

July 27, 1994

ROTTLER  
MANUFACTURING

**HP3A**

HONING MACHINE

MACHINE SERIAL NUMBER

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OPERATIONS AND MAINTENANCE  
MANUAL



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NOTE: WHEN ORDERING REPLACEMENT PARTS,  
PLEASE GIVE THE MODEL AND SERIAL NUMBER.

ORDER BY PART NUMBER.

THERE IS A MINIMUM ORDER OF \$25.00

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## INTRODUCTION

This manual is divided into chapters as listed in the table of contents.

It is required that the new user of the HP3A honing machine read this manual. Pay close attention to the chapter concerning safety.

## DESCRIPTION

The model HP3A Honing Machine is a wet, complete cylinder block and general purpose honing machine. Hone rotating power is supplied by a totally enclosed AC motor driving a belt and gear reduction drive mounted within a rocker arm arrangement. 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.

The support carriage is air floated and clamped 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 workpiece.

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

## LIMITED WARRANTY

Rottler Manufacturing Company model HP3A parts and equipment are 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 instruction in this manual.

Standard air and electric components are warranted by their respective manufacturers (NOTE: their individual warranty periods may vary significantly from Rottler manufacturing policy).

Tools proven 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 other direct or indirect costs in connection with cases covered by the warranty.

Freight charges on warranty items (non-air shipment only) will be paid by Rottler Manufacturing for a period of 60 days only from date of installation or set-up by a

qualified service technician or sales rep.

Freight charges after the 60 day period are the customers responsibility.

## SAFETY INFORMATION

### CAUTION:

This machine is capable of causing severe bodily injury.

As with all machine tools eye protection must be worn at all times by the operator or other personnel within the area of the machine.

In particular the operator should be very cautious of the hone head area.

The operator and nearby personnel should be familiar with the location and operation of the stop button.

ELECTRICAL POWER - Make sure all electrical equipment has the proper electrical overload protection.

MACHINE OPERATOR - Operator of this HP3A Honing machine should be a skilled machinist craftsman: that is, well versed in the caution, care, and knowledge required to safely operate 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 HP3A Honing Machine.

Rottler HP3A 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:

1. WORK CLAMPING - be sure work is clamped securely in accordance with the instructions.
2. LOWER STOP - Set lower limit carefully so that webs or other obstructions, in the bore, do not interfere with the guides or stones.
3. HONE HEAD AREA - Keep hands completely away from the rotating honing head at ALL times.
4. POWER STROKING - Do not operate power stroking without upper travel limit lever locked.
5. OPERATOR CONTROLS - Familiarize yourself with the exact location of the stop button so you can immediately react to an emergency.
6. HONING - Do not engage rotation power when hone head is out of a cylinder.

### REMEMBER

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

## MACHINE INSTALLATION

### LOCATION

The productivity of this machine will depend to a great extent on it's 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 HP3A machine is extremely important.

A slow travel (6' to 10'/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 would recommend that the open faces be placed at right angles to each other, with the machines approximately three feet apart.

### UNPACKING

Carefully uncrate the HP3A Machine. Remove all equipment in splash tank except the "v" fixture frame.

Completely clean these articles as well as the machine's upper table with solvent, also clean the lower travel limit stop rods. Rust inhibitor is applied to the machine at the time of shipment and must be removed before operating the machine.

### SHIPPING HOLD DOWN BOLT

(refer to illustration on page 5.10)

The Hone carriage is shipped with the hold-down system locked. This system must be unlocked. Remove the cover (514-3-3D). Remove the cotter pin in the hex nut. Loosen the nut all the way. Tighten the nut back down with just your fingers. Loosen the nut 1/4 turn. Insert cotter pin.

### 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 HP3A machine requires 5.7 cubic feet/minute at 100 P.S.I. compressed air (a minimum 1 HP air compressor output).

Attach air supply to the filter regulator on the 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 p.s.i. (located on the right side of the splash tank). (Push regulator knob down to set, pull up to lock).

---

### NOTE :

To assure a long service life for your HP3A machine the air supply must be moisture free. If there is any doubts about the air supply install a water trap.

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## POWER SUPPLY

Disconnect all power before servicing this machine.

This machine requires 208/230 volt AC three phase. (see wiring diagram page 5.2 & 5.4)

Electrically connect in accordance with the National Electrical Code and your local codes. Note: this machine requires the use of an electrical disconnect switch.

Attach three phase wiring to the L1, L2, L3 terminal on top of the hone motor starter. (see hook up illustration page 1.5).

---

### CAUTION :

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

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Turn the stroke toggle switch on the control panel to 'OFF'.

Pull the hone rocker arm down into its operating range to test run.

Push start button, check hone head rotation. The hone head should turn clockwise looking from the top. Exchange 2 wires on the L1, L2, L3 terminal on the motor starter, to change rotation.

Attach hone head assembly.

### COOLANT PUMP SYSTEM

Pour a maximum 30 Gallons of honing oil into splash tank - (Mobil Met 33 or Upsilon or any equivalent light honing oil.)

ELECTRICAL  
230 VOLTS 3 PHASE  
60 HERTZ  
IMPORTANT  
ELECTRICALLY CONNECT  
IN ACCORDANCE WITH  
NATIONAL ELECTRICAL  
CODE AND YOUR LOCAL  
CODES

PHONE MOTOR  
STARTER

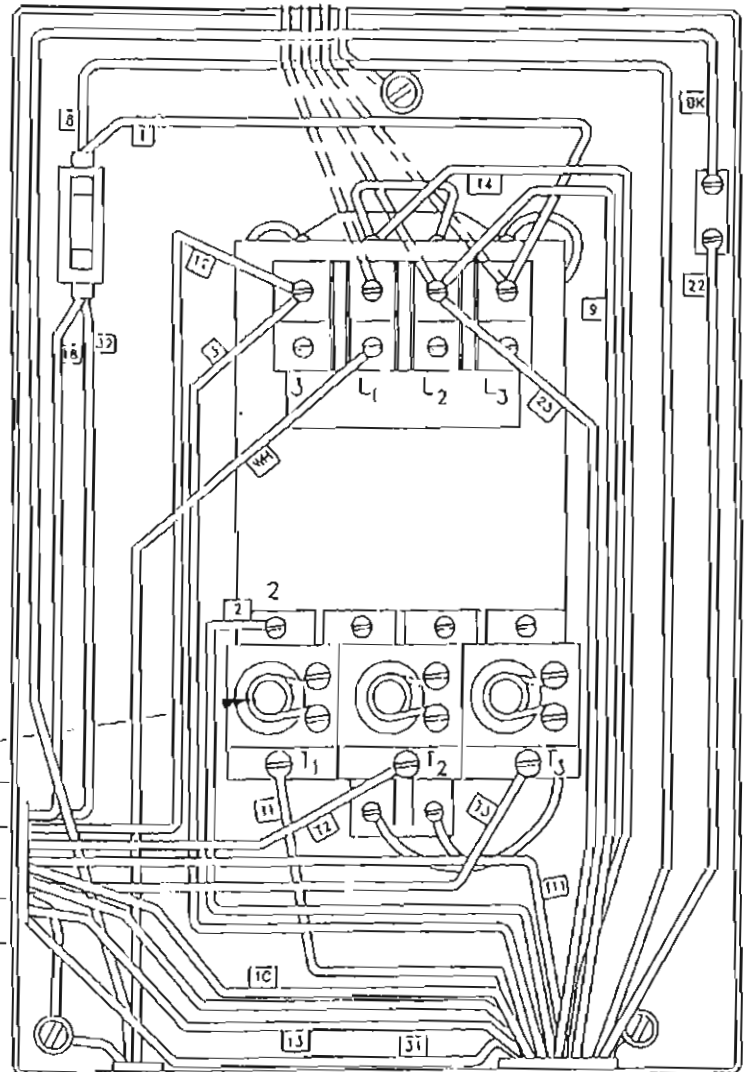
GREEN WIRE

FOR "H" TYPE  
HEATER ELEMENTS  
SEE BACK OF  
MOTOR STARTER  
ENCLOSURE COVER

TO CARRIAGE

TO COOLANT  
PUMP

TO CONTROL  
PANEL







The following information describes the sequence of control actions.

#### PARK POSITION LIMIT SWITCH

An electrical limit switch is located on the carriage under the rocker arm pivot. This normally open switch is closed by a cam when the rocker arm is lowered into its working range. When closed it allows the air control solenoid valve and the motor starter to be energized. When open it drops out the electrical control circuit.

#### COOLANT TOGGLE SWITCH

The coolant switch is located on the pendant control panel. This switch turns on and off the coolant pump motor. The lever on the left side of the carriage, regulates the coolant flow.

#### START PUSH BUTTON OR PROGRAM START

Press start button to close contacts on motor starter. This energizes the motor, which in turn provides rotational power to the hone head, through a V-belt and a gear reduction. It also energizes a solenoid valve. This opens to provide air pressure, from the upper limit valve, which is mechanically held open by a plunger on the end of the piston rod, to shift the spool of the stroking valve.

The stroking valve allows air pressure to flow to the upper part of the lower cylinder driving its piston and the rocker arm down. As the piston rod moves away from the upper limit valve, it closes and ex-

hausts the air from this control line.

The upper pivot of the rocker arm continues down until its actuating screw strikes the lower limit valve. Which opens and allows air to flow to the opposite air pilot port of the reciprocating valve.

This air pilot shifts the spool of the reciprocating valve. Which exhausts the air from the upper port of the lower cylinder and allows air pressure to flow to the bottom port of the lower cylinder, driving the piston and rocker arm up.

As the actuating screw moves away from the lower limit valve, it closes and exhausts air from this control line.

#### STOP PUSH BUTTON OR PROGRAM FINISH

Press stop button to open contacts of the motor starter to stop rotation of the motor. It also opens the electrical circuit to the solenoid valve causing it to close and exhaust the air from its tube to the upper limit valve.

Stroking will stop at the top of the up stroke and the spool of the reciprocating valve will remain in this position with air pressure in the bottom of the lower cylinder until start button is pressed.

#### STROKING TOGGLE SWITCH

The stroking toggle switch is located on the right center of the control panel. When this switch is turned off it opens the circuit to the solenoid valve, which stops the power stroking.

### STROKES PER FEED

This switch is used to program the number of strokes between stone feed increases. Toggle the switch up to increase the number of strokes. Toggle the switch down to decrease the number of strokes. As you increase and decrease the number of strokes you will notice the number in the above display. The 2 digits on the left of the display show the number of strokes between stone feed increases. The 2 digits on the right side of the display will count the actual strokes as the machine is running.

### TOTAL FEED

This switch is used to program the number of times the machine will repeat the strokes per feed program (described above). Toggle the switch up to increase the number. Toggle the switch down to decrease the number. The 2 digits on the left, in the above display show how many cycles you programmed. The 2 digits on the right record how many cycles the machine has completed.

### PROGRAM 'ON' LIGHT

The light comes on when a program has been activated, the program does not actually start until the start button is pressed.

### PROGRAM START/CLEAR

Toggle this switch up to activate a program. The program light comes on. When the start button is pressed the machine will start running the program represented by the 2 digital readouts.

Toggle this switch down to clear the program. The program stays as displayed on the digital readouts but the program light goes out and the program won't run.

### MANUAL FEED/PROGRAM HOLD

Toggle this switch up and hold it, for manual feed. Every time the rocker arm hits the bottom of its stroke the stones feed out one click. Release the switch and the program resumes.

Toggle this switch down and hold it for program hold. This stops feed outs of the stones, while the stroking continues. Release the switch to resume program as normal.

### STROKING SPEED CONTROL

The upper cylinder of the arm provides smooth control of the stroking motion and stroking speed control. This hydraulic cylinder pumps liquid back and forth through a ball valve, which is located on the right side of the carriage.

By opening and closing this valve, stroking speed can be changed. A reservoir is located on the carriage under the rocker arm pivot. This reservoir compensates for volume change due to temperature variations.

The reservoirs liquid is fed through a flow control valve, located on top of the ball valve. This valve can be opened for bleeding and re-filling.

A regulator is located on back of the carriage to regulate

the air pressure (15 psi) to the reservoir.

#### SHORT STROKING BOTTOM DWELL

A check valve is attached to the stroking valve between it and the upper limit valve. A jump air line is routed around the check valve and a push button control valve is located on this line.

When this push button control valve is pressed air can get thru the check valve only, then it is trapped in the air line. This keeps the spool in the stroking valve shifted to down stroke only.

Then the lower limit valve is actuated. Its higher pressure shifts the spool in the stroking valve to up stroke, but as soon as the pivot arm moves away from limit valve and exhausts its air, the air trapped in the other control line causes the spool to shift to down stroke again.

#### CLAMP FLOAT BUTTON

Press Clamp/Float button to float carriage. This allows air to flow through valve to regulator, then out two ports of the regulator. Air from one port flows through the right orifice on the bottom of the float plate. Air from the other port flows through a flow control valve then to the left side of the float plate and out the orifice on the bottom of the float plate.

#### FEED UP (STONE PRESSURE)

The manual feed up switch (or the program relay) sends a signal to the feed up solenoid valve. The valve shifts air pressure to the engagement side of the feed up cylinder. The piston of the cylinder moves the spool. This pivots the ratchet into engagement with the ratchet wheel. The ratchet pawl then rotates the wheel one tooth.

When the solenoid valve is de-energized it moves the air pressure to the retract side of the cylinder. The piston retracts the pawl, then returns the spool to its original position.

---

#### **NOTE :**

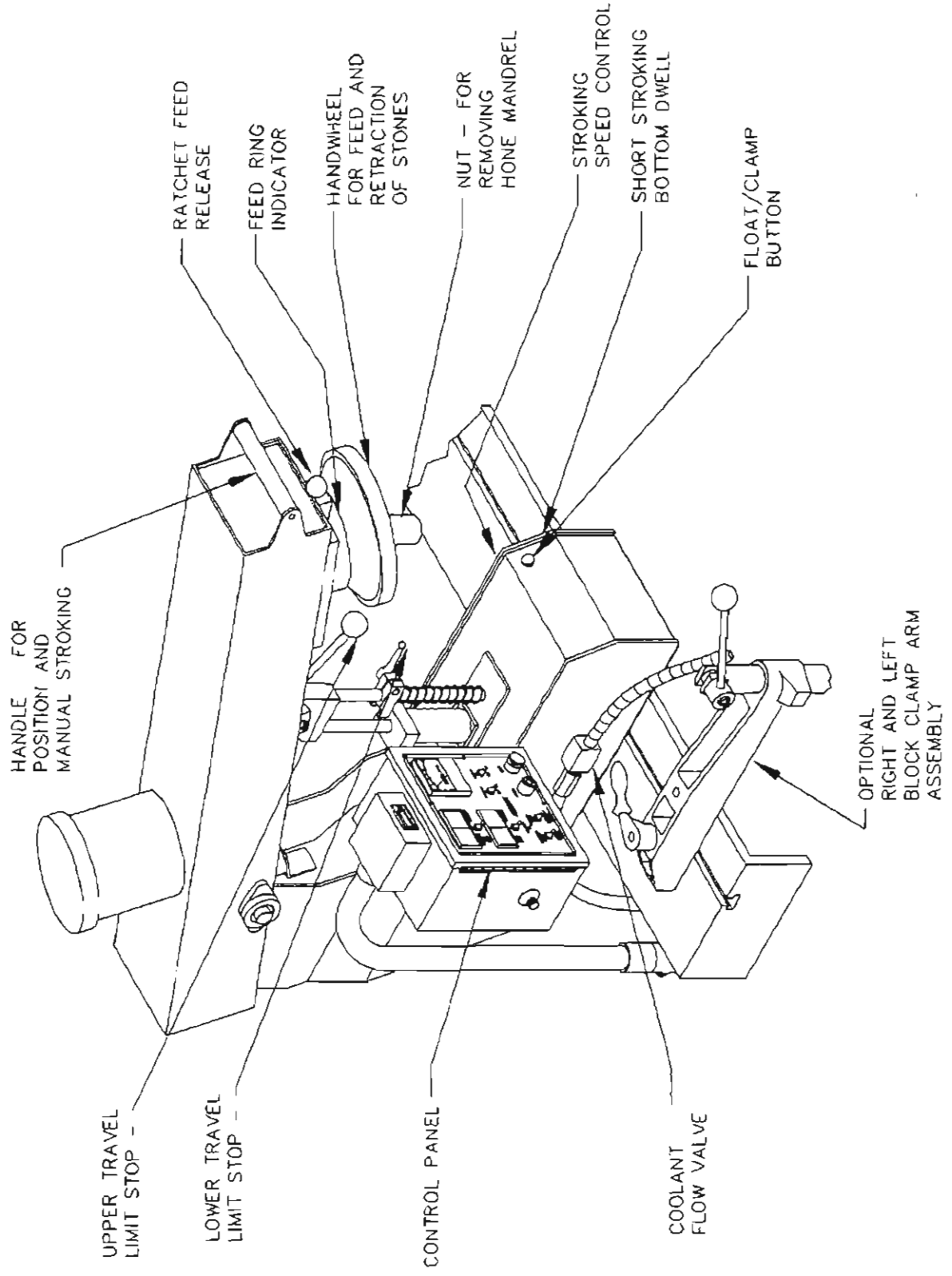
Interface sensor must be actuated for feed up.

---

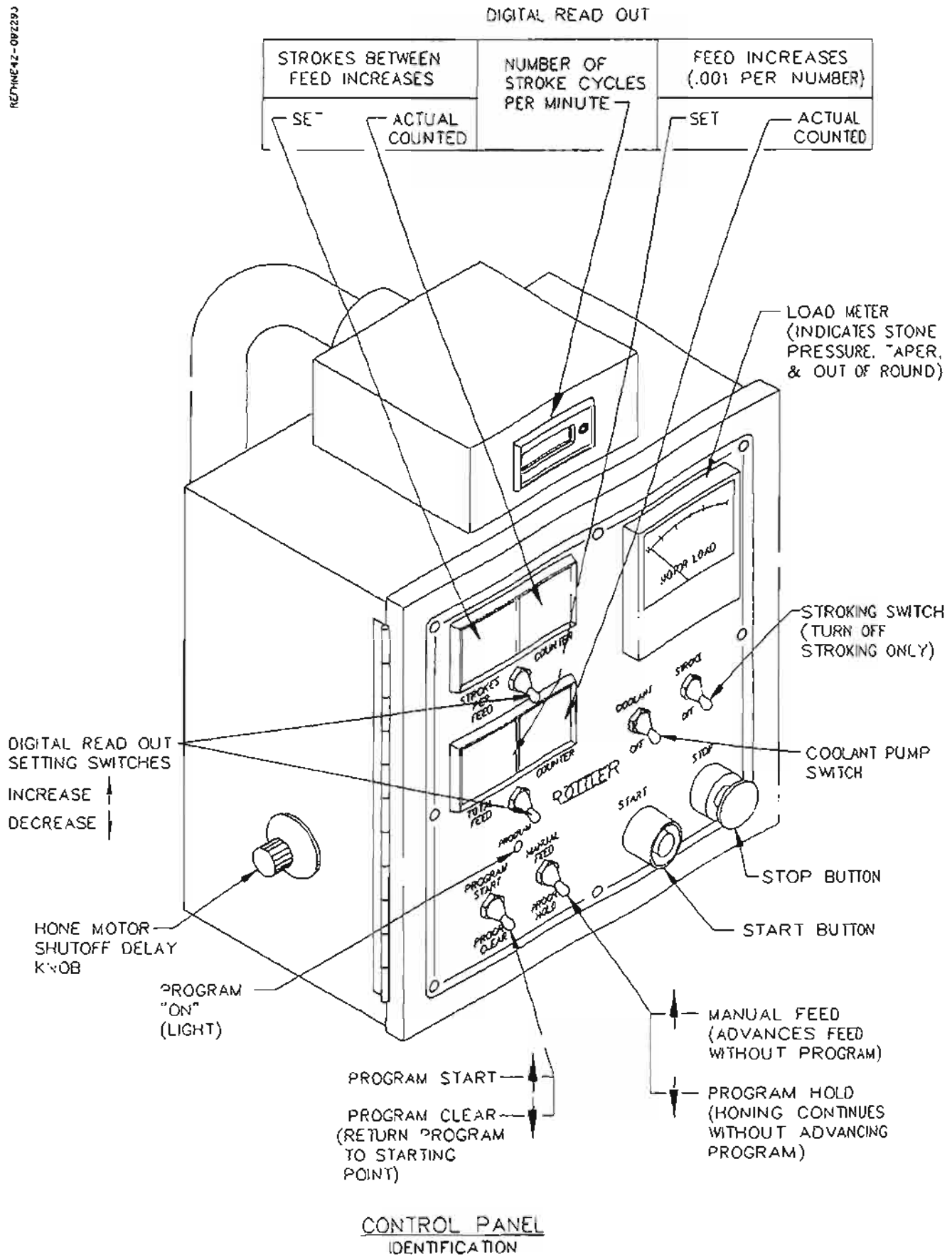
#### HONE MOTOR SHUTOFF DELAY

At the end of an automatic honing cycle, the hone head will stop rotating before the last stroke is complete. This will result in the machine, dragging a non-turning hone head in the cylinder. This knob can be adjusted so the hone head will continue to rotate until it reaches the top of the last stroke.

REFHNE187-082193



REF: 42-09229





## OPERATING THE HP3A

### HONING IN GENERAL

The Rottler hone with 120/180 grit stones is designed to remove .0012" from the diameter of a bore. If a finish better than 20 micro inch is required, finer grit stones should be used. 120/180 grit stones generally will remove the .0012" stock in about 30 seconds in a 4" diameter x 6" long cast iron bore.

80 grit stones should be used when you require more stock removal. They will generally remove stock at about .004 diameter per minute in a 4" diameter x 6" long cast iron bore.

Many cylinder bores prevent a through stroke. You must be careful to have at least 1/2" of stone extension at the bottom of the bore. Be sure the area is completely clear of webs or other obstructions. Grind them away if necessary.

You can correct a bore that is small at the bottom, by short stroking in that area.

The stones and guides could become tapered if they are not allowed to through stroke 1/2" beyond the bottom of the bore. The stones and guides can be trued up, by honing a fresh bored hole and providing proper top and bottom through stroke.

Allow 3/4 to 1" of stone through stroke at the top of bore.

Control your power stroking with dwelling to stabilize the

load meter. You will find the meter provides excellent information on sizing the bore. A fluctuation of the meter indicates a small area in the bore. The highest reading indicates the tightest spot. A temporary reduction in the stroking speed can facilitate reading of the meter. The knob or lever on the right side of the carriage controls stroking. Turn knob or lever clockwise to reduce speed, return knob (lever) to its full out position for normal honing. If you need to dwell at any spot, turn knob (lever) all the way in to stop stroke.

When through stroking is limited, you will find 3" length stones will require less attention to achieve an accurate bore.

A barrel shape pattern can usually be eliminated by using 3" stones. 4" stones can be easily trimmed down, by removing 1" from the top of the stones, with the aid of a bench grinder.

In general, the following approximate micro finish in cylinder block, cast iron will result from the following stone grits:

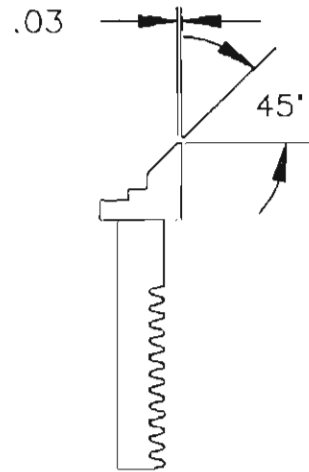
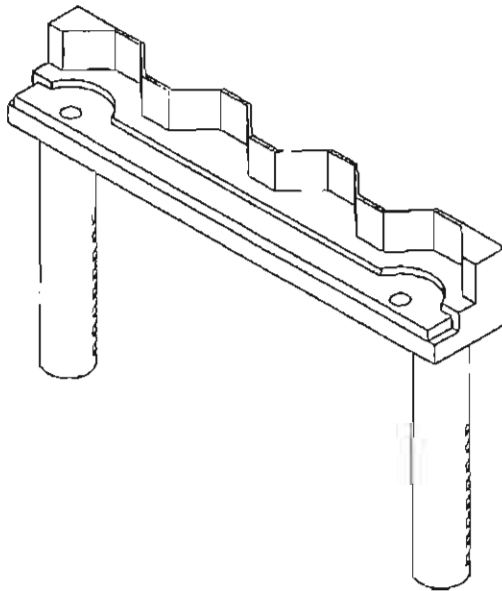
GRIT	-	RMS
50-80	-	40-70
120	-	28-35
150	-	24-32
180	-	20-25
220	-	15-21
280	-	10-16
320	-	8-15



**IMPORTANT FACTS**

The hone head will sometimes chatter or squeal when the stones wear down. This problem is caused by too much pressure on the guides. To correct this problem, remove the guides and dress them as shown in the sketch below.

The heat generated in honing will expand the bore diameter beyond its room temperature size, with more expansion in the thin wall mid-section. Expect approximately a .0005" reduction in size after cooling to room temperature.



**STONE AND GUIDE INSTALLATION**

To install new stones:  
 Lift inner adjusting shaft, and rotate clockwise to latch. Pivot hone head 90 degrees (horizontal) so that pinion can be removed.

**NOTE :**

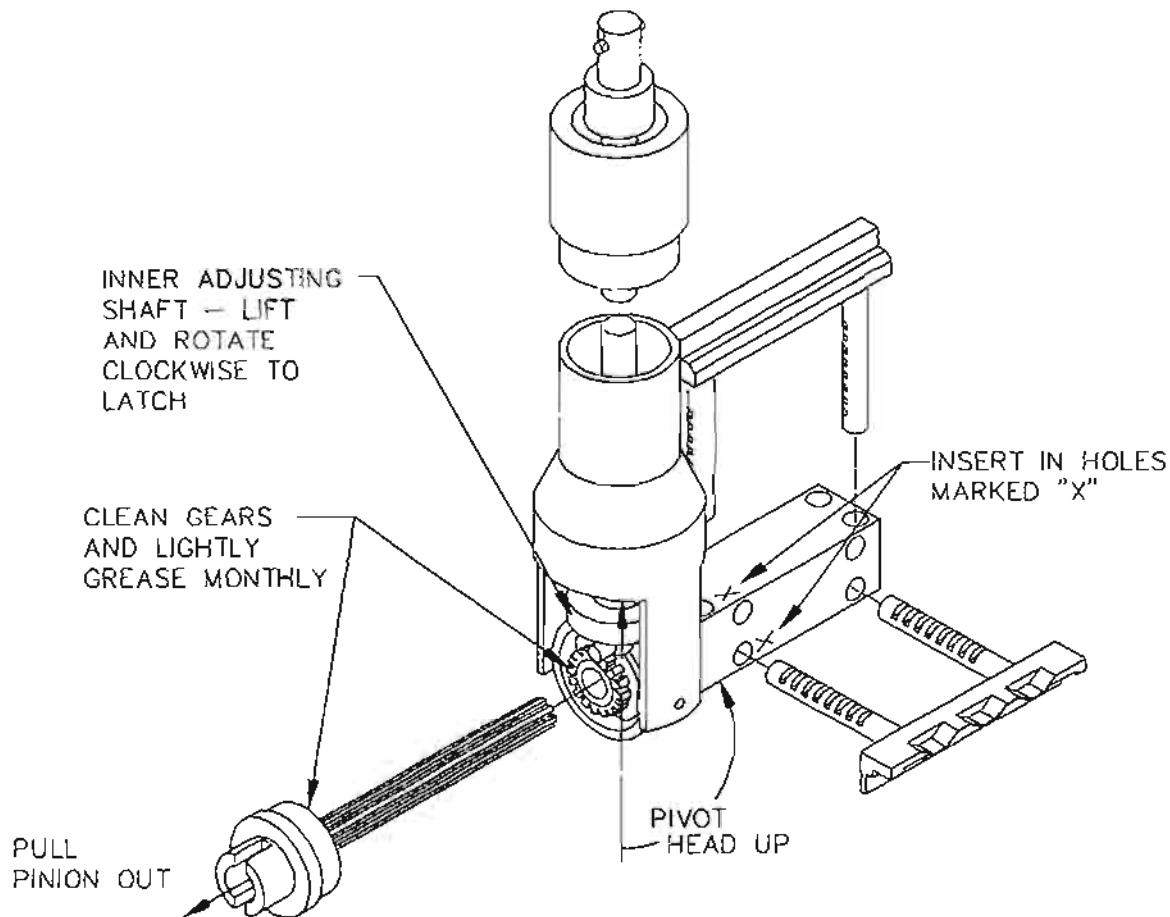
Stones and guides will fall out when adjusting pinion is removed and head is pivoted 90 degrees.

Insert stones and guides into holes marked with 'X'. The rack teeth must face the center of hone head.

While holding stones and guides in, pivot hone head 90 degrees (Horizontal). Insert adjusting pinion into head and pivot the head back to the vertical position. Unlatch and lower the inner adjusting shaft into its position in the pinion.

**NOTE :**

Used stones and guides that are to be reused must be kept in sets.



## HONING PROCEDURES

### BLOCK LOADING

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

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

Place block supports onto cradle with key engaged into slot (see page 5.20). Place supports on edge for blocks with exposed main bearing caps. Place supports flat for blocks with main bearing caps recessed above the pan rail.

---

#### NOTE :

Main bearing cap must be "ON".

---

Place clamp bar thru main bearings of block.

Rotate clamp screw 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.

### HONE HEAD POSITIONING

Press float button to float the hone carriage. Position hone head over the first hole. Release float button to clamp.

### LOWER TRAVEL LIMIT SETTING

Expand or contract the stone assembly to the approximate bore size. To expand - turn handwheel counter clockwise. To

contract - pull and turn ratchet feed release, turn handwheel clockwise.

Sometimes it is necessary to expand or contract the stone assembly a large distance. Lift inner adjusting shaft at hone head and rotate clockwise till it is latched. Lift adjusting pinion of hone head off of it's gear and rotate pinion to expand or contract stones.

Be sure to reengage the gear of centering pinion. Lift and turn inner adjusting shaft counter clockwise to unlatch.

Check for possible interference points in the lower part of all cylinders. Release both upper and lower stop levers. Lower hone head into a cylinder and position at lowest point of stroke.

---

#### NOTE :

Stones and guides should have approximately 3/4" through stroke. If there is interference the over travel can be reduced.

---

At this position expand stones lightly against cylinder walls to hold rocker arm. Raise the lower stop until it rests on the rocker arm, then clamp it.

Lower travel limit setting will not have to be changed in this block unless there is an obstruction in one of the other cylinders.

---

#### CAUTION :

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

---

UPPER TRAVEL LIMIT SETTING

Release stone pressure by pulling and turning ratchet feed release, then turn hand wheel clockwise. Raise hone head until stones extend about 1" out of the top of the block. Lock upper stroke limit. Do not over tighten upper stop limit clamp.

FEED SETTING

Set strokes required between stone feed increases. Set number of stroke/feed cycles.

The following honing examples were taken in a GMC block with a 4" diameter bore and a 5-7/8" length of bore. These results will vary with stone hardness, honed material etc.

Finish honing, .002 diameter stock removal, 180 grit stones in a cast iron block. Strokes were set to 9 and total feed to 17.

Rough honing, Stock removal, 80 grit stones in a cast iron block. Strokes were set to 9 and total feed to 17.

PROGRAM START

Once the program is set-up, toggle the program start switch up. This activates the program. Press start button.

HONE CYCLE

Turn stroke switch on control panel to 'ON' position.

Turn coolant toggle switch on control panel to 'ON' position.

Press the start button.

Remember: the limit switch in the rocker arm will not allow the motor to operate when the hone head is in park position.

Turn handwheel counter clockwise, with ratchet engaged. Bring load up to 80 to 100% on meter.

If you go over 100% you can release pressure by pulling and holding ratchet feed release knob, then turning handwheel clockwise.

FEED INDICATOR RING

Each mark on the feed ring represents .001 of the diameter of the bore. Each ratchet click also represents .001 on the diameter. Turn the feed ring to '0', after stones are brought up to honing load. As the load on the load meter drops, keep stone pressure up by turning handwheel counter clockwise. The movement of the '0' mark on the feed ring away from the index mark on the gear box will give you an indication of how much stock you have removed.

Due to stone break down it will be somewhat less than indicated by the feed ring.

NOTE :

Using with optional precision hone head (see page 6.9) each mark on feed ring and each ratchet advance is .0003 on diameter.

LOAD METER

Note load on load meter as the machine is stroking. A large swing of the needle indicates a small area in cylinder. The small area being the highest reading, usually at the bottom of the cylinder. Dwell in this area to open it up, then continue stroking. A temporary reduction in the stroking speed

can facilitate reading of the meter. The knob or lever on the right side of the carriage controls stroking speed. Turn clockwise to reduce speed, return to full out position for normal honing.

#### DWELL BUTTON (SHORT STROKE)

Push dwell button on right side of carriage. Hone will short stroke at the bottom of stroke. Press button on up stroke or the first 20% of down stroke at normal stroking speed. NOTE: If dwell button is pushed during the lower part of stroke (or any part of down stroke if stroking at slow speed) the dwell may be slow, long, or possibly stall mid-stroke. NOTE: If the bottom over travel is less than 1/2" lower dwell (short stroke) early in the cycle.

The length of short stroke can be reduced by reducing the stroking speed. To dwell at the top of the stroke turn stroking switch off.

#### CHECKING THE SIZE OF THE BORE

To check bore size, first reduce stone pressure. Press the stop button. Place left hand on rocker arm handle. Release upper travel limit lever. Move hone head out of the way. After checking size, reset upper travel limit lever, press start button and bring load up with the handwheel.

#### HONE CYCLE COMPLETE

After the bore is finished, reduce the stone pressure. Press the stop button, the machine will stop at the top of the stroke. Release the stone pressure fully. Place left hand on rocker arm handle release upper travel limit lever. Press

float button to float and move to next cylinder.

#### FINISH PLATEAU

If a plateau is required after bore is brought to size, continue honing for approximately 6 to 10 strokes at a 20% reduction in stone pressure.

#### MANUAL STROKING

To hand pump rocker arm, turn the stroke toggle switch on the control panel to 'OFF' position. Release upper travel limit lever. All functions will operate with exception of the power stroking. Use stop button to stop hone.

Do not operate power stroking without upper travel limit lever locked. If you start machine with power stroking on and lever unlocked, the piston will go to the bottom of the stroke and remain there.

To return it, press the stop button. Check to make sure upper travel limit lever is completely unlocked. Keep your hands well clear of all mechanisms.

Manually bring the rocker arm down to the lower stop or use a pencil or screwdriver to depress the lower limit valve and the cylinder will return to the top.

#### LIMITED OVER TRAVEL AND BLIND HOLES

A problem with stock removal with hone heads exists on the Chevrolet 350 block. There is a maximum over-stroke at the bottom of 3/8 to 7/16 and an often worse condition created by a remnant pad at the bottom that extends about 1/4" beyond the main bore.

The heavy-duty head loses 1/8" of the over-travel with the stone jacket making the situation more difficult.

If the lower remnant pads require stock removal, there is almost no way to hone properly without using a die grinder, portable grinder, or a boring bar to relieve the pads.

In order to achieve the best possible bore that is near blind (that is without relief) HP hones may be dwelled at the bottom with the stroke speed control. Stone lengths may be shortened to 2-1/2" or 2-1/4" by cutting off at the top end. It may be necessary to occasionally redress stones in a bore with minimum of 1" over travel at the bottom of bore.

The bottom short stroke may be used, but care must be exercised to avoid a barrel effect near the bottom.

#### STROKE CYCLES PER MINUTE COUNTER

When the machine is running this digital counter shows the actual stroke cycles per minute.

The cycles per minute can be changed at any time during the honing process. To change cycles per minute adjust the lever on the right side of the carriage.

The strokes per minute number is used to determine the crosshatch angle of the honed cylinder, using the chart given on page 3.8.

Select the bore dia., for our example we will use 4".

Follow across to the desired crosshatch angle.

Go straight up to the 5.25" stroke length line.

Follow the approximate curve to the correct stroke length.

(stroke length is measured as this example: 5.75" bore depth plus .50" overtravel top and bottom equals 6.75". Subtract 2.75" for the stone length to get 4" total stroke length).

Follow straight up from this point to determine the correct cycles per minute setting to obtain the desired crosshatch.

#### AUTO FEED STOP FEATURE

The autofeed stop feature automatically stops the machine when a predetermined amount of material has been removed.

Set the total feed display to '99', do this by starting at '0' and press down once on the toggle switch just below.

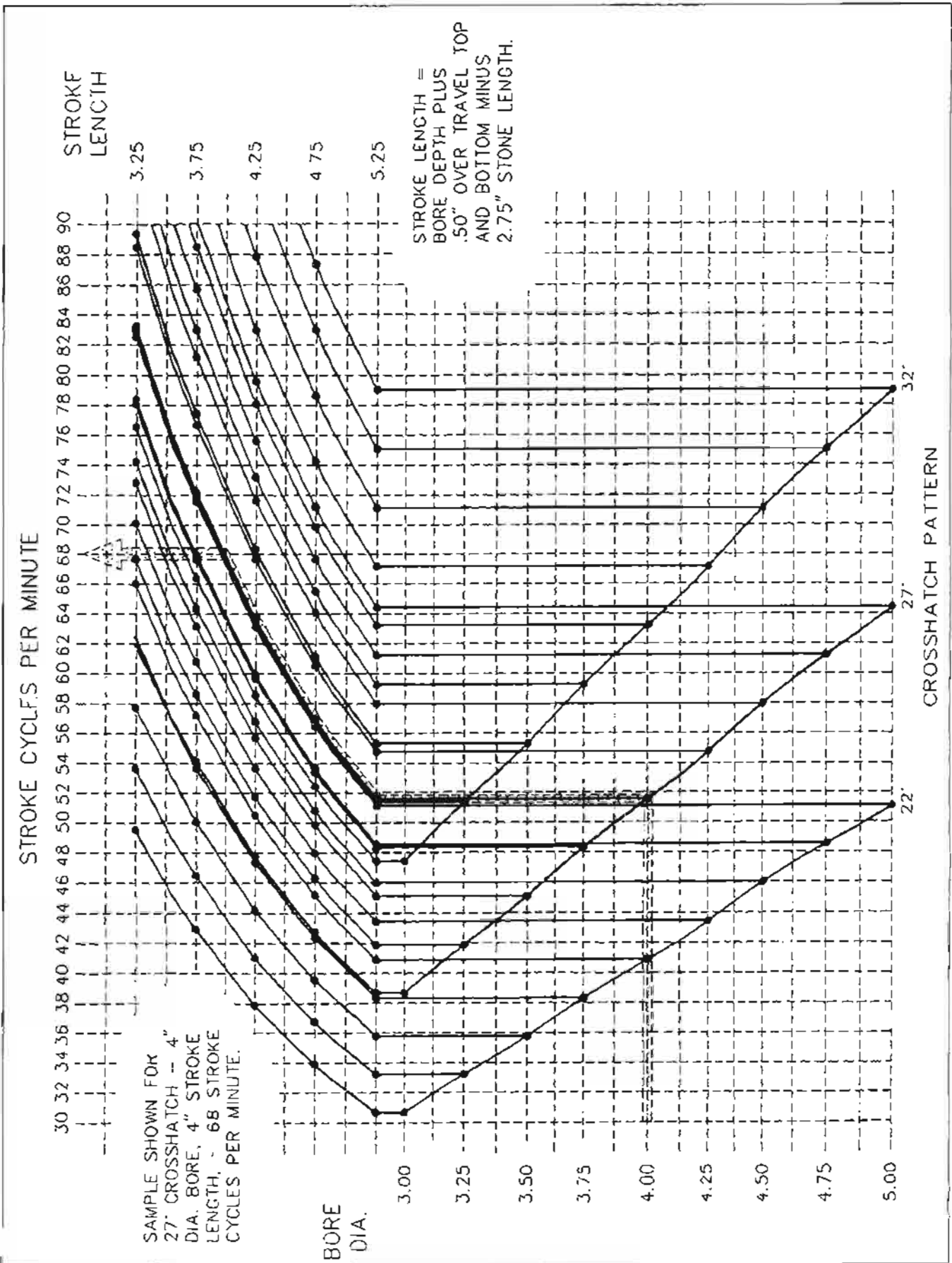
Lower the hone stones into the cylinder.

Turn the handwheel counter clockwise (looking from the top).

Feed stones out until they are pressing firmly to the cylinder walls. Adjust the feed ring clockwise, from '0' to the number corresponding to the amount of material you wish to remove.

Loosen the stones. Start the program as normal except leave the feed display set at '99'. When the handwheel feeds out enough so that the '0' on the feed ring reaches the pointer the hone will automatically turn off.

NOTE: In order to restart a cycle the feed ring must be rotated off the stop position.



---

## LUBRICATION

---

Refer to illustrations on page 4.3

---

### GREASE FITTINGS

There are 2 grease fittings located on the rocker arm pivot bearings. There is a grease fitting located on the upper cylinder pivot pin. There is a grease fitting located inside the handwheel at the top. On the block hold down fixture there are 3 grease fittings. There is a grease fitting located on the pendant arm mount. Each optional clamp arm assembly has one grease fitting.

Every 175 hours, these grease fittings should be greased, using F2 multipurpose grease, or Unoba F1 grease, or equivalent.

### GEAR BOX

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

Every 1,000 hours, check the oil level in the gear box. The arm must be in the horizontal position. Remove the plug on the upper rear of the gear box. The oil level should be up to this hole. If oil is needed lower rocker arm and add oil to this hole. Use Tellus #32 or Mobil Met DTE light or any equivalent light machine oil, only.

---

#### CAUTION :

DO NOT OVER FILL.

If over filled, oil will spill out of breather cap. To drain oil remove the plug at the bottom of the gear box.

---

### UNIVERSAL JOINT

The universal joint connects the hone head adjusting shaft assembly to the gear box.

Every 8 hours, Lubricate the hinge points of the universal joint with 30 weight machine oil.

### AUTOMATIC LUBRICATOR

The oil lubricator is located on the back of the main base. The oil lubricator lubricates the stroking cylinder.

When needed - Add hydraulic oil to the reservoir. Use Shell oil 'Tellus #32' or Mobil S.T.E., light oil. Or any equivalent highly refined, turbine, or hydraulic S.A.E. #10 or lighter petroleum oil (non-detergent) with a medium aniline point (ASTM oil #2).

---

#### CAUTION :

Only use an 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, fyrouel, pydraul, etc.) or fire resistant oils containing phosphate esters.

---

#### NOTE :

Plastic bowl and sight dome must be cleaned only with household soap

---



Set lubricator at one drop every (1) to (2) minutes.

#### 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.

#### INLINE AIR FILTER

A disposable inline air filter is installed in the air control circuit line. Remove and replace this filter when the element turns a red color.

---

#### **NOTE :**

Install new filter with arrow pointed in direction of air flow.

---

#### 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 oil when it gets dirty. When changing oil, completely clean tank and filter screen. Use 30 gallons max. of Mobil Met 33 or Upsilon or any equivalent light honing oil.

#### 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 pivot arm. If liquid is needed, add two parts water to one part Ethylene glycol (prestone) to the plugged hole on top of the reservoir. fill to mark on reservoir.

#### MUFFLER EXHAUST

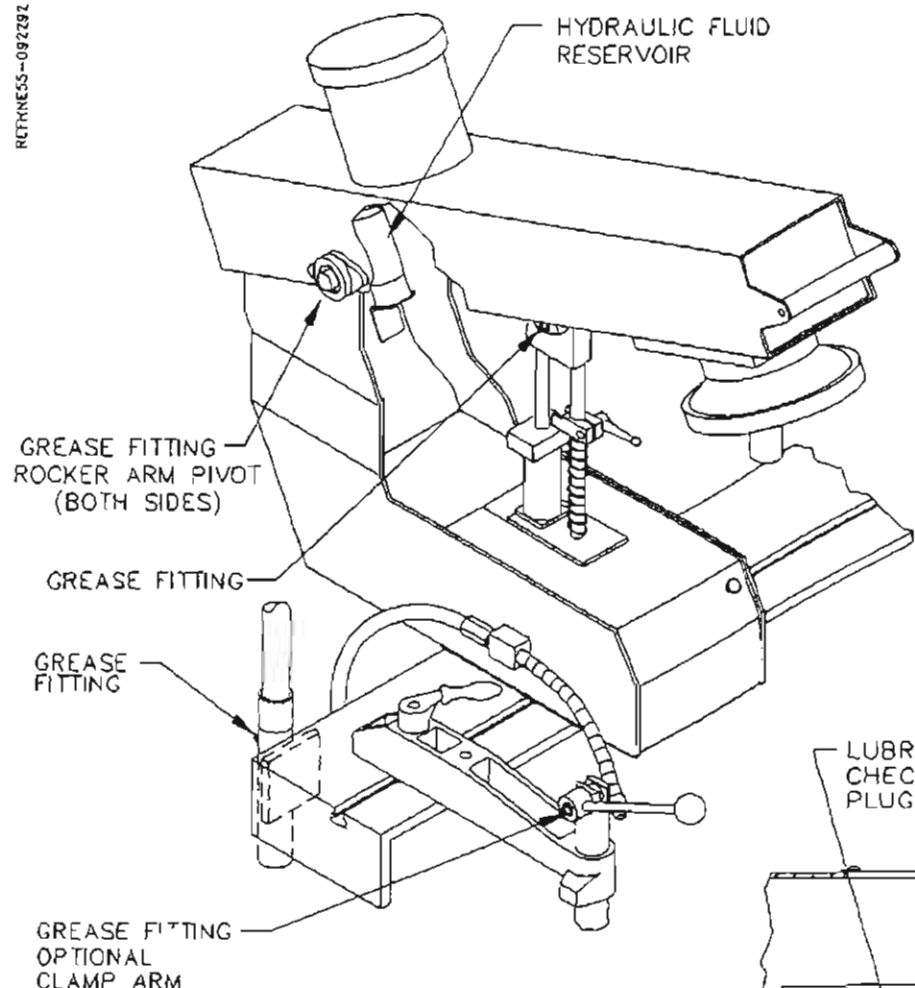
(see page 4.6)

The exhaust muffler, on the main stroking system, must be replaced periodically. If hone losses power in the stroking operation it could be caused by a dirty exhaust muffler.

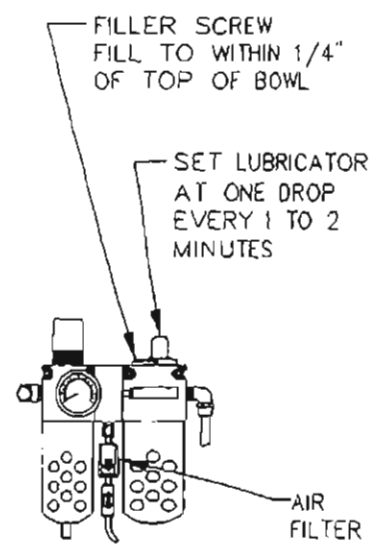
The exhaust muffler is located at the rear of the machine. Remove the mount screws from the side of the splash tank, remove the enclosure. Unscrew the muffler and replace with a new filter.

NOTE: Older models have 2 brass mesh exhaust mufflers located inside the rear of the carriage, These filters may be removed, rinsed with denatured alcohol, and reinstalled.

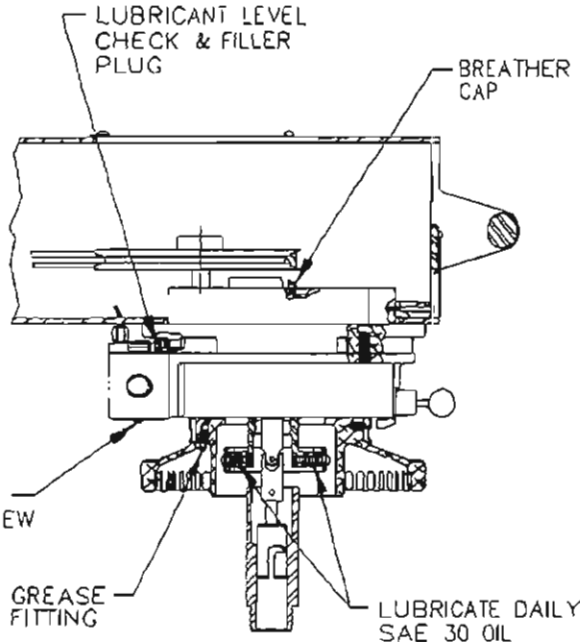
RETRYNESS-09278Z



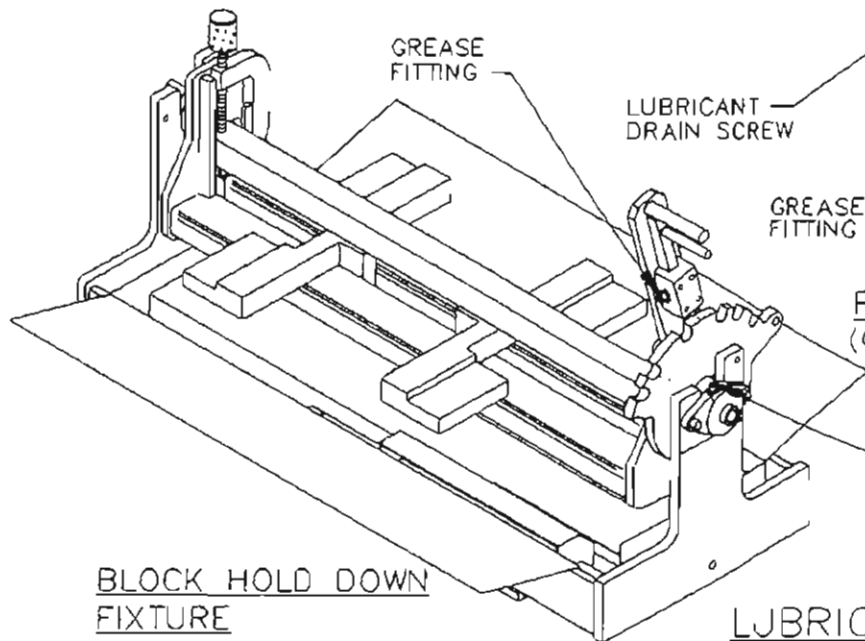
PHONE LUBRICATION



REGULATOR & LUBRICATOR



ROCKER ARM GEAR BOX  
(CHECK IN HORIZONTAL POSITION)



BLOCK HOLD DOWN  
FIXTURE

LUBRICATION

## HYDRAULIC SYSTEM

### SYSTEM CHECK

With the machine running, watch the pivot arm and see if there is any jerking or bouncing when the pivot arm is changing directions, Slow down the stroking speed to see. Jerking and bouncing indicate air in the hydraulic system.

---

#### NOTE :

At very slow stroking speeds, there may be some bouncing of the pivot arm at the bottom of the stroke. This is normal. To correct this increase the stroking speed slightly.

---

### SYSTEM BLEEDING

The following procedure assumes a drained hydraulic system. Start at step number 6, if your hydraulic system is already filled and has been in operation.

1. Turn off air flow from the regulator (1).
2. Remove plug from the top of the reservoir (2). Fill the reservoir with fluid as described on page 4.2. Replace plug.
3. Open the valve (3) all the way. Be sure valve (4) is closed.

---

#### NOTE :

Valve (7) is preset at the factory and should not be adjusted. If adjustment is necessary set to 65 strokes/minute with a 3" stroke at the hone head.

---

4. Turn the air regulator (1) all the way up. The fluid level in the reservoir will begin to drop. When the fluid is near the bottom of the reservoir (2) shut off the air flow from the regulator (1).
5. Repeat steps 1 and 2.
6. Turn the air regulator (1) all the way up again. The reservoir (2) should remain at least half full, If it drains below half, repeat steps 1 and 2.
7. Check the system for any leaks.
8. Slip on a length of vacuum line to the bleed valves (5) and (6). Run the other end of the lines into a can with some water in it.
9. Open the top bleed valve (5). Fluid and air will bleed into the can. Close the bleed valve when the air bubbles stop.

---

#### IMPORTANT

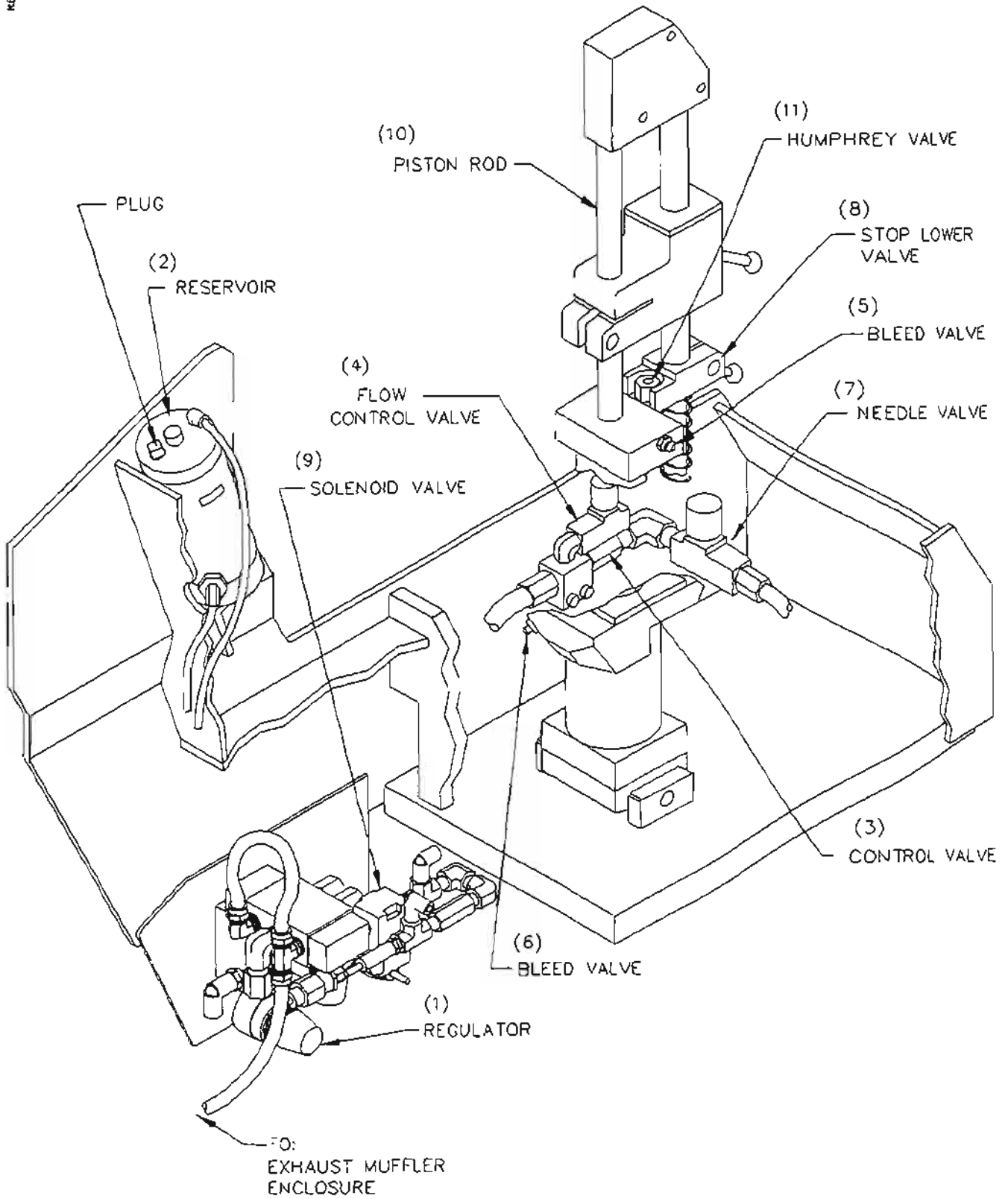
Do not allow fluid reservoir to drain completely. When the level gets low, refill following steps 1 and 2.

---

10. Open bottom bleed valve (6). Fluid and air will bleed into the can. Close the bleed valve when the air bubbles stop.

11. Set the lower stop limit valve (8) as far down as it will go.
12. Push the little plastic button on the back of the solenoid (9). The piston rod (10) will go down.
13. Repeat steps 9 and 10, filling reservoir (2) when needed.
14. Depress Humphrey valve (11), the piston rod will go back up. You will need a small screw driver or drill bit to actuate the valve.
15. Repeat steps 9 and 10 again to be sure no air remains in the system.
16. With the reservoir (2) full, shut off air flow from the regulator (1), Set the regulator pressure by turning clockwise 3 turns.
17. Do a system check again to see if any air remains in the system.

REF: 091.39.1



## V - BELT ADJUSTMENT - REMOVAL

### CAUTION:

Disconnect all electrical and air power before making any repairs

### V-BELT ADJUSTMENT

Remove the cover on top of the rocker arm at the front. Loosen the conduit clamp on the left side at the back 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 box.

### CAUTION:

DO NOT OVER TIGHTEN BELT.

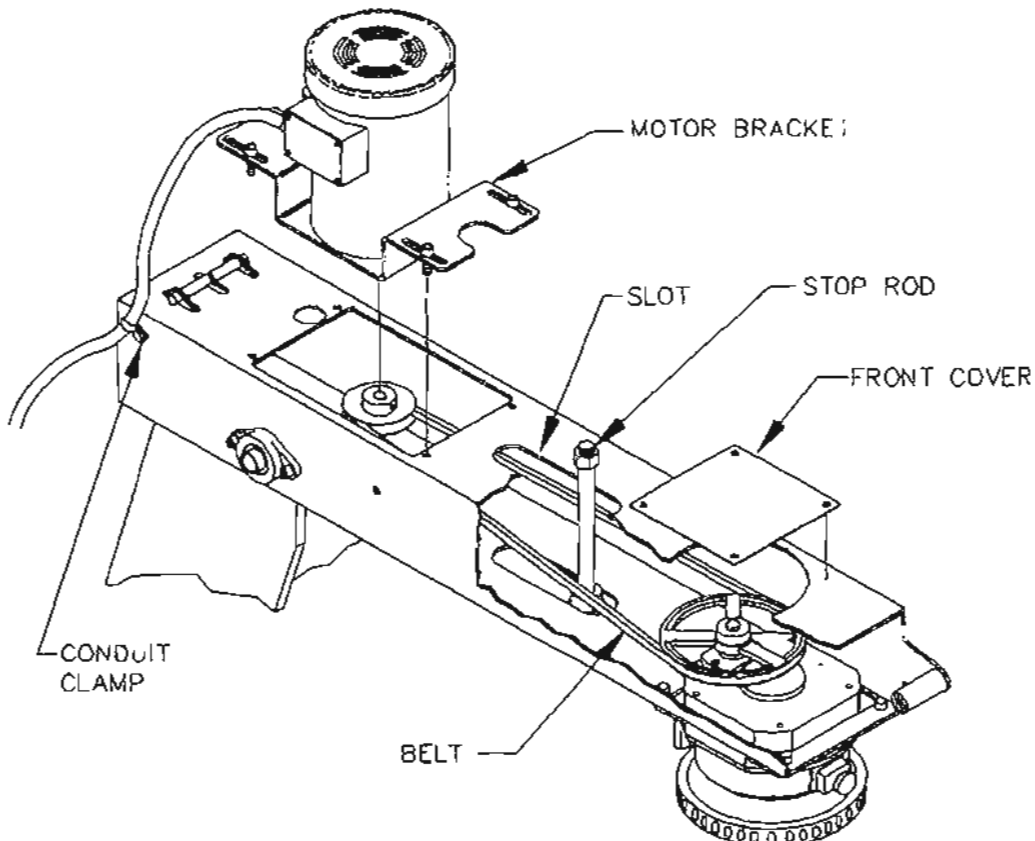
Tighten the motor mounting

plate. Tighten the conduit clamp. Replace the front cover and tighten its screws.

### V-BELT REMOVAL

Remove the cover on top of the rocker arm at the front. Loosen the conduit clamp on the left side at the back of the rocker arm. Loosen the 4 motor bracket mounting screws from the top of the rocker arm. slide the motor forward. 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.



## GEAR BOX REMOVAL

### CAUTION:

Disconnect all electrical and air power to hone before making any repairs.

Remove the hone head, at drive tube nut. The drive tube nut is located near the adjusting handwheel.

Remove the drive belt as described on page 4.7.

Remove two 1/4 socket head capscrews in the front cover of the rocker arm.

Remove the four gear box mounting screws, from inside the rocker arm.

### NOTE:

Use care as the gear box will drop when all of the screws are out.

## GEAR BOX DISASSEMBLY

(refer to page 5.9)

Drain oil. Remove the oil drain screw located on the back of the gear box toward the bottom.

Remove drive tube and drive yoke by holding pinion drive shaft, and unscrewing the drive tube.

To disassemble universal joint, remove its four 1/4" button head capscrews. On reassembly of the universal joint make sure all screws are tight.

Remove the six socket head capscrews on top of upper gear housing. Remove upper half of gear housing.

Remove bearing retainer (514-6-26), from the upper gear housing. Press pinion and bearing out of the housing. Loosen the socket set screw in the nut, on the pinion shaft. Remove the nut. Press the bearing off of the shaft.

Remove the four screws securing the lower gear housing to the cage. Remove the cage and handwheel, carefully. When reassembling be careful not to damage the oil seal. Note the o-ring on outer lip of cage. Ring gear can be lifted out of cage. Remove the four socket head screws in the handwheel hub. Remove handwheel and ratchet gear.

Remove sun gear 514-6-35, from the gear housing assembly. Press out the 1/8" spring pin. The adjusting shaft 514-6-43, and the thrust washers can be removed by sliding down. Press out the spring pin securing the driven planet gears 514-6-32A. Remove the gears.

Locate the locknut on top of the driven shaft 514-6-36. Bend the tabs of the lockwasher out of the way. Remove the locknut and washer. Press the driven gear 514-6-28 off of the driven shaft. Remove the three screws in the bearing retainer 514-2-3C. You must align the access holes in the sun gear 514-6-29 in order to get an allen wrench on the screws. Press the shaft and

bearing out of the upper housing. Press the bearing and the sun gear off of the driven shaft.

To remove the planet gears from the ratchet gear, press the shafts 700-6-5 out of the ratchet gear.

Remove the feed ring 514-6-72 by pulling it off of handwheel. NOTE: Balls and springs will fly out when removing.

Remove ratchet feed assembly from cage by removing one 1/4" socket head mounting capscrew. NOTE: O-ring, seal around hub.

Disassemble ratchet feed assembly by removing knob and pressing out 1/8" spring pin. Ratchet pawl, spring and o-ring can then be removed from carrier.

Remove Auto Feed Up Housing (see page 5.13). Remove the four screws holding the auto feed housing to the ratchet gear cage. Disassemble auto feed unit. Unscrew the drag pin housing (514-7-33), remove the spring and the pin. Remove the two screw and the cover (514-7-39). Remove the shoulder screw (514-7-32) from the shifting spool (514-7-26). Pivot the ratchet pawl (514-7-29) out and remove the pivot pin (514-7-31). Remove the ratchet pawl. Pivot the retraction arm (514-7-30) back inline with the spool. Lift the retraction arm straight out through the slot in the housing. Remove the three screws securing the slot in the housing. Remove the three screws securing the cylinder (514-7-28) to the housing.

Once the cylinder is removed the piston (514-7-27) and the shifting spool (514-7-26) can be pulled out from the end.

Reassembly is the reverse. The drag pin assembly should be tightened until spring is fully compressed, then loosen approximately 1/4 turn. Reassemble the auto feed housing onto the ratchet gear cage. The upper gear housing must be removed so the ratchet pawl can be seen while being assembled, and the spring loaded ratchet pawl can be attached.

Adjust the engagement of the pawl to the ratchet wheel by loosening the auto feed housing mounting screws, and moving the housing sideways. Ratchet pawl must just miss one ratchet tooth then fully engage the next.



**FLOAT and CLAMP****FLOAT**

Press the air float button, located on the front cover of the carriage. The air flows from the valve to the float regulator, then to holes in both sides of the float plate. This allows the carriage to float on a cushion of air. To adjust the air float system, adjust the air float regulator 502-27-18 (see page 5.3) until hone unit floats freely over the whole length of main base.

**NOTE :**

Hone will not float correctly unless carriage clamp is adjusted properly.

**CLAMP**

Release the air float button. The air flows from the valve to the air clamp cylinder. This cylinder lifts the clamp lever which pulls up on key in t-slot. It may be necessary to adjust the air clamp system.

Remove the four screws securing the carriage cover plate. Remove the cover. Disconnect the air supply. Inside the carriage remove cotter pin from slotted nut. Back the nut off and then hand tighten. Loosen nut approximately 1/4 turn. Insert cotter pin. Reconnect air supply. If the rod of the cylinder sticks in the up position, turn nut one notch looser or tighter until rod operates freely.

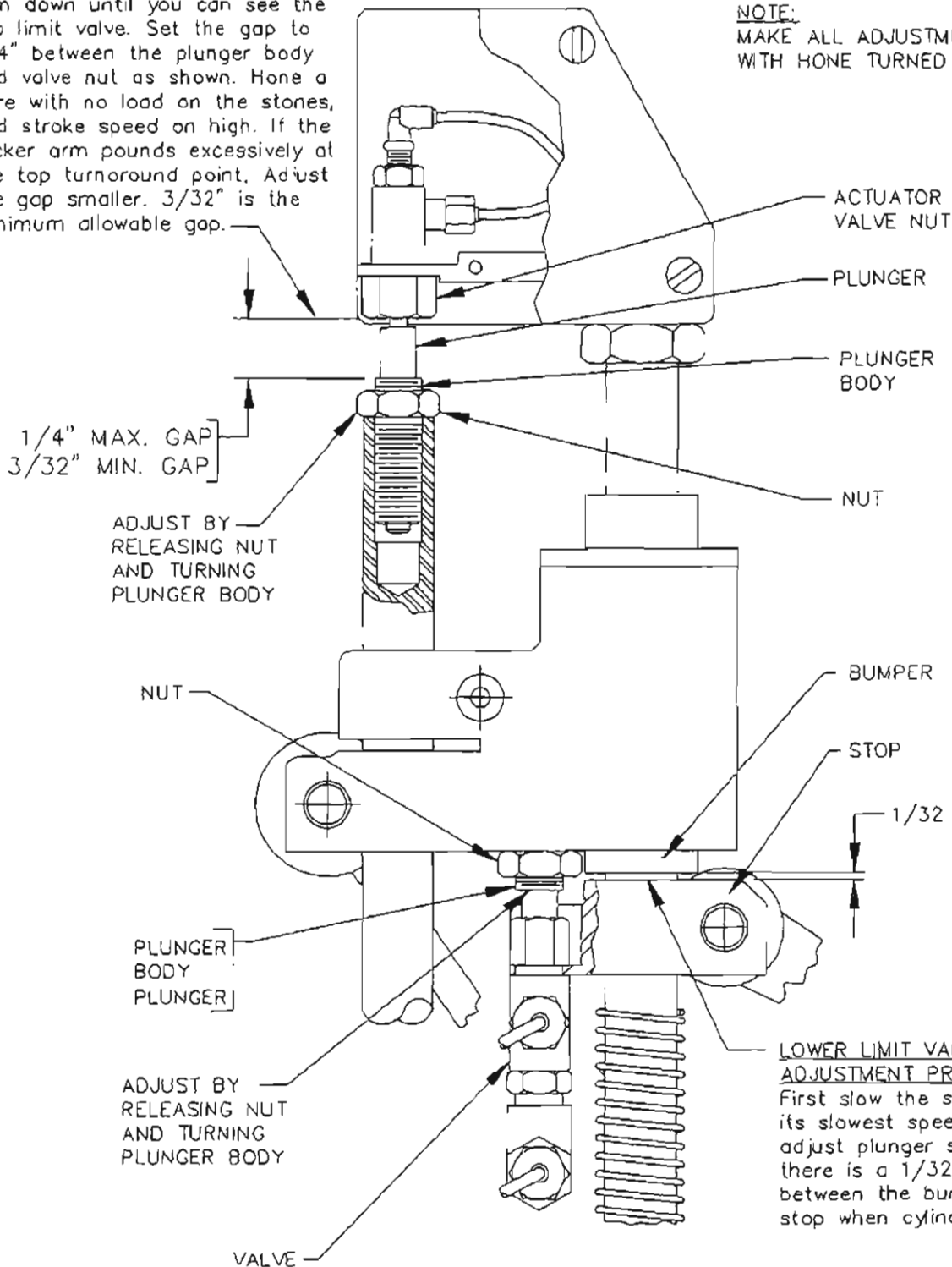
(see also oldstyle parts assemblies at the end of this manual)

UPPER LIMIT VALVE  
ADJUSTMENT PROCEDURE:

The stroking cylinder should be in the park position. Pull the rocker arm down until you can see the top limit valve. Set the gap to 1/4" between the plunger body and valve nut as shown. Hone a bore with no load on the stones, and stroke speed on high. If the rocker arm pounds excessively at the top turnaround point. Adjust the gap smaller. 3/32" is the minimum allowable gap.

NOTE:  
MAKE ALL ADJUSTMENTS  
WITH HONE TURNED OFF.

REF: HNE11 - 090482



LOWER LIMIT VALVE  
ADJUSTMENT PROCEDURE:  
First slow the stroking to its slowest speed. Then adjust plunger so that there is a 1/32 gap between the bumper and stop when cylinder reverses.

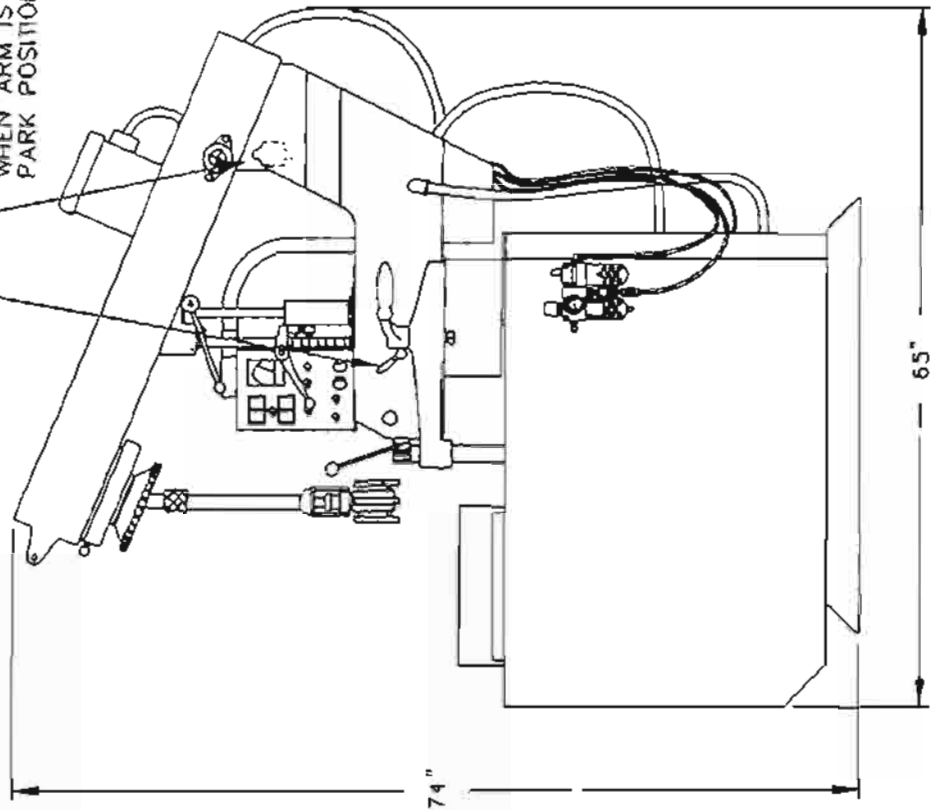
UPPER AND LOWER  
LIMIT VALVES ADJUSTMENT  
HUMPHREY VALVE



ROT-MEZ-0922R0

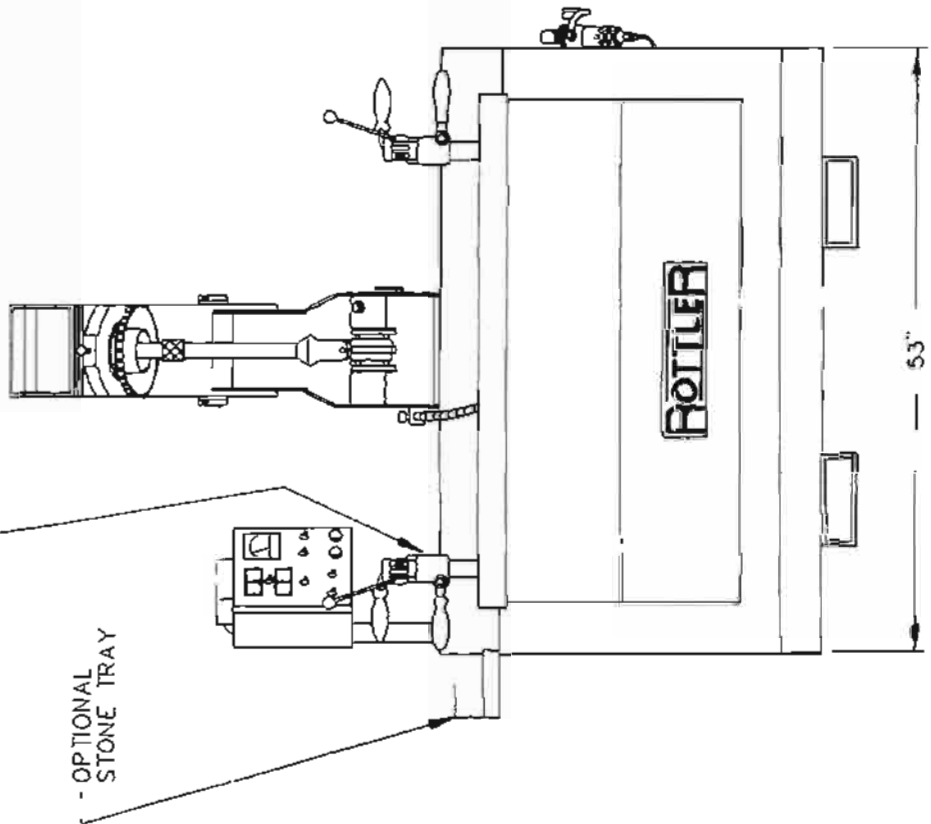
STROKING SPEED CONTROL LEVER (CAN ALSO BE USED AS A DWELL STOP ANY POSITION)

LIMIT SWITCH CUT OUT DRIVE WHEN ARM IS IN PARK POSITION

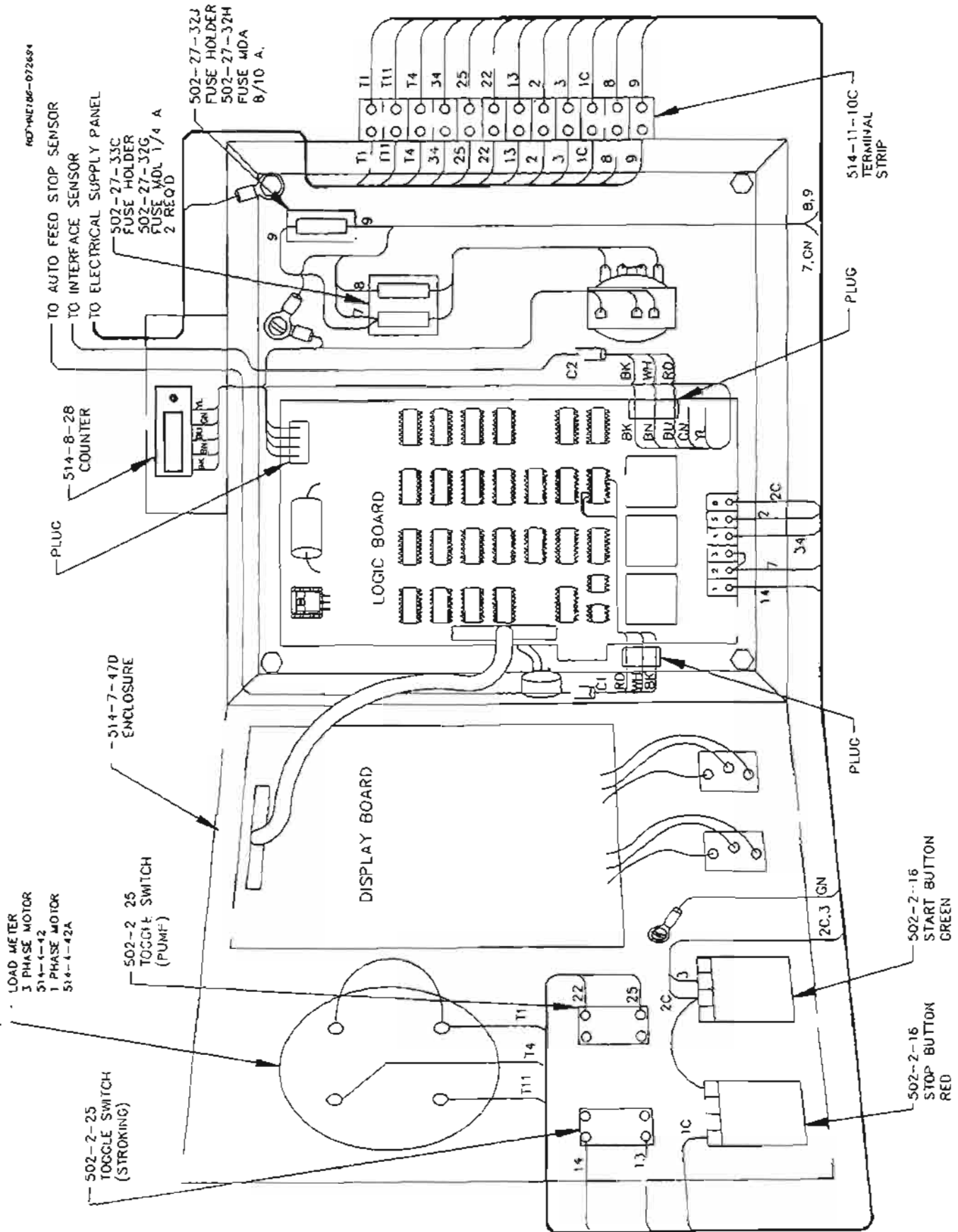


OPTIONAL RIGHT & LEFT BLOCK CLAMP ARM ASSEMBLY

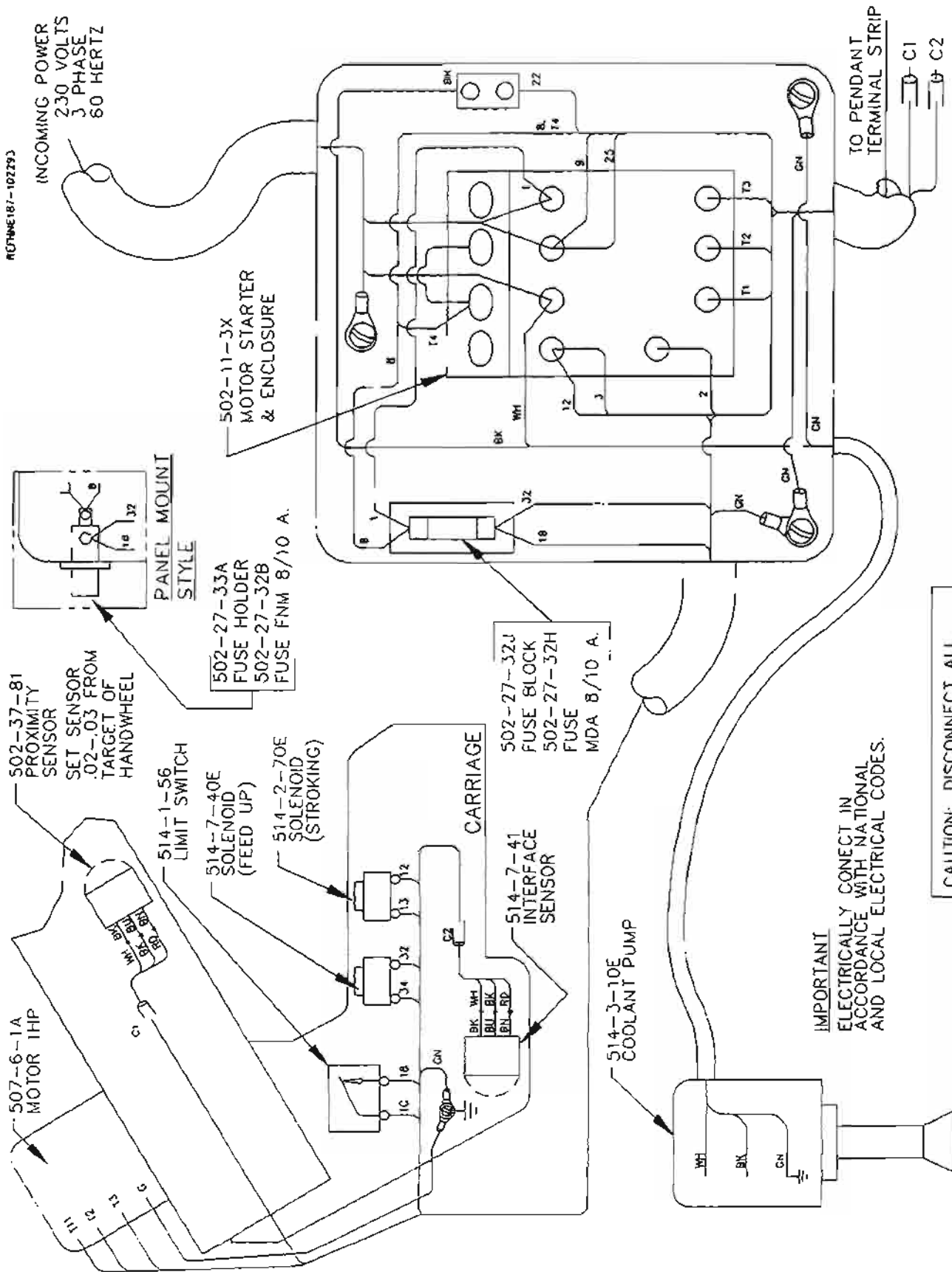
- OPTIONAL STONE TRAY



HP3A HONE



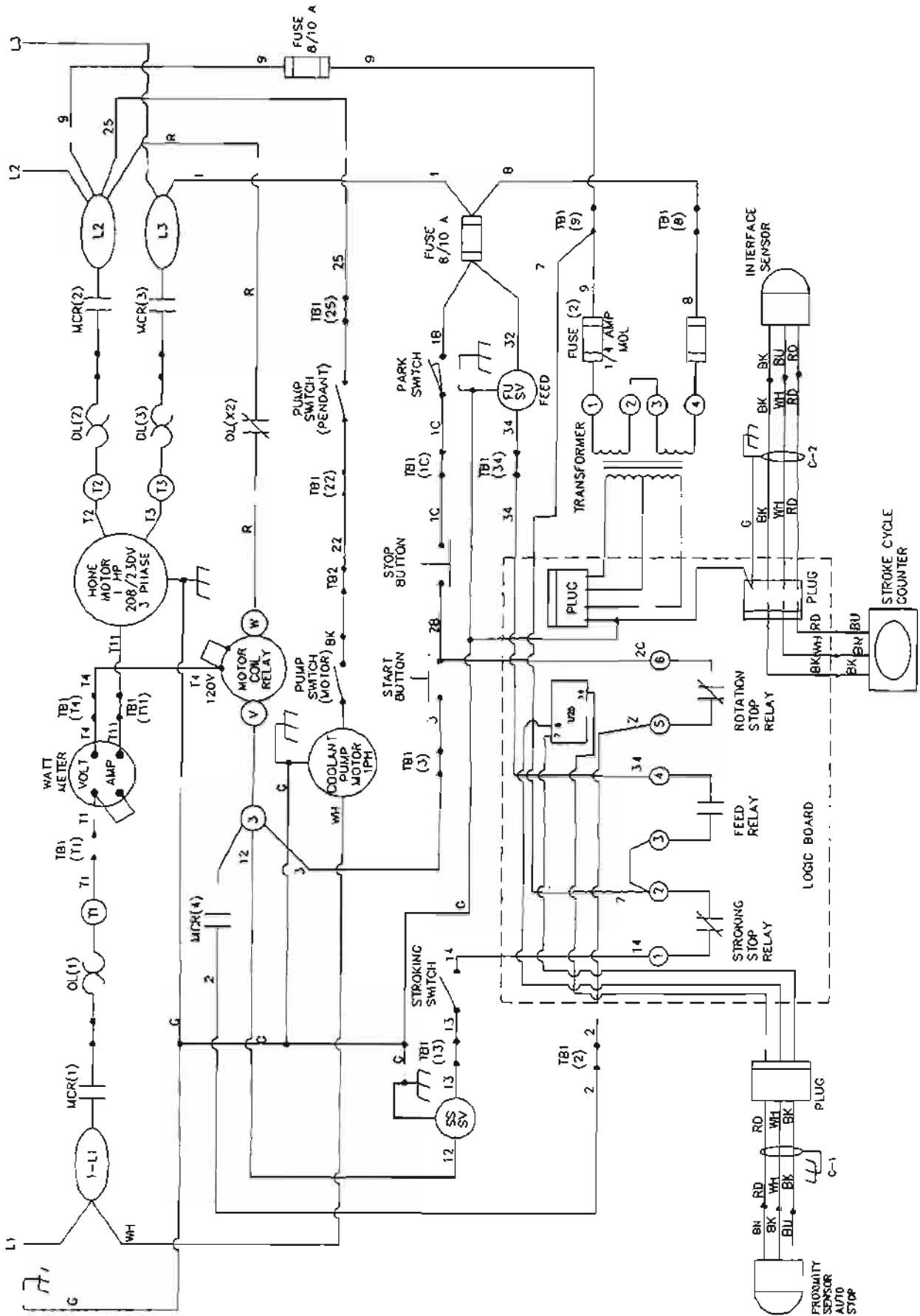
NOTE 187-107293



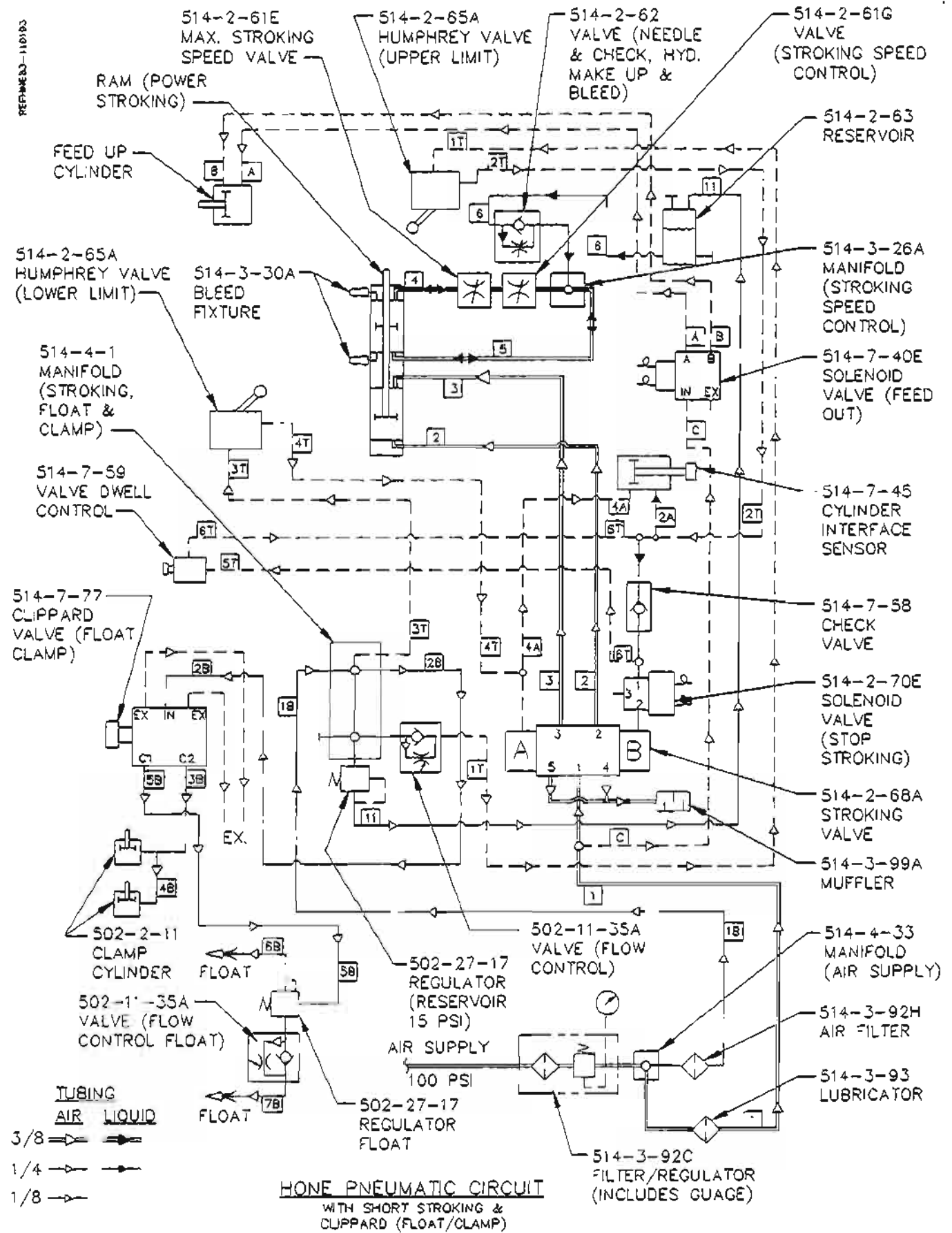
**IMPORTANT**  
ELECTRICALLY CONNECT IN ACCORDANCE WITH NATIONAL AND LOCAL ELECTRICAL CODES.

**CAUTION: DISCONNECT ALL POWER BEFORE SERVICING.**

REFRNET193-072694



(see also oldstyle parts assemblies at the end of this manual)



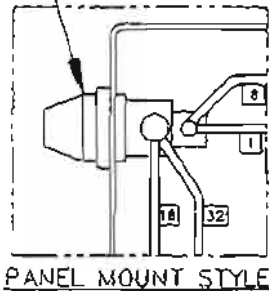


REF/INC 45-092282

502-27-33A  
FUSE HOLDER  
502-27-32B  
FUSE  
FNM 8/10 AMP

HONE MOTOR  
STARTER

ELECTRICAL  
230 VOLTS 3 PHASE  
60 HERTZ  
IMPORTANT  
ELECTRICALLY CONNECT  
IN ACCORDANCE WITH  
NATIONAL ELECTRICAL  
CODE AND YOUR LOCAL  
CODES



PANEL MOUNT STYLE

502-27-32J  
FUSE BLOCK  
502-27-32H  
FUSE  
MDA 8/10 AMP

502-11-3X  
MOTOR STARTER  
ENCLOSURE

FOR "H" TYPE  
HEATER ELEMENTS  
SEE BACK OF  
MOTOR STARTER  
ENCLOSURE COVER

TO CARRIAGE

700-4  
STRAIN RELIEF

400-7-8  
CORD

TO COOLANT  
PUMP

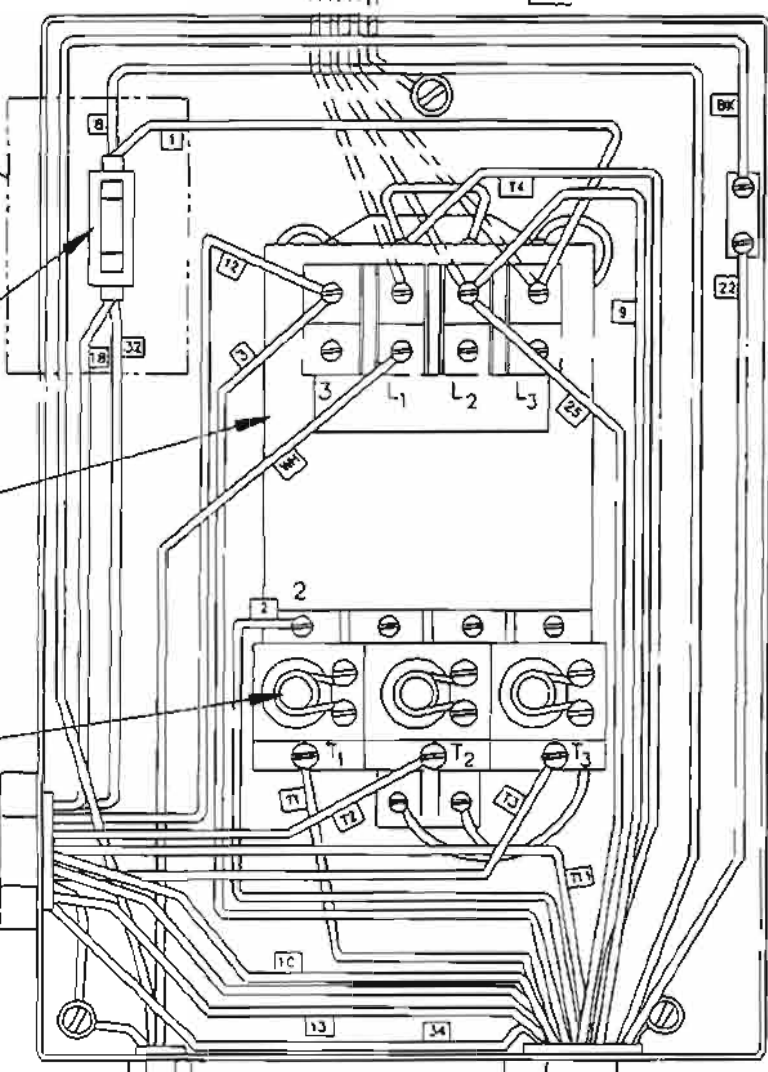
502-6-8  
CONNECTOR  
RIGHT ANGLE  
3/4" (2 REQ'D)

TO CONTROL  
PANEL

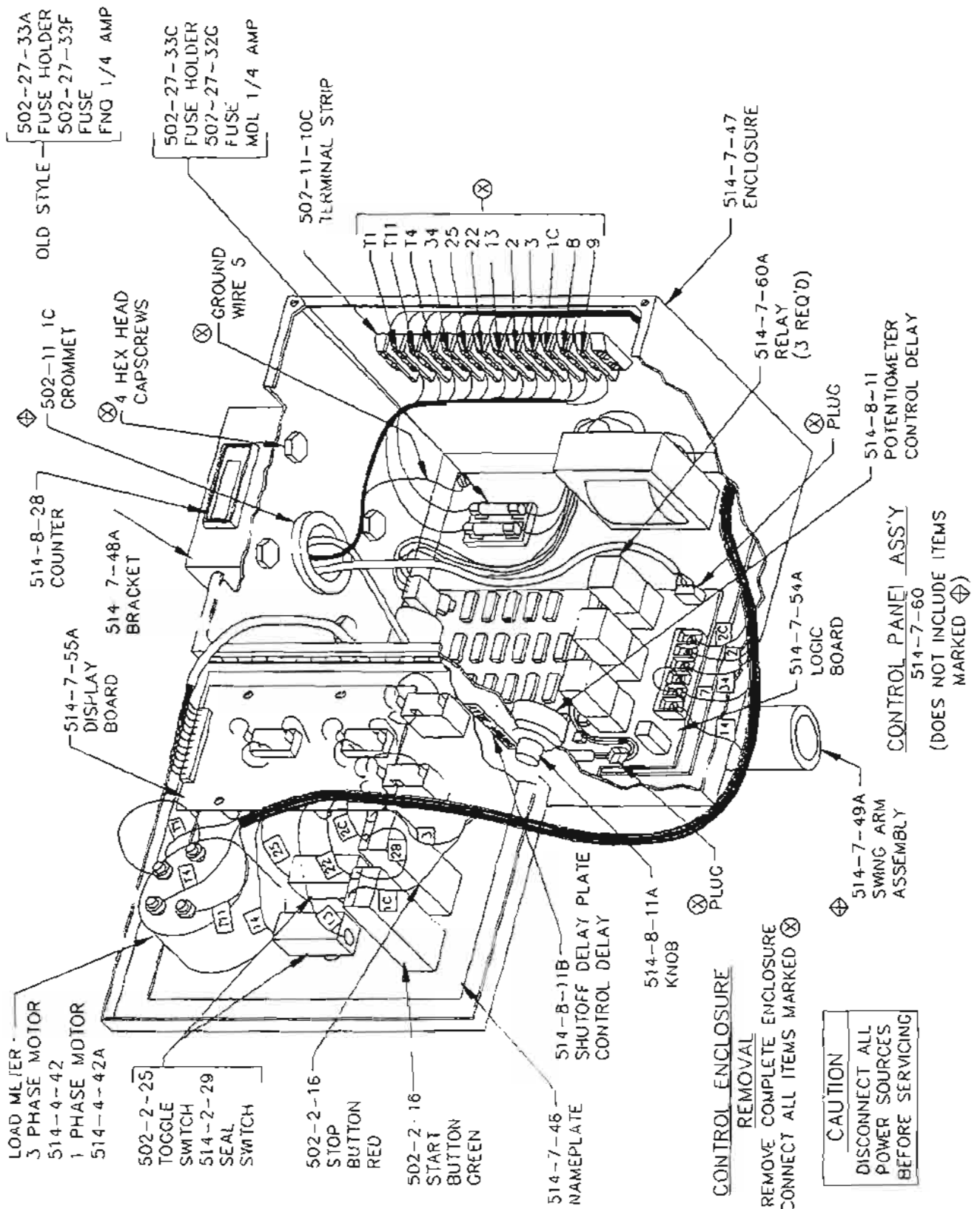
502-1-11A  
CONDUIT 3/4"  
(2 REQ'D)

**CAUTION**  
DISCONNECT ALL  
POWER SOURCES  
BEFORE SERVICING

ELECTRICAL POWER  
SUPPLY PANEL



REF: 48-110293

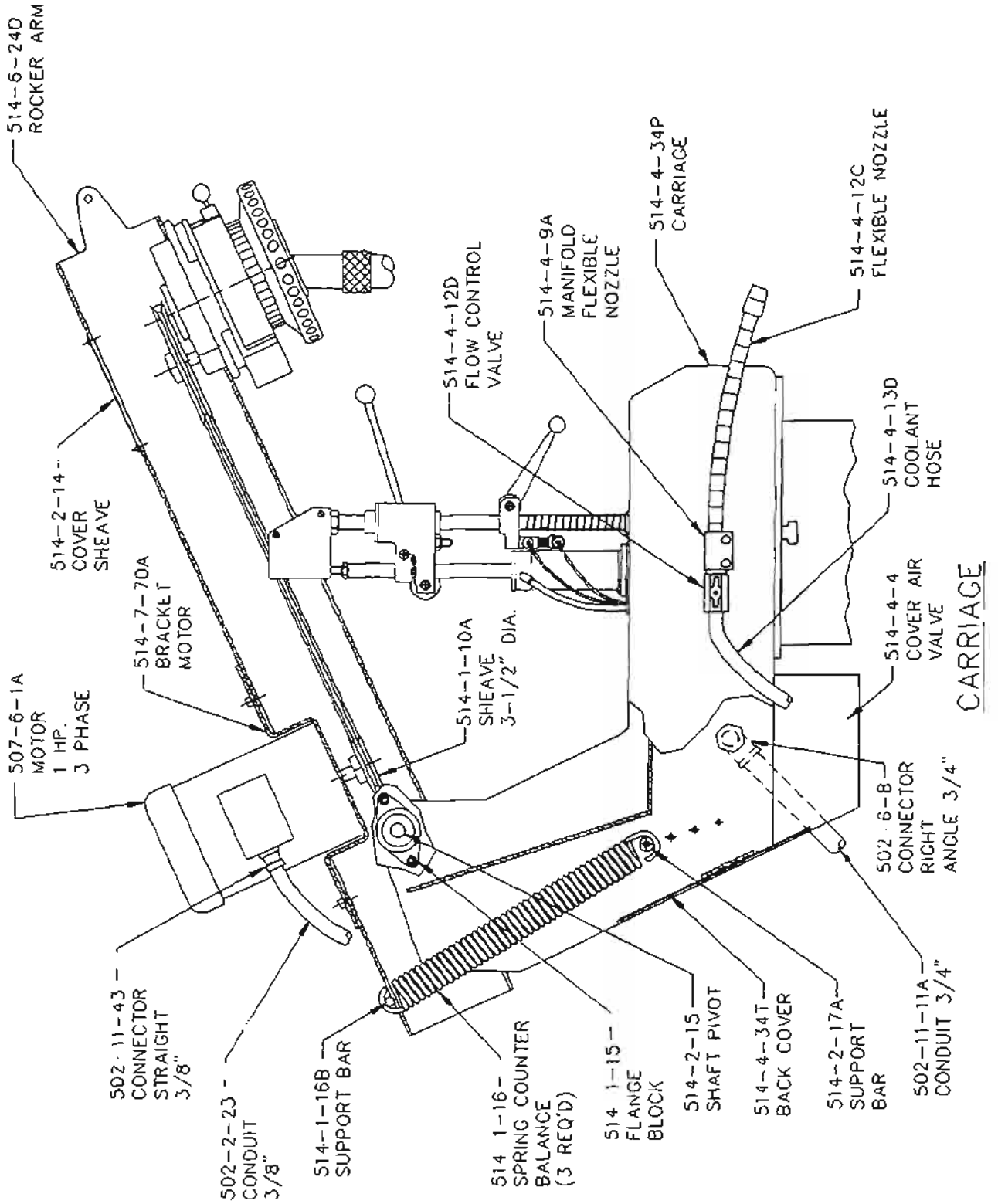


**CONTROL ENCLOSURE**

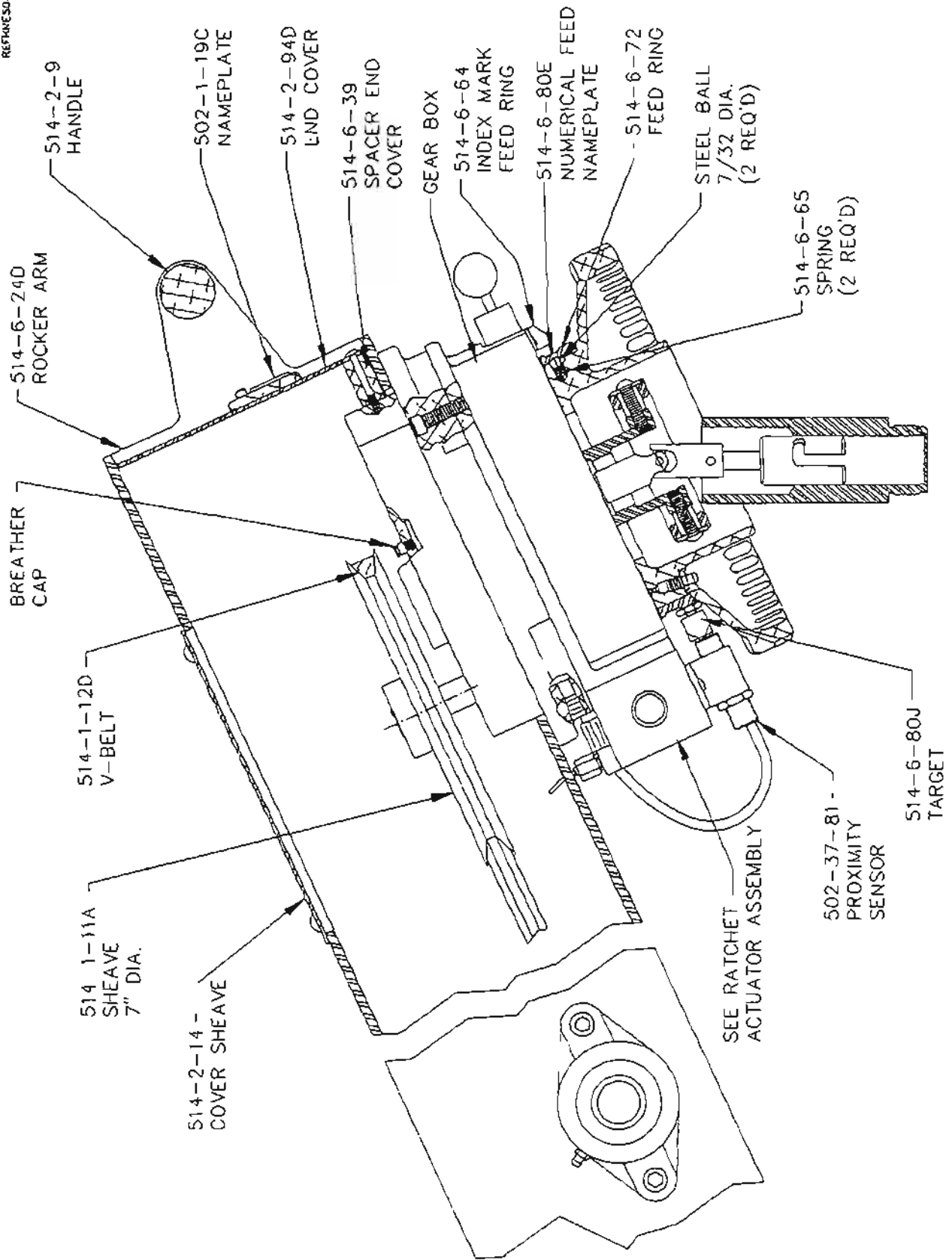
**REMOVAL**  
TO REMOVE COMPLETE ENCLOSURE  
DISCONNECT ALL ITEMS MARKED ⊕

**CAUTION**  
DISCONNECT ALL  
POWER SOURCES  
BEFORE SERVICING

REF: 40-092292

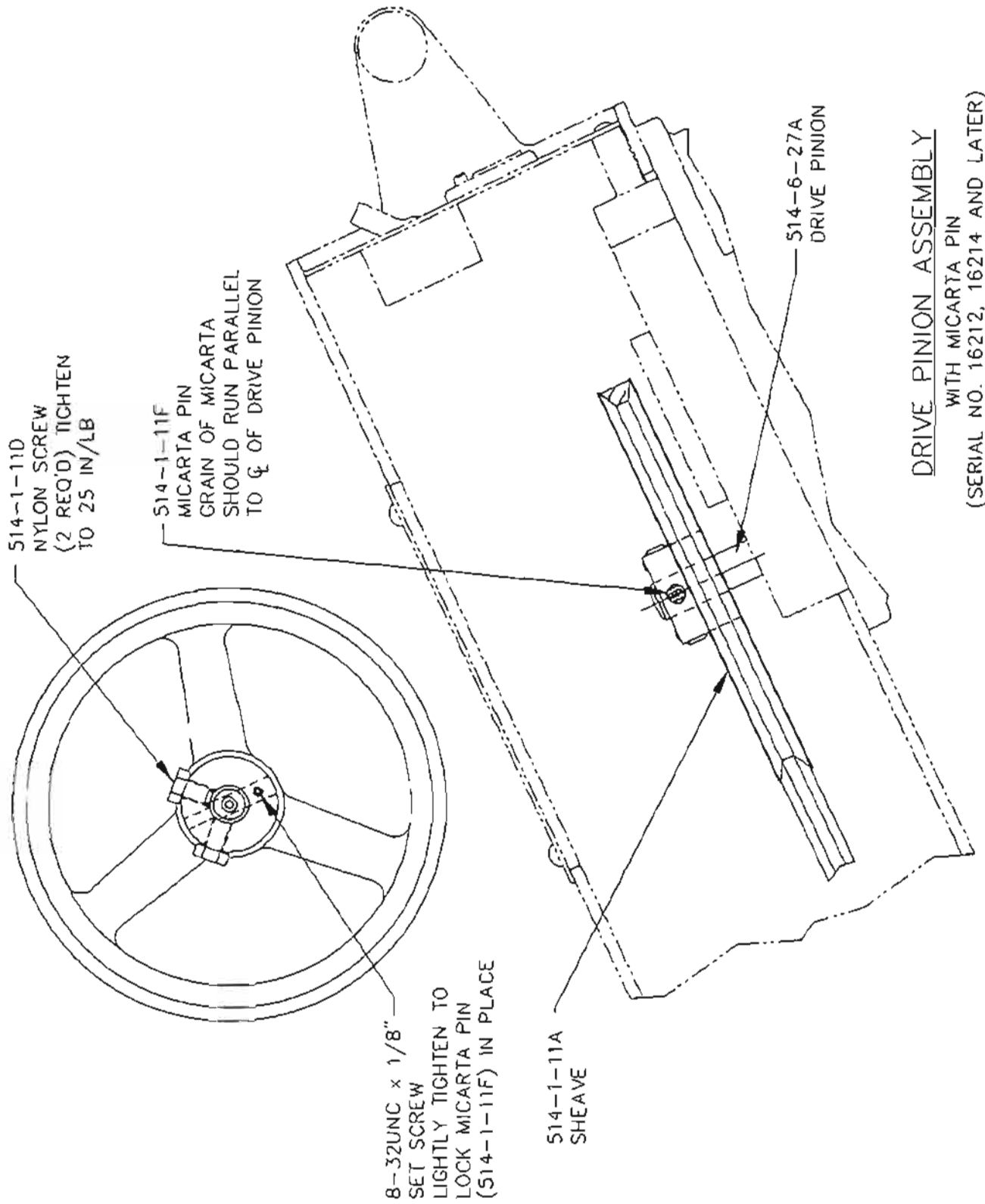


REF:44ES0-11029J



(see also oldstyle parts assemblies at the end of this manual)

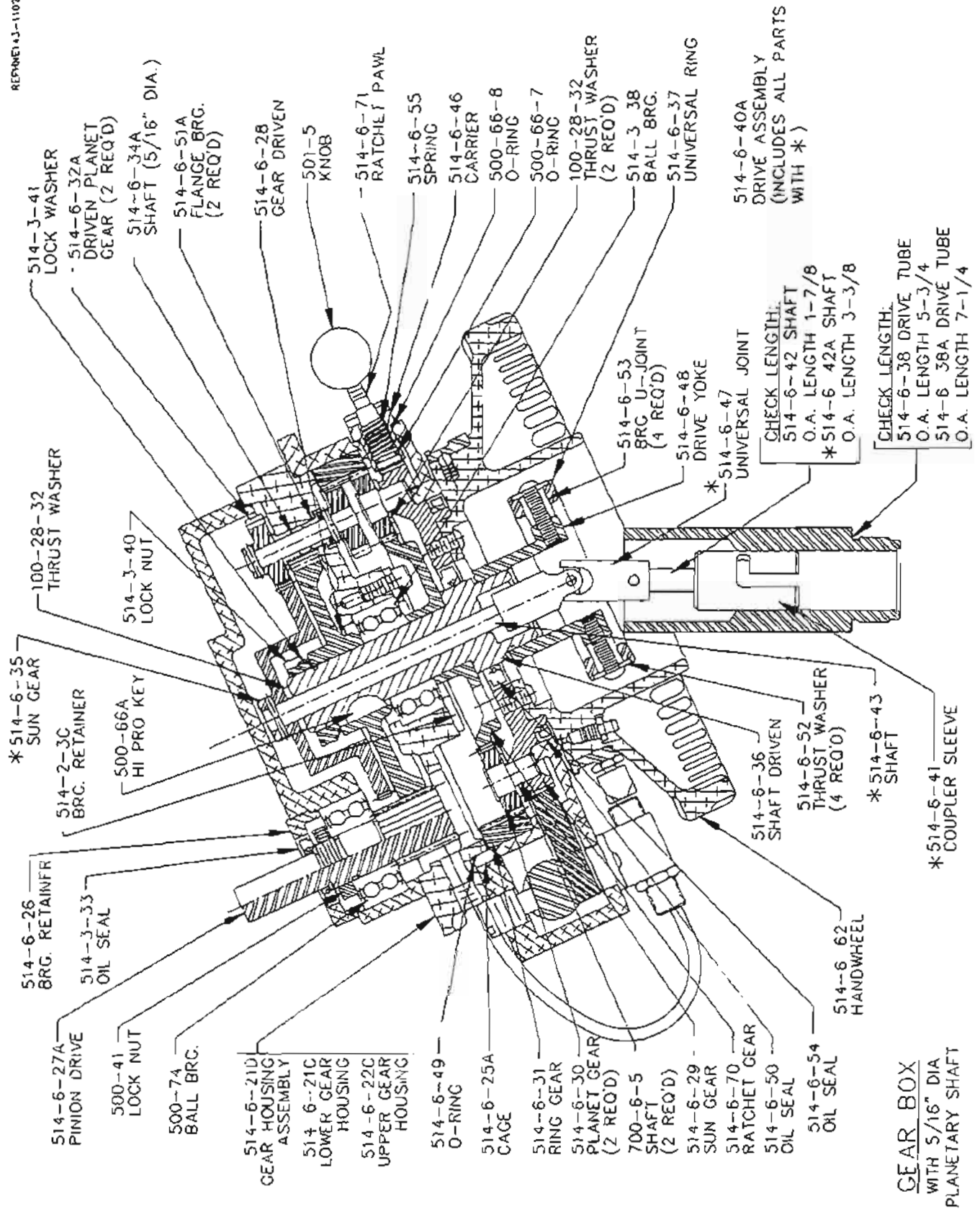
REF:AVEL 20-092292



DRIVE PINION ASSEMBLY  
 WITH MICARTA PIN  
 (SERIAL NO. 16212, 16214 AND LATER)

(see also oldstyle parts assemblies at the end of this manual)

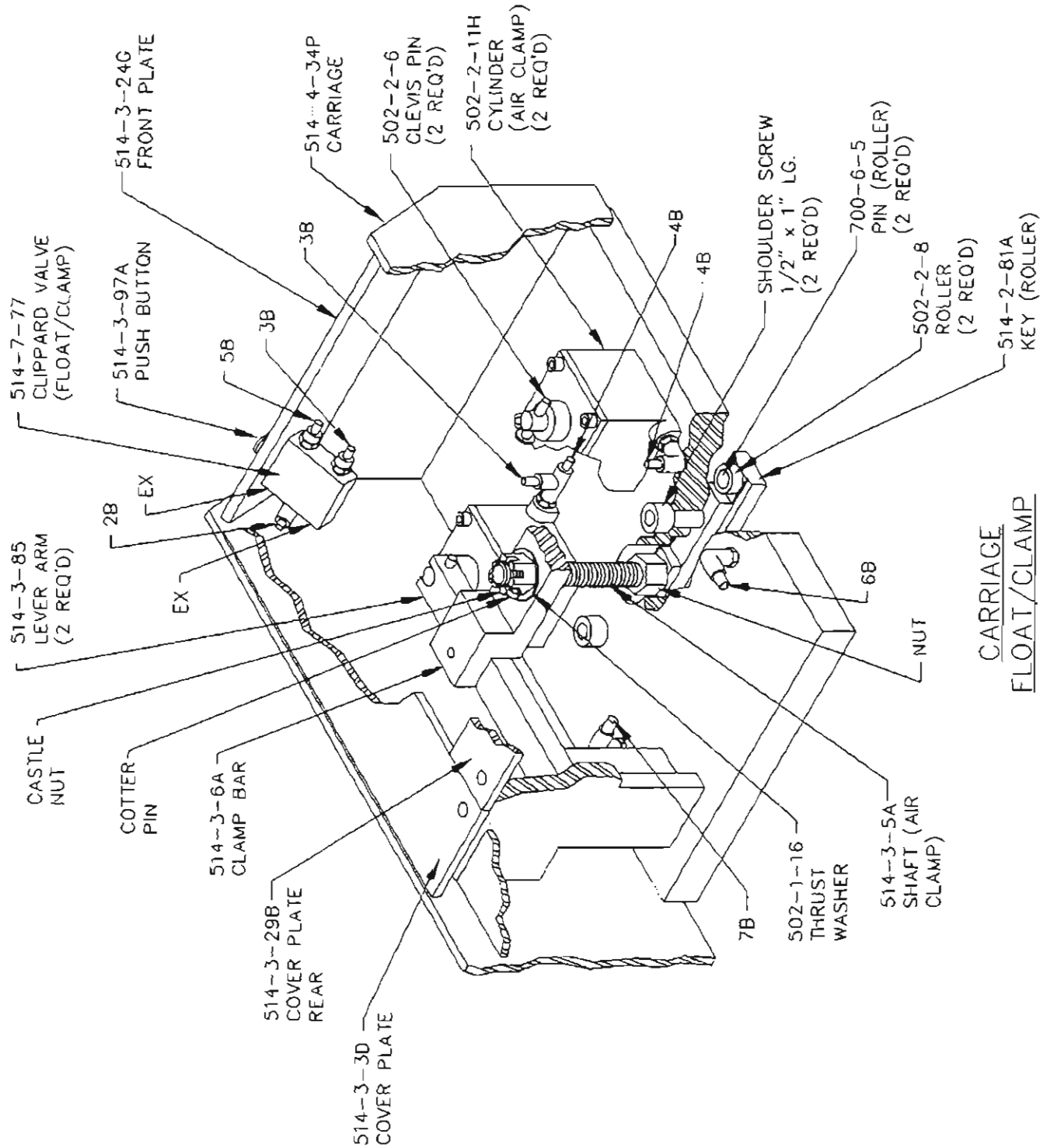
REF PARTS J-11029.



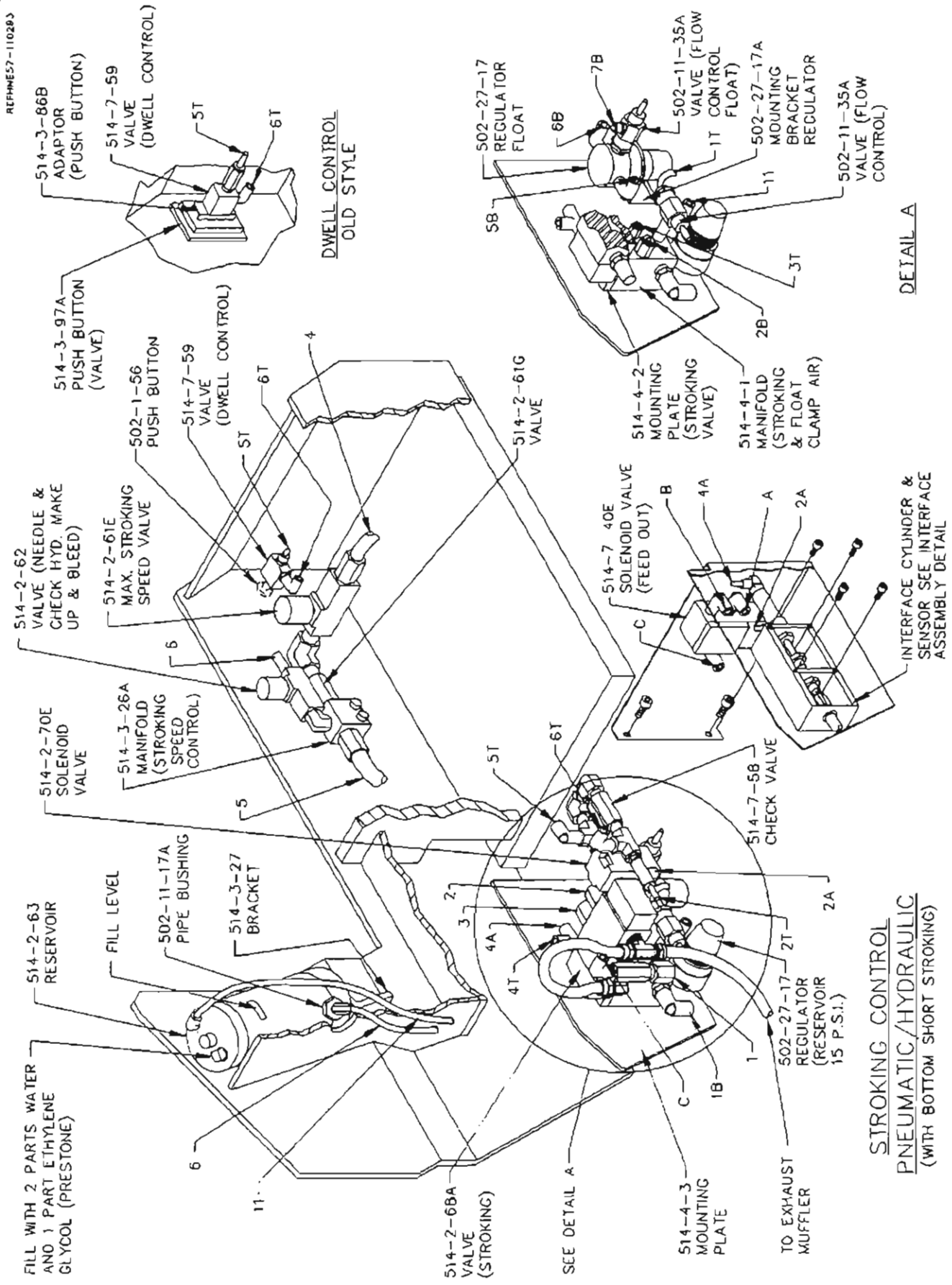
GEAR BOX WITH 5/16" DIA PLANETARY SHAFT

(see also oldstyle parts assemblies at the end of this manual)

REFRME34-062292



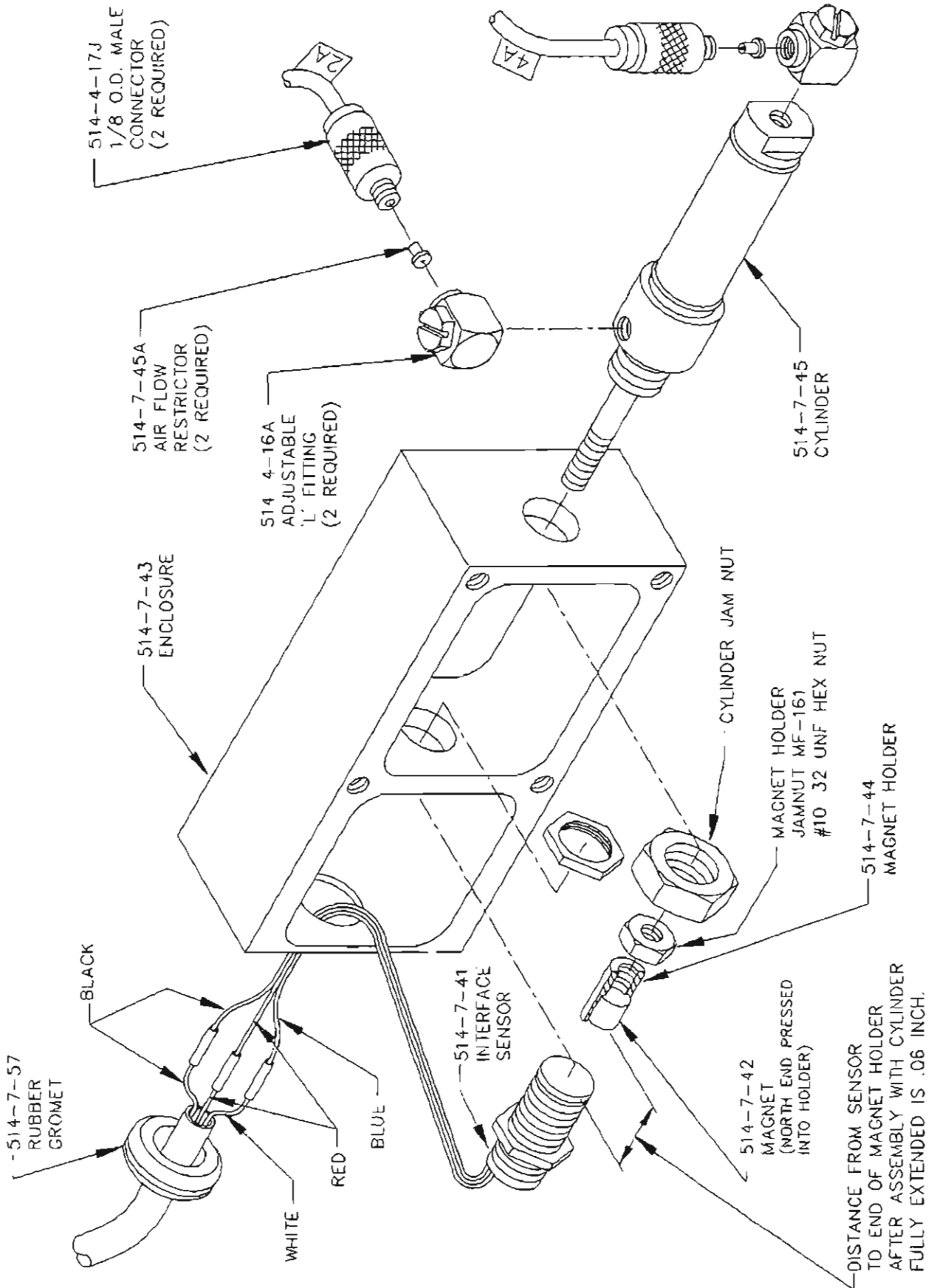
REFPME57-110283

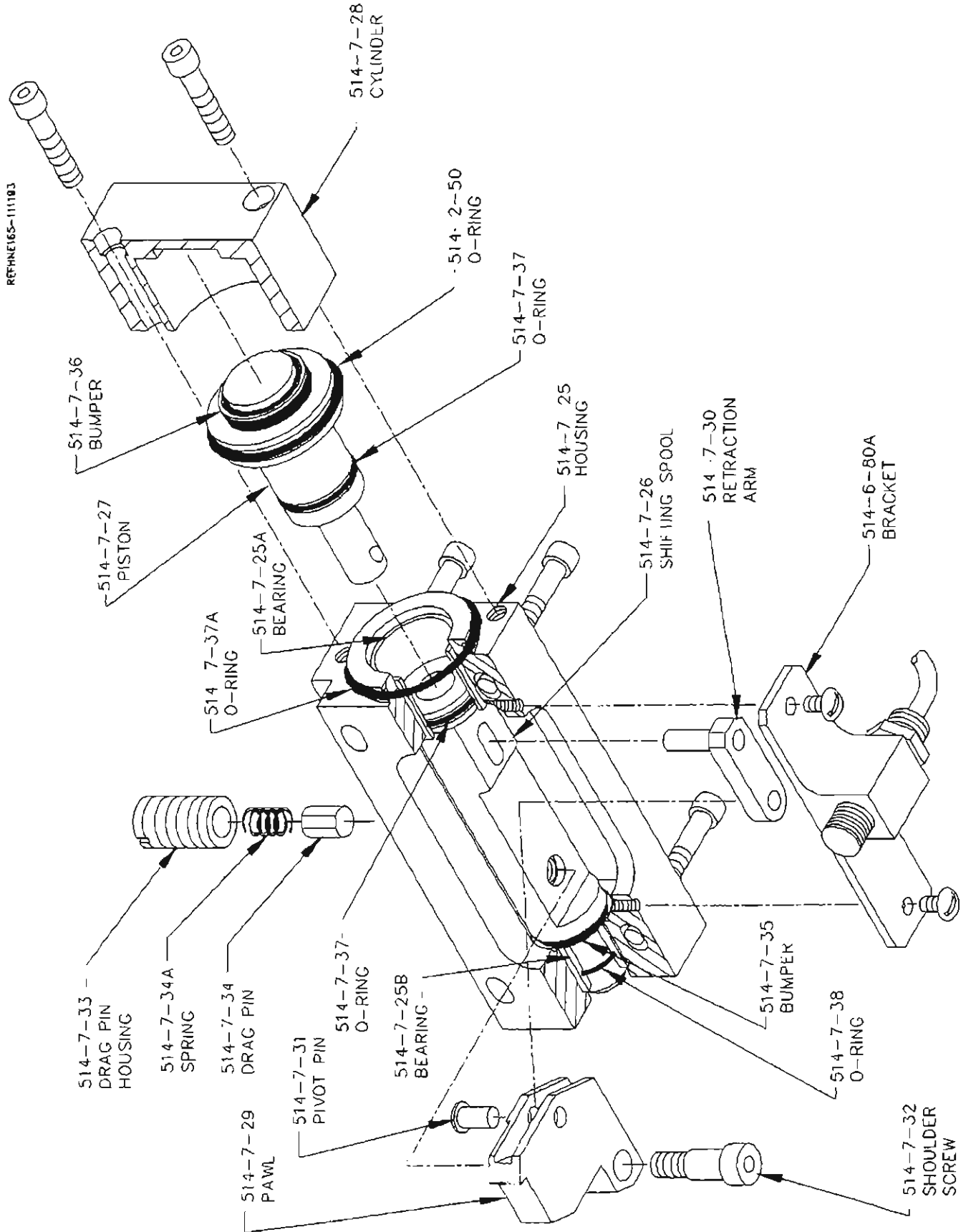


**STROKING CONTROL**  
**PNEUMATIC/HYDRAULIC**  
 (WITH BOTTOM SHORT STROKING)

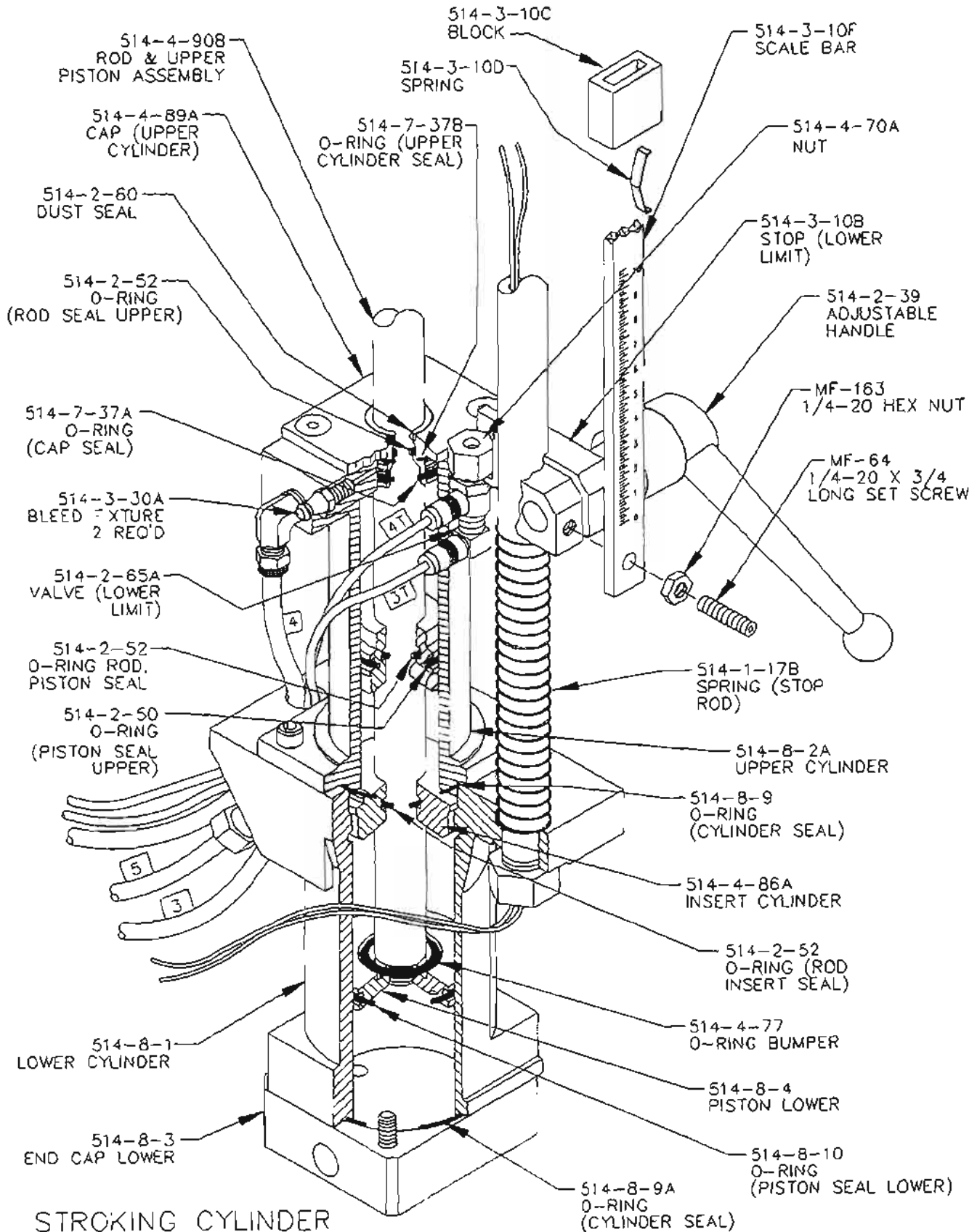


REF:HP163-111193





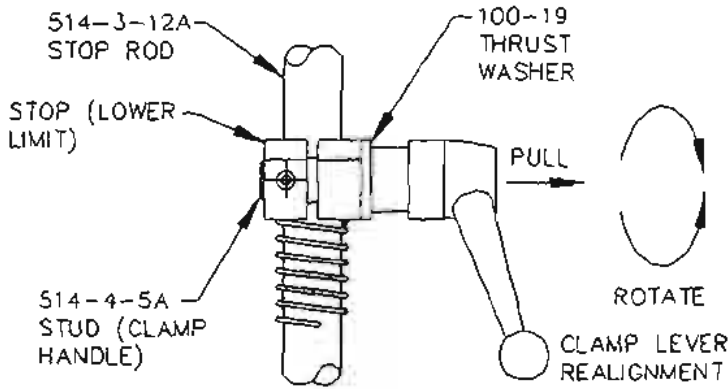
(see also oldstyle parts assemblies at the end of this manual)



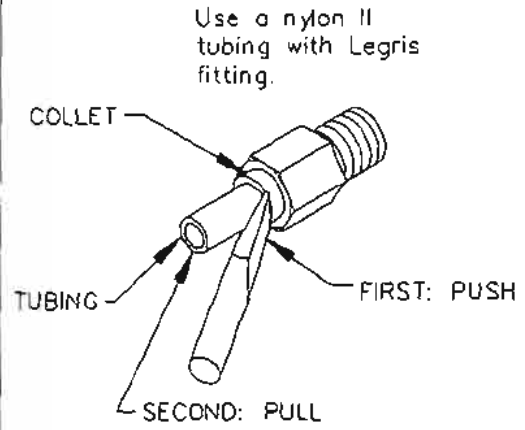
### STROKING CYLINDER

HUMPHREY VALVE ASSEMBLY 514-3-14E

AEPHHE12-0002102



LOWER TRAVEL LIMIT STOP LEVER  
VIEW B-B

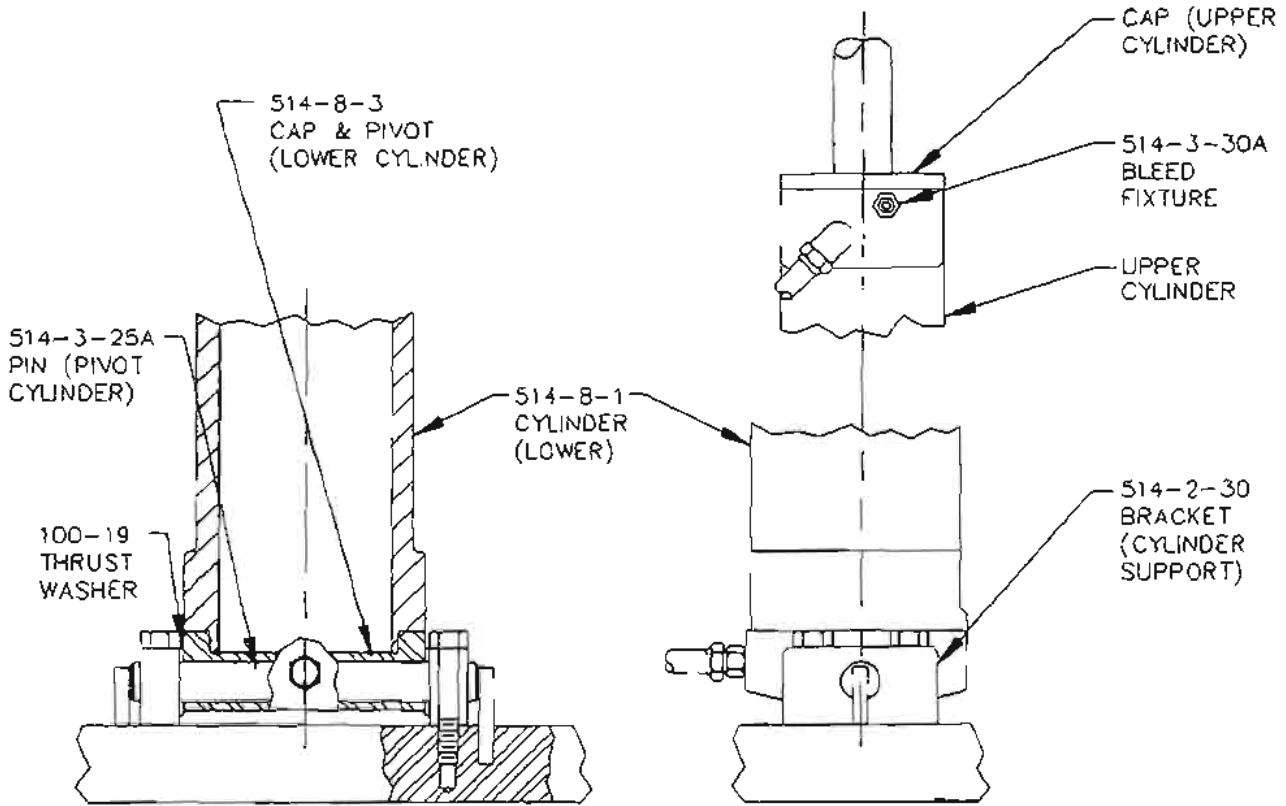


LEGRIS TUBE FITTINGS

To Disconnect Tubing from Legris fitting—push collet with a screwdriver then pull tubing.

To connect tubing to Legris fittings just push tubing into fitting.

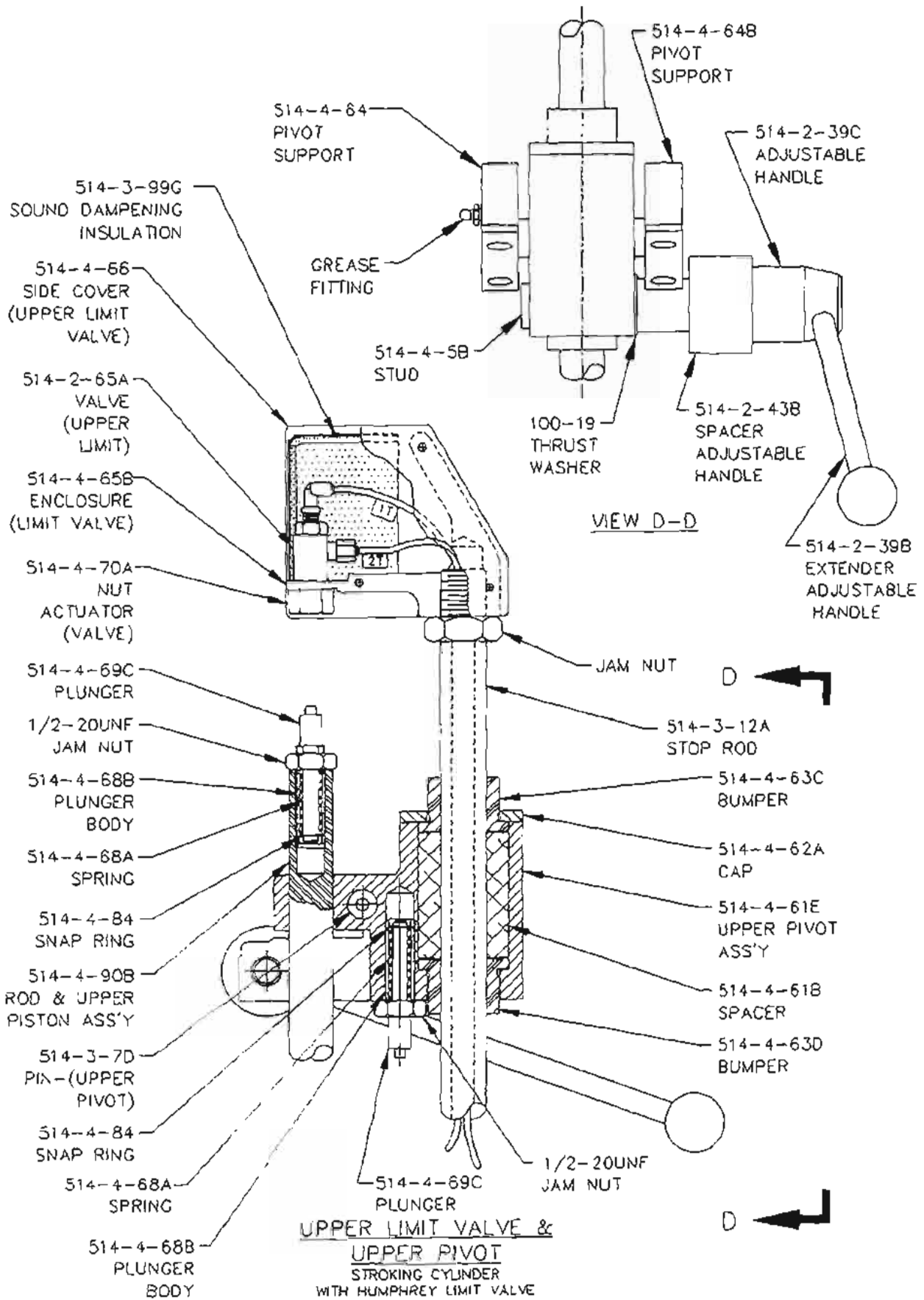
NOTE: Tubing must be all the way in to seal tubing. First past a gripping ridge then thru an O-ring.



SECTION A-A

(see also oldstyle parts assemblies at the end of this manual)

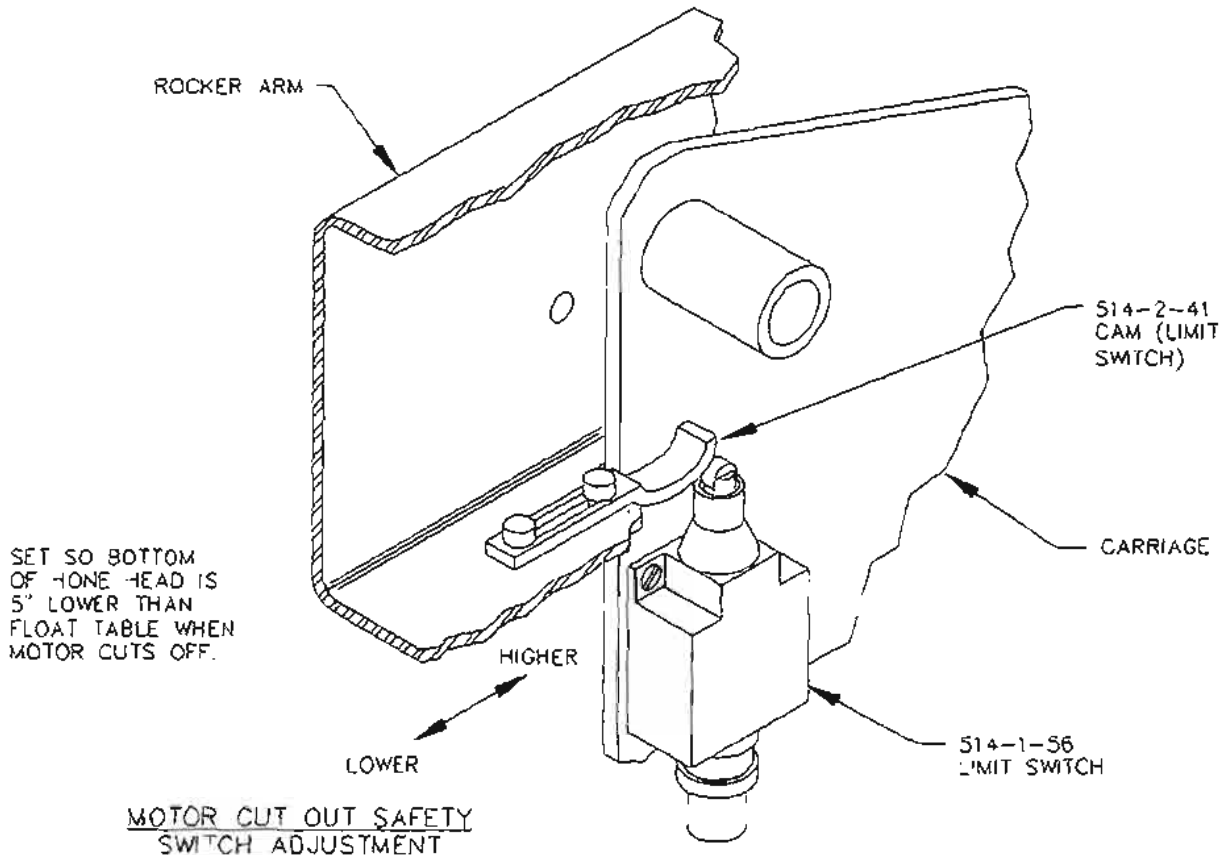
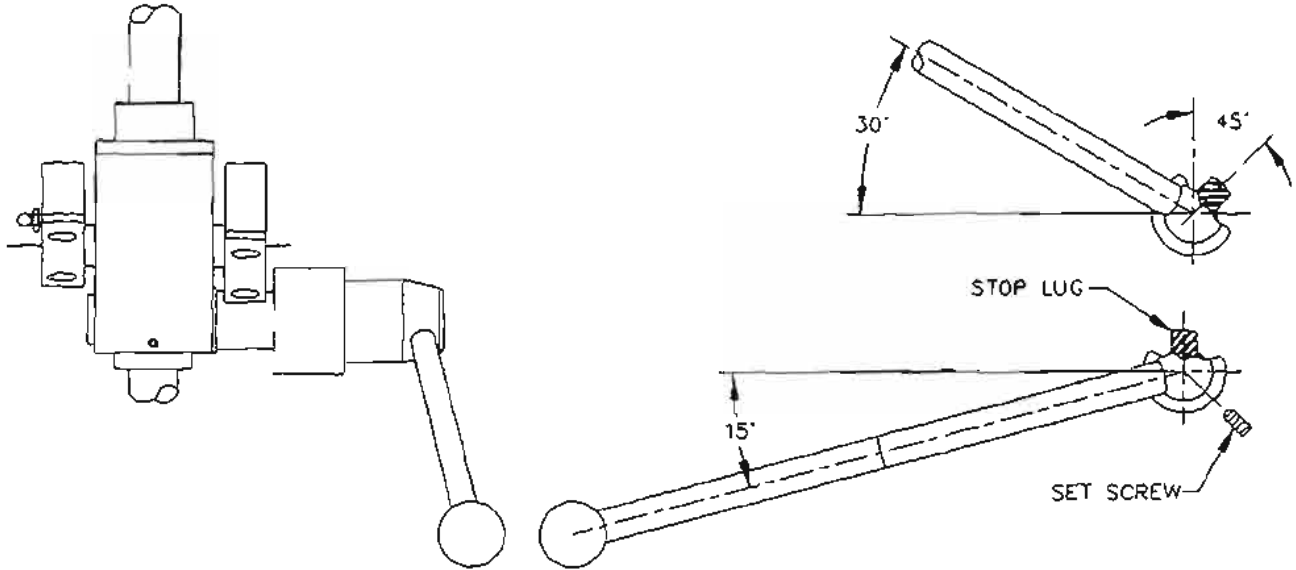
REFINING-081283



REF: 46-0100992

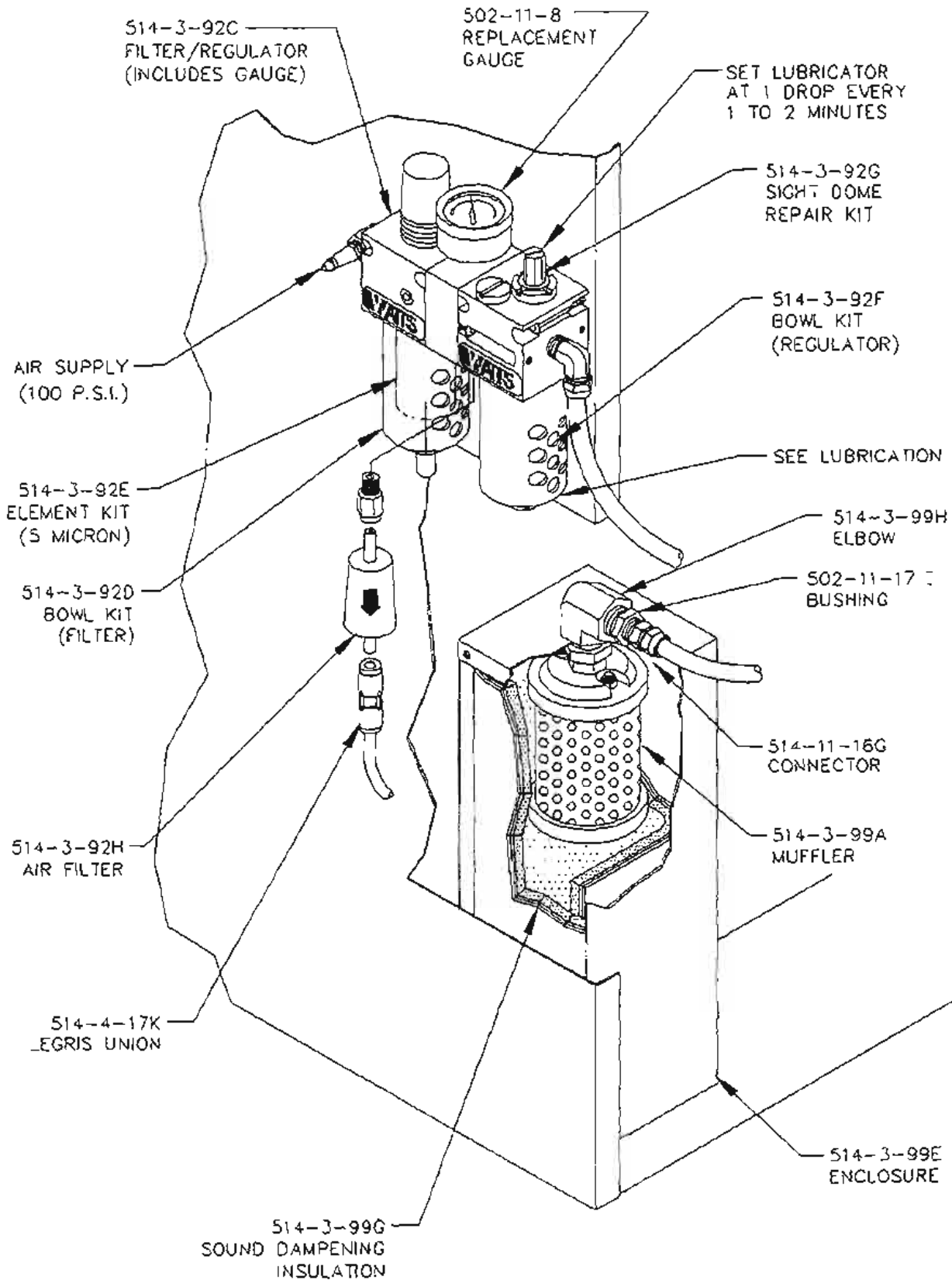
UPPER PIVOT ASSEMBLY LOCK

1. LOOSEN CLAMP HANDLE.
2. UNSCREW THE 2 DOG POINT SET SCREWS IN THE SPACER HUB.
3. TURN SPACER UNTIL STOP LUG IS 45° FROM VERTICAL.
4. TIGHTEN CLAMP HANDLE. WITHOUT MOVING SPACER FROM THIS POSITION, UNTIL UPPER PIVOT IS LOCKED TO PISTON ROD.
5. PULL HANDLE HUB OUT AND ROTATE HANDLE UNTIL IT IS 30° UP FROM HORIZONTAL AND THE TWO HOLES IN THE HANDLE HUB ARE LINED UP WITH THE HOLES IN SPACER HUB.
6. RETIGHTEN THE 2 DOG POINT SET SCREWS IN HUB OF THE SPACER.

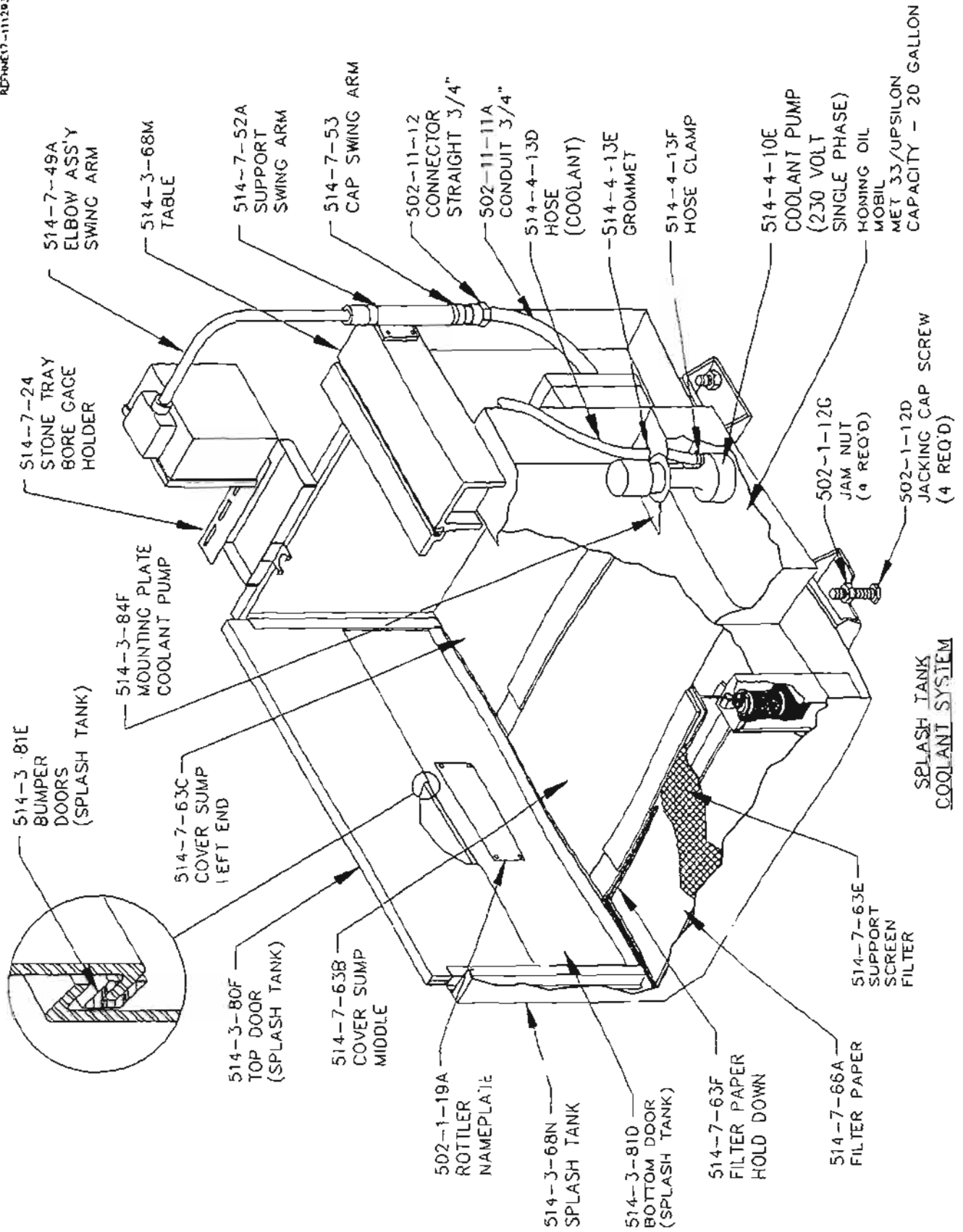


(see also oldstyle parts assemblies at the end of this manual)

REF: 91-21653



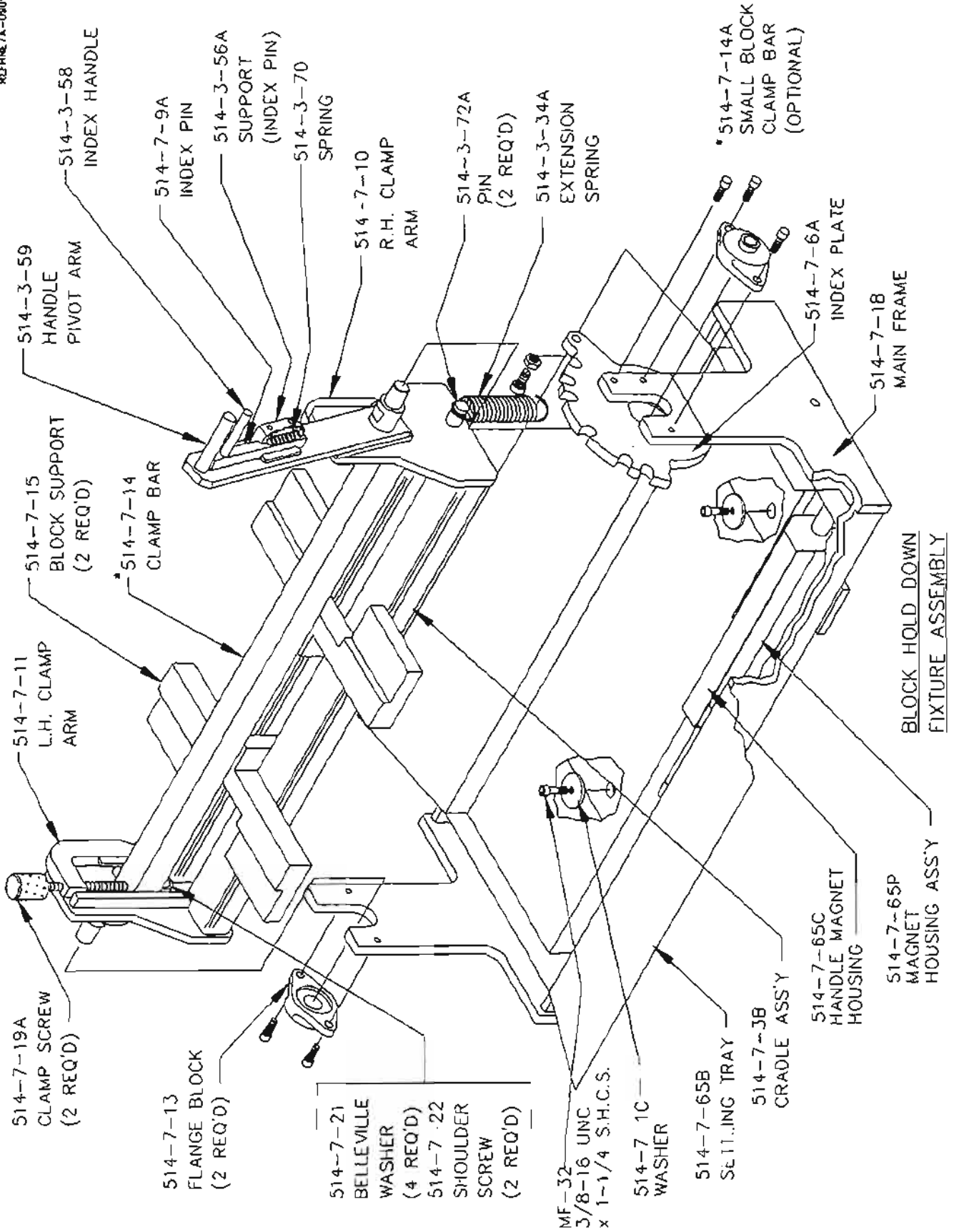
REF: 111293



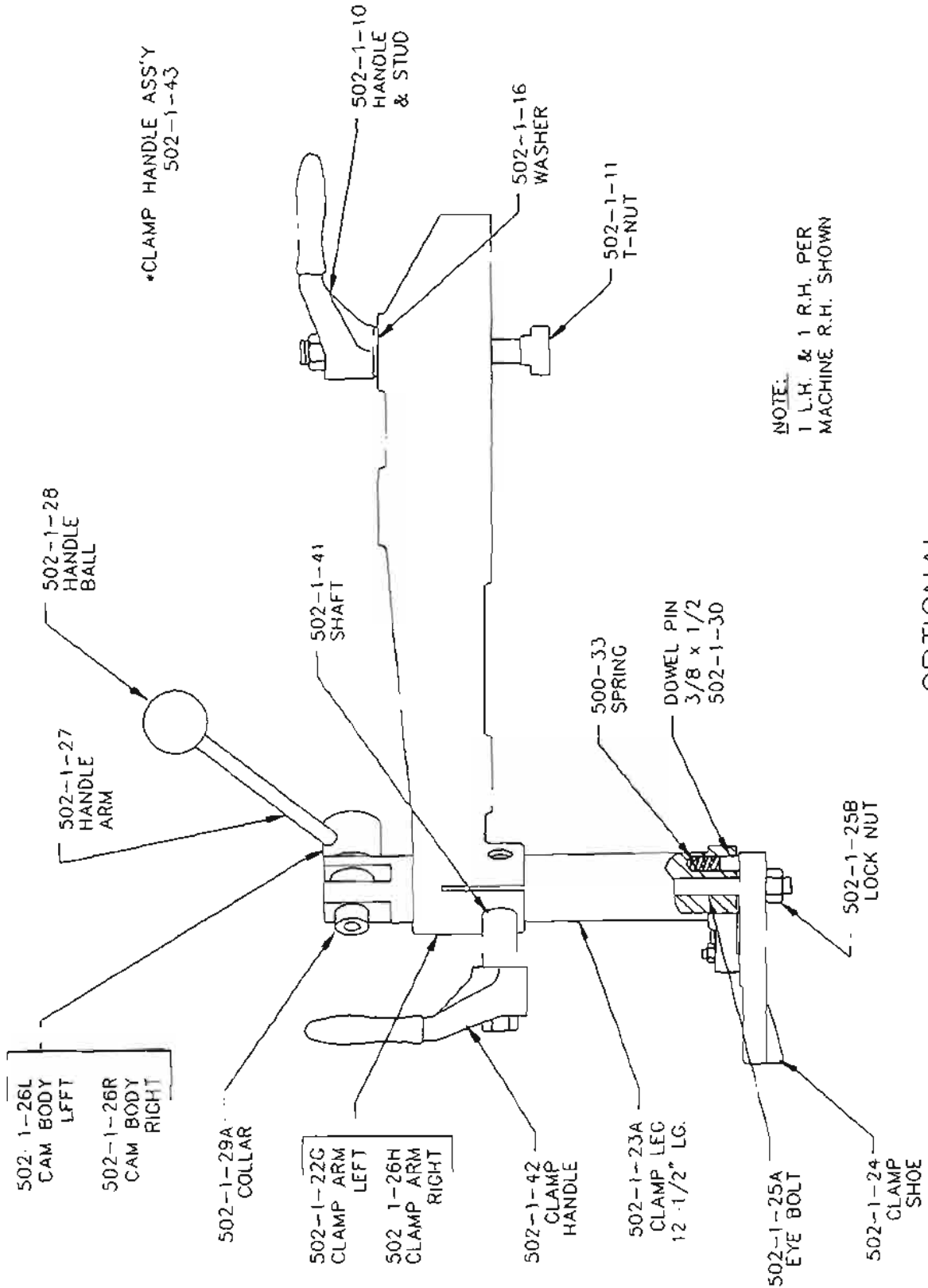




REF:NETA-060992

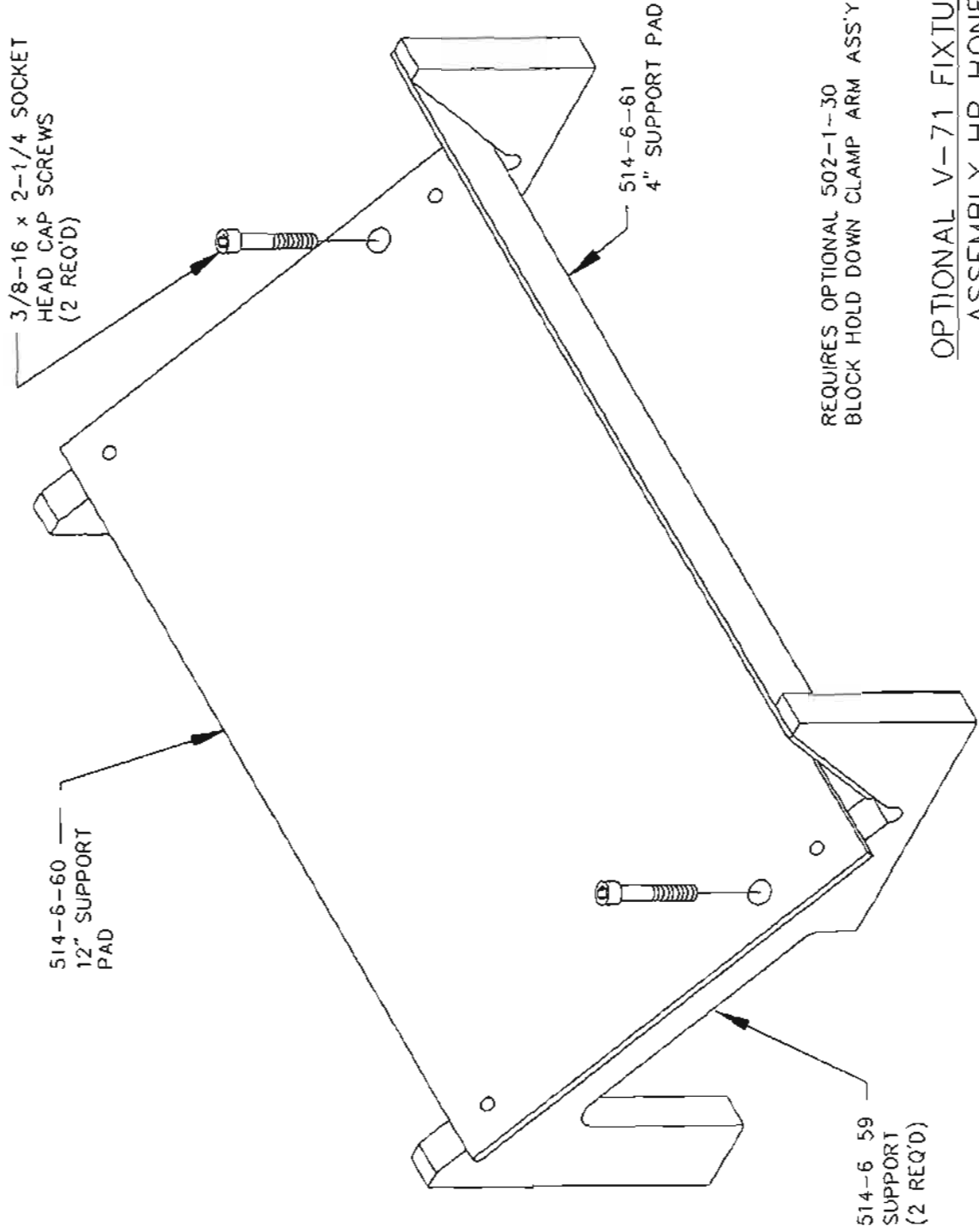


REF: 161-082062

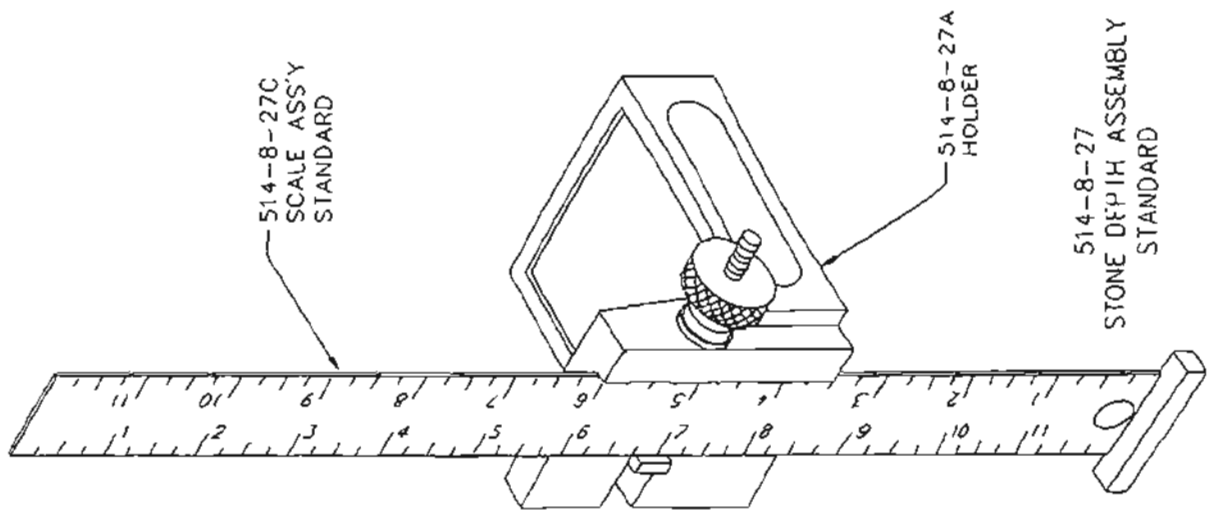
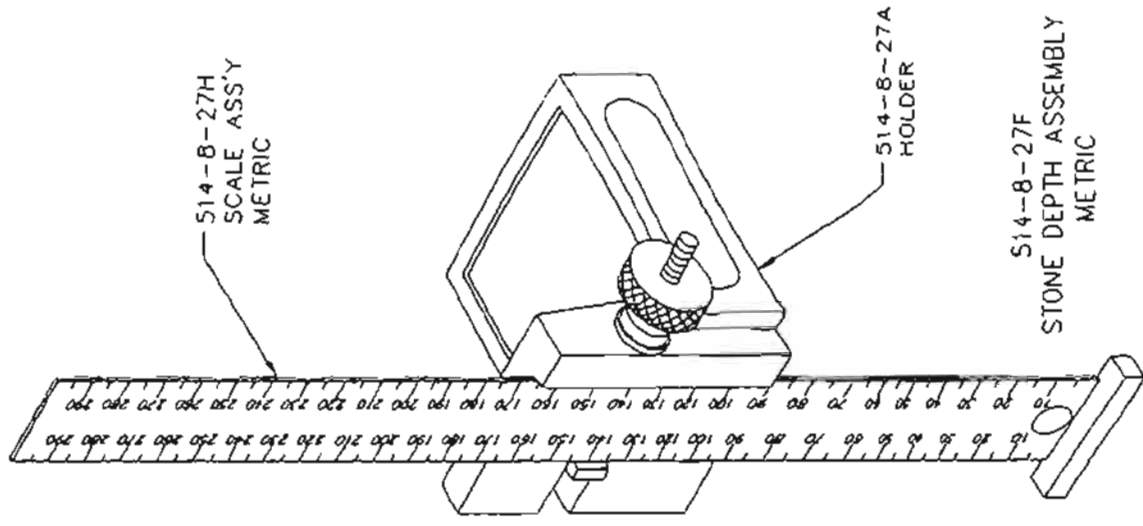


OPTIONAL  
BLOCK HOLDDOWN CLAMP ASSEMBLY

60794E32-002092



REF:MET 41-082092



OPTIONAL STONE DEPTH ASSEMBLY

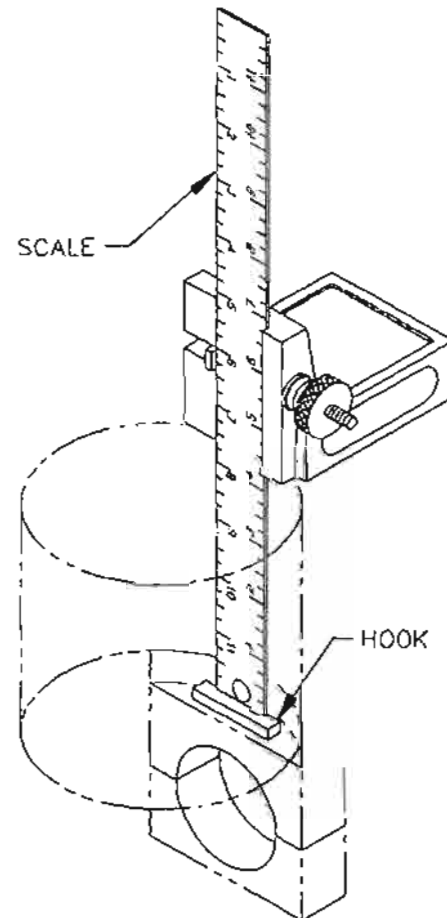
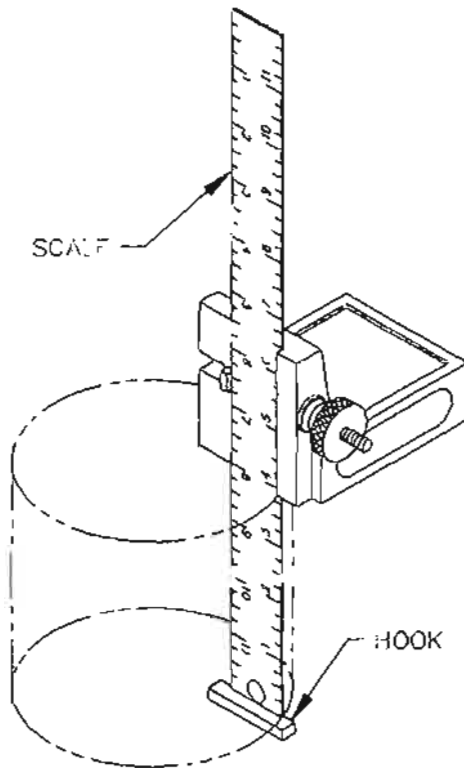
Setting lower travel limit:

1. Place stone depth setting assembly on deck surface of block with scale in cylinder.
2. Lower scale to touch upper surface of hook on deepest point of cylinder wall.
3. Read depth on scale, then lower scale 3/4" to 1" (19 to 25 mm). Lock scale.
4. Lower hone head into cylinder and touch the bottom of the stones to the upper surface of the hook. Lock this lower limit setting on the stroking cylinder.

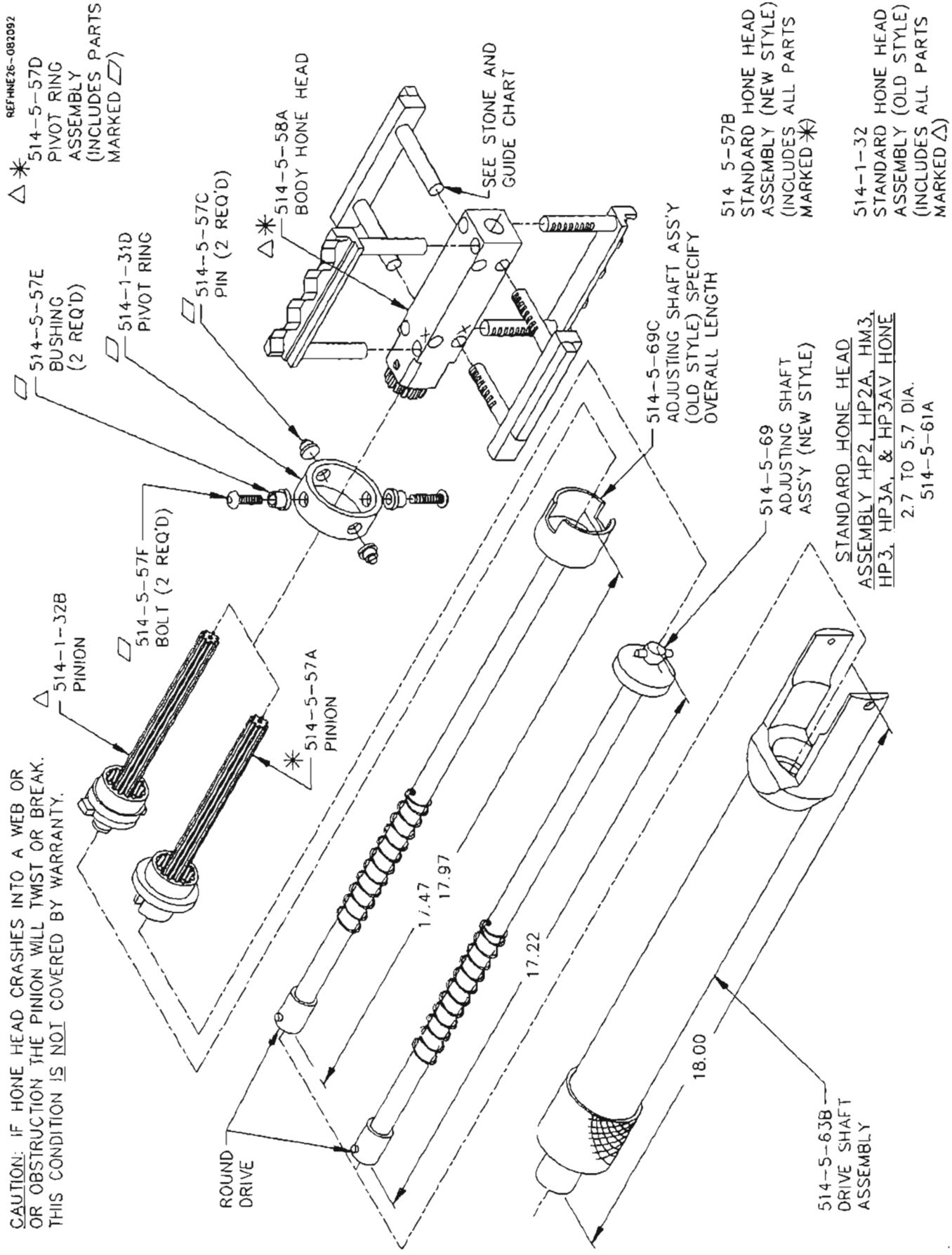
Setting lower travel limit with obstruction:

1. Place stone depth setting assembly on deck surface of block with scale in cylinder.
2. Lower scale until bottom of the hook touches the highest point of the obstruction (main bearing web, etc.).
3. Lower hone head into cylinder and touch the bottom of the stones to the upper surface of the hook. Lock this lower limit setting on the stroking cylinder.

8nα

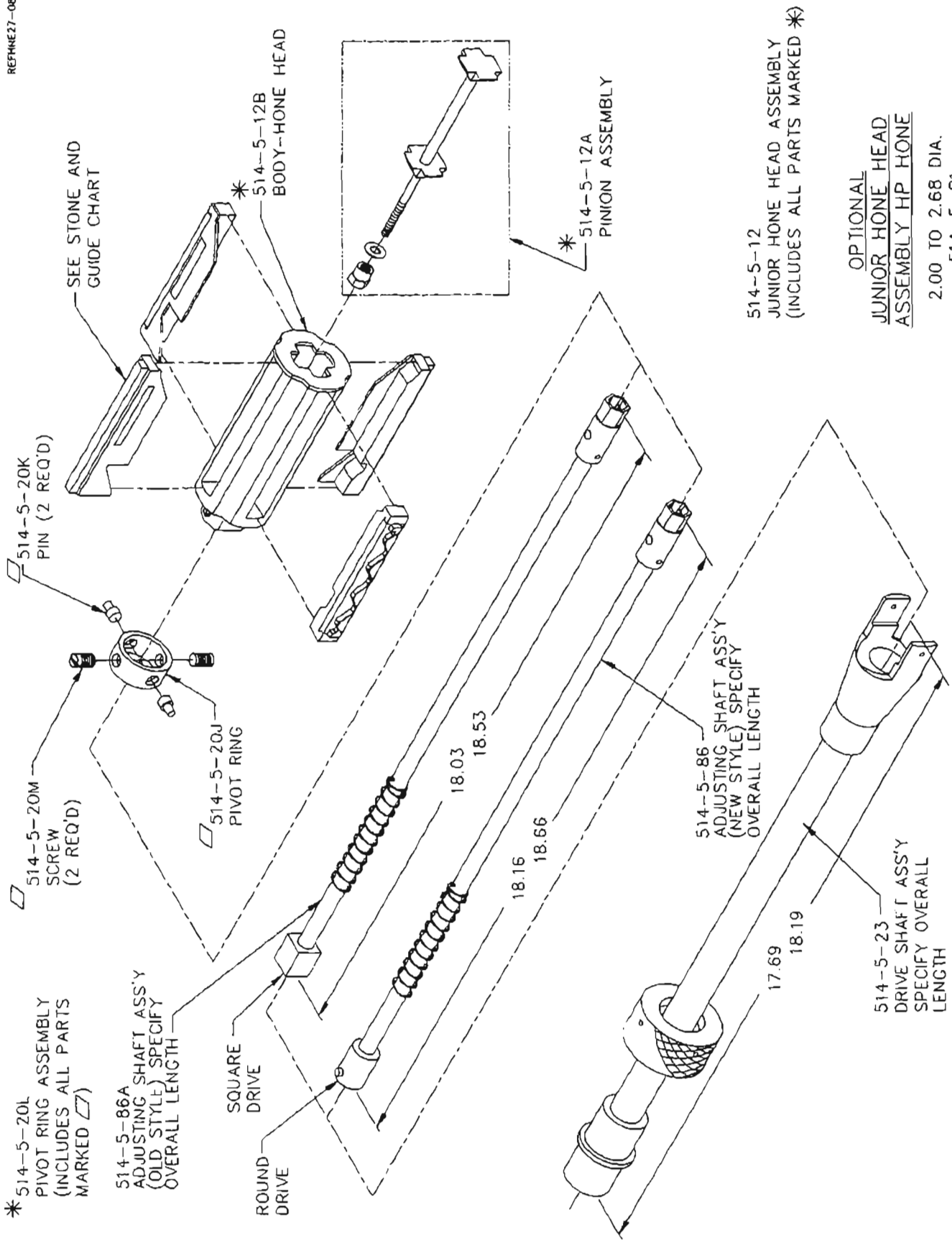


CAUTION: IF HONE HEAD CRASHES INTO A WEB OR OR OBSTRUCTION THE PINION WILL TWIST OR BREAK. THIS CONDITION IS NOT COVERED BY WARRANTY.



REF: HNE26-082092

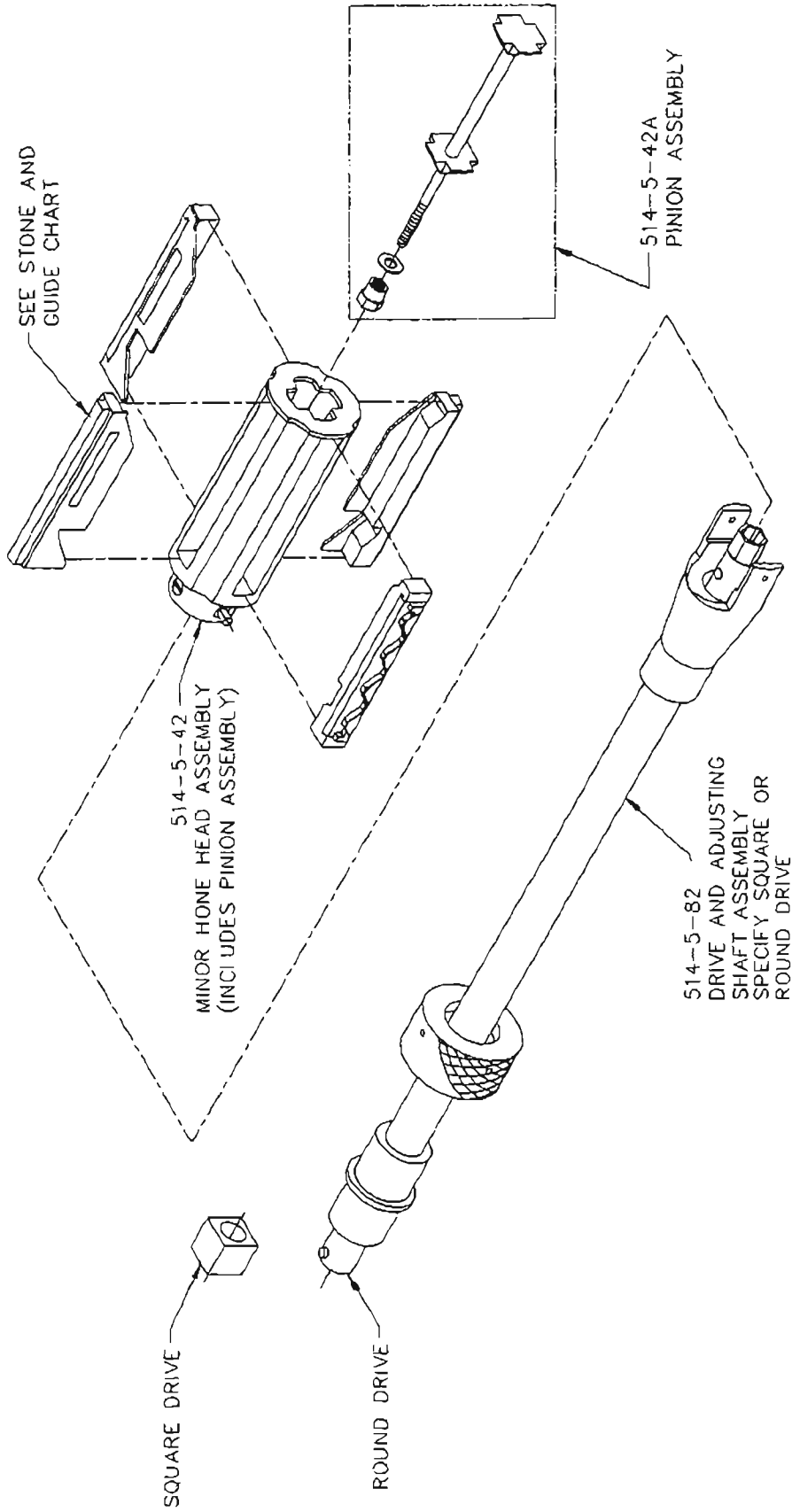
REFRNE27-082092



514-5-12 JUNIOR HONE HEAD ASSEMBLY (INCLUDES ALL PARTS MARKED \*)

OPTIONAL JUNIOR HONE HEAD ASSEMBLY HP HONE 2.00 TO 2.68 DIA. 514-5-81

REF:ME35-082092

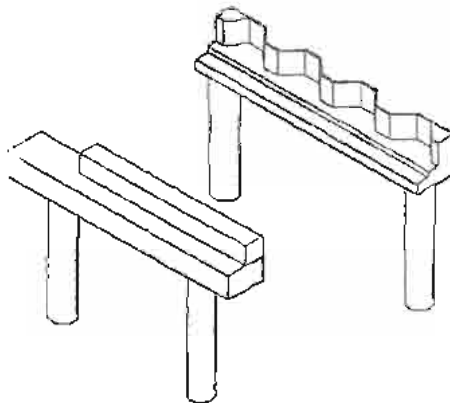


OPTIONAL  
MINOR HONE HEAD  
ASSEMBLY HP HONE  
1.50 TO 2.00 DIA.  
514-5-83



FOR ROTTLER STANDARD HONE HEAD  
 All S.N. listed - Grits and  
 overall stone lengths may be  
 mixed for quantity breaks.

ROTTLER#		DESCRIPTION
<u>RANGE 2.7" to 4.1"</u>		
<u>514-5-52-B</u>	SN100	80 grit, 4" overall stone length
<u>514-5-52-C</u>	SN100	80 grit, 3" overall stone length
<u>514-5-53-D</u>	SN200	180 grit, 4" overall stone length
<u>514-5-53-E</u>	SN200	180 grit, 3" overall stone length
<u>514-5-54-B</u>	SN300	220 grit, 4" overall stone length
<u>514-5-54-C</u>	SN300	220 grit, 3" overall stone length
<u>RANGE 3.4375" to 5.75"</u>		
<u>514-5-52</u>	SN101	80 grit, 4" overall stone length
<u>514-5-52-A</u>	SN101	80 grit, 3" overall stone length
<u>514-5-53-B</u>	SN201	180 grit, 4" overall stone length
<u>514-5-53-C</u>	SN201	180 grit, 3" overall stone length
<u>514-5-54</u>	SN301	220 grit, 4" overall stone length
<u>514-5-54-A</u>	SN301	220 grit, 3" overall stone length

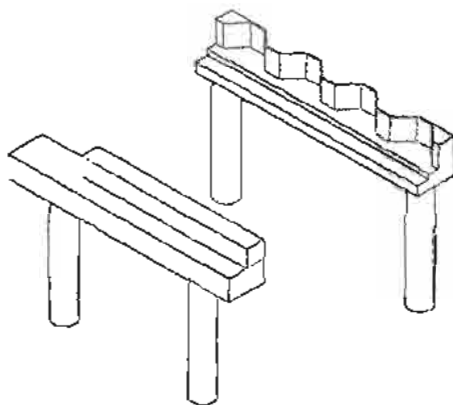


OPTIONAL STONE AND GUIDE SETS  
FOR ROTTLER STANDARD HONE HEAD  
(All orders subject to stock  
availability.)

RANGE: 2.68" to 4.25"

ALL M2F NUMBERS LISTED \*  
SUBJECT TO AVAILABILITY --  
Grits may be mixed for  
quantity breaks.

ROTTLER#		DESCRIPTION
514-1-33	M2F2F	120 Grit
514-1-34	M2F3F	180 Grit
514-5-6	M2F4F	220 Grit
514-5-6A	M2F6F	320 Grit
514-5-8	M2F0F	60 Grit



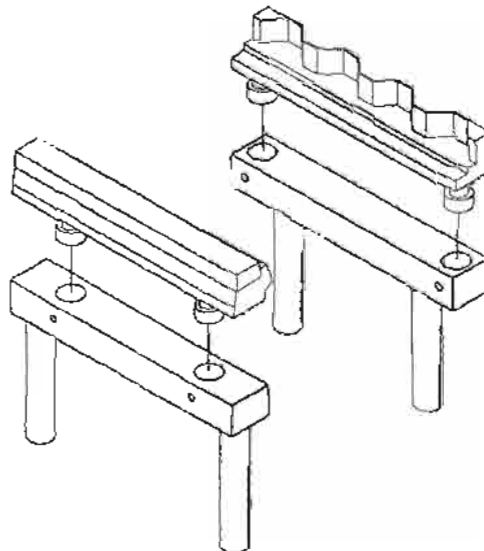
OPTIONAL STONE AND GUIDE SETS  
FOR ROTTLER STANDARD HONE HEAD  
\*(All orders subject to stock  
availability)

RANGE: 3.75" to 5.0" (REQUIRES  
PTN STONE CARRIER 514-1-37)

RANGE: 4.75" to 7.0" (REQUIRES  
PTN STONE CARRIER 514-1-37-A)

ALL PT2F NUMBERS LISTED \*  
SUBJECT TO AVAILABILITY -  
Grits may be mixed for  
quantity breaks.

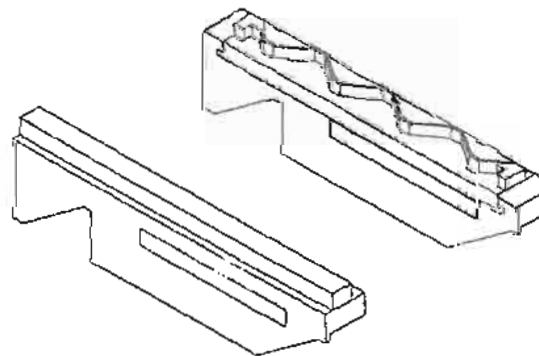
ROTTLER #		DESCRIPTION
514-1-35	PT2F2F	120 GRIT
514-1-36	PT2F3F	180 GRIT
514-5-7	PT2F4F	220 GRIT
514-5-7-A	PT2F6F	320 GRIT
514-5-9	PT2F0F	60 GRIT



## FOR ROTTLER JUNIOR HONE HEAD

ALL TF, UF, AND VF NUMBERS LISTED - Grits and ranges may be mixed for quantity breaks.

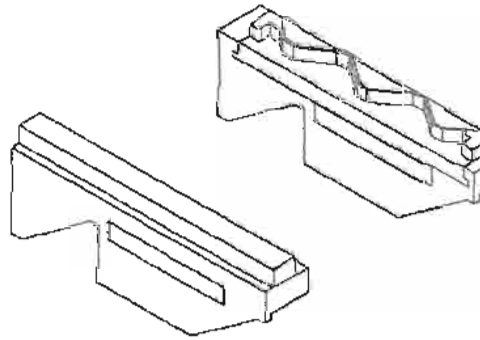
ROTTLER #		DESCRIPTION
514-5-14	TF2F	120 grit, 2.0" to 2.20"
514-5-15	UF2F	120 grit, 2.20" to 2.40"
514-5-16	VF2F	120 grit, 2.40" to 2.68"
514-5-17	TF3F	180 grit, 2.0" to 2.20"
514-5-18	UF3F	180 grit, 2.20" to 2.40"
514-5-19	VF3F	180 grit, 2.40" to 2.68"
514-5-17-A	TF4F	220 grit, 2.0" to 2.20"
514-5-18-A	UF4F	220 grit, 2.20" to 2.40"
514-5-19-A	VF2F	220 grit, 2.40" to 2.68"
514-5-17-B	TF6F	320 grit, 2.0" to 2.20"
514-5-18-B	UF6F	320 grit, 2.20" to 2.40"
514-5-19-B	VF6F	320 grit, 2.40" to 2.68"



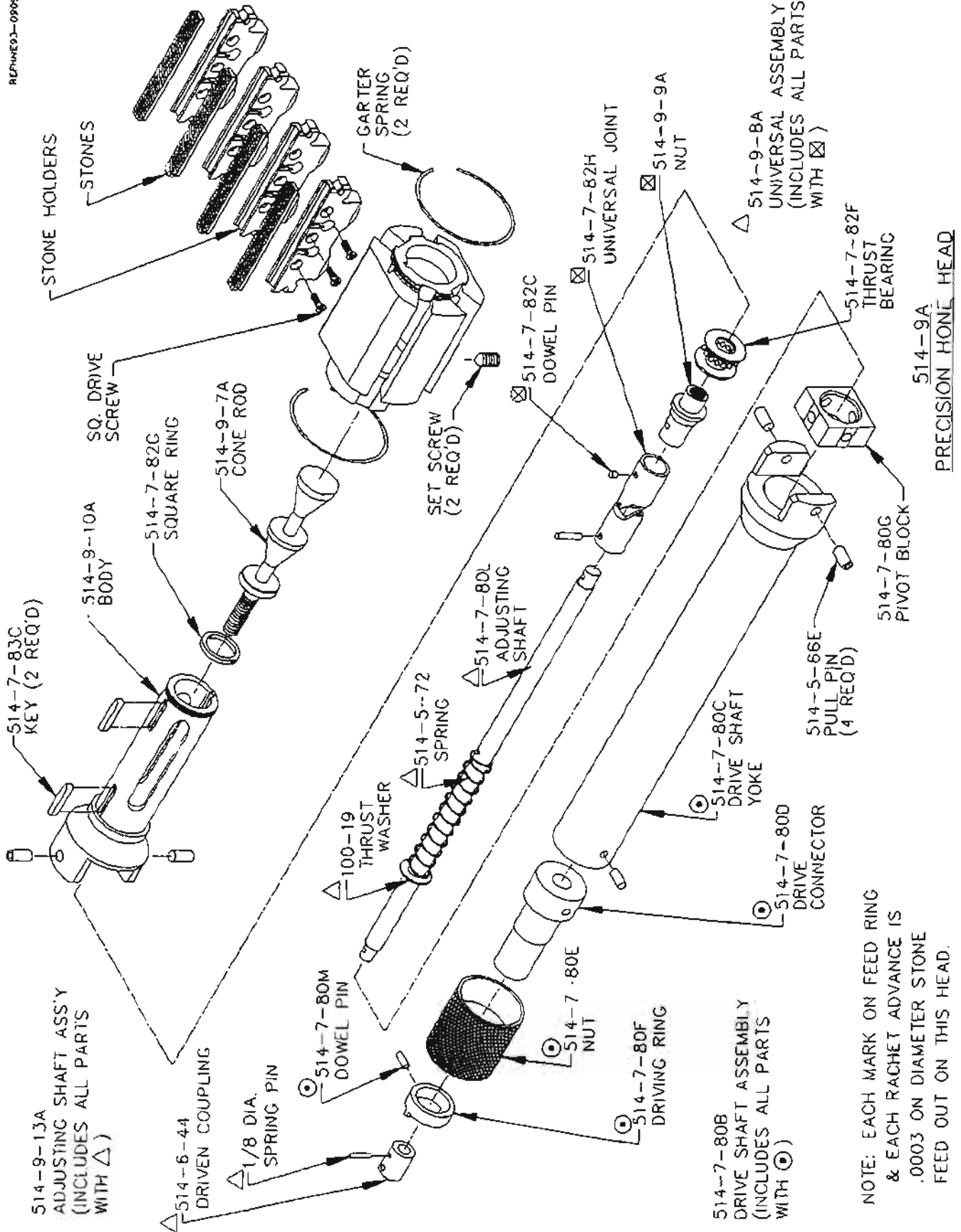
## FOR ROTTLER MINOR HONE HEAD

ALL 28F AND 29F NUMBERS LISTED  
- Grits and ranges may be  
mixed for quantity breaks.

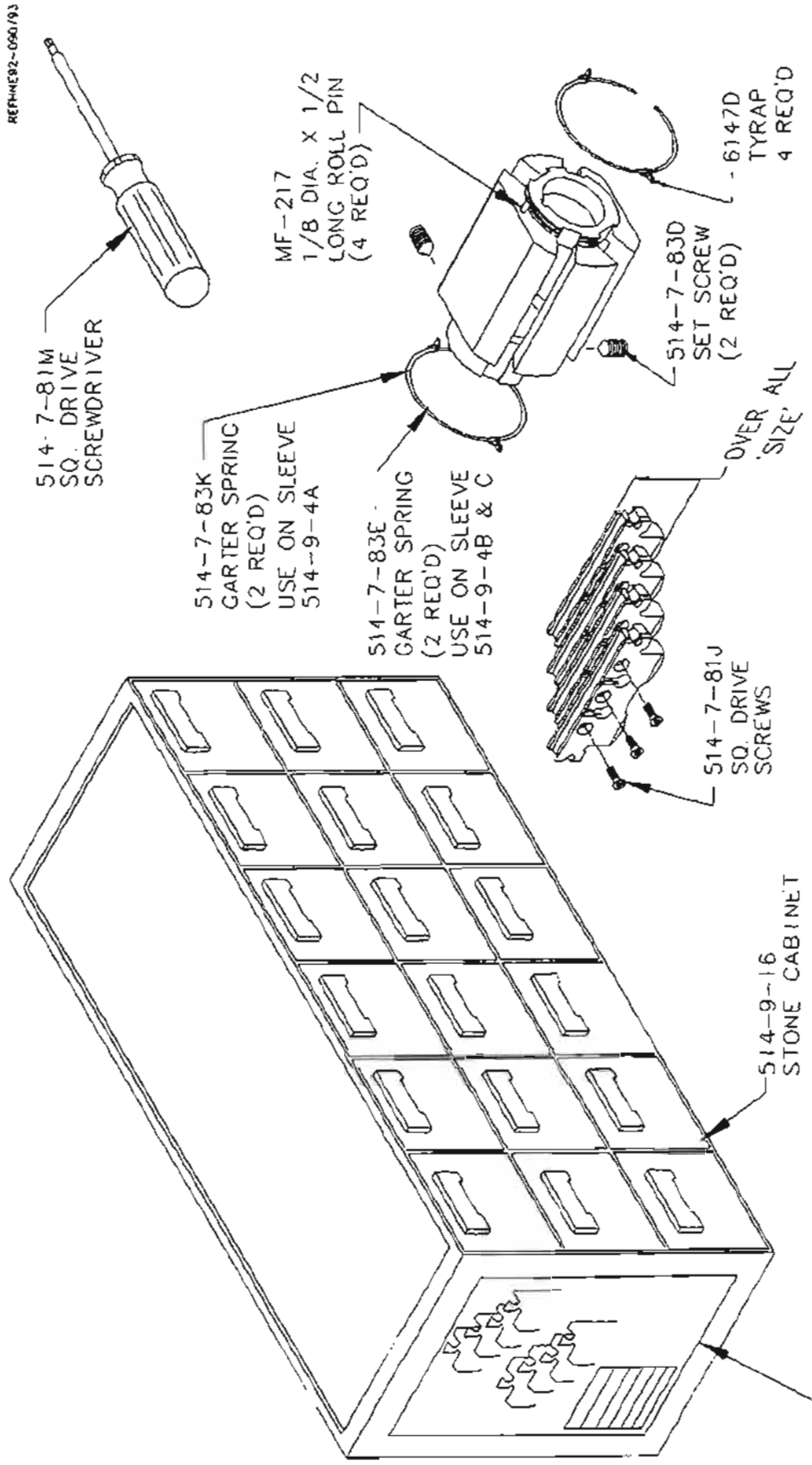
ROTTLER #		DESCRIPTION
514-5-43	28F2F	120 grit, 1.50" to 1.75"
514-5-44	28F3F	180 grit, 1.50" to 1.75"
514-5-45	29F2F	120 grit, 1.75" to 2.00"
514-5-46	29F3F	180 grit, 1.75" to 2.00"



REF:HP3A-090992



NOTE: EACH MARK ON FEED RING & EACH RACHET ADVANCE IS .0003 ON DIAMETER STONE FEED OUT ON THIS HEAD.

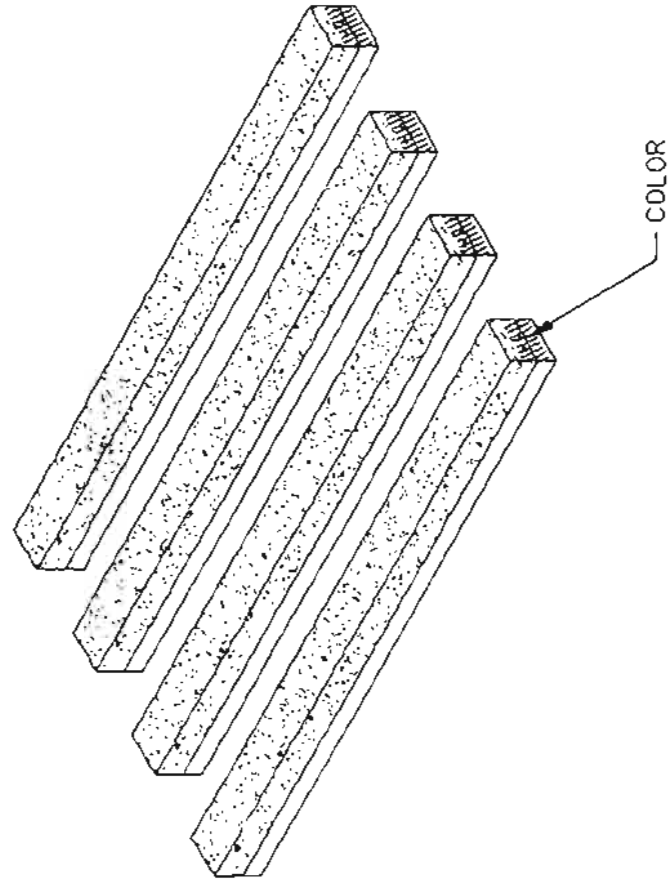
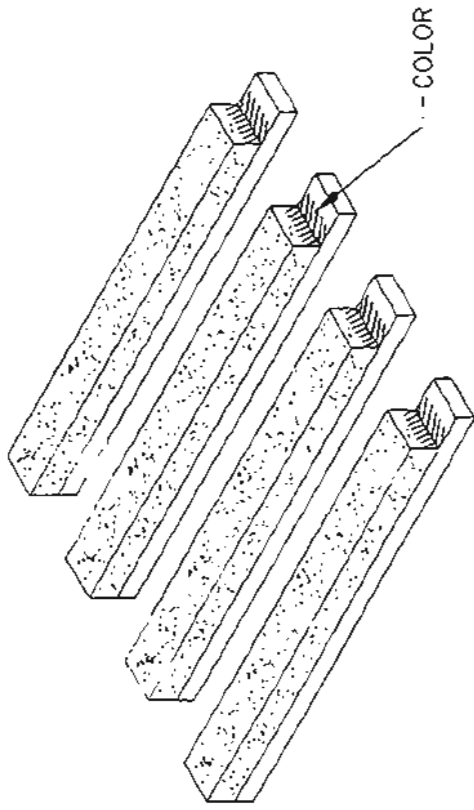


SIZE	STONE HOLDER SET			SLEEVE		
	PART NUMBER	RANGE (DIA.)	SIZE	PART NUMBER	RANGE (DIA.)	
1-04	514-9-6J	*2.900/3.090				
1-1/8	514-9-6A	3.050/3.312	A,B,J	514-9-4A	*2.75/3.56	
1-1/4	514-9-6B	3.250/3.562				
1-3/8	514-9-6C	3.500/3.812				
1-1/2	514-9-6D	3.750/4.062	C-E	514-9-4B	3.50/4.32	
1-5/8	514-9-6E	4.000/4.312				
1-3/4	514-9-6F	4.250/4.562				
1-7/8	514-9-6G	4.500/4.812	F-H	514-9-4C	4.25/5.06	
2	514-9-6H	4.750/5.062				

\* MINIMUM 2.750 WITH SPECIAL 1/4 HIGH STONE.

REF: HNES-0910P2

STONE PRECISION HONE HEAD



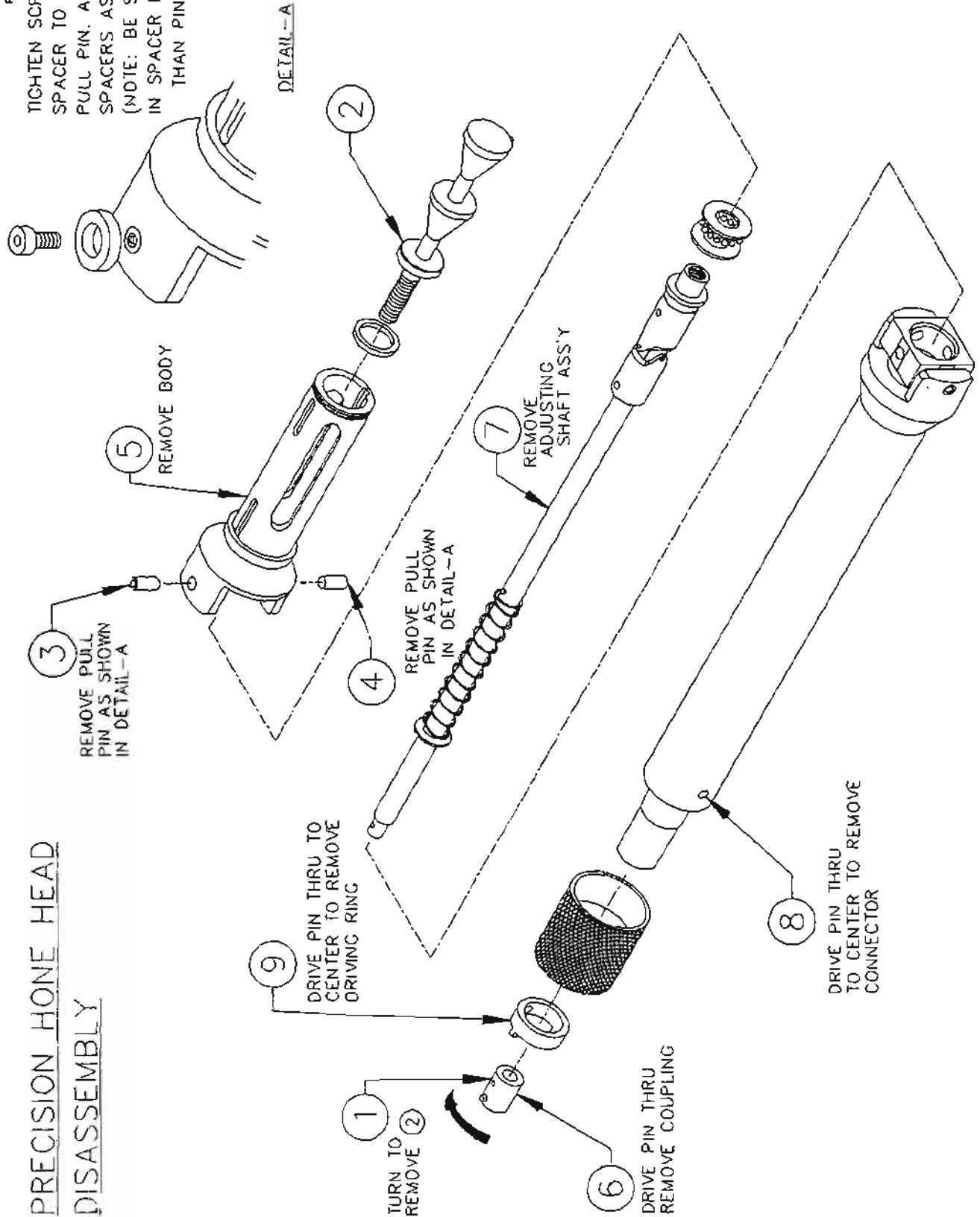
2-3/4" STONES			
PART NUMBER	GRIT & HARDNESS	COLOR	
514-9-18	80L	RED	
514-9-18A	180K	GREEN	
514-9-18B	180L	BLUE	
514-9-18C	220K	YELLOW	
514-9-18D	320K	WHITE	

4" STONES			
PART NUMBER	GRIT & HARDNESS	COLOR	
514-9-20	80L	RED	
514-9-20A	180K	GREEN	
514-9-20B	180L	BLUE	
514-9-20C	220K	YELLOW	
514-9-20D	320K	WHITE	



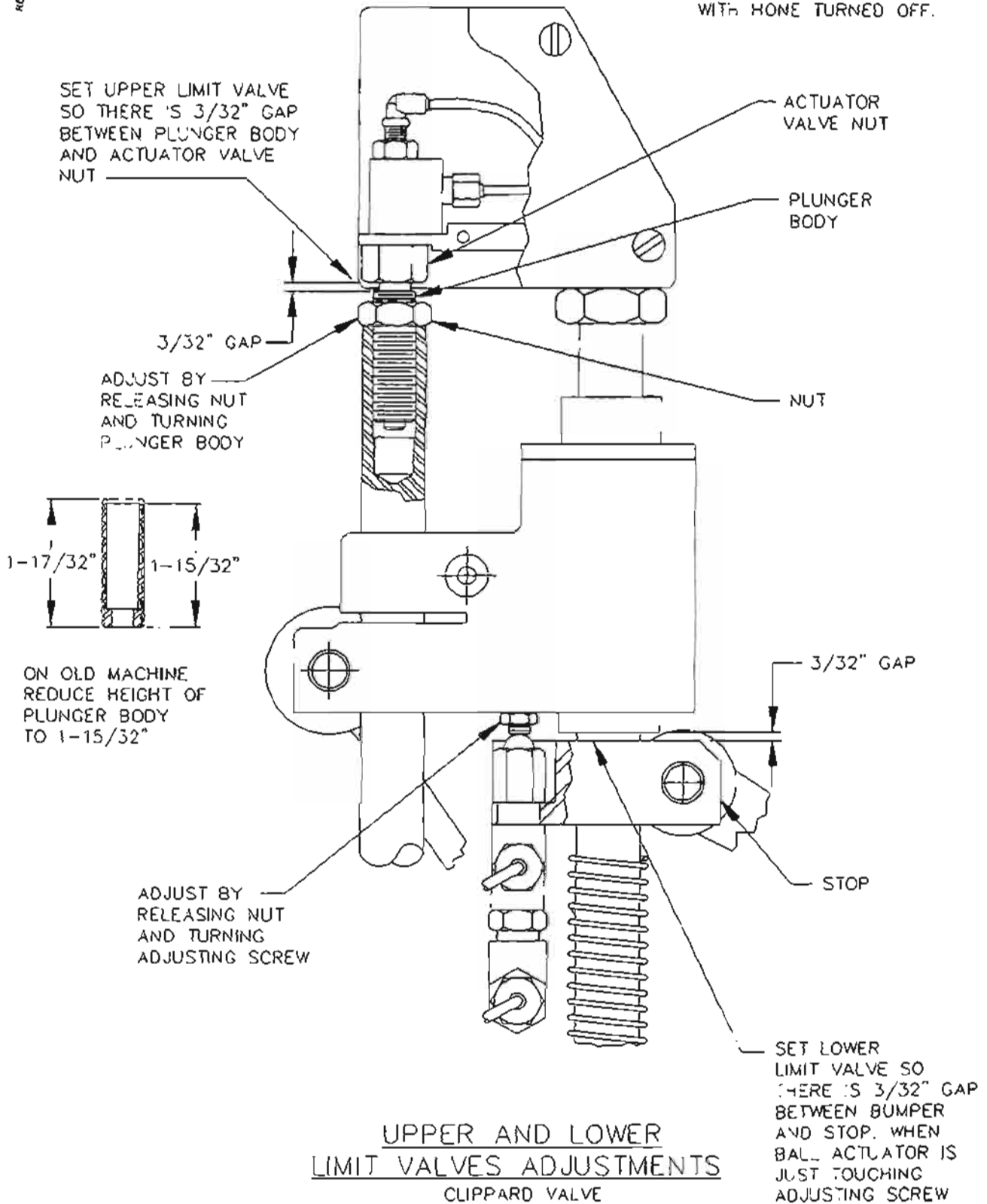
REF: 081092

TIGHTEN SCREW OVER SPACER TO REMOVE PULL PIN. ADD SPACERS AS NEEDED (NOTE: BE SURE HOLE IN SPACER IS LARGER THAN PIN DIA.)

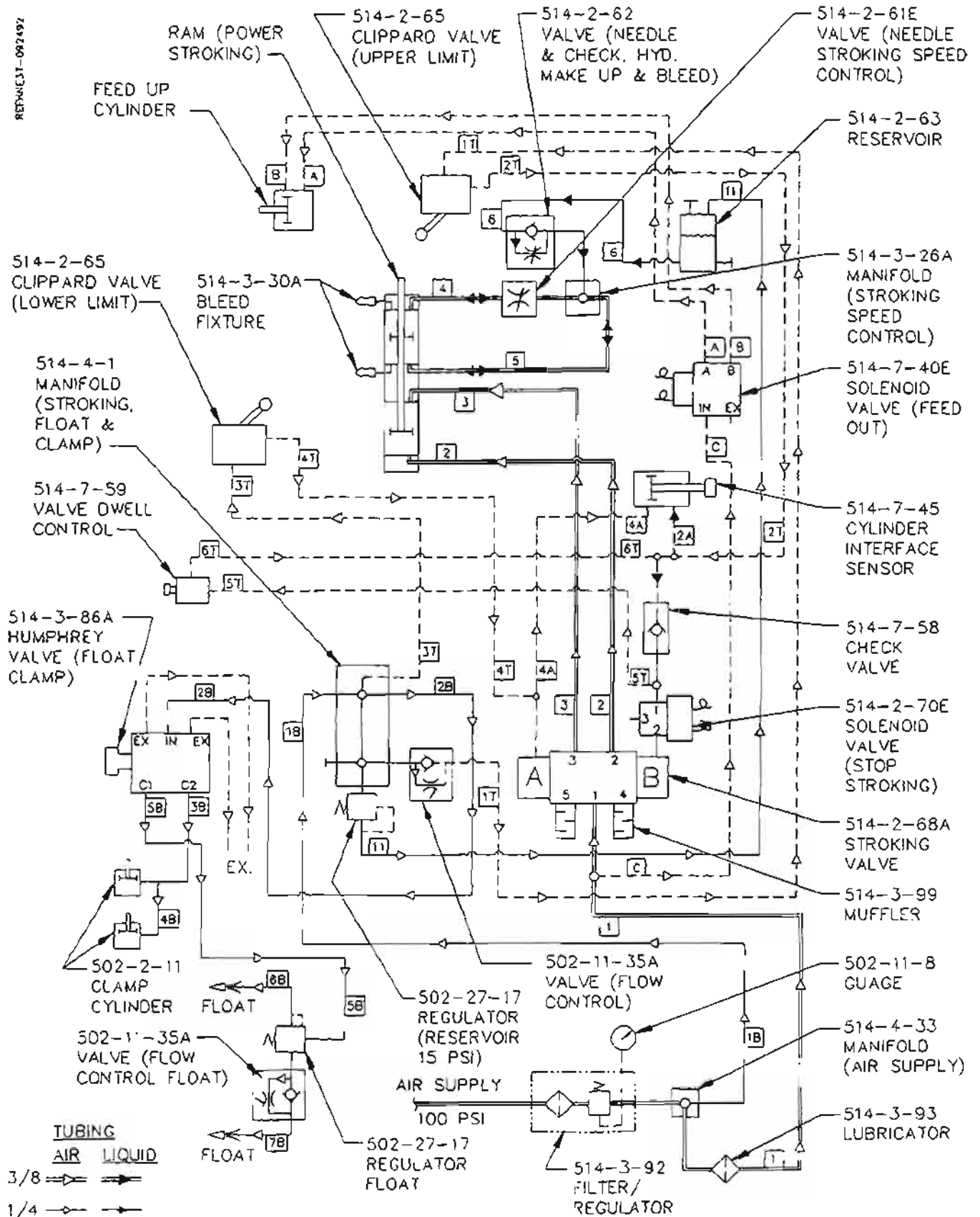


REFRAME13-091092

NOTE:  
MAKE ALL ADJUSTMENTS  
WITH HONE TURNED OFF.



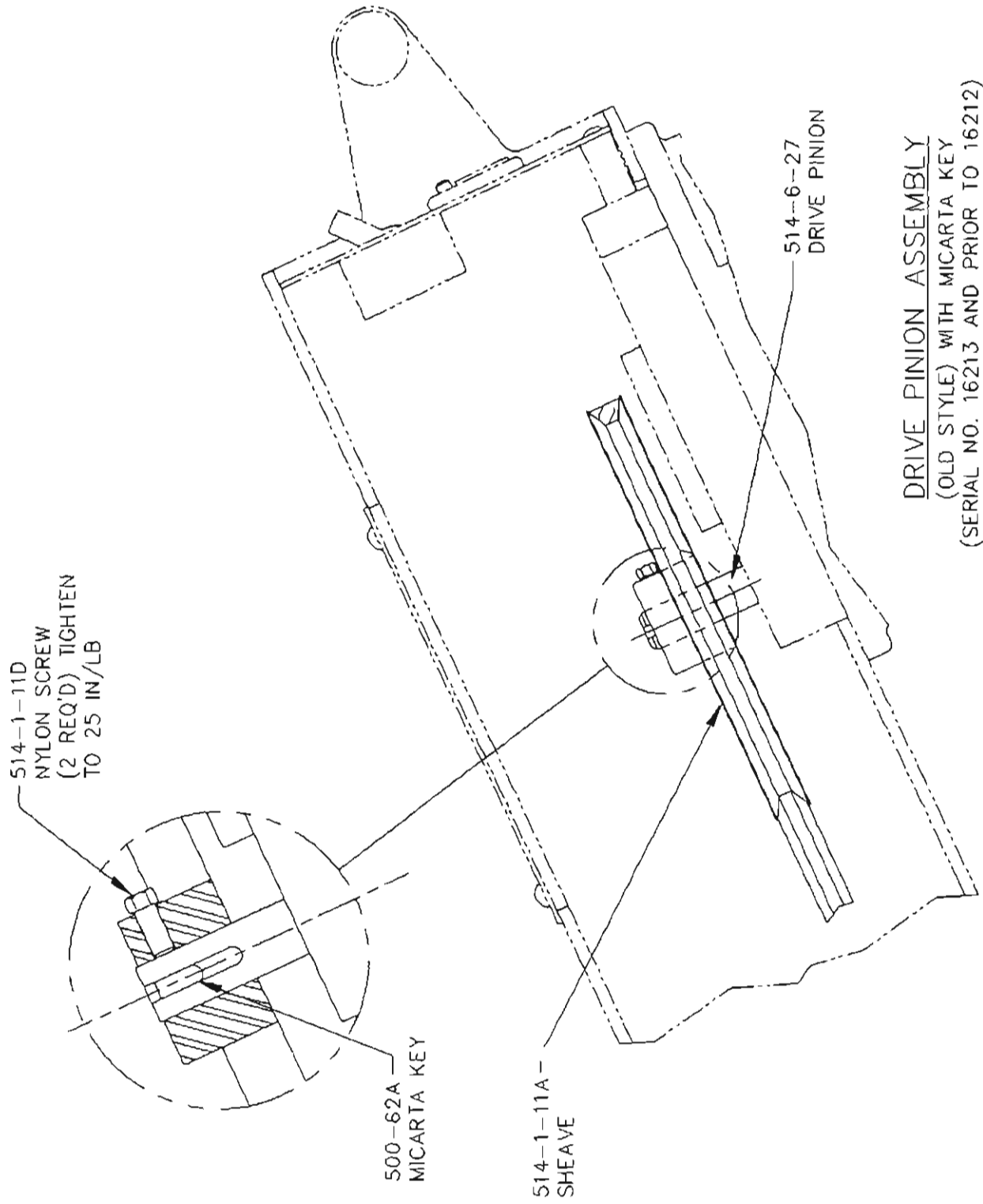
REF: 31-062492



HONE PNEUMATIC CIRCUIT WITH SHORT STROKING & HUMPHREY (FLOAT/CLAMP VALVE)

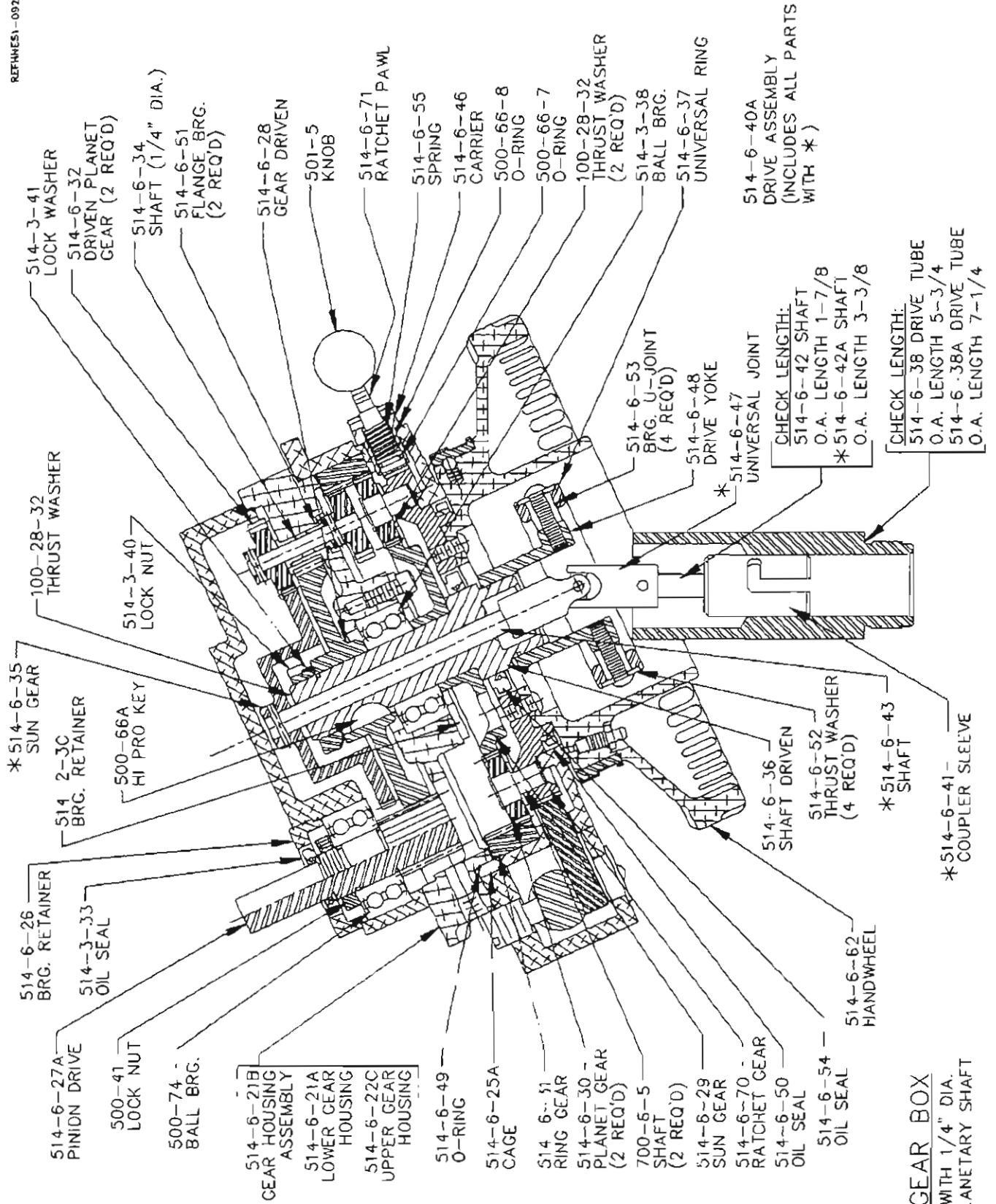
**TUBING**  
 AIR LIQUID  
 3/8 ———  
 1/4 ———  
 1/8 - - -

REFRNE121-002402



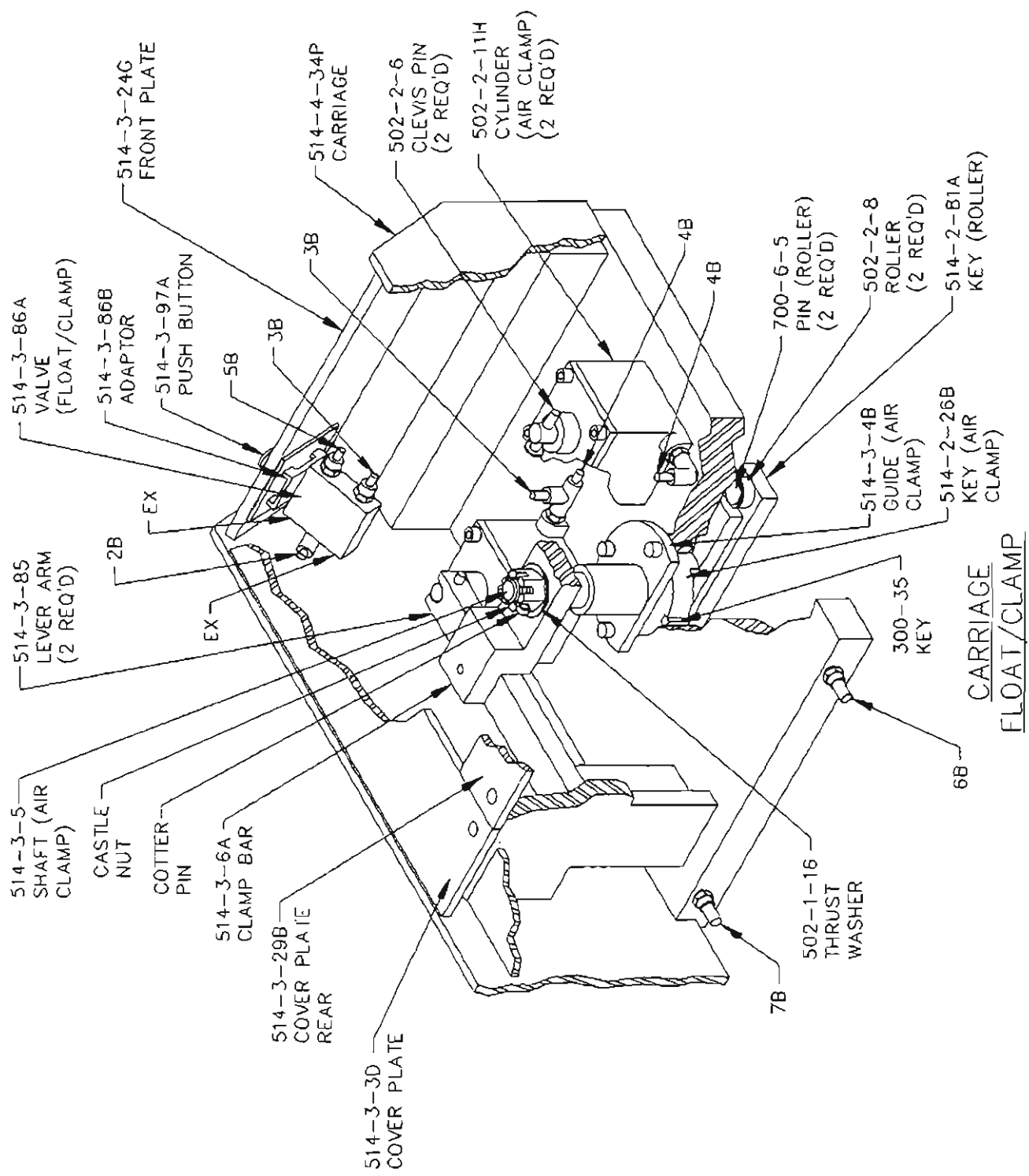
DRIVE PINION ASSEMBLY  
(OLD STYLE) WITH MICARTA KEY  
(SERIAL NO. 16213 AND PRIOR TO 16212)

REFHNES1-092492

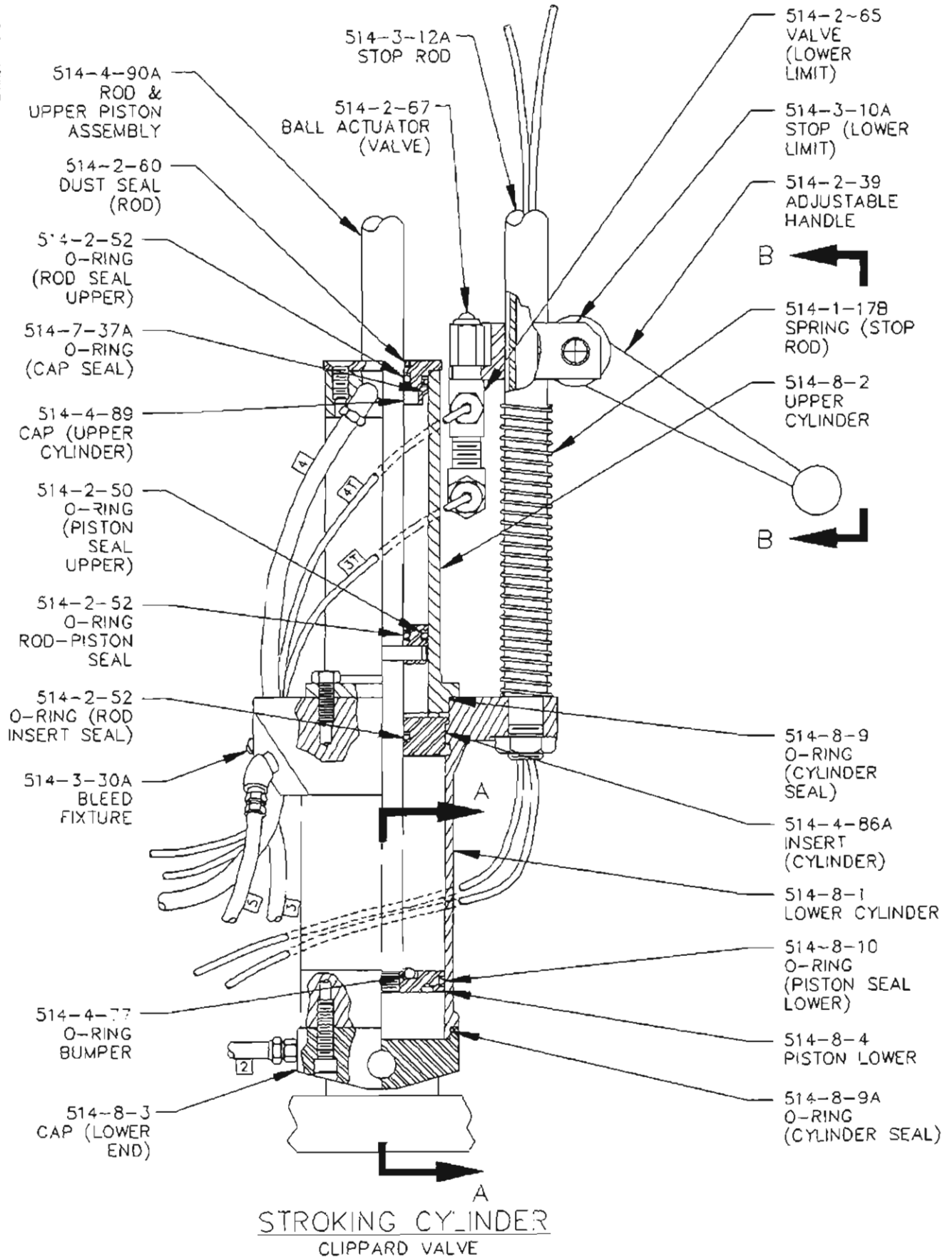


**GEAR BOX**  
 WITH 1/4" DIA.  
 PLANETARY SHAFT

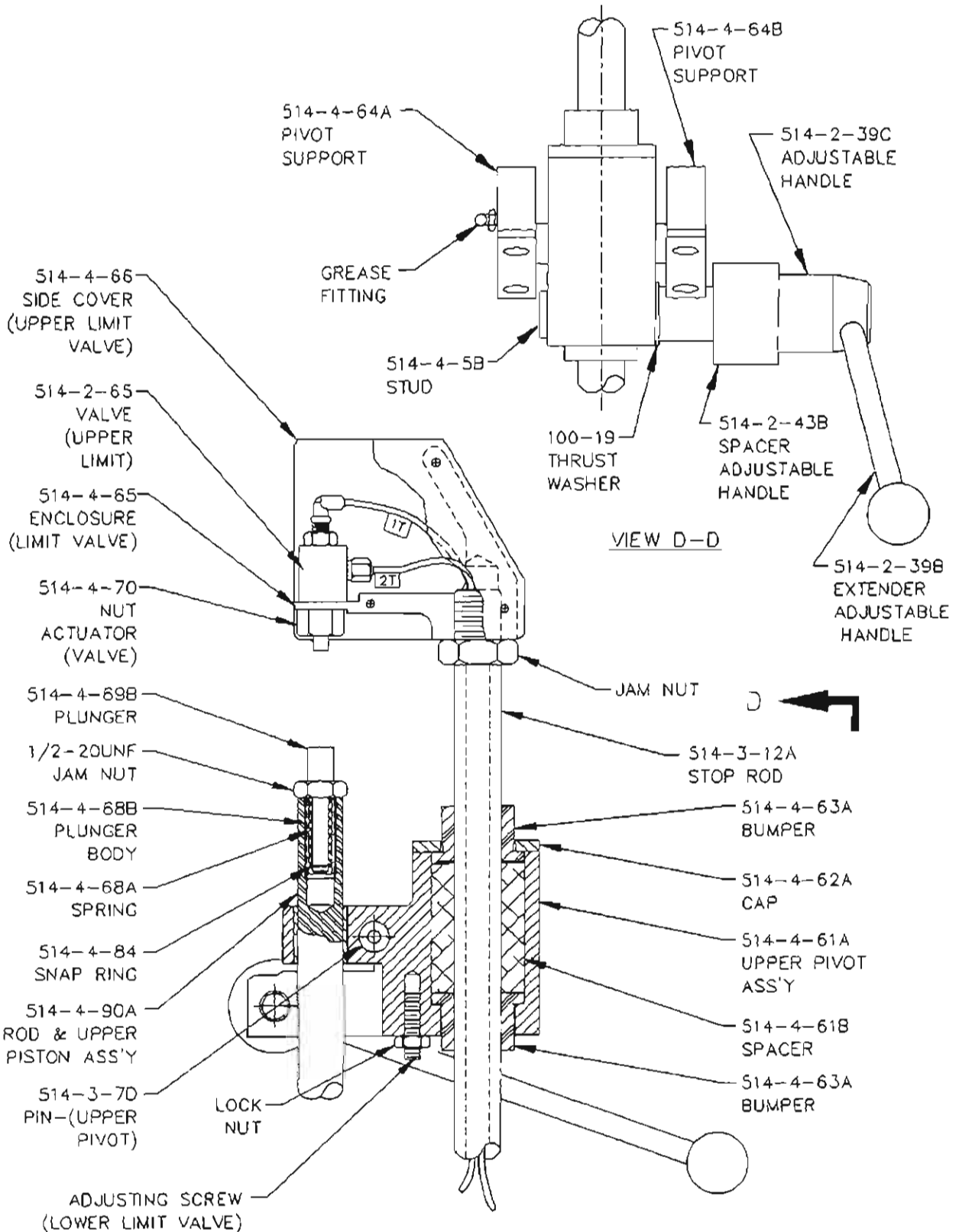
REFRAMEB2-0024B2



REF:NEV4-09109Z



REFRNE15-081002

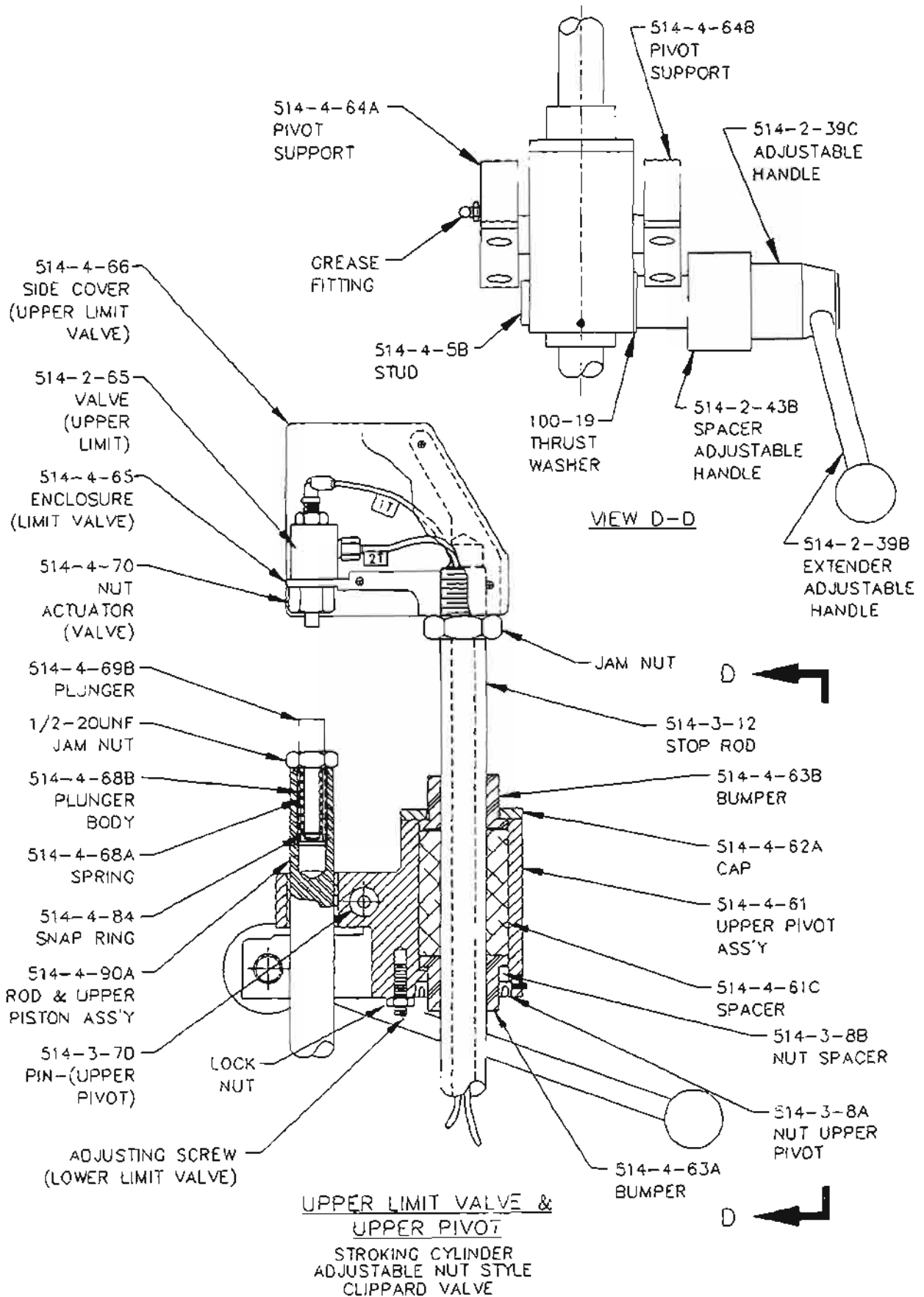


UPPER LIMIT VALVE & UPPER PIVOT CLIPPARD VALVE

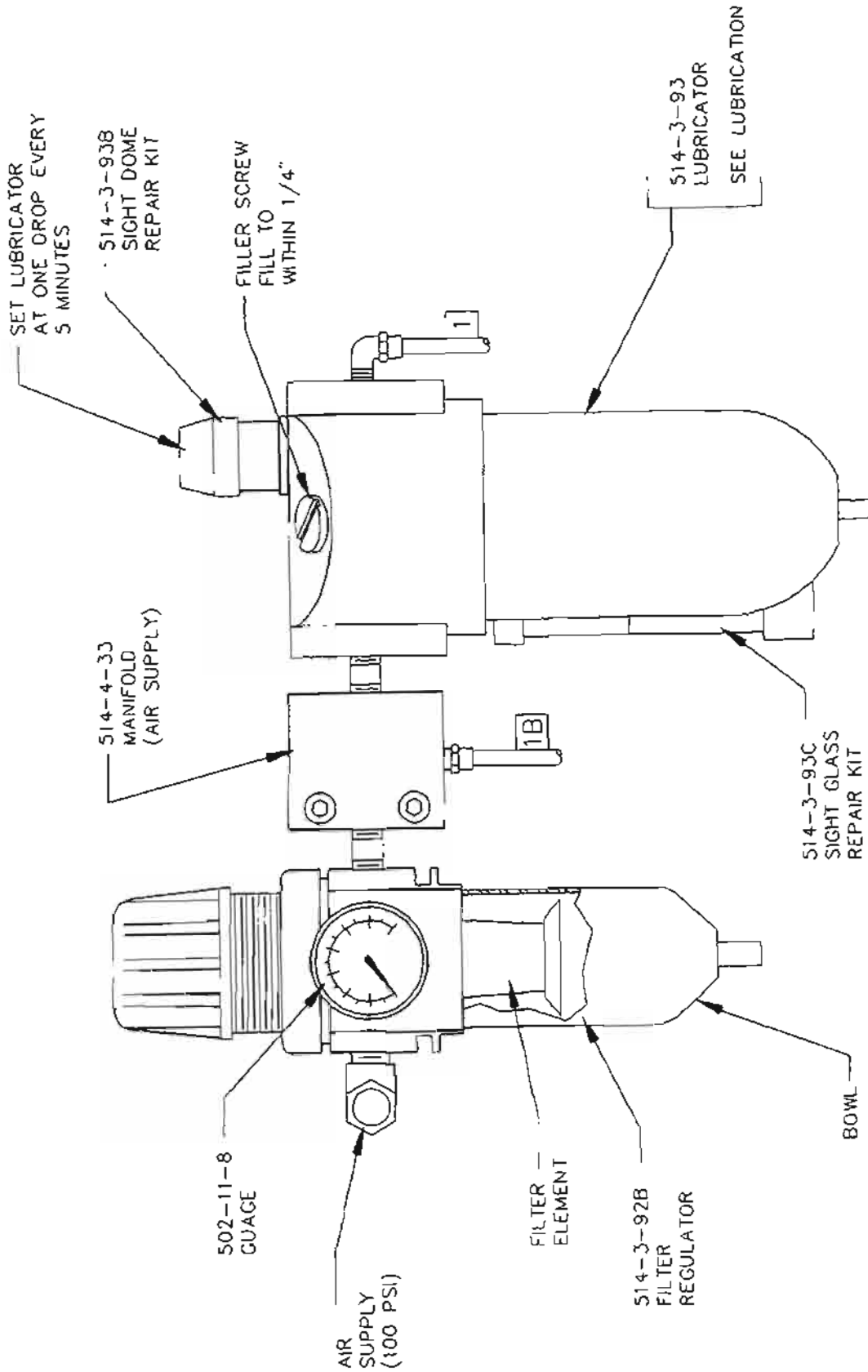
D



REPAIR 16-081002



REF: 16-000892



PNEUMATIC  
POWER SUPPLY



MOBIL OIL CORPORATION MATERIAL SAFETY DATA BULLETIN

\*\*\*\*\* I. PRODUCT IDENTIFICATION \*\*\*\*\*  
MOBILMET UPSILON

SUPPLIER: MOBIL OIL CORP. HEALTH EMERGENCY TELEPHONE: (212) 883-4411  
CHEMICAL NAMES AND SYNONYMS: PET. HYDROCARBONS AND ADDITIVES TRANSPORT EMERGENCY TELEPHONE (800) 424-9300 (CHEMTREC)  
USE OR DESCRIPTION: CUTTING FLUID

\*\*\*\*\* II. TYPICAL CHEMICAL AND PHYSICAL PROPERTIES \*\*\*\*\*

APPEARANCE: ASTM 5.0 LIQUID ODOR: MILD PH: NA  
VISCOSITY AT 100 F, SUS: 62.0 AT 40 C, CS: 10.2  
VISCOSITY AT 210 F, SUS: 35.1 AT 100 C, CS: 2.7  
FLASH POINT F(C): >325(163) (ASTM D-92)  
MELTING POINT F(C): NA POUR POINT F(C): 30(-1)  
BOILING POINT F(C): > 600( 316)  
RELATIVE DENSITY, 15/4 C: 0.849 SOLUBILITY IN WATER: NEGLIGIBLE  
VAPOR PRESSURE-MM HG 20C: < .1

NA=NOT APPLICABLE NE:NOT ESTABLISHED D=DECOMPOSES  
FOR FURTHER INFORMATION, CONTACT YOUR LOCAL MARKETING OFFICE.

\*\*\*\*\* III. INGREDIENTS \*\*\*\*\*

	WT PCT	EXPOSURE	LIMITS	SOURCES
	(APPROX)	MG/M3	PPM	(AND NOTES)
HAZARDOUS INGREDIENTS:				
NONE				
OTHER INGREDIENTS:				
REFINED MINERAL OILS	>95			
ADDITIVES AND/OR OTHER INGREDIENTS	< 5			

KEY TO SOURCES: A=ACGIH-TLV, A\*=SUGGESTED-TLV, M=MOBIL, O=OSHA  
NOTE: LIMITS SHOWN FOR GUIDANCE ONLY. FOLLOW APPLICABLE REGULATIONS.

\*\*\*\*\* IV. HEALTH HAZARD DATA \*\*\*\*\*

THRESHOLD LIMIT VALUE: 5.00 MG/M3 SUGGESTED FOR OIL MIST  
EFFECTS OF OVEREXPOSURE: PROLONGED REPEATED SKIN CONTACT WITH LOW  
VISCOSITY OILS MAY LEAD TO IRRITATION CAUSED BY DISSOLVING OF THE  
NATURAL OILS FROM THE SKIN. SLIGHT SKIN IRRITATION.

\*\*\*\*\* V. EMERGENCY AND FIRST AID PROCEDURES \*\*\*\*\*

EYE CONTACT: FLUSH WITH WATER.  
SKIN CONTACT: WASH CONTACT AREAS WITH SOAP AND WATER.  
INHALATION: NOT EXPECTED TO BE A PROBLEM.  
INGESTION: DO NOT INDUCE VOMITING. ADMINISTER VEGETABLE OIL. GET  
MEDICAL ASSISTANCE. (NOTE TO PHYSICIAN: MATERIAL IF ASPIRATED  
INTO THE LUNGS MAY CAUSE CHEMICAL PNEUMONITIS. TREAT APPROPRIATELY)

## \*\*\*\*\* VI. FIRE AND EXPLOSION HAZARD DATA \*\*\*\*\*

FLASH POINT F.F.C.: 303 (163) (ASTM D-92)  
FLAMMABLE LIMITS: LEL: 1.6 UEL: 7.0  
EXTINGUISHING MEDIA: CARBON DIOXIDE, FOAM, DRY CHEMICAL AND WATER FOG.  
SPECIAL FIRE FIGHTING PROCEDURES: FIREFIGHTERS MUST USE SELF-CONTAINED  
BREATHING APPARATUS.  
UNUSUAL FIRE AND EXPLOSION HAZARDS: NONE  
NFPA HAZARD ID: HEALTH: 0, FLAMMABILITY: 1, REACTIVITY: 0

## \*\*\*\*\* VII. REACTIVITY DATA \*\*\*\*\*

STABILITY (THERMAL, LIGHT, ETC.): STABLE  
CONDITIONS TO AVOID: EXTREME HEAT  
INCOMPATIBILITY (MATERIALS TO AVOID): STRONG OXIDIZERS  
HAZARDOUS DECOMPOSITION PRODUCTS: CARBON MONOXIDE.  
HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

## \*\*\*\*\* VIII. SPILL OR LEAK PROCEDURE \*\*\*\*\*

ENVIRONMENTAL IMPACT: REPORT SPILLS AS REQUIRED TO APPROPRIATE  
AUTHORITIES. U. S. COAST GUARD REGULATIONS REQUIRE IMMEDIATE  
REPORTING OF SPILLS THAT COULD REACH ANY WATERWAY INCLUDING  
INTERMITTENT DRY CREEKS. REPORT SPILL TO COAST GUARD TOLL FREE  
NUMBER 800-424-8802.  
PROCEDURES IF MATERIAL IS RELEASED OR SPILLED: ADSORB ON FIRE RETARDANT  
TREATED SAWDUST, DIATOMACEOUS EARTH, ETC. SHOVEL UP AND DISPOSE OF  
AT AN APPROPRIATE WASTE DISPOSAL FACILITY IN ACCORDANCE WITH  
CURRENT APPLICABLE LAWS AND REGULATIONS, AND PRODUCT  
CHARACTERISTICS AT TIME OF DISPOSAL.  
WASTE MANAGEMENT: PRODUCT IS SUITABLE FOR BURNING IN AN ENCLOSED,  
CONTROLLED BURNER FOR FUEL VALUE OR DISPOSAL BY SUPERVISED  
INCINERATION. SUCH BURNING MAY BE LIMITED PURSUANT TO THE RESOURCE  
CONSERVATION AND RECOVERY ACT. IN ADDITION, THE PRODUCT IS  
SUITABLE FOR PROCESSING BY AN APPROVED RECYCLING FACILITY OR CAN BE  
DISPOSED OF AT ANY GOVERNMENT APPROVED WASTE DISPOSAL FACILITY.  
USE OF THESE METHODS IS SUBJECT TO USER COMPLIANCE WITH APPLICABLE  
LAWS AND REGULATIONS AND CONSIDERATION OF PRODUCT CHARACTERISTICS  
AT TIME OF DISPOSAL.

## \*\*\*\*\* IX. SPECIAL PROTECTION INFORMATION \*\*\*\*\*

EYE PROTECTION: NO SPECIAL EQUIPMENT REQUIRED.  
SKIN PROTECTION: IF PROLONGED OR REPEATED SKIN CONTACT IS LIKELY, OIL  
IMPERVIOUS GLOVES SHOULD BE WORN. GOOD PERSONAL HYGIENE PRACTICES  
SHOULD ALWAYS BE FOLLOWED.  
RESPIRATORY PROTECTION: NO SPECIAL REQUIREMENTS UNDER ORDINARY  
CONDITIONS OF USE AND WITH ADEQUATE VENTILATION.  
VENTILATION: NO SPECIAL REQUIREMENTS UNDER ORDINARY CONDITIONS OF USE  
AND WITH ADEQUATE VENTILATION.

## \*\*\*\*\* X. SPECIAL PRECAUTIONS \*\*\*\*\*

STORAGE: SEE APPENDIX FOR PRECAUTIONARY LABEL. CL-402

## \*\*\*\*\* NI. TOXICOLOGICAL DATA \*\*\*\*\*

## ---ACUTE---

ORAL TOXICITY (RATS): LD50: > 5 G/KG SLIGHTLY TOXIC(ESTIMATED) ---  
 BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.  
 DERMAL TOXICITY (RABBITS): LD50: > 2 G/KG SLIGHTLY TOXIC(ESTIMATED) --  
 BASED ON TESTING OF SIMILAR PRODUCTS AND/OR THE COMPONENTS.  
 INHALATION TOXICITY (RATS): LC50: >5 MG/L FOR 4 HRS. 0/10 RATS DIED  
 AT THIS DOSAGE LEVEL. PRACTICALLY NONTOXIC  
 EYE IRRITATION (RABBITS): CAUSED NO SIGNIFICANT IRRITATION TO RABBITS.  
 EYE IRRITATION SCORES: 2.3 AT 1 HOUR, 0.1 AT 24 HOURS, 0 AT 7  
 DAYS.  
 SKIN IRRITATION (RABBITS): SLIGHTLY IRRITATING TO RABBITS. PRIMARY  
 IRRITATION SCORE: 1.6/8

## ---OTHER DATA---

\*\*\*\*\*THIS MIXTURE OR A SIMILAR MIXTURE DID NOT RESULT IN ANY FATALITIES  
 TO RATS AT CONCENTRATIONS (SEE INHALATION TOXICITY ABOVE)  
 SUBSTANTIALLY HIGHER THAN THE 5 MG/M3 TLV SUGGESTED FOR OIL MISTS.

## \*\*\*\*\* XII. REGULATORY INFORMATION \*\*\*\*\*

TSCA INVENTORY STATUS: ALL COMPONENTS REGISTERED.  
 D.O.T. SHIPPING NAME: NOT APPLICABLE  
 D.O.T. HAZARD CLASS: NOT APPLICABLE  
 US OSHA HAZARD COMMUNICATION STANDARD: PRODUCT ASSESSED IN ACCORDANCE  
 WITH OSHA CFR 1910.1200 AND DETERMINED TO BE HAZARDOUS.  
 RCRA INFORMATION: THE UNUSED PRODUCT, IN OUR OPINION, IS NOT  
 SPECIFICALLY LISTED BY THE EPA AS A HAZARDOUS WASTE (40 CFR,  
 PART 261); DOES NOT EXHIBIT THE HAZARDOUS CHARACTERISTICS OF  
 IGNITABILITY, CORROSIVITY, OR REACTIVITY, AND IS NOT FORMULATED  
 WITH THE METALS CITED IN THE EP TOXICITY TEST. HOWEVER, USED  
 PRODUCT MAY BE REGULATED.

THE FOLLOWING PRODUCT INGREDIENTS ARE CITED ON THE LISTS BELOW:

CHEMICAL NAME (OIL MIST)	CAS NUMBER	LIST CITATIONS
		2,10,11

## --- KEY TO LIST CITATIONS ---

1 = OSHA Z,      2 = ACGIH,      3 = IARC,      4 = NTP,      5 = NCI,  
 6 = EPA CARC,    7 = NFPA 49,    8 = NFPA 325M,    9 = DOT HMT,    10 = CA RTK,  
 11 = IL RTK,    12 = MA RTK,    13 = MN RTK,    14 = NJ RTK,    15 = MI 293,  
 16 = FL RTK,    17 = PA RTK.

\*\*\*\*\*  
 INFORMATION GIVEN HEREIN IS OFFERED IN GOOD FAITH AS ACCURATE, BUT  
 WITHOUT GUARANTEE. CONDITIONS OF USE AND SUITABILITY OF THE PRODUCT FOR  
 PARTICULAR USES ARE BEYOND OUR CONTROL; ALL RISKS OF USE OF THE PRODUCT  
 ARE THEREFORE ASSUMED BY THE USER AND WE EXPRESSLY DISCLAIM ALL  
WARRANTIES OF EVERY KIND AND NATURE, INCLUDING WARRANTIES OF  
MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN RESPECT TO THE  
USE OR SUITABILITY OF THE PRODUCT. NOTHING IS INTENDED AS A  
 RECOMMENDATION FOR USES WHICH INFRINGE VALID PATENTS OR AS EXTENDING  
 LICENSE UNDER VALID PATENTS. APPROPRIATE WARNINGS AND SAFE HANDLING  
 PROCEDURES SHOULD BE PROVIDED TO HANDLERS AND USERS.

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PREPARED BY: MOBIL OIL CORPORATION  
ENVIRONMENTAL AFFAIRS AND TOXICOLOGY DEPARTMENT, PRINCETON, NJ  
FOR FURTHER INFORMATION, CONTACT:  
MOBIL OIL CORPORATION, PRODUCT FORMULATION AND QUALITY CONTROL  
3225 GALLOWES ROAD, FAIRFAX, VA 22037 (703) 849-3265

\*\*\*\*\* APPENDIX \*\*\*\*\*  
FOR MOBIL USE ONLY: (FILL NO: MTJ354\*M201) MHC: 1\* 1\* 0 0 1 PPEC: A  
US86-089 APPROVE REVISED: 04/18/86

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PRECAUTIONARY LABEL TEXT FOR PACKAGED PRODUCTS:

CONTAINS LOW VISCOSITY OIL

CAUTION

MAY CAUSE SKIN IRRITATION ON PROLONGED,  
REPEATED SKIN CONTACT.

AVOID PROLONGED OR REPEATED CONTACT THAT  
COULD DEFAT THE SKIN.  
WASH SKIN CONTACT AREAS WITH SOAP AND WATER.

LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.  
AVOID WEARING OF CLOTHING SOAKED WITH FLUID.  
AVOID PROLONGED INHALATION OF MISTS OR VAPORS.

WHEN USE CONDITIONS ARE LIKELY TO RESULT IN  
EXCESSIVE MISTING (GREATER THEN 5 MG/M3),  
PROVIDE ADEQUATE LOCAL VENTILATION OR  
RESPIRATORY PROTECTION.

FOR INDUSTRIAL USE ONLY  
NOT INTENDED OR SUITABLE FOR USE  
IN OR AROUND A HOUSEHOLD OR DWELLING.

ATTENTION

EMPTY CONTAINERS MAY CONTAIN PRODUCT RESIDUE, INCLUDING  
FLAMMABLE OR EXPLOSIVE VAPORS. DO NOT CUT, PUNCTURE OR  
WELD ON OR NEAR CONTAINER. ALL LABEL WARNINGS AND PRE-  
CAUTIONS MUST BE OBSERVED UNTIL THE CONTAINER HAS BEEN  
THOROUGHLY CLEANED OR DESTROYED.

REFER TO PRODUCT MATERIAL SAFETY DATA BULLETIN  
FOR FURTHER SAFETY AND HANDLING INFORMATION.

MOBIL OIL CORPORATION, NEW YORK, N.Y. 10017 CL-402(1/86)

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