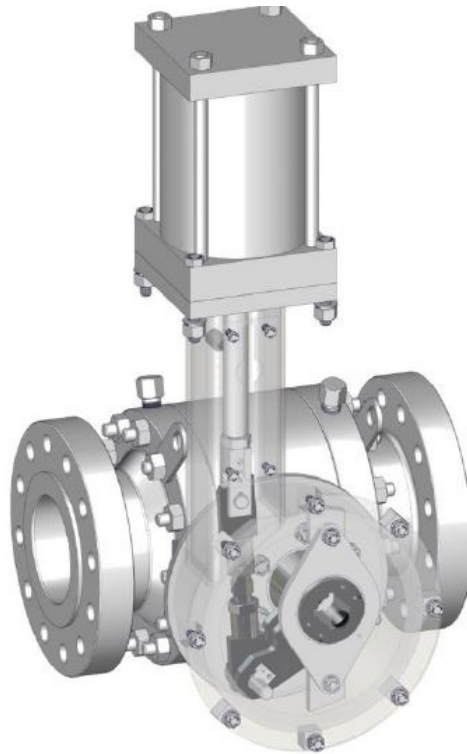




RHPA-DA SERIES ROTARY HIGH PRESSURE ACTUATOR – DOUBLE ACTING INSTALLATION, OPERATION & MAINTENANCE MANUAL



Applicable Models:

This Instruction Manual applies to the following VRG – RHPA-DA Rotary High Pressure Actuator – Double Acting. To confirm suitability for additional models and/or components, please contact VRG Controls or view us online at www.vrgcontrols.com.

RHPA-DA ABOVE GROUND – NO TAILROD
RHPA-DA ABOVE GROUND – WITH TAILROD

RHPA-DA BELOW GROUND – WITH TAILROD

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INTRODUCTION

The VRG Controls RHPA-DA Rotary High Pressure Actuator is a high performance pneumatic actuator designed specifically for natural gas regulation. The VRG RHPA-DA is built to exacting specifications in order to offer accurate and reliable performance. The RHPA-DA is easy to operate, requires minimal maintenance, and is available in a variety of configurations and sizes to fit your specific application. To best maintain accuracy, efficiency, and safety, all RHPA-DA applications should be designed and engineered with the assistance of VRG Controls factory personnel. All VRG Controls RHPA-DA's are shipped ready for installation and startup without any further adjustment. All instruction manuals supplied with the RHPA-DA should be reviewed prior to installation and startup. Only those qualified through training or experience should install, operate, or maintain VRG Controls RHPA-DA's.

VRG Controls RHPA-DA are typically shipped as a complete "regulating/control assembly" designed to control a process in a pipeline or other piping arrangement. The complete assembly is typically comprised of the following three (3) components:

1. RHPA-DA Rotary High Pressure Actuator
2. PRCV Pipeline Rotary Control Valve OR Other Quarter Turn Type Rotary Control Valve
3. Control Instrumentation and Related Accessories

Information about the RHPA-DA Rotary High Pressure Actuator is covered in this manual. For information about PRCV Pipeline Rotary Control Valve, Other Quarter Turn Type Rotary Control Valves supplied, Control Instrumentation, and related accessories refer to the appropriate instruction manual for the specific product from the associated manufacturer. These documents are typically supplied as part of the job-specific Installation, Operation, and Maintenance Manual booklet supplied with the original purchase shipment. Please contact VRG Controls or your local VRG Controls sales representative for assistance in locating or obtaining replacement documentation.

TECHNICAL ASSISTANCE

Should you have any questions, you may contact your local VRG Controls sales representative or VRG Controls technical assistance at:

VRG Controls
Attn: Technical Assistance 928 Donata Court
Lake Zurich, IL 60047
Toll-Free: 844-FLOW-VRG (844-356-9874)
Tel: + 1 847-778-6740
e-mail: sales@vrgcontrols.com website: www.vrgcontrols.com

To facilitate requests for technical assistance, please have the following information immediately available:

- RHPA serial Number (see ID tag affixed to RHPA actuator)
- VPC or VGP Serial Number(s) (see ID tag affixed to VPC or VGP)
- VRG Controls Invoice Number (see upper right corner of first page of instruction manual)

APPLICABLE MODELS:

This Instruction Manual applies to the following VRG – RHPA-DA Rotary High Pressure Actuator – Double Acting.

- RHPA-DA ABOVE GROUND – NO TAILROD
- RHPA-DA ABOVE GROUND – WITH TAILROD
- RHPA-DA BELOW GROUND – WITH TAILROD

GENERAL SERVICE INFORMATION

- This service procedure is offered as a guide to enable general maintenance to be performed on VRG Controls RHPA-DA Series Rotary High Pressure Actuator.
- Normal recommended service interval for this actuator series is every one (1) year and every five (5) years. NOTE: Storage time is counted as part of the service interval.
- This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator.
- Remove all piping and mounted accessories that will interfere with the module(s) that are to be serviced.
- This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.
- When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp corners rounded off to prevent damage to sealing surfaces.
- Use a non-hardening thread sealant on all pipe threads.
- CAUTION: FOLLOW MANUFACTURER'S INSTRUCTIONS
- Apply the thread sealant per the thread sealant manufacturer's instructions.
- VRG Controls recommends that disassembly of the actuator should be done in a clean, organize area free of dust, debris and protected from precipitation when possible.
- Note that many of the necessary instruction manuals for VRG and non-VRG manufactured components are available via the VRG website at: www.vrgcontrols.com.

DEFINITIONS**WARNING:**

If not observed, user incurs a high risk of severe damage to actuator and/or fatal injury to personnel.

CAUTION:

If not observed, user may incur damage to actuator and/or injury to personnel.

NOTE:

Advisory and information comments provided to assist maintenance personnel to carry out maintenance procedures.

GENERAL SAFETY INFORMATION

- Products supplied by VRG Controls, in its "as shipped" condition, are safe if the instructions contained within this Service Instruction are strictly adhered to and executed by well trained, equipped, prepared and competent personnel.
- WARNING: FOLLOW WARNING AND CAUTION SIGNS
- For the protection of personnel working on VRG Controls actuators, this procedure should be reviewed and implemented for safe disassembly and reassembly. Close attention should be noted to the WARNINGS, CAUTIONS and NOTES contained in this procedure.
- WARNING: FOLLOW COMPANY SAFETY PROCEDURES
- This procedure should not supersede or replace any customer's plant safety or work procedures. If a conflict arises between this procedure and the customer's procedures the differences should be resolved in writing between an authorized customer's representative and an authorized VRG factory representative.

TABLE 1.0 RHPA-DA SPECIFICATIONS

Actuator Type	Pneumatic Quarter Turn Crank-Arm Specifically Designed for Throttling Control Valve Applications
Output Rotation	90° Quarter Standard (Non-Adjustable) 85° - 95° Available Option (Non-Adjustable)
Installation	Indoor / Outdoor and Vertical / Horizontal All Components Explosion Proof Design Class 1, Div 1 Standard
Installation Orientation	Left Hand Mount – Vertical Standard Other Mounting Orientations Available Upon Request
Torque Output Range	2,250 in-lbs to 874,430 in-lbs – Standard Actuator Models Higher Torque Model Actuators Available Upon Requests
Operating Temperature Range	-20°F to +160°F
Pneumatic Connections	All cylinders have 1/2 NPT ports. Only high speed cylinders for surge control have 1” NPT ports
Instrumentation Tubing	Standard - 3/8 in OD x .035 Wall 316 SS Seamless Annealed Tubing, ASTM A269
Instrumentation Fittings	Standard - SSP 316 Stainless Steel Dual Ferrule Tubing Compression Fittings Optional - Swagelok 316 Stainless Steel Dual Ferrule Tubing Compression Fittings
Supply Gas Media	Instrument Quality Natural Gas, Air or Nitrogen
Maximum Supply Gas Range	8” Bore and smaller can be rated at 500 psig MAOP, 10” bore and larger 400 psig
Supply Gas Moisture Limitation	< 7 Lb. Per 1.0 MMSF Natural Gas If excessive moisture is present, a Filter Dryer may be necessary. Model FD5 is standard issue. If excessive entrained hydrocarbons are present, a Filter Deodorizer may be necessary. Model FACD5 is standard issue. If H2S is present in supply gas, consult VRG Controls for limitations.
Supply Gas Filtration Limitation	Nominal 10μ recommended. Model FD5 and Model FACD5 provide suitable filtration.
Supply Gas Heat Requirements	If ambient temperatures may fall below the specified temperature range, it is recommended that the RHPA Actuator be installed in a heated enclosure or building. Any heating devices utilized must be rated as “explosion proof for a hazardous environment.” VRG Controls recommends the use of catalytic heaters when heat is required. The catalytic heater utilizes natural gas fuel and provides a safe, flameless heat.
Coating	Above Ground Standard Coating: SP10 Sandblast, Epoxy Primer, Polyurethane Topcoat 6-10 mil Below Ground Standard Coating: SP10 Sandblast, Coal Tar Epoxy 16 mil Thickness Custom Coatings to Match Customer Specifications Available Upon Request

ACTUATOR STORAGE

- For applications where the actuator is not placed into immediate service, it is recommended that the actuator be cycled with regulated clean/dry pneumatic pressure occasionally. Indoor storage, if available, is recommended for all actuators. Care should be taken to plug all open ports on actuator and controls to keep out foreign particles and moisture.
- **CAUTION:** If the actuator and instrumentation must be stored outside, the assembly should be covered adequately great care should be taken to prevent intrusion of moisture, ice, dirt, dust and other elements that might have an adverse effect on the actuator assembly and accessories. Actuators should not be stored in an atmosphere that is harmful to resilient seals. Contact factory for extended storage period.

ACTUATOR OPERATION

- **Controlled Operation:** Controlled operation is accomplished by pressurizing and/or depressurizing the appropriate Actuator Cylinder inlet(s) of a double-acting. Do not exceed pressures indicated on actuator nameplate.
- It is important to maintain and inspect actuators on a regular basis. Instructions are provided for Annual, 5 year, and "As-needed" maintenance and inspection of the actuator. Although VRG Controls designs and manufactures products of the highest quality, all physical components are subject to wear and breakage under normal operating conditions. To prevent further damage to the actuator and the surrounding environment, adherence the maintenance and inspection procedures are recommended. See Page X for recommended maintenance summary checklists.

ACTUATOR INSTALLATION

Since there are many valve and actuator combinations, it is not practical to include detailed instructions for all valve and actuator mounting combinations. Mountings are designed to be as simple as possible to avoid complications from actuator installation.

Actuators that are shipped from the factory with the travel stops adjusted for approximately ninety-degree rotation. Generally, it is necessary to make slight travel stop adjustments once the actuator is installed onto the valve. Refer to the valve manufacturer's recommendations for specific requirements. When the valve has internal stops, the actuator should be adjusted at the same points.

Actuators that are shipped from the factory installed on control valves are preset to ensure full range of valve travel with specific attention to ensure "CLOSE" end of travel accomplishes full shutoff of the control valve. It is NOT typically necessary to travel stop adjustments when actuators are factory installed. There is no external stops, the travel stops are achieved by the cylinder ends. The connecting link length is adjustable.

NOTE: The actual travel limit should be accomplished by the actuator. If the valve does not have internal stops, adjust the actuator to the full open position. Using this as a reference point, rotate the valve closed and adjust to the valve manufacturer's specifications for total rotation.

Good instrument practices are also recommended. Clean/dry regulated pneumatic pressure is essential for long service life and satisfactory operation. It should be noted that new pneumatic lines often have scale, moisture, oil and other debris in them and these lines should be purged of all foreign material to prevent damage to critical seals inside the actuator and/or control instrumentation.

PRE-START UP CHECKS

1. Inspect to ensure the unit has been mounted onto valve properly. Control valve topworks mounting bolts, stem key, setscrew(s) are installed and secured.
2. No tubing damaged or accessories dislodged during the shipping or the installation.
3. Indicated position confirms valve position.
4. All switching valves in normal operating position as per SCHEMATIC / INSTRUCTIONS

CHECK CONNECTIONS

1. Pneumatic / hydraulic components connected as per schematic enclosed or in service manual supplied.
2. Pneumatic supply connected to the identified ports
3. Electrical connection terminals are secured.
4. Wiring as per enclosed diagram or service manual supplied.
5. When actuator is first placed into service, it should be cycled with regulated pneumatic pressure. This is necessary because the seals have been stationary, causing them to take a “set”. Therefore, the actuator should be operated through several cycles to exercise the seals so as to achieve a service ready condition.

**FACTORS THAT DETERMINE THE ACTUATOR SPEED
OF OPERATION**

1. Supply Gas Line Length
2. Supply Gas Line Size
3. Supply Gas Line Pressure
4. Torque Requirements of The Valve
5. Size of The Actuator
6. Setting of Speed Controls
7. Limiting Flow Capacity of Control Instrumentation

Due to the interaction of these variables, it is difficult to specify a “normal” operating time. Faster operating time may be obtained by using one or more of the following:

1. Larger Supply Lines
2. Higher Supply Pressure*
3. Higher Capacity Control Instrumentation
4. Alternate Piping Configuration of Control Instrumentation
5. Volume Booster Assemblies
6. Quick Exhaust Valves

* Not to exceed maximum operating pressure of actuator or control components

Slower operating time may be obtained by using flow control valves to meter the exhaust. Excessive exhaust flow metering may cause erratic operation.

TABLE 2.0 RHPA ROTARY HIGH PRESSURE CYLINDER ACTUATOR MODEL NUMBER DERIVATION

Actuator Bore (in)						
5	X	Actuator Stroke (in)				
6		4	Tailrod			
10		6	TR	Action		
12		8		DA	Double Acting	
14		12	NR	SR	Spring Return	
		13	DR	Actuator Spring(s)		
		14		10		
		16		20		
		20		30		
		24		40		
	26			50		
				60		
RHPA	10	X	6		SR	40
Example #1 : RHPA 10 in Bore x 6 in Stroke Piston Spring Return Actuator w/ #40 Actuator Spring						
RHPA	8	X	8	TR	DA	
Example #2 : RHPA 8 in Bore x 8 in Stroke Piston with Tailrod Double Acting Actuator						

Notes:

1. Actuator Bore x Stroke preceded by "D" indicate a DUAL cylinder (qty 2) configuration
2. Actuator Spring(s) preceded by "D" indicate a DUAL spring cartridge (qty 2) configuration
3. Certain Actuator Models May have Two (2) or More Different Cylinders or Spring Assemblies
4. Fail Closed OR Fail Open is typically specified w/ Actuator Description for Spring Return Actuators
5. "TR" Preceding "DA" Double Acting indicates TAILROD DESIGN Cylinder

TABLE 3.0 RHPA-DA SERIES ROTARY HIGH PRESSURE ACTUATOR –DOUBLE ACTING RECOMMENDED ANNUAL MAINTENANCE CHECKLIST NUMBER DERIVATION

No.	Check	Procedure Description	Pg.
1		Procedure 1.0: Verify Proper Actuator Stroking Operation	10
2		Procedure 2.0: Apply Lubrication to Control Valve	11
3		Procedure 3.0: Apply Lubrication to Actuator Cylinder Assembly	12-13
4		Procedure 4.0: Verify Control Valve Stem Seals	14
5		Procedure 5.0: Verify Actuator CYLINDER Rod Seals	15

TABLE 4.0 RHPA-DA SERIES ROTARY HIGH PRESSURE ACTUATOR –DOUBLE ACTING RECOMMENDED FIVE (5) YEAR MAINTENANCE CHECKLIST ANNUAL MAINTENANCE CHECKLIST NUMBER DERIVATION

No.	Check	Procedure Description	Pg.
1		Procedure 1.0: Verify Proper Actuator Stroking Operation	10
2		Procedure 7.0: Verify Actuator CYLINDER Tube Seals	16
3		Procedure 9.0: Verify Actuator Cylinder Seals (U-Cup)	20-22
4		Procedure 11.0: Verify Actuator Cylinder Tailrod Seals (if equipped)	22
5		Procedure 13.0: Verify Actuator Lost Motion	24
6		Control Instrumentation Inspection	n/a

TABLE 5.0 RHPA-DA SERIES ROTARY HIGH PRESSURE ACTUATOR–DOUBLE ACTING RECOMMENDED “AS-NEEDED” MAINTENANCE CHECKLIST

No.	Check	Procedure Description	Pg.
1		Procedure 2.0: Apply Lubrication to Control Valve	11
2		Procedure 3.0: Apply Lubrication to Actuator Cylinder Assembly	12-13
3		Procedure 4.0: Verify Control Valve Stem Seals	14

**PROCEDURE 1.0 -VERIFY PROPER ACTUATOR
STROKING OPERATION**

- Step 1:** Maintain full supply pressure as outlined in the associated packing slip, instrument schematic or IOM specifications originally provided with the actuator assembly.
- Step 2:** If the actuator is equipped with a VRG Controls VMO Series Valve Manual Override stroke the actuator from one end of travel to the other.
- Step 3:** If the actuator is not equipped with a VMO Series Valve Manual Override, the actuator may be stroked by:
- Step 4:** Adjust an installed VPC Valve Regulator Pilot to cause OPEN and CLOSE travel of the actuator.
- Step 5:** Adjust the pneumatic instrument signal applied to an installed VGP Valve Gas Positioner to cause OPEN and CLOSE travel of the actuator.
- Step 6:** Adjust the electrical instrument signal applied to an installed electro-pneumatic positioner to cause OPEN and CLOSE travel of the actuator.
- Step 7:** Triggering any override devices installed on the actuator.
- Step 8:** Applying appropriate pneumatic supply pressure directly to the actuator loading ports via regulated pressure source such as a volume bottle, air compressor or pipeline
- Step 9:** As the actuator strokes from one end of travel to the other, the linear position indicator scale or rotary Beacon™ travel indicator installed on the actuator should be monitored for the stroking of the actuator.

- Step 10:** When the actuator is stroked from one end of travel to the other, it should exhibit the following:
- Smooth, continuous stroking from one end of travel to the other.
 - No stalling or stopping of the actuator in mid travel.
 - Consistent stroking speed.
 - No abnormal noises (scraping, chattering, or metallic sounds).
- Step 11:** If the actuator exhibits abnormal operation during stroking or any of the unusual characteristics, corrective action may be required.

**COMMON CAUSES OF ABNORMAL
ACTUATOR STROKING**

The following actuator performance considerations may cause abnormal actuator stroking performance:

- Lost Motion or Excessive Wear of Mated Parts in the Actuator Assembly.
- Damaged Actuator Cylinder Seals.
- Damaged Actuator Cylinder Tube Walls Ice Buildup Inside Actuator Linkage Housing
- Interference of Foreign Items or Tools Left Inside the Actuator Linkage Housing or Actuator Cylinder

The following valve performance considerations may cause abnormal actuator stroking performance:

- Sticky Valves or High Torque Valves
- Damaged Valves
- Obstructions or Foreign Objects in the Body of The Valve

The following procedures are recommended to correct abnormal actuator stroking. The corrective measures may involve corrective action be performed on the actuator itself or ancillary devices such as control valves on which the actuator is mounted. The recommended corrective action procedures are presented in a specific order that considers difficulty of the specific procedure in tandem with the likelihood of success in correcting the problem. Corrective action procedures should be executed in the below order until satisfactory actuator stroking is achieved.

RECOMMENDED CORRECTIVE ACTION STEPS TO IMPROVE ACTUATOR STROKING

1. Apply Lubrication to Control Valve
2. Apply Lubrication to Actuator
3. Verify Control Valve Stem Seals
4. Verify Actuator Cylinder Rod Seals
5. Verify Actuator Tailrod Seals (If Applicable)
6. Verify Actuator Cylinder Seals
7. Verify No Obstruction to Actuator Mechanisms
8. Verify No Obstruction to Control Valve

PROCEDURE 2.0 -APPLY LUBRICATION TO CONTROL VALVE

- Step 1:** Control valves supplied by VRG Controls are factory lubricated and tested prior to shipment and should not require additional lubrication for some time.
- Step 2:** Control valves ultimately may require additional lubrication to ensure satisfactory operation depending upon frequency of use, gas quality, and cumulative control activity.
- Step 3:** Control valves supplied by VRG Controls are specifically designed for easy maintenance and application of valve lubrication to optimize performance.
- Step 4:** Refer to the PRCV Pipeline Rotary Control Valve IOM or other associated control valve IOM for specific instructions on control valve lubrication procedures.
- Step 5:** It is strongly recommended to review and adhere to control valve manufacturer's specific instructions for each specific model of control valve to ensure safe and effective.
- Step 6:** Isolate control valve to be lubricated by closing upstream and downstream block valves.
- Step 7:** Triggering any override devices installed on the actuator.
- Step 8:** Place the control valve to be lubricated in FULL CLOSED position. Only clean, dry, oil-free air or gas should be applied to avoid damage to actuator and/or control instrumentation.
- Step 9:** Apply lubricant to each Valve Seat Injection Fitting.
- Step 10:** Stroke valve from FULL OPEN to FULL CLOSED positions approximately 15 times. If normal control valve operation is achieved no additional action is necessary. Return control valve to service as appropriate.
- Step 11:** If applying lubrication to Valve Seats does not provide proper valve operation, it may be necessary to lubricate the ball valve directly through the Valve Body Bleed Fitting.
- Step 12:** Apply lubricant to each Valve Seat Injection Fitting.
- Step 13:** Stroke valve from FULL OPEN to FULL CLOSED positions approximately 15 times. If normal control valve operation is achieved no additional action is necessary. Return control valve to service as appropriate.
- Step 14:** If applying lubrication to Valve Seats does not provide proper valve operation, it may be necessary to lubricate the ball valve directly through the Valve Body Bleed Fitting.

TABLE 6.0 RECOMMENDED LUBRICATION QUANTITY FOR PRCV PIPELINE ROTARY CONTROL

PRCV Bore	Recommended Number Tubes to Apply (14 oz. Tube)	Recommended Total Lubricant Volume to Apply
2, 3, 4 in Bore	2 Tubes	28 oz.
6, 8 in Bore	4 Tubes	56 oz.
10 in Bore	6 Tubes	84 oz.
12 in Bore	8 Tubes	112 oz.
14 in Bore and Larger	Consult VRG Controls	Consult VRG Controls

Notes:

1. Additional lubrication volume may be necessary for applications that exhibit severe lubrication requirements.
2. Additional lubrication volume may be necessary for applications with BELOW GROUND RHPA Actuator extensions to accommodate extended control valve port piping.
3. VRG Controls recommends Molyllith SHC 220 or Valtex 2000 exclusively for lubrication to ensure satisfactory performance.
4. Control Valve “Cleaner” may be required for applications that exhibit severe lubrication requirements. Consult VRG Controls for assistance.

PROCEDURE 3.0 -APPLY LUBRICATION TO ACTUATOR CYLINDER

- | | |
|---|---|
| <p>Step 1: Stroke the Actuator to FULLY RETRACT the cylinder rod by applying up to full supply gas pressure (Up to 100 psig) to the appropriate actuator port. For RHPA-DA Actuators installed on PRCV Pipeline Rotary Control Valves, the actuator will be in the FULL CLOSED position with cylinder rod FULLY RETRACTED by applying supply gas pressure to the actuator BOTTOM PORT.</p> | <p>Step 5: Remove all control instrumentation and mechanical components from the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.</p> |
| <p>Step 2: When the actuator cylinder rod is FULLY RETRACTED, remove the supply gas pressure from the bottom port and top ports.</p> | <p>Step 6: Strike a vertical mark using an indelible marker (Sharpie®) that extends continuously as a reference between the RHPA Actuator Cylinder Cap Flange, Cylinder Tube, Cylinder Rod Flange and Actuator Housing. This will facilitate correct alignment of parts during Cylinder reassembly.</p> |
| <p>Step 3: Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.</p> | <p>Step 7: Remove Actuator Cylinder Tie-Rod Nuts from the Cylinder Cap Flange. It is preferable to remove the Tie-Rod Nuts separately from the Cylinder TieRods themselves as the Cylinder Tie-Rods provide a convenient alignment guide to optimize reassembly. In some cases if the Cylinder Tie-Rod bolts and nuts may be seized and require removal simultaneously as a single assembly.</p> |
| <p>Step 4: Remove all control instrumentation tubing and control instrumentation from the actuator cylinder assembly.</p> | <p>Step 8: Remove Cylinder Cap Flange by lifting straight up. Place the Cylinder Cap Flange with internal side face up to prevent damage. It is advisable to place a clean cloth of other</p> |

- Step 9:** Remove Cylinder Tube by lifting straight up. DO NOT STRIKE THE Cylinder TUBE WITH ANY OBJECT AS THIS MAY CAUSE IRREPARABLE DAMAGE. To facilitate removal of the Cylinder Tube it may be required to work the assembly back-and-forth only slightly by hand to cause it to release. Use caution when handling the Cylinder Tube as the internal surface may be slippery and difficult to hold.
- Step 10:** Place the Cylinder Tube on clean wood or other “soft” surface to prevent damage. Special attention must be exercised to prevent damage to the mating surface of the Cylinder Tube and internal diameter. It is advisable to place a clean cloth of other suitable material over the exposed Cylinder Cap Flange to protect it from damage or precipitation during
- Step 11:** Remove any rust, dirt, or foreign material from the Cylinder Tube internal diameter using appropriate solvent as needed. DO NOT USE ABRASIVE CLEANING METHODS SUCH AS WIRE BRUSHES OR SAND PAPER AS THIS MAY CAUSE IRREPARABLE DAMAGE.
- Step 12:** Inspect Cylinder TUBE internal diameter for scratches or excessive wear. If scratches or excessive wear is present, the Cylinder Tube may need to be replaced.
- Step 13:** Remove any rust, dirt, or foreign material from the Cylinder Flange mating areas using appropriate solvent as needed. DO NOT USE ABRASIVE CLEANING METHODS SUCH AS WIRE BRUSHES OR SAND PAPER AS THIS MAY CAUSE IRREPARABLE DAMAGE.
- Step 14:** Using a clean, lint-free cloth, apply a thin layer of STP® OIL TREATMENT (BLUE CONTAINER) to the Cylinder Tube inside diameter and the Cylinder Seals.
- Step 15:** Wipe excess STP® OIL TREATMENT from the Cylinder Tube inside diameter and the Cylinder Seals.
- Step 16:** Reinstall the Cylinder Tube ensuring proper alignment and top-to-bottom orientation. Be careful to not pinch the Cylinder Tube Seals when reinstalling.
- Step 17:** Reinstall the Cylinder Cap Flange ensuring proper alignment. Be careful to not pinch the Cylinder Tube Seals when reinstalling.
- Step 18:** Reinstall the Cylinder Tie-Rods ensuring proper alignment. It is advisable to return the Tie-Rods to the original installation quadrant on the Cylinder Cap Flange.
- Step 19:** Ensure proper engagement of the Cylinder Tie-Rods and Tie-Rod Nuts and tighten in a crossing pattern using an appropriate torque wrench. Refer to Table 7.0 for appropriate torque requirements. DO NOT OVER TIGHTEN OR UNDER TIGHTEN.
- Step 20:** Reinstall all control instrumentation and mechanical components on the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 21:** Reinstall all control instrumentation tubing and control instrumentation on the actuator cylinder assembly.
- Step 22:** Reestablish appropriate actuator supply pressure to actuator.
- Step 23:** Confirm satisfactory operation and return to service.

TABLE 7.0 TIE ROD TORQUE SPECIFICATIONS RHPA ACTUATOR TIE RODS

RHPA-DA Piston Bore	Tie-Rod Size	Tie-Rod Torque
5 in	½ - 20	48 ft-lbs
6 in	½ - 20	48 ft-lbs
8 in	5/8 - 18	115 ft-lbs
10 in	¾ - 16	170 ft-lbs
12 in	¾ - 16	170 ft-lbs
14 in	7/8-14	375 ft-lbs

PROCEDURE 4.0 -VERIFY CONTROL VALVE STEM SEALS

- Step 1:** Shut off actuator supply pressure and depressurize actuator completely.
- Step 2:** For Above Ground Actuators: Confirm the actuator cover plate and cover plate gasket are installed securely and tightened to ensure a bubble tight seal of the actuator housing.
- Step 3:** Secure all actuator access covers and access plates and ensure they are sealed properly to ensure a bubble tight seal.
- Step 4:** Remove one (1) vent elbow fitting from one (1) actuator access cover. All other actuator access covers should be sealed and/or plugged if necessary. All VRG Controls actuators are equipped with a single vent port to allow free exchange of air due to normal ambient temperature fluctuations. Ensure that only one access plate vent hole (1/4 NPT) is open.
- Step 5:** If access plates or plate vent plugs are missing, duct tape or other similar tape may be applied to ensure a single test port exists on the actuator housing.
- Step 6:** Valve Stem Seal leakage allows gas to escape from the pressurized valve body into the actuator Housing which is normally maintained at atmospheric pressure.
- Step 7:** Valve Stem Seal leakage will be apparent when gas escapes from the actuator housing while supply pressure is shut off.
- Step 8:** Minimal degrees of Valve Stem Seal leakage can be visually detected by placing a soap bubble” on the vent of the actuator access plate. This procedure is for BG PRCV, AG PRCV, which have a stem wistle which will leak and make noise.
- Step 9:** Valve Stem Seal leakage may be detected by an audible flow of gas coming from the actuator access plate vent hole.
- Step 10:** If venting gas is detected, there is a leak in the control valve stem and corrective action may be necessary.
- Step 11:** The complete RHPA Actuator must be removed to replace control stem seals. (Except 2-4 with T31 style valve)
- Step 12:** PRCV Pipeline Rotary Control Valve Stem Seal Kits are available directly from VRG Controls.
- Step 13:** Refer to control valve manufacturer’s specific instructions, or consult VRG Controls for recommended best practices to replace control valve stem seals.

PROCEDURE 5.0 -VERIFY ACTUATOR CYLINDER ROD SEALS

- Step 1:** Place PRCV Pipeline Control Valve in full closed position using onboard control instrumentation, VMO Valve Manual Override or other method.
- Step 2:** Maintain actuator supply pressure at specified pressure. Do NOT depressurize control instrumentation and/or actuator cylinder assembly.
- Step 3:** Using the PRCV Body Drain Fitting, depressurize the PRCV body cavity completely. This technique is suitable only for PRCV assemblies that incorporate upstream and downstream seats and are rated for a “bubble tight” flow shutoff.
- Step 4:** If the PRCV valve seats are damaged, it may be necessary to isolate the control valve by closing the upstream and downstream pipeline isolation valves and then depressurize the entire control valve piping assembly.
- Step 5:** If the PRCV valve seats are not designed to be bubble tight, it may be necessary to isolate the control valve by closing the upstream and downstream pipeline isolation valves and then depressurize the entire control valve piping assembly.
- Step 6:** For Above Ground Actuators: Confirm the actuator cover plate and cover plate gasket are installed securely and tightened to ensure a bubble tight seal of the actuator housing.
- Step 7:** Secure all actuator access covers and access plates and ensure they are sealed properly to ensure a bubble tight seal.
- Step 8:** Remove one (1) vent elbow fitting from one (1) actuator access cover. All other actuator access covers should be sealed and/or plugged if necessary. All VRG Controls actuators are equipped with a single vent port to allow free exchange of air due to normal ambient temperature fluctuations. Ensure that only one access plate vent hole (1/4 NPT) is open.
- Step 9:** If access plates or plate vent plugs are missing, duct tape or other similar tape may be applied to ensure a single test port exists on the actuator housing.
- Step 10:** Cylinder Rod Seal leakage allows gas to escape from the pressurized valve body into the actuator Housing which is normally maintained at atmospheric pressure.
- Step 11:** RHPA-DA ACTUATOR Cylinder ASSEMBLY MUST BE FULLY PRESSURIZED ON BOTTOM PORTION OF ACTUATOR TO VERIFY ACTUATOR Cylinder ROD SEAL LEAKAGE. THIS IS TYPICALLY THE “CLOSE” GAGE FOR VRG CONTROLS RHPA-DA ACTUATORS INSTALLED ON PRCV PIPELINE ROTARY CONTROL VALVES.
- Step 12:** Actuator Cylinder Rod Seal leakage will be apparent when gas escapes from the actuator housing while PRCV valve body is completely depressurized.
- Step 13:** Minimal degrees of Actuator Cylinder Rod Seal leakage can be visually detected by placing a soap bubble” on the vent of the actuator access plate.
- Step 14:** Greater degrees of Actuator Cylinder Rod Seal leakage may be detected by an audible flow of gas coming from the actuator access plate vent hole.
- Step 15:** If venting gas is detected, there is a leak in the Actuator Cylinder Rod Seal leakage and corrective action may be necessary.

PROCEDURE 6.0 -REPLACE CYLINDER ROD

- Step 1:** For ABOVE GROUND applications, Refer to Procedure x.0 – Page X for Removal of Actuator Cylinder Assembly.
- Step 2:** For BELOW GROUND applications, Refer to Procedure x.0 – Page X for Removal of Actuator Cylinder Assembly.
- Step 3:** This procedure requires removal of cylinder from actuator.
- Step 4:** Remove the Actuator Cylinder Assembly from the RHPA Actuator Housing.
- Step 5:** Once the Actuator Cylinder Assembly has been removed, remove the Cylinder Rod Gland Plate from the Cylinder Rod End of the Actuator Cylinder Assembly. Smaller bore (4", 5", & 6") Actuator Cylinder Assemblies are equipped with a Mounting Flange which must be removed to remove the Cylinder Rod Gland Plate.
- Step 6:** Carefully remove the existing Cylinder Rod Seals, being careful not to scratch mating surfaces. Discard old seals. Cylinder rod seal needs to be forced out by applying pressure on inside of the cylinder. The clevis must be used to prevent the seal blow out.
- Step 7:** Apply a small amount of grease to SCH-220 Grease to new Cylinder Rod Seals. Wipe off excess before installation of new seals.
- Step 8:** Install the new Cylinder Rod Seals into the Rod End of the Actuator Cylinder Assembly.
- Step 9:** Clean and reinstall the Cylinder Rod Gland Plate and Mounting Flange as necessary.
- Step 10:** Once the Actuator Cylinder Assembly is reassembled, it may be reinstalled on the Actuator Housing.

**PROCEDURE 7.0 -VERIFY ACTUATOR CYLINDER
TUBE SEALS**

- Step 1:** Maintain actuator supply pressure at specified pressure. Do NOT depressurize control instrumentation and/or actuator cylinder assembly.
- Step 2:** RHPA-DA ACTUATOR Cylinder ASSEMBLY MUST BE FULLY PRESSURIZED ON BOTTOM AND TOP PORTION OF ACTUATOR TO VERIFY ACTUATOR TUBE SEAL LEAKAGE. ALTERNATELY, ACTUATOR TOP AND BOTTOM TUBE SEAL LEAKAGE MAY BE TESTED INDEPENDENTLY BY APPLYING FULL SUPPLY PRESSURE TO ACTUATOR Cylinder TOP PORT WHEN VERIFYING ACTUATOR TOP TUBE SEAL. VERIFY ACTUATOR BOTTOM TUBE SEAL WHILE APPLYING FULL SUPPLY PRESSURE TO ACTUATOR BOTTOM PORT.
- Step 3:** Simultaneously apply full supply pressure to actuator TOP PORT and BOTTOM PORT. On board control instrumentation or alternate pressure source may be utilized to apply pressure.
- Step 4:** While the TOP PORT and BOTTOM PORT are pressurized apply a liquid leak detection solution such as Snoop® to the entire circumference of the actuator cylinder where the Cylinder Cap Flange and Cylinder Rod Flange mate with the Actuator Cylinder Tube.
- Step 5:** If Actuator Cylinder Tube Seals exhibit leakage, corrective action may be necessary.

**PROCEDURE 8.0 -REPLACE CYLINDER TUBE
SEALS**

- Step 1:** This procedure outlines procedure to replace Cylinder Tube Seals (O-Rings). THE PROCEDURE DOES NOT REQUIRE REMOVAL OF THE Cylinder ASSEMBLY FROM THE RHPA-DA ACTUATOR HOUSING.
- Step 2:** Place PRCV Pipeline Control Valve in full closed position using onboard control instrumentation, VMO Valve Manual Override or other method.
- Step 3:** Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.
- Step 4:** Remove all control instrumentation tubing and control instrumentation from the actuator cylinder assembly.
- Step 5:** Remove all control instrumentation and mechanical components from the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 6:** Strike a vertical mark using an indelible marker (Sharpie®) that extends continuously as a reference between the RHPA Actuator Cylinder Cap Flange, Cylinder Tube, Cylinder Rod Flange and Actuator Housing. This will facilitate correct alignment of parts during Cylinder reassembly.
- Step 7:** Remove Actuator Cylinder Tie-Rod Nuts from the Cylinder Cap Flange. It is preferable to remove the Tie-Rod Nuts separately from the Cylinder Tie-Rods themselves as the Cylinder Tie-Rods provide a convenient alignment guide to optimize reassembly. In some cases if the Cylinder TieRod bolts and nuts may be seized and require removal simultaneously as a single assembly.
- Step 8:** Remove Cylinder Cap Flange by lifting straight up. Place the Cylinder Cap Flange with internal side face up to prevent damage. It is advisable to place a clean cloth of other suitable material over the exposed Cylinder Cap Flange to protect it from damage or precipitation during rebuild.
- Step 9:** Remove Cylinder Tube by lifting straight up. DO NOT STRIKE THE Cylinder TUBE WITH ANY OBJECT AS THIS MAY CAUSE IRREPARABLE DAMAGE. To facilitate removal of the Cylinder Tube it may be required to work the assembly back-and-forth only slightly by hand to cause it to release. Use caution when handling the Cylinder Tube as the internal surface may be slippery and difficult to hold.
- Step 10:** Place the Cylinder Tube on clean wood or other “soft” surface to prevent damage. Special attention must be exercised to prevent damage to the mating surface of the Cylinder Tube and internal diameter. It is advisable to place a clean cloth of other suitable material over the exposed Cylinder Cap Flange to protect it from damage or precipitation during
- Step 11:** Remove any rust, dirt, or foreign material from the Cylinder Tube internal diameter using appropriate solvent as needed. DO NOT USE ABRASIVE CLEANING METHODS SUCH AS WIRE BRUSHES OR SAND PAPER AS THIS MAY CAUSE IRREPARABLE DAMAGE.
- Step 12:** Inspect Cylinder TUBE internal diameter for scratches or excessive wear. If scratches or excessive wear is present on the Cylinder Tube may need to be replaced.
- Step 13:** Remove Cylinder Tube seals (O-Rings) from Cylinder Cap Flange and Cylinder Rod Flange using an appropriate O-Ring removal tool. Be careful not to damage the surface of the Cylinder Cap Flange and Cylinder Rod Flange during seal removal. Inspect mating surface of the Cylinder Flanges for wear or damage. Discard the used Cylinder Tube Seals after removal to prevent re-use.

- Step 14:** Remove any rust, dirt, or foreign material from the Cylinder Flange mating areas using appropriate solvent as needed. DO NOT USE ABRASIVE CLEANING METHODS SUCH AS WIRE BRUSHES OR SAND PAPER AS THIS MAY CAUSE IRREPARABLE DAMAGE.
- Step 15:** Lubricate the replacement Cylinder Tube seals (O-Rings) with a thin film of lubricant suitable for Buna-N.
- Step 16:** Install new Cylinder Tube Seals (O-Rings) in each Cylinder Cap Flange and Cylinder Rod Flange ensuring complete engagement. Be careful not to damage replacement Cylinder Tube Seals during installation.
- Step 17:** Using a clean, lint-free cloth, apply a thin layer of STP® OIL TREATMENT (BLUE CONTAINER) to the Cylinder Tube inside diameter and the Cylinder Seals.
- Step 18:** Wipe excess STP® OIL TREATMENT from the Cylinder Tube inside diameter and the Cylinder Seals.
- Step 19:** Reinstall the Cylinder Tube ensuring proper alignment and top-to-bottom orientation. Be careful to not pinch the Cylinder Tube Seals when reinstalling.
- Step 20:** Reinstall the Cylinder Cap Flange ensuring proper alignment. Be careful to not pinch the Cylinder Tube Seals when reinstalling.
- Step 21:** Reinstall the Cylinder Tie-Rods ensuring proper alignment. It is advisable to return the Tie-Rods to the original installation quadrant on the Cylinder Cap Flange.
- Step 22:** Ensure proper engagement of the Cylinder Tie-Rods and Tie-Rod Nuts and tighten in a crossing pattern using an appropriate torque wrench. Refer to Table 8.0 for appropriate torque requirements. DO NOT OVER TIGHTEN OR UNDER TIGHTEN.
- Step 23:** Reinstall all control instrumentation and mechanical components on the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 24:** Reinstall all control instrumentation tubing and control instrumentation on the actuator cylinder assembly.
- Step 25:** Reestablish appropriate actuator supply pressure to actuator.
- Step 26:** Confirm satisfactory operation and return to service.

ATTENTION: VRG Controls Actuator Cylinder Repair Kits are sold as a complete assembly with all seals necessary to perform a complete seal replacement / rebuild of the RHPA-DA Actuator Cylinder assembly. It is suggested to also replace Cylinder Seals, Cylinder Wear Strip, and Tailrod Seals simultaneous to replacement of Cylinder Tube Seals as a matter of practicality.

TABLE 8.0 TORQUE REQUIREMENTS

RHPA-DA Piston Bore	Tie-Rod Size	Tie-Rod Torque
5 in	½ - 20	48 ft-lbs
6 in	½ - 20	48 ft-lbs
8 in	5/8 - 18	115 ft-lbs
10 in	¾ - 16	170 ft-lbs
12 in	¾ - 16	170 ft-lbs
14 in	7/8-14	375 ft-lbs

**PROCEDURE 9.0 -VERIFY ACTUATOR CYLINDER
SEALS (U-CUP)**

- Step 1:** Maintain actuator supply pressure at specified pressure. Do NOT depressurize control instrumentation and/or actuator cylinder assembly.
- Step 2:** RHPA-DA ACTUATOR Cylinder ASSEMBLY MUST BE FULLY PRESSURIZED ON BOTTOM AND TOP PORTION OF ACTUATOR TO VERIFY ACTUATOR TUBE SEAL LEAKAGE. ALTERNATELY, ACTUATOR TOP AND BOTTOM TUBE SEAL LEAKAGE MAY BE TESTED INDEPENDENTLY BY APPLYING FULL SUPPLY PRESSURE TO ACTUATOR Cylinder TOP PORT WHEN VERIFYING ACTUATOR TOP TUBE SEAL. VERIFY ACTUATOR BOTTOM TUBE SEAL WHILE APPLYING FULL SUPPLY PRESSURE TO ACTUATOR BOTTOM PORT.
- Step 3:** The RHPA-DA actuator cylinder is equipped with two (2) unidirectional U-Cup Seals that must be checked independently
- Step 4:** Reduce actuator supply pressure to approximately 100 psig.
- Step 5:** Apply 100 psig pressure to the actuator cylinder TOP PORT (Typically OPEN) and ZERO pressure to the actuator cylinder BOTTOM PORT (Typically CLOSE). It may be necessary to isolate common EXHAUST system especially when “BLEED TO PRESSURE SYSTEM” feature is utilized.
- Step 6:** With 100 psig pressure applied to actuator cylinder TOP PORT (Typically OPEN) and ZERO pressure to the actuator cylinder BOTTOM PORT (Typically CLOSE), disconnect the instrument tubing connection from actuator cylinder BOTTOM PORT (Typically CLOSE). CAUTION: BE CERTAIN THAT ACTUATOR Cylinder BOTTOM PORT IS FULLY DEPRESSURIZED PRIOR TO REMOVAL OF BOTTOM PORT TUBING CONNECTION TO AVOID EXCESSIVE RELEASE OF GAS AND/OR
- Step 7:** Check for excessive Actuator Cylinder Seal leakage from the open Actuator Cylinder TOP PORT. If excessive leakage is exhibited, it may be necessary to replace the Actuator Cylinder Seals.
- Step 8:** Apply 100 psig pressure to the actuator cylinder BOTTOM PORT (Typically CLOSE) and ZERO pressure to the actuator cylinder TOP PORT (Typically OPEN). It may be necessary to isolate common EXHAUST system especially when “BLEED TO PRESSURE SYSTEM” feature is utilized.
- Step 9:** With 100 psig pressure applied to actuator cylinder BOTTOM PORT (Typically CLOSE) and ZERO pressure to the actuator cylinder TOP PORT (Typically OPEN), disconnect the instrument tubing connection from actuator cylinder TOP PORT (Typically OPEN). CAUTION: BE CERTAIN THAT ACTUATOR Cylinder BOTTOM PORT IS FULLY DEPRESSURIZED PRIOR TO REMOVAL OF TOP PORT TUBING CONNECTION TO AVOID EXCESSIVE RELEASE OF GAS AND/OR INJURY.
- Step 10:** Check for excessive Actuator Cylinder Seal leakage from the open Actuator Cylinder TOP PORT. If excessive leakage is exhibited, it may be necessary to replace the Actuator Cylinder Seals.

TABLE 9.0 EXCESSIVE ACTUATOR CYLINDER SEALS (U-CUP) LEAKAGE DEFINITION

Ambient Temperature	Piston Seal Leakage EXCESSIVE DEFINITION
> +40°F (Warm Conditions)	Soap Bubble across “ZERO” pressure port breaks in five (5) seconds or less Must be bubble tight at room T

PROCEDURE 10.0 -REPLACE ACTUATOR CYLINDER SEALS (U-CUP)

- Step 1:** This procedure outlines the procedure to replace Cylinder Seals. THE PROCEDURE DOES NOT REQUIRE REMOVAL OF THE Cylinder ASSEMBLY FROM THE RHPA-DA ACTUATOR HOUSING.
- Step 2:** Place PRCV Pipeline Control Valve in full closed position using onboard control instrumentation, VMO Valve Manual Override or other method.
- Step 3:** Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.
- Step 4:** Remove all control instrumentation tubing and control instrumentation from the actuator cylinder assembly.
- Step 5:** Remove all control instrumentation and mechanical components from the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 6:** Strike a vertical mark using an indelible marker (Sharpie®) that extends continuously as a reference between the RHPA Actuator Cylinder Cap Flange, Cylinder Tube, Cylinder Rod Flange and Actuator Housing. This will facilitate correct alignment of parts during Cylinder reassembly.
- Step 7:** Remove Actuator Cylinder Tie-Rod Nuts from the Cylinder Cap Flange. It is preferable to remove the Tie-Rod Nuts separately from the Cylinder TieRods themselves as the Cylinder Tie-Rods provide a convenient alignment guide to optimize reassembly. In some cases if the Cylinder Tie-Rod bolts and nuts may be seized and require removal simultaneously as a single assembly.
- Step 8:** Remove Cylinder Cap Flange by lifting straight up. Place the Cylinder Cap Flange with internal side face up to prevent damage. It is advisable to place a clean cloth of other suitable material over the exposed Cylinder Cap Flange to protect it from damage or precipitation during rebuild.
- Step 9:** Remove Cylinder Tube by lifting straight up. DO NOT STRIKE THE Cylinder TUBE WITH ANY OBJECT AS THIS MAY CAUSE IRREPARABLE DAMAGE. To facilitate removal of the Cylinder Tube it may be required to work the assembly back-and-forth only slightly by hand to cause it to release. Use caution when handling the Cylinder Tube as the internal surface may be slippery and difficult to hold.
- Step 10:** Place the Cylinder Tube on clean wood or other “soft” surface to prevent damage. Special attention must be exercised to prevent damage to the mating surface of the Cylinder Tube and internal diameter. It is advisable to place a clean cloth of other suitable material over the exposed Cylinder Cap Flange to protect it from damage or precipitation during

- Step 11:** Remove any rust, dirt, or foreign material from the Cylinder Tube internal diameter using appropriate solvent as needed. DO NOT USE ABRASIVE CLEANING METHODS SUCH AS WIRE BRUSHES OR SAND PAPER AS THIS MAY CAUSE IRREPARABLE DAMAGE.
- Step 12:** Inspect Cylinder TUBE internal diameter for scratches or excessive wear. If scratches or excessive wear is present on the Cylinder Tube may need to be replaced.
- Step 13:** Remove Cylinder Tube seals (O-Rings) from Cylinder Cap Flange and Cylinder Rod Flange using an appropriate O-Ring removal tool. Be careful not to damage the surface of the Cylinder Cap Flange and Cylinder Rod Flange during seal removal. Inspect mating surface of the Cylinder Flanges for wear or damage. Discard the used Cylinder Tube Seals after removal to prevent re-use.
- Step 14:** Remove any rust, dirt, or foreign material from the Cylinder Flange mating areas using appropriate solvent as needed. DO NOT USE ABRASIVE CLEANING METHODS SUCH AS WIRE BRUSHES OR SAND PAPER AS THIS MAY CAUSE IRREPARABLE DAMAGE.
- Step 15:** Lubricate the replacement Cylinder Tube seals (O-Rings) with a thin film of lubricant suitable for Buna-N. SHC 220
- Step 16:** Install new Cylinder Tube Seals (O-Rings) in each Cylinder Cap Flange and Cylinder Rod Flange ensuring complete engagement. Be careful not to damage replacement Cylinder Tube Seals during installation.
- Step 17:** Using a clean, lint-free cloth, apply a thin layer of SHC 220 to the Cylinder Tube inside diameter and the Cylinder Seals.
- Step 18:** Wipe excess STP® OIL TREATMENT from the Cylinder Tube inside diameter and the Cylinder Seals.
- Step 19:** Reinstall the Cylinder Tube ensuring proper alignment and top-to-bottom orientation. Be careful to not pinch the Cylinder Tube Seals when reinstalling.
- Step 20:** Reinstall the Cylinder Cap Flange ensuring proper alignment. Be careful to not pinch the Cylinder Tube Seals when reinstalling.
- Step 21:** Reinstall the Cylinder Tie-Rods ensuring proper alignment. It is advisable to return the Tie-Rods to the original installation quadrant on the Cylinder Cap Flange.
- Step 22:** Ensure proper engagement of the Cylinder Tie-Rods and Tie-Rod Nuts and tighten in a crossing pattern using an appropriate torque wrench. Refer to Table 10.0 for appropriate torque requirements. DO NOT OVER TIGHTEN OR UNDER TIGHTEN.
- Step 23:** Reinstall all control instrumentation and mechanical components on the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 24:** Reinstall all control instrumentation tubing and control instrumentation on the actuator cylinder assembly.
- Step 25:** Reestablish appropriate actuator supply pressure to actuator.
- Step 26:** Confirm satisfactory operation and return to service.

TABLE 10.0 CYLINDER TIE-RODS AND NUTS TORQUE

RHPA-DA Piston Bore	Tie-Rod Size	Tie-Rod Torque
5 in	½ - 20	48 ft-lbs
6 in	½ - 20	48 ft-lbs
8 in	5/8 - 18	115 ft-lbs
10 in	¾ - 16	170 ft-lbs
12 in	¾ - 16	170 ft-lbs
14 in	7/8-14	375 ft-lbs

ATTENTION: VRG Controls Actuator Cylinder Repair Kits are sold as a complete assembly with all seals necessary to perform a complete seal replacement / rebuild of the RHPA-DA Actuator Cylinder assembly. It is suggested to also replace Cylinder Seals, Cylinder Wear Strip, and Tailrod Seals simultaneous to replacement of Cylinder Tube Seals as a matter of practicality.

**PROCEDURE 11.0 -VERIFY ACTUATOR
CYLINDER TAILROD SEALS (IF EQUIPPED)**

- Step 1:** REFERS TO RHPA-DA ACTUATORS THAT INCORPORATE A TAILROD ASSEMBLY DENOTED BY “TR” IN THE RHPA-DA ACTUATOR MODEL (i.e. RHPA-8X6-TR-DA).
- Step 2:** Maintain actuator supply pressure at specified pressure. Do NOT depressurize control instrumentation and/or actuator cylinder assembly.
- Step 3:** The RHPA-DA actuator cylinder is equipped with one (1) Actuator Cylinder Tailrod Seals that should be checked independently.
- Step 4:** RHPA-DA ACTUATOR Cylinder ASSEMBLY MUST BE FULLY PRESSURIZED ON TOP PORTION OF ACTUATOR TO VERIFY ACTUATOR Cylinder TAILROD SEAL LEAKAGE.
- Step 5:** Apply at 100 psig pressure (or greater based upon application specifications) to the actuator cylinder TOP PORT (Typically OPEN).

- Step 6:** With 100 psig (or greater based upon application specifications) pressure applied to actuator cylinder TOP PORT (Typically OPEN) apply a light grade oil to the sealing area between the Cylinder Tailrod and the Cylinder Tailrod Seal cartridge located on the Cylinder Cap Flange.
- Step 7:** If excessive Cylinder Tailrod leakage is exhibited, it may be necessary to replace the Cylinder Tailrod Seal. Tail Rod seals first are clean and lubricated before removal is

**PROCEDURE 12.0 -REPLACE ACTUATOR
CYLINDER TAILROD SEALS (IF EQUIPPED)**

(This procedure DOES NOT require removal of cylinder from actuator).

- Step 1:** This procedure outlines procedure to replace Actuator Tailrod Seals. THE PROCEDURE DOES NOT REQUIRE REMOVAL OF THE Cylinder ASSEMBLY FROM THE RHPA-DA ACTUATOR HOUSING.
- Step 2:** Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.
- Step 3:** Actuator may be in any location for Tail Rod Seal replacement. Fully retracted tail rod is recommended)
- Step 4:** Remove all control instrumentation, tubing and mechanical components from the Cylinder Tailrod Assembly if so equipped to facilitate tailrod seal replacement.
- Step 5:** Remove Actuator Cylinder Topworks Box (Older Models may have a Lexan Tube Assembly).
- Step 6:** Remove Topworks Box Mounting Flange to gain access to the Tail Rod Seals.
- Step 7:** Remove the Tail Rod Seal Cartridge Assembly and replace all Tail Rod Seals
- Step 8:** After replacement of all Tail Rod Seals, lubricate assembly with SHC-220 and reassemble the Gland Plate.
- Step 9:** Reinstall Topworks Assembly, instrumentation, and instrumentation tubing.

PROCEDURE 13.0 -VERIFY ACTUATOR “LOST MOTION”

VRG Controls RHPA actuators and PRCV control valves are manufactured to high tolerances in order to achieve precision action and optimal process control. “Lost Motion” phenomenon occurs when the actuator linkage does not have continuous communication with the final control element of the valve (ball). Continuous cycling of the control valve and actuator while in operation can cause “lost motion.”

Lost Motion can be exhibited in the following areas:

- Actuator linkage connections.
- The connection between the actuator torque arm and the control valve stem
- The connection between the control valve stem and the valve final control element (ball)

Lost Motion may be caused by:

- Excessive cycling of the control valve and actuator combination due to improper tuning or overactive process application.
- Extended service life
- Improper disassembly or assembly of the actuator and control valve assemblies

Step 1: Place the control valve in full closed position using onboard control instrumentation, VMO Valve Manual Override or other method.

Step 2: Reduce the supply gas to 10 psig or less.

Step 3: It is advisable to maintain a pressure differential across the control valve to prevent the valve from moving.

Step 4: If the actuator is equipped with a VRG Controls VMO Series Valve Manual Override attempt to stroke the actuator toward the OPEN position.

Step 5: If the actuator is not equipped with a VMO Series Valve Manual Override, the actuator may be stroked by applying pressure directly to cylinder top and to cylinder bottom.

Step 6: Adjust an installed VPC Valve Regulator Pilot to cause OPEN travel of the actuator.

Step 7: Adjust the pneumatic instrument signal applied to an installed VGP Valve Gas Positioner to cause OPEN travel of the actuator

Step 8: Adjust the electrical instrument signal applied to an installed electro-pneumatic positioner to cause OPEN travel of the actuator.

Step 9: Triggering any override devices installed on the actuator.

Step 10: With the power gas limited to 10 psig, the actuator should have only enough torque to exhibit Lost Motion in the actuator without be able to rotate the valve final control element (ball).

Step 11: Measure the amount of linear movement on the Linear Valve Position Indicator Scale.

Step 12: If the amount of Lost Motion exceeds 0.250 in, then excessive Lost Motion is present and corrective action may be required.

PROCEDURE 14.0 -CORRECT ACTUATOR “LOST MOTION”

- Step 1:** Lost Motion can typically be eliminated by examining key actuator and control valve interface points and replacing affected parts. Commonly affected parts that should be examined and considered for replacement include:
- Actuator Clevis and Clevis Pin Interface
 - Actuator Torque Arm and Stem Key Interface
 - Actuator Torque Arm and Control Valve Stem Interface
 - Control Valve Stem and Valve Final Control Element (Ball) Interface
- Step 2:** Contact VRG Controls factory personnel for assistance in determining the location and cause of the Lost Motion.
- Step 3:** Actuator and control valve parts are readily available from VRG Controls to replace affected parts.
- Step 4:** Once any amount of lost motion is exhibited it should be monitored. Records of the amount of Lost Motion exhibited by a control valve and actuator combination should be recorded annually to forecast the need for potential maintenance.

PROCEDURE 15.0 -REMOVE ACTUATOR CYLINDER ASSEMBLY ONLY (ABOVE GROUND)

- Step 1:** Refer to Figure 5.0 – Page 46 for Above Ground Actuators without Tailrod
- Step 2:** Refer to Figure 6.0 – Page 48 for Above Ground Actuators with Tailrod
- Step 3:** Stroke the Actuator to FULLY RETRACT the cylinder rod by applying up to full supply gas pressure (Up to 100 psig) to the appropriate actuator port. For RHPA-DA Actuators installed on PRCV Pipeline Rotary Control Valves, the actuator will be in the FULL CLOSED position with cylinder rod FULLY RETRACTED by applying supply gas pressure to the actuator BOTTOM PORT.
- Step 4:** When the actuator cylinder rod is FULLY RETRACTED, remove the supply gas pressure from the bottom port and top ports.
- Step 5:** Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.
- Step 6:** Remove all control instrumentation tubing and control instrumentation from the actuator cylinder assembly.
- Step 7:** Remove all control instrumentation and mechanical components from the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 8:** Strike a vertical mark using an indelible marker (Sharpie®) that extends continuously as a reference between the RHPA Actuator Cylinder Rod Flange and Actuator Housing. This will facilitate correct alignment of parts during Cylinder reassembly.
- Step 9:** Remove Cover Plate Bolts, Cover Plate Washers, and Cover Plate. Carefully remove the Cover Plate Gasket avoiding damage.
- Step 10:** Remove Torque Arm Pin Lockscrew, Lockwasher, and Torque Arm Pin Lock.



- Step 11:** Remove the Torque Arm Pin. The Torque Arm Pin should be easily removed without the use of excessive force. Take care not to damage the Torque Arm Pin, Spherical Bearing or Torque Arm precision surfaces.
- Step 12:** Remove the Travel Indicator Assembly and Travel Indicator Bar with lock washer to facilitate disassembly.
- Step 13:** Remove Cylinder Mounting Nuts, Cylinder Mounting Washers, Cylinder Mounting Lock Washers, and Cylinder Mounting Bolts from the actuator Cylinder Assembly.
- Step 14:** Actuator Cylinder Assembly can now be removed from the actuator assembly. Note that silicon adhesive may be applied to mating surfaces of Actuator Cylinder Assembly and Actuator Housing. Rotating the Actuator Cylinder Assembly will “sheer” the adhesive bond. Lift the Actuator Cylinder straight up to avoid damage to any parts. Note that the Clevis Assembly and Connecting Link Assembly will remain attached to the Actuator Cylinder Assembly.

PROCEDURE 16.0 -REINSTALL ACTUATOR CYLINDER ASSEMBLY ONLY (ABOVE GROUND)

- Step 1:** Refer to Figure 5.0 – Page 46 for Above Ground Actuators without Tailrod
- Step 2:** Refer to Figure 6.0 – Page 48 for Above Ground Actuators with Tailrod
- Step 3:** If the Actuator Connecting Link has not been removed, proceed to step 12.
- Step 4:** Install the Cylinder Rod Jam Nut on the threaded Cylinder Rod end of the Actuator Cylinder Assembly. Thread the Cylinder Rod Jam Nut all the way up the threaded Cylinder Rod until it jams against the shoulder of the

- Step 5:** Install the Cylinder Rod Clevis on the threaded Cylinder Rod end of the Actuator Cylinder Assembly. Rotate the Cylinder Rod Clevis until it matches the original installed position prior to disassembly. It is recommended to count the number of exposed threads on the Cylinder Cylinder Rod to achieve ensure correct re-installation. Also be sure that the Cylinder Rod Clevis pivot orientation matches the original installed orientation prior to
- Step 6:** Tighten the Cylinder Rod Jam Nut against the top of the Cylinder Rod Clevis.
- Step 7:** Insert the Connecting Link Assembly into the Cylinder Rod Clevis ensuring proper alignment of the Rod Clevis Assembly Hole with the Spherical Bearing on the Connecting Link
- Step 8:** Reinstall the Rod Clevis Pin by pushing it through the Rod Clevis and Spherical Bearing Assembly.
- Step 9:** Reinstall the Tru-Arc Ring on the Rod Clevis Pin.
- Step 10:** Apply a generous bead of SHC-220 on the Cylinder Rod Flange of the Actuator Cylinder Assembly.
- Step 11:** Reinstall the Actuator Cylinder Assembly attached Clevis Assembly and Connecting Link Assembly into the Actuator Housing.
- Step 12:** Insert the Cylinder Mounting Bolts and install Cylinder Mounting Lock Washer, Cylinder Mounting Washer, Cylinder Mounting Nuts only finger-tight. Do not tighten with wrench.
- Step 13:** Reinstall the Torque Arm Pin. The Torque Arm Pin should be easily inserted without the use of excessive force. Take care not to damage the Torque Arm Pin, Spherical Bearing or Torque Arm precision surfaces.
- Step 14:** Reinstall the Torque Arm Pin Lockscrew, Lockwasher, and Torque Arm Pin Lock and tighten.
- Step 15:** Tighten the Cylinder Mounting Nuts to full engagement.

- Step 16:** Stroke the actuator to the FULL OPEN and FULL CLOSED positions.
- Step 17:** If the control valve does not exhibit full range of travel, the Actuator Connecting Link must be adjusted so the bore of the control valve is in perfect alignment with the inlet/outlet closure of the control valve.
- Step 18:** Adjust the Connecting Link by rotating the Connecting Link Rod Eye clockwise or counter-clockwise to achieve proper alignment of the control valve. It is critical that the control valve exhibit full range of travel from FULL OPEN to FULL CLOSED positions and that control valve seats full engage at FULL CLOSED position.
- Step 19:** Tighten the Connecting Link Jam Nuts upon attaining full range of control valve travel.
- Step 20:** Reinstall Cover Plate Bolts, Cover Plate Washers, Cover Plate Gasket and Cover Plate.
- Step 21:** Reinstall Travel Indicator Assembly and Travel Indicator Bar with lock washer.
- Step 22:** Reinstall the Actuator Housing Vent Elbow as appropriate.
- Step 4:** Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.
- Step 5:** Remove all control instrumentation tubing and control instrumentation from the actuator cylinder assembly.
- Step 6:** Remove all control instrumentation and mechanical components from the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 7:** Strike a vertical mark using an indelible marker (Sharpie®) that extends continuously as a reference between the RHPA Actuator Cylinder Rod Flange and Actuator Housing. This will facilitate correct alignment of parts during Cylinder reassembly.
- Step 8:** Remove Actuator Housing Vent Elbow and Actuator Housing Access Plate as appropriate to expose Clevis Pin assembly.
- Step 9:** Remove the Tru Arc Ring from the Clevis Pin and push the Rod Clevis Pin through the actuator access hole. The Clevis pin should be easily removed without the use of excessive force. Take care not to damage the Rod Clevis Pin or Cylinder Rod Clevis precision surfaces.

PROCEDURE 17.0 -REMOVE ACTUATOR CYLINDER ASSEMBLY ONLY (BELOW GROUND)

- Step 1:** Refer to Figure 4.0 – Page 44 for Below Ground Actuators with Tailrod
- Step 2:** Stroke the Actuator to FULLY RETRACT the cylinder rod by applying up to full supply gas pressure (Up to 100 psig) to the appropriate actuator port. For RHPA-DA Actuators installed on PRCV Pipeline Rotary Control Valves, the actuator will be in the FULL CLOSED position with cylinder rod FULLY RETRACTED by applying supply gas pressure to the actuator BOTTOM PORT.
- Step 3:** When the actuator cylinder rod is FULLY RETRACTED, remove the supply gas pressure from the bottom port and top ports.
- Step 10:** Remove Cylinder Mounting Nuts, Cylinder Mounting Washers, Cylinder Mounting Lock Washers, and Cylinder Mounting Bolts from the actuator Cylinder Assembly.
- Step 11:** Actuator Cylinder Assembly can now be removed from the actuator assembly. Note that silicon adhesive may be applied to mating surfaces of Actuator Cylinder Assembly and Actuator Housing. Rotating the Actuator Cylinder Assembly will “sheer” the adhesive bond. Lift the Actuator Cylinder straight up to avoid damage to any parts. Note that the Clevis Assembly will remain attached to the Actuator Cylinder Assembly.

PROCEDURE 18.0 -REINSTALL ACTUATOR CYLINDER ASSEMBLY ONLY (BELOW GROUND)

- Step 1:** Refer to Figure 4.0 – Page 44 for Below Ground Actuators with Tailrod
- Step 2:** Install the Cylinder Rod Jam Nut on the threaded Cylinder Rod end of the Actuator Cylinder Assembly. Thread the Cylinder Rod Jam Nut all the way up the threaded Cylinder Rod until it jams against the shoulder of the
- Step 3:** Install the Cylinder Rod Clevis on the threaded Cylinder Rod end of the Actuator Cylinder Assembly. Rotate the Cylinder Rod Clevis until it matches the original installed position prior to disassembly. It is recommended to count the number of exposed threads on the Cylinder Rod to achieve ensure correct re-installation. Also, be sure that the Cylinder Rod Clevis pivot orientation matches the original installed orientation prior to disassembly
- Step 4:** Tighten the Cylinder Rod Jam Nut against the top of the Cylinder Rod Clevis.
- Step 5:** Apply a generous bead of high quality silicon sealant on the Cylinder Rod Flange of the Actuator Cylinder Assembly.
- Step 6:** Reinstall the Actuator Cylinder Assembly and attached Clevis Assembly into the Actuator Housing.
- Step 7:** Insert the Cylinder Mounting Bolts and install Cylinder Mounting Lock Washer, Cylinder Mounting Washer, Cylinder Mounting Nuts only finger-tight. Do not tighten with wrench.
- Step 8:** Align the Rod Clevis Assembly Hole with the Spherical Bearing on the Connecting Link Assembly.
- Step 9:** Reinstall the Rod Clevis Pin by pushing it through the Rod Clevis and Spherical Bearing Assembly.

- Step 10:** Reinstall the Tru-Arc Ring Rod Clevis Pin.
- Step 11:** Tighten the Cylinder Mounting Nuts to full engagement.
- Step 12:** Reinstall the Actuator Housing Vent Access Plate, Vent Elbow and Actuator Housing Access Plate as appropriate to cover Clevis Pin assembly.

PROCEDURE 19.0 -UNINSTALL COMPLETE ACTUATOR ASSEMBLY (ABOVE GROUND)

- Step 1:** Refer to Figure 5.0 – Page 46 for Above Ground Actuators without Tailrod
- Step 2:** Refer to Figure 6.0– Page 48 for Above Ground Actuators with Tailrod
- Step 3:** Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.
- Step 4:** Remove all control instrumentation tubing and control instrumentation from the actuator cylinder assembly.
- Step 5:** Remove all control instrumentation and mechanical components from the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 6:** Control Valve may be in any position for uninstallation of complete Above Ground type Actuator Assembly.

Step 7: Remove Cover Plate Bolts, Cover Plate Washers, and Cover Plate. Carefully remove the Cover Plate Gasket avoiding damage.

Step 8: Remove Square Key Setscrew from Torque Arm.

Step 9: Remove Square Key from Torque Arm if possible. Note that entire Actuator Assembly may be removed with Square Key engaged if necessary

Step 10: Remove Adapter Plate Nuts from Adapter Plate Studs.

Step 11: Remove COMPLETE Actuator Assembly from Control Valve assembly.

Step 7: Remove RHPA Actuator Cover Plate Bolts, Cover Plate Washers, and Cover Plate. Carefully remove the Cover Plate Gasket avoiding damage.

Step 8: Remove Square Key Setscrew from Torque Arm if installed.

Step 9: Remove Adapter Plate Nuts from Adapter Plate Studs if installed.

Step 10: Scrape and wire brush all corroded areas on Control Valve Mounting Flange and Control Valve Stem. Be certain to remove all burrs and deformation from Control Valve Stem using appropriate file or sandpaper. Generously lubricate Stem with grease or anti-seize compound.

Step 11: Install Actuator Assembly on Control Valve Mounting Flange while simultaneously aligning Control Valve Stem and Stem Keyway.

Step 12: Install and tighten Adapter Plate Nuts on Adapter Plate Studs in star pattern.

Step 13: Loosen both Outboard Bearing Bolts to allow alignment of the Control Valve Stem, Torque Arm and actuator bearings. Re-tighten.

Step 14: Apply supply gas pressure to Control Valve Actuator TOP PORT maintain actuator in FULL OPEN position.

Step 15: Check alignment of Control Valve Stem and Torque Arm keyway. If Torque Arm keyway does not align with Valve Stem Keyway adjustment must be made to the Connecting Link Adjust Stud.

PROCEDURE 20.0 -REINSTALL COMPLETE ACTUATOR ASSEMBLY (ABOVE GROUND)

Step 1: Refer to Figure 5.0 – Page 46 for Above Ground Actuators without Tailrod

Step 2: Refer to Figure 6.0– Page 48 for Above Ground Actuators with Tailrod

Step 3: Stroke the existing Actuator to place the control valve in FULL OPEN position. It is critical to ensure that the control valve has traveled 100% to FULL OPEN position

Step 4: When the actuator cylinder rod is FULLY EXTENDED, remove the supply gas pressure from the bottom port and top ports.

Step 5: Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.

Step 6: Remove existing valve actuator or gearbox.

**PROCEDURE 21.0 -UNINSTALL COMPLETE
ACTUATOR ASSEMBLY (BELOW GROUND)**

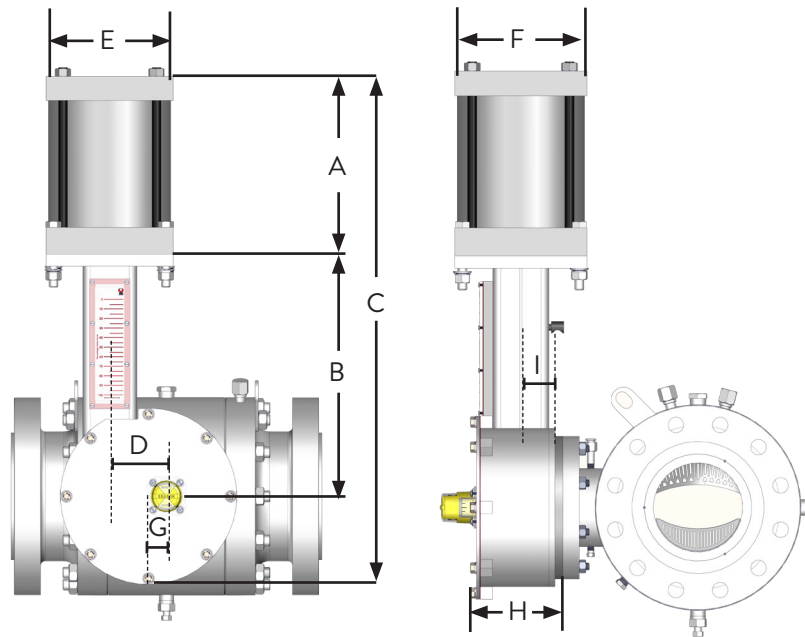
- Step 16:** Adjust the Connecting Link by rotating the Connecting Link Rod Eye clockwise or counter-clockwise to achieve proper alignment of the Valve Stem Keyway and the Connecting Link Adjust Stud.
- Step 17:** Insert Square Key into Torque Arm keyway and Valve Stem Keyway and tighten Square Key Setscrew.
- Step 18:** Tighten the Connecting Link Jam Nuts upon attaining full range of control valve travel.
- Step 19:** Stroke the actuator to the FULL OPEN and FULL CLOSED positions.
- Step 20:** If the control valve does not exhibit full range of travel, the Actuator Connecting Link must be adjusted so the bore of the control valve is in perfect alignment with the inlet/outlet closure of the control valve.
- Step 21:** Adjust the Connecting Link by rotating the Connecting Link Rod Eye clockwise or counter-clockwise to achieve proper alignment of the control valve. It is critical that the control valve exhibit full range of travel from FULL OPEN to FULL CLOSED positions and that control valve seats full engage at FULL CLOSED position.
- Step 22:** Tighten the Connecting Link Jam Nuts upon attaining full range of control valve travel.
- Step 23:** Reinstall Cover Plate Bolts, Cover Plate Washers, Cover Plate Gasket and Cover Plate.
- Step 24:** Note: Valve actuator is supplied with lubrication in essential areas. In highly corrosive installations, it is advisable to coat all rotating bearing areas with appropriate grease or anti-seize compound to reduce possibility of corrosion.
- Step 1:** Refer to Figure 4.0 – Page 44 for Below Ground Actuators with Tailrod
- Step 2:** When the actuator cylinder rod is FULLY RETRACTED, remove the supply gas pressure from the bottom port and top ports.
- Step 3:** Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.
- Step 4:** Remove all control instrumentation tubing and control instrumentation from the actuator cylinder assembly.
- Step 5:** Remove all control instrumentation and mechanical components from the Cylinder Tailrod Assembly if so equipped to facilitate handling and reassembly.
- Step 6:** Control Valve may be in any position for uninstallation of complete Below Ground type Actuator Assembly
- Step 7:** ATTENTION: It may necessary to isolate the control valve by closing the upstream and downstream pipeline isolation valves and then depressurize the entire control valve piping assembly. IT MAY BE ADVISABLE ALL PRESSURE MUST BE EVACUATED FROM THE ADJACENT PIPELINE AND ASSOCIATED CONTROL VALVE ASSEMBLY PRIOR TO DISASSEMBLY TO ENSURE APPROPRIATE SAFETY.
- Step 8:** Carefully excavate soil adjacent to below grade portion of the Below Ground type Actuator Assembly and Control Valve. Exercise caution not to damage the Actuator Housing,
- Step 9:** Disconnect the valve lubrication lines and “mounting brace” between Actuator Assembly and control valve as appropriate.
- Step 10:** Remove Cover Plate Bolts, Cover Plate Washers, and Cover Plate. Carefully remove the Cover Plate Gasket avoiding damage.
- Step 11:** Remove Square Key Setscrew from Torque Arm.

- Step 12:** Remove Square Key from Torque Arm if possible. Note that entire Actuator Assembly may be removed with Square Key engaged if necessary.
- Step 13:** Remove Adapter Plate Nuts from Adapter Plate Studs.

PROCEDURE 22.0 -REINSTALL COMPLETE ACTUATOR ASSEMBLY (BELOW GROUND)

- Step 1:** Refer to Figure 4.0 – Page 44 for Below Ground Actuators with Tailrod
- Step 2:** Stroke the existing Actuator to place the control valve in FULL OPEN position. It is critical to ensure that the control valve has traveled 100% to FULL OPEN position.
- Step 3:** When the actuator cylinder rod is FULLY EXTENDED, remove the supply gas pressure from the bottom port and top ports.
- Step 4:** Shut off actuator supply pressure and depressurize actuator completely. CAUTION: TO PREVENT INJURY TO OPERATOR AND/OR DAMAGE TO EQUIPMENT, ALL SUPPLY PRESSURE MUST BE EVACUATED FROM THE ACTUATOR Cylinder.
- Step 5:** Remove existing valve actuator or gearbox if applicable.
- Step 6:** Scrape and wire brush all corroded areas on Control Valve Mounting Flange and Control Valve Stem. Be certain to remove all burrs and deformation from Control Valve Stem using appropriate file or sandpaper. Generously lubricate Stem with grease or anti-seize compound.
- Step 7:** Remove RHPA Actuator Cover Plate Bolts, Cover Plate Washers, and Cover Plate. Carefully remove the Cover Plate Gasket avoiding damage.
- Step 8:** Remove Square Key Setscrew from Torque Arm if installed.
- Step 9:** Remove Adapter Plate Nuts from Adapter Plate Studs if installed.
- Step 10:** Install Actuator Assembly on Control Valve Mounting Flange while simultaneously aligning Control Valve Stem and Stem Keyway
- Step 11:** Loosen both Outboard Bearing Bolts to allow alignment of the Control Valve Stem, Torque Arm and actuator bearings. Re-tighten.
- Step 12:** Install and tighten Adapter Plate Nuts on Adapter Plate Studs in star pattern.
- Step 13:** Reconnect the valve lubrication lines and “mounting brace” between Actuator Assembly and control valve as appropriate.
- Step 14:** Apply supply gas pressure to Control Valve Actuator TOP PORT to maintain actuator in FULL OPEN position.
- Step 15:** Check alignment of Control Valve Stem and Torque Arm keyway. If Torque Arm keyway does not align with Valve Stem Keyway adjustment must be made to the Cylinder Rod Clevis.
- Step 16:** Remove Torque Arm Pin Lockscrew, Lockwasher, and Torque Arm Pin Lock. The Torque Arm Pin should be easily removed without the use of excessive force. Take care not to damage the Torque Arm Pin, Spherical Bearing or Torque Arm precision surfaces.
- Step 17:** Stroke the Actuator to place the control valve in FULL CLOSED position. It is critical to ensure that the control valve has traveled 100% to FULL CLOSED position.
- Step 18:** Remove Actuator Housing Vent Elbow and Actuator Housing Access Plate as appropriate to expose Cylinder Rod Clevis assembly.

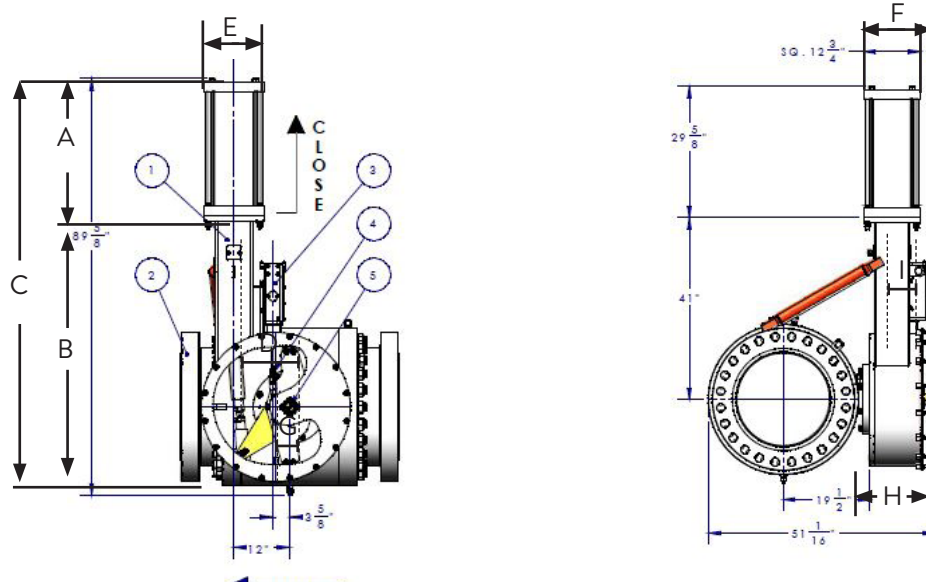
- Step 19:** Loosen the Rod Clevis Jam Nut and rotate the Connecting Link (with Rod Clevis Assembly) ONE FULL ROTATION in appropriate direction.
- Step 20:** Be sure that the Cylinder Rod Clevis pivot orientation matches the original installed orientation.
- Step 21:** Stroke the existing Actuator toward the OPEN position until the Torque Arm mating hole and Spherical Bearing are perfectly aligned to allow insertion of Torque Arm Pin.
- Step 22:** Loosen the Rod Clevis Jam Nut and rotate the Connecting Link (with Rod Clevis Assembly) ONE FULL ROTATION in appropriate direction.
- Step 23:** Reinstall the Torque Arm Pin Lockscrew, Lockwasher, and Torque Arm Pin Lock and tighten. The Torque Arm Pin should be easily inserted without the use of excessive force. Take care not to damage the Torque Arm Pin, Spherical Bearing or Torque Arm precision surfaces orientation.
- Step 24:** Insert Square Key into Torque Arm keyway and Valve Stem Keyway and tighten Square Key Setscrew.
- Step 25:** Tighten the Cylinder Rod Jam Nut against the top of the Cylinder Rod Clevis.
- Step 26:** Stroke the actuator to the FULL OPEN and FULL CLOSED positions.
- Step 27:** If the control valve does not exhibit full range of travel, the Cylinder Rod Clevis must be adjusted so the bore of the control valve is in perfect alignment with the inlet/outlet closure of the control valve.
- Step 28:** Adjust the Connecting Link by rotating the Connecting Link Rod Eye clockwise or counter-clockwise to achieve proper alignment of the control valve. It is critical that the control valve exhibit full range of travel from FULL OPEN to FULL CLOSED positions and that control valve seats full engage at FULL CLOSED position.
- Step 29:** Uninstall the Actuator Cylinder Assembly (Below Ground) per Procedure 17.0 – Page 27.
- Step 30:** Loosen the Cylinder Rod Jam Nut and rotate the Cylinder Rod Clevis as appropriate to achieve necessary travel adjustment.
- Step 31:** Utilize Procedure 18.0 – Page 28 to reinstall Actuator Cylinder Assembly (Below Ground).
- Step 32:** Ensure that complete travel is established such that bore of the control valve is in perfect alignment with the inlet/outlet closure of the control valve when FULL OPEN.
- Step 33:** Reinstall Cover Plate Bolts, Cover Plate Washers, Cover Plate Gasket and Cover Plate.
- Step 34:** Note: Valve actuator is supplied with lubrication in essential areas. In highly corrosive installations, it is advisable to coat all rotating bearing areas with appropriate grease or anti-seize compound to reduce possibility of corrosion.

TABLE 11.0 RHPA-DA (DOUBLE ACTING) ACTUATOR WEIGHTS & DIMENSIONS—UP TO RHPA14X12DA

Dimensions in Inches (mm)

Model	A	B	C	D	E	F	G	H	I	WEIGHT LBS (KG)
RHPA5X4DA	9.68 (243)	14.13 (359)	30.18 (735)	2.38 (60)	7.63 (194)	5.50 (140)	0.38 (10)	7.00 (137)	2.75 (54)	125.00 (57)
RHPA6X4DA	10.19 (259)	14.63 (371)	31.20 (764)	2.38 (60)	8.63 (219)	6.50 (165)	0.38 (10)	7.00 (137)	2.75 (54)	150.00 (68)
RHPA6X6DA	12.19 (310)	18.19 (462)	36.50 (927)	3.63 (92)	8.63 (219)	6.50 (165)	1.38 (35)	7.00 (178)	2.75 (70)	210.00 (95)
RHPA8X6DA	11.69 (297)	18.81 (478)	36.75 (933)	3.63 (92)	8.50 (216)	8.50 (216)	1.38 (35)	7.00 (178)	2.75 (70)	245.00 (111)
RHPA8X8DA	13.68 (347)	19.81 (503)	40.63 (1032)	4.75 (121)	8.50 (216)	8.50 (216)	1.50 (38)	7.00 (178)	2.75 (70)	295.00 (134)
RHPA10X6DA	13.06 (332)	19.25 (489)	38.56 (979)	3.63 (92)	10.63 (270)	10.63 (270)	1.38 (35)	7.00 (178)	2.75 (70)	345.00 (157)
RHPA10X8DA	15.06 (383)	20.25 (514)	42.44 (1078)	4.75 (121)	10.63 (270)	10.63 (270)	1.50 (38)	7.00 (178)	2.75 (70)	390.00 (177)
RHPA10X12DA	19.06 (484)	25.50 (648)	53.31 (1354)	7.25 (184)	10.63 (270)	10.63 (270)	4.00 (102)	8.50 (216)	3.50 (89)	545.00 (247)
RHPA12X12DA	19.56 (497)	25.50 (648)	53.81 (1367)	7.25 (184)	12.75 (324)	12.75 (324)	4.00 (102)	8.63 (219)	3.63 (92)	655.00 (297)
RHPA14X12DA	20.94 (532)	25.88 (657)	55.56 (1411)	7.25 (184)	14.75 (375)	14.75 (375)	4.00 (102)	8.63 (219)	3.63 (92)	850.00 (386)

Notes:

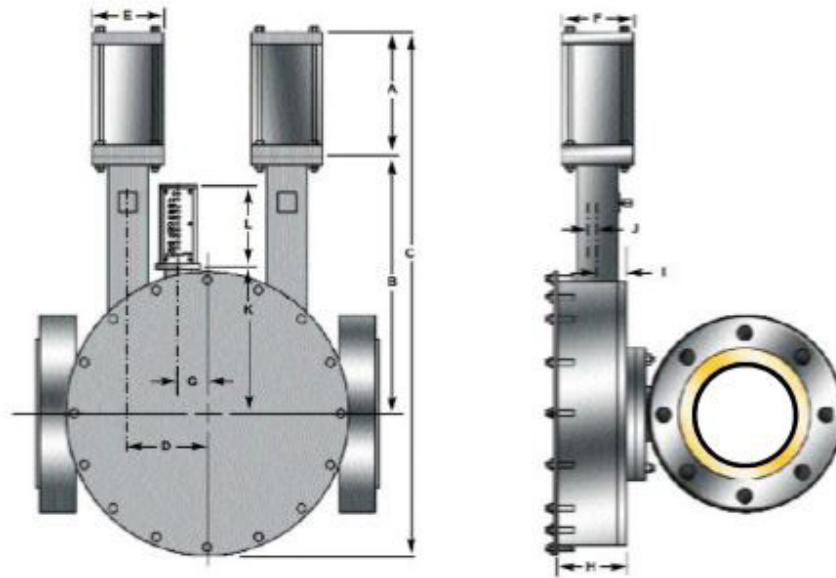
1. Dimensions "B" and "C" will change for BELOW GROUND control valve assemblies based upon depth of burial.

TABLE 12.0 RHPA-DA (DOUBLE ACTING) ACTUATOR WEIGHTS & DIMENSIONS—UP TO RHPA14X26DA

Dimensions in Inches (mm)

Model	A	B	C	D	E	F	G	H	I	J	K	L	WEIGHT LBS (KG)
RHPA12X20DA	29.56 (751)	41.00 (1041)	86.56 (2199)	12.00 (305)	12.75 (324)	12.75 (324)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	985 (447)
RHPA12X24DA	33.56 (852)	47.63 (1210)	100.38 (2550)	14.50 (368)	12.75 (324)	12.75 (324)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	1135 (515)
RHPA12X26DA	35.56 (852)	48.63 (1235)	103.38 (2626)	15.75 (400)	12.75 (324)	12.75 (324)	3.63 (92)	12.00 (305)	5.00 (1.27)	3.75 (95)	20.00 (508)	9.56 (243)	1295 (588)
RHPA14X20DA	30.94 (786)	41.5 (1057)	88.31 (2243)	12.00 (305)	14.75 (375)	14.75 (375)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	1165 (529)
RHPA14X24DA	34.94 (887)	48.00 (1219)	101.94 (2589)	14.50 (368)	14.75 (375)	14.75 (375)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	1335 (606)
RHPA14X26DA	36.94 (938)	49.00 (1245)	104.94 (2665)	15.75 (400)	14.75 (375)	14.75 (375)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	1425 (647)

Notes:

1. Dimensions "B" and "C" will change for BELOW GROUND control valve assemblies based upon depth of burial.

TABLE 13.0 RHPA-DA (DOUBLE ACTING) ACTUATOR WEIGHTS & DIMENSIONS—UP TO RHPAD14X26DA

Dimensions in Inches (mm)

Model	A	B	C	D	E	F	G	H	I	J	K	L	WEIGHT LBS (KG)
RHPAD12X20DA	29.56 (751)	41.00 (1041)	89.56 (2275)	12.00 (305)	12.75 (324)	12.75 (324)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	2097 (952)
RHPA12X24DA	33.56 (852)	47.63 (1210)	102.19 (2596)	14.50 (368)	12.75 (324)	12.75 (324)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	2375 (1078)
RHPA12X26DA	35.56 (903)	48.63 (1235)	106.19 (2697)	15.75 (400)	12.75 (324)	12.75 (324)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	2565 (1165)
RHPA14X20DA	30.94 (786)	41.63 (1057)	91.31 (2319)	12.00 (305)	14.75 (375)	14.75 (375)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	2110 (958)
RHPA14X24DA	34.94 (887)	48.00 (1219)	103.94 (2640)	14.50 (368)	14.75 (375)	14.75 (375)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	2380 (1081)
RHPA14X26DA	36.94 (938)	49.00 (1245)	107.94 (2742)	15.75 (400)	14.75 (375)	14.75 (375)	3.63 (92)	12.00 (305)	5.00 (127)	3.75 (95)	20.00 (508)	9.56 (243)	2580 (1171)

Notes:

1. Dimensions “B” and “C” will change for BELOW GROUND control valve assemblies based upon depth of burial.



TABLE 14.0 STANDARD RHPA-DA (DOUBLE ACTING) SELECTION FOR PRCV PIPELINE ROTARY

	PRCV Size	500 psid Differential	1000 psid Differential	1500 psid Differential
-20°F Temperature 90 psig Effective Supply Pressure	2" (50 mm)	RHPA5X4DA	RHPA5X4DA	RHPA5X4DA
	3" (80 mm)	RHPA5X4DA	RHPA5X4DA	RHPA6X4DA
	4" (100 mm)	RHPA6X6DA	RHPA6X6DA	RHPA6X6DA
	6" (150 mm)	RHPA8X6DA	RHPA8X8DA	RHPA8X8DA
	8" (200 mm)	RHPA10X6DA	RHPA10X8DA	RHPA10X12DA
	10" (250 mm)	RHPA10X12DA	RHPA10X12DA	RHPA12X12DA
	12" (300 mm)	RHPA10X12DA	RHPA12X12DA	RHPA12X12DA
	16" (400 mm)	RHPA14X12DA	RHPA12X20DA	RHPA12X24DA
	PRCV Size	500 psid Differential	1000 psid Differential	1500 psid Differential
+20°F Temperature 90 psig Effective Supply Pressure	2" (50 mm)	RHPA5X4DA	RHPA5X4DA	RHPA5X4DA
	3" (80 mm)	RHPA5X4DA	RHPA5X4DA	RHPA6X4DA
	4" (100 mm)	RHPA6X6DA	RHPA6X6DA	RHPA6X6DA
	6" (150 mm)	RHPA8X6DA	RHPA8X6DA	RHPA8X8DA
	8" (200 mm)	RHPA10X6DA	RHPA10X8DA	RHPA10X8DA
	10" (250 mm)	RHPA10X8DA	RHPA10X12DA	RHPA10X12DA
	12" (300 mm)	RHPA10X12DA	RHPA12X12DA	RHPA12X12DA
	16" (400 mm)	RHPA14X12DA	RHPA14X12	RHPA12X20DA
	PRCV Size	500 psid Differential	1000 psid Differential	1500 psid Differential
-20°F Temperature 125 psig Effective Supply Pressure	2" (50 mm)	RHPA5X4DA	RHPA5X4DA	RHPA5X4DA
	3" (80 mm)	RHPA5X4DA	RHPA5X4DA	RHPA5X4DA
	4" (100 mm)	RHPA6X6DA	RHPA6X6DA	RHPA6X6DA
	6" (150 mm)	RHPA8X6DA	RHPA8X6DA	RHPA8X8DA
	8" (200 mm)	RHPA8X8DA	RHPA10X8DA	RHPA10X8DA
	10" (250 mm)	RHPA10X6DA	RHPA10X12DA	RHPA10X12DA
	12" (300 mm)	RHPA10X8DA	RHPA12X12DA	RHPA12X12DA
	16" (400 mm)	RHPA12X12DA	RHPA14X12DA	RHPA14X12DA
	PRCV Size	500 psid Differential	1000 psid Differential	1500 psid Differential
+20°F Temperature 125 psig Effective Supply Pressure	2" (50 mm)	RHPA5X4DA	RHPA5X4DA	RHPA5X4DA
	3" (80 mm)	RHPA5X4DA	RHPA5X4DA	RHPA5X4DA
	4" (100 mm)	RHPA6X6DA	RHPA6X6DA	RHPA6X6DA
	6" (150 mm)	RHPA8X6DA	RHPA8X6DA	RHPA8X6DA
	8" (200 mm)	RHPA8X8DA	RHPA10X6DA	RHPA10X6DA
	10" (250 mm)	RHPA10X6DA	RHPA10X8DA	RHPA10X12DA
	12" (300 mm)	RHPA10X8DA	RHPA10X12DA	RHPA10X12DA
	16" (400 mm)	RHPA12X12DA	RHPA12X12DA	RHPA14X12DA

NOTES:

1. Consult VRG Controls for additional details and confirmation of RHPA-DA Actuator Sizing and larger bore PRCV Pipeline Rotary Control Valves.
2. Operating differential is equal to maximum pressure shutoff differential across PRCV Pipeline Rotary Control Valve.
3. For below ground PRCV application, use +20°F Temperature
4. Effective Supply Pressure = P(effective)=P(supply)-P(discharge)/ P(effective)=P(supply) when P(discharge)=ATM(0)
5. All actuator sizes are for PRCV-FP, PRCV-STH1, PRCV-STH2. For STHP use one size larger.

TABLE 15.0 RHPA ROTARY HIGH PRESSURE CYLINDER –DOUBLE ACTING –TORQUE OUTPUT (90 PSIG EFFECTIVE SUPPLY)CONTROL VALVES

$$\text{Actuator Torque} = \frac{P_{\text{Supply}} - P_{\text{Discharge}}}{100_{\text{psig}}} \times (\text{Torque Factor})$$

TYPE	MODEL	EFF. SUPPLY GAS (psig)	TORQUE FACTOR			
			ENDING TORQUE (in-lbs)	RUNNING TORQUE (in-lbs)	ENDING TORQUE (nm)	RUNNING TORQUE (nm)
RHPA-DA	5x4	90	3240	4801	366	542
RHPA-DA	6x4	90	4605	6824	520	770
RHPA-DA	6x6	90	6801	10239	768	1157
RHPA-DA	8x6	90	12385	18654	1399	2107
RHPA-DA	8x8	90	16359	23628	1848	2670
RHPA-DA	10x6	90	19329	29101	2184	3288
RHPA-DA	10x8	90	25449	29101	2875	3288
RHPA-DA	10x12	90	37351	55100	4220	6225
RHPA-DA	12x12	90	52884	84403	5975	9536
RHPA-DA	14x12	90	71678	114397	8099	12925
RHPA-DA	12x20	90	90371	140504	10211	15875
RHPA-DA	12x24	90	108015	168549	12204	19044
RHPA-DA	12x26	90	116130	182720	13120	20473
RHPA-DA	14x20	90	122484	190432	13839	21516
RHPA-DA	14x24	90	146399	228443	16541	25811
RHPA-DA	14x26	90	157397	247651	17784	27981
RHPA-DA	D12X20	90	180742	281009	20421	31750
RHPA-DA	D12X24	90	216031	337099	24408	38087
RHPA-DA	D12X26	90	232259	365440	26242	41289
RHPA-DA	D14X20	90	244968	380865	27678	43032
RHPA-DA	D14X24	90	292798	456888	33082	51621
RHPA-DA	D14X26	90	314795	495302	35567	55962

Tes:

1. P(effective) = P(supply) When P(discharge) = 0 (atmosphere)
2. Maximum P(effective) = 250 psig
3. Maximum P(supply) = 400 psig
4. Contact VRG Control for additional details or assistance.

TABLE 16.0 RHPA ROTARY HIGH PRESSURE CYLINDER –DOUBLE ACTING –TORQUE OUTPUT (125 PSIG EFFECTIVE SUPPLY)

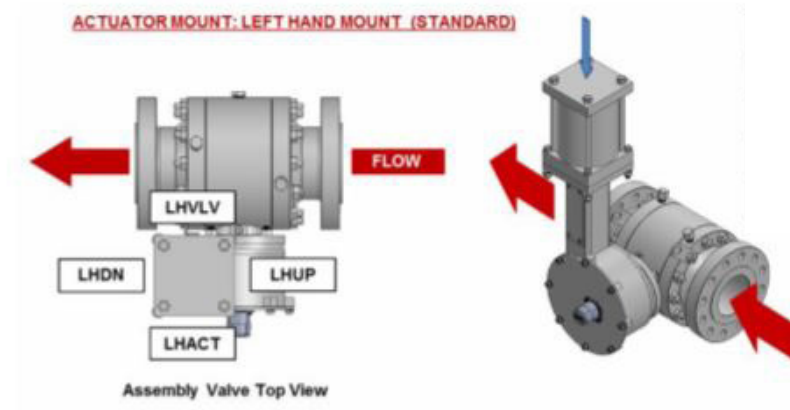
$$\text{Actuator Torque} = \frac{P_{\text{Supply}} - P_{\text{Discharge}}}{100_{\text{psig}}} \times (\text{Torque Factor})$$

Type	Model	Eff. Supply Gas (psig)	Torque Factor			
			Ending Torque (in-lbs)	Running Torque (in-lbs)	Ending Torque (nm)	Running Torque (nm)
RHPA-DA	5X4	125	4500	6688	508	753
RHPA-DA	6X6	125	9448	14221	1067	1607
RHPA-DA	8X6	125	17201	25898	1943	2926
RHPA-DA	8X8	125	22721	32818	2567	3708
RHPA-DA	10X6	125	26848	40418	3033	4567
RHPA-DA	10X8	125	35348	40418	3994	4567
RHPA-DA	10X12	125	51878	76528	5861	8646
RHPA-DA	12X12	125	73450	117228	8299	13245
RHPA-DA	14X12	125	99553	158885	11248	17952
RHPA-DA	12X20	125	125515	195145	14181	22048
RHPA-DA	12X24	125	150021	234098	16950	26449
RHPA-DA	14X20	125	170118	264489	19221	29883
RHPA-DA	14X24	125	203331	317283	22973	35848
RHPA-DA	14X26	125	218608	343960	24699	38862
RHPA-DA	D12X20	125	251030	390290	28363	44097
RHPA-DA	D12X24	125	300043	468193	33900	52899
RHPA-DA	D12X26	125	322583	507555	36447	57346
RHPA-DA	D14X20	125	340234	528979	38441	59767
RHPA-DA	D14X24	125	406684	634568	45947	71696
RHPA-DA	D14X26	125	437215	687920	49399	77725

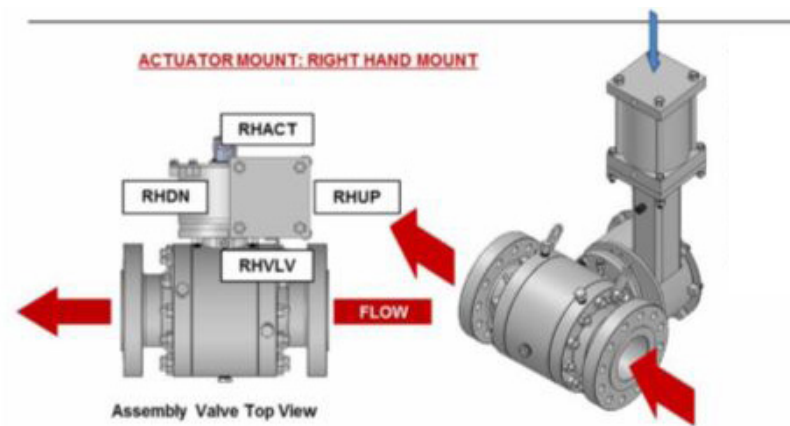
Notes:

1. $P_{\text{Effective}} = P_{\text{Supply}}$ When $P_{\text{Discharge}} = 0$ (Atmosphere)
2. Maximum $P_{\text{Effective}} = 150$ psig
3. Maximum $P_{\text{Supply}} = 400$ psig
4. Contact VRG Controls for Additional Details or Assistance

FIGURE 1.0 RHPA-DA ACTUATOR & INSTRUMENTATION MOUNTING ORIENTATION DESIGNATIONS

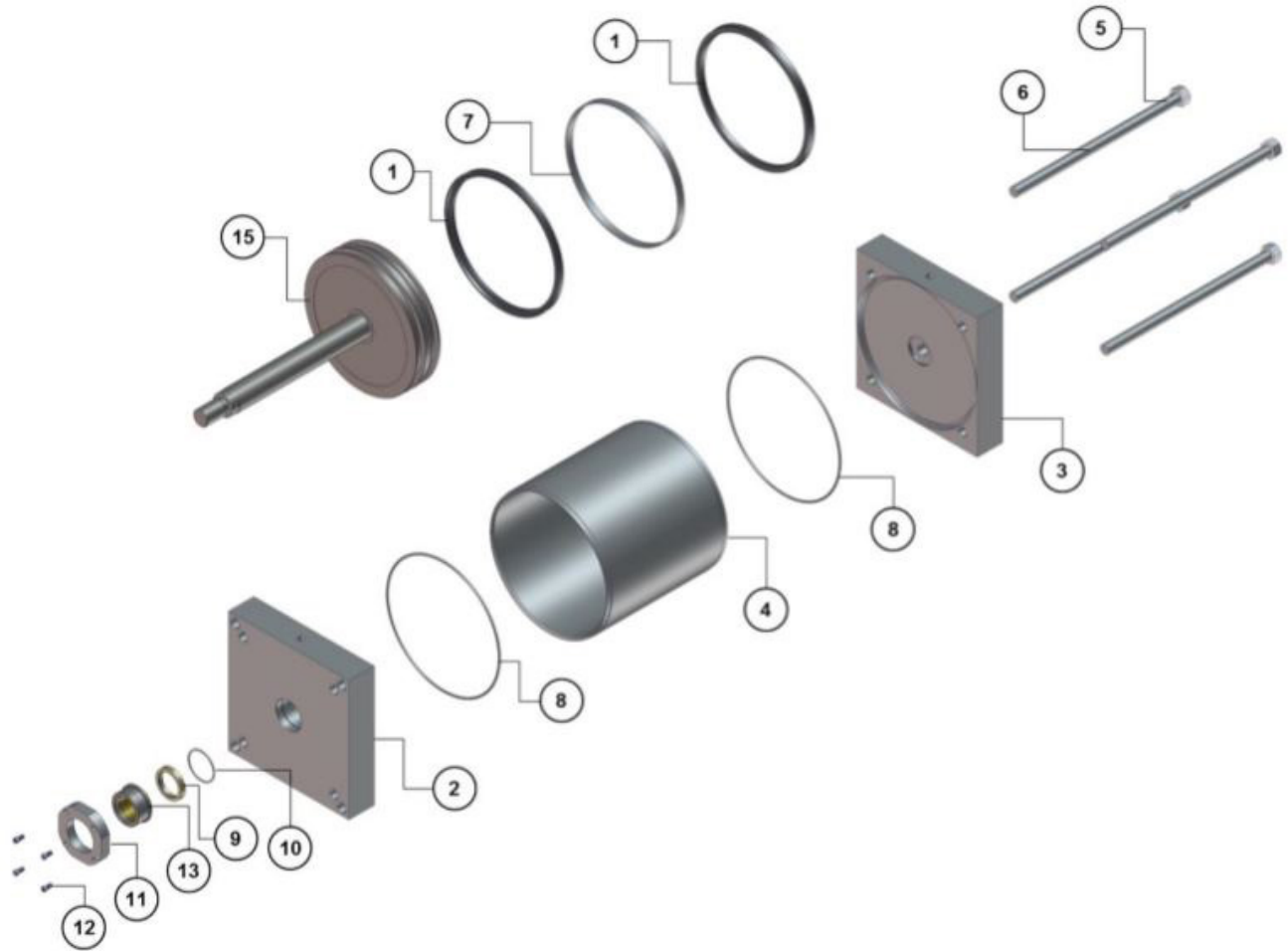


Actuator Mount	Intstrument Orientation	Designation
Left hand	Facing Valve	LHVLV
Left hand	Actuator Side	LHACT
Left hand	Facing Downstream	LHDN
Left hand	Facing Upstream	LHUP



Actuator Mount	Intstrument Orientation	Designation
Right hand	Facing Valve	RHVLV
Right hand	Actuator Side	RHACT
Right hand	Facing Downstream	RHDN
Right hand	Facing Upstream	RHUP

FIGURE 2.0 RHPA ACTUATOR CYLINDER ASSEMBLY–NO TAILROD–EXPLODED VIEW

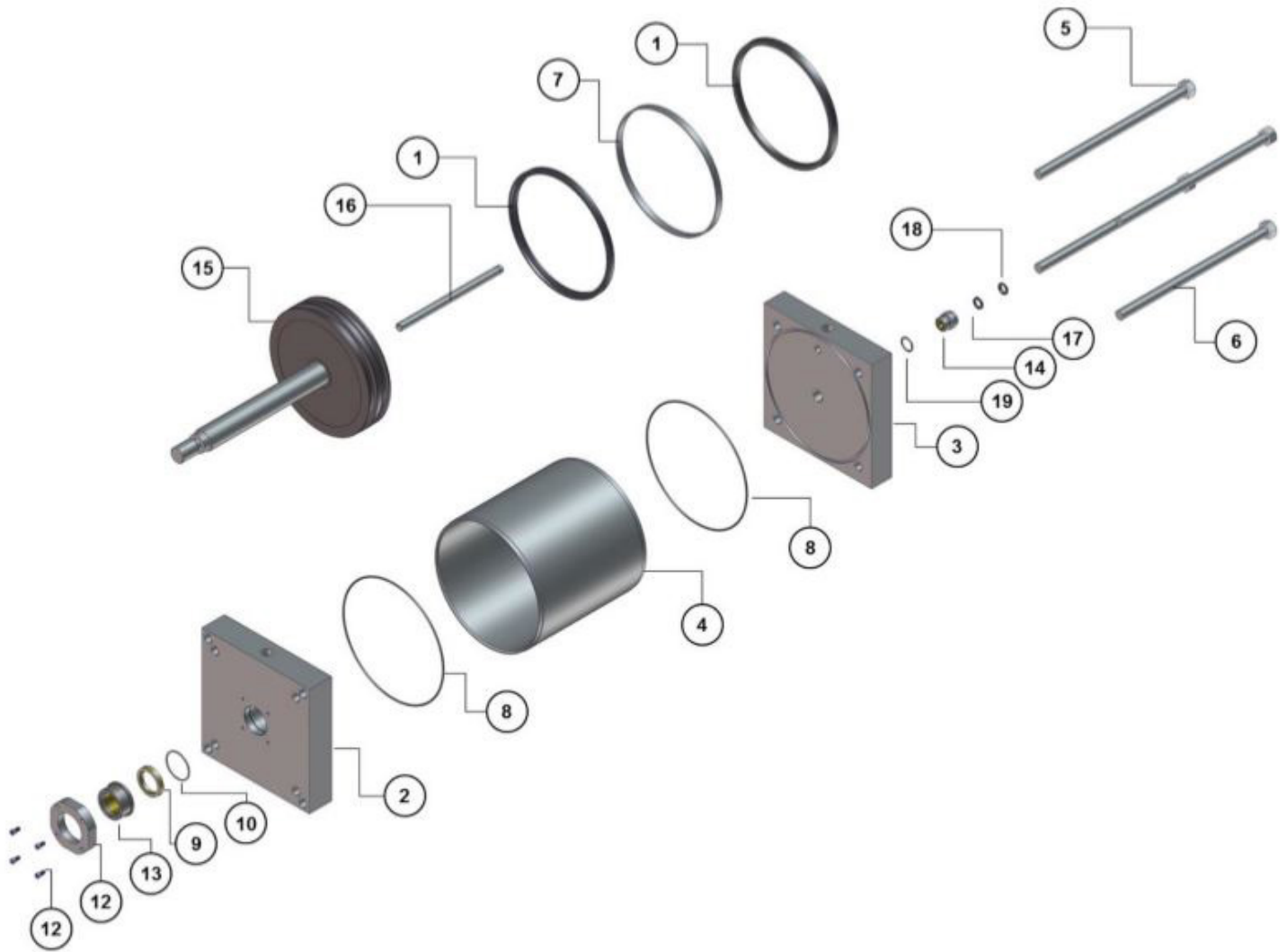


**TABLE 17.0 RHPA ACTUATOR CYLINDER ASSEMBLY–NO TAILROD–PARTS IDENTIFICATION FOR FIGURE 2.0 ON PG. 40**

ITEM	DESCRIPTION	MATERIAL
1	Cylinder U-Cup Seals (2)**	Buna-N
2	Cylinder Rod Flange	Carbon Steel / Stainless Steel Option
3	Cylinder Head Flange	Carbon Steel / Stainless Steel Option
4	Cylinder Tube	Precision Honed Steel
5	Cylinder Tie Rod Nuts	Grade 5 Carbon Steel
6	Cylinder Tie Rod	High Strength Carbon Steel
7	Cylinder Wear Strip**	Reinforced Teflon
8	Cylinder Tube Seals (2)**	Buna-N O-Ring
9	Cylinder Rod Seal**	Polyurethane
10	Cylinder Rod Seal Retainer Ring	Carbon Steel
11	Cylinder Gland Plate	Steel
12	Cylinder Gland Plate Screws	Alloy Steel SHCS
13	Cylinder Rod Bearing**	Duralon®
14	Cylinder Rod - Cylinder Assembly	Hard Chrome Plated Steel - Nodular Iron

Note:

** Denotes REPAIR KIT item. This items is a wear item that is included in VRG standard Actuator Cylinder Assembly Repair Kit.

FIGURE 3.0 RHPA ACTUATOR CYLINDER ASSEMBLY–WITH TAILROD

**TABLE 18.0 RHPA ACTUATOR CYLINDER ASSEMBLY–WITH TAILROD–PARTS IDENTIFICATION TABLE
FOR FIGURE 3.0 ON PG. 42**

ITEM	DESCRIPTION	MATERIAL
1	Cylinder U-Cup Seals (2)**	Buna-N
2	Cylinder Rod Flange	Carbon Steel / Stainless Steel Option
3	Cylinder Head Flange	Carbon Steel / Stainless Steel Option
4	Cylinder Tube	Precision Honed Steel
5	Cylinder Tie Rod Nuts	Grade 5 Carbon Steel
6	Cylinder Tie Rod	High Strength Carbon Steel
7	Cylinder Wear Strip**	Reinforced Teflon
8	Cylinder Tube Seals (2)**	Buna-N O-Ring
9	Cylinder Rod Seal**	Polyurethane
10	Cylinder Rod Seal Retainer Ring	Carbon Steel
11	Cylinder Gland Plate	Steel
12	Cylinder Gland Plate Screws	Alloy Steel SHCS
13	Cylinder Rod Bearing**	Duralon®
14	Tailrod Gland Assembly**	Carbon Steel w/ Duralon®
15	Cylinder Rod - Cylinder Assembly	Hard Chrome Plated Steel - Nodular Iron
16	Tailrod	Hard Chrome Plated Steel
17	Tailrod Seal**	Buna-N
18	Tailrod Wiper Seal**	Buna-N
19	Tailrod Gland O-Ring**	Buna-N

Note:

** Denotes REPAIR KIT item. This items is a wear item that is included in VRG standard Actuator Cylinder Assembly Repair Kit.

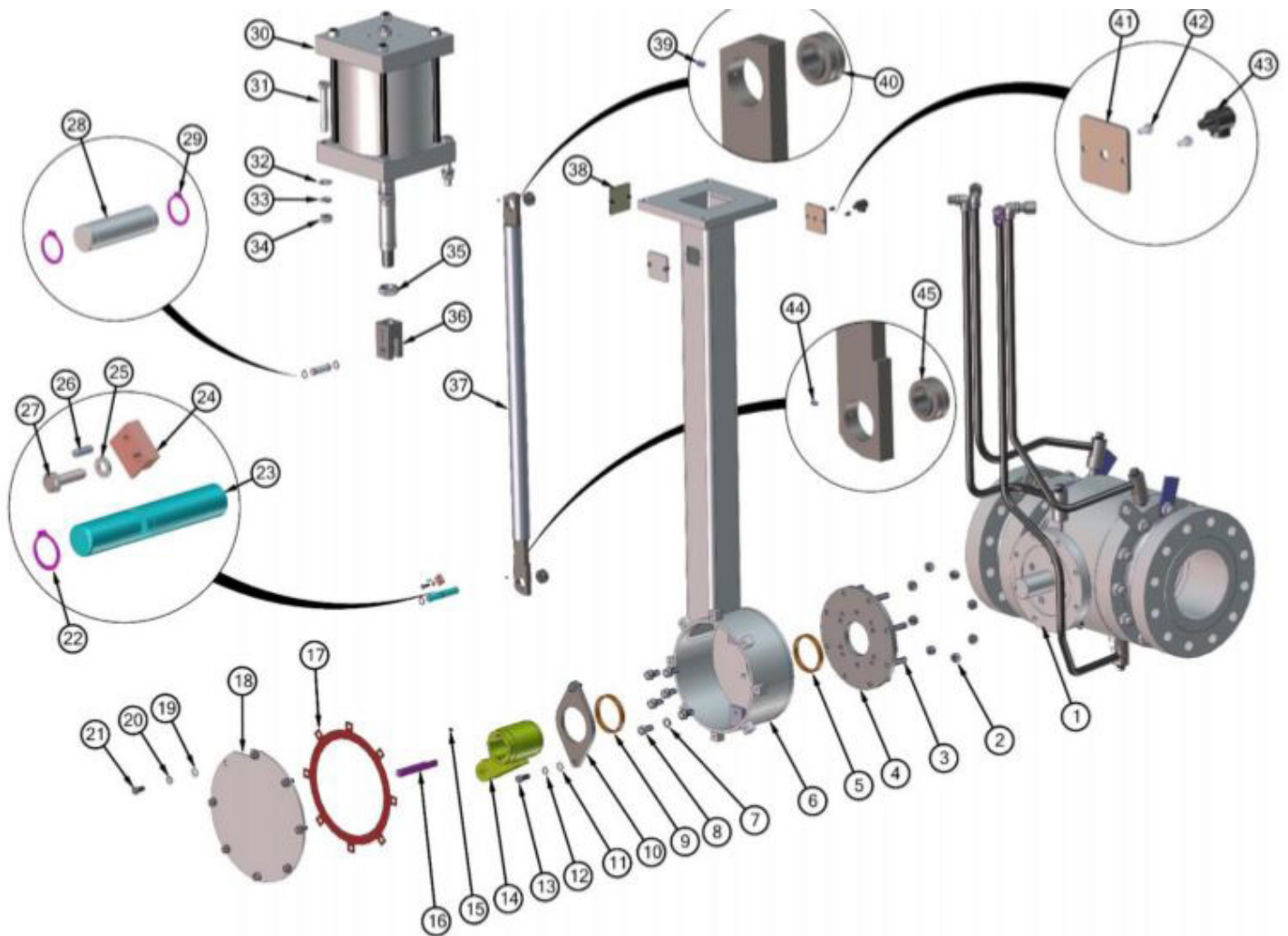
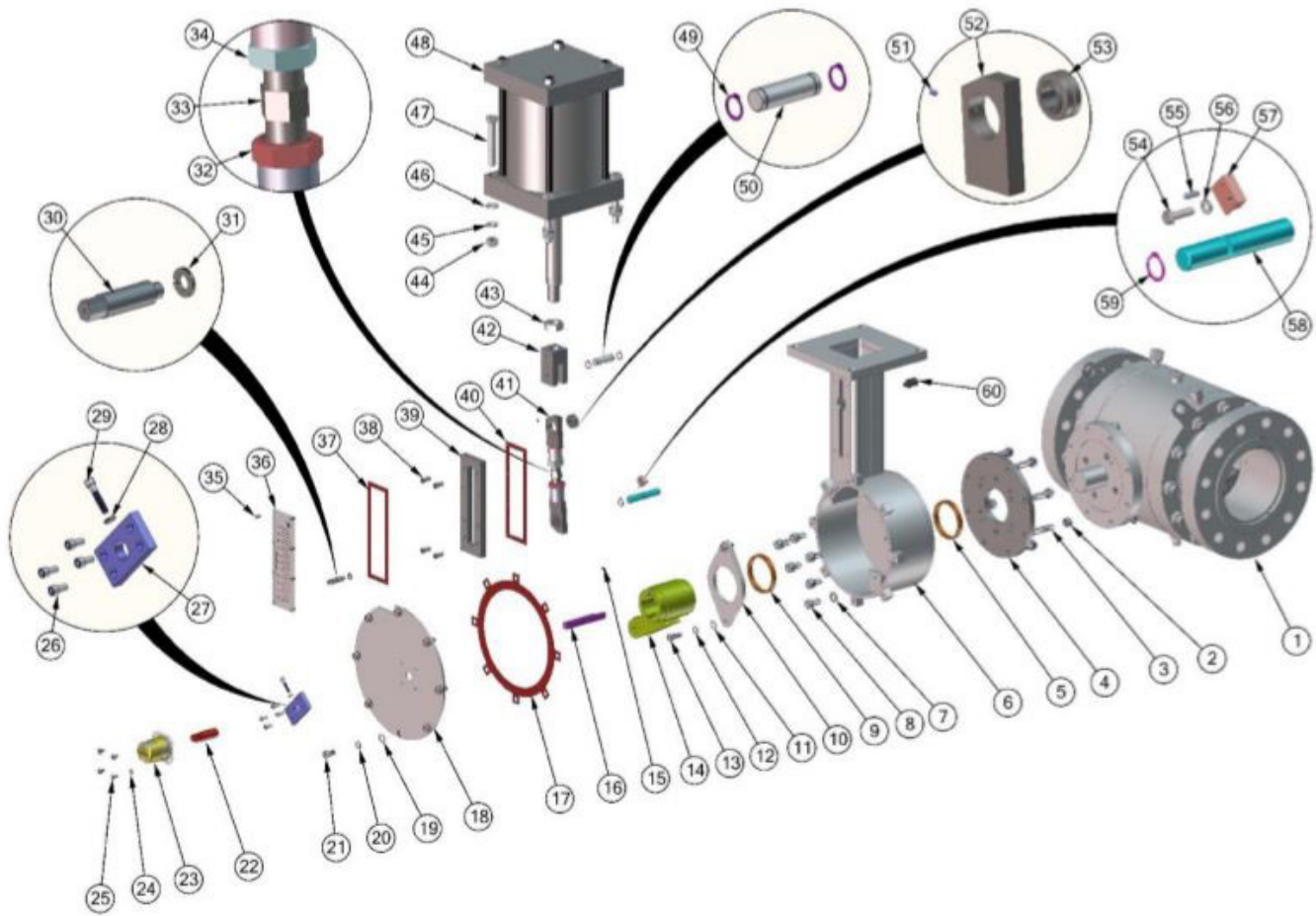
FIGURE 4.0 RHPA-DA BELOW GROUND ACTUATOR WITH TAILROD– EXPLODED VIEW


TABLE 19.0 RHPA-DA BELOW GROUND ACTUATOR WITH TAILROD – PARTS IDENTIFICATION FOR FIGURE 4.0 ON PG. 44

ITEM	DESCRIPTION	MATERIAL
1	PRCV Pipeline Control Valve	Per Application (Shown Lube Port Extensions)
2	Adapter Plate Nut	Grade 5 Carbon Steel
3	Adapter Plate Stud	Alloy Steel
4	Adapter Plate	Carbon Steel
5	Outboard Bearing	Proprietary High Duty Composite
6	Actuator Housing	Carbon Steel
7	Actuator Housing Lock Washer	Carbon Steel
8	Actuator Housing Bolt	Carbon Steel
9	Outboard Bearing	Proprietary High Duty Composite
10	Outboard Bearing Plate	Carbon Steel
11	Outboard Bearing Washer	Carbon Steel or Stainless Steel
12	Outboard Bearing Lock Washer	Carbon Steel or Stainless Steel
13	Outboard Bearing Bolt	Carbon Steel or Stainless Steel
14	Torque Arm	Carbon Steel
15	Square Key Setscrew	Alloy Steel
16	Square Key	Oversized CS Key Stock
17	Cover Plate Gasket	Rubber
18	Cover Plate	Carbon Steel
19	Cover Plate Washer	Stainless Steel
20	Cover Plate Lock Washer	Stainless Steel
21	Cover Plate Bolt	Stainless Steel
22	Tru Arc Ring	Alloy Steel

ITEM	DESCRIPTION	MATERIAL
23	Torque Arm Pin	Stress Proof Steel
24	Torque Arm Pin Lock	Carbon Steel
25	Torque Arm Pin Lock Washer	Stainless Steel
26	Torque Arm Pin Locate Pin	Stainless Steel
27	Torque Arm Pin Lock Screw	Stainless Steel
28	Cylinder Rod Clevis Pin	Stress Proof Steel
29	Tru Arc Ring	Alloy Steel
30	Actuator Cylinder Assembly w Tailrod	See Figure 3.0
31	Cylinder Mounting Bolt	Carbon Steel
32	Cylinder Mounting Washer	Carbon Steel
33	Cylinder Mounting Lock Washer	Carbon Steel
34	Cylinder Mounting Nut	Carbon Steel
35	Cylinder Rod Jam Nut	Carbon Steel
36	Cylinder Rod Clevis	Carbon Steel
37	Connecting Link	Carbon Steel
38	Actuator Access Plate	Stainless Steel
39	Spherical Bearing Setscrew	Stainless Steel w Nylon
40	Spherical Bearing	Stainless Steel
41	Actuator Vent Plate	Stainless Steel
42	Actuator Plate Screw	Stainless Steel
43	Vent Elbow	Anodized Aluminum

FIGURE 5.0 RHPA-DA ABOVE GROUND ACTUATOR NO TAILROD—EXPLODED VIEW


**TABLE 20.0 RHPA-DA ABOVE GROUND ACTUATOR NO TAILROD–PARTS IDENTIFICATION**

ITEM	DESCRIPTION	MATERIAL	ITEM	DESCRIPTION	MATERIAL
1	PRCV Pipeline Control Valve	Per Application	31	Travel Indicator Lock Washer	Stainless Steel
2	Adapter Plate Nut	Grade 5 Carbon Steel	32	Connecting Link Jam Nut	Carbon Steel
3	Adapter Plate Stud	Alloy Steel	33	Connecting Link Adjust Stud	Carbon Steel
4	Adapter Plate	Carbon Steel	34	Connecting Link Jam Nut	Carbon Steel
5	Outboard Bearing	Proprietary High Duty Composite	35	Travel Indicator Window Screw	Stainless Steel
6	Actuator Housing	Carbon Steel	36	Travel Indicator Window	Lexan
7	Actuator Housing Lock Washer	Carbon Steel	37	Travel Indicator Gasket	Rubber
8	Actuator Housing Bolt	Carbon Steel	38	Travel Indicator Frame Screw	Stainless Steel
9	Outboard Bearing	Proprietary High Duty Composite	39	Travel Indicator Frame	PVC
10	Outboard Bearing Plate	Carbon Steel	40	Travel Indicator Gasket	Rubber
11	Outboard Bearing Washer	Carbon Steel or Stainless Steel	41	Connecting Link Assembly	Carbon Steel
12	Outboard Bearing Lock Washer	Carbon Steel or Stainless Steel	42	Cylinder Rod Clevis	Carbon Steel
13	Outboard Bearing Bolt	Carbon Steel or Stainless Steel	43	Cylinder Rod Jam Nut	Carbon Steel
14	Torque Arm	Carbon Steel	44	Cylinder Mounting Nut	Carbon Steel
15	Square Key Setscrew	Alloy Steel	45	Cylinder Mounting Lock Washer	Carbon Steel
16	Square Key	Oversized CS Key Stock	46	Cylinder Mounting Washer	Carbon Steel
17	Cover Plate Gasket	Rubber	47	Cylinder Mounting Bolt	Carbon Steel
18	Cover Plate	Carbon Steel	48	Actuator Cylinder Assembly	See Figure 3.0
19	Cover Plate Washer	Stainless Steel	49	Tru Arc Ring	Alloy Steel
20	Cover Plate Lock Washer	Stainless Steel	50	Rod Clevis Pin	Stress Proof Steel
21	Cover Plate Bolt	Stainless Steel	51	Spherical Bearing Setscrew	Stainless Steel w Nylon
22	Shaft Extension	Stainless Steel	52	Connecting Link Rod Eye	Carbon Steel
23	Beacon	Plastic	53	Spherical Bearing	Stainless Steel
24	Beacon Mount Washer	Stainless Steel	54	Torque Arm Pin Lock Screw	Stainless Steel
25	Beacon Mount Bolts	Stainless Steel	55	Torque Arm Pin Locate Pin	Stainless Steel
26	Feedback Bracket Bolts	Stainless Steel	56	Torque Arm Pin Lock Washer	Stainless Steel
27	Feedback Bracket	Zinc Plated Carbon Steel	57	Torque Arm Pin Lock	Carbon Steel
28	Feedback Bracket Lock Washer	Stainless Steel	58	Torque Arm Pin	Stress Proof Steel
29	Feedback Bracket Lock Bolt	Stainless Steel	59	Tru Arc Ring	Alloy Steel
30	Travel Indicator Bar	Stainless Steel	60	Vent Elbow	Anodized Aluminum

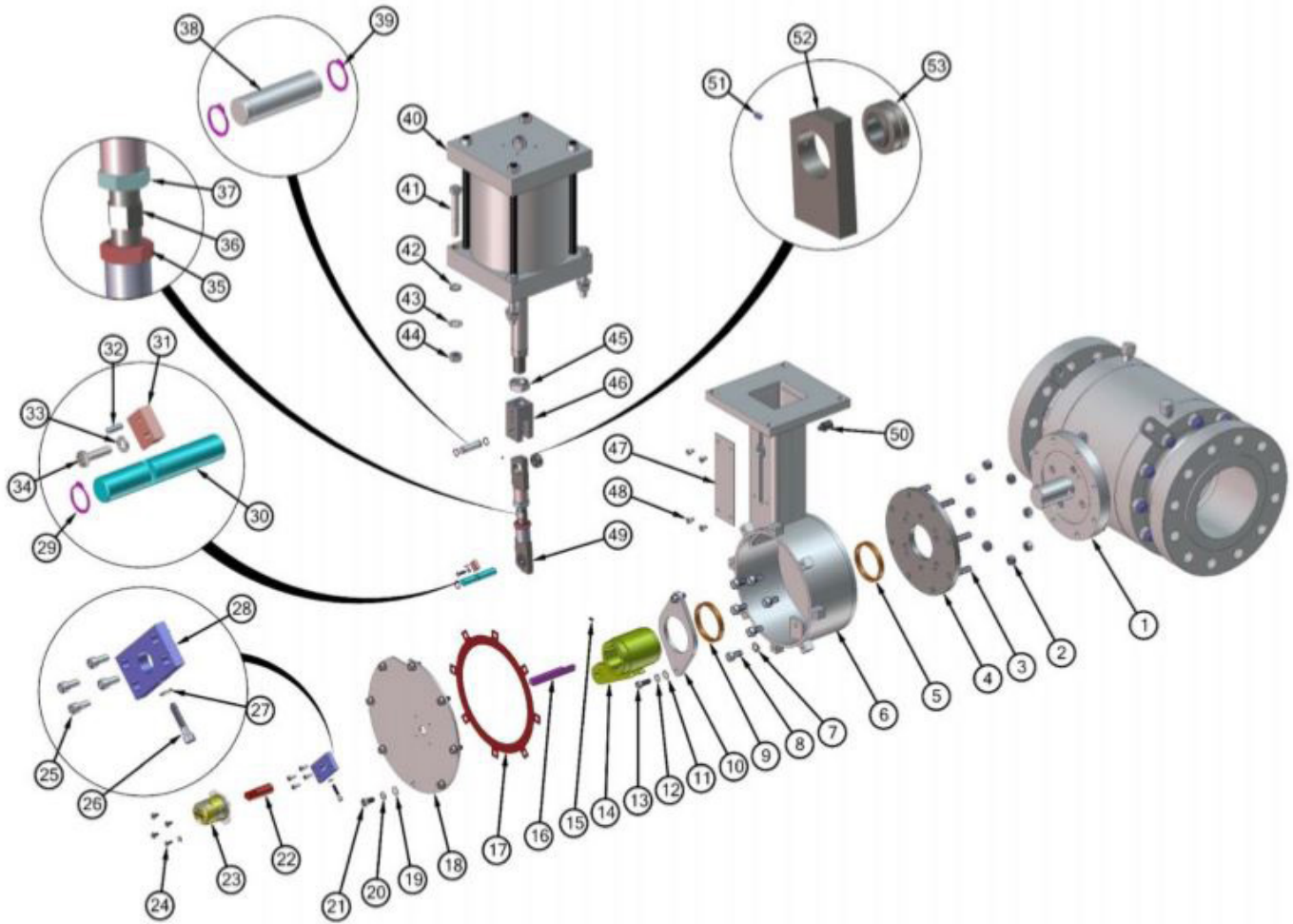
FIGURE 6.0 RHPA-DA ABOVE GROUND ACTUATOR WITH TAILROD– EXPLODED VIEW


TABLE 21.0 RHPA-DA ABOVE GROUND ACTUATOR WITH TAIL ROD–PARTS IDENTIFICATION TABLE FOR FIGURE 6.0 ON PG. 48

ITEM	DESCRIPTION	MATERIAL	ITEM	DESCRIPTION	MATERIAL
1	PRCV Pipeline Control Valve	Per Application	31	Torque Arm Pin Lock	Carbon Steel
2	Adapter Plate Nut	Grade 5 Carbon Steel	32	Torque Arm Pin Locate Pin	Stainless Steel
3	Adapter Plate Stud	Alloy Steel	33	Torque Arm Pin Lock Washer	Stainless Steel
4	Adapter Plate	Carbon Steel	34	Torque Arm Pin Lock Screw	Stainless Steel
5	Outboard Bearing	Proprietary High Duty Composite	35	Connecting Link Jam Nut	Carbon Steel
6	Actuator Housing	Carbon Steel	36	Connecting Link Adjust Stud	Carbon Steel
7	Actuator Housing Lock Washer	Carbon Steel	37	Connecting Link Jam Nut	Carbon Steel
8	Actuator Housing Bolt	Carbon Steel	38	Rod Clevis Pin	Stress Proof Steel
9	Outboard Bearing	Proprietary High Duty Composite	39	Tru Arc Ring	Alloy Steel
10	Outboard Bearing Plate	Carbon Steel	40	Actuator Cylinder Assembly w Tailrod	See Figure 3.0
11	Outboard Bearing Washer	Carbon Steel or Stainless Steel	41	Cylinder Mounting Bolt	Carbon Steel
12	Outboard Bearing Lock Washer	Carbon Steel or Stainless Steel	42	Cylinder Mounting Washer	Carbon Steel
13	Outboard Bearing Bolt	Carbon Steel or Stainless Steel	43	Cylinder Mounting Lock Washer	Carbon Steel
14	Torque Arm	Carbon Steel	44	Cylinder Mounting Nut	Carbon Steel
15	Square Key Setscrew	Alloy Steel	45	Cylinder Rod Jam Nut	Carbon Steel
16	Square Key	Oversized CS Key Stock	46	Cylinder Rod Clevis	Carbon Steel
17	Cover Plate Gasket	Rubber	47	Actuator Travel Access Plate	Stainless Steel
18	Cover Plate	Carbon Steel	48	Actuator Travel Access Plate Bolts	Stainless Steel
19	Cover Plate Washer	Stainless Steel	49	Connecting Link Rod Eye	Carbon Steel
20	Cover Plate Lock Washer	Stainless Steel	50	Vent Elbow	Anodized Aluminum
21	Cover Plate Bolt	Stainless Steel	51	Spherical Bearing Setscrew	Stainless Steel w Nylon
22	Shaft Extension	Stainless Steel	52	Connecting Link Rod Eye	Carbon Steel
23	Beacon	Plastic	53	Spherical Bearing	Carbon Steel
24	Beacon Mount Washer	Stainless Steel			
25	Beacon Mount Bolts	Stainless Steel			
26	Feedback Bracket Lock Bolt	Stainless Steel			
27	Feedback Bracket Lock Washer	Stainless Steel			
28	Feedback Bracket	Zinc Plated Carbon Steel			
29	Tru Arc Ring	Alloy Steel			
30	Torque Arm Pin	Stress Proof Steel			

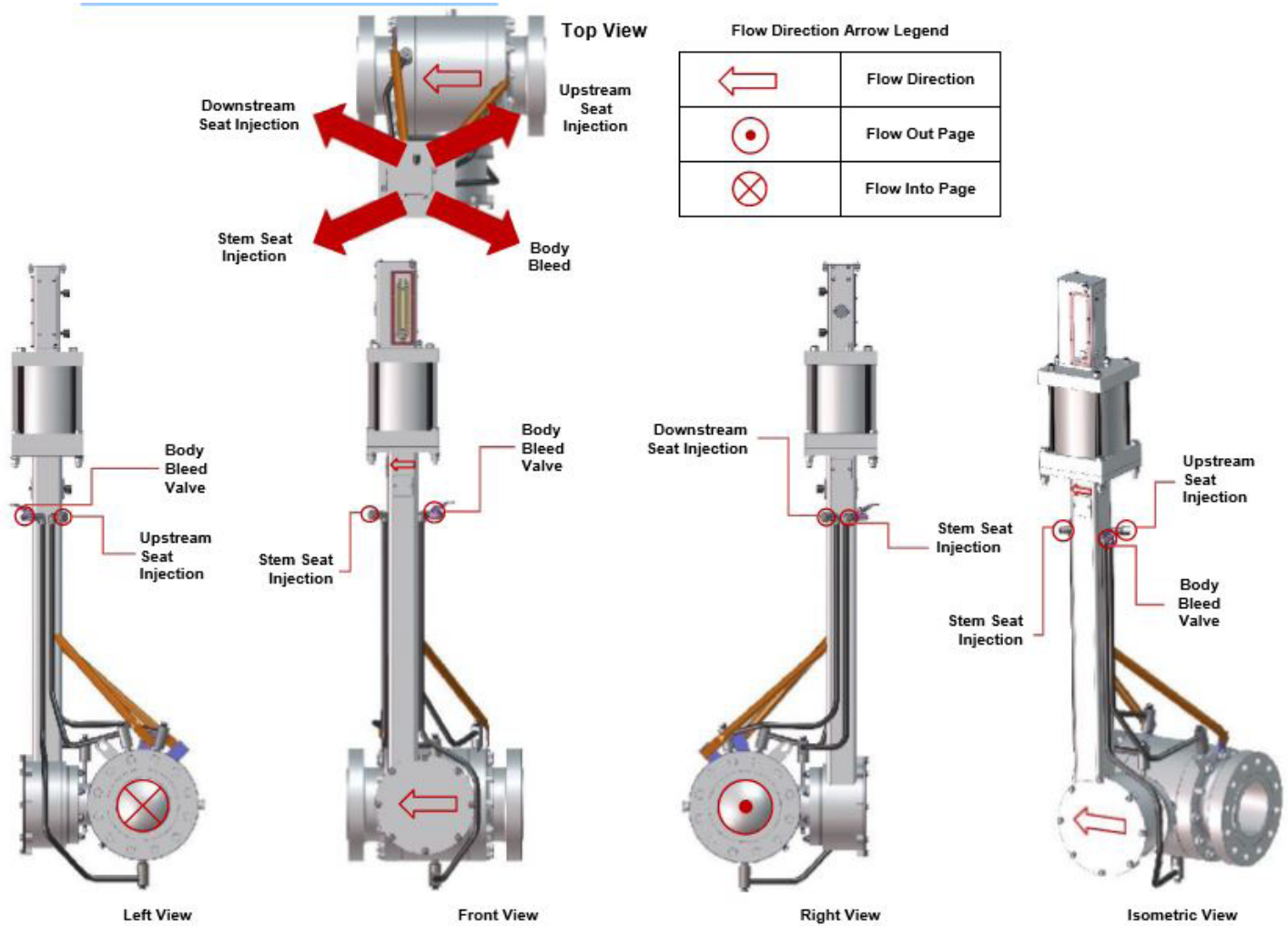
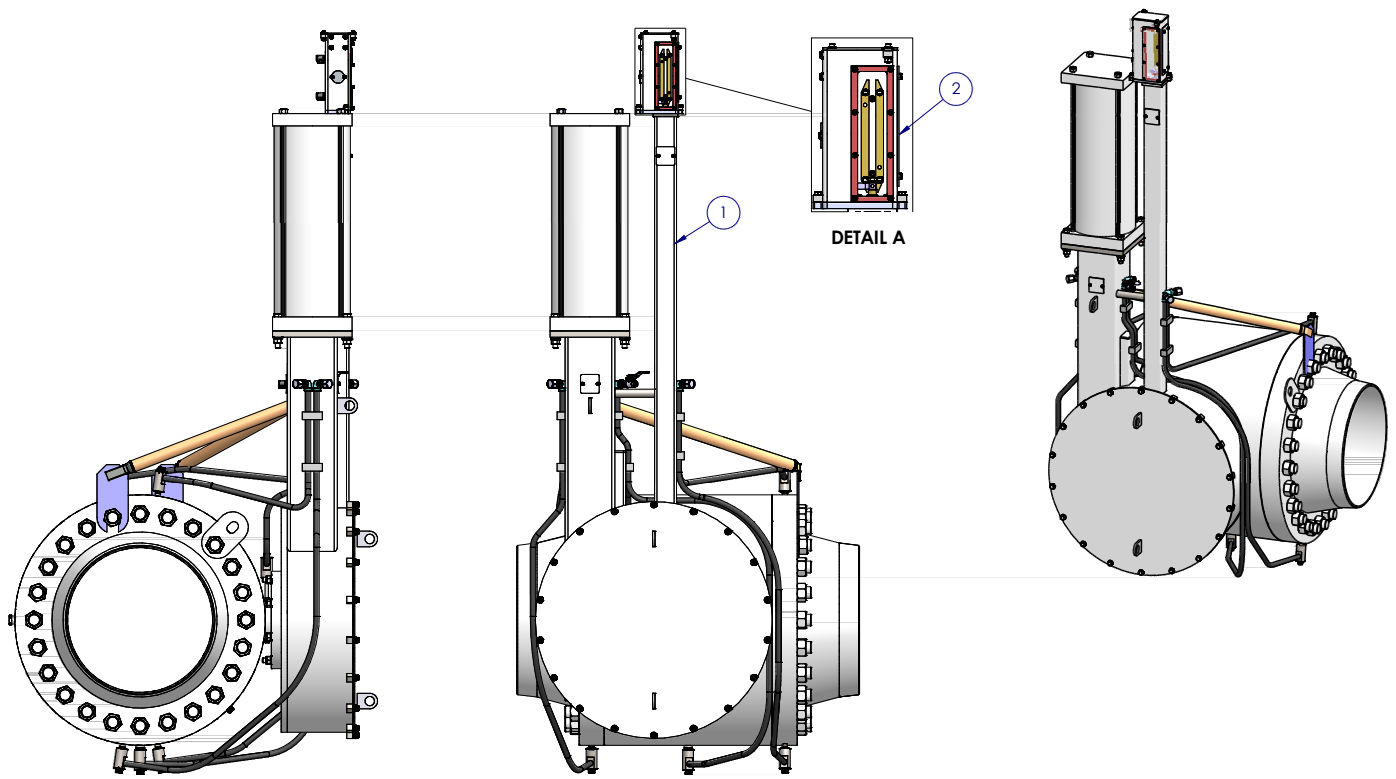
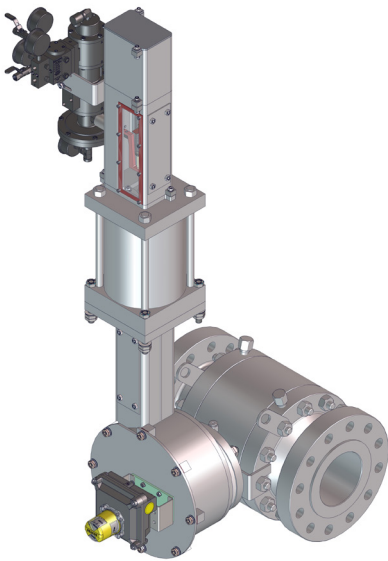
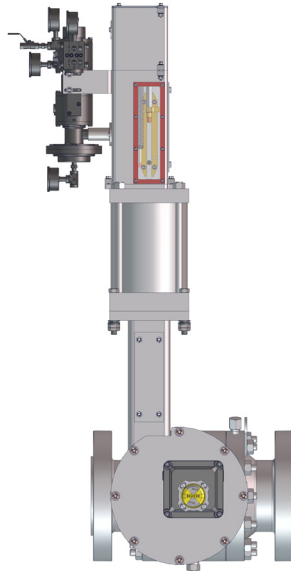
FIGURE 7.0 BELOW GROUND RHPA-DA LEFT HAND MOUNT CONFIGURATION


FIGURE 8.0 BELOW GROUND RHPA-DA WITH PROPORTIONAL FEEDBACK LEFT HAND CONFIGURATIONS

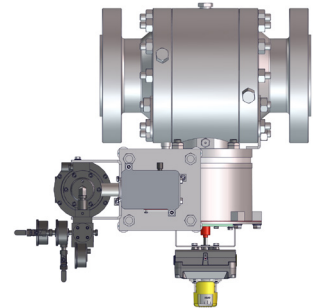


**FIGURE 9.0 ABOVE GROUND WITH TAILROD RHPA-DA LEFT HAND MOUNT CONFIGURATION
PART NUMBER: AA-5024**

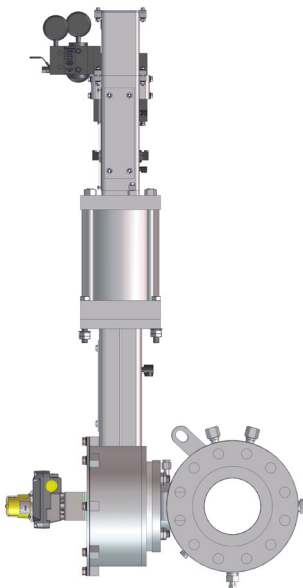
Isometric View



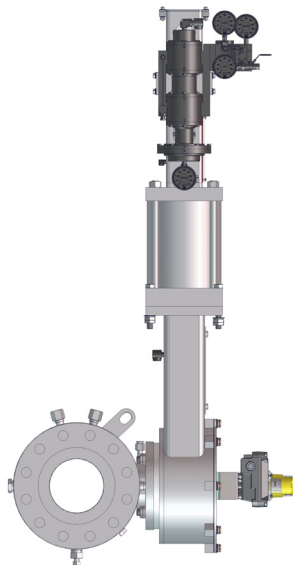
Front View



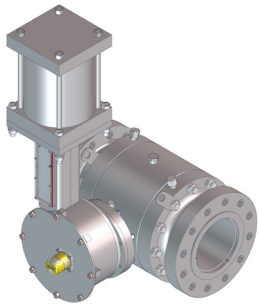
Top View



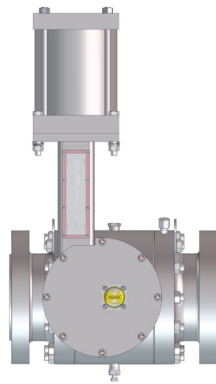
Right View



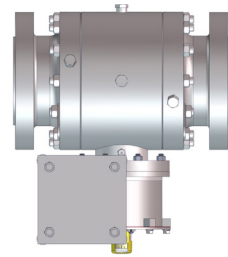
Left View

**FIGURE 10.0 ABOVE GROUND WITHOUT TAILROD RHPA-DA LEFT HAND MOUNT CONFIGURATION
PART NUMBER: AA-5048**

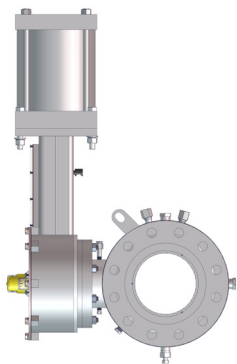
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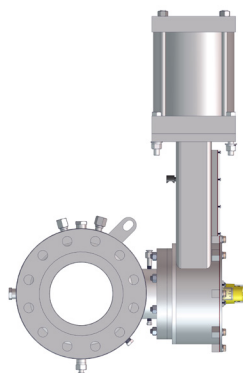
Front View



Top View



Right View



Left View

**TABLE 22.0 RPDA ACTUATOR CYLINDER REPAIR KITS-UNIVERSAL**

Actuator Cylinder Bore	Repair Kit	Description
5 in	RK-0090	5" Dia Cylinder Repair Kit
5 in	RK-0090-LT	5" Dia Cylinder Repair Kit - Low Temperature U Cups
6 in	RK-1095	6" Dia Cylinder Repair Kit
6 in	RK-1095-LT	6" Dia Cylinder Repair Kit - Low Temperature U Cups
8 in	RK-1100	8" Dia Cylinder Repair Kit
8 in	RK-1100-LT	8" Dia Cylinder Repair Kit - Low Temperature U Cups
10 in	RK-1110	10" Dia Cylinder Repair Kit
10 in	RK-1110-LT	10" Dia Cylinder Repair Kit - Low Temperature U Cups
12 in	RK-1120	12" Dia Cylinder Repair Kit
12 in	RK-1120-LT	12" Dia Cylinder Repair Kit - Low Temperature U Cups
14 in	RK-1130	14" Dia Cylinder Repair Kit
14 in	RK-1130-LT	14" Dia Cylinder Repair Kit - Low Temperature U Cups

Notes:

1. Includes ALL available seals and wear components for RPDA Actuator Piston Assemblies with tailrod and without tailrod
2. Suitable for ALL VRG Controls RHPA-DA Actuator Models
3. Includes following components:
 - Cylinder U-Cup Seals (2)
 - Cylinder Wear Strip
 - Cylinder Tube Seals (2)
 - Cylinder Rod Seal
 - Cylinder Rod Bearing
 - Tailrod Gland Assembly
 - Tailrod Seal
 - Tailrod Wiper Seal
 - Tailrod Gland O-Ring
4. For repair kit numbers without LT the temperature rating is -20°F to +160°F
5. For repair kit numbers with LT the temperature rating is -30°F to +160°F



While this information is presented in good faith and believed to be accurate, VRG Controls LLC. does not guarantee satisfactory results from reliance upon such information. Nothing contained herein is to be construed as a warranty or guarantee, expressed or implied, regarding the performance merchantability, fitness or any other matter

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