



HP 7A
PROGRAMABLE CYLINDER HONING MACHINE

MACHINE SERIAL NUMBER

OPERATIONS AND MAINTENANCE
MANUAL



MANUFACTURED BY:

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ORDERING PROCEDURE

Contact your regional Rottler sales rep for assistance in ordering optional equipment, replacement parts, or tooling.

If you are unable to contact your regional Rottler sales rep, call the factory at 253-872-7050 and ask to speak to the parts sales specialist.

Have the following information handy to expedite the ordering process:

1. Your name, business name, and contact number
2. Customer number
3. If you don't have a customer number, your billing address
4. Shipping address if different from billing address
5. Machine model and serial number
6. Part number and description of what you want to order
7. Preferred method of shipment
8. You may also contact us via e-mail with the above information. Send e-mail requests to:
parts@rottlermfg.com

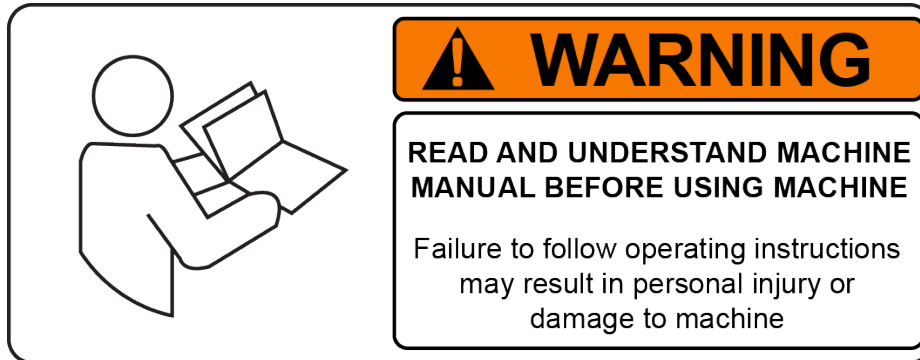
In some cases you may be requested to send a photo of the part you are ordering if it is a replacement part, or doesn't appear in the database.

If you are unsure which part you need to order, contact our service department and ask to speak to one of our service consultants. They will assist you in determining which part you require.

THERE IS A MINIMUM ORDER OF \$25.00

INTRODUCTION

READ THE SAFETY CHAPTER BEFORE INSTALLING MACHINE. THOROUGHLY UNDERSTAND ALL SAFETY ISSUES BEFORE OPERATING MACHINE.



ATTENTION OWNER/BUSINESS MANAGER

To validate the warranty on your new Rottler machine, please be sure to sign and complete the “Installation Report” located in the Installation Chapter of this manual.

We suggest that the new user of the HP7A read the CONTROL DEFINITIONS to get an idea how the machine operates.

The Operating Instructions chapter should be read in order to familiarize the user with the actual button pushing sequences required to carry out a job. These chapters in the manual should be considered an introduction. As the operators of the HP7A series machines gain experience with using the different functions of the machine, complicated setups and programs will make more sense.

The rest of the manual contains information and part number reference on fixtures, cutting tools, and machine maintenance. The operator should read and become familiar with these areas as well.

Description

The model HP7A Honing Machine is a wet, complete cylinder block and general purpose-honing machine. A totally enclosed AC motor driving a belt and gear reduction drive mounted within a rocker arm arrangement supplies Hone rotating power. The honing head is driven through a universal joint.

An air cylinder with a hydraulic check system provides stroking power. Stroking may also be manually operated.

A Windows based touch screen panel provides easy and convenient control of the HP7A. Block programs can be created and stored to memory for later recall, providing a quick set up for honing common blocks. All preferences such as dwell setting, cross hatch angle, and honing loads are automatically set up when a block program is selected at time of machine set-up.

The support carriage is mounted on linear rails to provide simple and easy hole-to-hole setup.

Convenient devices are provided to properly control honing operations and provide easy handling.

A 'V' fixture is provided, which efficiently holds V-6/V-8, and in-line blocks for honing. Optional clamps are available to clamp most any kind of in-line block or similar work piece.

Fixtures are available for doing large industrial engine sleeves.

A splash tank is located within the main frame and a coolant pump tank is located under the machine. A button is provided on the control panel to operate the coolant system.

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Limited Warranty

Rottler Manufacturing Company Model HP7A parts and equipment is warranted as to materials and workmanship. This limited warranty remains in effect for one year from the date of delivery, provided the machine is owned and operated by the original purchaser and is operated and maintained as per the instructions in the manual.

Tools proven to be defective within the warranty period will be repaired or replaced at the factory's option.

The products are warranted upon delivery to conform to their published specifications and to be free from defects in material and workmanship under normal use for a period of one year from shipment. Should a product not be as warranted, Rottler sole obligation shall be, at its option, to repair, correct or replace the product or to refund the amounts paid for the Product upon its return to a location designated by Rottler.

No warranty shall extend to rapid wear Products (including tooling) or to Products which have been subject to misuse (including any use contrary to Rottler instructions), neglect, accident (including during shipment), improper handling or installation, or subject to any modification, repair or service not certified by Rottler. Rottler shall not be liable for any consequential, direct or indirect damages or for any other injury or loss. Buyer waives any right, beyond the foregoing warranty, to make a claim against Rottler. No warranty is provided for any Products not paid in full.

Merchandise cannot be returned to Rottler without prior approval. Customer must contact the Order Department or representative to get approval and to be issued a Return Goods Authorization number (RGR#). Merchandise authorized for return must be returned prepaid. If merchandise is returned with shipping charges collect, the actual amount of these charges may be deducted from any credit which may be due the customer. The RGR # assigned by the Order Department should be written on the shipping label and must appear on a copy of the invoice(s) covering the original shipment. This invoice copy must be included in the box with the parts. Shipment must contain ONLY those items on the RGR as approved for return. Merchandise must be received within 10 days of the date of RGR or the RGR will be canceled. All returned merchandise may be subject to a 20% restocking fee on under \$1,000.00 amount or 10% on any items over \$1,000.00. Parts or tooling over 30 days old are considered as customer property and can only be returned with prior written approval from Rottler Corporation Management and/or Shipping Department.

The issuance of a RGR DOES NOT guarantee credit - it is only authorization for the return of the goods. Credit for return merchandise is at the sole discretion of Rottler. Credit will be issued only after inspection of returned goods.

Tools proven to be defective within the warranty period will be repaired or replaced at the factory's option. We accept no responsibility for defects caused by external damage, wear, abuse, or misuse, nor do we accept any obligation to provide compensation for direct or indirect costs in connection with cases covered by the warranty.

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INSTALLATION

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ATTENTION OWNER/BUSINESS MANAGER

To validate the warranty on your new Rottler machine, please be sure to sign the installation report after the installation technician has installed the machine and verified the machine is operating correctly and given the operators operation and maintenance training.

Thank you for your cooperation and the opportunity to be of service to you.

ROTTLER MANUFACTURING

Route to: Service Mgr → Andy → Machine Packet File
 HP7A Installation Report Rev 08202015

ROTTLER HP7A INSTALLATION REPORT

ROTTLER MANUFACTURING MUST HAVE THIS REPORT RETURNED TO PROPERLY QUALIFY WARRANTY ON EQUIPMENT

Customer: _____ Address: _____
 City: _____ State: _____ Zip: _____ Phone: _____
 Machine Model: _____ Serial Number: _____ Representative: _____

MACHINE INSTALLATION: Electrical information MUST be complete to validate this report.

Customer responsibility prior to the arrival of Rottler Sales/Service technician. Please Initial each item when it is completed.

CAUTION *VERY IMPORTANT:* Modern design machines contain electronic low voltage circuitry that provides great advantages and a better machine life. **BUT**, you must have an excellent, stable, isolated power supply along with an isolated ground. If not, electrical noise problems are likely to interfere with machine operation unexpectedly.

Customer is responsible for providing electricity to machine in a manner that meets the local electrical code requirements.

- _____ Remove machine from truck. Weight: 2,500 lbs.
- _____ Provide solid foundation for machine.
- _____ Remove fixturing and misc. from machine and clean.
- _____ Install machine on foundation with jack pads under jacking bolts.
- _____ Level machine. When level all leveling bolts should have equal pressure on them.
- _____ This machine requires between 208 and 240 Volts AC, Single Phase, 50/60 Hz, *isolated* power supply. Measure the incoming voltage between L1 and L2. Measure the incoming AC voltage at least twice during installation.
 L1 to L2 _____ VAC L1 to L2 _____ VAC
- _____ This machine should be externally breakered at 20 Amps, continuous draw.
- _____ Measure each leg of the incoming supply to ground.
 L1 to ground _____ VAC L2 to ground _____ VAC

CAUTION Neutral and machine ground are not the same thing. You should measure an open circuit between Neutral and ground.

CAUTION **IF VOLTAGE IS OUTSIDE THE CORRECT RANGE AT ANY TIME THE MACHINE WILL NOT OPERATE PROPERLY AND MAY BE DAMAGED.**

_____ Briefly describe the isolated ground connection to the machine you have made: (Instructions to make a correct isolated ground are included in the operating manual)

_____ Air of the proper pressure and capacity connected to the machine 5.7 cu. Ft./min at 100 PSI. Air supply must be free from oil and water. Oil or water will damage electrical and air components.



CAUTION

When applying air to the machine for the first time, the Rocker Arm may move up rapidly as air fills the stroking cylinder. Make sure all body parts are free of machine parts.

_____ Customer should attempt to have junk work piece available.

_____ Make sure coolant will be available for set up on wet machine.

_____ Have the operator read through the operation manual before training begins. This will help him be familiar with the button pushing sequences. Have the operator read through the manual again after training and some of the sequences will make more sense.

_____ The system is protected by fuses located on the circuit board in the rear enclosure. Show customer where they are located and confirm that spare fuses were shipped with machine.

_____ Clean any rust inhibitor from the machine surfaces. Slide the spindle base from side to side continually cleaning the machine base until all inhibitor is removed.

_____ Explain the coolant filtration system and necessity of maintenance to that system.

_____ Explain to the customer that the injection oiler is set to oil one (1) drop every 2 minutes of spindle operation. The timer is reset when the machine is turned off. The HP7A will not use oil in the reservoir very rapidly.

MACHINE START-UP

_____ **BEFORE** turning power on to the machine. Check all wires for security by using the correct screw driver and turning CW until movement stops. Stranded wire can “spread” slightly from vibration during transport.



CAUTION

When starting the machine for the first time, it may move out of control. Make sure all hands are clear of machine parts. Be ready to press the Emergency Stop button if needed.

_____ Turn Main power on at the power switch located on the rear enclosure.

_____ If any of the fuses blow, replace them, then call factory if further assistance is needed.

MACHINE MOVEMENTS

Remove hone head from machine for the following procedures.

_____ Make sure there is nothing obstruction the full travel of the rocker arm.

_____ Explain all movements of the machine.

INSTRUCTING THE OPERATOR:

- _____ Point out safety factors to customer and operator. Do not push any buttons without thinking safety first.
- _____ Explain and demonstrate the following controls and functions:
 - _____ START SCREEN PROGRAM SELECT BUTTON
 - _____ PROGRAM SELECT BUTTONS
 - _____ OPERATION SCREEN PROGRAM SELECT BUTTON
 - _____ MANUAL MODE BUTTON
 - _____ PLATEAU MODE 1 & PLATEAU MODE 2 BUTTONS
 - _____ FINISH MODE BUTTON
 - _____ ROUGH MODE BUTTON
 - _____ CYCLE START BUTTON
 - _____ COOLANT PUMP BUTTON
 - _____ MANUAL FEED BUTTON
 - _____ SHORT STROKE BUTTON
 - _____ BOTTOM DWELL BUTTON
 - _____ TOP DWELL BUTTON
 - _____ AUTO CROSS HATCH BUTTON
 - _____ + & - BUTTONS FOR ROUGH, FINISH, & STOP DELAY VALUE BOXES
 - _____ + & - BUTTONS ON LOAD GRAPH FOR ROUGH & FINISH LOAD
 - _____ 0 FEED BOX
 - _____ AUTO SHORT STROKE IN ROUGH AND FINISH MODE
 - _____ AUTO DWELL IN ROUGH AND FINISH MODE
 - _____ PLATEAU MODE OPERATION
 - _____ AUTO CROSS HATCH FUNCTION
 - _____ STROKING SPEED CONTROL
 - _____ E-STOP SWITCH
- _____ Explain Bleeding of the Hydraulic System.
- _____ Check manual operation of the Feed Wheel by rotating with your hand.
- _____ Demonstrate loading and roll over of V8 block.
- _____ Demonstrate in-line block clamp system.
- _____ Explain Optional block hold down arrangements.
- _____ Supervise the operator loading, cycling and unloading the block.
- _____ Develop the best block handling system you can for his shop.
- _____ Consider a block coolant drain area.
- _____ Examine several V8 blocks at the lower cylinder / bearing cap area and explain to the operator the necessity of setting the lower stop for maximum over stroke.
- _____ Explain the ABSOLUTE requirement for complete relief below the cylinder, which may include hand grinding.
- _____ Demonstrate removal and cleaning of cone in hone head.
- _____ Explain all stone options as well as hone head options.
- _____ Load a block into the cradle and thoroughly explain the lower stop setting method.
- _____ Set the upper limit cycle the hone in the cylinder, demonstrating the stroking speed control.
- _____ Demonstrate the proper use of the load meter and proper operator responses for both Rough and Finish modes.
- _____ Explain to the operator the methods for the fastest stock removal.
- _____ Explain the cause and cure of bad geometry and improper stone cutting.
- _____ Explain "breaking" the stones in.
- _____ Demonstrate proper stone dressing (refer to manual).
- _____ Explain the importance of maintaining the proper coolant mix.
- _____ Explain the importance of keeping the coolant clean.
- _____ Review the necessity of proper stone to coolant relationship.
- _____ Again review the operator manual, including all safety and emergency stop procedures.

MAINTENANCE SECTION

- _____ Review machine Lubrication per manual.
- _____ Demonstrate emptying the water trap.
- _____ Review coolant changing.
- _____ Review filter and filter paper changing.
- _____ Review filling oil reservoir.
- _____ Demonstrate checking and adding oil to the upper gear box.
- _____ Show operator hydraulic reservoir and adding the proper hydraulic oil.
- _____ Show operator the location of the shear pin on the driven pulley inside the Rocker Arm. Locate spare Shear Pin that was sent with machine and advise operator of its location.

General remarks on machine performance, adjustments as received and any further organization or parts required to complete the set up:

Instructions given to: _____

Sales/Service Engineer: _____ Date _____

Shop Foreman/Superintendent or Owner: _____ Date _____

Installation Procedure

Location

The productivity of this machine will depend to a great extent on its proper initial installation, particularly the means by which cylinder blocks are lifted into the machine as well as the material handling to and from other operations in your shop.

The proper loading arrangement and location for your HP7A machine is extremely important.

A slow travel (6' to 10' per min.) power hoist, operated from either a bridge crane or a jib crane arrangement works very well. A 1000-lb. hoist is generally adequate for lifting the engine block. An air hoist with speed control makes an ideal method for fast, convenient loading.

If some production honing with this machine is anticipated, and the cylinder blocks are not directly loaded and unloaded from a conveyor, we would recommend considerable attention be given to the crane so that it covers an adequate area to allow the operator to back up and remove cylinder blocks without cluttering up his own area. If two machines are to be operated by one operator, we recommend that the open faces be placed at right angles to each other, with the machines approximately three feet apart.

Unpacking

Carefully uncrate the HP7A Machine. Remove all equipment in splash tank except the 'V' fixture frame.

Completely clean these articles with solvent, also clean the lower travel limit stop rod, Rust inhibitor is applied to the machine at the time of shipment and must be removed before operating the machine.

Leveling

Four cap screws and jam nuts are provided with the machine for leveling. Insert the screws from the bottom of the base. Place the jam nuts on top of the threaded hole in the base.

Using a precision level, level the upper table within .002" per foot in both directions (Except favor the high setting to the front for best coolant return).

Air Supply

The HP7A machine requires 5.7 cubic feet/minute at 100 PSI compressed air (a minimum 1 HP air compressor output).

Attach air supply to the filter regulator on the rear right side of the splash tank. Push and hold the float clamp button located on the front of the carriage. While holding the push button adjust the air regulator to 100 PSI (Push regulator knob down to set, pull up to lock).

Note: To assure a long service life for your HP7A machine the air supply must be moisture free. If there is any doubts about the air supply install a water trap.

Coolant

Refer to the Coolant section in Chapter 5 of this manual for proper coolant types and mixes.

Power Supply



Disconnect all power before servicing this machine. Failure to do so could result in electrical shock.

This machine has the following power requirements:

208 to 240 VAC
Single Phase
50 or 60 Hertz
20 amps

(See wiring diagram for the HP7A Hone).

See illustration below for correct connection of “measured” incoming power. Connect single phase wiring to the main rear enclosure, located on the right rear of machine base. The connection point for power is located inside the enclosure. The connection termination point is located on the left hand side of the electrical panel about half way up. Connect L1 to the number 2 terminal on the power switch, L2 (neutral) to the number 4 terminal on the power switch. Attach wire from the grounding rod to the third terminal on the terminal block.

Important: *Electrically connect in accordance with national and local electrical codes.*



Note: *This machine requires the use of an electrical disconnect switch.*

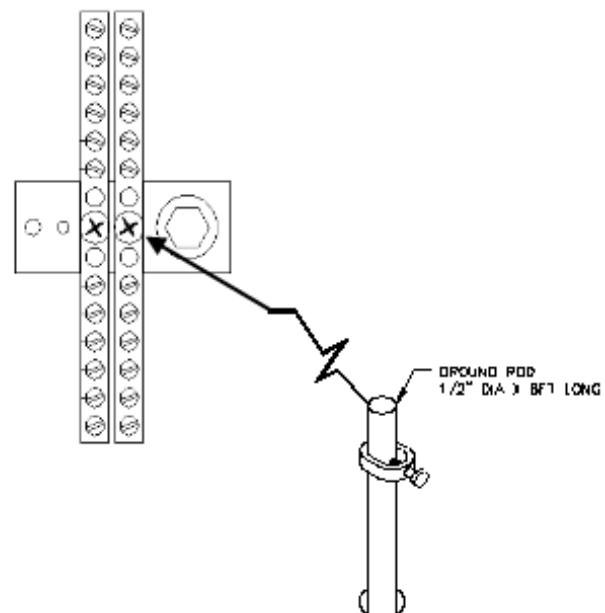


This machine cannot be run on 440 volts. A transformer must be installed if 440 volts must be used.

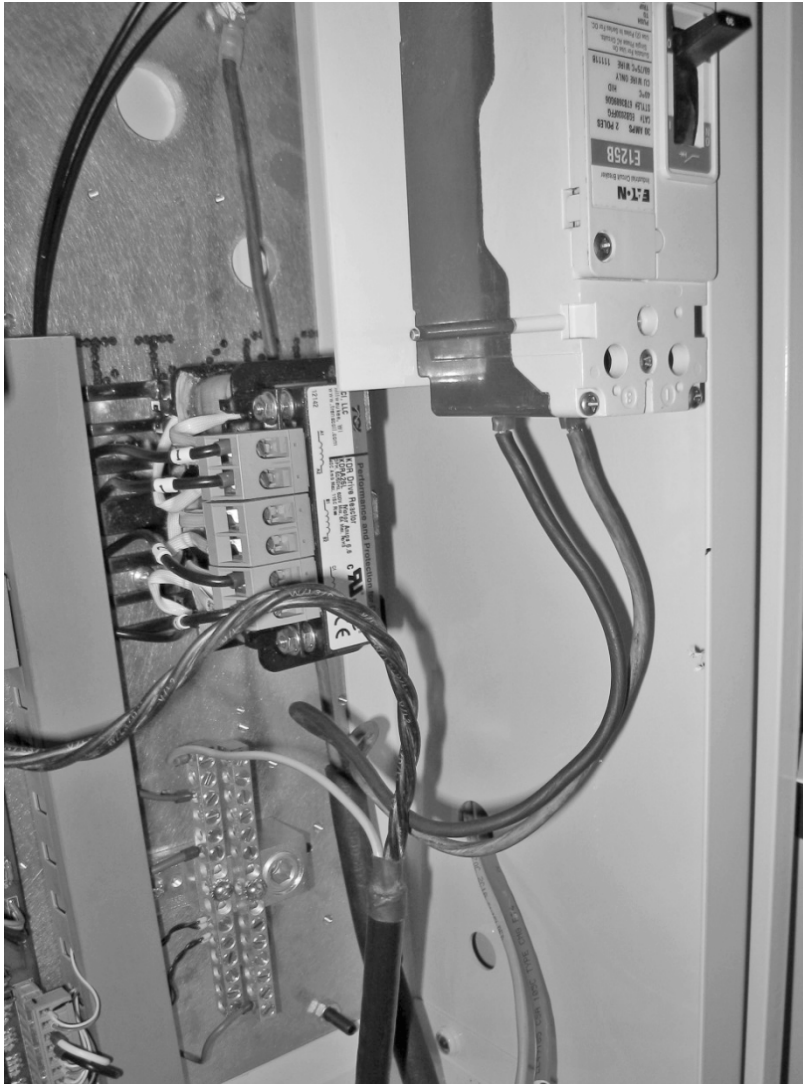
Grounding



This machine must be connected to a good earth ground rod. A 6 foot, 1/2” diameter, 15 OHM, Copper grounding rod driven into the earth next to the machines is preferred. Not providing a grounding rod could void factory warranty.



Single Phase Electrical Hook-Up



L1 and L2 power lines are attached to the power switch. Power supply ground wire goes to ground block. See electrical diagram for more detail.

CAUTION

Wire in accordance with local and national codes.

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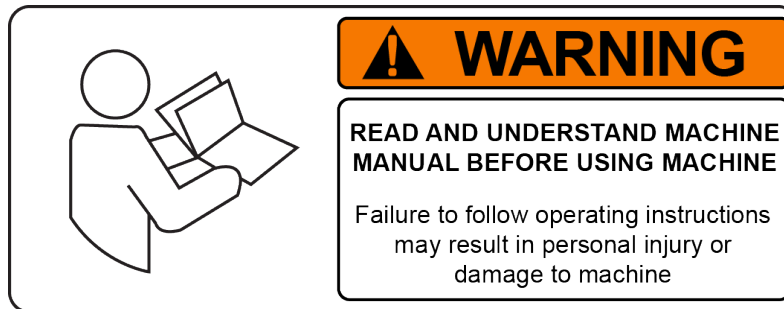
SAFETY

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Safety Information

For Your Own Safety Read This Instruction Manual Before Operating This Machine.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Safety Instructions for Machine Use



This machine is capable of causing severe bodily injury

ONLY A QUALIFIED, EXPERIENCED OPERATOR SHOULD OPERATE THIS MACHINE. NEVER ALLOW UNSUPERVISED OR UNTRAINED PERSONNEL TO OPERATE THE MACHINE. Make sure any instructions you give in regards to machine operation are approved, correct, safe, and clearly understood. Untrained personnel present a hazard to themselves and the machine. Improper operation will void the warranty.

KEEP GUARDS IN PLACE and in proper working order. If equipped with doors, they must be in the closed position when the machine is in operation.



KEEP WORK AREA CLEAN. Cluttered areas and benches invite accidents.



KEEP WORK AREA CLEAN. Clean spilled coolant from floor to avoid slipping hazard.

KEEP CHILDREN AND VISITORS AWAY. All children and visitors should be kept a safe distance from work area.

WEAR THE PROPER APPAREL. **DO NOT** wear loose clothing, gloves, rings, bracelets, or other jewelry which may get caught in moving parts. Non-Slip foot wear is recommended. Wear protective hair covering to contain long hair.



ALWAYS USE SAFETY GLASSES Everyday eye glasses only have impact resistant lenses, they are NOT safety glasses.

DO NOT OVER-REACH. Keep proper footing and balance at all times.

USE THE RECOMMENDED ACCESSORIES. Consult the manual for recommended accessories. The use of improper accessories may cause risk of injury.

CHECK DAMAGED PARTS. Before further use of the machine, a guard or other part that is damaged should be checked to determine that it will operate properly and perform its intended function. Check for alignment of moving parts, breakage of parts, mounting, and other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.

NEVER OPERATE A MACHINE WHEN TIRED, OR UNDER THE INFLUENCE OF DRUGS OR ALCOHOL. Full mental alertness is required at all times when running a machine.

NEVER ALLOW UNSUPERVISED OR UNTRAINED PERSONNEL TO OPERATE THE MACHINE. Make sure any instructions you give in regards to machine operation are approved, correct, safe, and clearly understood.

IF AT ANY TIME YOU ARE EXPERIENCING DIFFICULTIES performing the intended operation, stop using the machine! Then contact our service department or ask a qualified expert how the operation should be performed.



No list of safety guidelines can be complete. Every shop environment is different. Always consider safety first, as it applies to your individual working conditions. Use this and other machinery with caution and respect. Failure to follow guidelines could result in serious personal injury, damage to equipment or poor work results.

Electrical Power



All electrical power should be removed from the machine before opening the rear electrical enclosure. It is recommended that the machine have a electrical LOCK-OUT device installed.

Make sure all electrical equipment has the proper electrical overload protection.

In the event of an electrical short, grounding reduces the risk of electric shock by providing a path of least resistance to disperse electric current.



Electrocution or a fire can result if the machine is not grounded correctly. Make sure the ground is connected in accordance with this manual. DO NOT operate the machine if it is not grounded.

⚠ CAUTION ***No single list of electrical guidelines can be comprehensive for all shop environments. Operating this machinery may require additional electrical upgrades specific to your shop environment. It is your responsibility to make sure your electrical system comply with all local codes and ordinances.***

Machine Operator

Operator of this HP7A Honing machine should be a skilled machinist craftsman: that is well versed in the caution, care, and knowledge required to safely operating a metal cutting tool.

If the operator is not a skilled machinist, the operator must pay strict attention to the operating procedure outlined in this manual, and must get instruction from a qualified machinist in both the productive and safe operation of this HP7A Honing Machine.

Rottler HP7A Honing equipment has the following areas of exposed moving parts that you must train yourself to respect and stay away from when they are in motion:

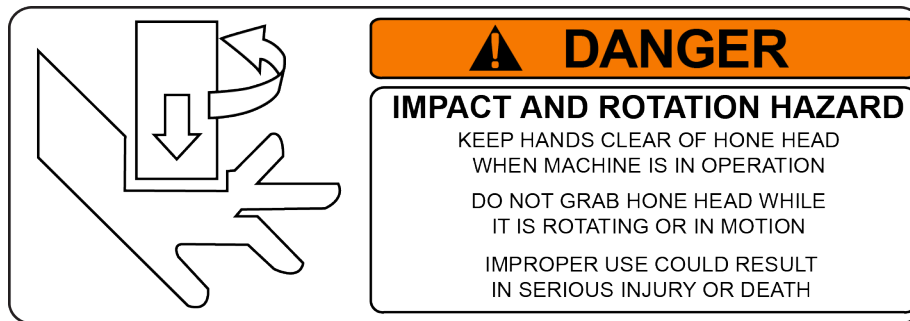


Safety glasses are recommended while machine is running.



Work Clamping - Be sure work is clamped securely in accordance with the instructions.

Hone Head Area - Keep hands completely away from the rotating honing head at ALL times.



Honing - Do not engage rotation power when hone is out of a cylinder.



Operator Controls - Familiarize yourself with the exact location of the e-stop button so you can immediately react to an emergency.

**⚠ DANGER**

Keep clear of spindle when working in tank area. Spindle can drop if there is a failure in the machine. Move spindle out of work area when changing blocks or fixtures.

IMPORTANT***Remember***

Machine tools have the speed and torque to severely injure any part of the human body exposed to them.

Emergency Procedure

Assuming one of the following has occurred: tool bit set completely off size, work piece or spindle base not clamped, spindle is not properly centered, and these mistakes will become obvious the minute the cut starts

PRESS THE EMERGENCY STOP BUTTON (on the front control panel) ***IMMEDIATELY!***

Find out what the problem is; return the spindle to its up position without causing more damage. To restart the machine, turn the Emergency Stop Button CW until the button pops out

Be alert to quickly stop the machine in the event of a serious disruption of the boring process either at the top or bottom of the bores.

CONTROL DEFINITIONS

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CONTROL DEFINITIONS

The purpose of this chapter is to define the function of the buttons throughout the various screens. Certain button functions may not make sense right away in this chapter. As the operator reads through the Operating Instructions chapter of this manual, the function of these buttons will become clear.

The Rottler HP7A is controlled by using a touch screen display that is based on the Windows CE operating system. All functions with the exception of stroke speed are controlled from the touch screen.

⚠ WARNING Downloading any program or changing any Rottler or Computer settings may cause the machine and/or software to become unstable. DO NOT install ANY screen saver, Anti-Virus, Spyware or any type of Security software on the computer. This could create a hazardous environment for the operator and personnel around the machine. Performing any of the above will also result in the machine warranty being NULL and VOID.

⚠ WARNING DO NOT connect any type of external hardware to the computer via USB or any other means. Do not install any type of Device Driver. This could create a hazardous environment for the operator and personnel around the machine. Performing any of the above will also result in the machine warranty being NULL and VOID.

MASTER POWER ON/OFF SWITCH

This switch is located on the main electrical control enclosure located on the back of the machine. The switch must be in the off position before removing the rear enclosure cover.

E-STOP

This switch is used in the event of any emergency situation that requires the machine to be quickly shut down. Push on the button to activate it. Twist it to release it and return machine to normal.



START SCREEN

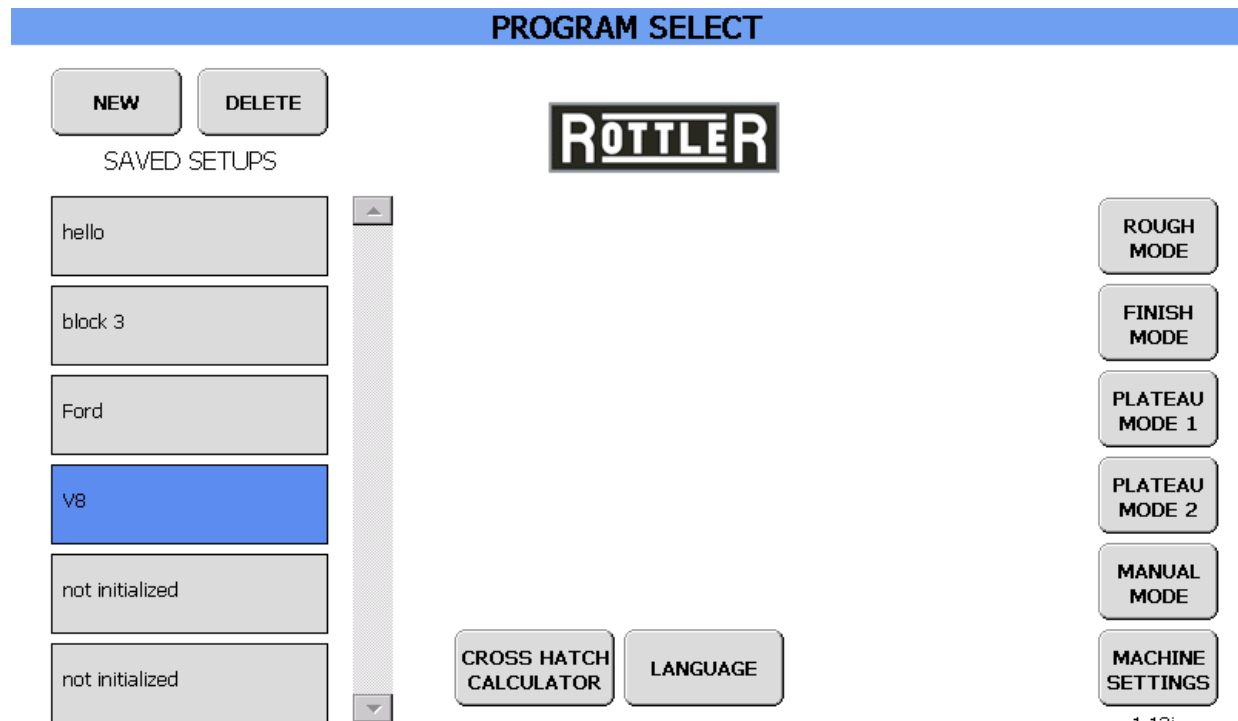
When the HP7A is powered up the screen below will appear after the boot process is completed.



PROGRAM SELECT BUTTON

Touch the PROGRAM SELECT button and the following screen will appear.

PROGRAM SCREEN



1.13i

In the upper left corner of the screen are the NEW and DELETE buttons.

NEW BUTTON

NEW button is used to create a new block program.

DELETE BUTTON

DELETE button is used to delete an existing block program.

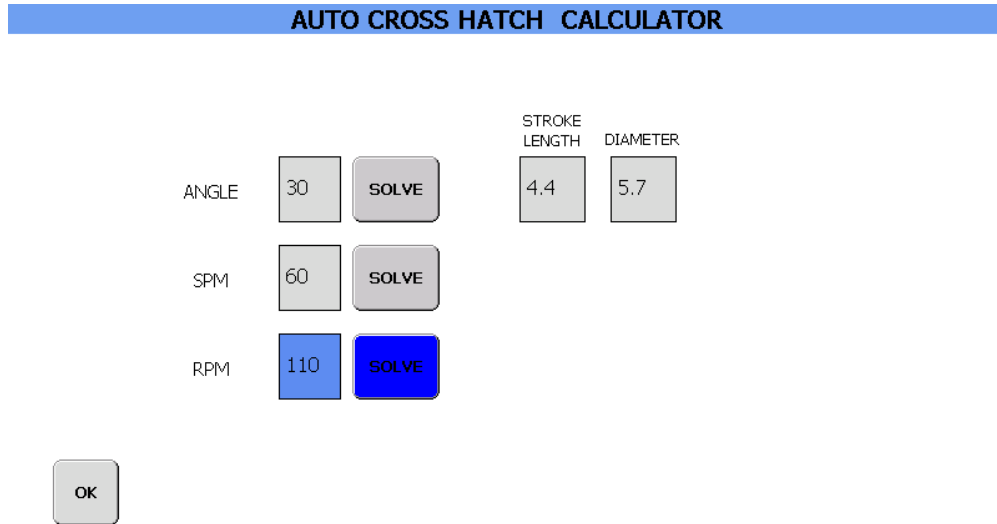
SAVED SETUPS

Below the SAVED SETUPS title are saved block programs. Touching one of the saved block program boxes will load the settings of that program for use in honing and bring up the Operation screen. The scroll bar next to the saved block program boxes is used to quickly scroll through a large number of saved programs.

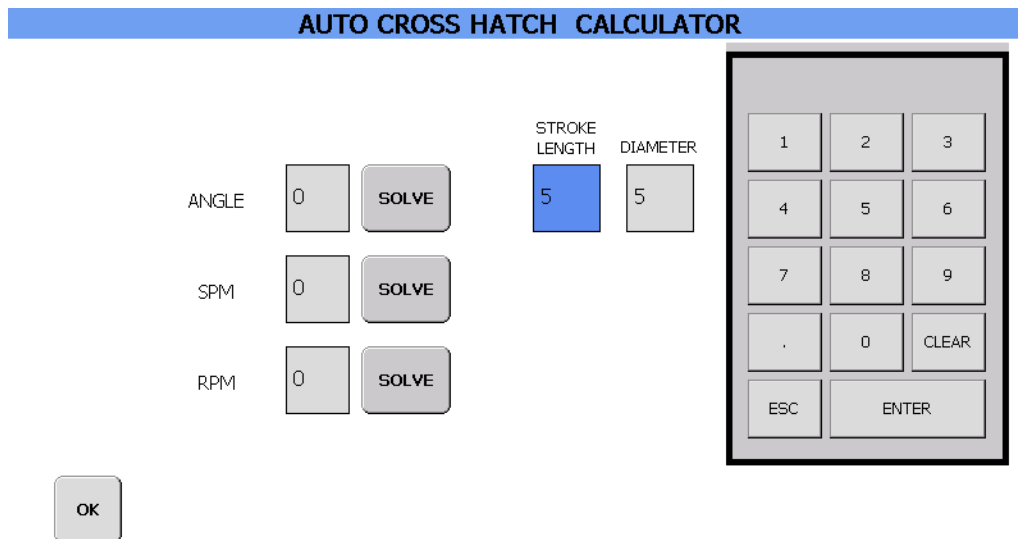
CROSS HATCH CALCULATOR BUTTON

The CROSS HATCH CALCULATOR button will bring up the AUTO CROSS HATCH CALCULATOR screen.

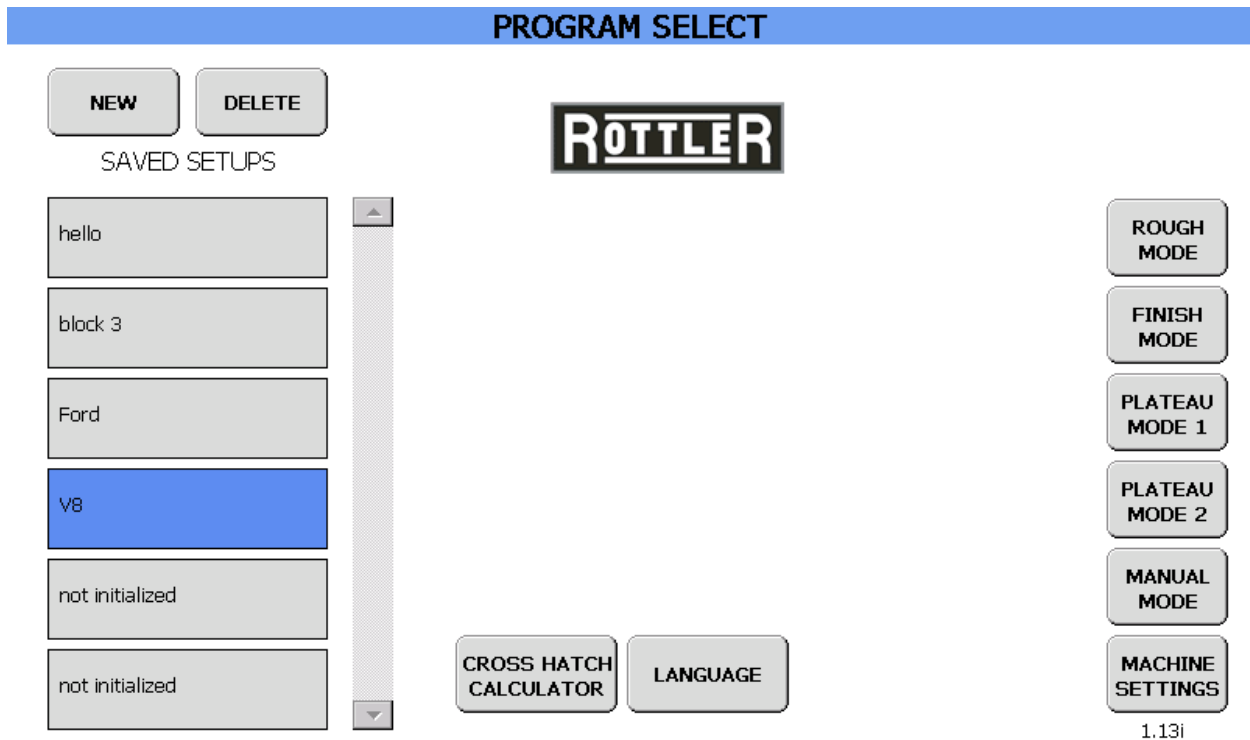
AUTO CROSS HATCH CALCULATOR SCREEN



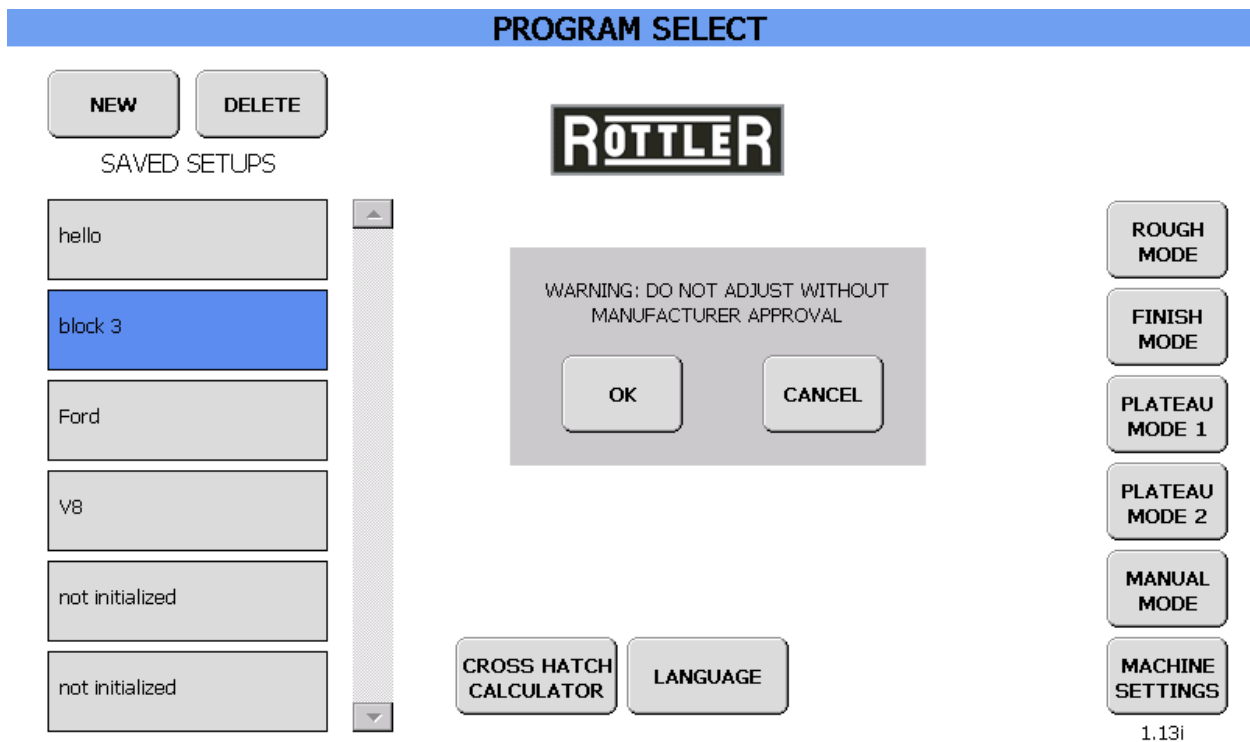
On this screen you can calculate the stroke speed and RPM needed to achieve a desired cross hatch angle. By touching one of the value boxes you can input a value used in the calculation by using the pop up keypad.



Enter the STROKE LENGTH, DIAMETER, ANGLE, and one other value, then press the SOLVE button next to the remaining blank value, and the required value will be displayed. Touch the OK button to return to the PROGRAM SELECT screen.



On the right side of the PROGRAM SELECT screen are the MODE buttons and the MACHINE SETTINGS button. The MODE buttons will be defined later in this section. Touching the MACHINE SETTINGS button will bring up a WARNING box. Touch the OK button to continue on to the MACHINE SETTINGS screen.



MACHINE SETTINGS SCREEN

MACHINE SETTINGS																																									
ROUGH MODE DEFAULT				FINISH MODE DEFAULT				PLATEAU MODE 1 DEFAULT																																	
180	150	50	35	180	150	50	35	130	15	4																															
START RPM	FINISH RPM	START LOAD	FINISH LOAD	START RPM	FINISH RPM	START LOAD	FINISH LOAD	RPM	LOAD	STROKES																															
AUTO DWELL/SHORT STROKE				AUTO DWELL/SHORT STROKE				PLATEAU MODE 2 DEFAULT																																	
5	20	5	SHORT	5	15	5	DWELL	130	15	10																															
DEAD BAND %	ERROR %	DWELL		DEAD BAND %	ERROR %	DWELL		RPM	LOAD	STROKES																															
<table border="1"> <thead> <tr> <th colspan="5">MOTOR LOAD</th> <th colspan="3">CROSS HATCH DEFAULT</th> <th colspan="2">AUTO DWELL SHORT STROKE</th> </tr> </thead> <tbody> <tr> <td></td> <td>1.5</td><td>7.0</td><td>55</td><td>5</td><td>OFF</td> <td>20</td><td>5.0</td><td>5.0</td> <td>5</td><td>20</td> </tr> <tr> <td>PASSWORD</td><td>MIN AMPS</td><td>MAX AMPS</td><td>OILER TIMER</td><td>COOLANT TIMER</td><td>UPPER LS LOCKOUT</td> <td>ANGLE</td><td>Length (cm)</td><td>Diameter (cm)</td> <td>DEAD BAND %</td><td>ERROR %</td> </tr> </tbody> </table>										MOTOR LOAD					CROSS HATCH DEFAULT			AUTO DWELL SHORT STROKE			1.5	7.0	55	5	OFF	20	5.0	5.0	5	20	PASSWORD	MIN AMPS	MAX AMPS	OILER TIMER	COOLANT TIMER	UPPER LS LOCKOUT	ANGLE	Length (cm)	Diameter (cm)	DEAD BAND %	ERROR %
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OK		USING METRIC																																							

Here is where the different operation modes are set up. Touching one of value boxes in the different MODE sections will cause the keypad to pop up so that a value can be entered. In the 2 AUTO DWELL/SHORT STROKE sections the last box can be toggled between SHORT, DWELL, and OFF. The MOTOR LOAD section is locked out, and can't be changed without first entering a pass code to access the value boxes.

At the bottom of the screen is a button labeled USING STANDARD. Touching this button brings up the following pop up asking if you want to change to metric values.

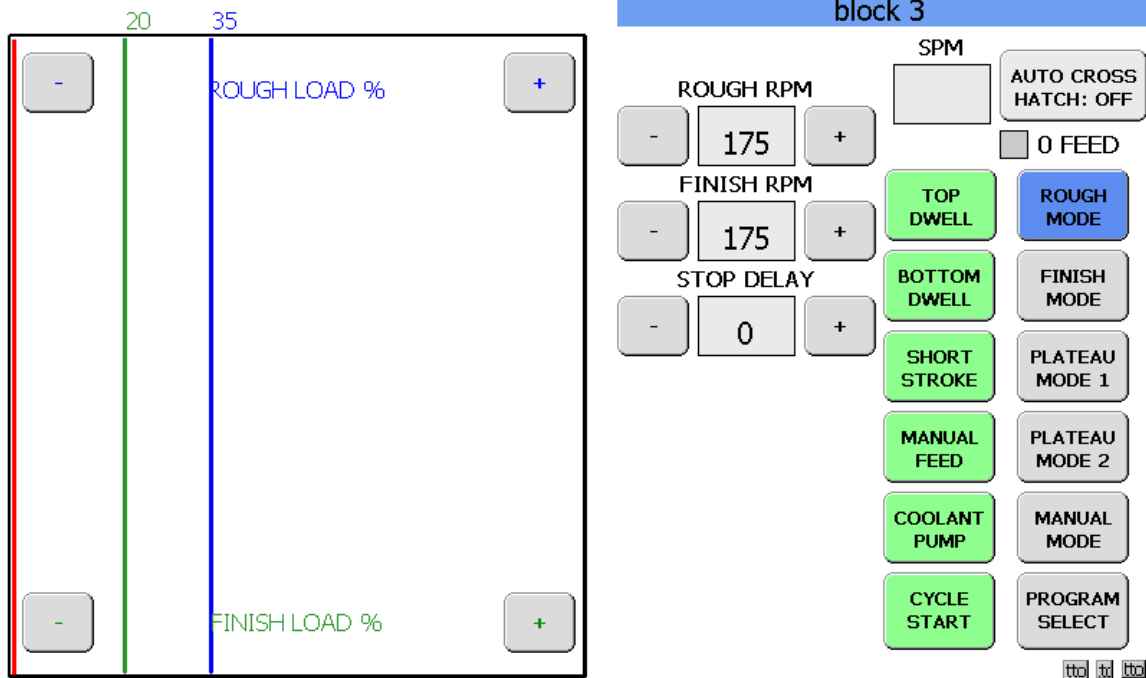
Are you sure you change
units to: Metric

SAVE	CANCEL SAVE
------	----------------

Touch SAVE to convert to metric values. The program will change to metric values and return to the MACHINE SETTINGS screen. Touch the OK button to return to the PROGRAM SELECT screen.

In the PROGRAM SELECT screen touch the selected block program button or one of the operation MODE buttons to bring up the standard operation screen.

OPERATION SCREEN



The right side of the screen contains the controls that will be used during the honing process. On the left side of the screen is the active graph that shows in real time the stock removal of the hone stones.

The SPM value box shows the stroke speed in real time. The AUTO CROSS HATCH: button turns the auto cross hatch function on or off. The 0 FEED box will turn red when the preset zero point is reached. The different MODE buttons will load the preset values into memory. The PROGRAM SELECT button will take you back to the PROGRAM SELECT screen.

CYCLE START BUTTON

The CYCLE START button will begin the auto cycle process allowing the machine to run through preset values of the current block program until the cycle is complete at which time the machine will automatically shut off. Touching the button while the machine is running will shut off the honing process. Touching to button again will resume the honing process.

COOLANT PUMP BUTTON

The COOLANT PUMP button will turn the coolant pump on or off at any time during the honing process.

MANUAL FEED BUTTON

The MANUAL FEED button will activate the feed actuator to feed the hone head out. This button is a momentary button and contact must be maintained until the action has occurred. The longer the button is held on the greater the number of feed outs that will occur.

SHORT STROKE BUTTON

Holding the SHORT STROKE button will cause the machine to short stroke at the bottom of the bore until the button is released.

BOTTOM DWELL BUTTON

Holding the BOTTOM DWELL button will cause the machine to dwell at the bottom of the bore until the button is released.

TOP DWELL BUTTON

Holding the TOP DWELL button will cause the machine to dwell at the top of the bore until the button is released.

ROUGH RPM BOX

ROUGH RPM section value box shows the preset rough RPM. The + and – buttons allow the operator increase or decrease the ROUGH RPM at any time, whether the machine is running or idle.

FINISH RPM BOX

FINISH RPM section value box shows the preset finish RPM. The + and – buttons allow the operator increase or decrease the FINISH RPM at any time, whether the machine is running or idle.

STOP DELAY BOX

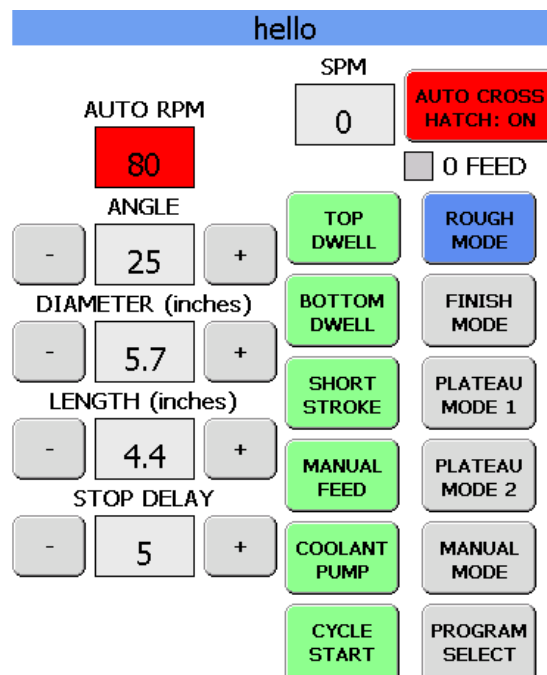
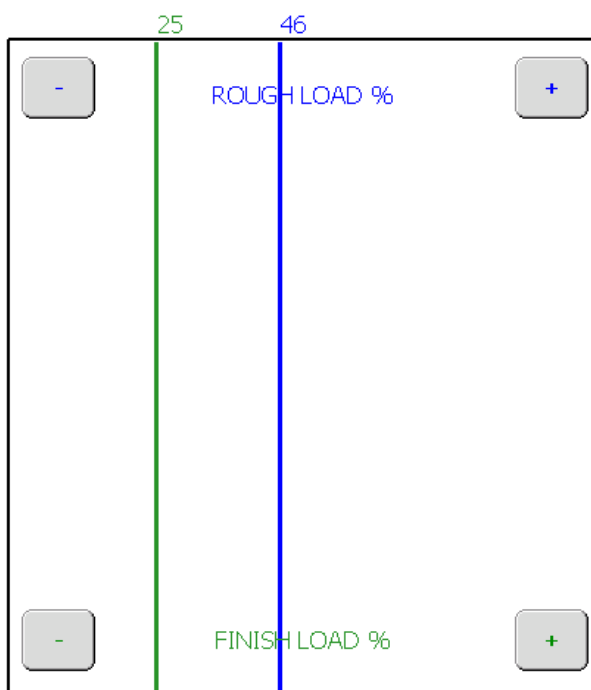
STOP DELAY allows the operator to adjust motor shut off timing. This is used when the standard shutoff delay is affected by incoming voltage variances

The left side of the screen will have the stock removal, stone load graph. The 2 vertical lines are the rough load setting and the finish load setting. Above them is the value that they represent. The upper section has the rough load + and – buttons. The bottom section has the finish load + and – buttons. These buttons can be used to increase or decrease the load setting at any time. When the load setting is changed the line and the value above it will also change.

AUTO CROSS HATCH BUTTON

When the AUTO CROSS HATCH button is ON and different center section will appear.

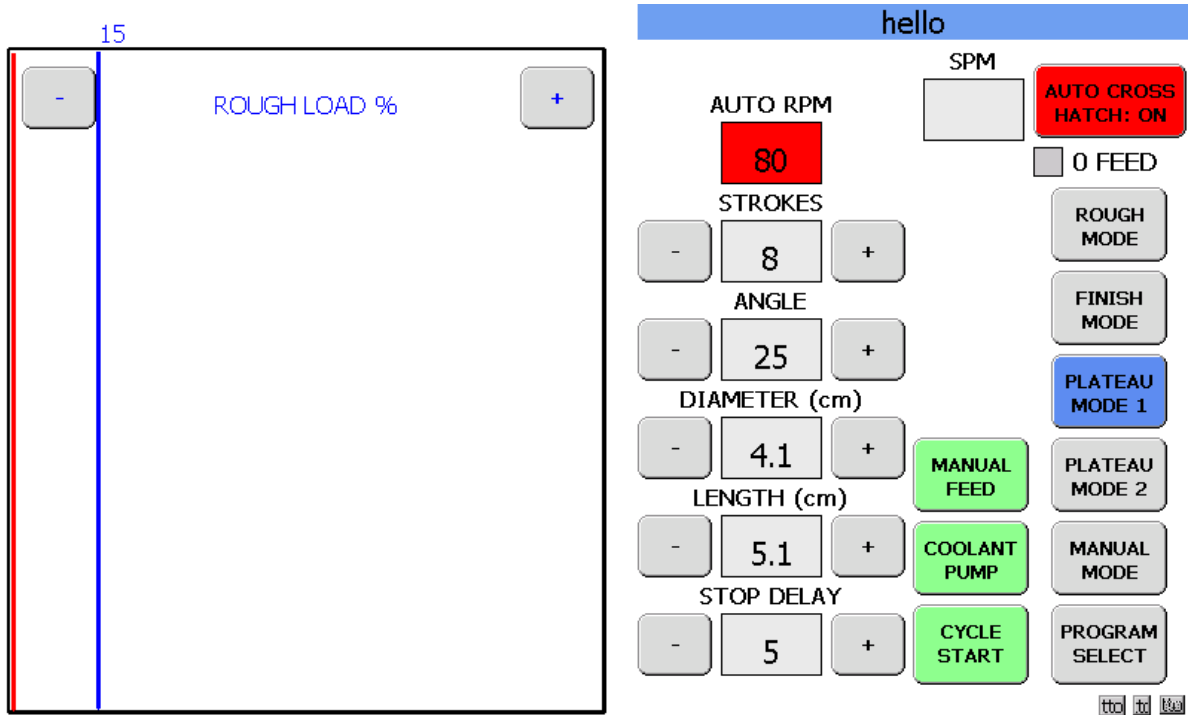
AUTO CROSS HATCH SCREEN



This will show the settings and the current RPM of the motor that is required to achieve the desired cross hatch angle. All the settings can be changed if desired at any time.

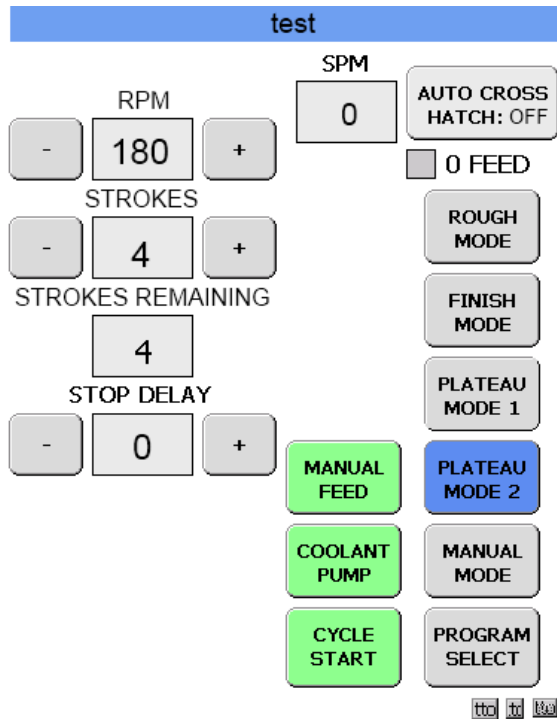
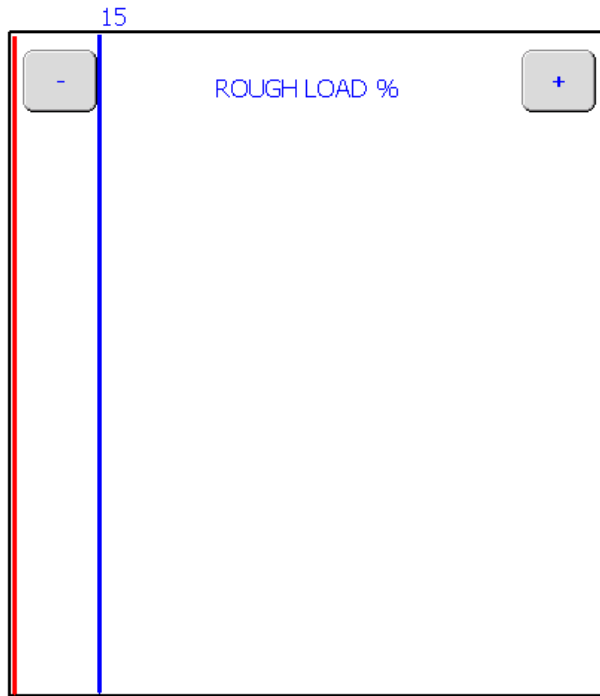
PLATEAU MODE BUTTONS

The PLATEAU MODE buttons will bring up a different center section and different graph section.



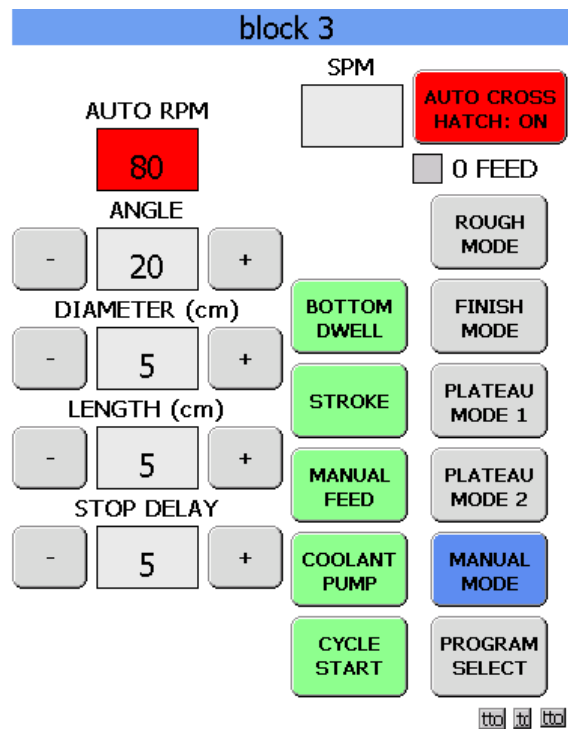
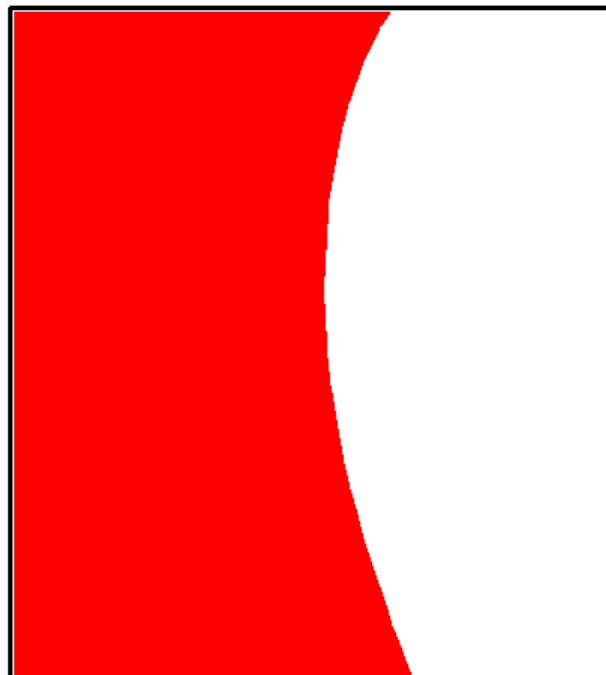
This screen has buttons for changing all the values. The graph section has the same layout as the honing section, except only with one load setting line and button set.

If the AUTO CROSS HATCH function is OFF then the following screen will appear when the PLATEAU MODE 1 or PLATEAU MODE 2 is touched. The RPM and number of STROKES can be set before the process is started.



MANUAL MODE BUTTON

If the MANUAL MODE button is touched the following screen will appear.



The manual operation mode has no preset values. It allows an operator to have total control of the honing process. The graph section will only show the real time motor load when the motor is running.

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Operating Instructions

Block Loading

The block hold down fixture can be used for inline, 'V', and 'Y' blocks.

Move the hone carriage to the far right of the main base.

Place block supports onto cradle with key engaged into slot. Place supports on edge for blocks with exposed main bearing caps (V-block). Place supports flat for blocks with main bearing caps recessed above the pan rail (Y-block).



Place clamp bar through main bearings of block.

Rotate clamp screws out of the way.

Lower the block into the fixture. Align the clamp bar with the front clamp bar guides on the cradle ends. Pull the block toward you after the bar engages the front guides. The clamp bar will rotate into its clamping position. Allow the clamp bar to slide down these guides as the block is lowered.

Rotate clamp screws forward and clamp the bar evenly.

Squeeze the index handle on the right side of the fixture to allow the fixture to rotate. Release the handle allowing the stop block to fall into the appropriate slot in the index plate. After honing the first bank of a V-block, simply squeeze the handle and rotate the fixture so the other bank is in position for honing.

Setting the Bottom and Upper Travel Limit

Check for possible interference points in the lower part of all cylinders. Push the side of the hone carriage and move the machine to the cylinder that has the highest interference point. The bottom stop should be set in this cylinder.

Measure the distance from the top of the cylinder to the bottom of the cylinder to obtain the cylinder length. The over stroke distance should be approximately 1/2". Less if there is interference. Add the cylinder length and over stroke length to obtain the bottom stop length.

Expand or contract the stone assembly to the approximate bore size. To expand: turn handwheel counter clockwise (looking from the top). To contract: pull and turn ratchet feed release, turn handwheel clockwise (looking from the top).

Push the upper lock button and use the handle to pull the stroking arm down and to touch the bottom of the stone to the top of the engine block. Lock the stroking arm in this position using by releasing the upper lock button.

Rotate the lower Adjustment Knob to the correct bottom stop length (cylinder length plus over stroke) using the bottom stop scale and the bottom of the pivot block.

Note: The stroke length gauge is not to scale and should be used for reference only.

Unlock the stroking arm and pull the stroking arm down against the bottom stop. **Make sure you pull hard enough to collapse the lower stop bumper.** At this position rotate the hone head one turn to make sure there are no obstructions. Adjust the bottom stop and re-check for obstructions if required. Bottom stop setting will not have to be changed in this block unless there is an obstruction in one of the other cylinders. **Be sure to tighten the thumbscrew on the Adjustment Knob.**



If the hone head crashes into a web or obstruction the pinion will twist or break. ***This condition is not covered by warranty.***

Raise hone head until stones extend about 1/2" out of the top of the block and release the upper lock button. This is the upper limit setting.

Automatic Cycle Operation

ROUGH MODE and FINISH MODE

When operating in ROUGH MODE and FINISH MODE, the machine will maintain a set motor load percentage until the desired amount of material has been removed from the bore. The Rough and Finish Load is set using the + and - buttons on the control screen and can be changed at anytime.

ROUGH LOAD

When the feed ring is on any number other than zero and the machine is in Automatic operation the control will automatically maintain the Rough Load value set in the control display.

FINISH LOAD

When zero is reached on the feed ring in Automatic Cycle operation, the machine will automatically switch to a preset Finish Load, and continue stroking until this value is reached. Once the Finish Load is activated by the feed ring, the value can be change while operating. The Finish Load value has a large effect on the finish cylinder accuracy. Thin wall cylinders generally require a lower finish load for accuracy than thick walled cylinders. The finish load is commonly set between 15% and 40% depending on the accuracy required.

CYCLE START

Use the handwheel to feed out the stones until they make contact with the cylinder wall. Press the Coolant button, be sure the coolant is flowing directly into the cylinder being honed. Press the CYCLE START button to start the motor turning and the rocker arm stroking. The hone will automatically feed out the stones until the ROUGH LOAD setting is reached. Now turn the feed ring for the desired stock removal and lock in place using the setting thumbscrew on the side of the feed ring.

The machine is now ready to begin an automatic cycle. Once the rough load is reached, the machine will automatically maintain that load until "0" is reached on the feed out wheel. When "0" is reached the machine will stop feeding out and the 0 FEED box will turn red. The Finish Load and continue to hone until the Finish Load is reached. When the Finish Load is reached the machine will stop at the top of the stroke.

MANUAL MODE

For some jobs you may wish to use the MANUAL MODE. In this mode the operator has control over all functions. The CYCLE START will only start the motor. The STROKE button is used to start and stop the stroke as needed.

Limited Over Travel and Blind Holes

A problem with stock removal with hone heads exists on many of today's blocks and cylinders. It may be necessary to relieve bores with a die grinder, portable grinder or boring bar.

Cross Hatch Angle

Desired Cross Hatch Angle can be achieved by activating the AUTO CROSS HATCH button. You have to input the angle desired, the bore size, and the bore length. This can be done while the hone is operating or can be set by accessing the MACHINE SETTINGS screen. There is also a CROSS HATCH CALCULATOR button that will access built in calculator that can be used to make calculations using different values.

Honing In General

The HP7A is capable of honing a cylinder very accurately with very little or no work from the operator. The goal of the operator should be to set the Upper and Lower Stops correctly, select the proper stone length, and honing pressure that will allow the machine to hone the cylinder to size.

While the HP7A is running, pay attention to the load graph display (left on the control screen). The load display measures the actual motor load and displays it in percentage of rated motor current. As the HP7A is honing, the control takes current measurements from the motor throughout the length of the cylinder and displays them with solid red colored bar that approximates the shape of the cylinder wall. The farther the bar moves to the right the smaller the bore is in that area. For example, if the bar near the bottom of the display moves farther to the right than the rest of the bar, it means the bottom of the bore is a slightly smaller diameter near the bottom. The same would be true for the top and middle of the bore.

Large Amount of Material Removal

When you have large amounts of material to remove from a cylinder (.005 and up) the following steps should be used to maintain size control.

For stock removal of .010 or more it is best to use a two step process. Start with 80 grit stones, (.004" removal per minute) use ROUGH MODE and bring all cylinders to within .005" of the final size. Switch to stones that will leave you the desired RA value and remove the final amount of material using FINISH MODE.

When there is less than .010" to remove start with 270 grit stones and bring cylinders to within .002" of final size using ROUGH MODE. Switch to stones that will leave you the desired RA value and remove the final amount of material using FINISH MODE. You can also use the 270 grit stones and bring the cylinder to final size. Then install finishing stones and use the PLATEAU MODE 1 operation to bring the cylinder to your desired RA value.

Common Surface Finishes

Today's modern engines are demanding smoother and more precise surface finishes. There are two commonly used plateau surface finishes in automotive engine cylinder bore finishing today. They are both described below. The single step, non-plateau finish is no longer recommended for engine cylinder bores. The processes described below are commonly used in the engine building industry. If the engine or ring manufacturer recommends a particular finish the engine manufacturers specifications or ring manufacturers recommendation should be followed.

Non-Plateau

The typical Ra finishes used for a Non-Plateau finish should be in the 16-24 range. A 16-24 Ra finish leaves adequate peaks to be knocked off during the engine break in period yet is not so rough as to cause oil burning problems before the cylinder walls have been plateaued by the rings. During initial start up of the engine the rings will create the plateau by knocking off the peaks of a non-plateau finish. Most modern ring manufacturers do not recommend using this type of finish.

Plateau

Plateau surface finishes are required to meet the demands of the modern engine designs whether the engine is a standard automotive engine or a performance engine. There are sophisticated measuring devices able to measure the details of a plateau finish. Although the cost of these devices have lowered significantly in the last few years, they are still cost prohibitive to the average shop. Rottler has established honing procedures, if closely followed, will produce a finish meeting the specifications of the engine or ring manufacturers.

Below are the current finish recommendations for most automotive engines.

Ra	10 to 20
Rpk	10 to 20
Rvk	30 to 60
Rk	25 to 50

The Plateau finish has become very popular. One of its purposes is to minimize the break-in or ring seating period. A plateau finish involves the use of a roughing stone followed by a finer grit finishing stone. When the finishing stone is used, only a few strokes are required to create the plateau. If you were to continue honing with the finer grit stone you would eventually eliminate the plateau effect and create a simple non-plateau finish equal in roughness to the finish stone.

Plateau Caution

When using plateau brushes do not exceed 7 strokes. Doing so may cause burnishing of the bore surface, which lead to improper ring seating and excess oil consumption.

Following are two slightly different methods for achieving the above finish. They differ slightly depending on the end use of the engine.

Method 1

Cast Iron Rings or Tougher Duty Cycle Applications

This finish is used for cast iron rings or with moly rings where the end use of the engine is for tough or long duty cycle application – dirt track racing or standard automotive use.

Step One:

Use part number 514-9-14K (170/200grit) diamond stones. In ROUGH MODE use a roughing load of 50% and a finishing load of 20%. Hone the cylinder to size.

Step Two:

Use part number 514-9-14L for 5 strokes in each cylinder. You can use the PLATEAU MODE 1 with a 20% load setting. Caution do not hone longer than 5 strokes or shorter than 5 strokes. This will affect your overall finish.

Step Three:

After using the 514-9-14L stones install the 514-9-14H brushes for plateau finishing. Use PLATEAU MODE 2 and brush each cylinder 3 strokes.

Method 2

Moly Rings or Shorter Duty Cycle Engine Applications

This finish is used with moly rings where the end use of the engine is for short duty cycles such as drag racing.

Step One:

Use part number 514-9-14J (270/325grit) diamond stones. In ROUGH MODE use a roughing load of 50% and a finishing load of 20%. Hone the cylinder to size.

Step Two:

Use part number 514-9-14L for 5 strokes in each cylinder. You can use the PLATEAU MODE 1 with a 20% load setting. Caution do not hone longer than 5 strokes or shorter than 5 strokes. This will affect your overall finish.

Step Three:

After using the 514-9-14L stones install the 514-9-14H brushes for plateau finishing. Use PALTEAU MODE 2 and brush each cylinder 3 strokes.

Productivity

Whether using vitrified or diamond abrasives, the honing process should be studied to maximize the productivity of the work center while providing the desired end result. Following is an example of two different ways to accomplish the same end result of an 18-22 Ra non-plateau finish. The customer requires .003 in./ .07mm stock removal for honing after boring.

Single Step Honing

Process: ROUGH MODE

Abrasive: Diamond 500 Grit.

Set machine stop to hone to size. 60 strokes per minute. Set the roughing load at 85%. Set the finishing load between 25 and 35%. At .0003 in./ .007mm per feed out a stock removal rate of .0015 in./ .038mm per minute is achieved. The result is 2 minutes of honing time per cylinder.

During this time the machine is running unattended allowing the operator to accomplish other tasks. Rottler no longer recommends a single step honing process to finish engine cylinder bores.

Total honing time for a V8 block = 16 minutes.

Two Step honing**Step One:**

Process: ROUGH MODE

Abrasive: Diamond 270 Grit

Set Feed Ring to leave .0005" / .01mm maximum for second honing process. 60 Strokes per Minute. 70% Roughing Load and 30% Finish Load. When using the precision hone head you will achieve .003" / .076mm per minute stock removal. The result is 55 seconds of honing time per cylinder. During this time the HP7A is running unattended allowing the operator to accomplish other tasks.

Honing time for a V8 block = 7.3 minutes

Step two:

Process: FINISH MODE

Abrasive: Diamond 500 Grit

Set Feed Ring to hone to size. 60 Strokes per Minute. 70% Roughing Load and 30% Finish Load. . When using the precision hone head you will achieve .0015" / .038mm per minute stock removal. The result is 24 seconds of honing time per cylinder.

Honing time for a V8 block = 3.2 minutes

Total honing time for a V8 Block with a Two Step Process = 10.5 minutes

Note:

When looking at actual honing time only, the two step process is 5.5 minutes faster than the single step process. Because the operator must change abrasives in the two-step process 1-2 minutes should be added for two abrasive changes. Considering the operator must position the machine in each cylinder two times for the two-step process, the time difference between the two methods is slight. The single step process allows for more operator uninterrupted free time.

The single step process would allow the operator to easily run two machines at one time or perform work other than honing.

The two step process becomes more effective as the ending surface finish requirement becomes smoother. If a 12 - 16 Ra finish was required, the honing time for a single step process would become approximately 24 minutes and the honing time for the two-step process would remain near 10.5 minutes. The two step process becomes more productive when more than .003 of material must be removed.

The above calculations should be made to determine the best method for the customer's particular requirements. Actual times will vary depending on the engine block material, stock removal required, and the desired accuracy. The purpose of the above comparison help the user understand different methods may be used to obtain the same result and that there is a significant difference in potential productivity when comparing the different methods.

Using Vitrified Abrasives

Abrasive grades are available for most any finish you want to achieve. Two or three bond hardnesses are available with most grits. The right bond hardness will break down gradually depending on the grit used. Too soft a bond will lose abrasive excessively. Too hard a bond will chatter and start glazing the bore, with rapid heating and poor stock removal.

Finer grit stones generally break down much faster than coarse grit does. They must break down quickly to prevent the stone from loading or glazing. Bond hardness will act differently with different cutting oils. Rottler abrasives were designed to be used with Rottler honing oils or equivalent. In general, Rottler honing oil is of low Sulfur content. Using other honing oils may have an adverse effect on the abrasive performance. Faster spindle rotation and light pressures will make abrasive act harder. Faster stroke speed and heavy pressures will make abrasive act softer.

Abrasive should wear relatively evenly and parallel to the shim support. If you encounter uneven abrasive wear, the cause may be damaged universal drive joint, unmatched stones, or misalignment of hone drive with cylinder bore.

Standard Vitrified abrasives can not be used in synthetic or water base coolants.

Generally, lighter honing pressures are required when using vitrified stones compared with diamond stones. The finer the grit the lighter the load should be as follows.

80 Grit40 – 60%
180 Grit40 – 60%
220 Grit30 – 50%
320 Grit20 – 40%
400 Grit10 – 30%
600 Grit05 – 25%

See H-Series Optional Equipment Catalog for list of available abrasives.

Using Diamond Abrasives

General

In the proper application, diamond abrasives are very effective for cylinder honing. The Rottler Precision Hone Head brings the cost of diamond honing down to a range that is much more affordable. Competitive hone heads require the purchase of multiple hone heads to cover the same size range as the Precision Head. The Rottler system is approximately 1/5 the cost.

Because of the long life of diamond abrasives the cost per hole of diamond abrasives is approximately 1/5 of the vitrified abrasives.

Diamond abrasives in combination with the Rottler Precision Honing Head make a very rigid honing head. The system will do an excellent job of truing tapered or out of round holes with little or no operator attention. An operator can set the roughing and finishing loads and expect the machine to hone the cylinder to size unattended with little or no attention. It is important to use proper stone pressure when using diamond abrasives. The roughing motor load setting should be in the 50 - 90% range. The finishing load should be set in the 20 – 40% area. Generally, the higher the roughing motor load reading the faster the stock removal. The lower the finishing load is set, the more accurate the bore will be.

The HP7A is capable of removing an unlimited amount of material from a cylinder with a high degree of accuracy. Generally, it is desirable for overall engine block geometry to use a boring machine to bore all material out except for .003 of hone stock.

It is important to use Rottler Synthetic Coolant, part number 514-4-71C, when using diamond stones. It must be mixed with water and maintained properly to give optimum honing results.

Note: When mounting new stones in holders it is recommended that you flat stone the back of the stones to remove any possibility of burrs causing misalignment of stones mounted in holders.

Scratching

Scratching in the cylinder looks as though a single grit of a larger abrasive particle has lodged between the cylinder wall and the hone head. Often the scratch will be less than one revolution of the hone head and it will follow the cross hatch angle of the honing machine. Several things can cause this problem.

Improper coolant mix

The ratio of water to synthetic additive to water will change after the initial mix is put in the coolant tank. A Refractometer can be purchased to accurately check the ratio. When the ratio is measured as a percentage it should be 5 – 8%. This corresponds to a reading of 3-5 on the Refractometer. It is important not to confuse the percentage with the true Refractometer reading.

Unacceptable synthetic coolant brand.

Lack of abrasive dressing.

Dirty Coolant.

Breaking In A New Set of Diamond Abrasives

Rottler diamond abrasives are pre-radiused to minimize the breaking in period. When a new set of diamonds is installed the surface finish obtained on the first few blocks will be 5-10 Ra rougher than after the break in period. You must hone 2 - 5 blocks before the surface finish stabilizes.

Dressing Diamond Abrasives

Diamond Abrasives use a metal bond to hold the individual diamond particles. Failing to dress the stones after honing 30 - 50 blocks will increase the pressure required to remove stock or the stock removal rate slows down significantly. This will result in finishes with excessive folded and torn metal. Undressed stones will also cause excess bore distortion and inaccuracies in the boring process. This is caused by the diamond abrasive dulling or the bond not breaking down. The edge of the stone will also become very sharp. This is a normal occurrence and is easily corrected by removing the holder/abrasive assembly, use a wire brush to dress the abrasive. A common method is to remove the stone holder from the hone head. Leave the stone in the stone holder and move the stone through a bench grinder wire wheel. The brush rotation should be across the narrow width of the stone. Turn the holder over and pass the stone through the wheel again. This process will return the abrasive to a like new cutting condition, and put a slight radius on the edge of the abrasive stick (approx. .005 inch.)

Torn Metal

This is often caused by improper coolant mix, lack of dressing, or the use of high honing pressure during the finishing process. The Rottler hone head is capable of very high loads. If problems with torn metal are encountered verify the coolant mix, proper dressing of the abrasives, and reduce the finishing load during the final hone stage. If required make several strokes by hand with minimum stone pressure (10-20%).

Stock Removal Rate

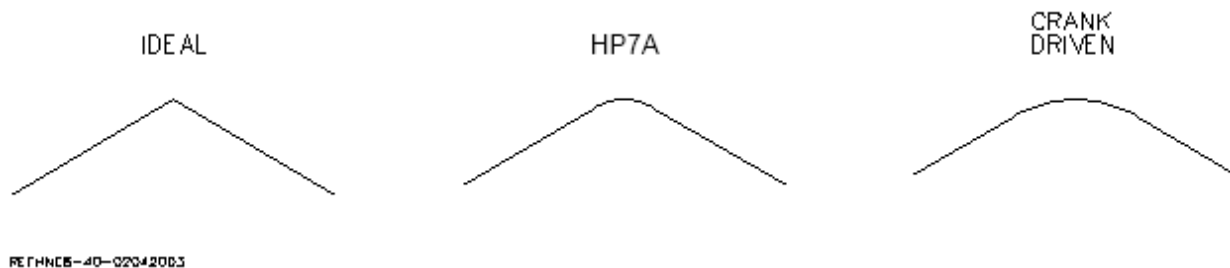
The hardness of the cylinder you are honing will affect the stock removal rate. If you find the stock removal rate for a given cylinder is slower than normal check to make sure you have properly dressed the stones. Improperly dressed stones can increase honing time by as 50% or more. Improperly dressed stones will also produce an unacceptable finish.

Diameter Range

Because the diamond abrasives break down very slowly, a single set of stones is limited in its diameter range. One set of diamonds should be used for each stone holder range. A set of diamonds can not be constantly changed from one stone holder size to another. The stones would constantly be in the break-in process and very poor performance or finishes will result.

Cross Hatch Angle and Washout

The ideal situation would be for a hone to change the direction it is traveling instantaneously. If this was possible the angle of the cross hatch would stay consistent through the entire cylinder. The Rottler HP7A uses high speed electronics in cooperation with an air driven ram to change the direction of travel. This reduces the amount of Cross Hatch wipe out considerably from a crank driven rocker arm. As a rocker arm changes direction, the rate of travel slows but the rotation speed of the hone head stays consistent. This is the cause of washout at the top and bottom of cylinders. Below are examples of ideal cross hatch, Rottler HP7A cross hatch and a crank driven cross hatch.



It is possible to mistake the slight washout of the cross hatch at the top of the cylinder as the hone head rotating after it has come to a stop at the top of the cylinder. It is important to understand the difference in washout and over rotation.

Stroking Speed

The HP7A is set at the factory to operate up to 250 inches per minute of stroking speed without banging at the top of the cylinder. The strokes per minute indicator on the HP7A cannot be used to judge the Inches Per Minute the hone head is traveling at. Stroking at 60 SPM in a 6 inch cylinder is allot different than stroking at 60 SPM in a 10 inch bore. The following will show how to correctly calculate Inches Per Minute with the HP7A.

Stroke Length = Length of Bore + Top and Bottom Overhang of stones – Length of stones.
Inches Per Minute = Stroke Length X Strokes per minute

Example:

60 SPM in 6 inch bore.

Stroke Length = Length of Bore (6) + Top and Bottom Overhang (.5 Top and .5 Bottom) – Length of Stones (4) = 3. The actual stroke of the rocker arm is 3 inches.

Inches Per Minute = Length of Stroke (3) X Strokes Per Minute (60) = 180 IPM

Vs.

60 SPM in 10 inch bore.

Stroke Length = Length of Bore (10) + Top and Bottom Overhang (.5 Top and .5 Bottom) – Length of Stones (4) = 7. The actual stroke of the rocker arm is 7 inches.

Inches Per Minute = Length of Stroke (7) X Strokes Per Minute (60) = 420 IPM

As shown above, there is quite a difference in the speed the hone head is traveling. The excessive speed will cause the machine to “bang” at the top of the cylinder. The correct way to solve this is to lower the stroking rate and increase the RPM of the Hone head. Use the cross hatch angel calculation screen on the control display to determine correct stroke rate and RPM for your desired cross hatch angle.

Coolant

Coolant types and Selection

When using Vitrified honing stones you must use a petroleum based coolant. Such as Mobil Met 33 or Upsilon or any equivalent light honing oil. This is required since vitrified honing stones are not compatible with water based synthetic coolants.

Diamond stones will work with oil or water based synthetic coolants, but work most efficiently with the water based synthetic coolants. Rottler Manufacturing recommends the use of Rottler 514-4-71C water based, synthetic coolant for diamond only applications. This coolant works best when mixed to a 5% – 8% solution.

Refractometer

A Refractometer is used to measure the amount of coolant to water ratio. A 5% to 8% ratio will read a 3 – 5 on the Refractometer. It is important not confuse the ratio with the actual Refractometer reading.

Coolant to Water Ratio is 1:20 thus 1 gallon of coolant to 20 gallons of water.

Coolant Pump System

The coolant tank on the HP7A will hold a maximum of 80 gallons of the selected coolant. Unless a Auxiliary tank is purchased, which will increase the capacity to 100 gallons.

Honing of Alusil, Silitec, and Lokasil Materials

These instructions are for honing Alusil and Lokasil materials with Rottler HP7A honing machine and water base coolant.

Equipment and parts needed

Machine:	Rottler HP7A
Coolant:	Rottler part# 514-4-71C
Hone Head:	Rottler part# 514-9B
Stone Holders:	Rottler parts determined by size of bore
Abrasives:	Rottler 400 grit diamonds part# 514-9-14V (do not substitute different grit size) KS finishing diamonds Rottler part# 514-9-18P KS silicon exposing stones Rottler part# 514-9-18N. Alternative to exposing stones is felt wipers and silicon compound. Rottler part# for felt wipers 514-9-21E. Rottler part# for silicon compound 514-9-21F

Instructions for Honing Alusil and Lokasil Cylinders

Cylinders should be bored to within .002 with a PCD insert. This is very important to prevent fracturing of silicon particles below the finish surface of bore. If PCD isn't used the exposure of the silicon will result in a defective sliding surface for piston and rings.

****NOTE: When using the diamond stones they should be trued in to diameter of cylinder by using them in cast iron cylinder the same diameter of aluminum cylinder being honed. This includes the KS finish diamonds also.***

Cylinders should then be honed on HP7A using Rottler 400 grit diamond stones (no substitutes only use 400 grit) to size with tolerance of +.0002 -.0000. Machine parameters should be set as follows: RPM 200 to 225, Honing loads should be set at 20% to 25% for roughing and 15% finish load.

Next install the KS finishing diamonds and run one cycle in the plateau mode. The plateau mode parameters for the HP7A hone are normally 20% load and 7 strokes per cycle. You will need to change these parameters (see operating instructions) to 10 strokes per cycle and a honing load of 15%. Cylinders should already be to size from previous step. You are not trying to remove much material with this operation. The need for this operation is to lower the surface finish for the next step.

****NOTE: Chamfer or break the edge of the exposing stones prior to using them in bore. This will help prevent chipping on stone edges.***

The last step in the process is to expose the silicon particles by eroding the surrounding metal away from the silicon particles. This can be accomplished with different methods. The first method (easiest and cleanest) is to use the exposing stones part# 514-918N. These stones will need to be installed in machine and run for two plateau cycles. The plateau cycles should be same as prior step (10 strokes and 15% honing load). The bores should be flushed with coolant after the first plateau cycle and then second cycle run. It is extremely important that during this last stage that operator not force exposing stones into cylinders. Operator should start stones slightly away from cylinder wall and let machine feed stones into cylinder wall at the 15% honing load specified. These stones are extremely soft and any forcing of stones into cylinder wall will shorten stone life.

The second method to exposing the silicon particles is to use Rottler part# 514-9-21E. These are a felt wiper that is used with Rottler part# 514-9-21F which is a silicon compound paste. When using this method the coolant will need to be shutoff. Take a small paint brush and apply paste to felt wipers and the entire cylinder. Install hone head in bore, hone for approximately 45 to 60 seconds per cylinder. Machine settings for this operation should be RPM 160 to 170, strokes per minute of 60, shut-off automatic stone feed up. Start machine and feed stones up manually until load reaches 15%. Let machine run for 45 to 60 seconds per cylinder. Reapply silicon compound to each cylinder. There is no need to over stroke cylinder during this process so shorten stroke length accordingly.

For honing the Lokasil and Alusil cylinders the preferred method is the use of exposing stones; however the other method will work.

When Honing Silitec Cylinders

When honing Silitec cylinders use the above method of boring and honing cylinders. When removing metal away from silicon particles the second method of silicon paste and felt wipers must be used for Silitec cylinders only.

Honing a Cylinder Block

Introduction

The purpose of this section is to familiarize the operator with various features of the HP7A.

The operator should have a working knowledge of honing and be familiar with using a power hone.

It is suggested that scrape block be used for the following walk-through.

Definitions of terms used in this section

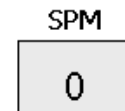


Button: A labeled icon on the control display screen.

Touch: To activate an icon button we will use the term touch. ie: Touch CYCLE START button to start motor. Most buttons will stay active once they have been touched and must be touched a second time to deactivate.

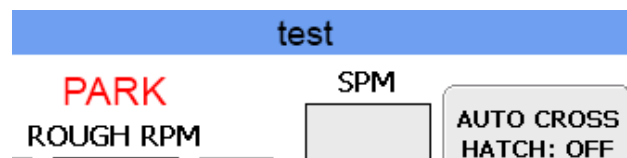
Touch and Hold: Some buttons are momentary buttons and you must maintain contact with the button to keep it active. i.e.: When the TOP DWELL button is touched and contact maintained the hone will dwell at the top of the bore until contact with button is released.

Value Box: A small box section of the screen that contains a number that indicates a value for the function listed next to it.

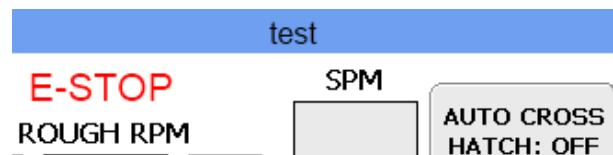


Safety Reminders

When machine is idle the rocker arm should always be keep in the PARK position. This deactivates touchscreen controls to prevent any accidental activation. The word PARK will be displayed on the operation screen



The operator can stop the honing process at anytime by touching the CYCLE START button. Touching the CYCLE START button again will restart the process.



If an emergency situation arises or if the touchscreen is not responding, pressing the E-STOP button will shut off power to all motors and solenoids and bring the hone to a stop. The word E-STOP will be displayed on the operation screen. To release the E-STOP turn the button until it pops out.

START SCREEN

Begin by loading and securing a block in the fixture.

Select stones and holders that will be used and mount them in the hone head.

Place the hone head in the first cylinder to be honed and set the lower limit.

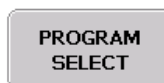
Set the upper stroke limit.

Note the bore diameter and length of stroke.

Turn on the power in back on the electrical panel.

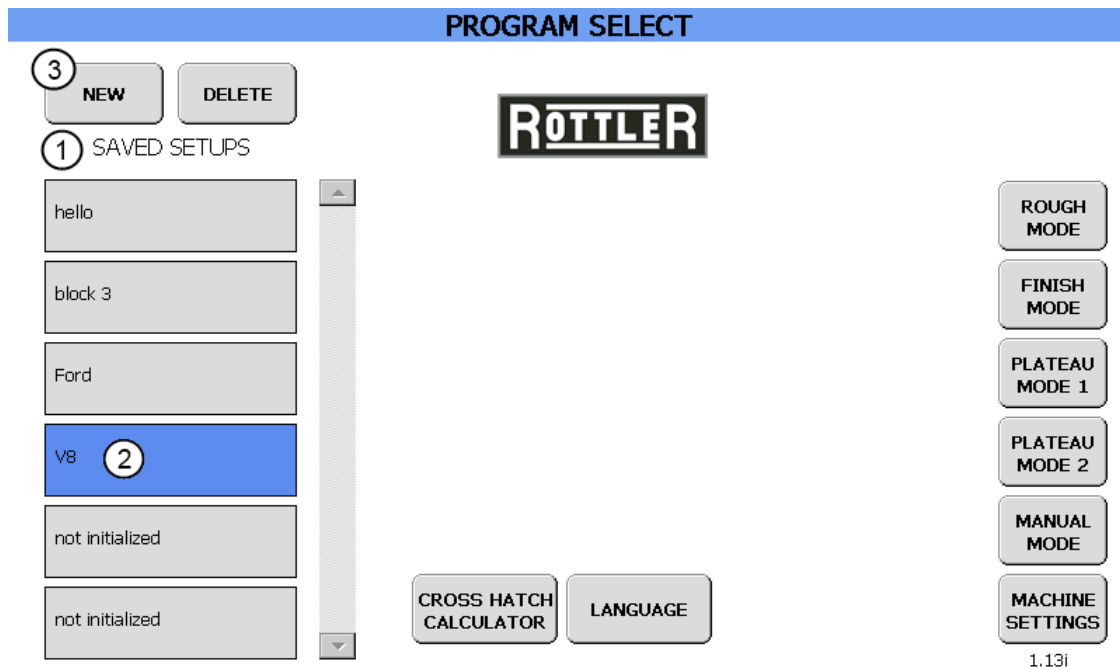


System will start up and after boot process is complete the START screen will appear.



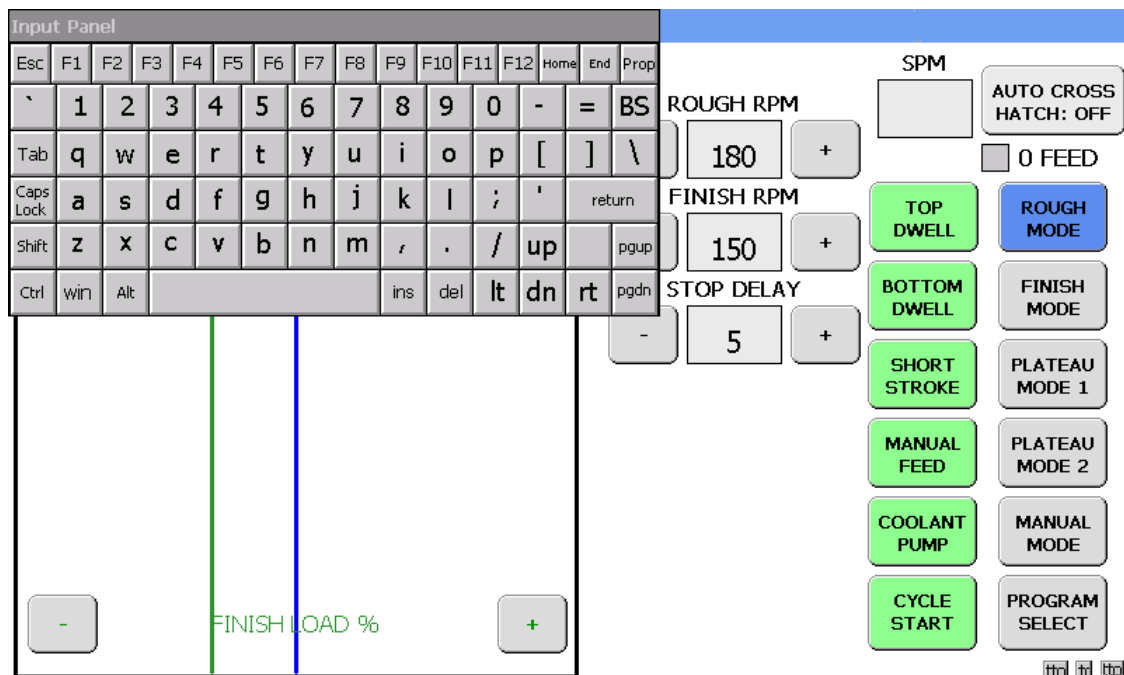
Touch the PROGRAM SELECT button and the PROGRAM SELECT screen will appear

PROGRAM SELECT SCREEN

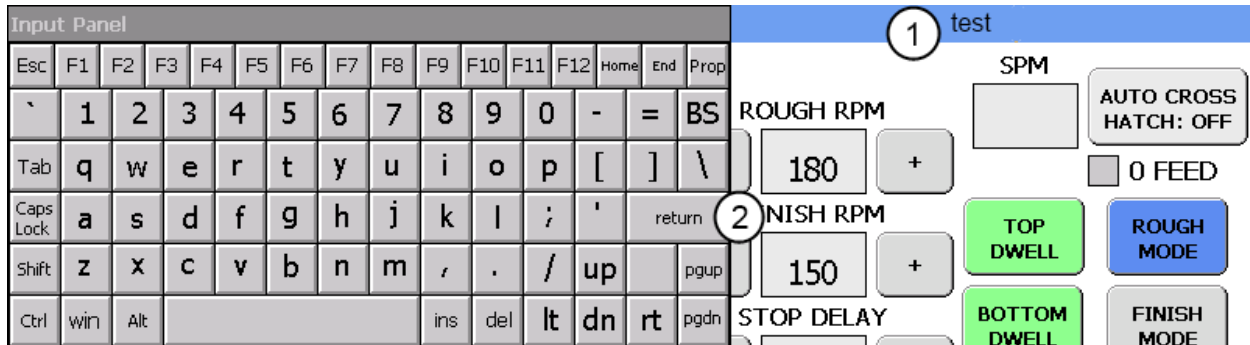


Select a program from the SAVED SETUPS (1) menu by touching it (2) or if creating a new program touch the NEW button. (3) In this instance a new program will be created. Touch the NEW button. (3)

That will bring up the keyboard that can be used to name the new program that is being created.

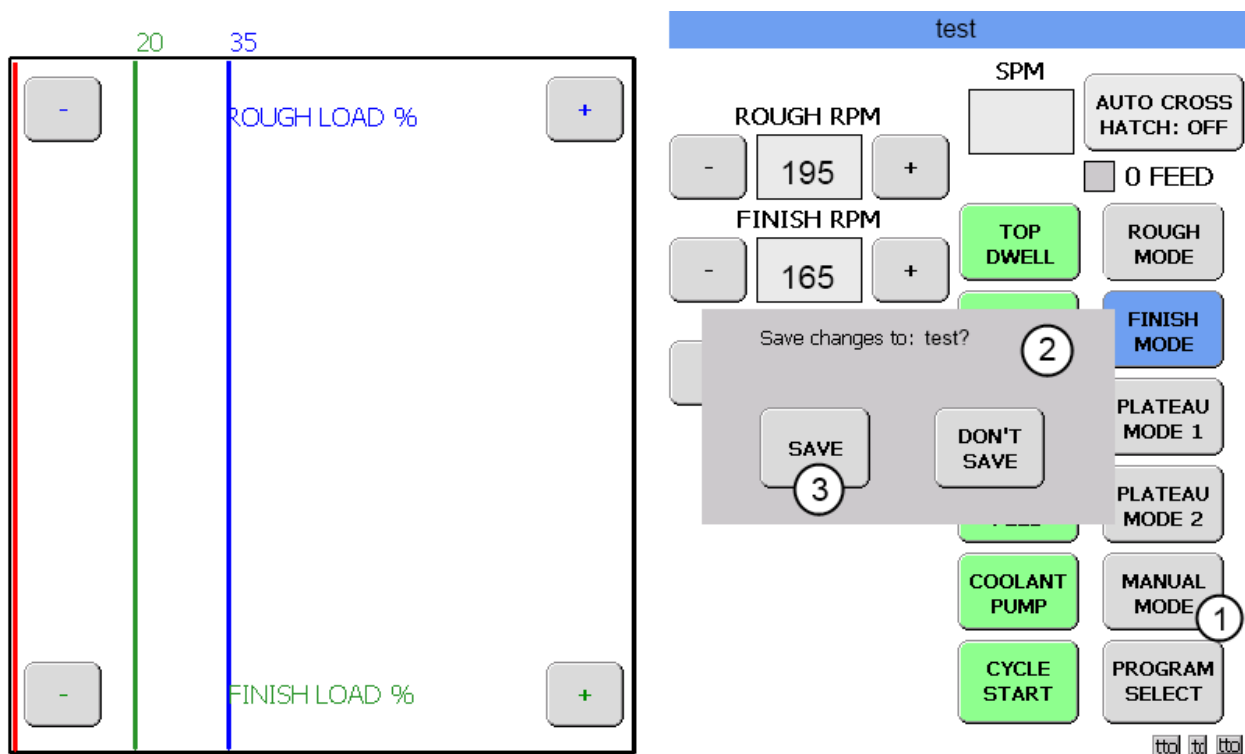


The program name will appear on the blue title bar as it is being typed.(1) In this instance the new block program was named test. Touch return (2) when the name has been completed.



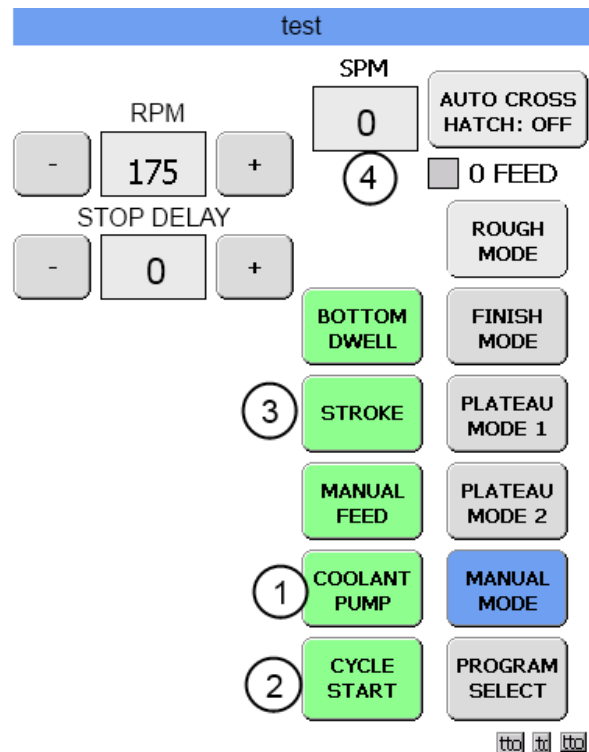
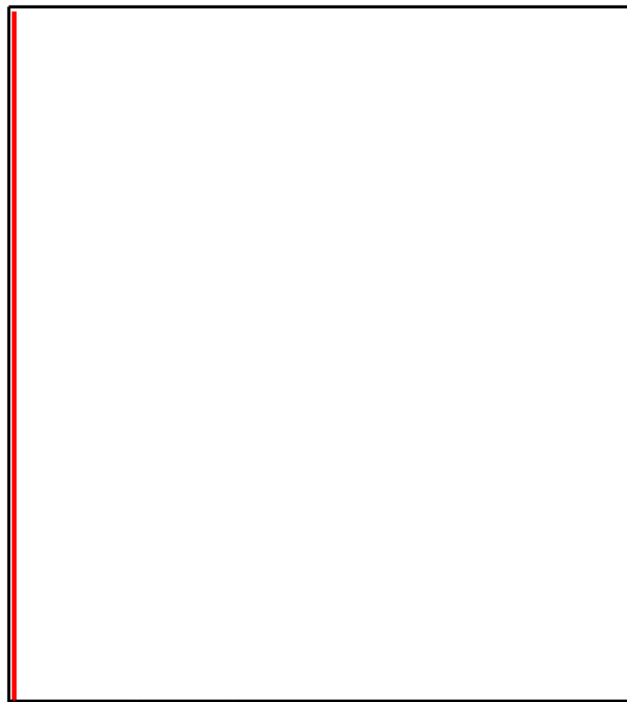
OPERATION SCREEN

The OPERATION screen will now appear. The hone is now ready to use with the factory default settings. If you want to use a different set of values for the various honing modes they can easily be changed.



Now that the hone is ready to operate we will first determine the stroke rate and verify bottom limit clearances. To do this the machine will be run in MANUAL MODE. Touch the MANUAL MODE button. (1) A Save changes box will appear.(2) Touch the SAVE button (3) and the MANUAL MODE screen will appear.

MANUAL MODE SCREEN



In this mode all the functions are available but must be activated manually.

Touch the COOLANT PUMP button (1) and the pump will turn on. Aim the nozzle toward the top of the bore so that the coolant floods the hone head.

Touch the CYCLE START button (2) and the motor will turn on causing the hone head to rotate.

Use the handwheel to feed out the stones until they just begin to touch the cylinder wall.

Grab hold of the rocker arm handle, press the upper clamp button and slowly pull the rocker arm down. Once the rocker arm reaches the bottom stop pull the rocker arm down with enough force to collapse the bumper spring in the pivot block. If at anytime during this process you hear the stones contacting the block stop immediately and recheck the lower stop setting. After verifying lower limit clearance shut off the motor and return the rocker arm to the upper setting.

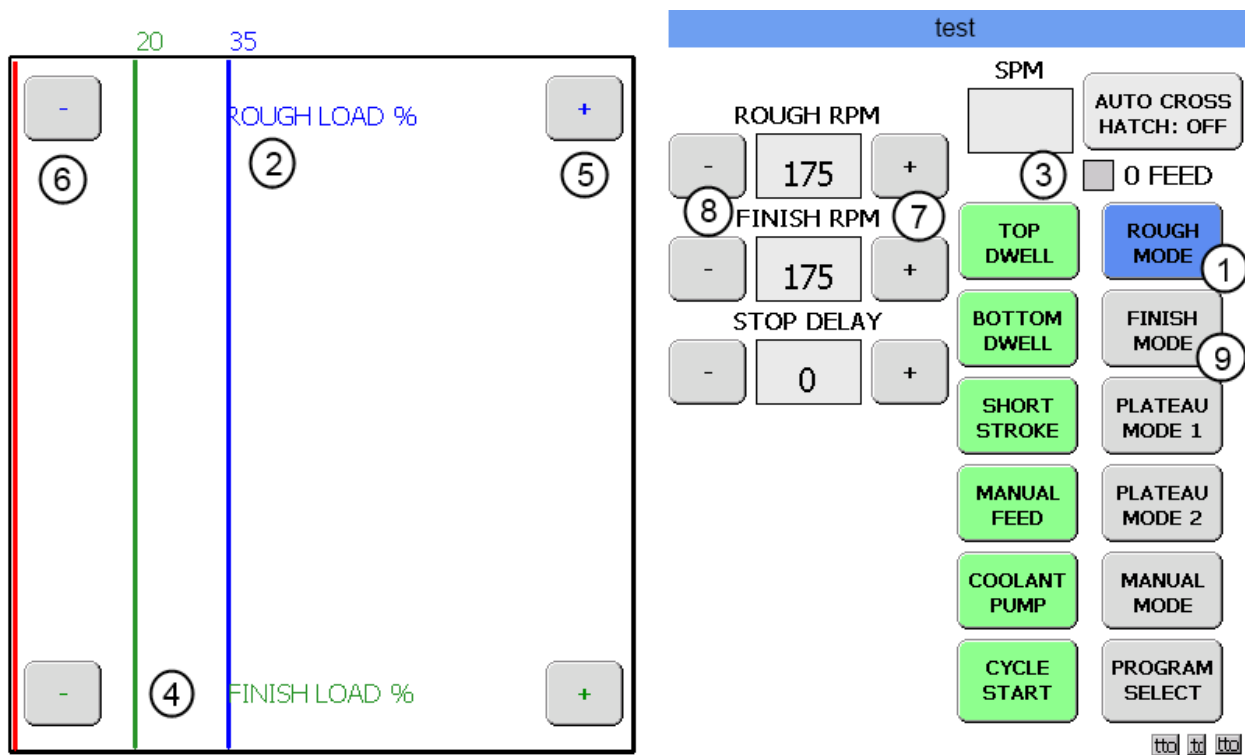
Touch the CYCLE START button (2) to restart the motor and then touch the STROKE button (3) and the rocker arm will begin to stroke up and down. Adjust the speed control handle until the desired stroking speed is achieved. The stroke rate is displayed in SPM box.(4) Make note of this setting.

Touching CYCLE START button will shut off the stroke and motor. Touch the COOLANT PUMP button to shut off the coolant pump.

Now that the hone is all set up and ready to run we can start to build a program for the block in the fixture.

ROUGH MODE SCREEN

Touch the ROUGH MODE button (1) and the Operation screen will appear.

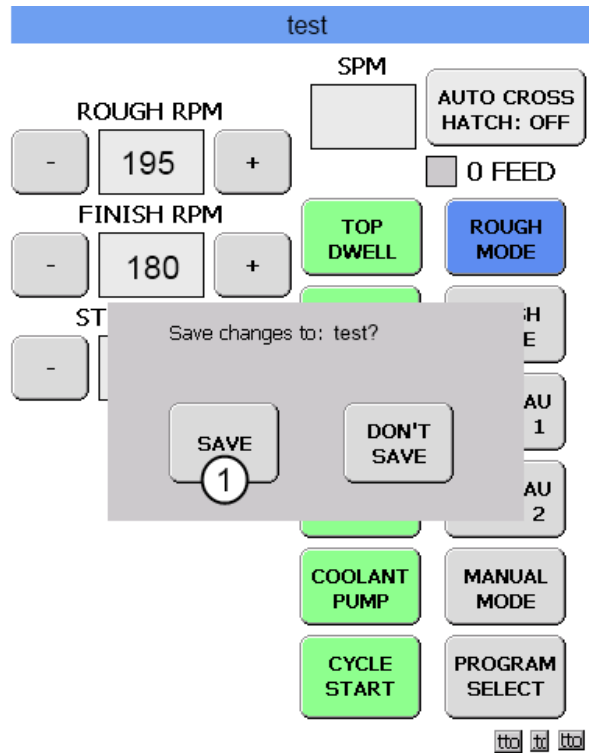
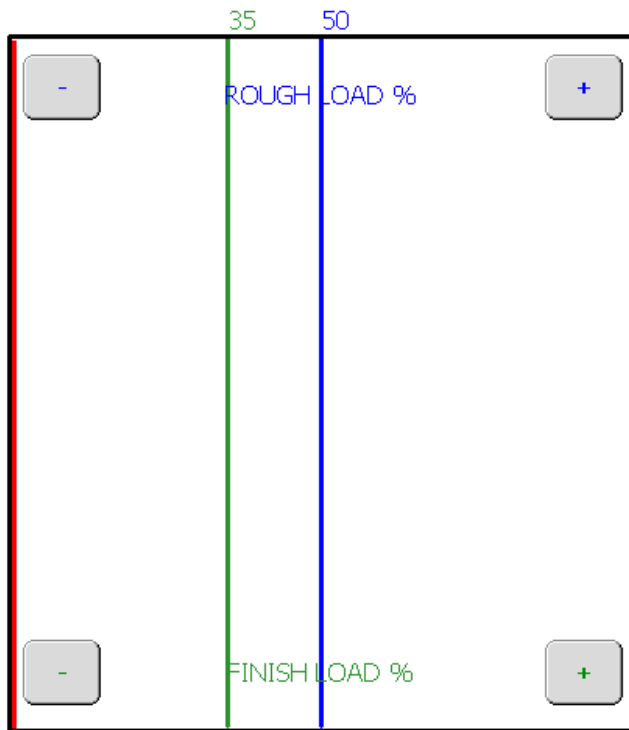


The ROUGH MODE button is blue in color to indicate that ROUGH MODE is the operation that is active.

The left side of the screen contains the active stone load graph. The blue line (2) indicates the ROUGH LOAD setting. This is the load that the hone will operate at while it is removing material from the cylinder. The hone will continue to feed (3) out to maintain that load until zero is reached on the feed ring. When zero is reached the 0 FEED box will turn red and the hone will stop feeding out the stones. The hone will continue to cycle until the load reaches the FINISH LOAD. The green line (4) on the graph shows what the FINISH LOAD is. When this setting is achieved the hone will automatically shut off. The load settings can be changed by touching either the + box (5) or the – box (6) on either side of the ROUGH LOAD % or the FINISH LOAD % titles. In this instance change the ROUGH LOAD setting to 50 and the FINISH LOAD setting to 35.

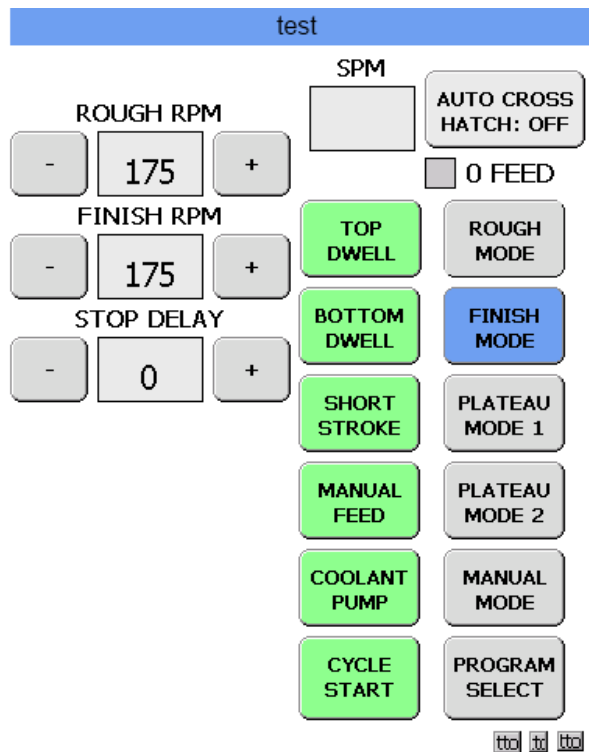
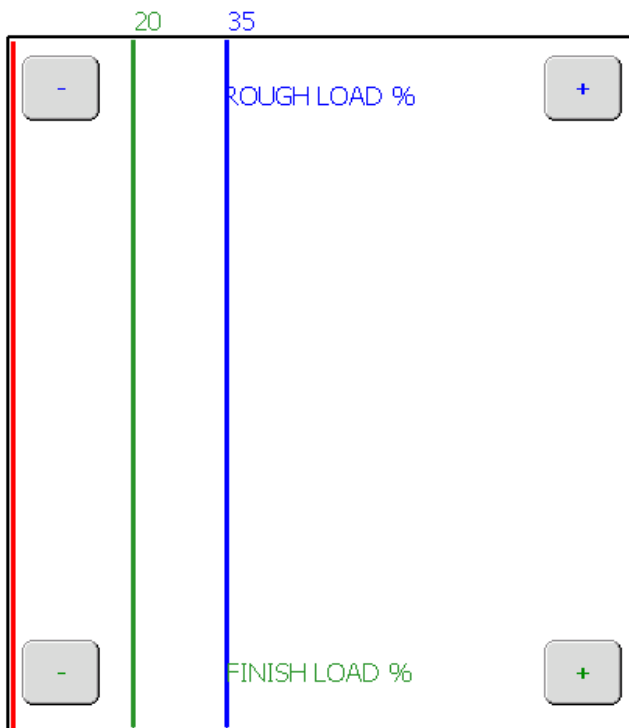
The center section of the screen contains the setting boxes for motor RPM. The ROUGH RPM and the FINISH RPM can be changed by pressing the + (7) or – (8) buttons next to each setting. In this instance change the ROUGH RPM to 195 and the FINISH RPM to 180.

Now touch the FINISH MODE button.(9) The following screen will appear.

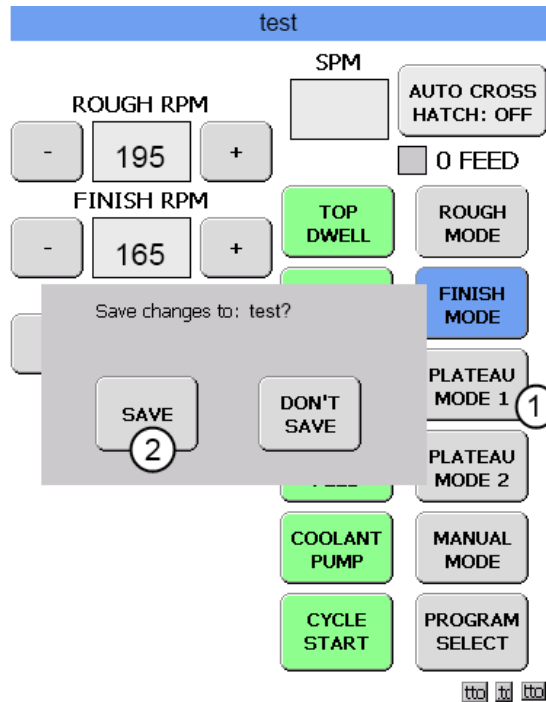
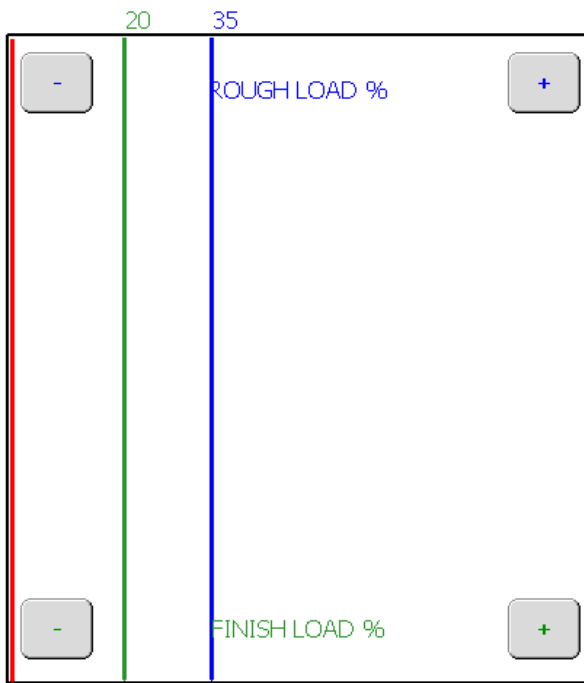


Touch SAVE (1) to save changes and bring up the FINISH MODE operation screen.

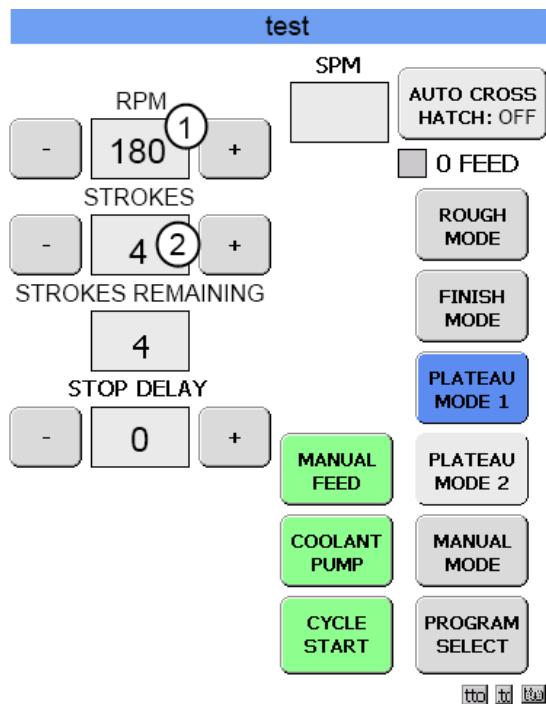
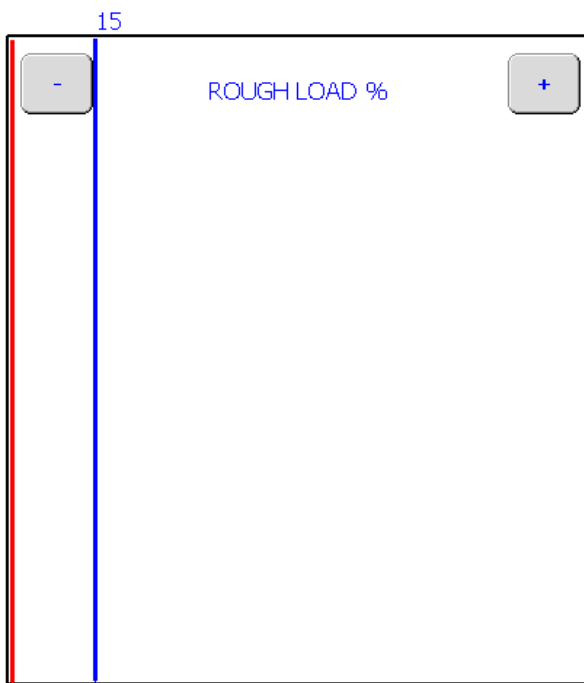
FINISH MODE SCREEN



Go through the same process as in ROUGH MODE to set the LOAD and RPM values. Then touch the PLATEAU MODE 1 button.(1) The Save changes to: box will appear. Touch SAVE (2) and the PLATEAU MODE 1 screen will appear.



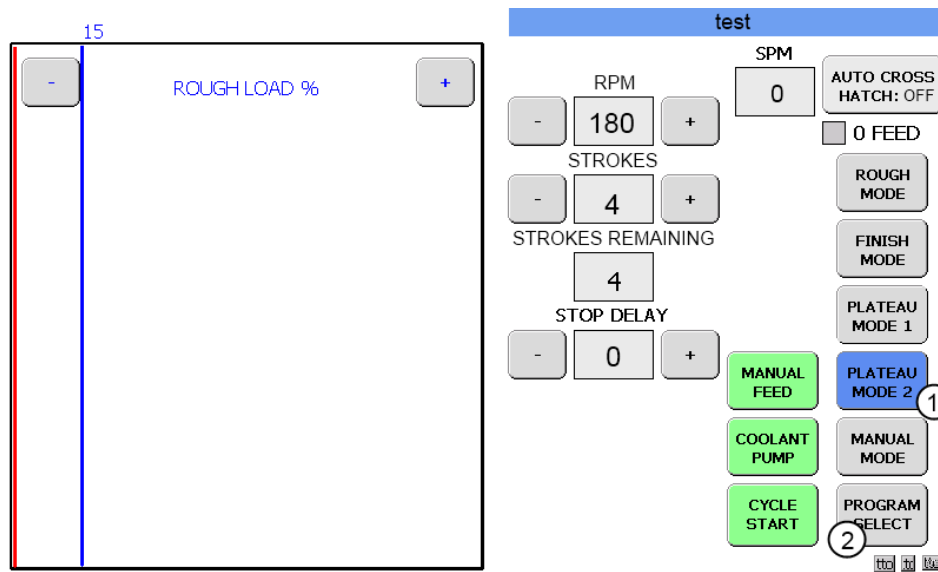
PLATEAU MODE 1 SCREEN



Enter the values that are desired for PRM (1) and STROKES.(2) The STROKES box displays the number of strokes the hone will stroke once the preset load is obtained. In this instance the default settings will be used.

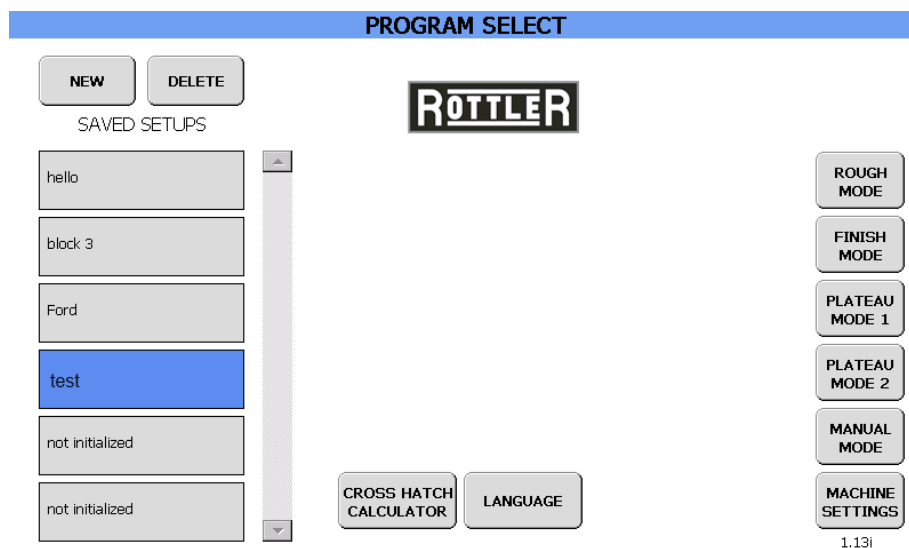
PLATEAU MODE 2 SCREEN

Touch the PLATEAU MODE 2 button (1) and the PLATEAU MODE 2 screen will appear.



In this instance the default setting will be used.

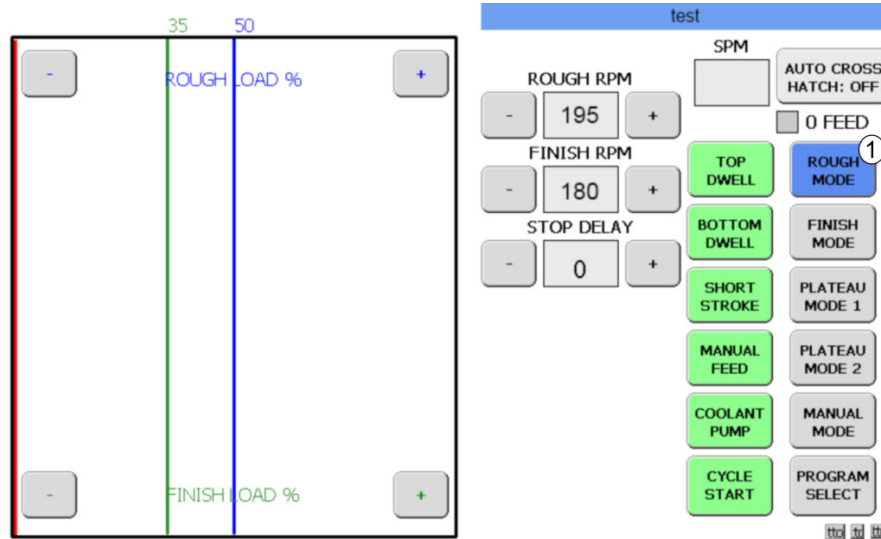
Touch the PROGRAM SELECT button (2) to take you back to the PROGRAM SELECT screen. If the Save changes to: pop up box appears touch the SAVE button to continue. The PROGRAM SELECT screen will now appear.



The program that was created will be in the SAVED SETUPS column, and it will be highlighted.

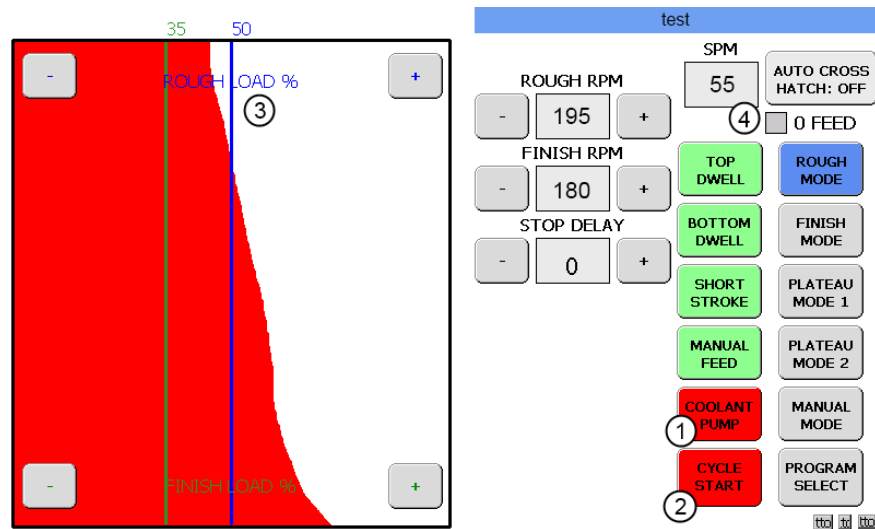
MACHINE OPERATION

The machine now has a saved program for the test block. Touch the ROUGH MODE button (1) and the Operation screen will appear with the ROUGH MODE button highlighted.



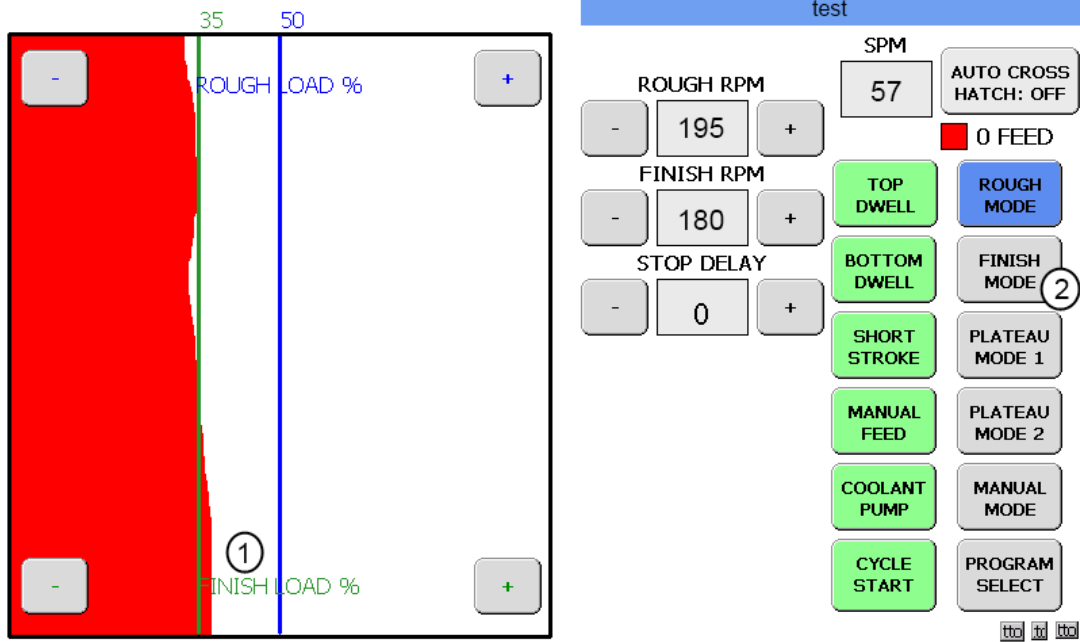
Confirm that the upper limit setting is correct and the stones have been expanded until the stones touch the cylinder wall. Set the feed ring so that the pointer is at 4 on the feed ring.

Touch the COOLANT PUMP button (1) to turn on the coolant pump. The button will become red when it is active and the pump is running. Now touch the CYCLE START button.(2) The motor will start, the hone head will start turning, and the rocker arm will begin stroking. The hone head will start to feed out the stones until the preset ROUGH LOAD is reached. The red line on the load graph will move towards the ROUGH LOAD setting until the preset load is reached.

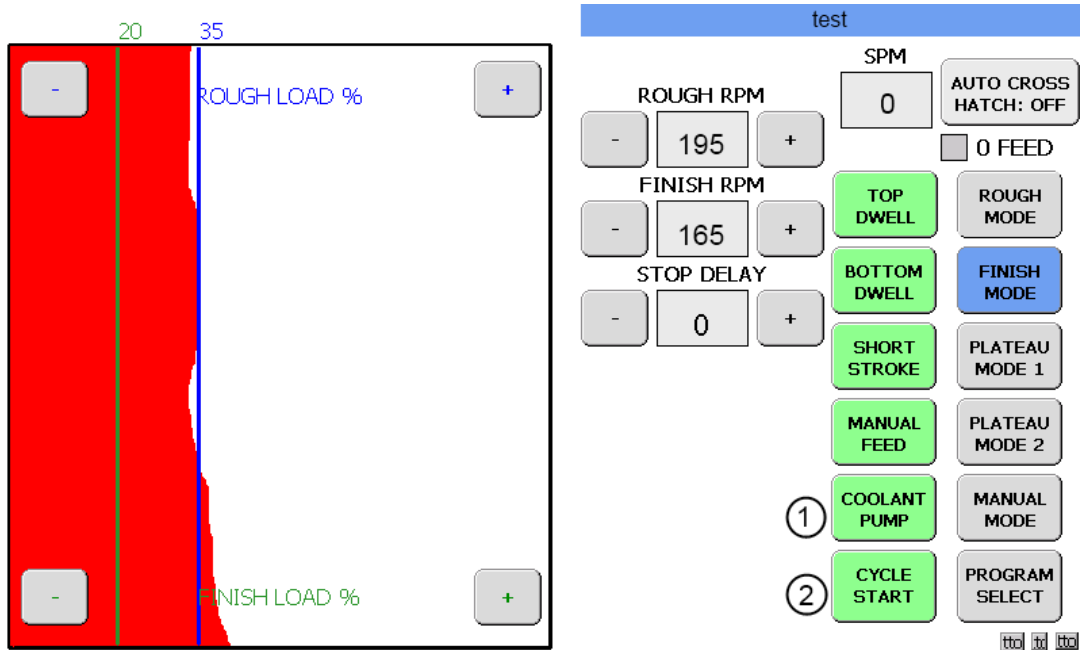


The machine will continue to hone and feed out in the ROUGH LOAD process (3) until the zero point is reached. When the zero point is reached the 0 FEED box (4) will become red and the machine will start the FINISH LOAD process.

The FINISH LOAD process will continue until the preset FINISH LOAD (1) is achieved at which time the hone will automatically shut off.

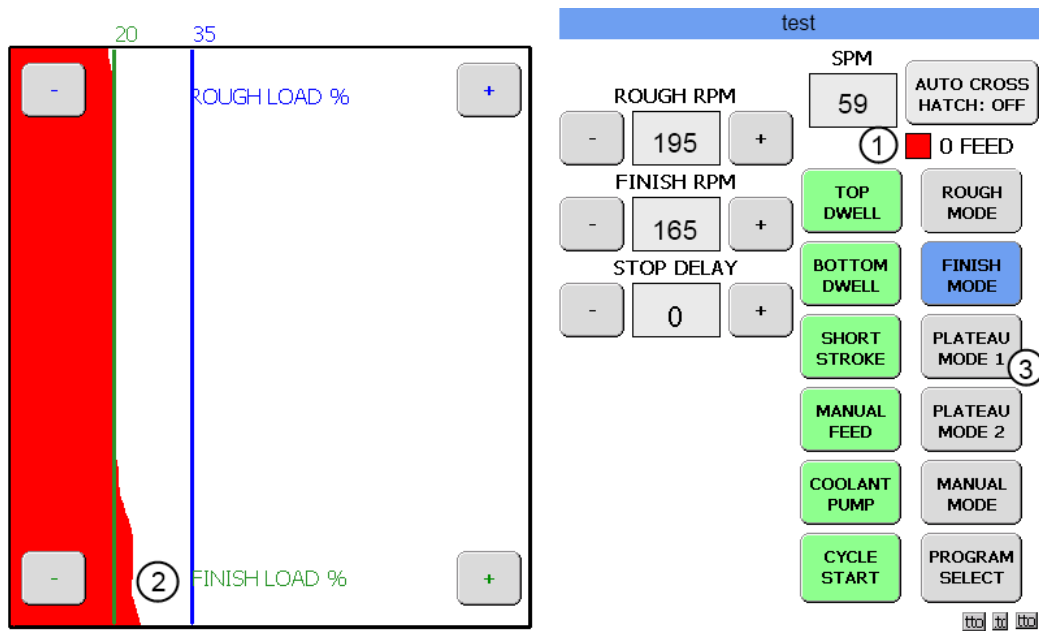


Touch the FINISH MODE button (2) and the following screen will appear.

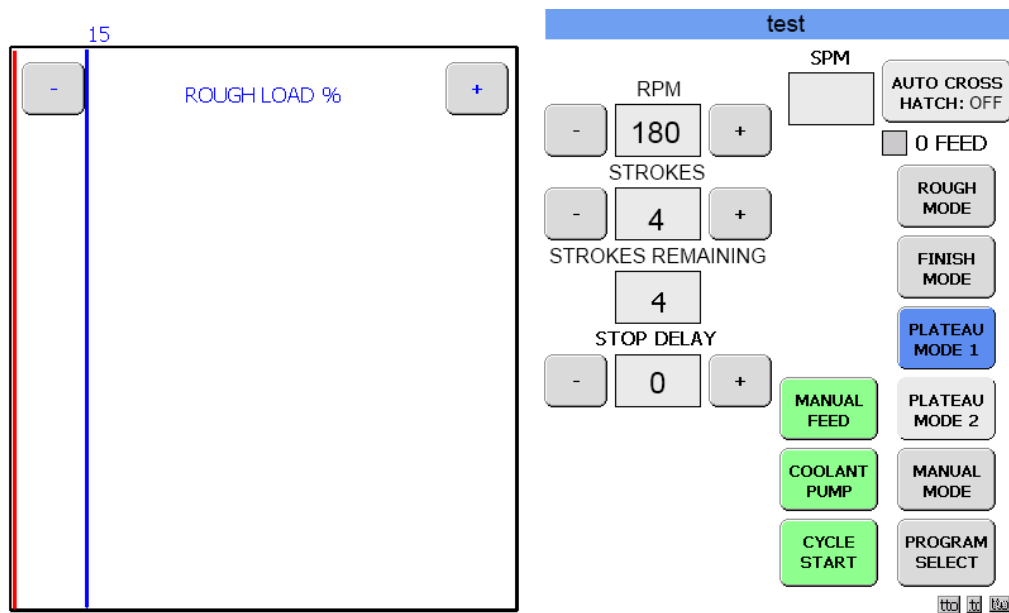


Reset the feed ring so that there will be at least 3 feed outs when the FINISH Operation is run. Touch the COOLANT PUMP button (1) to turn on the pump, then press the CYCLE START button (2) to start the honing process.

The hone will feed out to the preset ROUGH LOAD setting and continue to hone and feed out until the zero sensor is activated.(1) The hone will continue to remove material until the stone load reaches the preset FINISH LOAD setting.(2) The hone will then automatically shut off.

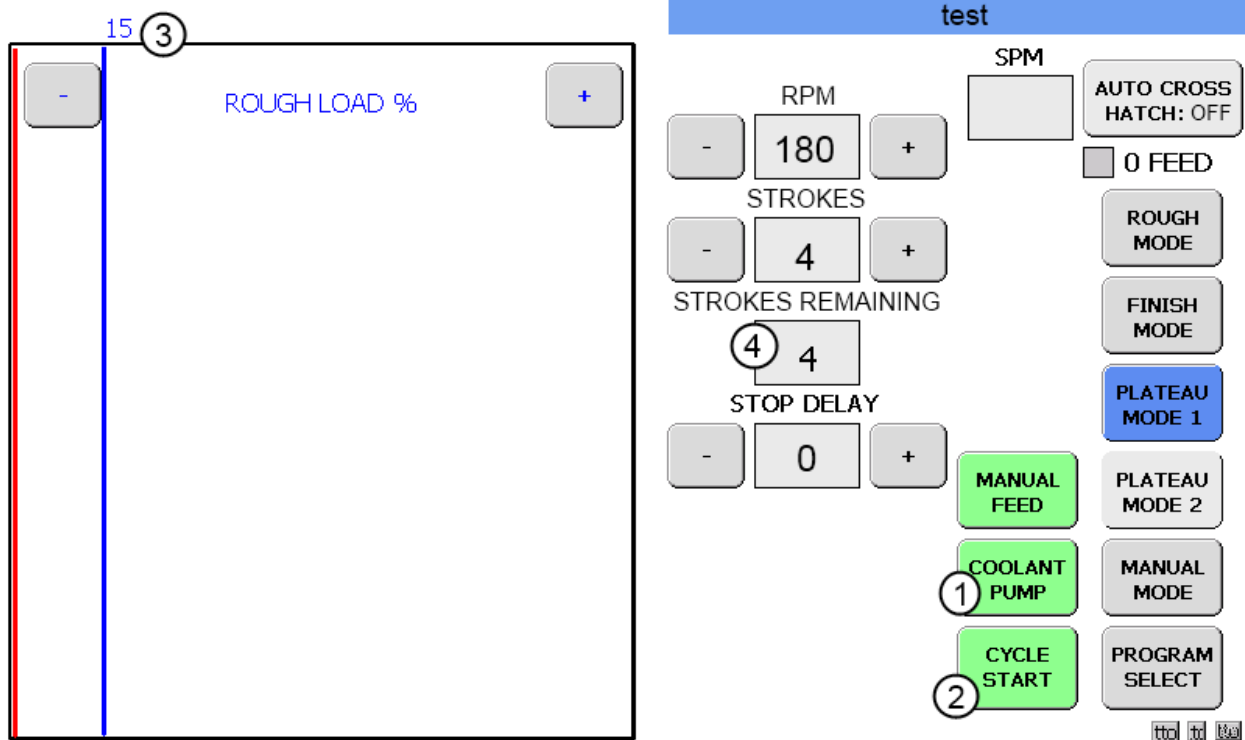


Touch the PLATEAU MODE 1 button (3) and the following screen will appear.



Remove the stones and holders from the hone head. Insert the brushes and holders into the hone head. Place the hone head back in the bore that has been honed and set the upper limit. Hand feed the brushes out until they make contact with the cylinder wall.

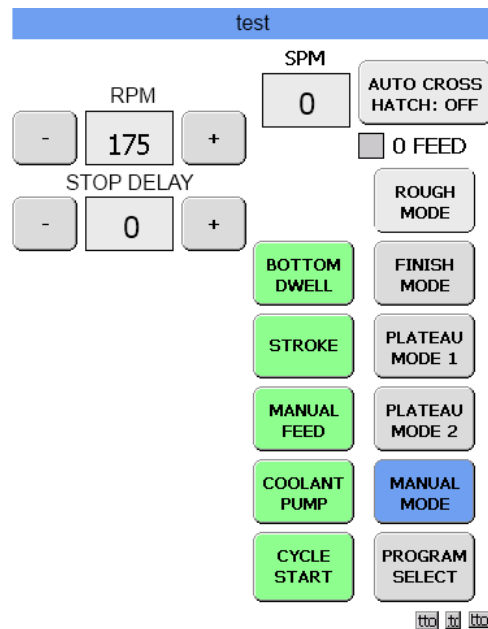
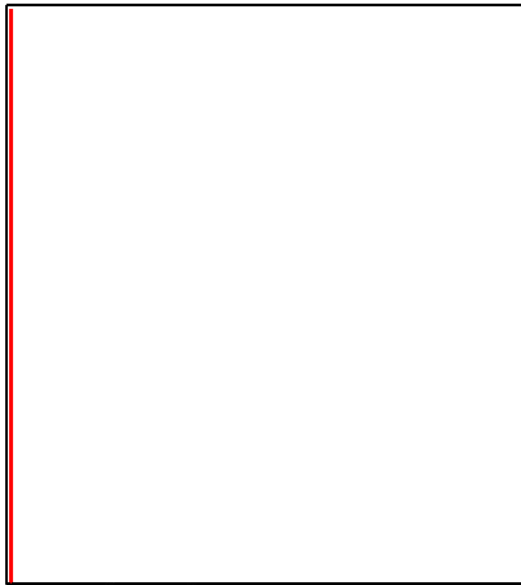
Turn on the coolant pump,(1) the touch the CYCLE START button.(2) The hone will start stroking and feeding out the brushes until the preset LOAD is reached.(3) Once the preset LOAD is reached the hone will count down the number of strokes from the number that was preset in the program.(4) In this instance that number is 4. When zero is reached in the strokes remaining box the hone will automatically shut off.



PLATEAU MODE 2 has the same functions as PLATEAU MODE 1 and is only used in very special applications.

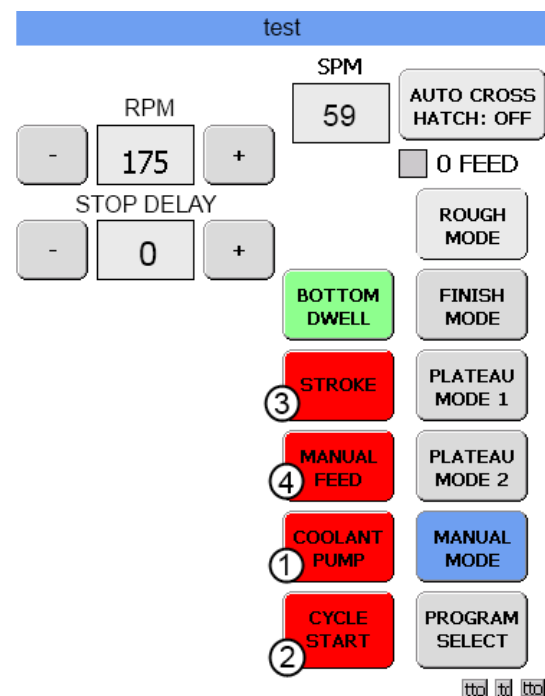
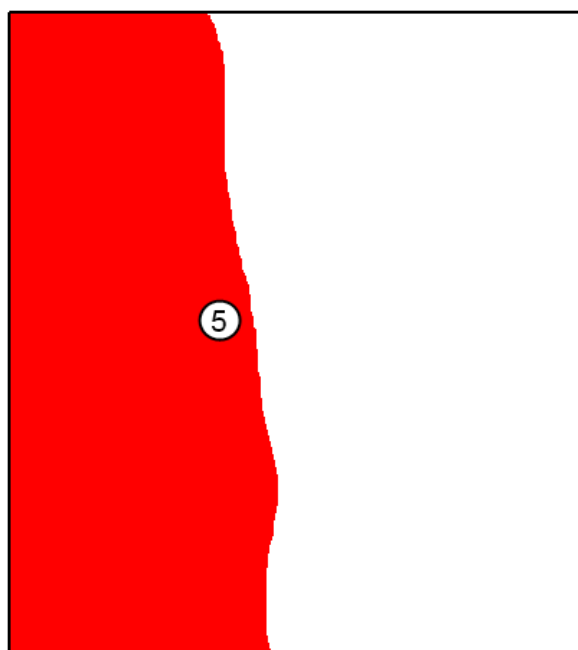
Replace the stones in the hone head and move the carriage to the next bore. Insert the hone head in the bore and set the upper limit. Hand feed the stones out until they make contact with the cylinder wall. Touch the MANUAL MODE button and the following screen will appear.

MANUAL HONING



MANUAL MODE is generally used for a quick touch up of cylinders when running a complete program is not needed. In this instance it will be used to become familiar with some of the specific buttons

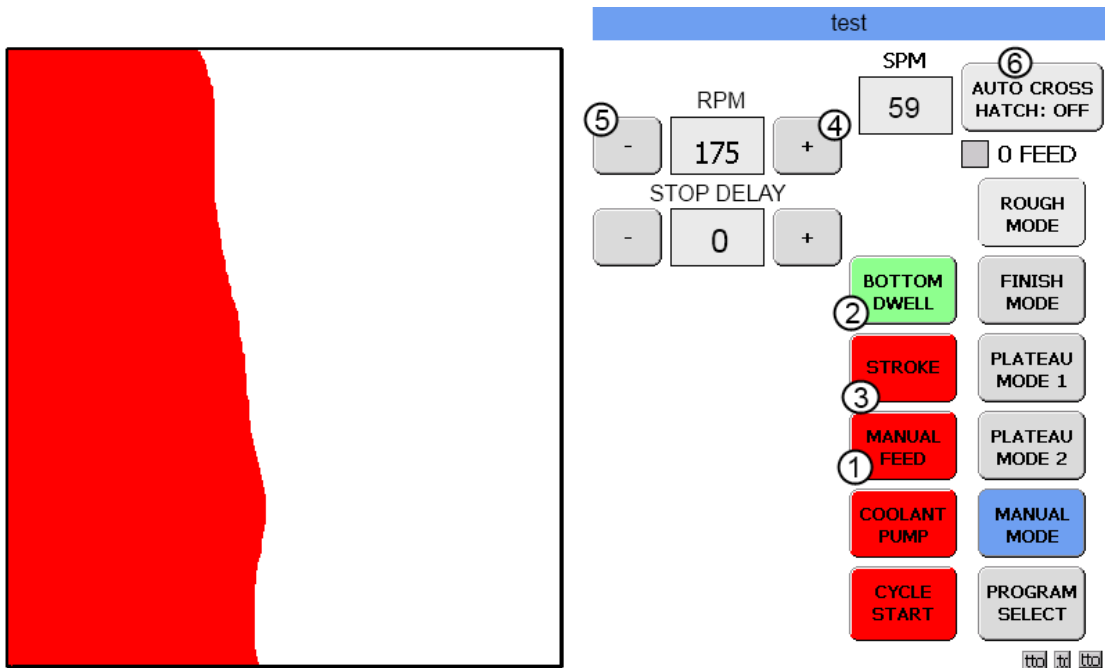
Start the coolant pump (1) and touch the CYCLE START button.(2) The motor will start running and the hone head will rotate. Touch the STROKE button (3) and the rocker arm will begin stroking. Touch and hold the MANUAL FEED button.(4) This will cause the stones to feed out and increase the load reading on the load graph. Hold the MANUAL FEED button until the load bar covers about 1/3 of the graph.(5)



Release the MANUAL FEED button (1) and let the hone continue to stroke. Touch and hold the BOTTOM DWELL button. The hone will stop stroking at the bottom of the bore while continuing to rotate. Release the button and the hone will start stroking. Touch the STROKE button (3) to deactivate it and the hone will stop stroking at the top of the bore. Touch the STROKE button again to reactivate it and the stroking will start again.

Now touch the + (4) and – (5) buttons next to the RPM box to increase or decrease the running RPM. Set RPM to 195 then touch the AUTO CROSS HATCH OFF button. (6) The button will turn red and the OFF will now read ON and the center row of control buttons will change to the following.

**AUTO CROSS
HATCH: ON**



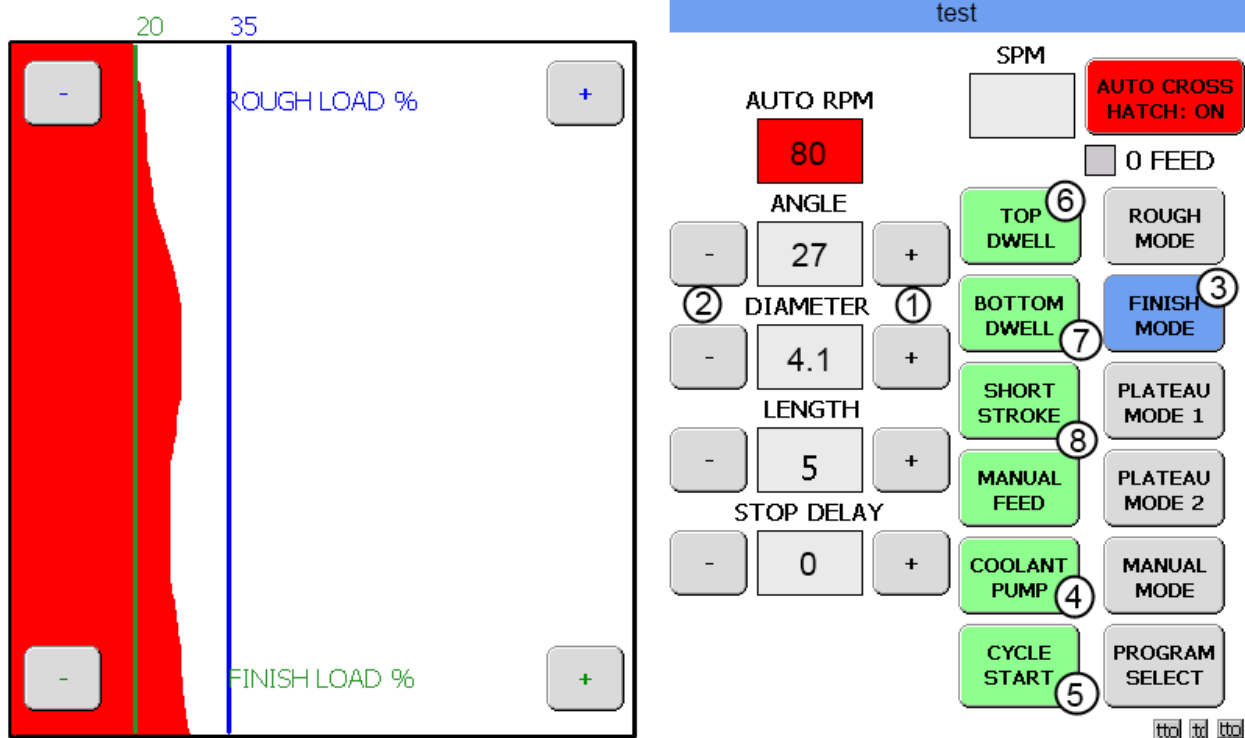
AUTO CROSS HATCH FUNCTION

In this mode the desired cross angle can be entered in the ANGLE box. Use the + (1) and – (2) buttons to input the DIAMETER and LENGTH of the block being honed. The RPM will be automatically adjusted to create the desired angle while the hone is stroking.

The AUTO CROSS HATCH process can be used in any Operation mode. Generally this feature is only used in the FINISH MODE and PLATEAU MODE 1.

Continue to hone in MANUAL MODE until you feel comfortable operating in this mode. When you feel ready, touch the CYCLE START button (5) to stop the hone. Turn off the coolant.(4)

Move the hone head to the next cylinder and after everything is set up, touch the FINISH MODE button. (3) If the Save changes box appears, touch SAVE to save program settings. The following screen will appear.



Start the coolant pump (4) and touch the CYCLE START button (5) to begin the honing process. Once the ROUGH LOAD has been achieved activate the different manual process buttons and observe what each one does. When touched and held on, the TOP DWELL button (6) will cause the stroke to stop at the top of the bore. When touched and held on, the BOTTOM DWELL button (7) will cause the stroke to stop at the bottom of the bore. When touched and held on, the SHORT STROKE button (8) will cause a short stroke to happen at the bottom of the bore.

This concludes the introduction process. Continue to practice on the test block until you feel comfortable operating the HP7A.

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MAINTENANCE

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Maintenance

Lubrication



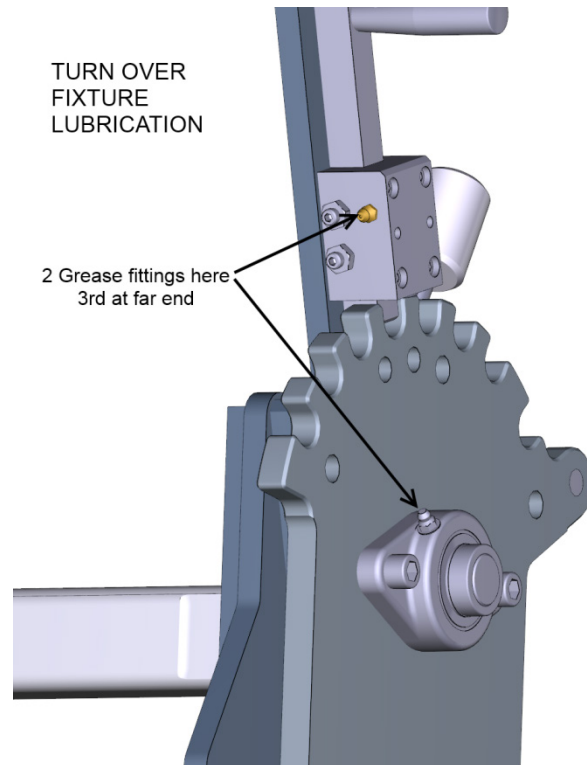
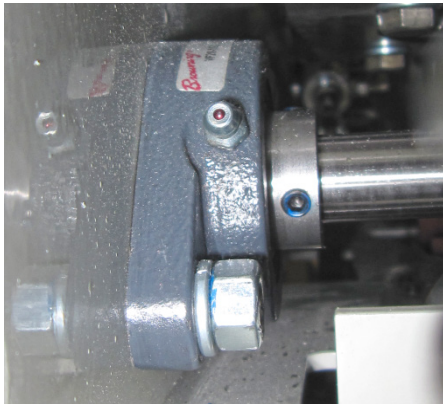
Refer to the Material Safety Data Sheets in Section 10 for information on proper use and handling of lubricants mentioned in this maintenance section.

Refer to illustrations and a list of manufacturers and oil types on following pages.

Grease Fittings

There are two grease fittings located on the rocker arm pivot bearings. On the block hold down fixture there are three grease fittings. Each optional clamp arm assembly has one grease fitting.

Every 175 hours, these grease fittings should be greased, using NLGI #2 White Lithium Grease.



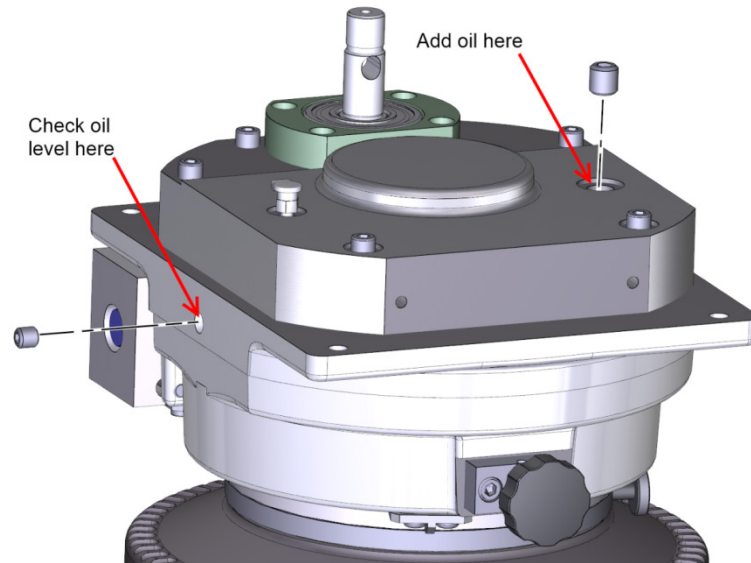
Gear Housing

The gear housing is located at the front end of the rocker arm. The gear housing is what drives and adjusts the hone head.

Every 1,000 hours:

check the oil level in the gear housing. The arm must be in the horizontal position. Remove the plug on the upper left side of the gear housing. The oil level should be up to this hole. If oil is needed, add to this hole. Use ISO VG 68 Bearing Oil.

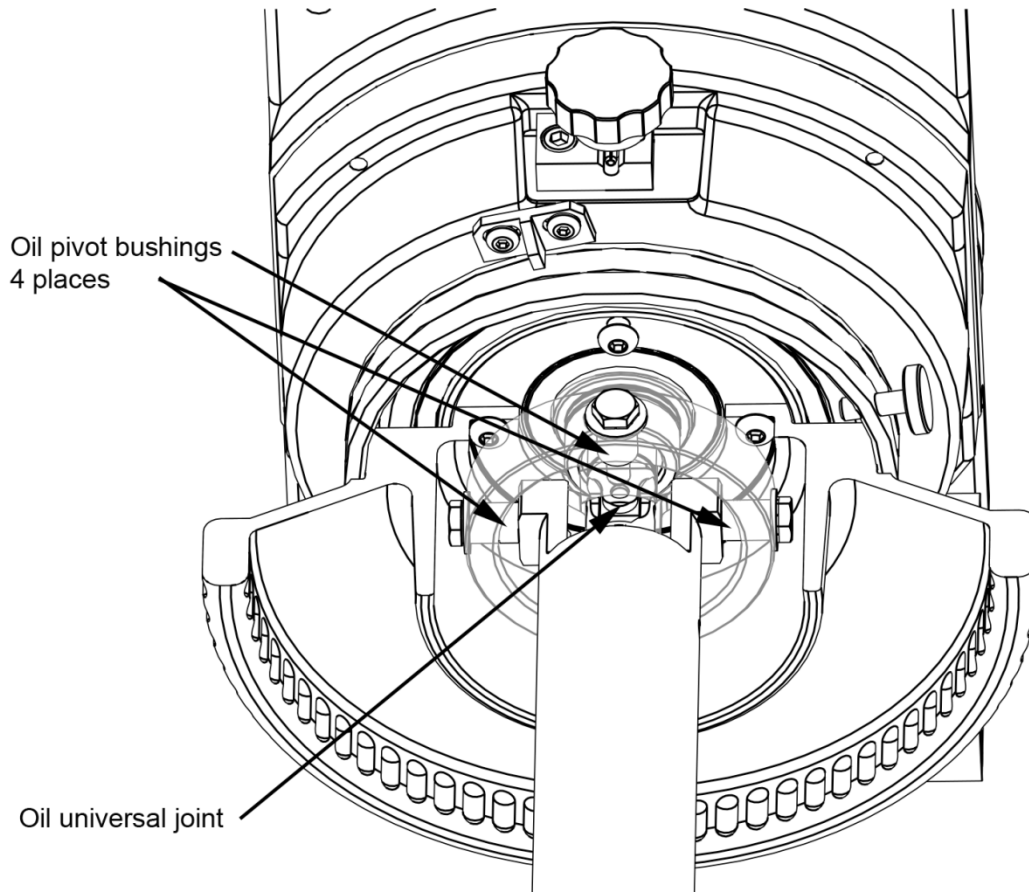
NOTE: DO NOT OVER FILL! If over-filled, oil will spill out of breather cap. To drain oil place rocker arm in a horizontal position and remove pipe plug on the side of the gearbox..



Drive Tube Pivot and Universal Joint

The drive tube assembly and universal joint connect the hone head drive and adjusting shaft assembly to the gear housing.

Every 8 hours, Lubricate the hinge points of the universal joint with ISO VG 68 Bearing Oil.



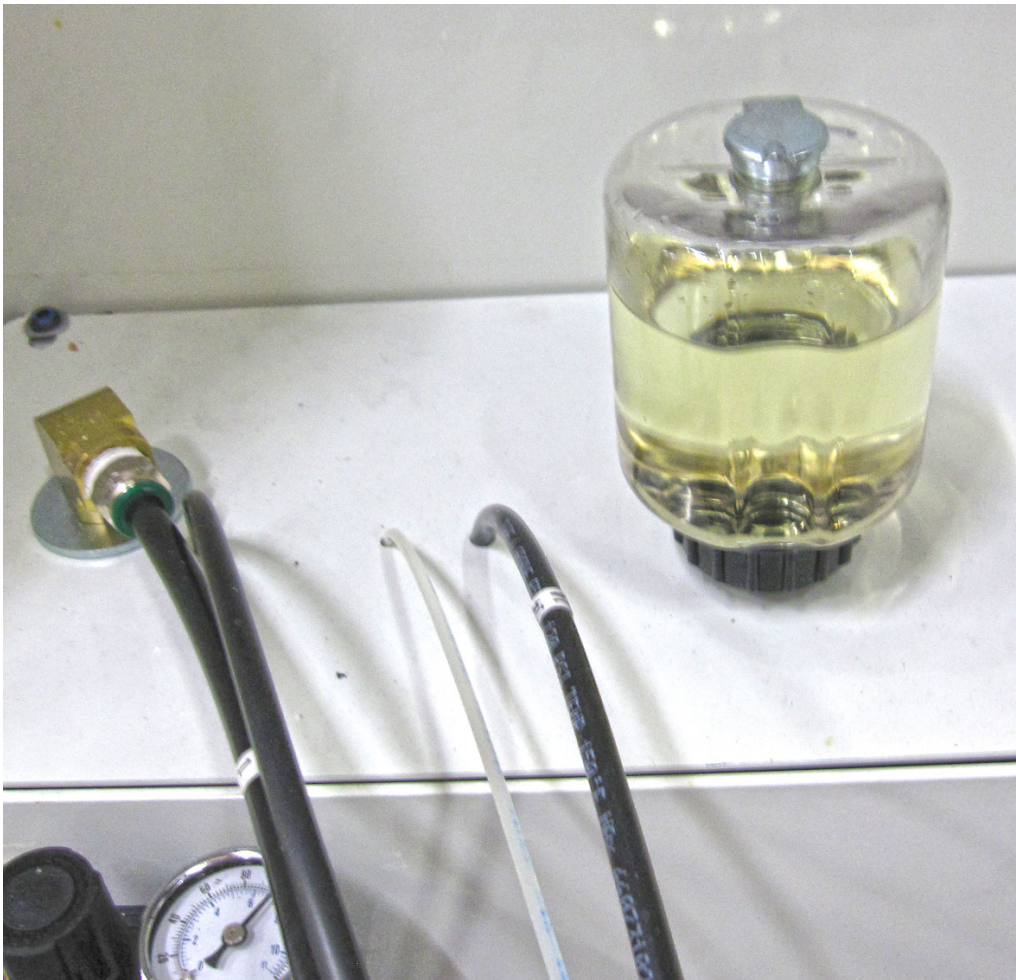
Automatic Lubricator

The oil injection lubricator is located on the back of the main base. The oil injector lubricates the stroking cylinder. The automatic injection lubricator is controlled by the program. The controller will activate the injection lubricator at a predetermined time interval. The time interval can be changed in the controller. See Machine Parameters.

When needed, add hydraulic oil to the reservoir. Use ISO VG 46 Hydraulic Oil. Rottler sells lubricator oil by the quart, part # 514-3-93A

NOTE: Only use oil that is compatible with Nitril seals, and will not cause them to swell.

DO NOT use compounded oils containing graphite, silicones, soaps or fillers. Hydraulic fluids containing phosphate esters (skydrol, fyruel, pydraul, etc.) or fire resistant oils containing phosphate esters.



Air Filter / Regulator

To maintain maximum filtering and efficiency, and to avoid excessive pressure drop, the filter regulator must be kept clean. Erratic regulator operation or loss of regulation is most always due to dirt in the disc area. If the air supply is kept clean the regulator should provide long periods of uninterrupted service.

As needed, depressurize and disassemble the filter / regulator (remove the bowl, filter and disc assembly). Clean parts with denatured alcohol and blow out body with compressed air. When reassembling, make sure disc stem fits into its center hole of diaphragm assembly. If diaphragm assembly is replaced, make sure disc stem fits into its center. Tighten bonnet slightly more than finger tight (50 inch pounds).

Wash porous filter elements with denatured alcohol.

Clean plastic bowl only with household soap.



Coolant Pump Honing Oil

The coolant pump is located in the back of the splash tank. The coolant drains under the block fixture into a sump under the machine.

Every 8 hours, change the filter paper. Change the honing coolant when it gets dirty. When changing coolant, completely clean tank and filter screen. **Use approximately 4 gallons of Rottler synthetic honing coolant mixed with 80 gallons of water. Use a Refractometer to achieve a more accurate mixture.**

Hydraulic System

This system is used to regulate the stroking speed.

Every 175 hours, check the hydraulic liquid level in the back of the carriage under the Rocker Arm. **If hydraulic oil is needed add specified oil to the top of the reservoir.** Remove breather to fill. Fill to mark on reservoir.

Use Mobil DTE EXCEL 46, or equivalent ISO VG 46 hydraulic oil.



Muffler Exhaust

The exhaust muffler on the main stroking system must be replaced periodically. If hone loses power in the stroking operation, a plugged exhaust muffler could be the cause.

The exhaust muffler is located at the rear of the machine. Remove the mount screws from cover plate. Remove cover plate. Unscrew the muffler and replace with a new filter.



Air Valve Lubricants

Rottler Manufacturing has compiled a partial list of suitable oils for customer applications. If given a choice, this list should help avoid potential problems down the road. The information is provided as a result of recent lab testing and a great deal of field experience. The suitable oil should have an aniline point in the 180-210 range and a viscosity of 150-200 seconds at 100 PSI (S.A.E. #10).

The following oils, without additives, are satisfactory:

Manufacturer	Oil Number
NFO	NFO 10 H/NR
NFO	NFO 10 W/NR
CHEVRON	AW 10 MACHINE OIL
CHEVRON	HANDY OIL 15
EXXON	TERESSTIC 32
MOBIL	MOBIL DTE LIGHT
MOBIL	DEXRON II ATF
MOBIL	AFT 210 TYPE F
MOBIL	DTE 13M
MOBIL	ALMO 525
MOBIL	MIST LUBE 24
MOBIL	DTE 24
MOBIL	HYDRAULIC OIL 13
MOBIL	HYDRAULIC OIL AW 32
WOLVERINE	A-INDUSTRIAL 150 R&O
TITAN	TYPE F ATF
TITAL	DEXRON II ATF
AMERICAN	INDUSTRIAL OIL 32

The use of Kerosene, animal or vegetable fats should be avoided for use as additives and or cleaning agents



Any penetrants such as WD40 or Marvel Wonder Oil should NEVER be used in the HP7A. Damage to the solenoid seals will result and are not covered by warranty.

Hydraulic System

System Description

The stroking action of the Rocker Arm is accomplished by applying air pressure to the top and bottom of the air cylinder, located in the middle of the Rocker arm. To control the speed of the air cylinder there is a closed hydraulic loop system. The Hydraulic fluid flow is restricted by the stroking speed control valve. As more or less fluid is allowed to pass through the speed control valve the faster or slower the Rocker Arm will stroke.

System Check

With the machine running, watch the Rocker Arm and see if there is any jerking, or bouncing when the Rocker Arm is changing directions, slow down the stroking speed to 40 SPM. Jerking and bouncing indicate air in the hydraulic system. Air bubbles will also be visible in the hydraulic lines.

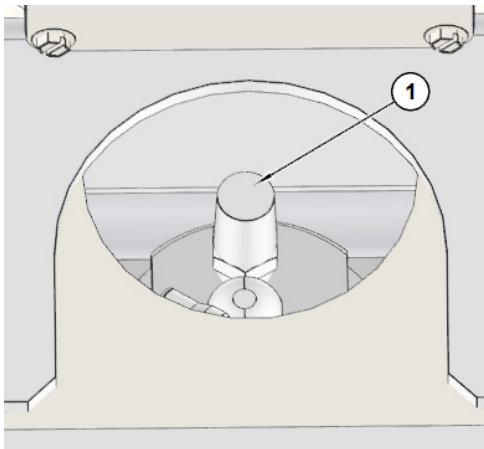
Note: At very slow stroking speeds, there may be some bouncing of the Rocker Arm at the bottom of the stroke. This is normal. Increase the stroking speed slightly.

System Refilling and Bleeding

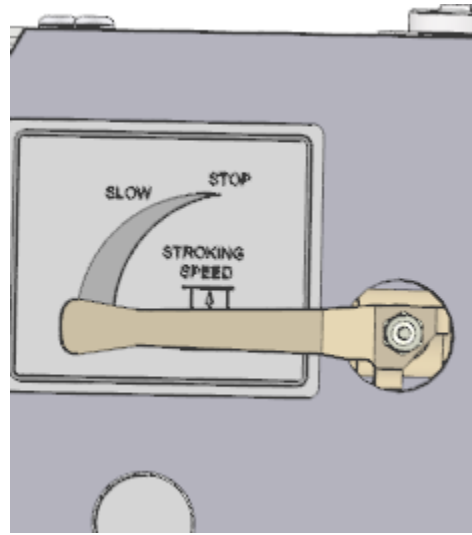
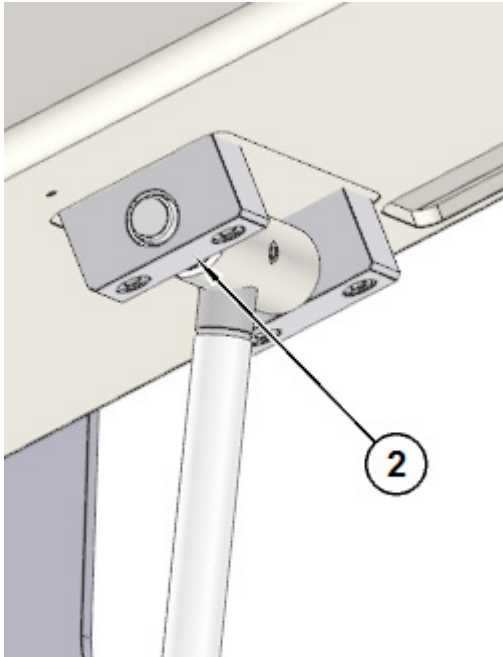
Locate the Hydraulic Bleeder kit (514-3-30C) that came with the HP7A. It should include the following:

- (1) 502-11-17H – 3/8" to 1/4" adapter
- (2) 514-4-17W – 1/4" fitting
- (2 ft) 514-4-26 – 1/4" air line
- (1.5 ft) RX-514-3-30B – Clear Bleeder Tubing

1. Turn the main air off.
2. Shut off power to the machine.
3. Remove the breather from the top of the Reservoir. (1) Fill the Reservoir (if it is not full) with specified hydraulic oil. Using a long neck funnel fill until the level reaches the top edge at the back of the reservoir, do not over fill.



4. Disconnect the Upper Hydraulic Mounting brackets from the Rocker Arm.(2)
5. Push the Hydraulic Cylinder Rod all the way down.
6. Open the Stroking Speed control valve all the way. (This is the lever on the right hand side of the carriage. Turn it Horizontal.)



7. Insert one of the 1/4" fittings into the 3/8" to 1/4" adapter. Insert the 1/4" air line into the fitting. Screw the adapter into the Hydraulic Reservoir where the breather was removed.
8. Screw the other 1/4" fitting into an air nozzle.
9. Slip the length of Bleeder Hose over the Bleed Valve . Run the other end of the hose into a small container.
10. Open the bleed valve. Apply no more than 40 PSI to the 1/4" air line that runs to the top of the Hydraulic Reservoir. As the air is applied to the reservoir, fluid will come out of the Bleed Valve.



NOTE: Do not let all of the fluid run out of the Hydraulic Reservoir. This will induce more air into the Hydraulic System.

11. Close the Bleed Valve and re-fill the reservoir.
12. Repeat the above procedure until there are no air bubbles coming through the bleed Hose.
13. Raise the Hydraulic Cylinder Rod (5) fully.
14. Repeat the filling and draining procedure again until there are no air bubbles coming through the bleed hose.
15. Reattach the Hydraulic Cylinder Rod to the Rocker arm via the Mounting Brackets.
16. Reapply air and electrical to the machine.
17. Start the machine stroking at 40 SPM, if there is still bouncing or jerking of the Rocker Arm repeat the bleeding procedure. Not all of the air has been removed from the Hydraulic System.

V-Belt Adjustment and Removal



WARNING

Disconnect all electrical and air power before making any repairs.

V-Belt Adjustment

Remove the wedge shaped cover on top of the rocker arm. Loosen the 4 motor bracket mounting screws from the top of the rocker arm. Push the motor back until there is approximately 1/2 inch deflection of the v-belt. Measure deflection midway between the motor and the gear housing.

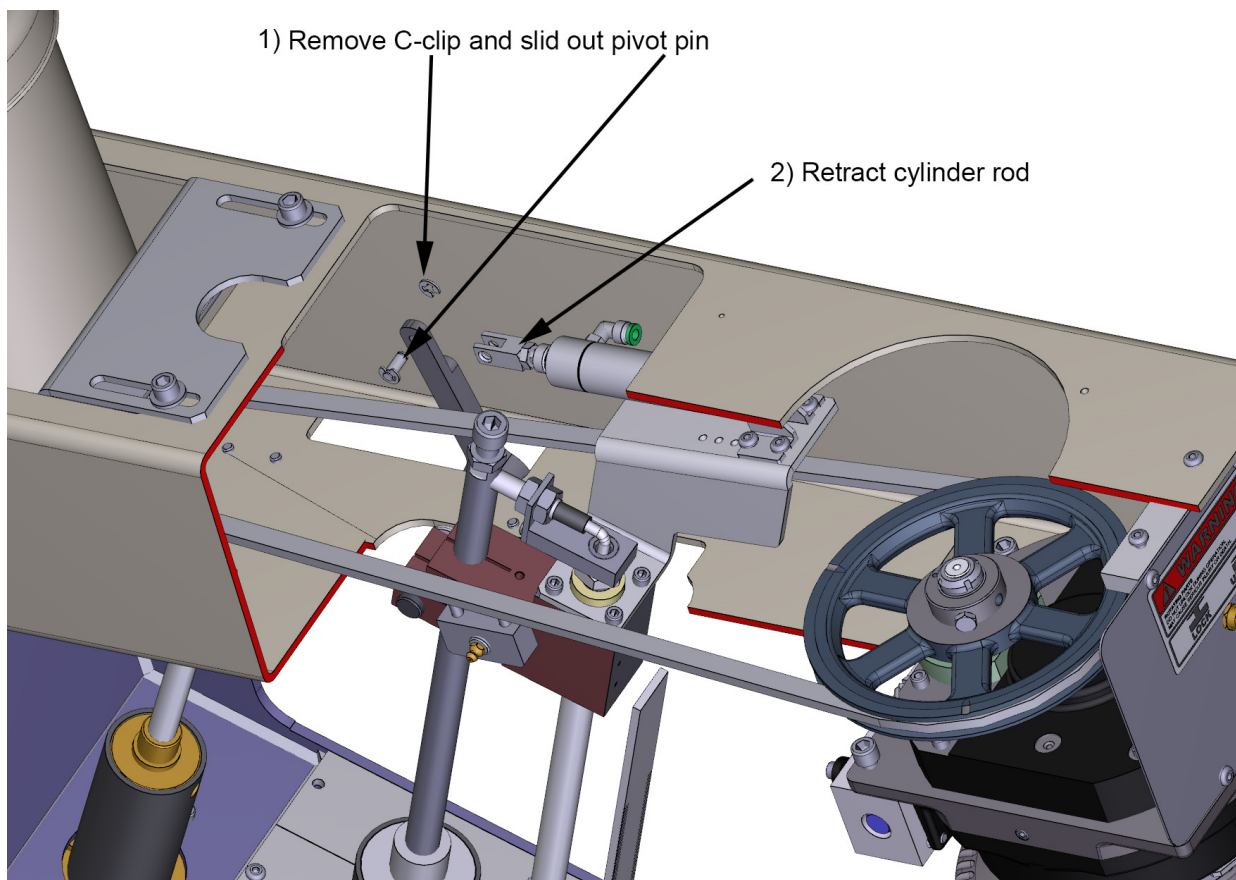
NOTE: *Do not over tighten belt.*

Tighten the motor mounting plate. Replace the front cover and tighten its screws.

V-Belt Removal

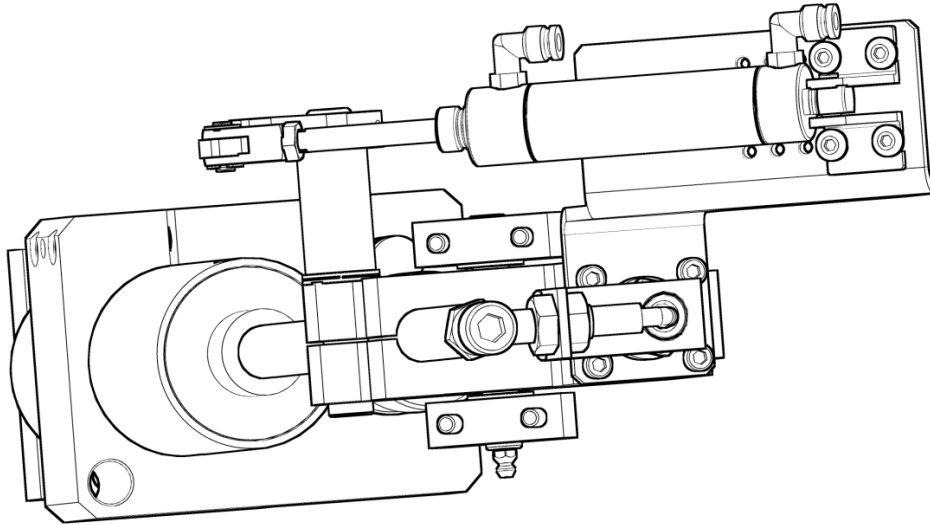
Remove the wedge shaped cover on top of the rocker arm. Loosen the 4 motor bracket mounting screws from the top of the rocker arm. Slide the motor forward. Remove pivot pin from air cylinder. Retract cylinder rod. Remove V-belt through the stop rod slot in the top of the rocker arm.

Installation of the new belt is the reverse. See above for V-belt adjustment.

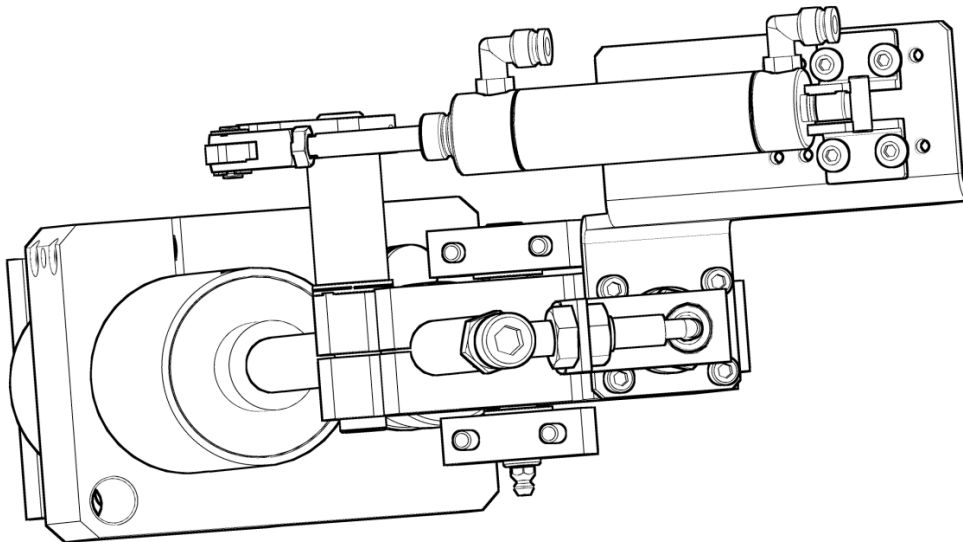


Adjusting Pivot Lock Cylinder Assembly

1. Shut off power and air supply for machine.
2. Remove rocker arm cover.
3. Remove 4 button head bolts holding cylinder brackets to mount plate.



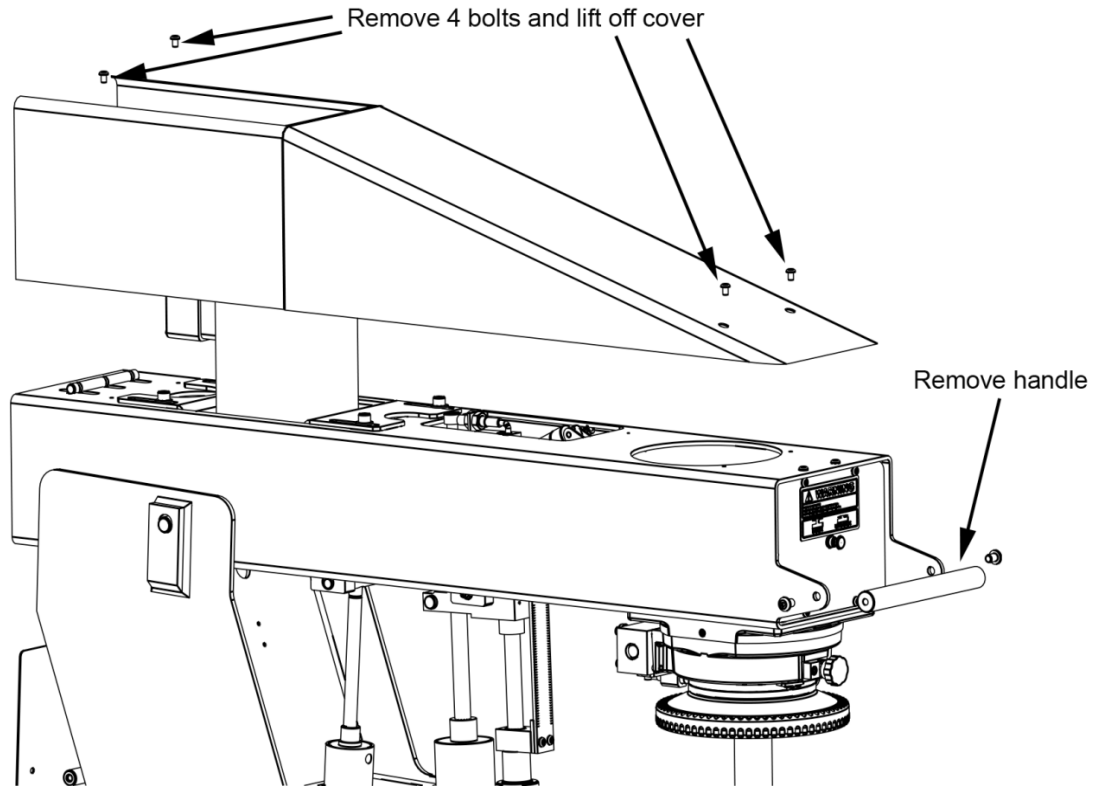
4. Move cylinder and brackets down to next set of mounting holes.
5. Replace 4 button head bolts.
6. Turn air supply on and confirm that pivot lock assembly is working correctly.



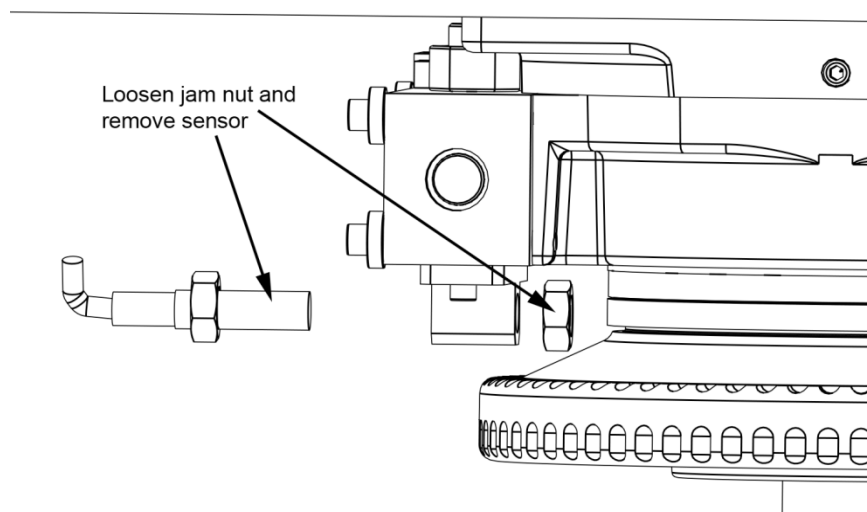
7. Replace rocker arm cover.
8. Turn power on.

Gear Housing Removal

1. Remove hone head assembly from drive tube if still attached.
2. Place rocker arm in a horizontal position.
3. Turn off the power and disconnect air supply to machine.
4. Remove top cover and rocker arm handle.



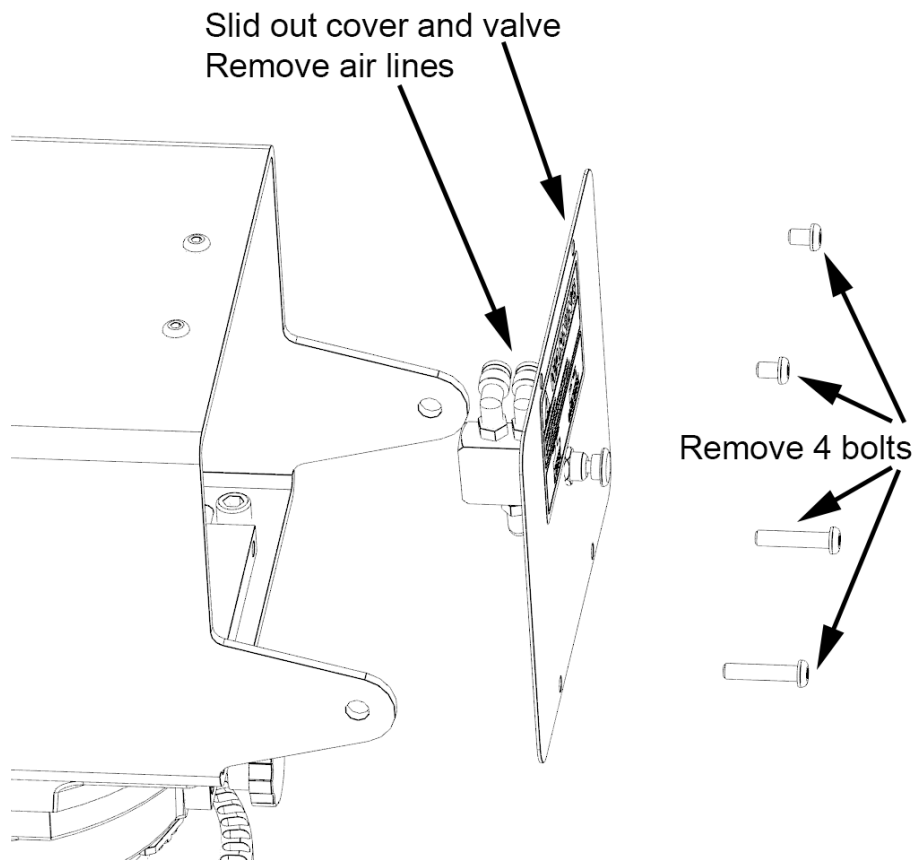
5. Remove sensor from back of gearbox assembly.



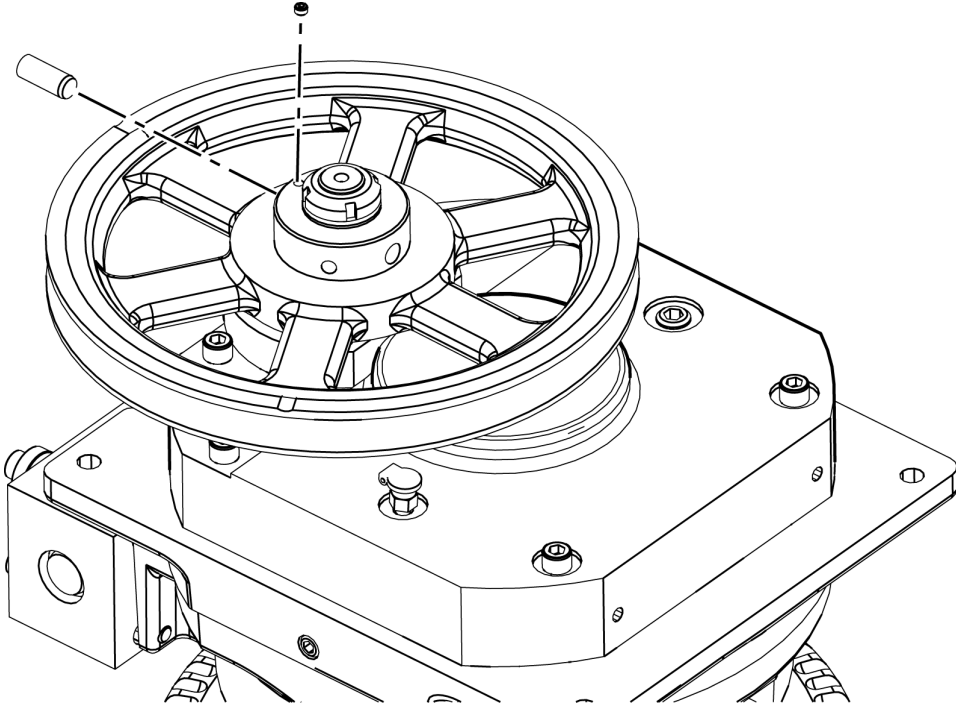
6. Remove air lines from fittings on feed actuator. Make note of which airline goes into which fitting.



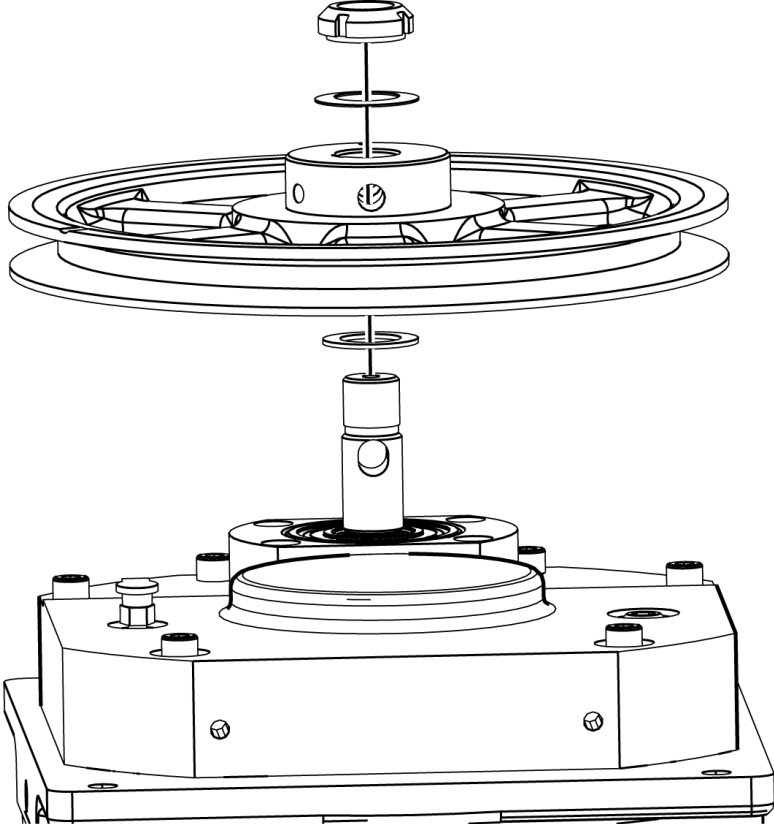
7. Remove front cover and air valve assembly. Make note of which airline goes into which fitting.



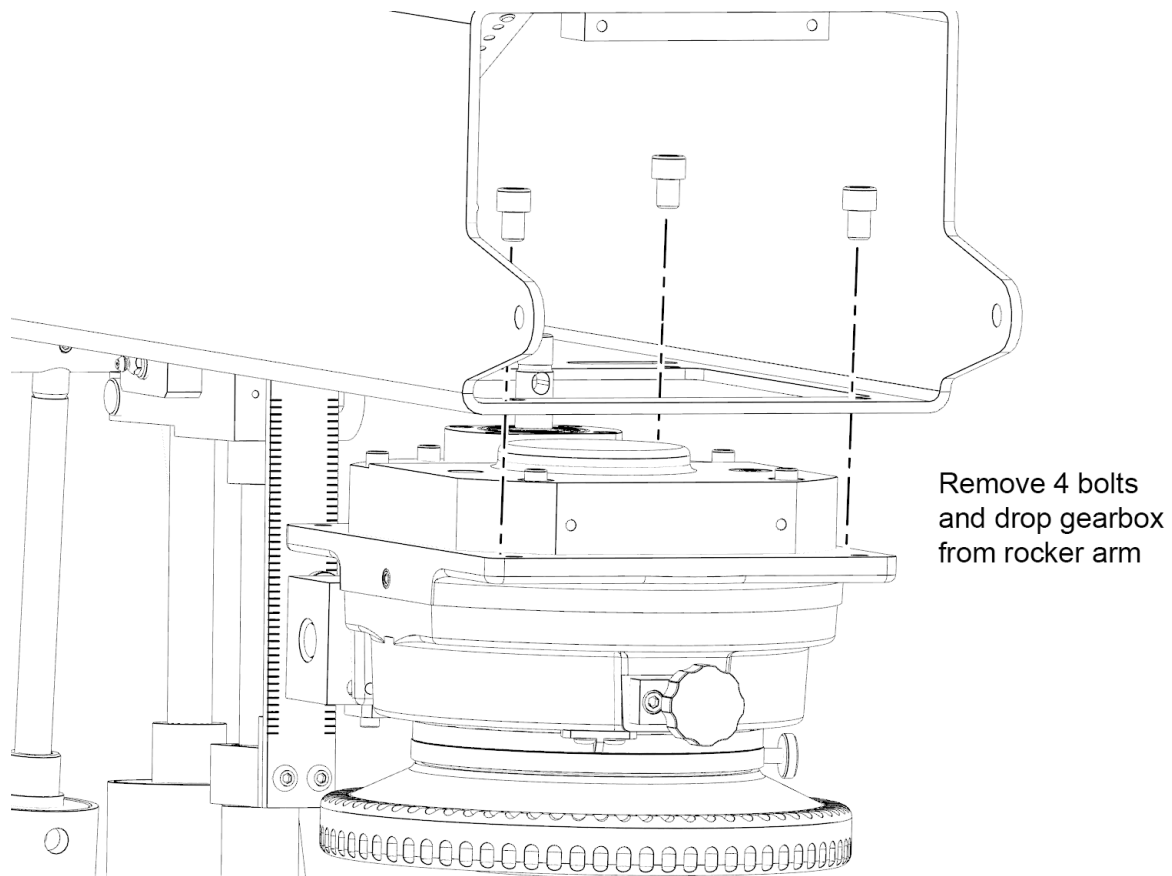
- 8. Loosen motor bracket bolts and remove belt from pulley.
- 9. Remove shear pin from pulley.



- 10. Remove pulley.



11. Unbolt gearbox and remove from rocker arm.

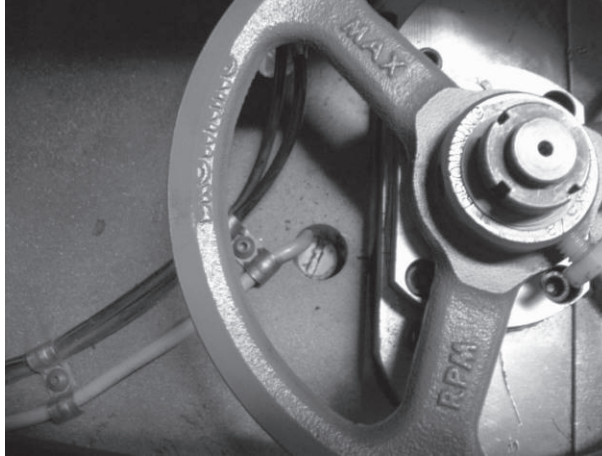


12. Install replacement gearbox reversing removal procedure. Be sure to adjust belt tension per instructions in maintenance section of the manual.

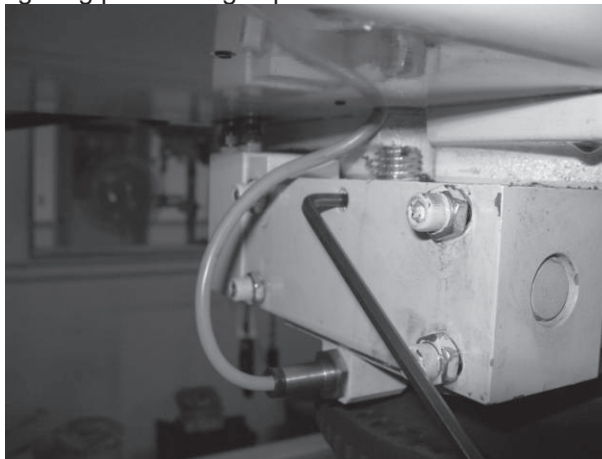
Adjusting Drag Pin Tension

⚠ WARNING *Disconnect all electrical and air power before making any repairs*

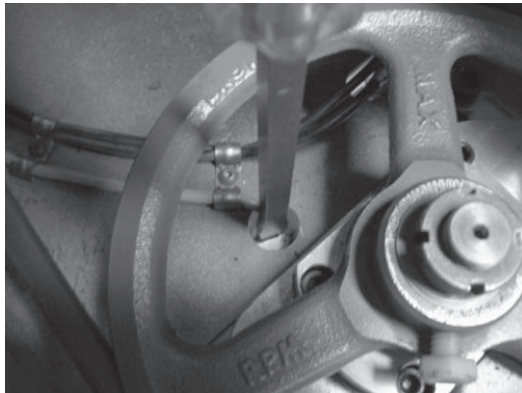
1. Remove top rocker arm cover to gain access to drag pin adjustment.



2. Loosen set screw holding drag pin housing in place.



3. Use large screwdriver to adjust drag pin tension. It may be necessary to use a wrench on the screwdriver to overcome hardened thread sealer.



4. When adjustment is completed tighten set screw on drag pin housing.
5. Replace top rocker arm cover.

Adjusting Feed Out Actuator Housing

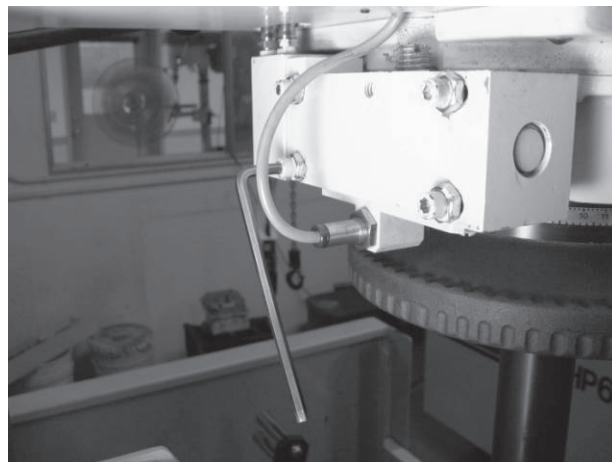


Disconnect all electrical and air power before making any repairs.

1. Place scribe mark on feed out actuator housing to mark original location.



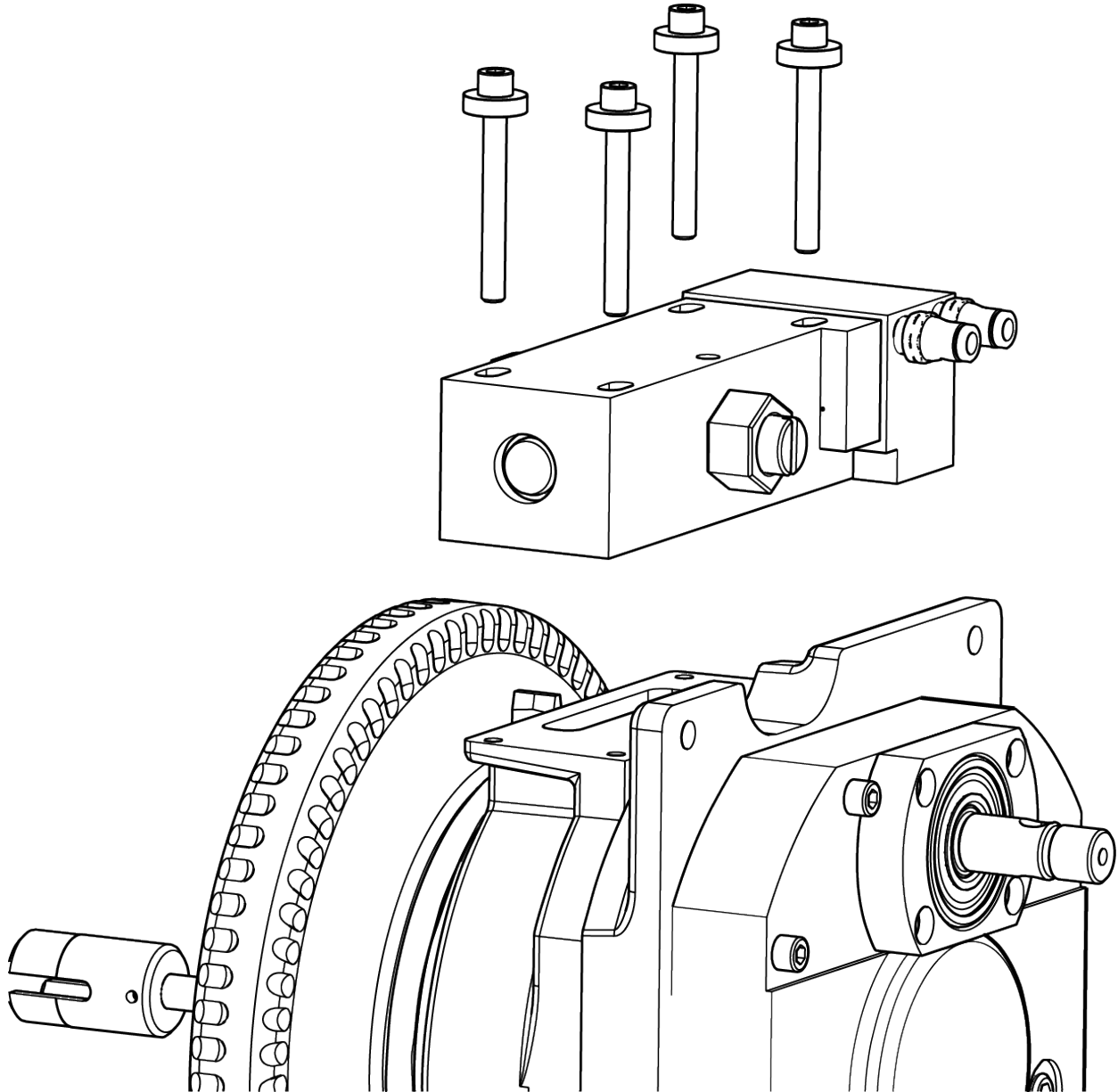
2. Loosen 4 bolts holding housing to back of gearbox.



3. Use rubber mallet to move housing to the left or right as needed. Take caution not to strike shifting spool pin.
4. Tighten bolts then test feed out performance.
5. Make further adjustments as needed.

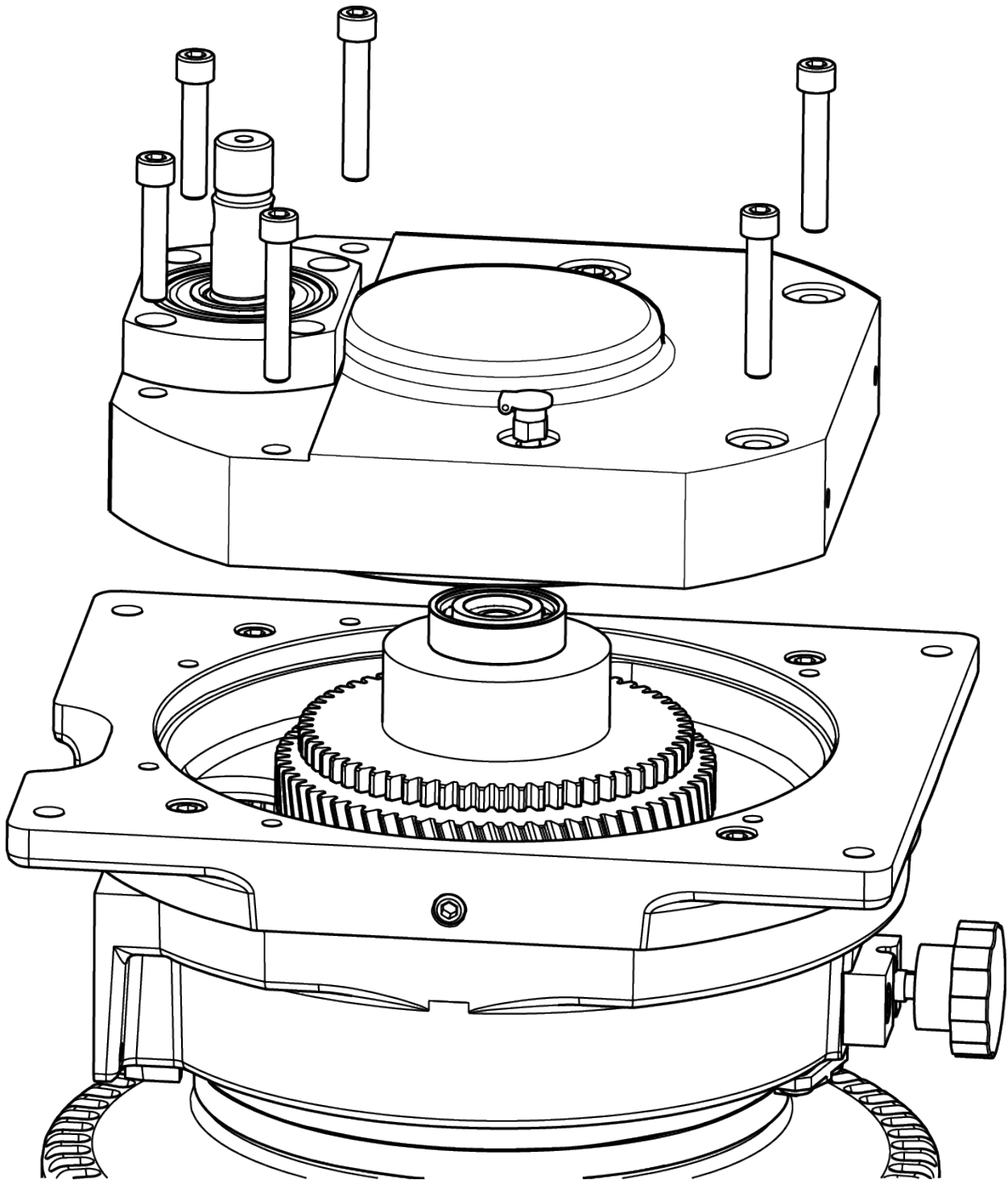
Gear Housing Disassembly

Follow procedure to remove gear housing from machine.
Set gear housing in the position shown and remove the actuator assembly.

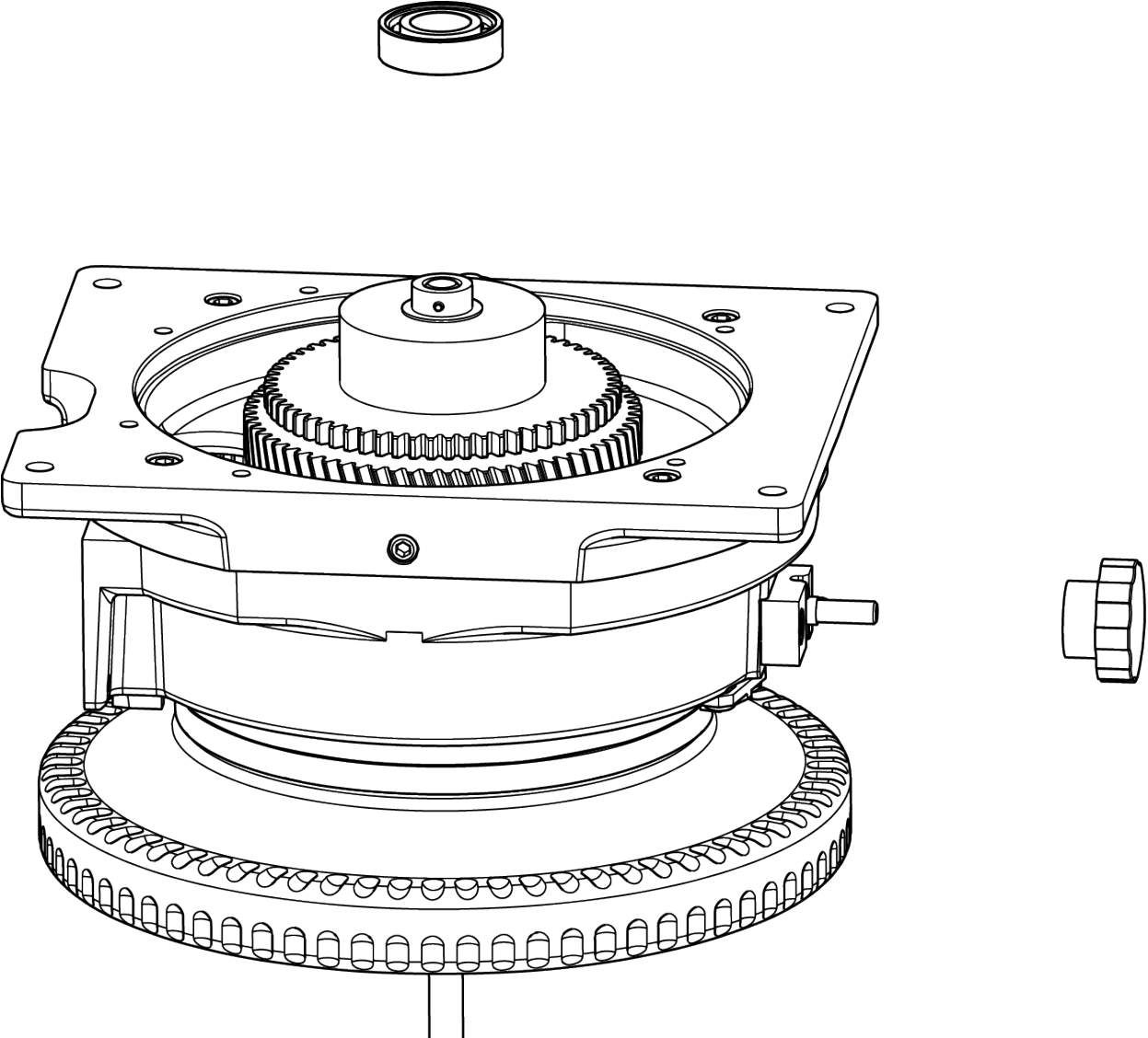


After actuator housing is removed drain oil from gear housing through opening for actuator housing.

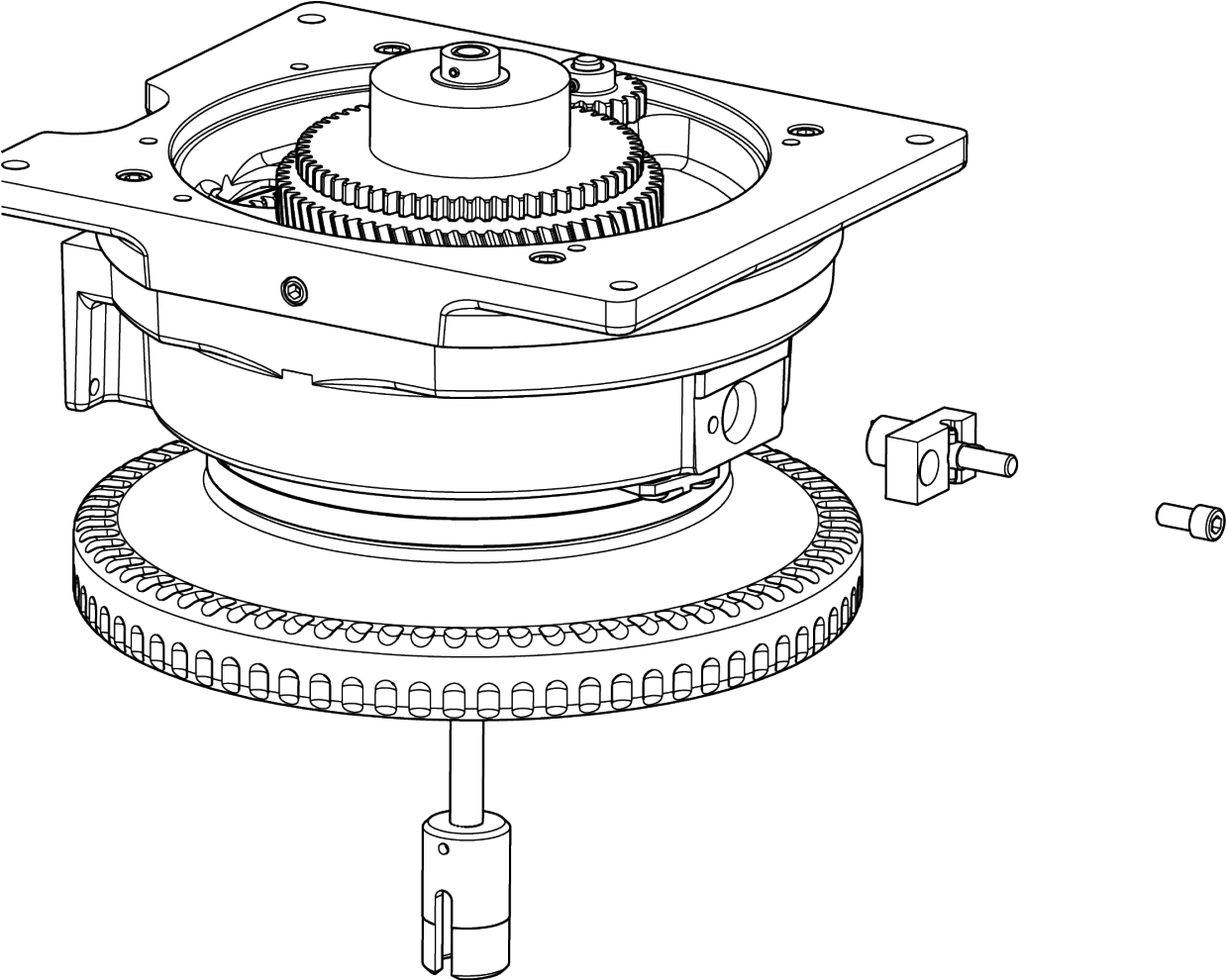
Remove upper housing assembly.



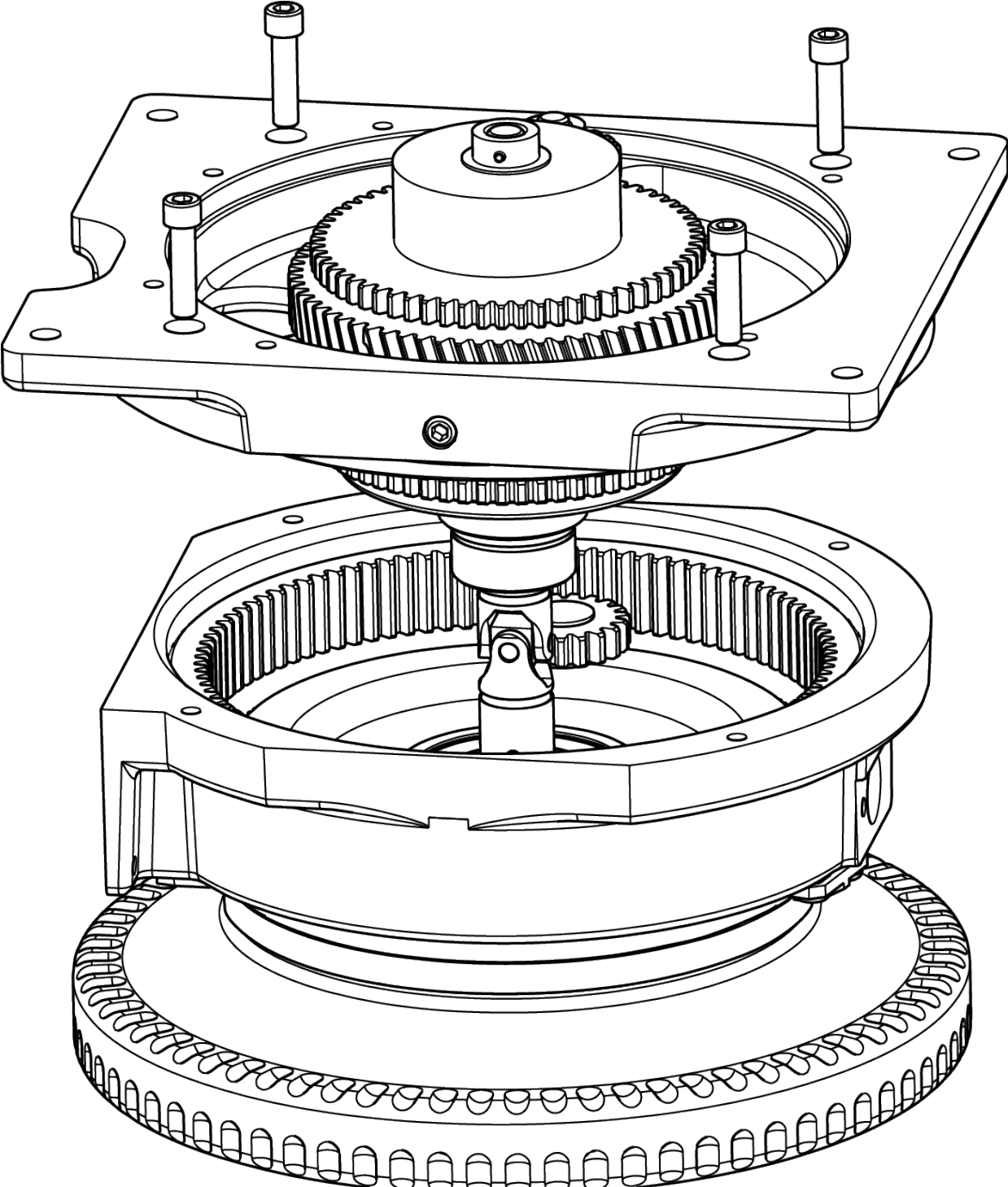
Remove bearing from sun gear and knob from ratchet pawl assembly.



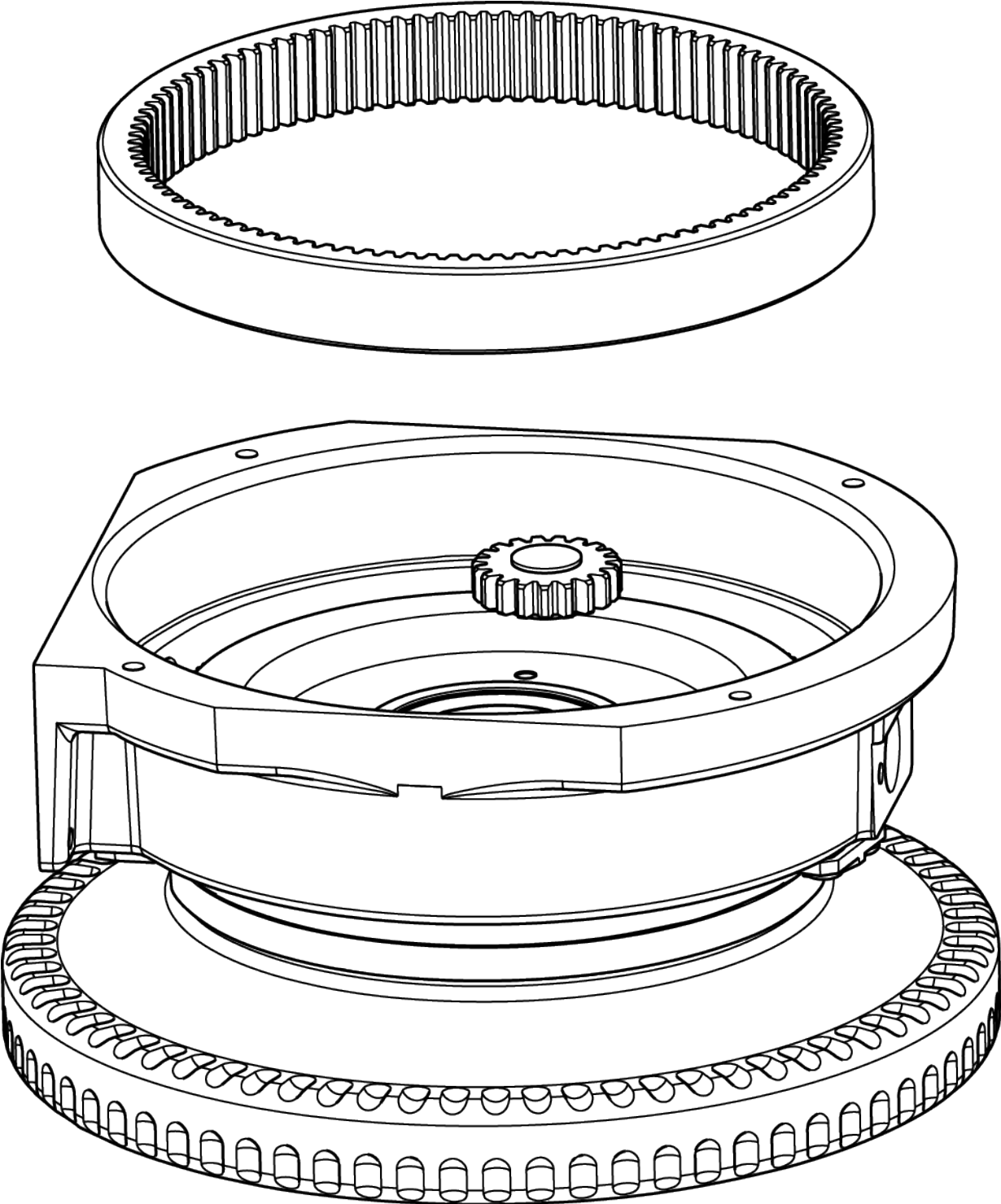
Remove ratchet pawl assembly from gear cage.



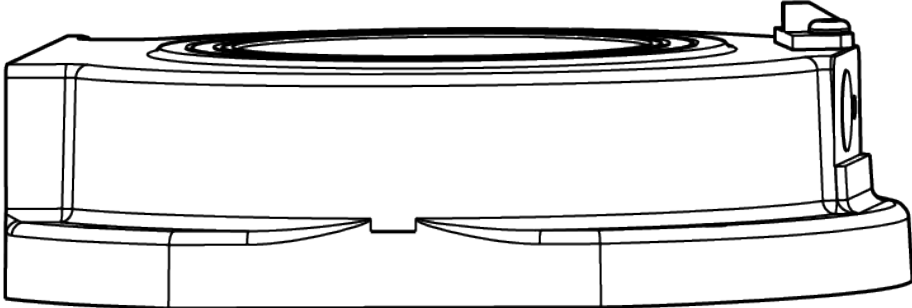
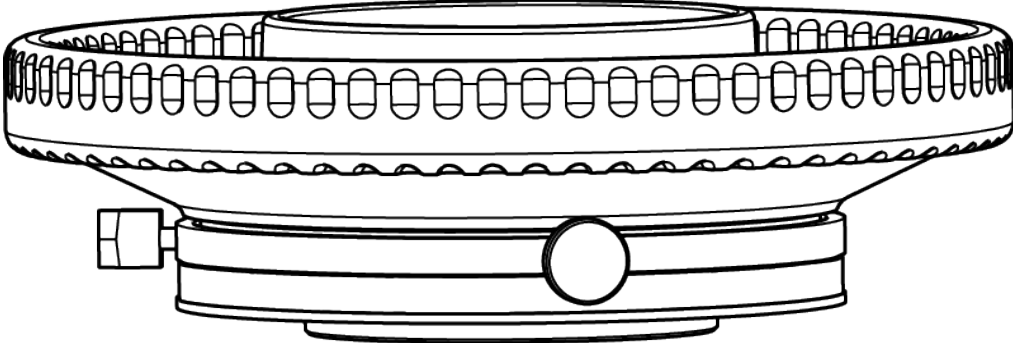
Remove fasteners from lower housing to cage assembly. Separate lower housing from cage assembly.



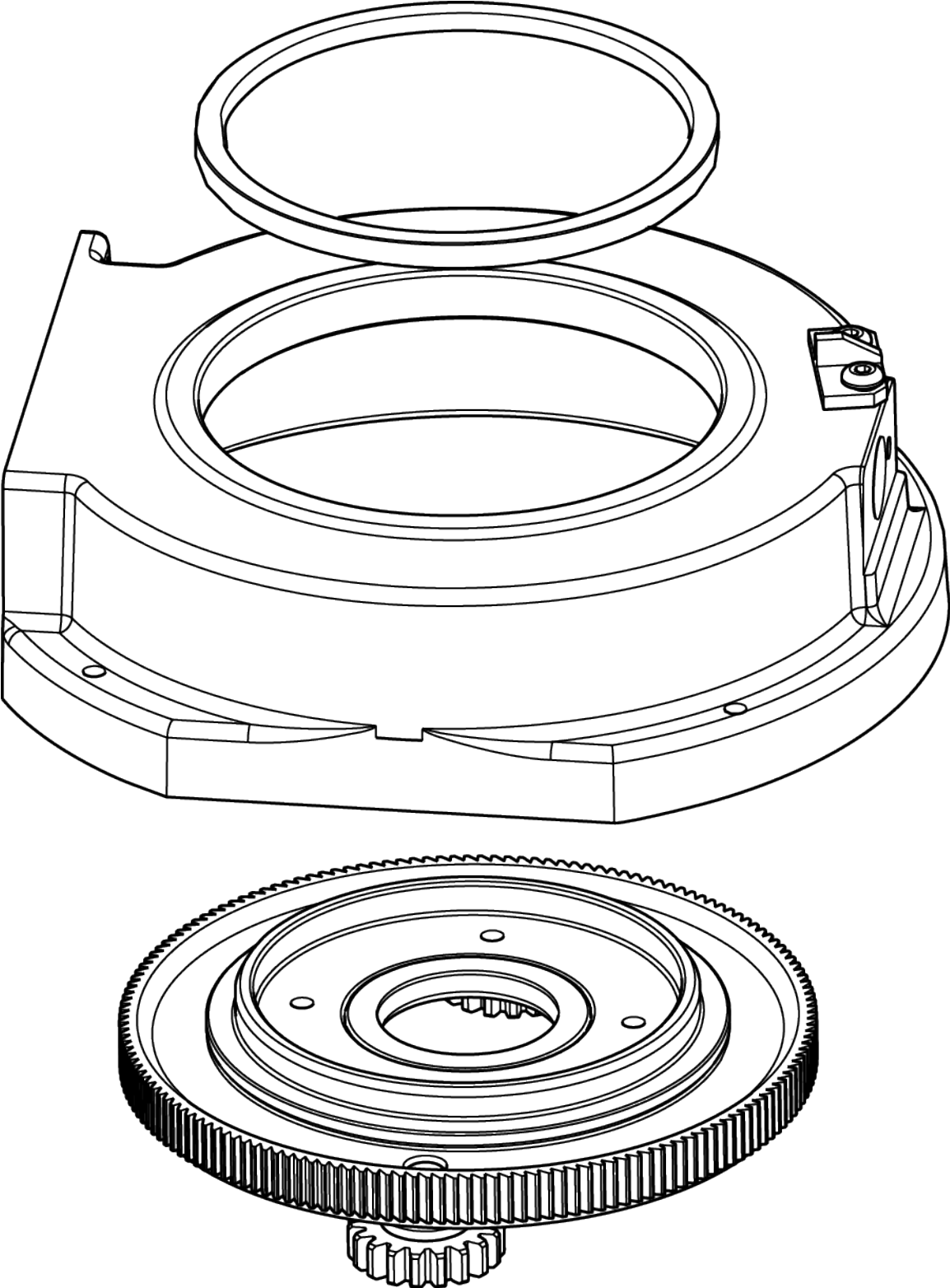
Remove ring gear from cage assembly.



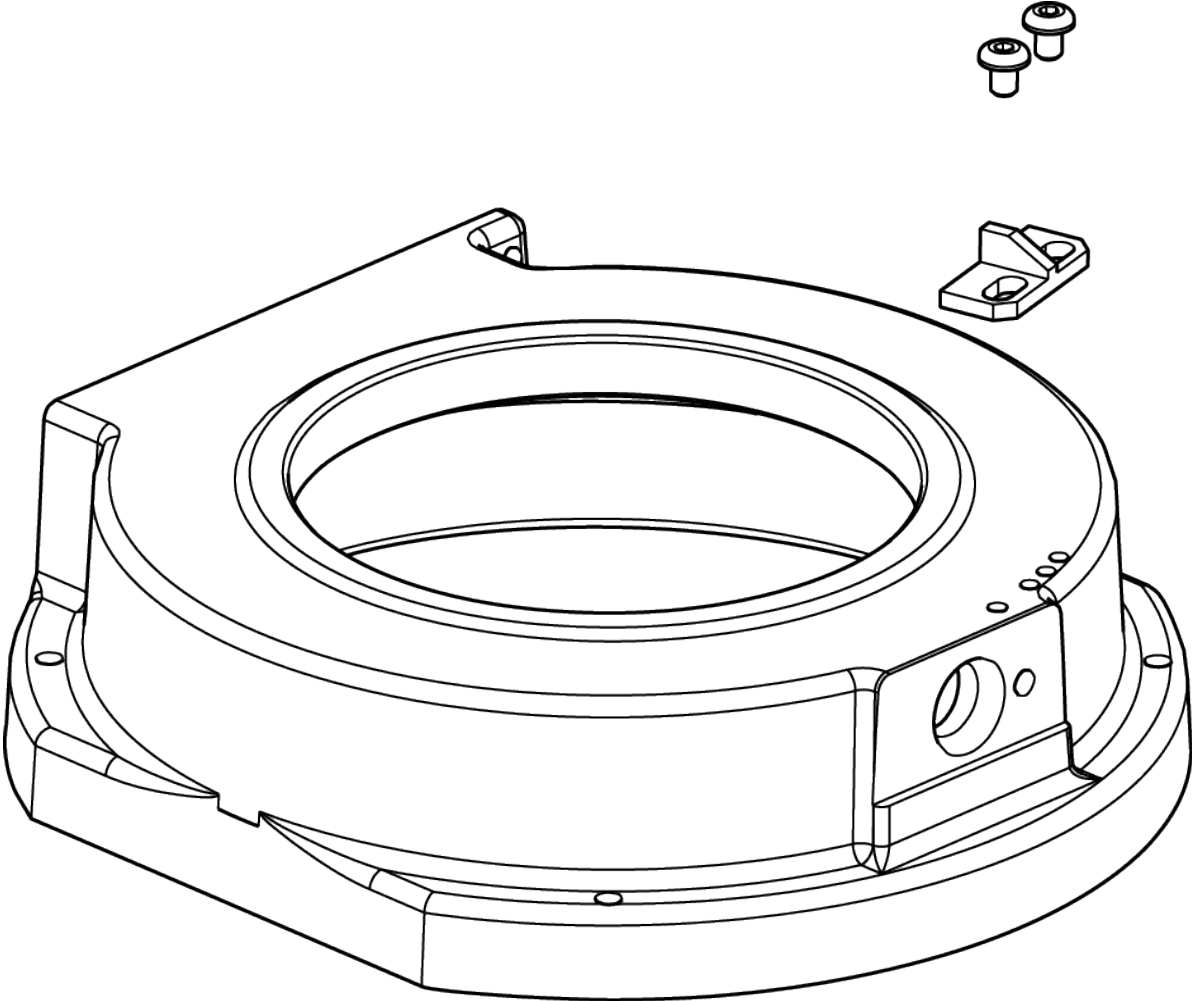
Remove fasteners holding hand wheel to cage assembly. Remove hand wheel assembly.



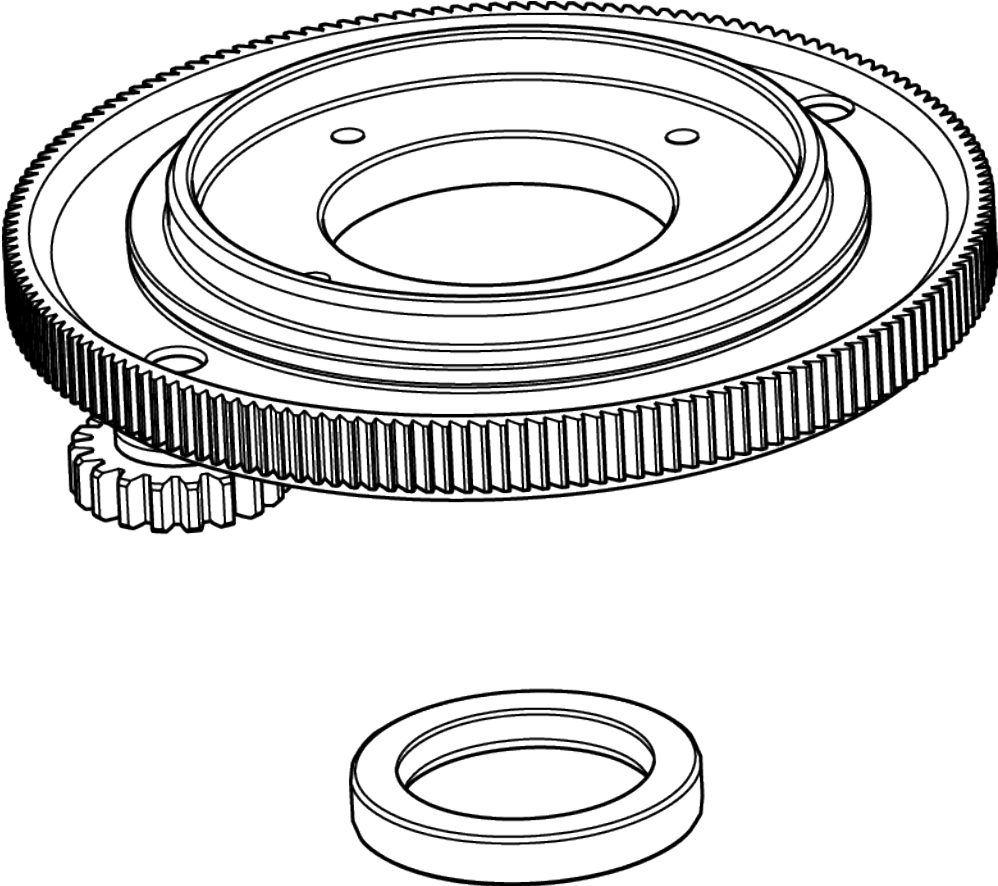
Drop ratchet gear assembly from cage assembly. Remove oil seal from cage assembly.



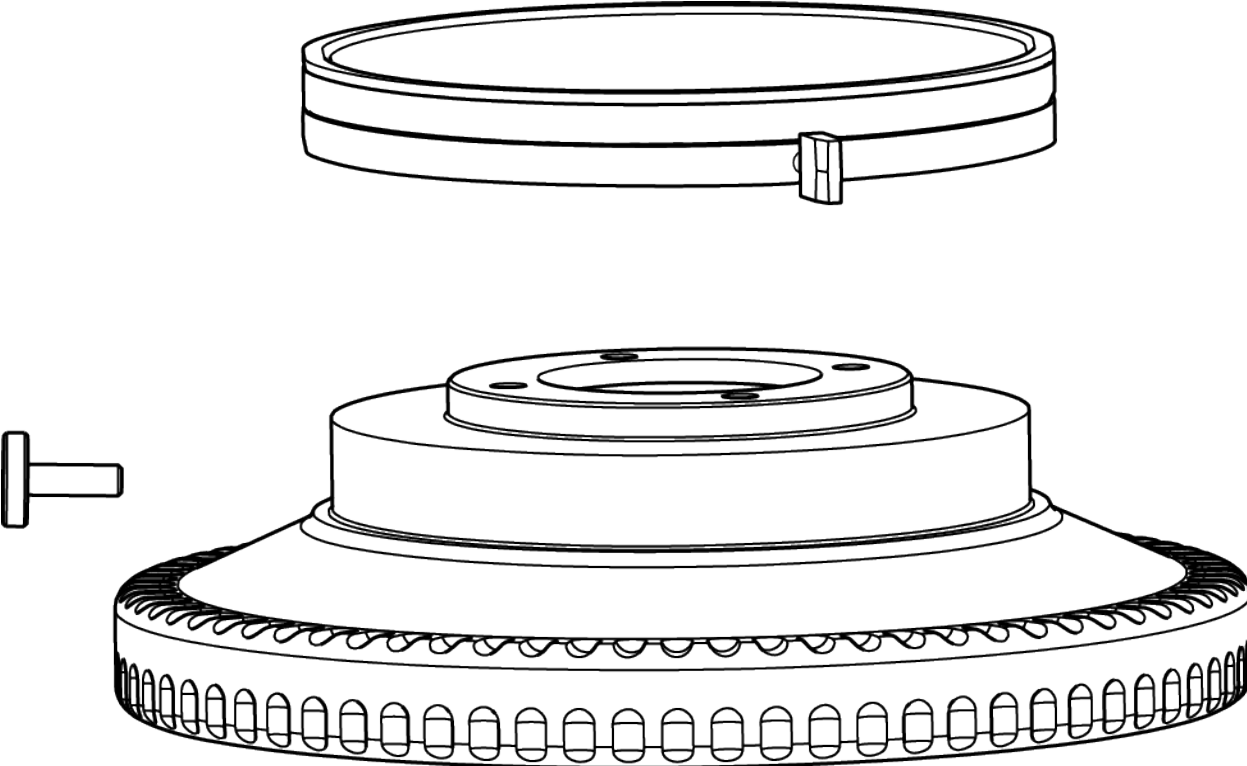
Remove fasteners and pointer from cage housing.



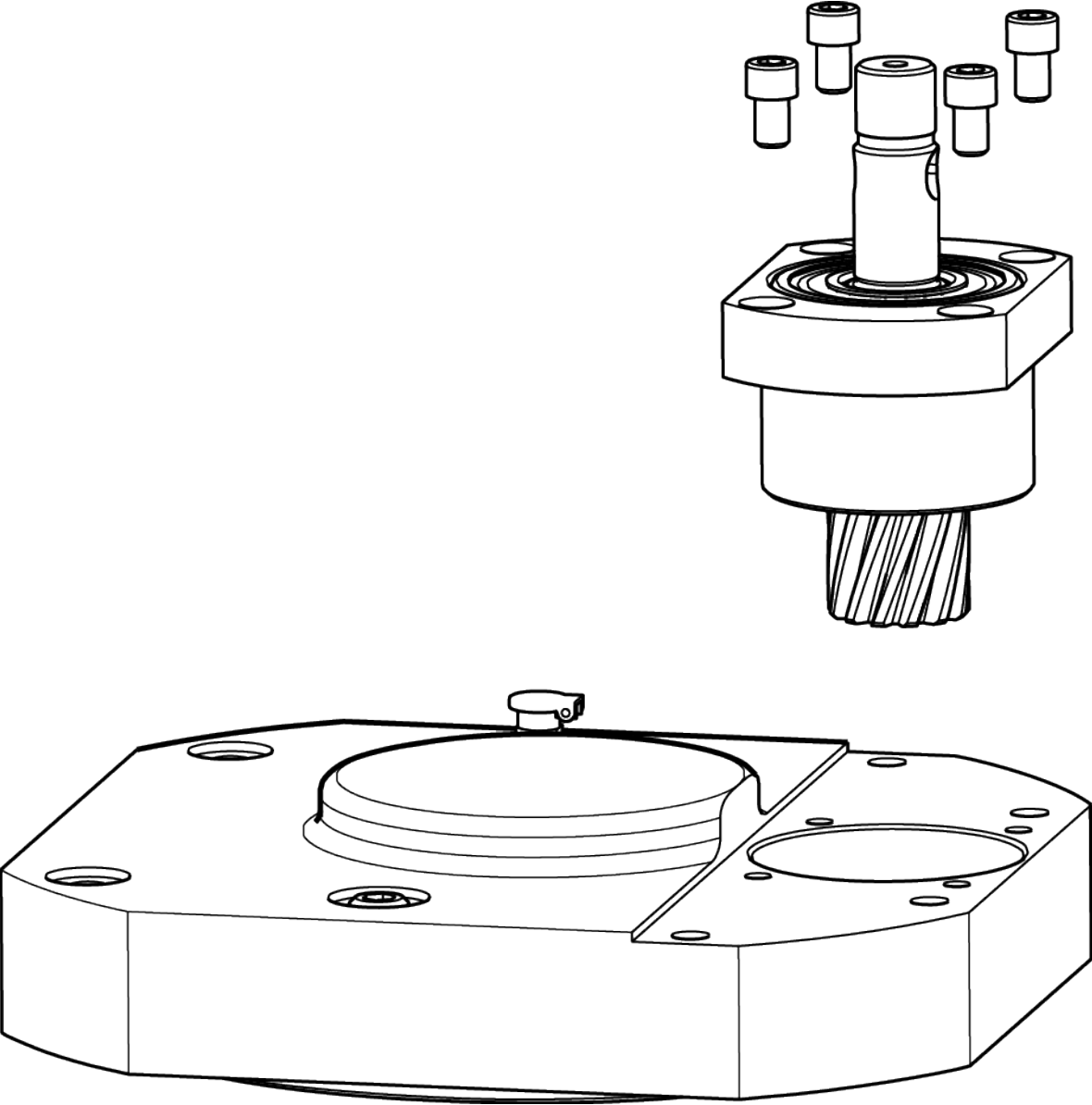
Remove oil seal from ratchet gear assembly.



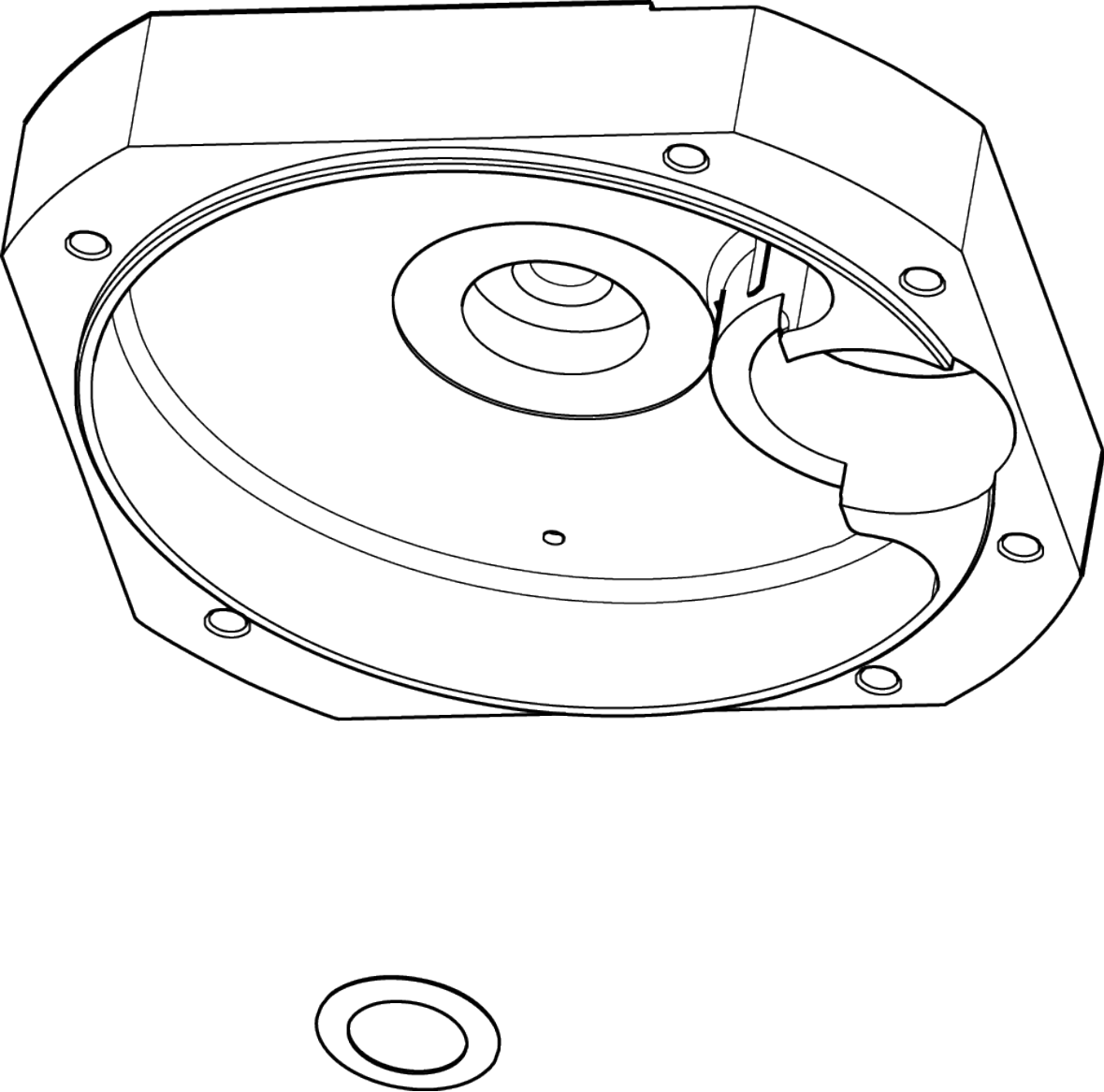
Remove thumbscrew from feed ring and lift feed ring from hand wheel.



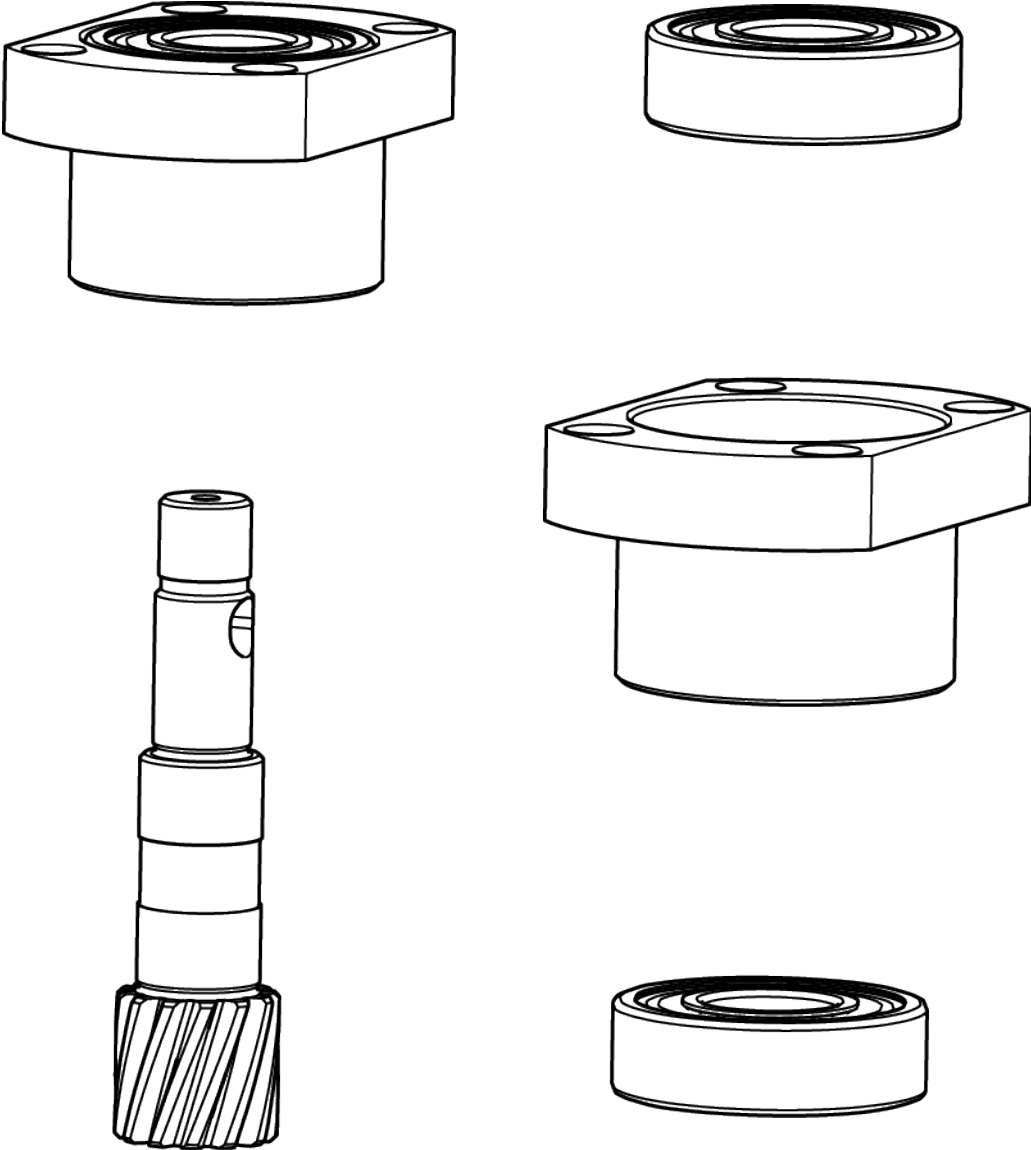
Remove fasteners from pinion gear assembly and lift gear assembly from upper housing.



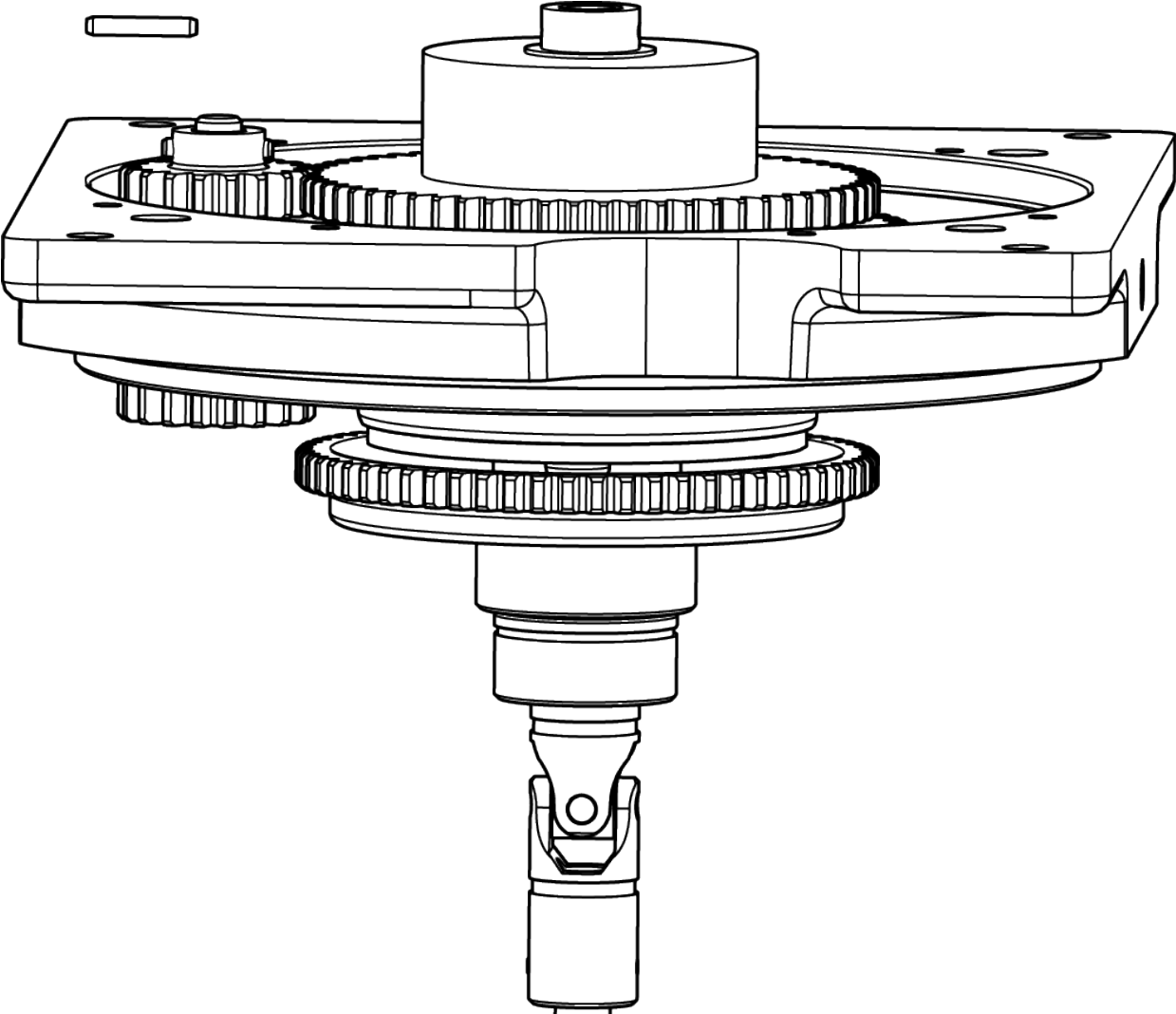
Remove Belleville washer from upper housing.



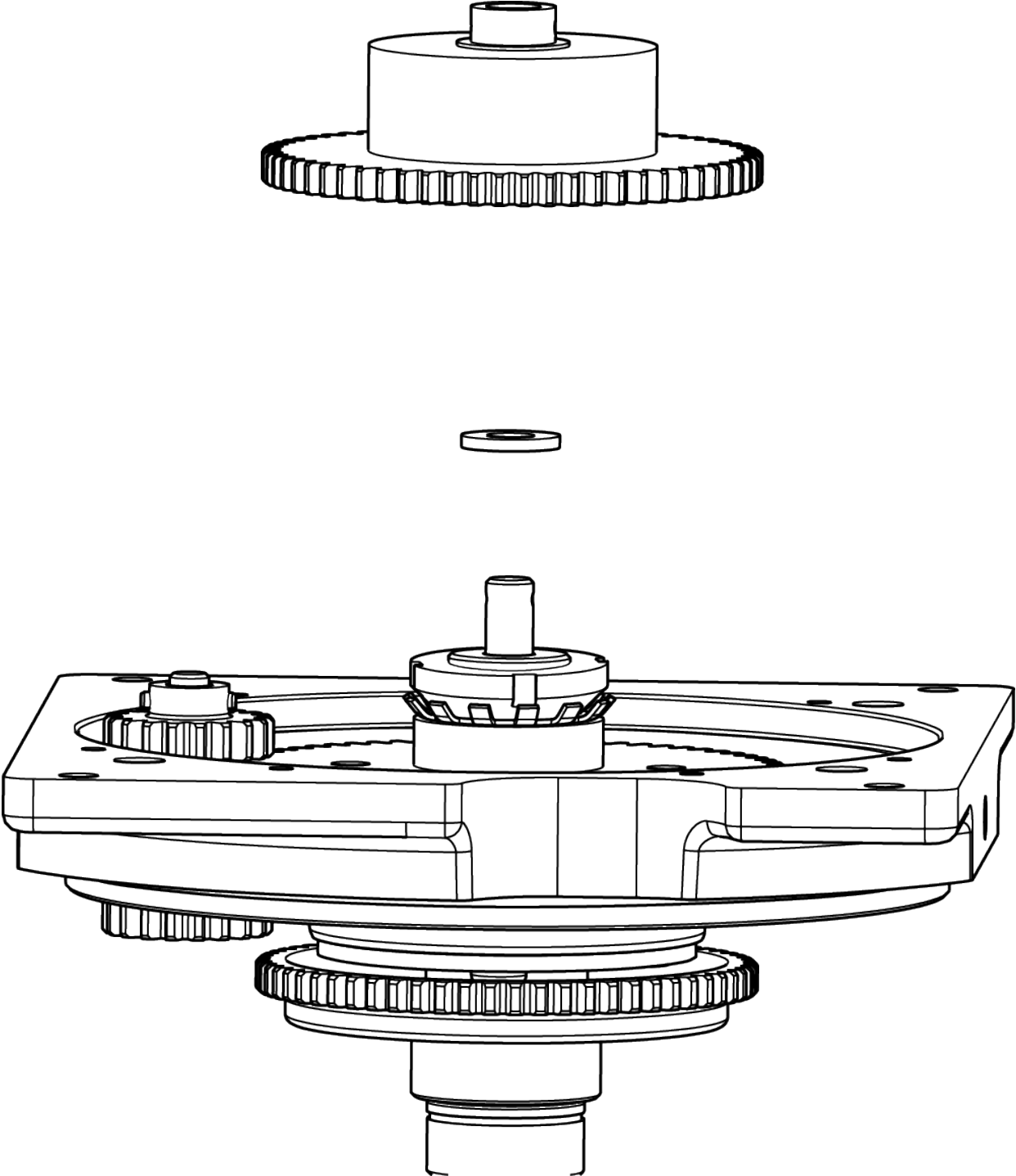
Press pinion gear from bearings then remove bearings from housing.



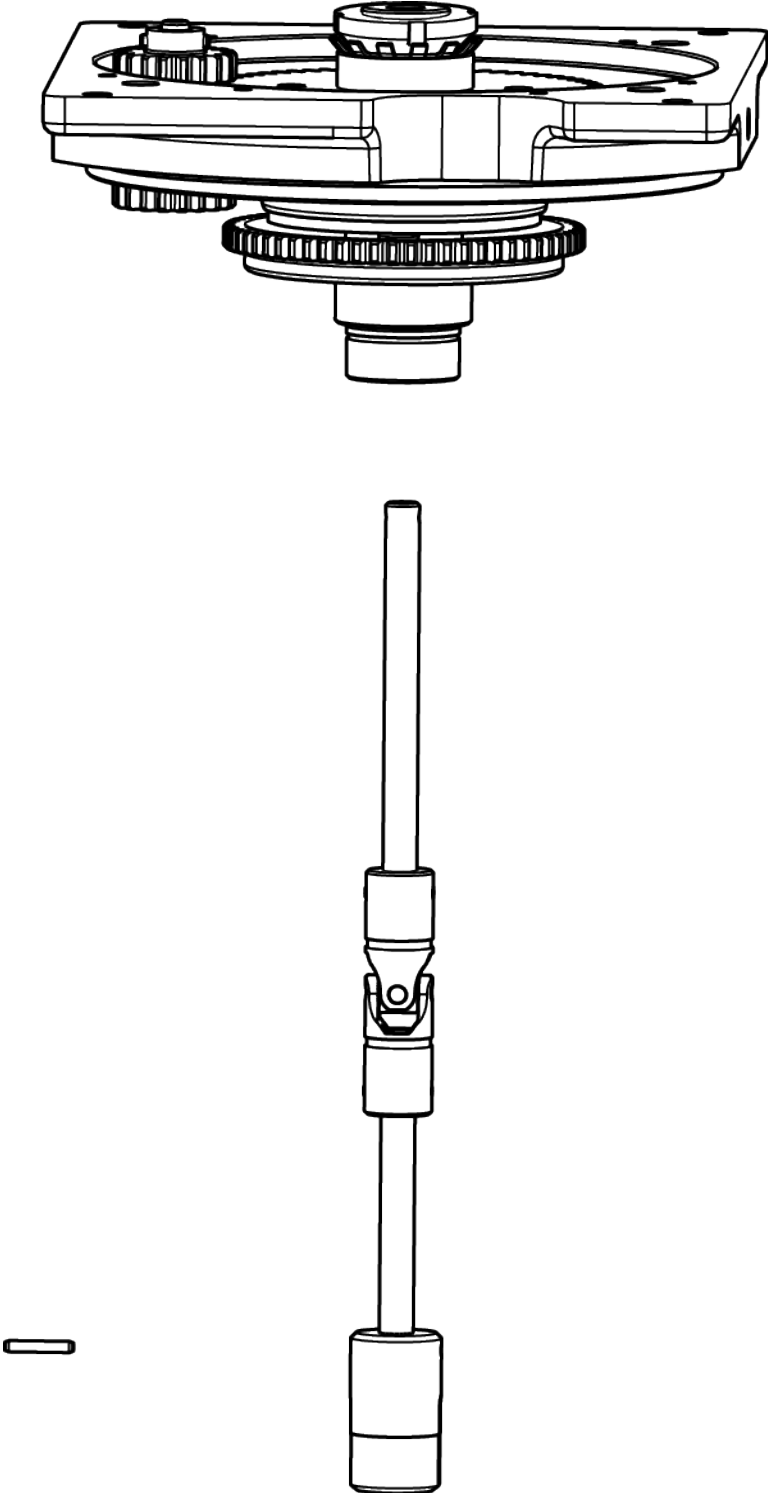
Remove roll pin from sun gear.



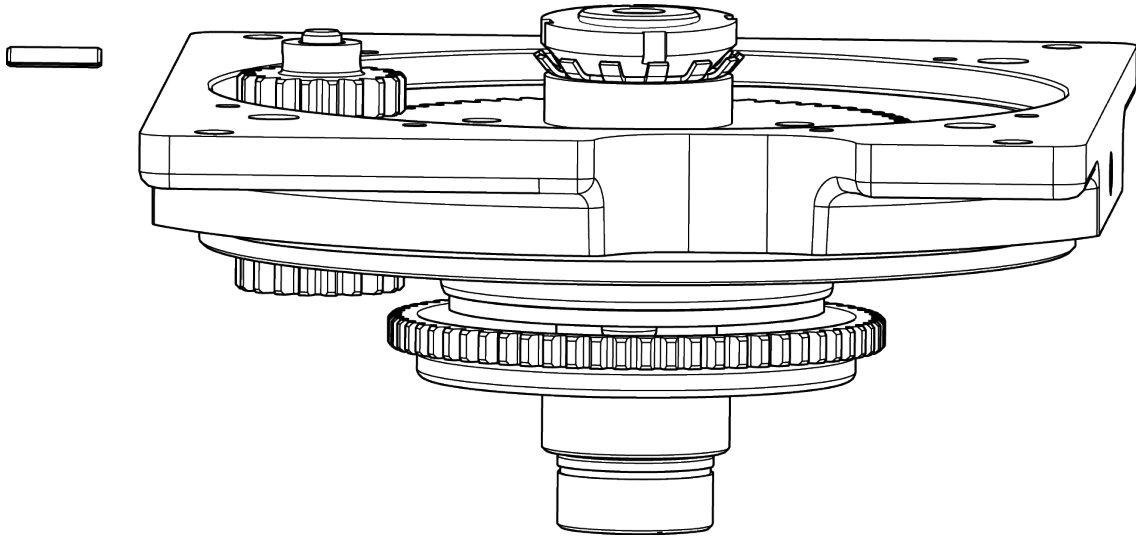
Remove sun gear and thrust washer from adjusting shaft assembly.



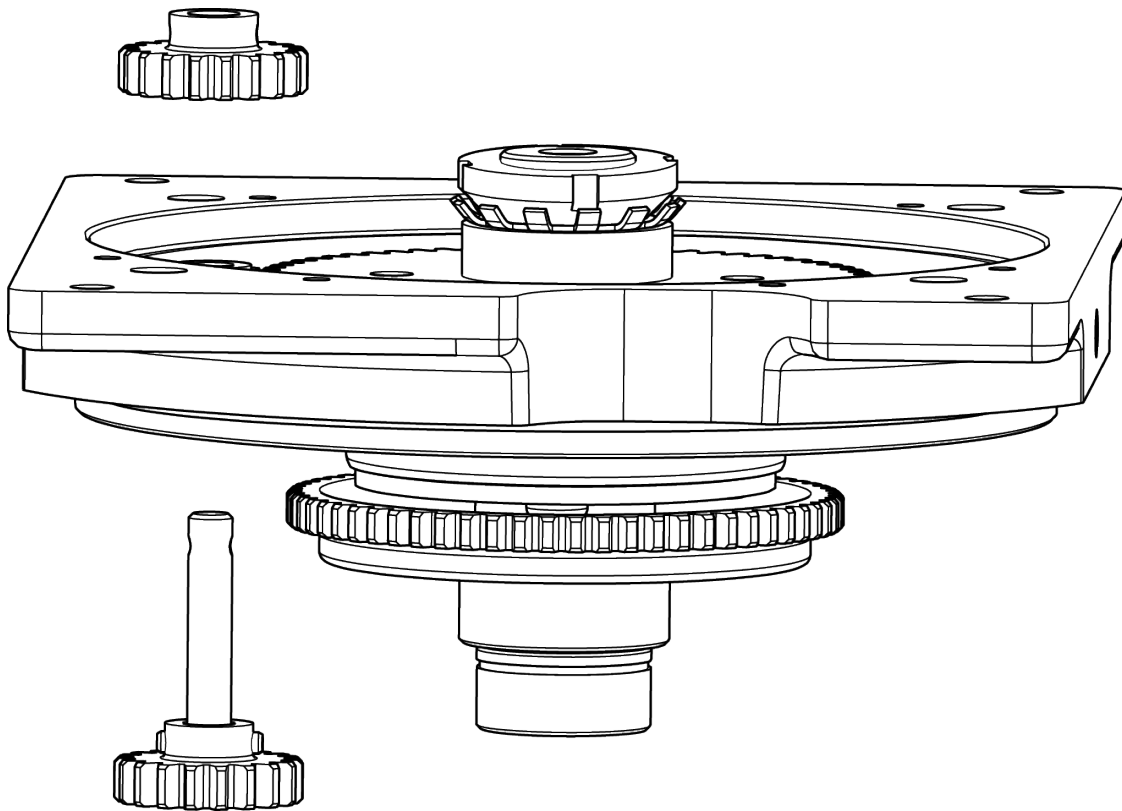
Remove adjusting shaft assembly from lower gear housing assembly.



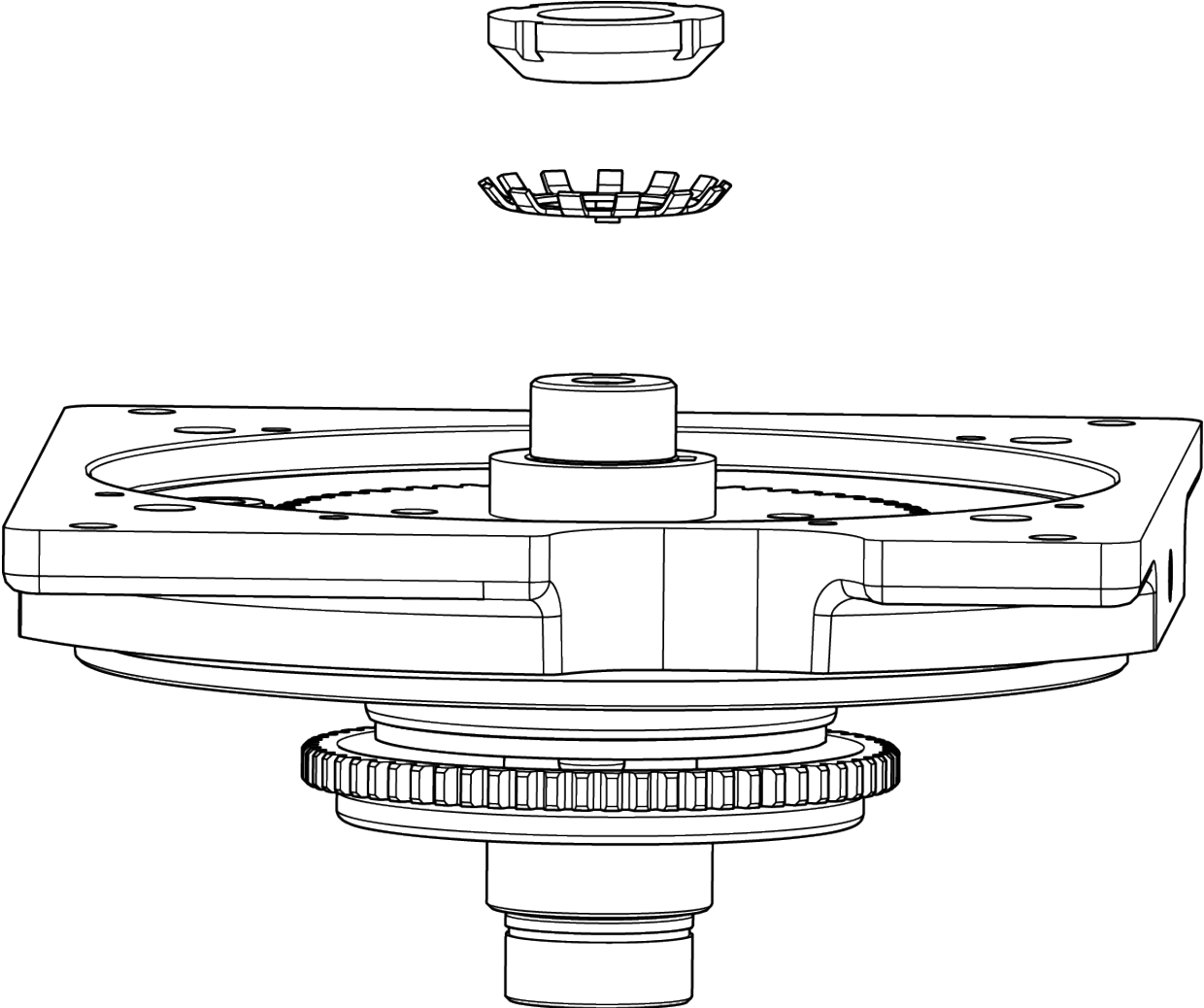
Remove roll pin from upper planet gear.



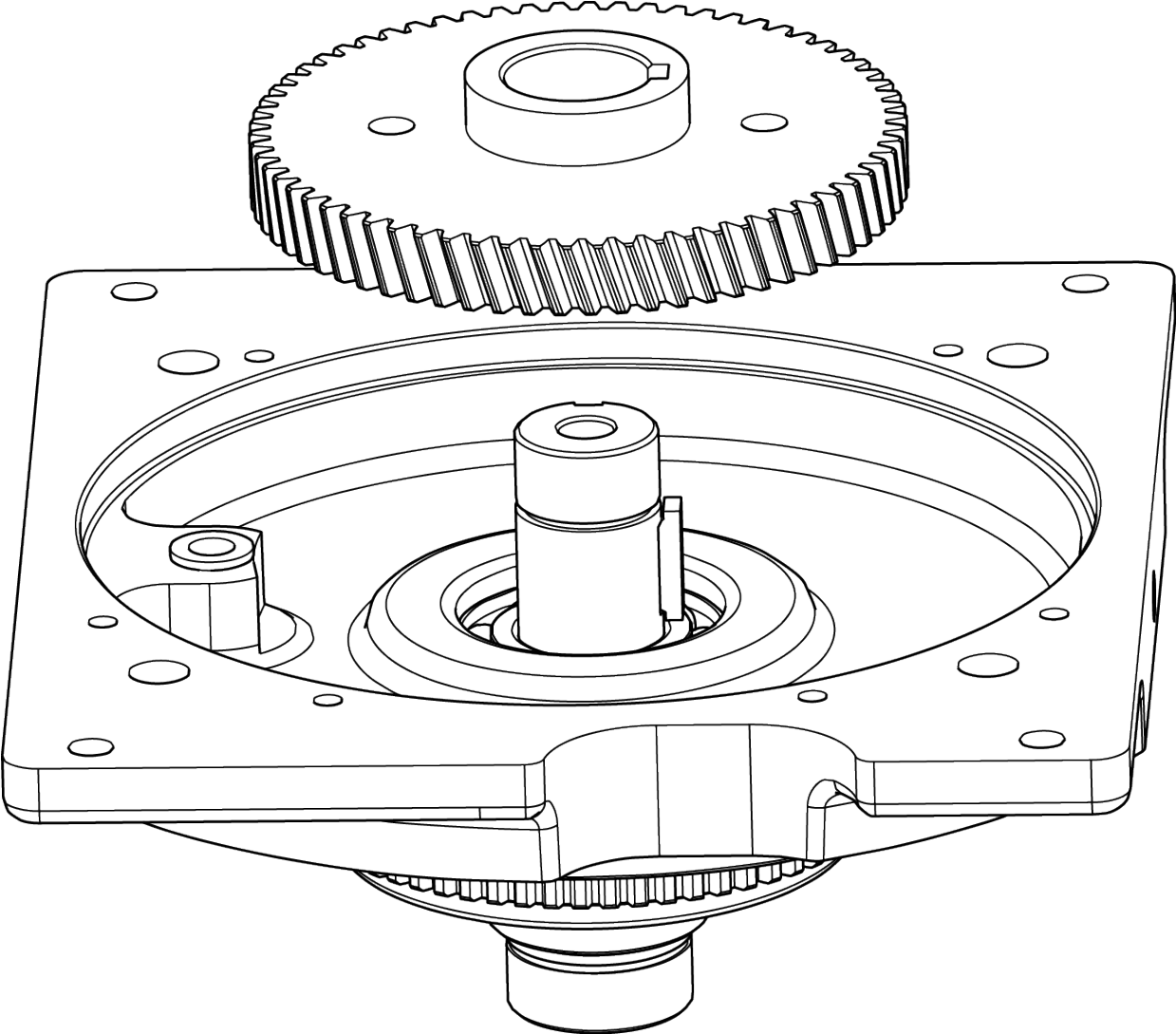
Remove upper planet gear and drop lower planet gear and shaft from lower housing assembly.



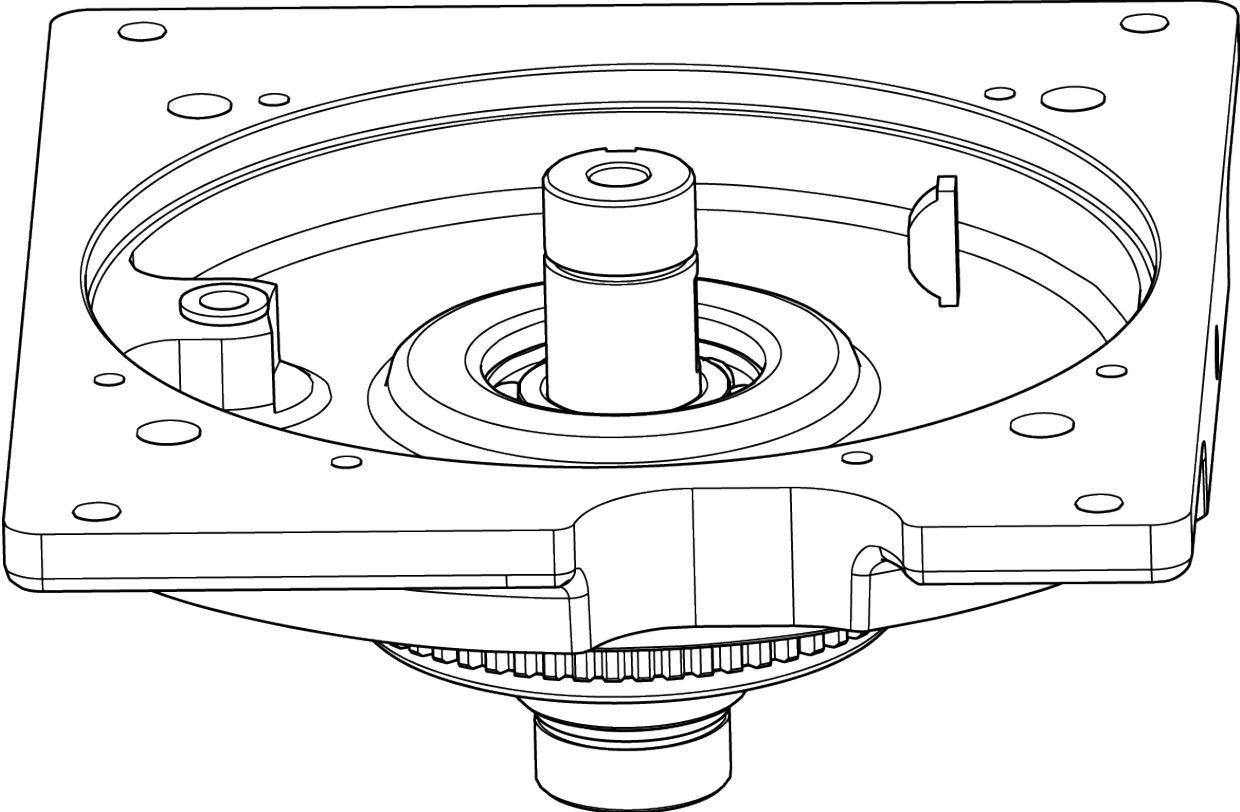
Remove lock nut and lock washer from drive shaft assembly.



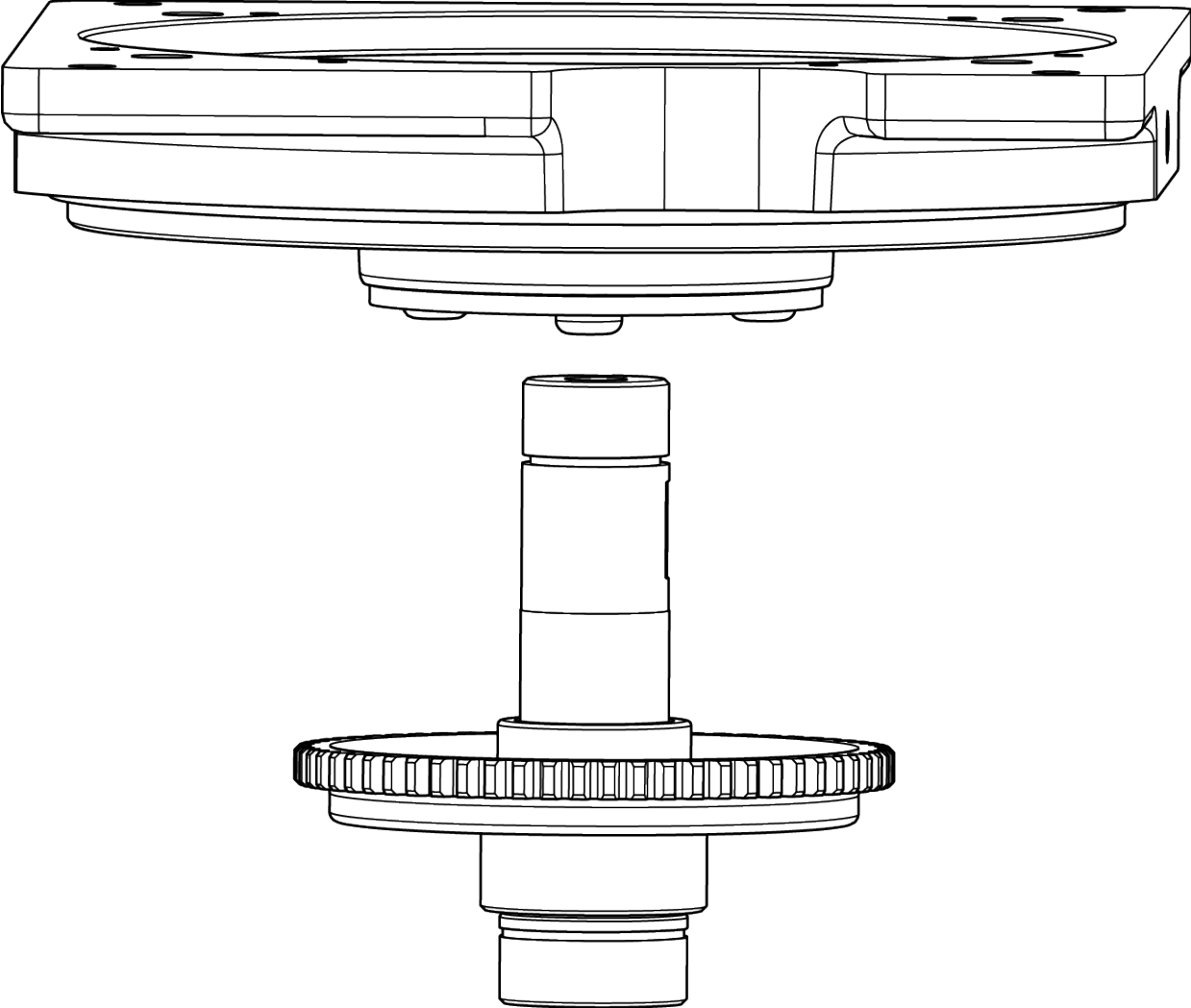
Remove gear from drive shaft assembly. You may need to thread bolts into gear to aid with removal.



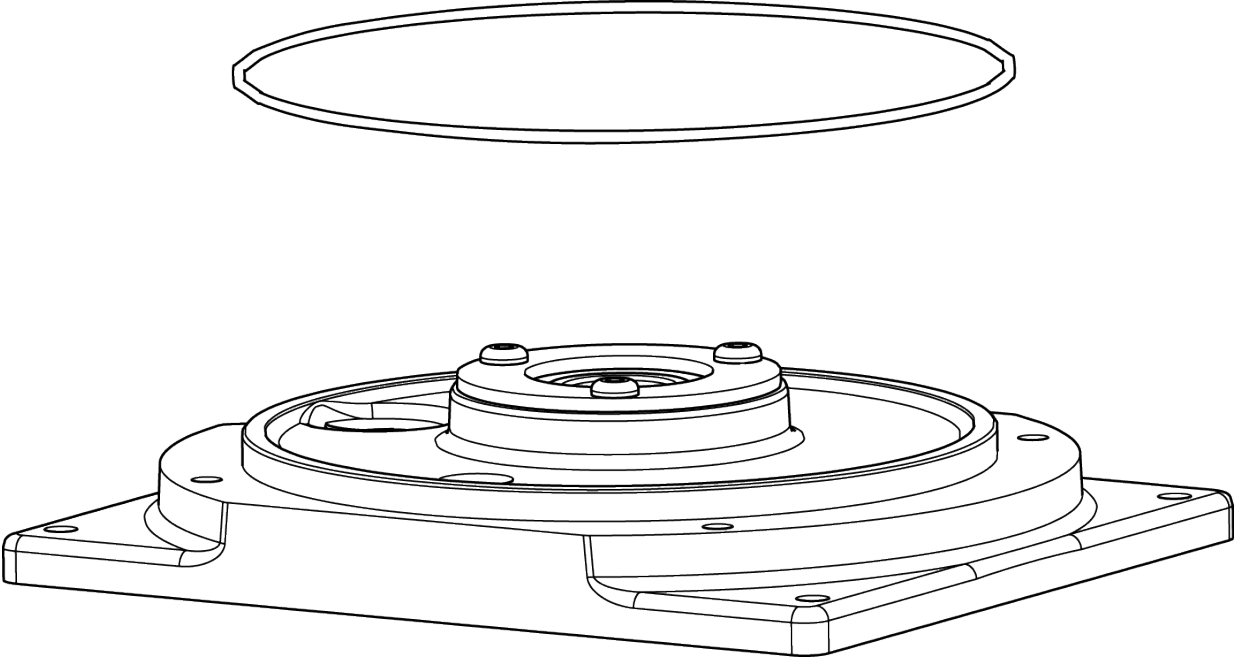
Remove drive key from drive shaft.



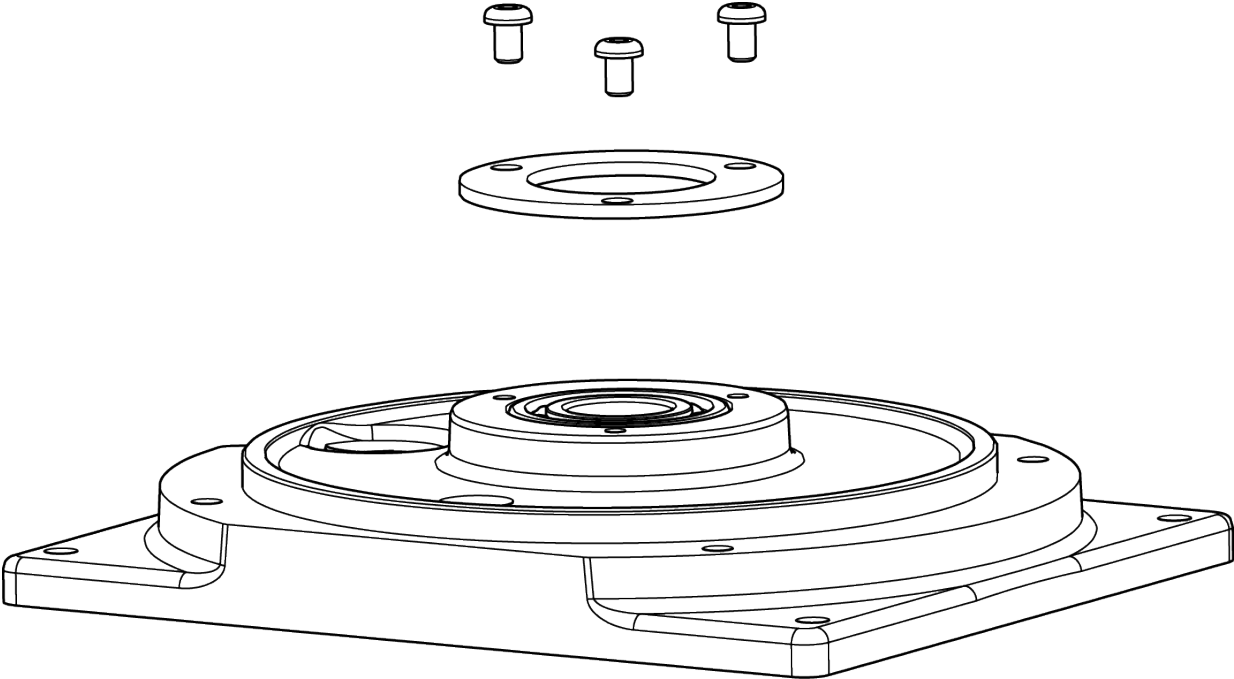
Press drive shaft assembly from lower housing assembly.



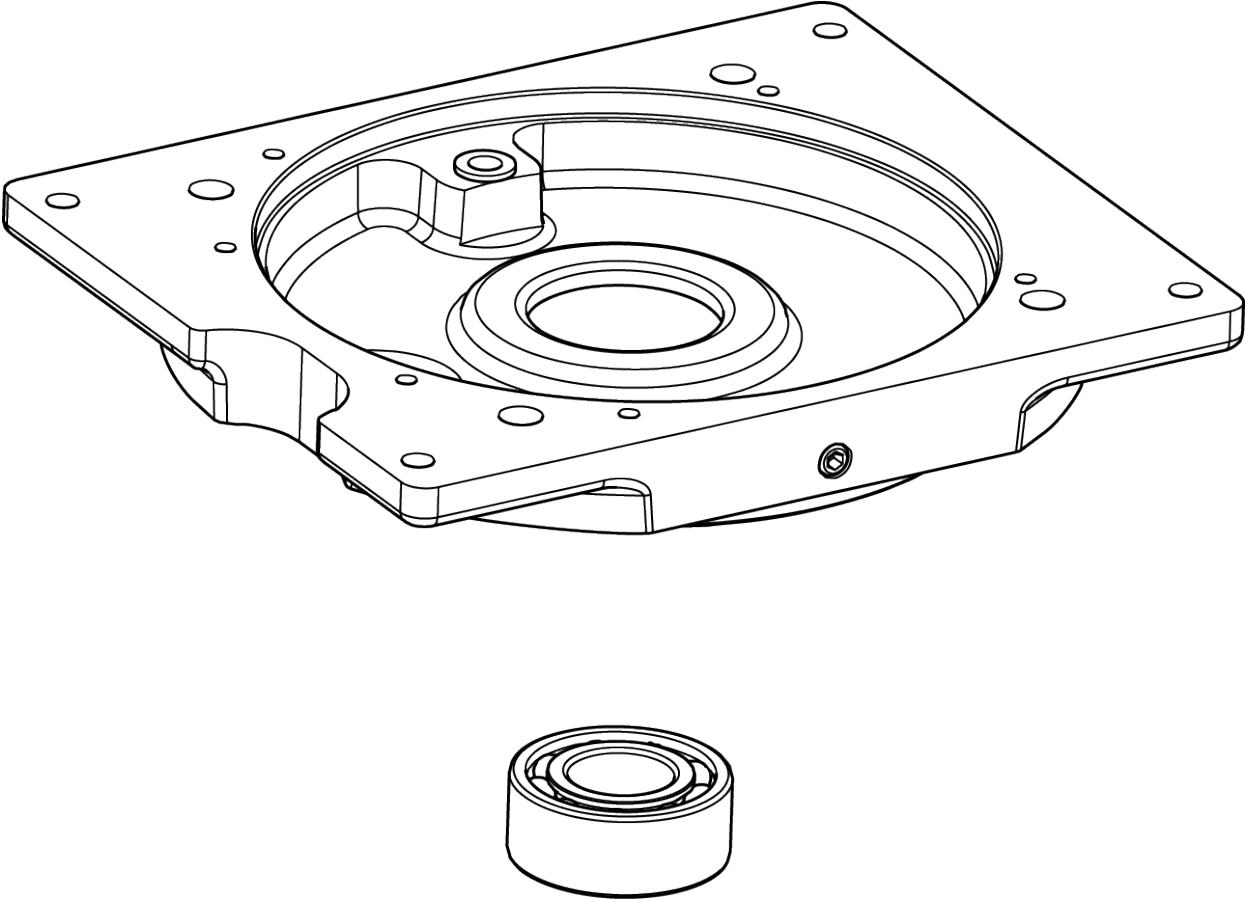
Slide O-ring from lower housing.



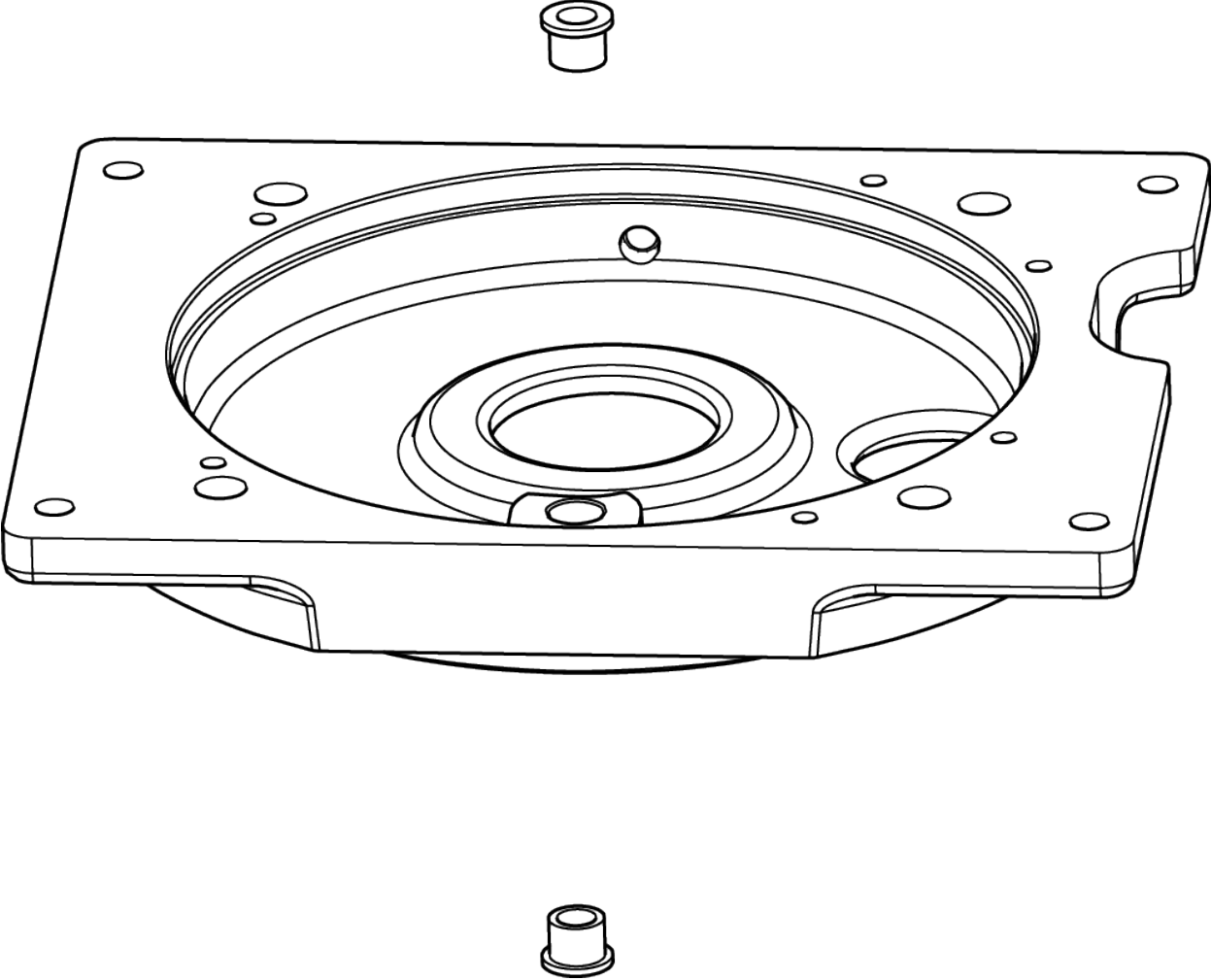
Remove fasteners and retaining ring from lower housing.



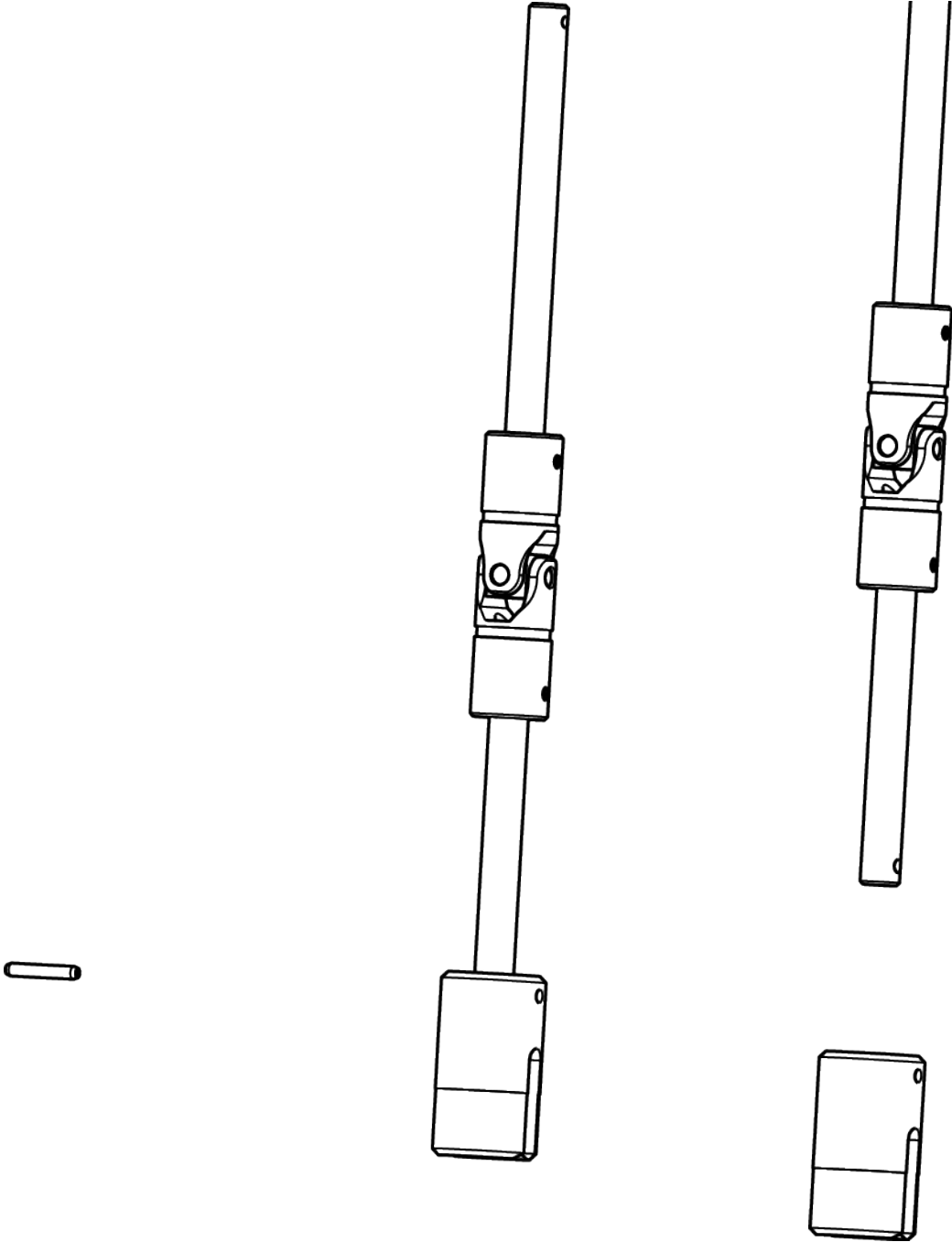
Press bearing out of lower housing.



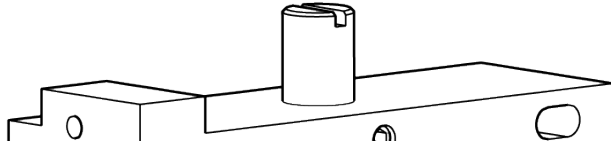
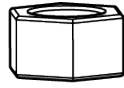
Remove planet gear bushing from lower housing.



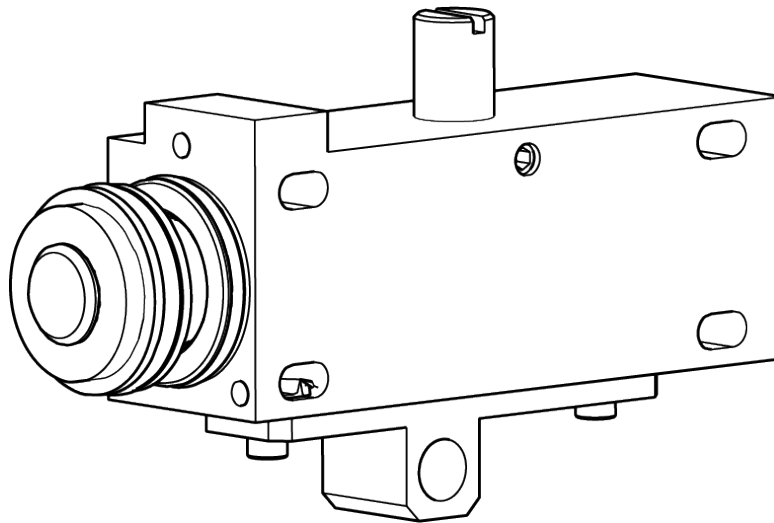
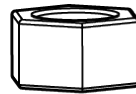
Remove roll pin holding coupler onto adjusting shaft assembly and remove coupler from shaft.



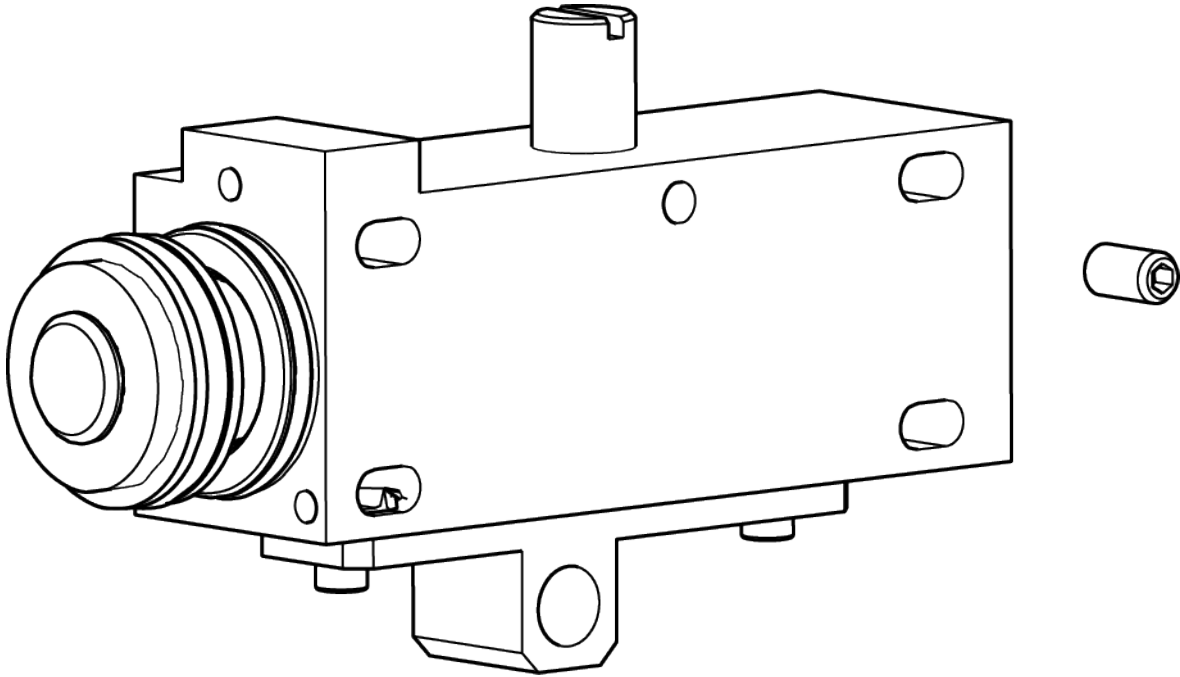
Remove fasteners and cylinder housing from actuator assembly.



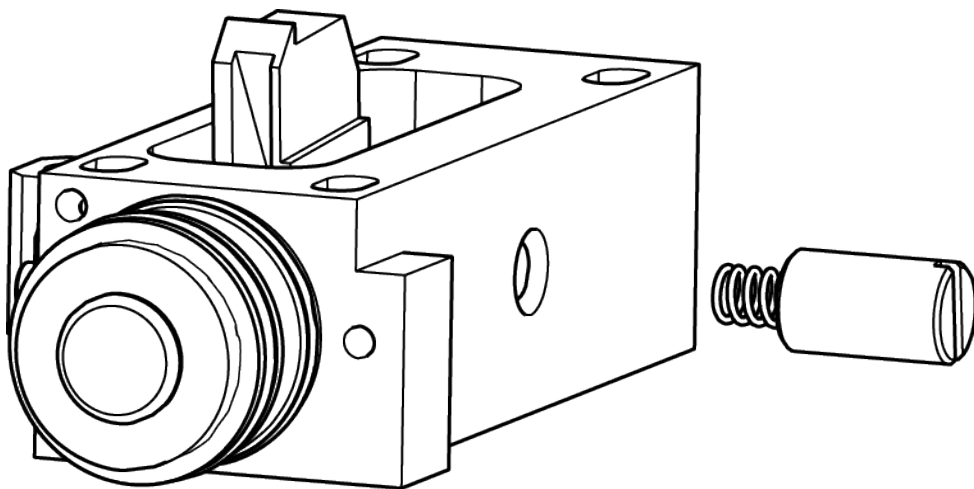
Remove jam nut from drag pin housing.



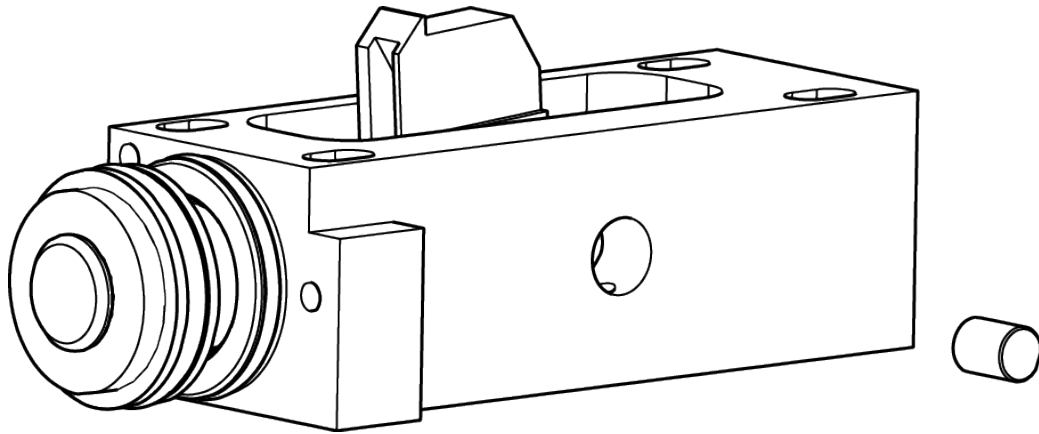
Remove set screw holding drag pin housing in place from actuator housing.



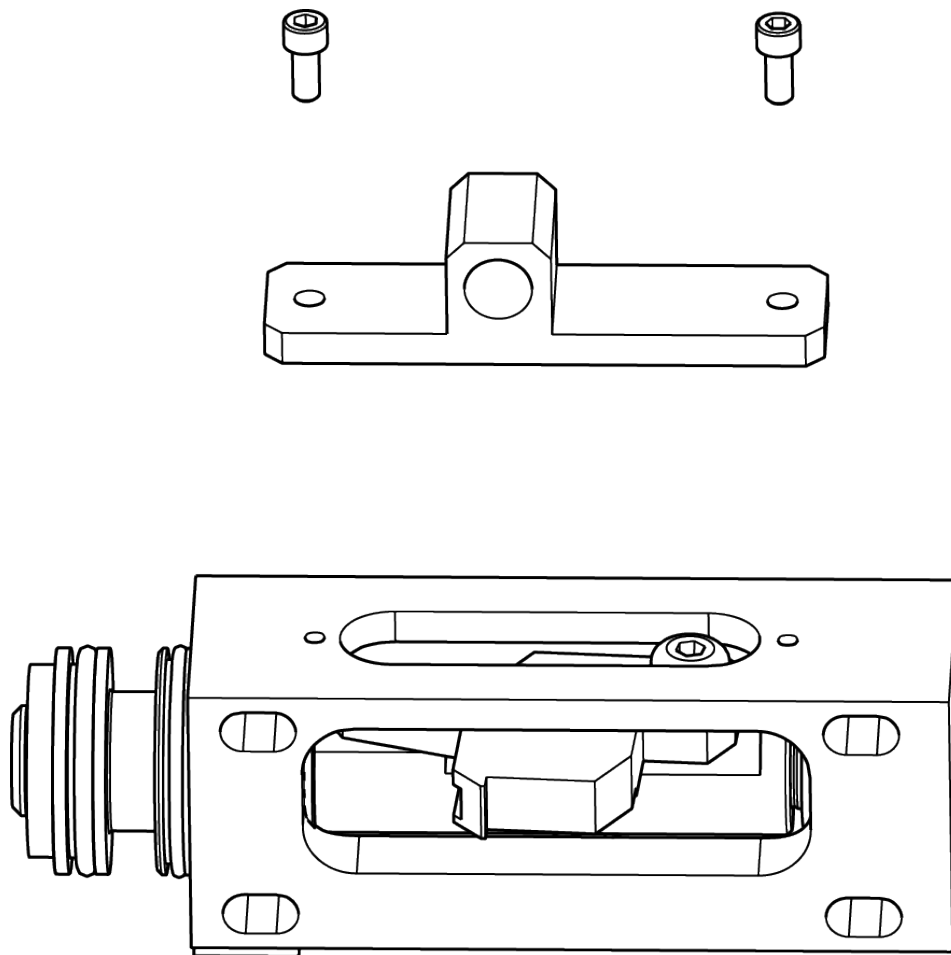
Remove drag pin housing from actuator housing.



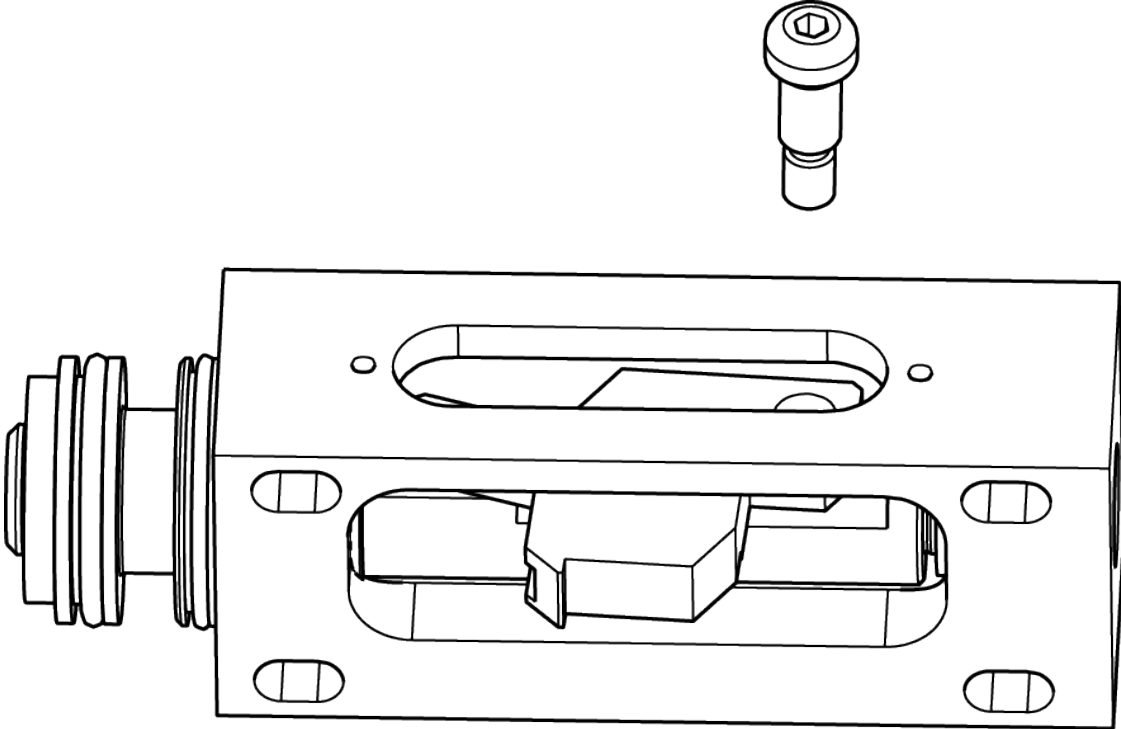
Remove drag pin from actuator housing.



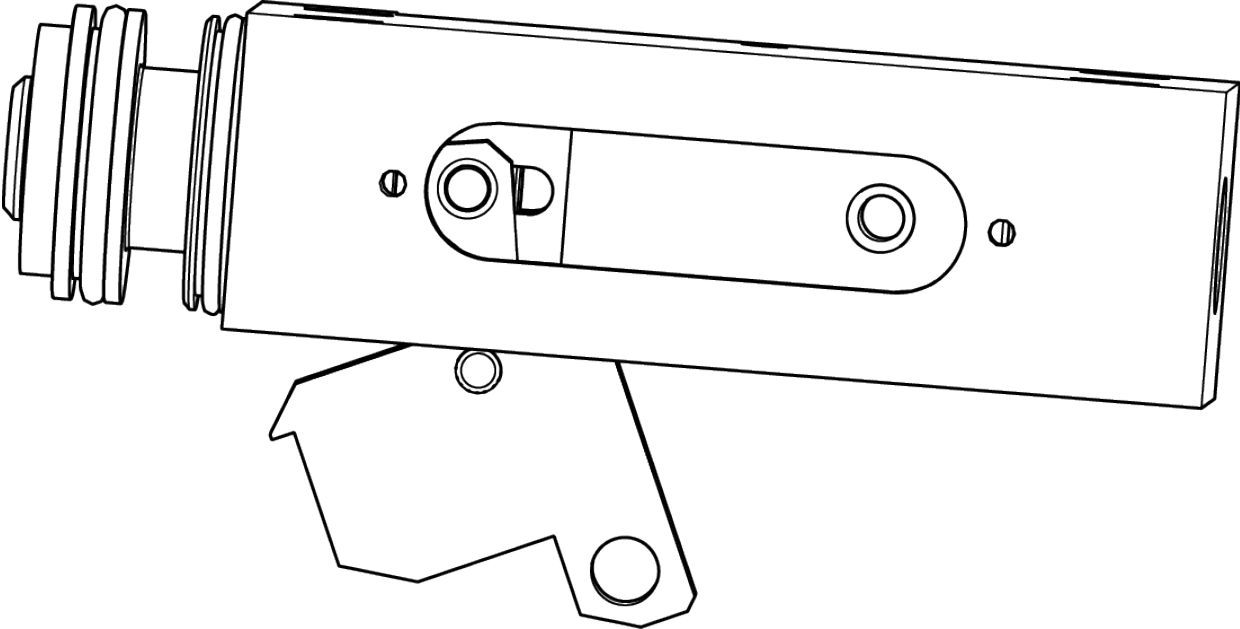
Remove fasteners and sensor bracket from actuator housing.



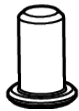
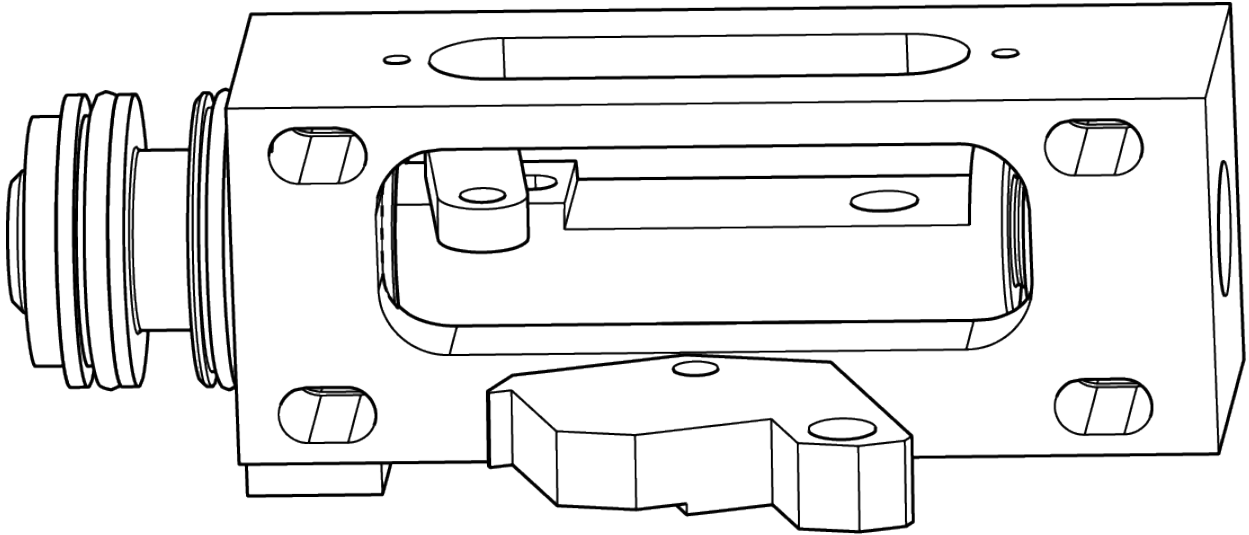
Remove shoulder bolt from feed pawl.



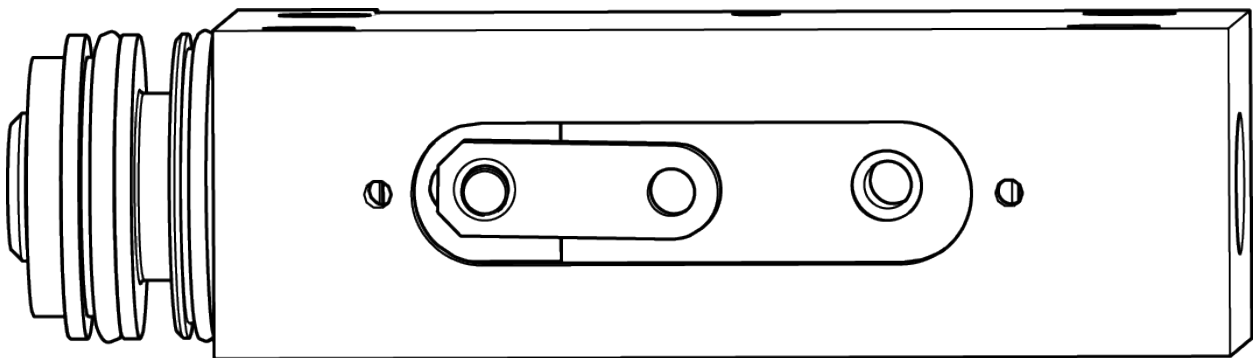
Rotate feed pawl outward.



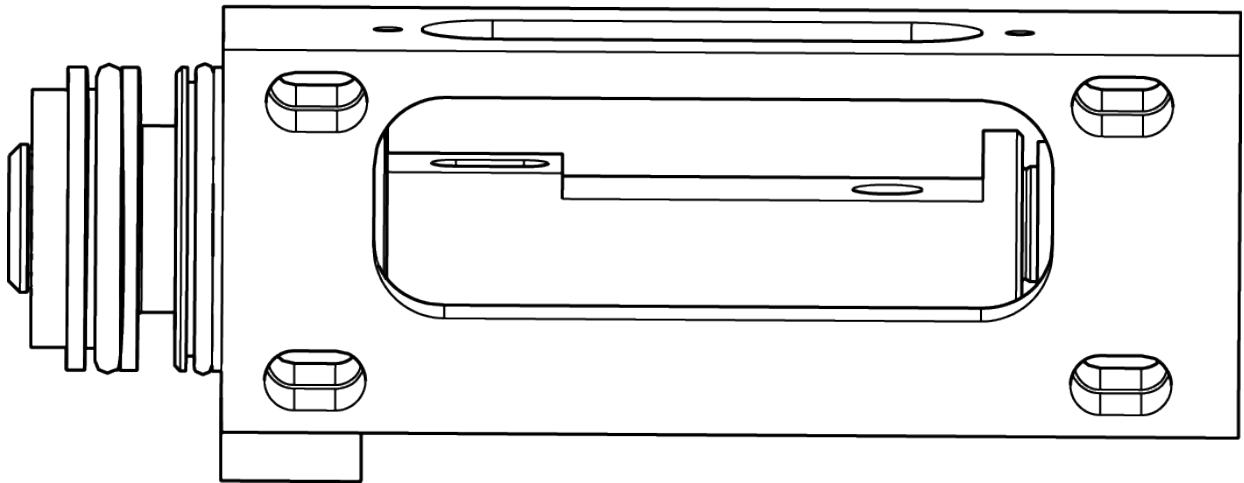
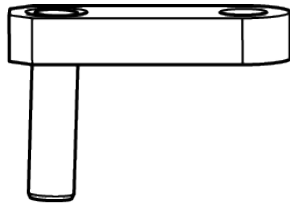
Remove pivot pin from feed pawl and remove pawl from pivot shaft.



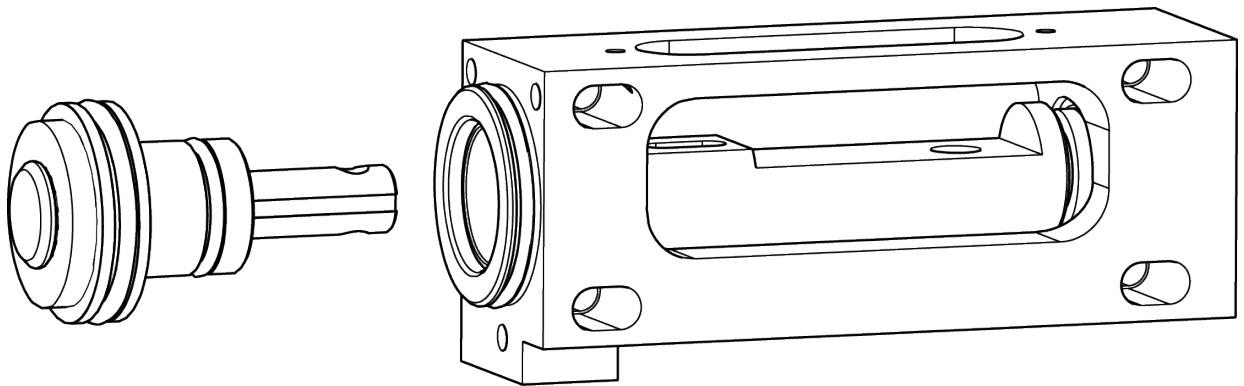
Push piston inward and align pivot shaft with shift spool.



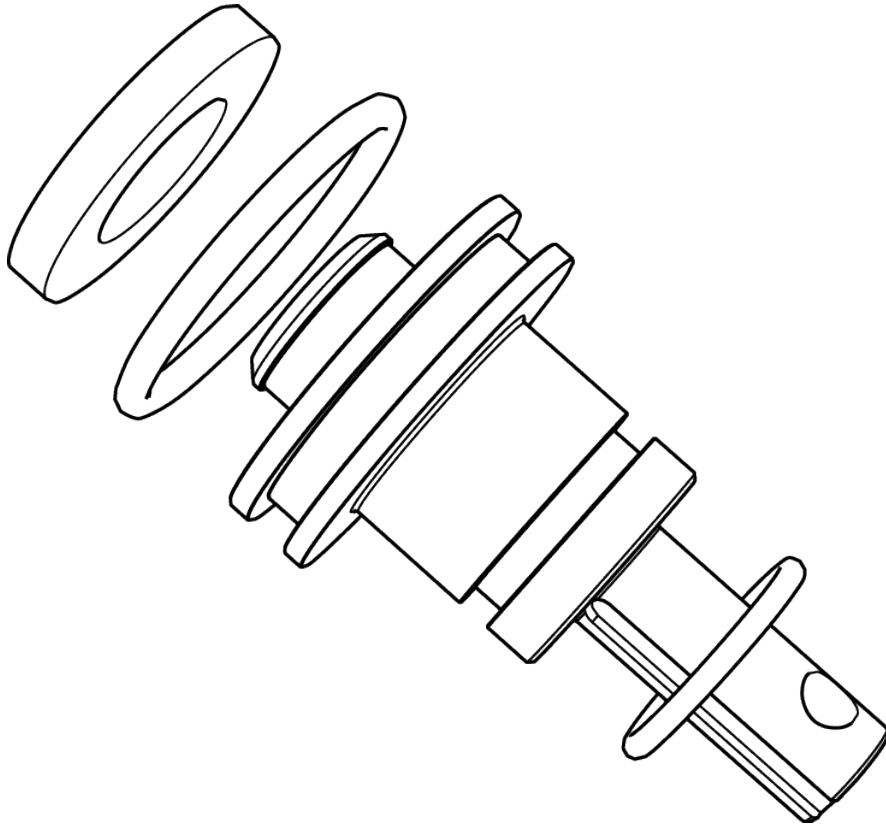
Remove pivot shaft from shift spool.



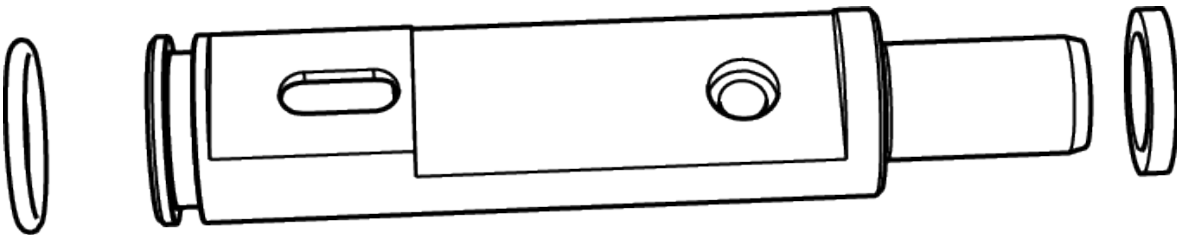
Pull out piston from shift spool.



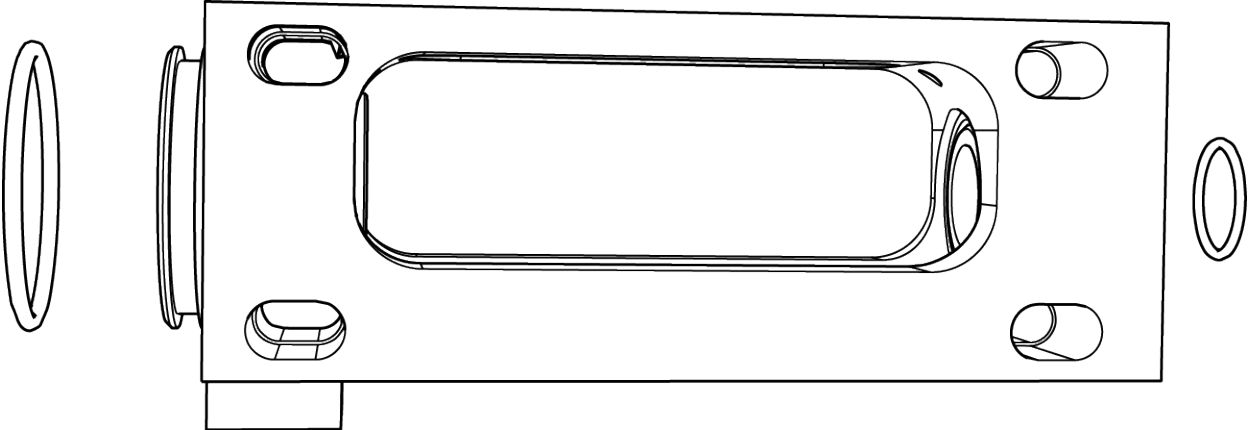
Remove O-rings and stop bumper from piston.



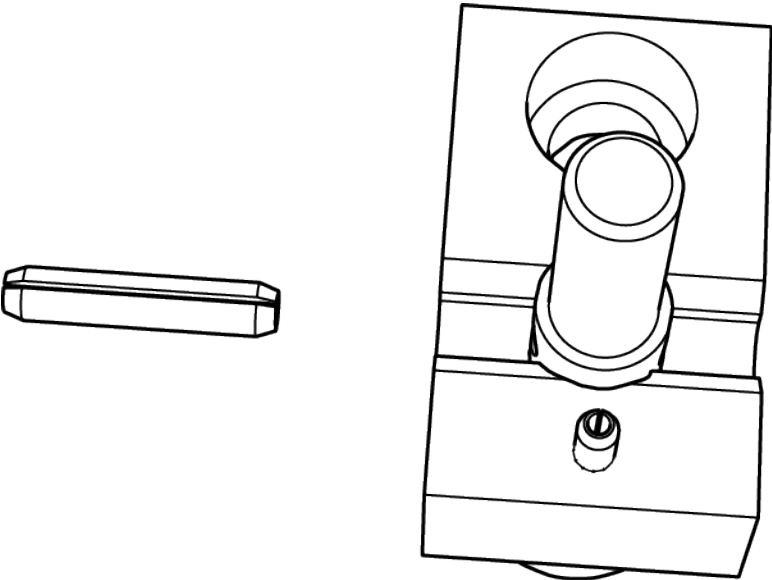
Remove O-ring and stop bumper from shift spool.



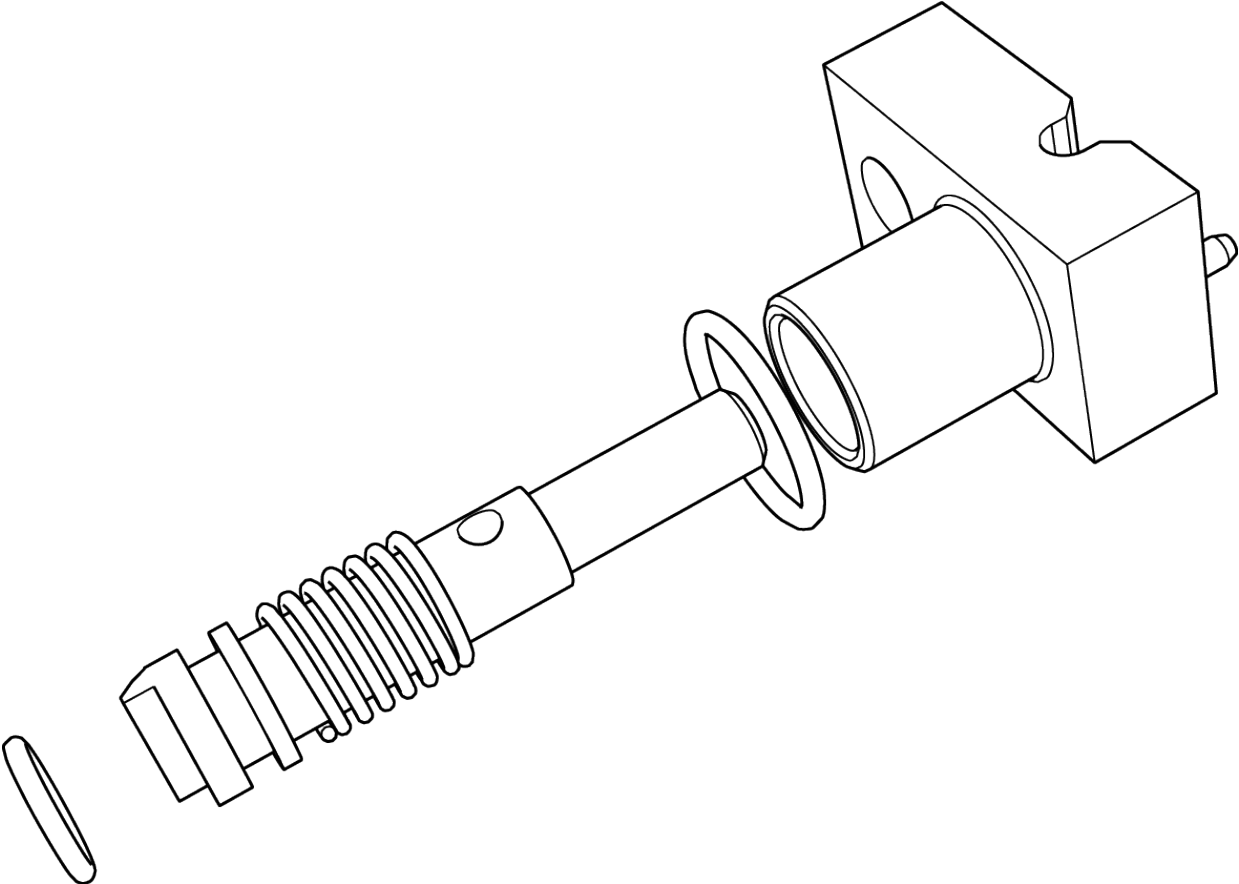
Remove O-rings from housing.



Remove roll pin from ratchet pawl shaft.



Pull out pawl shaft and remove O-rings from shaft and housing.



Replacing Shear Pin

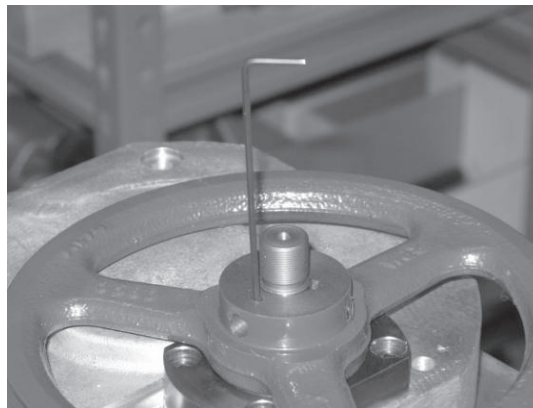


Disconnect all electrical and air power before making any repairs.

1. Remove motor cover, front cover plate, and handle.
2. Loosen bolts on motor bracket and remove v-belt from gearbox pulley.
3. Remove pulley lock down nut and 2 Belleville washers.



4. Remove set screw holding shear pin.

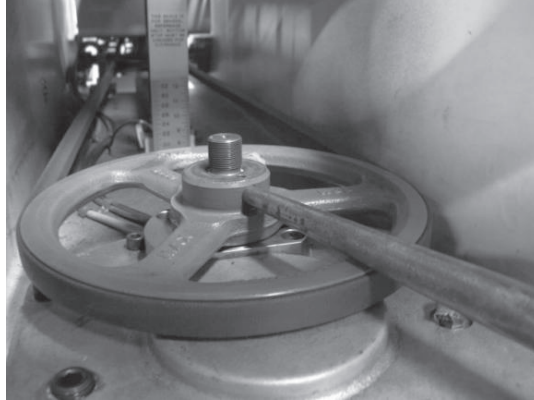


5. If shear pin is not broken it can be driven out with a small punch.
6. If shear pin is broken, loosen nylon bolt and remove pulley.
7. Remove broken pieces from pulley and pinion shaft.
8. Install new shear pin and reverse above procedure to reassemble.

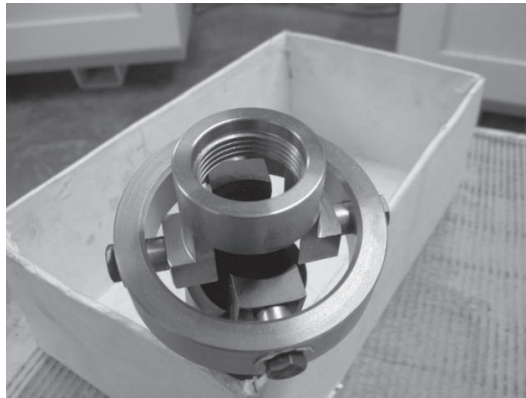
Removing Drive Tube Assembly

⚠ WARNING *Disconnect all electrical and air power before making any repairs.*

1. Follow procedure: Replacing Shear Pin
2. Place small pry bar or screwdriver in shear pin bore to prevent pulley from turning.



3. Drive tube assembly is screwed onto the gearbox with a normal right hand thread.



4. Use a pipe wrench to break the drive tube assembly loose. (If you wish to avoid scaring the drive tube with a pipe wrench, Rottler Mfg. has a special removal tool available for loaner use. Contact parts order desk for full details.)



5. Unscrew drive tube assembly.
6. Replace drive tube assembly by screwing back on hand tight. There is no need to tighten further. Normal operation will lock drive tube assembly in place.
7. Replace shear pin.

Removing Adjusting Shaft Assembly

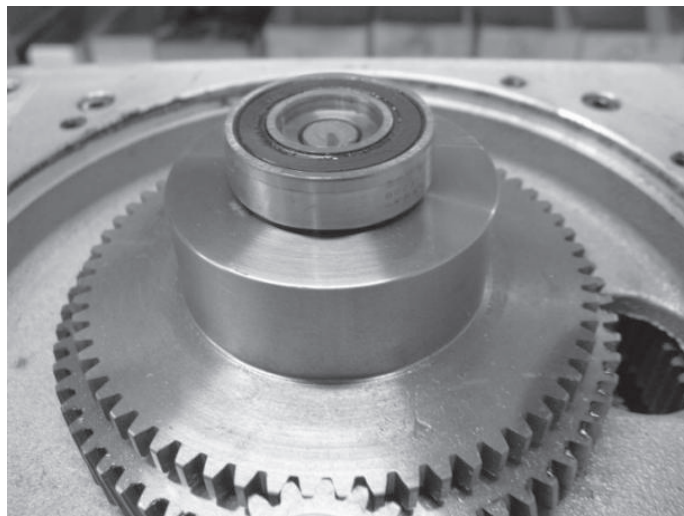


Disconnect all electrical and air power before making any repairs.

1. Follow procedure for replacing shear pin.
2. Place rocker arm in a level position.
3. Remove 6 bolts from top gearbox housing.



4. Remove top gearbox housing.



5. Remove bearing from top of sun gear.



6. Mark gear location on shaft then remove roll pin.
7. Remove gear and thrust washer.



8. Slide shaft assembly out through bottom of drive tube.
9. Reassemble by reversing above procedure.

Replacing Hydraulic Cylinder



Disconnect all electrical and air power before making any repairs.

1. Remove rear carriage cover.
2. Using bleed kit, drain fluid from system.



3. Unscrew hydraulic lines 22 and 25 at both ends.
4. Unscrew hydraulic line 26 at cylinder fitting.
5. Remove upper pivot blocks. Note if there are any shims located under pivot blocks.



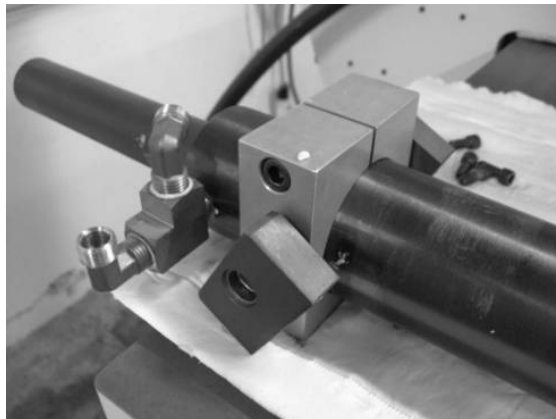
6. Loosen set screw on upper pivot pin then remove pivot pin from cylinder shaft.



7. Remove fittings from top of cylinder.
8. Remove bolts holding lower pivot blocks to carriage.



9. Pull out cylinder and remove pivot blocks from housing bracket.
10. Place pivot blocks on new cylinder.



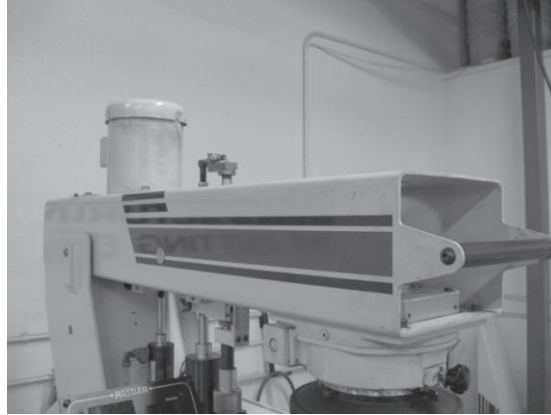
11. Hold new cylinder in place and attach lower pivot blocks to carriage.
12. Install fittings and pivot pin.
13. Install hydraulic lines that were removed.
14. Bleed hydraulic system following bleed procedure located in maintenance section of this manual.
15. Replace upper pivot blocks including any shims that may have been present when old cylinder was removed.
16. Test machine operation.
17. Remove upper and lower pivot block bolts individually, place blue Loctite on threads, then replace and tighten.
18. Replace rear carriage cover.

Replacing Air Cylinder

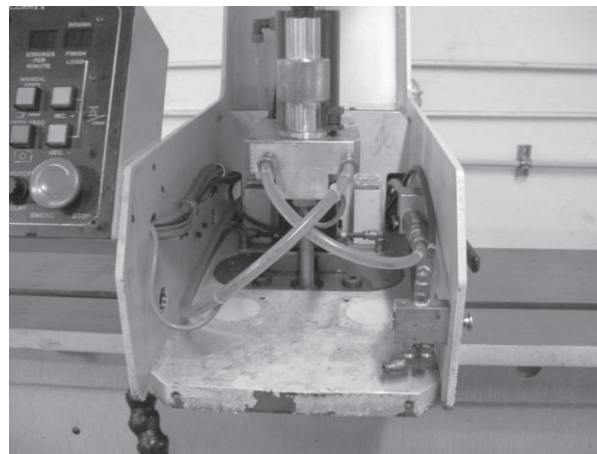


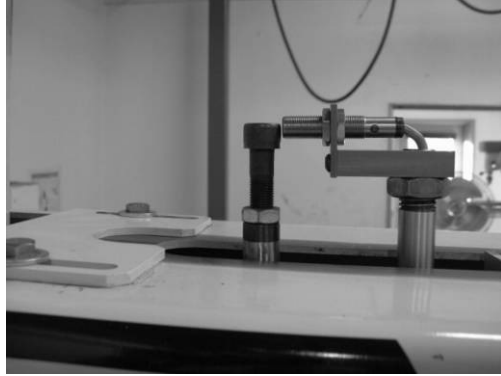
Disconnect all electrical and air power before making any repairs

1. Remove upper cover from rocker arm.

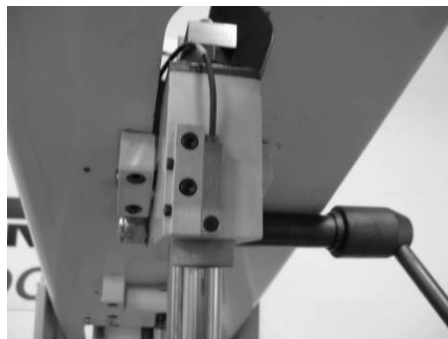


2. Remove carriage cover plates.
3. Remove clamp bar and lever arms.
4. Remove air cylinders.





6. Remove bore length gauge and lower sensor target.



7. Remove lower sensor from pivot clamp assembly.
8. Remove upper air line, oil line, and fittings from cylinder.



9. Remove lower air line and fitting.



10. Remove pivot blocks for upper pivot clamp assembly.



11. Bottom our air cylinder shaft. Lift up and rotate pivot clamp assembly.



12. Measure and make note of cylinder trunnion location.



13. Loosen lower pivot blocks.



14. Loosen bolts holding trunnion to cylinder.



15. Tighten recessed set screw to open trunnion bore.



16. Remove bolts from one pivot block.

17. Remove pivot block and pivot pin.



18. Remove old cylinder.

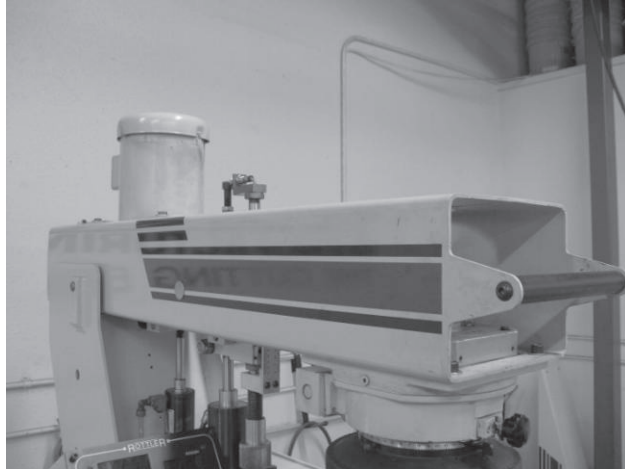


19. Install new cylinder.
20. Install pivot pin and pivot block. Leave bolts loose.
21. Place upper pivot clamp assembly back on cylinder shaft.
22. Raise cylinder shaft to full up position.
23. Attach pivot clamp assembly to rocker arm by installing upper pivot blocks. Leave bolts loose.
24. Adjust height of cylinder trunnion, loosen set screw, and tighten clamping bolts.
25. Tighten bolts for upper and lower pivot blocks.
26. Move rocker arm up and down, checking for freedom of movement. If movement is free and smooth remove pivot block bolts individually, apply Loctite and tighten.
27. Install cylinder fittings, upper and lower air lines, and oil line.
28. Install lower sensor, target, and bore length gauge.
29. Install clamp cylinders, lever arms, and cross bar.
30. Install actuation bolt and lock nut. Adjust by following procedure located in the maintenance section of this manual.
31. Install carriage cover plates.
32. Install top rocker arm cover.

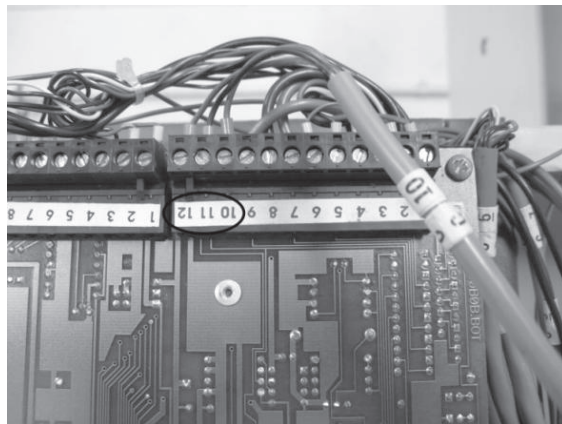
Replacing Pivot Block Assembly

⚠ WARNING *Disconnect all electrical and air power before making any repairs*

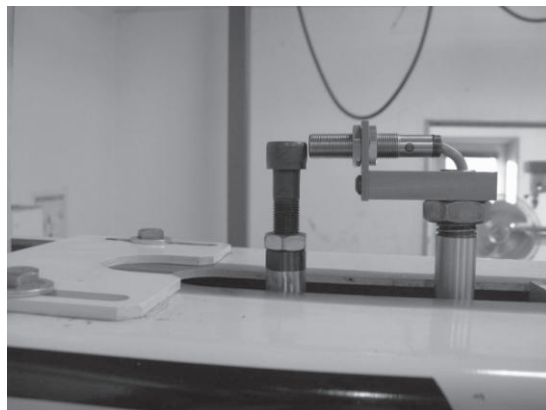
1. Remove upper cover from rocker arm.



2. Remove carriage cover plate.
3. Remove cable C-10 from terminal strip on back side of control panel. Note wire locations.



4. Remove actuation bolt and lock nut.



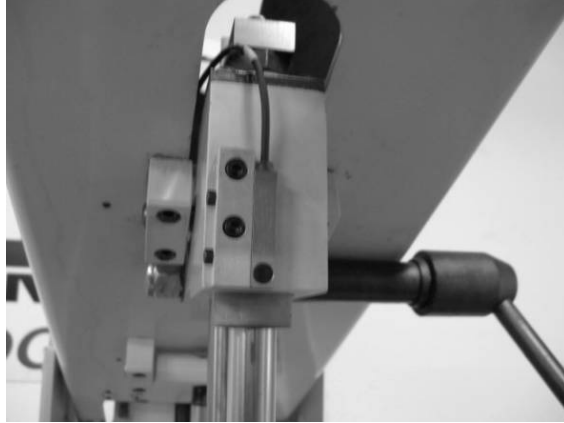
5. Remove upper sensor, bracket, and lock nut.



6. Remove bore length gauge and lower sensor target.



7. Remove lower sensor from pivot block assembly.
8. Remove handle assembly from pivot block assembly.



9. Remove pivot blocks from upper pivot block assembly.



10. Remove set screw and pivot pin from pivot block assembly.



11. Lower air cylinder shaft.



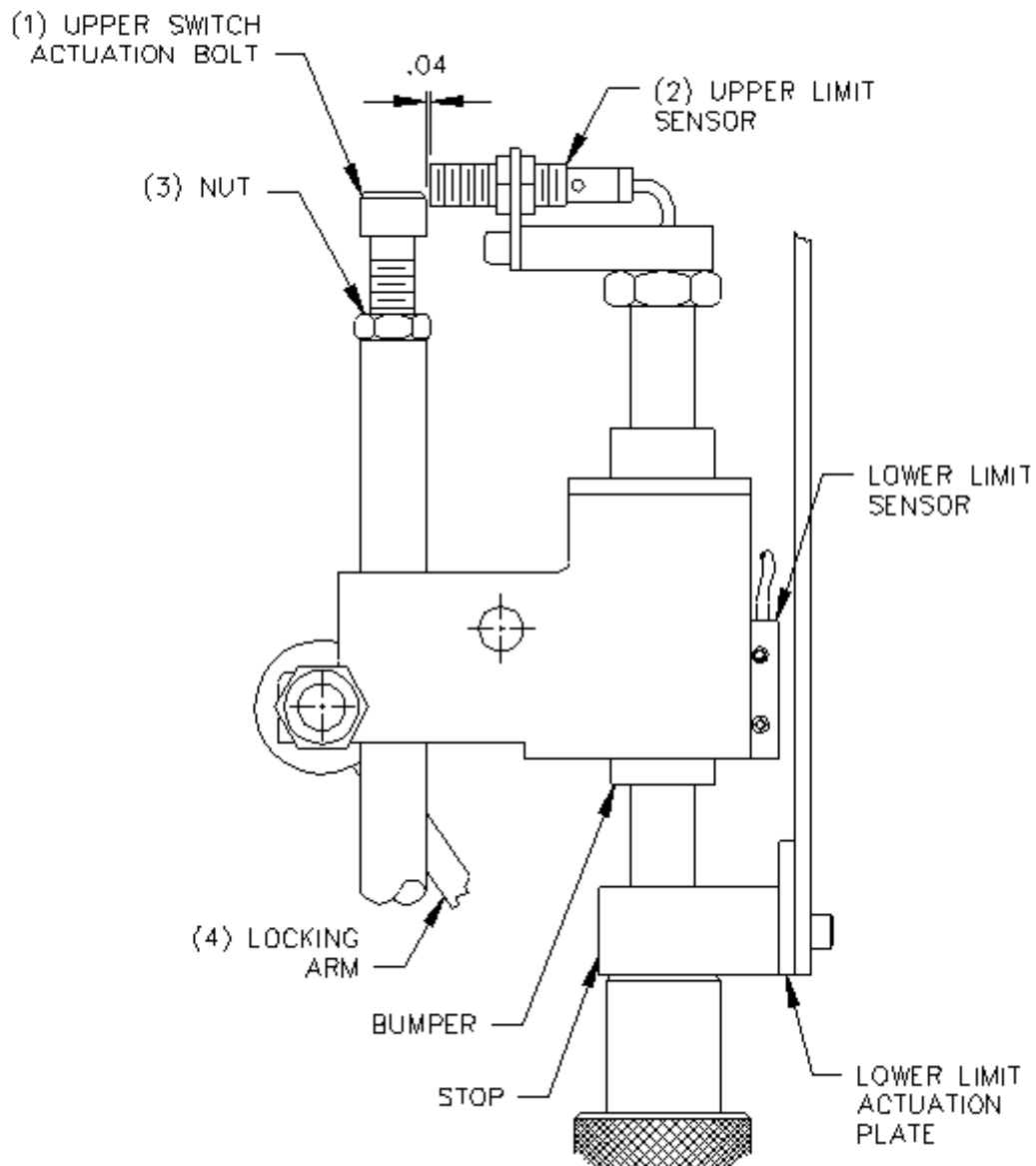
12. Lift pivot block assembly and remove from inside of pivot arm.



13. Replace pivot block assembly and reverse above procedure to reassemble. Make certain that flat on pivot pin aligns with set screw. Apply Loctite to set screw and pivot block bolts.
14. After hone is reassembled adjust upper sensor actuator bolt per instructions in maintenance section of this manual.

Upper Limit Switch Adjustment

1. Engage e-stop button so that control panel is not active.
2. Leave main air on the machine. This will keep the Stroking Cylinder Rod in the full up position. The Stroking Cylinder Rod must be in the full up position for accurate adjustment.
3. Remove the cover from the Rocker Arm (refer to page 6.5 part number 514-6-24F). There are two screws at the front and rear of this cover.
4. Move the lower stop down so the bolt (1) and sensor (2) can be seen above the Rocker Arm when it is brought down to the lower stop.
5. Adjust the sensor gap to the bolt, to .04 inches by loosening the two Allen bolts at the rear of the sensor.
6. Loosen the Locking Nut (3) and start turning the Adjustment Bolt (1) CW until the light on the sensor goes off. If the light is already off, go to step 7.
7. Start turning the Adjustment Bolt in a CCW direction until the light on the sensor comes on. Once the light is on turn the Adjustment Bolt another 3 turns and lock the Nut (3)



Updating HP7A Firmware

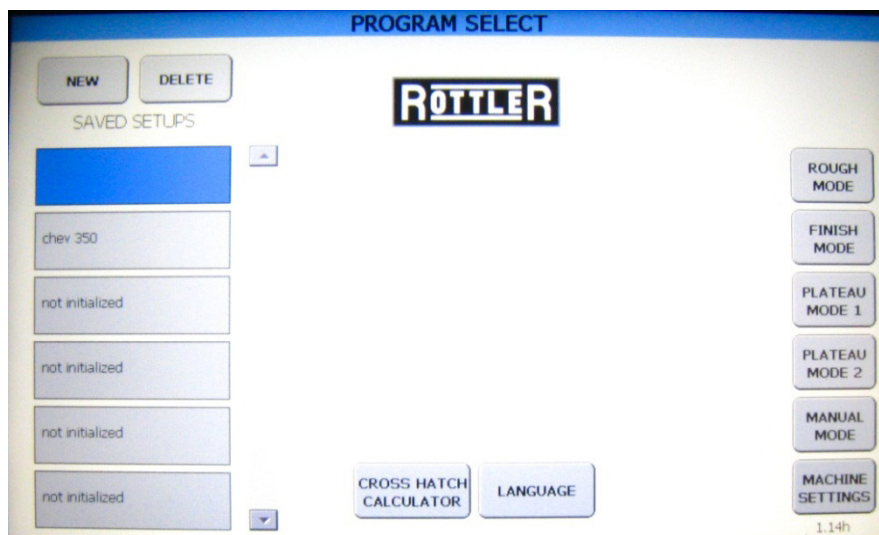


Disconnect air supply to the machine and confirm that e-stop is engaged before beginning the update.

Turn on the power switch located on the rear electrical enclosure.
The Start Up screen will appear.



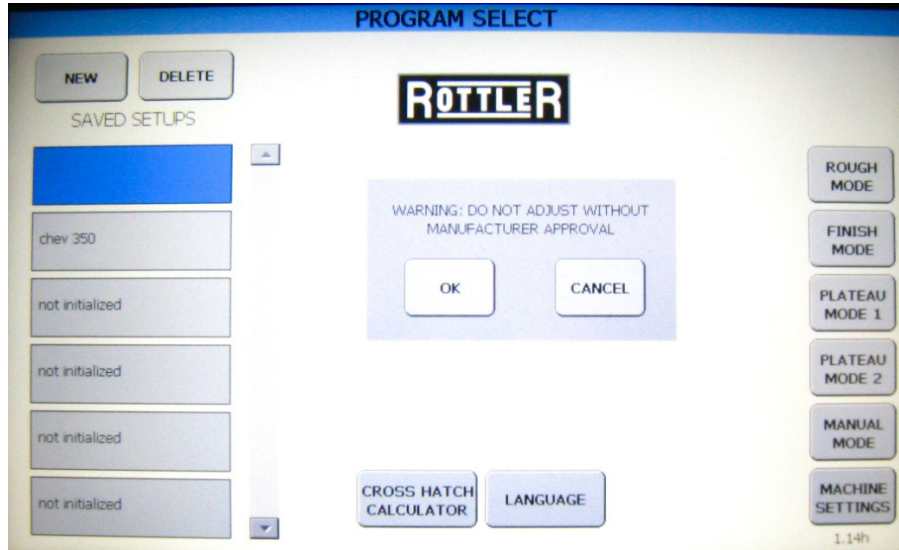
Touch the PROGRAM SELECT button.
The PROGRAM SELECT screen will appear.



Touch the MACHINE SETTINGS button.

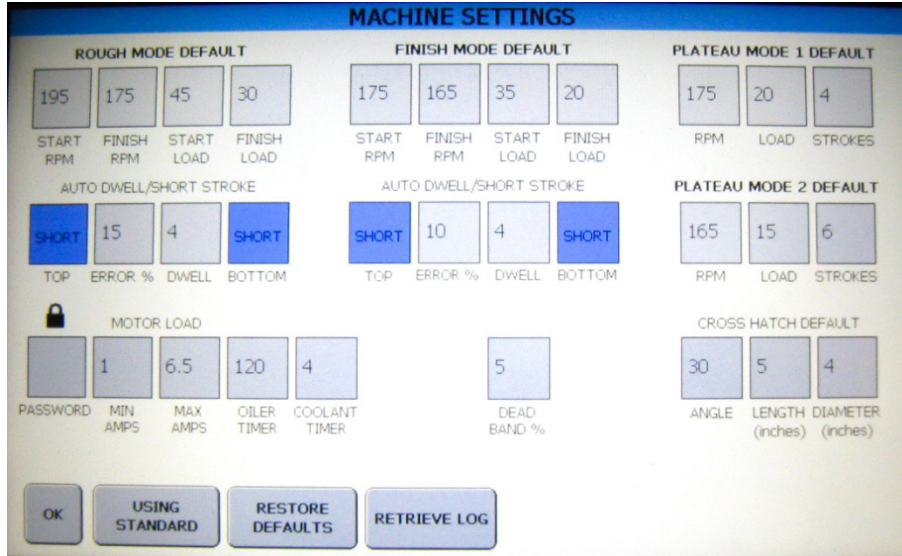


The following WARNING box will appear

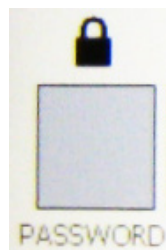


Touch the OK button.

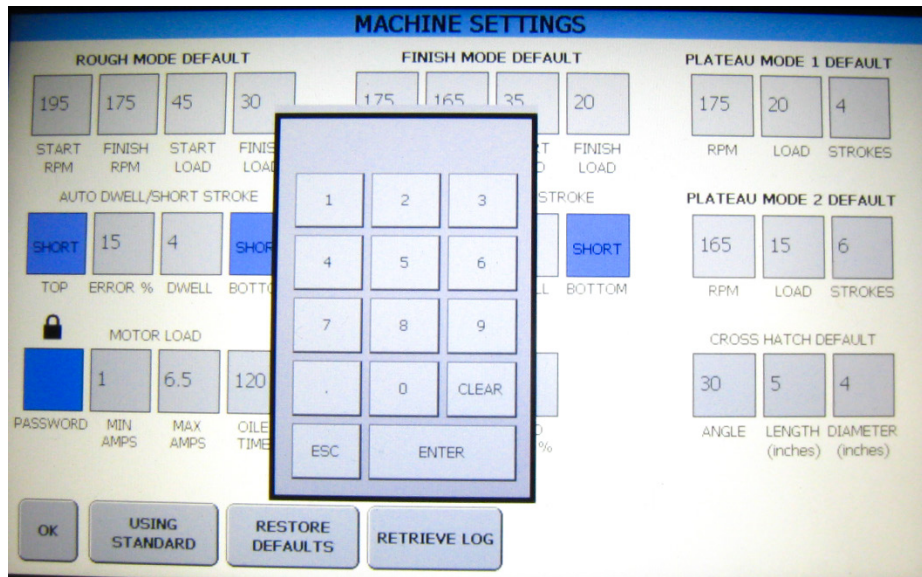
The MACHINE SETTINGS screen will appear.



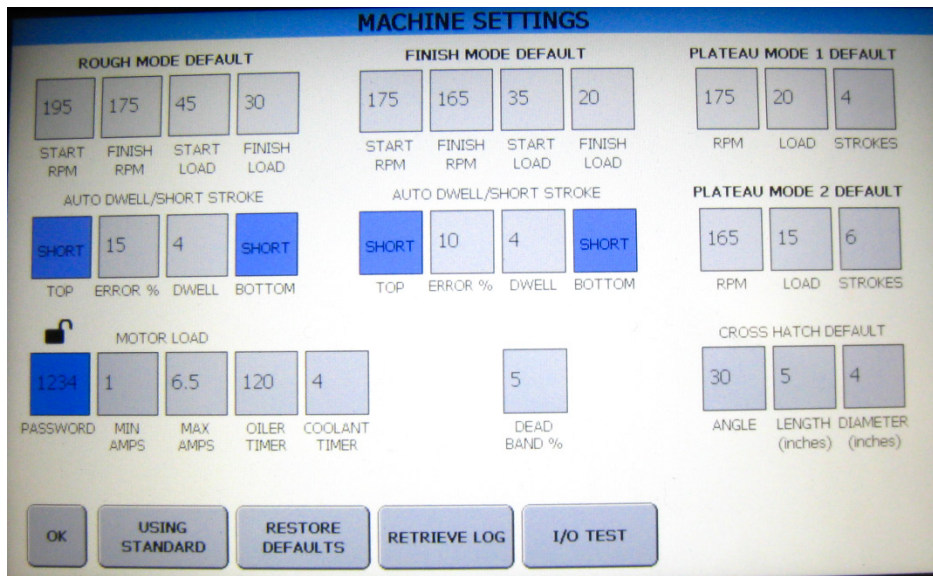
Touch the PASSWORD box.



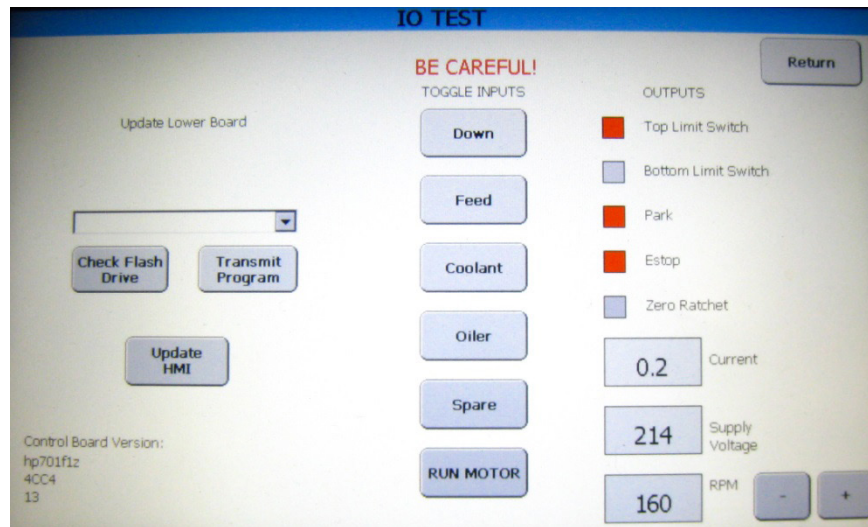
The Number Pad will appear on the screen.



Key in the pass code: 1234, then touch ENTER.
The unlocked MACHINE SETTINGS screen will appear



Touch the I/O TEST button and the I/O screen will appear



Find the USB hub located on the back of the control panel housing and insert the USB drive.



Touch the Check Flash Drive button.

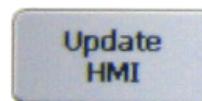
Update files for the Lower Board will appear in the Menu Bar. 

Touch the Down Arrow to view all updates located on the flash drive.

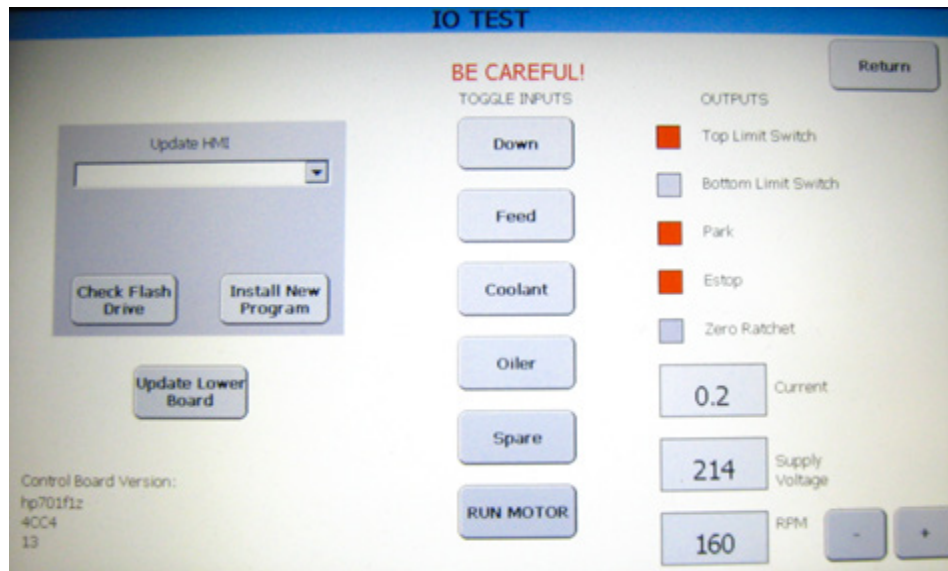
Touch the latest file to highlight and choose it.

Touch the Transmit Program button and the update will be installed.

After update has completed touch the Update HMI button



and the following screen



Touch the Check Flash Drive button.

Update files for the HMI will appear in the Menu Bar.

Touch the Down Arrow to view all updates located on the flash drive.

Touch the latest file to highlight and choose it.

Touch the Install New Program button and the update will be installed.

Once updates are completed, turn machine power switch off, reconnect airline, and turn machine back on.

Saving and Restoring Block Profiles

SAVE BLOCK PROFILES TO THUMBDRIVE

First you need to exit the program so you land on the desktop. From there, you need to browse to \residentflash\hp7\. You should now see a folder called "data". Hold your finger on the data folder and a context menu will appear, press copy.

Now make sure a thumb drive is in the HMI. Now browse back to "My Device". You should see a folder called "HardDisk"; that is your thumb-drive. Double click on the HardDisk folder. Hold your finger down in blank section of the folder, a context menu will appear, then press "paste".

If you followed the instructions, you should have your saved profiles on the thumb drive.

THUMBDRIVE PROFILES TO HMI

This process is basically the reverse of the above.

Exit the Program, you should now be in the desktop. Place the thumb drive (that has the data folder) in the HMI. Double click "My Device". You should see a "HardDisk" folder, that is the thumb drive. Enter into the HardDisk folder, you should see a data folder. Hold your finger down on the data folder, a context menu will appear, press copy.

Now go back to MyDevice. Enter into the \ResidentFlash folder. Enter into the \hp7 folder. Now, delete the old data folder by holding your finger on the data folder, and hit delete on the context menu. Now, that the old data folder is gone, hold your finger on a blank section of the \hp7 folder, a context menu will appear, hit paste.

Now, a copy of the data folder from the thumb drive should be in the hp7 folder. Please note, that the files that were previously on the machine will be deleted. Hopefully that is okay.

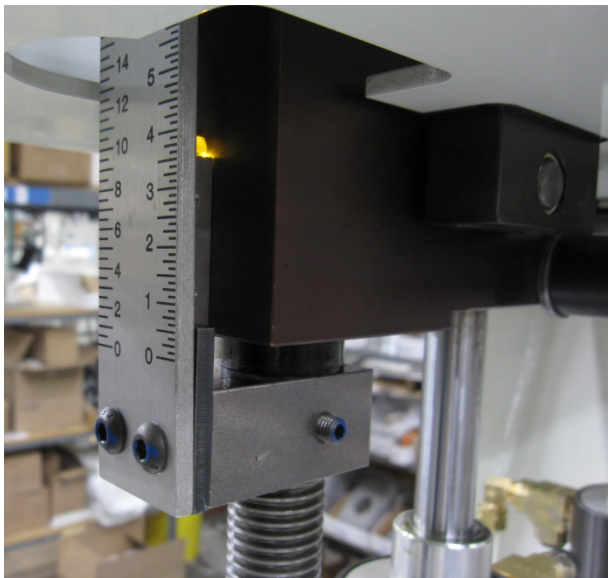
Verifying Lower Over Stroke Settings

Due to the method used to set limit sensor response, there will be a decrease of over stroke once the machine is stroking. Usually this is minimal and does not affect bore geometry. In some cases due to cylinder length, load settings, motor RPM, and other factors there may be a greater decrease in over stroke than normal. This may cause problems in maintaining proper bore geometry.

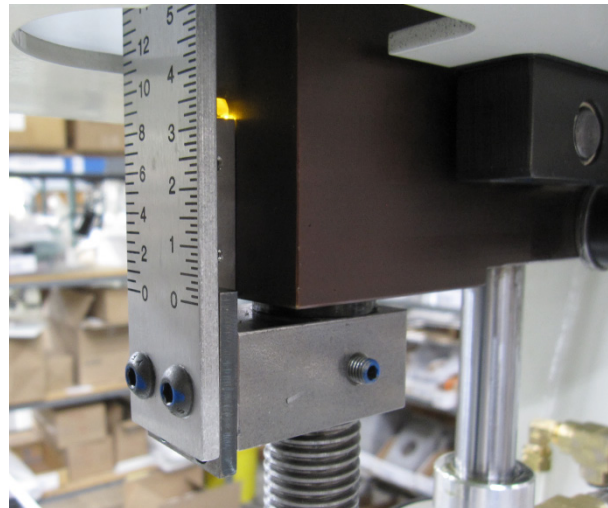
If there are problems in maintaining bore geometry, the lack of proper over stroke may be a cause. Watch the level that the pivot block reaches on the scale. If the over stroke is decreasing too much during the honing cycle stop the machine and reset the lower stop further down. If lower stop can't be set lower because of interference issues, then loosen the screws holding the scale to the pivot block and lower the sensor activation plate down. On machines that have the slotted plate it is possible to lower it past the point that the lower sensor is activated. If that occurs the rocker arm will go to the bottom of its travel and not go back up. You will need to shut off the machine, activate the sensor with a screwdriver and reset the plate a little higher. On machines that have drilled plates you will have to remove the screws and lower the plate down.

Lower Limit Plate Adjustment:

Before



After



Note that in the before picture the sensor is activated 1/2" from the bottom of the lower limit setting. The after picture shows the sensor activated at the zero point of the lower limit setting. Note that the activation plate has been lowered a like amount.

TROUBLESHOOTING

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Troubleshooting

The Following is a basic guide in trouble shooting the HP7A Honing machine.

Hone Head Will Not Feed Out.

Possible Cause: Air not getting to the Ratchet Actuator Assembly.

The Ratchet Actuator Assembly is located on the rear of the main gearbox (514-6-22A).

If the hand wheel on the gearbox does not try to feed out, then the Actuator assembly may not be getting air from the Feed Out solenoid. Locate the feed out solenoid in the rear of the spindle carriage (514-2-70H). There is a small button on this solenoid so it can be manually activated. Using a small Allen wrench or similar device to depress this button and see if the head feeds out.

If the head feeds out when manually activated, then the solenoid may have gone bad, a wiring connection has broken loose, or the machine is not seeing the strokes. The machine will not feed out if it is not seeing the strokes. Verify that the machine is seeing the stroke by changing the speed of the strokes, and the stroke speed display should change as you are changing the speed. Turn the machine power off, and check the wiring on the solenoid by removing the wire cap. Check all wire connections in the rear enclosure. If the head still does not feed, contact the factory for solenoid or possible board replacement.

If the head does not feed out when you activate the solenoid manually, then you may not be getting air to the solenoid. Check the incoming air supply and verify there is air to the solenoid pack.

Possible Cause: Precision Hone head assembly dirty.

If the precision hone head assembly is not kept clean and free of rust, the head may not feed out properly.

See Machine Parts section of this manual for disassembly of the precision hone head. Pay particular attention to the threads on the cone (524-9-7A). If they are not clean and free of rust, the feed of the head will not operate properly.

When the head has been thoroughly cleaned, re-assemble and test.

Possible Cause: Drag Pin tension on Ratchet Actuator Assembly not set correctly.

The Ratchet Actuator Assembly is located on the rear of the main gearbox (514-6-22A). See Machine Parts section of this manual for location of this assembly.

When the head is not feeding out correctly, put pressure with your thumb on the shifting spool (514-7-26) where it exits the housing on the left hand side. If the machine starts feeding correctly with pressure applied, then the drag pin tension is too light.

Refer to Maintenance section of this manual for the location of the drag pin. Loosen the locking set screw on the rear of the housing to allow the drag pin to be adjusted. Turn the drag pin counter-clockwise only a 16th of a turn at a time, and test the feed. Do not over tighten the drag pin tensioner. (Also see Adjusting Drag Pin Tension in maintenance section of this manual.)

Possible Cause: Ratchet Actuator Assembly not adjusted properly.

The Ratchet Actuator Assembly is located on the rear of the main gearbox (514-6-22A). See Machine Parts section of this manual for location of this assembly.

Air from the feed solenoid is sent to this assembly when a feed is required. The air moves the piston inside this assembly, which in turn activates a pawl (514-7-29). The pawl is the mechanism, which feeds out the gearbox.

If the Actuator Assembly is not adjusted correctly (left to right), then the head will not feed out under load. The actuator housing has four (4) slotted mounting holes in it. Loosen the four bolts in the mounting holes and move the Actuator housing to the left (as you are facing the front of the machine) by 1/32" at a time. After making an adjustment tighten the housing down again and try the feed system. Continue adjusting the box and testing until the head will feed out under load.

(Also see Adjusting Feed Out Actuator Housing in the maintenance section of this manual)

Hone Head Continues To Feed Out Without Reaching Preset Load Setting.**Possible Cause: Sheared roll pin in hone head assembly or in gearbox.**

Determine location of sheared pin by removing hone head assembly from drive tube. Place hone head in cylinder and feed out stones by hand by turning drive coupling until stones make contact with cylinder wall. Use a wrench to tighten stones further. If stones can't be tightened to lock up, then sheared pin is located in hone head assembly. If stones lock up, the sheared pin is located in the gearbox.

Taper or bore not straight.

There are several items in the honing procedure, that if not followed properly will cause the cylinder not to be straight. This could be taper, bowed out in the middle, or too big at the top. Any one, or combination of the causes listed below could cause the problem. It is very important to follow all steps of the honing process correctly. If you are in doubt of the correct process, contact your area representative or the factory for assistance.

Possible Cause: Incorrect Over stroke settings.

If the over stroke (length the stones extend out of the hole at the top and bottom) is set too long, the bore will end up being bigger in the area where the over stroke is not set correctly.

If the over stroke is set too short, that part of the cylinder will end up being small (taper). On some blocks it is not possible to get the correct amount of over stroke set on the bottom of the cylinder due to interference with the main webs. When this is the case, the dwell button can be used to straighten out the cylinder.

NOTE: Upper and Lower stops settings are very important when honing. Incorrect stop settings can cause the operator to think he needs to dwell the cylinder when that is not the case. Excessive dwelling can cause the stones to become tapered. If this happens it compounds the problem of taper in the cylinder.

Possible Cause: Tapered Stones.

If your over stroke is set correctly use a micrometer to measure the stones. When measuring the stones, measure the top of one stone to the top of the stone across from it. Record this reading and then measure the bottom of the same stones. If the bottom of the stones measure out smaller than the top, this will also create taper in the cylinder.

Possible Cause: Incorrect Pressure settings.

It is possible to set the Rough and Finish load setting improper for a certain type of cylinder. If there is very little support around a cylinder, using a high rough setting can cause the walls of the cylinder to push out while honing, and then to come in when there is no longer pressure on the cylinder wall. This would create a hour glass shaped cylinder. You can account for this by lowering the rough and finish settings. A lower rough setting will not push the walls out as much. A lower finish setting gives the hone head additional time to remove material from the block to straighten it.

Possible Cause: Diamonds need dressing.

For diamond dressing instructions refer to page 3.8 of this manual.

Erratic Finish Sizes

If the hone is not maintaining size from one bore to the next.

Possible Cause: Hone Head not connected properly.

The most common cause of erratic cylinder size is a wrong connection between the Driven Coupling (514-6-44) and Coupler Sleeve (514-6-41). When changing the hone head and yoke be sure not to put any upward pressure on the cone (514-9-7A), this will cause the driven coupling not to engage correctly with the coupler sleeve. When not engaged correctly the driven coupling can move around and cause the stones not to feed out correctly.

Possible Cause: Fluctuating Power.

If the incoming power to the machine is fluctuating more than 10 volts AC, it will cause the load display to fluctuate. Since the machines stopping times are set on the load value this can cause size variance. The power company can usually monitor the power and make recommendations for fixing the problem.

Possible Cause: Spindle Speed Changes.

Changing the spindle speed between cylinders will increase the load on the motor and thus the machine will shut off at a different size. Do not change the spindle speed between bores.

Chatter in bore.

Vertical lines extending from the top to the bottom of the bore.

Possible Cause: Bad Bearings.

If a bearing goes bad in the upper gearbox, it will tend to leave a vertical pattern in the cylinder. When honing especially hard blocks, the chatter becomes a lot more noticeable. A bearing can go bad from normal or hard usage and from a machine crash in the bottom of the bore. Contact the factory for a loaner gearbox while yours is being repaired.

Slow Stock Removal.**Possible Cause: Diamonds need dressing.**

For diamond dressing instructions refer to Maintenance section of this manual.

Machine not stroking.**Possible Cause: Feed Ring not set correctly**

If you are making a small adjustment to the Feed Ring it is important to back off the hand wheel several notches (5 to 10) before pressing the Auto Cycle button again. The HP7A takes at least two strokes to calculate the Strokes Per Minute and the load on the stones. If there is not enough stoking time before the "0" on the feed ring is reached, the control does not have enough data to calculate the correct stopping time for the hone head.

Possible Cause: Upper Stop Sensor Adjustment

If the upper stop sensor is not reading the machine can stroke and then stop at the top of the cylinder and not return towards the bottom. This can be intermittent. The hone head will continue to rotate even after travel has stopped. Refer to the Upper Sensor adjustment in the Maintenance section of this manual.

Possible Cause: Stroke Lever

Sometimes the stroking speed lever on the front right hand side of the spindle carriage has been moved into the full upright position. This will not allow any hydraulic fluid to pass. Therefore, the machine will not be able to stroke.

Possible Cause: Solenoid or Board Failure.

As with all electronic devices, solenoids will eventually fail. To determine if the solenoid is bad, turn the spindle on and press the stroke button. Does the stroke button light up?

If not then the I/O board should be replaced.

If the light does come on, but the rocker arm still does not stroke, leave the light on and locate the stroking solenoids in the back of the carriage. There is a small button on these solenoids so they can be manually activated. Use a small Allen wrench or similar device to depress these buttons. The rocker arm should go down. If you release the buttons the rocker arm should go back up. If the rocker arm does not go down when the buttons are depressed check all air lines for kinks.

If the rocker arm goes down as stated, turn the machine power off, check all wiring at solenoids, and in the rear enclosure. If the machine still does not stroke after checking the wiring, contact the factory for possible solenoid or board replacement.

Possible Cause: Oiler tank empty

If the Oiler tank goes dry the O-Rings in the shifting spooler may go dry. Add oil to the oiler, turn the drops per minute way up and start the machine stroking to re-lubricate the O-Rings. The Stroking may have to be activated by hand.

Uncontrollable Stroking Speed.**Possible Cause: Air in the Hydraulic System**

If there is allot of air in the hydraulic system, it will become compressed as the machine changes directions. If the air is becoming compressed the hydraulic fluid is not forced to go through the speed control ball valve, thus the rocker arm speed is uncontrollable. Take the precision head off of the machine, set the stroke length to its maximum travel, set the stroke speed to slow. This will allow the air to compress and then start forcing the hydraulic fluid through the speed control valve. The Rocker arm will be erratic at the top and the bottom of the stroke but this will confirm that there is air in the Hydraulic system.

Possible Cause: Check Valve Failed

The Check Valve (514-7-58) coming off of the bottom of the Reservoir may have failed.

Possible Cause: Hot Oil Shuttle may have failed.

To determine if this is the cause, watch the Reservoir while the machine is stroking. If there is excess fluid flowing into the reservoir from the top, the Hot Oil Shuttle relief valve has failed or is not adjusted correctly. If the relief valve has not been adjusted by your personnel, this is not the cause.

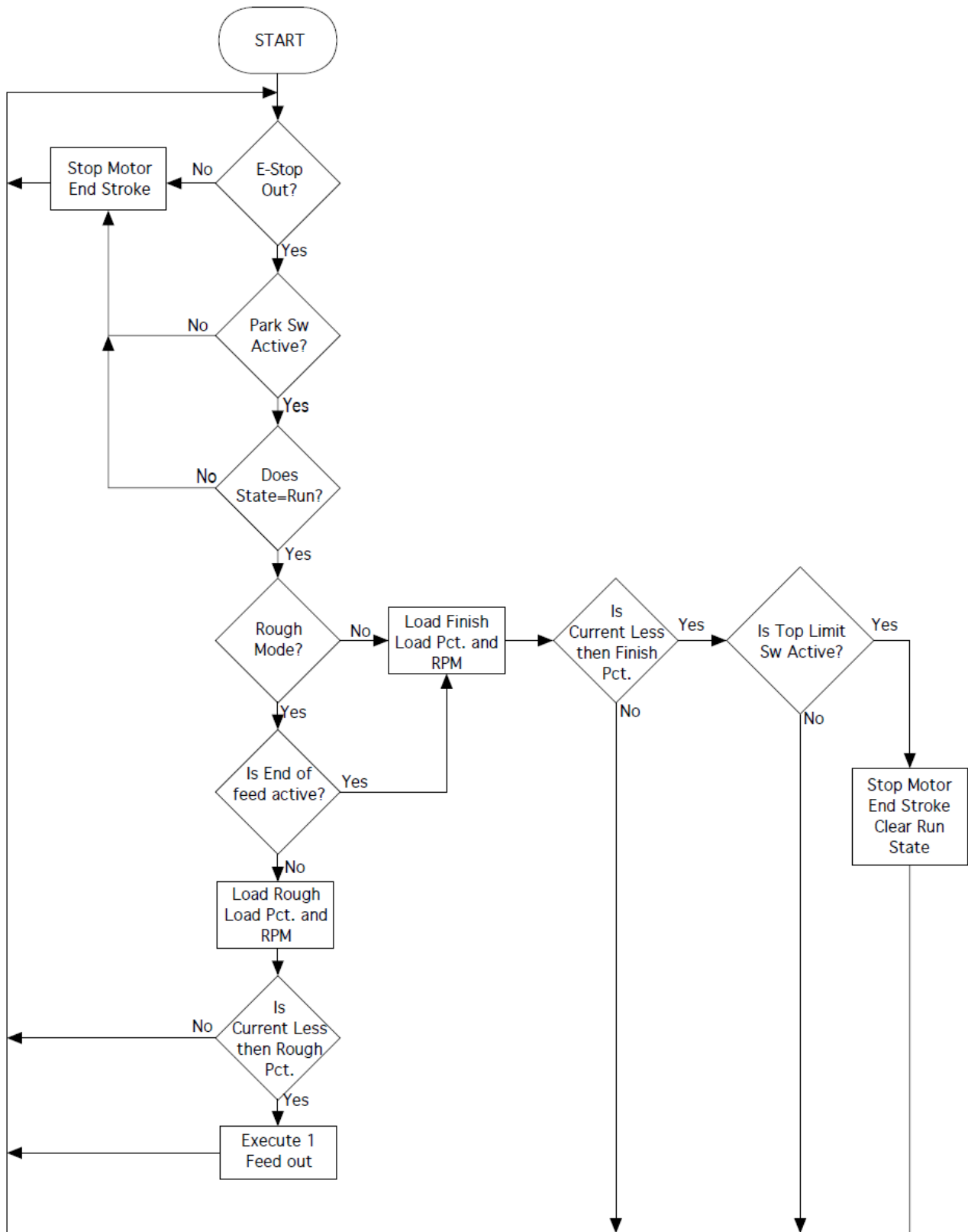
Banging at Top of Stroke.**Possible Cause: Upper Sensor has moved.**

It is possible the upper sensor has moved from its factory position. Refer to Upper Limit Switch Adjustment in the Maintenance section of this manual for the proper factory setting.

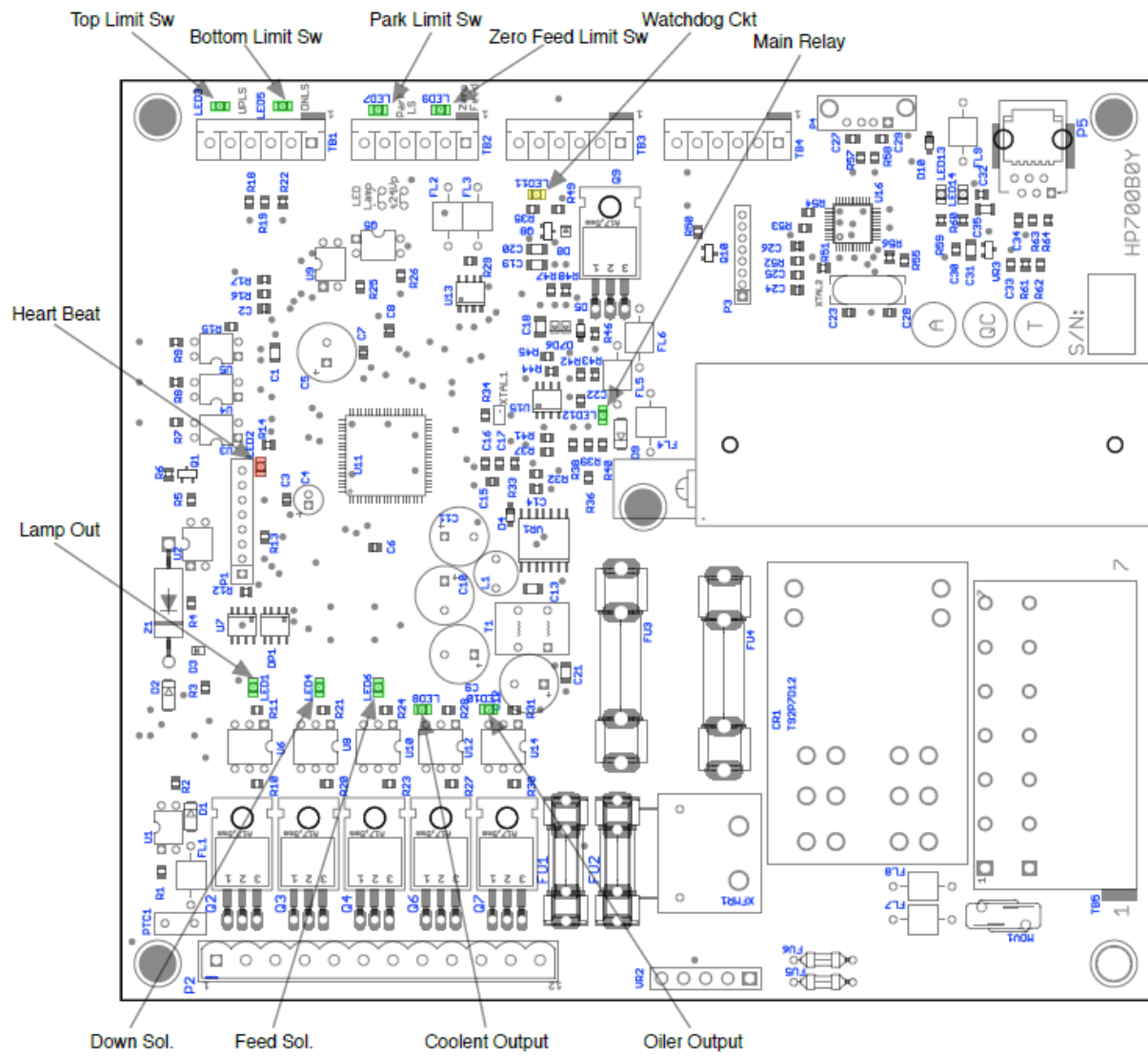
Possible Cause: *Improper Stroking Speed for length of cylinder being honed.*

Correct stroking speed can be calculated. Refer to Stroking Speed in the Operating Instructions chapter in this manual.

Operational Flow Chart



I/O Board LED Reference Map



MACHINE PARTS

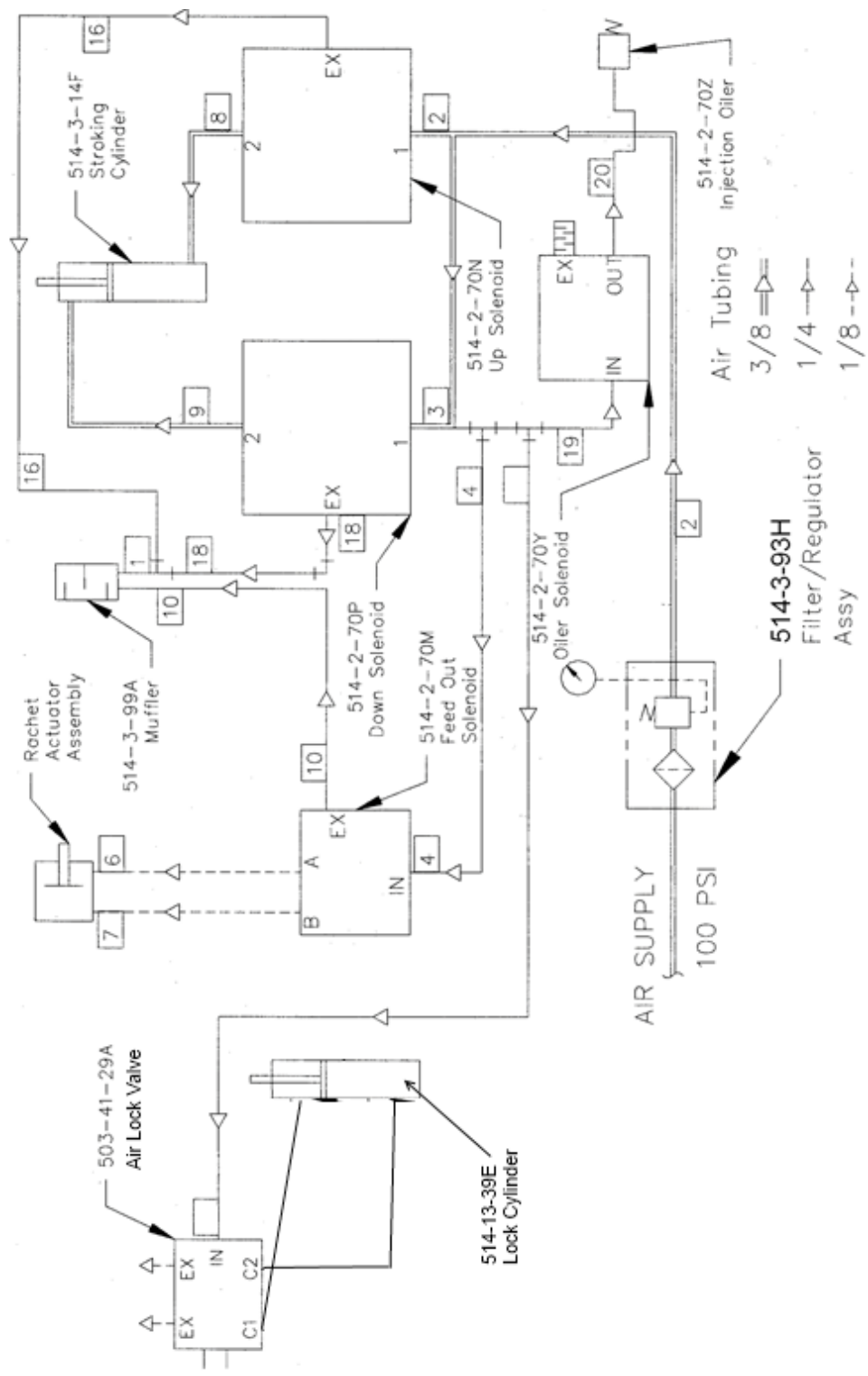
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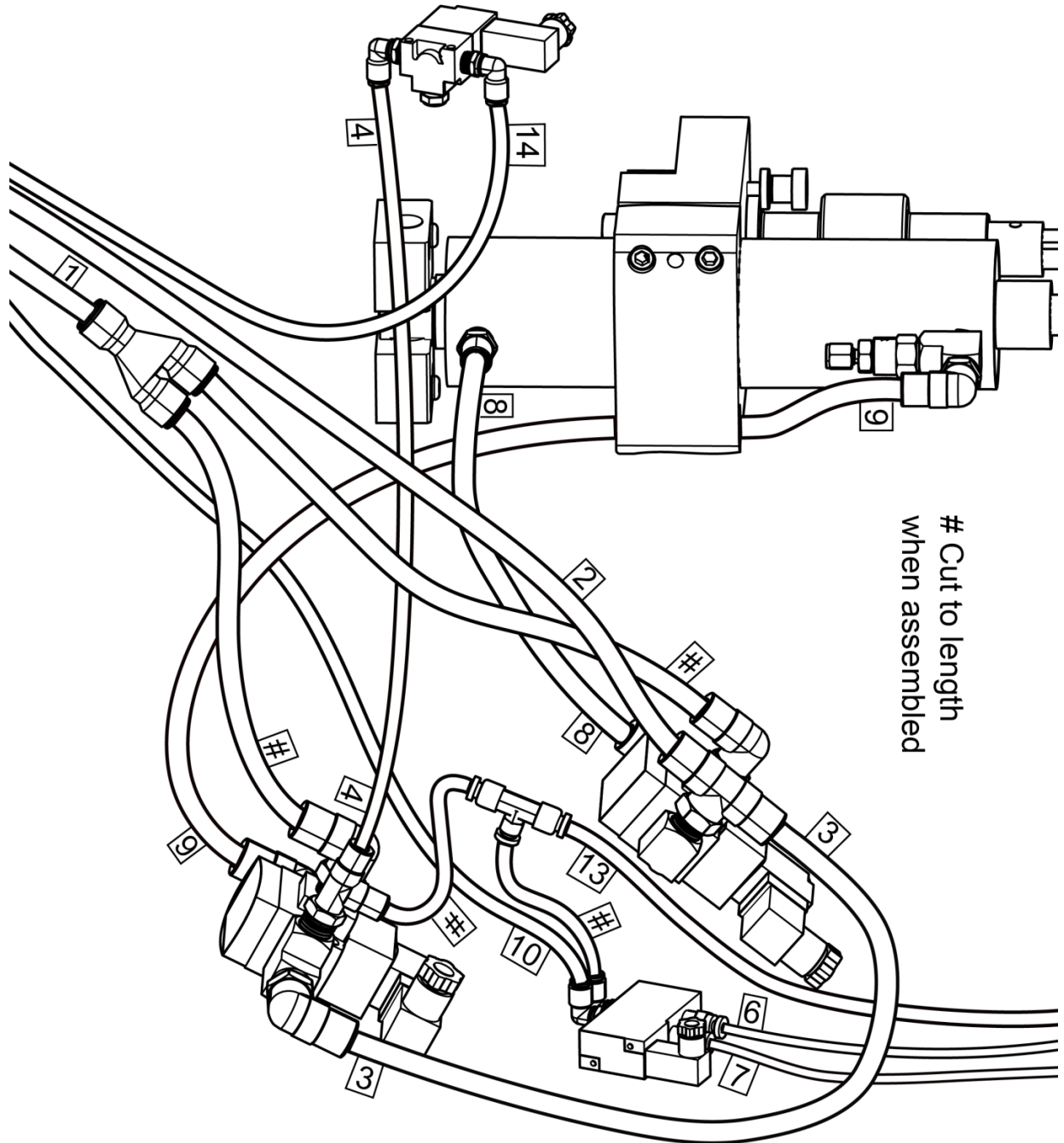
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Machine Parts

Air Logic Diagram

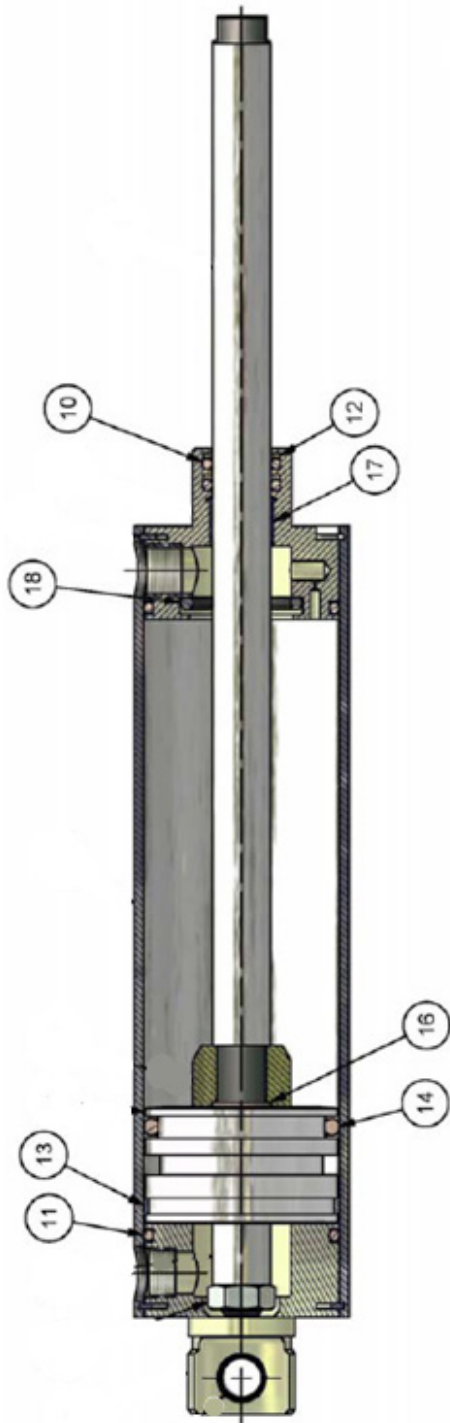


Air System Connections



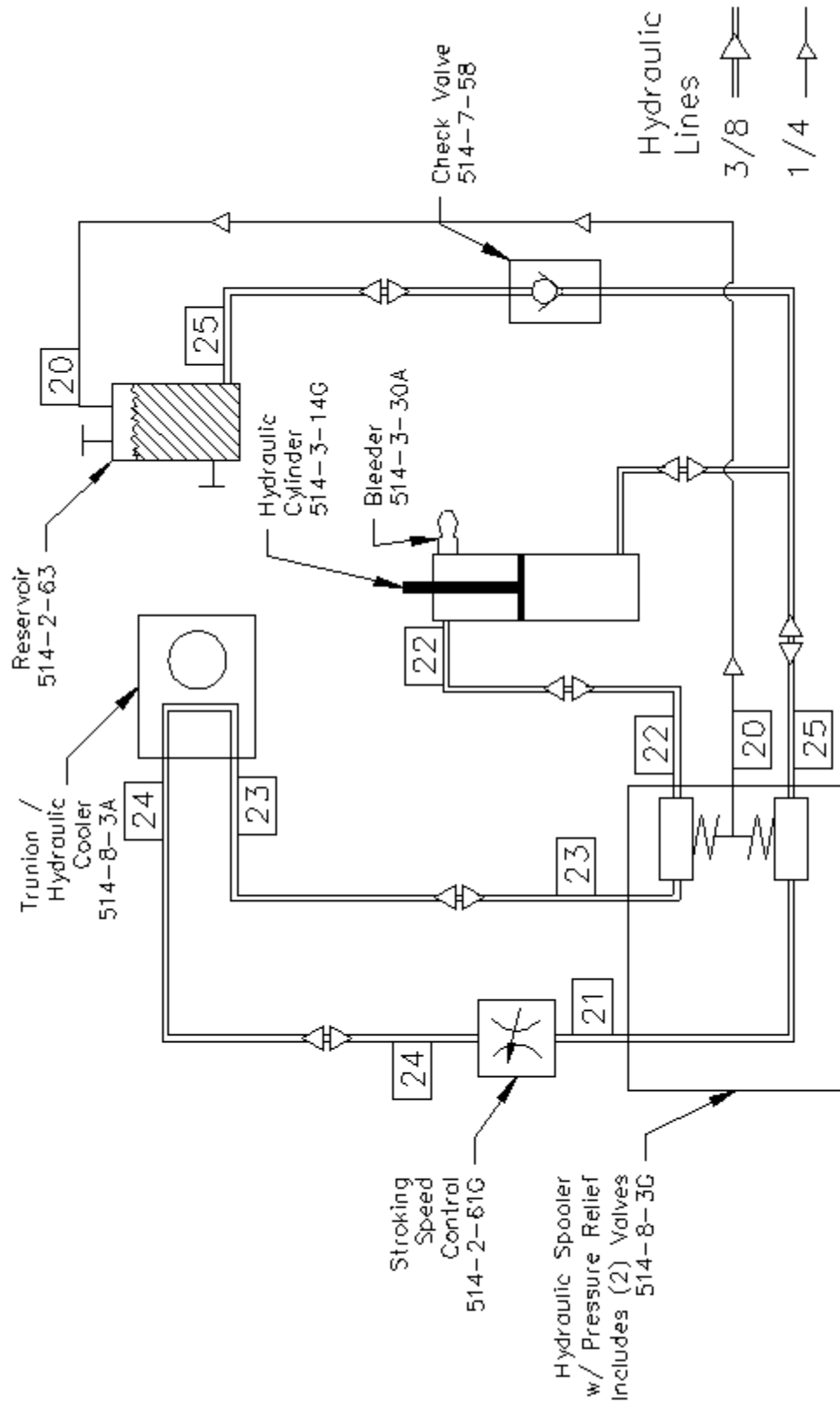
Stroke Cylinder

514-3-14N Repair Kit

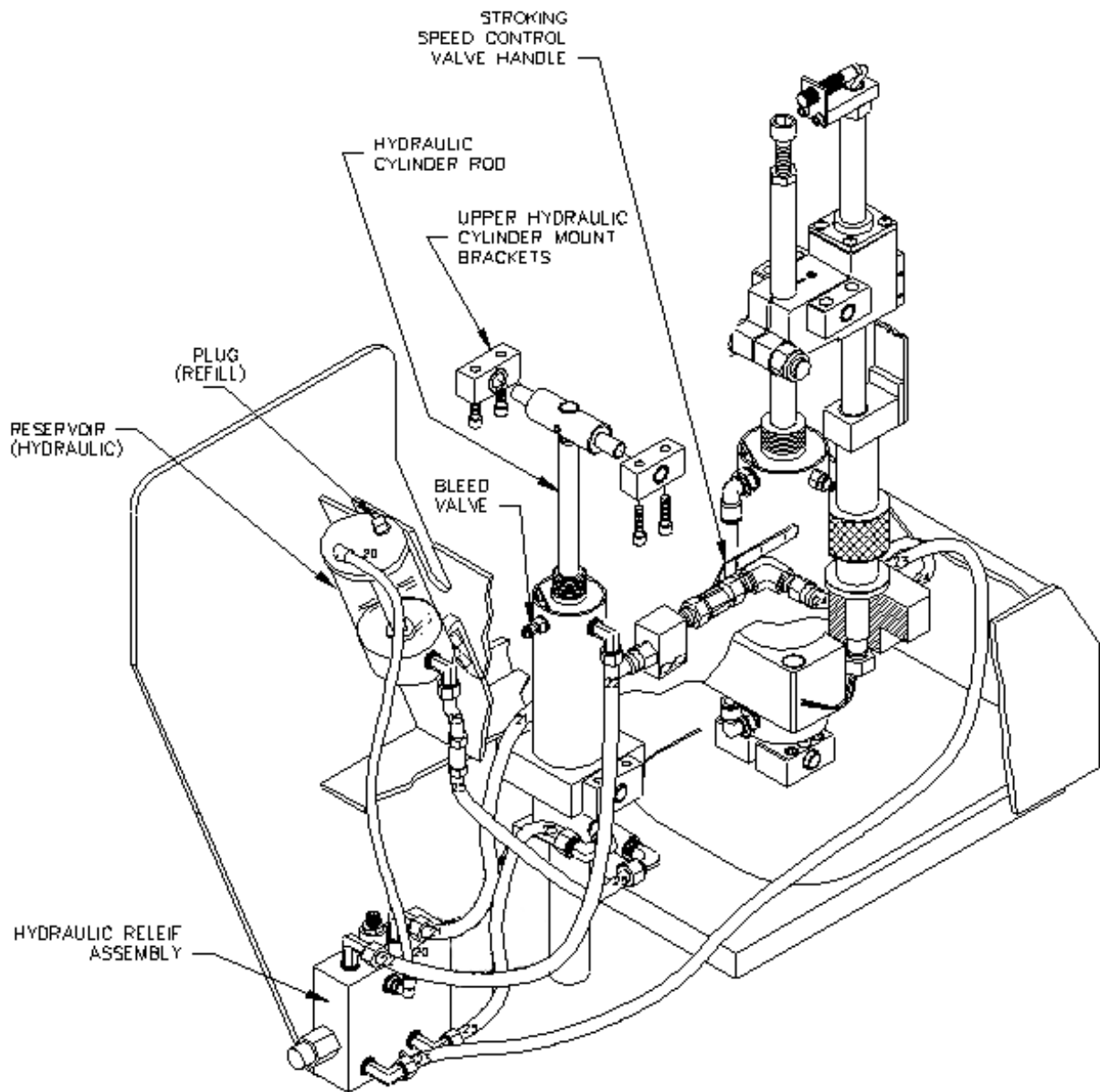


Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
10	2		O-Ring Seal (Viton)
11	2		O-Ring Seal (Viton)
12	2		Leather Back-Up Ring
13	1		Wear Strip
14	1		O-Ring Seal (Viton)
16	1		O-Ring Sea (Viton)
17	1		BEARING
18	1		Cushion Seal

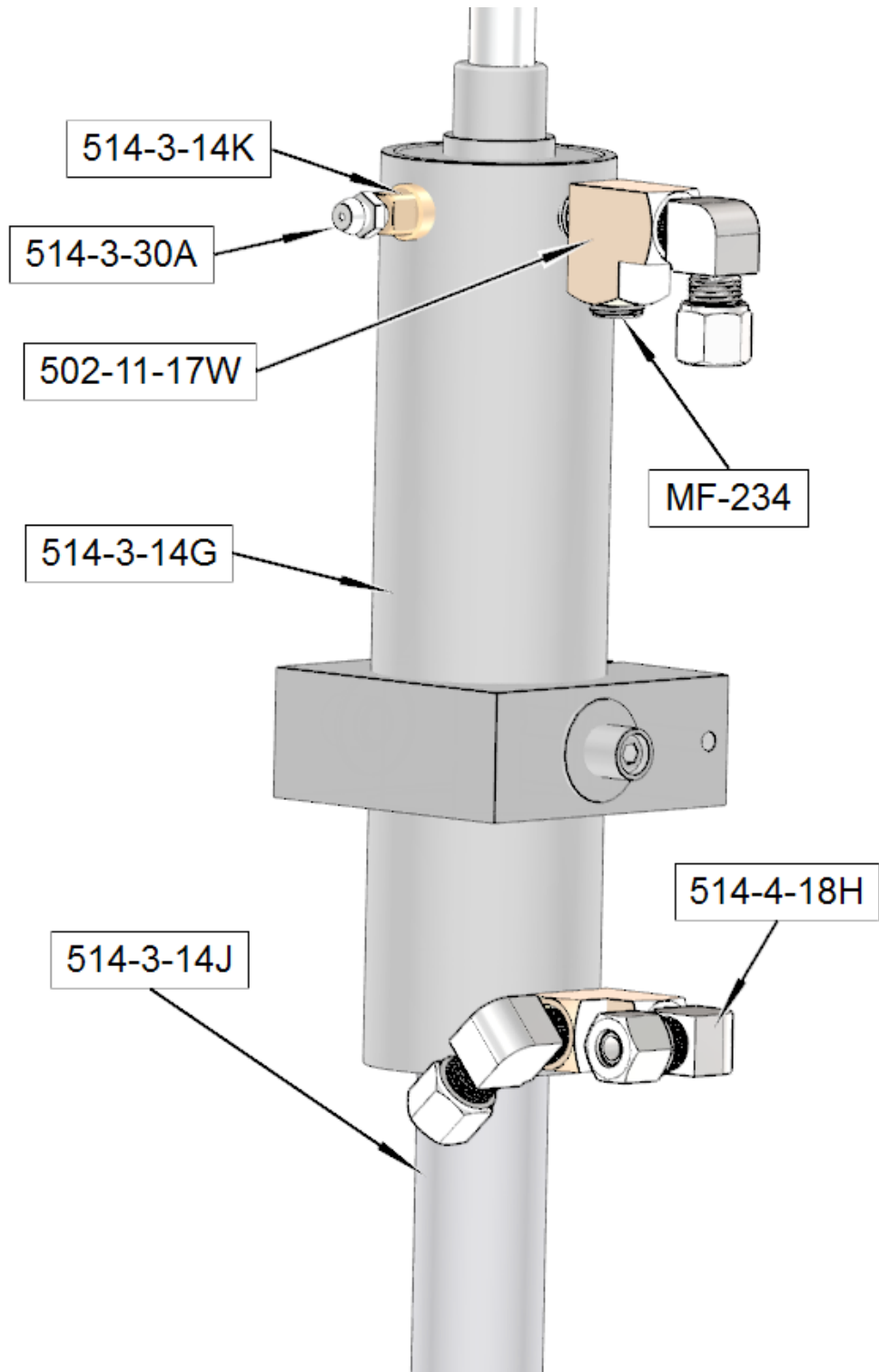
Hydraulic Logic Diagram



Hydraulic System Connections

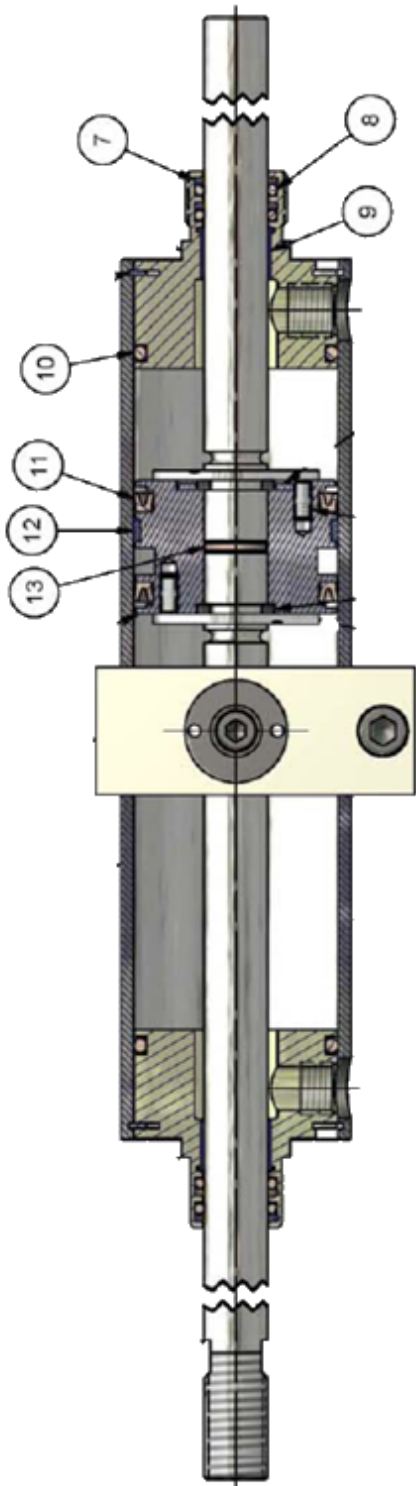


Hydraulic Cylinder Fittings



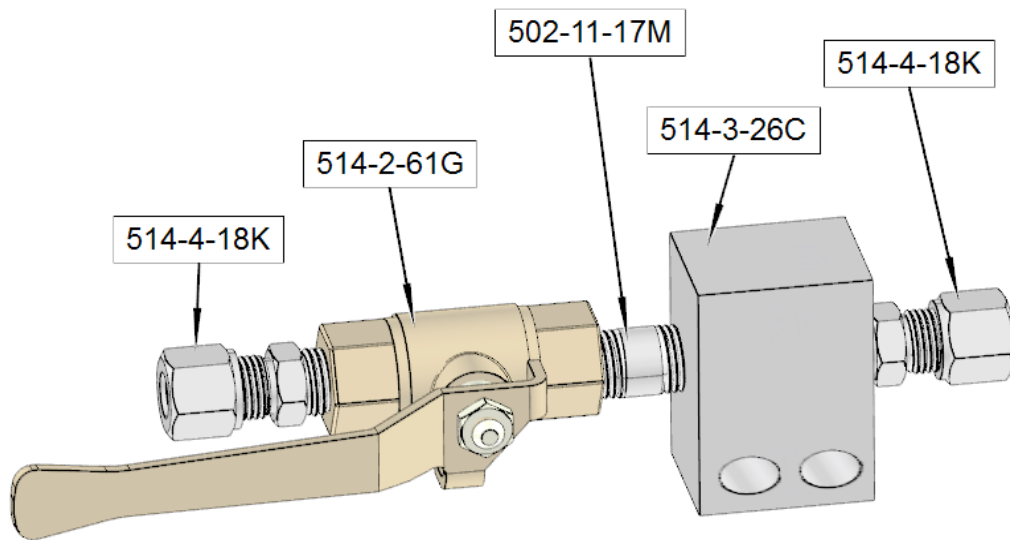
Hydraulic Cylinder

514-3-14M Hydraulic Cylinder Repair Kit

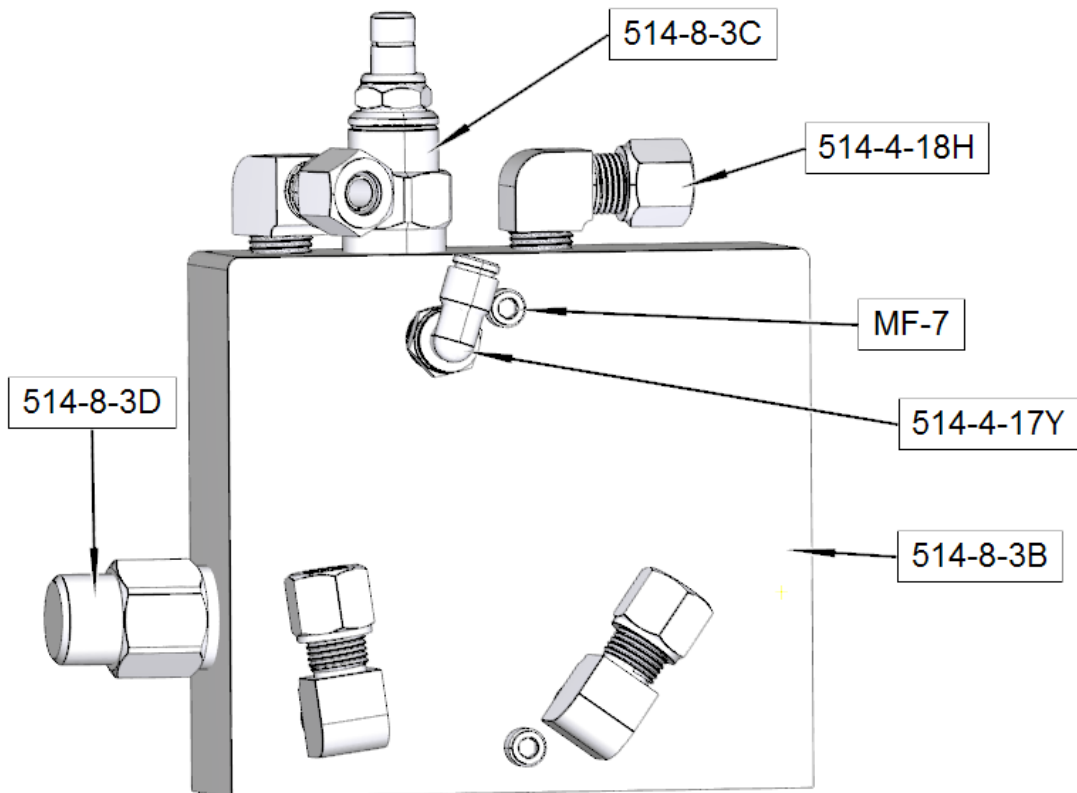


Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
7	4		Leather Back-Up Ring
8	4		O-Ring Seal (Viton)
9	2		Bearing
10	2		O-Ring Seal (Viton)
11	2		Block Vee Cup (Viton)
12	1		Wear Strip
13	1		O-Ring Seal (Viton)

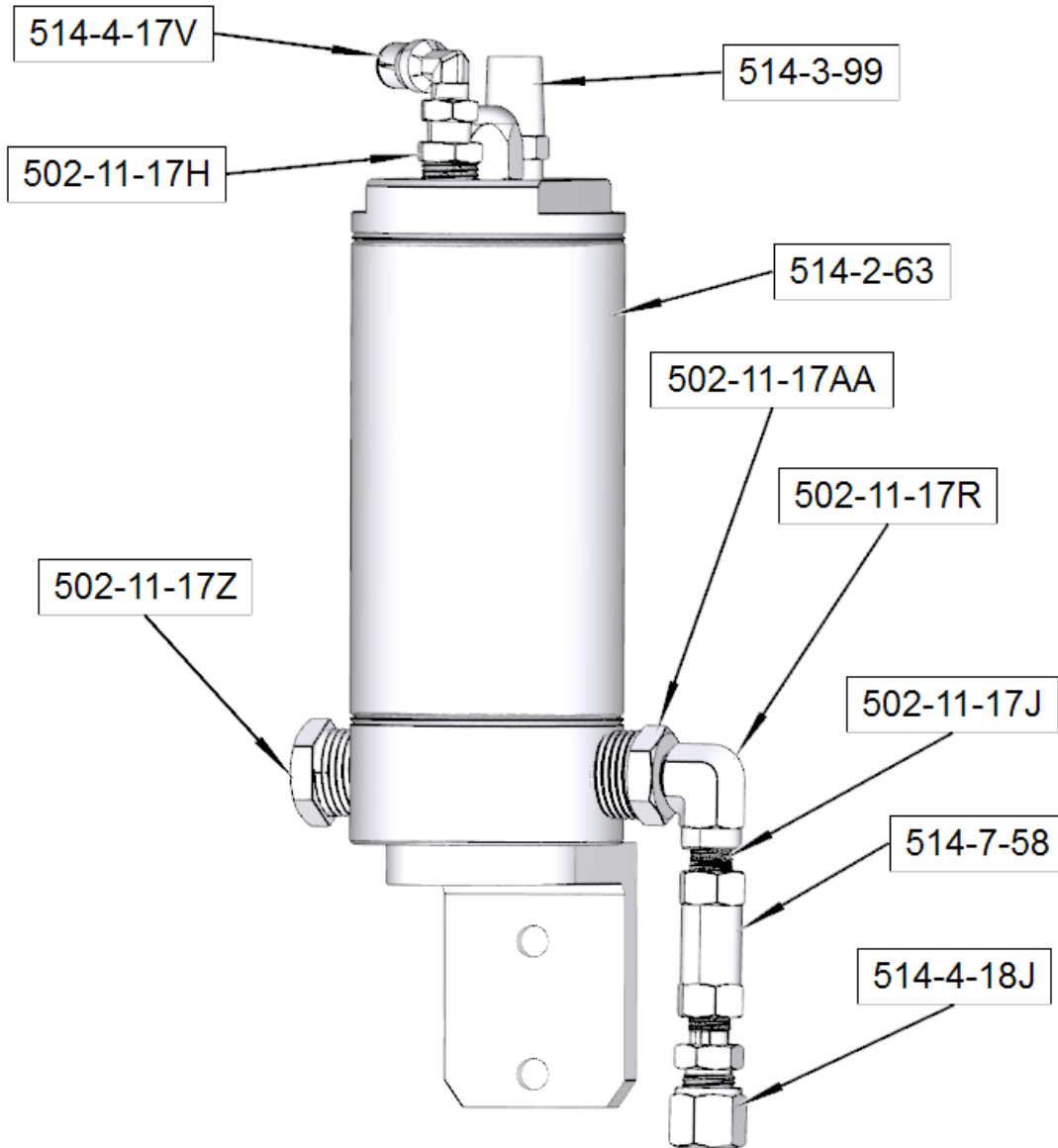
Stroke Control Valve Components



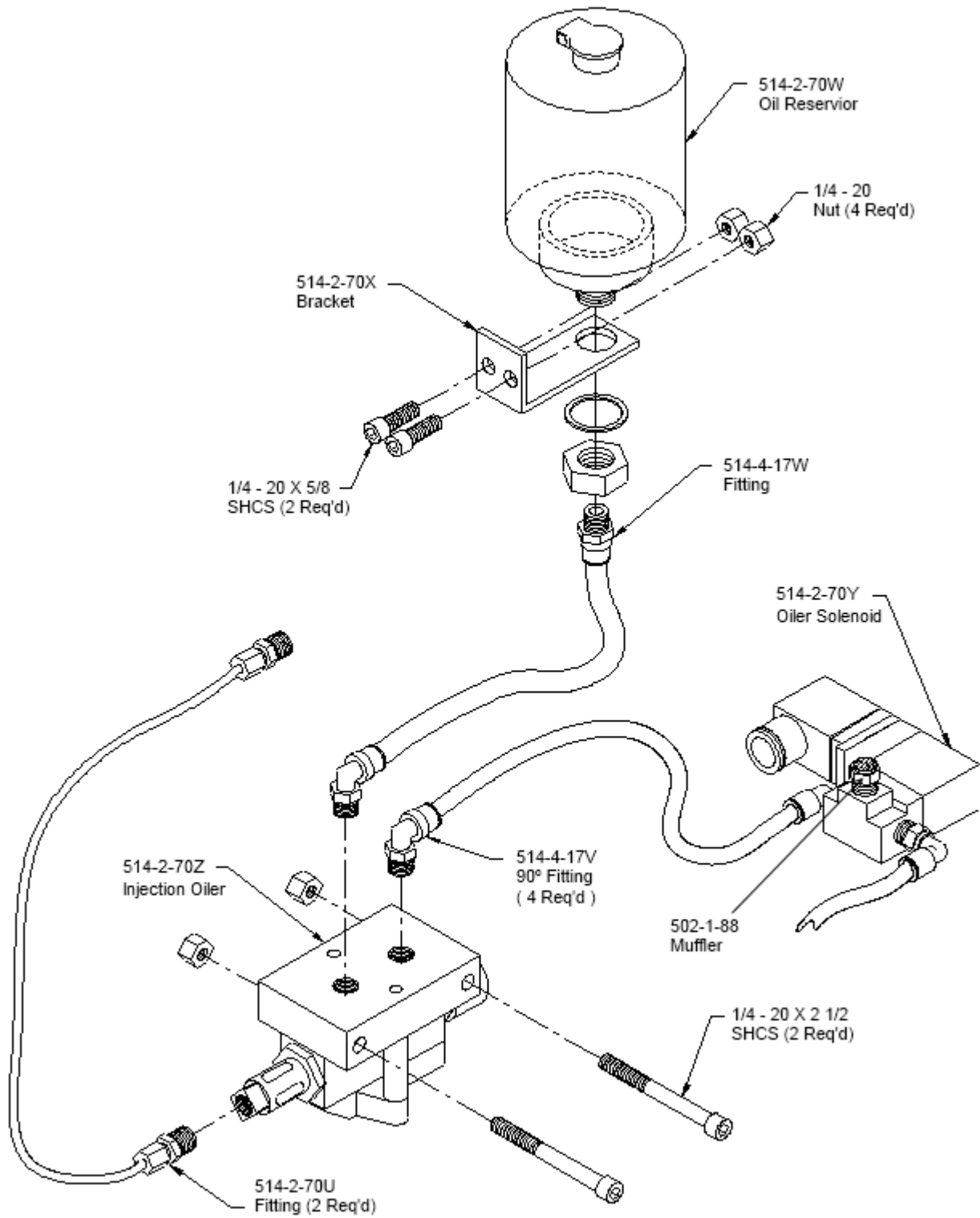
Hydraulic Bypass Components



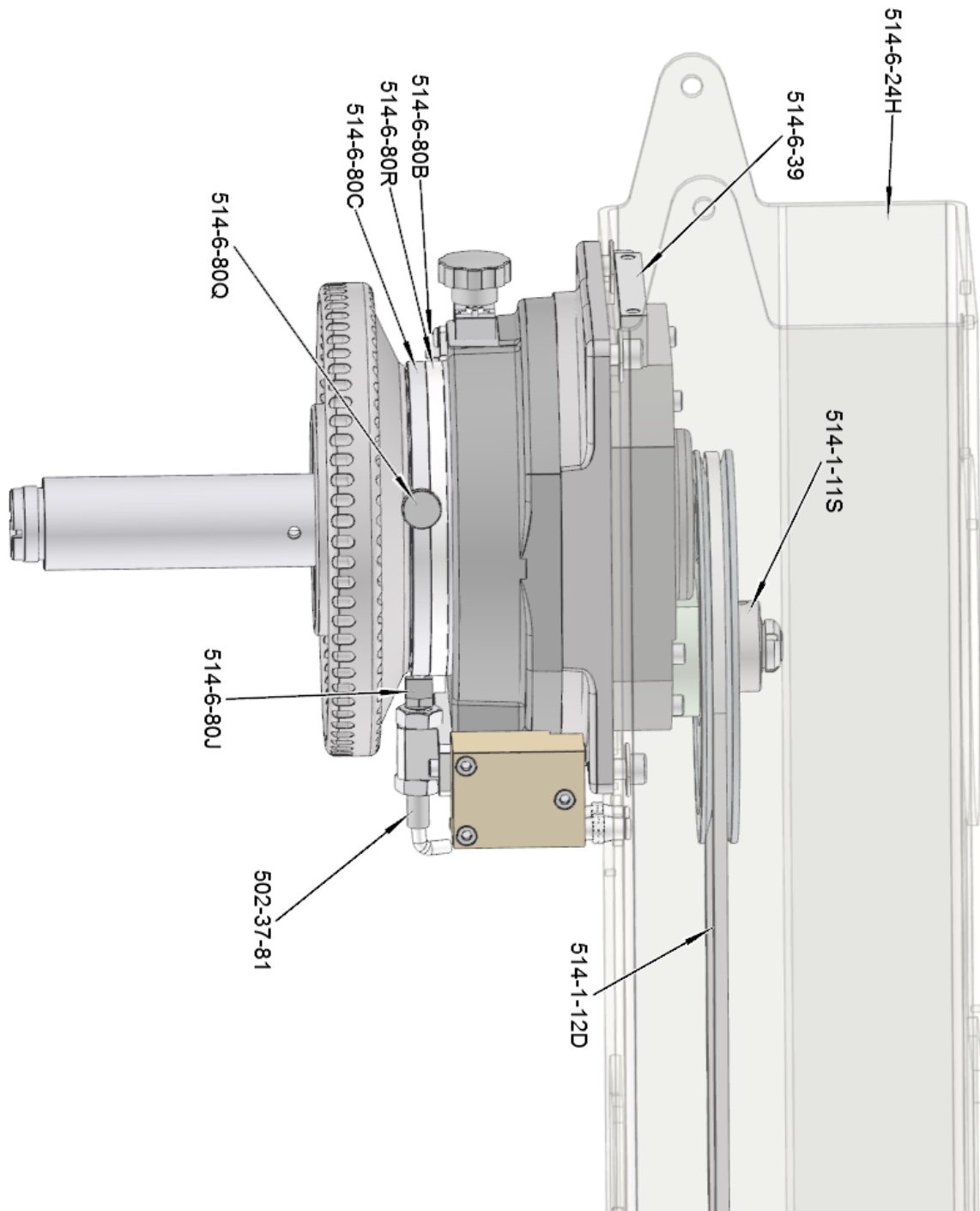
Hydraulic Reservoir Components



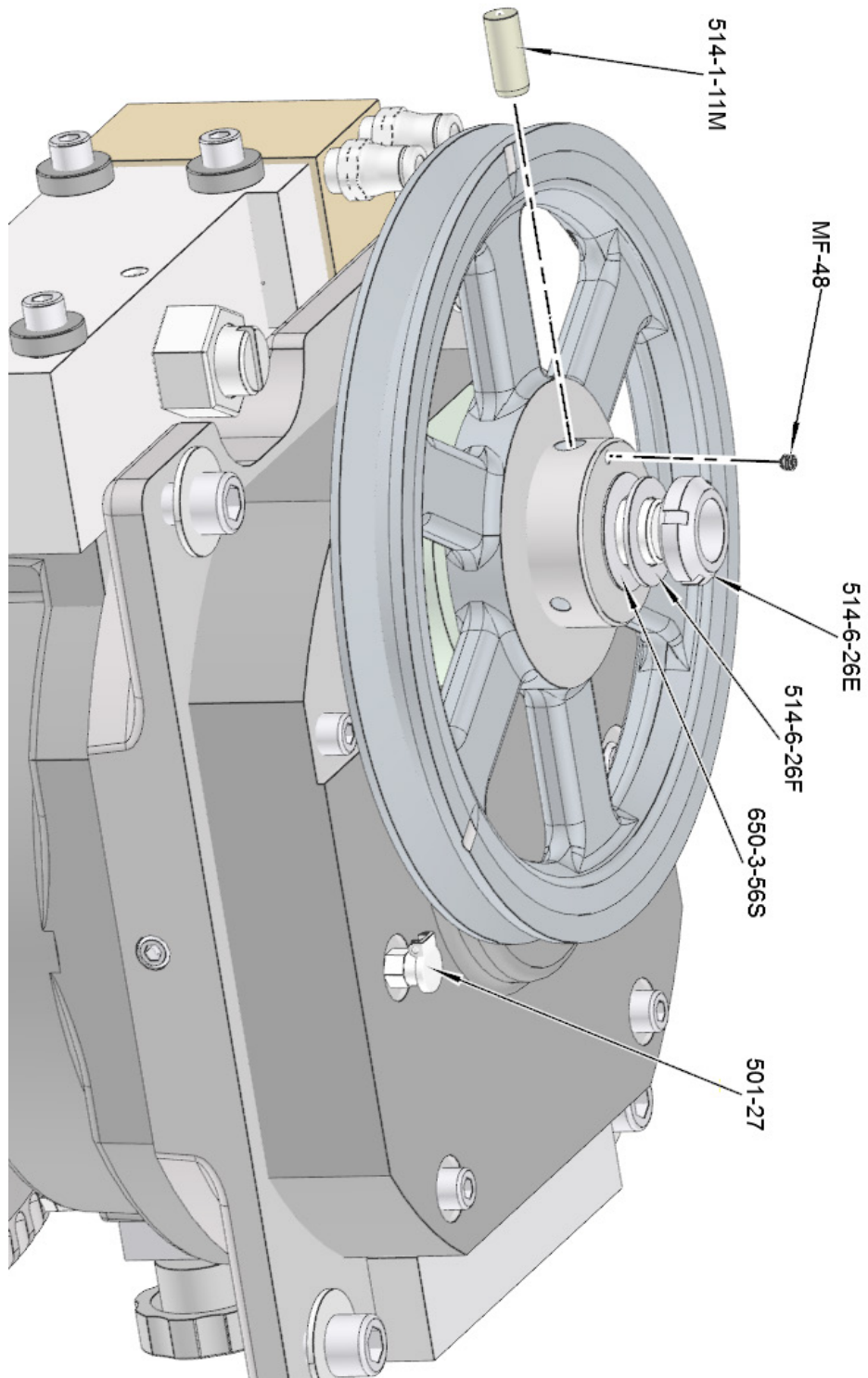
Injection Oiler



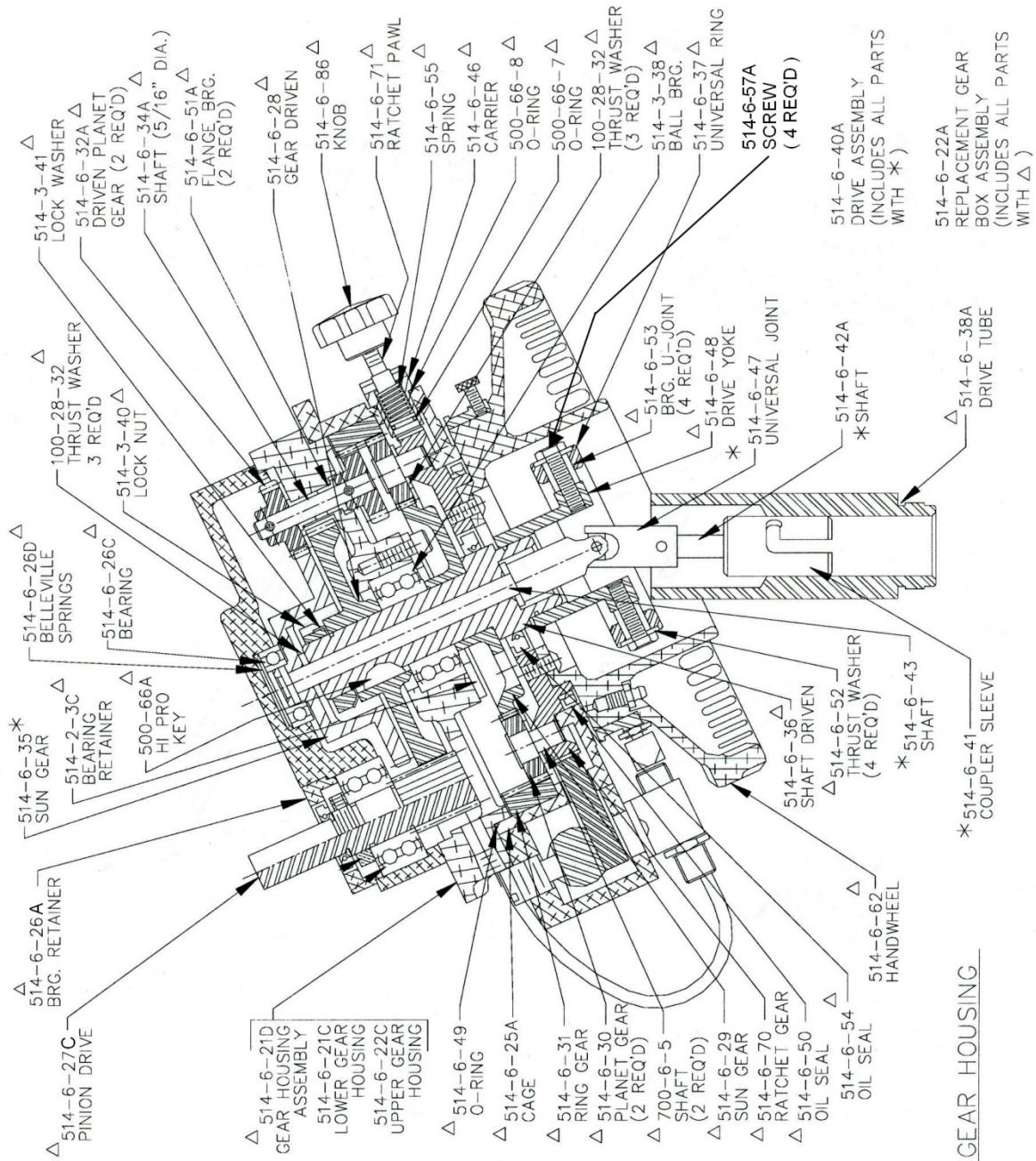
Front Section Rocker Arm



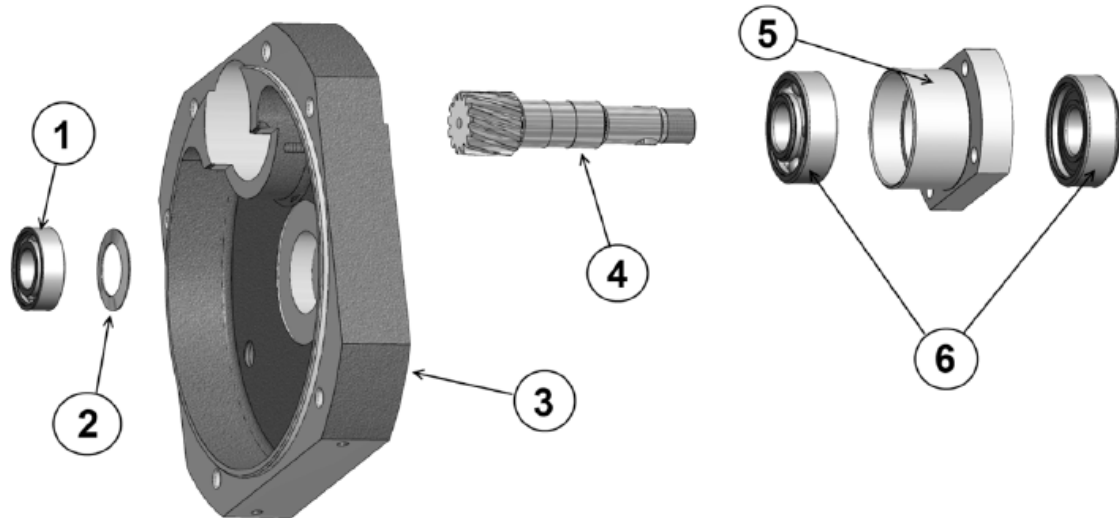
Drive Pinion Assembly



Gear Housing Section

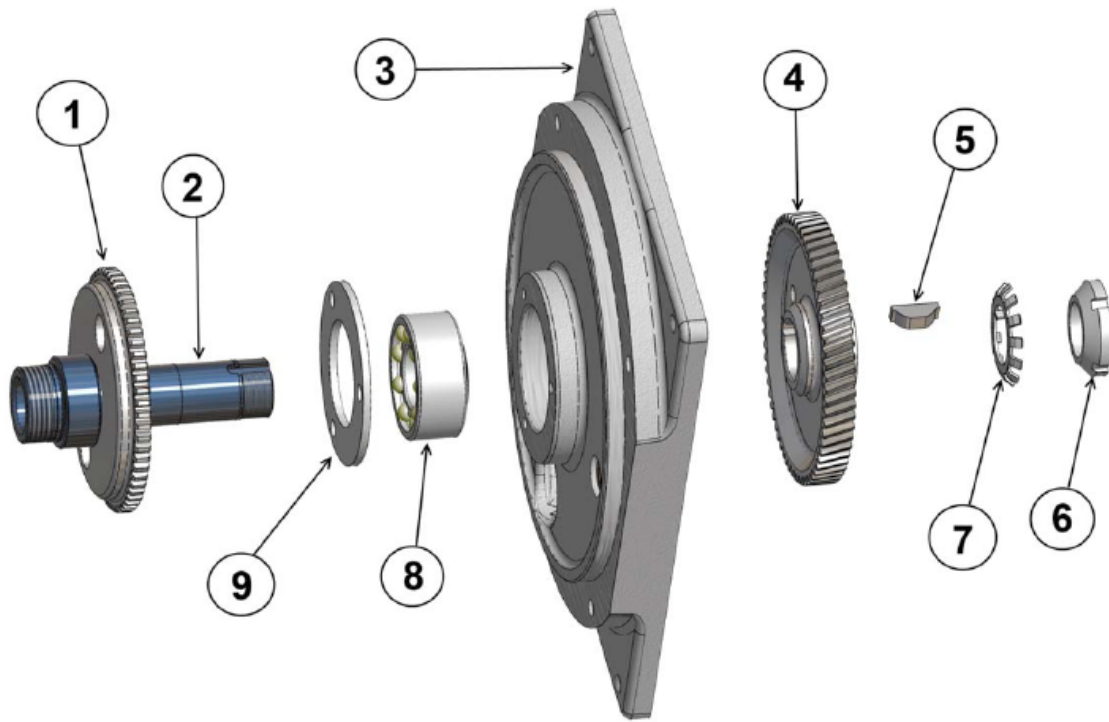


Upper Housing Parts



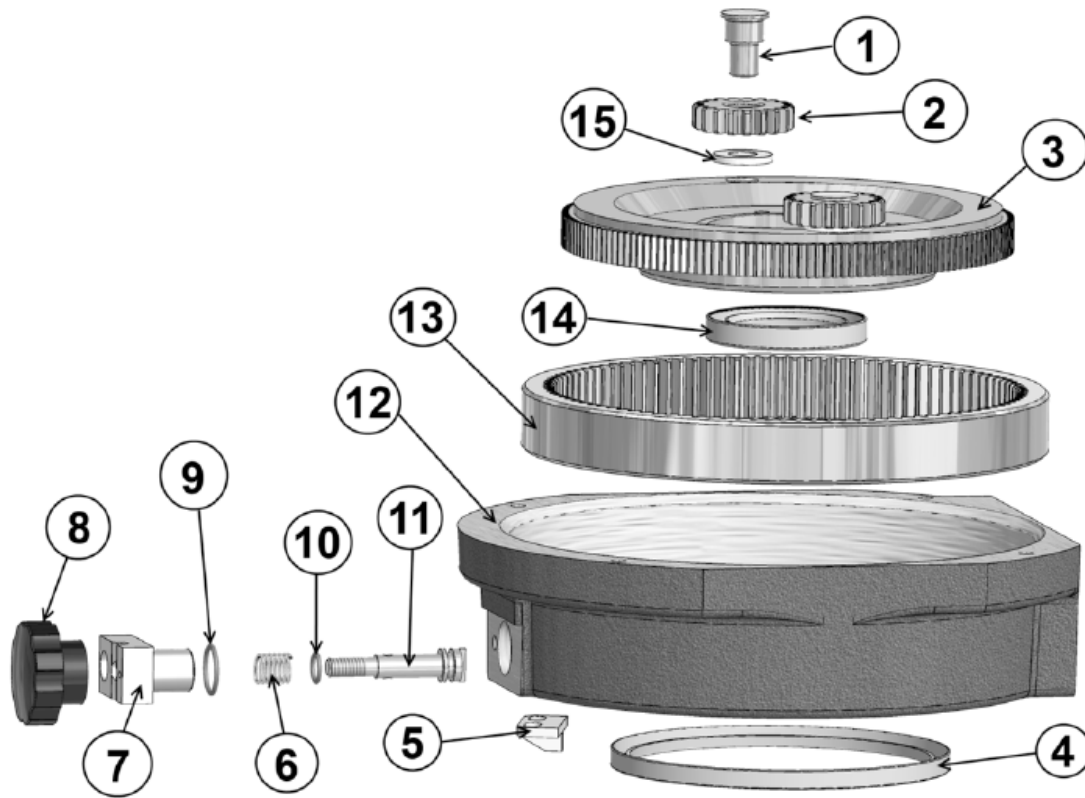
ITEM #	PART #	DESCRIPTION
1	514-6-26C	UPPER HOUSING BEARING
2	514-6-26D	BELLEVILE SPRING
3	514-6-22D	UPPER GEAR HOUSING
4	514-6-27C	DRIVE PINION
5	514-6-26A	BEARING CAGE
6	502-35-14	PINION BEARING

Lower Housing Parts



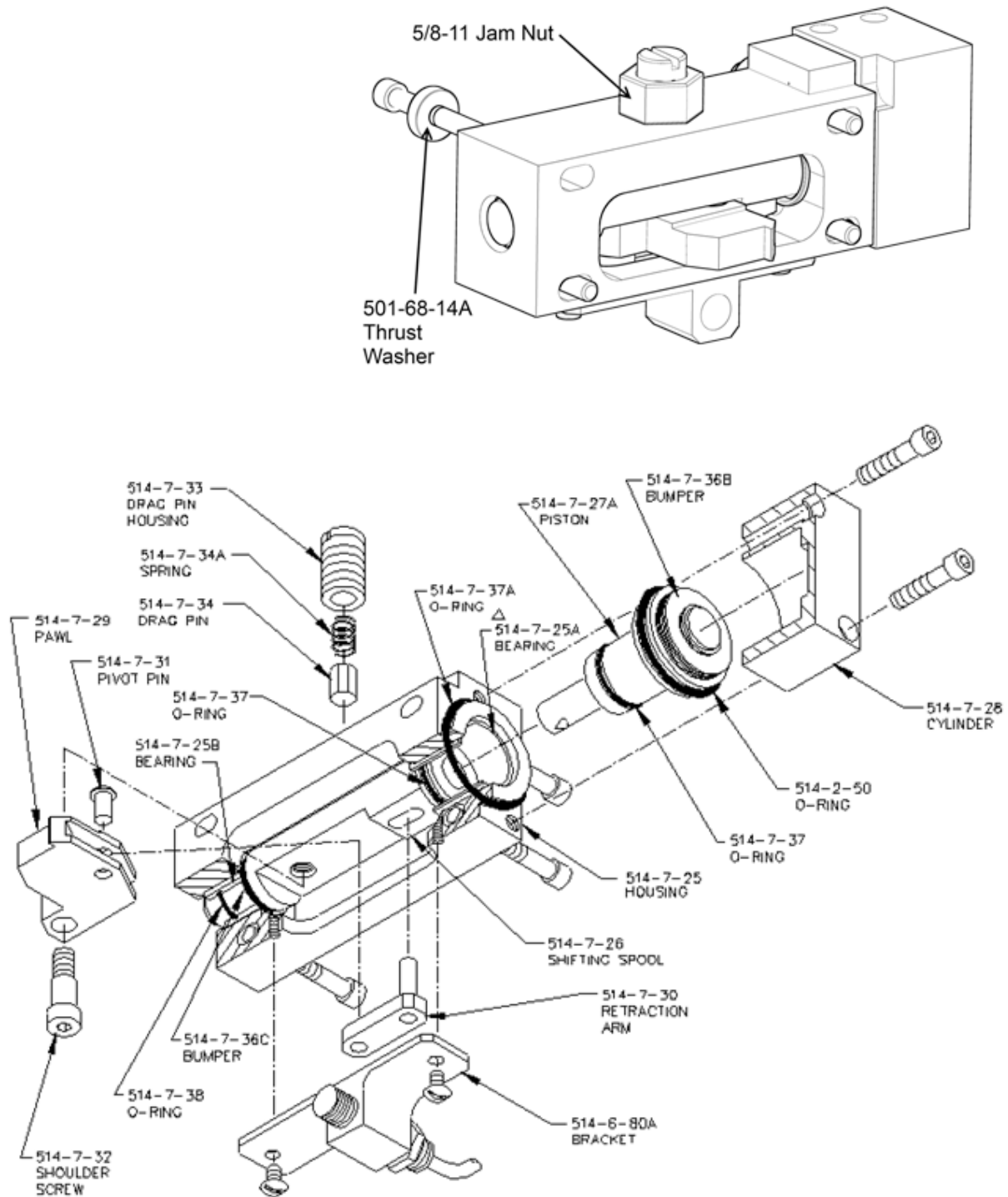
ITEM #	PART #	DESCRIPTION
1	514-6-29	SUN GEAR, DRIVEN
2	514-6-36	MAIN DRIVE SHAFT
3	514-6-21C	LOWER GEAR HOUSING
4	514-6-28	DRIVEN GEAR
5	500-66A	DRIVE KEY
6	514-3-40	LOCK NUT
7	514-3-41	LOCK WASHER
8	514-3-38	BEARING
9	514-2-3C	BEARING RETAINER

Cage Housing Parts



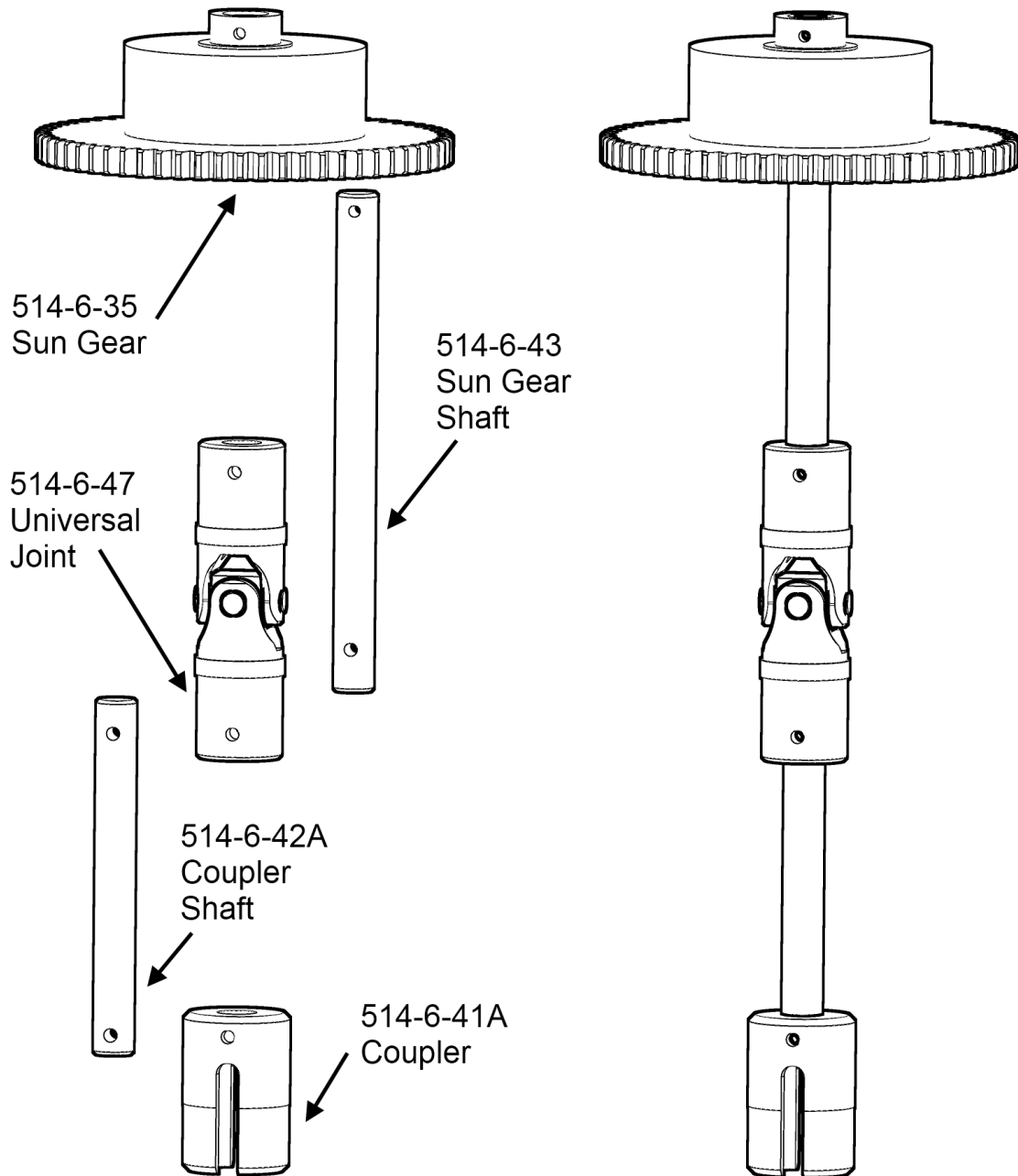
ITEM #	PART #	DESCRIPTION
1	700-6-5	IDLER PIN
2	514-6-30	PLANET GEAR
3	514-6-70	RATCHET GEAR
4	514-6-50	OIL SEAL, RATCHET GEAR
5	514-6-80B	INDEX MARK
6	514-6-55	SPRING
7	514-6-46	CARRIER
8	514-6-86	RELEASE KNOB
9	500-66-7	O-RING
10	500-66-8	O-RING
11	514-6-71	RATCHET PAWL
12	514-6-25A	RING GEAR CAGE
13	514-6-31	RING GEAR
14	514-6-54	OIL SEAL, DRIVE SHAFT
15	100-28-32	THRUST WASHER

Ratchet Actuator Assembly



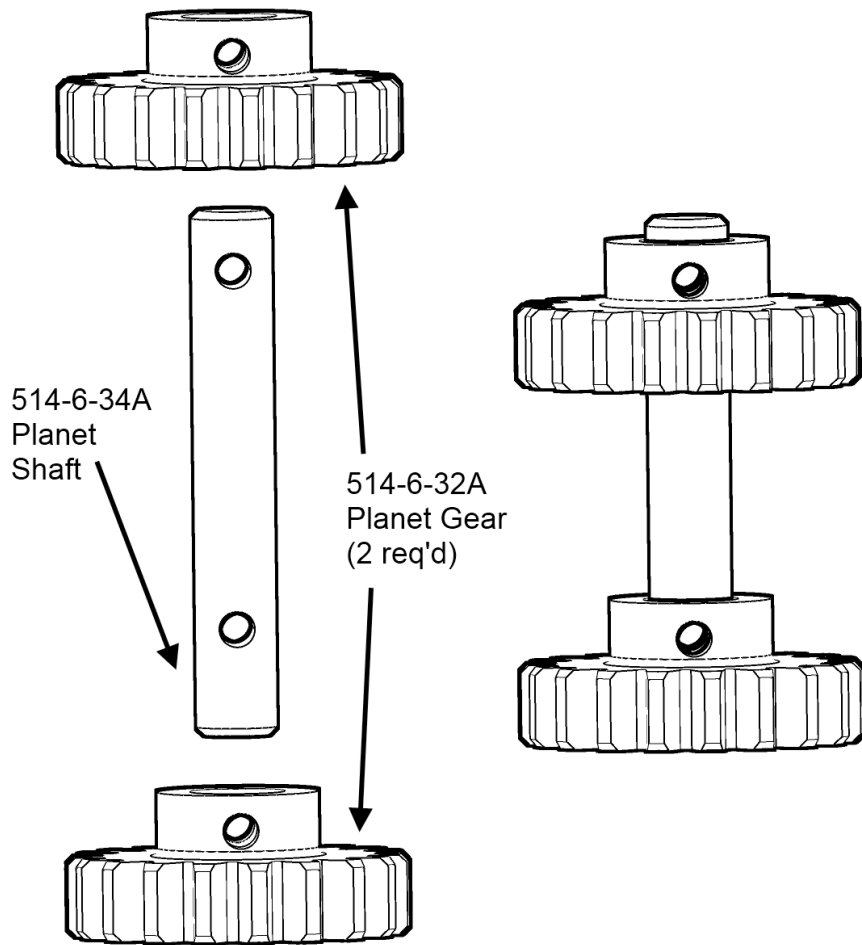
Drive Adjuster Assembly

Complete Assembly 514-6-40A

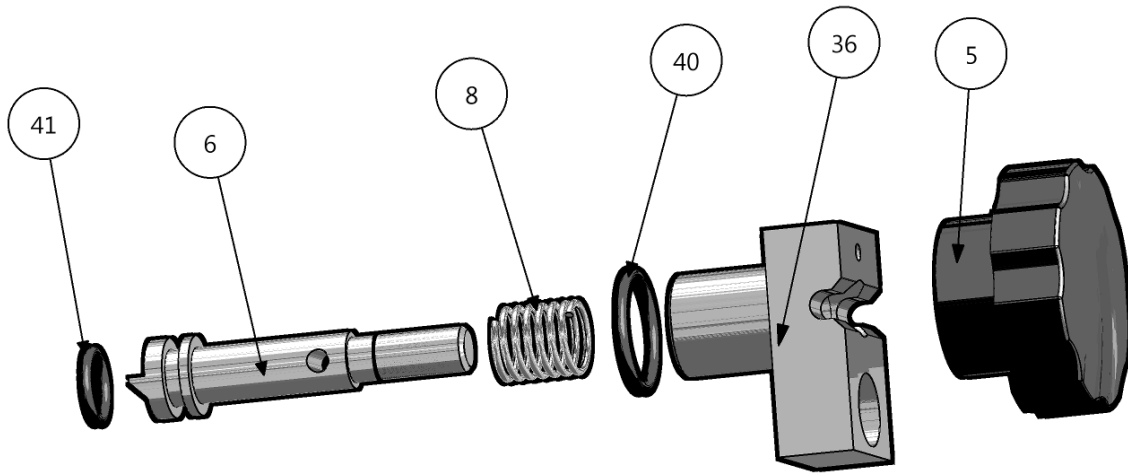


Planet Gear Assembly

Complete Assembly 514-6-33A

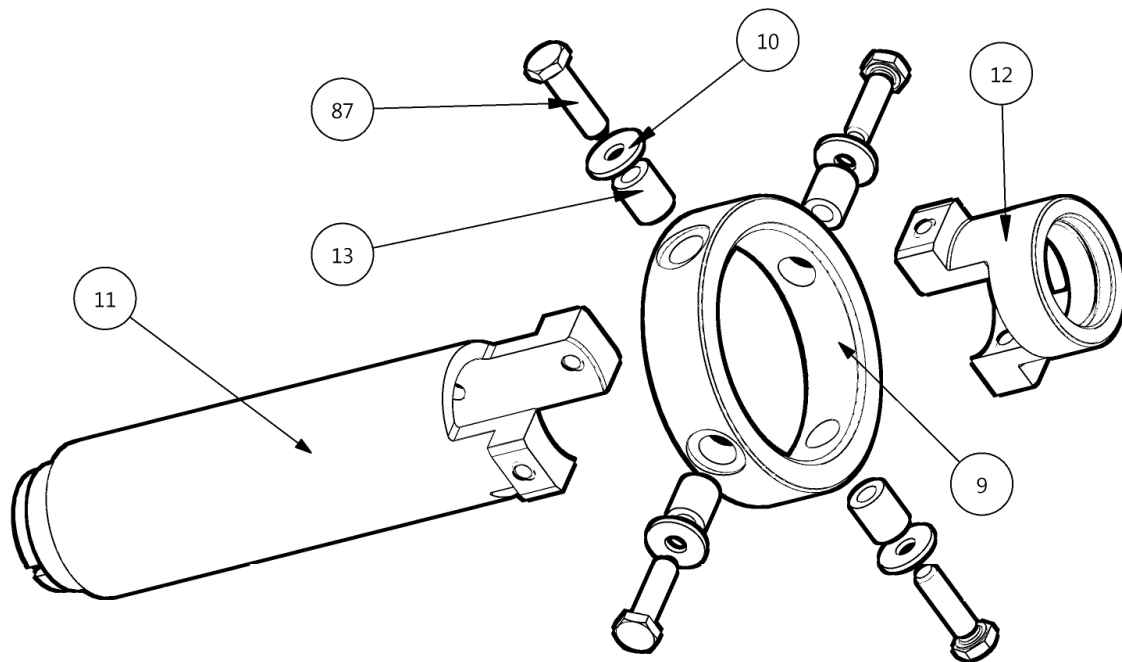


Feed Out Detent Assembly Parts



Item	Part Number	Description	Item QTY
5	514-6-86	Plastic Knob	1
6	514-6-71	Rachet pawl	1
8	514-6-55	Compression Spring	1
36	514-6-46	Carrier, Rachet Pawl	1
40	500-66-7	O-Ring	1
41	500-66-8	O-Ring	1

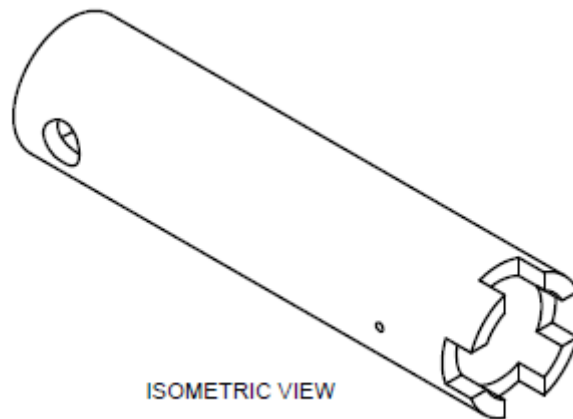
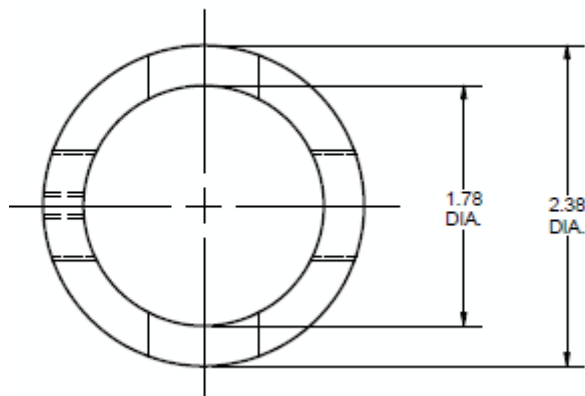
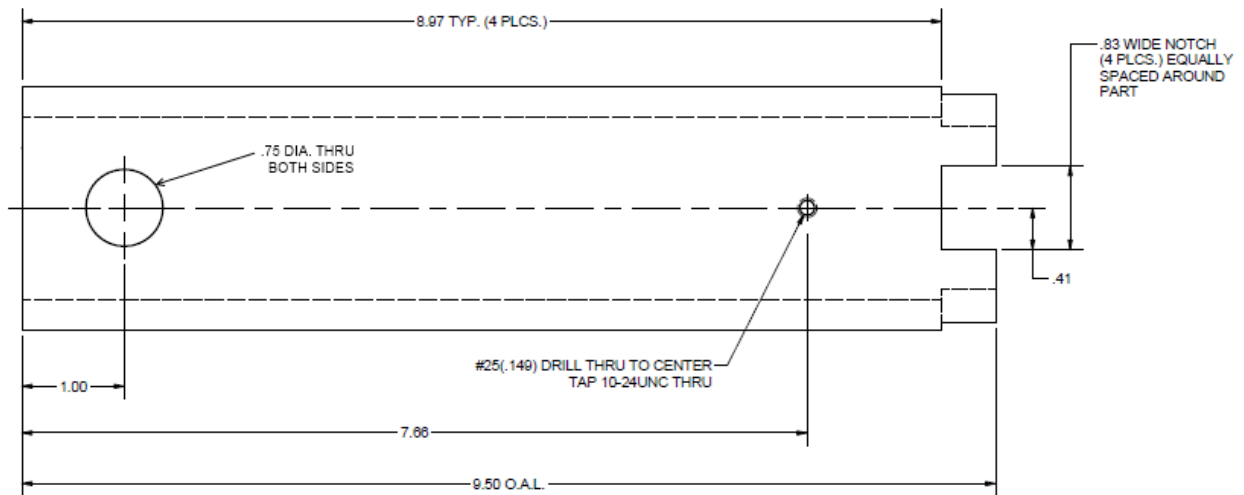
Drive Tube Assembly Parts



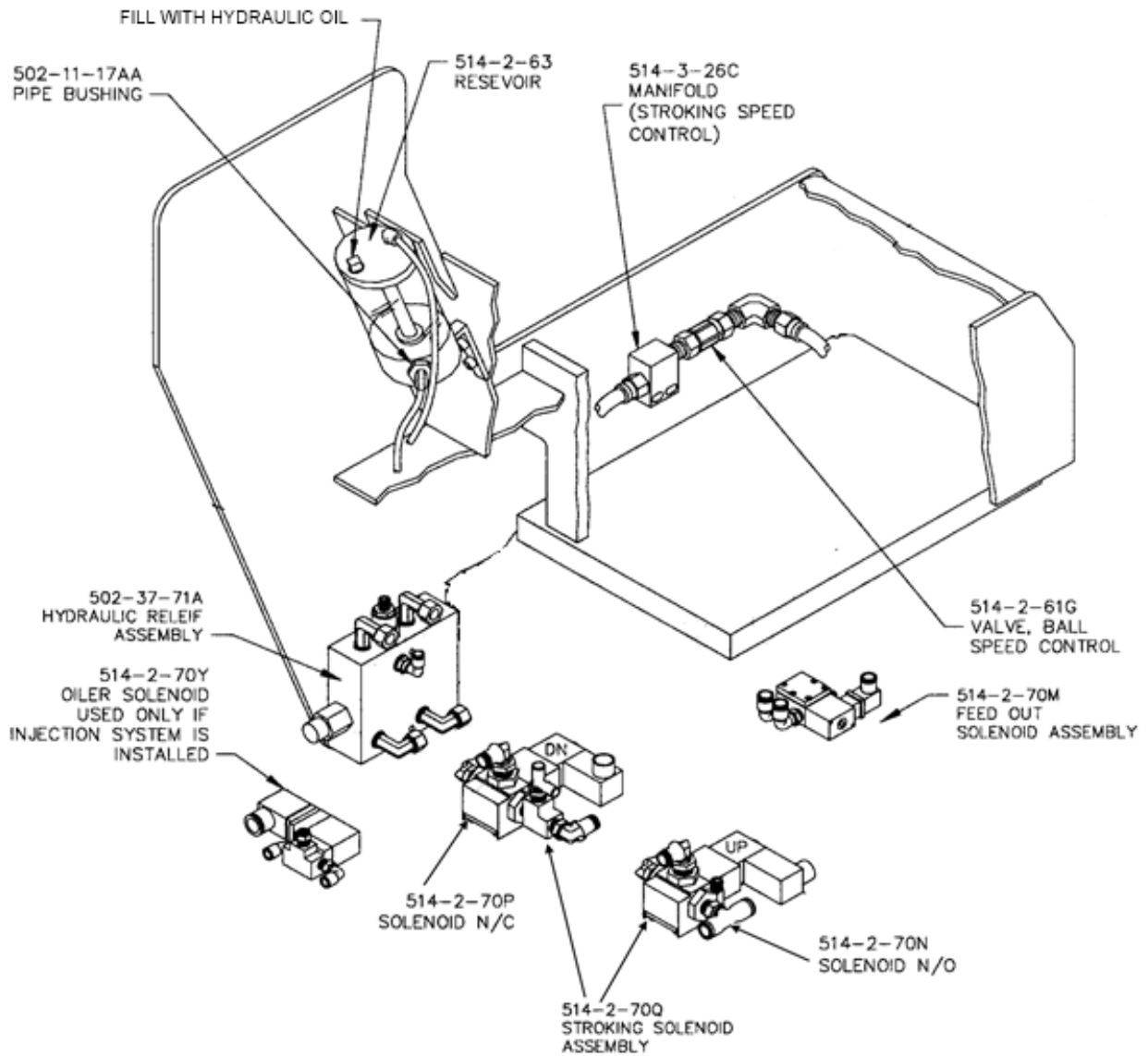
Item	Part Number	Description	Item QTY
9	514-6-37	Universal Ring	1
10	514-6-52	Thrust Washer	4
11	514-6-38A	Drive tube, Hone	1
12	514-6-48	Drive yoke	1
13	514-6-53	Bearing	4
87	514-6-57A	Hex Cap Screw	4

Drive Tube Removal Tool 514-6-38C

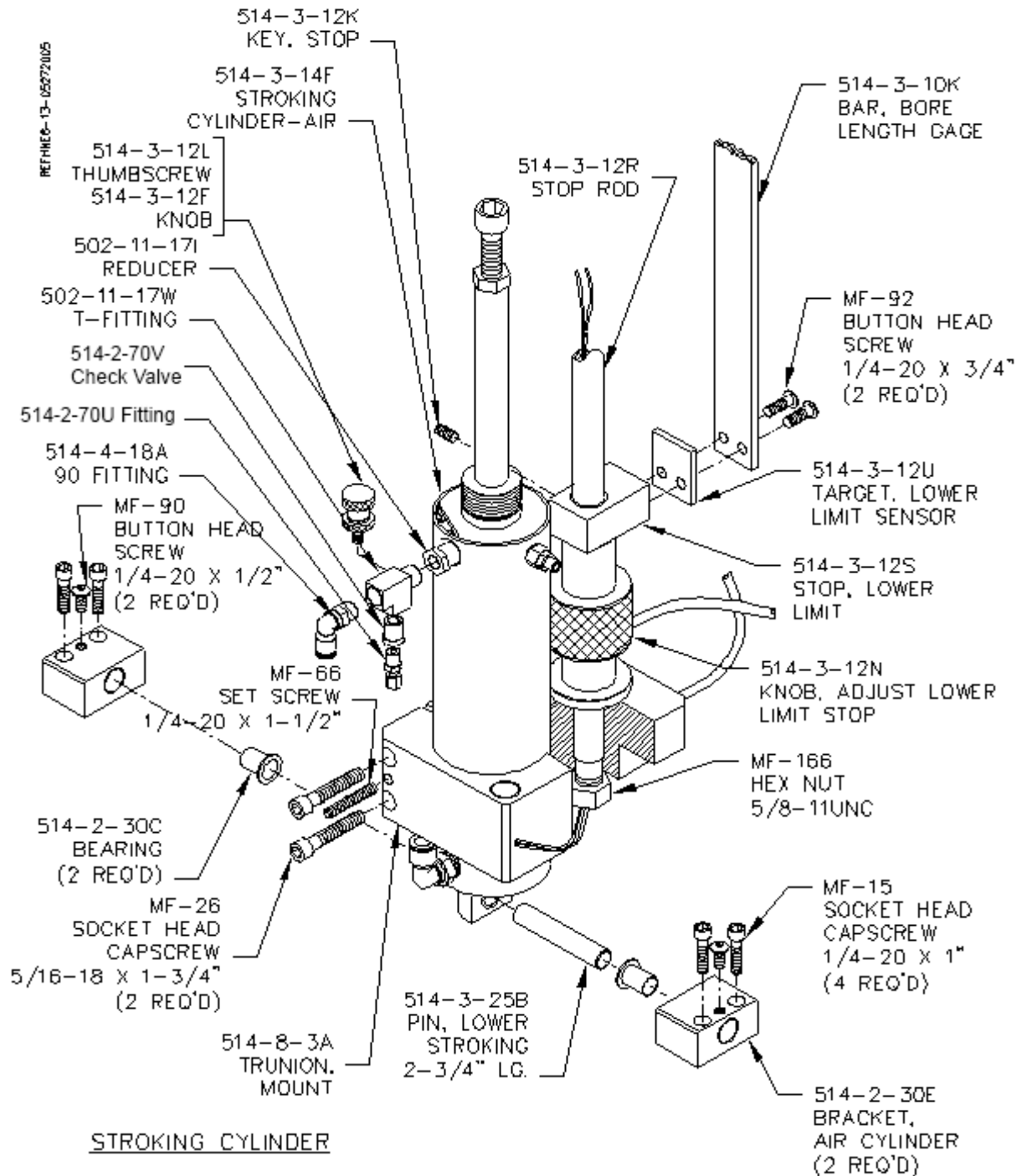
Call Rottler for availability or use dimensions below to make one.



Stroking Control - Air

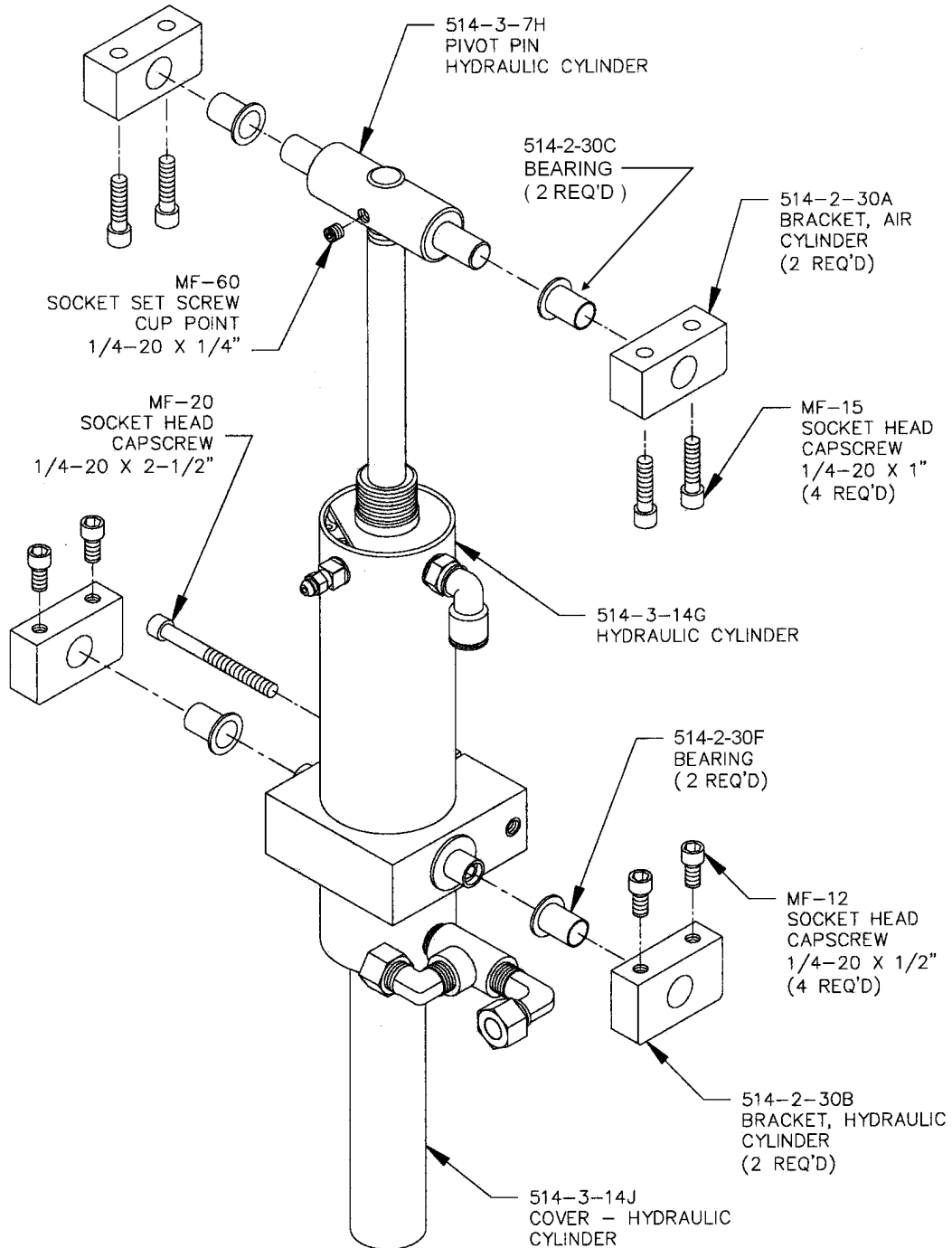


Stroking Cylinder Assembly



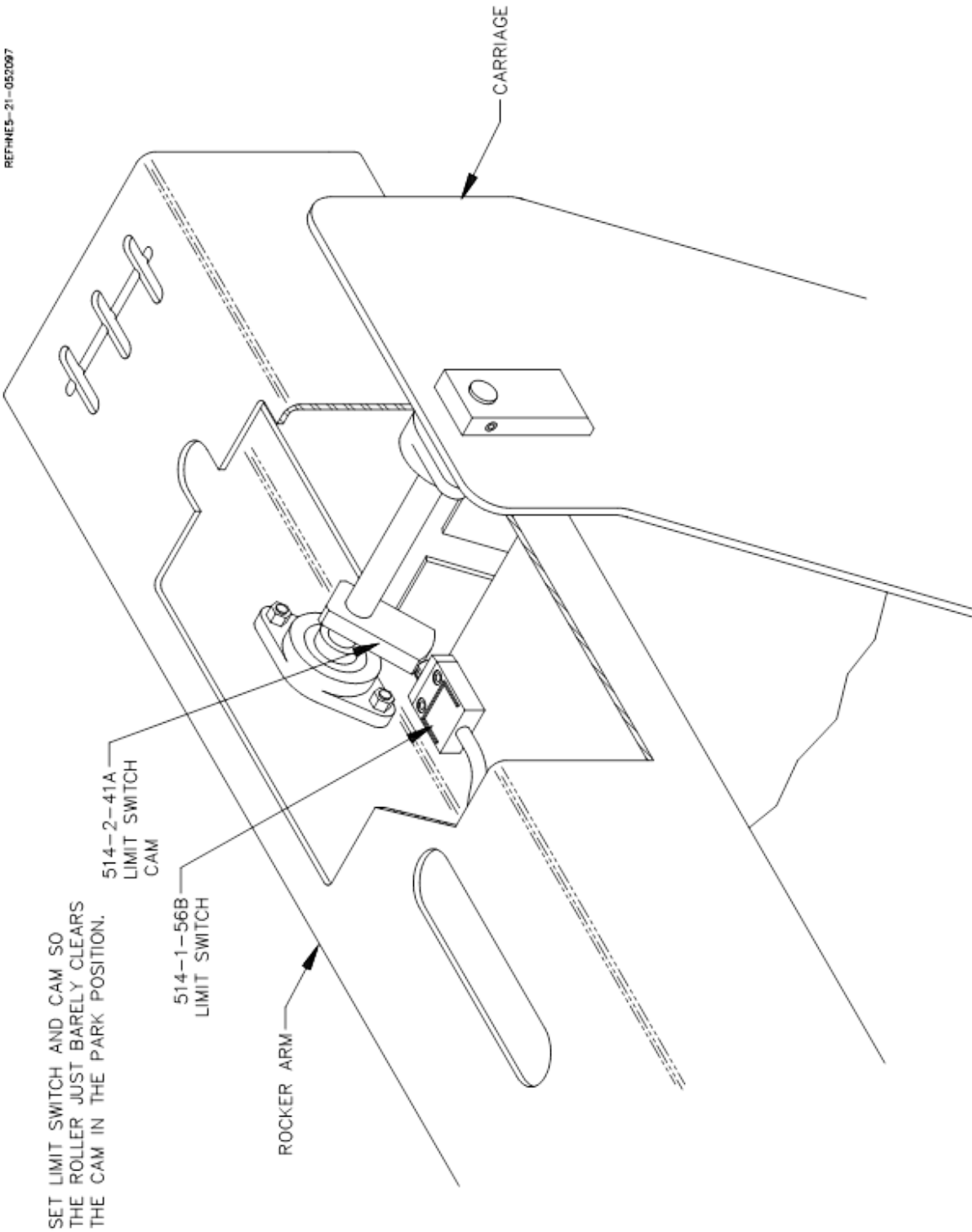
Hydraulic Cylinder Mount Components

REFHNE6-14-08312000

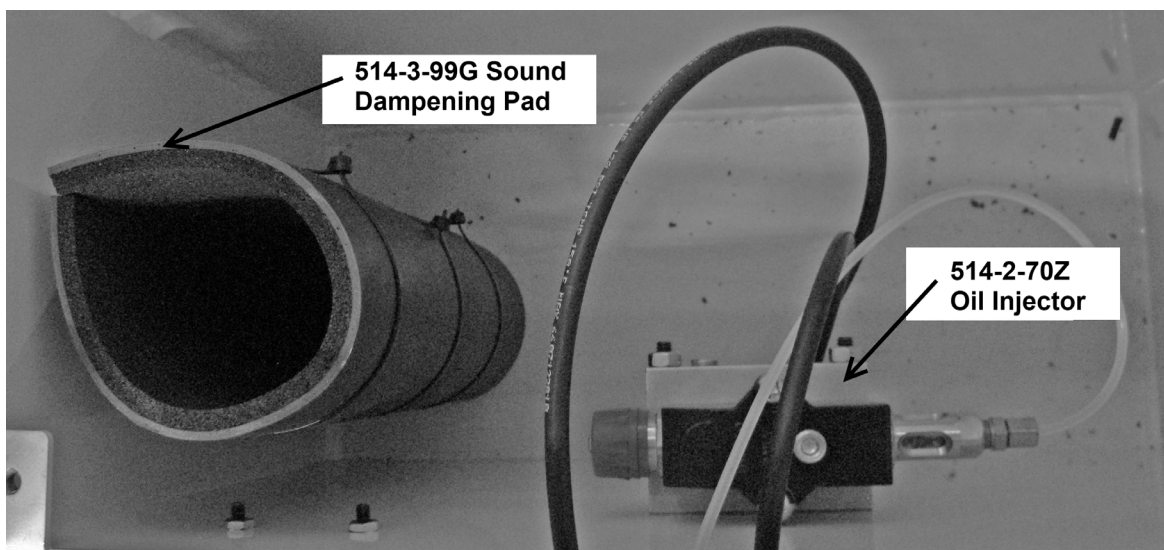
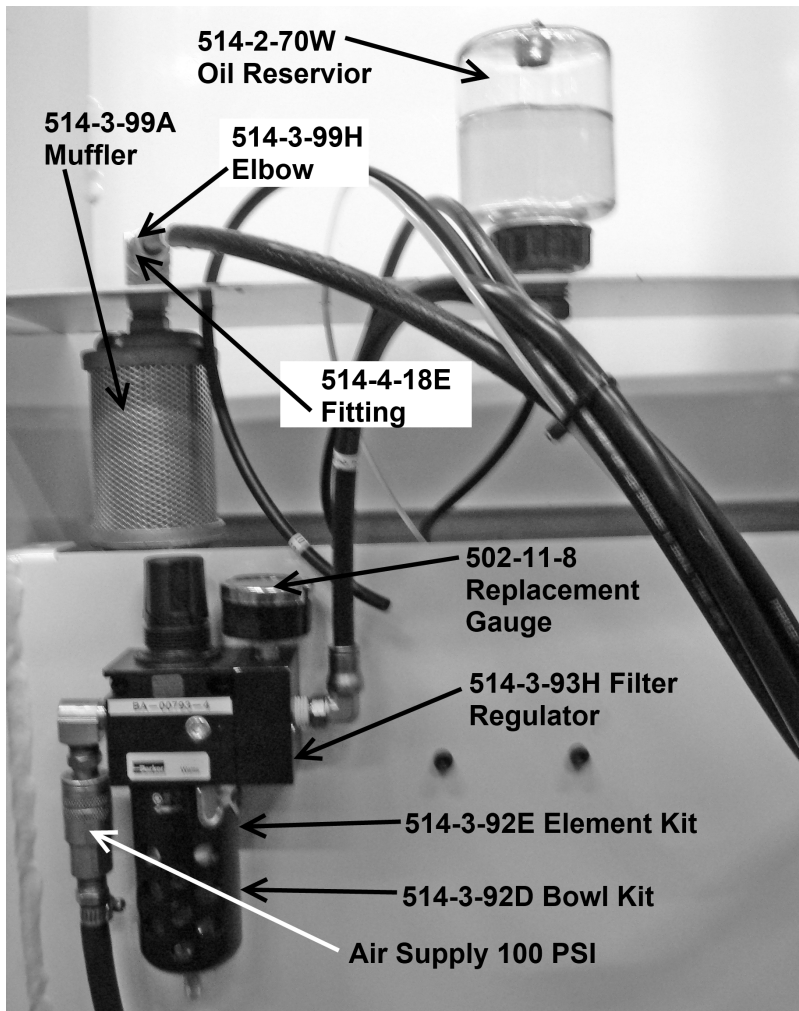


HYDRAULIC CYLINDER

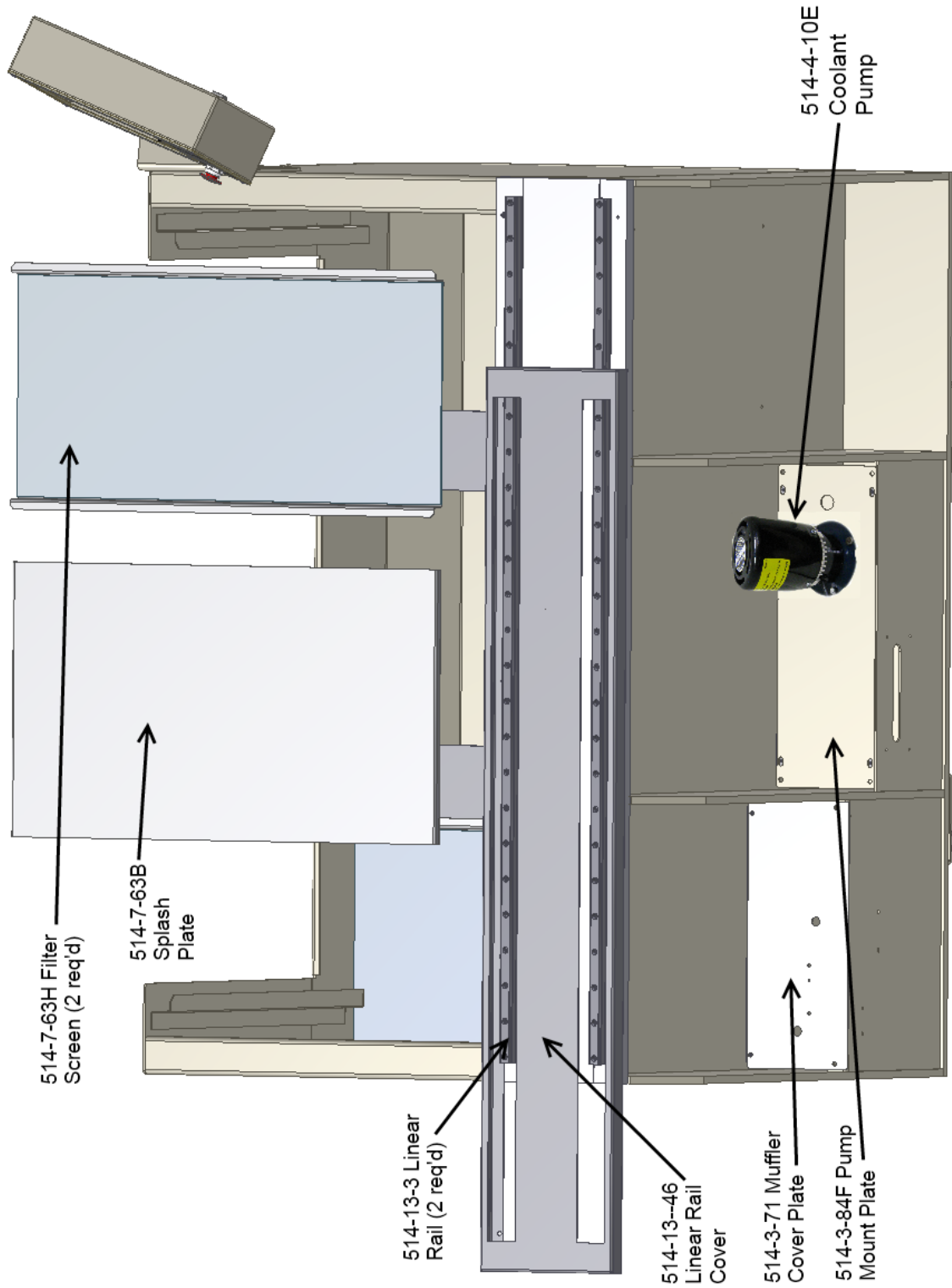
PARK Safety Switch



Pneumatic Supply



Hone Tank



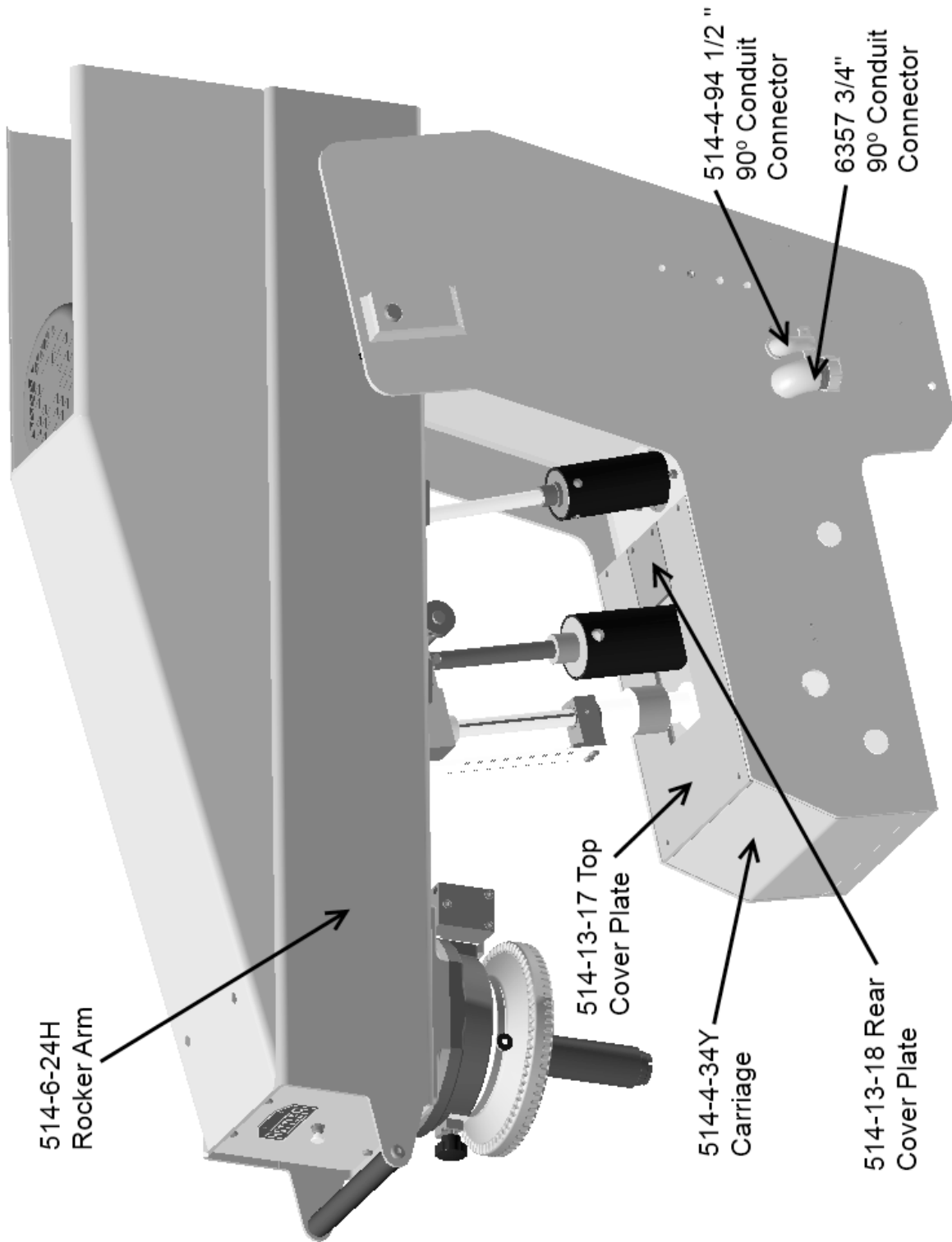
Splash Tray & Magnet

514-7-65S Splash Tray

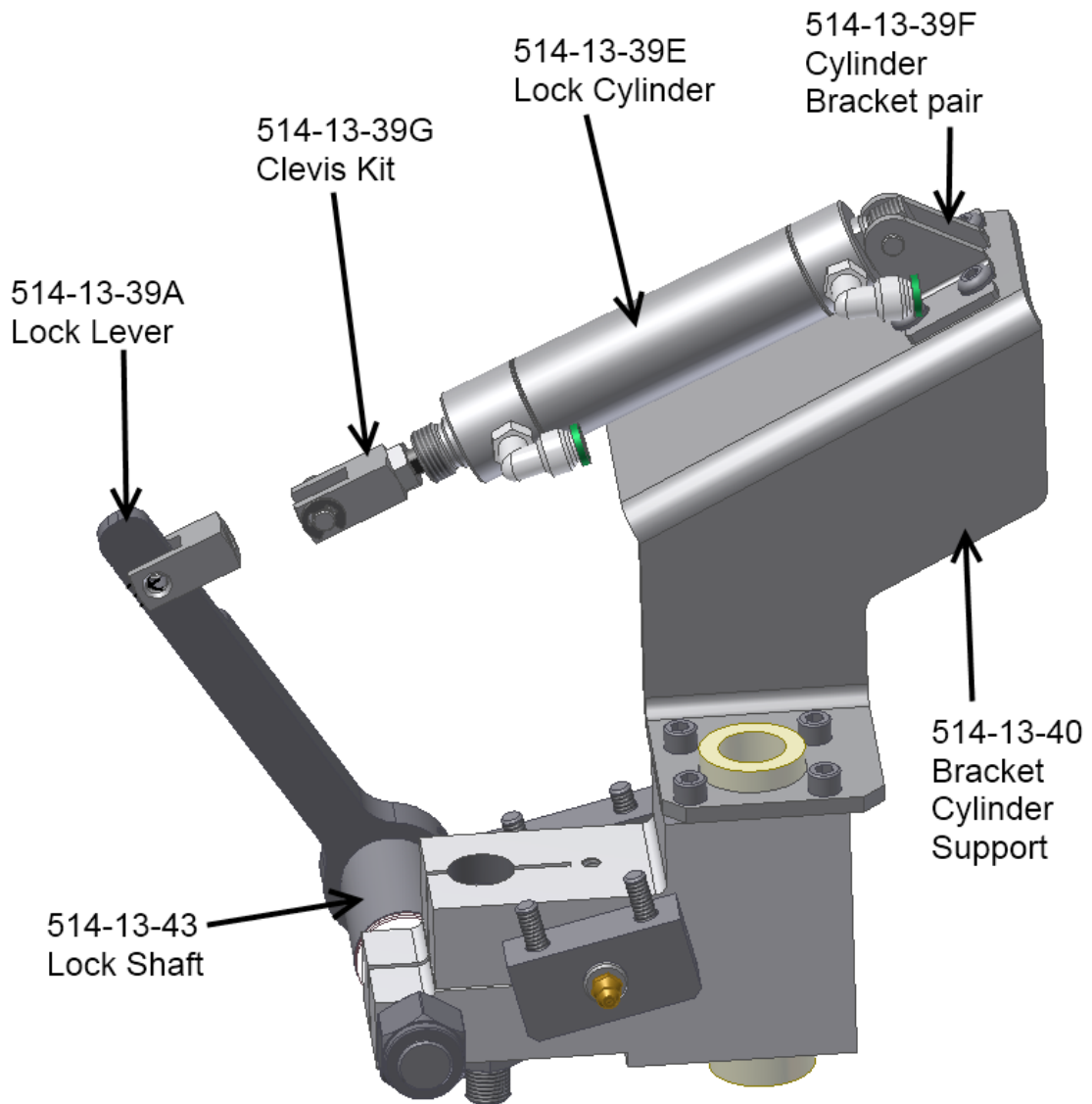
514-7-65T Magnet Assembly



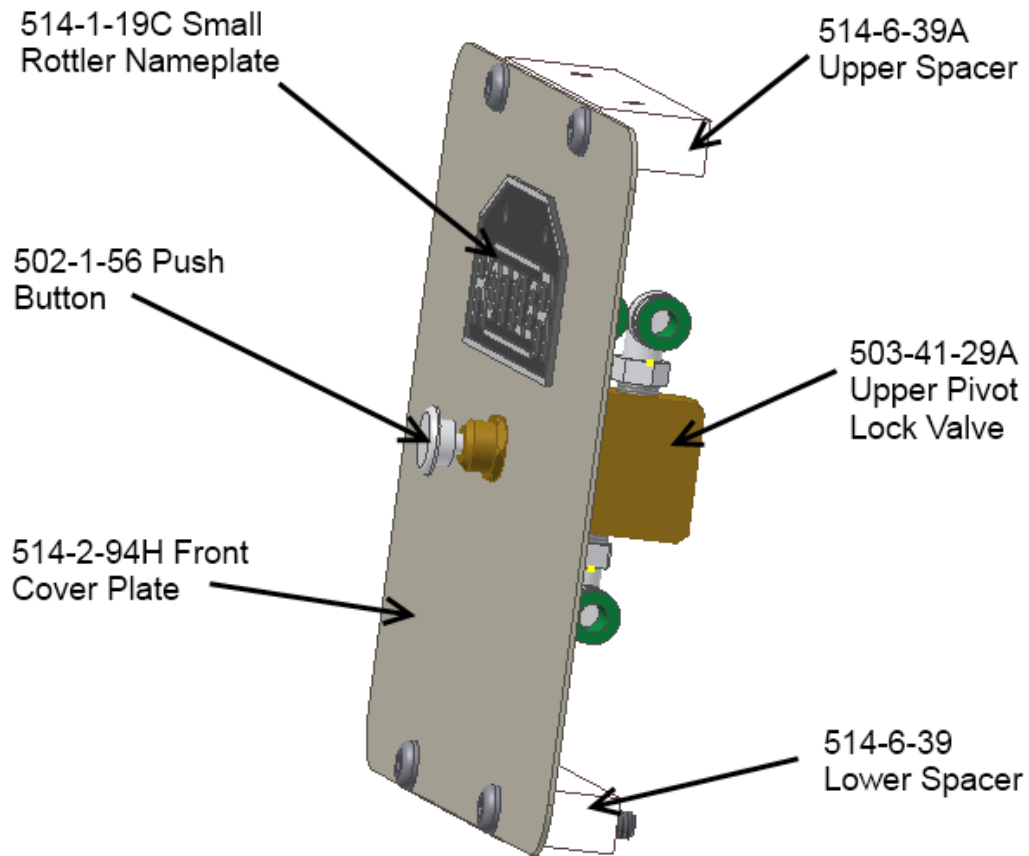
Carriage and Rocker Arm



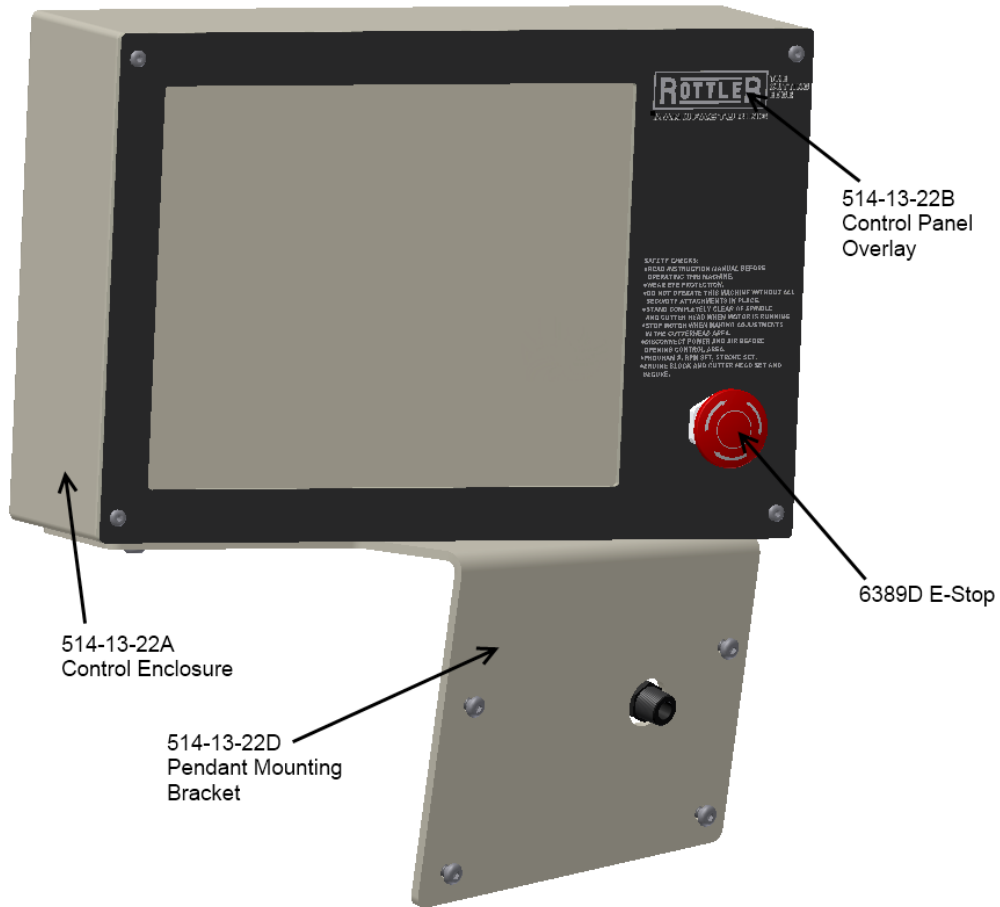
Air Lock Assembly



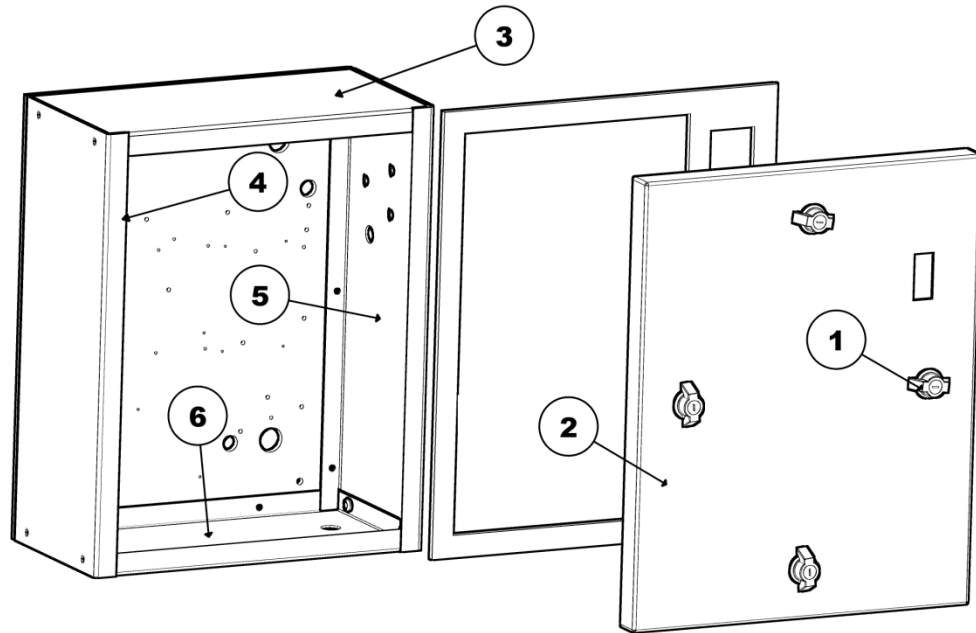
Rocker Arm Controls



Control Panel Assembly

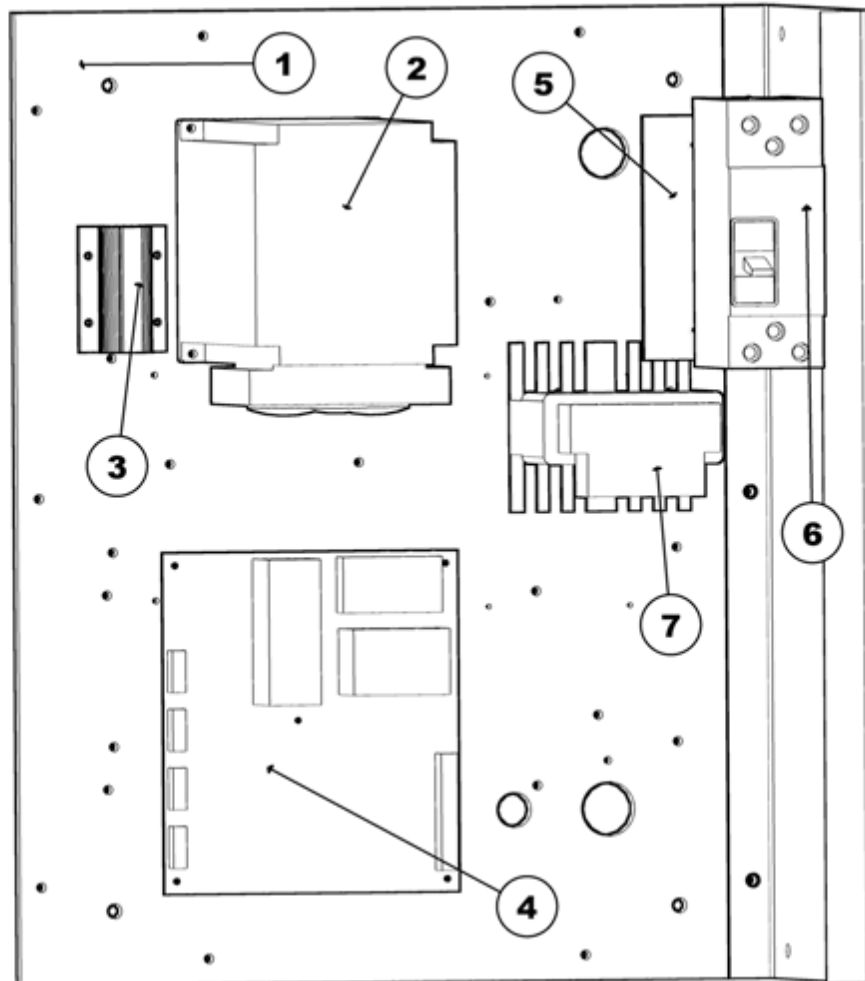


Electrical Enclosure Assembly



ELECTRICAL ENCLOSURE PARTS			
ITEM	PART NUMBER	DESCRIPTION	QTY
1	9035E	DOOR LATCH	4
2	514-7-47Q	DOOR WITH GASKET	1
3	514-7-47R	TOP PANEL	1
4	514-7-47T	LEFT SIDE PANEL	1
5	514-7-47U	RIGHT SIDE PANEL	1
6	514-7-47S	BOTTOM PANEL	1

Electrical Enclosure Components



ELECTRICAL ENCLOSURE COMPONENTS			
ITEM	PART NUMBER	DESCRIPTION	QTY
1	514-7-47X	PANEL	1
2	502-36-48C	MOTOR DRIVE	1
3	502-36-48F	BRAKING RESISTOR	1
4	514-7-54E	I/O BOARD	1
5	9030T	POWER SWITCH BRACKET	1
6	9035G	POWER SWITCH / CIRCUIT BREAKER	1
7	502-36-42H	LINE REACTOR	1

OPTIONS

Optional Equipment

Optional Equipment Catalog and Parts Manual are located on the Manual CD shipped with machine.

MSDS

The Material Data Safety Sheets list shown in this section are the substances and materials that an operator is most likely to come in contact with while using this machine.

Other substances and materials are used in the manufacture, testing, and shipping of this machine. A complete list of the Material Data Safety Sheets of substances and materials used by Rottler Manufacturing during manufacturing, testing, and shipping is located on the Manual CD shipped with the machine. Material Data Safety Sheets are also located on the company web site: <http://www.rottlermfg.com/documentation.php>

1) Rottler Honing Coolant

2) Mobil DTE Oil

YUMATE SC-870C

MATERIAL SAFETY DATA SHEET**SECTION I**

PRODUCT NAME OR NUMBER (as it appears on label) YUMATE SC-870C	DATE March, 2003
MANUFACTURER'S NAME YUMA INDUSTRIES INCORPORATED	EMERGENCY PHONE # YUMA 317-398-9862 CHEMTREC 800-424-9300
ADDRESS (Number, Street, City, State, & Zip Code) 783 W. Mausoleum Road, Shelbyville, IN 46176 – 9720	
HAZARDOUS MATERIAL DESCRIPTION, PROPER SHIPPING NAME, HAZ. CLASS, HAZ. ID # None	
ADDITIONAL HAZARD CLASSES (as applicable) None	
CHEMICAL FAMILY Water Miscible Cutting & Grinding Fluid Concentrate	FORMULA See Section II

SECTION II – INGREDIENTS

CAS REGISTRY#	Wt. %	CHEMICAL NAME	Listed as a carcinogen in NTP, IARC, or OSHA 1910 (specify)
102-71-6	10-19	Triethanolamine ACGIH(TLV): TWA=5mg/m ³	Not listed
141-43-5	1-9	Monoethanolamine ACGIH(TLV): TWA=3ppm, STEL=6mg/m ³ OSHA PEL : TWA=3ppm, STEL=6mg/m ³	Not listed
Balance classified as non-hazardous Ingredients			

SECTION III – PHYSICAL DATA

BOILING POINT Not available	SPECIFIC GRAVITY (H ₂ O=1) @20°C 1.07	ODOR THRESHOLD (ppm) Not available
VAPOR PRESSURE Not available	PERCENT VOLATILE (Vol. %) Not available	PERCENT SOLID (Wt. %) Not available
VAPOR DENSITY Not available	EVAPORATION RATE Not available	FREEZING POINT (°C) Not available
SOLUBILITY IN WATER 100%	pH (10% solution) 8.5	MATERIAL IS Liquid
APPEARANCE & ODOR Fluorescent with mild odor	VOLATILE ORGANIC COMPOUNDS (VOC) Not available	

SECTION IV – FIRE AND EXPLOSION HAZARD DATA

FLASH POINT none	METHOD USED	FLAMMABLE LIMITS LEL/UEL Not available	AUTO-IGNITION TEMPERATURE (°C) Not available
EXTINGUISHING MEDIA As appropriate for surrounding fire			
SPECIAL FIRE FIGHTING PROCEDURES None			
UNUSUAL FIRE AND EXPLOSION HAZARDS None			

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SECTION V – HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE See Section II		
EFFECTS OF OVEREXPOSURE – Conditions to avoid Transient eye irritation. Possible skin defatting and subsequent irritation on repeated or prolonged contact.		
PRIMARY ROUTES OF ENTRY	Inhalation: Skin Contact: X	Eye Contact: Ingestion:
EMERGENCY AND FIRST AID PROCEDURES		
<p>EYES: Flush with cool, clean water for at least 15 minutes.</p> <p>SKIN: Wash with soap and warm water.</p> <p>INHALATION: Remove to fresh air.</p> <p>INGESTION: If large quantities are ingested, pump stomach.</p> <p>In every case get medical attention as required.</p>		

SECTION VI – REACTIVITY DATA

STABILITY: UNSTABLE: STABLE : X	HAZARDOUS POLYMERIZATION	MAY OCCUR: WILL NOT OCCUR: X
CONDITIONS TO AVOID None		
INCOMPATIBILITY (MATERIALS TO AVOID) Avoid strong oxidizing agents, strong acids and nitrites.		
HAZARDOUS DECOMPOSITION PRODUCTS Thermal decomposition may produce CO, CO ₂ , NO _x and SO _x .		

SECTION VII – SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Mop up or use dry absorbent.
WASTE DISPOSAL METHOD Acid – Alum split Dispose in accordance with local, state and federal regulations.

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SECTION VIII – SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) None	
VENTILATION Local exhaust (Specify rate): Not normally required. Special: None Mechanical (general) (Specify rate): General room ventilation should be sufficient. Other: None	
PROTECTIVE GLOVES (Specify type) None	EYE PROTECTION (Specify type) Safety glasses
OTHER PROTECTIVE EQUIPMENT None	

SECTION IX – SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Keep container closed. Wash thoroughly after handling.
OTHER PRECAUTIONS None



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MATERIAL SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: MOBIL DTE OIL HEAVY MEDIUM
Product Description: Base Oil and Additives
Product Code: 201560501590, 600163-00, 970172
Intended Use: Turbine oil

COMPANY IDENTIFICATION

Supplier: EXXON MOBIL CORPORATION
3225 GALLOWS RD.
FAIRFAX, VA. 22037 USA

24 Hour Health Emergency: 609-737-4411
Transportation Emergency Phone: 800-424-9300
ExxonMobil Transportation No.: 281-834-3296
MSDS Requests: 713-613-3661
Product Technical Information: 800-662-4525, 800-947-9147
MSDS Internet Address: <http://www.exxon.com>, <http://www.mobil.com>

SECTION 2 COMPOSITION / INFORMATION ON INGREDIENTS

No Reportable Hazardous Substance(s) or Complex Substance(s).

SECTION 3 HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

NFPA Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0
HMIS Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4 FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use



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mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO₂) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Hazardous Combustion Products: Aldehydes, Oxides of carbon, Sulfur oxides, Smoke, Fume, Incomplete combustion products

FLAMMABILITY PROPERTIES

Flash Point [Method]: >223C (433F) [ASTM D-92]

Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0

Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.



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Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is a static accumulator.

STORAGE

Do not store in open or unlabelled containers.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists / aerosols can occur, the following are recommended: 5 mg/m³ - ACGIH TLV, 10 mg/m³ - ACGIH STEL, 5 mg/m³ - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of



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respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Work conditions can greatly effect glove durability; inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9

PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid

Color: Amber

Odor: Characteristic

Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.87

Flash Point [Method]: >223C (433F) [ASTM D-92]

Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0

Autoignition Temperature: N/D

Boiling Point / Range: > 316C (600F)

Vapor Density (Air = 1): > 2 at 101 kPa

Vapor Pressure: < 0.013 kPa (0.1 mm Hg) at 20 C

Evaporation Rate (n-butyl acetate = 1): N/D

pH: N/A

Log Pow (n-Octanol/Water Partition Coefficient): > 3.5

Solubility in Water: Negligible

Viscosity: 67.9 cSt (67.9 mm²/sec) at 40 C | 8.7 cSt (8.7 mm²/sec) at 100C



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Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -27°C (-17°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m3	Minimally Toxic. Based on test data for structurally similar materials.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on test data for structurally similar materials.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials.

CHRONIC/OTHER EFFECTS

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

Additional information is available by request.



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The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--
1 = NTP CARC 3 = IARC 1 5 = IARC 2B
2 = NTP SUS 4 = IARC 2A 6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land.
Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning PRECAUTIONARY LABEL TEXT: Empty containers may retain residue and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to refill or clean container since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum



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reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

SECTION 14	TRANSPORT INFORMATION
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LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15	REGULATORY INFORMATION
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OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: AICS, IECSC, DSL, EINECS, PICCS, TSCA

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below: None.

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16	OTHER INFORMATION
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N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

No revision information is available.



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