



**WARNING!**

**Before replacing actuator, damper must be inspected and determined to be fully functional. See NFPA checklists below.**

## Replacement of MP1161B or MP2781 on Ruskin with Belimo FSxx

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**WARNING!**

**Installer must be trained and experienced with repair of fire and smoke dampers and actuators.**

In the “Marking & Application Guide, Dampers for Fire Barrier and Smoke Applications & Ceiling Dampers” April 2013 by Underwriters Laboratories Inc.®, page 6 they state:

**DAMPER ACTUATORS**

“... field mounting or substitution of actuators is not covered within the scope of the UL certification of the product. However, this does not necessarily preclude replacement of actuators in the field. Like any appliance, field servicing of these products is not covered under the scope of the UL certification and factory follow-up service program. As with any part of the damper, it is expected that replacement of actuators in the field be done in accordance with the damper manufacturer’s normal field servicing program.”

**Code and Standard Issues**

In general, the administrative section of codes state that all mechanical and electrical systems must be kept in working order and an individual section may state that all life safety devices and systems must be operable. NFPA 80 (Fire) & NFPA 105 (Smoke) require periodic testing and repair of dampers as soon as possible after any deficiency is uncovered.

<b>Chapter 7 IBC &amp; IFC "Containment" Dampers</b>	
Commissioning End of first year Every 4 years except in hospitals every 6 years	
<b>Chapter 9 IFC "Smoke Control System" Dampers</b>	
<b>Dedicated</b> Commissioning Semi-annually	<b>Non-dedicated</b> Commissioning Annually
<b>Chapter 9 IBC &amp; IFC Fire detection &amp; Smoke control systems</b>	
<b>Dedicated</b> Weekly self-test	<b>Non-dedicated</b> Not required

Fire & smoke dampers are appliances and field replacement of components is required when failure of any component occurs.

The Authority Having Jurisdiction (local Fire Marshal and/or Building Official) must be consulted if any blade or auxiliary switches are employed and are connected to the fire alarm system or to a Fire Fighters Smoke Control System (FSCS) panel. Retesting is required. A permit and inspection may be required since connections to an alarm system have been touched.

## **NFPA 80 (Fire) & NFPA 105 (Smoke)**

NFPA requires damper inspection and repair of dampers.  
See [www.nfpa.org](http://www.nfpa.org) for Standards.

**See NFPA 80 & NFPA 105 for details. The damper cleaning and examination check list here is based on them.**

Damper installation shall meet code requirements. Fire stopping and drywall integrity shall be confirmed. Ducts shall be fall away with no fasteners connected to damper sleeve.

- a. Dampers and ducts shall be cleaned of all foreign debris and dust build-up.
- b. All exposed moving parts of the damper shall be dry lubricated as required by the manufacturer. (Do not use oil as it draws dirt.)
- c. Damper shall be examined without defective old motor or new actuator to determine:
  - i. The damper shall fully close from the open position.
  - ii. Damper shall fully open from the closed position.
  - iii. There are no obstructions to the operation of the damper. The damper shall not be blocked from closure in any way due to rusted, bent, misaligned, or damaged frame or blades. The damper shall not have defective hinges, side &/or blade seals, or other moving parts. The damper frame shall not be penetrated by any foreign objects that would affect operation.
- d. If the damper is equipped with a fusible link, the link shall be removed for testing to ensure full closure and lock-in-place if so equipped. If the link is damaged or painted, it shall be replaced with a link of the same size, temperature, and load rating.
- e. The fusible link shall be reinstalled after testing is complete.

After installation and wiring of new actuator it shall be tested.

- a. The checklist may be customized using material here and in NFPA Standards. Multiple geometric configurations of springs, fusible link, thermal sensor(s), and actuation are possible. Confirm with AHJ if any additional requirements exist.
- b. Electric thermal sensors, if present, must be tested and replaced if defective.
- c. The test shall be conducted with normal HVAC airflow.
- d. When equipped with smoke detection activation, the smoke detector shall be activated and damper operation observed.

Test voltage input to actuators and repair as necessary if voltage is not correct.  
Old breakers often deliver below 115V and failed actuators may be due to power supply problems.

**A record of all repairs must be kept on site and made available to AHJ.**

For the Air Movement and Control Association damper maintenance manual go to:  
[http://www.amca.org/publications/damper\\_maintenance.aspx](http://www.amca.org/publications/damper_maintenance.aspx)

## Local Code Approval

While it is not detailed in codes, the following rules should be followed for selecting Belimo actuators for replacement:

Check the technical specifications to ensure an “equal or better” actuator is used.

- **Temperature** – the replacement actuator shall have been UL555S tested at the same or better temperature as the original actuator. 250°F or 350°F are standard. (Code is 250°F. However, in engineered smoke control systems the consulting engineer may have required 350°F. Tunnels and some other applications require higher temperatures.)
- **Time** – the replacement actuator shall drive open and spring closed at a speed equal or faster than presently required by codes. (<75 seconds is UL 555S and most codes. Las Vegas is 60 seconds. Consult the AHJ with any questions.)
- **Torque** – replacement actuator shall have equal or greater torque than the failed actuator.
- **Voltage** – replacement actuator shall have the same voltage rating as the original.
- **Amperage** – the replacement actuator(s) shall not draw more amperage than the original(s) and cause the total connected amp draw on a circuit breaker to be greater than allowed by electrical code. (This is not a problem as Belimo actuators draw very low current.)
- **Final Testing** – actuated damper and associated devices shall be tested for proper operation. See Acceptance testing details below.

(Mnemonic device: TTT-VAT)



**In all cases, installation must comply with any and all local electrical and life safety codes. Operation of the system after installation must be performed to verify proper damper cycling. Final checkout requires verifying correct functions.**

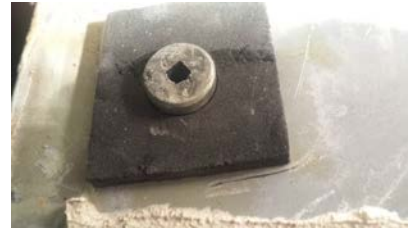


**Note that where any fire alarm wiring is touched, the fire department must be informed.**

### Examples of MP2781 or MP1161B motors



Below shows the square hole in the hub welded to the jackshaft.



Detail of duct, hub, shaft, and motor.



External view of motor attached to duct



1161B

Note that knowing the motor part number is insufficient for a proper retrofit.

Examination of the springs and fusible rods is necessary.

**Complete re-control is recommended.**

## ***Actuator replacement begins with the damper, not the old motor***

The negator damper design is unlike modern dampers.

A negator spring attaches from a post on the damper frame to the blade. A fusible rod connects between the blade and the jackshaft crank arm. The rod melts at 165°F (74°C) disconnecting the crank arm and motor from the blade. The negator blade spring pulls the damper closed. There is no external spring or spring in the motor. A fusible link and catch spring were used to hold the damper tightly closed.

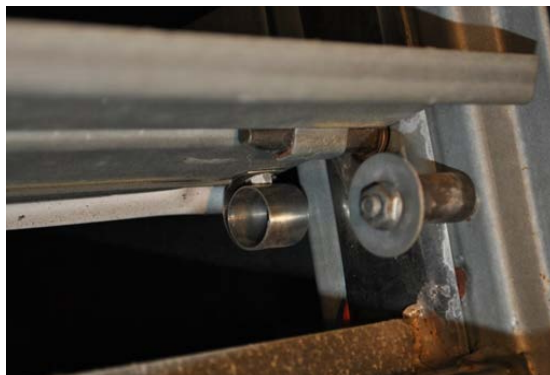
The motor was returned to its starting position when the negator spring pulled the damper blades closed.

The fusible link used to hold a spring metal catch that latched to the damper frame is not involved in the actuator replacement process. It should be replaced if broken. [It was also 165°F (74°C)].

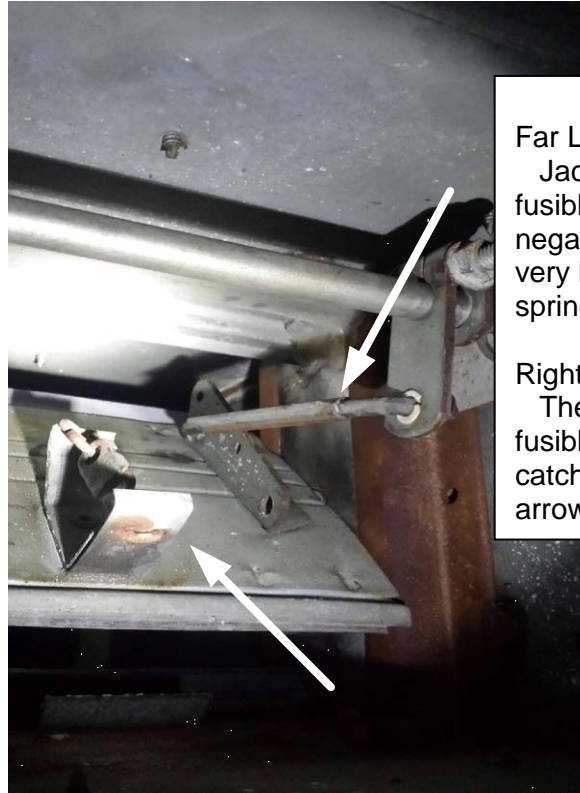
See following pages for examples.



**FUNCTIONAL**  
Negator spring  
connecting post  
and damper blade.



**BROKEN**  
Negator spring  
separated  
between post and  
damper blade.



Far Left. From top –  
Jackshaft, crank arm,  
fusible rod, blade,  
negator spring. At the  
very bottom left is the  
spring catch latch plate.

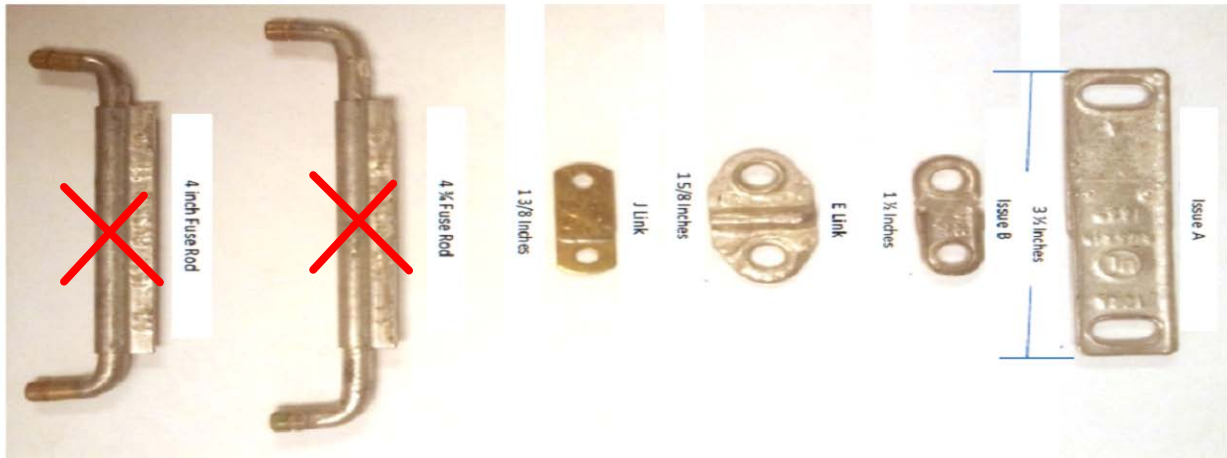
Right  
The fusible rod and  
fusible link with spring  
catch are shown by  
arrows.

The MP2781 and MP1161B were used on the FSD60, FSD36, FSD35, FSD34, SD60, SD36, SD35, and SD34. FSD are fire and smoke dampers. SD are smoke only dampers.

## ***Broken fusible-rod***

The manufacturer has discontinued production of the fusible rods and Ruskin has no stock. If either a spring assembly or a rod are defective then re-control is necessary as described below. Fusible links are still available as of this writing.

Replacement rods and negator springs are not available.



## ***Broken negator spring or fusible rod***

If the negator spring is missing or disconnected then the damper must be re-controlled. The blades will not be pulled closed in case of fire. If the fusible rod is broken the damper will not open or close as the motor is not connected.

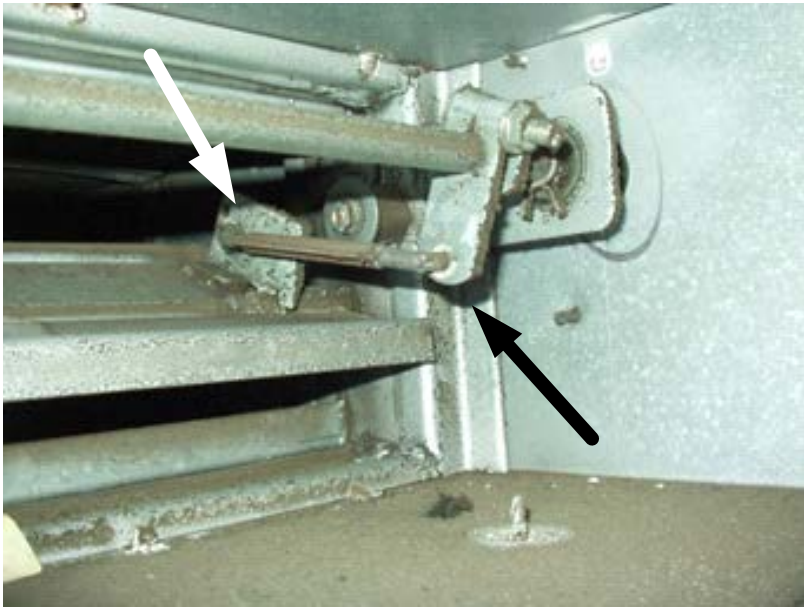
- 1) The old spring assembly must be removed to prevent possible obstruction and extra torque load on the Belimo actuator.
- 2) A modern spring return actuator must be installed. The FSLF is the recommended replacement.
- 3) The fusible-rod must be removed and replaced with two 5/16" ball joints and a length of 5/16" push rod. The holes in the crank arm and damper clip fit the 5/16" holes.
- 4) A new thermal switch must be installed to cut power and close the actuator by engaging its spring in case the ambient temperature in the duct rises to 165F. A Ruskin EFL (electronic fusible link) or a Belimo BAE165 US is inserted into the duct and wired per the drawing below.

**With a Belimo actuator with an internal spring, the damper will perform the same as modern dampers.**

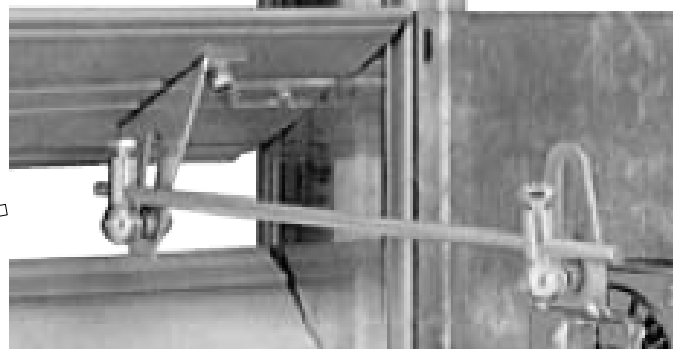


## Replacing the fusible rod

The pieces of the fusible-rod must be removed and two ball joints and a short push-rod installed to connect the damper blade to the jackshaft crank arm. The holes that the fusible rod fit into accept a 5/16" ball joint.



The holes into which the fusible rod connects are the same size needed for ball joints. White arrow points at the damper blade bracket and the black arrow points at the crank arm as ball joints. See white and black arrows above.



**WARNING!**

The damper's fire closing function will not operate unless the negator spring works and the rod between the crank arm and blade is intact.

## Miscellaneous parts

Should they be needed, Belimo carries a range of parts. Ball joints and 5/16" rods are available from most distributors.



**KH12**

Where the crank arm on the jackshaft is broken or not of the type needed, the KH12 fits over the shaft without removing it. Zinc plated steel. Slot is for the KG10A ball joint. V-bolt fits 3/4" to 1" (20 to 25mm) shafts.



**KH8**

KH-6. Zinc plated steel. For shafts 3/8" to 11/16"  
Uses KG6 ball joint. Slot width 1/4"

KH-8. Zinc plated steel. For shafts 3/8" to 11/16"  
Uses KG8 (90 degree) or KG10A ball joint. Slot width 21/64"



**KG8 3/8"**



**KG6, KG10A 1/4"**

**SH8** (not shown – see picture page 9). Push-rod for KG6 & KG8 ball joints. 5/16" 36" long  
Use SH10 3/8" rods for GMB and dual FSAF or FSNF linkages. 5/16" can bend under heavy loads.

**ZG-DC1**



**ZG-DC1** Damper blade clip and ball joints for blades typically 3.5" in width. Typically the actuator or rod to shaft is in front of blade.

**ZG-DC2**

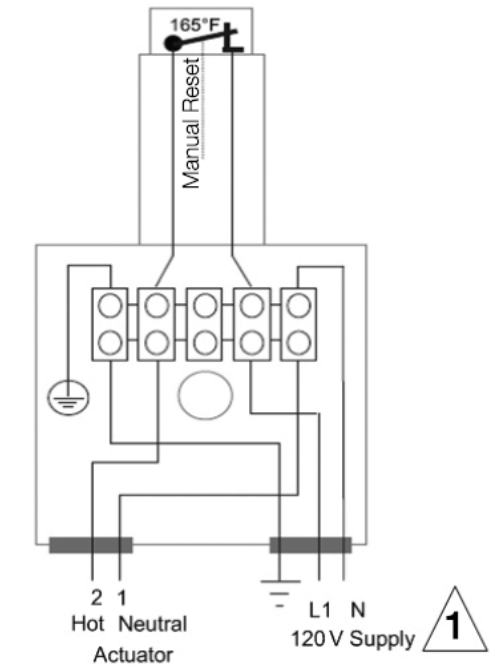


**ZG-DC2** Damper blade clip and ball joints – typically used for 6" wide blade control dampers. Typically the actuator or rod to shaft is above or below the damper.

# BAE 165 US



The BAE 165 is a primary heat sensitive device in UL's parlance. It is a manual reset bimetal. See wiring below.



See individual data sheets for wiring connections

All 120V actuators use same color wires.  
L1=Blk, N=Wht

Green Ground  
Connect case ground on all 120 V actuators

### Electric thermal disc

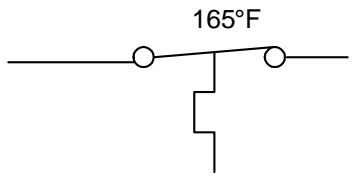


Diagram Symbol

## Actuator replacement

Ruskin makes a kit with the FSLF120 actuator and adaptors.

Belimo does not supply a replacement kit for the MP2781. The FSLF120/MP kit discussed below is available from local Ruskin representatives. See <http://www.ruskin.com/rebs/>

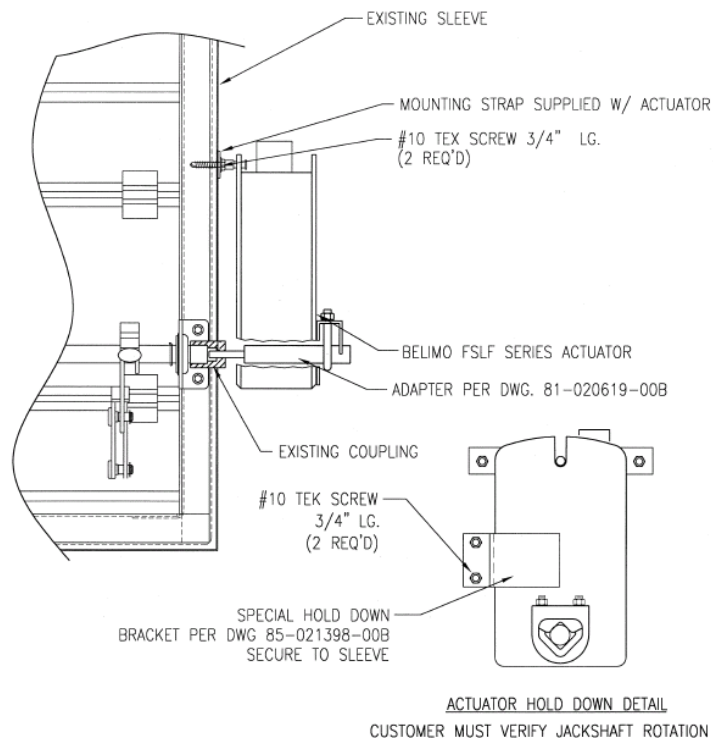
Belimo does have parts for replacement of pneumatic actuators. See Ruskin\_Negator\_Spring\_Pneumatic\_to\_Belimo\_FSxx\_2014

<https://www.belimo.us/solutions/actuators/product-documentation/damper-actuators-fire-and-smoke>

In order to adapt the old MP motor with its .2" square male shaft end, a female socket was welded onto the damper shaft. (See picture top right on page 5.) The welded piece must stay on the shaft. A shaft adapter insert and actuator with hold down bracket is contained in the Ruskin FSLF120/MP kit. These dampers were typically maximum 1 sq.ft. If large or multisection dampers are found with multiple negator springs, contact Belimo for assistance. The damper may not be a Ruskin.

### **Ruskin part number FSLF120/MP.**

This must be ordered from the local Ruskin Representative or from Ruskin. Not available from Belimo



#### **FSLF120/MP**

##### **Kit includes:**

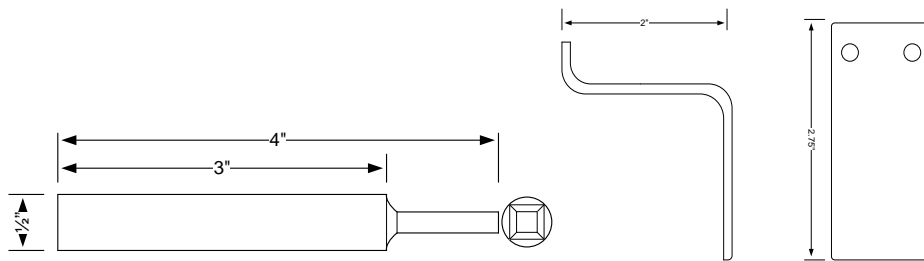
**Shaft adaptor  
Hold down bracket  
FSLF Actuator  
Anti-rotation mounting strap**

**ORDER FROM RUSKIN OR  
RUSKIN REPS ONLY.  
BELIMO DOES NOT  
SUPPLY THIS KIT.**

## Summary

**Defective negator spring, fusible rod, or motor.**

**The Ruskin FSLF120/MP kit must be purchased. Remove negator spring and replace fusible rod with 2 ball joints and a short section of push rod. Install Ruskin EFL or Belimo BAE.**

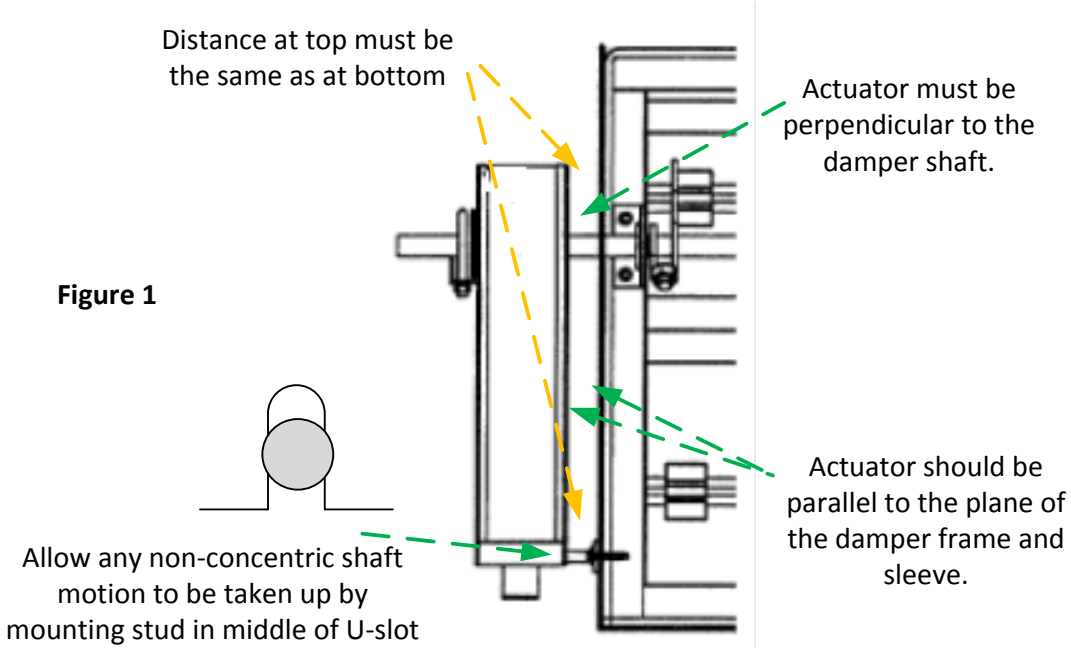


**SHAFT ADAPTOR**

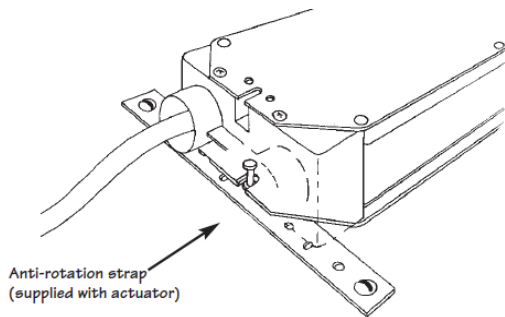
**HOLD DOWN**

NOTES: DISCONNECT POWER PRIOR TO REPLACEMENT PROCEDURE

1. REMOVE EXISTING ACTUATOR, ACTUATOR MOUNTING BRACKETS, AND ALL ACTUATOR HARDWARE FROM DAMPER.
2. VERIFY ROTATION OF SHAFT MATCHES ROTATION OF OPERATOR.
3. INSTALL ADAPTER 81-020619-00B.
4. INSTALL ACTUATOR ONTO ADAPTER (DO NOT TIGHTEN NUTS ON ACTUATOR CLAMP). INSTALL MOUNTING STRAP WITH (2) #10 X 3/4" TEK SCREWS. PIN ON MOUNTING STRAP TO ENGAGE SLOT ON MOTOR HOUSING.
5. INSTALL HOLD DOWN BRACKET #85-021398-00B AS SHOWN IN DETAIL BELOW. SECURE WITH (2) #10 X 3/4 TEK SCREWS.
6. WIRE ACTUATOR PER MANUFACTURERS INSTRUCTIONS AND PER LOCAL CODE.
7. FOR THE FOLLOWING OPERATION HOLD ADAPTER IN PLACE WHILE CYCLING ACTUATOR UNTIL NUTS ON CLAMP ARE TIGHTENED (TO PREVENT ADAPTER FROM WALKING OUTWARDS).
8. FULLY OPEN DAMPER AND ENERGIZE ACTUATOR. ONCE ACTUATOR HAS REACHED THE END OF ITS ROTATION, TIGHTEN NUTS ON CLAMP.
9. DE-ENERGIZE ACTUATOR, MAKE CERTAIN DAMPER REACHES THE FULLY CLOSED POSITION. CYCLE ACTUATOR SEVERAL TIMES TO ENSURE PROPER OPERATION.
10. CLAMP ON ACTUATOR MUST ENGAGE ROUND PORTION OF SHAFT. IF REQUIRED SQUARE PORTION OF ADAPTOR CAN BE TRIMMED IN FIELD FOR PROPER FIT.

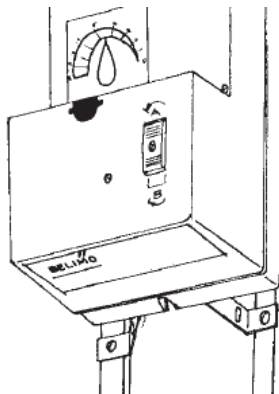


**Figure 1**



Note how the pin of the anti-rotation strap is mounted in middle of actuator U-slot.

**Figure 2**



This is acceptable as long as mechanically solid.

**Figure 3**

Note that actuator floats freely. Clamp cold welds when teeth dig into the damper shaft and the anti-rotation strap stud allows the actuator to move if shaft is not perfectly concentric. Rigid mounting by jamming the stud into the U-slot of actuator is NOT usually best.



**WARNING!**

**USE CAUTION!**

**Springs may be under high tension and may cause serious injury!  
Exercise caution – wear face and hand protection.**



**WARNING!**

**Disconnect and lock out power before starting to disconnect old motor.**

## **Pneumatic actuators**

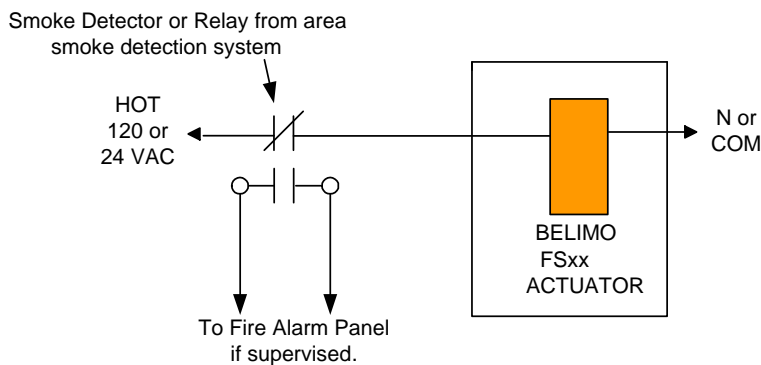
See:

[https://www.belimo.us/mam/americas/technical\\_documents/pdf-web/fire\\_and\\_smoke\\_doc/ruskin\\_negator\\_spring\\_pneumatic\\_to\\_belimo\\_fsxx.pdf](https://www.belimo.us/mam/americas/technical_documents/pdf-web/fire_and_smoke_doc/ruskin_negator_spring_pneumatic_to_belimo_fsxx.pdf)

## **Wiring**

Where an electric sensor is not present, the wiring below is typical.

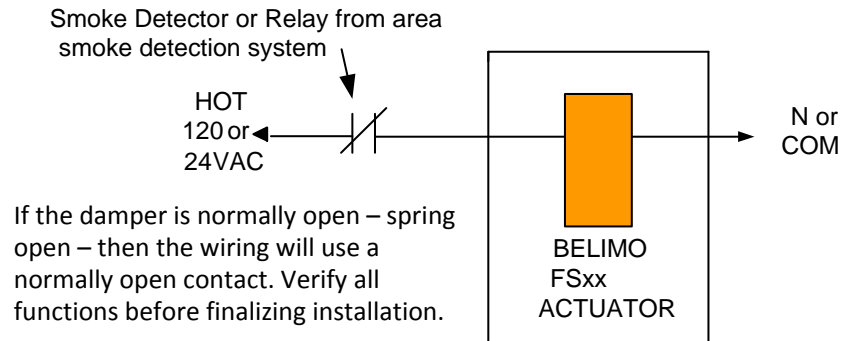
### **Original wiring**



Since the negator spring and fusible rod perform the damper fire closing function, the only wiring is to the smoke detection system. In some cases a thermal disc may be present. Contact Ruskin or Belimo for correct procedures.

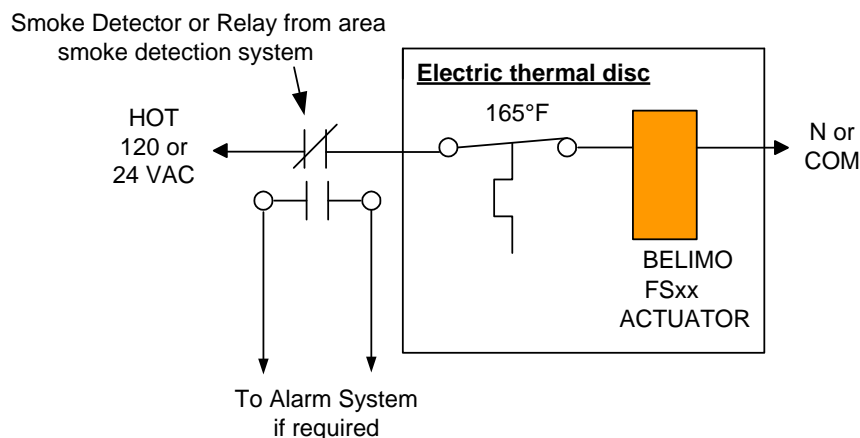
### Fusible-rod DAMPER ACTUATOR WIRING

Where the fusible-rod and negator spring(s) are present and functional, this is the typical wiring. There is no electrical thermal disk as the fire closing function is performed by the rod and negator spring.



Typical wiring for modern dampers is shown below.

### TYPICAL FIRE - SMOKE COMBINATION DAMPER WIRING



Note where actuator aux switch is used for alarm signaling or smoke control system, a retest of the alarm is typically required by local codes.

**If the damper is connected to a smoke control system, other wiring variations may exist. Contact Belimo for assistance.**



**WARNING!**

**Read Data Sheet provided in box with each actuator for specific wiring details.**



## Other variations



Other companies also used the negator spring and fusible rod method. Contact Belimo with make and model for instructions.

### ***Fire Marshal Form for Replacement Fire & Smoke Actuators***

Most jurisdictions require leaving a record of repairs of life safety devices on the building premises.

UL does not regulate replacement issues. Repair recommendations can be found in NFPA 80 Standard for Fire Doors and Other Opening Protectives and NFPA 105 Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives.

Fire & smoke dampers are considered to be appliances and field replacement of defective parts is expected.

Consult local Authority Having Jurisdiction (Building Dept or Fire Marshal) for other details.

## Building Official / Fire Marshal Notification Form

Retain this portion of checklist at premises for Fire Marshal inspection. See local AHJ or Fire Marshal for other information and requirements regarding conformance with NFPA 80 & NFPA 105.

Test Checklist (Smoke dampers do not have sensors. Only steps a & b apply.)

### 1. Single Sensor Combination Damper – modified negator spring damper

- a.  Open smoke detector or relay wire or contact to cut power. *Damper springs closed.*
- b.  Reconnect power. *Damper drives open.*
- c.  Using heat gun make EFL or BAE open contacts. *Damper springs closed.*
- d.  Allow sensor to cool and press reset button. *Damper drives open.*

Repeat 3 times to ensure operation. This imitates UL555S test.

### 2. Negator Spring Damper

- a.  Open smoke detector or relay wire or contact to cut power. *Damper springs closed.*
- b.  Reconnect power. *Damper drives open.*

The fusible rod cannot be tested.

### 3. Reopenable Two Sensor Fire-Smoke Combination Damper

(Since this system involves the Firefighters' Smoke Control System, inform fire department and request directions for retesting.)

Contact Ruskin or Belimo for instructions if any other sensors are mounted on damper.

When completed, ensure any sensors are reset and smoke detector is in normal state and FSCS switch is in Auto. Damper is normally Open; check sequence of operation.

Damper Numbers or Location Identifying Numbers .....

Date .....- .....- .....

Contractor.....

Service Technician

(Print).....

Service Technician

(Signed).....

Phone Number (.....).....

Notes.....

.....

.....

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