

L10 SERIES

Service and
Repair Manual

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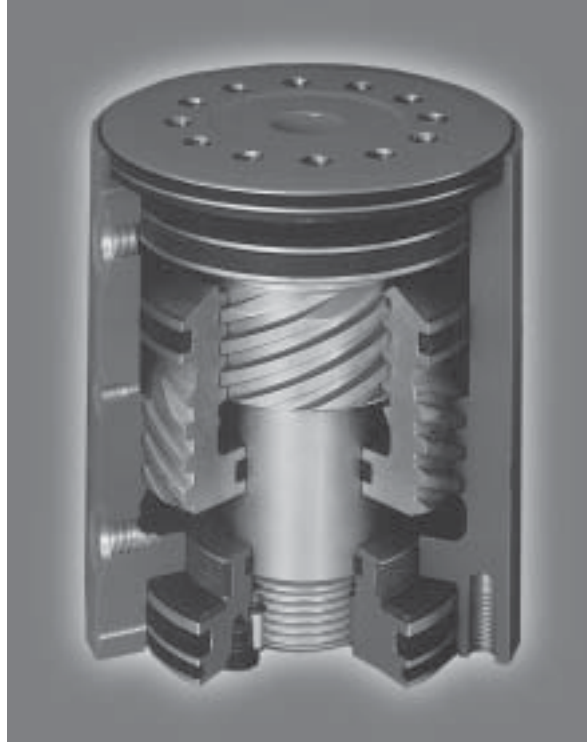
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Product Introduction



For over 30 years, Helac Corporation has been recognized for innovation in design of hydraulic rotary actuators and construction equipment attachments. Helac products are known for their tremendous torque output, compact configurations, exceptional load bearing capabilities, and rugged, reliable performance.

Over 1,000 mobile, industrial, construction and mining machinery manufacturers around the world depend on Helac actuators to perform such functions as rotation, positioning, manipulation, vehicle steering and indexing. Helac's L10 Series rotary actuators are used widely on utility aerials (basket rotation), rock drills (drill rod magazine rotation), industrial vehicles (steering), robotic

equipment (joint movement) and jib cranes (boom rotation), along with many other positioning, lifting and processing applications.

All L10 Series actuators incorporate the same internal design, though they vary in size depending on model.

Many actuators are equipped with a factory installed counterbalance valve, which performs three major functions.

- Protects the actuator in the event of overload
- Prevents drifting of the actuator and the assembly/component mounted to it
- Keeps the actuator pressurized in a holding position to reduce hydraulic backlash

General Safety Guidelines



Many actuator applications have several pinch points with the potential for severe injuries. Use extreme caution and remain clear of all rotating components whenever the machine is in operation.

Product Identification

Each Helac actuator is individually serial numbered. The serial number is a five or six digit number and must be provided before parts and/or service issues can be addressed.

The serial number can be found on the Identification (ID) Tag that is affixed to all actuators. The tag is a thin, silver colored, plastic label with a self-adhesive backing. Information is imprinted in black. The tag is located on the housing tube of the actuator. In some cases, the ID tag may be painted over by the

OEM (Original Equipment Manufacturer).

Additionally, the serial number of the actuator is stamped onto the housing tube. It may be necessary to remove paint to expose the serial number.

If the ID tag is not attached to the actuator and/or the stamped serial number cannot be located, the basic actuator model can be identified by measuring the outside diameter of the actuator.



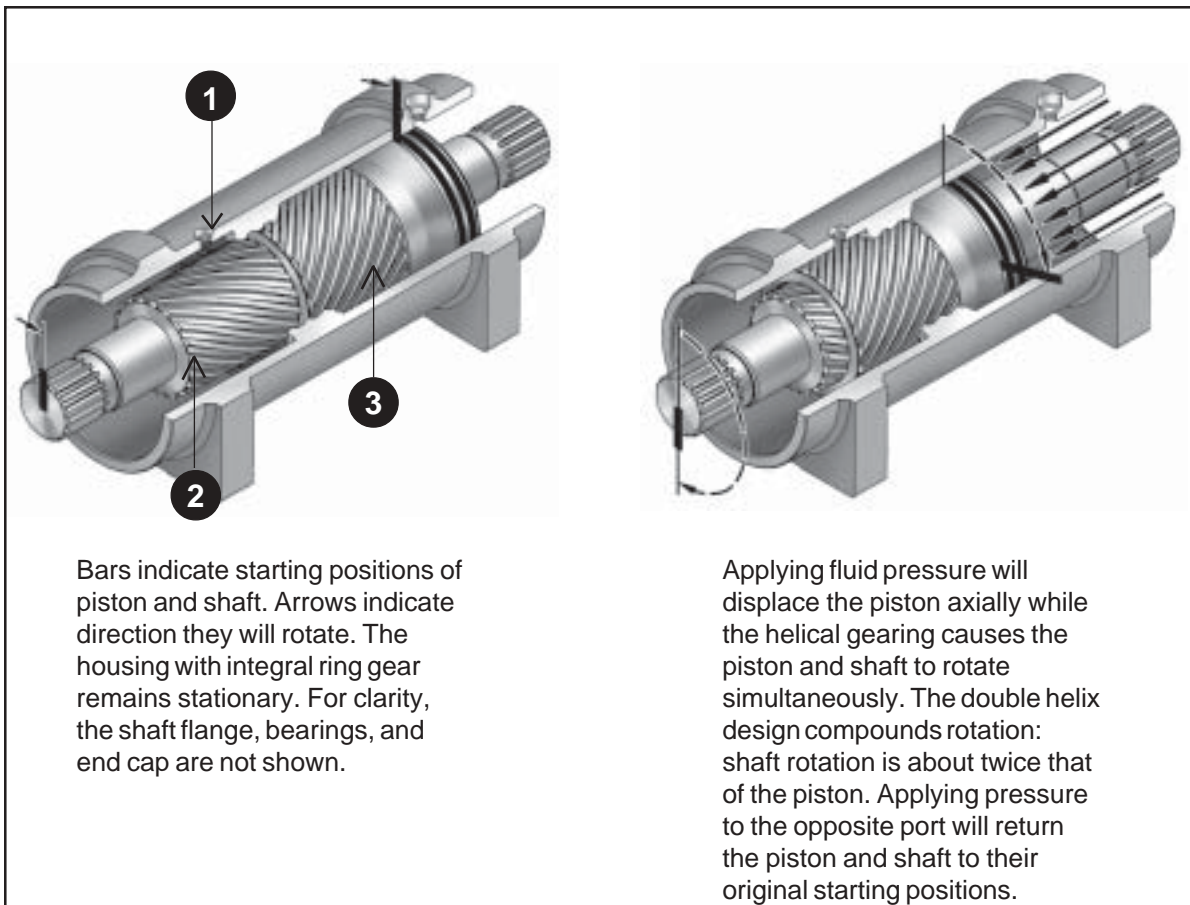
Theory of Operation

The L10 Series rotary actuator is a simple mechanism that uses Helac's sliding spline technology to convert linear piston motion into powerful shaft rotation. Each actuator is composed of a housing with an integral ring gear (1) and only two moving parts: the central shaft with an integrated bearing and mounting flange (2), and the annular piston sleeve (3).

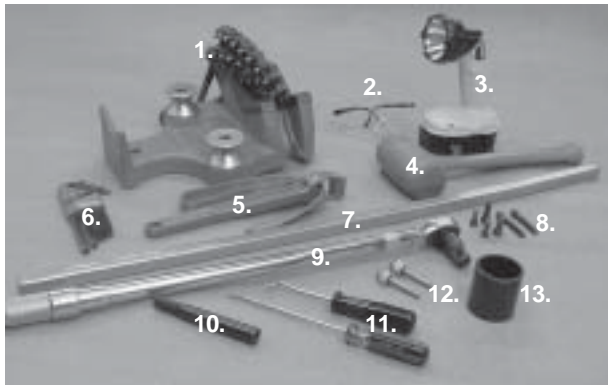
Helical spline teeth machined on the shaft engage matching splines on the inside diameter of the piston. The outside diameter of the piston carries a second set of splines, of opposite hand, which engage the matching splines of the housing's ring gear.

As hydraulic pressure is applied, the piston is displaced axially within the housing - similar to the operation of a hydraulic cylinder - while simultaneously, the splines cause the shaft to rotate. When the control valve is closed, oil is trapped inside the housing, preventing piston movement and locking the shaft firmly in position.

The shaft is supported radially by the large upper radial bearing and the lower radial bearing. Axially, the shaft is separated from the housing by the upper and lower thrust washers. The end cap is adjusted for axial clearance and locked in position by set screws or pins.



Tools Required



Several basic tools are required for the disassembly and the assembly of the actuator. The tools and their intended functions are outlined below:

- 1. PIPE VISE**
To secure the actuator to the work bench.
- 2. SAFETY GLASSES**
- 3. FLASHLIGHT**
Helps in locating and examining timing marks, component failure and overall conditions.
- 4. RUBBER MALLET**
Removal and installation of shaft and piston sleeve
- 5. STRAP WRENCH**
Used to turn the piston onto and off of the shaft
- 6. HEX WRENCH SET**
Removal and replacement of port plugs and set screws (106,110).
- 7. PRY BAR**
Removal of end cap and manual rotation of shaft.
- 8. ASSORTED SCREWS**
Removal and installation of shaft and piston sleeve.
- 9. TORQUE WRENCH**
Use when achieving certain torque specifications.
- 10. FELT MARKER**
Makes timing marks and outlines troubled areas.
Permanent ink is recommended.

11. SEAL TOOLS

Removal and installation of seals and wear guides.

12. DOWEL PINS

Removal and installation of end cap.

13. PROTECTIVE SLEEVE (see details on page 10)

Protects the internal gear teeth and threads during disassembly and assembly. (Provided with Helac seal kit for most models)

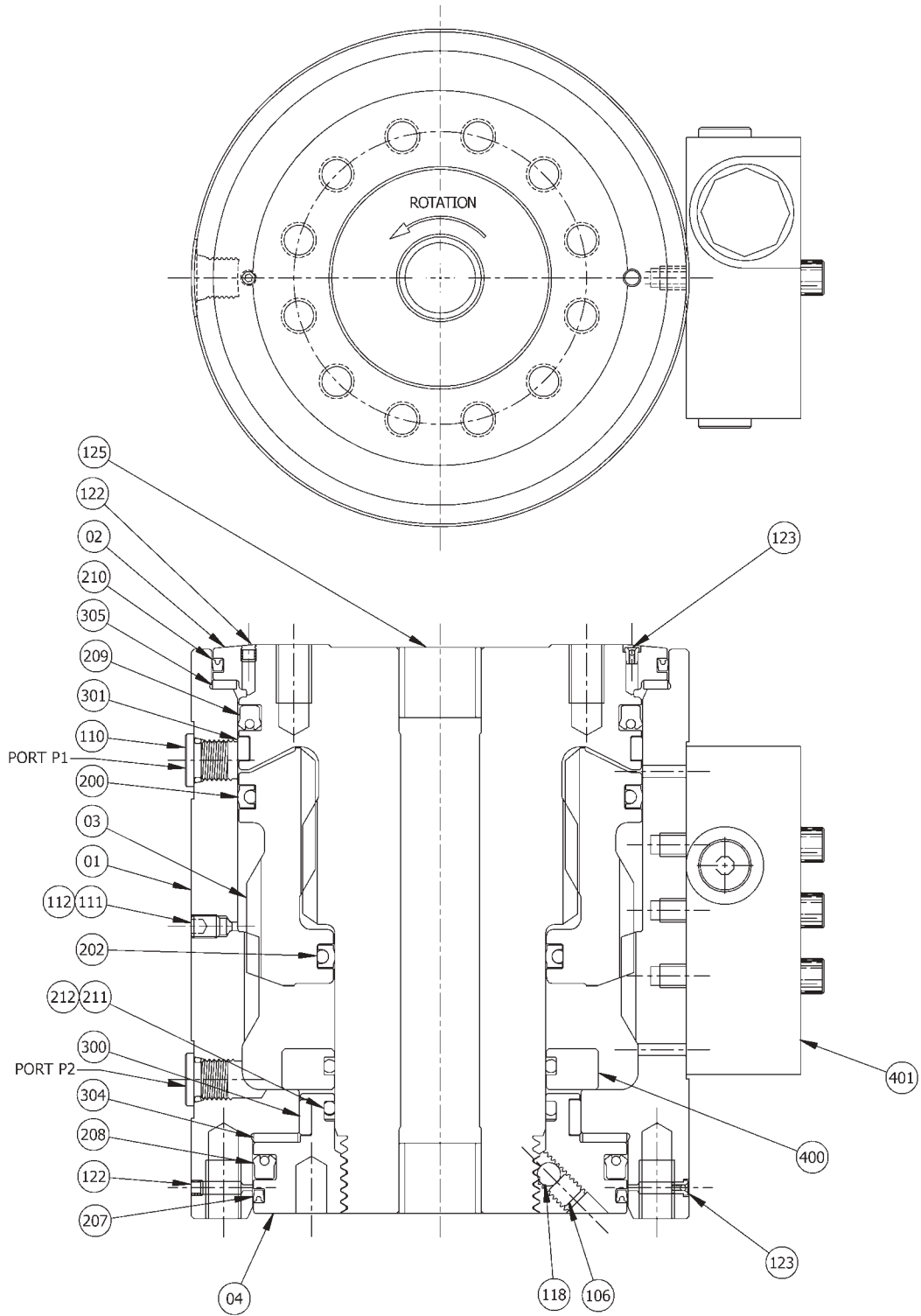
MAKING A SEAL TOOL

The seal tool is merely a customized standard flat head screwdriver.

1. Heat the flat end with a torch until it glows.
2. Secure the heated end of the screwdriver in a vise and bend the heated end to a slight radius.
3. Round off all sharp edges of the heated to a polished finish. The tool may be modified slightly to your own personal preference.

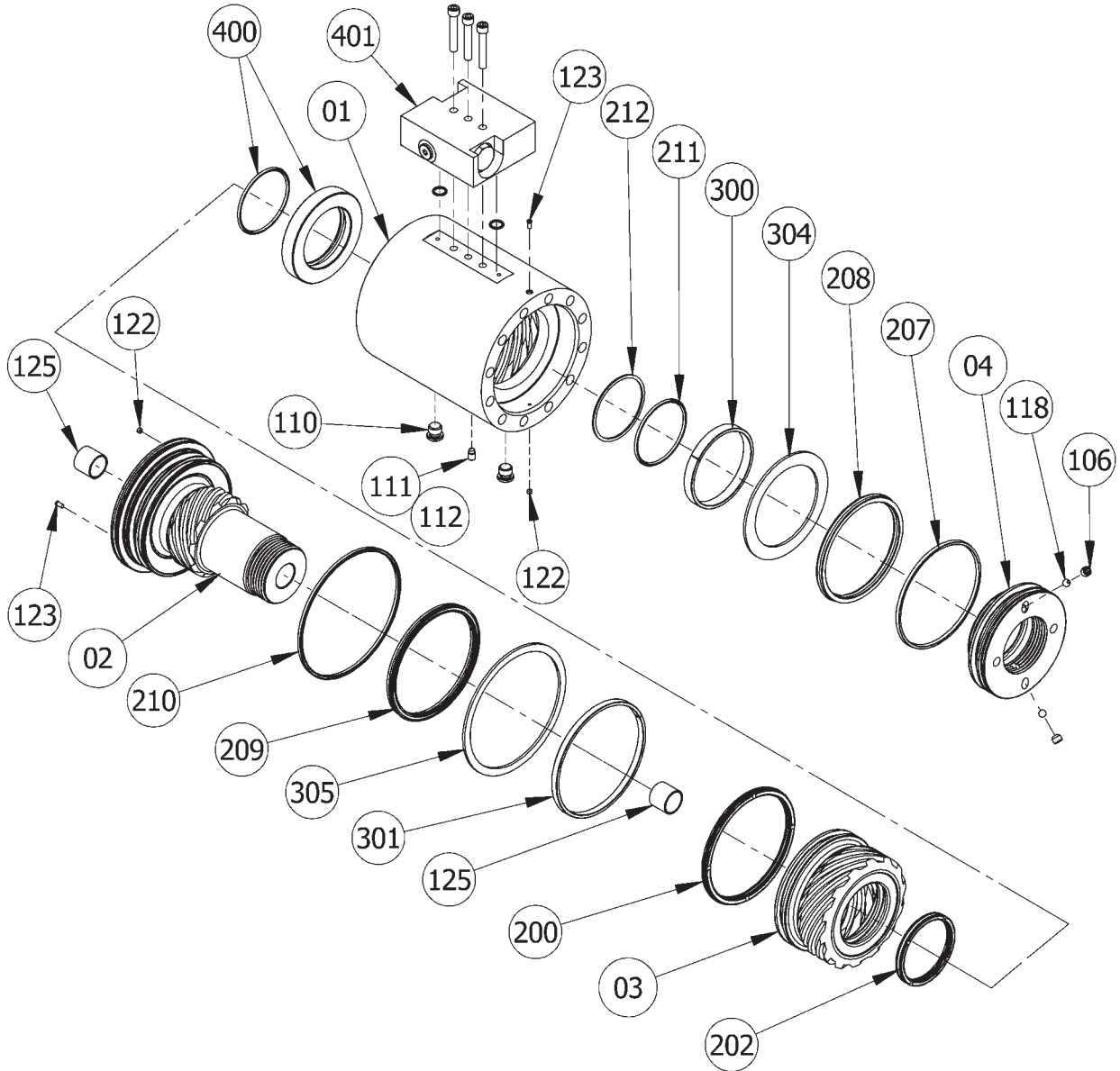


Assembly Drawing



Exploded View

Typical L10 Series Actuator



Parts List

Spare Parts

Spare parts must be ordered through the vehicle/machine OEM. Seals and bearings are available as complete kits only! In order to obtain the correct parts, it is essential to provide the serial number for the actuator to be repaired. See Product Identification on Page 4. To identify spare parts required, refer to the Assembly Drawing, Exploded View Drawing and the Parts List.

PARTS

Item	Description	Quantity
1	Housing	1
2	Shaft	1
3	Piston Sleeve	1
4	End Cap	1

HARDWARE

Item	Description	Quantity
106	Set Screw	2
110	Port Plug	4
111	Bleeder Port Plug	1
112	Bleeder Screw	1
118	Steel Ball	2
122	Set Screw (Grease Relief Port)	2
123	Grease Fitting (Grease Zerk - Female)	2

SEALS

Item	Description	Quantity
200	Crown Seal	1
202	Crown Seal	1
207	Cup Seal	1
208	Cup Seal	1
209	Cup Seal	1
210	Cup Seal	1
211	O-Ring	1
212	Back-Up Ring	1

BEARINGS

Item	Description	Quantity
300	Wear Guide	1
301	Wear Guide	1
304	Thrust Washer	1
305	Thrust Washer	1

OPTIONAL ACCESSORIES

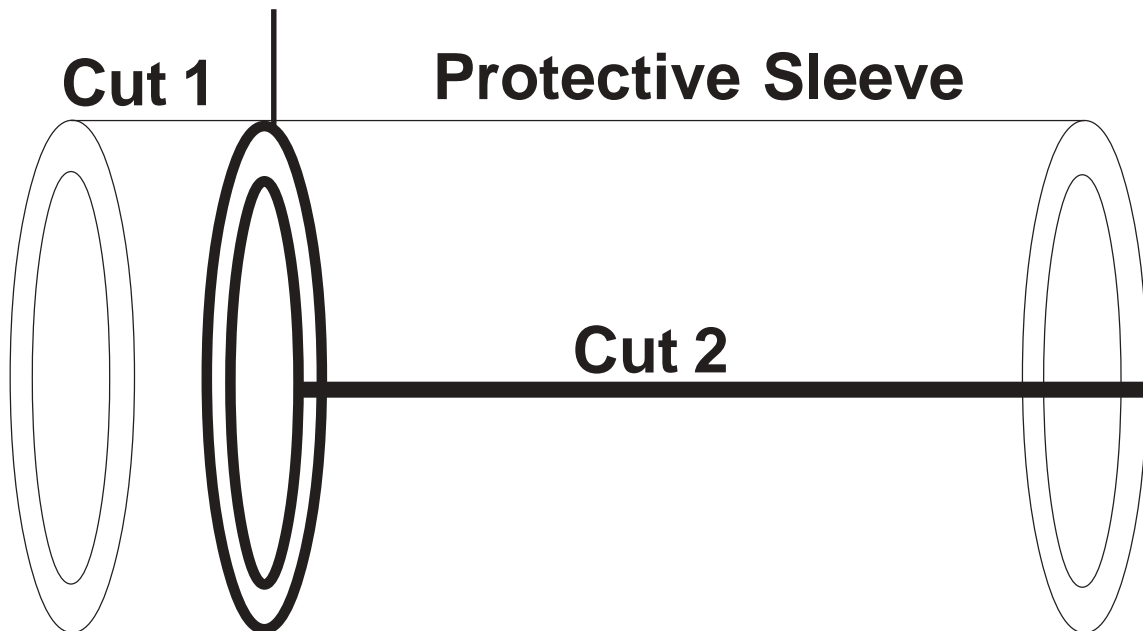
Item	Description	Quantity
125	Bushing	2
400	Stop Tube (O-Ring included)	1
401	Counterbalance Valve	1

Protective Sleeve

Protective Sleeve

The protective sleeve is included with each seal kit, and is pre-cut to a length determined by the base model configured with a 360 degree rotation. The sleeve needs to be cut down to a length that is approximately $\frac{1}{4}$ " longer than the exposed shaft, after the shaft flange has been rotated to the most clockwise position. (Refer to Step 7, page 12.) The sleeve protects the internal gear teeth, threads and housing bore during the disassembly and assembly process. Using a vise and a fine tooth hack saw or similar cutting tool, cut (1) (see illustration below) to length.

Note: The second cut (2) is only needed for the L25 model and for models when the protective sleeve is difficult to slide over the shaft. Then cut (2) (see Note above and illustration below) lengthwise down the entire body of the sleeve, this will allow the sleeve to open slightly and slide over the shaft without damaging the threads.



Disassembly

Before Disassembly



NOTICE

All numbers that appear in parenthesis () are referring to items on page 8 or 9. All letters that appear in parenthesis () are referring to a reference mark or timing mark.

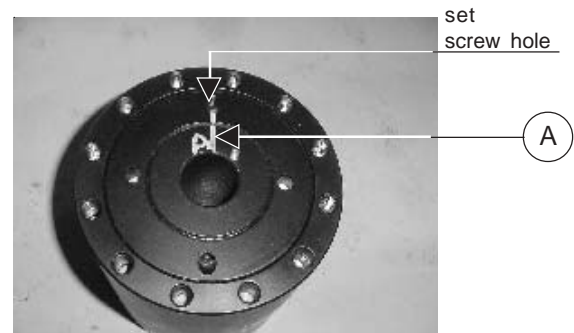
Inspect the actuator for corrosion prior to disassembly. Severe corrosion can make it difficult to remove the set screws (106) and unthread the end cap (4). If corrosion is evident, soak the set screws with penetrating oil for several hours before disassembly. Disassembly of entire actuator is considerably easier if the actuator is placed in a vise or metal table equipped with a slotted channel.

Disassembly

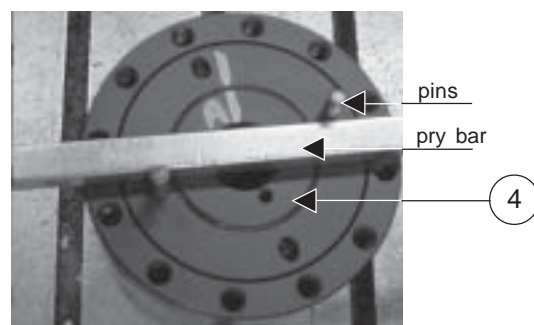


1. Using a hex wrench, remove all port plugs.
2. Drain the actuator of all oil into a suitable container. Examine oil for signs of contamination.

3. Insert two cap screws into the housing and secure the actuator, shaft flange facing up, to a slotted table. Insert two dowel pins into the shaft flange, place a pry bar between the dowel pins and rotate the shaft flange to end of rotation.
4. Remove cap screws and dowel pins, turn actuator over (end cap (04) side up). Using a sharp tool or permanent marker, make a reference mark (A) from the end cap set screw hole to the middle of the shaft. This reference mark will be needed for the assembly process on page 22. See Photo Below

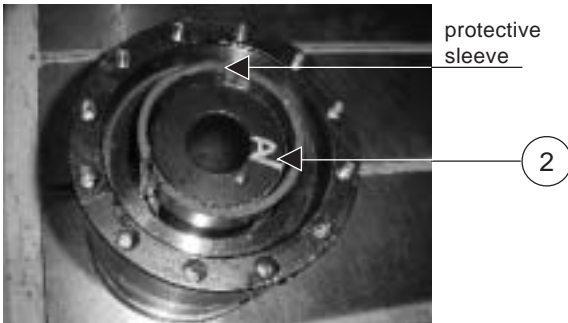


5. Using a hex wrench, remove the set screws (106) and steel balls (118) from the end cap.

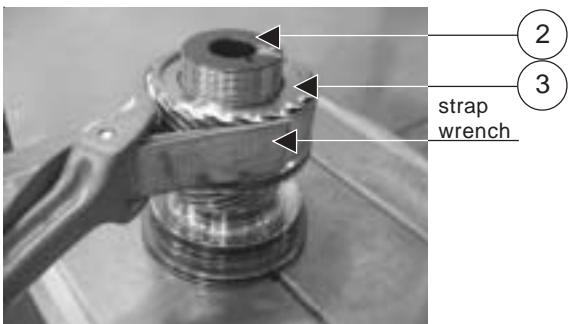


Disassembly

- Insert two cap screws into the shaft flange and secure the actuator to the slotted table. Insert the dowel pins into the end cap (4) spanner holes. Using a metal bar or something similar, unscrew the end cap by turning it counterclockwise.
- Place the protective sleeve from the seal kit, down over the threaded end of the shaft (2) until contact is made with the piston.



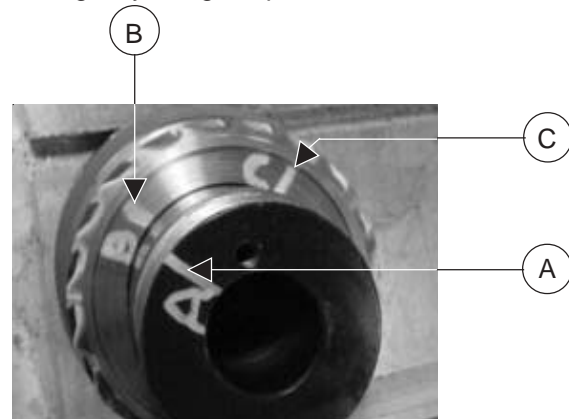
- Insert two cap screws into the shaft flange (02) and secure to slotted table with threads facing up. Place a strap wrench around the piston (03) gear teeth, turn clockwise until the piston is seated against the shaft.



- Using the reference mark (A) on top of the threaded end of the shaft, make a timing mark (B) on the piston surface closest to the shaft in direct radial alignment with reference mark (A). Marks (A and B) must line up with each other. Count the appropriate number of gear teeth clockwise from the first piston timing mark (B), make another timing mark (C), at this location. (See chart below for proper gear teeth count for timing mark (C)). See Photo Below for example.

Model	Gear Teeth Count
L10 - 3.0 (all models)	6 1/2 gear teeth clockwise
L10 - 5.5 (all models)	6 3/4 gear teeth clockwise
L10 - 9.5 (all models)	8 1/2 gear teeth clockwise
L10 - 15 (180°)	10 gear teeth clockwise
L10 - 15 (360°)	16 3/4 gear teeth clockwise
L10 - 25 - (360°)	18 1/2 gear teeth clockwise

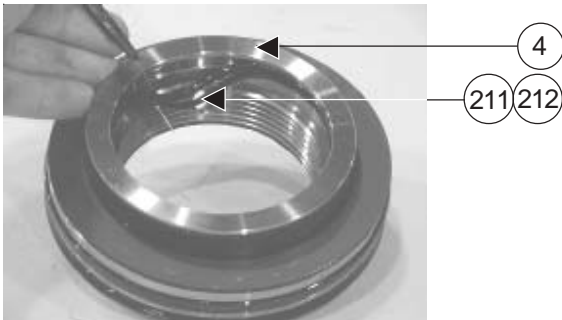
- Using the strap wrench, remove the piston by rotating counterclockwise slowly until the piston disengages, continue turning counterclockwise while gently lifting the piston off of the shaft.



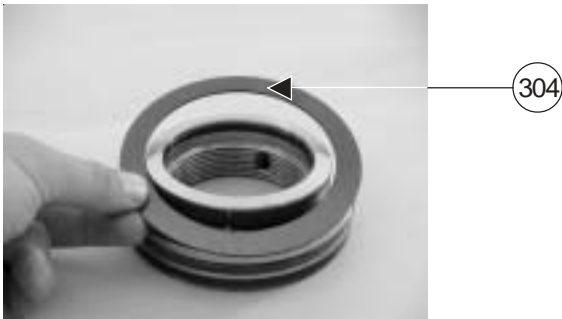
Disassembly

NOTICE
To avoid damage to machined parts:
Carefully remove seals using removed tools with rounded edges.

11. Remove the O-ring (211) and the backup ring (212) from the end cap (4).



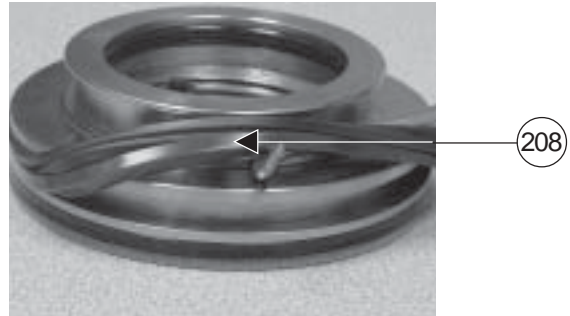
12. Remove the thrust washer (304) from the end cap (4).



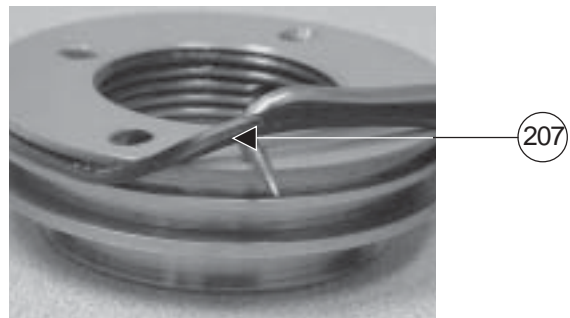
13. Remove the wear guide (300) from the end cap (4).



14. Remove the main pressure seal (208).



15. Remove the exclusion seal (207).

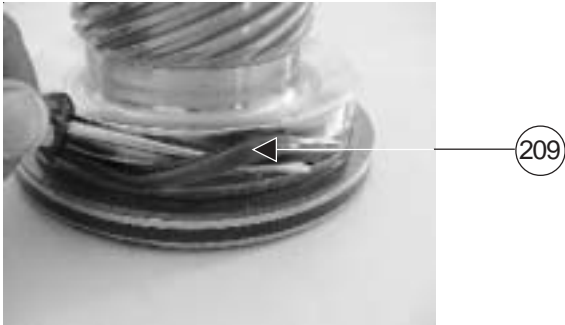


16. Remove the wear guide (301) from the shaft (2).

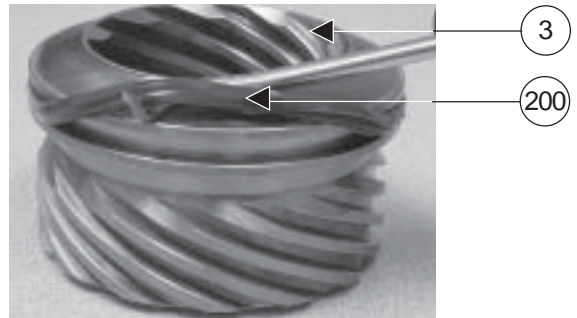


Disassembly

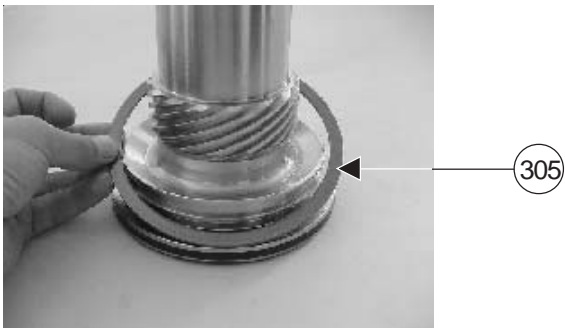
17. Remove the main pressure seal (209).



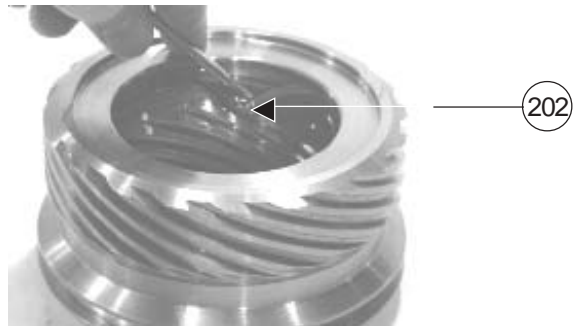
20. Remove the piston sleeve (3) OD seal (200),



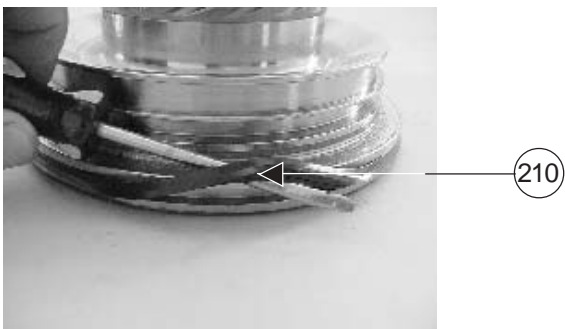
18. Remove the thrust washer (305).



21. Remove the piston sleeve (3) ID seal (202) using a small pick or seal tool.



19. Remove the exclusion seal (210), from the shaft (02).



Inspection



NOTICE Prior to assembly of actuator, these steps must be closely followed to insure proper operation of the actuator.

1. Clean all parts in a wash tank and dry with compressed air prior to inspecting.
2. Carefully inspect all critical areas for any surface finish abnormalities: Seal grooves, bearing grooves, thrust surfaces, shaft surface, housing bore and gear teeth.

NOTICE Small or minor surface scratches can be carefully polished.

Seal and Bearing Installation

NOTICE Lightly oil all seals, seal grooves bearings, and housings prior to installing.

Pre-Assembly

All actuators are timed according to OEM specifications at Helac's production facility. The timing ensures that the actuator will stop at the required position at the end of the rotation in either direction. Wrong timing can cause the actuator to over rotate resulting in interference and damage of equipment components. Rotation being too short can limit the operating range of the equipment. The proper gear engagement of shaft, piston and housing ensures the correct timing. The gear teeth are obstructed from view during the assembly of the L10 actuator, so following the manual step by step is crucial for a successful repair.

Dry Run

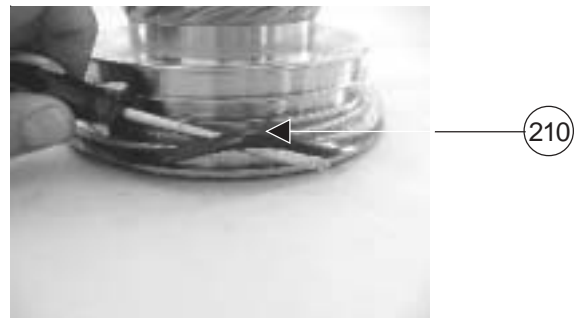
For repair personnel not familiar with the L10 actuator, it is recommended that a "dry run" with the following configuration be performed: Install only the inner piston seal (202) on page 18 step 10. The seal will prevent the piston from sliding off of the shaft during installation. Install the thrust washer (305) onto the shaft for proper internal spacing of components. Proceed to assembly procedures starting on page 19, ensure proper fit and timing of actuator, then disassemble and apply all seals and bearings. For seal and bearing orientation use the cut-away drawing on page 7 as a reference.

NOTICE Remove the end cap and shaft grease relief set screws (122) prior to assembly. This will allow excess grease applied to the thrust washers to escape during assembly. Failure to do so may prevent the end cap and/or shaft from fully seating into position.

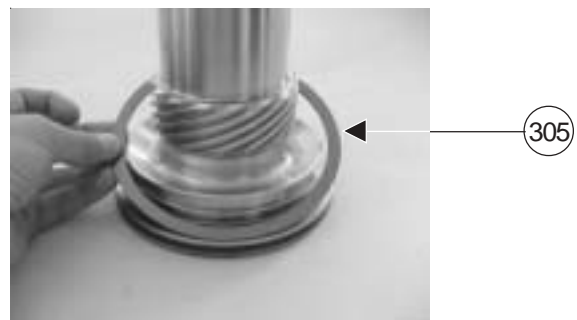
The set screws are recessed down deep below the surface of each grease relief port, be sure to use the appropriate size hex wrench for these set screws.



1. Using a seal tool (see Page 6) install the exclusion seal (210) onto the shaft.



2. Lightly grease the thrust washer (305) with Lithium grease and install onto the shaft (2).

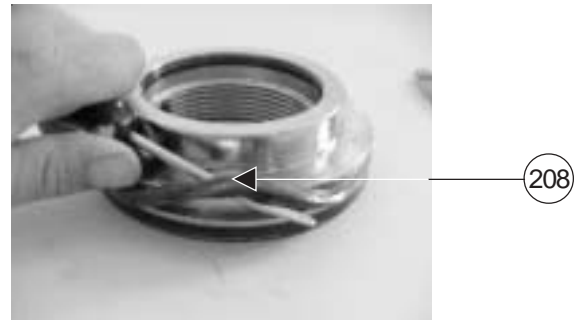


Seal and Bearing Installation

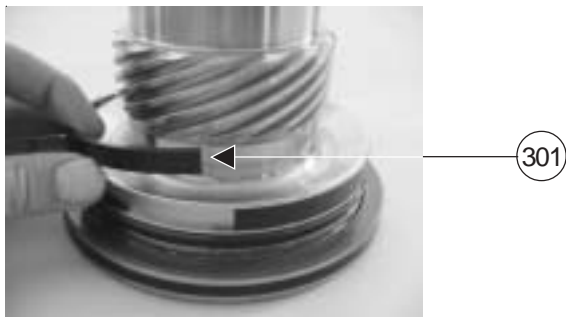
3. Install the main pressure seal (209) onto the shaft (2) using the seal tool.



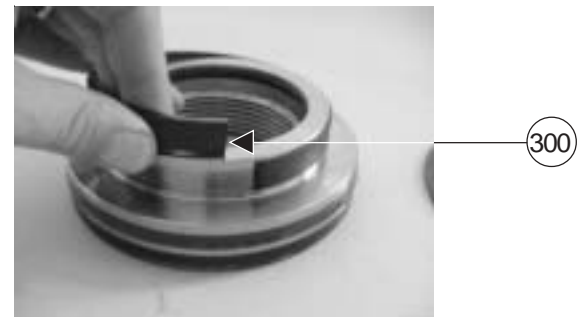
6. Install the main pressure seal (208) onto the end cap (4).



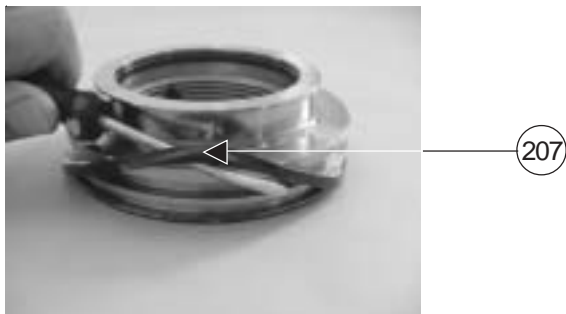
4. Install the wear guide (301) onto the shaft (2).



7. Install the wear guide (300) onto the end cap (4).



5. Install the exclusion seal (207) onto the end cap (4).

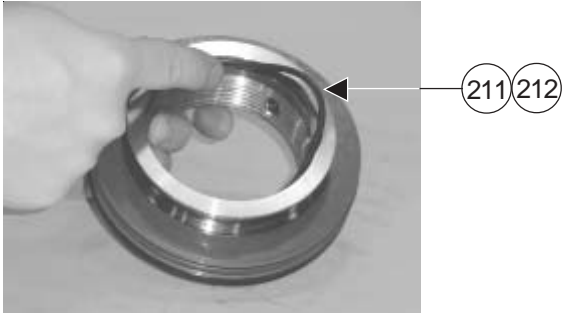


8. Lightly grease the thrust washer (304) with Lithium grease and install onto the end cap (4).

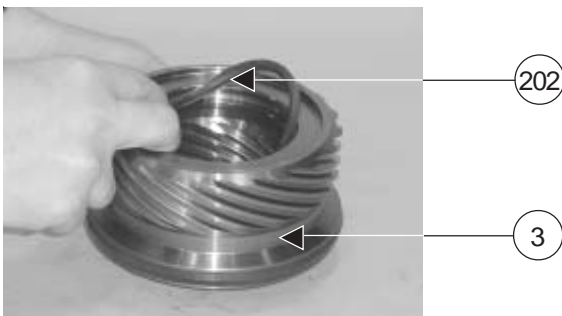


Seal and Bearing Installation

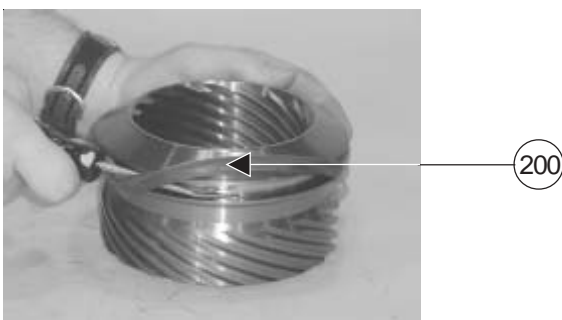
9. Install the O-ring (211) and backup ring (212) into the inner seal groove on the end cap (4).



10. Install the piston sleeve ID seal (202) into the piston (3) using a circular motion.



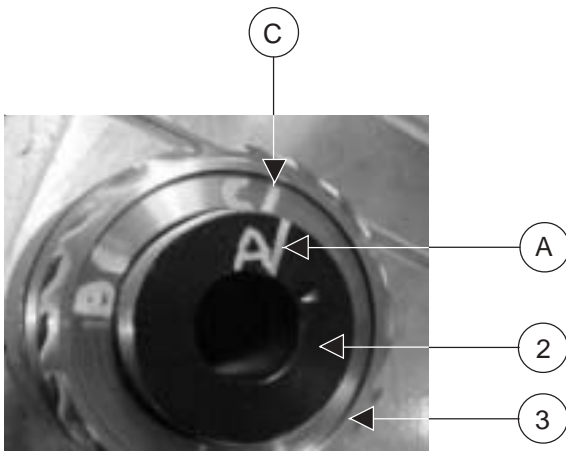
11. Install the piston sleeve OD seal (200) onto the piston sleeve (3).



Assembly



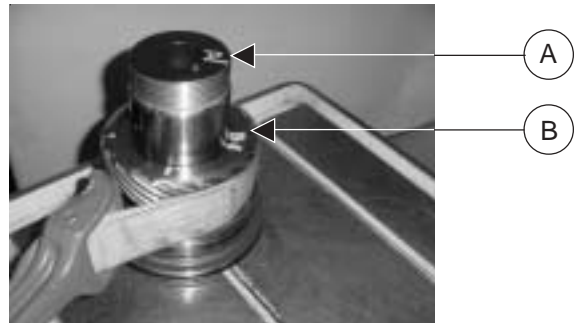
1. Secure the shaft, flange down to a slotted table, then place the piston (3) onto the threaded end of the shaft (2). Align vertically, the shaft reference mark (A) and the second timing mark (C) on the piston. Press the piston (3) down firmly over the shaft (2) until the piston ID seal (202) slides over the shaft chamfer (you will feel a pop or click) and the piston contacts the shaft gear teeth. Make sure the two marks (A) and (C) are still in line with each other.



2. Place a strap wrench around the piston OD (3) gear teeth, rotate the piston clockwise. The piston will engage the shaft (2) gear teeth. Rotate piston until it is firmly seated against the shaft

NOTICE

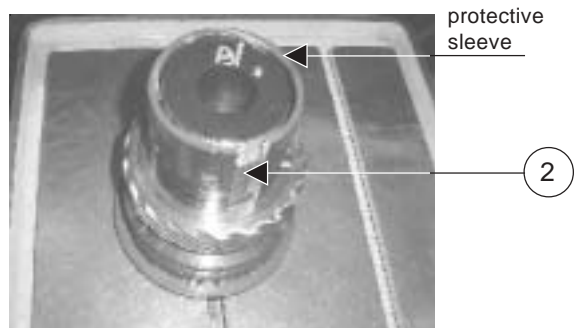
The shaft (2) reference mark (A) and the first timing mark (B) on the piston (3) must be lined up. If not, repeat steps 1-2.



3. If applicable, slide the stop tube (400) over the shaft.

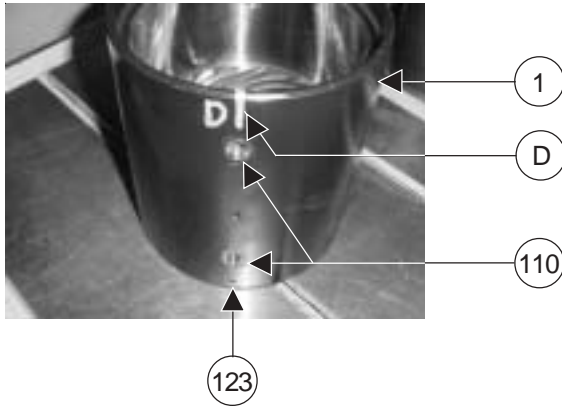
The seal inside the stop tube does not function as a seal, it's purpose is to keep the stop tube stationary on the shaft.

4. Place protective sleeve over the shaft (2).



Assembly

5. Make a timing mark (D) on the top lip of the housing (1), directly in line with the two hydraulic ports (110) on the side with the female grease zerk (123).

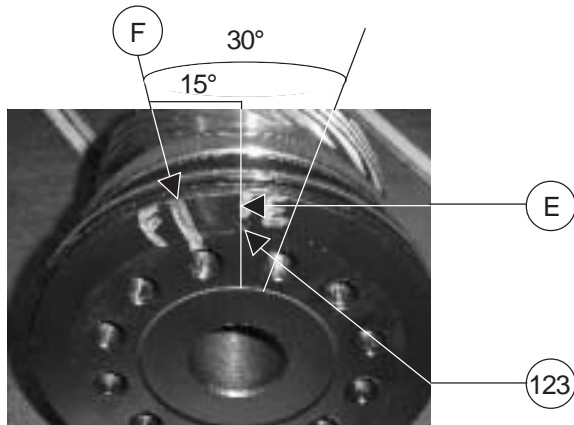


6. Make a timing mark (E) with a marker, in line with the female grease zerk (item 123 on assembly drawing page 7) on the shaft flange (2).

NOTICE

Do not use the grease relief port (122) with threaded hole and set screw for timing procedure.

Using the timing mark (E) or female grease zerk (123) as a reference point, go counterclockwise by the degrees shown in the chart below, and make another timing mark (F). Photo below shows L10-9.5 actuator.

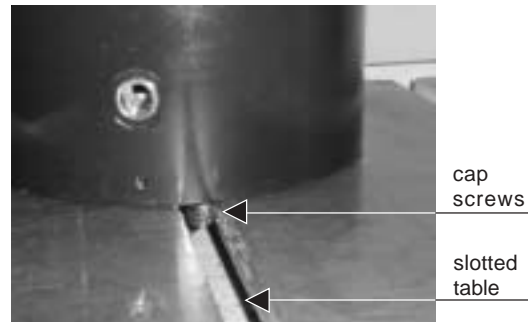


NOTICE

Approximate Degree Offset chart below for placement of timing mark (F) for each model.

Model	Approximate Degree Offset
L10 - 3.0 (180° and 360°)	30° counterclockwise
L10 - 5.5 (180°-185° and 360°)	30° counterclockwise
L10 - 9.5 (185° and 360°)	15° counterclockwise
L10 - 15 (180°)	15° counterclockwise
L10 - 15 (360°)	30° counterclockwise
L10 - 25 (180°)	30° counterclockwise
L10 - 25 (360°)	36° counterclockwise

7. Install two cap screws into the threaded mounting holes on the housing (1). Using a slotted table, secure the housing as shown.



8. Generously apply the appropriate grease to the shaft thrust washer prior to inserting into housing.

NOTICE

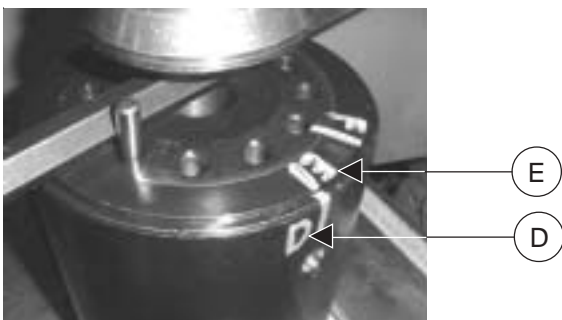
Be sure the end cap and shaft grease relief set screws (122) are removed prior to inserting into housing.

Assembly

9. Insert the assembled piston (3) and shaft (2) with protective sleeve applied into the housing (1) (see photo below). The assembly will come to a stop when the main pressure seal (200) contacts the piston bore in the housing. At this point, the outer gear teeth of the piston are close to coming into engagement with the gear teeth in the housing. Align the two timing marks (D and F) from steps 5 and 6.



10. Install two dowel pins into the shaft flange, place a pry bar between the dowel pins. Gently apply pressure to the top of the pry bar. The main pressure seal (200) will compress and slip into the housing bore, and the gear teeth between the piston and housing will come in contact. Be careful, the gear teeth may not completely line up. Using the pry bar rotate the shaft slightly back and forth while continuously applying gentle pressure (see photo below). The gear teeth will start to mesh and the shaft/piston assembly will rotate counterclockwise into the housing until the shaft flange is almost flush with the face of the housing. The timing marks D and E should line up.



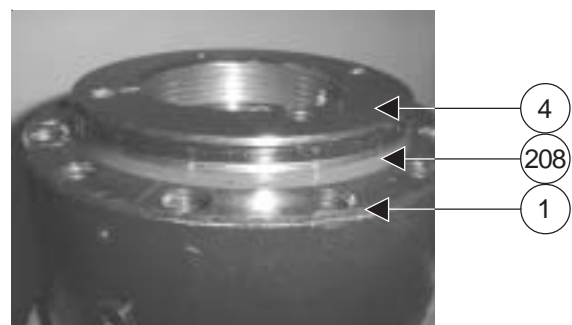
- NOTICE** If timing mark (E) goes past timing mark (D), press and rotate the shaft clockwise, back to timing mark (D).

- NOTICE** If the shaft raises (unseats) before timing mark (E) lines up with timing mark (D) going in either direction, the piston has moved from its seated position against the shaft and you must disassemble and repeat steps 9-10.

11. Turn actuator over and place the shaft flange end down, with threaded bolts inserted, into a vise or slotted table. Remove the protective sleeve from the shaft.

- NOTICE** If there is not a slotted table available, place a strap wrench around the housing to secure it.

12. Coat the threads of the shaft (2) and the end cap (4) with Lithium grease prior to assembly to prevent galling. Thread the end cap onto the shaft until the seal (208) on the end cap contacts the housing (01).



Assembly

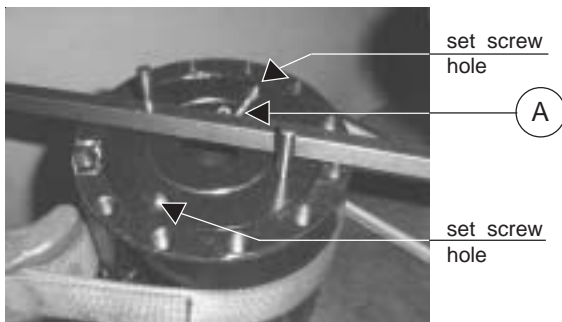
- 13.** Insert pins into the end cap (4) spanner holes. Using a pry bar, screw the end cap on by turning it in a clockwise direction until it becomes tight (see General Torque Guidelines chart). Use the reference mark (A) made during the disassembly process, as a reference point to line up the two set screw holes in the end cap with the grind marks (dimples) on the shaft threads.

NOTICE

During the assembly process at the factory, there are two small grind marks (dimples) made in the threads of the shaft to lock the end cap and shaft in position. A steel ball is placed into each set screw hole on the end cap and locked in position by the set screw.

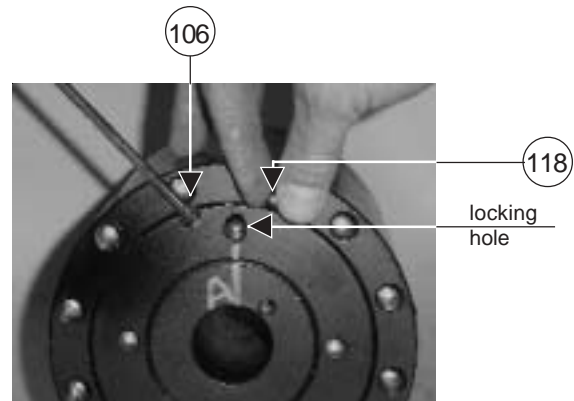
If the end cap gets tight and the grind marks (dimples) are not visible, you must use a small ball grinder similar in size to the steel balls (118) and make new grind marks (dimples). Be sure to clean out all of the grinding dust before continuing.

If any portion of the existing grind marks (dimples) are visible when the end cap gets tight, loosen or tighten the end cap until reference mark (A) is lining up.



Model	End Cap - General Torque Guideline	
L10 - 3.0	Approximately 40 ft-lbs	54 Nm
L10 - 5.5	Approximately 60 ft-lbs	81 Nm
L10 - 9.5	Approximately 90 ft-lbs	122 Nm
L10 - 15	Approximately 150 ft-lbs	202 Nm
L10 - 25	Approximately 225 ft-lbs	305 Nm

- 14.** Visually inspect each locking hole in the end cap (4) for alignment and possible grease and/or debris. Clean as needed. Place the appropriate size steel ball (118) (see spec chart below) into each locking hole. Using the proper size hex wrench, insert a set screw (106) coated with Loctite 242 locking compound into each locking hole, securing the end cap to the shaft.



Model	Steel Ball Size Specifications
L10 - 3.0	.250 inch (1/4")
L10 - 5.5	.250 inch (1/4")
L10 - 9.5	.312 inch (5/16")
L10 - 15	.312 inch (5/16")
L10 - 25	.312 inch (5/16")

Grease Thrust Washers

After the actuator is assembled but before it is put back into service, the thrust washers and exclusion seals must be packed with Lithium grease.

- 1 There are four grease ports, two of each are located on the shaft flange and the outer diameter of the housing (see exploded view on page 8 for reference). Some models will have a female grease zerk in one of each two ports. Using the appropriate size hex wrench, remove the grease port set screws from the shaft flange and the housing.

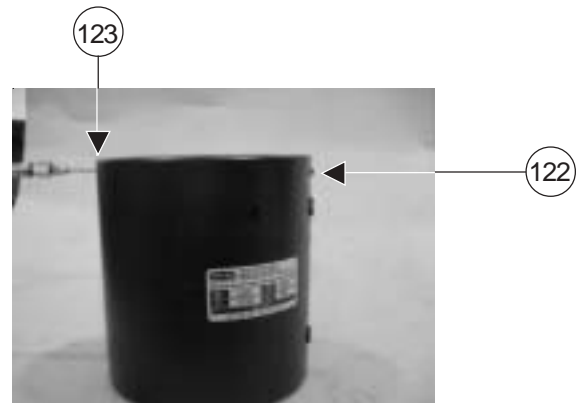
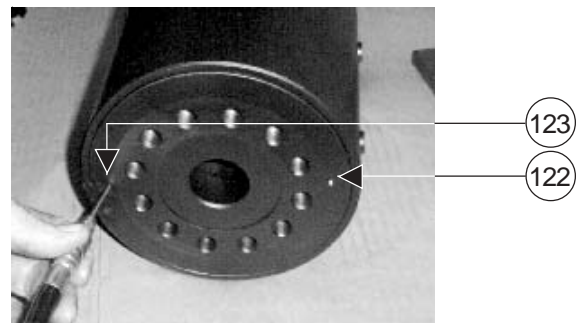
NOTICE

The set screws are recessed below the surface of each grease port, be sure to use the appropriate size hex wrench for these set screws.

NOTICE

If a hydraulic test bench is not available, the actuator can be rotated by hand, open the pressure ports and use a pry bar with cap screws inserted into the shaft flange to turn the shaft in the desired direction.

Insert the tip of the male grease needle nozzle into female grease zerk, if so equipped. Otherwise, put the nozzle into either grease port. Apply grease to the shaft flange. Continue applying until grease flows from the relief port. Cycle the actuator five times and apply grease again. Repeat this process at the housing. Insert the set screws into the grease port and tighten to 25 in-lbs (2.8 Nm).



Testing the Actuator



Testing the Actuator

If the equipment is available, the actuator should be tested on a hydraulic test bench. The breakaway pressure—the pressure at which the shaft begins to rotate—should be between 100 and 300 psi (7 to 21 bar). Cycle the actuator at least 25 times at 3000 psi (210 bar) pressure. At the end of rotation, increase the pressure to 4500 psi (315 bar) to check for leaks and cracks. Perform the test again at the end of the rotation in the opposite direction.

Testing the Actuator for Internal Leakage

Rotate the shaft to the end of rotation at 3000 psi (210 bar) and maintain pressure. Remove the hydraulic line from the non-pressurized side. Continuous oil flow from the open pressure port indicates internal leakage across the piston. Replace the line and rotate the shaft to the end of rotation in the opposite direction. Repeat the test procedure outlined above for the other port.

Installation and Bleeding



together to create a closed loop and pump hydraulic fluid through them. Review the OEM's operating manual and/or hydraulic schematic to determine which hydraulic lines to connect. The length and inside diameter of the hydraulic supply lines together with pump capacity will determine the amount of pumping time required to fully purge the hydraulic system.

Bleeding will be necessary if excessive backlash is exhibited after the actuator is connected to the hydraulic system. The following steps are recommended when a minimum of two gallons (8 liters) is purged.

The OEM has the choice to specify three different actuator versions for bleeding:

- single bleed screw (photo, page 26)
- single bleed plug (photo, page 27)
- dual bleed screw (photo, page 28)

Bleed screw assemblies can be ordered as an option. (Helac Part Number S52125)

Actuators with only a single bleed screw or plug will only bleed one side of the actuator.

Hydraulic systems with a flow rate of 2.0 gallons (7.5 liters) per minute or higher, and short return lines to tank may easily purge air from the actuator. In this case bleeding is not required.

NOTICE

This procedure is only for actuators that are positioned vertically, with the shaft flange facing up. All other positioned actuators must use the procedure on page 28.

NOTICE

For best bleeding results, the actuator should be mounted in such a way as to locate the ports as close to the top as possible.

NOTICE

The actuator will either have a bleed screw (112) inserted into the bleed plug location, or will have a bleed plug set screw (111) that can be removed and then bled with no bleed screw.

Actuators positioned vertically, with only a single bleed screw installed:

1. Connect a $\frac{3}{16}$ " inside diameter, clear vinyl drain tube to the bleed screw (112). Secure it with a hose clamp. Place the vinyl tube in a clean 5 gallon container to collect the purged oil. The oil can be returned to the reservoir when the procedure is complete if needed.



After installation of the actuator onto the equipment, it is important that all safety devices such as tie rods or safety cables are properly reattached.

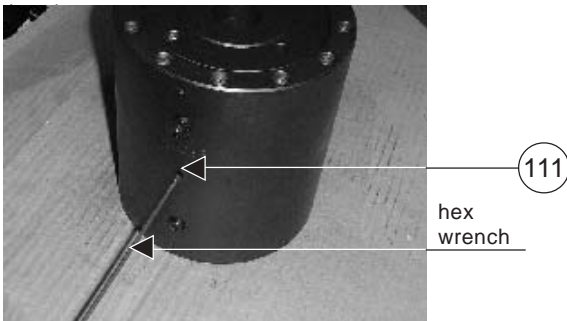
To purge air from the hydraulic lines, connect them

Installation and Bleeding

2. With an operator at the controls, open the bleed screw a $\frac{1}{4}$ turn. Hydraulically rotate the shaft flange clockwise to the end of rotation and maintain hydraulic pressure. Oil with small air bubbles will be seen flowing through the tube.
3. Keep the fitting open and rotate the shaft flange in the opposite direction to the end position. Oil with small air bubbles will be seen flowing through the tube.
4. Repeat steps 2 & 3 until at least a $\frac{1}{2}$ gallon of hydraulic fluid is purged and no bubbles can be seen in the oil. Close the bleed screw before rotating away from the end position.

Actuators positioned vertically, with only a single bleed plug installed:

5. Using a $\frac{1}{8}$ " size hex wrench, carefully remove the bleed plug (111), and insert a bleed screw



Repeat steps 1 through 4.

Hydraulic systems with a flow rate of 2.0 gallons (7.5 liters) per minute or higher, and short return lines to tank may easily purge air from the actuator. In this case bleeding is not required.

NOTICE

Instructions for bleeding an actuator that is positioned vertically, with the shaft flange facing up, is on page 27. All other positioned actuators use this procedure.

After installation of the actuator onto the equipment, it is important that all safety devices such as tie rods or safety cables are properly reattached.

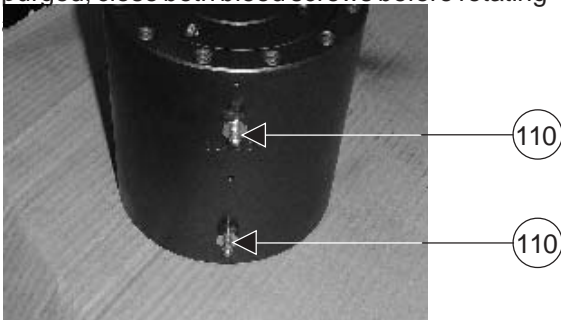
To purge air from the hydraulic lines, connect them together to create a closed loop and pump hydraulic fluid through them. Review the OEM's operating manual and/or hydraulic schematic to determine which hydraulic lines to connect. The length and inside diameter of the hydraulic supply lines together with pump capacity will determine the amount of pumping time required to fully purge the hydraulic system.

Bleeding may be necessary if excessive backlash is exhibited after the actuator is connected to the hydraulic system. The following steps are recommended when a minimum of two gallons (8 liters) is purged.

Installation and Bleeding

Actuators with two bleed screws installed:

1. Connect a $\frac{3}{16}$ " inside diameter, clear vinyl drain tube to each of the two bleed screws (110). Secure them with hose clamps. Place the vinyl tubes in a clean 5 gallon container to collect the purged oil. The oil can be returned to the reservoir when the procedure is complete if needed.
2. With an operator at the controls, open both bleed nipples a $\frac{1}{4}$ turn. Hydraulically rotate the actuator to the end of rotation (either clockwise or counterclockwise), and maintain hydraulic pressure. Oil with small air bubbles will be seen flowing through the tubes. Allow a $\frac{1}{2}$ gallon of fluid to be purged from the actuator.
3. Keep the fittings open and rotate the actuator in the opposite direction to the end position. Maintain hydraulic pressure until an additional $\frac{1}{2}$ gallon of fluid is pumped into the container.
4. Repeat steps 2 & 3. After the last $\frac{1}{2}$ gallon is purged, close both bleed screws before rotating



Troubleshooting Guide

PROBLEM	SEE CAUSES AND SOLUTIONS BELOW
Shaft rotates slowly or not at all	1-6
Operation is erratic or not responsive	7
Shaft will not fully rotate	8
Selected position cannot be maintained	3,4,7

CAUSE	SOLUTION
1. Insufficient torque output	Verify correct operating pressure. Do not exceed OEM's pressure specifications. Load may be above maximum capacity of the actuator.
2. Low rate of fluid flow	Inspect ports for obstructions and hydraulic lines for restrictions and leaks.
3. Control or Counterbalance valve has internal leak	Disconnect hydraulic lines and bypass valve. Leave valve ports open and operate the actuator through housing ports (do not exceed OEM's operating pressure). The valve must be replaced if a steady flow of fluid is seen coming from the valve ports.
4. Piston and/or shaft seal leak	Remove the plug and the housing's valve ports. Operate the actuator through the housing ports. Conduct the internal leakage test as described in the Testing Section on page 24 of this manual.
5. Corrosion build-up on the thrust surfaces	Re-build the actuator. Remove all rust and then polish.*
6. Swollen seals and composite bearings caused by incompatible hydraulic fluid	Re-build the actuator. Use fluid that is compatible with seals and bearings. Contact Helac for more information.
7. Air in actuator	Purge air from actuator. See bleeding procedure starting on page 25.
8. Port fittings are obstructing the piston during stroke	Check thread length of port fittings. Fittings should not reach inside the housing bore.
9. Twisted or chipped gear teeth.	Overload conditions. Check for binding. Actuator may or may not be able to be rebuilt and may need to be replaced.

* Replacement part may be needed.

Hydraulic Rotary Actuator Product Warranty

Standard Warranty Information

Helac Corporation warrants its manufactured products to be free from defective material and factory workmanship. Helac Corporation shall replace or repair such products, which under normal use and service disclose such defects, and return the repaired or replacement products to the purchaser prepaid. Claims under this warranty will be satisfied only by repair or replacement of the unit or any defective part thereof. No cash payment or credit will be made for defective materials, workmanship, labor or incidental charges. Products under warranty shall be returned to Helac Corporation's manufacturing facility at 225 Battersby Avenue, Enumclaw, Washington 98022 USA, transportation prepaid by the purchaser, for inspection by Helac Corporation, whose opinion as to defects shall be conclusive.

The warranty period shall be 12 months from the date of shipment from Helac Corporation's manufacturing facility for Helac Corporation approved applications. This warranty shall be voided as to any products which have been repaired, worked upon, or altered by persons not authorized by Helac Corporation, or which have been subject to misuse, negligence, accident, or overload. In no event shall Helac Corporation be liable for any incidental or consequential damages.

Helac Corporation reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligations to make changes or alterations to products previously sold.

This warranty is in lieu of all other and/or prior warranties, expressed or implied, and no other company or person is authorized to represent or assume for Helac Corporation any liability in connection with the sale of Helac Corporation products other than set forth herein.

Return and Debit Policy for Actuators

Unless agreed to in advance, all actuators will be shipped to Helac Corporation, freight prepaid within seven days after receipt of return authorization. Prior to any returns, a Return Material Authorization (RMA) form is to be requested from an authorized Helac Corporation representative. Upon receipt of the RMA form, the customer is to provide when applicable, the part number, serial number, failure date, description of problem and the customer claim or reference number. All shipments to Helac Corporation are to include the completed RMA form.

Upon receipt of the actuator(s) at the Helac Corporation facilities, an inspection will be performed and an authorized representative will provide a written quote. This quote will list the findings of the inspection and will state whether or not the warranty claim has been accepted. Actuators returned for credit may be subject to the Helac Corporation re-stocking fee.

If Helac Corporation does not receive a response to their quote within 30 calendar days, the actuator will be either scrapped or returned and an invoice for the debit amount, including the freight charges, will be sent to the claim originator.

Return and Debit Policy for Service Parts

Return of service parts, normally stocked by Helac Corporation, must be authorized in advance. This will include seal and bearing kits as well as any and all fabricated parts. Return of any special order parts will be authorized on a case-by-case basis. All returns are to be shipped to Helac Corporation freight prepaid within seven days after receipt of return authorization. Helac Corporation has a minimum re-stocking fee of 20 percent.

Prior to any returns, Return Material Authorization (RMA) form is to be requested from an authorized Helac Corporation representative. Upon receipt of the RMA form, the customer is to provide part number, receipt date, description of problem and the customer claim number. All shipments to Helac Corporation are to include the completed RMA form.

Notes

Notes

About Helac Corporation

As a leader in the fluid power industry for over 30 years, Helac Corporation manufactures a comprehensive line of hydraulic rotary actuators used as component parts for OEMs and aftermarket attachments for the construction equipment industry. Helac rotary actuators are best known for their tremendous torque output, compact dimensions,

exceptional load bearing capability and rugged, reliable performance. Helac PowerTilt and PowerGrip, two specialty products, increase the utilization of backhoes and excavators. Over 1,000 worldwide customers in diverse markets depend on Helac's product line to provide product quality, reliability, ease of use and durability.



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