

INSTALLATION, OPERATION & MAINTENANCE MANUAL MQ-150

Ball Screw Quill Feed Unit



Basic Unit Model MQ-150 (749-900) MANUAL: 790-7493-0203-1 Revised: 12/11/02



<u>INCORPORATED</u> 24000 Lakeland Blvd., Cleveland, OH 44132 216/731-0500 FAX: 216/731-8591 website: http://www.zagar.com E-mail: zagarfeed@aol.com

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Parts ListRefer to assembly drawing #749-90)1
Dimension Information Appendix & Drawing #749-90)1

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Introduction

The Zagar MQ-150 unit is a ball screw actuated, quill feed machining unit. It is ideally suited for single or multiple spindle applications on all types of metal removal machinery. The unique arrangement of few moving parts in a compact assembly provides for versatility of application and minimal maintenance in operation. The excellent quill bearing area, combined with the ball screw centerline thrust design, provide for extreme stability throughout the unit stroke. Your unit is configured at the factory with a specific spindle nose chosen at the time of order, a specific pulley ratio depending on your torque and output rpm needs and any additional options. These will be discussed in detail further in this manual.

An AC, brushless servo motor drives the ball screw (feed) axis and allows for infinite variability in feed rate up to the maximum speed. Use of this servo motor allows for elimination of mechanical speed reducers and clutches which are inherently maintenance items. The spindle axis may consist of a standard, fixed speed AC induction motor, an inverter drive for variable speed or an AC brushless servo motor for tapping and two axis synchronized motion. Zagar Incorporated offers full servo control packages complete with programming and an easy to use operator interface. Many tool setups can be permanently stored in these controls.

The standard program functions include pulley ratio entry, unit home, array initialization, offset entry, position display, jog and tool setup. Tool setup options for the single axis drives include (fixed speed and inverter) include drill, peck drill, multi-stage drill, skip drill, counterbore, countersink, spotface, ream, drill-ream. The two axis servo control offers that additional tool options of tap and drill-tap. The standard sensing switch assembly features commercial water tight proximity sensors.

Mounting position is not critical as the unit is grease lubricated. It can be mounted in any orientation.

When using this unit with a multiple spindle head, the head should be supported on guide bars and if used in vertical position the head must be counterweighted or used in conjunction with a brake on the servo feed motor.

Safety Instructions

It is Zagar, Inc.'s intention to make the safest product possible using today's state of the art material processes. Our Company offers you assistance with your individual application regarding controls, guarding and other safety matters. If you have any questions or need help please call us.

Never remove installed guards without first contacting Zagar to discuss any changes in guarding. WARNING tags permanently affixed to our products should remain in place. They are there to help prevent incorrect and/or unsafe operation of your equipment.

Caution

- Read this manual before operating or servicing this machine.
- Consult your supervisor for safe and correct operation of this machine.
- Do not operate this machine unless all guards and safety devices are installed and functioning properly.
- Do not operate this machine with any part of your body or loose clothing close to moving parts or working area.
- Disconnect and lock out power for any tooling change and/or servicing.
- All moving parts must be stopped before servicing or tooling changes.
- Use extreme caution when operating or servicing this equipment.

Think - Safety First

Use caution with all pneumatic and/or hydraulic devices and machines. It is important for those involved to understand the pneumatic and/or hydraulic circuit for controlling the movement of the mechanical members before attempting tool changes, valve replacement or servicing. Pneumatically and/or hydraulically operated mechanical components may be held in position by stored energy within the pneumatic and/or hydraulic circuit. Even with the power off or machine at rest.

If this energy is released by any means such as hose failure, valve failure, valve removal, solenoid or a manually operated valve, the mechanical member may move. Even nominal leakage and/or seepage through valves or piston seals can cause drifting.

It is, therefore, very important that all stored energy sources be vented from the system and that all movable members be mechanically secured before changing tooling, valves or performing service.

All operators, set-up and/or service people working on this machine **MUST BE** informed of these safety precautions in an effort to prevent possible injury. **WORK SAFELY AT ALL TIMES.**

4 Operation and Maintenance Manual

Specifications - MQ-150

Stroke	150 mm (5.90 in).			
Thrust Capacity				
Rapid Traverse Rate				
Feed Rates	0 to .030" IPR			
Feed Motor-Ball screw Pulley Ratio	o1 to 1			
Ball screw Pitch	5 mm/rev			
Spindle Motor-Spindle Pulley Ratio	Variable:1:1-2.91:1			
Depth Control	Programmed to +- 10 microns			
Quill Diameter	55mm			
*Spindle Noses ASA sizes M	.625, .750, .875, 1.062, 1.25, 1.375 Metric ASA sizes 25, 32, 45, 50mm Jacobs taper #1, #3, #33 sizes 16 and #25 single angle collet sizes			
	Tang drive for multi spindle head			
*Max. Spindle Speed	2.91:1 increase or 10,000 R.P.M.			
Spindle Torque				
Mounting Positions	No Limitations			
Unit weight (without motors)	120 lbs.			
Unit weight (typical with motors)				
*Consult factory for options or special requirements.				

Setup Instructions

Mechanical - Unpacking and installation

The MQ-150 unit has few setup requirements. The following instructions provide the necessary information to prepare the unit for operation. If you are providing your own controls, additional work will be required and is described at the end of this section.

- Refer to diagrams for dimensions and feature locations. A quick reference sheet is included in the appendix for general installation and connection requirements.
- Unpack the unit from the shipping container and inspect the unit. Report any damage to Zagar Incorporated immediately.
- Make certain when lifting the unit from the shipping container, a proper lifting device is used and is attached securely to the unit. A safe lifting location is the gap between the spindle motor mount and the unit it is attached to. This provides a closed opening from which the strap cannot slip.

* DO NOT lift the unit from the motor eyebolt. This is intended for lifting of the motor only.

* DO NOT lift the unit by the quill or spindle. Damage to the unit may result.

- The unit is provided with one of two types of mounting devices. They are either a base mount or a barrel mount. The base mount is an integral component which comes attached to the standard unit. The barrel mount is an optional mounting device which is specified at the time of order and is connected to the front barrel of the unit. Each of the mounting devices share the same features of four holes for bolting the unit to a mounting surface and a keyway for locating and orientating the unit.
- The base mount has holes are 9mm dia. thru for use with either M8 socket head cap screws or 5/16 socket head cap screws. The mounting hole has a 14.3mm dia. spot face which results in an overall base flange thickness height of approximately 16mm. This dimension can be used in choosing the screw length to be used for mounting. The center height of the unit with this mount is shown on the diagram in the appendix.
- Secure and align the unit to the mounting surface using the four holes and keyway on the mount.
- The unit is self contained with few external adjustments required and should not need any other mechanical installation requirements.
- If you are providing your own controls and motors, you will have already had to arrange for the proper feed and spindle motor mounting brackets. If the motors are not mounted at Zagar Incorporated, it will be necessary to bolt each motor to the corresponding motor mount or mounting plate and secure the included pulleys (may or may not have bushings). And properly tension the belts for proper operation. Belts must be secure without free slack but cannot be overtight or excessive noise, reduced belt life and premature failure of the spindle motor bearings may result.
- Feel free to contact the factory for any other mounting or installation questions.

Electrical

The standard Zagar control packages are simple to connect and come as complete enclosures ready for mounting and connection. We provide three basic packages for all Ball screw Feed Units. All include the same AC brushless servo motor on the feed (ball screw) axis. The distinction between the three packages is the spindle motor. The first package is the simplest containing a fixed speed AC three phase premium efficiency motor. The second package utilizes an inverter for variable speed operation. The speed is controlled with the servo control and is fully programmable. The third and most sophisticated package uses the same type of AC brushless servo motor on the spindle axis that is used on the feed axis. It provides the capability for positioning of the spindle in rotation for synchronized, 2 axis motion as is used in rigid tapping operations. This package has a two axis, programmable servo control whereas the other two packages have a one axis servo control for the feed axis only.

These controls only require connection to the unit and connection to power. Most of the connections to the units are quick connect, military style. A standard program is provided with all servo controls. No additional programming or programming experience is required to use these controls. The operator interface provides an easy to use, prompt type system for data entry and operation.

Please note that if you have chosen to provide your own controls, all engineering, mounting and connection requirements are the responsibility of the customer. Zagar Incorporated assumes no responsibility for operation, control or programming of the units when a control other than a Zagar Incorporated Servo Control Package is used.

- General Connection Instructions Refer to any manuals, special instructions and diagrams included with your specific unit for additional electrical information on the electronics drive and control package. The basic needs for electrical connection with a Zagar Servo Control Package are given below. Where necessary, they are described in greater detail following this section.
 - 1. Mount cabinet within 10 feet of unit using four mounting tabs attached to control enclosure.
 - 2. Run power, feedback and proximity sensor cables (included and attached) from control to unit and attach to motors and proximity sensors, see electrical drawings.
 - 3. If the spindle motor is being used with a variable speed drive select a proper length wire of no smaller than 12 gauge and connect the three phases of the spindle motor, see electrical prints, to terminal blocks inside the Zagar Servo Control enclosure.

- 4. If the spindle motor is a fixed speed motor, follow the same instructions as shown above in step 3. This will result in the power being connected to a motor starter rather than an inverter inside the servo control enclosure.
- 5. If the spindle motor is a servo motor, connect the quick connect cables labeled "Y" axis just as the feed motor was connected.
- 6. With power off on the disconnect of the Zagar Servo Control and power off on the incoming lines to be connected, connect the power lines to the servo control. All panels the power requirement is 230 VAC, three phase, 50/60 Hz.
- 7. Connect power lines into servo control with a proper strain relief or cord connector/grip.
- 8. Wire any additional I/O into programmable servo control.
- 9. Attach operator interface keypad to servo control using ribbon cable supplied with servo control. A popular option if mounting requirements allow is to make a cut out in door of servo control and mount interface in door.
- 10. When prepared to safely power up and operate unit, re-supply power to the incoming power lines. You are now ready to operate unit.
- **Spindle Pulleys** For programming reference, the ratio of the pulleys on the feed(or linear) axis is given in the specifications section. For the ratio of the spindle pulleys, please refer to your specific unit order (customer parts list), consult the factory, or inspect the pulleys inside of the pulley/belt cover. This pulley ratio can be entered into the servo control from the operator interface to properly adjust for speed and feed when a pulley ratio is changed. This ratio is entered at the factory for the set of pulleys that are shipped with the unit. The speed or speed range of the unit is marked on the nameplate on the side of the unit for reference. ALWAYS REPLACE THE BELT GUARD before applying power to the unit.
- Motor connection Each of the two motors must be properly connected before applying power to the unit. If servo motors are used, military style connectors are provided for quick connection in most cases. For motors with conduit boxes, refer to any diagrams provided or the diagram inside of the conduit box for proper connection.
- Proximity Sensors The three proximity sensors must be connected into the programmable control being used. With all Zagar Servo Control Packages a junction box is provided for this purpose. If the customer provides their own servo control system, the proximity sensors are still provided but require connection. They are 10-30V DC, 3 wire, PNP, inductive type. These sensors provide detection of forward overtravel, reverse overtravel, and home position. The home sensor provides the absolute zero point from which all move commands are referenced. In a normal, properly operating state, the LED on all three sensors will be visible. If this LED turns off, the sensor is performing the function it was designated for (ex. home, overtravel). In some other servo systems the proximity sensors may require isolating through a relay contact to function properly. The relay output contact is used as the input to the servo drive.
- The front sensor (quill/spindle end) is the forward overtravel and is detecting the quill at all times when NOT in overtravel. It is a normally open (N.O.) sensor, held closed.

When the unit (quill) overtravels forward, the quill **leaves** the path of this sensor and a forward overtravel condition results.

- The rear most sensor is the rear overtravel. It is a normally closed (N.C.) type sensor. When the unit overtravels in the rear direction the quill **enters** the path of this sensor and a rear overtravel results.
- The home sensor operates similar to the rear overtravel sensor in that the quill enters its path for detection of home. It is also a N.C. type sensor and breaks open during a HOME detection.
- **External connections** Additional inputs and outputs are available for various functions. These need to be wired by the customer as needed. The only required input is from the start buttons or the PLC for the START CYCLE. This is wired to INPUT 0. Two user outputs are provided via dry relay contact see electrical prints. OUTPUT 0 is for cycle complete and OUTPUT 4 is for faults. Check the Hardware Reference guide in the Appendix for detailed on the input and output specifications. All of the USER INPUTS and USER OUTPUTS are 24V DC with their own common return. This CYCLE START input must be wired according to local and federal safety codes for safe start operation. An anti-tie down, dual start button is recommended. If additional inputs or outputs are utilized by the customer the program must be modified for the needed function of this I/O. Zagar Incorporated provides custom programming services to accommodate this or if the customer chooses to do this modification, the software must be installed. Disclaimer: Zagar Incorporated is in no way responsible for damage to the unit, the controls or any equipment or personnel resulting from program modification done by parties other than Zagar Incorporated. Zagar Incorporated is available for wiring and program modification at Zagar headquarters or on-site at customers location.

Operating Instructions

Mechanical

- The spindle drive belt should be properly tensioned and adjusted from the factory.
- When using a Zagar multiple spindle drill or tap head, mount the drill head to the MQ-150 carefully by ensuring that the spindle tang has properly located itself into the mating slot on the drill head and that the pilot diameter slides into the mounting flange without binding. Use four bolts according to the drill head size to lock the drill head in place onto the flange. DO NOT rotate the flange on the MQ-150 feed unit to align the drill head. Make sure that alignment is done before the drill head bolts are tightened. This can result in release of the main spindle bearing preload and can cause excess noise and premature failure of these bearings. Rotating the flange in a clockwise direction causing overtightening can also result in damage to the quill anti-rotation assembly.
- DO NOT attempt to operate the unit beyond the specified stroke ranges (150 mm (5.91 in.) from the home proximity sensor).
- The proximity sensors are set at the factory and should not need any adjustment. If a sensor appears to be contacting the quill(too close) or it is not detecting repeatably(too far away) it will require minor adjusting. The sensor should be approximately 1mm away from the quill. It has a maximum sensing distance of 2mm. To adjust this first make sure that the quill is in the proper position for detection. Remove the two M3 screws holding the proximity sensor bracket into the unit. Lift the sensor assembly out of the unit. Loosen the jam nut on the underside of this assembly only slightly. Replace the assembly into the unit and secure with one screw only. Rotate the sensor clockwise to thread it in until it touches the quill. Back it off 1/4 to 3/4 of a turn. Hold this position as you again remove the assembly and retighten the jam nut on the underside securely. Replace the assembly into the unit and secure with both M3 screws.

Electrical

- Refer to any manuals, special instructions and diagrams included with your specific unit for additional electrical information on the electronics drive and control package.
- When a complete drive package is provided by Zagar Inc., only the following connections must be made. Carefully remove all electrical components from the packing. Included should be all components listed on the provided electrical diagram. The unit has already been fully tested with this drive and all other connections have already been made for you..
- Please contact the factory for any other questions or concerns on the operation of the servo drive and software.

Programming

General Description

The program structure of the Zagar MQ-150 Servo Control is a language called CTERM MINT and is nearly identical to basic. It adds the additional commands necessary for tuning and motion. Your unit will come with a program already stored in the memory of the controller. This program will run the unit and the operator interface keypad (Part #14-488-2) with a menu driven, operator prompt type setup. The menus are easy to use and are self explanatory. The typical menu has a request for information entry, an example of the format for entering it and a maximum limit for the parameter being entered.

The program structure has three files types. The CONFIGURATION file is usually very short. It contains the overall system setup parameters such as scale factors and tuning values. This file performs the system initialization. The standard Zagar CONFIGURATION file that is intact in the memory should not need to be modified. Use extreme caution when modifying this file. The unit performance can be drastically affected if these parameters are altered. **Damage to the unit can result**. Zagar does not bear any responsibility for any problems or damage resulting from modification of this file.

The PROGRAM file is the heart of the system and executes all operations for the program. It contains all of the motion commands and all of the text information that is printed to the operator interface. It is usually set up with a main program section that is very general and loops continuously and following it are a series of subroutines that handle all of the functions of calculations and sub-menus. The program uses numeric variables and array variables for calculations and storage of values entered in setup by the operator.

The last file type is the ARRAY file. This file stores the values of the array variables in the memory of the controller. All three of these file types can be uploaded or downloaded.

No additional programming work is required to setup and run the Zagar MQ-150. The program allows all of the capability of the unit to be realized. For special applications, a custom program can be provided or written by the customer. Contact Zagar Incorporated for software and programming options.

Installing the software

The software provided with the servo control can be used for program uploading, downloading and program editing. To install the software, insert disk 1 of 2 and using the Windows Run command, select the SETUP.EXE file. The program will prompt you through the installation. After installation, double click on the CTERM for Windows icon or select from the program list under Optimised Control Tools when using Windows 95. The program will execute.

Connecting to the servo control

For program upload and download, a **RS232 9 pin female to female null modem cable** is needed and can be bought at any local computer store or radio shack. Connect this cable to the serial port on the servo controller and the mouse port on the back of the computer. After connecting to the servo control, close the enclosure door and secure with the two clips. Power up the control by turning on the disconnect only. DO NOT hit the start button at this point.

Once this connection has been made you must set up the COM port to establish communications. Select SETUP and COM PORT. Pick the com port you have the RS232 cable connected to and set the baud rate at 9600. Hit OK. To check for proper communication select TOOLS and TERMINAL. You should get a blank window. Hit return and you should see a right pointing arrow prompt with either a C or a P before it. You have now established communication properly.

Downloading a file

You can download a file in two ways. They are each described below.

- Open the file you wish to download (CONFIGURATION, PROGRAM OR ARRAY). Hit the download button icon (the button that looks like a sheet of paper with a downward pointing arrow to the right). The file will now download and report the status of the download. If the download occurred properly, a message saying "Downloaded successfully" will be displayed briefly. The file will overwrite the previous file in the controller and will automatically save. You can disconnect the computer if the file executes properly. To test a download, cycle power to the servo controller by turning the disconnect off and back on again. The program will self execute. The AUTO command must be in the CONFIGURATION file for this to occur. The standard Zagar CONFIGURATION file has this statement already intact.
- 2. The other method for downloading a file is to select FILE DOWNLOAD FILE. Select the type of file you want to download and then pick the file from the directory listings. The file will be automatically downloaded.

Uploading a file

The same procedure is used to upload a file as is used to download a file. Simply select the upload icon (up arrow to right) or select UPLOAD from the FILE pulldown and continue the same as described in the DOWNLOADING section above.

Using the Zagar Servo Control Program with operator interface

The Zagar Servo Control Standard Program is designed to be used exclusively with the Zagar operator interface keypad, part number 14-488-7. It forms a complete, ready to run system capable of performing any of the machining operations the MQ-150 is able to run. The program is self-explanatory and only requires a short period of time to learn. A quick reference sheet is provided in the Appendix section. Use this sheet to see the sub-menu structure of the Zagar program.

The operator interface is a keypad consisting of a backlit, 4 line by 20 character wide display, six function keys and a numeric keypad. The screen provides all menu and setup information. It prompts the operator for needed information during setup and displays status and error conditions. The function keys are located above and below the screen. This allows the screen to display the functions and sub-menus which can then be selected with the corresponding function key above or below it.

The main program menu consists of two basic options - SETUP and REMOTE. The SETUP menu branches into several sub-options for many setup and display functions. The MAIN MENU is shown below in Figure 1.



Figure 1

Power up Screen

Verify that control power is on and follow menus instructions on screen.

(F2) – Allows program to process through error routines internal to motion controller.

Security Screen

The security screen is provided to keep unauthorized personal from changing setup data.

Security code – The security code is set to 1958 on all models unless otherwise specified by customer. The code can be changed if necessary by uploading the current program (see programming section) and changing the password.

Menu functions

Each of the menu functions is described below.

Main Menu - Menu displayed after power-up sequence

Setup (F1) - Goes to SETUP MENU #1 Pulleys (F1) - Goes to pulley settings display menu NEXT (F3) - Allows current pulley settings to be changed Enter driver pulley # of teeth - operator entry Enter driven pulley # of teeth - operator entry **EXIT (F6)** - Exits to SETUP MENU #1 without changing settings Select (F5) – Goes to TOOL SELECT for selecting keypad input or digital inputs. Home (F2) - Actuates homing sequence of unit NEXT (F3) - Goes to SETUP MENU #2 Enter tool number - operator entry Jog (F2) - allows unit to be jogged in and out using arrow keys Fast (F1) - Selects fast jog, good for approaching part Slow (F2) - Selects slow jog, good for near part motion Exit (F6) - Exits back to SETUP MENU #2 Pos? (F3) - Displays current position Arrayinit (F4) - Allows tool data storage array to be reset. Note once security code has been entered all tool data will be erased. Exit (F6) - Exits back to SETUP MENU #1 Tool (F4) - Allows tool/part/cycle to be set up Enter tool number - Allows entry of tool number to be set up **Select tool type -** Select tool type from list (Ex. drill, tap, etc.) Back (F1) - Move back one tool in list

Next (F2) - Move forward one tool in list

Done (F3) - Set tool to that which is being displayed **Jog to rapid** - Jog unit to end point of rapid travel (part should be loaded, use slow mode near part)

Fast (F1) - Selects fast jog, good for approaching part
Slow (F2) - Selects slow jog, good for near part motion
Done (F3) - Sets current location to rapid point
Skip (F6) - Keeps existing value stored in memory without overwriting with current position

Enter rapid rate - Enter rate of rapid travel in Inches Per Minute **Enter full back position -** Enter position ahead of home sensor to return back to after a cycle. This is an absolute position.

Enter # of drill stages - Enter # of segments to drilling cycle (Ex. entering drill point into part at one rpm and feed rate and drilling

through at a different rpm and feed rate = 2 drill stages) **Enter depth -** Enter *relative* depth for each drill stage. You will be prompted for which drill stage you are entering data for.

Enter feed rate - Enter feed rate for each drill stage in Inches Per Revolution

Enter rpm - Enter rpm for each drill stage

Enter tap pitch - Enter tap pitch in inch or metric (tap units only) **Enter tap rpm -** Enter tap rpm

Enter tap hand – Enter right or left hand tap(tap units only) Enter dwell time - Enter time in milliseconds to wait at bottom of drilling depth (typically used for blind hole and spot face clean up) Enter peck increment - Enter relative depth of each drill peck (peck drill tool only)

Tool properly set up, hit F2 to move to zero (F2) - If a tool has been successfully set up, hit F2 to move back to zero. This allows another tool to be set up or allows running of a part.

Exit (F6) - Exits back to MAIN MENU

Remote - Put unit in run mode (waits for start buttons or PLC signal)

Enter tool number - operator entry of tool number you wish to set up Automatic mode, use start buttons or PLC - Display screen only, waiting for cycle start command. Unit is enabled to run at this point.

Exit (F6) - Exits back to MAIN MENU

Lubrication Instructions

The MQ-150 unit bearings are lubricated with synthetic lubricant. Kluber Isoflex NBU-15 is used on all rolling bearings (ball bearings and ball screw). Kluberpaste 46 MR 401 is used on the sliding surface of the spline shaft. The quill is lubricated with standard petroleum based grease. Do not mix petroleum lubricants with the synthetic lubricants used on the spline shaft, ball screw and bearing.. This will cause breakdown of the synthetic lubricant and could result in premature failure of critical components.

Lubrication should only be required when service is done to the unit, components are replaced or the lubrication should dissipate from the lubricated component or surface for any other reason. The bearing lubrication is sometimes referred to as "permanent" in that it should last the life of that particular component unless subjected to abnormal use or exposure. Due to extreme load and speed conditions, it is highly advisable that the lubricated components should be checked at regular preventative maintenance intervals. Many coolants and cutting fluids are destructive to the lubrication, particularly the quill lubrication so it may be necessary to inspect and re-lubricate this component more frequently.

The benefit gained by the use of this type of grease lubrication is that it allows the unit to be mounted in any orientation and does not require extra and external lubricating devices. Use the table below for general guidelines. The unit should remain sealed and protected from contamination at all times. Any maintenance or service should be done in a clean environment.

Component	Check every	Relubricate every	Lubrication type
quill	500 hrs.	1000 hrs. or as needed	petroleum grease
spindle bearings	2000 hrs.	6000 hrs. or as needed	Kluber Isoflex NBU-15
ball screw bearings	6000 hrs.	6000 hrs.	Kluber Isoflex NBU-15
spline shaft bearings	6000 hrs.	6000 hrs.	Kluber Isoflex NBU-15
spline shaft	2000 hrs.	6000 hrs. or as needed	Kluber 46 MR 401
ball screw	2000 hrs.	6000 hrs. or as needed	Kluber Isoflex NBU-15

Inspection and Relubrication Guidelines Chart

Relubrication Instructions

A. Preparation of parts:

- Use disassembly instructions below to gain access to parts for lubrication.
- All oil and grease must be completely removed from all components before applying lubricants.
- All components must be clean and dry.
- Do not use kerosene or any petroleum based cleaning fluids.
- Use a synthetic based cleaner

B. Application of Lubricants:

Make certain that the application instrument is completely clean and will not contaminate the lubricant, dissolve or break apart into the lubricant. Syringes and plastic spatula type devices work well for this purpose. Use protective gloves when handling the lubricant and lubricated parts.

- QUILL Grease fitting on housing barrel provides lubrication point for grease gun. Remove set screw on opposing side of barrel before adding grease. Pump grease until it is visibly ejected from hole on opposing side. Replace set screw into relief hole on opposite side. Grease fills an undercut pocket inside of cylindrical housing.
- SPINDLE BEARINGS & SPLINE SHAFT BEARINGS For low speeds (<2500 rpm) fill as much as 100% of bearing free space. For medium speeds (2500 6000 rpm) fill 67% of free space. For high speeds (6000 10,000 rpm) fill 25% of free space.
- BALL SCREW BEARINGS Apply same as above spindle bearings but fill 1/3 of free thread tooth space with lubricant
- SPLINE SHAFT Apply lubricant in a thin coat along length of spline tooth section.
- BALL SCREW Apply the lubricant so that 1/3 of the screw thread free space is filled (see below).

UBRICATION

C. Run-in Procedure (bearings only):

The quill, ball screw and spline shaft do not need a run in period after relubrication and the ball screw bearings are not typically continuously running so they will break in effectively after resuming normal operation.

- 1. For any bearings, run at 10% of the maximum operating speed until a stable temperature is reached.
- 2. Increase speed incrementally when a stable temperature is reached. Continue incremental increases (usually about every 10-15 minutes) until no temperature rises are experienced. The ideal equilibrium operating temperature is 35 deg C to 40 deg C (95 deg F to 105 deg F). NOTE: Maximum bearing temperatures should not exceed 70 degrees C (158 deg. F). Temperatures in excess of 70 degrees C will cause excessive bearing pre-loads and possible permanent grease or bearing damage.
- 3. Allow the system to cool to room temperature.
- 4. If the speed cannot be varied, run the spindle at full speed for 30 seconds. Allow the heat in the bearing to dissipate. Repeat this procedure until the bearing temperature becomes constant. The non-running time should be at least 5 times greater than the running time.

Disassembly

If your unit is still under the factory warranty period you must contact Zagar Incorporated Service Department to obtain express written permission for any repair or service operations. Disassembly of the unit may result in voiding of the Warranty.

Please note that all socket head cap screw fasteners in the MQ-150 unit are metric. Proper tooling should be used accordingly. Assembly and disassembly work should only be done in a clean, assembly area free from chips and contamination.

Removing Spindle

- 1. Unthread black front external nut #749-921 using pin type spanner wrench while pulling spindle nose #749-927 out at the same time. This will remove the entire spindle assembly.
- 2. If spindle assembly needs to be disassembled further for bearing or seal replacement or change of nose style, remove internal nut #749-922 and continue unthreading it until it breaks the taper fit of the front spindle nose #749-927 with the rear spindle body #749-926. Next remove the retaining ring #11-5100-66 inside of the internal nut and remove the internal nut. Unthread the lock nut #10-727-4 and the spindle bearings #10-0201-2043-3 can now be pulled off with proper pulling equipment.

Removing spline drive shaft

- 1. Remove (4) screws holding outside half of belt guard #749-924 and remove guard.
- 2. Remove all pulleys and belt inside belt guard.
- 3. Remove (3) screws holding end cap #749-912 onto feed housing cover #749-904 and pull entire spline shaft #749-911-1 and end cap assembly out of unit.
- 4. To remove spline shaft bearings #10-0171-0036-3, loosen lock nut #10-727-3 and remove lock nut and bearings.

Removing Motors (may vary depending of motor mounting configuration)

- Remove feed motor by loosening bolts on feed motor adapter plate #749-907. Plate will now be free from unit. Carefully pull out to remove pulley from belt.
- 2. If necessary, remove motor from adapter plate by first removing pulley from motor shaft and then removing (4) screws from motor flange.
- 3. To remove spindle motor, remove (4) bolts holding motor onto spindle motor mount #749-908. Motor will now be free.

Removing quill and ball screw assembly

- 1. Remove (4) screws holding inside half of belt guard #749-925 then remove guard.
- 2. Remove (6) socket head cap screws from feed housing cover #749-904 and remove cover.

- 3. Remove (4) socket head cap screws from inside of feed housing #749-903 and carefully remove housing. Use caution as this part is heavy. Removing spindle motor mount #749-908 will help reduce the weight. To do this simply remove (4) socket head screws on legs of motor mount and lift motor mount upwards.
- 4. Turn unit so that bottom of unit base plate #749-905 is exposed. Remove (4) socket head cap screws in bottom of base. With a rubber mallet, carefully tap on flanges of base to loosen base from unit. When base is free from (2) dowel pins, you may safely remove the base.
- 5. With the underside of the quill exposed, remove the anti-rotation cam roller #12-633-2 using a flat head screw driver. Remove the cam roller and the bushing #12-149-9 inside the bumper #749-914. NOTE: The bumper will not be able to be removed at this point. When the quill is removed, this bumper will be able to be freely dropped out.
- 6. You can now freely pull the entire ball screw and quill assembly out of the back of the unit.
- 7. If this assembly needs to be disassembled further for bearing change or ball screw replacement, follow the instruction below.

Disassembling quill and ball screw assembly

- 1. To remove quill #749-910, remove set screws #12-525-16 and using strap wrench, unthread quill from ball screw. See note below.
- Remove lock nut #10-727-5 and pull bearing #10-0251-2047-7, spacer #749-916, pulley #749-929, spacers #749-915 & 749-916 and metallic seal ring #11-615-1 off of ball screw shaft.
- 3. Pull angular contact bearing pair #10-0301-9072-3 off of ball screw shaft using proper pulling equipment. This assembly is now fully disassembled.

NOTE: Thread connection between ball nut and quill is left hand, disengage accordingly. Set screws must be removed first and strap wrenches only should be used to loosen ball screw nut from quill.

CAUTION: Leave ball screw nut on ball screw shaft at all times.

Replacing anti-rotation cam roller

1. See step 4 & 5 in **Replacing quill and ball screw** above

Replacing spindle pulleys and belt

- 1. Remove (4) screws holding outside half of belt guard #749-924 and remove guard.
- 2. Remove (2) top button head screws #12-525-18 and washers in slots securing front guard #749-925 to spindle motor mounting bracket #749-908.
- 3. Loosen (4) socket head cap screws #12-525-15 on side of unit holding spindle motor mounting bracket legs to unit.
- 4. Loosen (2) locknuts and lower (2) jackscrews #12-525-20 attached to top of feed housing #749-903 to lower spindle motor mount and loosen belt.
- 5. Remove belt.

- 6. For plain bore (non-bushing) style pulleys with a key drive, loosen set screw above keyway on pulley. Slide off pulley.
- For plain bore pulleys with friction/bushing type coupling #12-856-1 (see spindle pulley), loosen hex on friction coupling and remove pulley. When replacing this coupling, use proper torque specs as shown on drawing 749-901.
- 8. For bushing style pulleys, loosen and remove (3) hex head screws in bushing. Replace same screws into jackscrew holes in bushing and by tightening each one a small amount in succession, the bushing will "pop" out of the pulley. The pulley can then be removed. When replacing pulleys, make certain to properly align pulleys and engage key properly in slot.

Replacing feed pulley and belt

- 1. Follow steps 1 & 2 of **Removing motors** and steps 1 & 2 of **Removing quill** and ball screw assembly.
- 2. Feed belt can be removed at this point.

Troubleshooting

Symptom	Possible causes	Solution	
Following error	Mechanical binding, Broken or dull tool causing stalling. Unit undersized.	Correct binding, Correct or replace tooling.	
During homing sequence machine passes home switch	Bad proximity switch or proximity switch not set to correct depth.	Verify that switch is working properly. Verify switch is at proper depth- See mechanical section.	
Servo E-stop hit	E-stop circuit has been broken.	Verify e-stop buttons / input 7 on motion controller.	
c>memory corrupt use new	Battery backup in motion controller has failed.	Send motion controller back to Baldor for inspection if under warranty. Purchase new battery and install.	
External error	Spindle and or feed drive has faulted.	Verify fault display on drives, use corresponding manuals for troubleshooting problem.	
Rear or Forward over travel which will not return to home.	Quill is bound up. Rear or Forward over ravel switch is faulty. Current program may have improper values.	Remove belt covers, belts, pulleys and manually turn shaft until quill becomes free. Verify that over travel switches are working properly.	

Appendix



Dimensional Information - MQ-150

Other Zagar Products

Drilling and Tapping Units

Ball Screw Actuated, Servo Controlled Quill Feed Units Servo Control Packages Air/Electric Quill Feed Units Cam Actuated Quill Feed Units Lead Screw Tap Units

Multiple Spindle Heads

Gearless or Geared Machining Center Heads Rotating Heads

Workholding Fixtures

Specializing in Collets and Collet Fixtures Standard and Special Manual Air and/or Hydraulic Automated Index Internal or External Clamping

Fixtures

Drill Jigs and Fixtures Multiple-Spindle, Individual Lead-Screw Tapping Automatic/Manual Clamping Systems

Standard & Special Machines

Turn-key Special Machine Systems Automatic Material Handling CNC Control Integration



24000 Lakeland Blvd., Cleveland, OH 44132 216/731-0500 FAX: 216/731-8591 www.zagar.com zagarfeed@aol.com