



WARNING!

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

Pottorff Siebe MA2xx Replacement with Belimo FS Series

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WARNING!

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

www.belimo.us/firesmoke

UL®

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.

Chapter 7 IBC & IFC "Containment" Dampers	
Commissioning	
End of first year	
Every 4 years except in hospitals every 6 years	
Chapter 9 IFC "Smoke Control System" Dampers	
Dedicated	Non-dedicated
Commissioning	Commissioning
Semi-annually	Annually
Chapter 9 IBC & IFC	
Fire detection & Smoke control systems	
Dedicated	Non-dedicated
Weekly self-test	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 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. 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.

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

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.

For the Air Movement and Control Association damper maintenance manual go to:
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)



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.

Cross Reference

For greater detail see 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

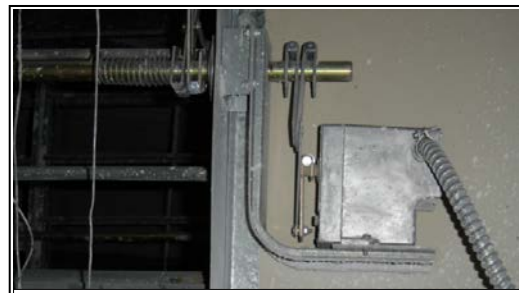
Barber Coleman-Siebe-Invensys

Siebe/Barber Coleman	Power	Torque	Aux Switches	Belimo	Notes
MA220	120 VAC	30		FSLF120 US	1, 2, 4
MA221	240 VAC	30		FSLF230 US	1, 2, 4
MA223	24 VAC	30		FSLF24 US	1, 2, 4
MA230	120 VAC	50		FSNF120 US	1, 2, 3
MA231	240 VAC	50		FSNF230 US	1, 2, 3
MA233	24 VAC	50		FSNF24 US	1, 2, 3
MA240	120 VAC	50			5,6
MA250	120 VAC	50		FSNF120 US	1, 2, 3, 4
MA251	230 VAC	50		FSNF230 US	1, 2, 3, 4
MA253	24 VAC	50		FSNF24 US	1, 2, 3, 4
MA-318	24 VAC	60		FSNF24 US	1, 3
MA-318-500	24 VAC	60	1	FSNF24 -S US	1, 3
MA-418	120 VAC	60		FSNF120 US	1, 3
MA-418-500	120 VAC	60	1	FSNF120-S US	1, 3
1	Direct couple the Belimo where shaft is available. Some were direct coupled..				
2	FSTF <1.5 sq.ft. FSLF <4 sq.ft.				
3	FSNF <12 sq.ft. FSAF*A <18 sq.ft.				
4	For Pottorff with shaft spring see: https://www.belimo.us/mam/americas/technical_documents/pdf-web/fire_and_smoke_doc/pottorff-ma2xx_to_belimo.pdf				
5	Motor was not 90 degree and pulley and cable were usually used. Some geometric changes are necessary to simplify.				
6	Provide photos. Motor, linkage, blades, fusible link, McCabe © Link, Typically direct couple to damper shaft if available. Otherwise, investigation necessary.				

4 sq.ft. in general for the FSLF. 36" w x 24" h is also UL555S listed with Pottorff. On MA318/418 -500 indicates aux switches. Use -S Belimo models. Where linkages required due to geometry of installation, use FSNF. FSLF does not have linkages. FSNF is UL555S listed on 2 sections up to 16 sq.ft. Call Pottorff for dimensions.

Nominal sq.ft. per UL555S testing.				
	Sq.ft.	Temp	Actuator	
	< 1.5	250°F	FSTF	
	<4	350°F	FSLF	.
	<6	350°F	FSLF	36" x 24" OK, not 24" x 36"
	12	350°F	FSNF	
	16	250°F	FSNF	Call for dimensions.
	12	350°F	FSAF*A	

Examples of various gear train motors and mounting



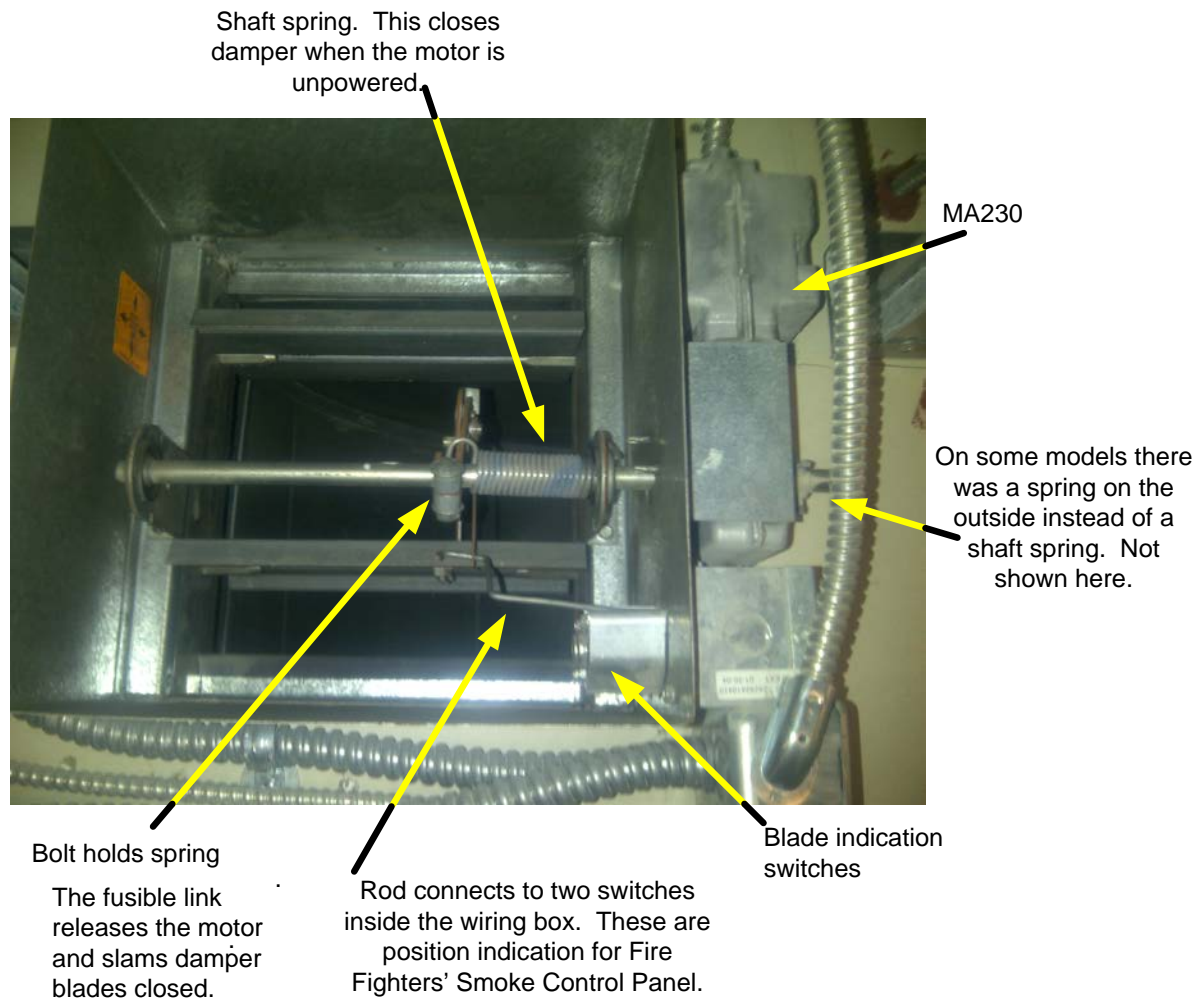
In general, oil-filled spring return motors like the MA418 are straightforward replacements. In this case, the Belimo FSNF or FSAF may be direct coupled. The shaft spring should be examined and exercised to prove it is still operational. The fusible link cannot be seen, however it should release the shaft spring.

For a cross reference or more retrofit instructions see Retrofit or Documentation Tabs in middle of page:

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

MA2xx with blade switches

Below is the common shaft spring with fusible link model. It has the less common blade indication switches. Since the switches go back to the fire alarm system, smoke control panel, or fire fighters' smoke control (FSCS) panel, and they are modified here, retest of the system must be performed. A Belimo –S model could be installed to avoid the blade switch adjustment problems which frequently occur.

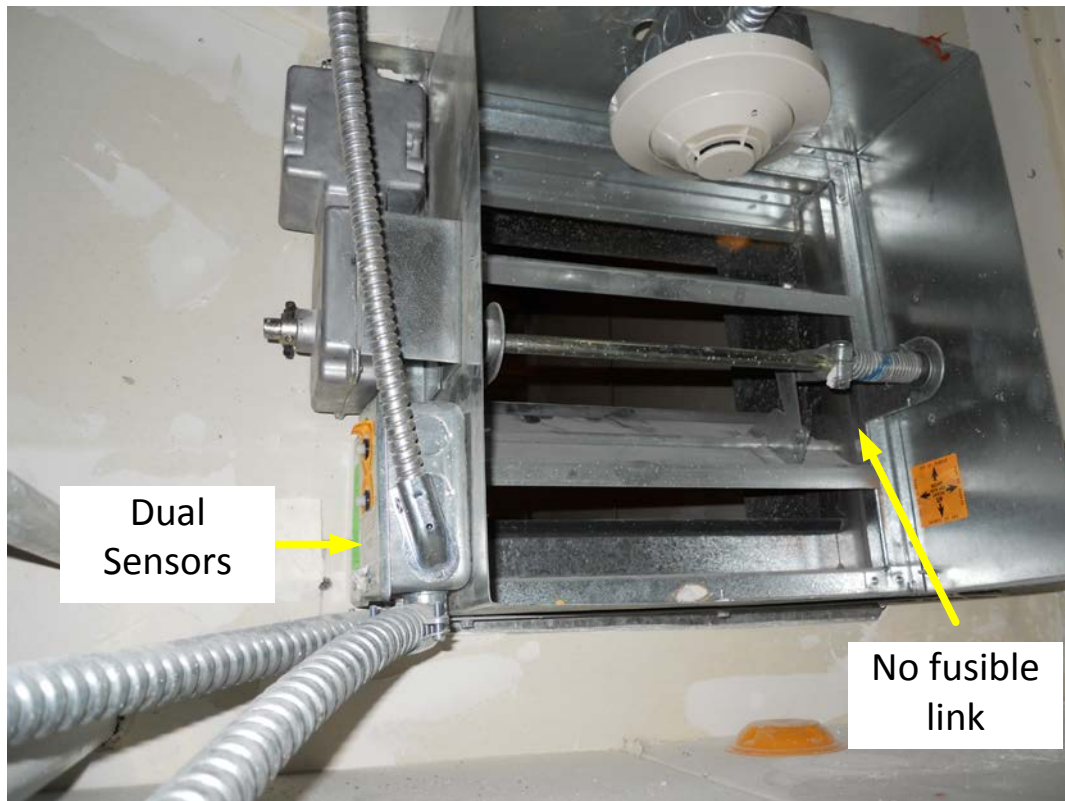


Transition model variation

The picture below shows a “transition” model between the older fusible link version and the modern Belimo spring return version. There are electrical thermal sensors instead of a fusible link. The steps shown in the main body of this installation instruction do not apply.

In this case, simply unhook the shaft spring making sure it cannot bind. Then replace the actuator and wire according to the diagram(s) in the wiring section.. *A dual thermal sensor can be seen at the lower left so this application is a reopenable damper.*

The spring must be disabled otherwise the Belimo FSLF would have to drive against its own spring as well as the shaft spring.



There are no switches although there are two sensors appearing here. It may be that only one sensor is used. Investigate operation of fire fighters' smoke control (FSCS) panel. Retest notifying fire department if necessary.

Step by Step Replacement Instructions

The MA220, 230, 250, 253 and similar actuators can be replaced by either of the Belimo FSLF120/24 or the FSNF120/24 provided the following conditions are met:

1. If the damper is equipped with an HS-10 or a DRS-30, the spring used on the MA250/253 set-up must be disconnected so as not to interfere with the operation of the Belimo actuator.
2. If the damper is equipped with a fusible link, the link must be removed and replaced with a blank (or the fusible link arm can be bolted to the jackshaft) and the shaft spring must be disconnected so as not to interfere with the operation of the Belimo actuator. **IN ADDITION, a Pottorff HS-10 or Belimo BAE165 must be installed on the damper and wired to the Belimo actuator per drawings in Wiring below.**

More modern dampers are electric thermal disk sensing only and the HS-10 is already present. In that case, replacement and testing of the actuator does not require spring disconnection.

1. Disconnect incoming power and wiring at junction box or actuator.
Tag all wires.
2. Remove old actuator and mounting bracket.
3. Mount Belimo FSNF or FSLF depending on torque or function required
4. Reconnect wiring per original drawing. Typical wiring shown on p9.
5. Restore incoming power.
6. **Test all functions per Fire Marshal Form on p10.**

DETAILED INSTRUCTIONS ON REMOVAL OF FUSIBLE LINK, DISABLING JACKSHAFT SPRING, AND HS10 INSTALLATION FOLLOW.



WARNING!

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



WARNING!

Anti-rotation strap may not be attached to the duct. It is attached to the damper sleeve or to a flat plate secured to the damper or sleeve.

The duct must be free to fall away leaving the damper in the wall.

1. Detach actuator from jackshaft
2. Remove the actuator-mounting bracket and loosen setscrews



3. Remove old motor.



Notes:

4. Remove the e-ring where knee lock attaches to the drive blade bracket

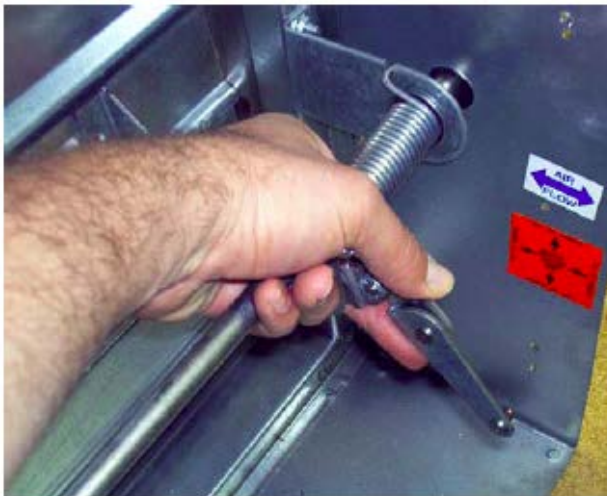


WARNING!

USE CAUTION!

SPRING IS UNDER HIGH TORSION AND MAY CAUSE SERIOUS INJURY!

5. Disconnect knee-lock



6. Carefully unwind spring.

The spring should no longer affect the damper. It must be disconnected so it is not an objectionable extra load on the actuator.

7. Insert knee lock pin back into drive blade bracket



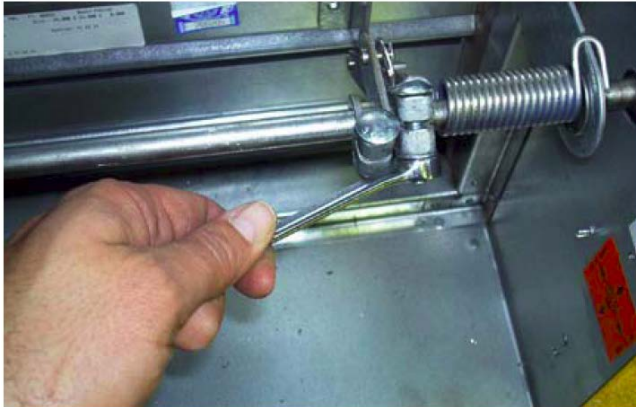
8. Secure knee lock to drive blade bracket with e-ring



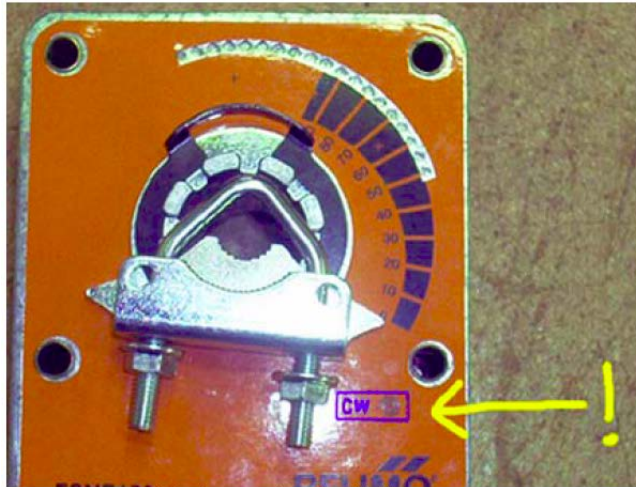
9. If a fusible link is on the damper, insert a 5/16" x 1-1/2" carriage bolt into the spring arm.
DO NOT REMOVE THE OTHER BOLT.



10. Shaft spring is disconnected. Actuator life span is shortened if it must drive against this unnecessary extra torque load.



11. Inspect your actuator. The clamp must be on the CW side. Double check that actuator springs damper closed.



12. If the clamp is not on the CW side, remove the clamp and reinstall on the CW side



13. While reinstalling the clamp, line up the indicator to zero position marked on the actuator

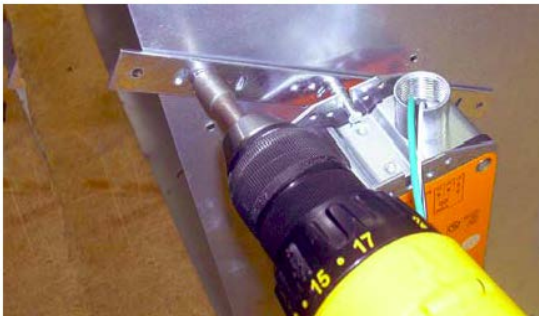


14. Slide the actuator over the jackshaft with the clamp outward.



15. Finger tighten the nuts

16. Attach the anti-rotation strap. It must not be completely tight and jammed into the slot on the actuator. The strap may not be connected to the duct since the duct must be able to fall away.



17. Tighten the bolts. Teeth in cold-weld clamp dig into shaft.

If convenient for wiring connections, attach a wiring box to the Belimo conduit connector with a 1/2" chase nipple.



18. Position the HS10 near the actuator and mark its location



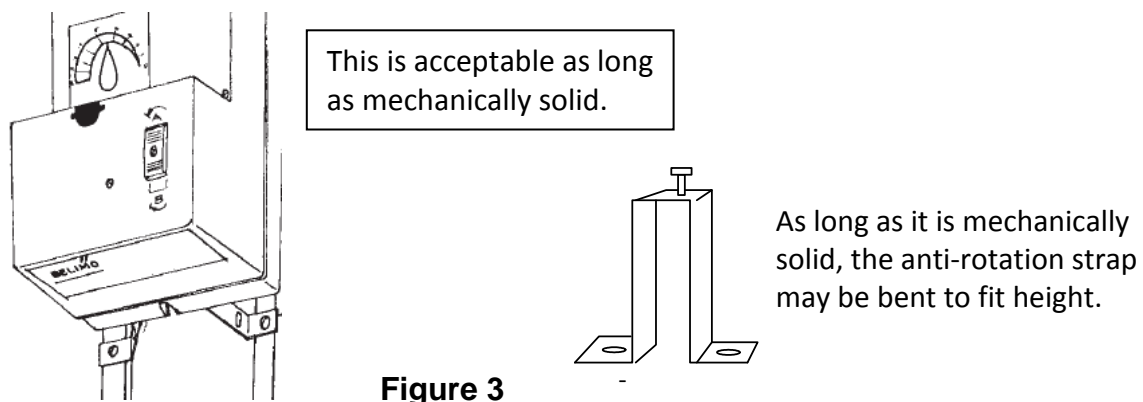
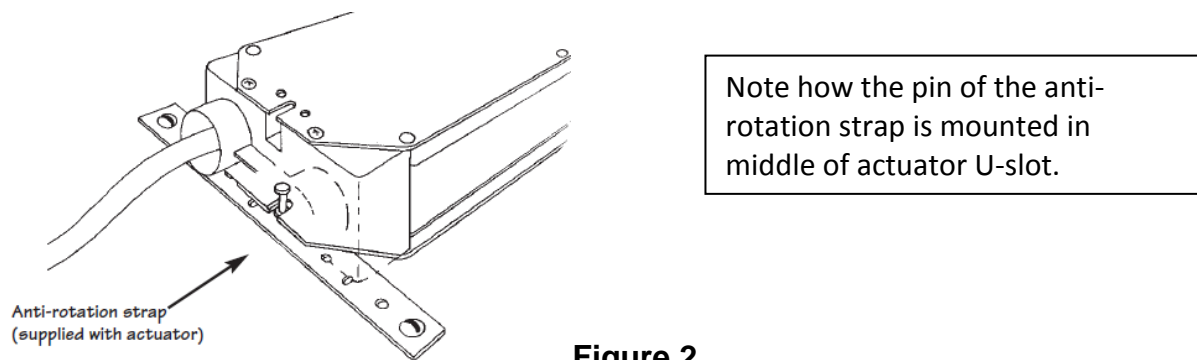
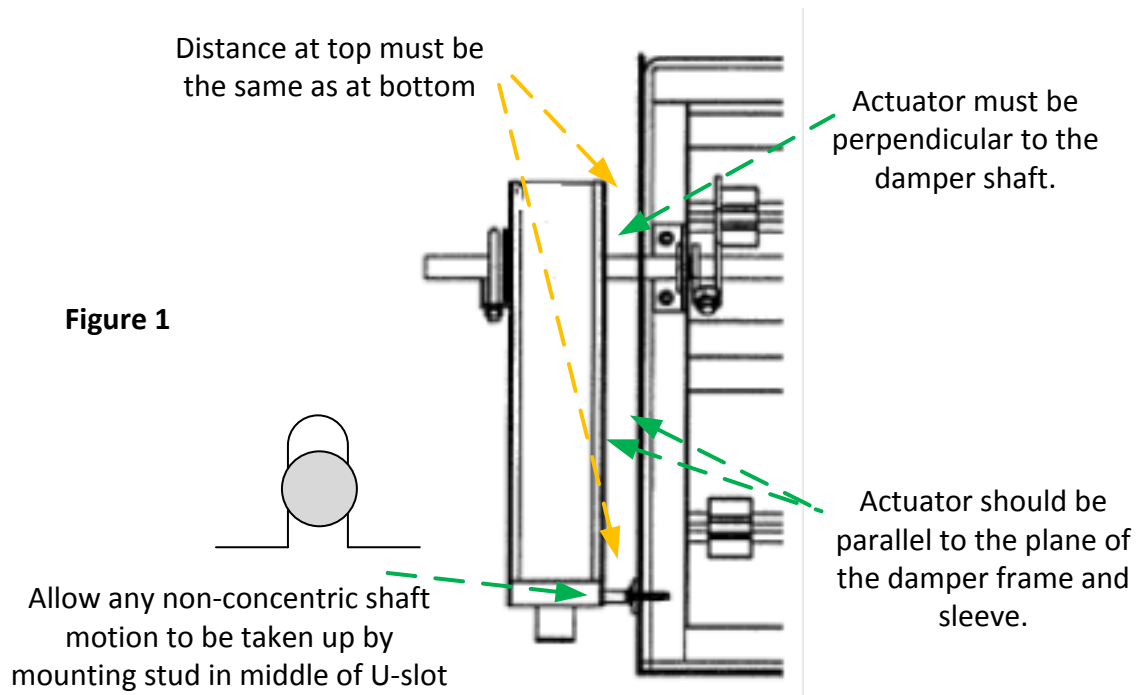
19. Make an 11/16" hole where the electronic link will be positioned

20. Mount the HS10 onto sleeve by inserting the electronic link into the 11/16" hole. Secure with #10x1/2" screws.



21. Wire the HS10 electric thermal sensor and the actuator in series with the hot wire going into the HS10 first.

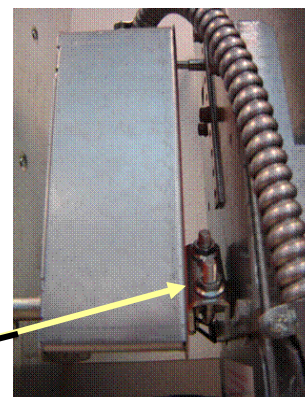
See Typical Fire-Smoke Combination Damper in Wiring section below.



Short shaft mounting



For short shaft mounting, the ZG-LMSA-1/2-5 can be used. Alternately, the clamp can be installed between the actuator and sheet metal.



Clamp

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



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.

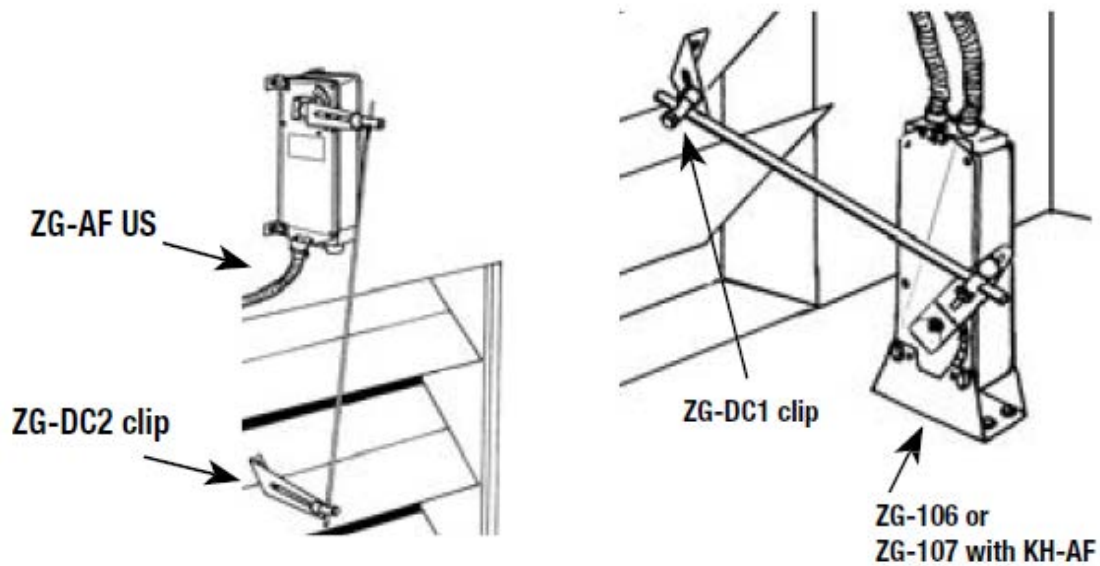
Note that actuator floats freely. Clamp cold welds when teeth dig into the damper shaft and the anti-rotation strap stud allows the actuator to move if shaft is not perfectly concentric. Rigid mounting by jamming the stud into the U-slot of actuator is NOT usually best.



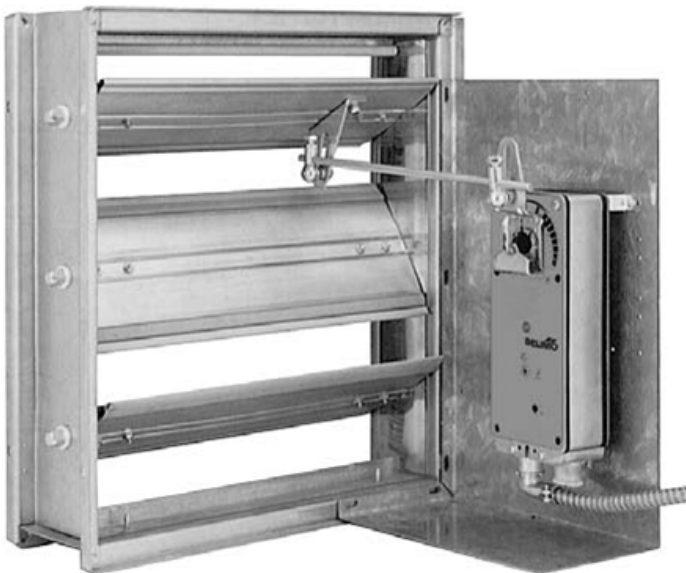
WARNING!

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

Linkage mounting



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

Mounting Methods Guide:

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.



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 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.

Auxiliary Switches

Damper blade switch assembly



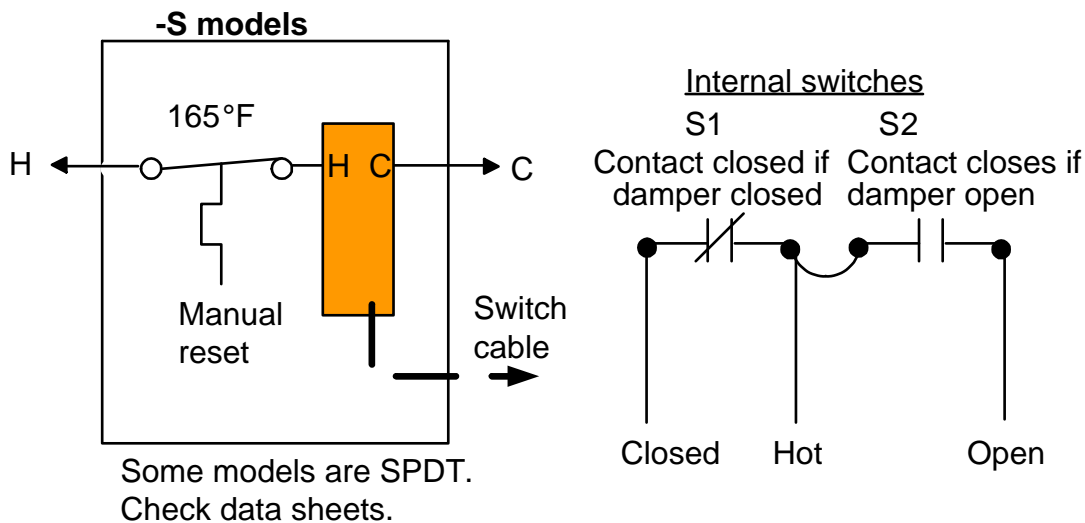
Externally mounted auxiliary switches



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 or a S2A-F may be installed.

Belimo S2A-F

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



Thermal sensor replacements – BAE165 US

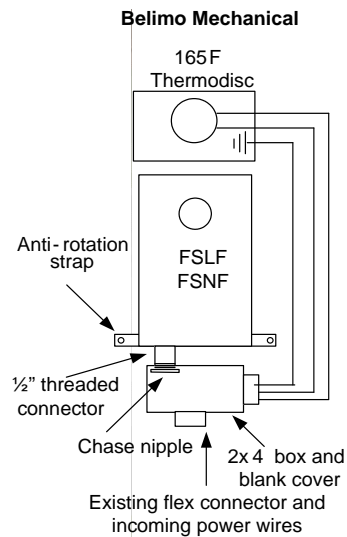
Original equipment is recommended although not strictly required by code. UL does not regulate replacement or repair. See NFPA 80 or NFPA 105. Pottorff's thermal switch is part number HS10. Belimo's version is shown below.



Belimo BAE165 US

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

Wiring

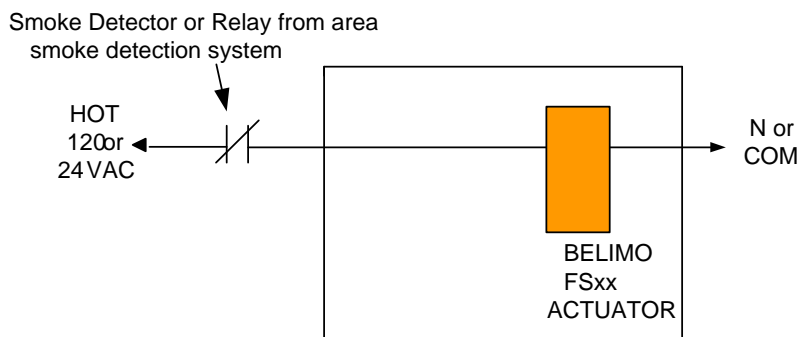


Where a junction box is required a chase nipple and box may be mounted on the Belimo conduit connector.

The wiring below is how the original damper was most typically wired. Most often, the wiring will have to be modified to appear like that shown in the next drawing with a thermal sensor.

Fusible link DAMPER ACTUATOR WIRING

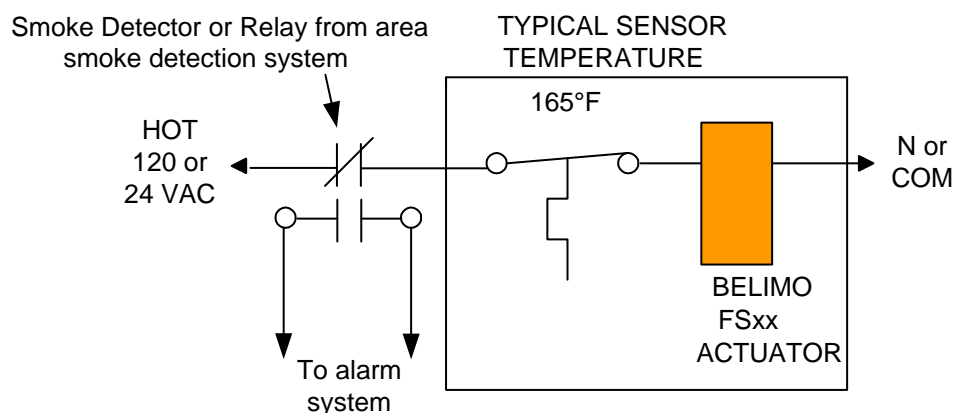
SMOKE DAMPER ACTUATOR WIRING



There are several wiring schemes that describe most applications. While the geometry of the wire runs may vary, the connections are essentially the same.

TYPICAL FIRE - SMOKE COMBINATION DAMPER WIRING

Electric thermal disc

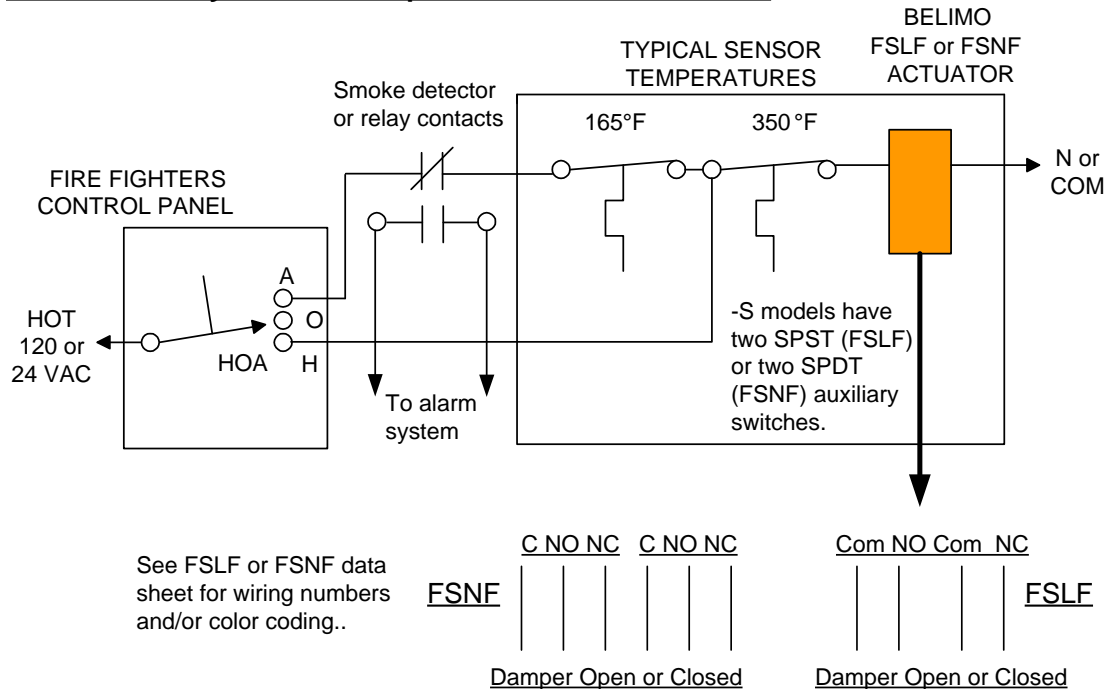


Regardless of the wiring routes used, this drawing shows the wiring necessary for a UL555S damper and actuator. Use it as a basis for any of the other wiring schematics. Note that the alarm connections are not touched when replacing an actuator. This is a major concern for Fire Marshals. If their wiring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

The wiring below is commonly connected to alarm or smoke control electronic modules in modern systems.

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.



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.

Some dampers are Normally Open. Reverse procedure regarding open & closed.
There is no longer a fusible link to test. Contact Belimo if any variations are uncovered.

☐ Test Checklist (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:

- ☐ Actuator springs damper closed if Primary sensor is still open.
- ☐ 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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