

D-4070 Two Stage Pneumatic Actuator

The D-4070 Two Stage Pneumatic Actuator is a multipurpose positioning device used to accurately position small dampers primarily on unit ventilators, Variable Air Volumes (VAVs), terminal units, and small ventilating dampers in response to output signals of a pneumatic controller or electro-pneumatic transducer.

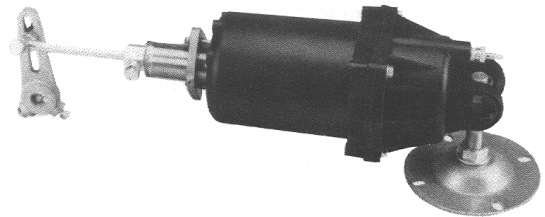


Figure 1: D-4070

The D-4070 was specifically designed to provide ASHRAE Cycle II and W control of unit ventilators where a minimum of outdoor air (15 to 50%) is admitted during the heating and ventilating stage and gradually increased to 100%, if needed, during the cooling and ventilating stage.

The D-4070 is a direct replacement for existing D-3070 actuators and a functional replacement for older D-255 actuators.

Features and Benefits	
<input type="checkbox"/> High Power to Size Ratio	Location in confined spaces
<input type="checkbox"/> Glass Reinforced Polymer Housing	Lightweight, corrosion and chemical resistant
<input type="checkbox"/> Telescoping Linkage	Fast, flexible installation
<input type="checkbox"/> Economical	Does function of two separate actuators

Application

The D-4070 has a first stage nominal spring range of 3 to 6 psig (21 to 42 kPa) and can be furnished with a second stage spring range of either 9 to 12 psig | (63 to 84 kPa) or 11 to 14 psig (77 to 98 kPa). The control air pressure for normal HVAC operation is 0-20 psig. The total stroke of the D-4070 is 2-3/4 inch (70 mm) and is adjustable from 0 to 50% during the first stage of operation.

The D-4070 incorporates several internal and external features that add functional flexibility. A 2-way swivel connection on the actuator cylinder head provides non-binding movement. All actuators have a telescoping piston rod for easy linkage of the damper for attachment points up to 8-3/4 inches (214 mm) away from the face of the actuator (see Figure 2). A swivel ball joint and slotted crank arm connector are furnished on all actuators for optional methods of linkage to the damper.

When used with proportional control, the damper size is limited by the torque requirement.

Operation

Air pressure from a pneumatic controller is applied to the diaphragm of the actuator, which moves the piston against the forces of the internal spring and the load. The external load force shifts the operating range from the nominal spring range. The piston will move to a position where the applied air pressure force and the internal spring plus external load forces are in equilibrium.

Figure 4 illustrates the relationship between the stroke and the control air pressure when Stage 1 is adjusted for 25 percent of total stroke (factory set). At 6 psig, the dampers are positioned to achieve a fixed minimum of outdoor air. Between 9 and 12 or 11 and 14 psig, the actuator positions the dampers to provide a variable quantity of outdoor air from the predetermined minimum to a 100% maximum of outdoor air at 12 or 14 psig. Below 3 psig, the springs provide the additional power for the return stroke, insuring positive closing of the damper. Above 12 or 14 psig, this additional positioning force holds the actuator at maximum stroke.

Table 1: Force Values at 20 psig (140 kPa) Supply

First Stage Spring Range psig (kPa)	Second Stage Spring Range psig (kPa)	Stroke	Force, lb (Newtons)	Torque Output for 90° Rotation
3 to 6 (21 to 42)	9 to 12 (63 to 84)	Power	53.6 (239)	73.7 in·lb (8.4 N·m)
		Return	20.1 (89)	27.6 in·lb (3.1 N·m)
3 to 6 (21 to 42)	11 to 14 (77 to 98)	Power	40.2 (179)	55.3 in·lb (6.3 N·m)
		Return	20.1 (89)	27.6 in·lb (3.1 N·m)

Note: Force calculated using 6.7 lb/psig available actuator force.

Dimensions

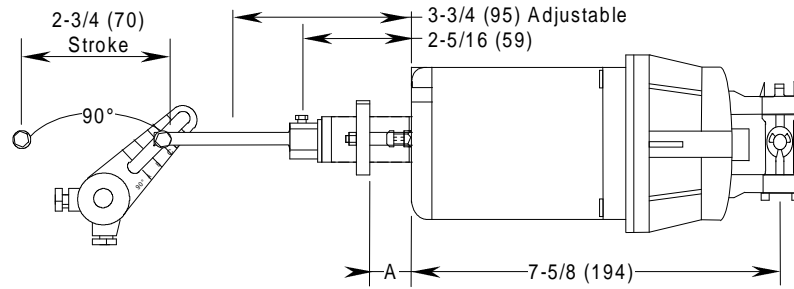


Figure 2: D-4070 Dimensions, inches (mm)

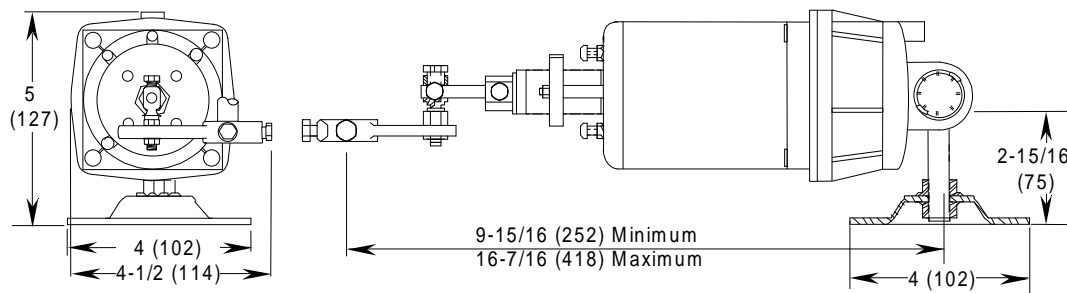


Figure 3: D-4070 with Auxiliary Mounting Bracket, inches (mm)

Table 2: "A" Dimensions, inches (mm)

Percent of Stroke First Stage	"A" Dimension	Percent of Stroke First Stage	"A" Dimension
15	13/32 (10)	40	1-1/8 (29)
25	11/16 (17)	50	1-3/8 (35)
33	15/16 (24)	-	-

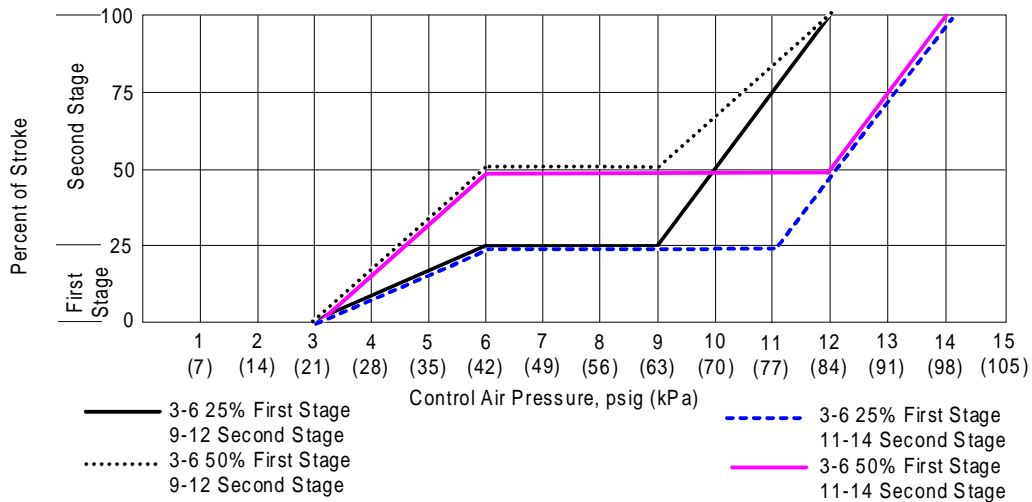


Figure 4: Control Air Pressure vs. Stroke

Mounting Components

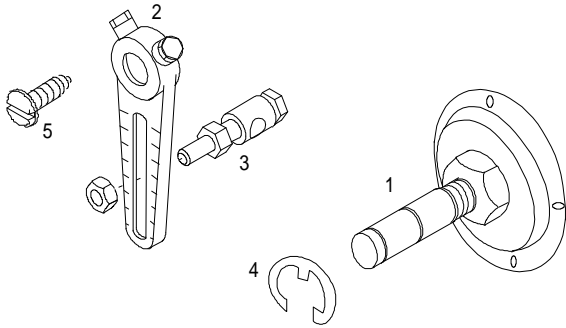


Figure 5: Kit Components

Table 3: Item Descriptions

Item	Description	Qty
1	Auxiliary Mounting Bracket Assembly	1
2	Crank Arm	1
3	Swivel Ball Joint	1
4	E-ring Clip	2
5	No. 12 x 1/2 inch (13 mm) Pan-head Thread-forming Screws	4

Tools Required

- standard screwdriver, 6 inch shank with 5/16 inch blade
- open end wrench adjustable to 1 inch
- drill bit (3/16 inch, 4.8 mm, No. 9 or 10) and drill

Installation

The auxiliary mounting bracket assembly facilitates applying the D-4070 actuator to allied equipment manufacturer's products, and non-Johnson Controls installations for actuator conversions. These assemblies are furnished with a crank arm linkage and pedestal style bracket. Special brackets are also available to adapt unique situations.

A 1/8 inch NPT straight barbed fitting for 5/32 or 1/4 inch O.D. polytubing is furnished.

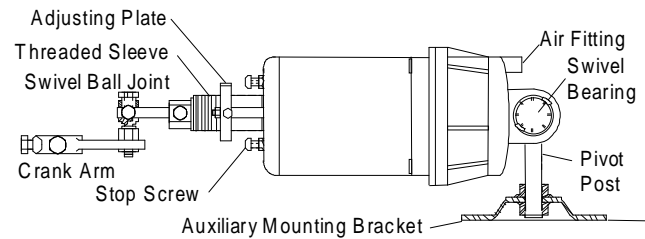


Figure 6: Mounting Components

Drive Shaft Linkage

1. Determine whether clockwise or counterclockwise drive shaft rotation is required. Check that the shaft has adequate bearing support, or add an optional bearing bracket.

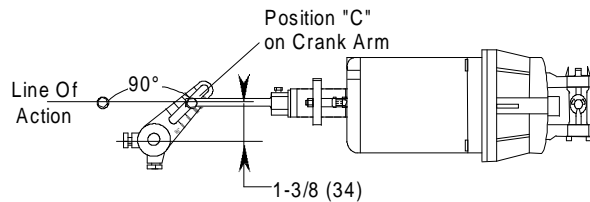


Figure 7: Crank Arm Position

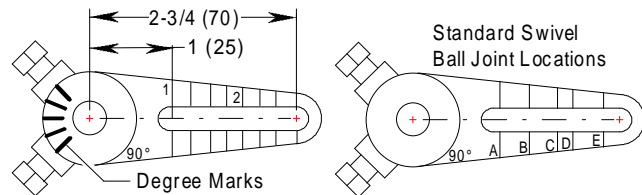


Figure 8: Crank Arm Detail

Note: The hub of the crank arm that fastens over the shaft is marked in 22-1/2 degree increments, and one side of the arm is marked in 1/4 inch increments in order to facilitate crank arm adjustments. Many unit ventilators use a 65° damper rotation. Then set the ball joint at position "E" on the crank arm.

- Temporarily set the swivel head bearing of the actuator onto the pivot post of the auxiliary bracket, and align the linkage point for 90° rotation at a 2-3/4 inch (70 mm) stroke. Try to maintain the factory settings for the crank arm (1-15/16 inch radius or point "C" on the crank arm) and the piston rod length. The actuator line of action (Figure 7) should form a straight line through the ball joint axis at the beginning and end of stroke. Orient the crank arm or adjust the extension rod length if necessary.
- With the crank arm located over the shaft, finger tighten the set screws and make sure that the actuator is in a level position.

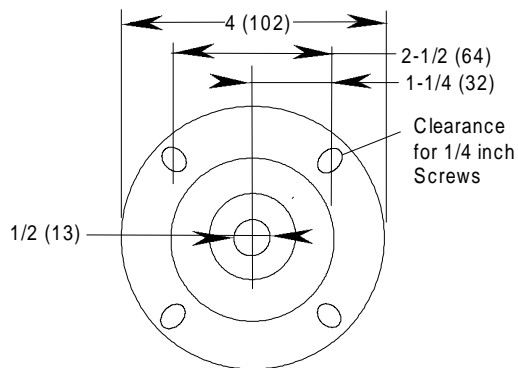


Figure 9: Auxiliary Mounting Bracket Dimensions, inches (mm)

- If there are no further adjustments necessary, mark the four mounting holes using the auxiliary bracket as a template and swing the actuator and mounting bracket aside.
- Make sure that the mounting surface is solid and stable (that it can retain thread-forming screws).
- Drill a 3/16 inch (5 mm) hole at each of the marked places and mount the auxiliary bracket using four No. 12 x 1/2 inch pan-head, thread-forming screws supplied.
- Replace the swivel head bearing onto the pivot post and secure it with the second E-ring.
- Tighten the crank arm set screws and check all other linkage fasteners before making air line connections.

Direct Blade Linkage

- Remove the swivel ball joint from the crank arm.
- Determine direction of blade rotation for normally closed application and either select or fabricate a blade arm (leaf connection). The swivel ball joint on the end of the piston rod is adaptable.

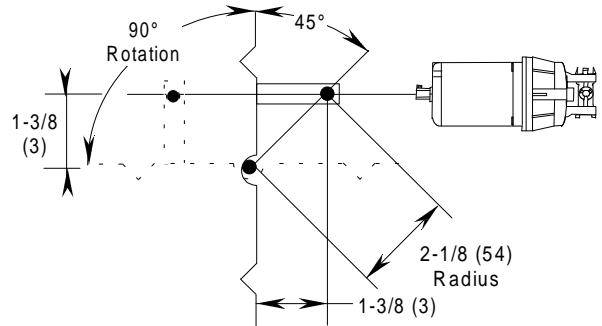


Figure 10: Normally Closed Location

For normally closed operation, form an angle of 45°. When used with a Johnson Controls damper, use a D-3153-100 blade arm connector.

Note: The D-4070 is not used for normally open operations.

- Choose the auxiliary bracket mounting position (usually on the existing or on the adjacent duct or wall).

Note: Whenever possible, locate the auxiliary mounting bracket in a level position where alignment can be readily maintained.

- Locate the pivot post within 10 to 16-1/2 inches (254 to 419 mm) from the blade arm linkage point to use the telescoping piston rod feature of the D-4070. Make sure that the damper blades will clear the actuator when rotated.
- Mark the four mounting holes using the auxiliary bracket as a template and swing the actuator and mounting bracket aside.
- Make sure that the mounting surface is solid and stable (that it can retain thread-forming screws).
- Drill a 3/16 inch (5 mm) hole at each of the marked places and mount the auxiliary bracket using four No. 12 x 1/2 inch pan-head, thread-forming screws supplied.

Note: For heavier gauge mounting surfaces, 1/4 inch diameter bolts can be substituted for the bracket attachment.

8. Place the swivel head bearing onto the pivot post and secure it with the second E-ring.
9. If the extension of the piston rod is required, loosen the set screw located on the shaft extension hex nut.
10. Telescope the piston rod to allow attachment of the swivel ball joint to the blade bracket.
11. Tighten the crank arm, swivel ball joint, and piston rod set screws before making the air line connections.

Special Linkages and Offset Surfaces

In order to achieve the desired mounting bracket location, it may be necessary to extend the piston rod. This can be done by loosening the set screw on the shaft extension hex nut and telescoping the piston rod.

If the actuator axis is perpendicular to the drive shaft, the normal crank arm radius of 1-15/16 inches (49 mm), position C on the crank arm, will result in a 90° shaft rotation. If the actuator axis is at a moderate angle to the drive shaft, the crank arm radius will need to be adjusted in order to achieve a 90° shaft rotation.

If, when mounted, the actuator axis is at an angle steep enough to result in binding of the ball joint, the extension rod must then be bent as much as necessary to prevent binding. To test the angle of rotation after mounting, loosen the set screw on the shaft extension hex nut and manually extend the piston rod 2-3/4 inches (70 mm) to simulate an actual stroke.

To minimize axis angles for best operation and maximum thrust, or to reach a more remote mounting location, up to 4 feet (122 cm) of 5/16 inch rod stock (D-3153-102) may be substituted as required. The rod must be ordered separately and cut to the required length.

Adjustment

The first stage of operation is factory set to provide 25% of the total stroke. Table 2 indicates dimension "A" settings for typical proportions.

1. Loosen the set screw at the side of the adjusting plate.
2. Turn the threaded sleeve clockwise to increase and counterclockwise to decrease dimension "A".

Check Out Procedure

1. Supply air pressure to the actuator and operated the damper for at least three complete cycles.
2. Verify that the damper blades open or close fully.
3. Run the actuator to close the damper. If the blades are not fully closed, adjust the position of the linkage rod.
4. Run the actuator to open the damper. The blades should not rotate more than 90° or past full open. Adjust the crank arm or blade arm radius by repositioning the ball joint if necessary.
5. Repeat procedures as necessary.

Repair Information

Field repairs must not be made. For a replacement D-4070, contact the nearest Johnson Controls representative.

When a unit ventilator manufacturer calls for a D-4070, be sure to pick the one that is designed for that unit.

Table 3: Ordering Information

Nominal Spring Range (psi)		with Auxiliary	
First Stage	Second Stage	Mounting Bracket	Body Only
3 to 6	9 to 12	D-4070-1	D-4070-6001
3 to 6	11 to 14	D-4070-2	D-4070-6002

Notes: Check your UV standard equipment sheets for the various models for the unit ventilator manufacturers.

Table 4: Accessories

Description	Weight, lb (Kg)	Code Number
Crank Arm: 1/2 inch shaft radius adjustable to 2-3/4 inch radius	0.5 (0.23)	D-3153-101
Crank Arm: 3/8 inch shaft radius adjustable to 2-3/4 inch radius	0.5 (0.23)	D-3153-108
Crank Arm: 7/16 inch shaft radius adjustable to 2-3/4 inch radius	0.5 (0.23)	D-3153-109
Rod - 4 feet (122 cm)	2.0 (0.91)	D-3153-102
Rod - 8-3/4 inch (222 mm) replacement	1.0 (0.45)	D-3153-103
Blade Arm Kit - for Johnson Controls dampers	0.5 (0.23)	D-9999-100
Universal Mounting Bracket	3.5 (1.13)	D-3153-105
Mounting Post Kit	0.5 (0.23)	D-3073-105
E-rings for Pivot Post , 10 per kit	0.5 (0.23)	D-3153-111
Mounting Nuts for Pivot Post , 10 per kit	0.5 (0.23)	D-3153-112
Auxiliary Mounting Bracket	1.0 (0.45)	D-3153-106
Swivel Ball Joint	0.5 (0.23)	D-9999-154
Ball Joint - weather resistant	0.5 (0.23)	D-3073-604

Specifications

Product	D-4070 2-stage Pneumatic Actuator
Stroke	2-3/4 inches (70 mm)
Control Air Pressure	0 - 20 psig for HVAC, 25 psig (171 kPa) Maximum
Air Connections	1/8 inch NPT straight barbed fitting for 1/4 inch O.D. polytubing (furnished)
Ambient Storage Condition	-20 to 150°F (-29 to 66°C)
Ambient Operating Conditions	35 to 150°F (2 to 66°C)
Effective Diaphragm Area	6.7 square inches (45 cm ²)
Housing Material	Glass reinforced polymer, UL 94 HB flame class rating
Diaphragm Material	Synthetic elastomer
Dimensions (H x W x D)	See Figure 2.
Shipping Weight	3.5 lb (1.6 kg)

For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

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