Helical Hydraulic Rotary Actuators
T30-27 Service & Repair Manual
# Table of Contents

## Introduction
- Table of Contents ................................................................. 2
- Operation Technology ......................................................... 3
- General Safety Guidelines .................................................... 4
- Product Identification ........................................................... 5

## Maintenance and Troubleshooting
- Maintenance ................................................................. 6
- Troubleshooting Guide ......................................................... 7

## Drawings
- Assembly Drawings .......................................................... 8
- Exploded Views ............................................................... 9
- Parts List ................................................................. 10

## Disassembly
- Component Identification .................................................... 11
- Housing Disassembly .......................................................... 12
- Shaft Removal ............................................................... 14
- Piston Sleeve Removal ......................................................... 15
- Bushing and Thrust Washer Removal ........................................... 16
- Seal Removal ............................................................... 17
- Component Inspection .......................................................... 18
- Timing Mark Inspection ......................................................... 18

## Assembly
- Dry Assembly ............................................................... 19
- Pre-Assembly ............................................................... 19
- Thrust Washer, Bushing and Seal Installation ....................... 19
- Shaft and Piston Sleeve Assembly .......................................... 22
- Shaft and Piston Sleeve Installation ......................................... 22
- Housing Assembly .......................................................... 23

## Post Assembly
- Testing the Actuator .......................................................... 24
- Bleeding the Actuator .......................................................... 25
- Offer of Sale ............................................................... 26
Operation Technology

The T30-27 rotary actuators use Helac Corporation’s 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 Helac Corporation's Service Department for assistance.

Important Notice

Helac 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.
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

Helac Corporation 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

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft rotates slowly or not at all</td>
<td>Insufficient torque output</td>
<td>Verify correct operating pressure. Do not exceed OEM’s pressure specifications. Load may be above maximum capacity of the actuator.</td>
</tr>
<tr>
<td></td>
<td>Low rate of fluid flow</td>
<td>Inspect ports for obstructions and hydraulic lines for restrictions and leaks.</td>
</tr>
<tr>
<td></td>
<td>Counterbalance valve has internal leakage</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Leak in piston and/or shaft seal</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Corrosion build-up on the thrust surfaces</td>
<td>Re-build the actuator. Remove all rust, clean thoroughly and then polish.*</td>
</tr>
<tr>
<td></td>
<td>Swollen seals caused by incompatible hydraulic fluid</td>
<td>Re-build the actuator with new seals. Use fluid that is compatible with seals and bearings. Contact Helac Corporation for more information.</td>
</tr>
<tr>
<td></td>
<td>Air in actuator</td>
<td>Purge air from actuator. See bleeding procedures outlined on Page 25.</td>
</tr>
<tr>
<td>Operation is erratic or not responsive</td>
<td>Air in actuator</td>
<td>Purge air from actuator. See bleeding procedures outlined on Page 25.</td>
</tr>
<tr>
<td>Selected position cannot be maintained</td>
<td>Counterbalance valve has internal leakage</td>
<td>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.</td>
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</tr>
<tr>
<td></td>
<td>Air in actuator</td>
<td>Purge air from actuator. See bleeding procedures outlined on Page 25.</td>
</tr>
</tbody>
</table>

* Replacement parts may be needed.
T30-27 Exploded View

PORT P2
2X

PORT P1
2X

Exploded View
### Spare Parts

Spare parts must be ordered through the vehicle/machine OEM. Seals and wear guides are available as complete kits only! In order to obtain the correct parts, it is essential to provide the serial number for the actuator to be repaired. See Product Identification on Page 5. To identify spare parts required, refer to the Assembly Drawing, Exploded View Drawing and the Parts List.

#### PARTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.1</td>
<td>Housing (P1)</td>
<td>1</td>
</tr>
<tr>
<td>01.2</td>
<td>Housing (P2)</td>
<td>1</td>
</tr>
<tr>
<td>02</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>03</td>
<td>Piston Sleeve</td>
<td>1</td>
</tr>
<tr>
<td>05</td>
<td>Bearing Retainer</td>
<td>2</td>
</tr>
<tr>
<td>07</td>
<td>Adapter</td>
<td>2</td>
</tr>
<tr>
<td>09</td>
<td>Spacer</td>
<td>2</td>
</tr>
</tbody>
</table>

#### SEALs

Sold as "kit" only

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Cup Seal — Piston Sleeve</td>
<td>1</td>
</tr>
<tr>
<td>201</td>
<td>Cup Seal — Piston Sleeve*</td>
<td>1</td>
</tr>
<tr>
<td>202</td>
<td>Cup Seal — Piston Sleeve</td>
<td>1</td>
</tr>
<tr>
<td>203</td>
<td>Cup Seal — Piston Sleeve*</td>
<td>1</td>
</tr>
<tr>
<td>205</td>
<td>Cup Seal — Shaft</td>
<td>2</td>
</tr>
<tr>
<td>206</td>
<td>Wiper Seal</td>
<td>2</td>
</tr>
<tr>
<td>208</td>
<td>O-Ring Seal — Adapter</td>
<td>2</td>
</tr>
<tr>
<td>220</td>
<td>O-Ring Seal — Housing</td>
<td>1</td>
</tr>
<tr>
<td>221</td>
<td>B/U Ring — Housing</td>
<td>1</td>
</tr>
<tr>
<td>230</td>
<td>O-Ring Seal — Housing</td>
<td>1</td>
</tr>
</tbody>
</table>

#### BEARINGS

Sold as "kit" only

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>302</td>
<td>Bushing</td>
<td>2</td>
</tr>
<tr>
<td>304</td>
<td>Thrust Washer</td>
<td>2</td>
</tr>
</tbody>
</table>

*Energizer Removed

Seal and Bearing kits can be ordered online at [http://www.helac.com/store/](http://www.helac.com/store/)
Component Identification

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.

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.

3. Gently remove shaft and piston sleeve assembly.

4. Mark timing between piston sleeve and shaft spline.

   **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.
Piston Sleeve Removal

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

2. Remove piston sleeve (03) from 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.
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.

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.

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


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

NOTICE

To avoid damage to machined parts:

Carefully remove seals using removal tools with rounded edges.

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.

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 and seal the piston spline and remove the energizer O-Ring from the ID seal further 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.

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

4. Install cup seals (205) onto both ends of piston shaft assembly.

---

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.

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

3. Install grease fittings.
Testing the Actuator

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.

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.
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 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.

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

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

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

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 offer for any Products that Seller accepts is binding upon Seller only if any such offer is in writing. Terms and Conditions of Sale are binding on Buyer 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 stated in the Quote, all prices are valid for thirty (30) days and do not include any sales, use, value added, or similar taxes, which shall be paid by Buyer. All Products shall be shipped F.O.B. Buyer’s address and shipped to Buyer as directed by Buyer. All prices are subject to change without notice to Buyer. Buyer shall be billed on 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 repurchase any Products without the prior written authorization of Buyer, and any return shall be at the sole cost and expense of Buyer.

3. Warranty. The warranty for the Products is as follows: (i) Goods are warranted against defects in material and 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 (iii) if software is delivered to Buyer as a separate line item to the invoice, Buyer shall be responsible for any additional software charges incurred by Seller due to Buyer’s acts or omissions. Buyer shall not return or repurchase any Products with the prior written authorization from Seller, and any return shall be at the sole cost and expense of Buyer.

4. Limitation of Liability. In no event shall Seller be liable for any special, indirect, incidental, or consequential damages including but not limited to lost profits, lost savings, lost business, lost contracts, or interruption of business, whether direct or indirect, foreseeable or unforeseeable, whether determined on an absolute or percentage basis, or determined by any other means.

5. Claims: Commencement of Actions. Buyer shall promptly inspect all Products upon receipt. No claim for damages 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 warranty within twelve (12) months from the date of the alleged breach of warranty or other alleged event, without regard to the date of discovery.

6. 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 the claim. Seller shall control 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 option and expense, procure for Buyer the right to continue using the Products, modify the Products so as to render them non-infringing, 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 to Buyer other than those designed 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.

17. Termination. Seller may terminate any agreement governed by or arising from these Terms for any reason upon thirty (30) days prior written notice to Buyer. All obligations hereunder shall cease upon termination, in writing, if: (i) Buyer breaches any provision of these Terms, (ii) Buyer becomes insolvent, (iii) Buyer has been or will be disclosed, delivered or made available, whether directly or indirectly, to Buyer where Buyer’s access to the Products will result in the transfer of significant rights, including, but not limited to, the design and improvement of the Products. Buyer will return or destroy all Products and all Confidential Information, except for Confidential Information, has been and will be received in confidence and will remain the property of Seller. Buyer further agrees that it shall use Seller’s Confidential Information for any purpose other than for the benefit of Seller.

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 of the Software for the sole purpose of using the Products. Buyer has no ownership rights in the Software and Buyer agrees to hold Seller harmless and indemnify Seller against any and all claims, suits, actions, liabilities, costs, expenses, and damages arising from any use of the Software that is not consistent with the terms of this Section.

19. 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.