WARNING!

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

Replacement of Ruskin with MA2xx with Belimo FSxx Series

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Mike Knipple 203 749-3170 Laure Pomianowski 775 355-2466
800 543-9038

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 ac•tuators 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 Commissioning Semi-annually	**Non-dedicated** Commissioning Annually
Chapter 9 IBC & IFC **Fire detection & Smoke control systems**	
Dedicated Weekly self-test	**Non-dedicated** 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.

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.

For the Air Movement and Control Association damper maintainance 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

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.

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.

See Retrofit or Documentation Tabs in middle of page:
https://www.belimo.us/solutions/actuators/product-documentation/damper-actuators-fire-and-smoke

See https://www.belimo.us/mam/americas/technical_documents/pdf-web/fire_and_smoke_doc/fire_smoke_competitive_replacement_data_reference.pdf for greater detail.

WARNING!

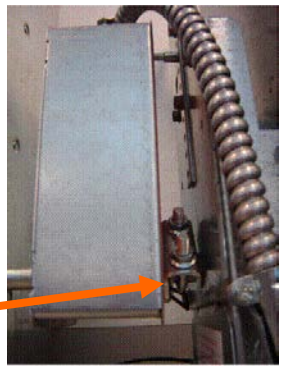
Read Data Sheet provided in box with each actuator for specific wiring details.

Direct coupling

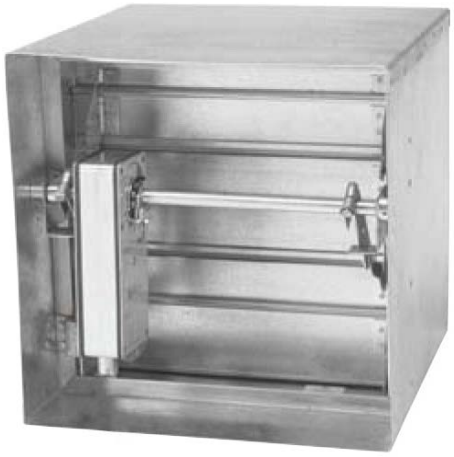
Note that actuator floats freely. Clamp cold welds when teeth dig into the damper shaft and the anti-rotation strap stud allows the actuator to move if shaft is not perfectly concentric. Rigid mounting by jamming the stud into the U-slot of actuator is NOT usually best.

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.



Internal mount



Internal mount

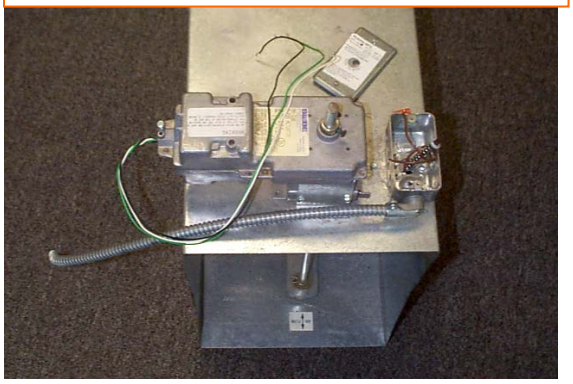
The jackshaft must be removed and the old motor slid off and the replacement slid on. Use of existing brackets with slight modification is possible.

Typical Siebe MA220 Replacement

WARNING!

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

Existing Defective Motor



Disconnect power

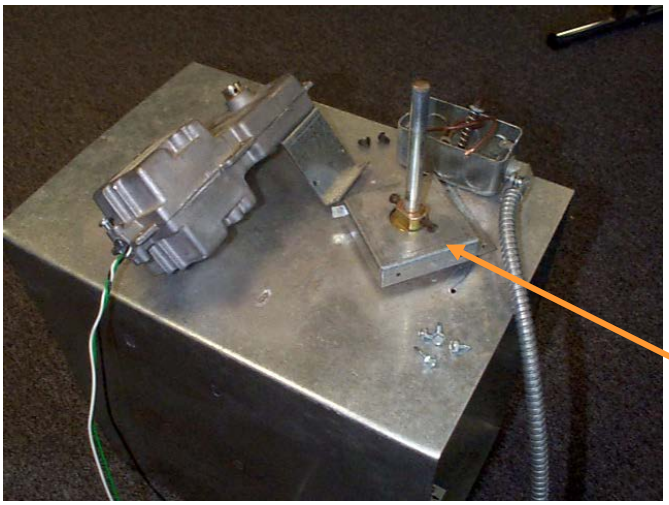
Disassembly – Open sensor electrical J-box, disconnect wire nuts and pull old wires out of box. Flex can be reused in most cases.

Examine damper, seals, and blades to ensure damper will perform properly.

WARNING!

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.

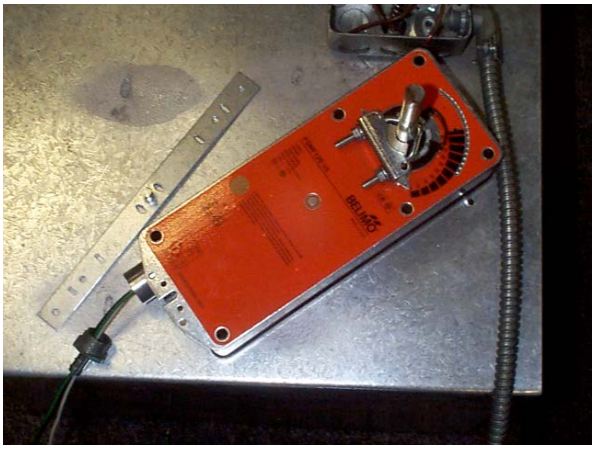


Disassembly – motor, electrical, & spring housing

Remove 2 setscrews & 4 sheet metal screws to remove spring cover. Loosen square head bolts to remove spring mechanism. External spring mechanism and housing can then be removed. **Note spring under tension. Wear eye and hand protection.**

Operate damper open and closed without motor attached to ensure smooth action.

Disassembled



Orient Belimo FSLF or FSNF (shown) to allow anti-rotation strap to be attached to the sleeve.

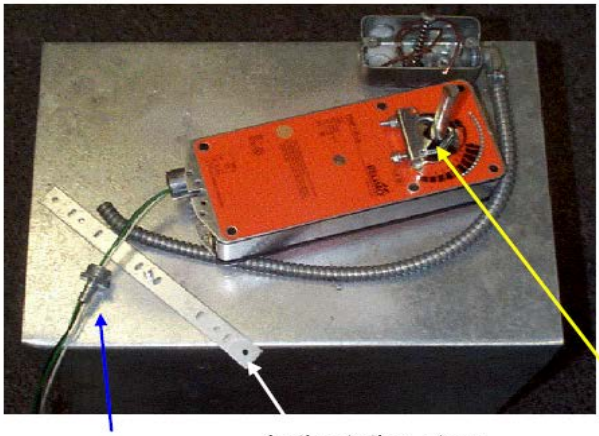
Do not attach strap to the duct as this could prevent duct from falling away in a fire if the ceiling collapsed.

Do not insert screws where they could interfere with the damper blade movement.

If necessary add an extension bracket to mount.

Mounting

a. Screw anti-rotation strap into sleeve. Place actuator over shaft. If necessary use one screw initially and rotate strap stud into slot before attaching 2nd screw.
b. Close damper tightly when tightening Belimo clamp.



Select orientation to avoid running screws into damper frame and allow available flex to reach.

Standard clamp has insert for ½", 5/8" or remove for 1"

c. Pull Belimo wires thru flex. Cut off excess. Attach green ground to case on 120V models
d. Reconnect wire-nuts.
e. Reinstall cover of thermal sensor making sure reset button is aligned.
f. Reconnect power.
g. Operate open and closed 3 times.
h. Test sensor with heat gun to be sure it is still functional.
i. Finished.

x 

Mounting Trick

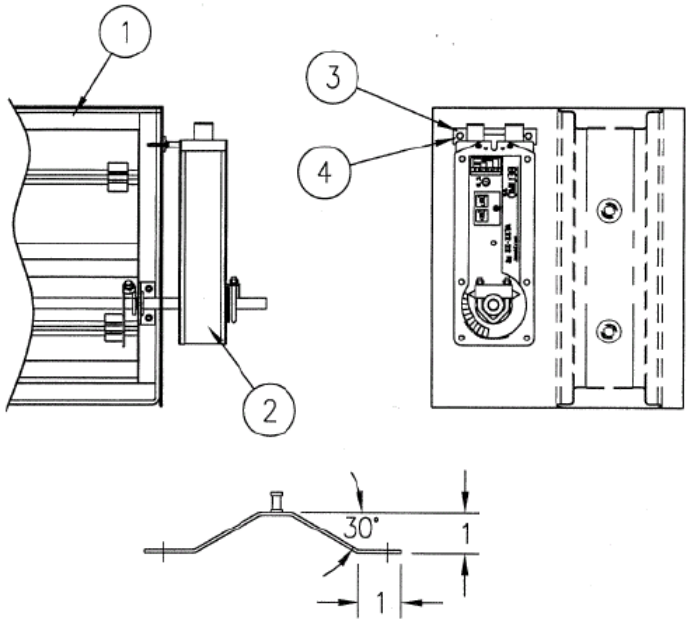
Sometimes a spacer is required to hold the actuator exactly straight. The old housing from the spring makes a good spacer.

RUSKIN® 3900 Dr. Greeves Rd. • Grandview, MO 64030

FIELD INSTALLATION INSTRUCTION FOR MODEL FSNF120/FSNF24 ACTUATOR MOUNTING IN THE AIRSTREAM

ON RECTANGULAR FIRE & LEAKAGE RATED DAMPERS

ITEM	DRAWING NO.	DESCRIPTION
1		FIRE/SMOKE DAMPER
2		ACTUATOR: FSNF120 OR FSNF24
3		ANTI-ROTATION STRAP
4		TEK SCREW: #10-16 X 3/4" LG. HWH (4 REQ'D)



GENERAL INSTALLATION INSTRUCTIONS

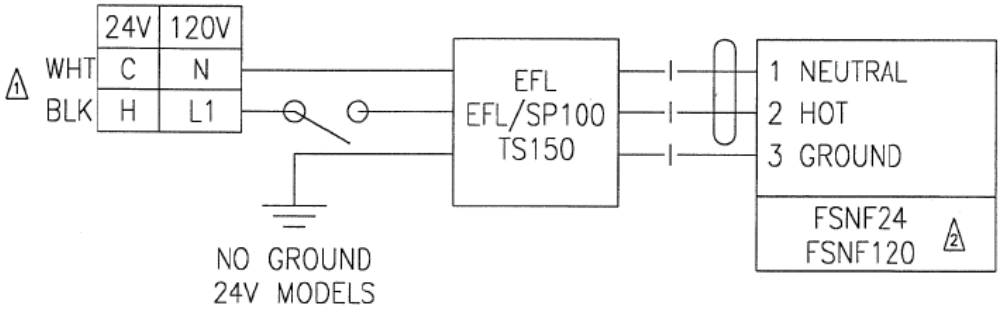
1. OPERATE DAMPER MANUALLY TO DETERMINE THE DIRECTION OF ROTATION OF THE EXTENDED SHAFT ON WHICH THE FSNF ACTUATOR IS TO BE INSTALLED ON. LEAVE DAMPER IN THE FULLY OPEN POSITION.
2. ASSEMBLE CLAMP SUPPLIED WITH ACTUATOR AND INSTALL ON ACTUATOR. CLAMP WILL NEED TO BE LOCATED ON OUTSIDE OF MOTOR. INSTALL ACTUATOR ON EXTENDED SHAFT AS SHOWN. ACTUATOR MAY NEED TO BE ENERGIZED TO DETERMINE IF ACTUATOR ROTATION MATCHES DAMPER ROTATION. IF IT DOES NOT, REMOVE ACTUATOR AND FLIP 180°. CLAMP WILL ALSO NEED TO BE REMOVED AND REINSTALLED ON THE OPPOSITE SIDE OF ACTUATOR.
3. MANUALLY BEND ANTI-ROTATION STRAP TO MATCH ABOVE SKETCH.
4. INSTALL PIN ON ANTI-ROTATION STRAP INTO NOTCH ON BOTTOM OF ACTUATOR. SECURE ANTI-ROTATION STRAP TO DAMPER SIDE PLATE OR SLEEVE W/ (2) #10 X 3/4" LG. TEK SCREWS. MAKE CERTAIN THAT SCREWS WILL NOT INTERFERE WITH DAMPER LINKAGE.
5. ENERGIZE ACTUATOR. AFTER ACTUATOR STOPS ROTATING, TIGHTEN U-BOLT NUTS ON ACTUATOR CLAMP TO SECURE ACTUATOR TO DAMPER SHAFT.
6. DE-ENERGIZE ACTUATOR, DAMPER SHOULD REACH IT'S FULL CLOSED POSITION. CYCLE ACTUATOR SEVERAL TIMES TO ENSURE PROPER OPERATION.

14-020906-00B SHEET 1 OF 2 04/24/06

NOTES

1. DAMPER MUST BE RUSKIN U.L. CLASSIFIED LEAKED RATED TYPE. SEE TABLE FOR APPROPRIATE MODEL.
2. ACTUATOR MUST BE A U.L. LISTED FIRE DAMPER OPERATOR AND MARKED BY THE DAMPER MANUFACTURER.
3. ACTUATOR MUST BE SELECTED AND INSTALLED TO FUNCTION PER SYSTEM REQUIREMENTS. SEE TABLE TO DETERMINE THE MAXIMUM DAMPER SIZE, AIR FLOW, AND STATIC PRESSURE RATING FOR THE DAMPER/ACTUATOR ASSEMBLY.
4. ACTUATOR MUST BE CONTROLLED BY SMOKE DETECTION DEVICES OR FIRE ALARM SYSTEM.
5. INSTALLATION MUST COMPLY WITH LOCAL CODE AND NFPA70A REQUIREMENTS. NATIONAL ELECTRICAL CODE WITH LOCAL CODES HAVING JURISDICTION. SEE ELECTRICAL RATINGS MARKED ON ACTUATOR.
6. IF MULTIPLE ACTUATORS ARE REQUIRED ON DAMPER ASSEMBLY, ACTUATORS MUST BE INSTALLED TO OPERATE SIMULTANEOUSLY.
7. PROVIDE ADEQUATE SUPPORT FOR ACTUATOR TO GUARANTEE PROPER DAMPER FUNCTION. GENERAL INSTALLATION IS DEPICTED ON PREVIOUS SHEET. INSTALLATION MUST BE COMPLETED WITH THE HARDWARE PROVIDED.
8. DAMPER OPERATOR MUST BE WIRED TO EFL, EFL/SP100, OR TS150 SO THAT INCREASE IN TEMPERATURE WILL CLOSE DAMPER.

MAXIMUM SQUARE FOOT RATING FOR FSNF120/FSNF24 ACTUATOR				
DAMPER	A X B	MAX. SQ. FT.	MAX. VELOCITY (FPM)	MAX. STATIC PRESSURE
FSD35	72 X 36	8	2000	4"
FSD36	72 X 36	8	2000	4"
FSD37	64 X 36	8	2000	4"
FSD60	64 X 36	8	2000	4"



1 PROVIDE OVERLOAD PROTECTION AND DISCONNECT AS REQ'D.

2 ACTUATORS MAY BE CONNECTED IN PARALLEL. POWER CONSUMPTION MUST BE OBSERVED.

TYPICAL WIRING

RUSKIN®

14-020906-00B SHEET 2 OF 2 04/24/06

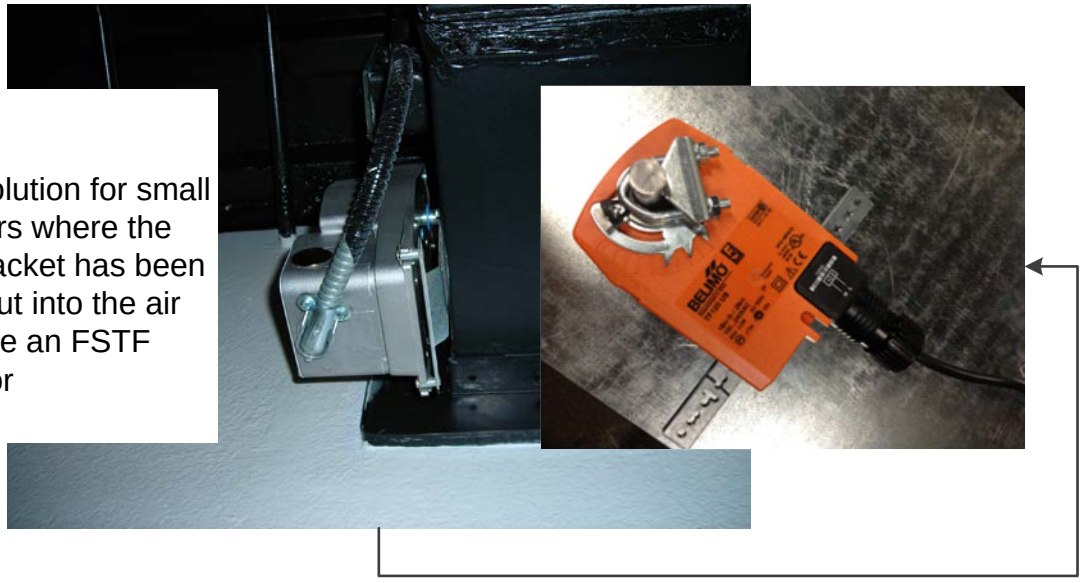
Direct Coupled Mounting

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 for more at www.belimo.com/Documentation.

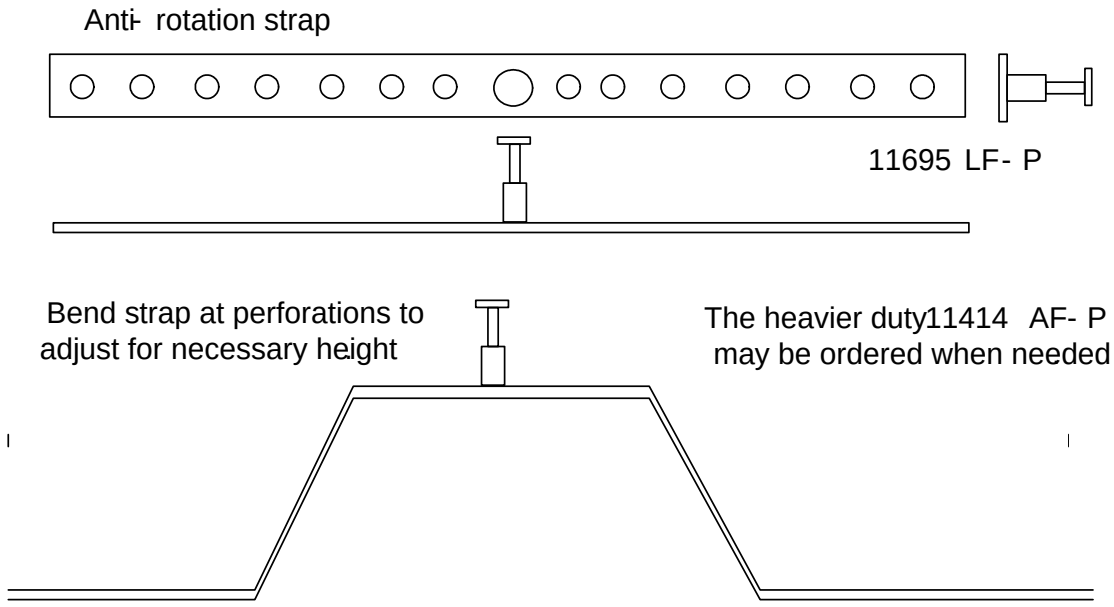
FSTF
Best solution for small dampers where the HW bracket has been hung out into the air is to use an FSTF actuator



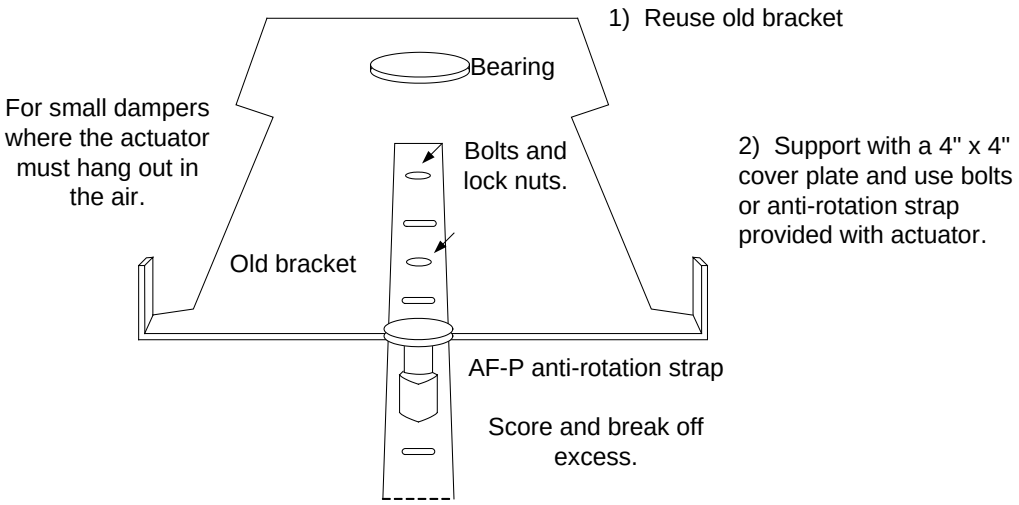
WARNING!

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.

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



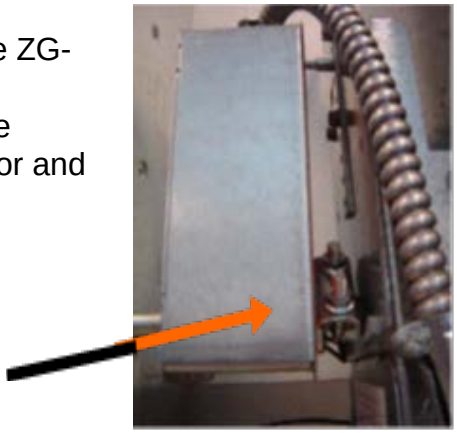
Notes:



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



FSNF mounted on the damper shaft. Two sheet metal screws hold the anti-rotation strap. Two nuts secure cold-weld clamp onto shaft. A variety of brackets can be used to hold the conduit connector end of the actuator.

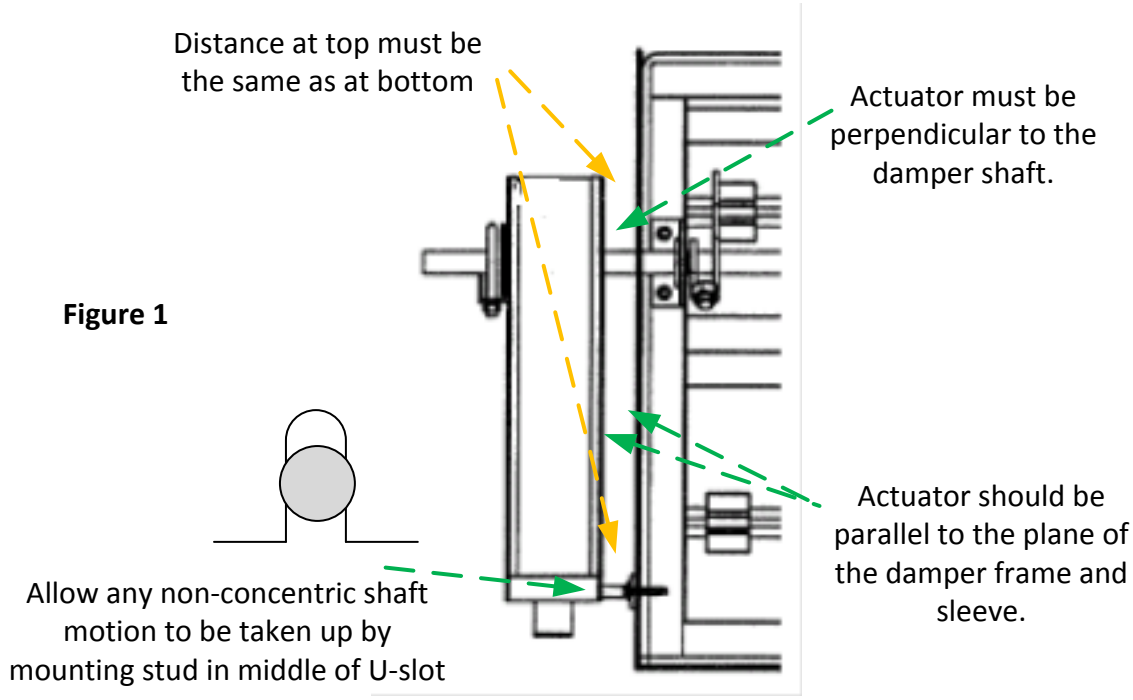
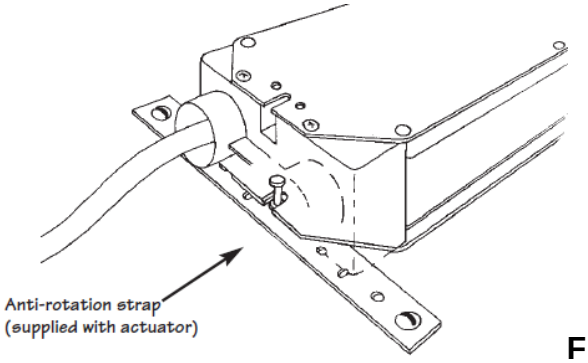
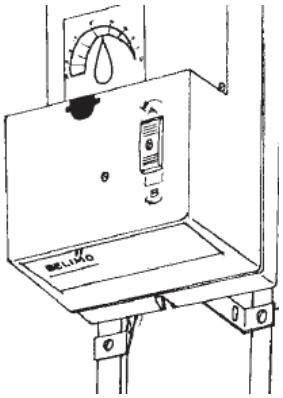


Figure 1

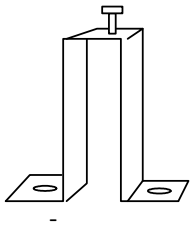


Note how the pin of the anti-rotation strap is mounted in middle of actuator U-slot.

Figure 2



This is acceptable as long as mechanically solid.



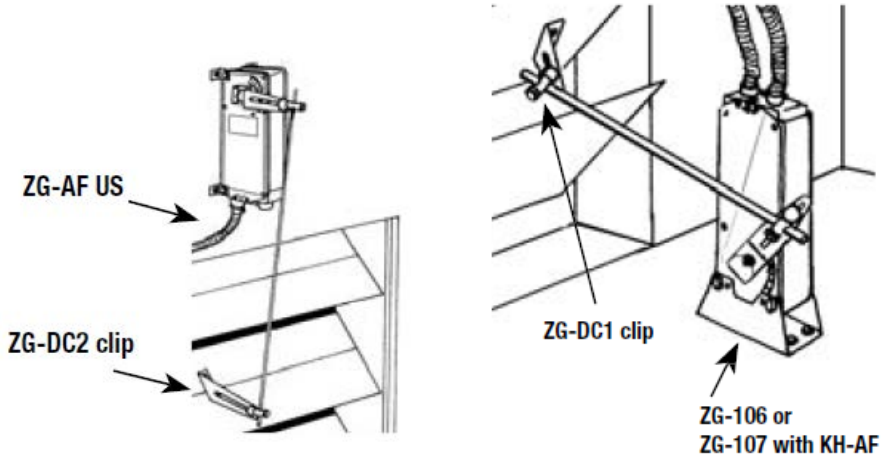
As long as it is mechanically solid, the anti-rotation strap may be bent to fit height.

Figure 3

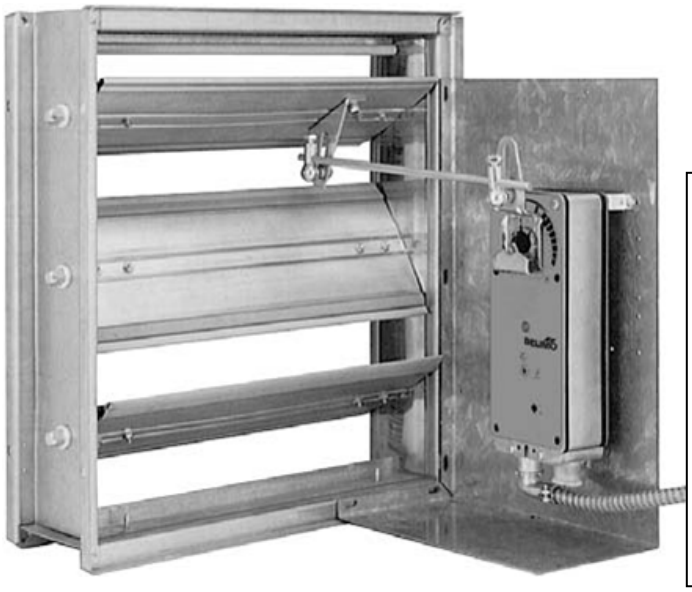
Linkage mounting

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

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.

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 ¾” 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 ¼”

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 ctuator or rod to shaft is above or below the damper.

Wiring

Belimo BAE165 US

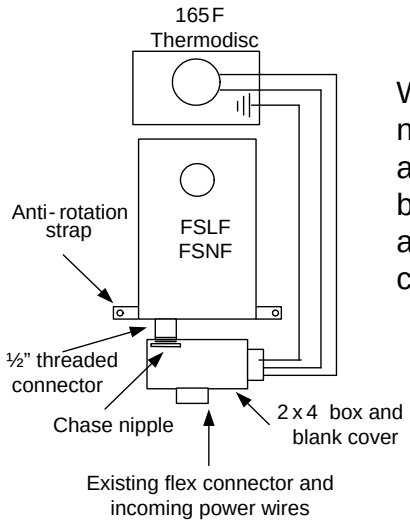
Belimo BAE165 US

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

The Ruskin EFL (electronic fuse link) and TS150 (dual sensor for reopenable dampers) schematics can be found at www.ruskin.com

There are three wiring schemes that describe all applications. While the geometry of the wire runs may vary, the connections are straightforward.

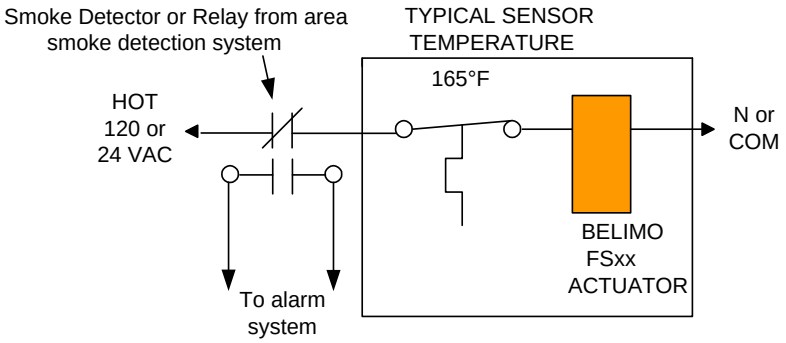
Regardless of the wiring routes used, this drawing shows the wiring necessary for a UL555S damper and actuator. Use it as a basis for any of the other wiring schematics. Note that the alarm connections are not touched when replacing an actuator. This is a major concern for Fire Marshals.



Where a J-box is needed a chase nipple and 2x4 or 4x4 box can be attached to the actuator's conduit connector

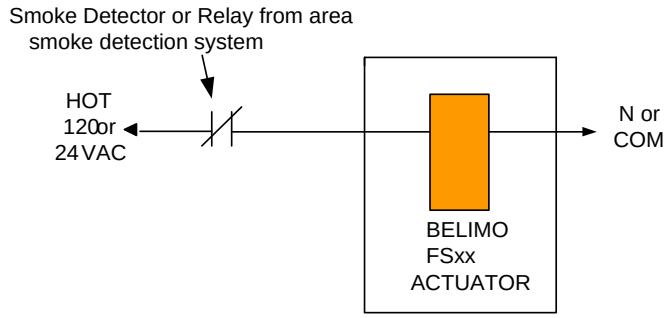
TYPICAL FIRE - SMOKE COMBINATION DAMPER WIRING

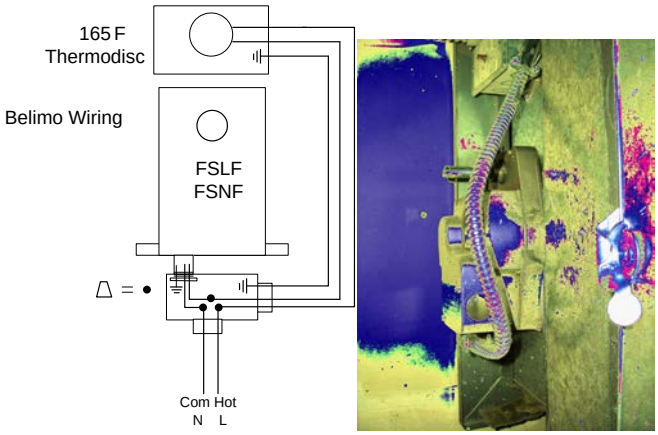
Electric thermal disc



In rare cases the Honeywell motor was installed as a retrofit on dampers with fusible links. There is no electric sensor in the damper in that case as there is typically a shaft spring performing the fire function. Wiring is shown to right.

Fusible link damper actuator wiring

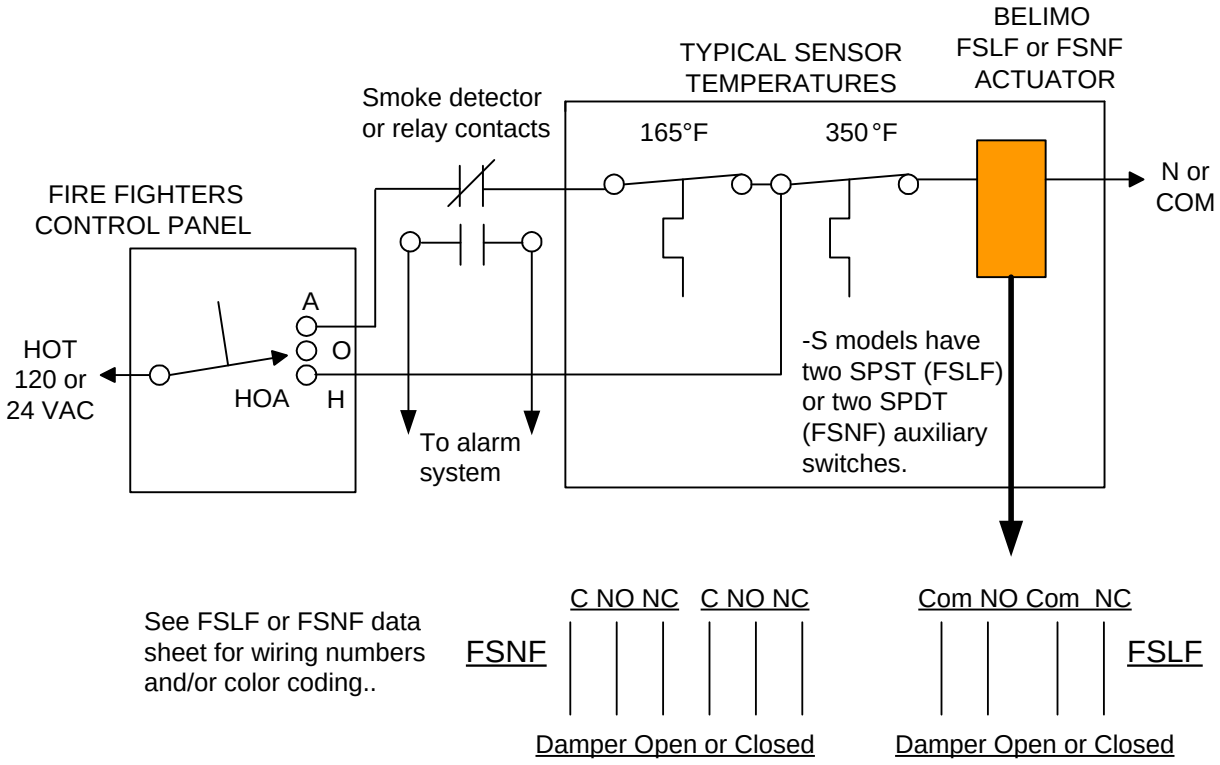




Where a J-box is needed for wiring, a chase nipple and 2x4 or 4x4 box can be attached to the actuator.

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.

Auxiliary Switches

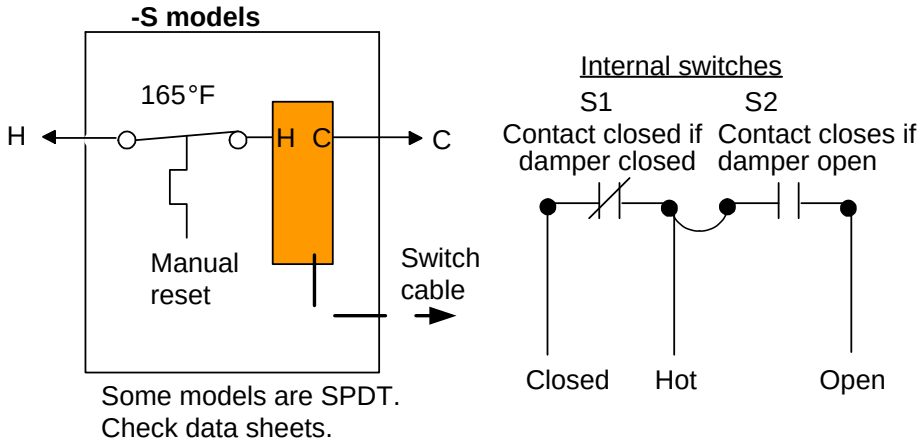
Where the original switches for signaling position to a Fire Fighters' Smoke Control Panel or to local indicator lights must be replaced or are inoperative, the Belimo –S model actuators may be used.

Damper blade switch assembly

Belimo S2A-F Add on auxiliary switch

Belimo S2A-F

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



Some models are SPDT. Check data sheets.

Fire Marshal / Building Official 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**
   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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