Sales Guide
January 2016
RGS011110-7 Rev. 0

Bettis RGS Q and F-Series Actuators

Mitigating Factors Why Were These Actuators Designed

BETTIS

EMERSON

Reviewing the Bettis RGS-Series Actuators

Mitigating Factors that Led to the Bettis RGS Q-Series Actuator Design

Considering Typical Rack and Pinion Actuators:

Piston axis aligns with the center of the body bore and as such, locate the rack gearing off center with the piston. When pressure is applied, a cantilever force occurs forcing the piston against the cylinder walls, thereby creating friction and wear. The added friction denigrates the actuator's ability to perform satisfactorily on throttling services and causes a high degree of stiction when intending to initiate motion.

- The cylinders of all Bettis RGS-Series actuators are offset to align with the pitch circle diameter of the pinion gear. In this way, cantilevering forces are completely eliminated.

Sliding friction occurs between the piston and cylinder wall. Rack and pinion designs locate polymeric bushings on the pistons to reduce friction and wear but, while friction is reduced, it and the accompanying stiction is not eliminated.

- Bettis RGS-Series actuators employ rollers such that the rack motion is supported in a manner that effectively eliminates sliding friction, thereby reducing stiction to near zero.

Due to sliding friction, rack and pinion actuators are seldom used in throttling control applications.

- The low friction and close tolerances of the Bettis RGS-Series actuators make them ideal for throttling and a thorough hole in the shaft enables the actuator to "swallow" the extended splined shafts of 1/4 turn control valves and to provide a compact, corrosion and vibration resistant alternative to diaphragm actuators in critical control applications.

Rack and Pinion actuator springs are located outward of the pistons. To operate, pressure is applied in the body center to push the pistons outward against the springs. The actuator shaft seals are pressurized every cycle such that when they wear, the actuator requires removal from the valve followed by complete disassembly and rebuild or replacement.

- All Bettis RGS-Series springs are located inward of the pistons (and are an integral parts of the captured spring assembly) such that pressure is applied between the end caps and pistons with the shaft seals never seeing pressure. If the shaft seals wear or are even omitted from the actuator, no shaft leakage will occur.

Rack and Pinion actuators exhibit a strong tendency to cause a high seating torque valve to "jump" off the seat when opening from the closed position. This is caused by the high volume of compressed air that fills the void between the pistons as pressure is built to overcome the valve torque. Once the valve is unseated, there is little torque resisting further opening of the valve and the compressed air is free to quickly force the pistons apart, that is jump open.

- The Bettis RGS Q and F-Series pistons are very near the end cap when the spring closed or double-acting valve is closed. The relatively small air volume has much less energy to release with the result being far less opening jump.

Shaft bushings in rack and pinion actuators are notoriously ineffective as they hardly exceed the shaft in diameter. The shaft contains the shaft seals and therefore fits very close to the shaft hole in the body. Even a small amount of corrosion could cause shaft seal leakage or complete binding of the shaft to the body.

- Bettis RGS-Series actuator shafts are supported by thick wall bushings that bear the loads as well as containing the seals. There is no possibility of the Bettis RGS-Series shaft touching the body.

Many rack and pinion actuator shafts are of larger diameter at the bottom than at the top and the bottom must accommodate fitting the valve shaft while the top must accommodate accessory mounting. When pressure is applied to push the pistons apart, it acts on the area imbalance resulting in a pistoning effect that forces the shaft toward the bottom of the actuator. Retaining rings located on the extended portion of the top end of the shaft serve to prevent axial shaft movement. Friction and wear between the rotating ring and body leads to component failure and unscheduled downtime.

- Bettis RGS Q-Series actuators have female drive geometries on both ends of the shaft. A unique conversion kit converts the top side female to an accessory drive, meeting all international mounting standards while adapters serve to convert the oversized, double-square, female geometry to match the valve shaft. Bettis RGS Q and F-Series actuators can all be turned top side down to reverse the spring-fail direction of travel. This results in convenience to the user but also balances the shaft with zero axial forces acting on the shaft.

Proprietary seals are used in many actuators forcing users to purchase overpriced repair kits while waiting for delivery from the sole source actuator manufacturer.

- The sole dynamic seals in Bettis RGS-Series spring-return actuators are the piston O-rings. These are commonly available seals that can be purchased locally for quickness and low cost – and we will share their descriptions to enable local, low cost, rapid sourcing (or we obviously will sell seal kits).

Upon failure of any component, rack and pinion actuators require removal from the valve plus complete disassembly for repair (or replacement).

- The piston O-ring is the only dynamic seal in Bettis RGS-Series spring-return actuators and is replaceable while the actuator remains on the valve by simply removing the end cap and pulling off the cylinder. There is no need to remove the actuator
  from the valve.

If in service, contaminants cause damage to the rack and pinion actuator cylinder bore, the actuator must be discarded.

- Bettis RGS-Series spring-return actuator cylinders have sufficient length that the inward portion is not in service, thereby allowing the user to turn the debris damaged cylinder end for end to provide a new bore surface – in effect, having a built-in spare cylinder on each end of the Bettis RGS-Series actuator.

Springs in some Rack and Pinion actuators are full diameter and captured. Some are full diameter and not captured - they are compressed into the actuator as the end caps are installed. Still, others use multiple small diameter springs with each providing a portion of the total spring force. Some are captured style, some are not. All non-captured spring designs rely on the user's careful disassembly to prevent injury or damage.

- Bettis RGS-Series springs are nested, full diameter and are fully captured for safety and remain integral with the body when the end cap and cylinder are removed.

Rack and Pinion actuator travel stops are of two main types. Some are mounted in the end caps with one end cap stopping outward piston motion and the other, via extended rods, stopping the inward piston motion. This design applies significant side loading to the actuators shaft and "bushings". Another common travel stop design places a cam on the shaft internal to the body.
This type causes severe side forces on the shaft in reaction to the forces that occur between the cam and the stop screw.

- Bettis RGS-Series travel stops are always located in a manner to stop the piston motion and are aligned to the piston axis. Full pressure can be applied to the pistons with no additional stress to any component.

Considering Morin Scotch Yoke Actuators:

- The Morin scotch yoke actuator design has been around for many decades with few, if any, significant improvements.
- Inherent issues/Bettis RGS F-Series design solution.

Hugely unbalanced weights for spring-return models.

- Are weight and force balanced similar with their Center of Gravity (COG) located mid-way along the shaft axis.

Massive side loading (and wear) of the actuator shaft and bushings as the rotary motion requires the bushing to serve as the pivot point to convert linear to rotary motion.

- As there are two diametrically located force modules, there are zero side loading forces acting on the shaft or shaft bushings.

Travel stops stop the lever arm allowing piston and spring forces to highly stress the yoke arms.

- Travel stops act directly in line with the piston axis to stop motion while applying zero additional stress on the yoke arms.

Rod seals are required as the pistons are typically pushed outward by the applied pressure while a rod extending through the actuator body serves to compress the spring toward the body module. The rod requires a difficult to replace proprietary seal.

- Rod seals have been eliminated in Bettis RGS-Series spring-return actuators.

Captured but hidden springs render it next to impossible to recognize if the springs have failed.

- Bettis RGS-Series springs are fully captured and allow maintenance with confidence and safety while being fully visible when cylinders are removed.

Sliding contact between yoke slot and force mechanism with resulting friction and loss of torque output while making them unsuited to throttling applications.

- Patented slots in the body provide guidance to the piston allowing termination of the rods at the yoke arm by absorbing 100% of the side loading forces inherent in scotch yoke mechanisms. Rollers roll in the body slots as well as the yoke arm slot to eliminate sliding friction.

Requirement to remove from valve plus complete (difficult) disassembly to replace even a simple failed seal.

- End caps and cylinders are safely removed from the actuator while it remains on the valve allowing replacement of the piston seals and reversal of the cylinder if damaged by debris.

Proprietary seals.

- All Bettis RGS-Series seals are commodity types O-rings available from Bettis RGS-Series or from local sources, thereby assuring availability and low cost.

The basic scotch yoke mechanism exerts significant side loading onto the piston rod. Some low price scotch yoke designs have only bushings in the body to support the piston rod. Other improved designs have superior internal structures to support the rods but suffer from higher costs and added complexity.

- Bettis RGS F-Series actuators experience no side loading from the scotch mechanism applied to the piston rod as all is absorbed in the body slots. Aside from shaft bushings, the Bettis RGS F-Series body module consists of essential only three components, two body halves and a one piece shaft/yoke arm.
- Assembly is accomplished simply by positioning the yoke arm fully clockwise and sliding the force modules inward until they contact the body.

Reversing the action of the typical scotch yoke actuator requires removal of both the piston and spring force modules and reassembly with each on the opposite end of the body module - a difficult task made more difficult with larger actuator sizes.

- Bettis RGS Q and F-Series actuators are action reversible by simply turning them top side down.

Commentary regarding Morin Scotch Yoke Actuators, RGS Q and F-Series Actuator comparisons

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Overview:

Engineers differ in opinion regarding designs. The following is our engineer's opinion pertaining to the design of Morin scotch yoke actuators.

- Morin spring-return actuator tie rods are over stressed.
- Loss of engagement between the piston rod and yoke slot is possible should the travel stop setting be backed off too far.
- The non-captured springs are awkward and dangerous.
- The cylinders are inexpensive but the walls are thin to the point of being subject to denting by dropped tools and improper handling.
- The piston rod to yoke slot engagement is via highly stressed track rollers which are subject to fracture failure.
- Heavily loaded piston rod bushings are all that support the piston from bending under the side loading forces exerted by the scotch yoke mechanism.
- Seals located in the rod support bushings are subject to failure due to side loading and debris shed from the rod support bushings.
- In addition to the thrust forces between the piston rod, track rollers and yoke slot, there are binding type stresses on the track rollers as they are the sole means to resist rotation of the piston rod - caused by the action of the springs as they are stroked.
- The yokes and shaft are separate parts and are pinned to one another with subsequent pin failure possible.

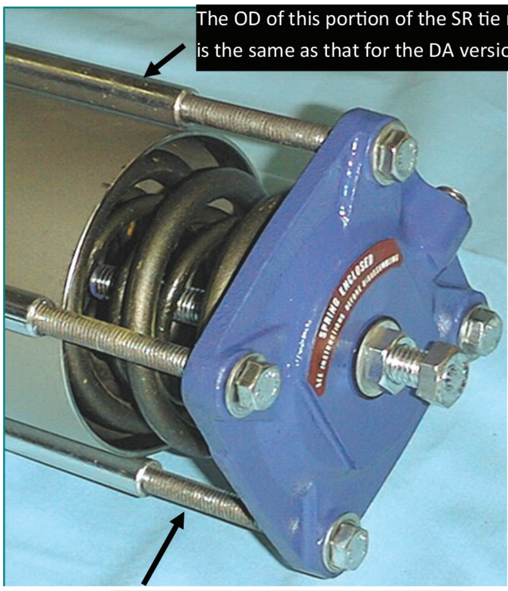
In general, Morin actuators are known as being on the low end of the price scale for scotch yoke type actuators. There is ample reason they are able to sell at lower than average prices, that being that the actuator design is as simple and as low cost as possible - with the accompanying deficiencies as evaluated by our engineers.

The following is a more detailed review of our opinions regarding the Morin actuators

Small diameter tie rods / uncaptured springs

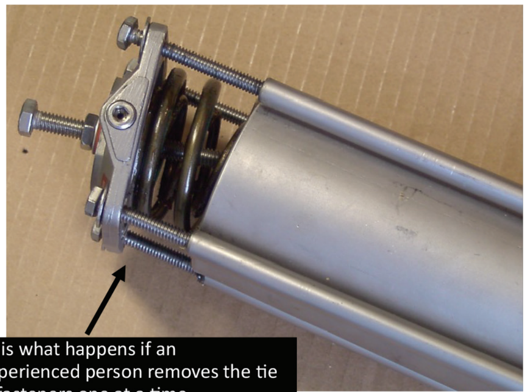
– Their double-acting tie rods appear suitable but for spring-return the approach is to use an internally threaded tubular center section of the same outer diameter (OD) as the double-acting (DA) tie rods. This weakens the section but more importantly it mandates substantially smaller threaded fasteners that thread into the center section. These may be well below what we would consider a size suitable for good design practice.

– The springs are not captured but rather are compressed when the tie rod fasteners are threaded into the center section (from both ends).
The fasteners must be tightened in incremental steps to maintain a square fit between the end cap and spring. More importantly, the fasteners must be incrementally unthreaded when disassembling the actuator. An unknowing person might fully remove each fastener before removing the next. This could result in tilting of the end cap with added stress (bending and tensile) on the remaining fastener, possibly allowing for the spring to escape, or worse, for the end cap, fastener and spring to launch out of the actuator. Amazingly, Morin claims this is the safest approach to spring design.
We wholeheartedly disagree.



The OD of this portion of the SR tie rods is the same as that for the DA versions.

Long, relatively smaller diameter, highly stressed fasteners secure the end cap and retain the uncaptured springs



This is what happens if an inexperienced person removes the tie rod fasteners one at a time

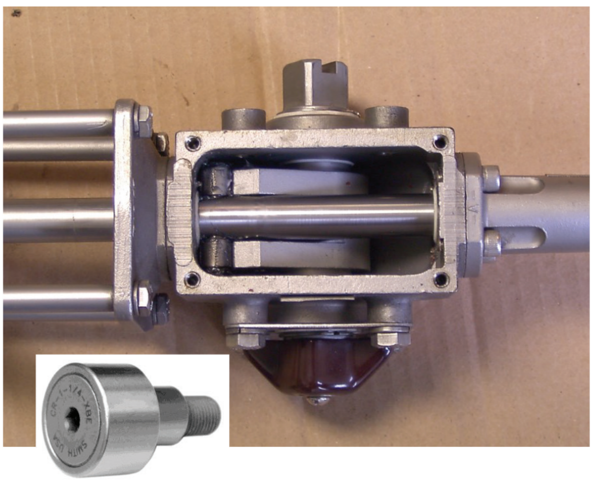
A review of Morin's literature shows that the spring-return (SR)
tie rod fasteners have three stress causing forces applied to them.

1. The force required to compress the cylinder seals on both ends of the cylinder.
2. The force applied by the spring.
3. The force applied by the pistons as supply pressure pushes the piston against the end cap located travel stop.

In our opinion, the tie rod fasteners are not adequate to withstand these combined forces and could result in a sudden failure of the fasteners which could then allow the spring and end cap to break free and impact nearby equipment or personnel.

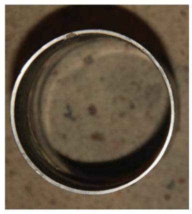
Disengagement of yoke

Because of the body design, assembly requires that the yoke arm and shaft be assembled first (pinned connection) followed by insertion of the piston rod. Next the piston rod is axially rotated to allow installation of the two pin rollers. In order to provide space to install the rollers, the yoke must be rotated fully forward. Then after the rollers are installed, the yoke is rotated toward the pins as shown. Finally, the piston rod and rollers are moved forward for the rollers to engage the yoke slot, and the travel stop is set to prevent disengagement of the rollers from excessive outward travel. As a result, if in serve the travel stops are backed off, disengagement may occur leaving the valve free to move on its own.



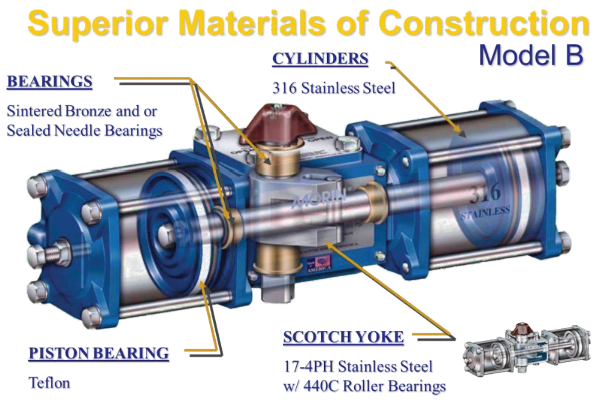
Cylinder walls

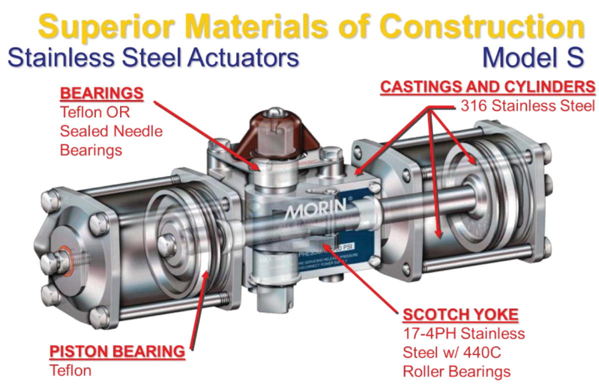
The cylinders walls are extremely thin. In the smaller sizes they are approximately 0.06." This leaves them subject to denting from dropped tools and improper handling. We believe the wall thickness should be doubled.



Cylinder and other materials

- 316 stainless steel.
- But even in the all stainless steel (SS) S-series, not all parts are 316SS. As an example, the shaft is 17-4 PH which is somewhat less corrosion resistant than 316SS.
- Morin places a large "316 stainless steel" sticker on the cylinders. It would appear that they want to infer that the actuator is SS even on the carbon steel versions.





- Piston rod bushings are sintered bronze, Teflon or needle bearings. We do not have a positive opinion regarding the use of sintered bronze as a long life bushing material. It is relatively high friction and it tends to shed debris which could negatively impact the adjacent rod seals. Teflon, if unfilled, has minimal resistance to cold flow under load. As for needle bearings, we are not aware they are applicable to linear applications.

- Seals located in the rod support bushings are subject to failure due to side loading and debris shed from the rod support bushings. Replacement requires removal of the actuator from the valve and complete disassembly - including the - in our opinion - dangerous removal of the end cap and non-captured spring.
- When springs are compressed and decompressed, the ends tend to rotate about the center axis. These rotational forces impart a rotational force on the pistons which, in turn, impart a rotational force to the piston rod. The rollers that engage the yoke slot must therefore, not only transfer the operating forces to the yoke, they must also serve to prevent rotation of the piston rod so as to maintain proper slot engagement. Any rotation could place the rollers in such a position as to cause binding within the yoke slot with the accompanying yet higher stress on, and possible failure of, the rollers.

Square, male shafts top and bottom on 45-degree angle

Because of the male shafts, Morin actuators cannot be direct mounted to valves except by a faux direct mount assembly which simply replaces the normal open bracket with an enclosed cast bracket. This is a poor, space consuming, substitute for actual direct mounting.

Water tightness

Based on experience and observed testing, it is difficult to exclude water entry into the body housing. As standard, only a thin cover encloses on face of the body. Heavier plates have not proven completely effective.

Torque values

When benchmarking Morin torque values we found that there is little consistency of end torque values to mid travel values. As a comparison, a very large scotch yoke actuator provider publishes end of stroke DA torque as 1.85 times the mid travel values for every size actuator. Such consistency is not present in the Morin published values.

Mounting geometry

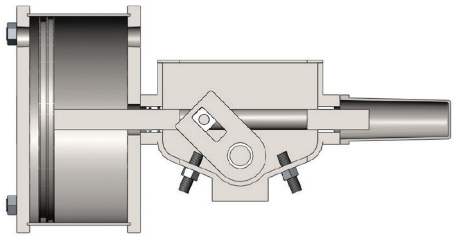
Does not meet ISO 5211 bolting or bolt pattern nor NAMUR accessory mounting dimensions which disallows use of industry common accessory mounting brackets.

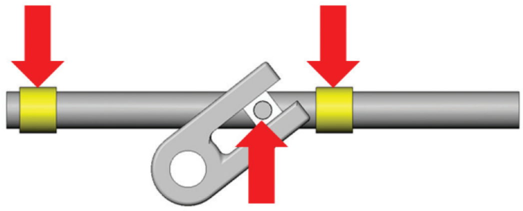
Reversibility

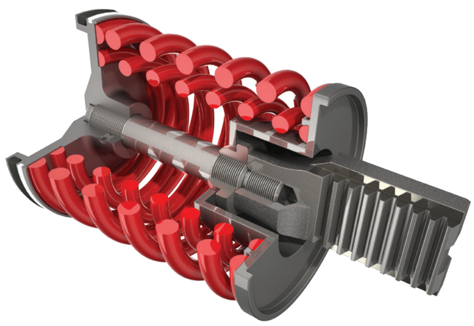
We don’t know if the actuators can be easily turned top side down for reversibility. At one time top and bottom sides were identical but a redesign may have resulted in the top and bottom shaft lengths being different with one adapted to NAMUR length and the other left as in the original design.

Taking the original summary of opinions and comparing to RGS Q-Series actuators:

- The RGS Q-Series is a design versus the Morin scotch yoke design.
- Morin spring return actuator tie rods are excessively stressed.
  RGS Q-Series tie rods are always solid and designed for minimum stress regardless if DA or SR.
- Loss of engagement between the piston rod and yoke slot is possible should the travel stop setting be backed
  off too far.
  Disengagement of the RGS Q-Series rack and pinion gear
  is not possible regardless of the travel stop settings.
- The non-captured springs are awkward and dangerous.

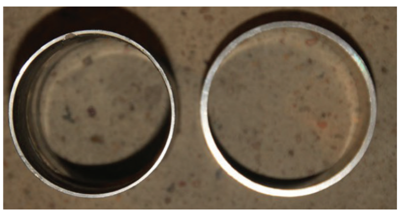






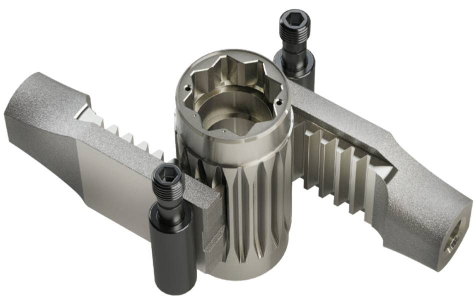
RGS Q-Series springs are always captured. In addition to the rack that is integral to the springpaq assembly, a separate safety collar is threaded onto the piston bolt in a manner that exerts zero stress on the collar during operation and which locates the collar in the highest strength section of the piston bolt.

- The cylinders are inexpensive but the walls are thin to the point of being subject to denting by dropped tools and improper handling.

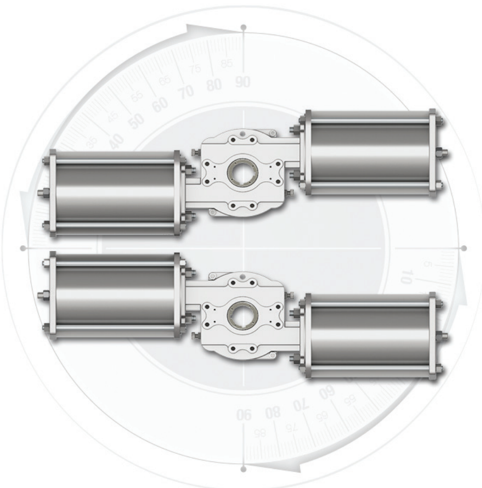


RGS Q-Series cylinder walls are never less than 1/8 inch thick and they are even thicker in large sizes.

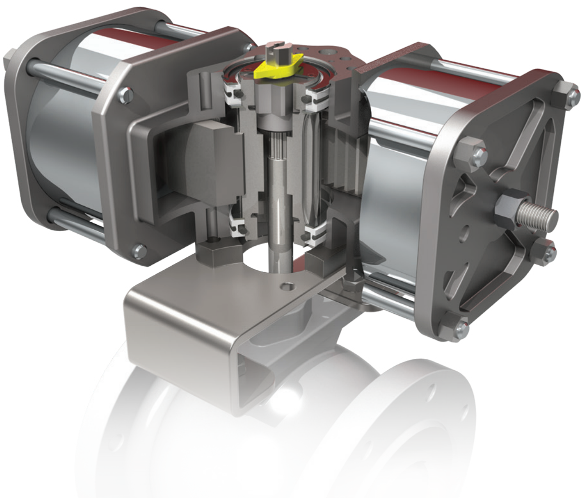
- The piston rod to yoke slot engagement is via highly stressed track rollers (cam followers) which are subject to fracture failure which effectively allows the valve to move on its own.
  RGS Q-Series racks are designed so that stresses are well below the material allowances and are aligned to the pinion gear via body located low friction rollers.
- Heavily loaded piston rod bushings are all that support the piston from bending under the side loading forces exerted by the scotch yoke mechanism.
  There are no piston rod bushings in the RGS Q-Series actuators.
- Seals located in the rod support bushings are subject to failure due to side loading and debris shed from the rod support bushings.
  There are no piston rod seals in the RGS Q-Series actuators. What does not exist cannot fail.
- In addition to the thrust forces between the piston rod, track rollers and yoke slot, there are binding type stresses on the track rollers as they are the sole means to resist axial rotation of the piston rod - caused by the action of the springs as they are stroked.
  Typically RGS Q-Series springs sets consist of more than one spring with each being would opposite of the other to allow the rotational forces to cancel one another. Regardless, the rack cannot rotate as it fully aligned between the pinion gear and the guiding rollers.
- The yokes and shaft are separate parts and are pinned to one another with subsequent pin failure possible.
  RGS Q-Series shafts are of single piece construction.



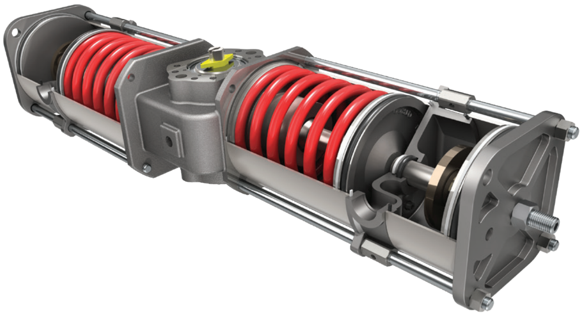
- Submersible service is a challenge for Morin actuators due to the body being closed with a thin metal cover. RGS Q-Series actuators have been tested to be fully water tight.
- Reversibility of Morin actuators is not well known to us.
- The action of RGS Q-Series actuators is reversed simply by turning the actuator top side down.



- Morin actuator mounting dimensions do not conform to international standards.
  All RGS Q-Series actuators meet ISO 5211 mounting geometries.
- The relatively high internal friction of the basic scotch yoke mechanism make them unsuitable for throttling applications.
  RGS Q-Series series actuators pass the most stringent throttling tests plus they offer a 'close mount' option for extended shaft type valves.

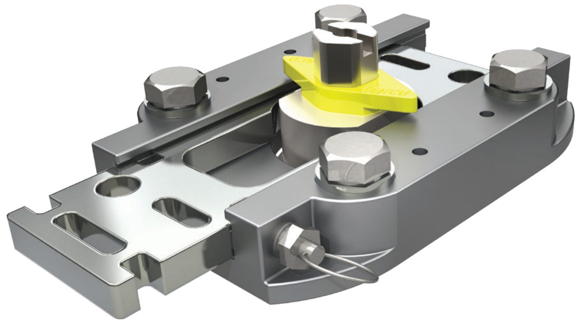


- Partial stroke version of the Morin is mechanical with a 'pin' being inserted into the actuator to prevent spurious travel. The positive is that the actuator will develop full output torque to initiate valve movement. The negative is that operating personnel must participate for every partial stroke testing (PST) + it is not possible to close the EDDV should an emergency occur during the PST test.

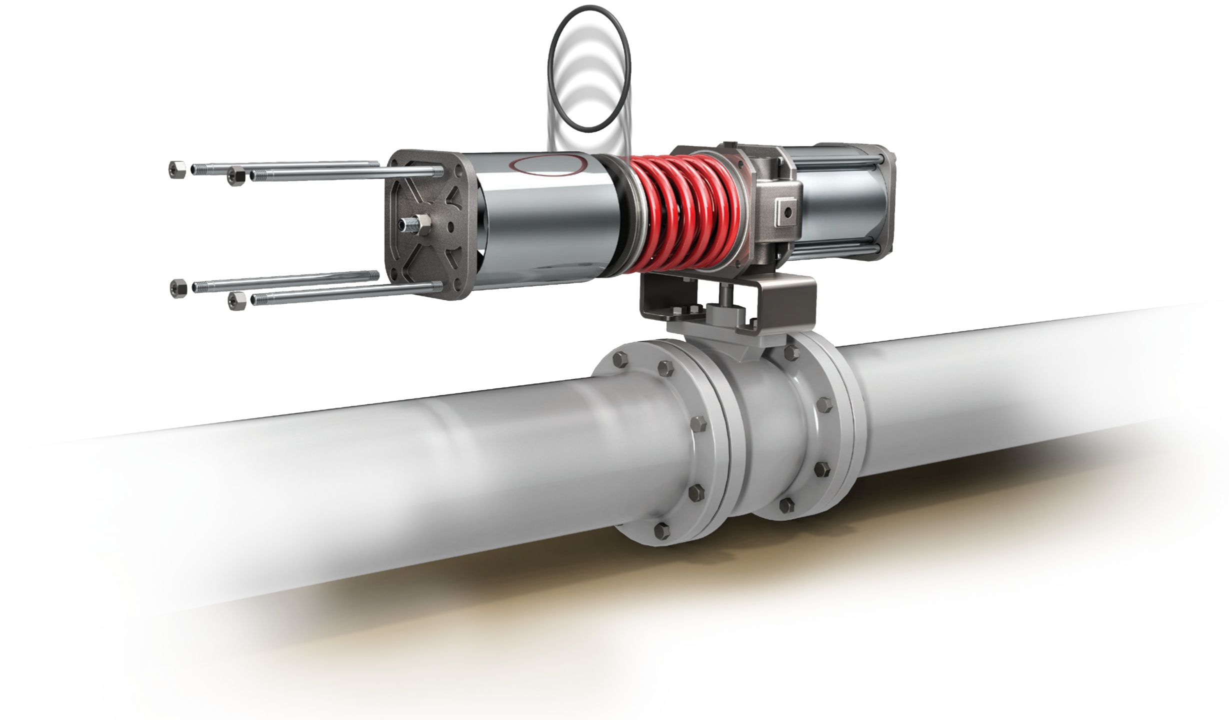


RGS Q-Series partial stroke testing device (PSTD) employs the unique XRCISER™ option that resolves every concern regarding PSTD.

- Interchangeability
  RGS actuators can readily be mounted on brackets and couplings intended for use with MORIN and many other actuator brands. This means that an OEM or end user may select RGS actuators without the need to redesign or replace existing brackets and couplings.
- Lock out - tag out is not available as an integral component of the Morin actuator RGS Q-Series actuators offer a simple, low cost lock out - tag out option.



– On site / on valve replacement of seals and cylinders is not practical with the Morin design.



The RGS Q-Series piston seals are non-proprietary and can be replaced while the actuator remains in place on the valve.

– Direct to valve mounting is not possible with the male shafted Morin actuators - although a faux direct mounting is offered with a solid cast mounting bracket in place of common open brackets.

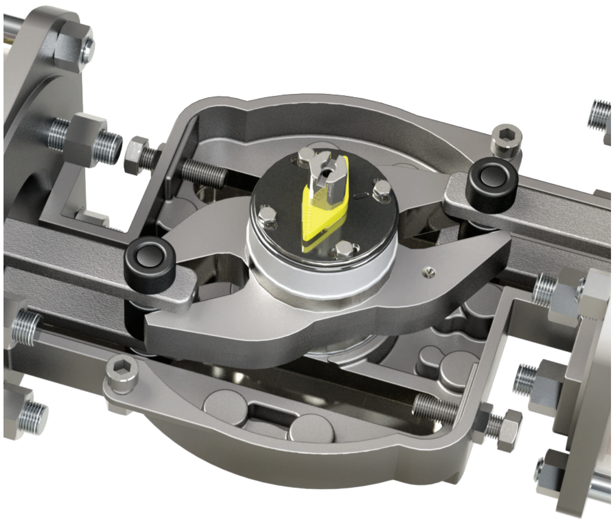
RGS Q-Series actuators are readily direct mounted to valve with flat top plates.

Taking the original summary of opinions and comparing to RGS F-Series actuators:

The F-Series design versus the Morin scotch yoke design.

- Morin spring return actuator tie rods are excessively stressed.
  RGS F-Series tie rods are always solid and designed for minimum stress regardless if DA or SR.
- Loss of engagement between the piston rod and yoke slot is possible should the travel stop setting be backed off too far.
  Disengagement of the RGS F-Series and driving clevis is not possible regardless of the travel stop settings.
- The non-captured springs are awkward and dangerousRGS F-Series springs are always captured. In addition to the clevis that is integral to the springpaq assembly, a separate safety collar is threaded onto the piston bolt in a manner that exerts zero stress on the collar during operation and which locates the collar in the highest strength section of the piston bolt.
- The cylinders are inexpensive but the walls are thin to the point of being subject to denting by dropped tools and improper handling.
  RGS F-Series cylinder walls are never less than 1/8 inch thick and they are even thicker in large sizes.
- The piston rod to yoke slot engagement is via highly stressed track rollers (cam followers) which are subject to fracture failure which effectively allows the valve to move on its own.
  RGS F-Series clevises are designed so that stresses are well below the material allowances and are engaged with the yoke via minimally stressed rollers and pins.
- Heavily loaded piston rod bushings are all that support the piston from bending under the side loading forces exerted by the scotch yoke mechanism.
  There are no piston rod bushings in the RGS F-Series actuators as 100% of the side loading is absorbs in the body slots.
- Seals located in the rod support bushings are subject to failure due to side loading and debris shed from the rod support bushings.
  There are no piston rod seal in the RGS F-Series SR actuators. What does not exist cannot fail. RGS F-Series DA actuators do necessarily employ rod seals but these are placed in floating seal carriers and are replaceable on site the same as the piston seals.
- In addition to the thrust forces between the piston rod, track rollers and yoke slot, there are binding type stresses on the track rollers as they are the sole means to resist axial rotation of the piston rod - caused by the action of the springs as they are stroked.
  Typically RGS F-Series springs sets consist of more than one spring with each being would opposite of the other to allow the rotational forces to cancel one another. Regardless, the clevis cannot rotate as it fully aligned by and with the body slots.
- Morin yokes are of the single arm, split design.

RGS F-Series yokes are dual arm, flat design to balance the forces and eliminate side loading of the shaft and bushings.



- Their yokes and shaft are separate parts and are pinned to one another with subsequent pin failure possible RGS F-Series shafts and yoke arms are a single piece casting.
- Submersible service is a challenge for Morin actuators due to the body being closed with a thin metal cover RGS F-Series actuators use a two piece body design and require consideration for submerged applications.
- Reversibility of Morin actuators is not well known to us as with RGS Q-Series actuators, the action of RGS F-Series actuators is reversed simply by turning the actuator top side down.
- Morin actuator mounting dimensions do not conform to international standards.
  RGS F-Series actuators also do not conform to ISO 5211 mounting geometries.
- The relatively high internal friction of the basic scotch yoke mechanism make them unsuitable for throttling applications.
  RGS F-Series actuators have balanced forces and very little friction allowing the use in throttling applications.
- Partial stroke version of the Morin is mechanical with a 'pin' being inserted into the actuator to prevent spurious travel. The positive is that the actuator will develop full output torque to initiate valve movement. The negative is that operating personnel must participate for every PST + it is not possible to close the EDDV should an emergency occur during the PST test.
  Just as with RGS Q-Series actuators, RGS F-Series PSTD versions employ the employ the unique XRCISER that resolves every concern regarding PSTD.
- Lock out - tag out is not available as an integral component of the Morin actuator.
  RGS F-Series actuators also do not offer a lock out - tag out option integral to the actuator.
- On site / on valve replacement of seals and cylinders is not practical with the Morin design.
  The RGS F-Series piston seals are non-proprietary and can be replaced while the actuator remains in place on the valve - if the cylinder bore is scratched by contaminants, it can be turned end for end and reused.
- Direct to valve mounting is not possible with the male shafted Morin actuators - although a faux direct mounting is offered with a solid cast mounting bracket in place of common open brackets.
  RGS F-Series actuators employ female (keyed) shaft drives that do provide for direct mounting to valves with flat top plates - also, RGS F-Series actuator drive geometries may be offered as female square, make square or just about any option a user can desire.

Frequently Asked Questions (FAQs)

We are often asked: What makes our actuators different? What is a Flat Yoke? or How does a Bettis RGS actuator differ from a Rack and Pinion actuator? Also customers that are not as familiar with Bettis RGS are curious how we achieve such quick cycle times, and how do I change the fail position. So we have compiled a list of questions that are frequently asked.

How is a Bettis RGS actuator different from a Rack & Pinion actuator?

Offset cylinders align the piston axis with the pinion gear pitch circle diameter, eliminating the cantilever forces inherent in rack and pinion type actuators. Low friction rollers maintain correct engagement of the stainless steel gearing for absolutely exceptional cycle life.

How is a Flat Yoke actuator different from a Scotch Yoke actuator?

A unique slotted body concept absorbs 100% of the yoke mechanism's side loading forces leaving the piston rod completely free of bending stresses while allowing termination of the rod at the yoke, and the addition of a weight and force balancing second force module diagonally offset from the first. The balanced weight makes lifting and handling of the actuators safer and easier, while reducing valve neck stress caused by unbalanced scotch yoke actuators. Internally, the balanced forces assure less friction loss and less wear as there is no net force applied to the shaft bushings.

What is Amalga or Black Amalgon?

Constructed of fiber reinforced thermoset epoxy matrix, Black Amalgon (BA) is a light weight, high strength, corrosion resistant composite material. Approximately ¼ the weight of steel or brass and ¾ the weight of aluminum, BA is much easier to handle than traditional steel tubing. Assembly and maintenance times are reduced and stress loads on connected parts are decreased.

Superior Corrosion Resistance
Trouble-free performance in chemical, high moisture and other adverse environments including salt and chlorinated water which results in significant life cycle costs. BA's manufacturing process ensures a smooth self-lubricating inside surface that prevents pistons from sticking, even after they have remained idle for months. Ongoing tests conducted on non-lubricated cylinders resulted in cycles of greater than a million strokes without requiring seal replacement.

Unlike metals, the product does not dent. Material impact strength is 40 Izod lbf-ft.

With a very low coefficient of thermal expansion, BA operates efficiently up to 275 °F and customers have reported success in using the product at temperatures below -300 °F.

This non-magnetic material permits magnetic sensors to control piston movement directly through the wall thickness.

Why are Bettis RGS actuators a better choice for control applications than traditional quarter-turn actuators?

Bettis RGS-Series actuators have extremely low internal friction, consume minimal air volume, are able to handle the most severe vibration and are available in stainless steel for complete protection against corrosion. Bettis RGS-Series actuators provide throttling capabilities consistent with those of diaphragm actuators with a high level of reliability.

The Bettis RGS-Series actuators thru-shaft design results in substantial space savings. These actuators have been proven to be excellent companions to quarter-turn control valves including those with extended stems. Our revolutionary "Close Mount" design reduces the size, weight and cost of the assembly by passing the valve stem through the actuator shaft with no valve modifications.

How is Bettis RGS-Series actuator able to achieve such fast stroking speed when others cannot?

Unlike most actuators on the market, Bettis RGS-Series actuators apply pressure directly to the pistons without internal passages that cause speed restrictions to the air flow into and out of the actuator. This approach allows the actuator pressure ports to be increased to suit the users speed requirements. This feature is available on all actuator sizes and types (DA, SR – fail closed or fail open).

Why are Bettis RGS-Series actuators safer than other actuators?

We feel strongly that our actuators shouldn't cause injury to anyone. Thus, we have made safety an integral part of our actuator design, specifically the springs, which can cause serious harm to personnel or damage other equipment if not captured. All Bettis RGS-Series springs are captured and contained within the force module even if the end cap and cylinder are removed.

How does the XRCISER PSTD work?

The standard Bettis RGS-Series actuator uses a travel stop screw in the end cap to limit outward travel of the actuator piston, and therefore valve travel. In the XRCISER configuration, the pneumatically engaged tandem pistons become the outward travel stop. By confirming tandem piston pressure and position; spurious valve travel is prevented during the partial stroke cycle.

Why do Bettis RGS actuators claim to have the lowest total cost of ownership?

Due to our belief that actuators should not fail - all Bettis RGS-Series actuators feature robust designs and premium materials. Throughout our history, user's need for replacement parts has been practically non-existent. The unique simplicity and reduced friction of our designs see to this, and our warranty is a testament to the commitment we have to our customers.

How is the Bettis RGS-Series performance warranty different from most actuator manufacturer's warranties?

Bettis RGS-Series will during the period of 3 years from the date of original invoice, repair or replace (at Bettis' sole option) any actuator that fails in service regardless of the number of cycles, provided always that the actuator was installed correctly, properly maintained/serviced and applied as per the original user application specifications. The actuator must be returned to Bettis within the 3 year warranty period at the sender's cost. The warranty does not apply to any freight or other charges.

How difficult is it to change the fail position in the field?

Both sides of the Q-Series and F-Series actuators are identical in all aspects. Unlike other actuators that require disassembly for action reversal, Bettis RGS-Series actuators require only that you remove the top hat and turn them top side down. Q-Series actuators have a female double-square drive and the F-Series have two key ways located 90-degrees apart to readily accommodate action reversal.

Can I replace the individual actuator springs for higher or lower pneumatic supply pressures?

Bettis RGS-Series actuator spring cartridges are provided in a captured state for your safety. These spring cartridges are assembled at our factory using specially designed equipment, with no intent on being disassembled and replaced in the field. Bettis RGS-Series does offer complete spring cartridges that are field replaceable and safe for handling and installation by the user. Or as another option, the actuator may be returned back to Bettis RGS-Series and we will change out the springs as required.

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