



**Before replacing actuator, damper must be inspected and determined to be fully functional. See NFPA 80 & NFPA 105 below for checklist.**

## **Replacement of Safe-Air Honeywell ML & MS Motors with Belimo FSNF120 Series**

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800 543-9038



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

[www.belimo.us/firesmoke](http://www.belimo.us/firesmoke)

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. Details not covered here.

**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. Damper blades shall be in plane of wall. Duct 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 and made available to AHJ.**

## 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.
- **Time** – the replacement actuator shall drive open and spring closed at a speed equal or faster than presently required by codes. (The AHJ may grant an exception and “grandfather” slower actuators where the original actuator was slower.)
- **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.
- **Final Testing** – actuated damper and associated devices shall be tested for proper operation. See Acceptance testing details below.

(Mnemonic device: TTT-VAT)



**WARNING!**

**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 function.**



**WARNING!**

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

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)

## Cross Reference

For greater detail see [www.belimo.us/firesmoke](http://www.belimo.us/firesmoke) RETROFIT or download from [https://www.belimo.us/mam/americas/technical\\_documents/pdf-web/fire\\_and\\_smoke\\_doc/fire\\_smoke\\_competitive\\_replacement\\_data\\_reference.pdf](https://www.belimo.us/mam/americas/technical_documents/pdf-web/fire_and_smoke_doc/fire_smoke_competitive_replacement_data_reference.pdf)

Honeywell	Voltage	Control	Torque	Aux	Replacement	
ML4105A1000	120 VAC	On/Off	30		FSLF120 US	*
ML4105B1009	120 VAC	On/Off	30		FSLF120 US	*
ML4105C1008	230 VAC	On/Off	30		FSLF230 US	*
ML4105D1007	230 VAC	On/Off	30		FSLF230 US	*
ML4115A1009	120 VAC	On/Off	30		FSLF120 US	*
ML4115A1017	120 VAC	On/Off	30		FSLF120 US	*
ML4115B1008	120 VAC	On/Off	30		FSLF120 US	*
ML4115B1016	120 VAC	On/Off	30		FSLF120 US	*
ML4115C1007	230 VAC	On/Off	30		FSLF230 US	*
ML4115C1015	230 VAC	On/Off	30		FSLF230 US	*
ML4115D1006	230 VAC	On/Off	30		FSLF230 US	*
ML4115D1014	230 VAC	On/Off	30		FSLF230 US	*
ML4115H1002	120 VAC	On/Off	30		FSLF120 US	*
ML4115J1019	120 VAC	On/Off	30		FSLF120 US	*
ML4202F1000	120 VAC	On/Off	20		FSLF120 US	*
ML4202F1000	120VAC	On/Off	20		FSLF120 US	*
ML4302F1008	120 VAC	On/Off	20		FSLF120 US	*
ML8105A1006	24 VAC	On/Off	30		FSLF24 US	*
ML8105B1005	24 VAC	On/Off	30		FSLF24 US	*
ML8115A1005	24 VAC	On/Off	30		FSLF24 US	*
ML8115A1013	24 VAC	On/Off	30		FSLF24 US	*
ML8115B1004	24 VAC	On/Off	30		FSLF24 US	*
ML8115B1012	24 VAC	On/Off	30		FSLF24 US	*
ML8115H	24 VAC	On/Off	30		FSLF24 US	*
ML8115J	24 VAC	On/Off	30		FSLF24 US	*
ML8202	24 VAC	On/Off	20		FSLF24 US	*
ML8302	24 VAC	On/Off	20		FSLF24 US	*
MS4104F1010	120 VAC	On/Off	30		FSLF120 US	*
MS4104F1210	120 VAC	On/Off	30	2	FSLF120-S US	*
MS4109F1010	120 VAC	On/Off	80		FSNF120 US	
MS4109F1210	120 VAC	On/Off	80	2	FSNF120-S	
MS4120F1006	120 VAC	On/Off	175		FSAFA120	
MS4120F1204	120 VAC	On/Off	175	2	FSAF120A-S	
MS4209F1007	120 VAC	On/Off	80		FSNF120 US	

MS4309F1005	120 VAC	On/Off	80		FSNF120 US	
MS4604F1010	230 VAC	On/Off	30		FSLF230	*
MS4604F1210	230 VAC	On/Off	30	2	FSLF230-S	*
MS4609F1010	230 VAC	On/Off	80		FSNF230	
MS4609F1210	230 VAC	On/Off	80	2	FSNF230-S	
MS4620F1005	230 VAC	On/Off	175		FSAF230A	
MS4620F1203	230 VAC	On/Off	175	2	FSAF230A-S	
MS4709F1014	230 VAC	On/Off	80		FSNF230 US	
MS4809F1012	230 VAC	On/Off	80		FSNF230 US	
MS7520A2015	24 VAC	2-10V, 4-20mA	175		FSAFB24-SR US	
MS8104F1010	24 VAC	On/Off	30		FSLF24	*
MS8104F1210	24 VAC	On/Off	30		FSLF24	*
MS8109F1010	24 VAC	On/Off	80		FSNF24	
MS8109F1210	24 VAC	On/Off	80	2	FSNF24-S	
MS8120F1002	24 VAC	On/Off	175		FSAF24A	
MS8120F1200	24 VAC	On/Off	175	2	FSAF24A-S	
MS8209F1003	24 VAC	On/Off	80		FSNF24 US	
MS8309F1001	24 VAC	On/Off	80		FSNF24 US	
S20230-F	230 VAC	On/Off	175		FSAF230A	
S20230-F-SW2	230 VAC	On/Off	175	2	FSAF230A-S	
S2024-F	24 VAC	On/Off	175		FSAF24A	
S2024-F-SW2	24 VAC	On/Off	175	2	FSAF24A-S	
SPH2 Aux Switch						**
32003532-002 Aux Switch						**

\* Use FSNF series if damper is > 4 sq.ft.

\*\* Use -S model of proper voltage.

Nominal sq.ft. per UL555S testing.	Temp	Actuator	
<4	350°F	FSLF	36" w x 24" h also.
<12	350°F	FSNF	Multisections also.
<16	250°F	FSNF	Multisections also.
<18	350°F	FSAF*A	Multisections also.

The FSTF series actuators were introduced in 2013. They are 18 in-lb and designed for under 1.5 sq.ft. of fire and smoke damper. Use on larger dampers only when replacing an existing FSTF on a fire and smoke damper.

The FSLF is recommended for small dampers.

Belimo actuators pass UL555S at the same damper sizes as the Honeywell.	NOTE. Although an actuator may operate a larger sized damper use the UL listed sizing. Call for assistance.
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**Siemens**

Make & Model	Power	Belimo Replacement	
GGD121	24	FSAF24	FSNF24
GGD221	120	FSAF120	FSNF120
GGD321	230	FSAF230	FSNF230

GND12x.1x	24V		FSLF24
GND22x.1x	120V		FSLF120
GND32x.1x	230V		FSLF230

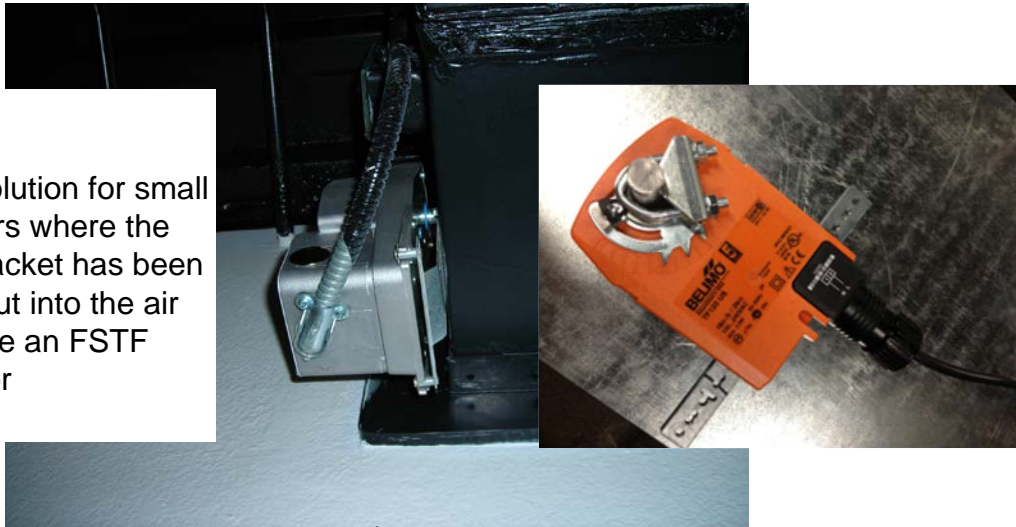
Electronic Fuse Link (24 Vac)

ASK79.165 165°F (74°C)	BAE165 US
ASK79.212 212°F (100°F)	None. Call if needed.
ASK79.250 250°F (121°C)	None. Call if needed.
ASK79.350 350°F (177°C)	None. Call if needed.

Optional	Two Auxiliary Switches Fixed 5° and 85°
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**FSTF**

Best solution for small dampers where the HW bracket has been hung out into the air is to use an FSTF actuator



## MultiProducts

### Prefco 5800 EMB

In all cases disconnect external motor spring without compromising fusible link and internal spring ability to close the blades. These are quite old and changes may have been made over the years. Investigate operation. Confirm voltage. Check fusible links or McCabe © Link. Verify damper functions after replacement by testing damper open and spring closed.	FSTF if less than 1.5 sq.ft.  FSLF from 1.5 to 4 sq.ft.  FSNF up to 10 sq.ft.	Use -S models if auxiliary switches are required.
Use of FSLF is recommended for dampers less than 4 sq.ft. For linkage applications all FSTF & FSNF parts can be used.		

5800EMB2XPO	FSLF120	
5800EMB2XPC	FSLF120	
5800EMB1	FSLF120	5800EMB1 - Outside the duct, top mount, power open
5800EMB7	FSLF120	5800EMB7 - Inside the duct, bottom mount, power closed
5800EMB10	FSLF120	5800EMB10 - Outside the duct, bottom mount, power closed
5800EMB5	FSLF120	5800EMB5 - Inside the duct, top mount, power open
5800EMB8	FSLF24	
5800EMB9	FSLF120	

While direct coupling is preferable, some applications require linkages. See **Linkages** below for an example of a FSTF linked to a Prefco internally.

Model	Voltage	Notes
2430	120VAC	
2553A	120VAC	1
2585	120VAC	2
2659	120VAC	3
2724	120VAC	4
2781	24/120 VAC	5
2814A-SQ	120VAC	6
2814-SQ	120VAC	7
2920	120VAC	8
2985	120VAC	9
2986	120VAC	10
3158	120VAC	11
3159	120VAC	12
5983	120VAC	13
6247	120VAC	14
MZRHM	120VAC	15
TB2000/1	120VAC	16

All 120V, FSLF120	
<b>Nailor</b>	
5953	
5949	
M12, MZRHM	
6247	
5186	



1	Square shaft inserted into damper sleeve with special crankarm. If a smoke damper, replacement may be possible and requires a new shaft and other linkage parts. If a combination fire and smoke damper, Belimo may not be capable of being used. See Air Balance with MP2553.
2	Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.
3	Safe-Air / Imperial. Typically linkaged. There was an internal spring and fusible link for the fire function.
4	Except in rare occasions where space constraints exist, simply remove all linkage parts and direct couple on damper shaft. Use old motor as a mounting platform for anti-rotation strap
5	Usually on a Negator Spring damper. For pneumatic, the FSLF120 will usually work. For electric, the Ruskin kit FSLF120/MP must be ordered from a Ruskin rep.
6	10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary
7	10 in-lb. "A" model = CW rotation; plain = CCW. Check voltage. FSLF replaces both in most cases. Use FSTF when linkages necessary.
8	Inside clamp mounting or a shaft extension required.
9	See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft.
10	See Greenheck Installation Instructions. Typically these were linkaged using a crank arm on the square shaft and the spring was on the round shaft. Remove all linkage parts and direct couple to damper shaft
11	Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.
12	Some were direct coupled to the damper shaft with an external spring. Some were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove all linkage parts and direct couple.
13	<a href="https://www.belimo.us/mam/americas/technical_documents/pdf-web/fire_and_smoke_doc/nailor_multiproducts_to_belimo_fs_instructions.pdf">https://www.belimo.us/mam/americas/technical_documents/pdf-web/fire_and_smoke_doc/nailor_multiproducts_to_belimo_fs_instructions.pdf</a>
14	Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq.ft. and FSNF for dameprs > 4 sq.ft.
15	Nailor. Remove linkage parts and mount to damper shaft. FSLF for dampers < 4 sq.ft. and FSNF for dameprs > 4 sq.ft.
16	Typically these were linkaged using a crank arm on the square motor shaft and the spring was on the round shaft. Remove spring and all linkage parts and direct couple to damper shaft.

## SAFE-AIR damper with Honeywell Motor



External view.

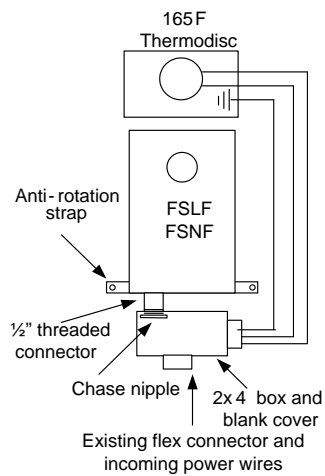
Belimo FSNF mounts on shaft with the clamp on the side of the actuator necessary to spring closed.



Internal view.

The fusible link releases a spring that closes the damper. This should not be modified.

### Belimo Mechanical



Where a J-box is needed for wiring, a chase nipple and 2x4 or 4x4 box can be attached to the actuator.

## Direct Coupling



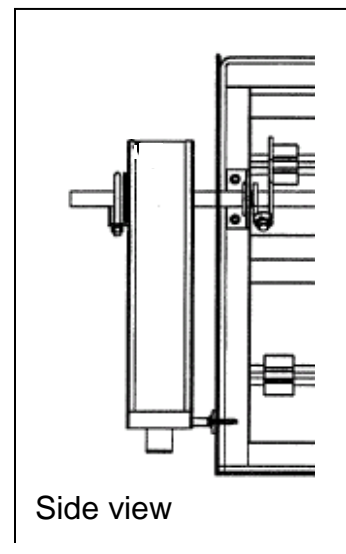
### USE CAUTION!

Spring is under high torsion and may cause serious injury! If any external springs are present, exercise caution – wear face and hand protection.



FSNF mounted on the damper shaft. Two screws hold the anti-rotation strap. Two nuts secure cold-weld clamp onto shaft.

FSAF mounts the same.



Side view

### Mounting

The Belimo Anti-rotation strap may be attached to the HW bracket or to the sleeve. Duct must be able to fall away; do not attach so that this is prevented. A 4" x 4" or larger electrical plate will serve as an anti-rotation mounting plate if old actuator is hung over free air.

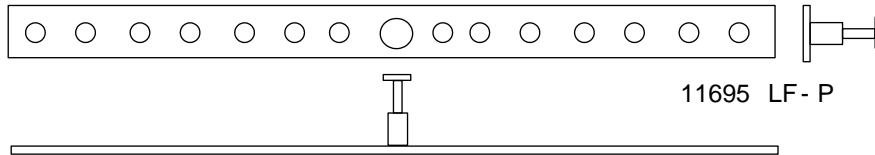
See Belimo Mounting Methods Guide



Anti-rotation strap can be attached to bracket, 4 x 4 plate, or sheet metal bracket.

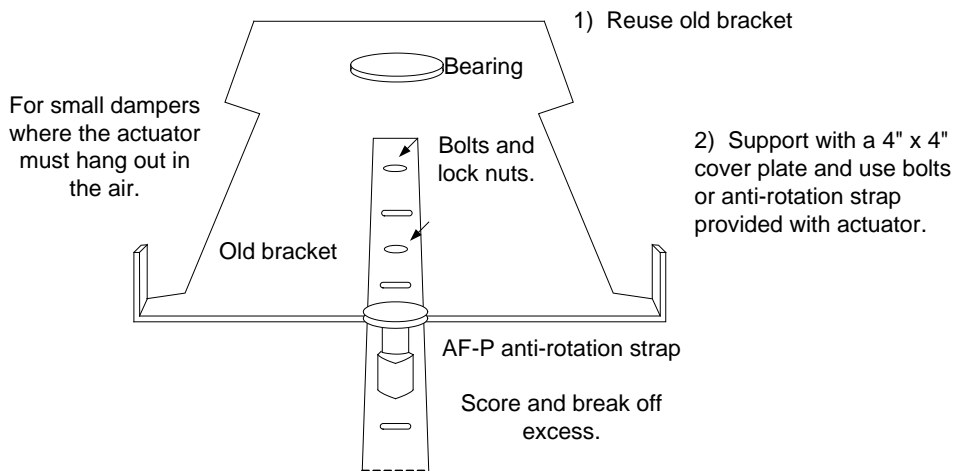
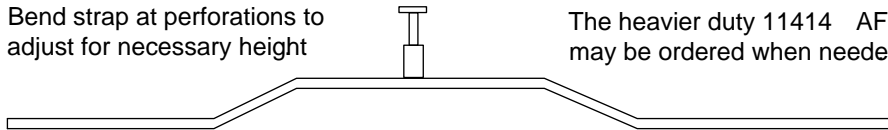
Best to mount the Belimo anti-rotation strap perpendicular to the actuator to allow for movement on non-concentric shaft.

Anti-rotation strap



Bend strap at perforations to adjust for necessary height

The heavier duty 11414 AF-P may be ordered when needed



**WARNING!**

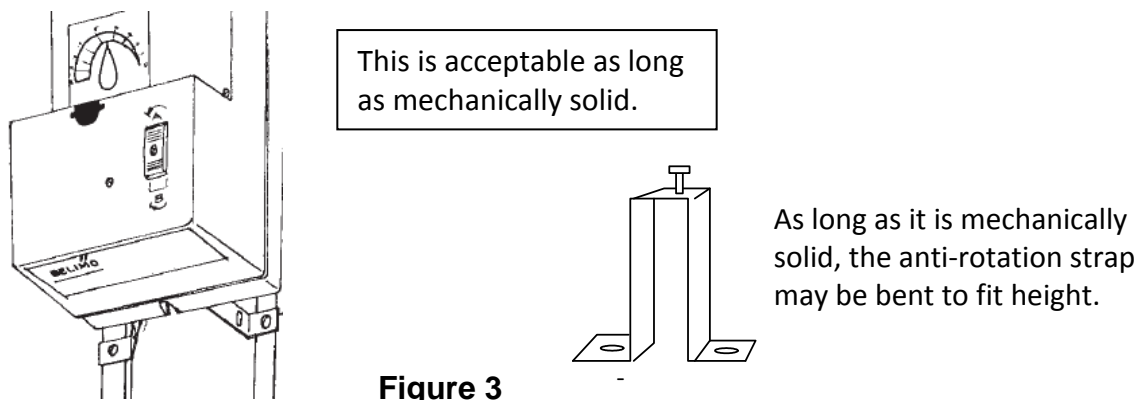
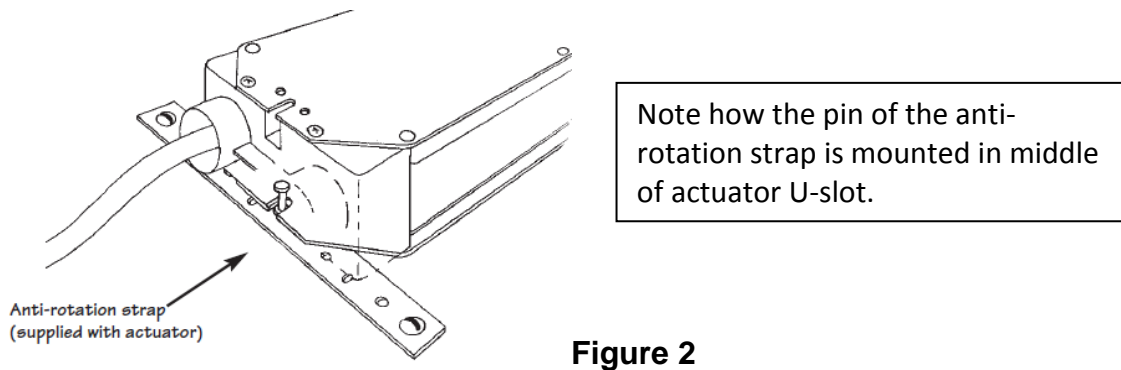
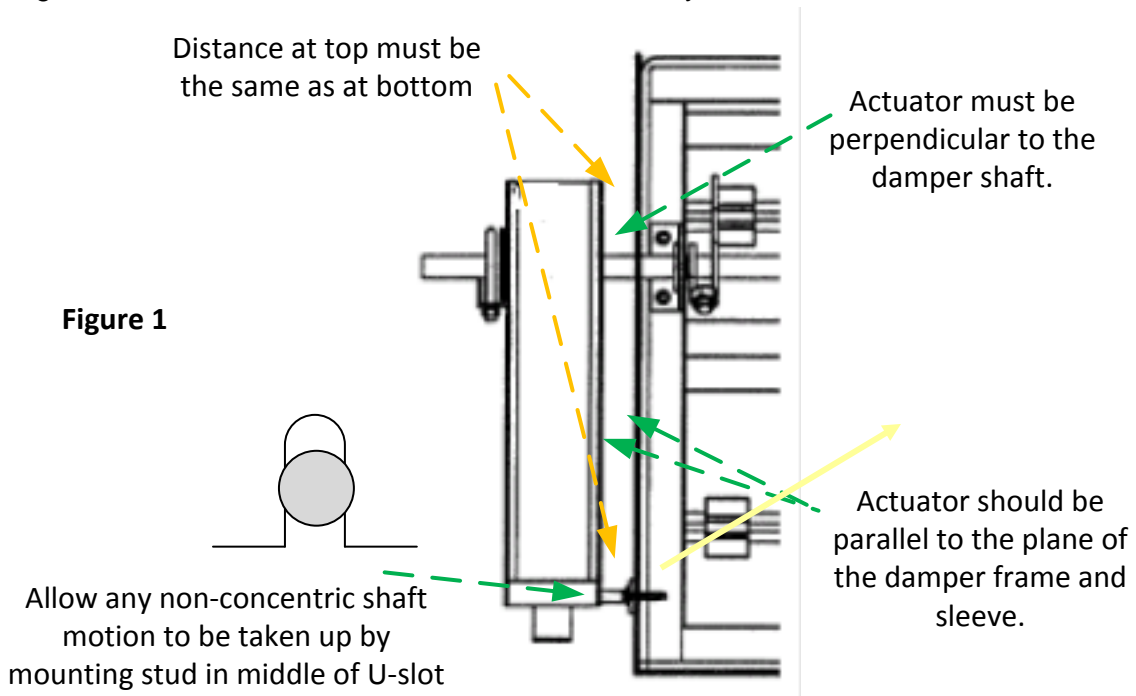
**Read Data Sheet provided in box with each actuator for specific wiring details.**



**WARNING!**

**Actuator anti-rotation strap may not be screwed to the duct. It must attach to either the sleeve or to the mounting bracket. The duct must be able to fall away from the damper in case of ceiling collapse in a fire.**

ote 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.

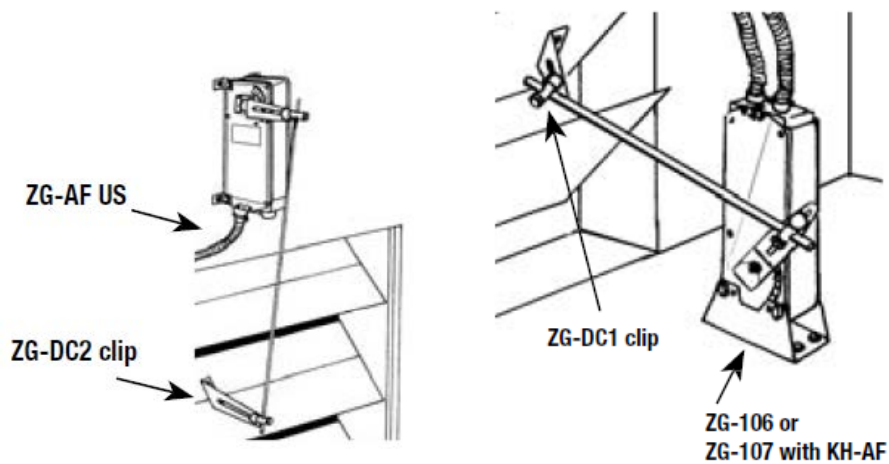


## Linkage mounting

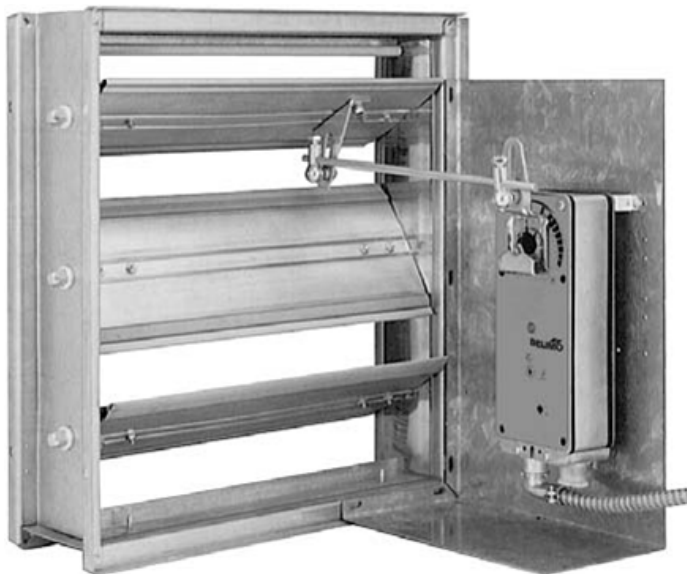


**WARNING!**

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



Possible alternate arrangements for damper clip. (FSNF, FSAF actuators shown.)



**Belimo linkage kits:**

[https://www.belimo.com/pim/mam/americas/technical\\_documents/data\\_sheets/man-air-acc/Mechanical\\_Accessories.pdf](https://www.belimo.com/pim/mam/americas/technical_documents/data_sheets/man-air-acc/Mechanical_Accessories.pdf)

**Mounting Methods Guide:**

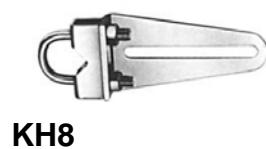
[https://www.belimo.us/mam/americas/technical\\_documents/pdf-web/guides/mounting\\_methods.pdf](https://www.belimo.us/mam/americas/technical_documents/pdf-web/guides/mounting_methods.pdf)

## Miscellaneous parts

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



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.



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"



**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** 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** 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.



## Thermal sensor replacements – BAE165 US

Original equipment is recommended although not strictly required by code. UL does not regulate replacement or repair. See NFPA 80 or NFPA 105.



### Belimo BAE165 US

Where existing sensor is defective or one must be added, the 165°F primary sensor may be used.

## Auxiliary Switches

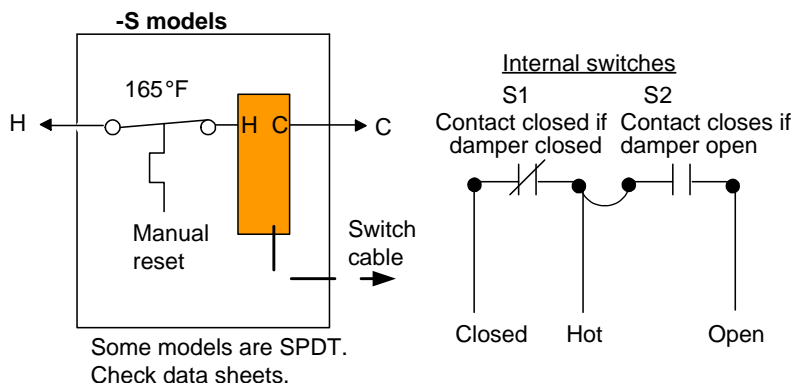
Where the original switches for signaling position to a Fire Fighters' Smoke Control Panel or to local indicator lights must be replaced or are inoperative, the Belimo –S model actuators may be used.

### Belimo S2A-F



### Belimo S2A-F

FSLF (mid 2014ff), FSNF, FSAF actuators can use the add on switch package.

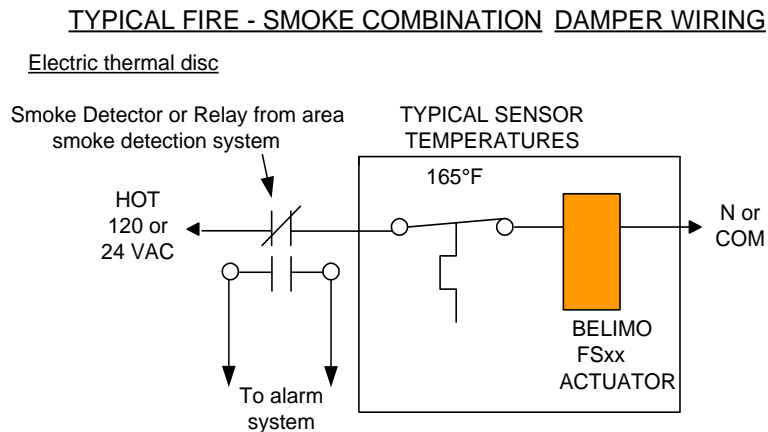


**-S actuators have built in switches.** See data sheets as configuration and wire colors vary among actuators.



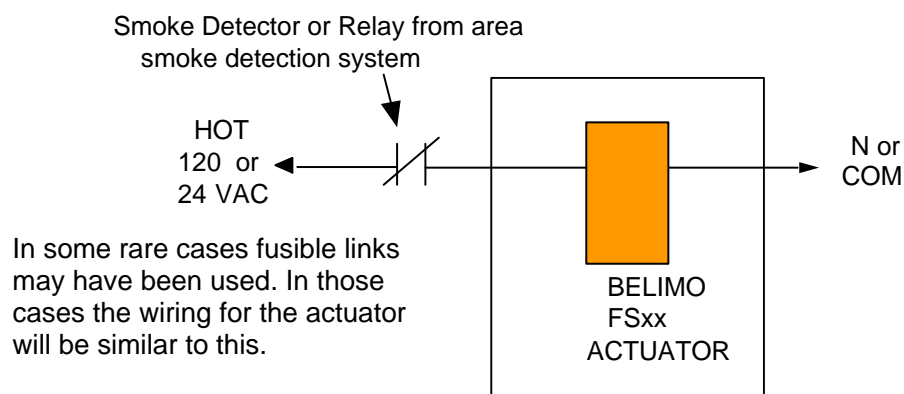
## Wiring

This is the most common wiring method used.



Regardless of the wiring routes used, this drawing shows the wiring necessary for a UL555S damper and actuator. Use it as a basis for any of the other wiring schematics. Note that the alarm connections are not touched when replacing an actuator. This is a major concern for Fire Marshals.

### Fusible link DAMPER ACTUATOR WIRING

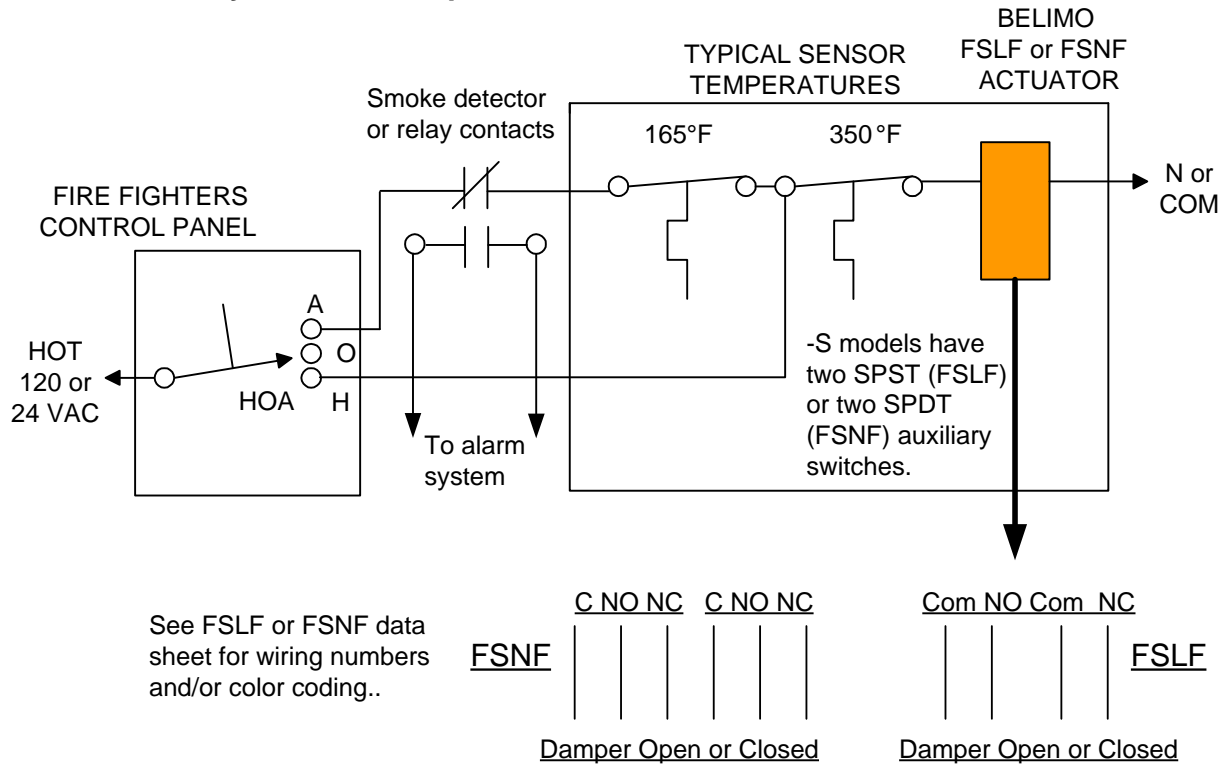


**WARNING!**

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

**TYPICAL REOPENABLE DAMPER with FSCS**

**Belimo Auxiliary Switches for position indication to FSCS**



**The auxiliary switches are used to provide status indication to the fire fighters' smoke control panel. Typically there are two or three status lights or leds. This wiring is the responsibility of the fire alarm company. If it is touched, they must retest to verify proper operation. These switches are not alarm, but rather indicating.**



**WARNING!**

- Damper must be free to move from open to closed without undue stress.
- Damper and duct must be clean and free of all debris.
- Test damper and controls per Fire Marshal's checklist below.
- Fire alarm company may need to be present to verify proper status indication at FSCS panel.

## 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 (Fusible Link and Smoke dampers do not have sensors. Only steps a & b apply.)

### 1. Single Sensor Combination Damper

- a.  Open smoke detector or relay wire or contact to cut power. *Damper springs closed.*
- b.  Reconnect power. *Damper drives open.*
- c.  Open thermal sensor using heat gun. *Damper springs closed.*
- d.  Press thermal sensor manual reset. *Damper drives open.*

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

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

(Since this system involves the Firefighters' Smoke Control System, inform fire department.)

#### With FSCS switch in Auto position:

- a.  Disconnect power from smoke detector or relay contacts. *Actuator springs damper closed.*
- b.  Reconnect power. *Actuator drives damper open.*
- c.  Trip thermal sensor. *Actuator springs damper fully closed.*
- d.  Press manual reset. *Actuator drives damper open.*

#### Test FSCS switch functions:

- a.  Move FSCS switch to Off position. *Actuator springs damper fully closed.*
- b.  Move FSCS switch to Hand position. *Actuator drives damper open.*
- c.  Trip secondary (higher temperature) thermal sensor. *Actuator springs damper fully closed.*
- d.  Press manual reset of secondary sensor. *Actuator drives damper open.*

#### Move FSCS switch back to Auto position:

- a.  Actuator springs damper closed if Primary sensor is still open.
- b.  Actuator stays open if Primary sensor has re-closed.

When completed, ensure 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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