



WARNING!

Before replacing actuator, damper must be inspected and determined to be fully functional.

INSTRUCTION SHEET - Replacement of Ruskin Phillips P150 to Belimo FSNF or FSAF Actuator

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WARNING!

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

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.

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 Semi-annually	Commissioning 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 requires damper inspection and repair of dampers.
See www.nfpa.org for Standards. Details not covered here.

NFPA 80 (Fire) & NFPA 105 (Smoke)

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.
- **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 Fire Marshal Notification Form on last page.

(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.



WARNING!

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

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

Nominal sq.ft. per UL555S testing.				
	Sq.ft.	Temp	Actuator	
	12 or less	350°F	FSNF	Ruskin
	16 or less	350°F	FSAF*A	Ruskin

Ruskin has passed multiple sections with multiple FSNF& FSAF actuators.

The Phillips motor is no longer made. It was applied several different ways. Investigation into the temperature sensing and spring return method is needed to confirm that replacement and any rewiring is done correctly. **The Phillips motor did not have a spring in it.** To replace with a modern Belimo with a spring, either of two changes may be necessary.

One, if a thermal sensor exists, the old spring must be removed or disconnected. Make sure the spring cannot jam any part of the damper. The vast majority of these applications had the thermal sensor initially.

Two, if a fusible link is present, then an electric thermal sensor like the Ruskin EFL may be installed and wired according to one of the drawings in the wiring section. **Contact Belimo with photographs of the installation for discussion.**

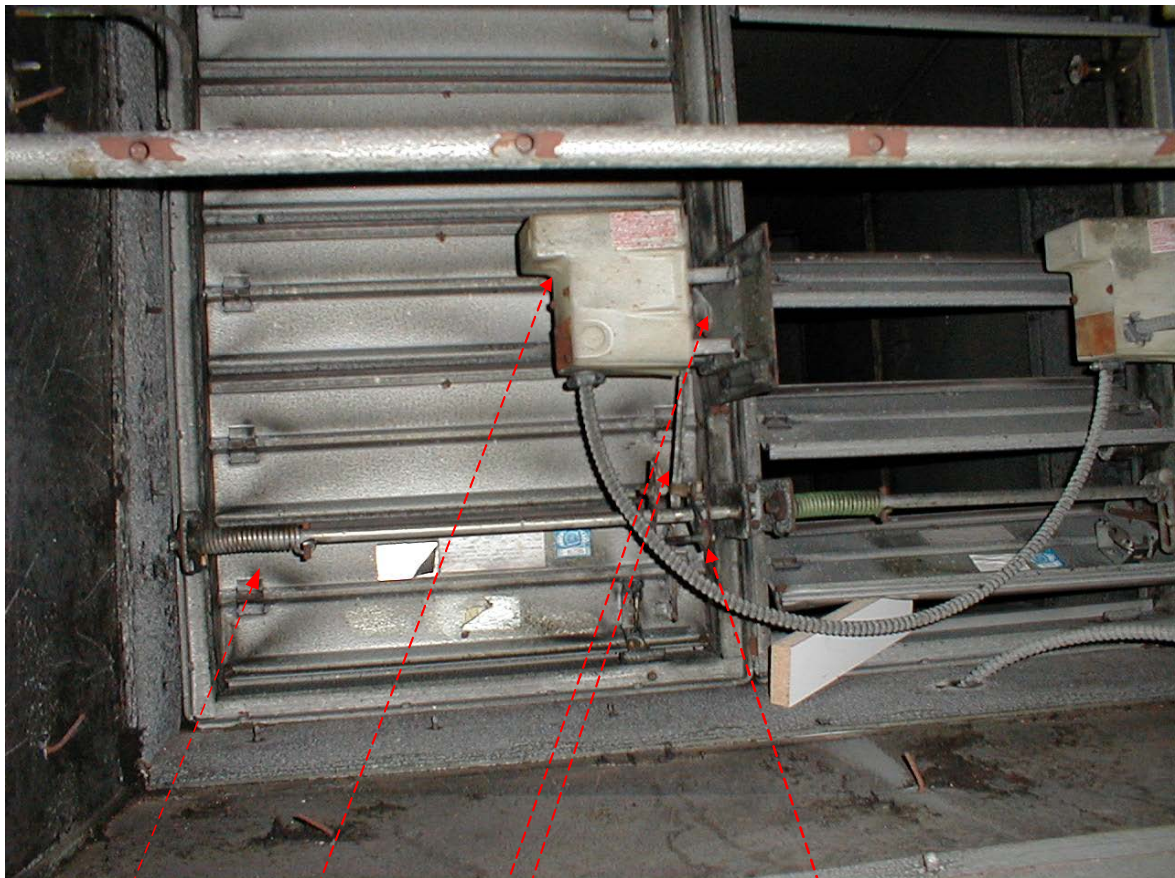
Typical existing installations



Typical jackshaft spring

The Phillips P150 motor was non-spring.

This spring will be disabled by allowing damper to spring closed, pounding out the stud, sliding the spring down the jackshaft, and resetting the stud to prevent the spring from interfering with damper operation.



0
With damper closed, remove pin and disconnect spring. Secure or remove.

2
remove motor

1
disconnect linkage and rod

3
remove old linkage parts and put KH8 damper arm onto jackshaft. Loose until setup finalized.

4
Note direction of rotation of damper arm and set crank arm (3) accordingly to synchronize.

Install leg kit of ZG-AF onto actuator with direction of rotation correct for synchronization.

5
Drill holes for actuator leg kit and mount with bolts.

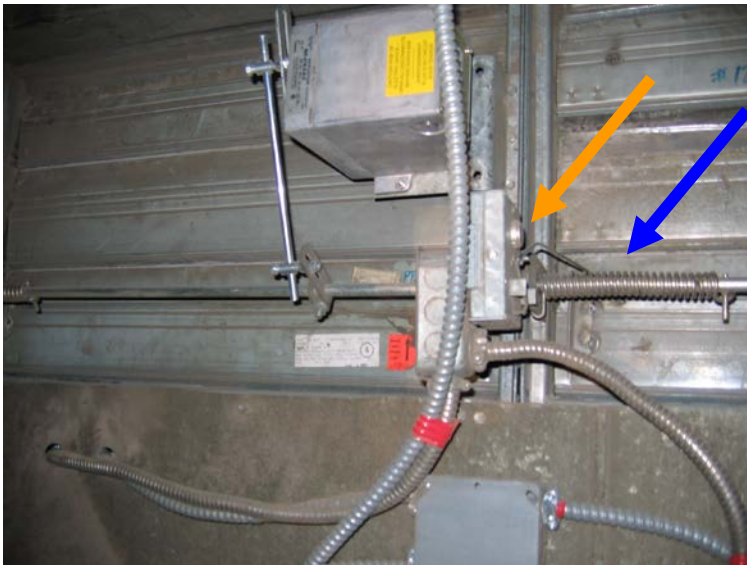
Attach crank arm and ball joint beforehand if most expedient.

6
Attach ball joint on jackshaft arm and connect SH8 rod.

Fiddle with the parts and rotation until close.

Make final adjustments, tighten, test, redo.

7
Test everything. Release the fusible link to ensure damper closes in fire mode. Replace the fusible link. Open power or use test button to check the smoke closing and opening function.

**WARNING!****USE CAUTION!****SPRING IS UNDER HIGH TORSION AND MAY CAUSE SERIOUS INJURY!****WRONG**

The original motor was a Phillips P150. A Siebe MA418 was used to replace it. The shaft spring was not disconnected. The MA418 failed due to high holding torque load against its own internal spring and the external shaft spring.

Orange arrow points at the primary thermal sensor.

Blue arrow points at the shaft spring. Note pin on far right of spring. It can be used to hold the spring in place after disconnecting and sliding spring onto the shaft.

**Note on sensor wiring.**

When a number of damper sections are used and multiple motors drive the sections, only one fire sensor is allowed. All sections of the damper assembly must close together. The sensor above is the only one for several sections.

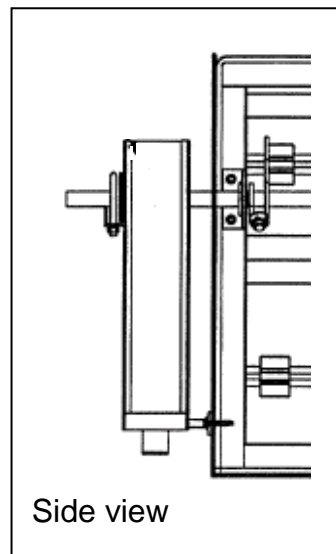
The motor at the right does not have a separate sensor. It is wired to the single sensor shown in the top picture.

Direct coupling



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

Depending on the geometry, any number of mounting arrangements are correct. Direct coupling is easiest and most

Alternately, the anti-rotation strap can be attached to any Belimo linkage, an electrical J-box cover plate, or to a piece of U-channel.

It is important to remember that the ducts are fall-away. The actuator mounting cannot interfere with the ability of the duct to fall from the damper. The damper must continue to protect the wall.

See Belimo Mounting Methods Guide.

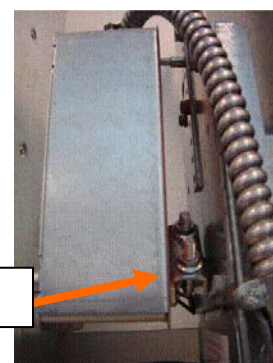
Note that actuator floats freely. Clamp cold welds when teeth dig into the damper shaft and the anti-rotation strap stud allows the actuator to move if shaft is not perfectly concentric. Rigid mounting by jamming the stud into the U-slot of actuator is NOT usually best.

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

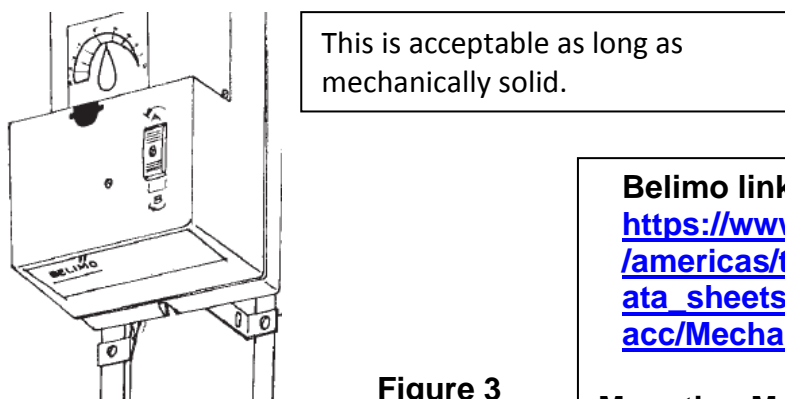
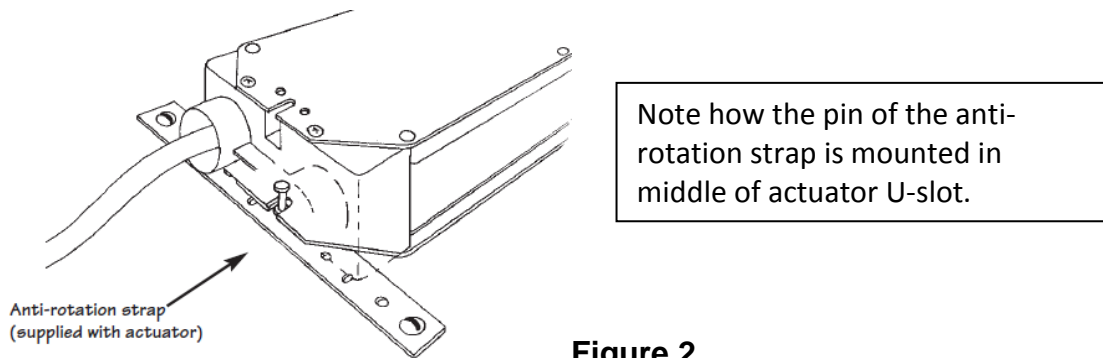
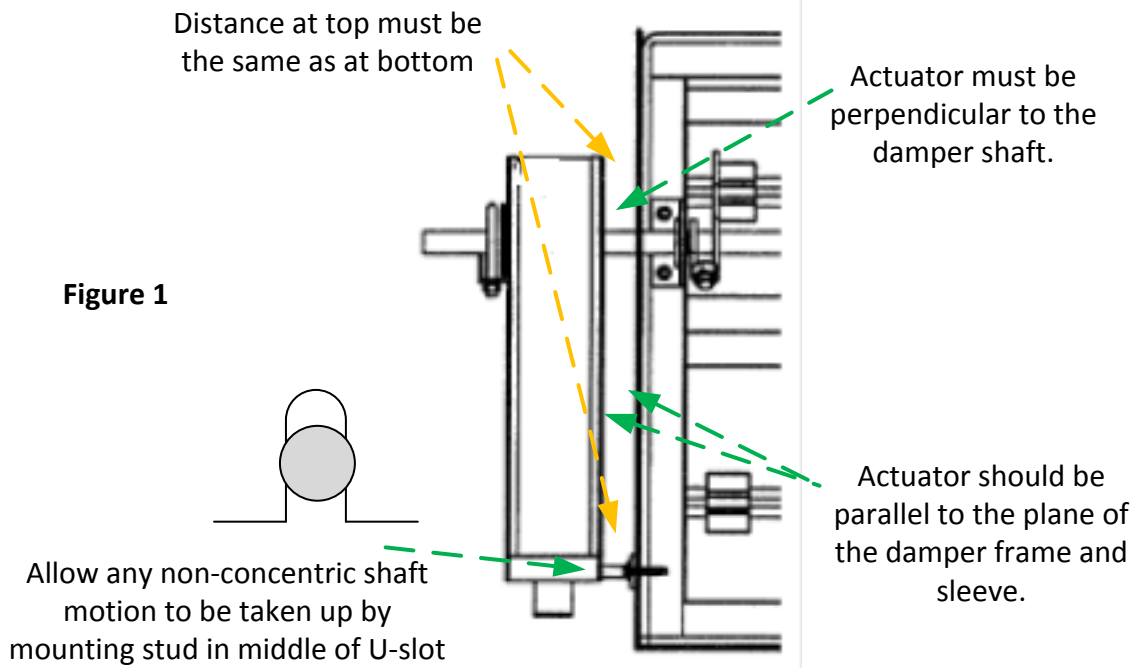
Short shaft mounting



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

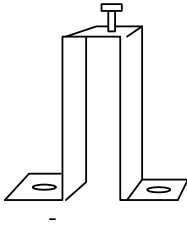


Belimo linkage kits:

https://www.belimo.com/pim/mam/americas/technical_documents/d ata_sheets/man-air-acc/Mechanical_Accessories.pdf

Mounting Methods Guide:

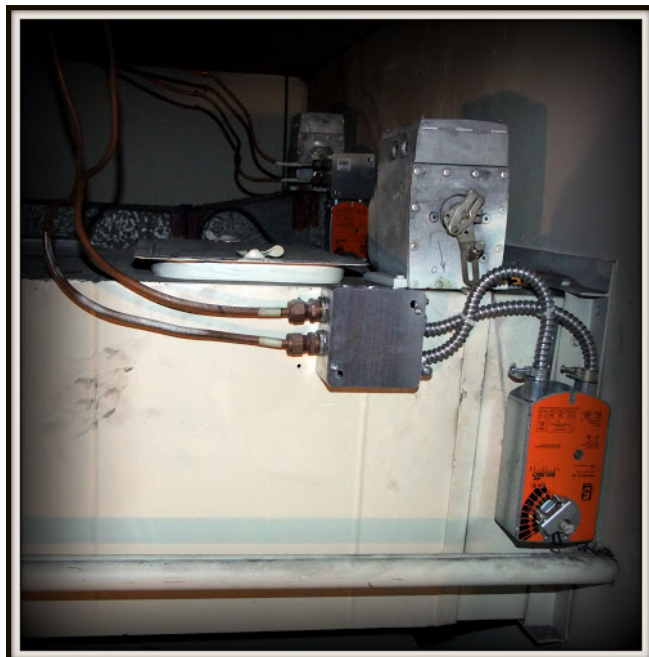
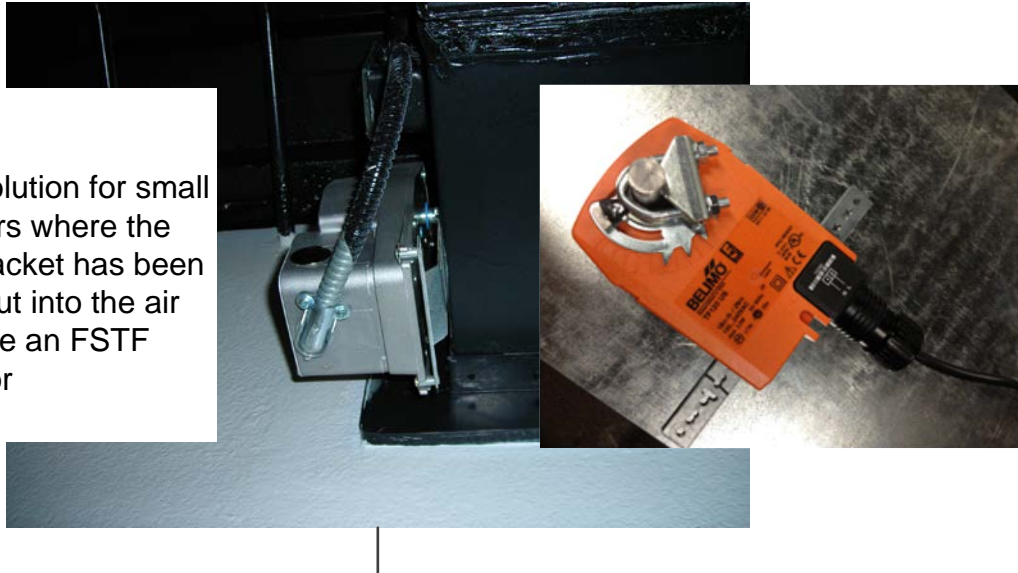
https://www.belimo.us/mam/americas/technical_documents/pdf-web/guides/mounting_methods.pdf



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

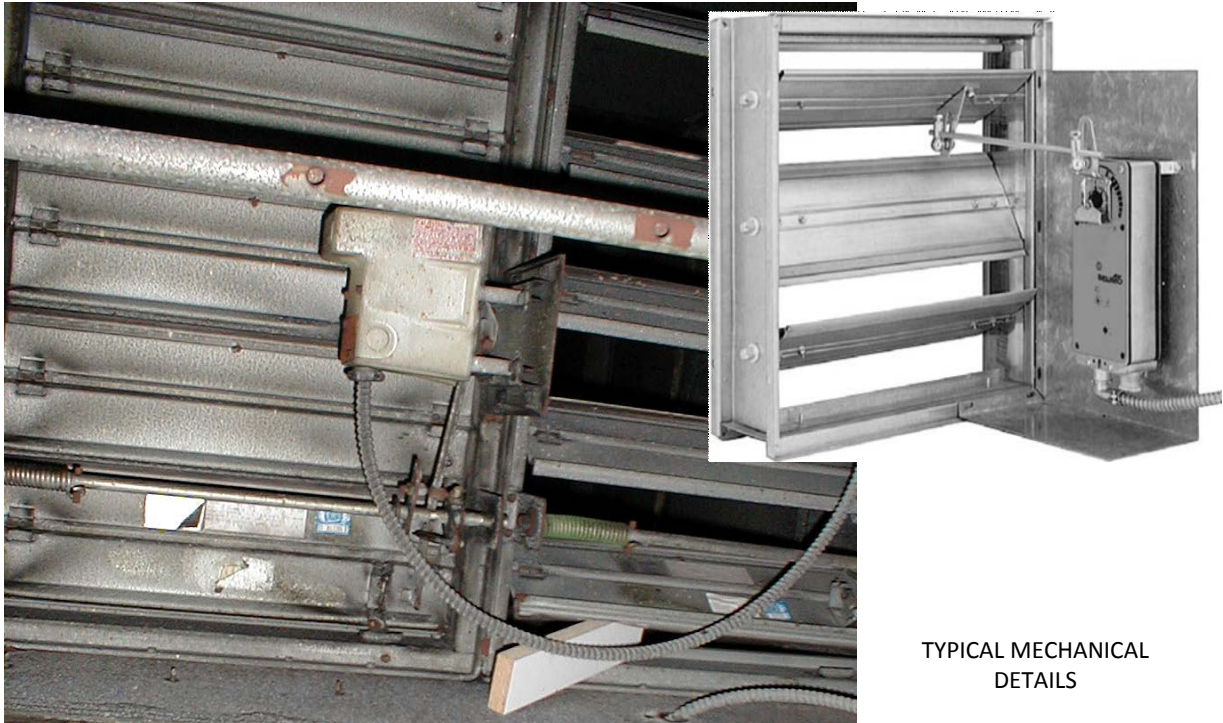
FSTF

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



FSLF direct coupled with old motor and linkage removed.

Linkage mounting



TYPICAL MECHANICAL
DETAILS

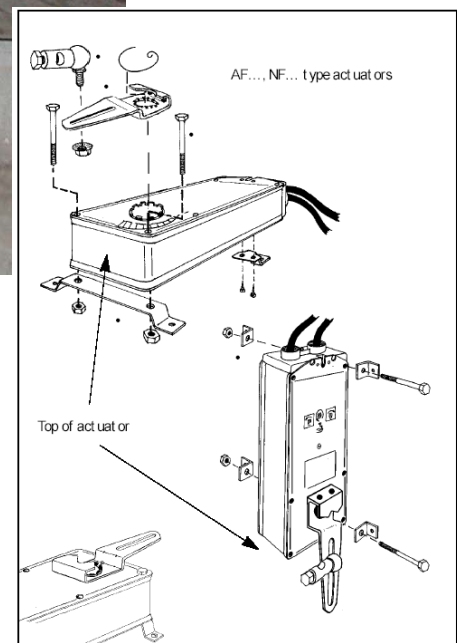
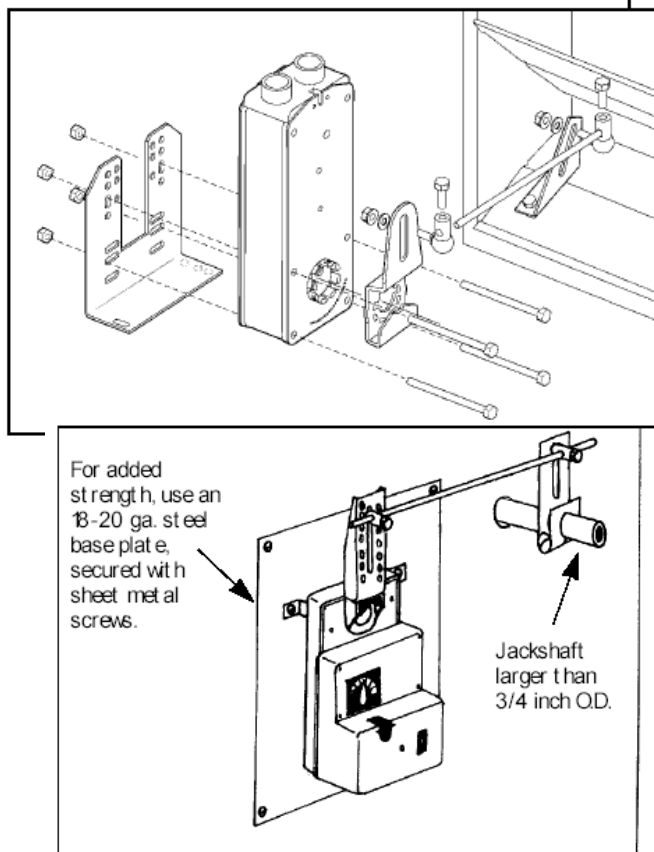
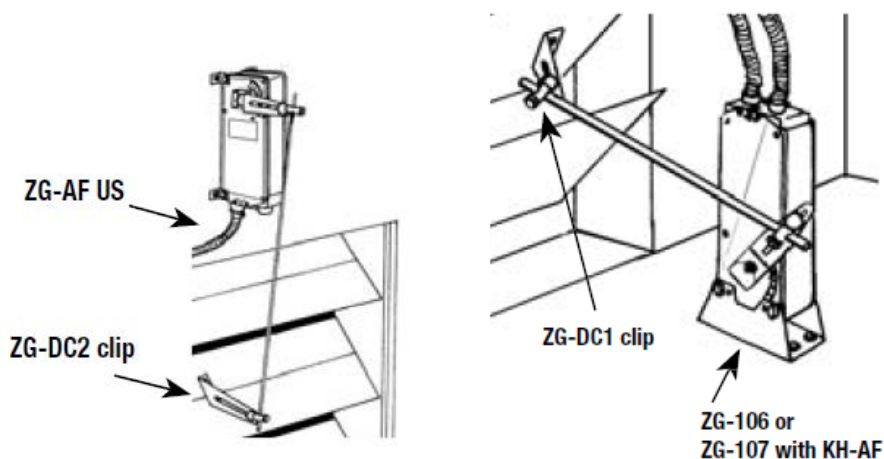


Fig. 1.12 ZG-AF Damper linkage kit. Kit contains:
• 1 crankarm with retaining clip, • 2 standoff brackets,
• 4 mounting feet, • 2 bolts w/ nuts, • 2 ball joints



WARNING!

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



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

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.

Negator spring hybrids

There are some models of dampers that mix negator springs and fusible rods with the Phillips motors. Call for assistance. Photos will be needed to identify exact procedures. See also:



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.

The Ruskin EFL (electronic fuse link) may be purchased from Ruskin reps.

<http://www.ruskin.com/model/13875~EFL> or
<http://www.ruskin.com/catalog/servefile.aspx?id=3160>

Alternately, the TS150 may be replaced. It is the dual sensor for reopenable dampers.

<http://www.ruskin.com/catalog/servefile.aspx?id=797>

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.

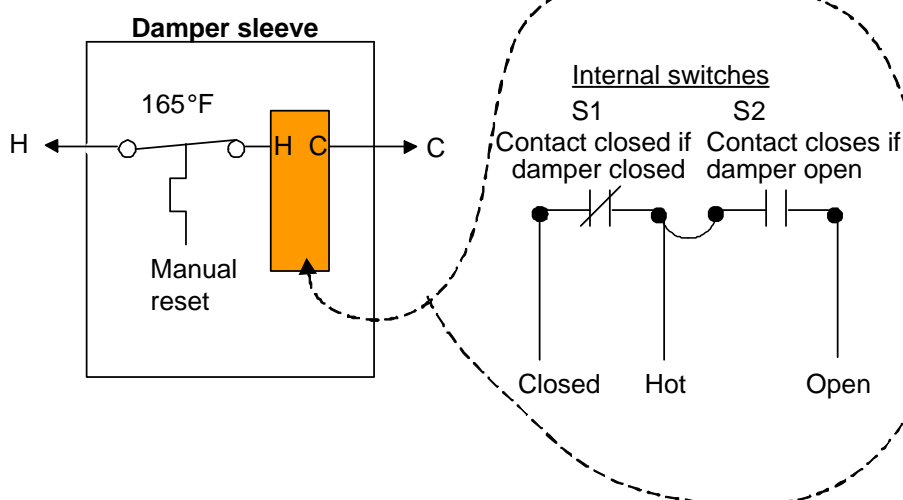


Damper blade switch package

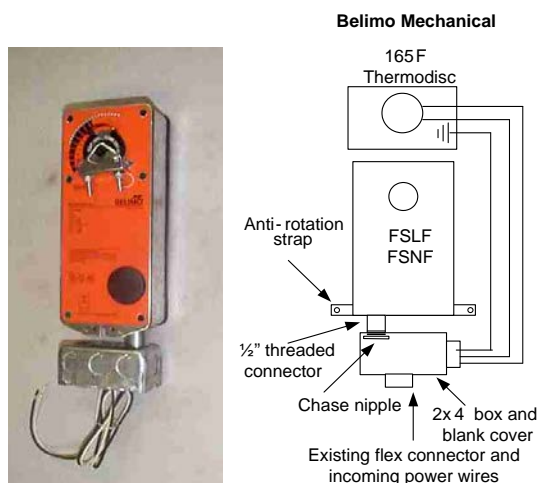
Belimo S2A-F



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.



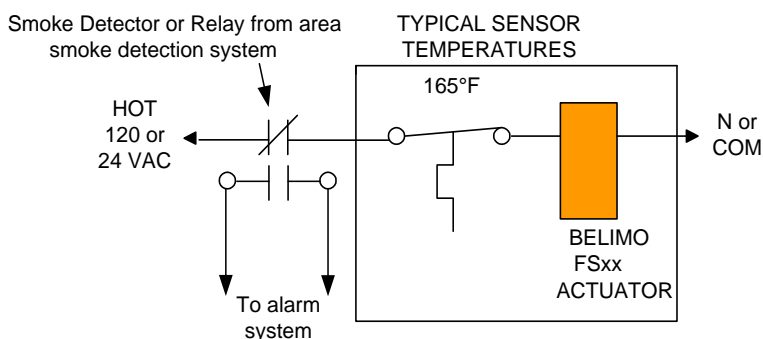
**Where a J-box is
needed for wiring,
a chase nipple and
2x4 or 4x4 box can
be attached to the
actuator.**

Wiring

This is the most common wiring method used. The damper has an electric switch to open power to the actuator and spring the damper closed.

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.

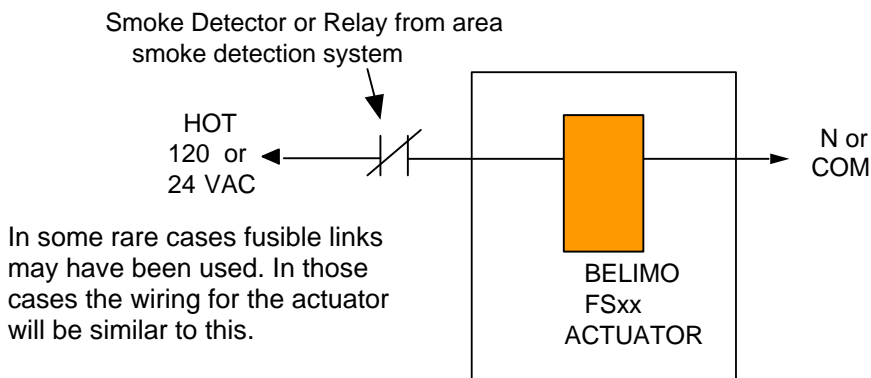


WARNING!

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

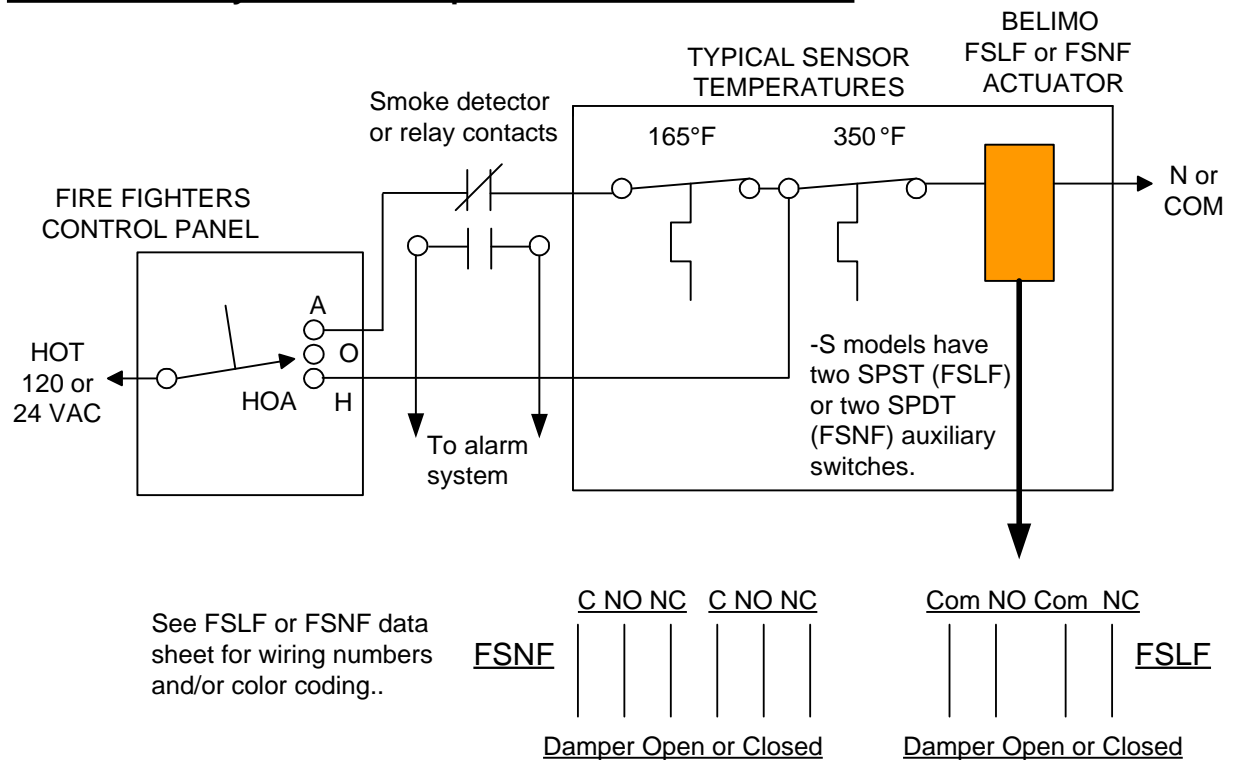
The drawing below is typical of a smoke control only damper or a negator spring damper.

Fusible link DAMPER ACTUATOR WIRING



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.
- The 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 (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.....

.....

.....