WARNING!

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

Replacement of Nailor Honeywell ML & MS motors to Belimo FS series actuators.

Contents

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800 543-9038

WARNING!

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

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 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.

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 in Fire Marshal Notification Form.

(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 maintainance manual go to:
http://www.amca.org/publications/damper_maintenance.aspx

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

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.

Multisection Damper Assembly

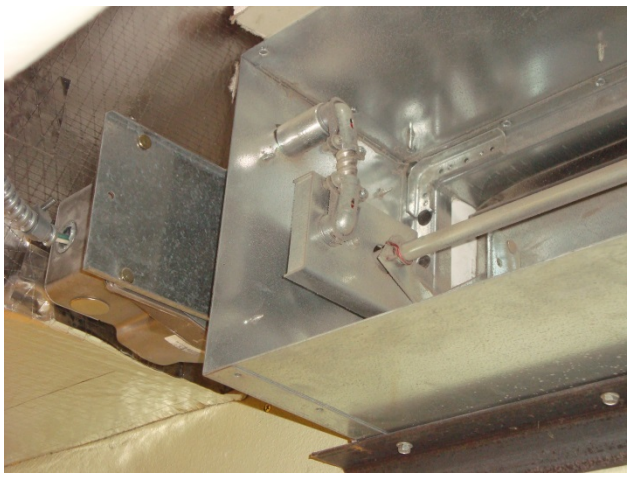
When measuring damper size, add the area of multiple sections together if controlled by a single actuator.

Fusible Link

The photograph below shows a shaft spring held by a fusible link. If the link melts due to 165ºF ambient temperature, then the spring closes the damper. The actuator is bypassed. Some Nailor dampers use this fire function closing method. Others use an electrical thermal sensor.

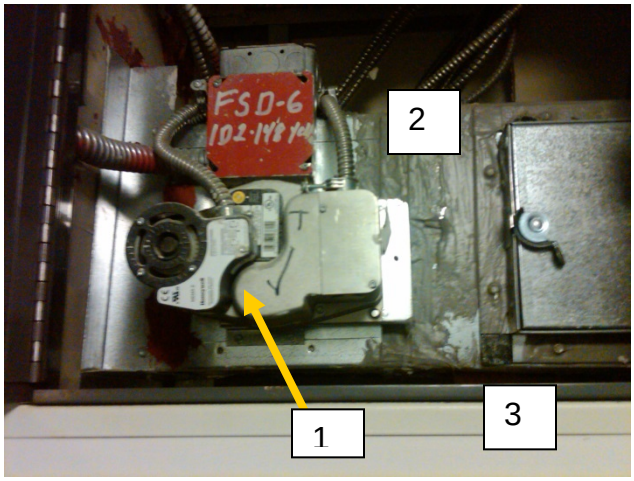
Nailor damper configurations

Typical damper and motor with auxiliary switch package



View inside damper. Make and model information is on blade. If there is no thermal sensor or fusible link and shaft spring, then the damper is a smoke damper that closes when smoke detection occurs.

In the motor mounting above, the plate is retained. The Belimo FSLF is set on the shaft and the anti-rotation strap is attached to the plate. Internally mount the Belimo clamp (see below) if the shaft is short.



1. Externally mounted auxiliary switch and flex to J-box.
2. Flex with power connections.
3. Hidden under actuator or sign is the thermal sensor if used. It is not part of the motor.

When replacing a motor with an external switch, use Belimo –S models with internal switch.

Typical Installations

Typical Honeywell mounting.

Remove set screws and disconnect anti-rotation bolts.

Various arrangements can exist. In many, the actuator performs a smoke closure only and the fusible link with shaft spring performs the high temperature closing function. See wiring diagrams below for alternate wiring.

Direct Coupling

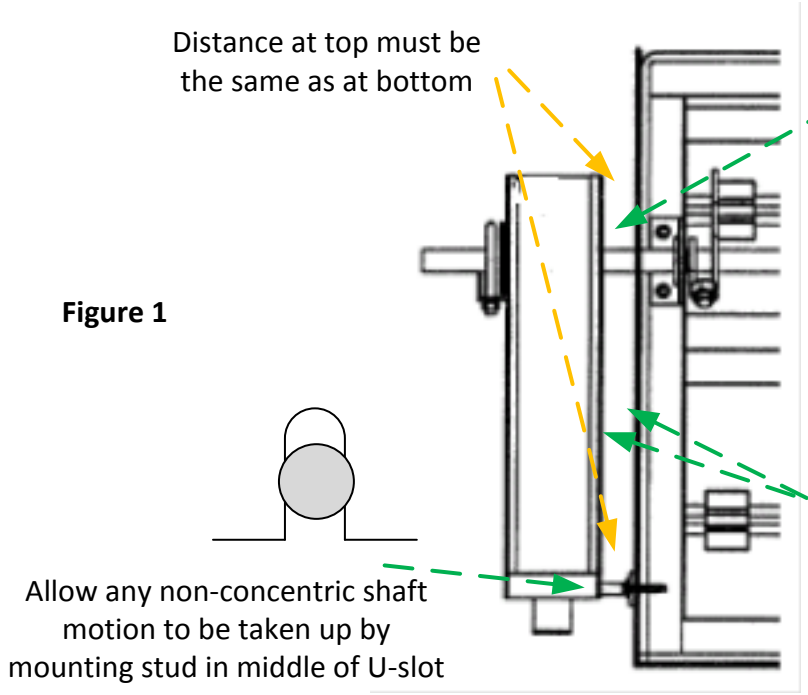
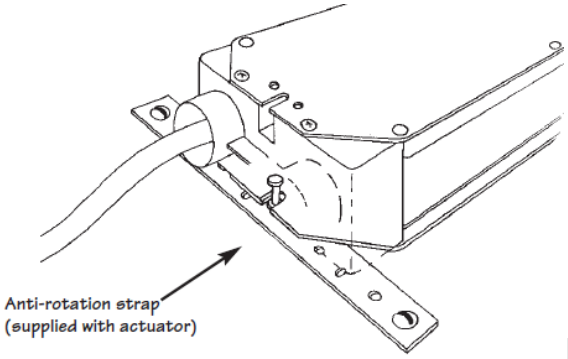
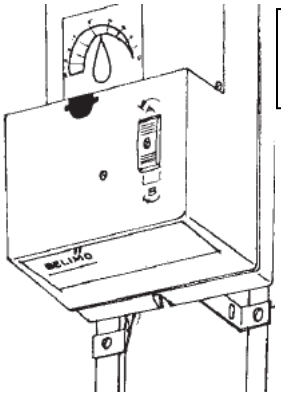


Figure 1

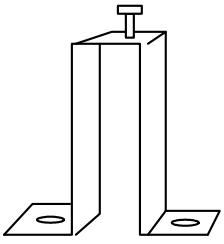


Note how the pin of the anti-rotation strap is mounted in middle of actuator U-slot.

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

Basic Replacement and Installation of Belimo

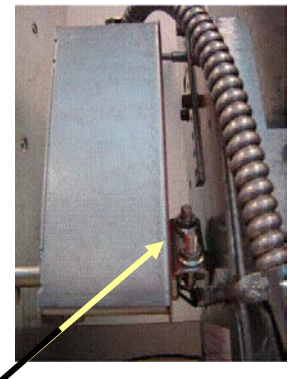
Obsolete Honeywell motor mounted on a damper manufacturer base.

Remove old motor and tag all wiring.

Mount Belimo FSLF or FSNF and wire.

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.

The base may be the housing used to hold the thermal sensor and old motor. Do not remove old housing.

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.

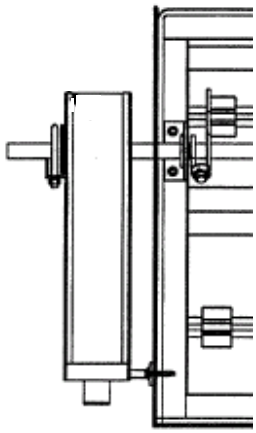
WARNING!

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.

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

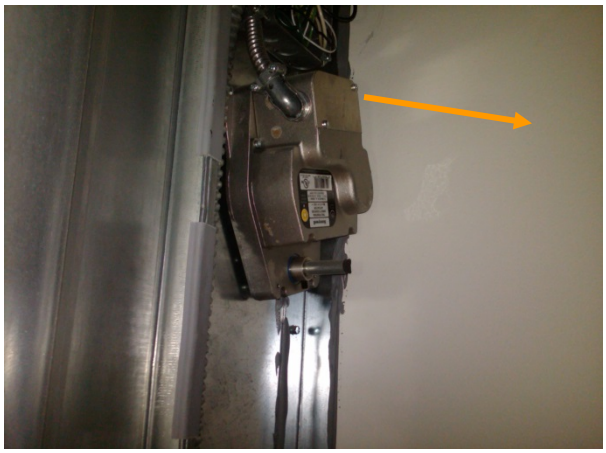
FSAF mounts the same.



Side view

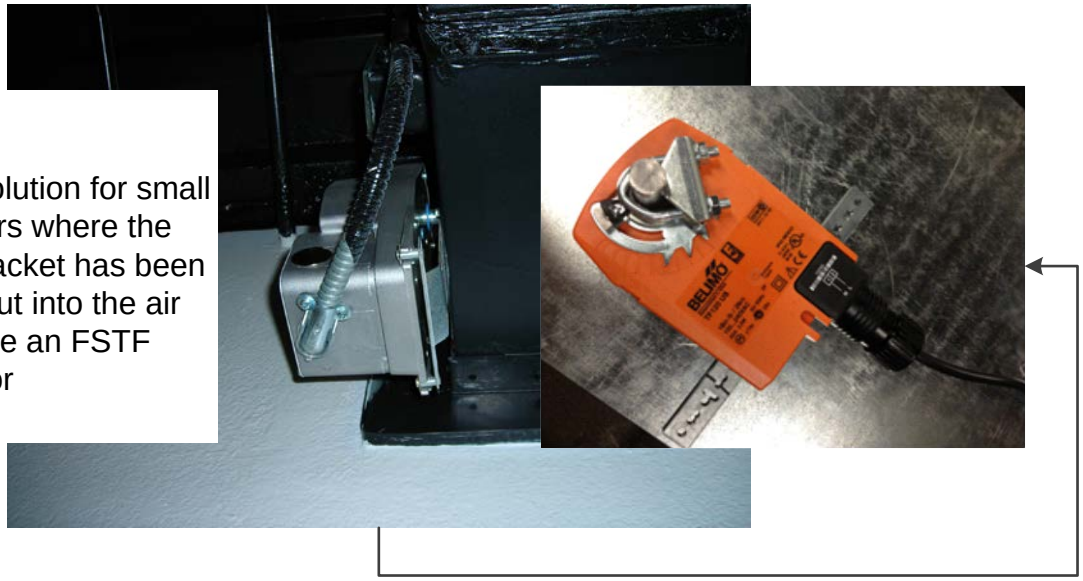
IMPORTANT:

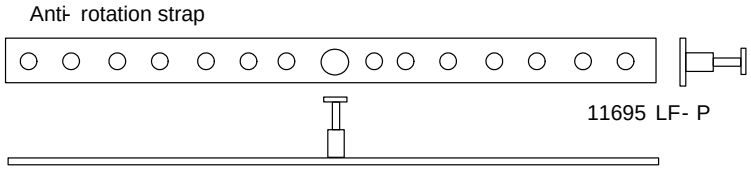
Mount the actuator straight so that no stress twists the damper shaft inside the hollow cylinder or clamp. Undue stress will shorten the life of the motor. See photograph below of an incorrectly mounted Honeysell motor.

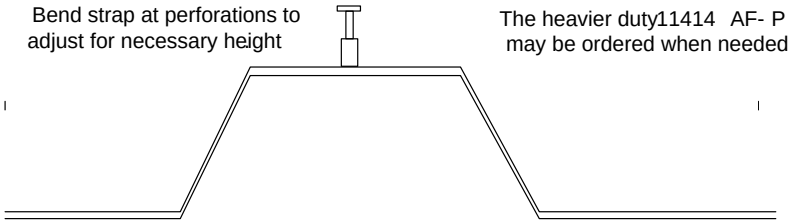


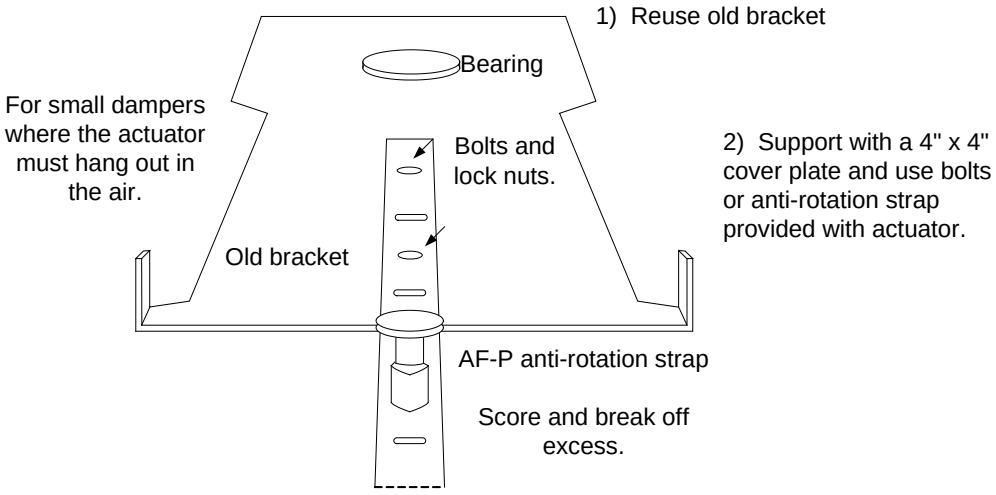
Special Mounting

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





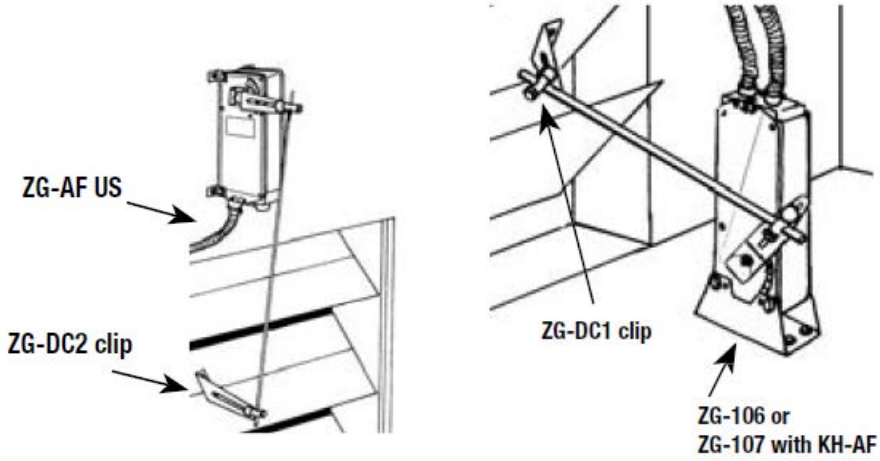




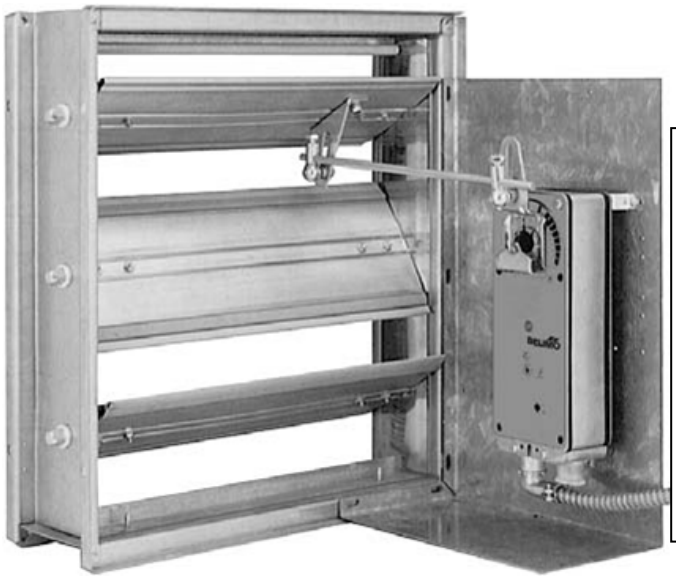
Linkage mounting

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.

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 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.

Auxiliary Switches

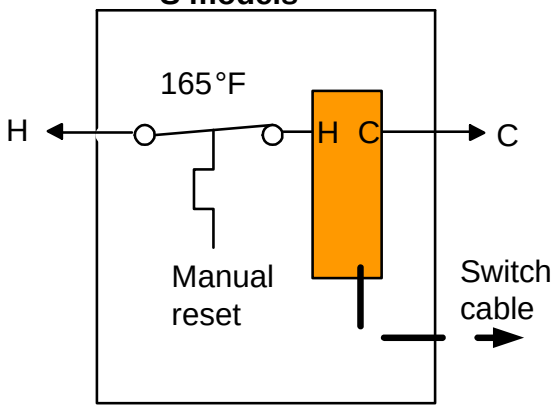
Damper blade switch assembly

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.

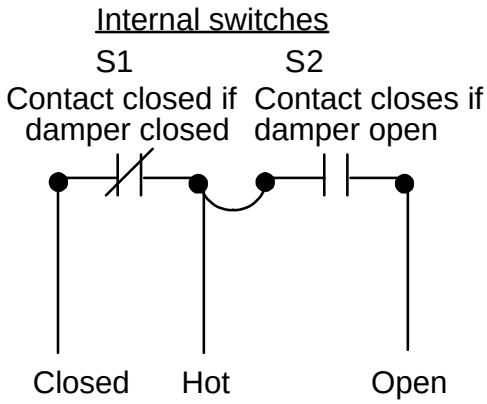
Belimo S2A-F

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

-S models



Some models are SPDT. Check data sheets.



Thermal sensor replacements – BAE165 US

Belimo BAE165 US

Where existing sensor is defective or one must be added, the 165°F primary sensor may be used. Original equipment is recommended although not strictly required by code. UL does not regulate replacement or repair. See NFPA 80 or NFPA 105.

Wiring

WARNING!

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

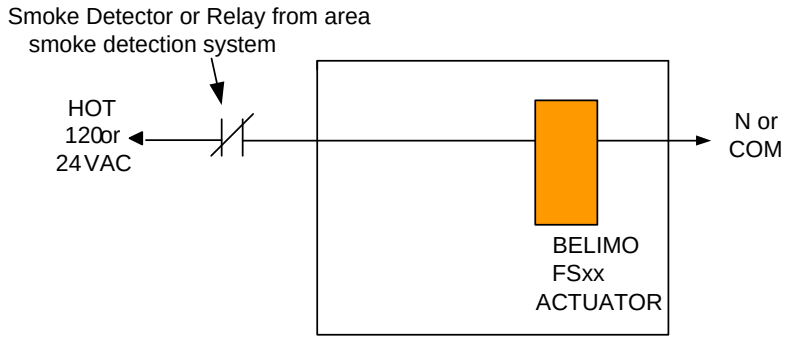
WARNING!

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

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

Fusible link DAMPER ACTUATOR WIRING

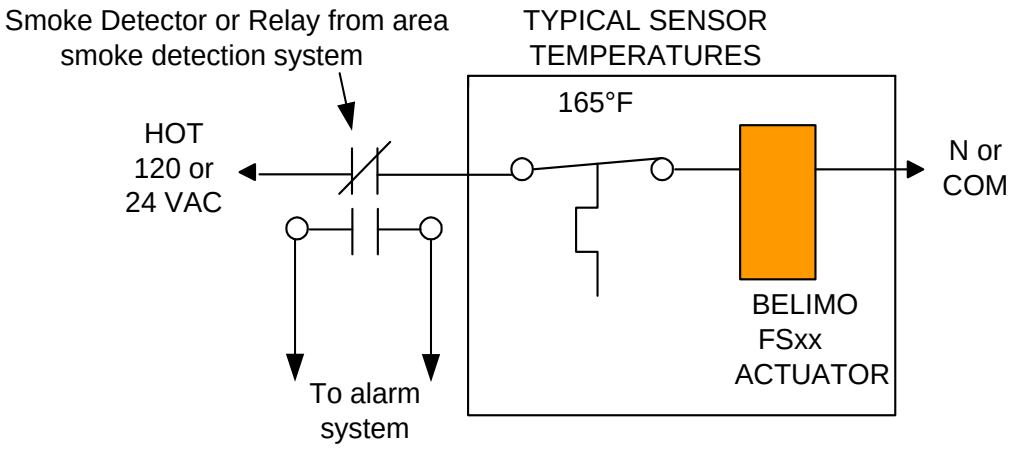
SMOKE DAMPER ACTUATOR WIRING



The drawing to the left shows the wiring when there is a fusible link and separate spring on the damper shaft. The same wiring is used when the damper is smoke only since then there is no temperature sensor.

TYPICAL FIRE - SMOKE COMBINATION DAMPER WIRING

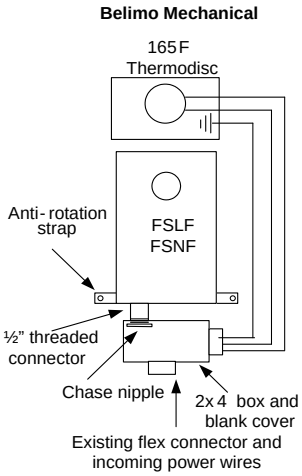
Electric thermal disc



WARNING!

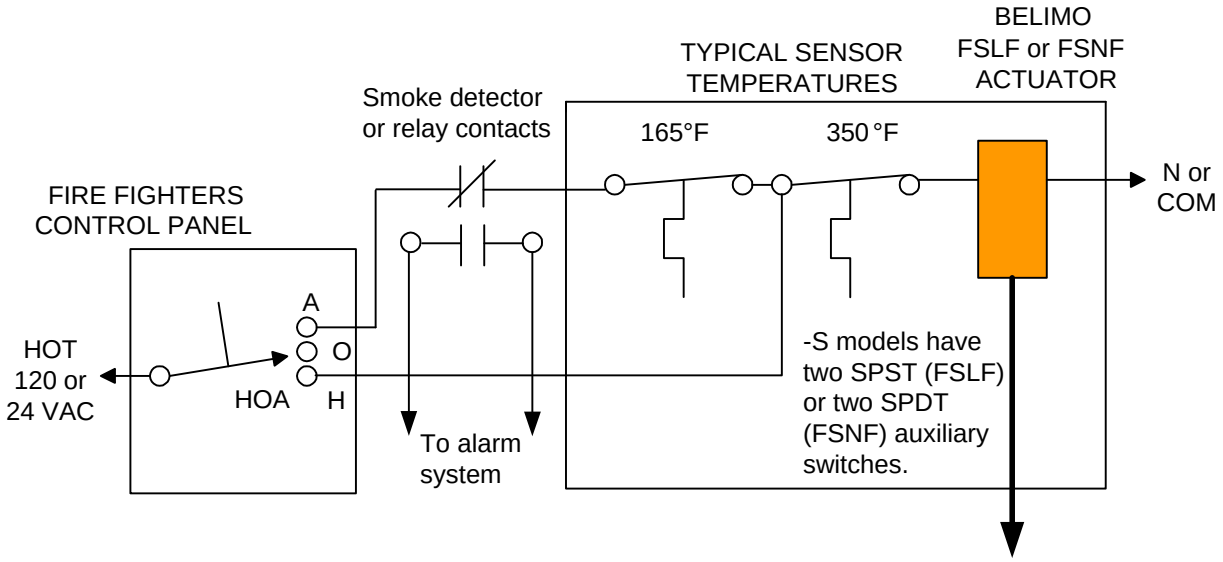
Note that where any fire alarm wiring is touched, the fire department or fire alarm company must be informed.

The drawing above shows the wiring when the primary sensor is an electrical thermal disk. Note that the alarm connections are not touched when replacing an actuator. This is a major concern for Fire Marshals.

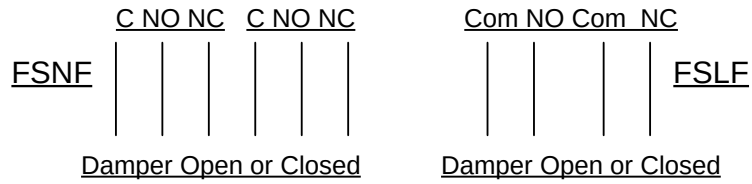


TYPICAL REOPENABLE DAMPER with FSCS

Belimo Auxiliary Switches for position indication to FSCS



See FSLF or FSNF data sheet for wiring numbers and/or color coding..



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 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 or disconnect fusible link. *Damper springs closed.*
   d1. □ Press thermal sensor manual reset. *Damper drives open.*
   d2. □ Open damper and reinstall fusible link or replacement.

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 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.

Verification of status indication lights at FSCS panel is required with each step.

☐ **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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Contact Belimo for instructions on any special configuration found on projects.