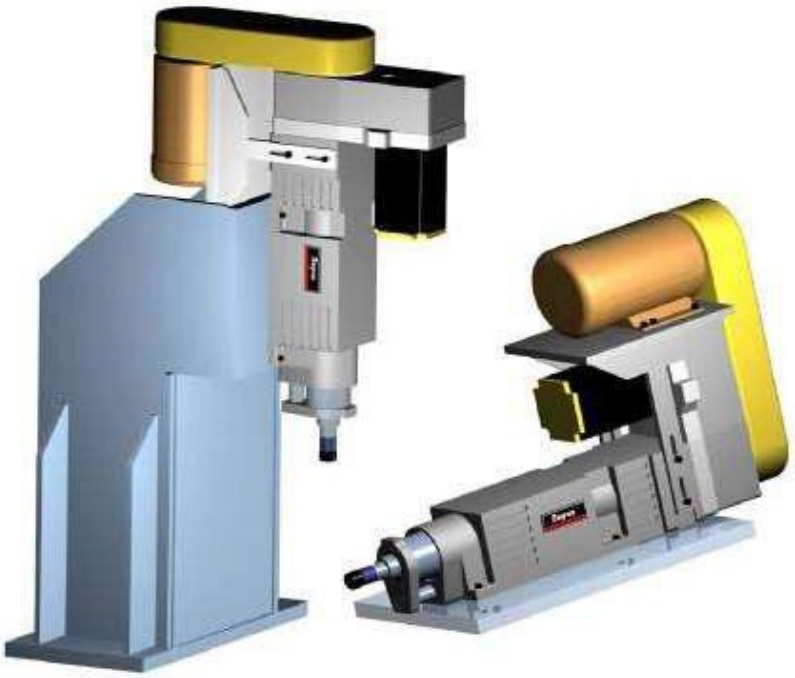
INSTALLATION, OPERATION & MAINTENANCE MANUAL

MQ-60, -120, -140

Ball Screw Quill Feed Unit



BASIC UNIT MODEL MQ-60, MQ120, & MQ140
MANUAL: NO. 790-7493-0606-2

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Contents

Introduction

The Zagar MQ60, 120, & 140 are ball screw actuated, quill feed machining units. Each 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 required torque and output RPM; and any additional options. These will be discussed in detail further in this manual.

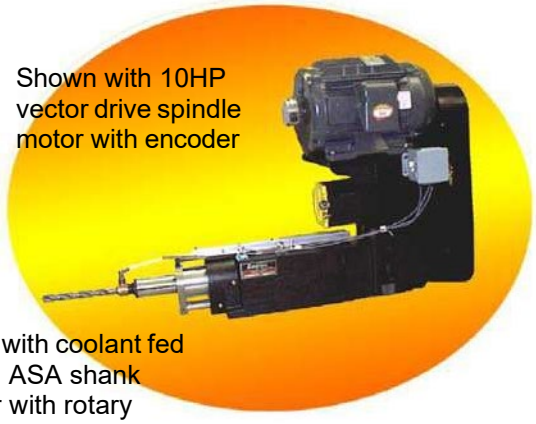
An AC, brushless servo motor drives the ball screw (feed) axis and allows for infinite variability in feed rate up to the maximum speed. Use of this servo motor allows for elimination of mechanical speed reducers and clutches which are inherently maintenance items. The spindle axis may consist of a standard, fixed speed AC induction motor, an inverter drive for variable speed, or an AC brushless servo motor for rigid tapping and two axis synchronized motion. Zagar LLC 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 drill, peck drill, multi-stage drill, skip drill, counterbore, countersink, spotface, ream, and back-feed for de-burring both ends of thru holes The two axis servo control offers that additional tool options of rigid CNC tap and drill-tap. The standard sensing switch assembly features commercial, water tight, quick disconnect, 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 used in conjunction with a brake on the servo feed motor.

Adjacent MQ140
Vertical 10 HP Stations



MQ140 unit with coolant fed drill and ASA shank adapter with rotary coolant gland

Safety Instructions

It is Zagar, LLC'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 function 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.

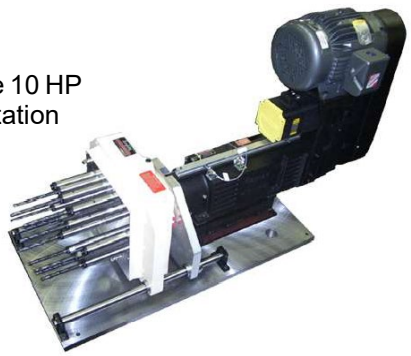
Think - Safety First

Use caution with all electrically controlled devices and machines with servo actuated motion. It is important for those involved to understand the electrical control system for controlling the movement of the mechanical members. Turn off power to the control system before attempting tool changes or servicing.

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.**

MQ 60, 120 & 140 Specifications	
Stroke	MQ60– 6” (152mm) MQ120- 12” (305mm) MQ140- 14” (356mm)
Thrust Capacity	3,200 lbs. (1,451 kg.) 5,000 lbs. (2,268 kg.)*
Rapid Traverse Rate	315 I.P.M. (8 M.P.M.)
Feed rates	0 to .12” per rev. (0 to 3mm per rev.)
Feed motor, ball screw pulley ratio	1 to 1
Ball screw pitch	.250”/rev.
Spindle motor – spindle pulley ratio	Variable: 1:1 – 3:1
Depth control (linear position)	0.0002” (0.005mm) Closed loop CNC, pre-loaded, ground ball screw
Spindle noses	Integral collets—ER25 thru ER40 ASA Standard—1.062” thru 1.875” I.D. bore ABS 40 thru ABS 63 HSK 40 thru HSK 63 Tang or keyed drive for multiple spindle heads
Spindle speed	6,000 RPM max.
Spindle torque	1,300 in. lbs. (147 N-m)
Approx. weight with motors	600 lbs. (272 kg.)
* Thrust capacity with multi-spindle drill head	

Multi-spindle 10 HP
MQ140 Station



Setup Instructions

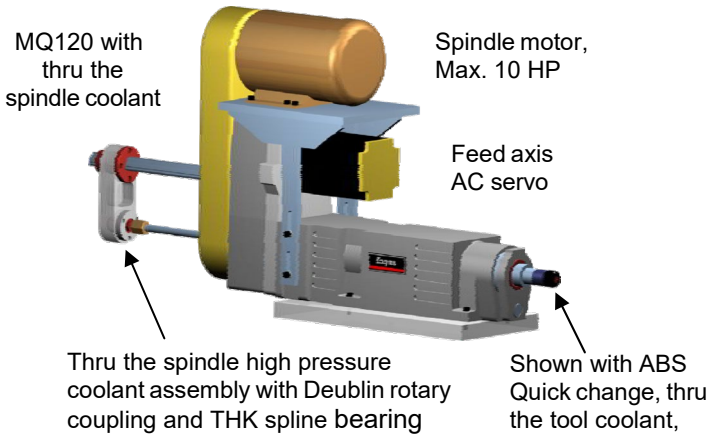
Mechanical - Unpacking and installation

The MQ-60, 120, or 140 units have 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 LLC immediately.
- Make certain when lifting the unit from the shipping container, that a proper lifting device is used and that it is attached securely to the unit.

*** 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.**

- Mounting and datum holes are part of the units housing. Four mounting holes are provided for .375" socket head screws. Two datum holes are provided for .3750" dia. dowel pins.
- Secure and align the unit to the mounting surface using the four holes and dowel pin positions.
- 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 Inc, it will be necessary to bolt each motor to the corresponding motor mount or mounting plate and secure the included pulleys which may or may not have bushings. Next, properly tension the belts for proper operation. Belts must be secure without free slack but cannot be over tight 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 LLC assumes no responsibility for operation, control or programming of the units when a control other than a Zagar LLC 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. Incoming power requirements are noted on panel drawings (230 or 460v, 3ph, 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 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 three switch, quick-disconnect harness 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 over travel, reverse over travel, 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, over travel). 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 over travel and is detecting the quill at all times when NOT in over travel. It is a normally open (N.O.) sensor, held closed. When the unit (quill) over travels forward, the quill **leaves** the path of this sensor and a forward over travel condition results.
- The rear most sensor is the rear over travel. It is a normally closed (N.C.) type sensor. When the unit over travels in the rear direction the quill **enters** the path of this sensor and a rear over travel results.
- The home sensor operates similar to the rear over travel 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 4 . Two user outputs are provided via +24 volt DC signal (see electrical prints). OUTPUT 3 is for cycle complete and OUTPUT 2 is for faults. 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 LLC provides custom programming services to accommodate this or if the customer chooses to do this modification, the software must be installed. **Disclaimer: Zagar LLC 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 LLC** Service support is available for wiring and program modification at Zagar LLC or on-site at customer's 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 unit 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 attempt to operate the unit beyond the specified stroke ranges (MQ60 – 6", MQ 120 – 12", MQ140 – 14") from the home proximity sensor.
- The proximity sensors are set at the factory and should not need any adjustment. The sensor should be approximately 1mm away from the trip screw. It has a maximum sensing distance of 2mm.

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 LLC, 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.

Lubrication Instructions

The MQ unit bearings are lubricated with synthetic lubricant. Kluber Isoflex NBU-15 is used on all rolling bearings (ball bearings and ball screw). Kluber paste 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.

Inspection and Re-lubrication Guidelines Chart

Component	Check every	Re-lubricate 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

Re-lubrication Instructions

A. Preparation of parts:

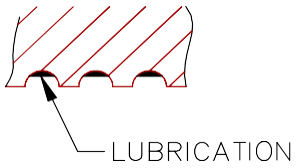
- Use disassembly instructions below to gain access to parts for lubrication.
- All oil and grease must be completely removed from all components before applying lubricants.
- All components must be clean and dry.
- Do not use kerosene or any petroleum based cleaning fluids.
- Use a synthetic based cleaner

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).



C. Run-in Procedure (bearings only):

The quill, ball screw and spline shaft do not need a run in period after re-lubrication 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

Consult the Service Department at Zagar before attempting any repairs. Disassembly of the unit without authorized approval may result in voiding of the Warranty.

Removing Front Spindle

Remove (2) 5/16-18 screws from dog rail #749-2913. Then remove rail and spacer from flange #749-1728. Loosen (2) 3/8-16 set screws that hold torque bar #749-7815 to flange. Remove (6) 1/4-20 screws that hold flange to quill. Remove flange from quill and torque bar. Spindle can now be removed from quill complete with bearings.

Removing rear drive shaft

Remove (4) screws holding outside half of belt guard #749-2907. Then remove guard. Loosen (4) 1/2-13 screws supporting motor mounting plate and (4) 3/16 screws holding motor mounting plate. This will remove tension from drive belt. Remove (3) 1/4-20 screws holding bearing retainer #749-1706. Then remove retainer drive shaft #749-2905 can now be removed complete with bearing #10-0353-4080-8.

Removing Servo Motor(may vary depending on motor mounting configuration)

Remove tension on Servo Motor by loosening (4) 1/2-13 motor mounting screws and (1) 1/2-13 jack screw. Remove timing belt, remove (4) motor mounting screws then remove motor with sheave.

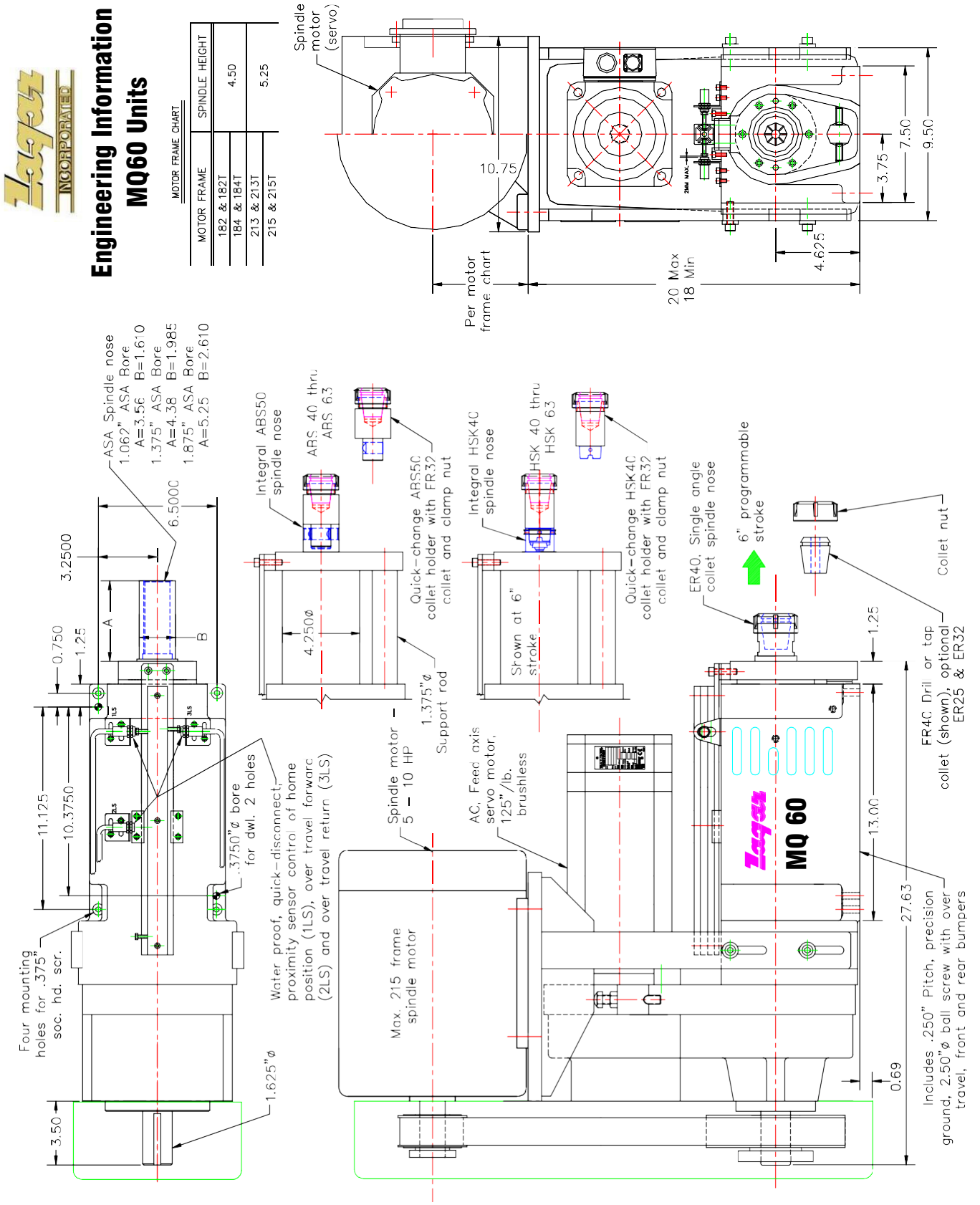
Quill and ball screw

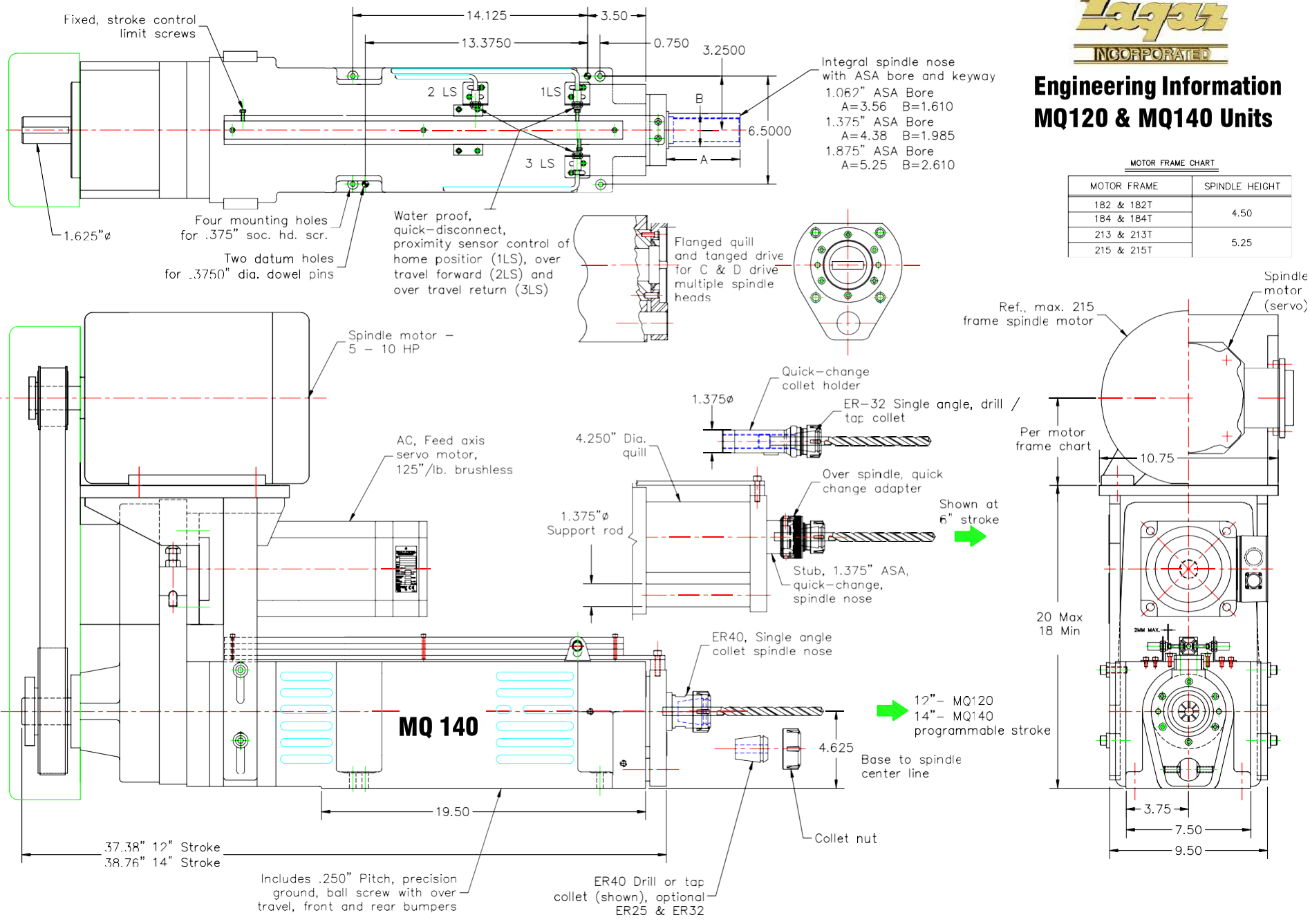
- Front spindle, rear spindle and Servo motor must be removed first.
- Remove (4) screws holding inside half of belt guard then remove guard. Remove (8) 3/8-16 screws from belt housing #749-1727 then remove housing.
- Remove following parts from ball screw shaft - Bearing #10-0552-1100-8, Locknut 10-724, Sheave #749-2908, Key and Seal Spacer #749-2909.

  NOTE: Motor plate should be free of jack screws. Remove (5) 1/2-13 screws that hold cover plate #749-1726 to body.
- Next, by rotating ball screw shaft move front face of quill (3) to (4) inches in front of body. Now ball screw, quill and cover can be pulled from body exposing part 749-1734. Remove (4) 1/4-20 screws from retainer 749-1734, remove cover 749-1726. Loosen 5/16-18 set screw in bumper then remove bumper exposing ball screw nut.

  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 ballscrew nut from quill.

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


Engineering Information
MQ60 Units
MOTOR FRAME CHART
MOTOR FRAME
SPINDLE HEIGHT
182 & 182T
184 & 184T
213 & 213T
215 & 215T
4.50
5.25
Spindle motor (servo)
10.75
Per motor frame chart
20 Max
18 Min
4.625
3.75
7.50
9.50
ASA Spindle nose
1.062" ASA Bore A=3.56 B=1.610
1.375" ASA Bore A=4.38 B=1.985
1.875" ASA Bore A=5.25 B=2.610
6.5000
3.2500
0.750
1.25
A
B
11.125
10.3750
3.50
Four mounting holes for .375" soc. hd. scr.
1.625"ø
.3750"ø bore for dwl. 2 holes
Water proof, quick-disconnect, proximity sensor control of home position (1LS), over travel forward (2LS) and over travel return (3LS)
Integral ABS50 spindle nose
ARS 40 thru ARS 63
Quick-change ABS50 collet holder with FR32 collet and clamp nut
4.250ø
1.375"ø Support rod
Integral HSK40 spindle nose
HSK 40 thru HSK 63
Quick-change HSK40 collet holder with FR32 collet and clamp nut
Shown at 6" stroke
6" programmable stroke
ER40, Single angle collet spindle nose
Collet nut
1.25
FR40 Dril or tap collet (shown), optional ER25 & ER32
Spindle motor 5 - 10 HP
AC, Feed axis servo motor, 125"/lb. brushless
Max. 215 frame spindle motor
MQ 60
13.00
27.63
0.69
Includes .250" Pitch, precision ground, 2.50"ø ball screw with over travel, front and rear bumpers



Lagar INCORPORATED

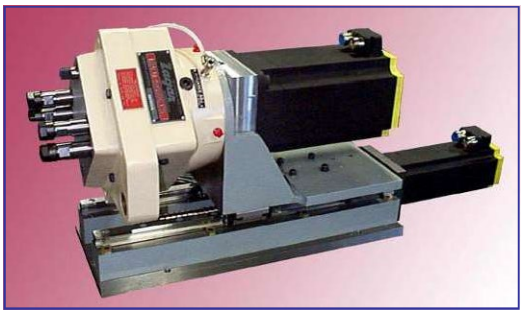
Engineering Information
MQ120 & MQ140 Units

MOTOR FRAME CHART

MOTOR FRAME	SPINDLE HEIGHT
182 & 182T	4.50
184 & 184T	
213 & 213T	5.25
215 & 215T	

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



Motorized, multi-spindle2 axis, CNC slide station
(click on photo for video)

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

Multi-part, auto. collet
fixtures on manifold pallet

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

Standard & Special Machines
Turn-key Special Machines
Rotary & linear transfer systems
Automatic Material Handling
CNC Control Integration

Standard 10 HP Drill / tap
MQ60-140 CNC Production
Machine with quick-change
multi-head

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