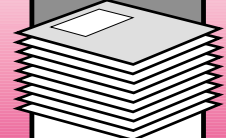


Installation, Operating and Maintenance Instructions

HYTORK

Hytork
Dossier



MAC099811

XL Series Actuators

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1 Important Safety Procedures

Qualified maintenance personnel should read and follow these straightforward instructions.

ALWAYS disconnect the Air and Electrical Supplies before carrying out any form of maintenance on an Actuator.

Always contain the Spring tension with HYTORK Retractor Rods as explained in Section 7.2. Follow instructions for using the Retractor Rods carefully.

Never attempt to remove the Pistons from the Actuator body by using air pressure when the End Caps have been removed.

Do not shorten or distort the SAFEKEYS; correct length SAFEKEYS are supplied with the Maintenance Kit.

When replacing items use only those supplied by HYTORK or its Stocking Distributors.

Numbers in brackets (#) refer to parts on the exploded XL diagram (Fig. 1).

Read the relevant sections carefully before continuing.

2 Mounting and Operating Instructions *(Refer to Fig. 1)*

2.1 Actuator to Valve Installation.

The mounting hole sizes and bolt hole circle are to ISO 5211. These holes are ISO METRIC COARSE on metric models (UNC COARSE on imperial models for the USA) as standard. When mounting the Actuator to a Valve using a Mounting Kit,

the Pinion drive, coupling device and Valve Stem should be centred and concentric to prevent any side loading to the bottom Pinion Radial Bearing and Valve Stem Seal area.

Ensure that the square coupling shaft to be operated is a close, but free sliding fit into the female drive in the Actuator shaft (4).

2.2 Maximum Operating Pressure.
XL models 45 to 2585
Do not exceed 8.2 bar (120 psi).

XL model 4580
Do not exceed 7 bar (100 psi).

2.3 Operating media.

Use clean, dry or lubricated air. Other medias may be used, but consult your local HYTORK VALVE AUTOMATION CENTER for confirmation as to suitability.

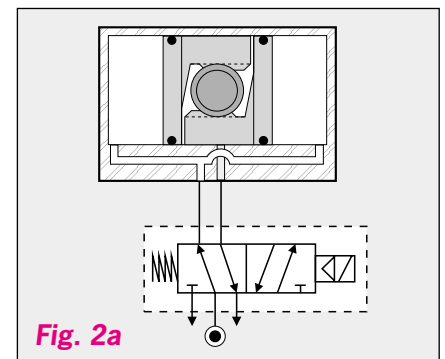


Fig. 2a

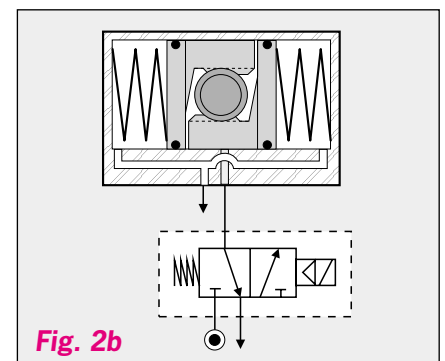


Fig. 2b

Quality
Assured
registered
management
systems
to ISO 9001

Part No. Component	Quantity	Part No. Component	Quantity
1 Travel Stops & Seals	2	11 Piston 'O' Rings	2
2 End Caps	2	12 End Cap 'O' Rings	2
3 Pistons	2	13 Pinion 'O' Rings	2
4 Pinion	1	14 DURASTRIP Thrust Bearings	2
5 Body	1	15 Steel Thrust Washers	2
6 SAFEKEYS & 'O' Rings	2	16 Snap Ring (Circlip)	1
7 Springs*	2, 3 or 4	17 Position Indicator	1
8 Retractor Caps*	2	18 Sealing 'O' Rings*	2
9 DURASTRIP Pinion Radial Bearings	2	19 Sealing Bolts*	2
10 DURASTRIP Piston Bearing Strips	2		

*Spring Return Models only

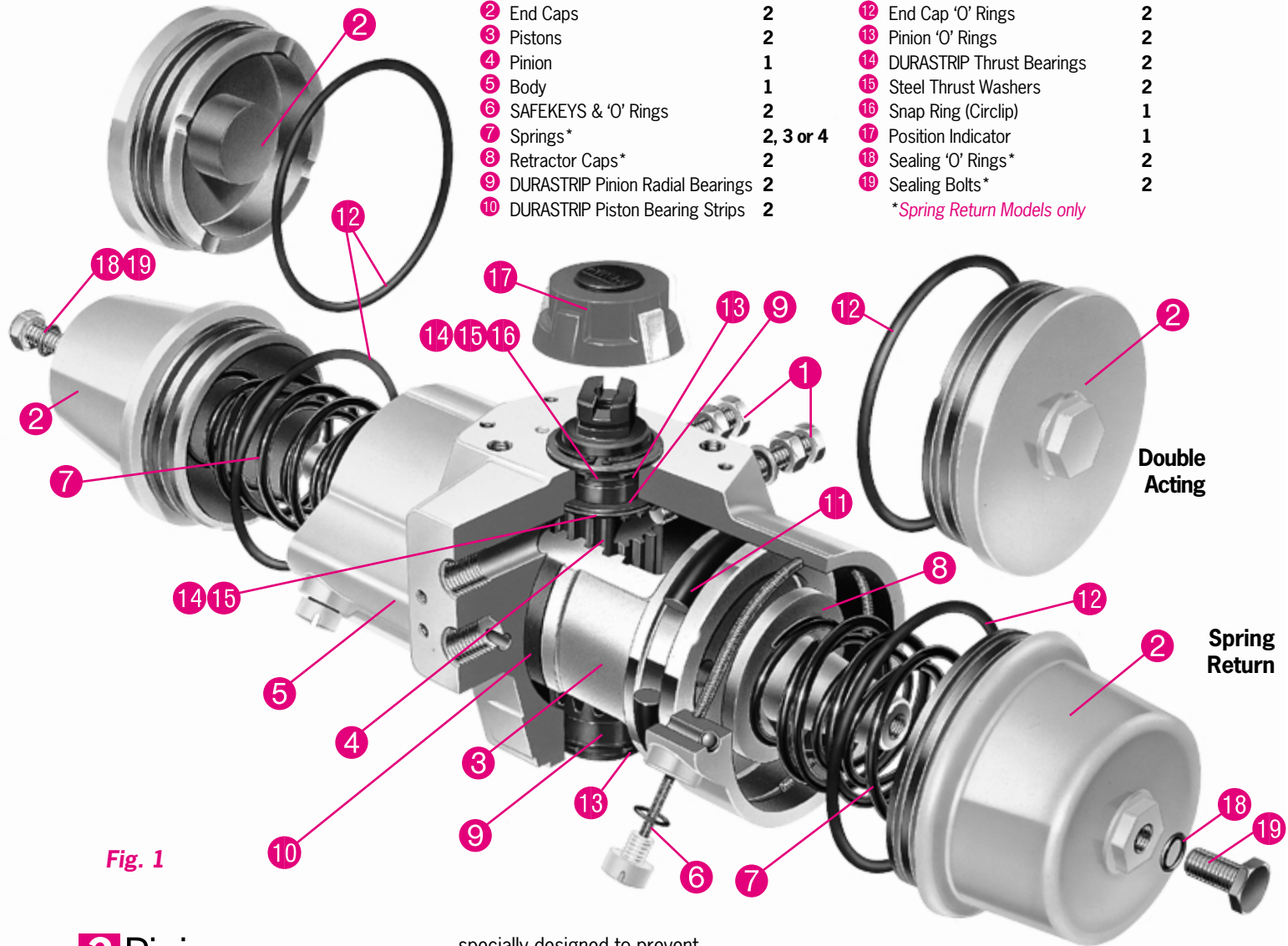


Fig. 1

3 Piping Instructions (Fig. 2a & 2b)

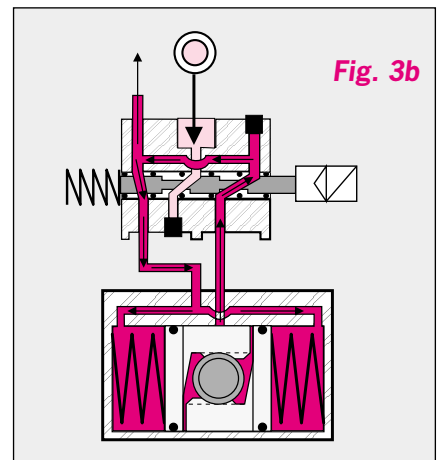
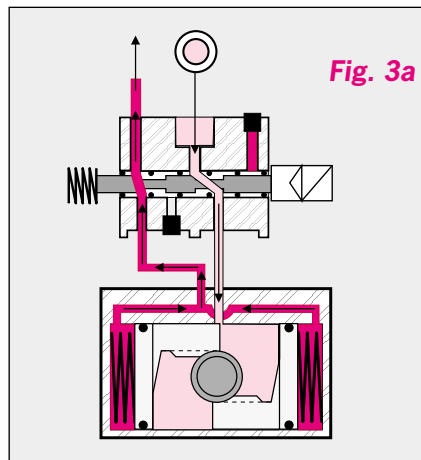
All Actuators can be either piped with solid or flexible tubing with the Solenoid Valve mounted remotely from the Actuator or by mounting a NAMUR designed Solenoid Valve DIRECTLY onto the NAMUR Mounting Pad on the side of the Actuator. (ALL Solenoids made to the NAMUR standard can be mounted in this way.)

4 Solenoid Valves on Spring Return Actuators (Fig. 3a & 3b)

It is recommended that on Spring Return Actuators, the HYTORK "CATS" Solenoid Valves are used. These Valves are

specially designed to prevent contamination of the internals of the Actuator by dirt from the atmosphere. This increases the working life of the Actuator which reduces down time and maintenance periods.

(See Dossier DSLxxxxx1)



5 Spares Recommendations

When disassembling and carrying out maintenance work on the XL Actuator, a HYTORK XL Spares Kit must be used to replace all 'O' Rings, DURASTRIP Bearing Strips, Washers etc. This Kit is available from HYTORK or its Stocking Distributors.

Important: Read Safety Instructions before starting (see Section 1).

6 Complete Disassembly - Double Acting Actuator

6.1 Removal of Travel Stops. (Fig. 4)

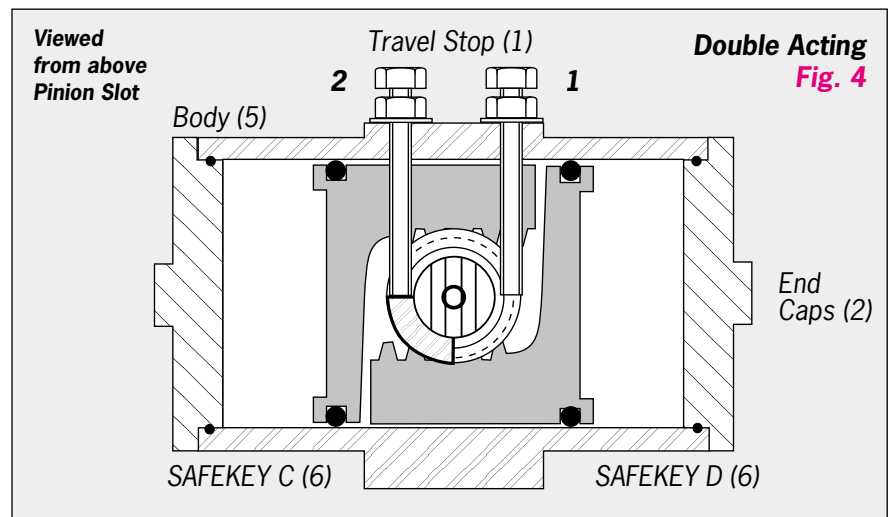
Release the lock nut and remove both Travel Stops and Seals (1) (cast Identity numbers 1 & 2), which are located at the top of the Actuator body (5) on the side opposite the Actuator air connections.

6.2 Removal of End Caps.

Unscrew the two slotted SAFEKEY screws (6) (cast Identity letters C & D) located in the body next to each End Cap (2), and gently pull them from the body, removing each SAFEKEY. If the SAFEKEY screw tends to spring, then rotate the End Cap slightly to assist release. For larger models (1125 to 4585) use a wrench (spanner) on the End Cap to turn it to assist the release of the SAFEKEY (ensuring the End Cap is always flush to the body). When both SAFEKEYS have been removed, detach the Position Indicator (17) from the top of the Pinion and use a wrench (spanner) to rotate the Pinion (4), driving the Pistons (3) apart until they partially push the End Caps from the body. Remove the End Caps by pulling them free from the body, keeping them square to the end face of the body.

6.3 Removal of Pistons.

Rotate the Pinion using a wrench (spanner) to drive the Pistons apart until the Pinion rotates freely. Rotate the Pistons in the Actuator approximately 10 degrees. Rotate the Pinion carefully with a little force and the Pistons will push free of the Actuator body. On later models of XL



Actuators, the Pistons are provided with cast extraction holes in the face of the Piston. By screwing the Travel Stop Bolt into this hole it can be used to pull the Pistons from the Actuator body using pliers or vice grips.

6.4 Removal of Pinion.

On XL models 680, 1125 & 1370 with Location Rings to ISO 5211 (metric versions only), the Location Ring is a loose item and must be removed before the removal of the Pinion. Remove the Snap Ring (Circlip) (16), Steel Thrust Washer (15) and Thrust Bearing (14) from the top of the Pinion and CAREFULLY remove the Pinion from the cylinder body through the bottom. (If the Actuator is a 680, 1125 or 1370 gently tap the top of the Pinion with a rubber hammer to remove the Location Ring first.) Care MUST be taken to ensure that the Pinion Radial Bearing Strips (9) on the top and bottom of the Pinion do not become trapped in the bores during this operation. Take care that the Pinion does not damage the Pinion bores on removal. If necessary, remove any burrs, etc. from the top of the Pinion before removing it.

6.5 Inspection.

Clean and examine all parts for damage and wear. Check SAFEKEYS for damage and length (Fig. 10). HYTORK recommends that ALL 'O' Rings, Bearing Strips, Washers etc. are replaced using a HYTORK XL Spares Kit.

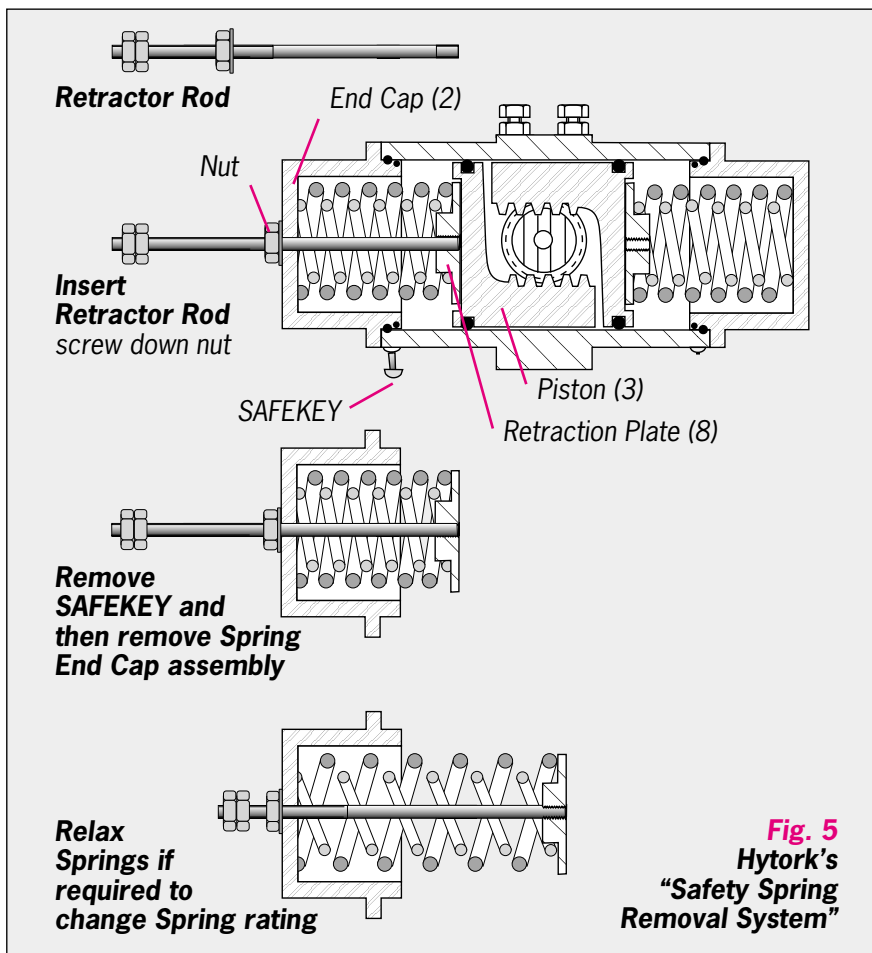
7 Complete Disassembly - Spring Return Actuator

7.1 Removal of Travel Stops. (Fig. 4)

Release the lock nut and unscrew both Travel Stops and Seals (1) (cast Identity numbers 1 & 2), which are located at the top of the Actuator body (5) on the side opposite the Actuator air connections.

7.2 Removal of Spring Pack Modules. (Fig. 5)

Remove Sealing Bolts (19) and 'O' Rings (18) from each End Cap (2). Place the HYTORK Retractor Rod (see Section 13.10) through the hole in the End Caps and screw the Rod into the Spring Retractor Caps (8) until travel is stopped, the nut and washer being free of the End Cap face. Screw the nut and washer clockwise down the Retractor Rod until they come up against the face of the End Cap. Using a wrench (spanner), continue to screw the nut clockwise down the Rod exactly two turns, to draw the Spring Retractor Cap away from the Piston head (3). This compression of the Springs releases the Spring force and unlocks the SAFEKEY for removal. Repeat for the other End Cap. Rotate the Caps to ensure that the Springs are retracted; if the Cap will not turn easily, screw the nut further. Once the Retractor Rods have compressed the Spring and the Caps can be rotated freely, unscrew the two SAFEKEY slotted screws (6) located in the body (5) next to each End Cap to which the SAFEKEYS (cast Identity letters C & D)



are connected. Gently pull the slotted screws from the body removing the SAFEKEY. If the SAFEKEY slotted screw tends to spring, rotate the End Cap slightly to assist release. For larger models (1125 to 4580) use a strap wrench to turn the End Cap to assist the release of the SAFEKEY (*ensuring the End Cap is always flush to the body*).

When both SAFEKEYS have been removed, detach the Position Indicator (17) from the Pinion top and use a wrench (*spanner*) to rotate the Pinion (4), driving the Pistons (3) apart until they partially push the End Caps from the body. Remove the End Caps by pulling them free from the body, keeping them square to the end face of the body.

For normal maintenance when Spring changes are not required, it is not necessary to relax the Springs. The Spring End Cap assembly can be left with the Retractor Rod holding the assembly together, ready for reassembly.

If it is necessary to change the Spring rating refer to Section 10.1.

7.3 Disassembly of the center module.

These operations are as described for Double Acting Actuators, Sections 6.3, 6.4 and 6.5.

8 Assembly Instructions -

IMPORTANT: All HYTORK XL Spares Kits are supplied with SAFEKEY (6) assemblies cut to an exact length which will fit the circumference of the End Cap (2) when fully assembled into the Actuator. Any shortened SAFEKEYS must not be used. If in doubt contact HYTORK or your local Stocking Distributor.

Double Acting Actuators

8.1 Inspection.

Check that all components are clean and free from damage. HYTORK recommend that ALL 'O' Rings, Bearing Strips,

Washers, etc. are replaced using only a HYTORK XL Series Spares Kit.

8.2 Installing the Pinion.

Lightly grease the Pinion, 'O' Ring grooves and Bearing Strip grooves of the Pinion (4) and Pinion 'O' Rings (13) with Lithium based grease. Install one Steel Thrust Washer (15) over the top of the Pinion and slide it down to the top of the gear form. Take the top Pinion Radial Bearing Strip (9) and fit it into the top Pinion location groove and slide one Thrust Bearing Washer (14) down over the DURASTRIP Bearing Strip, holding the strip in position around the Pinion shaft.

Fit the top 'O' Ring into the top Pinion groove. Fit the bottom Radial Bearing Strip (9) into the bottom Pinion location groove and hold in position using the bottom 'O' Ring. Lightly grease the Pinion bores of the body before assembly. Carefully insert the Pinion into the body (5) until the top of the Pinion rests in the top bore but the bottom Radial Bearing Strip groove is still protruding from the bottom of the Actuator. Gently slide the Pinion up through the body making sure that the ends of the bottom Bearing Strip are not trapped and the 'O' Ring slides or rolls into the 'O' Ring groove as the Pinion is pushed home into the body.

With the Pinion in this position, install the top Thrust Bearing Washer (14), then the Steel Thrust Washer (15) and lastly the Snap Ring (*Circlip*) (16) into the narrow groove at the top of the Pinion (*making sure the Snap Ring fits properly in the groove*).

Standard mode of operation (8.3, 8.4 & 8.5).

THIS MODE IS USED FOR MOST FAIL CLOSED SITUATIONS. CLOCKWISE ROTATION OF THE PINION WITH PISTONS MOVING TOWARDS EACH OTHER. (Fig. 6)

8.3 Alignment of Pinion for correct Piston installation. (Fig. 6)

Rotate the Pinion to the position shown in Fig. 6 (*when viewed from above the slot at the top of the Pinion*) ensuring that the machined Stop Flats are in the correct

orientation. On later XL Actuators the top of the Pinion is marked with a single identification dot to indicate the correct orientation. To install the Pistons for standard air Fail Close operation, proceed as follows. Rotate the Pinion so that the dot on the top of the Pinion is positioned close to the single dot on the top pad of the Actuator body. Accurate Pinion alignment can now take place by lining the center of the slot on the top of the Pinion with the single dot on the body. (As indicated by the arrow on Fig.6.)

8.4 Installing the Pistons.

Ensure that the dovetail on the Bearing Strip is correctly aligned to the dovetail grooves machined into the Piston with the tang, in the center of the Strip, pointing away from the Piston head. Once in the correct orientation, the small tang in the middle of the Strip must be adjusted to point away from the dovetail groove so that the Strip can be pushed into the Piston dovetail grooves. When the Strip is fully in the dovetail groove, the tang must be pushed into the retaining slot on the Piston. Lightly grease the Piston 'O' Rings (11) with Lithium based grease. Liberally grease the Actuator body bore and the

Pistons (3) using Lithium based grease and fit the 'O' Rings into the 'O' Ring groove on the Pistons. Insert the Pistons into the bore, one Piston in each end with the teeth facing each other (see Fig. 6), to ensure that the Piston rack lines up with the Pinion gear. The alignment groove in the front face of the Piston must be lined up parallel to the Pinion and "gun sights" cast in the body. Push both Pistons together until they are both in contact with the Pinion, so that when the Pinion is rotated clockwise (see Fig. 6) the Pistons are drawn together. When the Pistons are together and the racks correctly engaged with the Pinion, the top Pinion drive flats should now be at right angles to the axis of the body.

8.5 Installing the Travel Stops. (Fig. 4)

With the Pistons together, screw in the Travel CLOSING Stop assembly complete with lock nut and seal (cast Identity number 2) until it comes into contact with the Pinion. Rotate the Pinion 90 degrees only to drive the Pistons apart and screw in the Travel OPENING Stop (cast Identity number 1) until it comes into contact with the Pinion. Final adjustment is easily made

when the Actuator has been mounted to its Valve, damper or other device, to suit individual requirements. Ensure the lock nut is tightened. **HYTORK Actuators have an over travel of 3 degrees at each end of the stroke. (See Dossier ACT039503 for benefits)**

Reverse action mode of operation (8.6, 8.7 & 8.8)

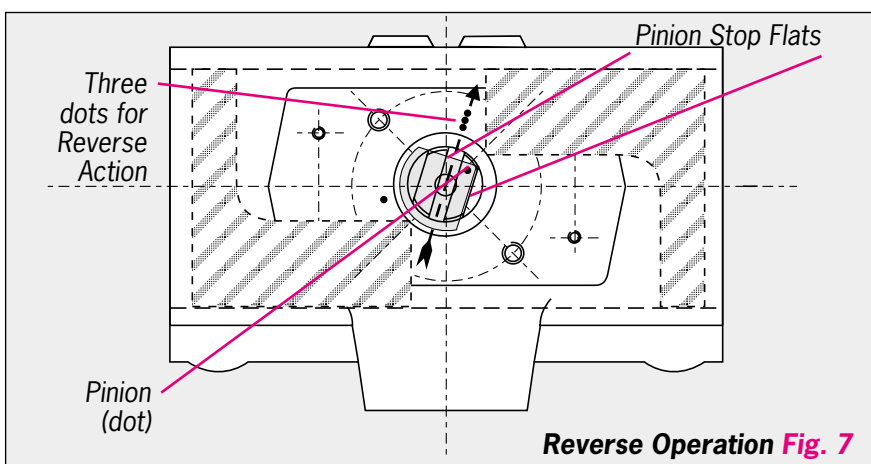
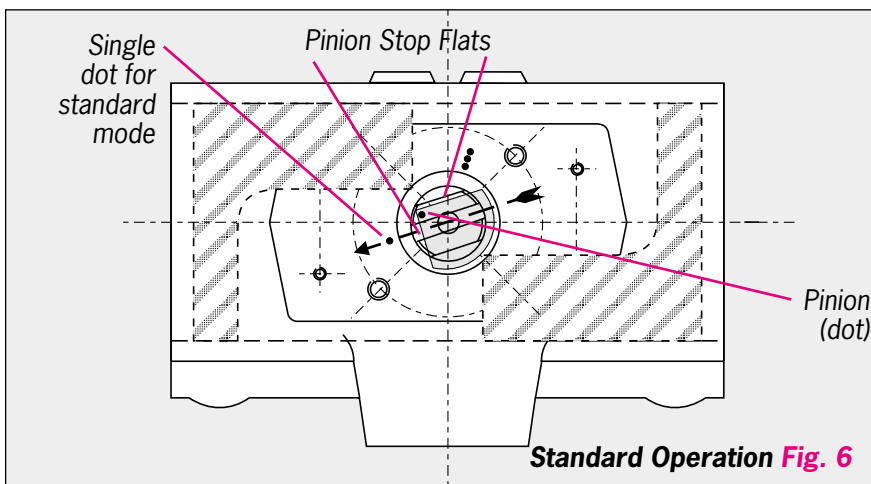
THIS MODE IS USED FOR MOST FAIL OPEN SITUATIONS. ANTI-CLOCKWISE ROTATION OF THE PINION WITH PISTONS MOVING TOWARDS EACH OTHER. (Fig. 7)

8.6 Alignment of Pinion for correct Piston installation. (Fig. 7)

Rotate the Pinion to the position shown in Fig. 7 (when viewed from above the slot at the top of the Pinion) ensuring that the machined Stop Flats are in the correct orientation. On later XL Actuators the top of the Pinion is marked with a single identification dot to indicate the correct orientation. To install the Pistons for standard air Fail Open operation, proceed as follows: rotate the Pinion so that the dot on the top of the Pinion is positioned close to the three dots on the top pad of the Actuator body. Accurate Pinion alignment can now take place by lining the centre of the slot on the top of the Pinion with the three dots on the body. (As indicated by the arrow on Fig. 7.)

8.7 Installing the Pistons.

Assemble Bearing Strips and 'O' Rings and grease as described in Section 8.4. Insert the Pistons into the bore, one Piston in each end with the teeth facing each other as shown in Fig. 7. The alignment groove in the front face of the Piston must be lined up parallel to the Pinion and cast "gun sights" in the body. Push both Pistons together until they are both in contact with the Pinion, so that when the Pinion is rotated anti-clockwise (see Fig. 7) the Pistons are drawn together. When the Pistons are together and the racks correctly engaged with the Pinion, the top Pinion drive flats should now be approximately parallel to the axis of the body.



8.8 Installing the Travel Stops.

(Fig. 4)

With the Pistons together, screw in the Travel OPEN Stop (cast Identity number 1) until it comes into contact with the Pinion. Rotate the Pinion 90 degrees to drive the Pistons apart and screw in the Travel CLOSING Stop (cast Identity number 2) until it comes into contact with the Pinion.

8.9 Installing the End Caps.

Install the SAFEKEY 'O' Ring Seals to the slotted screws on the SAFEKEY assemblies (6). Lightly grease the End Cap 'O' Rings (12) with Lithium based grease. Grease the ends of the body bore and the End Caps (2), making sure the grease goes into the grooves. Install the 'O' Ring into the square bottomed groove in the End Cap and insert the Cap into the body. Holding the SAFEKEY close to the entry hole to prevent kinking, insert the SAFEKEY into the hole and gently push into place. For larger models (1125 to 4580) use a wrench (*spanner*) on the End Cap, ensuring the End Cap is flush to the body, to turn the End Cap to assist the insertion of the SAFEKEY. With the slotted screw in contact with the body, tighten with a screw driver to create a pressure seal by compressing the 'O' Ring. Repeat the operation for the other End Cap. With the Pistons together, replace the Position Indicator (17) with the white and red pegs located as required to indicate the Valve position.

8.10 Location Ring.

On XL models 680, 1125 and 1370 (*metric versions only*) press the loose Location Ring into the bottom of the Pinion bore in the body.

8.11 Testing the HYTORK Actuator.

Using compressed air at 80 - 100 psi, check the seal areas with soapy water, ensuring no bubbles are produced and that the Pinion rotates smoothly over its full travel.

SPRING RATING CHART

Fig. 8

For Actuator Models 45, 70, 185, 425, 680, 1370, 2585, 4580

Spring Rating	Left Spring Assembly		Right Spring Assembly	
	Inner 15 psi	Outer 25 psi	Inner 15 psi	Outer 25 psi
S30	15 psi	none	15 psi	none
S40	none	25 psi	15 psi	none
S50	none	25 psi	none	25 psi
S55	15 psi	25 psi	15 psi	none
S65	15 psi	25 psi	none	25 psi
S80	15 psi	25 psi	15 psi	25 psi

For Actuator models 130, 280, 1125

Spring Rating	Inner 20 psi	Outer 20 psi 30 psi	Inner 20 psi	Outer 20 psi 30 psi
	S40	none	20 psi	none
S60	none	30 psi	none	30 psi
S80	20 psi	20 psi	20 psi	20 psi

9 Assembly Instructions - Spring Return Actuators

9.1 Assembly of Main Body Module.

Assemble in accordance with the instructions for Double Acting Actuators as described in Section 8.1 to 8.8.

9.2 Installing the Spring End Cap Module.

If the Springs have been completely relaxed on disassembly refer to Section 10 before proceeding.

Lightly grease the End Cap 'O' Rings (12) with Lithium based grease. Grease the ends of the body bore and the End Caps (2), making sure the grease goes into the grooves. Install the 'O' Ring into the square bottomed groove in the End Cap and insert the Cap into the body (5), (*making sure that the Springs have been sufficiently compressed so that the Retractor Cap locates in the Piston recess*). Install the 'O' Ring Seals to the slotted screws on the SAFEKEY assemblies (6). Holding the SAFEKEY close to the entry hole to prevent kinking, insert the SAFEKEY into the hole and gently push into place. For larger models (1125 to 4580) use a strap wrench on the End Cap, ensuring the End Cap is flush to the body, to turn the End Cap to assist the insertion of the SAFEKEY. With the slotted screw in contact with the body, tighten the screw with a screw driver to create a pressure seal. Repeat the operation for the other End Cap. Line up each End Cap

so that the safety symbols are correctly aligned for easy reading.

When the End Caps are in place and the SAFEKEY is fitted correctly, remove the HYTORK Retractor Rod completely. First place a wrench (*spanner*) onto the double lock nuts at the end of the Retractor Rod to stop it turning while releasing the single nut and washer that is against the End Cap. When this nut is free, unscrew the Rod by using the lock nuts at the end of the Retractor Rod and replace the Sealing Bolts (19) and 'O' Rings (18) in each End Cap. With the Pistons together, in the Fail position, replace the Position Indicator (17) with the white and red pegs located as required to indicate the valve position.

9.3 Testing the HYTORK Actuator.

Using compressed air at 80 - 100 psi, check the seal areas with soapy water, ensuring no bubbles are produced and that the Pinion rotates smoothly over its full Travel.

10 Spring Adjustments

10.1 Spring selection. (Fig. 8)

Diverse types of quarter turn Valves have significantly different operating torque characteristics. Plants have requirements for both Fail Open and Fail Close Valves. The air supply pressure to the Actuator also effects the Actuator size. HYTORK Springs are designed to give the user flexibility for whatever application is required. The actual selection of the correct Spring combination can be done by either referring to the torque charts

given in the literature on Spring Return Actuators or by consulting your local HYTORK VALVE AUTOMATION CENTER.

10.2 Normal Maintenance Requirements.

For normal maintenance when Spring changes are not required it is not necessary to fully relax the Springs. The Spring End Cap assembly can be left with the Retractor Rod holding the assembly together ready for reassembly.

10.3 Spring Removal. (Fig. 5)

If it is necessary to alter the Spring rating, the nut on the Retractor Rod next to the End Cap is gradually unscrewed ensuring that the Retractor Rod does not

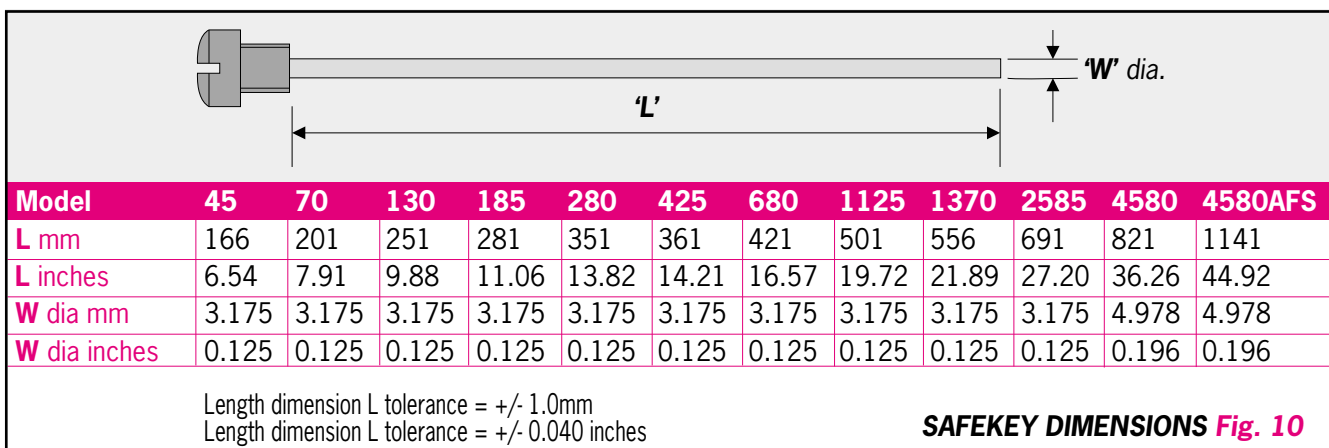
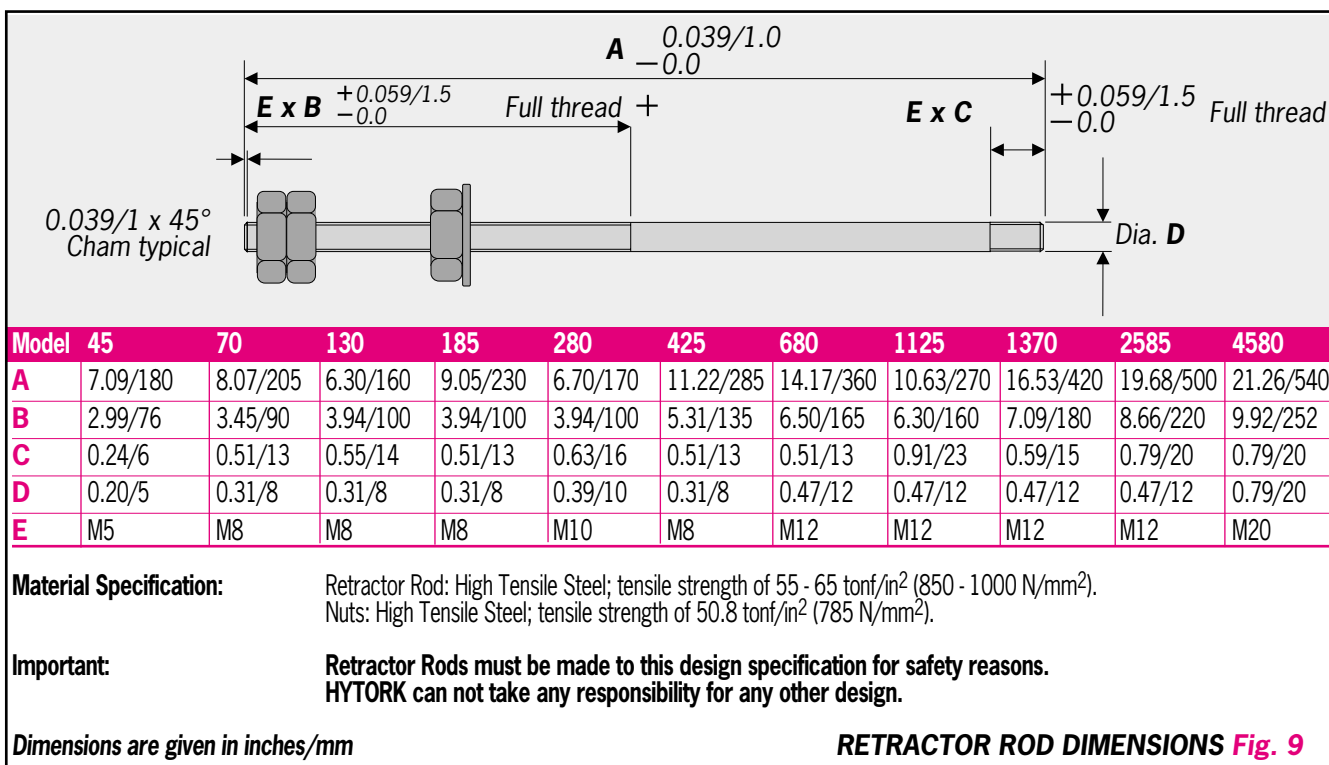
turn by using a spanner (wrench) on the lock nuts at the top of the Rod. Continue until the Spring is in its relaxed position. Once the Spring is fully relaxed the Retractor Rod can be unscrewed from the Retractor Cap and the Springs changed as required.

10.4 Spring Module Assembly. (Fig. 5)

To compress the Springs reverse the process ensuring that the Retractor Rod is screwed fully into the Retractor Plate before compressing the Springs.

11 Testing and Cycling of Infrequently Used or Stored Actuators

Actuators not in current use (i.e. Actuators in stores or stock and/or not operated for at least a 3 month period), should be cycled a minimum of ten times and tested against the possible 'pre-set' of the Seals. This is a safety precaution recommended by the Seal manufacturers.



12 Spares Kits

Contents List:

- 1 x I, O and M Instructions
- 2 x SAFEKEY Assemblies (6)
- 2 x SAFEKEY Seal 'O' Rings (6)
- 2 x Piston DURASTRIP Bearing Strips (10)
- 2 x Steel Thrust Washers (15)
- 1 x Pinion top 'O' Ring (13)
- 1 x Pinion top DURASTRIP Radial Bearing (9)
- 2 x DURASTRIP Thrust Bearing (14)
- 1 x Pinion bottom 'O' Ring (13)
- 1 x Pinion bottom DURASTRIP Radial Bearing (9)
- 2 x Stop Seals (1)
- 2 x Piston 'O' Rings (11)
- 2 x End Cap 'O' Rings (12)
- 1 x Pinion Snap Ring (Circlip) (16)

13 Retractor Rods

13.1 Spring Removal System Board.

HYTORK'S "SPRING REMOVAL SYSTEM BOARD" contains a full set of Retractor Rods so that any size of Actuator can be disassembled on site. Ask your local HYTORK VALVE AUTOMATION CENTER or your local Stocking Distributor of HYTORK Products for details.

The HYTORK Retractor Rod tools are specially designed for the safe removal of the Spring Return End Cap modules. Only HYTORK manufactured or approved rods are to be used for Spring End Cap removal.

Important: As with any threaded tool that is used frequently Retractor Rods should be checked to ensure that the threads are not worn or damaged in any way and greased regularly. Any damaged or worn Rods must not be used and must be destroyed.

13.2 Retractor Rod dimensions. (Fig. 9)

Important: Retractor Rods must be made to this design specification for safety reasons. HYTORK can not take any responsibility for any other design.

14 Service

It is the policy of HYTORK to give the best possible service to our customers. We are happy to assist you in any way we can and if you have any questions about HYTORK Actuators or other HYTORK Products please do not hesitate to contact one of HYTORK'S VALVE AUTOMATION CENTERS or your local HYTORK Stocking Distributor.

Quality Assured registered management systems to ISO 9001

MAC099811

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UK Patents:

GB 2 102 887 B;
GB 2 123 517 B;
GB 2 138 505 B;
GB 2 216 229 B;
GB 2 225 079 B;
GB 2 229 254 B;
GB 2 253 459 B;
GB 2 268 574 B.

US Patents:

4,496,071;
4,651,627;
4,716,815.

Warranties:

Unauthorised modification to any Hytorc Product totally invalidates all warranties.

Important:

We have endeavoured in this publication to make the contents as accurate as possible, but being given as general information, it is not to be taken as binding unless specifically confirmed in writing. Due to Hytorc's continuing commitment to engineered product advancement, the product specifications and data presented in this publication are subject to change without notice.

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