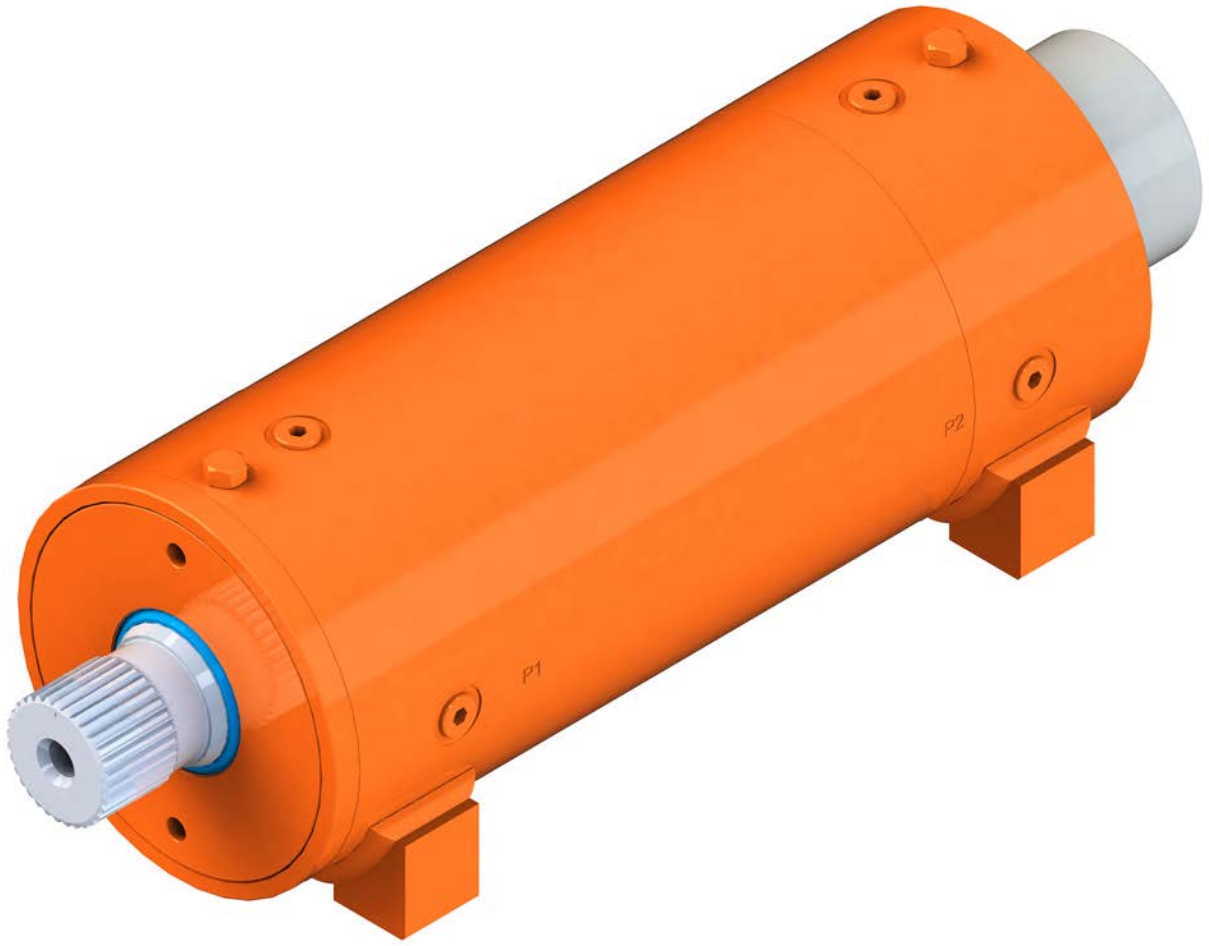

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Helical Hydraulic Rotary Actuators

T20 Series Service & Repair Manual

Parker

HELAC®

ENGINEERING YOUR SUCCESS.

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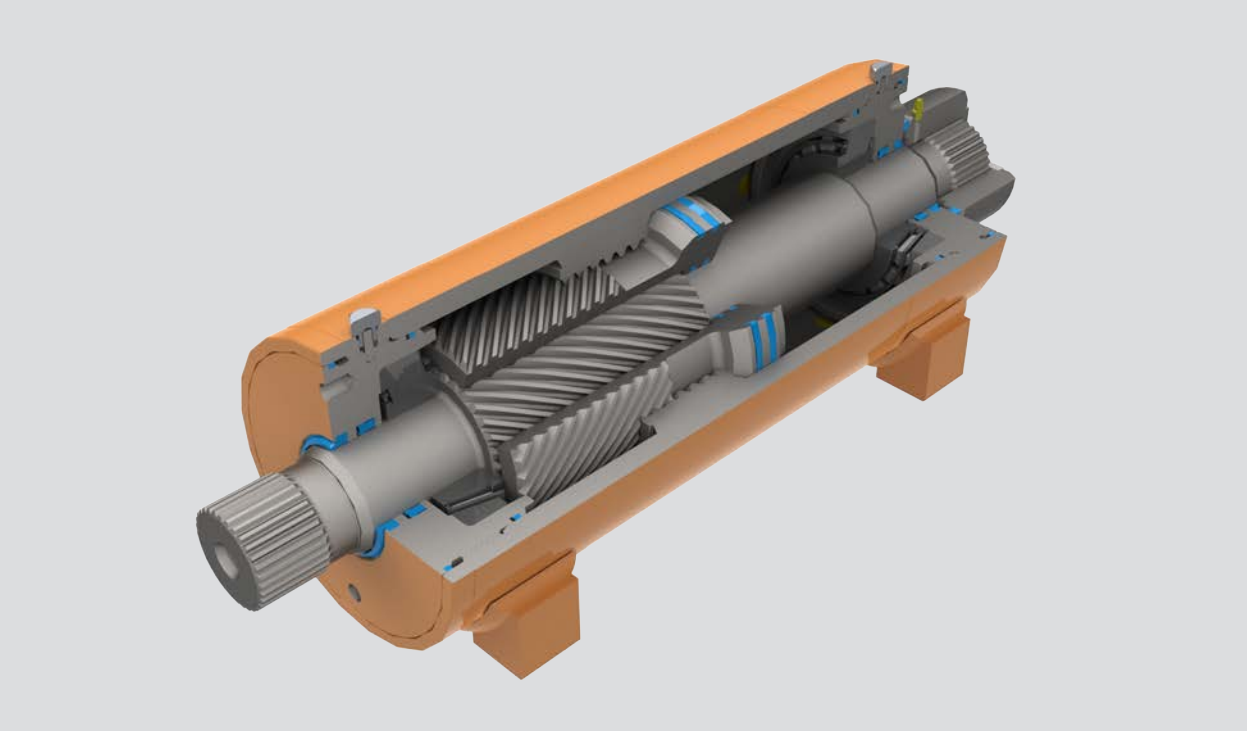
Product Overview



Product Introduction

NOTICE

Content in this Service and Repair Manual applies to all current T20 Series product models — unless otherwise noted. For information on maintaining, servicing or repairing earlier HS Series actuators — please contact Parker Hannifin Service Department at +1 800 327 2589 (U.S. and Canada) or +1 360 825 1601 (Worldwide).

NOTICE

We have used the T20-25 model actuator as a baseline throughout the manual. Variations in the T20-45 and T20-60 models will be noted where applicable.

The T20 Series rotary actuators feature a one-piece through shaft and internal tapered roller bearings and are commonly used for applications where torque generation and higher frequency cycling are the primary requirements. The T20 Series can carry substantial radial, thrust and moment loads without external bearings while, at the same time, facilitating smooth operation and low breakaway pressures.

The T20 Series is available in three different sizes with torque outputs ranging from 25,000 - 60,000 in-lbs at 3,000 psi.

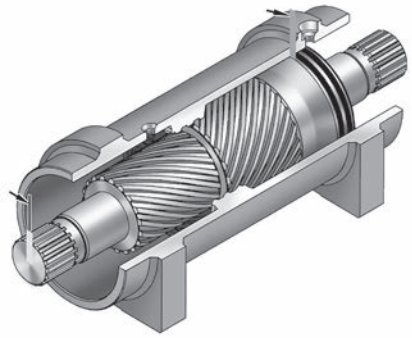
Operation Technology

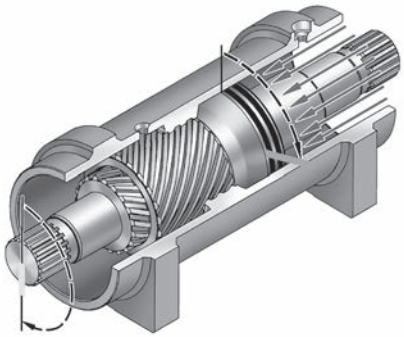
The T20 Series rotary actuators use Parker Hannifin Corporation innovative, sliding-spline operating technology to convert linear piston motion into powerful shaft rotation. Each actuator is composed of a housing and two moving parts — the central shaft and piston.

Helical spline teeth on the shaft engage matching teeth on the piston's inside diameter. A second set of splines on the piston's outside diameter mesh with the gear in the housing.

Starting Position

The piston is completely bottomed out. Bars indicate starting positions of piston and shaft. Arrows indicate directions they will rotate. The housing with integral ring gear remains stationary.





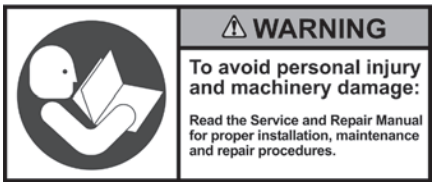
Ending Position

When hydraulic pressure is applied to the piston, it moves axially while the helical gearing causes the piston and shaft to rotate simultaneously. Applying pressure to the opposite port will return the piston and shaft to their original starting positions.

General Safety Guidelines

Cautionary Notices

Before beginning service and/or repair of the T20 Series rotary actuator, there are several cautionary notices that should be considered. If you are not comfortable with repair or maintenance of this product, contact Parker Hannifin's Service Department for assistance.



Important Notice

Helac Corporation does not assume any responsibility beyond the design and performance of its rotary actuator product. The customer is solely responsible for engineering of mating structures, fasteners, and other associated components related to the installation of the product and its ultimate application.

Due to the unlimited variety of operating conditions and applications, Helac Corporation does not certify any application unless specifically requested to do so by the customer. The overall integrity of the installation, and the application's safety and compliance with industry standards and warning requirements are the ultimate responsibility of the customer. Helac Corporation recommends that prototype testing be conducted to verify installation integrity. Testing with applied loads that equal or exceed the static and dynamic load frequency and intensity are recommended to determine the suitability of the actuator for the application.

To prevent misapplication of our products and to assure the most appropriate actuator is used for the application under consideration, a Helac Corporation questionnaire is available so that installation details can be evaluated.

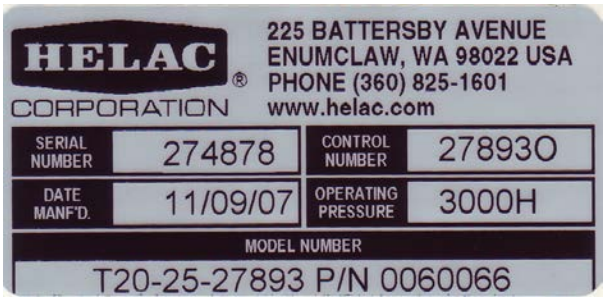
⚠ WARNING

IMPROPER SELECTION, INSTALLATION OR USE OF HELAC PRODUCTS OR SYSTEMS MAY RESULT IN FAILURE AND CAUSE DEATH, PERSONAL INJURY OR PROPERTY DAMAGE.

Documents or information provided by Helac Corporation, its subsidiaries or authorized distributors are intended for users having technical expertise. It is important to thoroughly analyze all aspects of your application and review current product information. The user is solely responsible for the final selection of any Helac Corporation product or system and its suitability for the application in question.

Product Identification

A unique serial number is located on each T20 Series rotary actuator. The serial number is stamped on the housing and can also be found on the Identification (ID) Tag. The serial number may be required before parts and/or service issues can be resolved. In some cases, it may be necessary to remove paint to expose the serial number.



Maintenance

Daily

1. Apply a clean lithium or compatible grease to the grease fittings daily when operating the actuator in severe conditions such as abrasive dust or prolonged submersion in water. Apply grease until grease flows from the grease reliefs or shaft exclusion seal.
2. Make sure the grease reliefs are functioning properly. Open or replace non-functioning grease reliefs immediately.

NOTICE Never replace the grease relief valves with grease fittings or plugs.

NOTICE Do not operate the actuator if the grease reliefs are not functioning.

NOTICE Helac Corporation uses a lithium-based grease in assembly. A high quality grease compatible with lithium grease may be used.

NOTICE The T20-25 and T20-45 are greased through the grease zerks on the spline adapters.

The T20-60 is greased through the grease zerks on the housing and grease relief fittings on the end cap.

Weekly

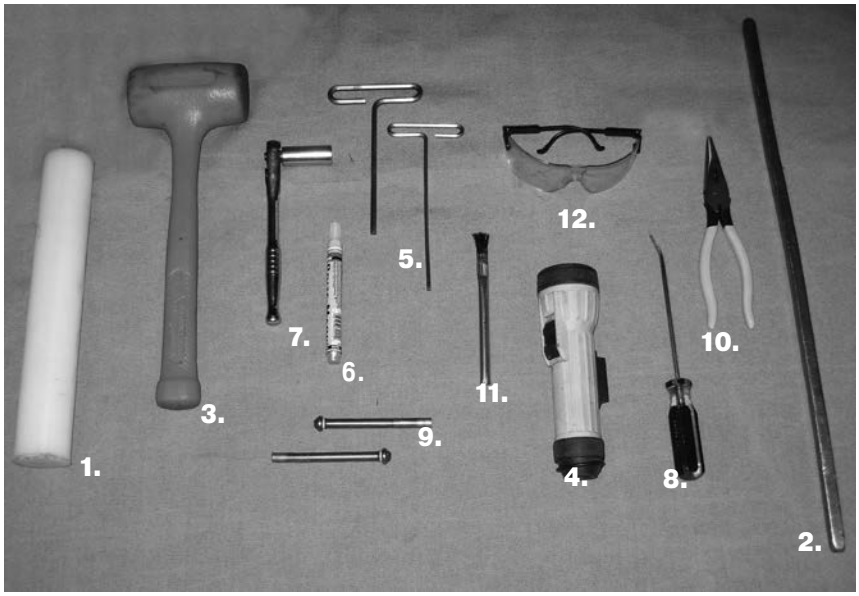
1. Apply a clean lithium or compatible grease to the grease fittings weekly when operating the actuator in non-severe environments and conditions. Apply grease until grease flows from the grease reliefs.
2. Make sure the grease reliefs are functioning properly. Open or replace non-functioning grease reliefs immediately.

Troubleshooting Guide

Problem	Possible Cause	Solution
Shaft rotates slowly or not at all	Insufficient torque output	Verify correct operating pressure. Do not exceed OEM's pressure specifications. Load may be above maximum capacity of the actuator.
	Low rate of fluid flow	Inspect ports for obstructions and hydraulic lines for restrictions and leaks.
	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.
	Leak in piston and/or shaft seal	Remove the port plugs 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 32.
	Corrosion build-up on the thrust surfaces	Re-build the actuator. Remove all rust, clean thoroughly and then polish.*
	Swollen seals caused by incompatible hydraulic fluid (standard actuators only)	Re-build the actuator. Use fluid that is compatible with seals and bearings. Contact Helac Corporation for more information.
	Air in actuator	Purge air from actuator. See bleeding procedures outlined on Page 33.
Operation is erratic or not responsive	Air in actuator	Purge air from actuator. See bleeding procedures outlined on Page 33.
Selected position cannot be maintained	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.
	Leak in piston and/or shaft seal	Remove the port plugs 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 32.
	Air in actuator	Purge air from actuator. See bleeding procedures outlined on Page 33.

* Replacement parts may be needed.

Tools Required



Several basic tools are required for the disassembly and reassembly of the actuator. The suggested tools are outlined below:

1. Plastic mandrel
2. Pry bar
3. Plastic or rubber mallet
4. Flashlight
5. Hex wrenches
6. Felt marker
7. Socket wrench
8. Seal tool
9. Dowel pins
10. Needle nose plier
11. Brush
12. Safety glasses

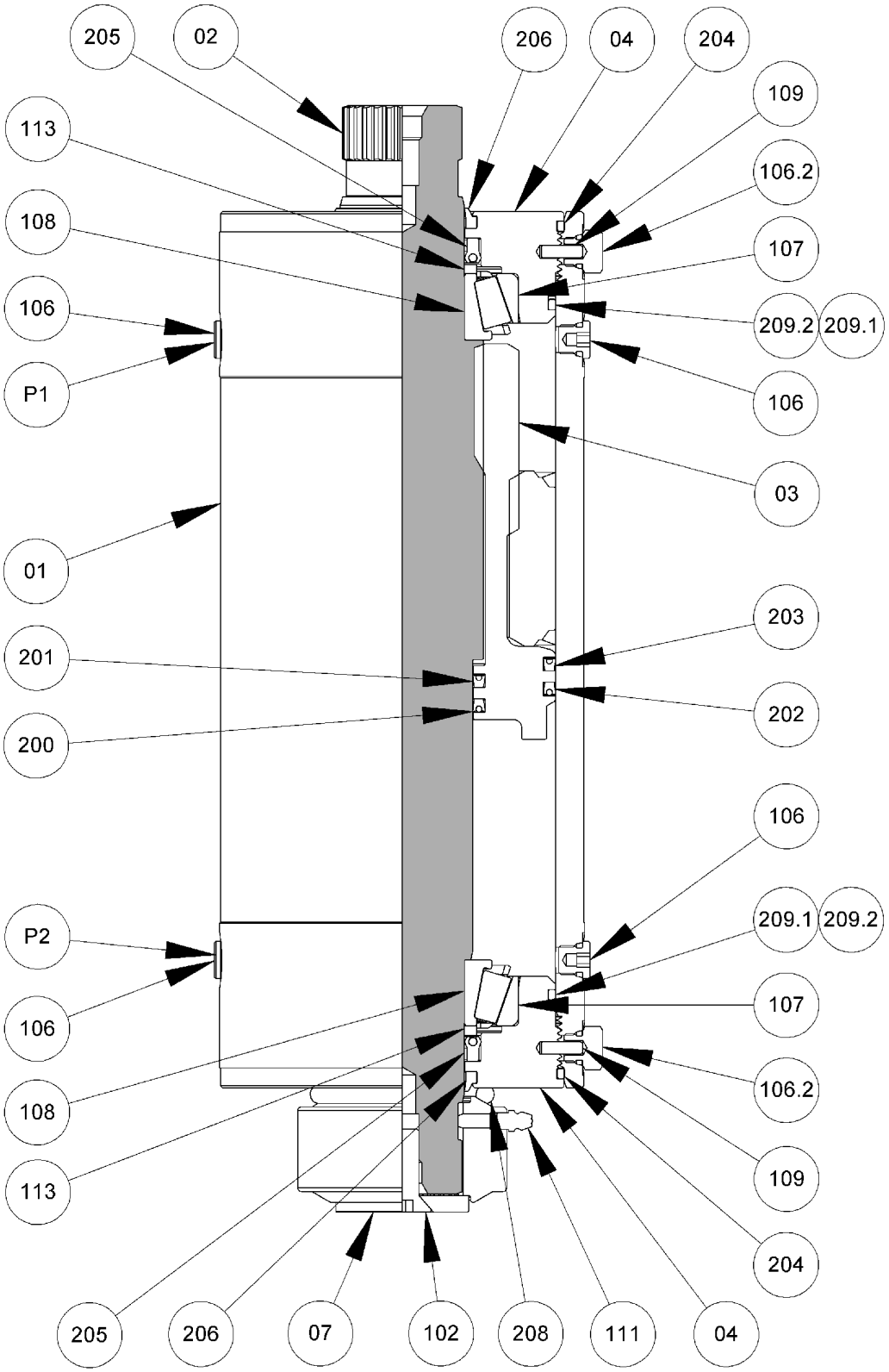
NOTICE All fasteners are english.

Making a Seal Tool

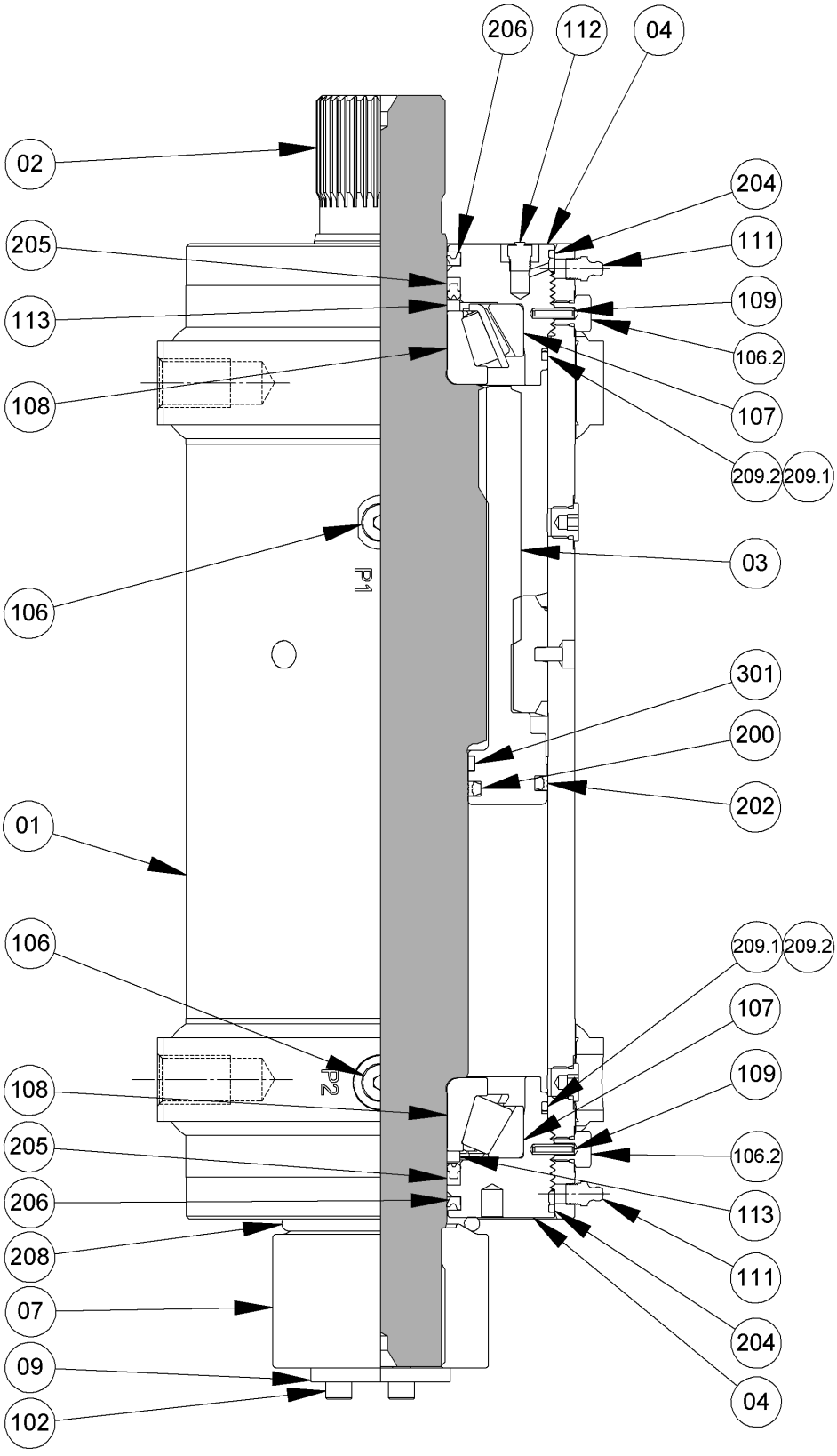
The seal tool is merely a customized standard flat head screwdriver.

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 tip to a polished finish. The tool may be modified slightly to your own personal preference.

T20-25 and T20-45 Assembly Drawing

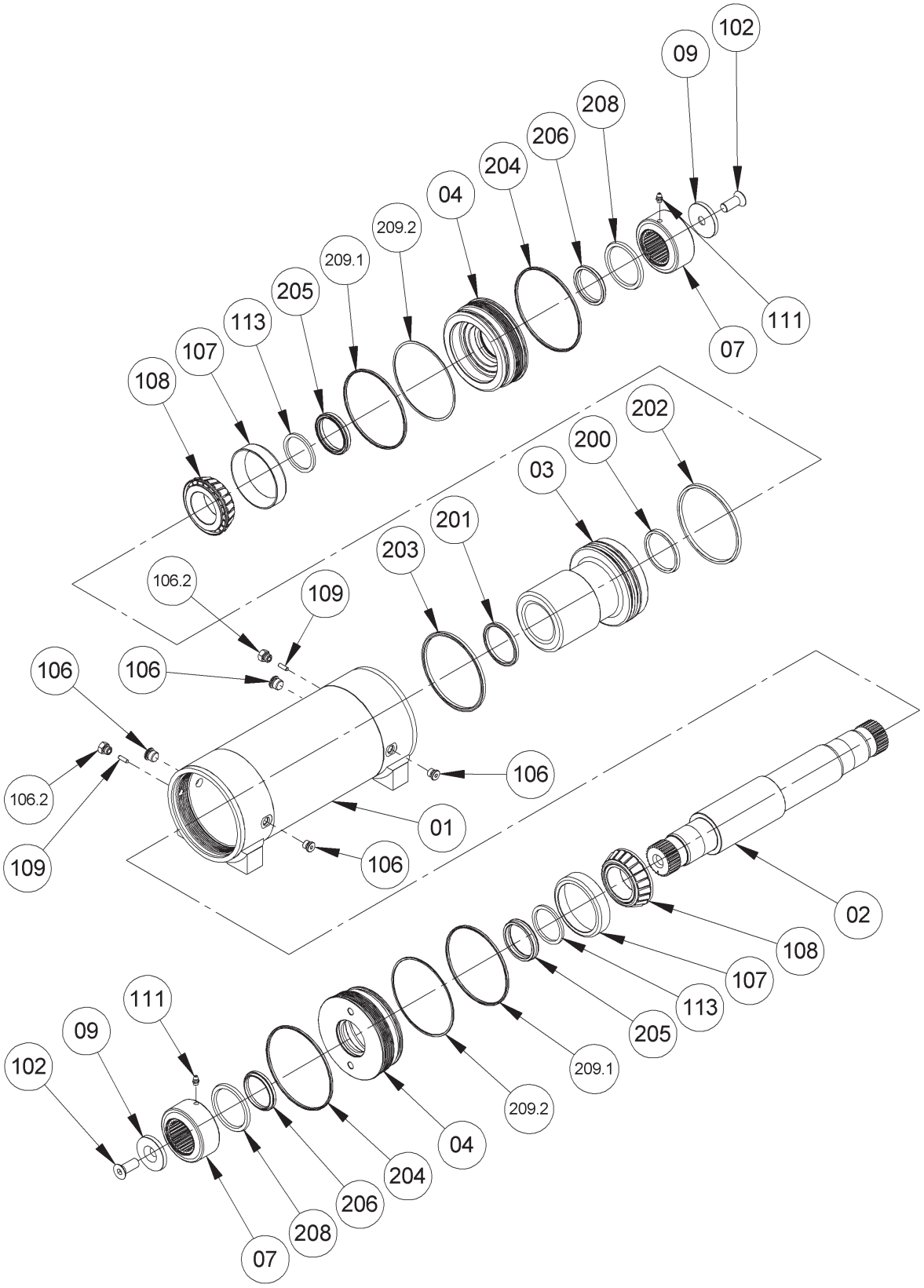


T20-60 Assembly Drawing

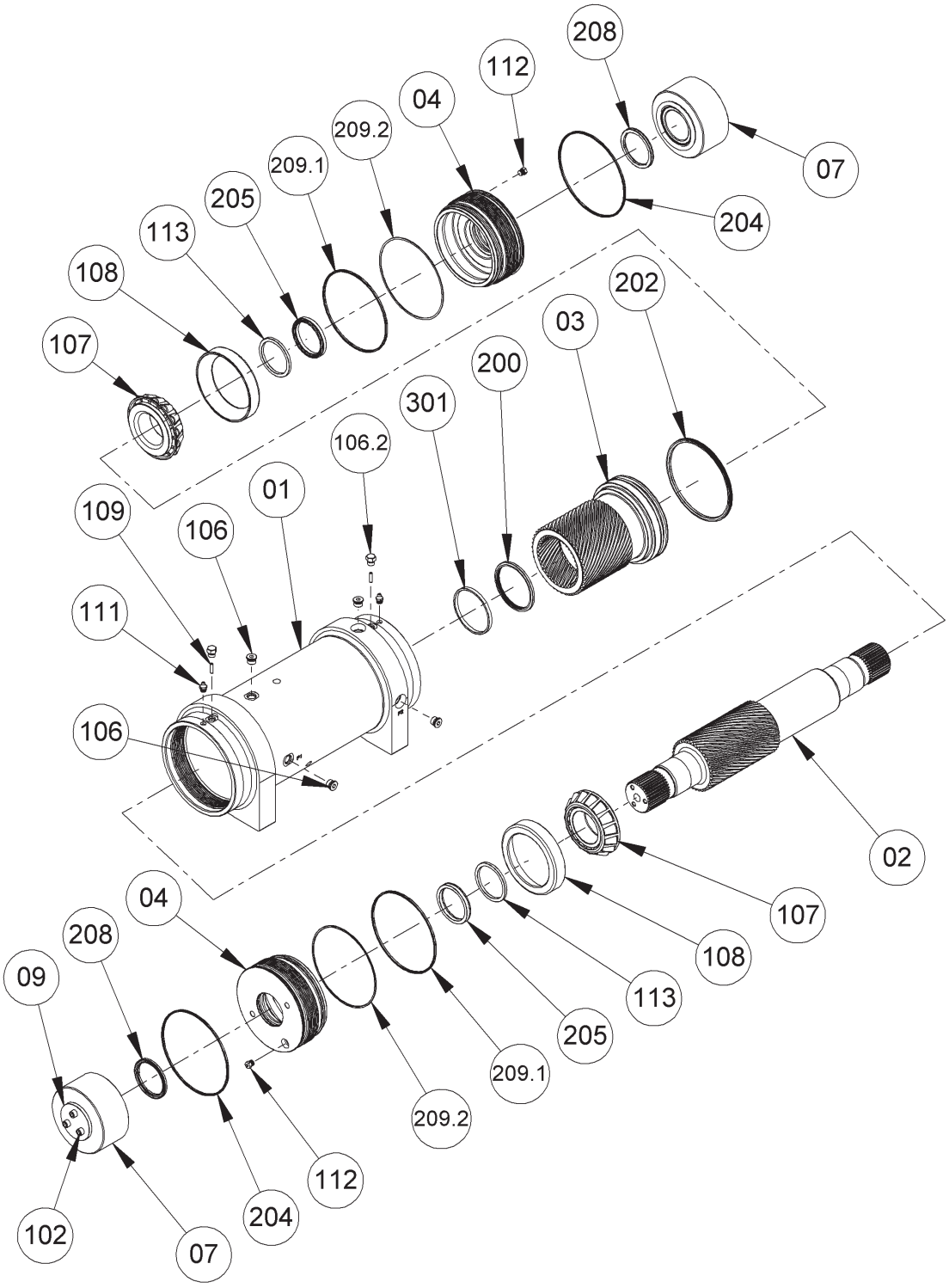


Parker Hannifin Corporation
Helac/Cylinder Division
Enumclaw, Washington USA

T20-25 and T20-45 Exploded View



T20-60 Exploded View



Parts List - T20-18

Parts

Part Number	*Item #*	*Description*	*Qty*
N/A	01	Housing - Not Available as Spare Part	1
28974	02	Shaft	1
28971	03	Piston Sleeve	1
29262	04	End Cap	1
S28972		**Hardware Kit and Bearing Kit (includes item 105, 106, 107, 108, 113)**	
	105	Set Screw, Socket Head, 5/16"-18 x .313" Half dog, Grade 8	2
	106	Port Plug (SAE-4)	4
	107	Bearing - Cone	2
	108	Bearing - Cup	2
	113	Spacer	2
S28968		**Seal Kit Standard (Includes items below)**	
	200	Cup Seal	1
	201	Cup Seal (expander removed)	1
	202	Cup Seal	1
	203	Cup Seal (expander removed)	1
	204	O-Ring	2
	205	Cup Seal	2
	206	Wiper Seal	2
	208	O-Ring	2
	209	Back-up Ring	2

Parts in kits not sold individually unless listed separately

Seal and bearing kits can be ordered online at
http://www.parker.com/helac

Parts List - T20-20

Parts

Part Number	*Item #*	*Description*	*Qty*
N/A	01	Housing - Not Available as Spare Part	1
N/A	02	Shaft - Not Available	1
28837	03	Piston Sleeve	1
29875	04	End Cap	1
29147		**Hardware Kit and Bearing Kit (includes item 105, 106, 107, 108, 113)**	
	105	Shortened Hex Head SAE-4 Port Plug	2
	106	Port Plug (SAE-4)	2
	106	Port Plug (SAE-6)	2
	107	Bearing - Cone	2
	108	Bearing - Cup	2
	109	Dowel pin, hardened, .188" x .625" long	2
	*113	Spacer	2
S28468		**Seal Kit Standard (Includes items below)**	
	200	Cup Seal	1
	201	Cup Seal (expander removed)	1
	202	Cup Seal	1
	203	Cup Seal (expander removed)	1
	204	O-Ring	2
	205	Cup Seal	2
	206	Wiper Seal	2
	208	O-Ring	2
	209	Back-up Ring	2
	*113	Spacer	2

*Included in seal kit

Parts in kits not sold individually unless listed separately

Seal and bearing kits can be ordered online at
http://www.parker.com/helac

Parts List - T20-25

Parts listed are standard components per the catalog. Parker-Helac has and does make special designs for OEM's that may differ. Model codes beginning with T20-25-S, T20-25-ES or T20-25-MS could use different parts.

Parts

Part Number	*Item #*	*Description*	*Qty*
N/A	01	Housing - Not Available as Spare Part	1
28463	02	Shaft "E"	1
32748	02	Shaft "M"	1
28887	03	Piston Sleeve	1
28888	04	End Cap	1
31846		**Hardware Kit "E" and Bearing Kit (includes item 105, 106, 107, 108, 109, 113)**	
	105	Shortened Hex Head SAE-4 Port Plug	2
	106	Port Plug (SAE-4)	4
	107	Bearing - Cone	2
	108	Bearing - Cup	2
	109	Dowel pin, hardened, .188" x .625" long	2
	113	Spacer	2
32752		**Hardware Kit "M" and Bearing Kit (includes item 105, 106, 107, 108, 109, 113)**	
	105	Shortened SAE-4 Port Plug	
	106	Port Plug (BSPP G1/4)	
	107	Bearing - Cone	
	108	Bearing - Cup	
	109	Dowel pin, hardened, .188" x .625" long	
	*113	Spacer	
29920	401	**Counterbalance Valve Kit: 2 x SAE-4 Ports (includes valve, mounting screws and o-rings) Top of valve stamped 29919**	
		CB Valve	1
		Socket head cap screw; 1/4"-20 x 1.50" ASTM A574	3
		Port plug: SAE-4 Hollow hex, o-ring	2
	406	Hydraulic tube assembly (made locally)	1

*Included in seal kit

Note: Parker-Helac supplies many different counterbalance and motion control valves specific to an OEM application. If the valve you have is not one of the part numbers listed, contact the OEM of the equipment installed on to purchase the correct valve.

"E" - Shaft has SAE splines. Housing has SAE oil ports and foot mounting holes tapped for SAE bolts.

"M" - Shaft has Metric splines. Housing has BSPP oil ports and foot mounting holes tapped for Metric bolts.

Part Number	*Item #*	*Description*	*Qty*
S28886		**Seal Kit Standard (Includes items below)**	
	200	Cup Seal	1
	201	Cup Seal (expander removed)	1
	202	Cup Seal	1
	203	Cup Seal (expander removed)	1
	204	O-Ring	2
	205	Cup Seal	2
	206	Wiper Seal	2
	208	O-Ring	2
	209	Back-up Ring	2
	113	Spacer	1
34454		**Spline Adapter Kit "E" (Includes items below) 2 ea. Required per Actuator**	
	07	Spline Adapter	1
	09	Spacer	1
	102	Screw (HSFHCS; 1/2"-13 x 1.250", Grade 8	1
	111	Grease Fitting (B-641 BALCRANK, 715-1051)	1
	210	Spline Adapter Urethane O-Ring	1
32746		**Spline Adapter Kit "M" (Includes items below) 2 ea. Required per Actuator**	
	07	Spline Adapter	1
	09	Spacer	1
	102	Screw (HSFHCS; M12-1.75 x 35 mm, Grade 10.9	1
	111	Grease Fitting (B-641 BALCRANK, 715-1051)	1
	210	Spline Adapter Urethane O-Ring	1
925463	210	Spline Adapter Urethane O-Ring "E" & "M"	1

Parts in kits not sold individually unless listed separately

Seal and bearing kits can be ordered online at http://www.parker.com/helac

Parts List - T20-45

Parts listed are standard components per the catalog. Parker-Helac has and does make special designs for OEM's that may differ. Model codes beginning with T20-45-S, T20-45-ES or T20-45-MS could use different parts.

Parts

Part Number	Item #	Description	Qty
N/A	01	Housing - Not Available as Spare Part	1
32069	02	Shaft "E"	1
32853	02	Shaft "M"	1
31862	03	Piston Sleeve	1
31859	04	End Cap	1
32026		**Hardware Kit "E" and Bearing Kit (includes item 105, 106, 107, 108, 109, 113)**	
29151	105	Shortened Hex Head SAE-4 Port Plug	2
977009	106	Port Plug (SAE-4)	4
932166	107	Bearing - Cone	2
932167	108	Bearing - Cup	2
964037	109	Dowel pin, hardened, .188" x .625" long	2
32026-1		**Hardware Kit "M" and Bearing Kit (includes item 105, 106, 107, 108, 109, 113)**	
29151	105	Shortened SAE-4 Port Plug	
977015	106	Port Plug (BSPP G1/4)	
932166	107	Bearing - Cone	
932167	108	Bearing - Cup	
964037	109	Dowel pin, hardened, .188" x .625" long	
29920	401	**Counterbalance Valve Kit: 2 x SAE-4 Ports (includes valve, mounting screws and o-rings) Top of valve stamped 29919**	
		CB Valve	1
		Socket head cap screw; 1/4"-20 x 1.50" ASTM A574	3
		Port plug: SAE-4 Hollow hex, o-ring	2
	406	Hydraulic tube assembly (made locally)	1

Note: Parker-Helac supplies many different counterbalance and motion control valves specific to an OEM application. If the valve you have is not one of the part numbers listed, contact the OEM of the equipment installed on to purchase the correct valve.

"E" - Shaft has SAE splines. Housing has SAE oil ports and foot mounting holes tapped for SAE bolts.

"M" - Shaft has Metric splines. Housing has BSPP oil ports and foot mounting holes tapped for Metric bolts.

Part Number	Item #	Description	Qty
S32027		**Seal Kit Standard (Includes items below)**	
	200	Cup Seal	1
	201	Cup Seal (expander removed)	1
	202	Cup Seal	1
	203	Cup Seal (expander removed)	1
	204	O-Ring	2
	205	Cup Seal	2
	206	Wiper Seal	2
	208	O-Ring	2
	209	Back-up Ring	2
32042		**Spline Adapter Kit "E" (Includes items below) 2 ea. Required per Actuator**	
	07	Spline Adapter	1
	09	Spacer	1
	102	Screw (HSFHCS; 1/2"-13 x 1.250", Grade 8	1
	111	Grease Fitting, Short (B-641 BAL-CRANK, 715-1051)	1
	210	Spline Adapter Urethane O-Ring	1
32855		**Spline Adapter Kit "M" (Includes items below) 2 ea. Required per Actuator**	
	07	Spline Adapter	1
	09	Spacer	1
	102	Screw (HSFHCS; M12-1.75 x 35 mm, Grade 10.9	1
	111	Grease Fitting (B-641 BALCRANK, 715-1051)	1
	210	Spline Adapter Urethane O-Ring	1
925463	210	Spline Adapter Urethane O-Ring "E" & "M"	1

Parts in kits not sold individually unless listed separately

Seal and bearing kits can be ordered online at http://www.parker.com/helac

Parts List - T20-60

Parts listed are standard components per the catalog. Parker-Helac has and does make special designs for OEM's that may differ. Model codes beginning with T20-60-S, T20-60-ES or T20-60-MS could use different parts.

Parts

Part Number	*Item #*	*Description*	*Qty*
N/A	01	Housing - Not Available as Spare Part	1
29848	02	Shaft "E"	1
32804	02	Shaft "M"	1
31664	03	Piston Sleeve	1
29404	04	End Cap	1
S29373		**Hardware Kit "E" and Bearing Kit (includes item 105, 106, 107, 108, 109, 111, 112, 113, 301)**	
	105	Shortened Hex Head SAE-4 Port Plug	2
	106	Port Plug SAE-6 Port Plug	4
	107	Bearing - Cone	2
	108	Bearing - Cup	2
	109	Dowel pin, hardened, .188" x .625" long	2
	111	Grease Fitting (Balcrank, 5000 Lincoln, 1/8-27 NPT)	2
	112	Grease Relief Valve (50500, 1/8-27 NPT, Alemite 400-650 PSI)	2
	113	Spacer	2
	301	Wear Guide	1
32811		**Hardware Kit "M" and Bearing Kit (includes item 105, 106, 107, 108, 109, 111, 112, 113, 301)**	
	105	Shortened SAE-6 Port Plug	2
	106	Port Plug (BSPP G1/4)	4
	107	Bearing - Cone	2
	108	Bearing - Cup	2
	109	Dowel pin, hardened, .188" x .75" long	2
	111	Grease Fitting (Balcrank, 5000 Lincoln, 1/8-27 NPT)	2
	112	Grease Relief Valve (50500, 1/8-27 NPT, Alemite 400-650 PSI)	2
	113	Spacer	2
	301	Wear Guide	1
29920	401	**Counterbalance Valve Kit: 2 x SAE-4 Ports (includes valve, mounting screws and o-rings) Top of valve stamped 29919**	
		CB Valve	1
		Socket head cap screw; 1/4"-20 x 1.50" ASTM A574	3
		Port plug: SAE-4 Hollow hex, o-ring	2
	406	Hydraulic tube assembly (made locally)	1

Note: Parker-Helac supplies many different counterbalance and motion control valves specific to an OEM application. If the valve you have is not one of the part numbers listed, contact the OEM of the equipment installed on to purchase the correct valve.

Part Number	*Item #*	*Description*	*Qty*
31663		**Seal Kit Standard (Includes items below)**	
	200	Cup Seal	1
	202	Cup Seal	1
	204	O-Ring	2
	205	Cup Seal	2
	206	Wiper Seal	2
	208	O-Ring	2
	209	Back-up Ring	2
32019-P082		**Spline Adapter Kit "E" (Includes items below) 2 ea. Required per Actuator**	
	07	Spline Adapter	1
	09	Spacer	1
	102	Screw (SHCS; 15/16"-18 x .75", Grade 8	3
	210	Spline Adapter Urethane O-Ring	1
32806		**Spline Adapter Kit "M" (Includes items below) 2 ea. Required per Actuator**	
	07	Spline Adapter	1
	09	Spacer	1
	102	Screw (HHCS; M12-1.25 x 40 mm, Grade 10.9	1
	103	Flat Washer (1/2" or M12)	1
	210	Spline Adapter Urethane O-Ring	1
925463	210	Spline Adapter Urethane O-Ring "E" & "M"	1

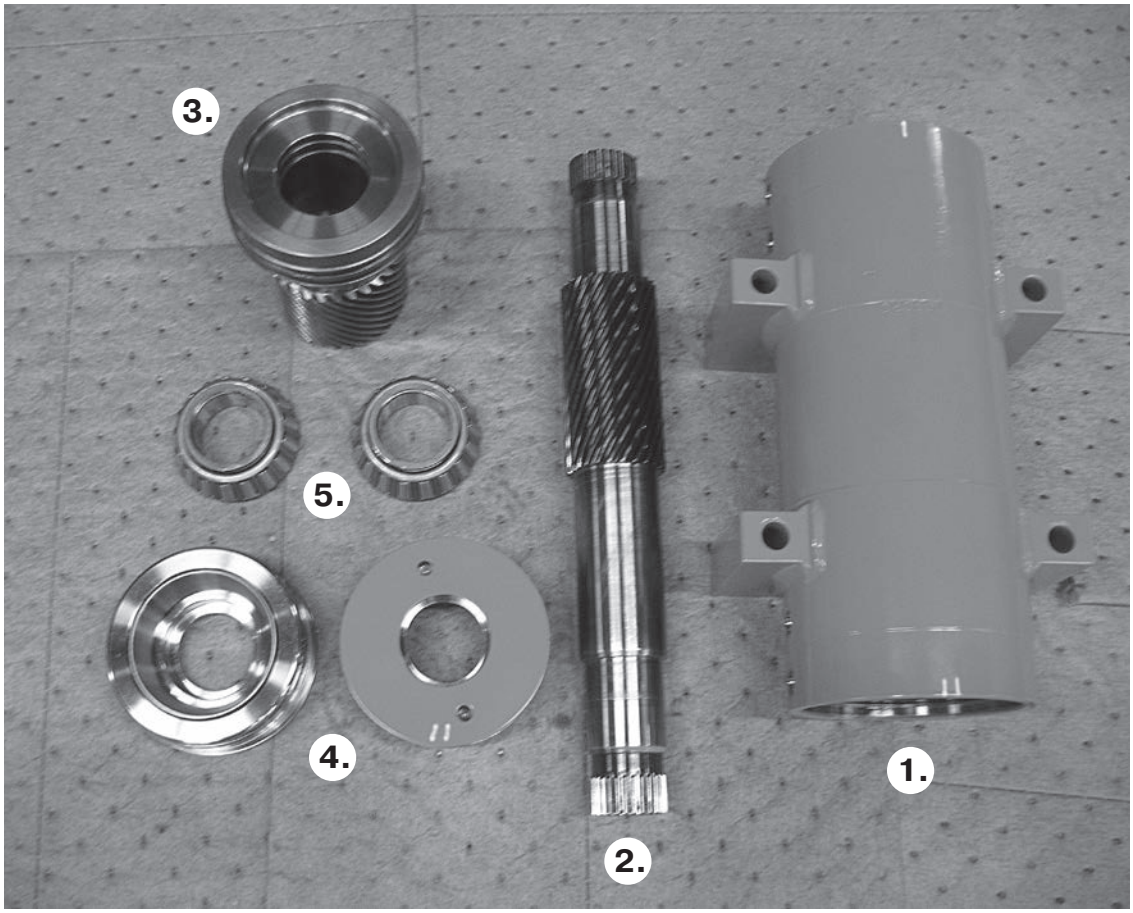
Parts in kits not sold individually unless listed separately

"E" - Shaft has SAE splines. Housing has SAE oil ports and foot mounting holes tapped for SAE bolts.

"M" - Shaft has Metric splines. Housing has BSPP oil ports and foot mounting holes tapped for Metric bolts.

Seal and bearing kits can be ordered online at http://www.parker.com/helac

Component Identification



⚠ CAUTION

Spraying fluids:
Contents under pressure.
Wear approved eye protection.
Use caution when removing port plugs and fittings.

⚠ CAUTION

To avoid injury or damage to product:

Secure product to work bench.

NOTICE

To avoid contamination to machined parts:

Make sure work area is clean.

NOTICE All numbers that appear in parenthesis ( ) in the following sections refer to items on Pages 14-18.

The T20 helical, hydraulic rotary actuator is comprised of the following components:

1. Housing
2. Shaft
3. Piston Sleeve
4. End Caps
5. Bearings

Product Inspection

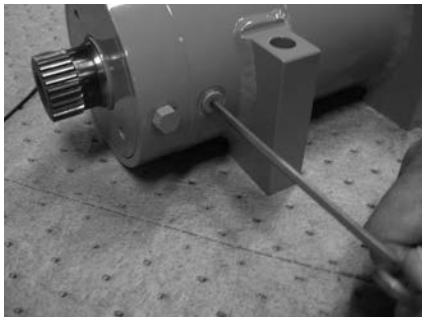
Make sure the T20 is thoroughly cleaned prior to disassembly. Continue to clean all machined parts in a wash tank and dry with compressed air. Be sure to inspect the actuator prior to disassembly.

Severe corrosion can make it difficult to remove the dowel pins (109) or set screws and to unthread the end cap (04). If corrosion is evident, soak the pins or screws for several hours with penetrating oil before attempting to disassemble the actuator.

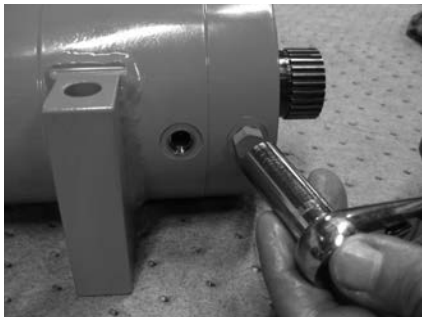
End Cap and Bearing Removal

Be sure actuator has been fully rotated clockwise from Port P1 and the actuator housing is firmly secured to a work bench.

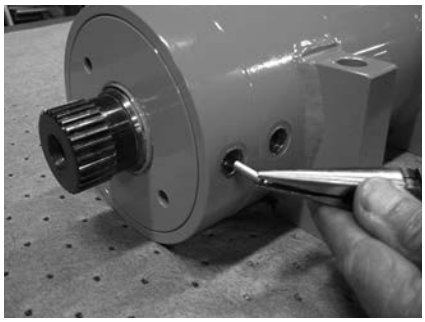
1. Carefully remove the four plug fittings (106). Drain the hydraulic oil and inspect for contamination (i.e., dirt, water and metal).



2. On models equipped with grease relief fittings (112), remove them from each end cap (04).
3. Remove the SAE 4 fitting plug (106.2) to access the end cap locking device, the dowel pin (109).



4. Use the needle nose plier to remove the dowel pin that locks the end cap.

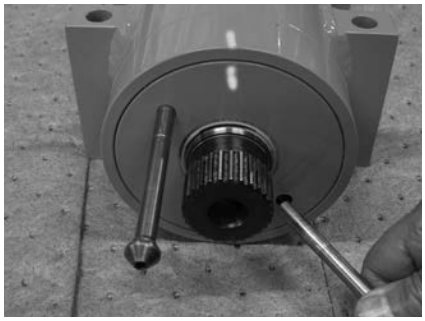


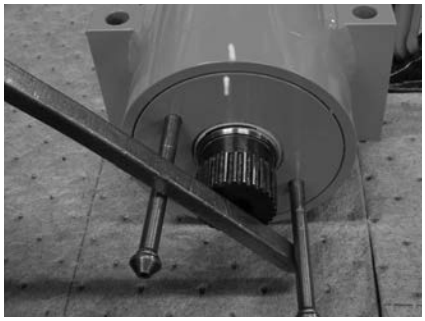
NOTICE The T20-60 end cap is locked with a dowel pin and closed with a SAE 4 plug, 90° from mounting plane, in line with ports and grease zerk — one on each end.

5. On models equipped with grease zerk fittings, (111) remove them from each end of the housing.
6. To simplify re-assembly, mark the position of the end caps (04) in relation to the housing (01).

End Cap and Bearing Removal

7. Unscrew both end caps (04) using dowel pins or bolts placed opposite each other in the spanner holes. Turn counterclockwise with a pry bar. Slide end caps off.





8. Remove the seal (205) and spacer (113).

9. Remove the bearing (108). Take note of which end the bearings are removed, so they can
be paired with the same bearing race during

T20-60 Bearing Removal

The T20-60 bearings are press off bearings and require special care during removal. We recommend utilizing a ram and bearing splitter to remove the T20-60 bearings.

NOTICE

To avoid damage to gear teeth and housing bore:

Carefully support the weight of the shaft as it clears the housing.

1. Align ram with port P2 end of shaft.

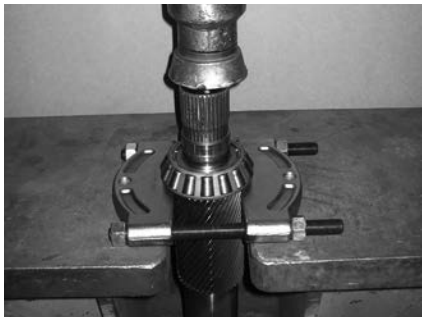
2. Depress ram to force shaft downward to release the bearing.

End Cap and Bearing Removal

2. Depress ram to force shaft downward to release the bearing.

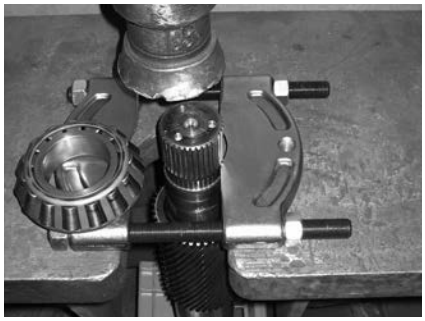
3. Remove bearing from the shaft. Verify timing marks on the shaft.

4. Install bearing splitter and replace shaft in the ram.



5. Depress ram to force shaft downward to release the bearing.

6. Remove bearing from the shaft.



Check the condition of the bearings after the removal procedure, they may need to be replaced.

Shaft Removal

re-assembly.

1. Look inside the housing (01), locate the gear teeth end of the piston sleeve (03). Timing marks (center punches) will be visible on the ring gear inside the housing (01), on the piston sleeve (03) and on the shaft (02). Typically there should be two marks close together on the piston sleeve, one for inside and outside gear teeth. The shaft timing marks could also be in the valley between the teeth of the gears. If no timing marks are located on any items, use a push type center punch to make new marks.

   When timing marks are located, use either punch or a permanent marker (may wash off) to mark all the items. When doing re-assembly, these marks will need to be lined up to achieve proper timing.

2. Slowly remove the shaft (02) from the piston sleeve (03) by pulling and turning at the same time.

1.

NOTICE The T20-60 shaft is removed during the bearing removal procedure outlined in the previous section.

NOTICE

To avoid damage to gear teeth and housing bore:

Carefully support the weight of the shaft as it clears the housing.

Piston Sleeve Removal

1. Before removing the piston sleeve (03) double check the timing marks of the housing (01) in relation to the piston sleeve (03).

2. Slowly turn the piston sleeve (03) while using a plastic hammer and mandrel to gently tap the piston sleeve (03) to disengage the gear teeth from the housing ring gear teeth inside the housing bore.

3. Place a mark on the housing (01), and on the piston sleeve (03) in line with a port fitting or some other reference. This will simplify the process of aligning the piston to the ring gear teeth during re-assembly.

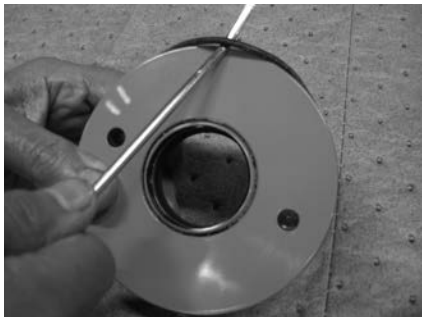
NOTICE

To avoid damage to gear teeth and housing bore:

Carefully support the weight of the piston sleeve as it clears the housing.

Seal Removal

Remove shaft I.D. cup seal (205) and end cap O.D. O-ring seal (204) from the end cap (04). Watch for any signs of scratches or gouges that could cause internal leaks or premature wear.



2. Remove end cap O.D. O-ring seal (209.1) and B/U ring seal (209.2).

3. Remove end cap I.D. wiper seal (206).

4. Remove the piston sleeve O.D. cup seals (202, 203) from the piston (03).

5. Remove the piston sleeve I.D. cup seals (200, 201) from the piston (03).

NOTICE

To avoid damage to machined parts:

Carefully remove seals using removal tools with rounded edges.

NOTICE

The T20-45 does not include a spacer ring. Instead it features a complete seal groove.

The T20-60 features bronze PTFE/HNBR cap seals on piston and rod sides and a duracomp wear guide on the rod side of the sleeve. The T20-60 also features a Nitrile Z-seal for the end cap pressure seal and a polyurethane burp seal as the end cap exclusion seal.

Component Inspection

1. Prior to inspection, clean all parts in a wash tank and dry with compressed air.
2. **Housing**

   Inspect the cylinder bore for wear and scratches. Local polishing can repair minor scratches and damage. Inspect all bearing and seal surfaces for signs of wear or damage. Check the condition of the gear teeth for any signs of extreme wear or chipping. Inspect the exterior of the housing for signs of damage or cracking.
3. **Shaft**

   Check the shaft surface for scratches from the piston seal or other damages. Small or minor scratches can be carefully polished. Examine the condition of the gear teeth.
4. **End Caps**

   Inspect the threads for galling or cross threading. Make sure that the end cap spins freely in the threads of the housing. Evaluate the surface finish of the seal grooves.
5. **Piston Sleeve**

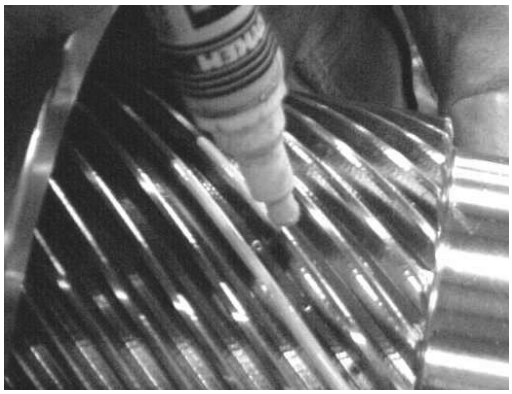
   Inspect the condition of the gear teeth. Evaluate the surface finish of the seal grooves.
6. **Bearings**

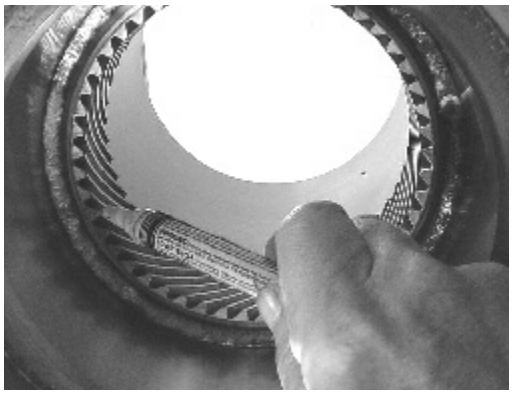
   Check bearings for cracks, damage and signs of wear. Bearings showing wear or damage should be replaced.
7. **Seals**

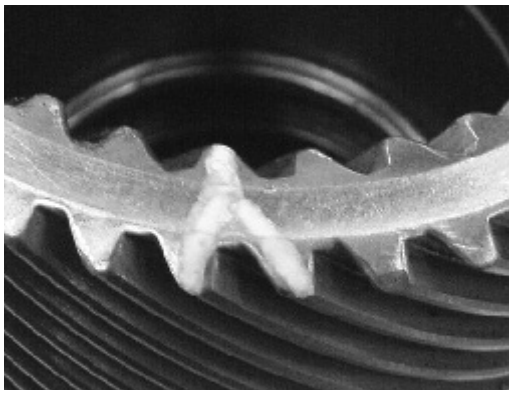
   Helac recommends replacement of all seals.

Timing Mark Inspection

1. Locate the timing marks on the shaft (02), piston sleeve assembly (03) and housing (01). Re-mark with a permanent marker or paint stick if needed.







Dry Assembly

In some cases, for repair personnel not familiar with the actuator assembly process, it may be beneficial to perform a "dry" assembly.

This will provide a better idea of how to properly align the gear teeth. A "dry" assembly is typically done without seals, yet requires bearing installation.

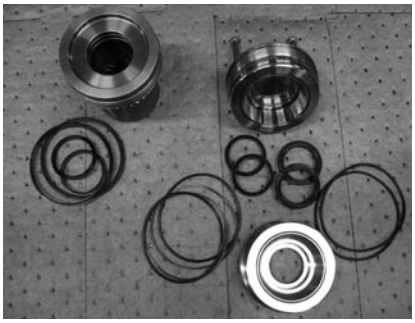
Seal Installation

Pre-Assembly

NOTICE Assembly procedures require the housing to be firmly secured to the work bench.

NOTICE Thoroughly clean all components and lubricate all seals, bearings and contact surfaces with hydraulic oil prior to final installation.

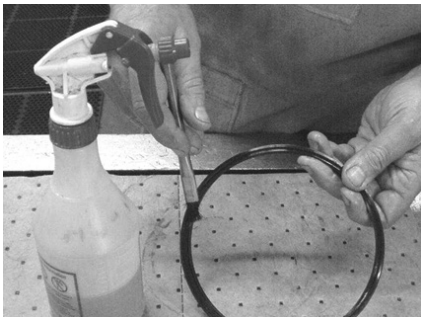
1. Gather all the components and tools into one location prior to re-assembly. Use the drawings on Page 12 and 13 to reference the seal orientations.



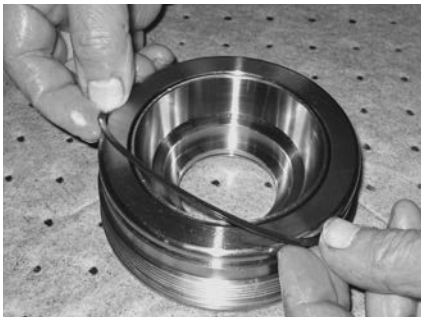
NOTICE The T20-45 does not include a spacer ring. Instead it features a complete seal groove.

The T20-60 features bronze PTFE/HNBR cap seals on piston and rod sides and a duracomp wear guide on the rod side of the sleeve. The T20-60 also features a Nitrile Z-seal for the end cap pressure seal and a polyurethane burp seal as the end cap exclusion seal.

2. Before installing seals, coat the seals and machined surfaces with a clean hydraulic oil.



3. First, install the end cap O.D. B/U ring seal (209.2) to the end cap (04). Ensure the concave side of the B/U seal faces the O-Ring.



4. Next, install the end cap O.D. O-ring seal (209.1) into the end cap (04). Seal (209.1) is slightly smaller in diameter than (204).

Seal Installation

5. Using hands or a seal tool install the end cap exclusion O-ring seal (204). Seal (204) is slightly larger than (209.1).

6. Install the end cap I.D. wiper seal (206) into the end cap (04).

7. If needed remove the energizer (small O-ring) from the inside the piston sleeve O.D. cup seal (203) prior to installation. Also remove the energizer from inside the piston sleeve I.D. cup seal (201).

NOTICE

To avoid premature seal wear and pressure trapping on some models:

Remove the energizer O-ring from one I.D. and one O.D. seal nearest to the piston gearing.

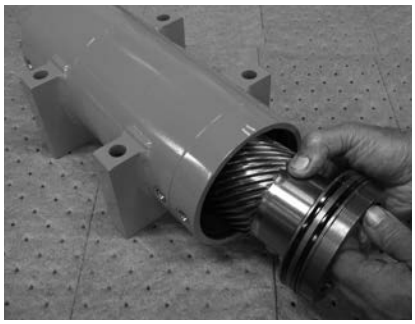
8. Install the piston sleeve O.D. cup seal (203) onto the piston sleeve (03). Make sure to remove the energizer from the cup seal to prevent pressure trapping.

9. Install the piston sleeve O.D. cup seal (202) onto the piston sleeve (03). (This seal should still have the energizer in it.)

10. Remove the energizer from the piston sleeve I.D. cup seal (201) prior to installation. Install the piston sleeve I.D. cup seals (200) and (201) inside the piston sleeve (03). (201) should be closest to the gearing.

Piston Sleeve Installation

1. Secure the actuator housing to a work bench. Coat the inside of the housing (01) with clean hydraulic oil to reduce the chance of seal damage.
2. Carefully slide the piston sleeve (03), gear teeth first, into the housing (01). Be careful not to bind or jam the piston sleeve in the housing. Refer to Pages 10-13 for piston

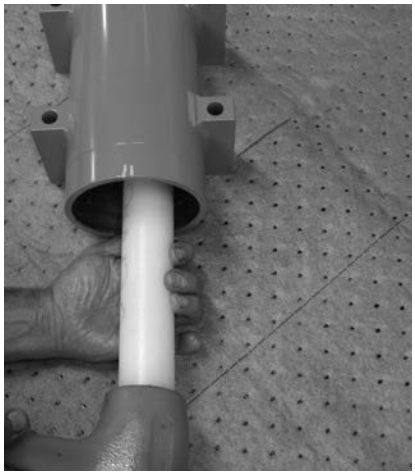


orientation.

3. Confirm proper timing by aligning the piston

sleeve (03) timing marks with timing marks in the housing (01).

4. Use a rubber or plastic mallet and plastic drift to engage the piston sleeve gear teeth and housing ring gear. Drive the piston sleeve in



until the front of the piston sleeve (03) is lined up with the timing marks on the housing (01) ring gear.

5. Using a rubber or plastic mallet and a plastic drift, continue to drive the piston sleeve (03) towards the end of the actuator, until the piston sleeve reaches the end of its travel.

Shaft Installation

1. Before installing the shaft (02), coat the shaft with clean hydraulic oil.
2. Insert the shaft (02) into the piston sleeve (03), carefully aligning the timing marks on the shaft with the piston. Take care not to damage the piston seals with the spline end of the shaft.

3. Verify the timing marks before fully rotating the shaft into the piston sleeve (03).

End Cap and Bearing Installation

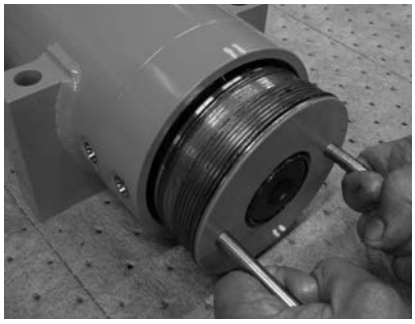
1. Coat the bearings (108) with clean hydraulic oil and install on each end of the shaft (02) as noted during disassembly. If needed, use a sleeve to press bearing onto shaft. Be careful not to damage the shaft, seal surfaces or splines during installation. Install spacer (113) and seal (205) on each end of the shaft.

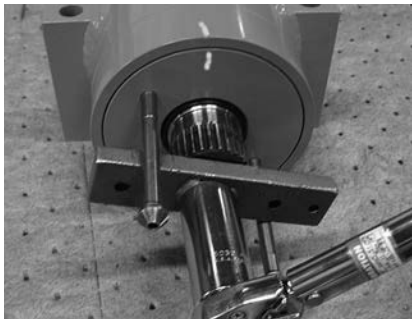
2. Coat end cap (04) threads with anti-seize grease.

NOTICE It may be necessary to heat T20-60 bearings to 200° Fahrenheit prior to installing on each end of the shaft for a slip fit.

End Cap and Bearing Installation

3. Install end caps (04) one at a time. The first end cap installed must line up with the marks on the housing and dowel pin (109). Next install the second end cap (04) and torque to 200 ft. lbs. Loosen and re-torque end cap to 200 ft. lbs. If the locking pin (109) does not line up within one diameter of the hole, the holes must be re-drilled. If within one diameter, loosen end cap or tighten to align the holes. Both end caps should be very close to flush with the end of the housing.





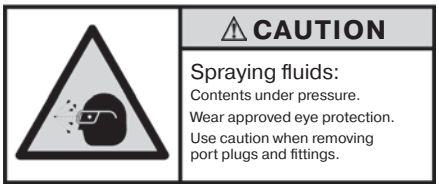
4. For re-drilling actuators with dowel pins (109), use a drill bushing to create a 0.188" diameter hole. Drilled depth should match the dowel pin hole on the opposite end. Do not drill deeper.

5. On models equipped with set screws (105), install them using Loctite 242. Firmly torque, and then back off one-quarter turn. On models equipped with the dowel pin (109) and port plugs (106.2) install them into the housing (01).

6. On models equipped with grease zerks and reliefs, install them on the housing (01). Install grease relief valves on both end caps (04).

7. Shaft seals must then be filled with lubricating grease. The grease provides lubrication, prevents water condensation and minimizes water ingress, which can corrode internal surfaces. In order to maximize grease distribution, the actuator should be connected to the hydraulic system of the equipment or
a test bench and cycled slowly as grease is applied. Apply grease slowly as the actuator is rotating until grease flows from the relief valve. Cycle the actuator and apply grease again.

Testing the Actuator



Testing and Greasing

Attach the actuator to either a hydraulic test bench or portable pump for greasing and testing. Make sure the actuator is secured to prevent movement. If not in place, install the grease fittings and grease reliefs.

1. After the actuator is assembled but before it is put back into service, the shaft seals must be packed with clean lithium or compatible grease.
2. Locate the grease fittings or ports on the actuator and using a grease gun, pack the seals with grease until it exhausts from the grease reliefs.
3. Cycle the actuator slowly and re-grease as necessary. During testing, it is recommended that the actuator be cycled 20 to 30 times to remove air, check for leaks and the proper degrees of rotation.

NOTICE

The T20-25 and T20-45 are greased through the grease zerks on the spline adapters.

The T20-60 is greased through the grease zerks on the housing and grease relief fittings on the end cap.

Testing for Internal Leakage

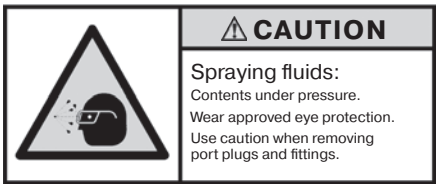
1. Connect a 350 bar test gauge into the hydraulic line to Port P1. Pressurize Port P1 until the shaft reaches the end of rotation.

NOTICE

If the shaft is not completely bottomed out, hydraulic fluid will exhaust from Port P2 at a high velocity.

2. Remove and cap the hydraulic line to Port P2. Pressurize Port P1 to 175 bar. Check for leakage at Port P2 and from around the main shaft and end cap seals. Leaks indicate improperly installed parts.
3. Reconnect the hydraulic line to Port P2 and pressurize P2 as in Step 1 above.
4. Check for leaks at Port P1 and around the main shaft and end cap seals as in Step 2 above.

Bleeding the Actuator



After installation of the actuator onto the equipment, it is important that all safety devices such as tie rods or safety cables be properly reattached. The actuator body is equipped with a pair of port plugs (106) which can be removed for bleeding.

For actuator with an optional valve block installed.

1. Connect the pressure lines to ports V1 and V2.
2. Connect a hydraulic line to port P1 routed either back to tank or to a 5 gallon container to collect the purged oil.
3. Apply pressure to port V2 until actuator has fully rotated to one side.
4. With port P1 still venting to tank or 5 gallon container, apply pressure to the primary port V1 allowing oil/air to be purged from the open port.
5. Install port P1 plug and attach purge line to port P2.
6. Apply pressure to port V1 until actuator has fully rotated in the opposite direction.
7. With port P2 still venting to tank or 5 gallon container, apply pressure to port V2 allowing oil/air to be purged from the open port.
8. Install port P2 plug.
9. All air should be purged from the actuator.

For actuator without optional valve block installed.

Air should be purged through the upper ports P1 and P2. With that in mind, apply pressure hoses to the lower ports P1 and P2. See T20 Assembly Drawing on Page 10 and 11 for port location.

1. Connect a hydraulic line to upper port P1 routed either back to tank or to a minimum 5 gallon container to collect the purged oil.
2. Apply pressure to lower port P2 until actuator has fully rotated to one side.
3. With upper port P1 still venting to tank or 5 gallon container, apply pressure to the lower port P1 allowing oil/air to be purged from the open port.
4. Install upper port P1 plug and attach purge line to upper port P2.
5. Apply pressure to lower port P1 until actuator has fully rotated to the opposite side.
6. With upper port P2 still venting to tank or 5 gallon container, apply pressure to the lower port P2 allowing oil/air to be purged from the open port.
7. Install upper port P2 plug.
8. All air should be purged from the actuator.

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4. Warranty. The warranty for the Products is as follows: (i) Goods are warranted against defects in material or workmanship for a period of eighteen (18) months from the date of delivery or 2,000 hours of use, whichever occurs first; (ii) Services shall be performed in accordance with generally accepted practices and using the degree of care and skill that is ordinarily exercised and customary in the field to which the Services pertain and are warranted for a period of six (6) months from the date of completion of the Services; and (iii) Software is only warranted to perform in accordance with applicable specifications provided by Seller to Buyer for ninety (90) days from the date of delivery or, when downloaded by a Buyer or end-user, from the date of the initial download. All prices are based upon the exclusive limited warranty stated above, and upon the following disclaimer: EXEMPTION CLAUSE; DISCLAIMER OF WARRANTY, CONDITIONS, REPRESENTATIONS: THIS WARRANTY IS THE SOLE AND ENTIRE WARRANTY, CONDITION, AND REPRESENTATION, PERTAINING TO PRODUCTS. SELLER DISCLAIMS ALL OTHER WARRANTIES, CONDITIONS, AND REPRESENTATIONS, WHETHER STATUTORY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THOSE RELATING TO DESIGN, NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE SOFTWARE IS ERROR-FREE OR FAULT-TOLERANT, OR THAT BUYER'S USE THEREOF WILL BE SECURE OR UNINTERRUPTED. UNLESS OTHERWISE AUTHORIZED IN WRITING BY SELLER, THE SOFTWARE SHALL NOT BE USED IN CONNECTION WITH HAZARDOUS OR HIGH RISK ACTIVITIES OR ENVIRONMENTS. EXCEPT AS EXPRESSLY STATED HEREIN, ALL PRODUCTS ARE PROVIDED "AS IS".

5. Claims; Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claims for shortages will be allowed unless reported to Seller within ten (10) days of delivery. Buyer shall notify Seller of any alleged breach of warranty within thirty (30) days after the date the non-conformance is or should have been discovered by Buyer. Any claim or action against Seller based upon breach of contract or any other theory, including tort, negligence, or otherwise must be commenced within twelve (12) months from the date of the alleged breach or other alleged event, without regard to the date of discovery.

6. LIMITATION OF LIABILITY. IN THE EVENT OF A BREACH OF WARRANTY, SELLER WILL, AT ITS OPTION, REPAIR OR REPLACE THE NON-CONFORMING PRODUCT, RE-PERFORM THE SERVICES, OR REFUND THE PURCHASE PRICE PAID WITHIN A REASONABLE PERIOD OF TIME. IN NO EVENT IS SELLER LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING ANY LOSS OF REVENUE OR PROFITS, WHETHER BASED IN CONTRACT, TORT OR OTHER LEGAL THEORY. IN NO EVENT SHALL SELLER'S LIABILITY UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCTS.

7. Confidential Information. Buyer acknowledges and agrees that any technical, commercial, or other confidential information of Seller, including, without limitation, pricing, technical drawings or prints and/or part lists, which has been or will be disclosed, delivered or made available, whether directly or indirectly, to Buyer ("Confidential Information"), has been and will be received in confidence and will remain the property of Seller. Buyer further agrees that it will not use Seller's Confidential Information for any purpose other than for the benefit of Seller.

8. Loss to Buyer's Property. Any tools, patterns, materials, equipment or information furnished by Buyer or which are or become Buyer's property ("Buyer's Property"), will be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer ordering the Products manufactured using Buyer's Property. Furthermore, Seller shall not be responsible for any loss or damage to Buyer's Property while it is in Seller's possession or control.

9. Special Tooling. "Special Tooling" includes but is not limited to tools, jigs, fixtures and associated manufacturing equipment acquired or necessary to manufacture Goods. Seller may impose a tooling charge for any Special Tooling. Such Special Tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in the Special Tooling, even if such Special Tooling has been specially converted or adapted for manufacture of Goods for Buyer and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller has the right to alter, discard or otherwise dispose of any Special Tooling or other property owned by Seller in its sole discretion at any time.

10. Security Interest. To secure payment of all sums due from Buyer, Seller retains a security interest in all Products delivered to Buyer and, Buyer's acceptance of these Terms is deemed to be a Security Agreement under the Uniform Commercial Code. Buyer authorizes Seller as its attorney to execute and file on Buyer's behalf all documents Seller deems necessary to perfect Seller's security interest.

11. User Responsibility. Buyer, through its own analysis and testing, is solely responsible for making the final selection of the Products and assuring that all performance, endurance, maintenance, safety and warning requirements of the application of the Products are met. Buyer must analyze all aspects of the application and follow applicable industry standards, specifications, and any technical information provided with the Quote or the Products, such as Seller's instructions, guides and specifications. If Seller provides options of or for Products based upon data or specifications provided by Buyer, Buyer is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the Products. In the event Buyer is not the end-user of the Products, Buyer will ensure such end-user complies with this paragraph.

12. Use of Products, Indemnity by Buyer. Buyer shall comply with all instructions, guides and specifications provided by Seller with the Quote or the Products. Unauthorized Uses. If Buyer uses or resells the Products in any way prohibited by Seller's instructions, guides or specifications, or Buyer otherwise fails to comply with Seller's instructions, guides and specifications, Buyer acknowledges that any such use, resale, or non-compliance is at Buyer's sole risk. Further, Buyer shall indemnify, defend, and hold Seller harmless from any losses, claims, liabilities, damages, lawsuits, judgments and costs (including attorney fees and defense costs), whether for personal injury, property damage, intellectual property infringement or any other claim, arising out of or in connection with: (a) improper selection, design, specification, application, or any misuse of Products; (b) any act or omission, negligent or otherwise, of Buyer; (c) Seller's use of patterns, tools, equipment, plans, drawings, designs, specifications or other information or things furnished by Buyer; (d) damage to the Products from an external cause, repair or attempted repair by anyone other than Seller, failure to follow instructions, guides and specifications provided by Seller, use with goods not provided by Seller, or opening, modifying, deconstructing, tampering with or repackaging the Products; or (e) Buyer's failure to comply with these Terms. Seller shall not indemnify Buyer under any circumstance except as otherwise provided in these Terms.

13. Cancellations and Changes. Buyer may not cancel or modify, including but not limited to movement of delivery dates for the Products, any order for any reason except with Seller's written consent and upon terms that will indemnify, defend and hold Seller harmless against all direct, incidental and consequential loss or damage and any additional expense. Seller, at any time, may change features, specifications, designs and availability of Products.

14. Limitation on Assignment. Buyer may not assign its rights or obligations without the prior written consent of Seller.

15. Force Majeure. Seller is not liable for delay or failure to perform any of its obligations by reason of events or circumstances beyond its reasonable control. Such circumstances include without limitation: accidents, labor disputes or stoppages, government acts or orders, acts of nature, pandemics, epidemics, other widespread illness, or public health emergency, delays or failures in delivery from carriers or suppliers, shortages of materials, war (whether declared or not) or the serious threat of same, riots, rebellions, acts of terrorism, fire or any reason whether similar to the foregoing or otherwise. Seller will resume performance as soon as practicable after the event of force majeure has been removed. All delivery dates affected by force majeure shall be tolled for the duration of such force majeure and rescheduled for mutually agreed dates as soon as practicable after the force majeure condition ceases to exist. Force majeure shall not include financial distress, insolvency, bankruptcy, or other similar conditions affecting one of the parties, affiliates and/or sub-contractors.

16. Waiver and Severability. Failure to enforce any provision of these Terms will not invalidate that provision; nor will any such failure prejudice either party's right to enforce that provision in the future. Invalidation of any provision of these Terms shall not invalidate any other provision herein and, the remaining provisions will remain in full force and effect.

17. Termination. Seller may terminate any agreement governed by or arising from these Terms for any reason and at any time by giving Buyer thirty (30) days prior written notice. Seller may immediately terminate, in writing, if Buyer: (a) breaches any provision of these Terms, (b) becomes or is deemed insolvent, (c) appoints or has appointed a trustee, receiver or custodian for all or any part of Buyer's property, (d) files a petition for relief in bankruptcy on its own behalf, or one is filed against Buyer by a third party, (e) makes an assignment for the benefit of creditors; or (f) dissolves its business or liquidates all or a majority of its assets.

18. Ownership of Software. Seller retains ownership of all Software supplied to Buyer hereunder. In no event shall Buyer obtain any greater right in and to the Software than a right in the nature of a license limited to the use thereof and subject to compliance with any other terms provided with the Software.

19. Indemnity for Infringement of Intellectual Property Rights. Seller is not liable for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights ("Intellectual Property Rights") except as provided in this Section. Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on a third party claim that one or more of the Products sold hereunder infringes the Intellectual Property Rights of a third party in the country of delivery of the Products by Seller to Buyer. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of any such claim, and Seller having sole control over the defense of the claim including all negotiations for settlement or compromise. If one or more Products sold hereunder is subject to such a claim, Seller may, at its sole expense and option, procure for Buyer the right to continue using the Products, replace or modify the Products so as to render them non-infringing, or offer to accept return of the Products and refund the purchase price less a reasonable allowance for depreciation. Seller has no obligation or liability for any claim of infringement: (i) arising from information provided by Buyer; or (ii) directed to any Products provided hereunder for which the designs are specified in whole or part by Buyer; or (iii) resulting from the modification, combination or use in a system of any Products provided hereunder. The foregoing provisions of this Section constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for claims of infringement of Intellectual Property Rights.

20. Governing Law. These Terms and the sale and delivery of all Products are deemed to have taken place in, and shall be governed and construed in accordance with, the laws of the State of Ohio, as applicable to contracts executed and wholly performed therein and without regard to conflicts of laws principles. Buyer irrevocably agrees and consents to the exclusive jurisdiction and venue of the courts of Cuyahoga County, Ohio with respect to any dispute, controversy or claim arising out of or relating to the sale and delivery of the Products.

21. Entire Agreement. These Terms, along with the terms set forth in the main body of any Quote, forms the entire agreement between the Buyer and Seller and constitutes the final, complete and exclusive expression of the terms of sale and purchase. In the event of a conflict between any term set forth in the main body of a Quote and these Terms, the terms set forth in the main body of the Quote shall prevail. All prior or contemporaneous written or oral agreements or negotiations with respect to the subject matter shall have no effect. These Terms may not be modified unless in writing and signed by an authorized representative of Seller.

22. Compliance with Laws. Buyer agrees to comply with all applicable laws, regulations, and industry and professional standards, including those of the United States of America, and the country or countries in which Buyer may operate, including without limitation the U.S. Foreign Corrupt Practices Act ("FCPA"), the U.S. Anti-Kickback Act ("Anti-Kickback Act"), U.S. and E.U. export control and sanctions laws ("Export Laws"), the U.S. Food Drug and Cosmetic Act ("FDCA"), and the rules and regulations promulgated by the U.S. Food and Drug Administration ("FDA"), each as currently amended. Buyer agrees to indemnify, defend, and hold harmless Seller from the consequences of any violation of such laws, regulations and standards by Buyer, its employees or agents. Buyer acknowledges that it is familiar with all applicable provisions of the FCPA, the Anti-Kickback Act, Export Laws, the FDCA and the FDA and certifies that Buyer will adhere to the requirements thereof and not take any action that would make Seller violate such requirements. Buyer represents and agrees that Buyer will not make any payment or give anything of value, directly or indirectly, to any governmental official, foreign political party or official thereof, candidate for foreign political office, or commercial entity or person, for any improper purpose, including the purpose of influencing such person to purchase Products or otherwise benefit the business of Seller. Buyer further represents and agrees that it will not receive, use, service, transfer or ship any Products from Seller in a manner or for a purpose that violates Export Laws or would cause Seller to be in violation of Export Laws. Buyer agrees to promptly and reliably provide Seller all requested information or documents, including end-user statements and other written assurances, concerning Buyer's ongoing compliance with Export Laws. 8/20

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