# Spring Return FLAT YOKE ACTUATORS

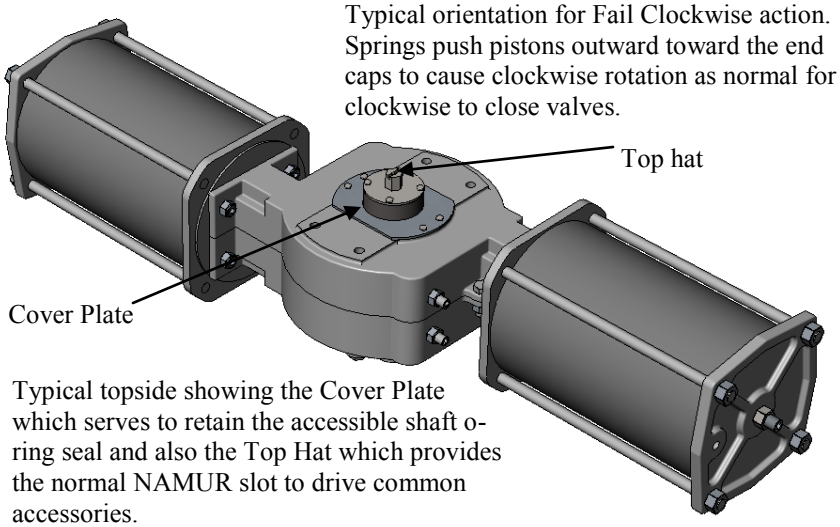
## Installation, Operating & Maintenance Instructions

## IOM-FY-SR-070309

**Basics**:

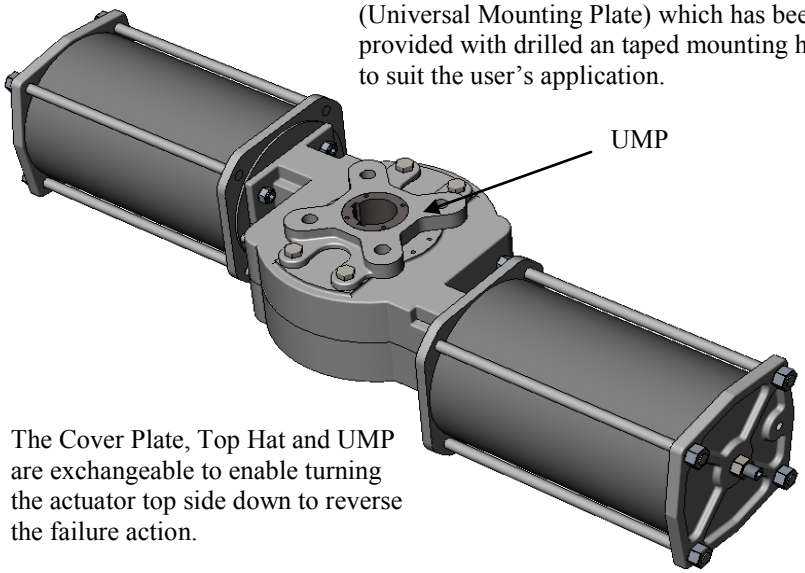
- Flat Yoke actuators offer balanced weight, long life and 'in-place' seal replacement.
- Also, they are able to be turned top side down to reverse the action from Fail Closed to Fail Open as both top and bottom sides are of identical geometry.
- Fully accessible, Bi-directional Travel Stops stop piston motion directly without incurring added stress on the shaft, yoke lever or piston rod - Unlike traditional scotch yoke designs which stop yoke rotation, thereby applying the full force of the piston to produce bending and compressive forces onto the shaft bushings, shaft, yoke lever, piston rod, rod seals and rod bushings.
- There are two opposing yoke levers in the FLAT YOKE actuator, and two diametrically symmetric pistons that apply equal forces in opposite directions to the yoke arms, thereby eliminating side loading of the actuator shaft and shaft bushings.
- Seals are eliminated except for the piston o -rings and one weather seal o-ring at each end of the shaft. The piston o-rings are replaceable by removing the cylinder while the actuator remains mounted on the valve. Shaft o-rings are readily replaced without disassembly of the actuator as they are held in place by the UMP (bottom side) and cover plate (top side).

Typical orientation for Fail Clockwise action. Springs push pistons outward toward the end caps to cause clockwise rotation as normal for clockwise to close valves.

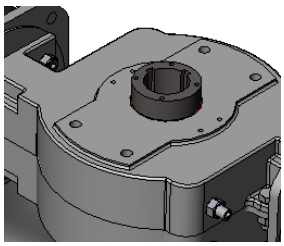



Typical topside showing the Cover Plate which serves to retain the accessible shaft o-ring seal and also the Top Hat which provides the normal NAMUR slot to drive common accessories.

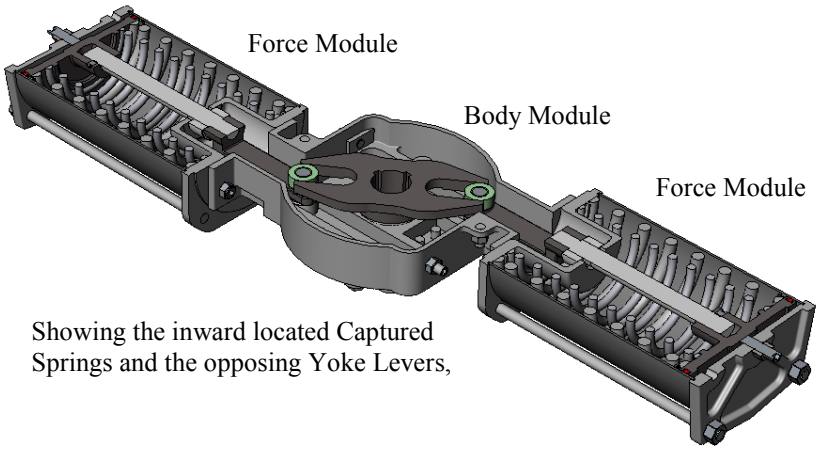
Typical bottom side showing the UMP (Universal Mounting Plate) which has been provided with drilled an taped mounting holes to suit the user's application.




The Cover Plate, Top Hat and UMP are exchangeable to enable turning the actuator top side down to reverse the failure action.



Top and Bottom sides of the body module are identical - shown without UMP and Cover Plate.




Showing the inward located Captured Springs and the opposing Yoke Levers,

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**Installation**:

- The FLAT YOKE weight balanced design provides for easier lifting and handling than traditional scotch yoke actuators. Slings may be wrapped around the bodies, inward of the Force Module on smaller sizes. Sizes F375 and larger have 2 diametrically opposite lifting eye holes which pass entirely through the body module in a manner that places no tensile loading on the actuator components.
- Based on user requirements and valve mounting geometries, the FLAT YOKE actuator shafts may be machined to mate directly with the valve stem. Otherwise, they are typically bored and keyed as per applicable dimensional drawings.
- After installation onto the valve, adjust inward and outward travel stop screws to obtain the desired valve travel. A minimum of 5 degrees of over travel is available on all FLAT YOKE actuators.

**Travel Stop Adjustment:**

Outward adjustment; Loosen jam nuts on the travel stop screw located on each end cap, back off one screw then the other (it may be necessary to apply low supply pressure to the end cap ports to reduce force against screws). Continue until desired outward piston travel is obtained. One stop screw will be looser than the other. Turn looser screw inward until snug, then 1/4 additional turn. Tighten jam nuts.

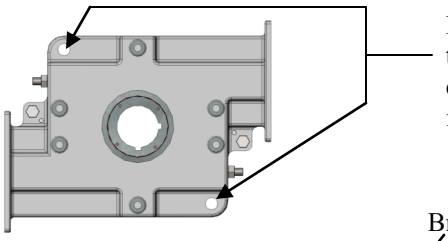
Inward adjustment; Loosen jam nuts on all 4 inward travel stop screws and turn screws outward. Apply supply pressure(5 psig) until desired travel is achieved. Turn all 4 screws inward until each contacts their respective clevis end. Tighten jam nuts.

- FLAT YOKE actuators may be installed in any orientation.

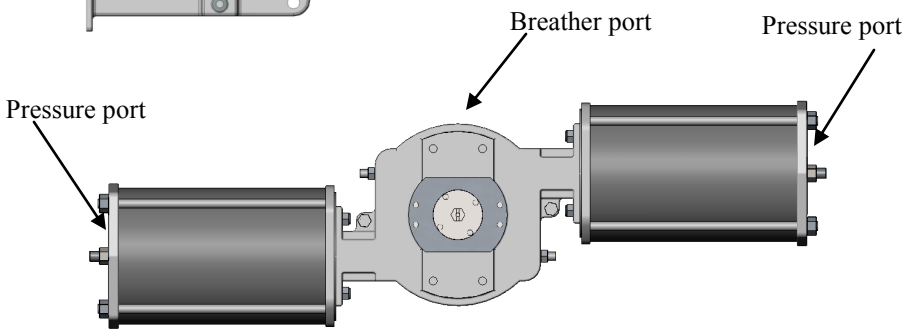
**Operation**:

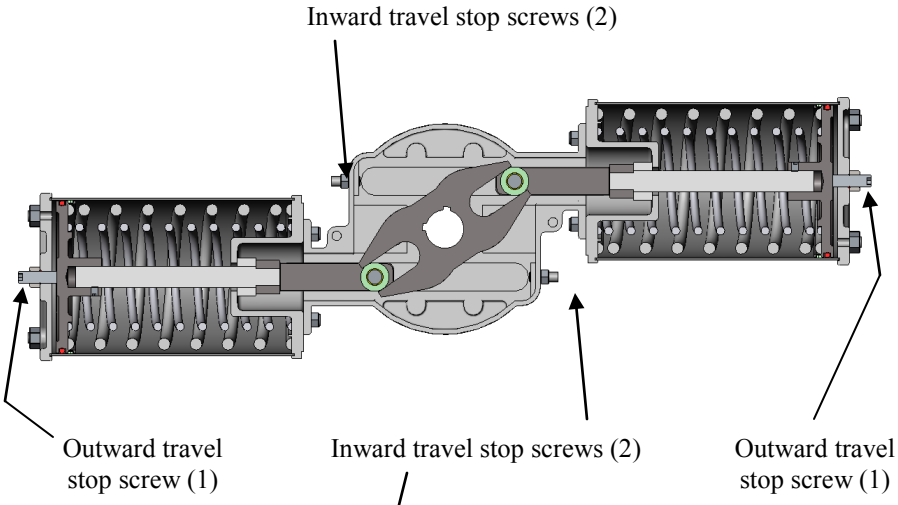
Two air supply connections are required as well as one breather port. To stroke with pressure, media (typically air, but also water or hydraulic fluid) flows into the end cap ports, pushing the pistons inward while compressing the springs and providing output torque to operate the valve. When fully inward, the ends of each clevis will contact individual travel stop screws to limit motion while applying no additional stress to the yoke arms and shaft bushings.

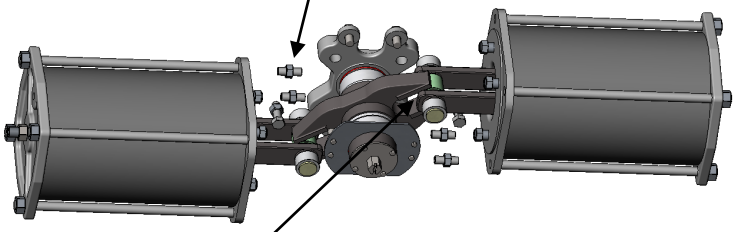
Upon exhaust of pressure, the springs push the pistons outward until the pistons contact end cap



Typical lifting eye holes of sizes F375 and larger pass entirely through the housing allowing lifting eye bolts and nuts in a non-stress inducing arrangement



Both ends of the Force Module Clevis (replaces piston rod found in typical scotch yoke actuator) make contact with individual travel stop screws to prevent side loading

**Maintenance (Piston seal Replacement)**:

Because FLAT YOKE actuators have captured springs and no internal dynamic pressure retaining seals (including no piston rod seals and no seals on rods passing through the pistons) all wearable pressure retaining seals (only the pistons o-ring seals are subject to wear) are replaceable while the actuator remains mounted on the valve.

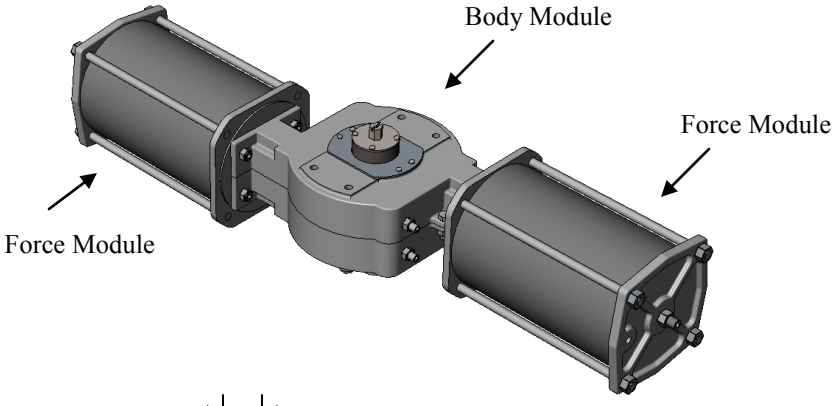
Also, because the actuator need not be removed from the valve, the calibration of mounted accessories is undisturbed during seal replacement.

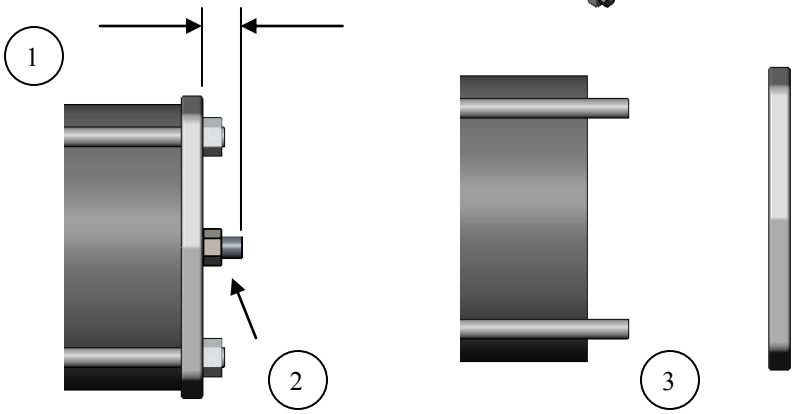
**Instructions** -

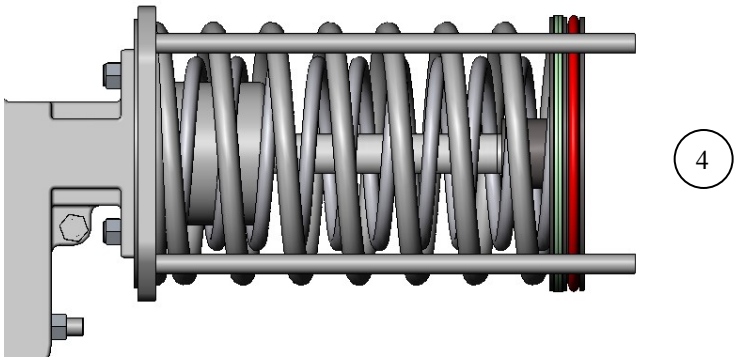
Complete the seal replacement on one force module, then do the other.

Release all supply pressure and disconnect all piping to the end cap ports.

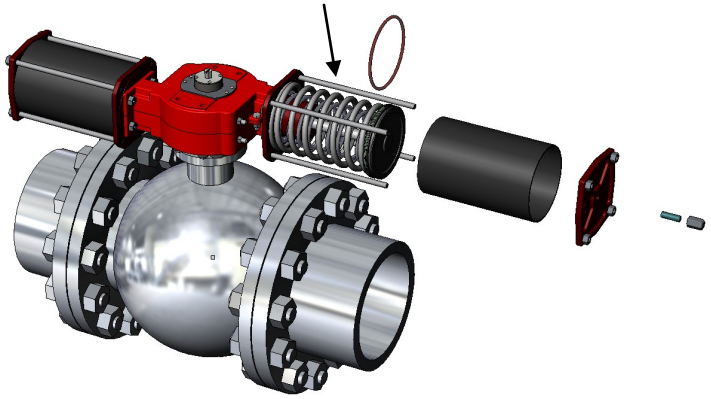
1. Measure extension of the travel stop screw
2. Loosen the travel stop jam nut and turn the travel stop screw counter clockwise until it turns freely (no longer contacts the piston)
3. Remove the end cap tie rod nuts and the end cap
4. Remove the cylinder
5. Remove the piston o-ring, clean the o-ring groove and install a new lubricated o-ring.
6. Clean and inspect the cylinder bore. If damaged, turn cylinder end for end, lubricate the bore and re-install (each FLAT YOKE actuator inherently contains a spare cylinder surface on each force module as the pistons travel only in the outer half of the cylinder).
7. Re-install end cap and tie rod nuts and tighten to 25 pound foot torque for each 1" of tie rod diameter
8. Turn travel stop screw clockwise until the height is equal to the original value.
9. Tighten jam nut
10. Proceed to second force module




Captured Springs allow safe removal of End Cap and Cylinder for Piston O-Ring replacement



**Maintenance (Complete Disassembly)**:

It is extremely unlikely that the complete disassembly of a FLAT YOKE actuator will be required.

Note that the Springpaq portion of the force module is built in a manner as to not be disassembled. **If ever there is a problem with a spring, the entire Springpaq is to be replaced - no exceptions - DO NOT attempt to disassemble a Springpaq.**

Before beginning disassembly, remove the actuator from the valve and also remove all accessories.

Exhaust all pressure to the end caps and remove all piping.

**Instructions** -

1. Remove the hex nuts which secure each force module to the body module.
2. Simultaneously pull each force module away from the body module. Note that no mechanical disassembly is required between the force module drive components and body module components. Just pull the force modules away from the body module.

FLAT YOKE actuators are designed so that neither force module is removable if the other remains fastened to the body module. For either force module to disengage from the yoke lever, the yoke must over-rotate but it is prevented from doing so unless the second force module is simultaneously removed.

3. Remove the two fasteners used to join the body halves

4. Lift off the top body half

Note that neither the cover plate nor travel stop screws need be removed. Removal of the Top hat assembly is optional.

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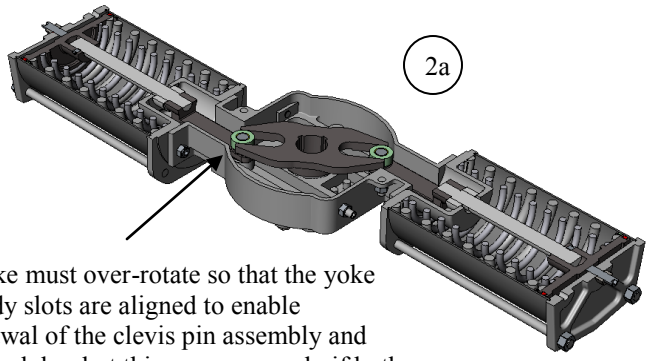
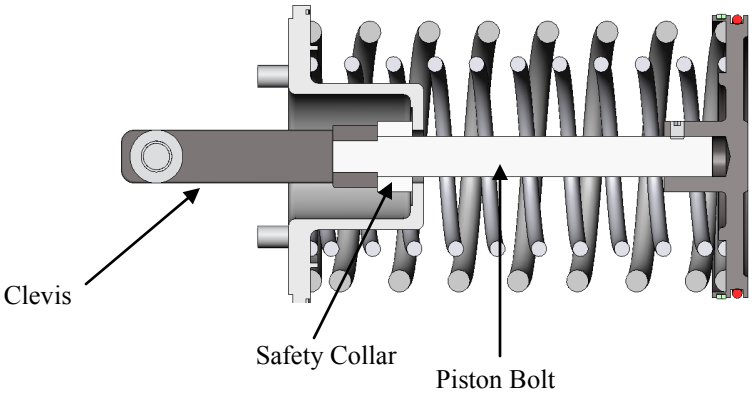
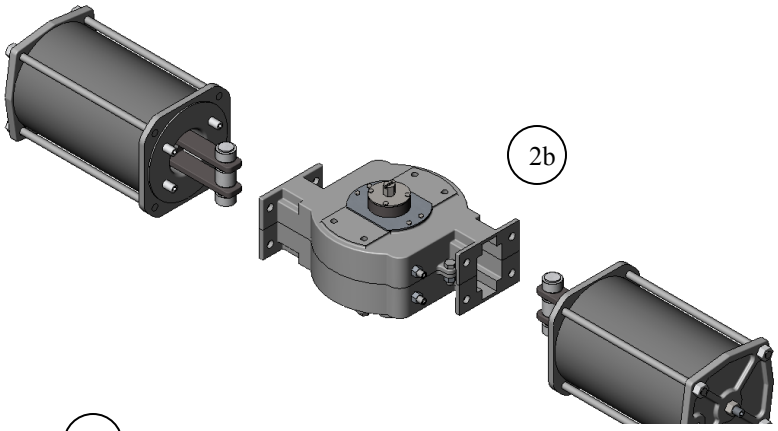
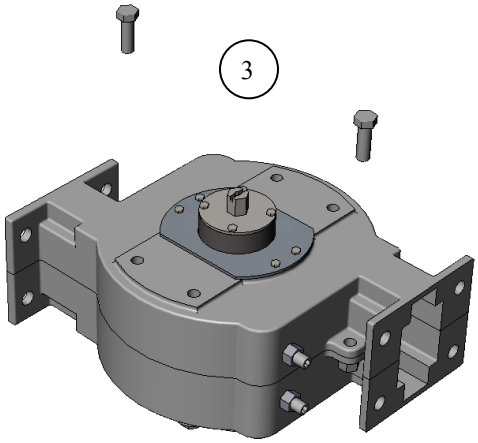


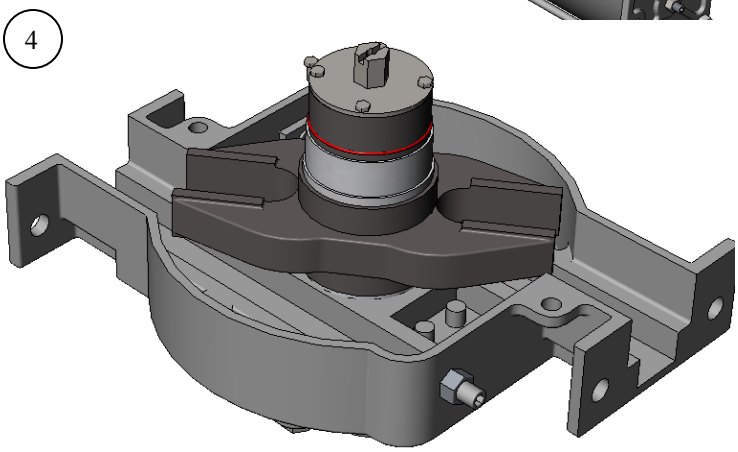

The yoke must over-rotate so that the yoke and body slots are aligned to enable withdrawal of the clevis pin assembly and force module - but this can occur only if both force modules are withdrawn simultaneously

**Springpaq** = Force module without cylinder, end cap and tie rods
For your safety DO NOT ATTEMPT to DISASSEMBLE any Springpaq

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**Maintenance (continued)**:

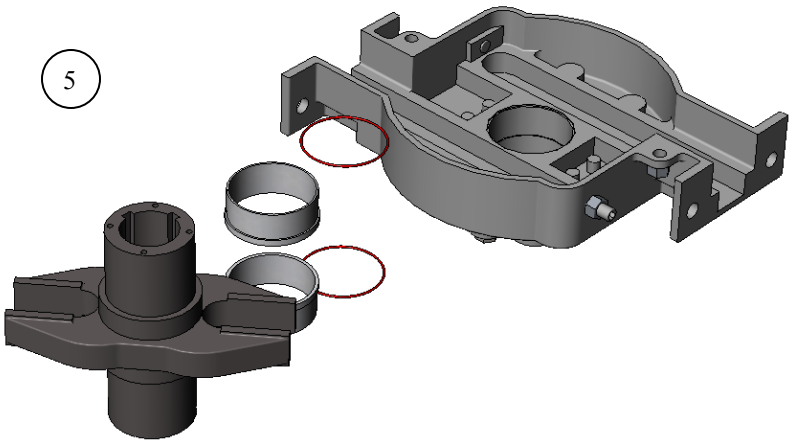
5. Remove the yoke/shaft along with shaft bushings and rain guard o-ring seals

6. Inspect parts for wear, replace as appropriate

Because of designed force balance, there is no side loading on the shaft or bushings, thus neither are likely to exhibit any wear.

As visible, the entire body module consists of 3 major parts (bottom body half, top body half and the yoke)

In addition there are two shaft bushings and two non-pressured o-rings and a few fasteners.

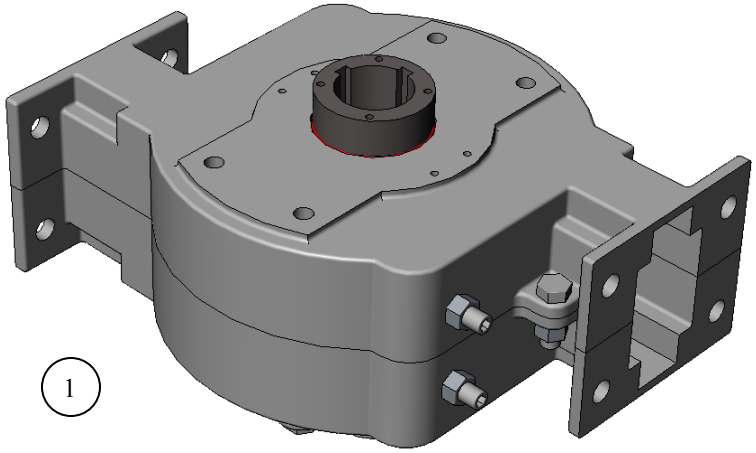


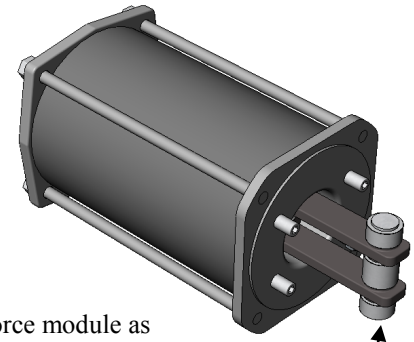

**Re-Assembly**:

Note that we have not changed the travel stop screw settings. If the screws are to be removed, first measure their respective extension from the body and reset them to these heights upon reassembly. It is likely that no adjustment will be required upon re-mounting on the valve.

Note also that no lubrication is required to reassemble FLAT YOKE actuators. In fact, only the piston o-ring seals are recommended to be lubricated.

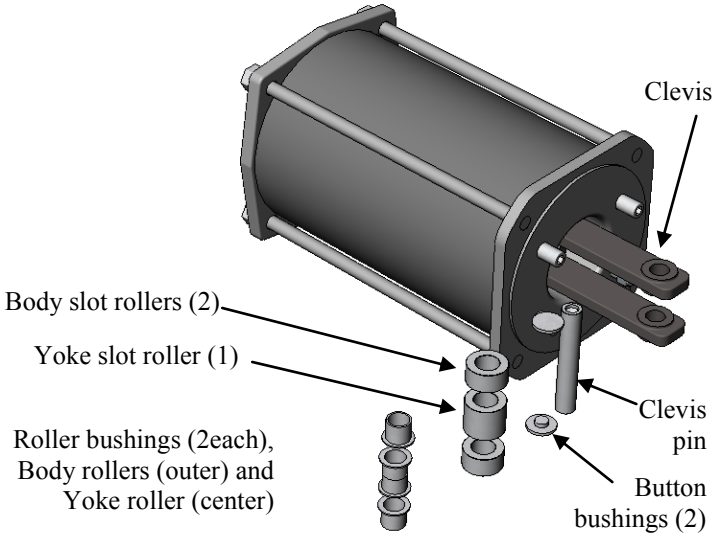
1. Reverse the above steps to reassemble the body module.
2. Before re-installing the force modules, inspect the clevis pin, rollers and bushings. Replace any components as necessary. The body module does not need to be disassembled to obtain access to the clevis pin assembly.
3. Over rotate the yoke arms to align the yoke slots with the body slots. Simultaneously install both force modules. As with disassembly, no mechanical attachment is required other than the exposed flange fasteners.



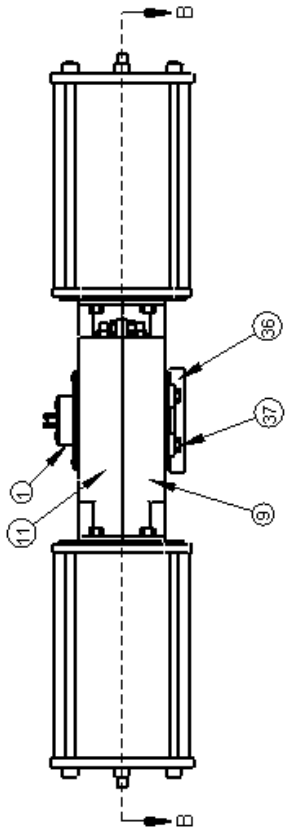
Force module as removed from the body module

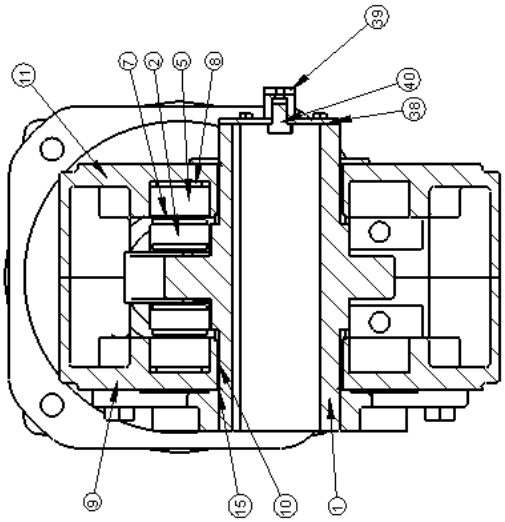
Clevis, pin, rollers and bushings assembly

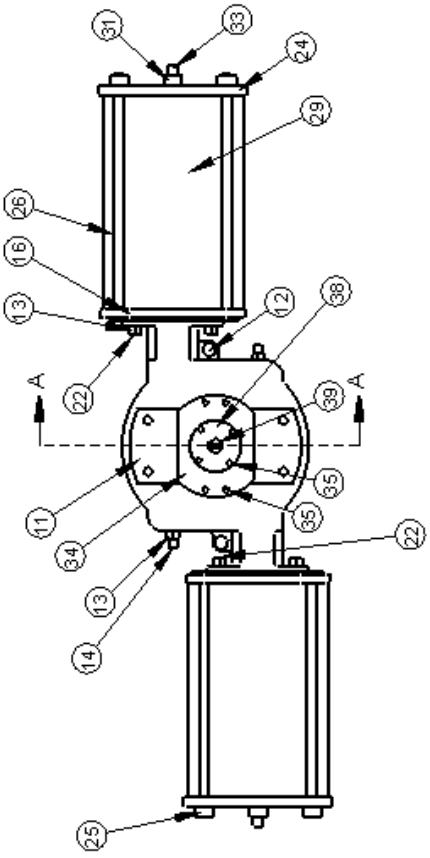


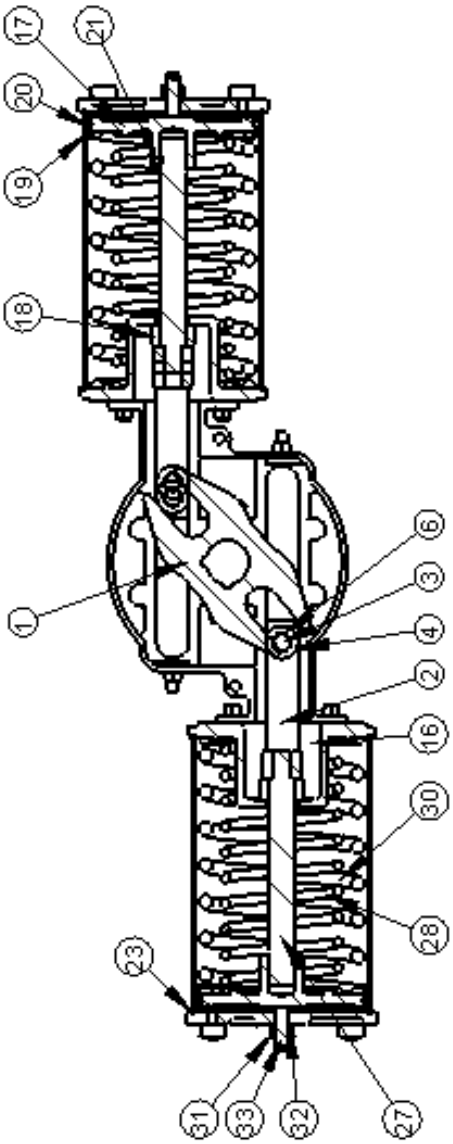

Note: depending upon the service, some FLAT YOKE actuators have no roller bushings as 316SS rollers roll directly on Nitronic 60 pins

# IOM-FY-SR-070309 Typical Materials



| ITEM NO. | PART NUMBER | Typical materials FD Series Option - All SS Fasteners | Typical Materials FS Series | QTY. |
|---|---|---|---|---|
| 1 | Yoke - Shaft and Arms | Ductile Iron | CF8M | 1 |
| 2 | Clevis | Ductile Iron | CF8M | 3 |
| 3 | Clevis Pin | 18-8 SS | Nitronic 60 | 3 |
| 4 | Yoke Roller | 18-8 SS | 316 SS | 3 |
| 5 | Body Roller | 18-8 SS | 316 SS | 6 |
| 6 | Bushing - Yoke roller | Igus T Series | NA | 6 |
| 7 | Bushing - Body roller | Igus T Series | NA | 6 |
| 8 | Button Bushing - Clevis Pin | Acetal | Acetal Option: Peek | 6 |
| 9 | Body - Bottom Side | Ductile Iron | CF8M | 1 |
| 10 | Bushing - Shaft | Acetal | Acetal Option: PEEK | 2 |
| 11 | Body - Top Side | Ductile Iron | CF8M | 1 |
| 12 | Cap Screw | Steel, plated | 316 SS | 2 |
| 13 | Hex Nut | Steel, Plated | 316 SS | 14 |
| 14 | Socket Set Screw | Steel, Plated | 316 SS | 4 |
| 15 | O-Ring | Buna Option: EPDM, VITON | Buna Option: EPDM, VITON | 2 |
| 16 | Spring Retainer | Ductile Iron | CF8M | 2 |
| 17 | Piston | Ductile Iron | CF8M | 2 |
| 18 | Safety Collar | Steel, Plated | 316 SS | 2 |
| 19 | Wiper Ring | RPTFE | RPTFE Option: PEEK, UHMWPE | 4 |
| 20 | Piston o-ring | Buna Option: EPDM, VITON | Buna Option: EPDM, VITON | 2 |
| 21 | Socket Set Screw | Steel, Plated | 316 SS | 2 |
| 22 | Socket Set Screw | Steel, Plated | 316 SS | 8 |
| 23 | Cylinder Seal Ring | PTFE | PTFE Option: PEEK, UHMWPE | 4 |
| 24 | End Cap | Ductile Iron | CF8M | 2 |
| 25 | Hex Nut | Steel, Plated | 316 SS | 8 |
| 26 | Tie Rod | 18-8 SS | 316 SS | 8 |
| 27 | Piston Bolt | Steel, Plated | 316 SS | 2 |
| 28 | Spring | Chrome Silicone Powder Coated | Chrome Silicone Powder Coated Option: Non-Coated or SS | 2 |
| 29 | Cylinder | Amalga Composite Option: 316 SS | 316 SS Option: Amalga Composite | 2 |
| 30 | Spring | Chrome Silicone Powder Coated | Chrome Silicone Powder Coated Option: Non-Coated or SS | 2 |
| 31 | Hex Nut | Steel, Plated | 316 SS | 2 |
| 32 | O-Ring | Buna Option: EPDM, VITON | Buna Option: EPDM, VITON | 2 |
| 33 | Socket Set Screw | 18-8 SS | 316 SS | 2 |
| 34 | Cover plate | Steel, Plated | 316 SS | 1 |
| 35 | Hex Head Cap Screw | Steel, Plated | 316 SS | 8 |
| 36 | Universal Mounting Plate | Ductile Iron | CF8M | 1 |
| 37 | Hex Head Cap Screw | Steel, Plated | 316 SS | 4 |
| 38 | Plate - Top Hat Base | Steel, Plated | 316 SS | 1 |
| 39 | Top Hat | 18-8 SS | 316 SS | 1 |
| 40 | Hex Head Cap Screw | Steel, Plated | 316 SS | 1 |

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