



Quadrant Valve & Actuator Engineering Specification

Number: IOM- 10

Date: 4/27/2003

Title: Installation, Operation and Maintenance Manual for C-Series Double Acting and Spring Return Pneumatic Actuators

I. Initial Inspection

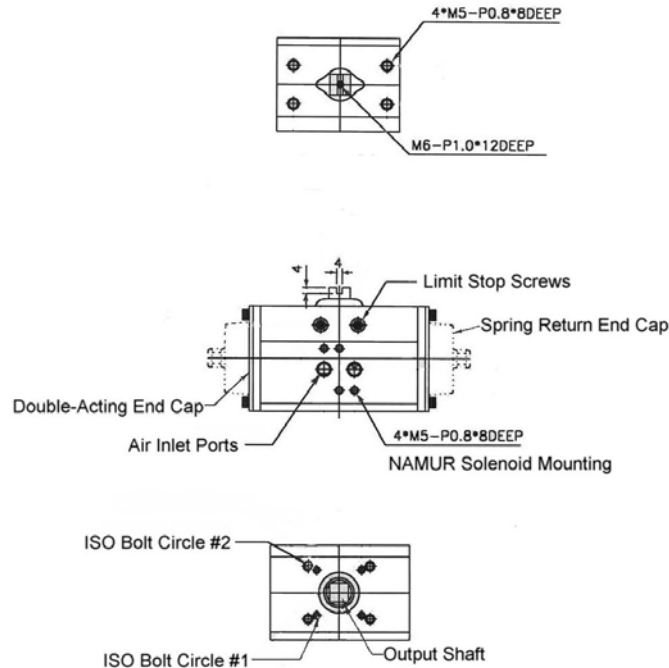
- A. Remove actuator from packaging; remove thread protectors and discard, if so equipped.
- B. Inspect entire exterior of actuator for any damage caused in shipment or handling. Pay special attention to top position indicator, upper & lower drive shaft bores and drives, limit stop screws and spring retention screws in spring return end caps.
- C. Confirm actuator size, stamped on label, is correct for installation and conforms to your purchase requirement.

II. Operational Theory and Function

- A. Quadrant C-Series Pneumatic Actuators are manufactured and assembled in two different configurations: **double-acting** and **spring return**.
- B. Both types provide a maximum of 100 degrees of output shaft rotation, and this rotation is adjustable from 80 degrees to 100 degrees by adjustment of limit stop screws – see drawing.
- C. **Double Acting** actuators require that the instrument air signal be applied to one of the (2) air inlet ports (identified on drawing) to cause output shaft to rotate in one direction, and then for the instrument air to be exhausted from the first port and then applied to the alternate air inlet port, which causes the output shaft to rotate in the opposite direction back to original position. This can be accommodated by mounting of a NAMUR-compliant 4-way solenoid valve to the actuator using the tapped holes above and below air inlet ports. Quadrant C-Series Double-acting actuators are assembled so that when air is applied to right hand air inlet port (facing actuator), output shaft will rotate COUNTER-CLOCKWISE when viewed from top of actuator (looking down on orange position indicator).
- D. **Spring Return** actuators require that instrument air be applied to only the “right-hand” (facing actuator) air inlet port, which causes the output shaft to rotate COUNTER-CLOCKWISE (viewed from above), and simultaneously compresses the internal springs located inside the end caps. When the instrument air signal is removed from the right-hand side air inlet port and pressure is exhausted, the internal springs extend and cause the output shaft to rotate CLOCKWISE back to its original position. Quadrant spring return actuators are assembled and shipped to provide this rotation sequence, because most applications require “spring return closed” valve operation, and the international standard for ¼-turn valve products is

for “CLOCKWISE TO CLOSE” operation. The operation described can be facilitated by mounting a 3-Way NAMUR-compliant solenoid to the tapped holes above & below air inlet ports.

- E. If the Spring Return actuator application requires that the output shaft rotate COUNTER-CLOCKWISE (viewed from above actuator) on the spring stroke, a special “CCW” spring return configuration is available from the Quadrant factory, or the normal spring return actuators can be converted to “CCW” spring stroke in the field- see “Conversion to CCW Spring Return Operation” section.



III. Assembly of Actuator to a Quarter-Turn Valve or Valve Mounting Bracket

- A. Quadrant C-Series pneumatic actuators are manufactured with a female “double-square” broached hole in the portion of the output shaft that is adjacent to the tapped mounting pattern (s). The actual “across-flats”, “across corners” and depth dimensions for each size C-Series actuator is shown in Table 1. Special “double-square” inserts that engage with these output shafts and reduce the size of the female broach square size are available from Quadrant- see “Metric Double Square Insert” brochure.
- B. Quadrant C-Series actuators have one or more tapped bolt circles surrounding the output shaft (see drawing) that are in compliance with ISO 5211 requirements. Specific bolting patterns and dimensions for each C-Series actuator are shown in Table 1.
- C. The assembly of Quadrant C-Series pneumatic actuators to Quadrant butterfly valves is simplified because the C-Series actuators are designed to directly “bolt-on” to Quadrant butterfly valves, and Quadrant butterfly valve stems either engage the actuator’s output shaft directly, or use one of the “Metric Double Square Inserts” noted above. See “C-Series Actuator to Quadrant Butterfly Valve Chart” on Quadrant website.
- D. The assembly of C-Series actuators to Quadrant ball valves is also simple, as our threaded ball valve brackets & “drivers” directly bolt-on and engage the Quadrant actuators- see “C-Series Actuator to Ball Valve Mounting Chart” on Quadrant Website.

- E. For mounting of Quadrant C-Series actuators to other valves, a bracket and a “driver” to connect the actuator to the subject valve must be produced. Use the dimensions shown in Table 1 to manufacture the mounting bracket or mounting flange and the “driver” to connect the output shaft to the valve stem. Be certain to allow some clearance between the “driver” male square and the actuator’s female square broach, and between the driver’s female slot or broach and the valve stem’s male shape. Also, maintain a good concentricity between the mounting pattern that attaches the bracket or flange to actuator and the mounting pattern that connects the bracket/flange to valve. **Non-concentricity will cause premature stem packing failure, actuator output shaft seal failure, or both.**

TABLE #1

C-SERIES UNIT	ISO MOUNT PATTERN(S)	ISO BOLT CIRCLE #1	ISO BOLT CIRCLE #2	TAPPED HOLES- #1	TAPPED HOLES- #2	SQUARE BROACH ACROSS-FLATS	SQUARE BROACH ACROSS-CORNERS	SQUARE DEPTH
C-125	F04	1.65"	N/A	M5-P.8	N/A	.354/.356"	.492/.493"	.40"
C-250	F05	1.97"	N/A	M6-P1.0	N/A	.433/.435"	.570/.573"	.67"
C-450	F05	1.97"	N/A	M6-P1.0	N/A	.551/.553"	.740/.743"	.83"
C-1000	F05 & F07	1.97"	2.76"	M6-P1.0	M8-P1.25	.669/.671"	.906/.908"	1.00"
C-2250	F07 & F10	2.76"	4.02"	M8-P1.25	M10-P1.5	.866/.868"	1.161/1.164"	1.22"
C-3650	F10 & F12	4.02"	4.92"	M10-P1.5	M12-P1.75	1.063/1.065"	1.398/1.400"	1.38"
C-5000	F10 & F12	4.02"	4.92"	M10-P1.5	M12-P1.75	1.063/1.065"	1.398/1.400"	1.38"
C-11000	F14	5.51"	N/A	M16-P2.0	N/A	1.417/1.419"	1.870/1.873"	1.77"

III. Testing Operation of Actuated Valve Assembly and Setting of Limit Stops:

- A. After assembly of the C-Series actuator to the quarter-turn valve, the “open” and “closed” limit stops of the actuator must be adjusted, and the operation of the actuator and valve must be tested for proper function.
- B. **CAUTION:** this step requires the connection of compressed air to the actuator- follow all of the safety precautions outlined in compressed air equipment manufacturers’ manuals.
- C. Confirm that source compressed air pressure is below 120PSIG.
- D. Adjust compressed air pressure to be connected to the actuated assembly to actual installation compressed air pressure available at the point of installation but in no case higher than 120PSIG.
- E. **CAUTION:** NEVER use any other compressed gas other than compressed air for this testing. Use of other gases could cause injury or death!!
- F. Mount actuated valve assembly in a suitable holding fixture, such as a vise. Make sure that the valve operating device (ball, disc, plug, etc) is visible and that the rotation of this device will not be impeded by holding fixture.
- G. **CAUTION:** NEVER put hands, fingers or other body parts near rotating valve or actuator parts- tremendous forces are generated by the actuator that will sever body parts!!
- H. Connect air supply to “right-hand” air inlet port and apply controlled air pressure. Actuator output shaft will rotate counter-clockwise (viewed from top), causing valve rotating element to rotate counter-clockwise. **NOTE:** if valve element does not rotate- check air pressure. If pressure is correct, the valve requires more torque than actuator delivers- check valve torque.
- I. Observe valve ball, disc or plug position. If it is not in desired position, loosen the locknut on the “left-side” limit stop screw. Using an Allen wrench, rotate the adjustment screw to change valve element position. NOTE: compressed air may have to be removed from air inlet port to allow limit screw rotation.
- J. On spring return actuators, remove compressed air supply from right-side air inlet port. Springs will rotate valve element to “closed position”. Observe valve rotating

element position, if adjustment is required, loosen lock nut on “right side” limit stop screw. Using an Allen wrench, rotate the adjustment screw to change valve element position. **Note:** if valve element does not rotate & return to original position, actuator does not deliver enough spring-induced torque to rotate valve element- check valve torque.

- K. On double-acting actuators, remove compressed air supply from right-side air inlet port and apply to “left-hand” side air inlet port. Output shaft will rotate valve element clockwise to “closed position”. Observe valve rotating element position, if adjustment is required, loosen lock nut on “right side” limit stop screw. Using an Allen wrench, rotate the adjustment screw to change valve element position. NOTE: compressed air may have to be removed from air inlet port to allow limit screw rotation.
- L. After adjustment, tighten locknuts on limit stop adjustment screws.

IV. Maintenance and Field Rebuilding of C-Series Actuators

- A. No normal maintenance is required on Quadrant C-Series actuators, as long as compressed air supplied to the C-Series Actuator is clean, dry and lubricated. The use of a high quality compressed air filter, regulator and lubricator is recommended at each Quadrant pneumatic actuator location. **NOTE:** if synthetic compressor oil is used, check compatibility with Quadrant C-Series standard Buna-N seals.
- B. If leakage occurs at output shaft seals, or if actuator’s output torque decreases significantly, this can be an indication of internal seal wear or failure. Replacement of internal seals will be required.
- C. Before starting the rebuilding process, first contact your Quadrant distributor, agent or the Quadrant factory to obtain a repair kit for your actuator. You will need to supply the actuator Model Number and the Serial Number, located on the product label.