

Helical Hydraulic Rotary Actuators

T30-27 Service & Repair Manual



ENGINEERING YOUR SUCCESS.

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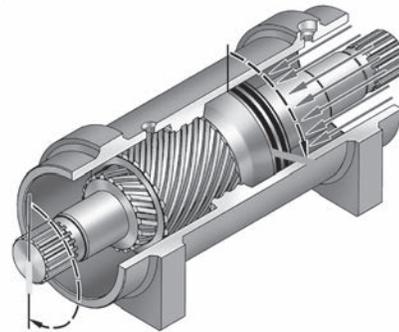
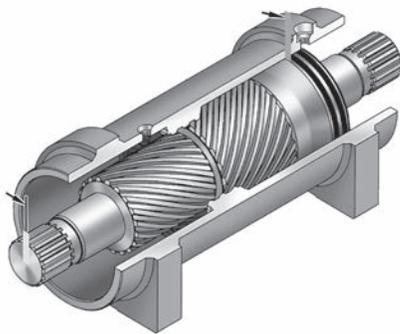
Operation Technology

The T30-27 rotary actuators use Parker Hannifin Corporation innovative, sliding-spline operating technology to convert linear piston motion into powerful shaft rotation. Each actuator is comprised 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 T30-27 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.

	⚠ WARNING
	<p>To avoid personal injury and machinery damage: Read the Service and Repair Manual for proper installation, maintenance and repair procedures.</p>

	⚠ CAUTION
	<p>Pinch point hazard: Moving parts can cause serious injury. Keep clear during operation.</p>

	⚠ CAUTION
	<p>To avoid injury or damage to product: Secure product to work bench.</p>

Important Notice

Parker Hannifin Corporation does not assume any responsibility beyond the design and performance of its rotary actuator product due to the unlimited variety of operating conditions and applications. The customer is solely responsible for the final selection of any Helac Corporation product or system and its suitability for the application in question.

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. The customer is solely responsible for the engineering of mating structures, fasteners, and other associated components related to the installation of the product and its ultimate application. 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.

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.

⚠ WARNING

For all Helac Models:

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

It is important to thoroughly analyze all aspects of your application and review current product information and guidelines.

Product Identification

A unique serial number is located on each T30-27 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.

		225 BATTERSBY AVENUE ENUMCLAW, WA 98022 USA PHONE (360) 825-1601 www.helac.com	
SERIAL NUMBER	<input type="text"/>	CONTROL NUMBER	<input type="text"/>
DATE MANF'D.	<input type="text"/>	OPERATING PRESSURE	<input type="text"/>
MODEL NUMBER			
<input type="text"/>			

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 wiper seal.
2. Make sure the grease reliefs are functioning properly. Open or replace non-functioning grease reliefs immediately.

NOTICE

Parker Hannifin uses a lithium-based grease in assembly. A high quality grease compatible with lithium grease may be used.

Weekly

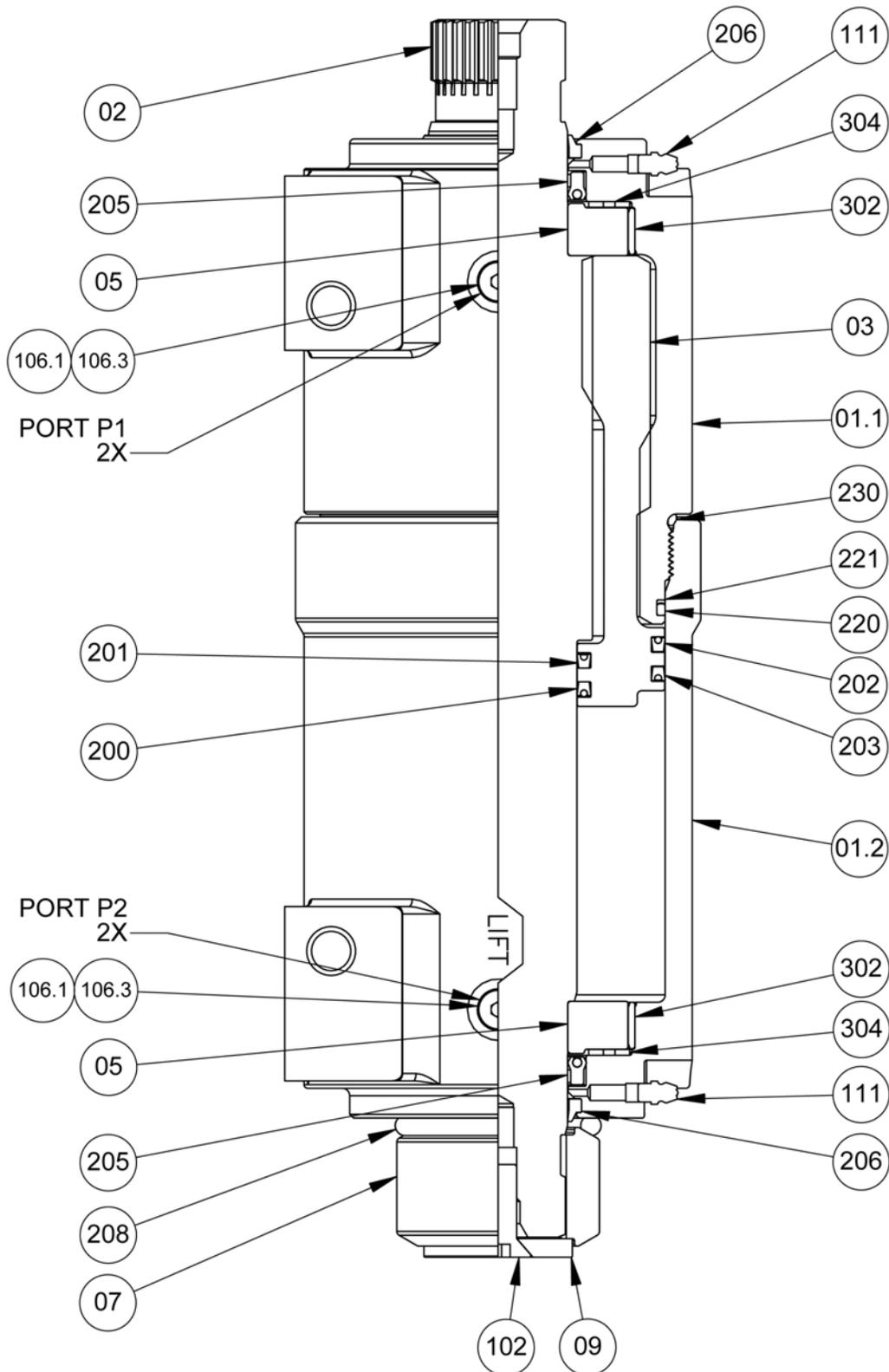
1. Apply a clean lithium or compatible grease to the grease fittings weekly when operating the actuator in non-severe environments and conditions.

Troubleshooting Guide

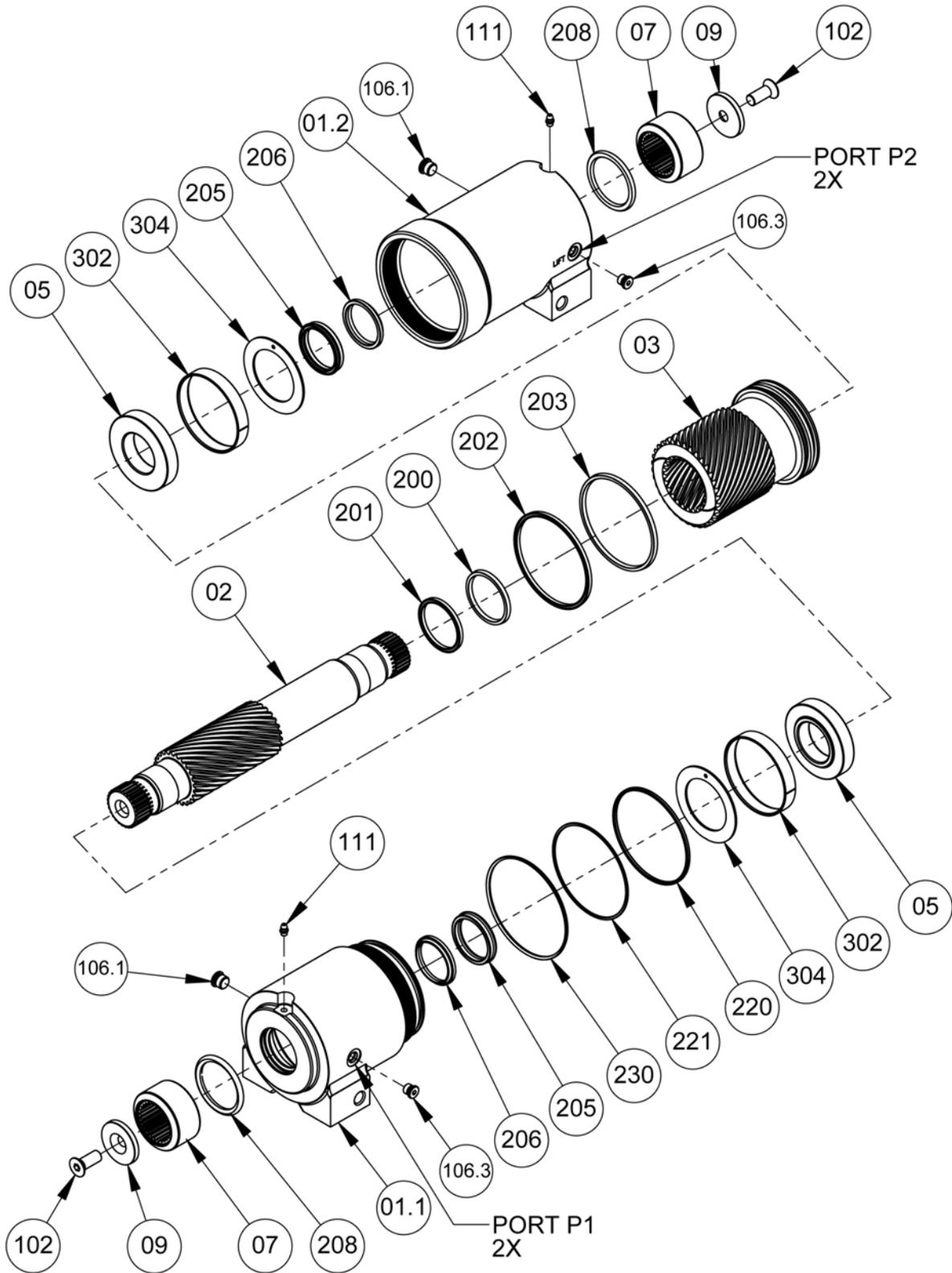
Problem	Possible Cause	Solution
Shaft rotates slowly or not at all	Insufficient torque output	Verify correct operating pressure. Do not exceed OEM's pressure specifications. Load may be above maximum capacity of the actuator.
	Low rate of fluid flow	Inspect ports for obstructions and hydraulic lines for restrictions and leaks.
	Counterbalance valve has internal leakage	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 24.
	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	Re-build the actuator with new seals. 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 25.
Operation is erratic or not responsive	Air in actuator	Purge air from actuator. See bleeding procedures outlined on Page 25.
Selected position cannot be maintained	Counterbalance valve has internal leakage	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 24.
	Air in actuator	Purge air from actuator. See bleeding procedures outlined on Page 25.

* Replacement parts may be needed.

T30-27 Assembly Drawing



T30-27 Exploded View



Parts List

Parts List - T30-27

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 T30-27-S, T30-27-ES or T30-27-MS could use different parts.

Parts

Part Number	Item #	Description	Qty
N/A	01	Housing - Not Available as Spare Part	1
33234	02	Shaft "E"	1
33237	03	Piston Sleeve	1
35968	04	Bearing Retainer	2
33238		Hardware Kit "E" and Bearing Kit (includes item 106, 108, 111, 302, 304)	
	106	Port Plug SAE-6 Port Plug	2
	108	Port Plug (SAE-4)	2
	111	Grease fitting - short	2
	302	Radial Bearing	2
	304	Thrust Bearing	2
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.

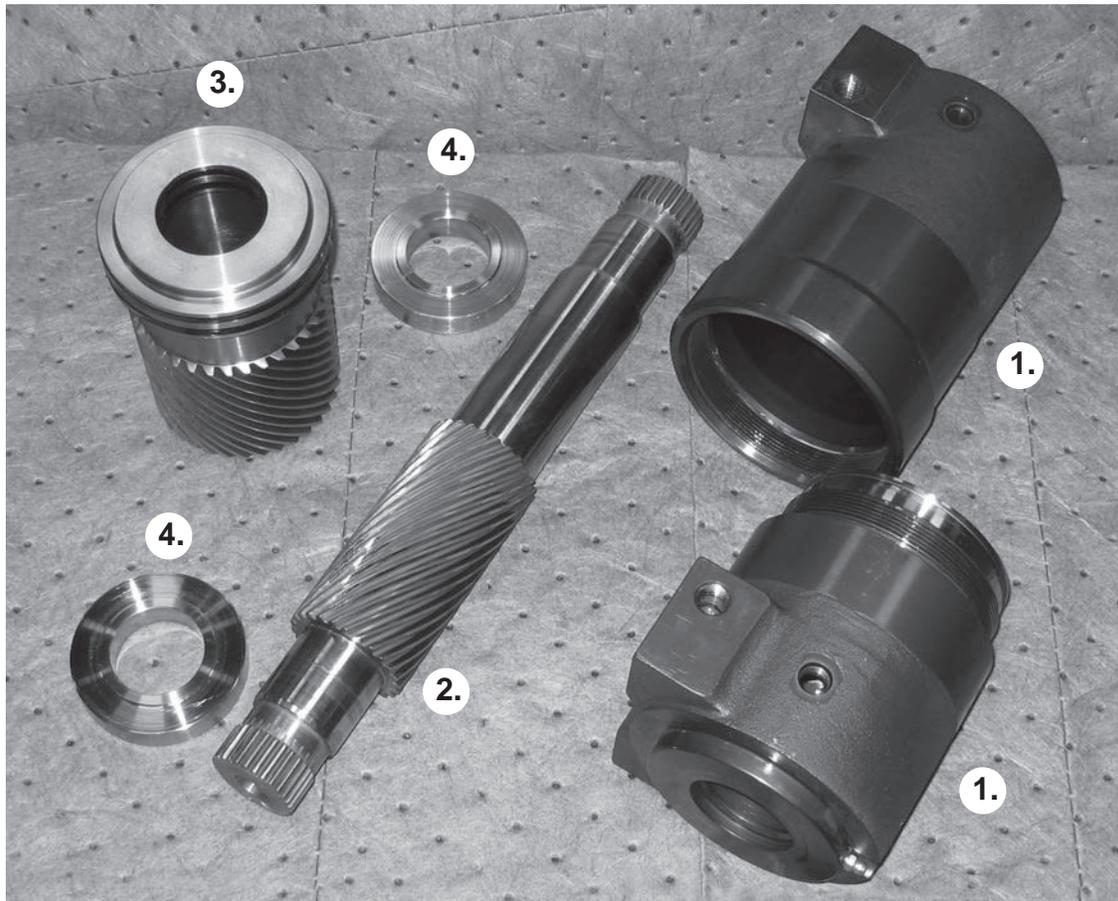
Part Number	Item #	Description	Qty
33077		Seal Kit Standard (Includes items below)	
	200	Cup Seal	1
	201	Cup Seal (expander removed)	1
	202	Cup Seal	1
	203	Cup Seal (expander removed)	1
	205	Cup Seal	2
	206	Wiper Seal	2
	220	O-Ring	1
	221	Back-up O-Ring	1
	230	O-Ring	1
34454		Spline Adapter Kit "E" (Includes 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
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.

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

Component Identification



	<p>CAUTION</p>
	<p>Spraying fluids: Contents under pressure. Wear approved eye protection. Use caution when removing port plugs and fittings.</p>

	<p>CAUTION</p>
	<p>To avoid injury or damage to product: Secure product to work bench.</p>

<p>NOTICE</p>
<p>To avoid contamination to machined parts:</p>
<p>Make sure work area is clean.</p>

NOTICE All numbers that appear in parenthesis () in the following sections refer to items on Page 8, 9 and 10.

The T30-27 helical, hydraulic rotary actuator is comprised of the following major components:

1. Housing
2. Shaft
3. Piston Sleeve
4. Bearing Retainers

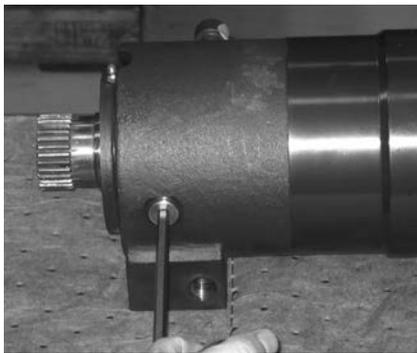
Product Inspection

Make sure the T30-27 is thoroughly cleaned prior to disassembly. Clean all machined parts in a wash tank and dry with compressed air. Be sure to inspect the actuator prior to disassembly.

Housing Disassembly

Ensure that the actuator is at end of stroke from Port P2.

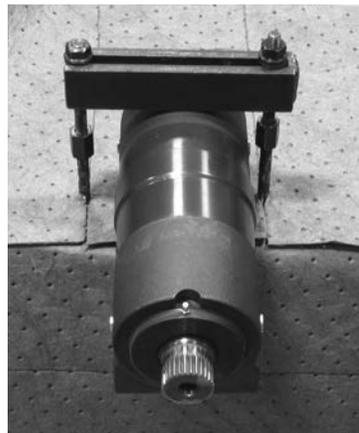
1. Carefully remove the four plug fittings (106). Drain the hydraulic oil and inspect for contamination (i.e., dirt, water and metal).



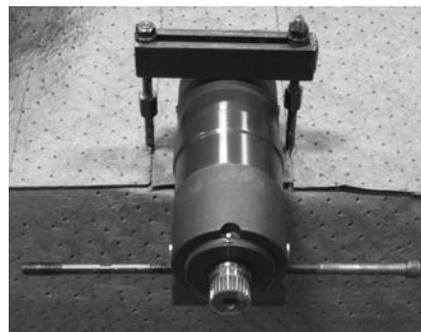
2. Remove the grease fittings (111) from each end of the housing.



3. Firmly secure the P1 (01.1) end of the actuator housing to a work bench.

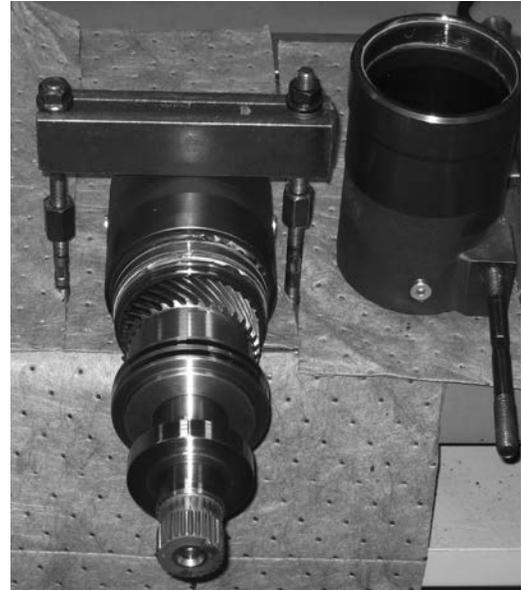


4. Insert 5/8-11 bolts or studs into mounting holes in P2 housing half feet.



Housing Disassembly

5. Unscrew housing halves.

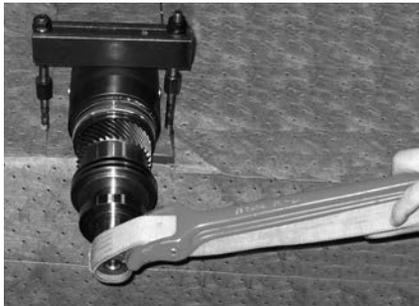


6. Gently remove P2 housing half (01.2)



Shaft Removal

1. Use a strap wrench to begin rotating shaft and piston sleeve assembly out of P1 housing half using clockwise rotation.



3. Gently remove shaft and piston sleeve assembly.



2. Look inside the housing. Timing marks (center punches) will be visible on the ring gear inside the housing and the piston sleeve. Typically there should be two marks close together on the piston sleeve one for the inside and outside gear teeth. If no timing marks are located on any items, use a push type center punch to make new marks.

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

NOTICE
To avoid damage to gear teeth and housing bore: Carefully support the weight of the shaft and piston sleeve as it clears the housing.

4. Mark timing between piston sleeve and shaft spline.



Timing Marks



Timing Marks

Piston Sleeve Removal

1. Press bearing retainer (05) off of P2 end of shaft (02).



NOTICE

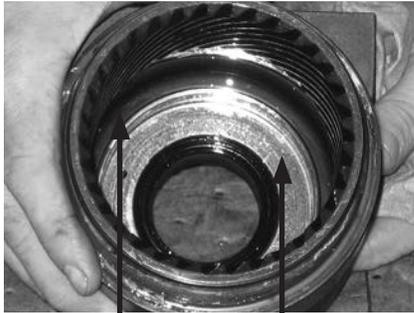
To avoid damage to gear teeth and housing bore: Carefully support the weight of the piston sleeve as it clears the shaft.

2. Remove piston sleeve (03) from shaft (02)



Bushing & Thrust Washer Removal

1. The thrust washer (304) is retained in the housing by the bushing (302) which is a press fit. Removal of the bushing is accomplished by collapsing it. Do not remove unless it needs to be replaced.



Bushing Thrust Washer

NOTICE

Use care to avoid damage to teeth and housing bore.

2. The bushing in the P2 housing half is accessible through the SAE-6 port opening. Using a punch, carefully collapse the bushing enough to relieve the press fit. Care must be exercised to prevent damage to the port threads.



3. Remove the bushing and thrust washer from the P2 housing half.



4. The bushing in the P1 housing half is accessible only through the inside of the housing. Using a chisel punch, carefully collapse the bushing enough to relieve the press fit. Care must be exercised to prevent damage to the housing.



5. Remove the bushing and thrust washer from the P1 housing half.



Seal Removal

1. Remove wiper (206) and cup (205) seals from both housing halves.



NOTICE

To avoid damage to machined parts:

Carefully remove seals using removal tools with rounded edges.

2. Remove exclusion seal O-ring seals (220, 221, 230) from P1 housing half.



3. Remove piston sleeve O.D. cup seals (202, 203).



4. Remove piston sleeve I.D. cup seals (200, 201)



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.



	CAUTION
	To avoid injury: Be careful when handling the screwdriver when hot.

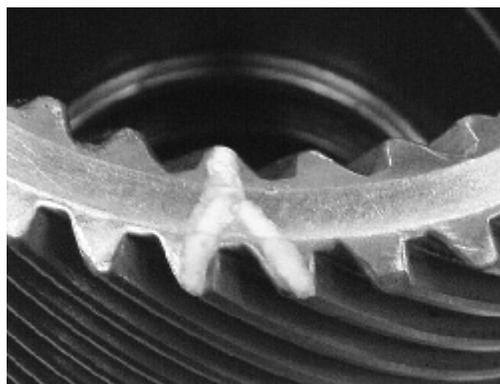
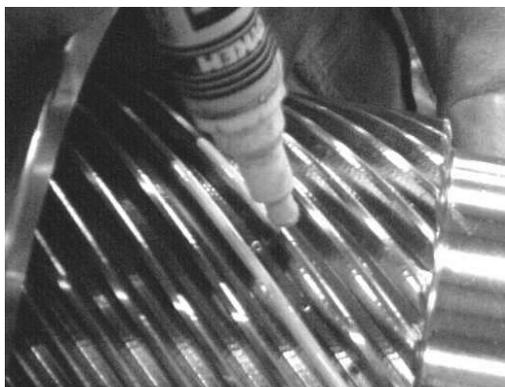
Component Inspection

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. Inspect the threads for galling or cross threading. Make sure that the housing halves spin freely together. Evaluate the surface finish of the seal grooves.

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. **Piston Sleeve**
Inspect the condition of the gear teeth. Evaluate the surface finish of the seal grooves.
5. **Seals**
Helac recommends replacement of all seals.

Timing Mark Inspection

1. Locate the timing marks on the shaft (02), piston sleeve (03) and housing (01.1). 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.

Pre-Assembly

NOTICE

Assembly procedures require the P1 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. Before installing seals, coat the seals and machined surfaces with clean hydraulic oil.



Thrust Washer, Bushing and Seal Installation

1. Install thrust washers (304), coated side up and drive bushings (302) into housing halves. Use care not to damage the bushings or housing halves.

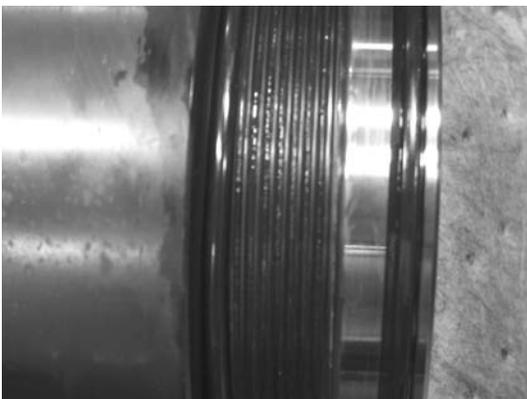


Thrust Washer, Bushing and Seal Installation

2. Install wiper seals (206) into both housing halves.



3. Install O-Ring (230) then O-Ring (220) and B/U Ring (221) onto P1 (01.1) housing half.



↑
O-Ring

↑↑
O-Ring
B/U Ring

5. Remove and discard the energizer (small O-Ring) from the inside of the piston sleeve O.D. cup seal (203) prior to installation. Also remove the energizer from inside of the piston sleeve I.D. cup seal (201).



Thrust Washer, Bushing and Seal Installation

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



7. 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.



8. Remove and discard 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.



NOTICE

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

Remove the energizer O-Ring from the ID seal nearest the piston spline and remove the energizer O-Ring from the OD seal furthest from the piston spline.

Shaft and Piston Sleeve Assembly

1. Before assembly of the shaft and piston sleeve, coat them with clean hydraulic oil.
2. Install piston sleeve (03) onto shaft (02) carefully aligning the timing marks on the shaft with the piston sleeve. Take care not to damage the piston seals with the shaft spines.
4. Install cup seals (205) onto both ends of piston shaft assembly.



3. Press the bearing retainer (05) onto the P2 end of shaft.



Shaft and Piston Sleeve Installation

1. Before installing the shaft and piston sleeve assembly, coat with clean hydraulic oil.
2. Install shaft / sleeve assembly, carefully aligning the timing marks on the sleeve with the housing spline. Use strap wrench to rotate shaft into housing half, taking care to fully seat cup seal into housing half.

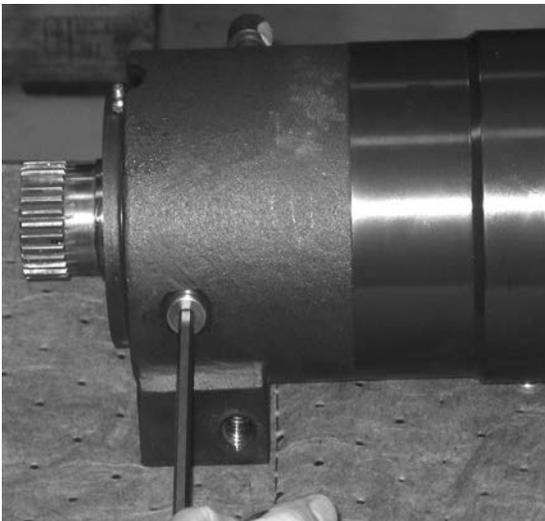


Housing Assembly

1. Re-assemble housing halves taking care to not damage housing O-rings or shaft cup seal.
3. Install grease fittings.



2. Ensure O-Rings on port plug fittings (106.1 and 106.3) are in good condition. Install plug fittings.



Testing the Actuator

	⚠ CAUTION To avoid injury or damage to product: Pinch points may occur when testing, bleeding, installing and using actuator due to moving components.
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	⚠ CAUTION Spraying fluids: Contents under pressure. Wear approved eye protection. Use caution when removing port plugs and fittings.
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	⚠ CAUTION To avoid injury or damage to product: Secure product to slotted table.
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NOTICE To avoid contamination to machined parts: Make sure work area is clean.
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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.

1. Locate the grease fittings or ports on the actuator and using a grease gun, pack the seals with grease until it exhausts from the wiper seals.
2. 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.

Testing for Internal Leakage

1. Connect a 5,000 PSI 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 2,500 PSI. 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

	⚠ CAUTION
	To avoid injury or damage to product: Pinch points may occur when testing, bleeding, installing and using actuator due to moving components.

	⚠ 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 slotted table.

NOTICE
To avoid contamination to machined parts: Make sure work area is clean.

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 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 T30-27 Assembly Drawing on Page 8 and 9 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.

The items described in this document and other documents and descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors ("Seller") are hereby offered for sale at prices to be established by Seller. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any item described in its document, when communicated to Seller verbally, or in writing, shall constitute acceptance of this offer. All goods, services or work described will be referred to as "Products".

1. **Terms.** All sales of Products by Seller are expressly conditioned upon, and will be governed by the acceptance of these Terms. These Terms are incorporated into any Quote provided by Seller to Buyer. Buyer's order for any Products whether communicated to Seller verbally, in writing, by electronic data interface or other electronic commerce, shall constitute acceptance of these Terms. Seller objects to any contrary or additional terms or conditions of Buyer. Reference in Seller's order acknowledgement to Buyer's purchase order or purchase order number shall in no way constitute an acceptance of any of Buyer's terms or conditions of purchase. No modification to these Terms will be binding on Seller unless agreed to in writing and signed by an authorized representative of Seller.

2. **Price; Payment.** The Products set forth in the Quote are offered for sale at the prices indicated in the Quote. Unless otherwise specifically stated in the Quote, prices are valid for thirty (30) days and do not include any sales, use, or other taxes or duties. Seller reserves the right to modify prices at any time to adjust for any raw material price fluctuations. Unless otherwise specified by Seller, all prices are F.C.A. Seller's facility (INCOTERMS 2020). All sales are contingent upon credit approval and full payment for all purchases is due thirty (30) days from the date of invoice (or such date as may be specified in the Quote). Unpaid invoices beyond the specified payment date incur interest at the rate of 1.5% per month or the maximum allowable rate under applicable law.

3. **Shipment; Delivery; Title and Risk of Loss.** All delivery dates are approximate, and Seller is not responsible for damages resulting from any delay. Regardless of the manner of shipment, delivery occurs and title and risk of loss or damage pass to Buyer, upon placement of the Products with the carrier at Seller's facility. Unless otherwise agreed prior to shipment and for domestic delivery locations only, Seller will select and arrange, at Buyer's sole expense, the carrier and means of delivery. When Seller selects and arranges the carrier and means of delivery, freight and insurance costs for shipment to the designated delivery location will be prepaid by Seller and added as a separate line item to the invoice. Buyer shall be responsible for any additional shipping charges incurred by Seller due to Buyer's acts or omissions. Buyer shall not return or repackage any Products without the prior written authorization from Seller, and any return shall be at the sole cost and expense of Buyer.

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, NON-INFRINGEMENT, 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

Notes

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