

# TERATORK® PNEUMATIC ACTUATOR

## INSTALLATION OPERATION AND MAINTENANCE MANUAL



**MICROFINISH VALVES PVT. LTD.** 

Block no.23B, Plot no.1 to 6, Hubballi-Dharwad Bypass Road, Itigatti Village,  
Dharwad-580 114, Karnataka state, India. Phone: +91 836 2310015 / 16 / 19  
Email: sales@microfinishgroup.com Website: www.microfinishgroup.com

**THE AMERICAS**

**MICROFINISH VALVES, INC.** 

7505 Bluff Point Drive, Suite 100 Houston, Texas 77086, United States.  
Phone: +1 281-885-4250 / +1 281-885-4259 Fax: +1 281-866-0996  
Email: usasales@microfinishgroup.com Website: www.microfinishvalvesinc.com

## SIZES INCLUDED

Double Acting DA-T52-T400

Spring Return SR-T52-T400

## GENERAL

The **Teratork**<sup>®</sup> actuator is a pneumatic quarter-turn Rack & Pinion actuator.

Air pressure applied to the piston surface area generates thrust which transforms linear motion to rotary motion of the pinion. This Installation, Operating & Maintenance manual covers the instructions required for the safe use of this product.

**Read the entire IOM prior to using this product.**

### 1.0 WARNINGS & SAFETY INSTRUCTIONS

1. Improper use of the product may result in injuries or property damage.
2. Only trained and qualified maintenance personal who have read these instructions should disassemble or assemble the actuator.
3. Assure that the actuator is isolated from compressed gas supply or electrical ancillaries before maintenance commence.
4. Before operating an actuator which is connected to a valve in the pipeline make sure you know the valve function.
5. Do not remove the actuator pistons by use of gas pressure when the covers have been removed.
6. Use the actuator within the pressure and temperature limits indicated on the nameplate.
7. Product warranty will be invalidated in the event of improper operation results from product misuse or faulty maintenance.
8. Microfinish will bear no responsibility for external accessories attached to the **Teratork**<sup>®</sup> actuator.

### 2.0 STORAGE

The **Teratork**<sup>®</sup> actuator has been packaged to provide protection during shipment; however, it can be damaged in transport. Prior to storage, inspect the actuator for shipping damage. Keep the actuators in their original packing box during storage. It is recommended to keep the actuators in a clean and dry environment until ready for use. The actuator has two air ports, which should be plugged during storage to prevent liquids or other materials from entering the actuator during storage. If the actuators are to be stored for a long period of time before installation, it is recommended to stroke them periodically to prevent setting of the seals. Store the actuators indoors to protect them from humidity and dust.

### 3.0 OPERATING CONDITIONS

#### Lubricants

The **Teratork**<sup>®</sup> actuator is factory lubricated; **additional lubrication through the compressed gas line must be avoided.**

In the event of actuator maintenance it is recommended to use the following lubricants:

For NBR O-rings use EP1 grease.

This grease is suitable for use from -20°C (-4°F) to +80°C (+176°F)

For Viton O-rings use Molykote 111 or OKS 1110.

These lubricants are suitable for use from -40°C (-40°F) to +140°C (+284°F).

### Compressed gas

Use clean dry compressed air to operate the Teratork® actuator.

Other inert gases may be used such as nitrogen, argon and natural gas.

Oxygen or hydrogen must NOT BE USED.

The compressed gas used to operate the actuator shall be filtered to 30 micron particle size or less.

Tube or hose connected to the actuator or to the accessories should be fitted according to recommended instrumentation tubing practice.

Confirm that all tube lines are free of water, oil and other contaminants.

Flush the tubes with compressed gas to clean all passages.

Do not allow sealant tapes from entering the actuator ports.

### Supply Pressure

The supply pressures for the Teratork® actuator are as follows:

Double-acting: 2-8 bar (30-120 psig)

Spring-return: 3-8 bar (40-120 psig)

### Temperature

The standard temperature limits for the Teratork® actuator is -20°C (-4°F) to +80°C (+176°F).

For temperatures below or above these figures special preparation and materials are required such as grease, O-rings, pinion bearings and pads.

The Teratork® maximum working temperature is 130°C (266°F) when used with Viton O-rings and HT grease.

The Teratork® minimum working temperature is -40°C (-40°F) when used with EPDM O-rings and LT grease.

For temperatures below -40°C (-40°F) please consult with Compact.

When used in sub-zero temperatures it is essential to use an air dryer for the supply to avoid any moisture.

### Humidity – Corrosion

When using a spring return actuator in a corrosive environment, or in a high humidity environment, it is recommended to use a 5/2 solenoid valve; in this case controlled compressed air will flow into the actuator spring chamber, and uncontrolled air from the environment will be avoided from entering.

### Air Connections

The actuator air connections are marked **A** and **B**.

Port A is connected to the actuator inner chamber.

Port B is connected to the outer piston chamber.

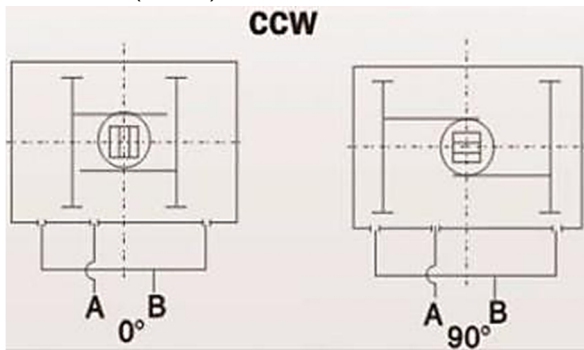
Pressure entering port **A** into the inner chamber pushes the pistons outward and rotates the pinion **CCW**.

Pressure entering port **B** into the outer chambers pushes the pistons inward and rotates the pinion **CW**.

### Double Acting (DA)

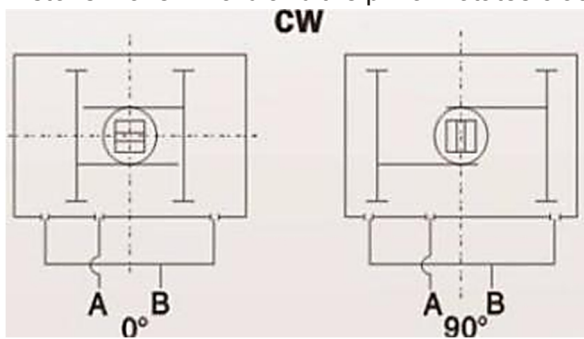
Pressurizing port A to open:

Pistons move outward and the pinion rotates counter clockwise (CCW)



Pressurizing port B to close:

Pistons move inward and the pinion rotates clockwise (CW).

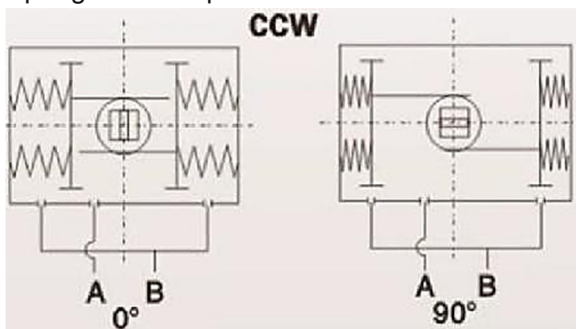


### Spring Return (SR)

Pressurizing port A to open:

Pistons move outward and the pinion rotates counter clockwise (CCW).

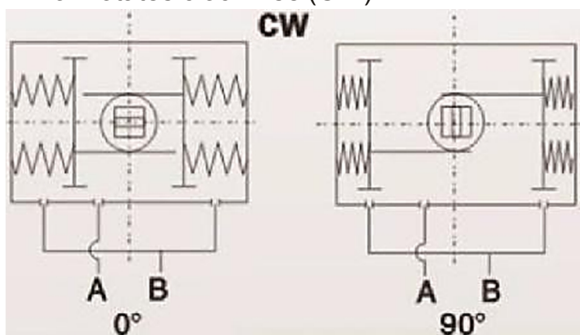
Springs are compressed.



De-Pressurizing port A to close:

Air released from inner chamber. Springs drive pistons inward.

Pinion rotates clockwise (CW).



### NAMUR Solenoid Mounting

Use NAMUR Solenoid valve to mount the unit directly onto the actuator body.

Non-NAMUR solenoid valve shall be mounted remotely, and connected to the actuator passage through appropriate tubing.

### ISO 5211 Standard

The actuator bottom flange is in accordance with ISO 5211 standard.

The actuator pinion includes a star shaped female drive to fit square or diamond oriented shaft.

**Teratork**<sup>®</sup> actuator can be mounted directly onto a valve, or mounting through a bracket and coupler.

### Travel adjustment

The **Teratork**<sup>®</sup> actuator is adjusted to 90° rotation.

The rotation is restricted by limit stops (#17) with allowable adjustment of +/-5°.

The screws are threaded into the actuator body

### Indicator

All actuators are assembled with a highly visible indicator. The indicator has interchangeable “Snap-On” flow direction arrows for identification of valve position.

The arrows provide any type of pattern according to the valve ports.

Use a screw driver or sharp object at the arrow head to push it out.

The puck has three position signaling inserts screws to allow signaling of any position. The puck is screwed to the pinion Namur thread. The indicator snaps to the pinion with its Namur interface projecting above it and enabling any ancillary to connect to the pinion.

### Identification

**Teratork**<sup>®</sup> actuator includes a nameplate located on the side of the actuator body. The information includes actuator size, model, type, spring set, threads, indicator, additional options, and date of manufacture, pressure limits and company logo.

## 4.0 DISASSEMBLY

### General

Before performing any disassembly operations make sure you read all the warnings and safety instructions in this leaflet. Do not attempt to disassemble the actuator while it is still connected to the valve or to any ancillary.

Verify that the actuator is not pressurized.

Check that the air ports are vented and spring return actuators are in the fail close position.

Work in a clean area, free of dust, debris, grease, corrosives and moisture.

For security and comfort do the repairs on a table with a vice and available air supply. Clamp an adaptor to a vice and place the actuator drive on it.

Use only metric tools and make sure they are not blunt on the edges.

### Disassembly of Double Acting covers

1. Remove the cover screws (#25).
2. Remove the covers (#24) make sure the covers O-rings (#23) are undamaged.

To convert a DA actuator to SR actuator, skip to section 6 for assembly. To convert a DA actuator to SR actuator, skip to section 6 for assembly.

### Disassembly of Spring Return covers

**Caution: The springs in the actuator are loaded.**

1. Remove the cover screws in a sequence by turning each opposing screw two rotations at a time. The springs of Teratork® actuator will be unloaded before the covers screws are loosened.
2. Remove the covers (#24) make sure the covers O-rings (#23) are undamaged.
3. Remove the springs (#22) from the cylinder and place them in a clean area ready for the assembly stage.

**To replace the spring configuration or to convert to DA actuator, skip to section 6 for assembly.**

### Pistons Disassembly

1. Loosen the lock nut (#16) and thread the adjustment screw (#17) 10-15 mm outward from the actuator body (#6), this operation will enable the limit stop to rotate beyond its limit and the pistons to slide out.
2. Grip the actuator body with both hands and rotate it clockwise, both pistons will eject out of their cylinders.
3. Remove the piston O-rings (#20), plastic piston bearing (#21) and piston guide (#19), do not damage the soft part while pulling them out. Note: Usually it is not required to remove the piston guide (#19).
4. If necessary, remove the elastomer plugs (#14) from both sides of the actuator through-way tunnel.

## 5.0 ASSEMBLY PROCESS

### Parts preparation

5. Clean the cylinders and all the actuator parts.
6. Check the cylinder for scratches, indentation or surface irregularity, the surface must be smooth, without any damage, debris, rust or any other contaminants.
7. Apply grease to the cylinder, pistons, and pinion prior to the assembly.

### Pinion assembly

8. Slide the two plastic bearing (#10, #12) onto the pinion (#11) upper and lower grooves.
9. Apply grease to the pinion O-rings (#9, #13) and fit them on the pinion (#11) upper and lower grooves.
10. Insert the pinion from the bottom plane of the actuator body (#6), once it protrudes into the actuator cavity; place the limit stop (#8) as per the orientation shown in **figure A**, and the plastic washer (#7) on the pinion (#11) upper side.
11. Push the pinion up through the actuator body (#6) top plane, until the pinion bottom side is flat with the actuator body bottom plane.
12. Slide first the outside plastic washer (#5) and then the stainless steel washer (#4) on top of the pinion.
13. Use a proper tool and insert the stainless steel snap ring (#3) onto the pinion (#11) top side groove.
14. Always use a new snap ring (#3).

### Pistons assembly and actuator adjustment

15. Place the assembled body and the pinion on the rig with the adaptor for inserting the pistons back in the cylinders.
16. Hold the actuator body, turn it +/- 90 degrees, and verify smooth operation.
17. Apply grease to the piston's O-rings (#20) and fit them onto the pistons (#18).
18. Press fit the plastic piston guide (#19) into the piston (#18) back side.
19. Slide the plastic bearing (#21) onto the piston (#18).

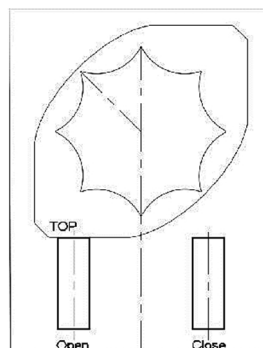
20. Apply grease in the body cylinders, and to the pistons rack.
21. Looking from the top of the actuator, rotate the body 90° CW and another 30° to the position of gripping the pistons.
22. Insert the two pistons into the cylinders, keeping the orientation of the racks so the teeth engage with the pinion teeth.
23. Hold the pistons with both hands and rotate the body CCW both pistons are pulled into the actuator body.
24. Confirm both pistons are in the same position inside the cylinder.
25. Assemble the adjustment screw (#17), lock nut (#16) and O-ring (#15) to the actuator body (#6),
26. Tread the adjustment screw (left hand side) until it stops against the limit stop.
27. Rotate the body back 90° CW to the open position so the pistons are now almost flush with the actuator body.
28. Tread the adjustment screw (right hand side) until it stops against the limit stop.
29. Adjust both adjustment screws the pinion flats are parallel with the body plane.
30. Turn both lock nuts, tighten the O-rings against the actuator body (#6), and lock the adjustments screws from turning.
31. Press fit the elastomer plugs (#14) into both sides of the actuator through-way tunnel.

### Covers assembly

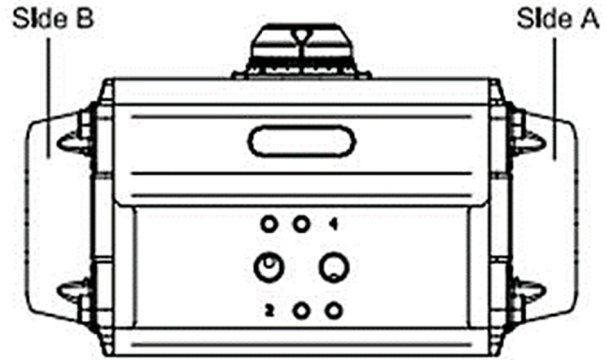
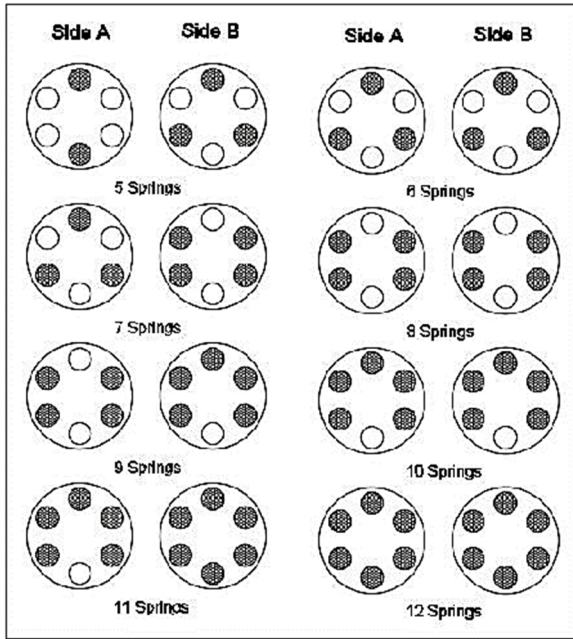
32. Rotate the body back and forth and verify pistons smooth operation.
33. Bring the pistons to the closed position and once again apply grease to the cylinders pistons back side.
34. Apply grease to the spring sets (#22) and to the cover O-ring (#23).
35. Place the O-ring (#23) inside the cover groove (#24).
36. For Spring-Return actuator, place the spring set inside the piston pockets with the pattern shown in **figure B**.
37. Lubricate the cover screws (#25).
38. Place the actuator cover, and the O-ring attached to it, on the spring set.
39. Tighten the cover screws (#25) in a sequence, only two turns at a time, allowing uniform load on all springs.
40. Double acting actuator Assemble the covers (#24) without the spring set.
41. Torque tightening the cover screws to the figures shown in **Table 1**.

### Final stage

42. Use a clean cloth and clear the actuator from grease stain and other contaminates.
43. Press fit the plastic indicator (#2) on the pinion (#11) top flats.
44. Hold the indicator (#2) in place by threading the indicator screw (#1) to the pinion top plane.
45. Attach the product nameplate and manufacturer sticker to the actuator body.
46. Transfer the actuator to the testing stage.



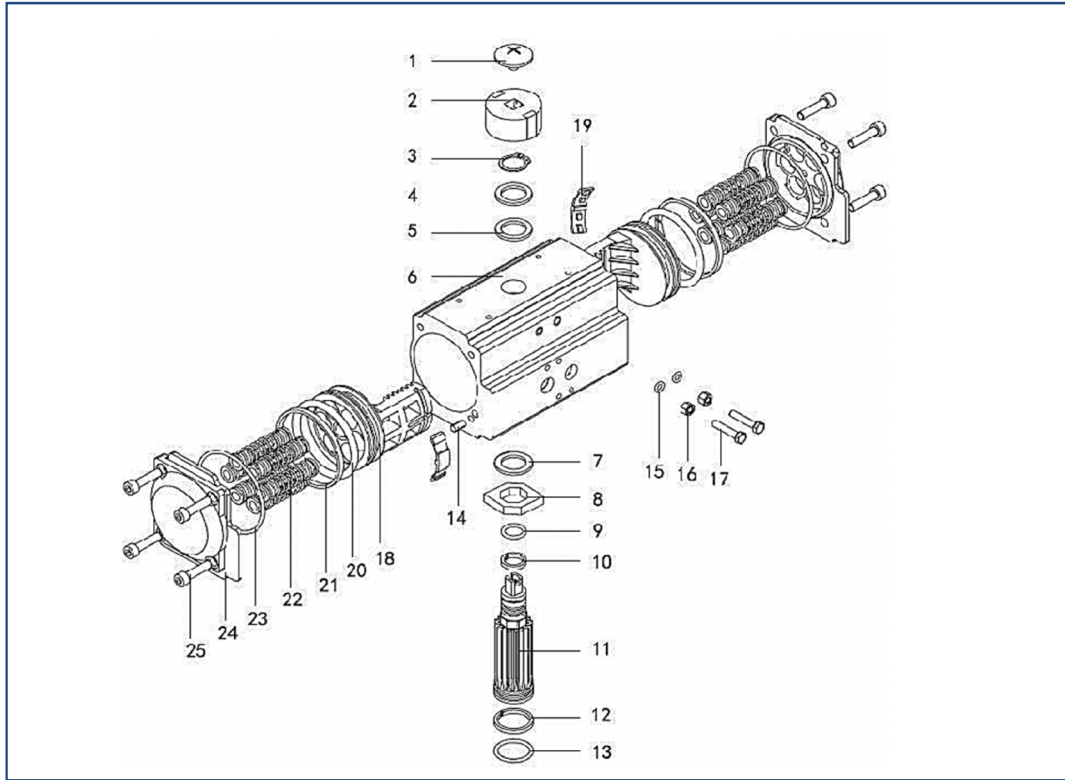
**Figure A**



**Figure B**

Table 1 – Actuator cover screw tightening torque				
Actuator Size	Screw size	Nm	lb*ft	In*lbft
AT52	M6	10	7.4	88.5
AT63	M6	10	7.4	88.5
AT75	M6	10	7.4	88.5
AT83	M6	10	7.4	88.5
AT92	M8	24	17.7	212.4
AT105	M8	24	17.7	212.4
AT125	M10	50	36.9	442.5
AT140	M10	50	36.9	442.5
AT160	M10	50	36.9	442.5
AT190	M12	82	60.5	725.7
AT210	M14	135	99.6	1194.8
AT240	M16	200	147.6	1770.0
AT270	M16	200	147.6	1770.0
AT300	M20	390	287.8	3451.5
AT350	M20	390	287.8	3451.5
AT400	M20	390	287.8	3451.5

## Exploded view



## Material of construction

Sl.No	Name	Qty	Material	Treatment	Option Material
1	Indicator Screw	1	Plastic		
2	Indicator	1	Plastic		
3	Snap Ring	1	SS		
4	Washer	1	SS		
5	Outside Washer	1	Plastic		
6	Body	1	Aluminum Alloy	Hard Anode Oxidation	
7	Inside Washer	1	Plastic		
8	Cam	1	ANSI 1045	ENP Coating	
9	O Ring	1	NBR		VITON
10	Bearing	1	Plastic		
11	Pinion	1	ANSI 1045	ENP Coating	SS
12	Bearing	1	Plastic		
13	O Ring	1	NBR		VITON
14	Plug	2	NBR		VITON
15	O Ring	2	NBR		VITON
16	Nut	2	SS		
17	Adjust Screw	2	SS		
18	Piston	2	Die Casting Aluminum	Hard Anode Oxidation	
19	Guide Piston	2	Plastic		
20	O Ring	2	NBR		VITON
21	Bearing	2	Plastic		
22	Spring	0-12	Steel	Dipping Lacquer	
23	O Ring	2	NBR		VITON
24	End Cap	2	Die Casting Aluminum	Powder Polyester Painting	
25	Screw	8	SS		

## 6.0 TESTING

After completion of actuator assembly it is required to follow these testing procedures to ensure the actuator has been assembled correct and to minimize the risk of personal.

### Pneumatic Leak Test

The pneumatic test checks there is no leakage across the pistons or to environment.

Use commercial leak testing solution to check leakage to atmosphere. It is acceptable to allow a small amount of leakage to atmosphere. A bubble which breaks every 10 seconds is considered acceptable.

The leak testing pressure will be 80 psig (5.5 bar g). Use a calibrated pressure regulator to apply pressure to the actuator.

**WARNING: Do not exceed the maximum operating pressure rating listed on the nameplate.**

Cycle the actuator at least 5 times to allow the seals to find their position before commencing with the leak test.

### Piston leakage

Any leakage across the piston is not acceptable.

1. Apply the pressure to port A and leave port B open.
2. Apply a leak testing soap solution to port B and check for leakage.
3. For DA actuators repeat this applying pressure to port B and check port A for leakage.
4. If leakage is observed, disassemble the actuator again and check the seals, surface finish and cleanliness of the internal parts to find the cause of leakage.

After doing the repair work, the leakage test must be performed again.

### External leakage

For SR actuators apply the pressure to port A and leave port B open.

For DA actuators apply the pressure to both port A and port B.

After applying pressure, wait a few seconds to let the pistons stabilize and then check for leakage.

Apply the leak testing solution to the pinion output.

For DA actuators apply the leak testing solution to the covers.