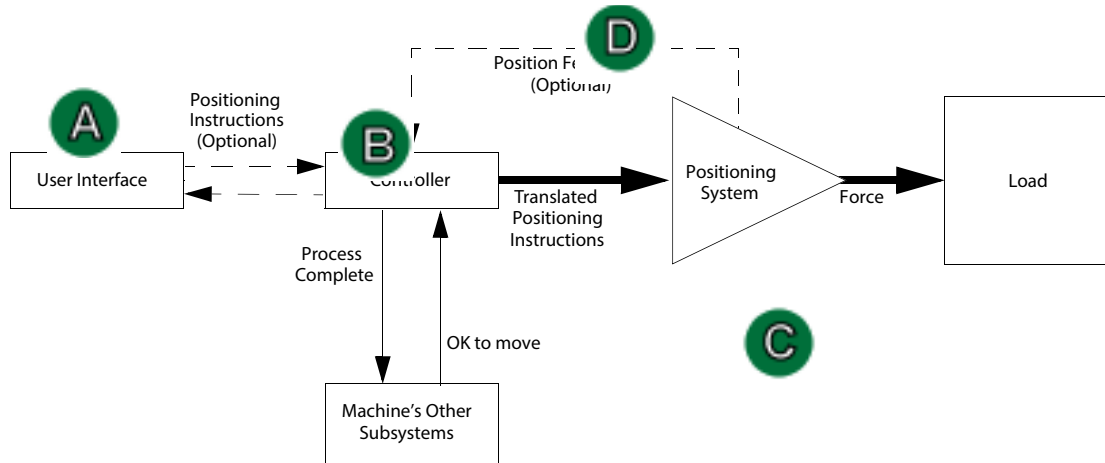


FIGURE 4-1. Block Diagram of Basic Motion Control

A

The User Interface:

- Allows communication between the humans and the machine.

Examples: A touch screen, a PC or a button panel.

B

The Controller:

- Translates entered information into a form the positioning system can understand.
- Listens to the machine's other subsystems waiting for the OK to move command.
- Sends the positioning instructions to the positioning system.
- Listens to the positioning system for position status (if there is a feedback loop).
- Tells the machine's other subsystems when the move process is completed.

Examples: A PLC or a dedicated motion control board.

C

Positioning System:

- Moves the load.

Examples: A motor or a pneumatic cylinder.

D

The Position Feedback.

- Provides location information to the controller.

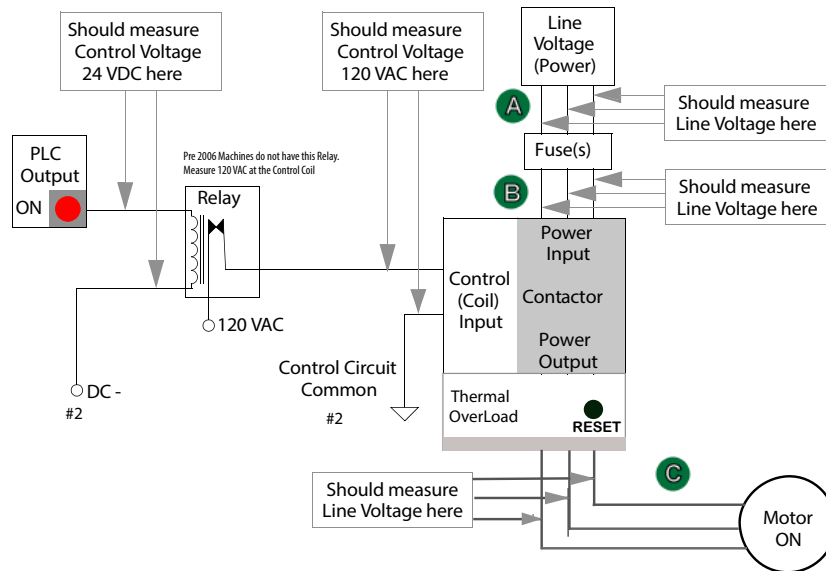
Examples: A limit switch, a photo eye, or ferrous eye, a resolver or an encoder

About a Typical Contactor Control

Unlike general-purpose relays, contactors are designed to be directly connected to high-current load devices. Contactors are designed to control and suppress the arc produced when interrupting heavy motor currents. The figures below shows a block diagram of a typical contactor circuit with typical voltages. Thermal overload relays are commonly attached to the contactor. They offer protection for motors in the event of overload or phase failure. A Reset button is included to clear an error in the relay.



High Voltage may cause personnel **injury or death**. Troubleshooting checks *must* be performed by a Qualified Electrical Technician.



Note: Pre-2006 machines may not contain the 24 Volt relay. 120 Vac is directly fed into the Control Coil. Check the input circuitry to the Control Coil for 120 Vac.

Troubleshoot
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Schematic Drawing of Contactor and Thermal Overload

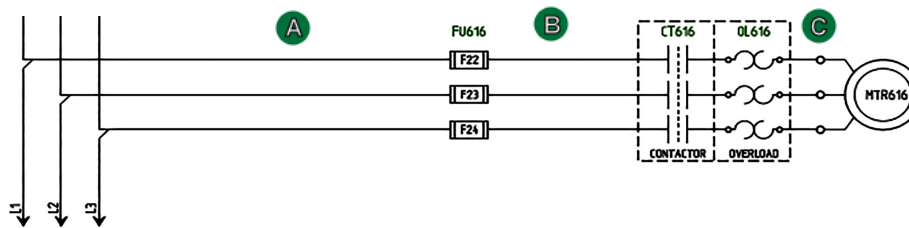


FIGURE 4-2. Block Diagram of a Common Contactor Circuit



FIGURE 4-3. Contactor Bank

About Contactor Troubleshooting

The Thermal Overload Circuit opens the motor circuit when current draw causes the motor to run too hot. The overload limits are set at the factory, do not adjust the limits.

The overloads are normally in series, therefore if one trips, all on that circuit stop working.

Use the Six Light panel as a trigger to check the circuit. See [“Troubleshooting with the Status Light Panel” on page 4-22](#).

1. Open the Main Electrical Cabinet to find the Contactor /Thermal Overload Assembly
2. Press each ‘Green’ Reset button on the Thermal Overload. An audible click will be heard on the tripped circuit. (Take note of tripped circuit.)
3. Once the overloads are reset, verify LED’s are on.
4. Rerun the machine and verify that motor runs without tripping the circuit.
5. If the same overload keeps tripping, verify condition.
6. Follow circuit path using the E-Drawing as a reference.
 - a. Common issues: Check for bad wire, bad motor, or if load is too great for current draw.

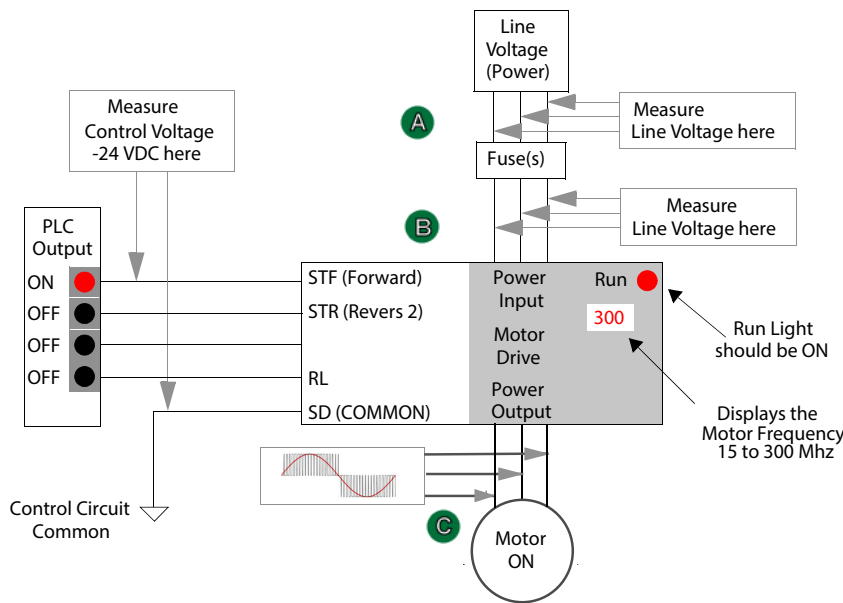
About Typical VFD Motor Drive Control

An adjustable-speed drive is used to control the motor speed and torque by varying motor input frequency and voltage. A variable-frequency drive (VFD) is used in KVAL machinery to accurately drive motors for machining or moving product through the machine. The figure below shows a block diagram of a typical motor drive circuit.



High Voltage may cause personnel **injury or death**. Troubleshooting checks *must* be performed by a Qualified Electrical Technician.

Common Motor Drive Control:



Note: The output to motor **C** contains pulse signals at varying frequencies. A DMM may not be able to measure the frequency and the pulse rate. Use the VFD interface to check, current, voltage and frequency.

Troubleshoot CH-4

Schematic Drawing of VFD

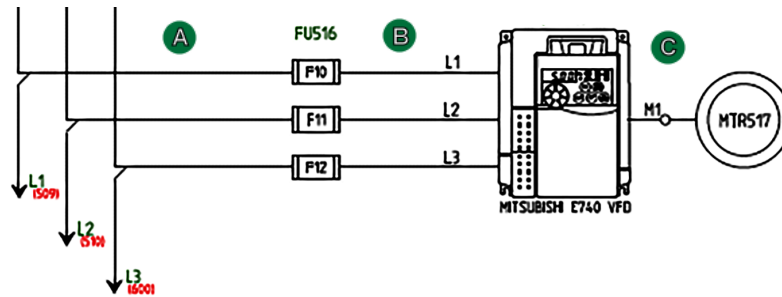


FIGURE 4-4. Block Diagram of a Common Drive Control

About the VFD

A VFD (Variable Frequency Drive) takes the raw input from the 3 phase line voltage and converts it by varying the frequency and voltage of the input voltage. Changes in the output voltage varies speed and force of the motor. For example: A lower frequency will result in a slower speed.

The VFD converts the voltage but is “told what to do” by the PLC (Programical Logic Controller). The output voltage is then sent to the motor. For a block diagram, see [Figure 4-4 on page 4-9](#)

VFD models vary in KVAL machines depending on where it is used, voltage requirements and type of PLC used. This is a general view on the VFD. See the machine’s Electrical Print for detailed information.

CH-4
Troubleshoot

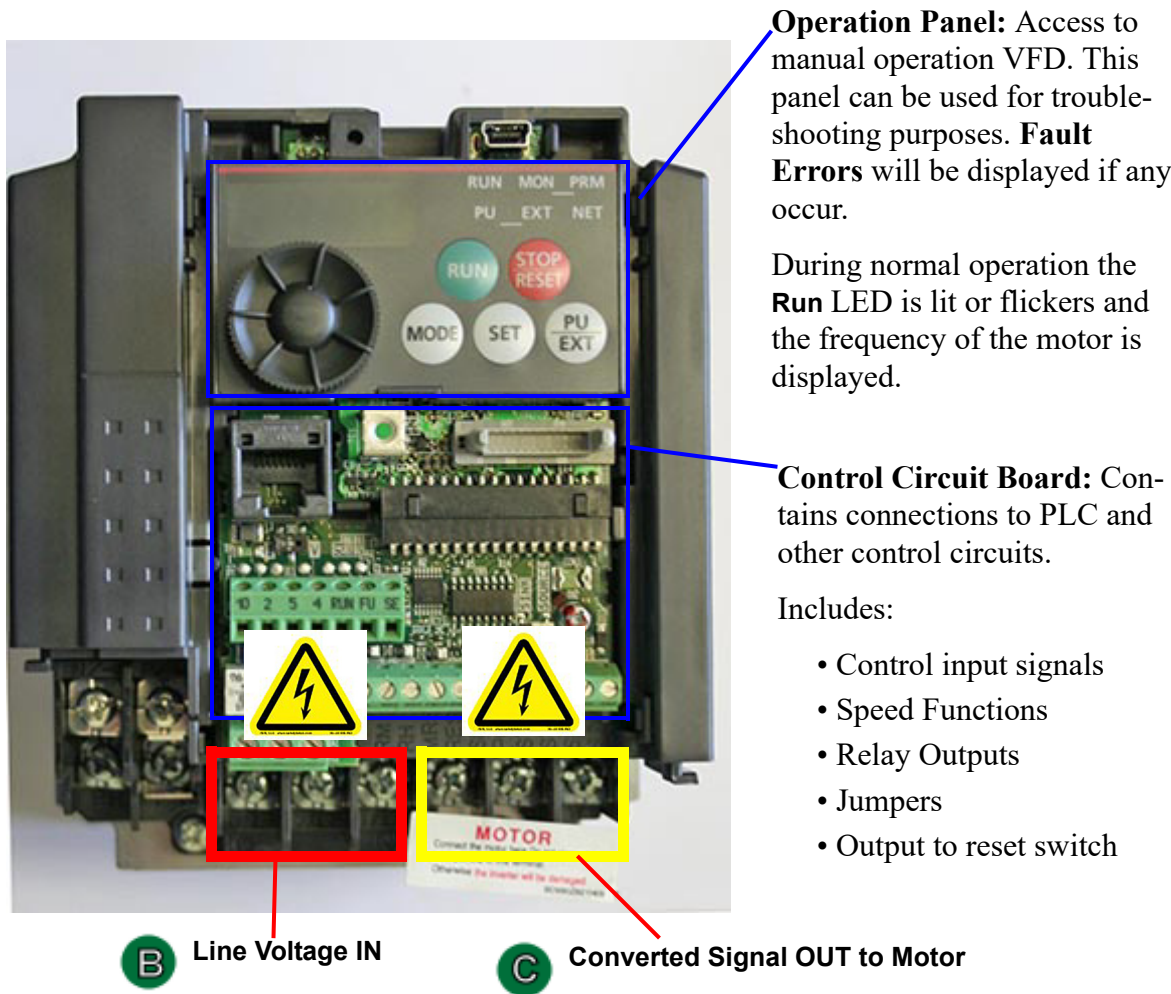


FIGURE 4-5. Sample of VFD

About VFD Troubleshooting

This section describes some troubleshooting tools for the VFDs.

Error Checking on the Variable Frequency Drives

VFDs (Variable Frequency Drives) interact with hinge and faceplate routers, width adjust motors, and feed motors. If issues occur, error codes are displayed on the VFDs. To help troubleshoot, refer to the VFD manuals located in the High Frequency Panel for lists of the error codes.

Using the Reset Buttons

In some rare occasions an electrical spike may cause a VFD to shut down. The reset buttons are located on the door of the VFD panels. The button contains the VFD function printed on the button. If a VFD is tripped to “OFF” the button will be lit. To reset a VFD:

1. Push lighted button to reset the indicated motor
 - b.If the button light turns off, continue with production.
 - c.If the button stays lit:
 - identify the motor by way of the label on the button.
 - turn off that function at the switch panel. Check the corresponding output on the PLC output. If the output is on it will not let the motor reset. Disconnect the output wire and verify that the motor circuit is not causing the issue.
 - d.If issue continues, read error code on the VFD* display and look up the error code in the VFD manual. Follow the instructions in the VFD manual. If issues continue, contact our Service Center.

VFD Reset Buttons



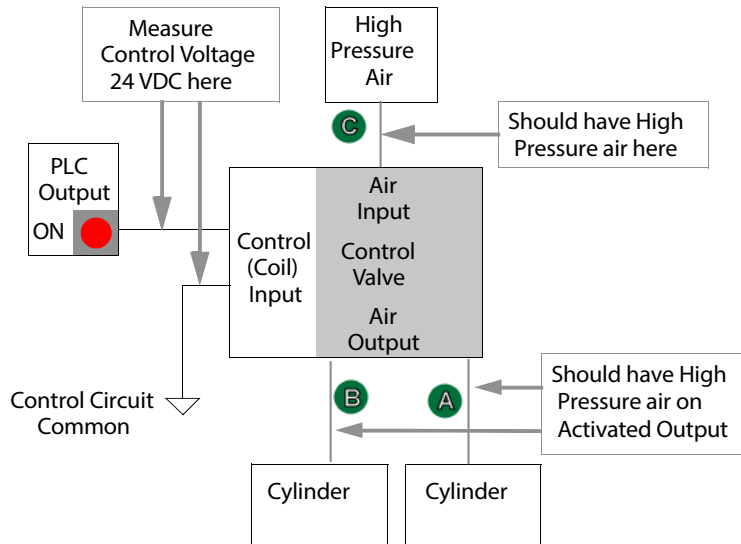
FIGURE 4-6. VFD Reset Buttons

Note: The number of reset buttons depends on the machine type and option. The figure above shows a machine with 11 VFDs

* The VFD manuals are located in the Electrical Panels. On some machines, documentation can be found in the operation station in the documentation folder.

About a Typical Pneumatic Circuit

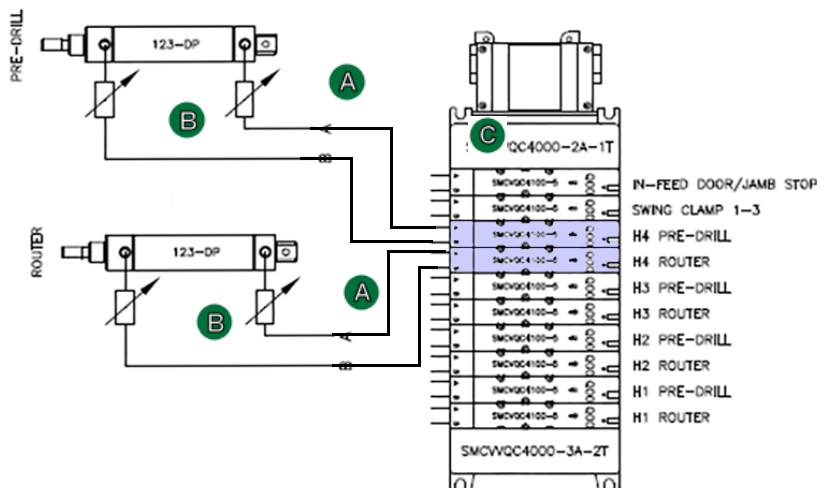
A control valve (solenoid) is used to drive cylinders to move different loads in the machine. The solenoid is controlled by the PLC by applying a high voltage or a low voltage to a control coil. Controls for example are: extending and retracting router, drill, clamping a door.



Note: Pre-2006 machines may not contain the 24 Volt relay. 120 Vac is directly fed into the Control Coil. Check the input circuitry to the Control Coil for 120 Vac.

Schematic Drawing of Pneumatic Circuit

ROUTER HEAD #4



Note: In this sample set-up, Port A is normally closed and Port B is normally open. If power is OFF, air should be on Port B.

FIGURE 4-7. Block Diagram of a Pneumatic Circuit

Typical Pneumatic Assembly

Pneumatic assembly setups vary in KVAL machines depending on where it is used and air requirements. **This is a general overview of a pneumatic assembly. See the machine's Air Print for detailed information.**

Electrical Wiring Box:
Contains inputs from PLC to Coils (Solenoids)

Coil (Solenoid): Receives input(24V) from PLC to open a port

Manifold: Base to accept air input and output air.

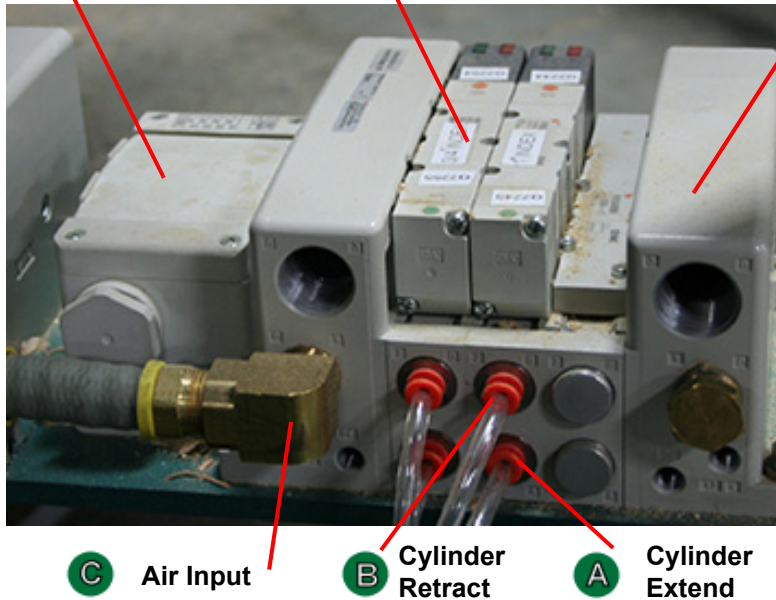


FIGURE 4-8. Typical Pneumatic Assembly

About the Coil (Solenoid)

The Solenoids are connected to the top of the manifold. Labels indicating their function and PLC connections are attached to the solenoid body. Use this information to troubleshoot system if necessary.



FIGURE 4-9. Solenoids in Manifold

Solenoid type will vary with machine application. Common controls include an operational LED and Manual operation button.

Manual Activate Button: Push to toggle solenoid to the 'ON' state. activates if power is off.

Indicator: a Lit LED indicates the solenoid is in use. Red LED= the 'A' Port on a single valve. If double valve, Red LED= the 'A' Port and Green LED = the 'B' port.

About Cylinder Operation

To see a block diagram of general pneumatic connections, see [Figure 4-7 on page 4-12](#). The figure below, shows a cross-section of a cylinder in action.

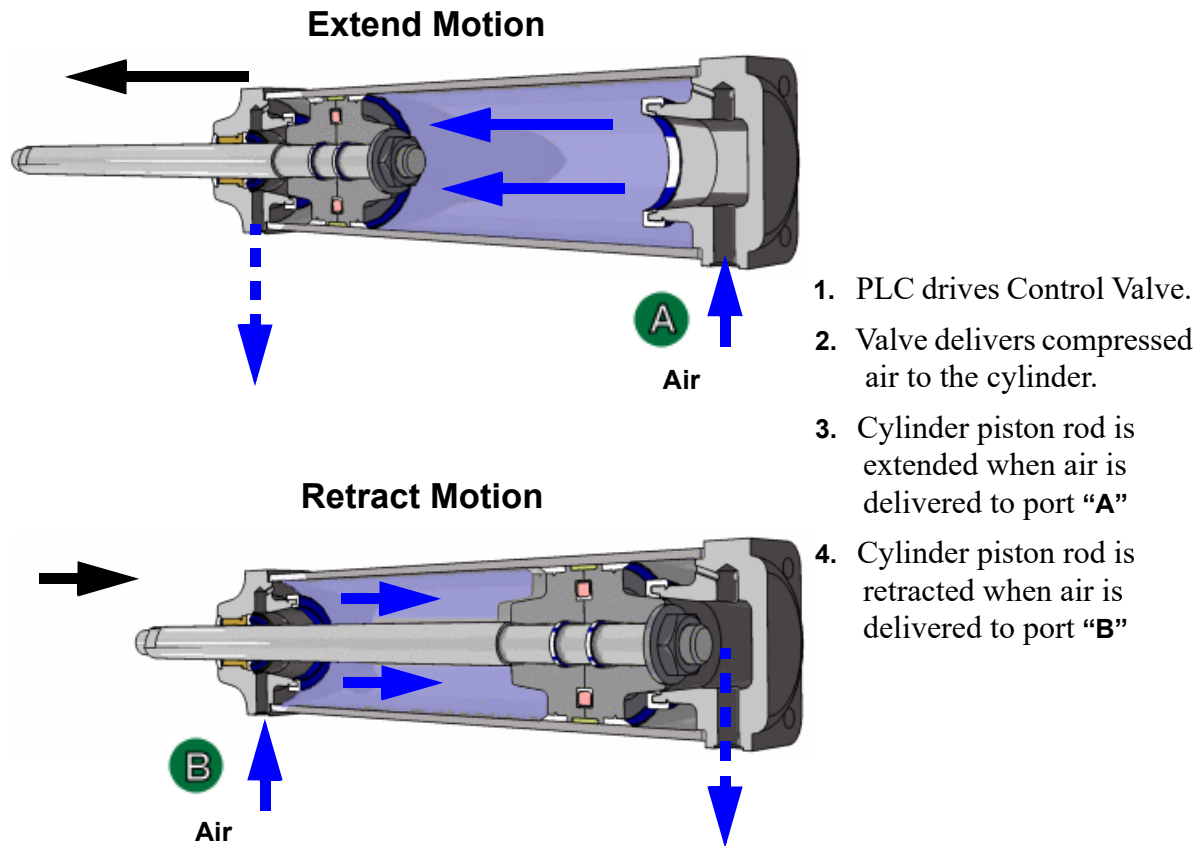


FIGURE 4-10. Cross-section of Air Cylinder

How the Pneumatic System Works

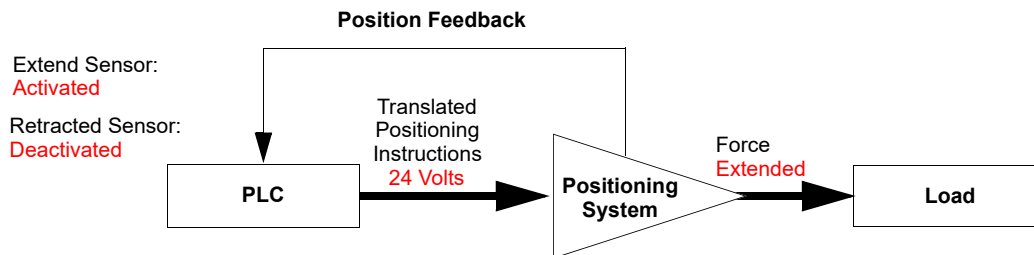
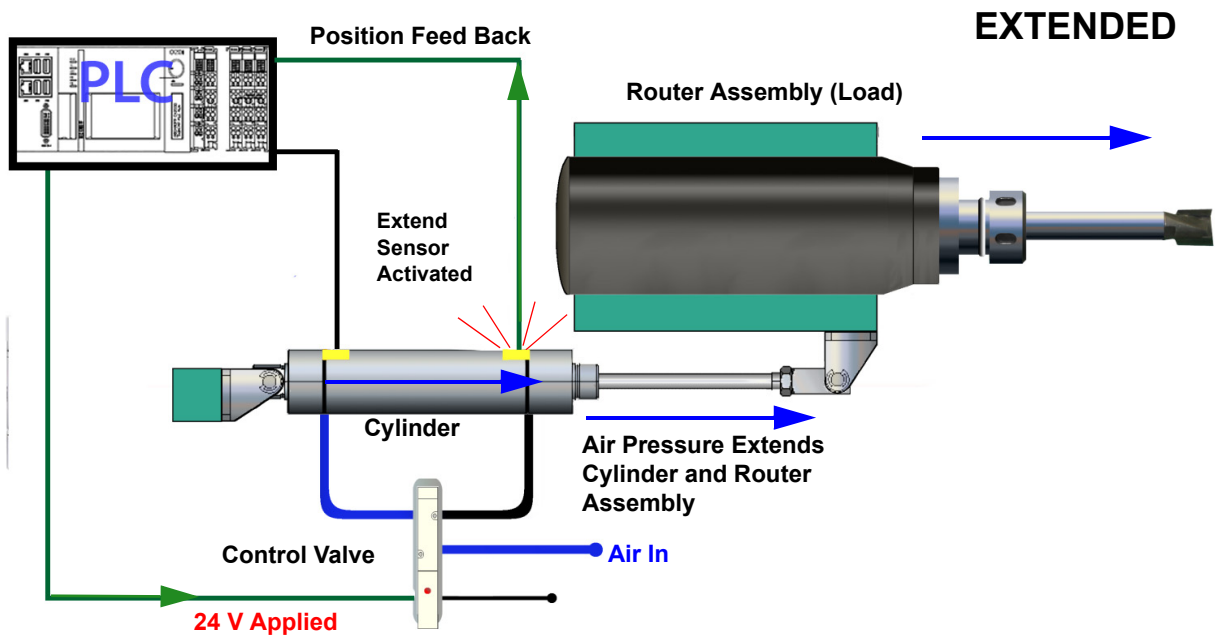
The Pneumatic system consists of a brain (PLC), an action (Positioning System), and a result (Moving the Load). For a generalized representative, this section describes the process to move a router to the extend and the retract position with a double valve.

Extend Process

If PLC determines the conditions are right to extend the Router:

1. The PLC applies the control voltage to the **Control Valve** which directs compressed air to extend port of the **Cylinder**.
2. The **Cylinder** and **Router** are extended deactivating the **Retract Sensor**
3. The **Router** fully extends activating the **Extend Sensor**.

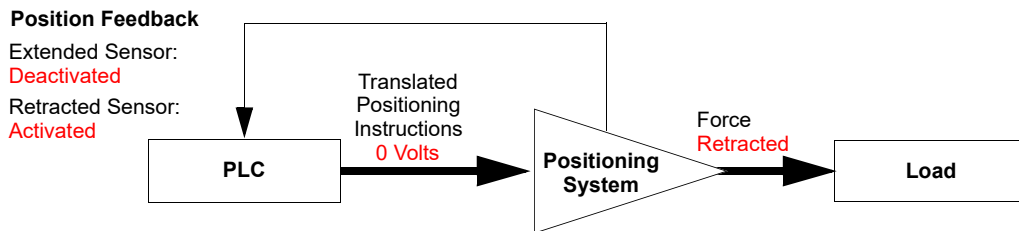
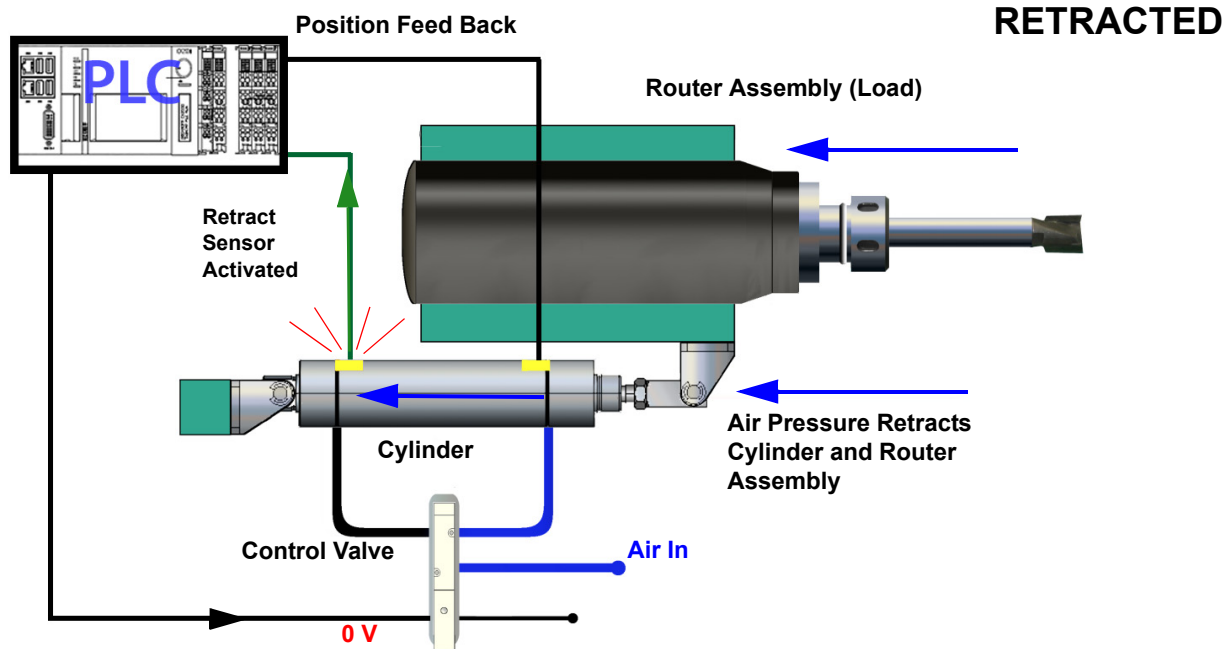
- The **PLC** senses the voltage from the **Extend Sensor** and removes the control voltage to the **Control Valve**.



Retract Process

If the **PLC** determines the conditions are right to retract the **Router**:

- The **Control Valve** directs compressed air to the retract port of the **Cylinder**.
- The **Cylinder** and **Router** retract deactivating the **Extend Sensor**
- When the **Cylinder** and **Router** are fully retracted, the **Retract Sensor** is activated.
- The **PLC** senses the voltage from the **Retract Sensor** completing the process



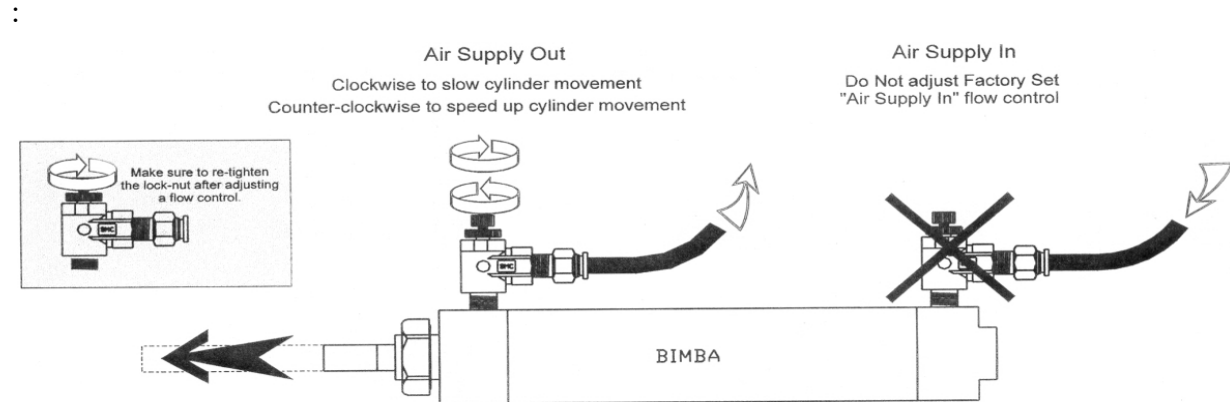
Important Notice about Adjusting Cylinder Speed

Do not adjust the cylinders to speed up production. The air cylinder timing is part of a well tuned system of electronics, programming, and mechanics. Adjustment of the cylinders for speed can cause unsatisfactory results, in-feed and out-feed problems, far marks in the corners of hinge pockets, and flipping screws in Hoppers.

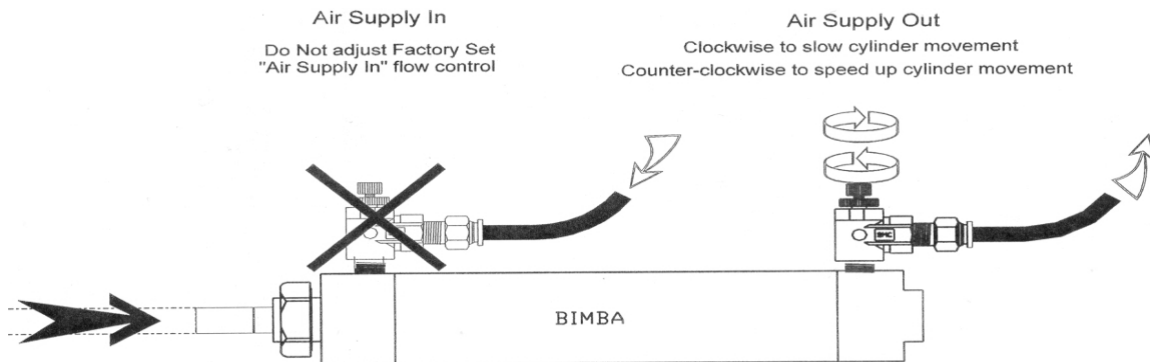
However, sometimes machine settling, mechanics be “broken in” may be cause to slightly adjust extend and retraction speed.

If more than 1/2 turn on adjustment knobs are needed, call in a specialist or check with KVAL customer service at 1-800-553-5825.

Adjusting Cylinder Extend Speed



Adjusting Cylinder Retraction Speed



Tip: If Installing a **new flow control assembly**, shut down the flow control and back out 4 to 5 turns. this position is a good starting point for fine adjust.

Network System Overview

A PLC controls the Vision Line. The Vision Line PLC's can process multiple analog and digital inputs, and output arrangements. The system can handle extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact.

The PLC is located in the Main Electrical Panel. From the PLC, connections are made to coupler interfaces located near the sections they control. See your machine's schematic package for detailed wiring information.

Connections to Servo Drives

The Servo Drives are located in the Main Electrical Panel. The outputs connect to the servo motors of various assemblies. They may include the:

- Head X, Y and Z motors
- feed motors
- back section location X, Y, and Z motors.

For detailed wiring information, see your machine's electrical drawings.

CH-4 Troubleshoot

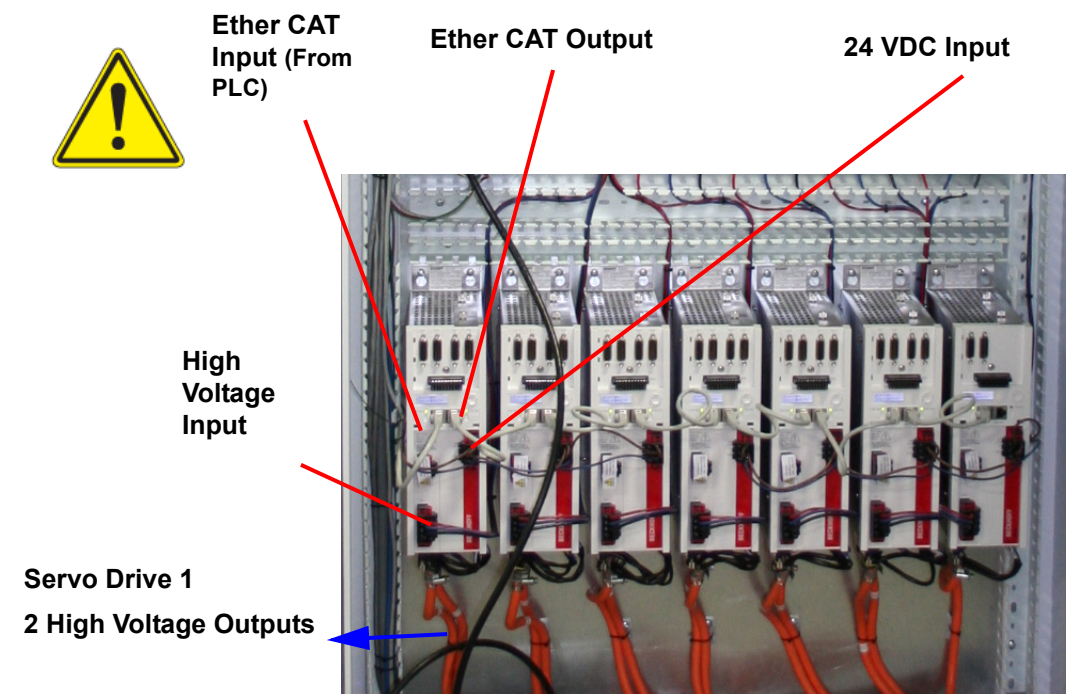


FIGURE 4-11. Typical Servo Drives

About Switches and Sensors

On the Machines, the sensors and limit switches provide input to the PLC as part of the automation of the door cutting process. Inputs can include feed through, door clamping, door location, and limits of movement of machine assemblies.

Sensors are electronically tripped while limit switches are mechanically tripped. It is important to keep the sensors cleaned and aligned to keep the door process running smoothly. There are two classifications of sensors: Photo Electronic and Inductive Proximity Sensor.

The **Photo Electronic Detector** uses light as a trigger.

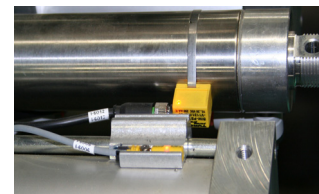
- **Photo Eye Detectors** contain both emitter and receiver. If an object is within the Photo Eye's sensing field light from the emitter is reflected from the object back to the receiver. With *no object* in front of the Photo Eye a constant 24VDC is sent to the PLC. If an object is sensed by the Photo Eye, 0VDC is sent to the PLC.
- As a result, any of the photo detectors output equals 0VDC when a door is sensed.
- Some detectors have an emitter and receiver built in one unit, such as an in-feed sensor where a door blocks the light and reflects back to the unit.
- Some detectors have an emitter and receiver built in separate units, such as the through beam sensor set at a distance from each other. If an assembly is in between the two sensors the machine will not operate.



One Package

The **Proximity Sensor** detects metallic objects without touching them.

- An inductive proximity sensor consists of a coil and ferrite core arrangement, an oscillator and detector circuit, and a solid-state output. The ferrite core and oscillator create a field generating out the front of the sensor. When a metal object enters the field, a loss in amplitude occurs. The detector circuit recognizes the loss of amplitude and generates 0VDC to send to the PLC. When the metal object leaves the sensing area, the sensor returns to 24VDC and sends it to the PLC.
- As a result, if a metal object is sensed, the output of the sensor equals 0VDC

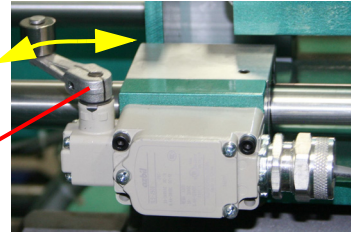


Sensors on Piston and Cylinder

The **Limit Switch** is activated by an assembly moving a switch arm.

- Depending on the model of limit switch, the amount of “pre-travel” (amount of movement from the arms resting position) is either 5 or 20 degrees before the limit switch actuates (Clicks).

Switch Arm



Using Sensors to Trouble Shoot

- Photo Sensors often get dirty. Make sure they are clean. If they are not clean, debris may block the signal or provide a false signal.
- Check output voltages of the sensors in the **active** mode. The voltage should effectively equal **0 VDC**
- Check the output voltages of the sensors in **inactive** mode. The voltage should effectively equal **24 VDC**

The distance from an eye to the door should be in range. Typically the range should be 3/4" to 7/8" from the top of all eyes to the door.

Troubleshooting Electrical Problems

NOTE: Refer to Air and Electrical Schematics provided with delivery of the machine. Schematics are located in the Electrical Panel. If copies are unavailable, contact the KVAL Service Department. Have model number and serial number of machine readily available.

Warning The following checks require the electrical panel to be energized. These troubleshooting checks *must* be performed by a **Qualified Electrical Technician**.



The electrical component systems are designed to expedite the troubleshooting process and minimize “down time”. In general, component systems have the input or feed functions at the top. Output or load functions are positioned at the bottom. Most two-voltage electrical panels are designed with the LOW VOLTAGES on the LEFT, and the HIGH VOLTAGES on the RIGHT. The majority of the system components are labeled with numbers that correspond with the electrical prints included in the electrical box door.

Computer controlled machines have signals on the computer that light up when the input or output functions are energized, respectively. Computer controlled as well as non-computer controlled machines have white 120V control power terminal strips. This will indicate power supply from the respective circuits.

PLC controllers also have lights on them for the input and output functions. You can easily find out which circuits are failing by watching the lights turn on or off. Compare the lights on the IDEC or Beckhoff controllers to the electrical print to determine what systems are being affected.

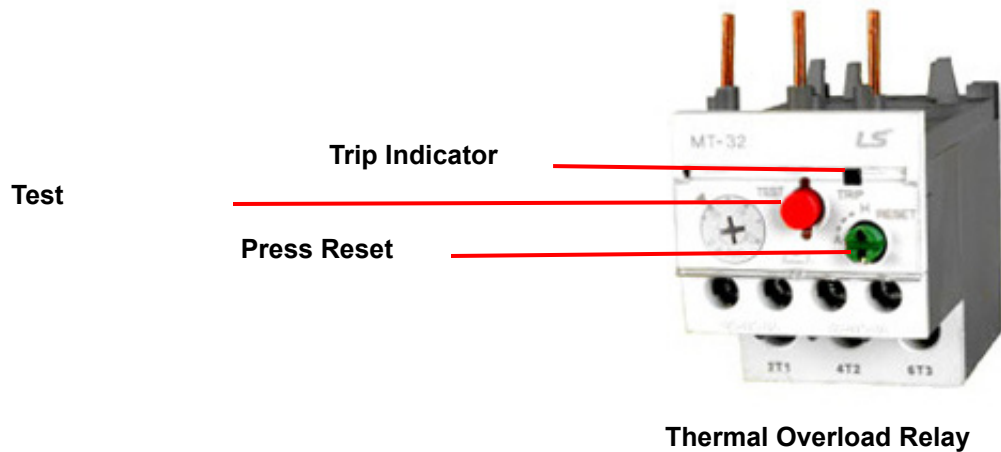
If the Power Stops During Normal Operation

1. Check that the input power disconnect switch is not turned off.
2. Check that all of the emergency stop buttons are in the normal position.
3. Check the Six Lights on the Electrical Panel. See “Troubleshooting with the Status Light Panel” on page 4-22.

Lockout and Tagout the main power source.

1. Turn the panel disconnect switch in the off position, open the electrical panel door.
2. Observe the disconnect switches. Look for loose or broken wires at the disconnect then at all of the components.
3. Check for continuity of all fuses with an OHM meter. (Fuses need to be removed from the bottom side of the fuse holder before measuring the fuses)

4. With the power off, check for motor overloads by pressing each reset button (usually at the bottom of the panel) in SEQUENCE. If one is tripped there will be a slight resistance to touch and a “click” sound as it is reset.



Thermal Overload Relay

Check for Tripped Circuits

1. Remove lock and tag outs on the main power sources.
2. Manually close disconnect sensors and energize the control circuit or transformer with its respective sensor. Check the Status Light Panel. If all lights are observed, there are no overloads or emergency stops tripped. See” *Troubleshooting with the Status Light Panel* “below, for more information.

Note: Most electrical problems are related to mechanical malfunction (e.g., stuck motors, jammed chain, blocked photo sensors etc.)

Note: If a solenoid valve is suspected, and not cleared in the air checks section (see), it can be electrically jumped to check operation.

Troubleshooting with the Status Light Panel

The Status Light Panel is located on the Electrical Panel. All six lights are illuminated when the system is in proper working order. The lights turn on in a sequence and will stop at the point where a fault is first detected.

The sequence that the lights turn on are as follows:

1. Control Power (Amber)
2. Overload Relay (Amber)
3. E-Stop (Amber)
4. Stop (Amber)
5. Start (Amber)
6. 24VDC (Green)



If one or more lights are OFF, follow the process below to isolate the cause.

NOTE: Be sure to proceed down the table, starting with the CONTROL POWER light.

STEP 1:Control Power (Amber). If light is OFF go to item **A** on page 4-24.

STEP 2:Overload Relay (Amber) If light is OFF go to item **B** on page 4-25.

STEP 3:E-Stop (Amber) If light is OFF go to item **C** on page 4-25.

STEP 4: Stop (Amber) If light is OFF go to item **D** on page 4-25.

STEP 5: Start (Amber) If light is OFF go to item **E** on page 4-26.

STEP 6: 24VDC (Green light is OFF go to item **F** on page 4-26.

A

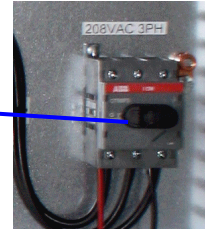
Control Power Light OFF

1. Check if the Control Transformer button is pulled out.



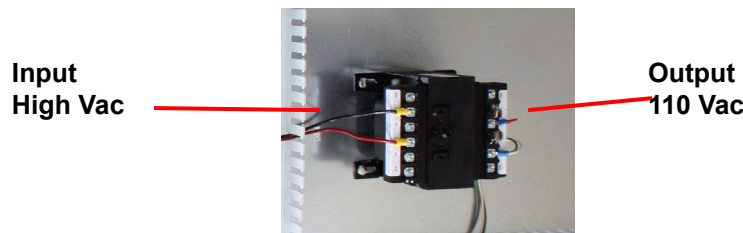
2. Is the Disconnect Switch on the main electrical cabinet set to ON?

Switch



3. Is there 208, 220, 440, or 575 VAC to the top side (input) of the Control Transformer? If not, check the fuses at the Fuse Block, and the contacts on the Control Transformer button on the switch panel.

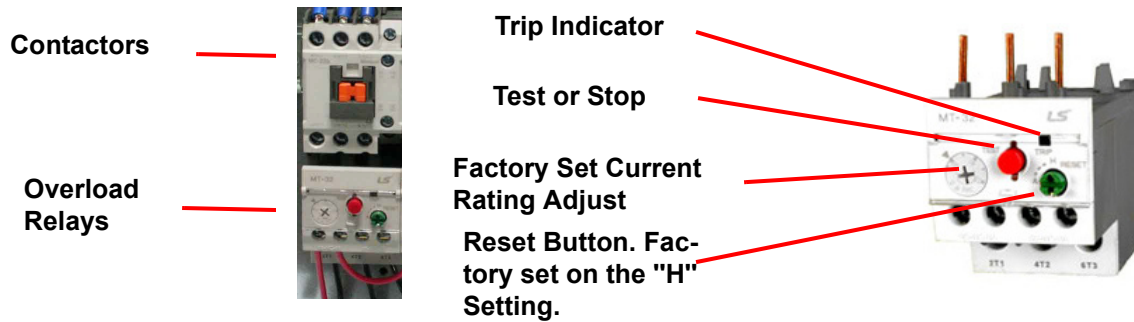
Typical Control Transformer



4. Is there 110 VAC between #1 & #2 on the 110 VAC Terminal Strip? If not, check the fuse on the output side of the Control Transformer. If fuse is good, check power coming out of Control Transformer.
5. If no power on the output side, and there is power going into the top of the Control Transformer, replace the Control Transformer.
6. If there is power at the Control Transformer, check the wiring of the black and white wire going from the Control Transformer to the 110 VAC Terminal Strip.

B Overload Relay Light OFF

1. Check Motor Overload Circuits
2. With power on, check the trip indicator LED on the overload. If indicator is orange, press the Reset Button to reset the overload circuit. Retest the Machine.



Troubleshoot
CH-4

C E-Stop Light OFF

Check to see the if any E-Stop buttons are pulled out.

NOTE: Location and quantity of E-Stop buttons varies depending on customer need. Typical locations for E-Stop buttons are near the Rear Access Gate and near the Tool Changer Access Gate



D Stop Light OFF

Check for 110 VAC between #2 and #4 If there is voltage, press the Start button. If no voltage, check the Stop button to make sure it is all the way out and not stuck in, then check the contact to make sure it is closed. If still no voltage, check the wiring.



E

Start Light OFF

If the Start light remains unlit, push in the Start button and hold it in while a second person checks for voltage between #2 and #7₅. If there is 110 VAC, replace the ACR relay. If there is no voltage while the button is held in, check the wiring.



F

24VDC Light OFF

First isolate the power supply. Check between DC+ and DC- for 24VDC. If no DC voltage, disconnect the output (V+ and V-) wires from the 24VDC power supply-and check for DC voltage where those wires were disconnected.



If no voltage:

Check the input side for 110 VAC. If no 110 VAC, check the fuse. If there is 110 VAC and no 24VDC, replace the 24VDC Power Supply.

Input 110 VAC

Output 24 VDC



If there is 24VDC:

Reconnect the output wires to the 24VDC power supply.

Trace the output wire to the DC terminal block.

Disconnect all (+ 24V positive) wires from the + DC from the DC terminal block except the + output wire from the + 24VDC power supply.

Check for +24VDC at between any -DC and +DC terminal on the DC Terminal block.

Reinstall the (+ 24V positive) wires one by one, checking for +24VDC after installing each. If at any point no voltage is found trace the last reinstalled wire and check for shorts





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<http://www.kvalinc.com>



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