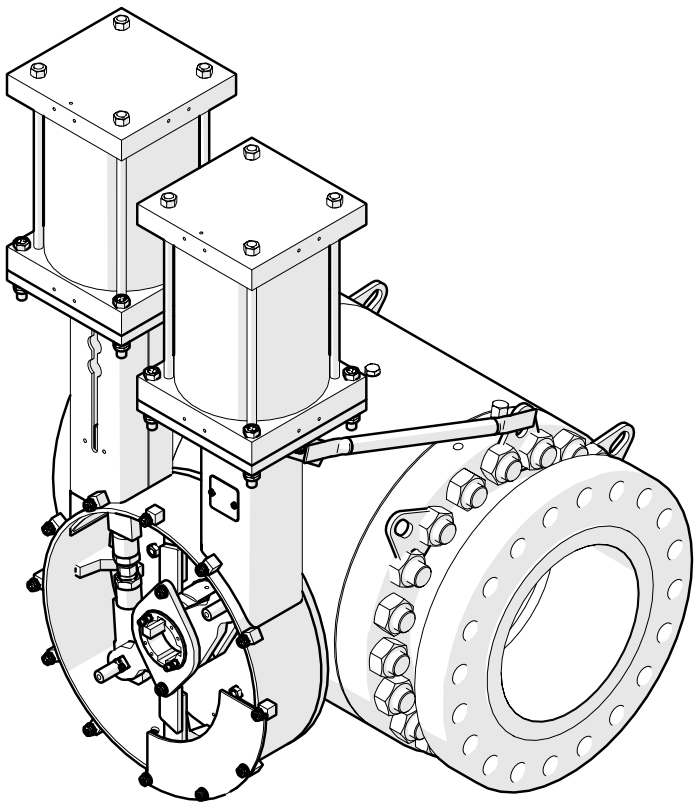
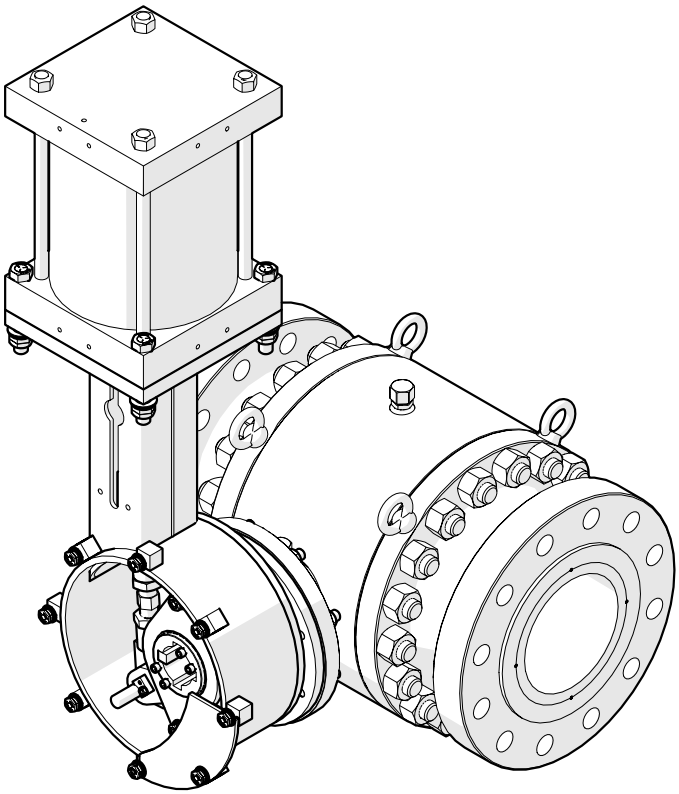




Applicable Models:
This Instruction Manual applies to the following VRG Double Acting Rotary High Pressure Actuators. To confirm suitability for additional models and/or components, please contact VRG Controls or view us online at www.vrgcontrols.com.

ABOVE GROUND – W/ TAILROD
ABOVE GROUND – W/ PROPORTIONAL TOPWORKS
ABOVE GROUND – W/ RISER PIPE
BELOW GROUND – W/ TAILROD
BELOW GROUND – W/ PROPORTIONAL TOPWORKS

STAY IN TOUCH!
Scan the QR Code at right for company information and product updates.

ADDRESS: VRG Controls, LLC.
1199-B Flex Court
Lake Zurich, IL 60047, USA
TOLL FREE: (800) 844-FLOW-VRG
FAX: (208) 246-0304
E-MAIL: sales@vrgcontrols.com
WEBSITE: vrgcontrols.com

TABLE OF CONTENTS

DESCRIPTION	PAGE
Scope of Manual	3-4
Table 1.0 Technical Specifications	5
Actuator Information	6-7
Table 2.0 Model Number Derivation	8
Maintenance Checklists	9
Procedure 1.0 Verify Proper Actuator Stroking Operation	10
Procedure 2.0 Apply Lubrication to Control Valve	11
Procedure 3.0 Apply Lubrication to Actuator Cylinder Assembly	12-13
Procedure 4.0 Verify Control Valve Stem Seals	14
Procedure 5.0 Verify Actuator Cylinder Rod Seals	15
Procedure 6.0 Replace Cylinder Rod Seals Procedure 7.0 Verify Actuator Cylinder Tube Seals	16
Procedure 8.0 Replace Cylinder Tube Seals	17-18
Procedure 9.0 Verify Actuator Cylinder Seals (U-Cup)	19
Procedure 10.0 Replace Actuator Cylinder Seals (U-Cup)	20-22
Procedure 11.0 Verify Actuator Cylinder Tailrod Seals (If Equipped)	22
Procedure 12.0 Replace Actuator Cylinder Tailrod Seals (If Equipped)	23
Procedure 13.0 Verify Actuator Lost Motion	24
Procedure 14.0 Correct Actuator Lost Motion	25
Procedure 15.0 Remove Actuator Cylinder Assembly Only (Above Ground)	25-26
Procedure 16.0 Reinstill Actuator Cylinder Assembly Only (Above Ground)	26-27
Procedure 17.0 Remove Actuator Cylinder Assembly Only (Below Ground)	27
Procedure 18.0 Reinstill Actuator Cylinder Assembly Only (Below Ground)	28
Procedure 19.0 Uninstall Complete Actuator Assembly (Above Ground)	28-29
ProcedWure 20.0 Reinstall Complete Actuator Assembly (Above Ground)	29-30
Procedure 21.0 Uninstall Complete Actuator Assembly (Below Ground)	30-31
Procedure 22.0 Reinstall Complete Actuator Assembly (Below Ground)	31-32
Actuator Weights & Dimensions	33-35
Actuator Selection Tables	36-38
Actuator Torque Tables	39-40
Valve and Actuator Orientation Nomenclature	41
Cylinder Diagrams & BOM	42-45
Actuator Diagrams & BOM	46-50
Model Isometric Views	51
Repair Kits	52

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 style 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. 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.

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, organized area free of dust, debris and moisture 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 arestrictly adhered to and executed by well trained, equipped, prepared and competent personnel.
- 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.
- 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.

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) Adjustable Stop Available Option
Installation	Indoor / Outdoor and Vertical / Horizontal All Components Weather Tight Standard with Water Tight Option
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 -30°F to +160°F Optional
Pneumatic Connections	All cylinders have 1/2 NPT ports. Only high speed cylinders for surge control have 1” NPT ports and pneumatic cushions
Instrumentation Tubing	Standard - 3/8 in OD x .035 Wall 316 SS Seamless Annealed Tubing, ASTM A269
Instrumentation Fittings	SSP or 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.

RHPA-DA MODEL NUMBER DERIVATION

PROPORTIONAL TOPWORKS MODELS

Actuator Bore (in.)	X	Actuator Stroke (in.)	Grade
12		14	Above Ground/Below Ground
12		20	Above Ground/Below Ground
12		24	Above Ground/Below Ground
12		26	Above Ground/Below Ground
14		14	Above Ground/Below Ground
14		20	Above Ground/Below Ground
14		24	Above Ground/Below Ground
14		26	Above Ground/Below Ground

RISER PIPE MODELS

Actuator Bore (in.)	X	Actuator Stroke (in.)	Grade
6		6	Above Ground
8		6	Above Ground
8		8	Above Ground
10		6	Above Ground
10		8	Above Ground
10		12	Above Ground
12		12	Above Ground

TAILROD MODELS

Actuator Bore (in.)	X	Actuator Stroke (in.)	Grade
5		4	Above Ground/Below Ground
6		4	Below Ground
6		6	Below Ground
8		6	Below Ground
8		8	Below Ground
10		6	Below Ground
10		8	Below Ground
10		12	Below Ground
12		12	Below Ground

Notes:

1. Actuator Bore x Stroke preceded by “D” indicate a DUAL cylinder (qty 2) configuration.
Example: D10X12 indicates qty 2 of 10x12 cylinders.
2. Full model name example: RHPA-DATR-8X8BG indicates a Double Acting Rotary High Pressure Actuator with a tailrod, 8in. bore and 8 in. stroke, installed below ground.

RHPA-DA RECOMMENDED ANNUAL MAINTENANCE CHECKLIST

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

RHPA-DA RECOMMENDED FIVE (5) YEAR MAINTENANCE CHECKLIST

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

RHPA-DA 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 pressure. Only clean, dry, oil-free air or gas should be applied to avoid damage to actuator and/or control instrumentation.

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:

a. Smooth, continuous stroking from one end of travel to the other.
b. No stalling or stopping of the actuator in mid travel.
c. Consistent stroking speed.
d. 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 incorrecting 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. procedures are followed. Below instructions are provided as guidelines only and are not intended to supersede safe maintenance practices as outlined in the control valve manufacturer's IOM or your company's operative practices.

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.

RECOMMENDED LUBRICATION QUANTITY FOR PRCV PIPELINE ROTARY CONTROL VALVES

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 forapplications 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 Mobyllith 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 ASSEMBLY

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.

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: 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 theCylinder 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 rebuild.

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.

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 theupstream 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-DAACTUATOR CylinderASSEMBLY 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 SEALS

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 ActuatorCylinder 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 matingsurfaces. 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 change 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-DAACTUATOR CylinderASSEMBLY 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 ACTAUTOR 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

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 beslippery 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 rebuild.

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

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.

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-DAACTUATOR CylinderASSEMBLY 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 ACTAUTOR 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 INJURY.

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.

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 rebuild.

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.

CYLINDER TIE-RODS AND NUTS 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

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-DAACTUATOR CylinderASSEMBLY 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 nessasary.

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 or 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:

a. Actuator Clevis and Clevis Pin Interface
b. Actuator Torque Arm and Stem Key Interface
c. Actuator Torque Arm and Control Valve Stem Interface
d. 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

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 Cylinder Rod.

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 disassembly.

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 Assembly.

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. TheTorque 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.

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 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 Pinthrough 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.

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 Cylinder Rod.

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 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.

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.

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 certainto 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.

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 thecontrol 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.

PROCEDURE 21.0 -UNINSTALL COMPLETE ACTUATOR ASSEMBLY (BELOW GROUND)

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, Lubrication Lines, or Control Valve. Minimize potential damage to the associated protective coating on the complete assembly.

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 easilyinserted 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 controlvalve 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.

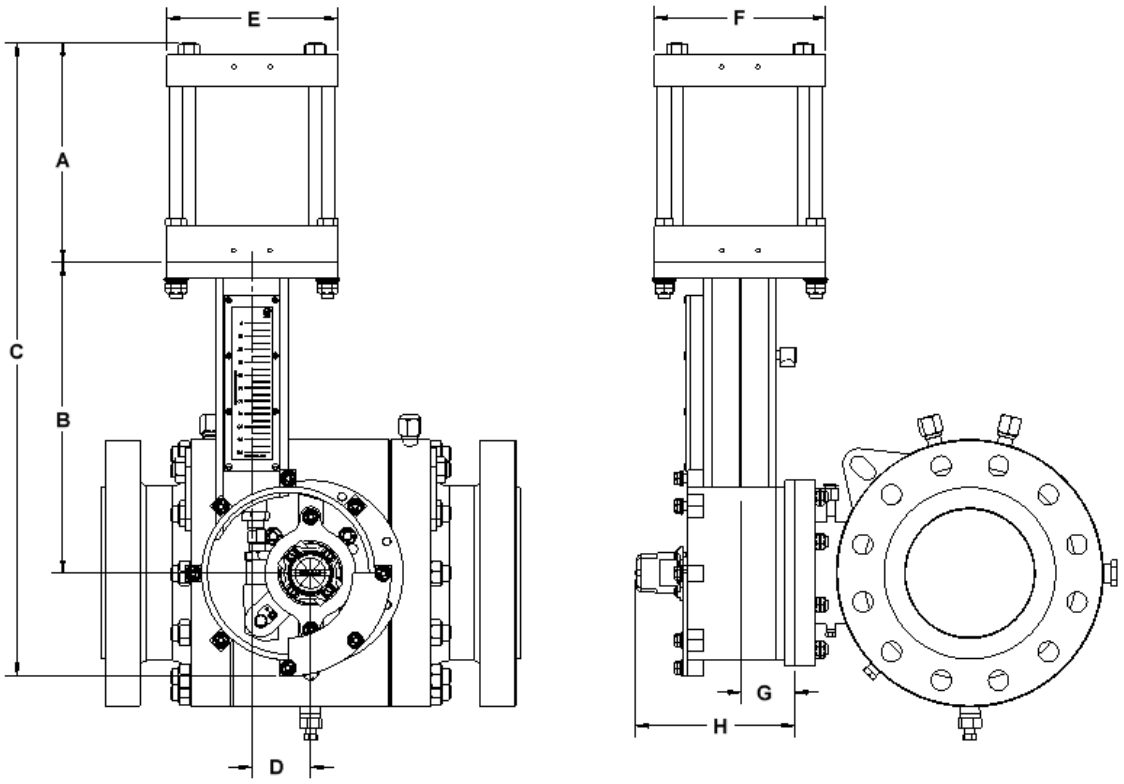
Step 31: Utilize Procedure 18.0 – Page 28 to reinstall Actuator Cylinder Assembly (Below Ground).

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.

RHPA-DA ACTUATOR WEIGHTS & DIMENSIONS - SINGLE PISTON



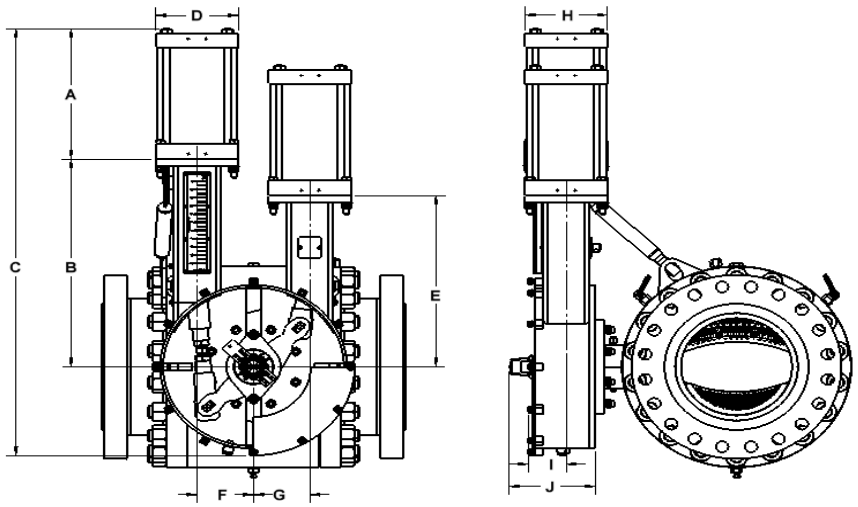
Dimensions in Inches (mm)

Model	A	B	C	D	E	F	G	H	WEIGHT LBS (KG)
RHPA5X4DA	9.68 (243)	14.13 (359)	30.18 (735)	2.38 (60)	7.63 (194)	5.50 (140)	2.12 (54)	9.43 (240)	125.00 (57)
RHPA6X4DA	10.19 (259)	14.63 (371)	31.20 (764)	2.38 (60)	8.63 (219)	6.50 (165)	2.12 (54)	9.43 (240)	150.00 (68)
RHPA6X6DA	12.19 (310)	18.19 (462)	36.50 (927)	3.63 (92)	8.63 (219)	6.50 (165)	2.75 (70)	9.43 (240)	210.00 (95)
RHPA8X6DA	11.69 (297)	18.81 (478)	36.75 (933)	3.63 (92)	8.50 (216)	8.50 (216)	2.75 (70)	9.43 (240)	245.00 (111)
RHPA8X8DA	13.68 (347)	19.81 (503)	40.63 (1032)	4.75 (121)	8.50 (216)	8.50 (216)	2.75 (70)	9.43 (240)	295.00 (134)
RHPA10X6DA	13.06 (332)	19.25 (489)	38.56 (979)	3.63 (92)	10.63 (270)	10.63 (270)	2.75 (70)	9.43 (240)	345.00 (157)
RHPA10X8DA	15.06 (383)	20.25 (514)	42.44 (1078)	4.75 (121)	10.63 (270)	10.63 (270)	2.75 (70)	9.43 (240)	390.00 (177)
RHPA10X12DA	19.06 (484)	25.50 (648)	53.31 (1354)	7.25 (184)	10.63 (270)	10.63 (270)	3.50 (89)	10.93 (278)	545.00 (247)
RHPA12X12DA	19.56 (497)	25.50 (648)	53.81 (1367)	7.25 (184)	12.75 (324)	12.75 (324)	3.50 (89)	10.93 (278)	655.00 (297)

Notes:

1. Dimensions “B” and “C” will change for BELOW GROUND control valve assemblies based upon depth of burial.
2. For Tailrod models, add 12 7/8” inches to dimension A and C for strokes up to 12”, and add 20” to dimensions A and C for strokes of 12” and above.

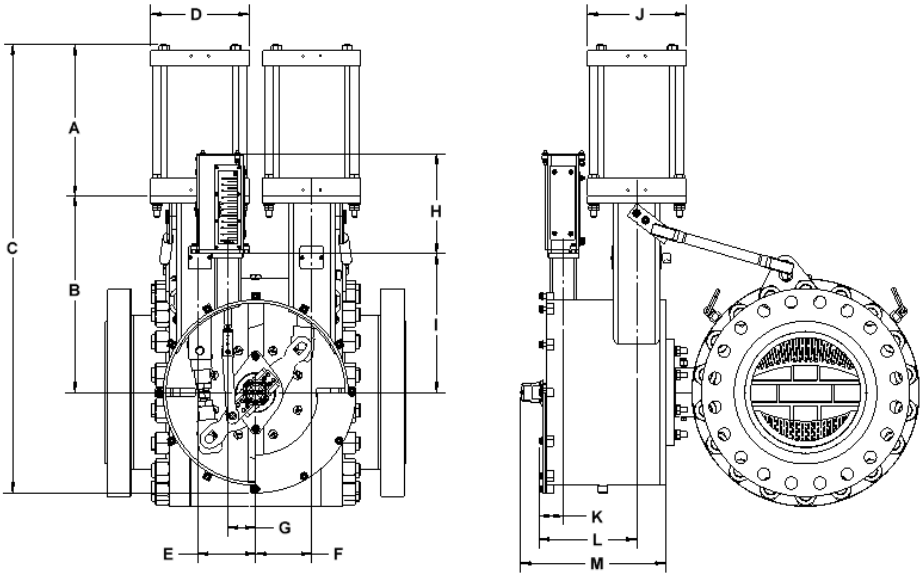
RHPA-DA ACTUATOR WEIGHTS & DIMENSIONS - DOUBLE PISTON



Dimensions in Inches (mm)

Model	A	B	C	D	E	F	G	H	I	K	WEIGHT LBS (KG)
RHPAD10X12DA	19.125 (484)	30.5 (774)	64.375 (1635)	10.625 (270)	25.125 (638)	7.25 (184)	7.25 (184)	10.625 (270)	4.875 (124)	11 (281)	812 (376)
RHPAD12X12DA	19.625 (498)	30.75 (781)	64.375 (1635)	12.75 (324)	25.5 (648)	7.25 (184)	7.25 (184)	12.75 (324)	4.75 (121)	11 (281)	1086 (493)

RHPA-DA ACTUATOR WEIGHTS & DIMENSIONS - DOUBLE PISTON W/ PROPORTIONAL TOPWORKS BUCKET STYLE



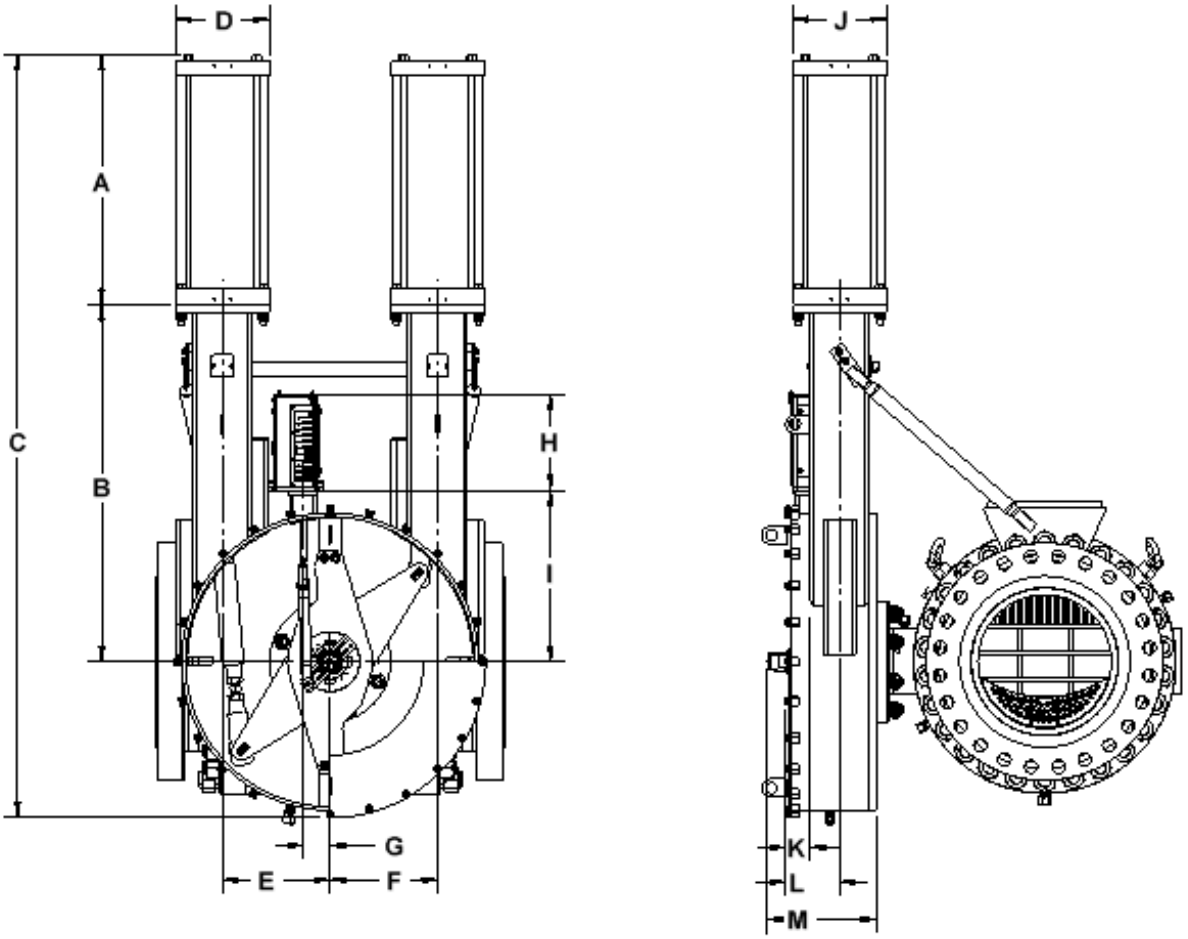
Dimensions in Inches (mm)

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	WEIGHT LBS (KG)
RHPAD12X14DA	21.625 (549.275)	29.25 (743)	65.875 (1673)	12.75 (324)	8.5 (216)	8.5 (216)	3.625 (92)	18 (457)	18 (457)	12.75 (324)	3.6875 (94)	13.75 (349)	21.175 (538)	1470 (667)
RHPA12X12/12X14	21.625 (549.275)	29.25 (743)	65.875 (1673)	12.75	8.5 (216)	8.5 (216)	3.625 (92)	18 (457)	18 (457)	14.75 (375)	3.6875 (94)	13.75 (349)	21.175 (538)	1600 (727)
RHPAD14X14DA	22.875 (581.025)	29.375 (748)	67.25 (1708)	14.75 (375)	8.5 (216)	8.5 (216)	3.625 (92)	18 (457)	18 (457)	14.75 (375)	3.6875 (94)	13.75 (349)	21.18 (538)	1858 (843)

Notes:

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

RHPA-DA ACTUATOR WEIGHTS & DIMENSIONS - DOUBLE PISTON W/ PROPORTIONAL TOPWORKS



Dimensions in Inches (mm)

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	WEIGHT LBS (KG)
RHPAD12X24DA	33.625 (854.075)	48 (1219)	101.625 (2581)	12.75 (324)	14.5 (368)	14.5 (368)	3.625 (92)	13 (330)	23 (584)	12.75 (324)	3.25 (83)	7.3125 (186)	14.75 (374)	2368 (1074)
RHPAD12X26DA*	35.625 (904.875)	49 (1245)	169.25 (4299)	12.75 (324)	15.75 (400)	15.75 (400)	3.625 (92)	13 (330)	22.5 (572)	12.75 (324)	3.15 (80)	7.3675 (187)	14.75 (374)	2165 (982)
RHPAD14X24DA	34.875 (885.825)	48 (1219)	103.875 (2638)	14.75 (375)	14.5 (368)	14.5 (368)	3.625 (92)	13 (330)	23 (584)	14.75 (375)	3.1875 (81)	7.3125 (186)	14.75 (374)	2537 (1151)
RHPAD14X26DA*	36.875 (936.625)	49 (1245)	171.75 (4362)	14.75 (375)	14.75 (375)	14.75 (375)	3.625 (92)	13 (330)	23 (584)	14.75 (375)	3.25 (83)	7.375 (187)	14.75 (374)	2720 (1234)

Notes:

1. Dimensions “B” and “C” will change for BELOW GROUND control valve assemblies based upon depth of burial.
2. * Denotes opposing cylinder actuator style

Full Port, H1 and H2 Selections at 20F

	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 80 psig	2	5X4	5X4	6X4
	3	6X4	6X6	6X6
	4	6X6	6X6	8X6
	6	8X6	8X8	8X8
	8	10X6	10X8	10X12
	10	10X12	10X12	12X12
	12	10X12	12X12	D10X12
	16	D10X12	D12X12	D12X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 90 psig	2	5X4	5X4	6X4
	3	5X4	6X4	6X6
	4	6X6	6X6	8X6
	6	8X6	8X6	8X8
	8	10X6	10X8	10X8
	10	10X8	10X12	10X12
	12	10X12	12X12	12X12
	16	12X12	D10X12	D12X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 100 psig	2	5X4	5X4	5X4
	3	5X4	5X4	6X4
	4	6X6	6X6	8X6
	6	8X6	8X6	8X8
	8	8X8	10X6	10X8
	10	10X8	10X12	10X12
	12	10X12	10X12	12X12
	16	12X12	D10X12	D10X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 125 psig	2	5X4	5X4	5X4
	3	5X4	5X4	5X4
	4	6X6	6X6	6X6
	6	8X6	8X6	8X8
	8	8X8	10X6	10X6
	10	10X6	10X8	10X12
	12	10X12	10X12	10X12
	16	12X12	12X12	D10X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 150 psig	2	5X4	5X4	5X4
	3	5X4	5X4	5X4
	4	6X6	6X6	6X6
	6	6X6	6X6	8X6
	8	8X6	8X6	8X8
	10	8X8	10X6	10X8
	12	10X8	10X8	10X12
	16	10X12	12X12	12X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 175 psig	2	5X4	5X4	5X4
	3	5X4	5X4	5X4
	4	6X6	6X6	6X6
	6	6X6	6X6	8X6
	8	8X6	8X6	8X8
	10	8X6	8X8	10X8
	12	10X8	10X8	10X12
	16	10X12	10X12	12X12

Note: Listed Differential indicates differential pressure in full closed position for ON-OFF service. Control Differential is assumed to be 50% of listed differential pressure at 50% open position.

Full Port, H1 and H2 Selections at -20F

	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 80 psig	2	5X4	5X4	6X4
	3	6X4	6X4	6X6
	4	6X6	8X6	8X6
	6	8X6	8X8	10X6
	8	10X6	10X8	10X12
	10	10X12	12X12	12X12
	12	12X12	12X12	D10X12
	16	D10X12	D12X12	D12X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 90 psig	2	5X4	5X4	6X4
	3	6X4	6X6	6X6
	4	6X6	8X6	8X6
	6	8X6	8X8	8X8
	8	10X6	10X8	10X12
	10	10X12	10X12	12X12
	12	12X12	12X12	D10X12
	16	D10X12	D12X12	D12X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 100 psig	2	5X4	5X4	5X4
	3	5X4	6X4	6X4
	4	6X6	6X6	8X6
	6	8X6	8X8	8X8
	8	10X6	10X8	10X12
	10	10X12	10X12	12X12
	12	12X12	12X12	12X12
	16	D10X12	D10X12	D12X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 125 psig	2	5X4	5X4	5X4
	3	5X4	5X4	6X4
	4	6X6	6X6	6X6
	6	8X6	8X6	8X6
	8	8X8	10X6	10X8
	10	10X8	10X8	10X12
	12	10X12	10X12	12X12
	16	12X12	D10X12	D10X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 150 psig	2	5X4	5X4	5X4
	3	5X4	5X4	6X4
	4	6X6	6X6	6X6
	6	6X6	8X6	8X6
	8	8X6	8X8	10X6
	10	10X6	10X8	10X12
	12	10X12	10X12	12X12
	16	12X12	12X12	D10X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 175 psig	2	5X4	5X4	5X4
	3	5X4	5X4	5X4
	4	6X6	6X6	6X6
	6	6X6	6X6	8X6
	8	8X6	8X6	8X8
	10	8X8	10X6	10X8
	12	10X12	10X12	10X12
	16	10X12	12X12	D10X12

Note: Listed Differential indicates differential pressure in full closed position for ON-OFF service. Control Differential is assumed to be 50% of listed differential pressure at 50% open position.

HP, HM, H4 and H5 Selections at -20F

	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 80 psig	4	8X6	8X8	10X6
	6	8X8	10X6	10X8
	8	10X8	10X12	10X12
	10	10X12	12X12	12X12
	12	12X12	12X12	D10X12
	16	D10X12	D12X12	D12X14
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 90 psig	4	8X6	8X8	10X6
	6	8X8	8X8	10X6
	8	10X6	10X8	10X12
	10	10X12	10X12	10X12
	12	10X12	12X12	D10X12
	16	D10X12	D12X12	12X12/12X14
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 100 psig	4	8X6	8X6	8X8
	6	8X6	8X8	10X6
	8	10X6	10X8	10X12
	10	10X12	10X12	10X12
	12	10X12	12X12	D10X12
	16	D10X12	D12X12	D12X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 125 psig	4	6X6	8X6	8X8
	6	8X6	8X8	8X8
	8	10X6	10X8	10X8
	10	10X8	10X12	10X12
	12	10X12	12X12	12X12
	16	12X12	D10X12	D10X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 150 psig	4	6X6	6X6	8X6
	6	6X6	8X6	8X8
	8	8X8	10X6	10X8
	10	10X8	10X8	10X12
	12	10X12	10X12	12X12
	16	12X12	12X12	D10X12
	PRCV Size	500 psi Differential	1000 psi Differential	1500 psi Differential
Supply = 175 psig	4	6X6	6X6	6X6
	6	6X6	6X6	6X6
	8	8X6	8X8	10X6
	10	10X6	10X8	10X8
	12	10X12	10X12	10X12
	16	10X12	12X12	12X12

Note: Listed Differential indicates differential pressure in full closed position for ON-OFF service. Control Differential is assumed to be 50% of listed differential pressure at 50% open position.

RHPA-DA TORQUE OUTPUT - 90PSIG EFFECTIVE SUPPLY

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

MODEL	TORQUE FACTOR			
	ENDING TORQUE (in-lbs)	RUNNING TORQUE (in-lbs)	ENDING TORQUE (nm)	RUNNING TORQUE (nm)
5x4	3240	4801	366	542
6x4	4605	6824	520	770
6x6	6801	10239	768	1157
8x6	12385	18654	1399	2107
8x8	16359	23628	1848	2670
10x6	19329	29101	2184	3288
10x8	25449	39447	2875	4457
10x12	37454	58122	4232	6567
12x12	52875	83942	5974	9484
12X14	61864	97932	6990	11065
D10X12	74908	116244	8463	13134
D12X12	105751	167884	11948	18968
12X12/12X14	114582	177602	12946	20066
D12X14	123728	195864	13979	22130
D14X14	167248	259235	18896	29290
D12X24	216031	337099	24408	38087
D12X26	232259	365440	26242	41289
D14X24	292798	456888	33082	51621
D14X26	314795	495302	35567	55962

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

RHPA-DA TORQUE OUTPUT - 125 PSIG EFFECTIVE SUPPLY

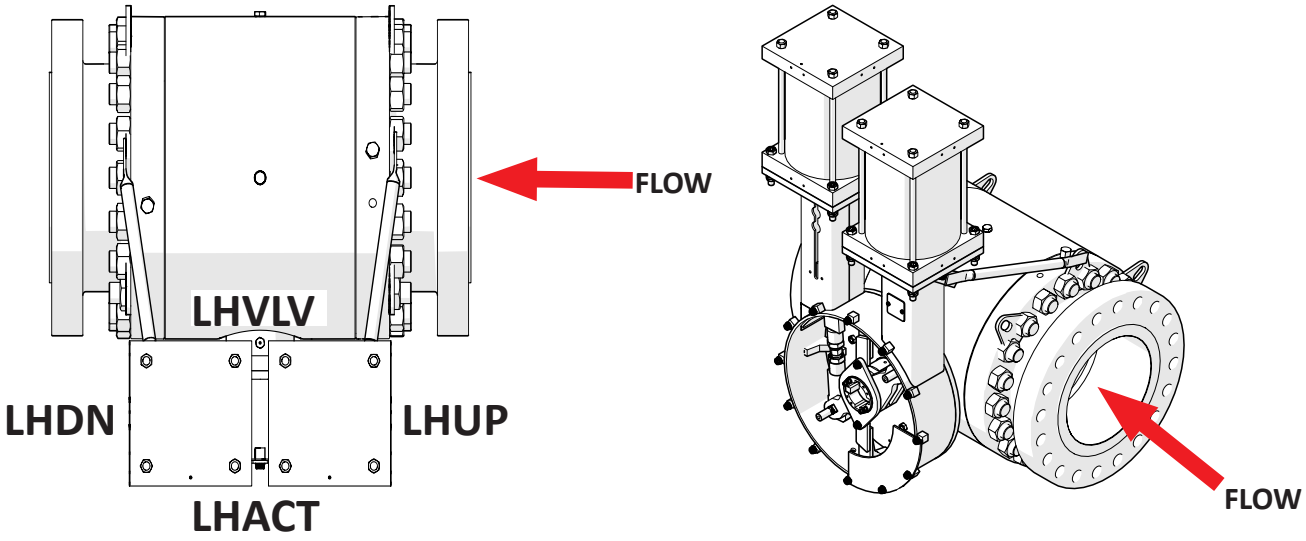
$$\text{Actuator Torque} = \frac{P_{Supply} - P_{Discharge}}{100_{psig}} \times (\text{Torque Factor})$$

MODEL	ENDING TORQUE (in-lbs)	RUNNING TORQUE (in-lbs)	ENDING TORQUE (nm)	RUNNING TORQUE (nm)
5x4	4500	6975	508	788
6x4	6396	9914	723	1120
6x6	9446	14642	1067	1654
8x6	17201	26662	1943	3012
8x8	22646	35102	2559	3966
10x6	26846	41612	3033	4702
10x8	35346	54787	3994	6190
10x12	51876	80408	5861	9085
12x12	73450	113848	8299	12863
12X14	85692	132822	9682	15007
D10X12	103752	160816	11722	18170
D12X12	146900	227695	16597	25726
12X12/12X14	159142	246670	17980	27870
D12X14	171383	265644	19364	30014
D14X14	232289	360049	26244	40681
D12X24	300043	468193	33900	52899
D12X26	322583	507555	36447	57346
D14X24	406664	634566	45947	71696
D14X26	437215	687920	49399	77725

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

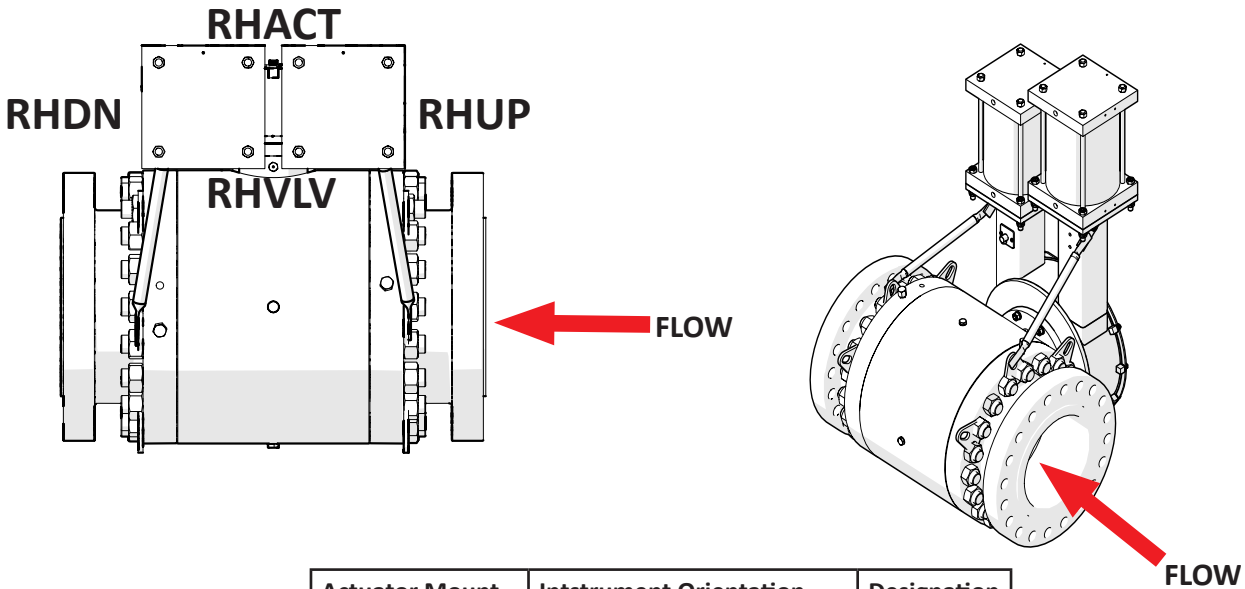
RHPA-DA ACTUATOR & INSTRUMENTATION MOUNTING ORIENTATION DESIGNATIONS

LEFT HAND MOUNT ACTUATOR (STANDARD)



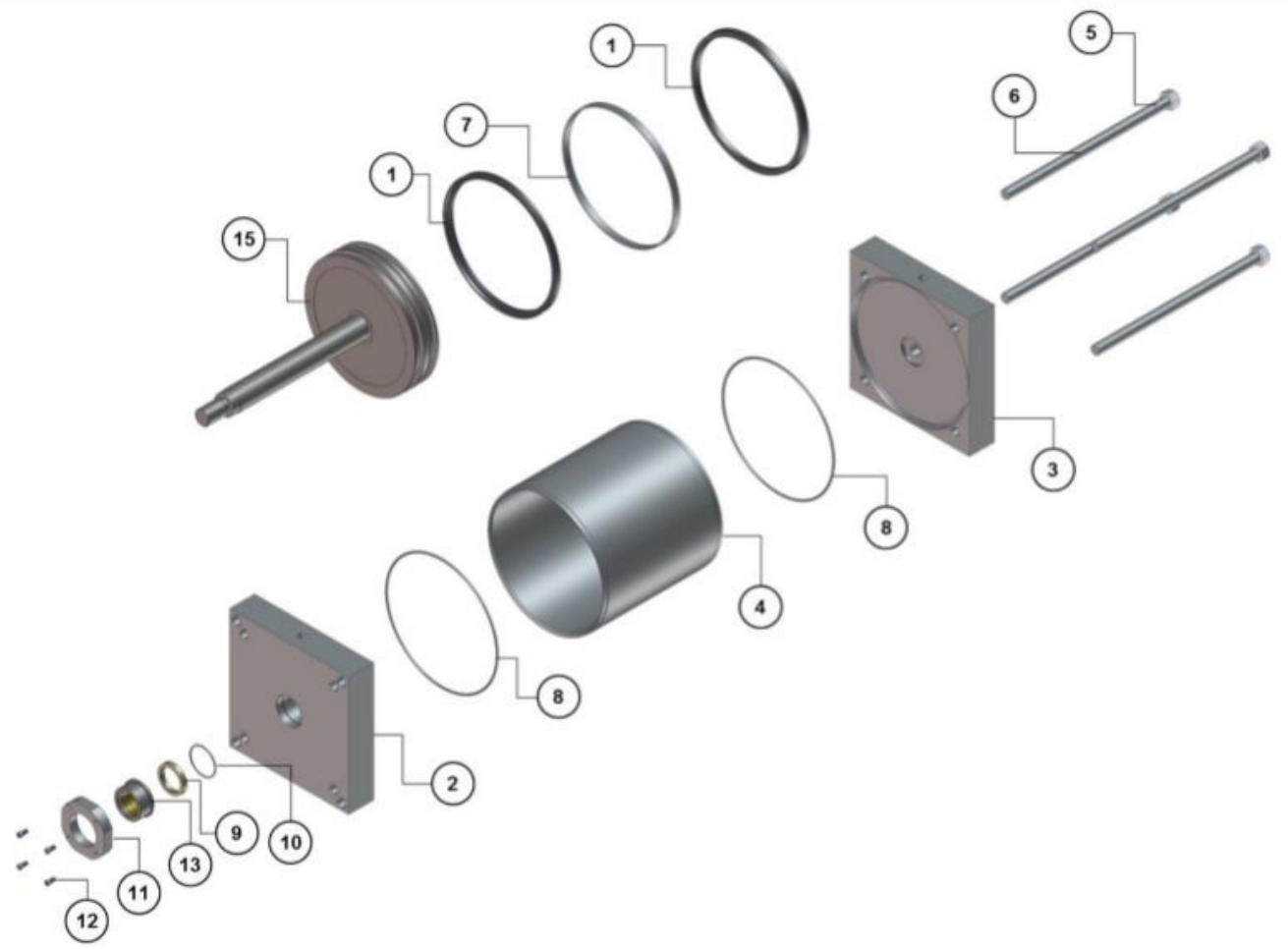
Actuator Mount	Intstrument Orientation	Designation
Left hand	Facing Valve	LHVLV
Left hand	Actuator Side	LHACT
Left hand	Facing Downstream	LHDN
Left hand	Facing Upstream	LHUP

RIGHT HAND MOUNT ACTUATOR



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

RHPA ACTUATOR CYLINDER ASSEMBLY–NO TAILROD–EXPLODED VIEW

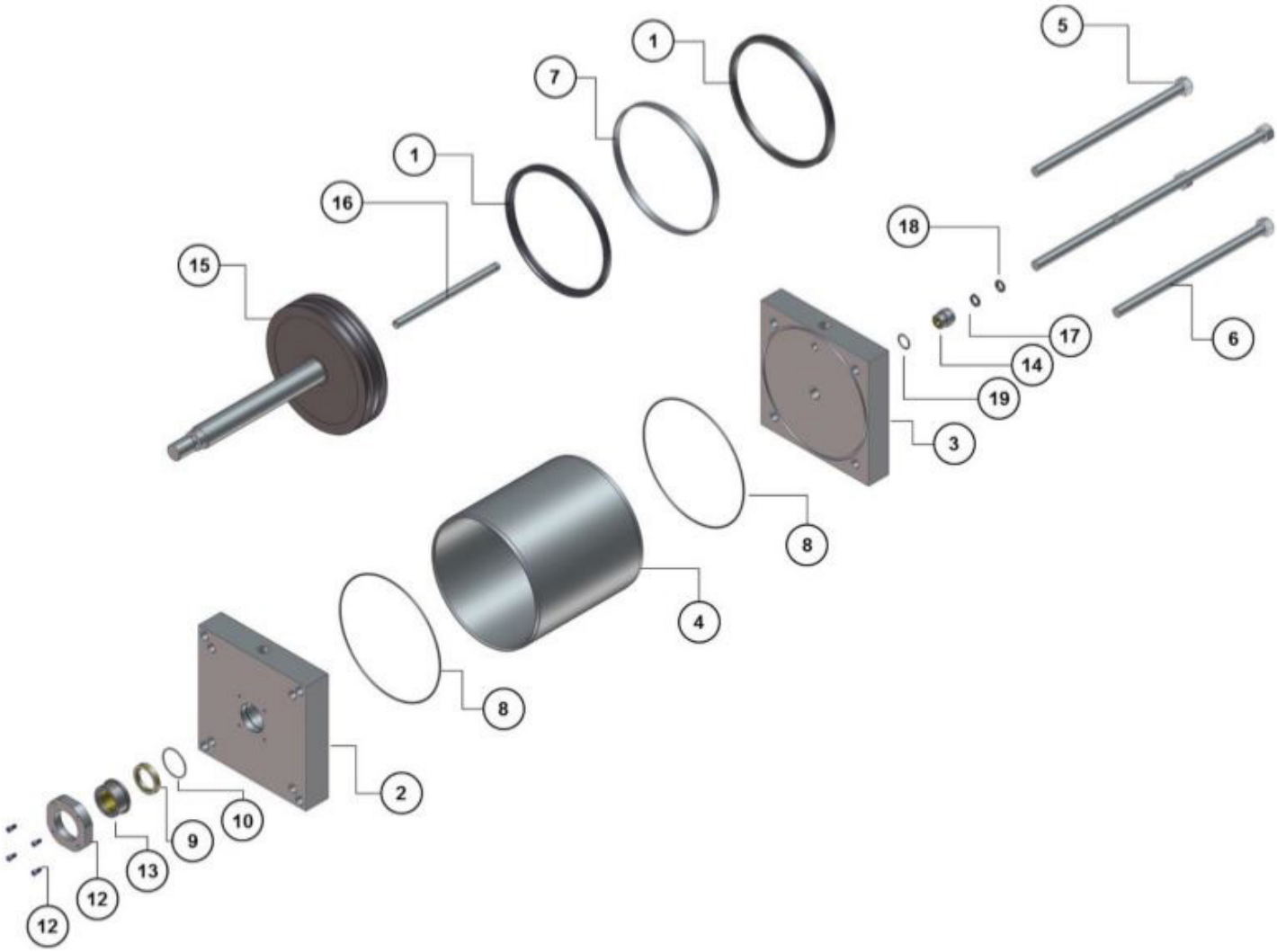


RHPA ACTUATOR CYLINDER ASSEMBLY–NO TAILROD–PARTS IDENTIFICATION

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.

RHPA ACTUATOR CYLINDER ASSEMBLY–WITH TAILROD

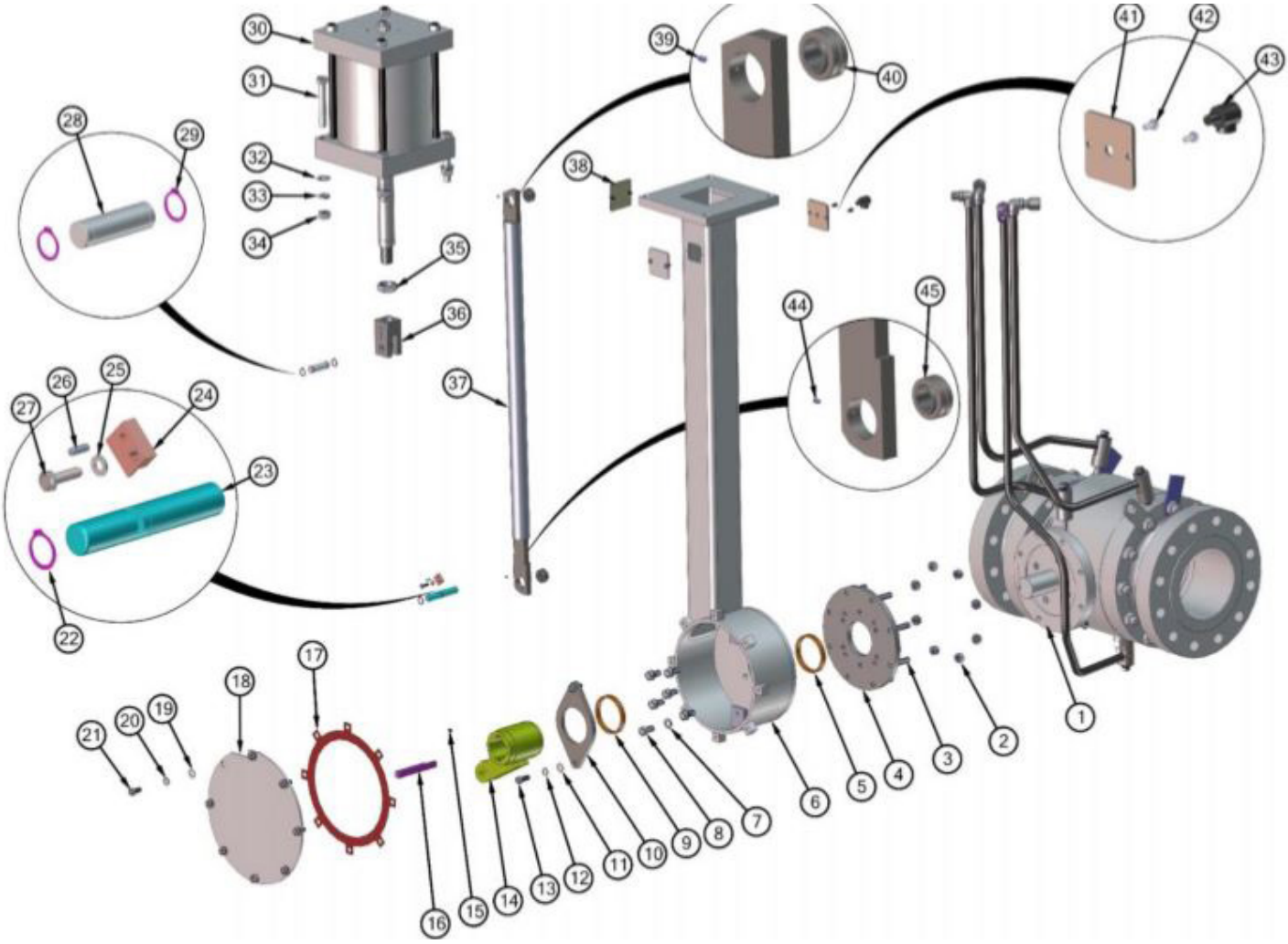


RHPA ACTUATOR CYLINDER ASSEMBLY–WITH TAILROD–PARTS IDENTIFICATION TABLE

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.

RHPA-DA BELOW GROUND ACTUATOR WITH TAILROD– EXPLODED VIEW

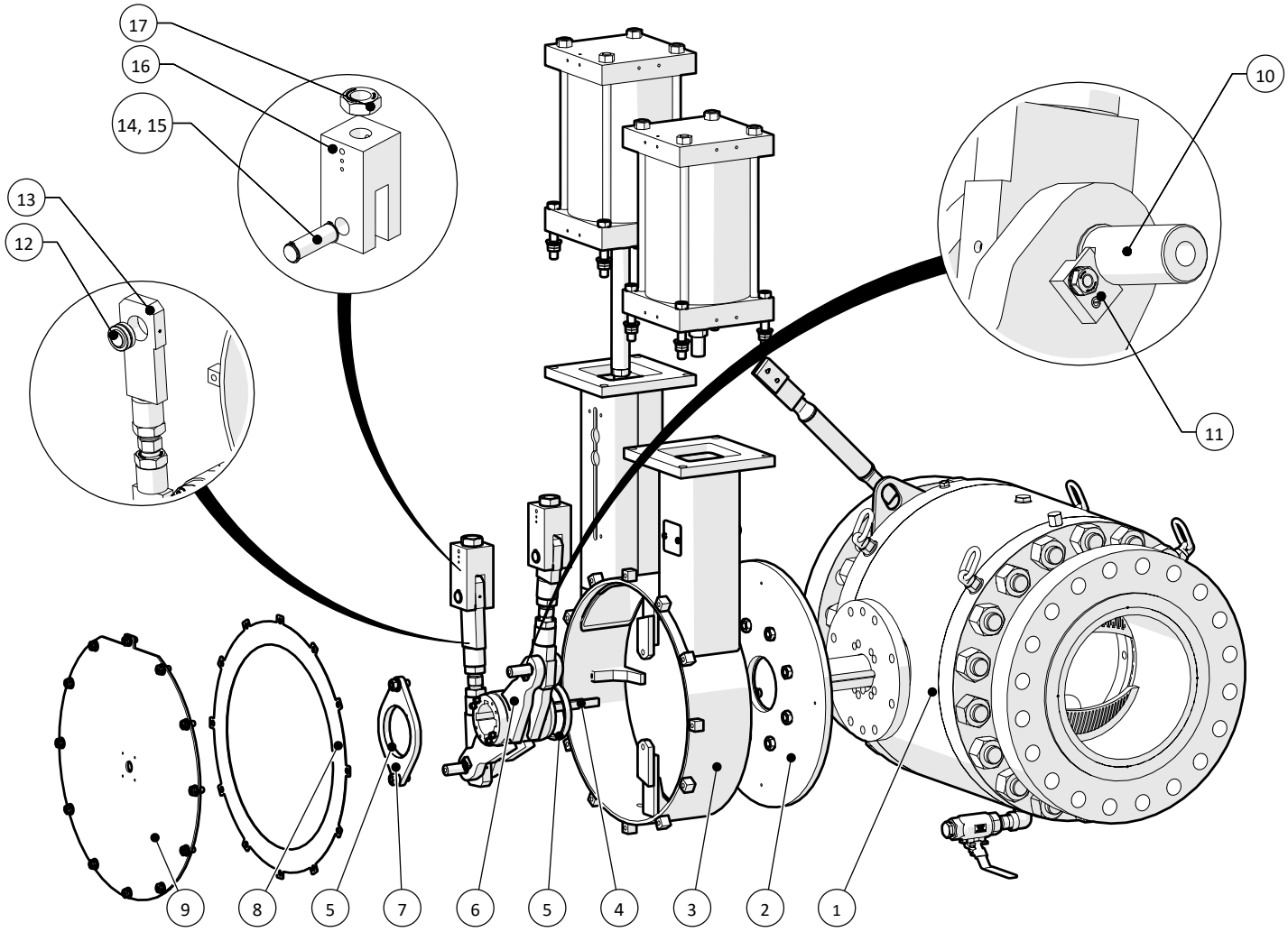


RHPA-DA BELOW GROUND ACTUATOR WITH TAILROD – PARTS IDENTIFICATION TABLE

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

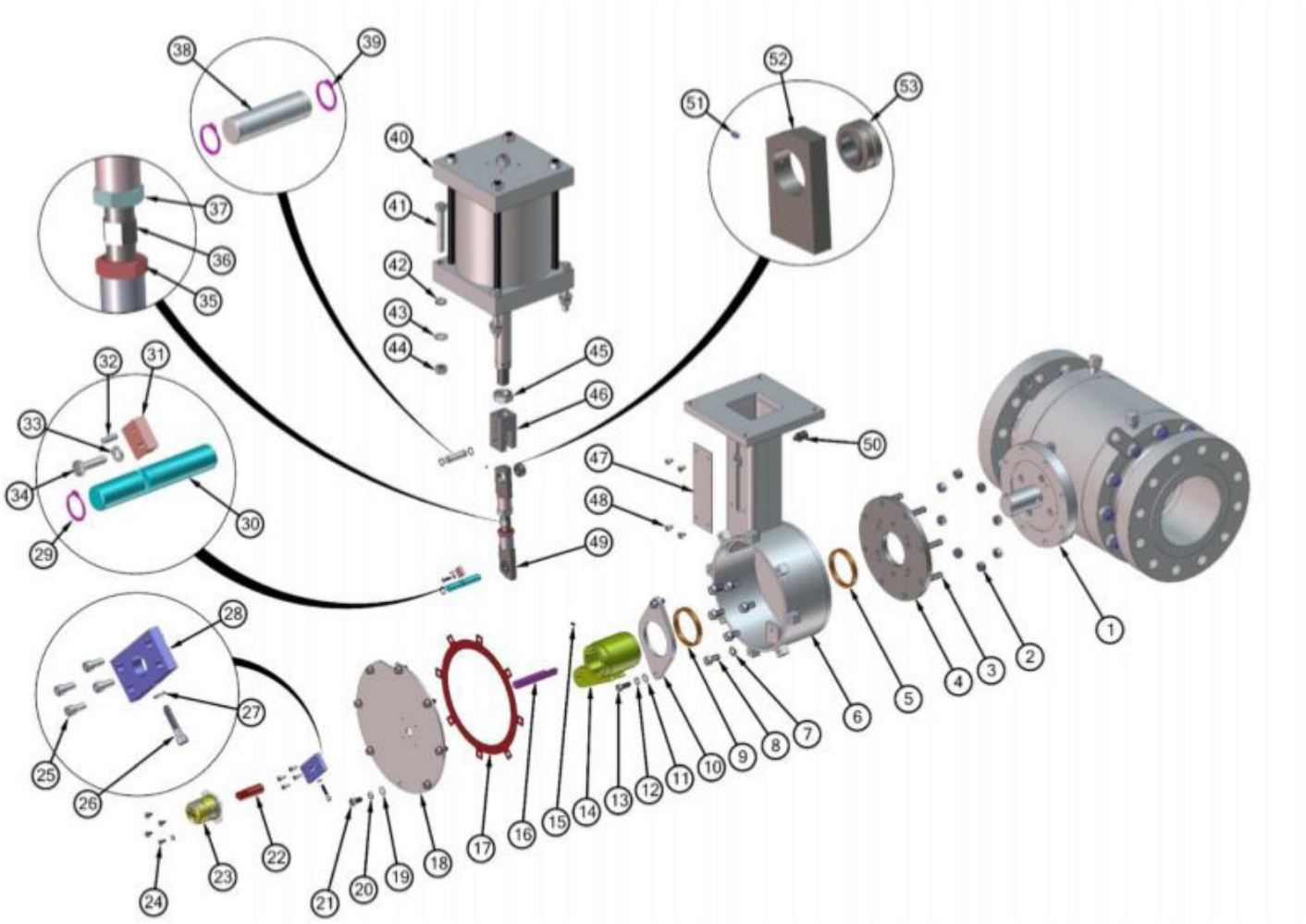
RHPA-DA ABOVE GROUND ACTUATOR DUAL–EXPLODED VIEW



ITEM	DESCRIPTION	MATERIAL
1	PRCV Pipeline Control Valve	Per Application
2	Adapter Plate	Carbon Steel
3	Actuator Housing	Carbon Steel
4	Square Key	Oversized CS Key Stock
5	Outboard Bearing	Proprietary High Duty Composite
6	Torque Arm	Carbon Steel
7	Outboard Bearing Plate	Carbon Steel
8	Cover Plate Gasket	Rubber
9	Cover Plate	Carbon Steel

10	Torque Arm Pin	Stress Proof Steel
11	Torque Arm Pin Lock	Carbon Steel
12	Spherical Bearing	Carbon Steel
13	Connecting Link Rod Eye	Carbon Steel
14	Tru Arc Ring	Alloy Steel
15	Rod Clevis Pin	Stress Proof Steel
16	Clevis	Carbon Steel
17	Cylinder Rod Jam Nut	Carbon Steel

RHPA-DA ABOVE GROUND ACTUATOR WITH TAILROD– EXPLODED VIEW



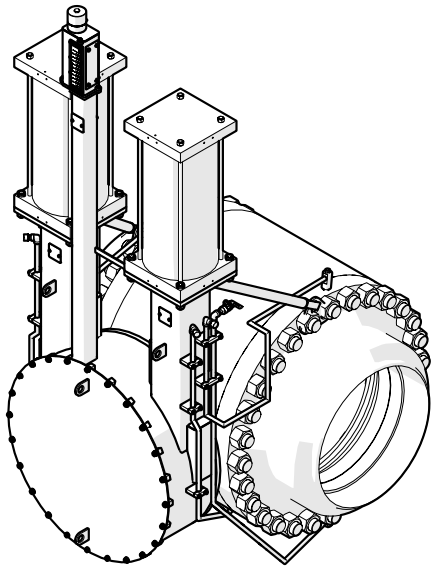
RHPA-DA ABOVE GROUND ACTUATOR WITH TAIL ROD–PARTS IDENTIFICATION TABLE

ITEM	DESCRIPTION	MATERIAL
1	PRCV Pipeline Control Valve	Per Application
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	Shaft Extension	Stainless Steel
23	Beacon	Plastic
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

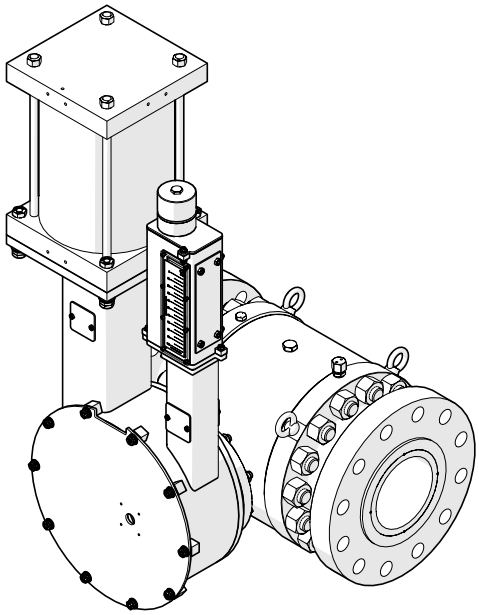
ITEM	DESCRIPTION	MATERIAL
31	Torque Arm Pin Lock	Carbon Steel
32	Torque Arm Pin Locate Pin	Stainless Steel
33	Torque Arm Pin Lock Washer	Stainless Steel
34	Torque Arm Pin Lock Screw	Stainless Steel
35	Connecting Link Jam Nut	Carbon Steel
36	Connecting Link Adjust Stud	Carbon Steel
37	Connecting Link Jam Nut	Carbon Steel
38	Rod Clevis Pin	Stress Proof Steel
39	Tru Arc Ring	Alloy Steel
40	Actuator Cylinder Assembly w Tailrod	See Figure 3.0
41	Cylinder Mounting Bolt	Carbon Steel
42	Cylinder Mounting Washer	Carbon Steel
43	Cylinder Mounting Lock Washer	Carbon Steel
44	Cylinder Mounting Nut	Carbon Steel
45	Cylinder Rod Jam Nut	Carbon Steel
46	Cylinder Rod Clevis	Carbon Steel
47	Actuator Travel Access Plate	Stainless Steel
48	Actuator Travel Access Plate Bolts	Stainless Steel
49	Connecting Link Rod Eye	Carbon Steel
50	Vent Elbow	Anodized Aluminum
51	Spherical Bearing Setscrew	Stainless Steel w Nylon
52	Connecting Link Rod Eye	Carbon Steel
53	Spherical Bearing	Carbon Steel

RHPAA-DA MODEL ISOMETRIC VIEWS

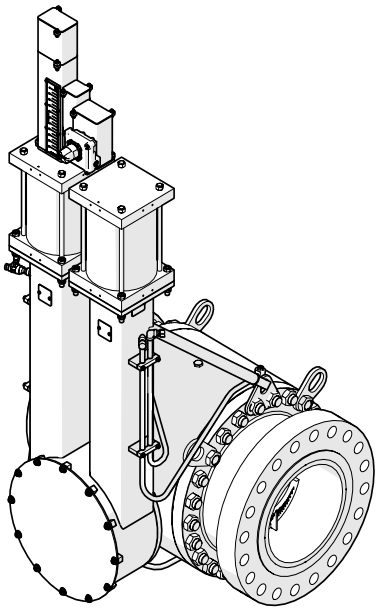
BELOW GROUND PROPORTIONAL TOPWORKS



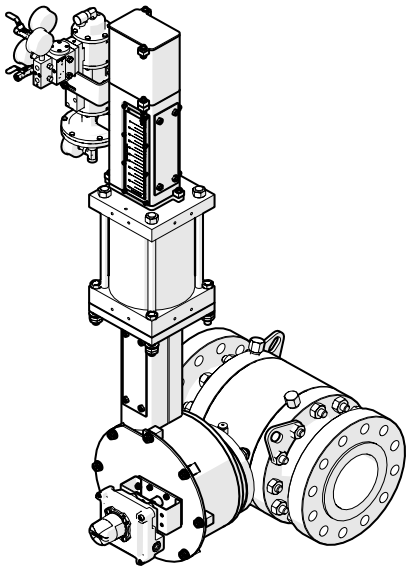
ABOVE GROUND PROPORTIONAL TOPWORKS



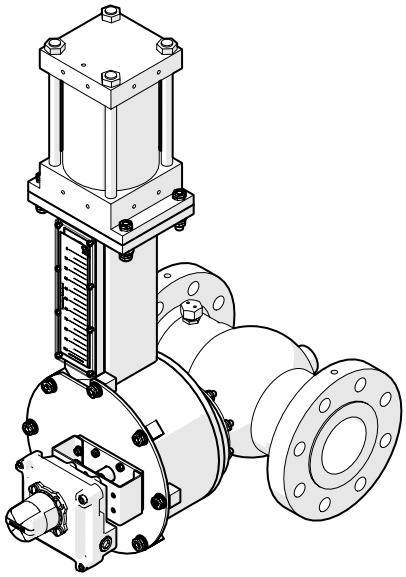
BELOW GROUND TAILROD



ABOVE GROUND TAILROD



ABOVE GROUND RISER PIPE



RPDA ACTUATOR CYLINDER REPAIR KITS-UNIVERSAL

Actuator Cylinder Bore (in.)	Repair Kit	Description
5	RK-0090	5” Dia Cylinder Repair Kit
5	RK-0090-LT	5” Dia Cylinder Repair Kit - Low Temp. U-Cups
6	RK-1095	6” Dia Cylinder Repair Kit
6	RK-1095-LT	6” Dia Cylinder Repair Kit - Low Temp. U-Cups
8	RK-1100	8” Dia Cylinder Repair Kit
8	RK-1100-LT	8” Dia Cylinder Repair Kit - Low Temp. U-Cups
10	RK-1110	10” Dia Cylinder Repair Kit
10	RK-1110LT	10” Dia Cylinder Repair Kit - Low Temp. U-Cups
12	RK-1120	12” Dia Cylinder Repair Kit
12	RK-1120-LT	12” Dia Cylinder Repair Kit - Low Temp. U-Cups
14	RK-1130	14” Dia Cylinder Repair Kit
14	RK-1130-LT	14” Dia Cylinder Repair Kit - Low Temp. U-Cups
All cylinders	RK-1150	Hanna 5/8 Tailrod Kit
All Cylinders	RK-1155	Hanna Tailrod Bushing Assembly

Notes:

1. Includes ALL available seals and wear components for RHPA 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 -40°F to +160°F

ADDRESS: VRG Controls, LLC.
Lake Zurich, IL 60047, USA
TOLL FREE: (800) 844-FLOW-VRG
FAX: (208) 246-0304
E-MAIL: sales@vrgcontrols.com
WEBSITE: vrgcontrols.com