	INDEX:				
01	Introduction	04	Installation	07	Packaging and Storage
02	Technical Specifications	05	Operation	08	Warnings
03	Parts Identification	06	Maintenance	09	Assistance

01 INTRODUCTION

*This manual provides information on installation, operation, and maintenance procedures and related instructions for the **Rotex Manufacturers & Engineers Private Limited ECF Series** spring return and double acting pneumatic actuators.*

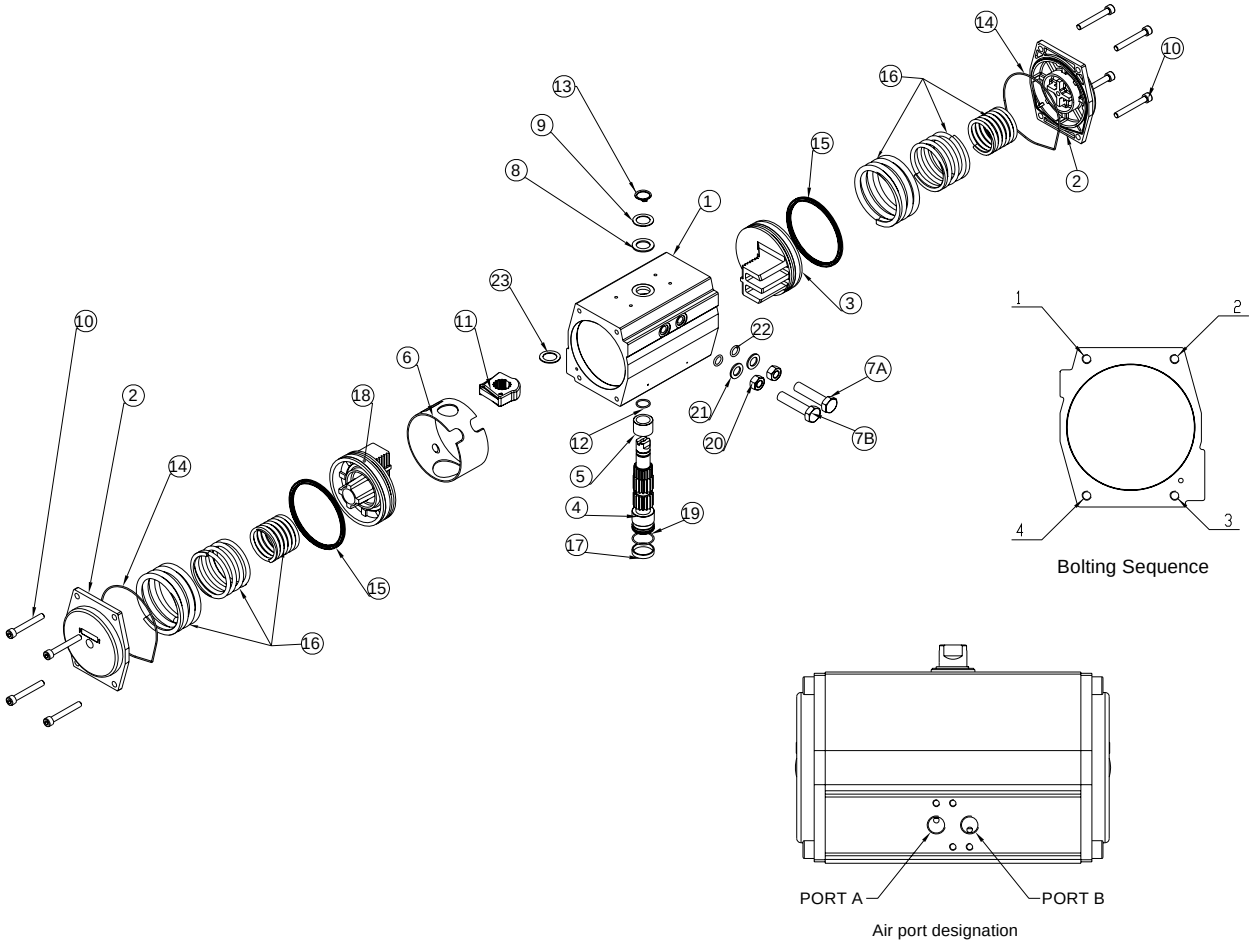
01.1 SAFETY NOTES

N1> Keep hands and clothing away from valve ports and actuator pinion at all times.
N2> Ensure air supply has been disconnected from actuator before any disassembly takes place.
N3> Never remove end caps when actuator is pressurized.
N4> Actuators must be sized accurately for proper installation.
N5> Operating actuators over temperature or pressure limits will result in damage to actuators.

02 TECHNICAL SPECIFICATIONS

Mounting	In accordance with ISO 5211/DIN 3337/VDI/VDE 3845 NAMUR		
Dimensions	As per ***Rotex Manufacturers & Engineers Private Limited*** Technical Brochure.		
Materials of Construction	*See Section 3 Parts Identification on page 2 of this manual.*		
Operating Principle (Standard Mode)	**DOUBLE ACTING**	**SPRING RETURN – Fail CW**	
	• Both ports A and B are used as inlet ports. • When air is supplied to Port A, the pistons #3 are moved *away from each other*, and the pinion #4 is rotated CCW. • When air is supplied through Port B, the pistons come closer and return to their home position, rotating the pinion CW.	• Port A is used as inlet • When air is supplied to Port A, the pistons #3 are moved *away from each other,* the springs #16 are compressed, and the pinion #4 is rotated CCW. • When the air is exhausted through Port A, the springs return the pistons to the home position, rotating the pinion CW.	
Operating Medium	• Air or non-corrosive gas compatible with the internal materials of construction. • Dry or lubricated. • Gas must be clean and filtered to minimum 100 micron level.		
Operating Conditions	Supply pressure, *max* (Standard)	**Model**	***psi*** / ***bar*** / ***kg/cm2***
		Direct Acting	120 / 8.3 / 8.4
		Spring return	120 / 8.3 / 8.4
	Operating temperature, *max* (Standard)	**Model**	***Deg F*** / ***Deg C***
		Direct Acting	180 / 82
		Spring return	180 / 82
Operating Controls	Stroke adjustment using stroke adjustment screws #7A/7B.		
Lubrication	Seals and sealing surfaces # 1/6/12/14/15/19. Rack #3 and pinion #4.		

03 PARTS IDENTIFICATION



PART NO	DESCRIPTION	MATERIAL OF CONSTRUCTION	PART NO	DESCRIPTION	MATERIAL OF CONSTRUCTION
1	BODY	ALUMINUM	12	O RING	NBR
2	END COVER	ALUMINUM	13	EXTERNAL CIRCLIP	SPRING STEEL
3	PISTON WITH RACK	ALUMINUM	14	COVER SEAL	NBR
4	PINION	STEEL/EN	15	PISTON SEAL	NBR
5	TOP PINION BEARING	POLYACETAL	16	SPRINGS	SPRING STEEL GR3
6	CENTER BORE SLEEVE	POLYACETAL	17	BOTTOM PINION BEARING	POLYACETAL
7A	STROKE ADJUSTMENT SCREW	STEEL	18	PISTON BEARING	POLYACETAL
7B	STROKE ADJUSTMENT SCREW	STEEL	19	BOTTOM PINION SEAL	NBR
8	WASHER	POLYACETAL	20	LOCK NUT	STEEL
9	WASHER	SS 304	21	WASHER	STEEL
10	HEX SOCKET SCREW	SS 304	22	O RING	NBR
11	CAM INSERT	CAST CARBON STEEL	23	CAM WASHER [1]	POLYACETAL

[1] Cam Washer only on ECF Models 80,110,125, 150, and 175.

04 INSTALLATION (Applicable to all Models)

Notes:

N1 > Ensure the installation meets the legal and regulatory requirements of the country and state of use.
N2 > Until the actuator is installed, keep it in its original packaging and stored between 40 °F and 120 °F (4 °C and 49 °C).

N3 > Ensure the operating medium meets the above requirements.
N4 > Use proper rigging to handle the actuators weighing more than 60 lb (27 kg) to avoid personal injury.

04.1 MOUNTING

Step 1	Keep the valve on which the actuator is to be mounted in home position, until the installation is complete. Ensure that valve is secure.
Step 2	Fix the brackets on the valve.
Step 3	Ensure the coupling slides on the stem smoothly without any play.
Step 4	Check the other end of the coupling with the actuator for the length of engagement.
Step 5	Mount the actuator *(Refer Note N4 above)* on the bracket with fasteners.
Step 6	Tighten all the fasteners to the torque as recommended by the fastener manufacturer.

04.2 SETTING

All actuators are factory set to 0 and 90 degrees. Even minor adjustments of the stroke adjustment screws *(#7A and 7B)* will result in over travel or incomplete travel of the pinion.

04.2.1 ADJUSTMENT

ADJUSTMENT FOR	POSITION	PART #	SCREW ADJUSTMENT DIRECTION	PISTON TRAVEL
Closing	0 degree	# 7B	Counter-clockwise	Travel further (over travel)
			Clockwise	Stops
Opening	90 degree	# 7A	Counter-clockwise	Travel further (over travel)
			Clockwise	Stops

05 OPERATION

- Provide air connections using proper fittings.
- Air supply to meet above specifications.
- **Ensure air supply pressure is regulated to ensure maximum air supply is not exceeded.**

Now the actuator is ready to perform

06 MAINTENANCE

06.1 RECOMMENDED SERVICING

#	Life in cycles	Recommendations
I	1,000,000	Apply grease on seals #1/6/12/14/15/19. Apply grease on rack #3 and pinion #4.
II	1,000,000	Replace all plastic #5/6/18 and rubber parts #12/14/15/19. Inspect springs # 16 for any rust or deformity. Replace if necessary.

Notes

N1 > Carry out maintenance involving disassembling of actuator in a safe indoor place free from dust, water.
N2 > Ensure that air supply has been disconnected.
N3 > Ensure proper lifting procedures are followed when moving or lifting actuators.
N4 > DO NOT use accessory mounting holes on top of actuator for lifting.
N5 > If actuator is spring return, ensure actuator is in the failed position and spring are de-energized before disassembling.

06.2 DISASSEMBLY

Refer the view on page 2.

Step 1	Loosen the lock nuts #20, and remove stroke adjustment screws #7A and 7B, washers #21, and o-rings #22.
Step 2	Loosen the cover bolts # 10 on each end cap gradually in 1 – 3 - 2 – 4 sequence. *The bolts are long enough to retain the cover connected to the cylinder until the spring tension is fully released.* ***CAUTION: Spring return actuator end caps are under spring tension. Caution must be used when removing end cap bolts and end caps. It is suggested that the actuator be put into a press during removal of end caps to ensure safe release of spring tension.***
Step 3	Rotate the pinion #4 in the counter-clockwise direction until the pinion becomes free.
Step 4	Pull the piston out from each side by holding with pliers. ***NOTE: NEVER attempt to remove pistons from actuator body using air pressure when the end caps have been removed!!***
Step 5	Remove external circlip # 13 and then washers #8 and #9.
Step 6	Tap the pinion gently from the top using a rubber mallet until the pinion is approximately half way into the body.
Step 7	Remove the top pinion seal #12 and the top pinion bearing #5.
Step 8	Remove the cam stop ring #11 and washer #23.
Step 9	Pull the pinion the rest of the way out of the body.
Step 10	Check the pinion bearing #5 for its condition.
Step 11	If removal and replacement of the pinion bearings are required, *carefully* push the pinion bearing off with the help of a screw driver and remove from the body.
Step 12	Push and remove the center bore sleeve #6.
Step 13	Remove the bottom pinion bearing #17, the bottom pinion seal #19, and the end cap seals #14.

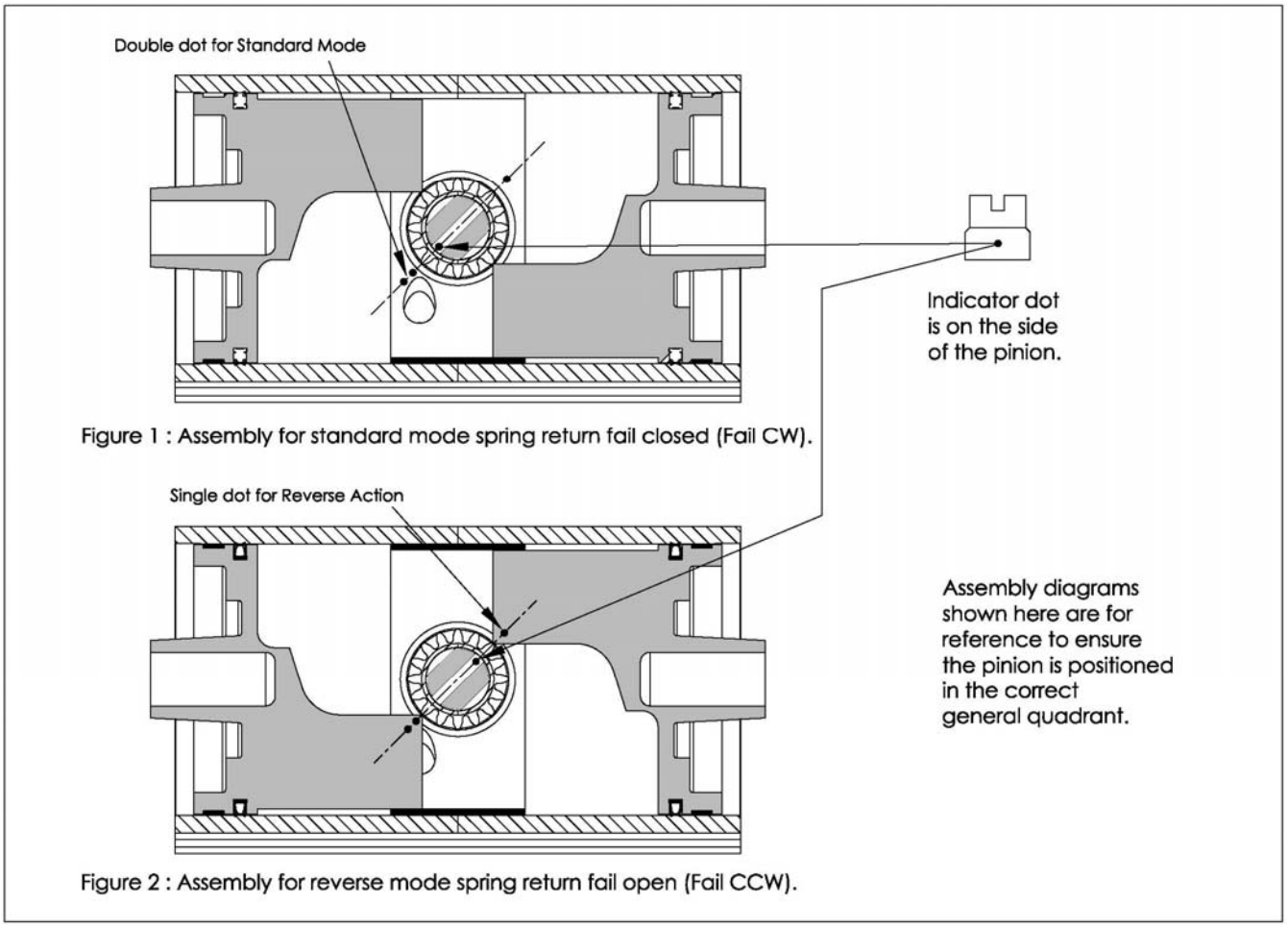
06.3 ASSEMBLY for DOUBLE ACTING AND STANDARD MODE SPRING RETURN (Fail CW)

Notes

N1 > Follow the sequences as given below to ensure proper assembly.
N2 > Use only the recommended accessories and lubricants.
N3> Assembly instructions in this section are for double acting and standard mode spring return (fail closed / fail clockwise) actuators. ***For assembly notes on reverse mode spring return actuators (fail open / fail counter-clockwise) see notes in section 6.4.***

Step 1	Clean all the parts.
Step 2	Insert center bore sleeve #6 into the body #1.
Step 3	Ensure that the hole in the center bore sleeve is aligned with port A.
Step 4	Fit bottom pinion bearing #17 and bottom pinion seal #19 on to the pinion #4. Apply recommended grease over the pinion bearing surface #17 and on the bottom pinion seal #19. Apply a thin coat all over the surface; avoid excess grease.
Step 5	Insert pinion carefully into the body #1 from the bottom, approximately half way.
Step 6	Install the cam stop ring #11 and polyacetal cam washer #23 on top of pinion.
Step 7	Install top pinion seal #12 on pinion and apply a light layer of grease.
Step 8	Install top pinion bearing #5 on pinion.
Step 9	Push the pinion the rest of the way into the body. Apply gentle force while rotating the piston to facilitate the insertion.
Step 10	Install polyacetal washer #8, SS washer #9, and external circlip #13 on top of pinion.
Step 11	Check for free rotation of pinion.
Step 12	Apply recommended grease over the bore of the body and over the interior of the center bore sleeve; avoid excess grease.
Step 13	Rotate the pinion so that the dot on the pinion is positioned close to the two dots 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 two dots on the body. (See figure #1, page 6)
Step 14	Insert the pistons, pressing only until the seals enter the body. Push in both the pistons simultaneously. ***CAUTION:*** ***C1> Extreme caution should be used as piston seals are slid into the actuator body. Misalignment of piston seals during this step WILL result in damage to the seal and air leak paths.***
Step 15	Ensure both the pistons are engaged in the same position. *Same amount of gap between the face of each piston and the end of the body will confirm this.*
Step 16	For spring return actuators, insert the springs #16. *NOTE:* *N1> When assembling springs and end caps on spring return actuators, it is necessary to have the actuator body in the vertical position. This is required to ensure that springs remain properly aligned and centered during assembly.*
Step 17	Fix the seals #14 on the left and right end caps and install on to body. Ensure the air ports on the end caps are aligned properly. *Ensure uniform tightening sequence of the bolts 1 – 3 – 2 – 4.*
Step 18	Install stroke adjustment screws #7a and 7B with o-rings #22, washers #21, and lock nuts #20.
Step 19	Apply air to Port A to move pistons to the extended 90 degree position.
Step 20	Adjust stroke adjustment screw #7A for the 90 degree position, turning clockwise until the screw is barely touching the piston. Tighten the lock nut.
Step 21	For spring return actuators, release the air pressure, for double acting actuators, apply air to Port B. This will bring the pistons back to the 0 degree position.
Step 22	Adjust the stroke adjustment screw #7B for the 0 degree position, turning clockwise until the bolt is barely touching the piston. Tighten the lock nut.
Step 23	Apply air as required to stroke the actuator several times to confirm that the stroke adjustment screws are set correctly and ensure that there is no air leakage from any of the seals.
Step 24	Re-install or repack for storage (see section 7 for Packaging and Storage).

Figures 1 and 2:
Assembly diagram for use with Section 6.3 Step 13 and Section 6.4 Step 13 – for alignment of pinion.



06.4 ASSEMBLY for REVERSE MODE (Fail CCW) SPRING RETURN ACTUATORS

Notes

N1 > Follow the sequences as given below to ensure proper assembly.
N2 > Use only the recommended accessories and lubricants.
N3> Assembly instructions in this section are for spring return actuators in the reverse mode (fail open / fail CCW). ***For assembly notes on standard mode spring return actuators (fail closed / fail clockwise) see notes in section 6.3.***

Step 1	Clean all the parts.
Step 2	Insert center bore sleeve #6 into the body #1.
Step 3	Ensure that the hole in the center bore sleeve is aligned with port A *(refer view).*
Step 4	Fit bottom pinion bearing #17 and bottom pinion seal #19 on to the pinion #4. Apply recommended grease over the bearing surface and on the O ring - uniformly and a thin coat all over the surface; avoid excess grease.
Step 5	Insert pinion carefully into the body from the bottom, approximately half way.
Step 6	Install the stop ring #11 and polyacetal washer #23 on top of pinion.
Step 7	Install top pinion seal #12 on pinion and apply a light layer of grease.
Step 8	Install top pinion bearing #5 on pinion.
Step 9	Push the pinion the rest of the way into the body. Apply gentle force while rotating the piston to facilitate the insertion.
Step 10	Install polyacetal washer#8, SS washer #9, and external circlip #13 on top of pinion.
Step 11	Check for free rotation of pinion.
Step 12	Apply recommended grease over the bore of the body and over the interior of the center bore sleeve; avoid excess grease.
Step 13	Rotate the pinion so that the dot on 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 top of the pinion with the single dot on the body. (See figure #2, page 5).
Step 14	Insert the pistons, pressing only until the seals enter the body. Push in both the pistons simultaneously. ***CAUTION:*** ***C1> Extreme caution should be used as piston seals are slid into the actuator body. Misalignment of piston seals during this step WILL result in damage to the seal and air leak paths.***
Step 15	Ensure both the pistons are engaged in the same position. *Same amount of gap between the face of each piston and the end of the body will confirm this.*
Step 16	Insert the springs #16. *NOTE:* *N1> When assembling springs and end caps on spring return actuators, it is necessary to have the actuator body in the vertical position. This is required to ensure that springs remain properly aligned and centered during assembly.*
Step 17	Fix the seals #14 on the left and right end caps and install on to body. Ensure the air ports on the end caps are aligned properly. *Ensure uniform tightening sequence of the bolts 1 – 3 – 2 – 4.*
Step 18	Install stroke adjustment screws #7A and 7B with o-rings #22, and lock nuts #20.
Step 19	Apply air to Port A to move pistons to the extended 0 degree position.
Step 20	Adjust stroke adjustment screw #7B for the 90 degree position, turning clockwise until the screw is barely touching the piston. Tighten the lock nut.
Step 21	Release the air pressure to bring the pistons back to the 90 degree position.
Step 22	Adjust the stroke adjustment screw #7A for the 0 degree position, turning clockwise until the screw is barely touching the piston. Tighten the lock nut.
Step 23	Apply air as required to stroke the actuator several times to confirm that the stroke adjustment screws are set correctly and ensure that there is no air leakage from any of the seals.
Step 24	Re-install or repack for storage (see section 7 for Packaging and Storage).

07. PACKAGING and STORAGE

- When not in use, actuators should be kept in a sealed plastic bag in a cardboard box to prevent moisture or dust from contacting product.
- Actuators should be stored in a dry place free from water and dust.
- Store at temperature between 40 and 120 ℉ (4 ℃ and 49 ℃).
- Locate in an area to avoid damage by impact.

08 WARNINGS

W1 > Use only genuine spares parts supplied by ***Rotex.***

W2 > Use only the recommended accessories and lubricants.

W3 > Install, operate and maintain as per the instructions and recommendations of this manual.

W3 > Any **deviation** from the above warnings will cease the responsibilities of ***Rotex.***

09 ASSISTANCE

For technical questions or assistance, contact any authorized distributor of ***Rotex*** or:

ROTEX MANUFACTURERS & ENGINEERS PRIVATE LIMITED
Manpada Road, Dombivli (East)-421204
Maharastra, INDIA.
Tel: +91 251 2871033/ 2871390/ 2871196/ 2871989
Fax: +91 251 2871191
rotexdbl@rotexindia.com